

ICHNO- AND BODY-FOSSILS FROM THE UPPER TRIASSIC-LOWER JURASSIC SINIVIR FORMATION IN THE BALABAN DERE VALLEY (EAST STARA PLANINA MTS., EAST BULGARIA) AND THE PROBLEM OF THE TRIASSIC/JURASSIC BOUNDARY

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Abstract: The Triassic and Jurassic sediments in East Stara Planina Mts. are of two types: (a) parautochthonous - relatively deep marine sediments, Tethyan type, and (b) allochthonous - shallow marine deposits, Peri-Tethyan type (included in the first as olistolites). The parautochthonous type had been sedimented in unilateral rift-basin, and the allochthonous type - on the shelf, connecting the basin with the dry land to the South. The Glogova Fm. (Upper Carnian (p. p.) - Norian (p. p.)), and Sinivir Fm. (Norian (p. p.) - Toarcian (p. p.)) are studied here. They are related to a progressive transition and contain deep-water ichnofossils – *Nereites* ichnofacies. Middle Norian bivalves – *Monotis salinaria salinaria*, and *Monotis cf. salinaria haueri* are collected in the lower parts of Sinivir Fm., and higher - fragments of Jurassic belemnites. In a nearby section spores and pollens of Late Pliensbachian *Ischyosporites variegates*/*Matonisporites crassiangulatus* Biointerval Zone, *dinocystes* as *Nannoceratopsis gracilis* (Pliensbachian - Middle Bathonian), which indicate *Spheripollenites subgranulatus* Acme-Zone, as well as Liassic foraminifers *Ammodiscus infimus*, *Annulina metensis*, etc. are collected. The boundary Triassic/Jurassic, in deep water conditions, is located in Sinivir Fm. and is connected with progressive transition, whilst in shelf conditions the boundary is related to a break in the sedimentation.

Keywords: Triassic/Jurassic boundary, East Stara Planina Mountains, Bulgaria

INTRODUCTION

The study of the Triassic and Jurassic rocks in eastern Stara Planina Mts. started in the beginning of the 20th century Bakalov (1910, 1942), Kockel (1929), Berndt (1930, 1934), Ganev (1961), Kancev, Encheva (1967), Budurov, Trifonova (1974), Kancev (1993,1995). Nachev et al. (1967) introduced the hypothesis that all Triassic and Jurassic rocks in eastern Stara Planina Mts. represented olistolites within the Upper Cretaceous black shales of the Kotel Fm. Tchoumatchenco (1988) reconstructed the primary position of the allochthonous Jurassic blocks. Tchoumatchenco & Cernjavaska (1989), created a lithostratigraphy for the Jurassic, and Budurov et al. (1997) - for the Triassic sediments. The Triassic and Jurassic deposits in eastern Stara Planina Mts. are of 2 types (fig. 1): (a) parautochthonous, and (b) allochthonous. The parautochthonous Triassic and Jurassic rocks are of basinal (Tethyan) type. The allochthonous sediments are olistolites, formed from shelf Triassic and Jurassic sediments, and from small blocks, coming from the partly destroyed Matore rifted basin. The lower boundary of the Triassic sediments is not exposed. The upper boundary coincides with the upper boundary of the youngest Jurassic sediments - the Kotel Fm. and the transgressive Upper Cretaceous sediments. The allochthonous Triassic and Jurassic sediments derived predominantly from the destructed paleoshelf of the Exotic Range of Zlatarski (Tchoumatchenco, 1988) and partly from the southern slope of the Matore basin. Huge Triassic

olistolites build up the tops of Kayite Hills in the Louda Kamchia Gorge, Orbitsite, etc. The summits of Kodzha Kaya, Orta Kaya, Ouch Kaya Hills are build up of more than 100 m thick Upper Triassic sub-reef bioclastic, thick bedded limestones in which corals formed irregular patch reefs. These limestones contain Upper Triassic foraminifers: *Tolypammia discoidea*, *Milolipora cuvillieri*, *Duostomina alta*. Ganev (1961) collected from them *Cyrtina uncinata*, *Rhaetina gregaria*, "*Rhynchonella*" aff. *fissicostata*, *Nautilus* n. sp.; Budurov et al. (1997) individualized them as Orta Kaya type Upper Triassic limestones. Berndt (1934) compared these limestones with the German Dachstein limestones. They are included into Jurassic sediments. The Lower Jurassic blocks are subdivided (Tchoumatchenco, 1988) into 4 types, and namely, the (1) Bilka; (2) Djula; (3) Karaveljovo, and (4) Cerkoviste type. They were deposited in different parts of the paleoshelf – connected with relatively deepening of the sea. The boundary between the Triassic and the Lower Jurassic rocks is transgressive and erosional.

The parautochthonous Triassic rocks are subdivided (Budurov et al., 1997) in three formal lithostratigraphic units: Mayadere, Gyurgenliya., and Glogova Fm. and the Jurassic (Tchoumatchenco, Cernjavaska, 1989) is referred to Louda Kamchia Group and subdivided into Sinivir Fm., Balaban Fm. and Kotel Fm. (fig. 1).

Mayadere Fm. (93,5m) is represented by irregular, flysch-like alternation of marls, shales, silstones, sandstones and limestones. The age corresponds to the upper parts of the Olenekian

