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Upper Permian ostracode assemblage from the Jadar Block (Vardar Zone, NW Serbia)

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Abstract. Ostracodes from the Changhsingian (latest Permian age) in the uppermost part of the "Bituminous Limestone" Formation of the Komirić Section in NW Serbia (Jadar Block, Vardar Zone) are described and illustrated. Three new species of ostracodes are introduced: *Basslerella jadarensis* n. sp., *Acratia serbianella* n. sp., and *Knoxiella vardarensis* n. sp. The ostracode assemblage, together with conodonts and foraminifers, is the first record of the youngest Late Permian age microfaunas from Serbia and from the central part of the Balkan Peninsula.

Key words: ostracodes, latest Permian (Changhsingian), taxonomy, stratigraphy, Vardar Zone, Jadar Block, NW Serbia.

Апстракт. У раду су приказани остракоди чангсјингског ката најгорњег перма из највиших делова формације „битуминозних кречњака" локалитета Комирић (СЗ Србија, Јадарски блок, Вардарска зона). Међу нађеним остракодима, утврђене су и описане три нове врсте: *Basslerella jadarensis* n. sp., *Acratia serbianella* n. sp. и *Knoxiella vardarensis* n. sp. Остракодска асоцијација, заједно са конодонтима и фораминиферима, представља први налаз микрофауне најмлађе горњопермске старости, како у Србији, тако и у централном делу Балканског полуострва.

Кључне речи: остракоди, највиши перм (чангсјингски кат), таксономија, стратиграфија, Вардарска зона, Јадарски блок, СЗ Србија.

Introduction

The Permian and Triassic deposits widely distributed in the Jadar Block area (NW Serbia) have been the subject of numerous geological investigations. Among these strata, sediments belonging to the Permian–Triassic (P–T) boundary interval, represented by shallow-water marine carbonates with different fossil associations and specific characteristics of the depositional environments, are unique in Serbia. They lack ammonoids, but diverse Upper Permian macro- and micro-assemblages (brachiopods, bivalves, gastropods, algae, foraminifers, *etc*.), and a poor Lower Triassic microfossil association (foraminifers, ostracodes) have been determined.

During long-term geological investigations, particularly in NW Serbia, the Serbian authors of this paper collected many samples for palaeontological and sedimentological analysis. The main interest was to confirm the presence of conodonts in Palaeozoic and Triassic sediments, especially in the P–T interval beds. Additionally, with these intensive geological studies of NW Serbia, the authors intended to document palaeontological, biostratigraphical, and sedimentological data in order to refine the existing lithostratigraphical definitions.

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These investigations resulted in several important papers on the Variscan and Early Alpine evolution of the Jadar Block (FILIPOVIĆ *et al*. 2003), Late Pennsylvanian conodont biostratigraphy and sedimentology (SUDAR *et al*. 2007b), Late Permian conodonts (SUDAR *et al*. 2007a), Late Permian foraminifers (NESTELL *et al*. 2009), and Early Viséan ammonoid fauna (KORN *et al*. 2010) during the last few years.

The current investigation represents a continuation of the above mentioned studies. In this paper, the Upper Permian ostracode fauna, not only from NW Serbia, but also from the whole of Serbia and the central part of the Balkan Peninsula is determined for the first time. From these regions, only PANTIĆ-PRODANOVIĆ (1979) mentioned "Campilian" ostracodes in the vicinity of Valjevo, and KRSTIĆ (1980) reported the ostracode fauna of the same age from the Gučevo Mt.

The ostracodes described and illustrated herein were found in samples taken from the Komirić section in the Vlašić Mt. region of NW Serbia. They occur together with conodonts and foraminifers in the uppermost part of the "Bituminous Limestone" Formation from the lower part of the section (SUDAR *et al*. 2007a, NESTELL *et al*. 2009).

Geological setting

The Jadar Block, situated at the southern margin of the Pannonian Basin, covers almost the whole area of NW Serbia and southern Srem (Vojvodina). Westwards, it extends beyond the Drina River to eastern Bosnia (Fig. 1A).