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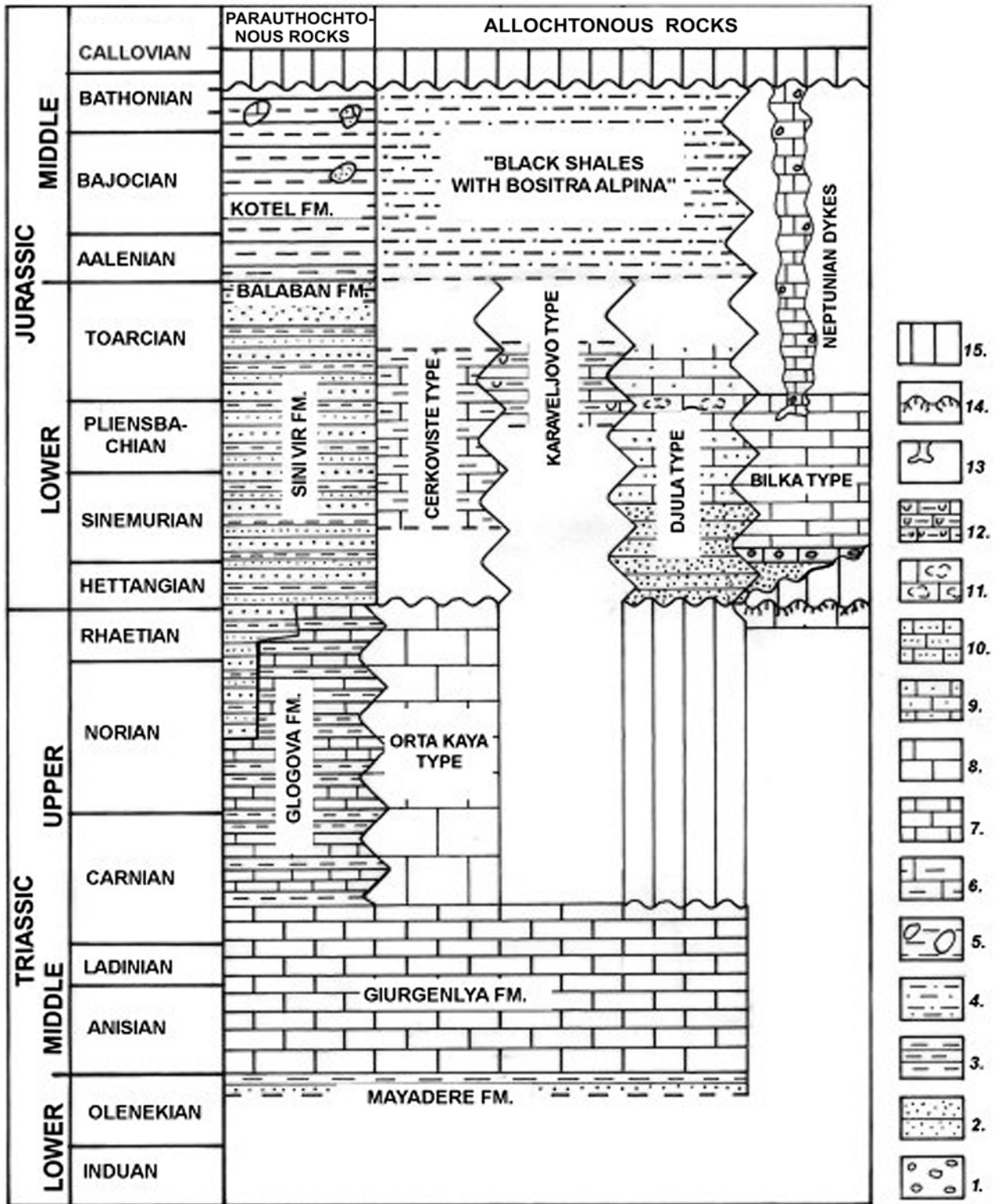


Fig. 1. Correlation of Triassic and Jurassic sections in Eastern Stara Planina Mts.

- 1 – conglomerates, 2 – sandstones, 3 – shales, 4 – black shales with *Bositra alpina*, 5 – shales with olistolites, 6 – marls, 7 – limestones, thin bedded, 8 – limestones, thick bedded, 9 – bioturbated limestones, 10 – sandy limestones, 11 – nodular limestones, 12 – bioclastic limestones, 13 – neptunian dykes, 14 – bioturbated surface, 15 – eroded sediments

Stage (Spathian) – conodont zones *Neospathodus triangularis-N. homeri*, foraminifer zone *Meandrosira pusilla*, and the palynozones *Densoisporites nejborgii* and *Cycloverruitiles presselensis*. Gyurgenliya Fm. (29,7 m) follows up above the Mayadere Fm. and is built up of gray, gray-greenish, reddish or yellowish limestones.

The age is determined as Lower Anisian-Lower Carnian - *Paragondolella timorensis* conodont Zone and lower parts of the foraminifer *Pilamina densa* Zone (Aegean Substage), *Paragondolella bulgarica* Zone and parts of *Pilamina densa* Zone (Pelsonian Substage), *Pridaella constricta* Zone (Illyrian – lower parts of Fassanian Substage),

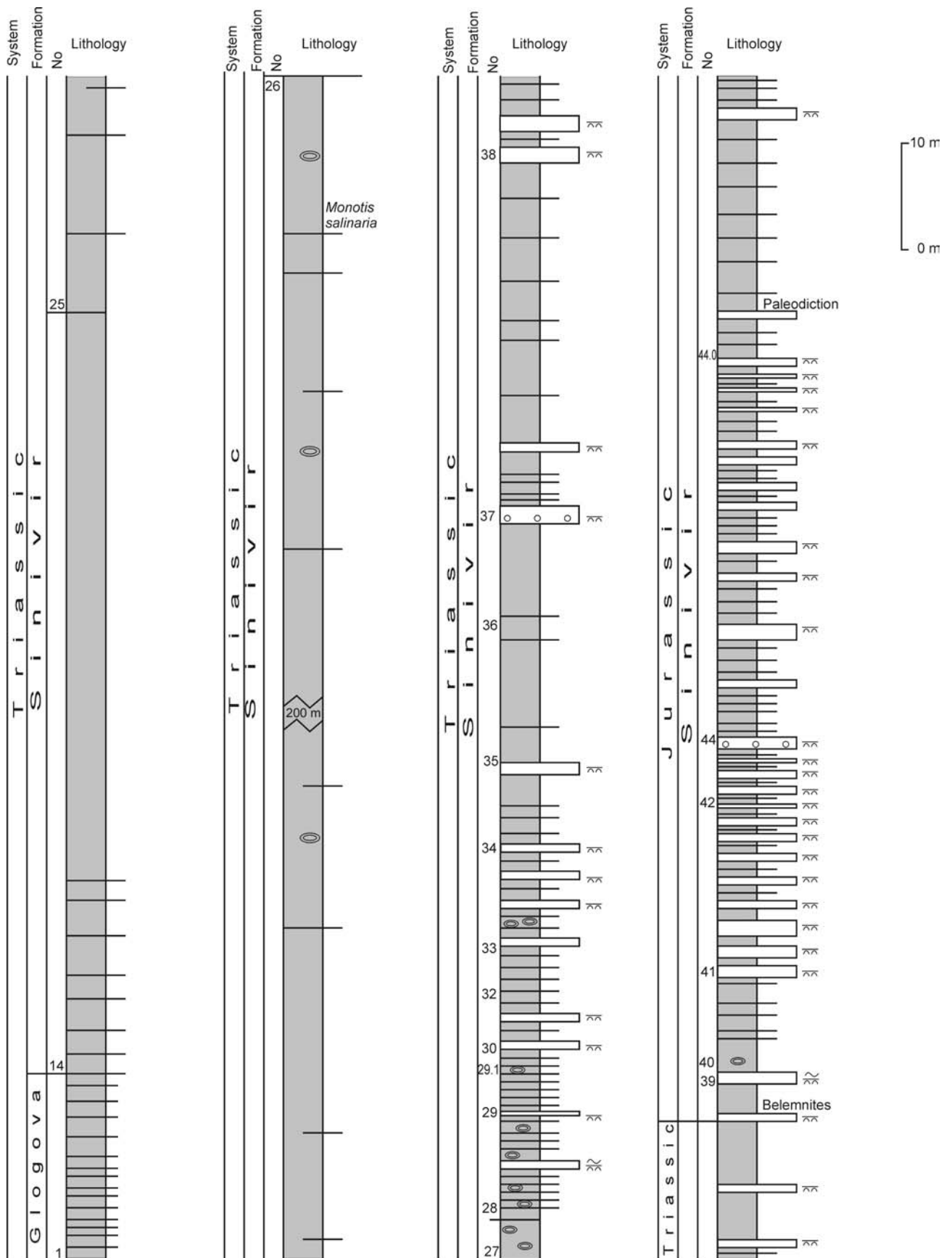


Fig. 2. Sedimentological log showing the lower part (units 1-44) of Sinivir Formation along the forest road in Cheshme Bair Hill, Balaban Dere Valley, South of Dobromir Village. Legend as in Fig. 3.

Paragondolella foliata Zone and part of *Turriglomina mesotriassica* Zone (upper parts of Fassanian - Longobardian Substage),

Paragondolella polygnathiformis Zone and parts of *Paraophtalmidium carpathicum* Zone (Cordevolian-Julian Substage). Glogova Fm. (cc. 30 m) is with

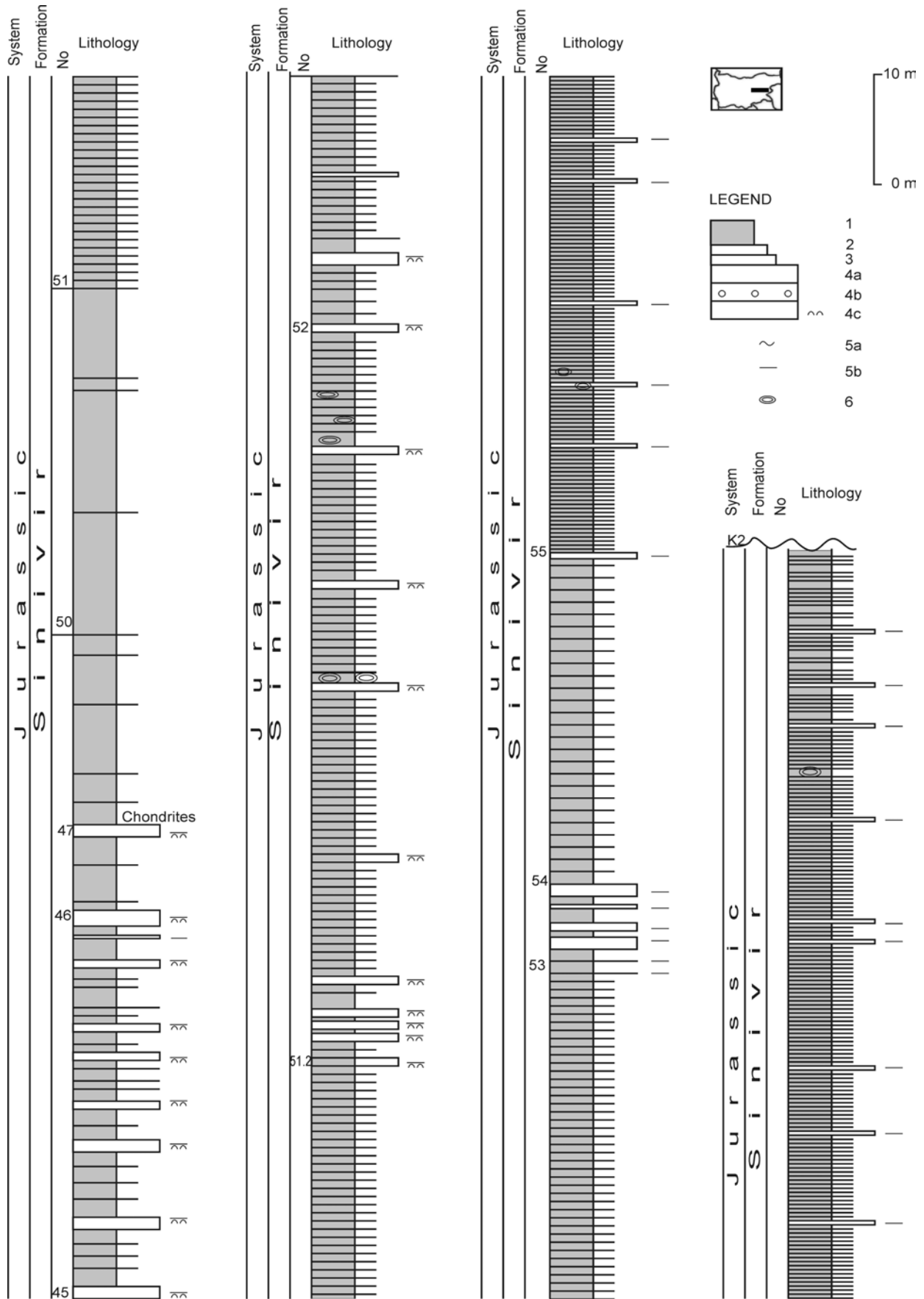


Fig. 3. Sedimentological log showing the upper part (units 44-55) of Sinivir Formation in Balaban Dere Valley, South of Dobromir Village: 1 - ferriferous mudstones to sandy silts; 2 - silty and sandy peloidal limestones; 3 - calcareous silty sandstones (with horizontal lamination); 4 - calcareous sandstones; 4a – calcareous sandstones to gravelitic limestones with 4b-lithoclasts and/or 4c - bioclasts; *structure of sandstones*: 5a - horizontal lamination; 5b - ripple lamination; 6 - sideritic concretions

thin-bedded limestones, silty limestones, calcareous siltstones and peloidal limestones. The age is Late Carnian-Norian-Rhaetian – in the outer shelf sediments and up to Middle Norian – in the basin sediments. Sini Vir Fm. (cc. 800 - 1000 m.) (fig. 2, 3) is characterized by a turbidite siliciclastic alternation – sandstones to calcareous sandstones, aleurolites and argillites to marls, containing many sideritic concretions. The age is Late Triassic (Middle Norian-Rhaetian) – Early Jurassic (Hettangian-Toarcian). These sediments are described by Kockel (1929) as “Schwarzflysch serie” and by Kancev (1993, 1995) as “Norian flysch”. Balaban Fm. is represented by thick beds of sandstones (cc. 60 m) to which is attributed Toarcian age, due to its stratigraphic position. The Kotel Fm. (cc. 1000m) is with Aalenian-Middle Bathonian age (probably the younger parts of the Kotel Fm. were subsequently eroded). It is introduced in the Bulgarian literature by Nachev et al. (1967) as an Upper Cretaceous lithostratigraphic formation. Later Tchoumatchenco & Cernjavaska (1989) returned its Middle Jurassic age, assumed by Cernjavaska (1965). The Kotel Fm. is built of black shales containing many Triassic and Jurassic olistolites

The aim of this paper is to demonstrate the ichno- and bodyfossils contained in the Sinivir Fm, and to comment the problem of the Triassic/Jurassic boundary. The studied section is situated in the Balaban Dere Valley, South of the village of Dobromir Burgas District, eastern Stara Planina Mts. It is characterized by a flysch siliciclastic alternation – mainly by calcareous sandstones, calcareous silty sandstones, and silty siltstones, as well as silty shales and siltstones, containing many sideritic concretions. Its age is Late Triassic (Middle Norian (p.p.) - Rhaetian) – Early Jurassic (Hettangian-Toarcian (p.p.) The basement is represented by the Glogova Fm. with Late Carnian-Middle Norian (p.p.) age - an irregular alternation of ferriferous mudstones and thin-bedded silty and sandy peloidal limestones.