This tectonostratigraphic unit is today an exotic block terrane within the Vardar Zone. It is surrounded by the Vardar Zone Western Belt, except on the farthest south-eastern part where it is in direct contact with the Kopaonik Block and the Ridge Unit, which is also a part of the Vardar Zone (Fig. 1A). Unlike the Vardar Zone Western Belt, the absence of post-Early Jurassic sediments, ultramafites, ophiolitic mélange, and Cretaceous flysch development is evident in the Jadar Block (FILIPOVIĆ *et al.* 2003).

In the Jadar Block, the deposition occurred during the Variscan and Early Alpine evolution with a predomination of Dinaridic features. The later tectonic stage is characterized by sedimentation of Upper Permian and lowermost Triassic shallow-water marine carbonates, dolomites of Anisian age, "porphyrites" and pyroclastics of Ladinian age, platform-reefal limestones of Middle and Late Triassic age and their gradual transition into Lower Jurassic limestone.

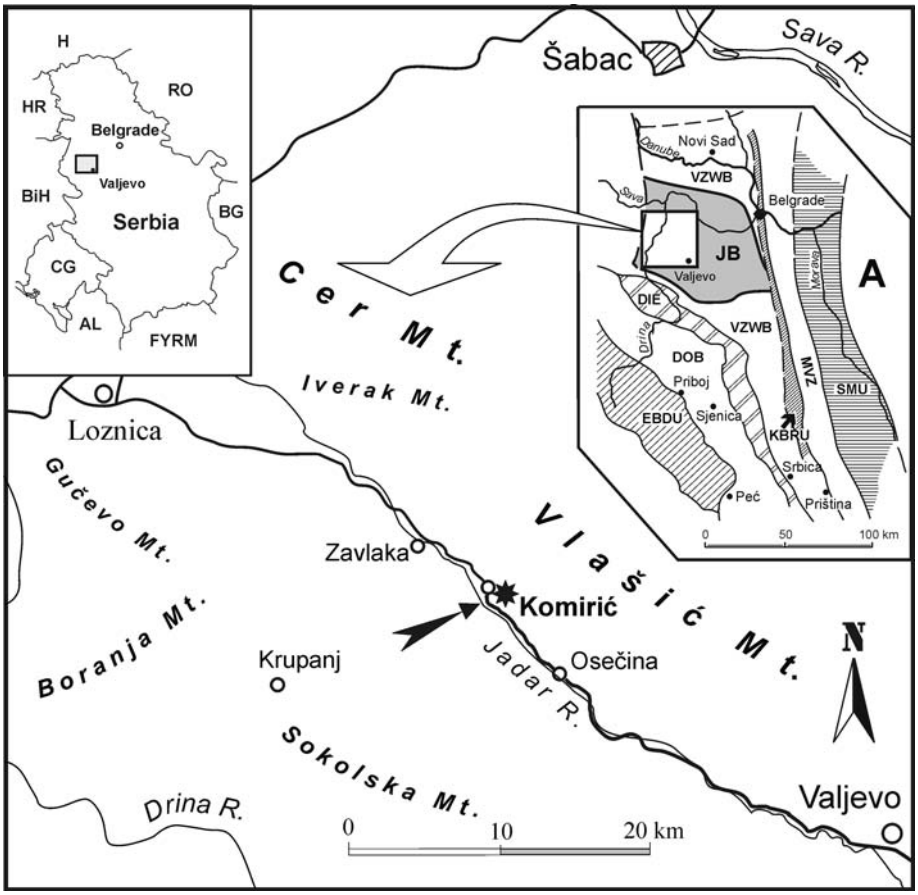

Fig. 1. Location maps of the Komirić Section in NW Serbia, Jadar Block, Vardar Zone (modified after SUDAR *et al*. 2007a). **A.** Terranes of a part of the Balkan Peninsula (KARAMATA *et al*. 2000; KARAMATA 2006): SMU – Serbian-Macedonian Unit; MVZ – Main Vardar Zone; KBRU – Kopaonik Block and Ridge Unit; VZWB – Vardar Zone Western Belt; JB – Jadar Block; DIE – Drina–Ivanjica Element; DOB – Dinaridic Ophiolite Belt; EBDU – East Bosnian–Durmitor Unit.