The new field research (Yaneva, 2005, Yaneva et al., 2004) are made by P. Tchoumatchenco, M. Yaneva (who make also the sedimentological determinations), and L. Petrunova. The ichnofossils are studied by A. Uchman and P. Tchoumatchenco (Tchoumatchenco, Uchman, 1999, 2005), the bivalves – by D. Tronkov, and the foraminifers – by E. Trifonova (1990).

ICHNO- AND BODYFOSSILS IN SINIVIR FM.

Ichnofossils. The most diverse ichnoassemblage occurs in the distal sediments of the Sinivir Fm., near the ex-village of Emirovo (Tchoumatchenco & Uchman, 1999, 2005). The presence of graphoglyptids (*Desmograption*, *Megagraption*, *Paleodictyon*) and meandering pascichnia (*Nereites*) is typical of the *Nereites* ichnofacies, which indicates deep-sea environment (Seilacher, 1967, Frey & Seilacher, 1980). The

mesodistal facies of the Sinivir Fm., in the Cheshme Bair Hill (fig. 2, 3) yields less diverse ichnofossils (Plate 3, fig. 4 - 8) – *Paleodictyon* (*Glenodictyon*) *miocenicum* Sacco 1886 /upper part of packet 44/, *Nereites missouriensis* (Weller 1899), *Chondrites* cf. *intricatus* (Brongniart 1823) /packets 47, 51/, but the *Nereites* ichnofacies with *Paleodictyon* and *Nereites* is still present. The limestone beds in the alternation ferriferous mudstones/silty and peloidal limestones of the Glogova Fm. yielded many ichnofossils of the *Nereites* ichnofacies, but they are eroded and not well preserved to be photographed. In a block of the Glogova Fm., included in the black shale of the Kotel Fm., found in the road cutting South of the of town Kotel, a slab with *Arthropycus strictus* Ksiazkiewicz 1977 was collected (the same are found in the Cheshme Bair section) – characteristic for the *Nereites* ichnofacies (Plate 3, fig. 7, 8). This proved that the Glogova Fm., as well as the Sinivir Fm. had been sedimented in deep and quite water, disturbed only by bottom currents, i.e. it is not logic to suppose any break in sedimentation with formation of dry land between the two formations.

Bivalves. Kancev & Encheva (1967), Kancev & Ivanova-Panayotova (1972) and Kancev (1993-1995) communicated many bivalves as *Halobia verbecky* Wanner, *H. distincta* Mojs., *H. partschi* Kittl., *H. superbescens* Kittl., *H. alascana* Smith., *H. fallax* Mojs., *H. parasicula* Kittl., *H. comata* Bitt., *H. superba* Mojs., *H. dilatata* Kittl., *H. plicosa* Mojs., *Pseudomonotis* cf. *subcircularis* Gabl., *Monotis salinaria* (Schlotheim) from different outcrops. With these bivalves they proved for the first time that the rocks of the “Black Flysch” (Kockel, 1929, etc.), are not of Tithonian age, as it was supposed by Ganev (1961), etc. Unfortunately these bivalves are reported only in various outcrops, but they are not situated in stratigraphic sections and their position is unknown. From the parautochthonous sediments in the section of the Sinivir Fm. at Cheshme Bair Hill (valley of Balaban Dere River) we collected specimen from *Monotis salinaria salinaria* and *Monotis* sp. cf. *Monotis salinaria haueri* Kittl.

***Monotis salinaria salinaria* (Schlotheim, 1820)** (Pl. 2, fig. 2-9)

1820. *Pectinites salinarius* Schlotheim, p. 230.

1830. *Monotis salinaria* – Bronn, p. 279, pl. 4, fig. 1.

1912. *Monotis salinaria* – Kittl, p. 169, pl. 10, figs. 1-6.

1934. *Monotis salinaria* – Berndt, p. 50-51.

1958. *Monotis (Monotis) salinaria salinaria* – Ichikawa, p. 176, pl. 23, figs. 2-4.

Non 1962. *Monotis salinaria* - Entcheva, Kancev, pl. 9, fig. 6 (= *M. haueri*).

1972. *Monotis salinaria* – Entcheva, p. 49, pl. 14, fig. 1, non pl. 27, fig. 8 (= *M. haueri*).

Material: 5 left and 2 right valves partially conserved and fragments, deformed by fissures.

Dimensions: Left valve: length: 36, 5 – 39 mm; height: 30,5 -32 mm; length/height: 1,19 - 1,22. Right valve: length: cc. 24 mm; height: cc. 19 mm; length/height: 1,26

Description: The valves are with moderate dimensions and inflated, diagonally oval. The left valves are slightly higher and more elongated. The length of the posterior wing plus the pre-umbonal length is slightly shorter than the half-length of the valve. The posterior wing is with middle dimension, and is clearly separated from the valve, obtusely cut, with clear and non-profound sinus. The surface of the valves is covered by straight radial plicae. The first order plicae are 23 to 26, moderated thick, rounded, high. The second order plicae are less numerous. The plicae of third order are rare and are present in the periphery of the ventral margin in some specimen. In the posterior part of some left valves the plicae are obsolete. Fine, concentric lines of growth are present on the whole surface of the valve, including on the posterior wing of one of the right valves. There are up to 8 concentric folds, which are more expressive in the part where the radial plicae are obsolete.

Geographic and stratigraphic distribution. From the Northern Calcareous Alps up to Pamir, Himalaya, and Timor. Probably rare specimens are present in North America and NE Asia. Middle Norian and lower part of the Upper Norian.

Locality. Section Cheshme Bair Hill, Sinivir Formation, packet 26, eastern Stara Planina Mts.

***Monotis* sp. cf. *Monotis salinaria haueri* Kittl, 1912 (Pl. 2, fig. 1)**

With some hesitation some fragments are attributed to this sub-species, the biggest of which (lower-posterior part of right valve is shown to Pl. 2, fig. 1). The first order plicae are large and flat and are similar to the specimen from Caucasus of Payevskaya (1979, pl. 10, fig. 3), and partially to this figured by Kochanova, Kollarova- Andrusovova (1983, pl. 3, fig. 1, 5) from the Western Carpathians. After Ichikawa (1958, p. 172) this sub-species can be present to the same slab with the nominated sub-species *M. salinaria salinaria*, but is more frequent in the lower part of the Upper Norian.

Locality. In one slab together with *M. salinaria salinaria*, section Cheshme Bair Hill, Sinivir Formation, packet 26, eastern Stara Planina Mts. (fig. 2).

Notes on the presence of genus *Monotis* in eastern Stara Planina Mts.

For the first time the genus is mentioned by Berndt (1934) from the Upper Triassic of Bulgaria. He had found specimens of "*Monotis salinaria* Bronn", "*Monotis (inaequivalvis)* Bronn var. *salinaria* Tell.", "*Monotis salinaria* Bronn var." (= *Monotis inaequalvis* Bronn") in massive red

bioclastic limestones in the locality Orbitsite in the Rish pass, eastern Stara Planina Mts. In later publications different authors communicated 8-9 species of *Monotis* from calcareous blocks ("clips", "olistolites") from the vicinities of the town of Kotel. Only Kancev and Encheva (1967, p. 366) communicated *Monotis salinaria* (Schloth.) and *Pseudomonotis* cf. *subcircularis* Gabb. from the terrigenous rock of the "Black Flysch" (now Sinivir Fm.) found in the vicinities of the village of Turnak and the ex-village Zvezda (valley of Louda Kamchia River). Unfortunately only the taxons of *Monotis salinaria* and *M. haueri* of Entcheva & Kancev (1962) and Encheva (1972) are documented by text and figures. The presence of some discrepancies between the published and the original specimens, conserved in the Paleontologic Museum of the University of Sofia, does not allow, at least for the moment, a paleontologic revision of the specimens of genus *Monotis* in eastern Stara Planina Mts. and in Bulgaria.

The remains of *Monotis* were found on the upper surface of sandy beds, and all of the conserved valves are in unstable hydrodynamic position – with its inner concave side upwards to the next muddy bed. This position of the valves in the locality Cheshme Bair Hill suggests a free falling of the disintegrated valves on the floor in calm water conditions.

Belemnites. Many of the sandstones in the Sinivir Fm., predominantly the thicker one (fig. 2, 3), are composed of two distinct parts: basal, composed of biodetritus (bioclastic "limestones") and upper – of fine grained sandstones, horizontally laminated. In the biodetritic part of a sandstone bed, build of bivalves and brachiopods fragments, in the uppermost part of packet 38 (at 4 meters below the base of packet 39) (fig. 2), we collected two fragments of belemnites (Plate 3, fig. 1, 2). Primary they had been deposited in the shelf zone and latter transported and redeposited by strong bottom currents in the basin zone. During the transportation the belemnites had been fragmented. The belemnites fragments are indeterminable at generic and specific level, but after Prof. M. Vergilova, the eminent Bulgarian belemnite specialist (oral communication, August 2005) these two belemnites fragments are post-Triassic, probably Jurassic. The first occurrence of the belemnites fragments in the uppermost part of packet 38 is the reason to trace the boundary Triassic/Jurassic in the section of Cheshme Bair in packet 38 (fig. 2).

Foraminifers. In the sediments of the Glogova Fm. (figs. 2, 3) - alternation of ferriferous mudstones and silty and sandy peloidal limestones in the section of Cheshme Bair Hill (D. Ivanova in Budurov et al., 2004) the foraminifers *Agathammina austroalpina* Kristan-Tollmann & Tollmann (unit 7b), *Aulotortus friedly* (Kristan-

Tollmann) (units 1b, 2b, 15b), *Austrocolomia marshali* Oberhauser (unit 7b), *Endothyra keupperi* Oberhauser (unit 2b), *Grillina oberhauseri* (Sellier de Guvrieux & Dessauvagie) (unit 7b), *Gsollbergella spiroloculiformis* (Oravec-Scheffer) (units 2b, 9b), *Nodosaria cf. hoae* (Trifonova) (unit 4b, 7b), *N. ordinate* Trifonova (unit 7b), *Ophthalmidium exiguum* Koehn-Zaninetti (unit 2b, 11b), *Planiinvoluta multitalabulata* Kristan-Tollmann (unit 15b), *Pseudonodosaria cf. lata* (Tappan) (unit 15), *Trochamina balcanica* Trifonova (units 1b, 2b, 7b, 9b) were collected. The ranges of these foraminifers coincide with the Upper Triassic, but we are not able to delimitate the different stages. In unit 21 of the lower part of Sinivir Fm. (Yaneva, 2005; Yaneva et al., 2004) (which builds here the southern limb of the Cimmerian Matore planina anticline) the foraminifers are completely different (D. Ivanova in Budurov et al., 2004): *Involutina liassica* (Jones), *Trocholina cf. umbo* Frentzen, *Eophthalmidium leischneri* (Kristan-Tollmann); they have range in the Tethyan area - Late Triassic-Early Jurassic, with a maximum in the Early Jurassic. Taking into account that above them Middle Norian bivalves (*Monotis salinaria salinaria*, and *M. cf. salinaria hauri*) were found, here (in unit 21) the Late Triassic part of their range could be present. Higher in the section only undeterminable foraminifers were collected. In the sediments of the North flank of the Late Cimmerian Matore planina anticline, in the vicinity of the ex-village of Emirovo Trifonova (1990, p. 54-55) found an association of agglutinated foraminifers with sandy shell. This association is represented by (Plate 1, figs. 1 - 22): *Annulina metensis* Terquem, 1862, *Ammodiscus infimus* (Strickland, 1846), *A. varians* Kaptarenko-Tschernousova, 1959, *Hyperamminoides expansus elongates* Kristan-Tollmann, 1964, *Textularia haeusteri* Kaptarenko-Tschernousova, 1959, *Ammobaculites agglutinans* (d'Orbigny, 1846), *A. fontinensis* (Terquem, 1870), as well as *Pseudonodosaria* sp., *Dentalina cf. integra* (Kubler & Zwingli, 1870), *D. cf. oligostegia* Reuss, 1845. These foraminifer species are frequent in the Jurassic sediments of Europe and Russia, and this gave us the reason to report the sediments in which they were found – the upper parts of the Sinivir Fm. - to the Lower Jurassic (we are not able to precise the stages). A Lower Jurassic foraminifer association (determined also by E. Trifonova) was found also in the nearby Eleshnitsa River Valley (Kancev, 1995, p. 28-29) at the point situated to 150m northern from the source Iarmazkaya (to 400 m of the boundary Jurassic/Upper Cretaceous): *Ammobaculites agglutinans* (d'Orb.), *Dorothia cf. gradata* Berdh., *Ammodiscus infimus* Strickl., *Dentalina subtenicolis* Franke, *D. pseudocommunis* Franke, *D. cf. bamesteine* Tappan, *Pseudoglandulina vulgare* Borneman..