Komirić Section

The Komirić Section is located on the north side of the Valjevo–Loznica road, in the Komirić Village, on the southern slope of the Vlašić Mt. (GPS coordinates x 4918588, y 7985697, Fig. 1). About 78 m of marine carbonates of Late Permian and Early Triassic age are exposed in this site, but only 19 m of the column were sampled for microfauna. The lower part of the outcrop consists of 7 m dark grey and black, massive to thick-bedded bituminous bioclastic limestones belonging to the "Bituminous Limestone" Formation (Fig. 2). Abundant

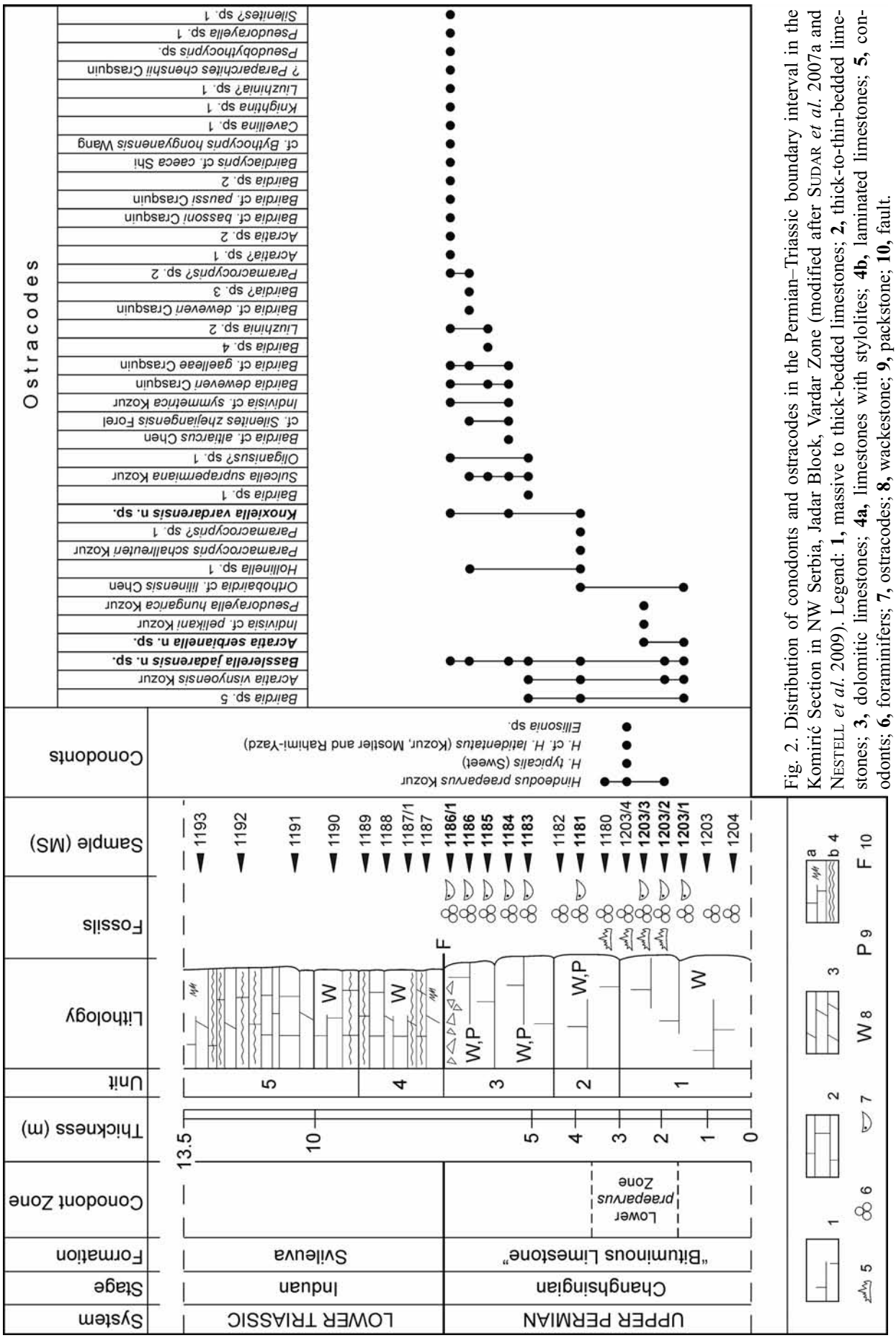

Fig. 2. Distribution of conodonts and ostracodes in the Permian–Triassic boundary interval in the Komirić Section in NW Serbia, Jadar Block, Vardar Zone (modified after SUDAR *et al*. 2007a and NESTELL *et al*. 2009). Legend: **1,** massive to thick-bedded limestones; **2,** thick-to-thin-bedded limestones; **3,** dolomitic limestones; **4a,** limestones with stylolites; **4b,** laminated limestones; **5,** conodonts; **6,** foraminifers; **7,** ostracodes; **8,** wackestone; **9,** packstone; **10,** fault.

foraminifers, algae, ostracodes, conodonts, holothurian sclerites, crinoids, echinoids, brachiopods, gastropods and ophiuroids occur. After a fault, marked with 15 cm-thick breccia, there are 12 m of the thick-to-thin bedded light grey and grey fine crystalline limestones (wackestones) with stylolites and laminae in certain levels. Occurrences of dolomitic limestones are less frequent. These latter limestones contain very rare indeterminable specimens of ostracodes, foraminifers and different parts of echinoids, and belong to the Svileuva Formation, which in Fig. 2 represent only 5.5 m of the column.

Ostracode fauna

Nine samples from the Changhsingian (Late Permian), processed for conodont study by 15–17 % acetic acid digestion, gave a poorly preserved ostracode fauna. However, it is the first time that ostracodes of this age have been discovered in Serbia and it is an important step in the knowledge of the distribution patterns of Upper Permian ostracodes.