Spores and pollens. The spores and pollens were studied by Cernjavska in Tchoumatchenco &

Cernjavska (1989, 1990), by Cernjavska (1990) and by Cernjavska and Lachkar in Tchoumatchenco et al. (1992). The rocks of the Sinivir Fm., included as blocks in the Kotel Fm. in the vicinities of the town of Kotel, contains (Lachkar in Tchoumatchenco et al., 1992) *Aratrisporites minimus*, *Rhaetogonyaulax rhaetica*, *Chasmatosporites hians* – especially indicative is *Rhaetogonyaulax rhaetica* whose range coincides with Rhaetian and the Hettangian. Other rocks in the Sinivir Fm., also in allochthonous blocks, contain different spores of the genus *Concavisporites* and pollens *Spheripollenites subgranulatus*, *Chasmatosporites* spp., *Disaccites* div.gen. et sp. and *Classopollis* morphogroup, together with more rare miospores *Leptolepidites argenteaformis*, *Foraminisporis jurassicus*, *Duplexisporites* spp., *Cerebropollenites thiergarti*, *C. macroverrucosus*, *Quadraeculina annellaeformis*. The vertical distribution of these species coincides, after the Bulgarian palynological standard (Cernjavska, 1986) with the Acme-Sub-zone *Classopollis* of the *Cerebropollenites macroverrucosus-Trachysporites asper* Zone, corresponding approximately to Lower Pliensbachian. The upper part of the section of the Sinivir Fm. – in parautochthonous situation, is characterized by the presence of *Leptolepidites bossus*, *Ischyosporites variegates*, *Foraminisporites jurassicus*, *Concavisporites cf. toralis*, *Lycopodiumsporites gracilis* which indicate the presence of the *Ischyosporites variegates/Matonisporites crassiangularulatus* Biointerval Zone, coinciding in Bulgaria with the Upper Pliensbachian. The Lower Jurassic complex of the uppermost part of the Sinivir Fm. contains the first spores of *Staplinosporites* and the pollen *Calliasporites dampieri*, together with numerous grains of *Spheripollenites subgranulatus* which indicate the presence of the *Spheripollenites subgranulatus* Acme Zone (Cernjavska, 1986). To the present day the summary of the palynological data prove the presence in the Sinivir Fm. of the Rhaetian (?), Hettangian, Lower and Upper Pliensbachian and the Toarcian.

CONCLUSION

The ichnofossils collected from the Glogova and the Sinivir Formations – *Nereites* ichnofacies - proved that they were deposited in deep-sea conditions. The find of *Monotis salinaria salinaria* and *M. cf. salinaria hauri* shows that the lower part of the Sinivir Fm. is of Middle Norian age, and the find of belemnites higher in the section indicates that the boundary Triassic/Jurassic is, probably, within the packet 38 of the section in Cheshme Bair Hill. The collection of foraminifers and spores and pollens in the nearby outcrops of Sinivir Fm. - in the vicinities of the ex-village of Emirovo demonstrate also that the upper parts of the Sinivir Fm. are of Liassic (foraminifers), or Pliensbachian and Toarcian (spores and pollens) age. This is the first time when in Bulgaria it is possible to trace

bilaterally the proximate Triassic/Jurassic boundary in the conditions of progressive passage in deep-sea conditions. Future research must prove the existence or non-existence of connections to the east with the known in the literature (Gradinaru, 1984, 1988, 2000, etc.) Upper Triassic and Jurassic sediments from North Dobrogea.

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Plate Captions

PLATE 1

- Fig. 1, 2. *Ammodiscus infimus* (Strickland, 1846). Outcrop near the ex-village Emirovo, Burgas District; Sinivir Fm., upper part; Lower Jurassic, X 75
- Fig. 3, 4. *Annulina metensis* Terquem, 1862. *Ibid.*; X 75.
- Fig. 5, 6, 8, 9. *Ammobaculites agglutinans* (d'Orbigny, 1846); *Ibid.*, X 75.
- Fig. 7. *Ammobaculites fontinensis* (Terquem, 1870). *Ibid.*, X 75.
- Fig. 10, 11. *Hypermmminoides expansus elongates* Kristan-Tollman, 1964. *Ibid.*, X 75.
- Fig. 12-14. *Ammodiscus varians* Kaptarenko-Tchernousova, 1959. *Ibid.*, X 75.
- Fig. 15-19. *Textularia hauesleri* Kaptarenko-Tchernousova, 1959. *Ibid.*, X 75.
- Fig. 20. *Pseudonodosaria* sp. *Ibid.*, X 75.
- Fig. 21. *Dentalina* cf. *integra* (Kubler & Zwingli, 1870). *Ibid.*, X 75.
- Fig. 22. *Dentalina* cf. *oligostegia* Reuss, 1845. *Ibid.*, X 75.

PLATE 2

- Fig. 1. *Monotis* sp. cf. *Monotis salinaria haueri* Kittl, right valve, Sinivir Fm. packet 26, Cheshme Bair, Balaban Dere valley, Middle-Upper Norian.
- Fig. 2. *Monotis salinaria salinaria* (Schlotheim), left valve, Sinivir Fm. packet 26, Cheshme Bair, Balaban Dere valley, Middle-Upper Norian.
- Fig. 3. *Monotis salinaria salinaria* (Schlotheim), *ibid.*, Middle-Upper Norian, (plaster cast (positive) of fig. 2).
- Fig. 4. *Monotis salinaria salinaria* (Schlotheim), left valve, Sinivir Fm. packet 26, Cheshme Bair, Balaban Dere valley, Middle-Upper Norian.
- Fig. 5. *Monotis salinaria salinaria* (Schlotheim), *ibid.*, Middle-Upper Norian, (plaster cast (positive) of fig. 4).
- Fig. 6. *Monotis salinaria salinaria* (Schlotheim), left valve Sinivir Fm. packet 26, Cheshme Bair, Balaban Dere valley, Middle-Upper Norian.
- Fig. 7. *Monotis salinaria salinaria* (Schlotheim), *ibid.*, Middle-Upper Norian, (plaster cast (positive) of fig. 6).
- Fig. 8. *Monotis salinaria salinaria* (Schlotheim), left valve, Sinivir Fm. packet 26, Cheshme Bair, Balaban Dere valley, Middle-Upper Norian.
- Fig. 9. *Monotis salinaria salinaria* (Schlotheim), *ibid.*, Middle-Upper Norian, (plaster cast (positive) of fig. 8).

PLATE 3

- Fig. 1. *Belemnites* gen. & sp. indet. – Sinivir Fm., Cheshme Bair Hill, Balaban Dere valley, packet 38 (uppermost part), Lower Jurassic ?
- Fig. 2. *Belemnites* gen. & sp. Indet. *ibid.*, Lower Jurassic ?
- Fig. 3. Sinivir Fm., section Cheshme Bair Hill, Balaban Dere valley, packet 38 (uppermost part) with *Belemnites* gen. & sp. indet., field photograph.
- Fig. 4. *Nereites missouriensis* (Weller 1899); Sinivir Fm., Balaban Dere valley, packet 47, *Nereites* ichnofacies, Lower Jurassic, field photograph (diameter of the coin = 2 cm).
- Fig. 5. *Chondrites* cf. *intricatus* (Brongniart 1823); *ibid.*, field photograph (diameter of the coin = 2 cm).
- Fig. 6. *Paleodictyon (Glenodictyon) miocenicus* Sacco 1886; Sinivir Fm., Cheshme Bair Hill, Balaban Dere valley, packet 44.0, *Nereites* ichnofacies, Lower Jurassic, field photograph (the knife is 8 cm long).
- Fig. 7. *Arthropycus strictus* Ksiazkiewicz 1977, allochthonous block of Glogova Fm. (Norian?) included in the Kotel Fm. (Middle Jurassic); road cutting South of Kotel town.
- Fig. 8. *Arthropycus strictus* Ksiazkiewicz 1977; *ibid.*, detail of fig. 7.

PLATE 1

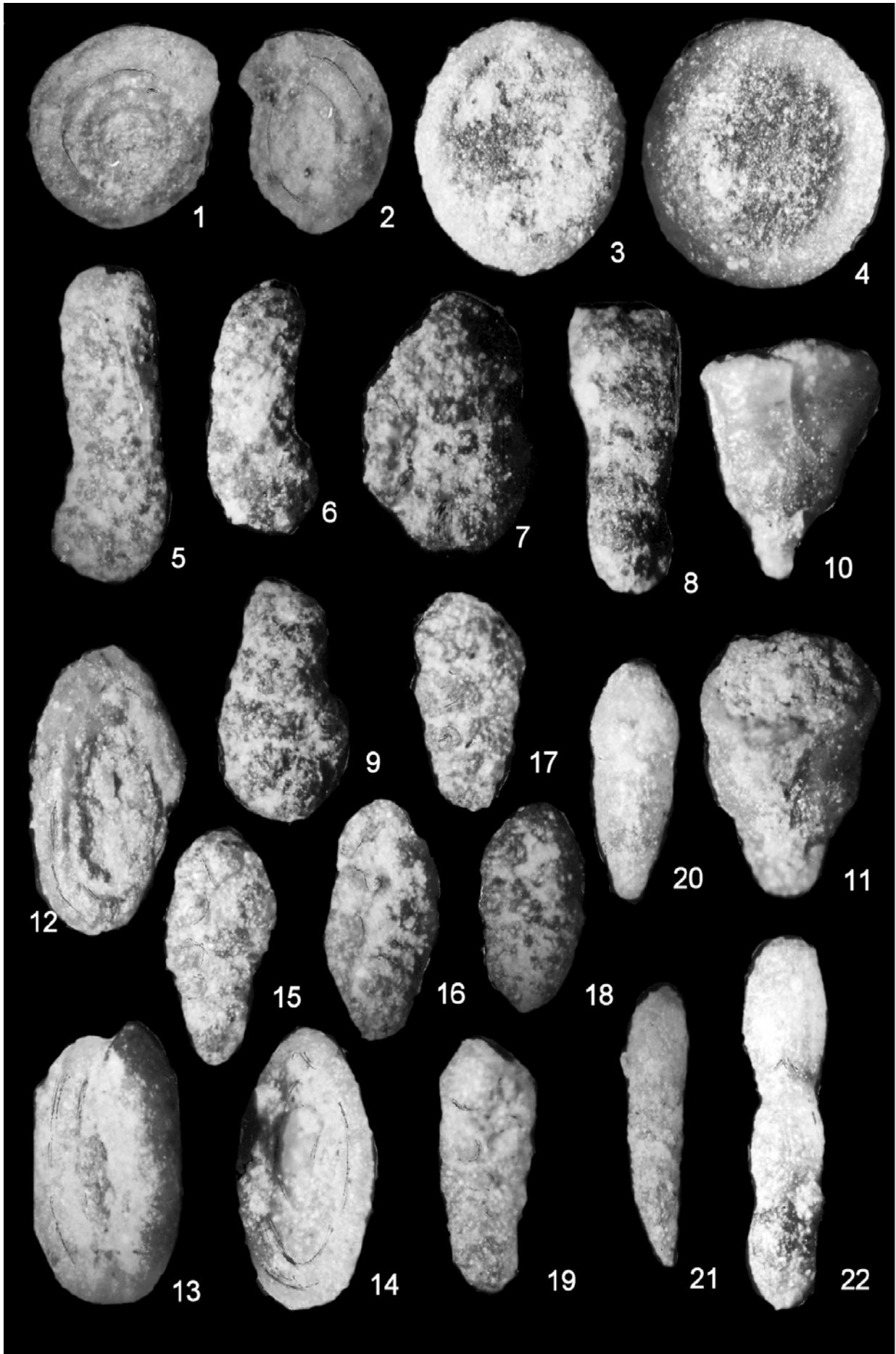


PLATE 2

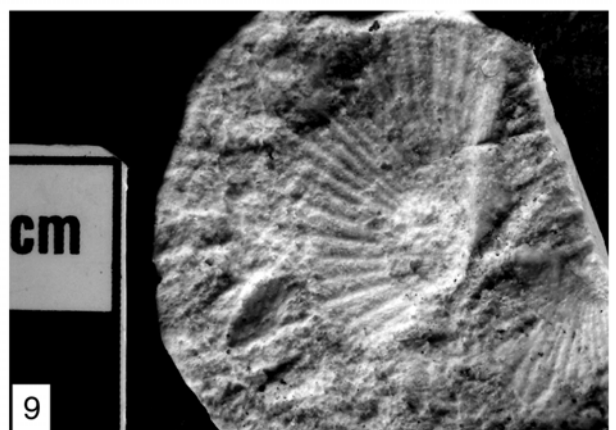
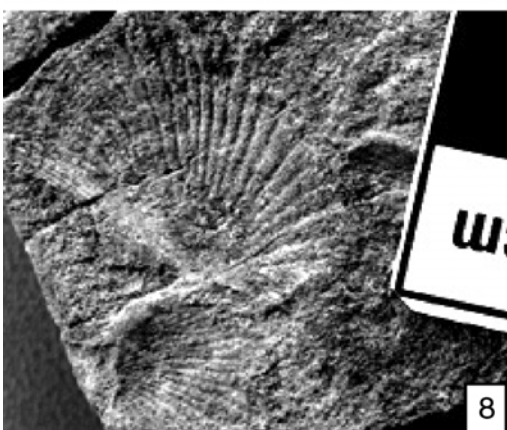
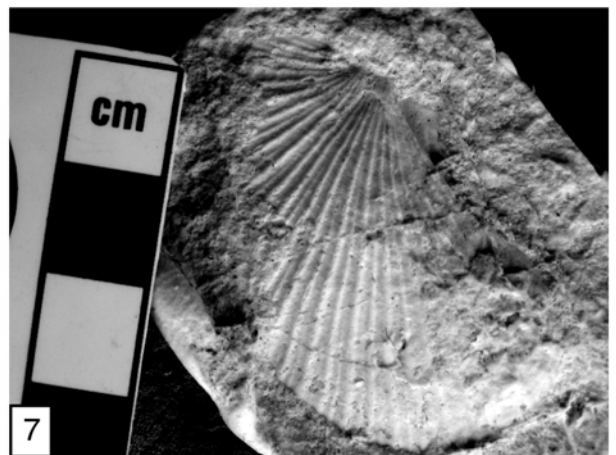
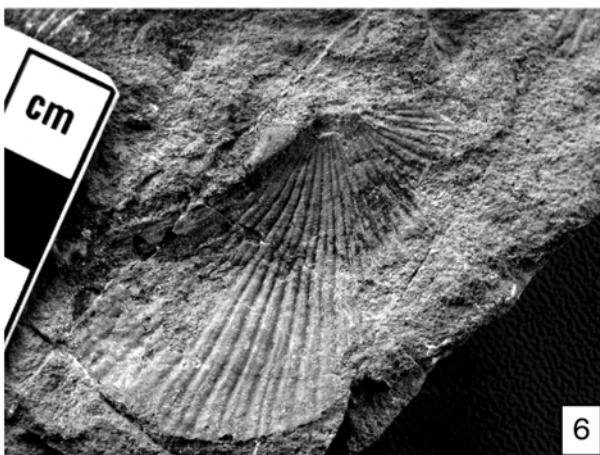
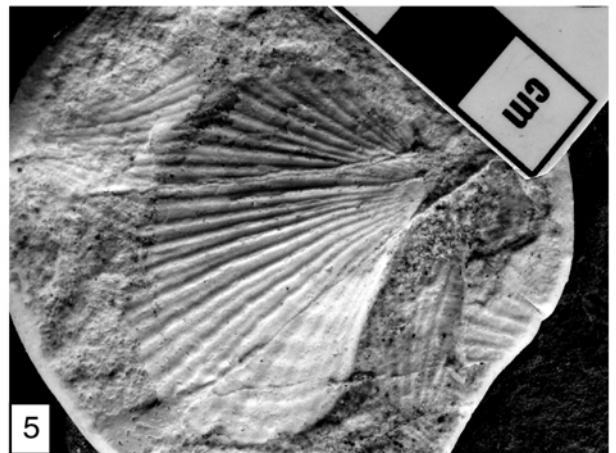
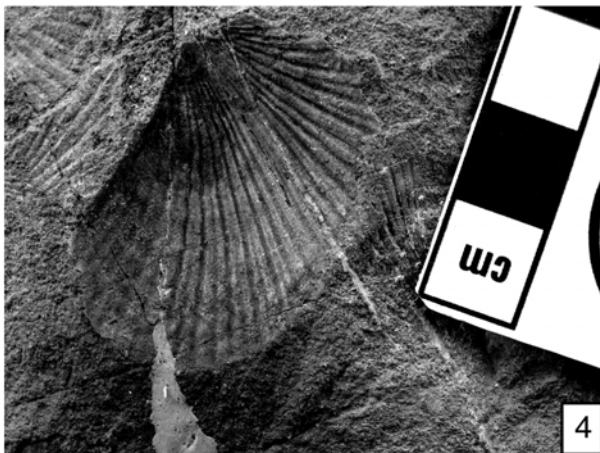