Thirty eight species, including three new ones, belonging to 18 genera were distinguished: *Oliganisus*? sp. 1, *Knoxiella vardarensis* n. sp., *Indivisia* cf. *pelikani* KOZUR, 1985, *Indivisia* cf. *symmetrica* KOZUR, 1985, *Knightina* sp. 1, *Hollinella* sp. 1, ?*Paraparchites chenshii* CRASQUIN, 2010, *Bairdia deweveri* CRASQUIN, 2010, *Bairdia* cf *altiarcus* CHEN, 1958, *Bairdia* cf. *bassoni* CRASQUIN, 2010, *Bairdia* cf. *deweveri* CRASQUIN, 2010, *Bairdia* cf. *gaelleae* CRASQUIN, 2010, *Bairdia* cf. *paussi* CRASQUIN, 2010, *Bairdia* sp. 1, *Bairdia* sp. 2, *Bairdia*? sp. 3, *Bairdia* sp. 4, *Bairdia* sp. 5, *Orthobairdia* cf. *lilinensis* CHEN, 2002, cf. *Bythocypris hongyanensis* WANG, 1978, *Liuzhinia* sp. 2, *Liuzhinia*? sp. 1, *Paramacrocypris schallreuteri* KOZUR, 1985, *Paramacrocypris*? sp. 1, *Paramacrocypris*? sp. 2, *Pseudobythocypris* sp., *Bairdiacypris* cf. *caeca* SHI, 1987, *Pseudorayella hungarica* KOZUR, 1985, *Pseudorayella* sp. 1, cf. *Silenites zhejiangensis* FOREL, 2010, *Silenites*? sp. 1, *Acratia serbianella* n. sp., *Acratia visnyoensis* KOZUR, 1985, *Acratia*? sp. 1, *Acratia* sp. 2, *Basslerella jadarensis* n. sp., *Cavellina* sp. 1, and *Sulcella suprapermiana* KOZUR, 1985. Most are in open nomenclature due to their bad preservation and no internal features were observed. Only the new species are described. All the species are figured (Plates 1 and 2). The species distributions are given in Fig. 2.

The collection of ostracodes is deposited in Department of Palaeontology, Faculty of Mining and Geology, University of Belgrade, Belgrade, Serbia under the numbers from MS 1203/1.01 to MS 1186/1.61, corresponding to certain samples in the collection of MILAN SUDAR.

SEM photographs were prepared at the Pierre et Marie Curie University, Micropaleontology Laboratory (Paris).

Abbreviations: L2: median lobe; S2: median sulcus; L3: posterior lobe; DB: dorsal border; AB: anterior border; VB: ventral border; PB: posterior border.