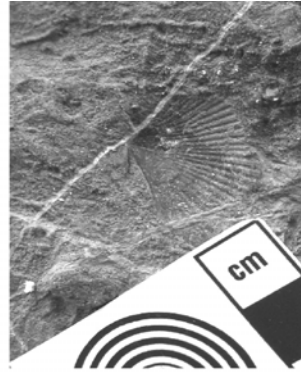
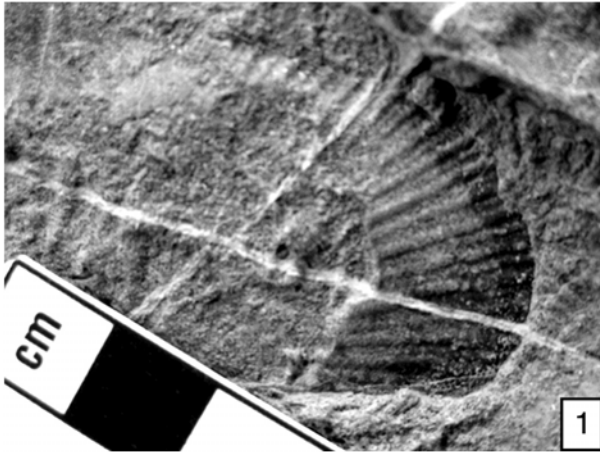
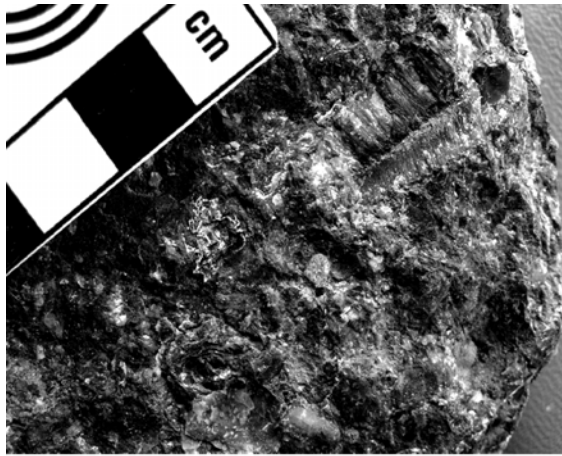
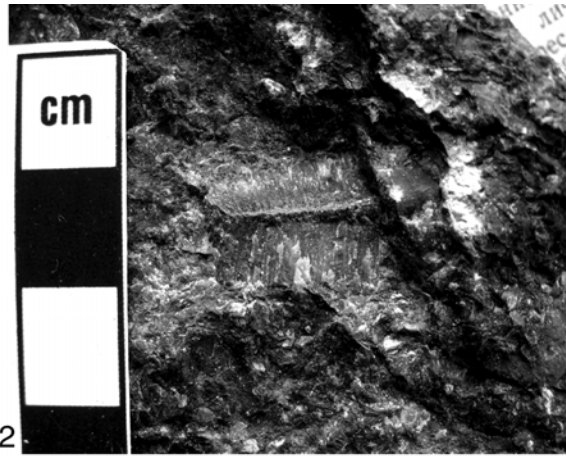


PLATE 3



1



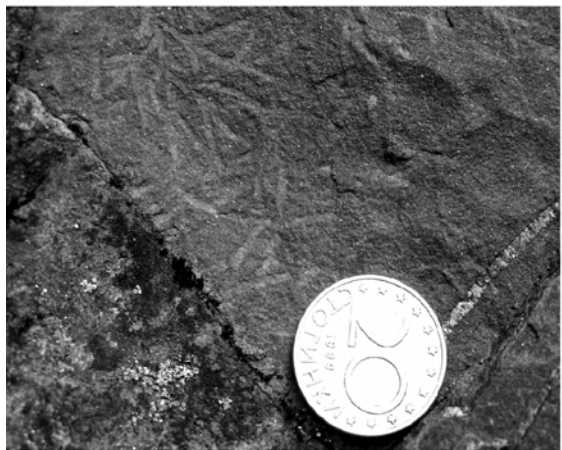
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