Class Ostracoda LATREILLE, 1806
Subclass Podocopa MÜLLER, 1894
Order Palaeocopida HENNINGSMOEN, 1953
Suborder Kloedenellocopina SCOTT, 1961
Superfamily Kloedenelloidea ULRICH & BASSLER, 1908
Family Geisinidae SOHN, 1961

Genus ***Knoxiella*** EGEROV, 1950
Type species. *Knoxiella semilukiana* EGEROV, 1950

Knoxiella vardarensis n. sp.
Pl. 1, figs. 3–6

Derivation of the name. From the Vardar Zone, where the Jadar Block and the type locality are located.

Holotype. One complete male carapace figured on Pl. 1, fig. 3; collection number MS 1181.21.

Paratype. One complete male carapace figured on Pl. 1, fig. 4, collection number MS 1186/1.39.

Type locality. Komirić Section, Komirić Village, southern slope of the Vlašić Mt., NW Serbia.

Type level. Bed 2, sample MS 1181, 3.80 m at the base of the "Bituminous Limestone" Formation exposed in the Komirić Section, uppermost Permian, Changhsingian.

Material. 3 complete and 1 broken carapaces.

Diagnosis. A species of *Knoxiella* with a blade ridge on L3.

Description. Carapace subrectangular with straight DB; AB regularly rounded with maximum curvature located at mid height; VB regularly rounded; PB with medium radius of curvature and maximum convexity located at the upper third of height; ACA = 140–145°; PCA= 130–135°; free margins flattened; L2 poorly expressed; S2 deep, with lower part located between upper third and mid height; L3 large and clearly marked with a ridge in blade form on the dorsal part, its upper part extends beyond DB; maximum of height located between the anterior third and mid length; no secondary ornamentation observed. Sexual dimorphism expressed by a thickening of posterior part of the carapace in heteromorphs. RV overlaps slightly LV on free margins

Remarks. *Knoxiella vardarensis* n. sp. has the same outline as *Knoxiella infirma* SHI, 1982 from the Late Permian of South China and Turkey (CHEN & SHI 1982; CRASQUIN-SOLEAU *et al*. 2004). Here, the free margins are more flattened and there is a ridge on the dorsal part of L3. A similar ridge is present in some *Sargentina* species, such as *Sargentina pamucakensis* CRASQUIN-SOLEAU, 2004 or *Sargentina transita* (KOZUR, 1985), but the overlap, of course, differs completely between *Knoxiella* and *Sargentina*.

Size. L = 450–575 μm, H = 285–325 μm.

Occurrence. Latest Permian, Changhsingian, uppermost part of the "Bituminous Limestone" Formation; Komirić Section, Jadar Block, Vardar Zone, NW Serbia; samples MS 1181, MS 1184, and MS 1186/1 (see Fig. 2).

Order Podocopida MÜLLER, 1894
Suborder Podocopina SARS, 1866
Superfamily Bairdioidea SARS, 1887
Family Acratiidae GRÜNDEL, 1962

Genus ***Acratia*** DELO, 1930
Type species. *Acratia typica* DELO, 1930

Acratia serbianella n. sp.
Pl. 2, figs. 10–13

?2004 *Acratia* n. sp. 1. - CRASQUIN-SOLEAU, S., MARCOUX, J., ANGIOLINI, L., RICHOZ , S., NICORA, A., BAUD, A. & BERTHO, Y, p. 286, pl. 3, figs. 25–26.

Derivation of the name. From Serbia, where the type locality is located.

Holotype. One complete carapace figured on Pl. 2, fig. 10; collection number MS 1203/1.09.

Paratype. One complete carapace figured on Pl. 2, fig. 11, collection number MS 1203/1.10.

Type locality. Komirić Section, Komirić Village, southern slope of the Vlašić Mt., NW Serbia.

Type level. Bed 1, sample MS 1181, 1.5 m at the base of the "Bituminous Limestone" Formation exposed in the Komirić Section, uppermost Permian, Changhsingian.

Material. 4 carapaces.

Diagnosis. An elongated species of *Acratia* with a reversed overlap and a large radius of curvature at AB.

Description. Carapace elongated (H/L = 0.33–0.38); RV overlaps LV; overlap weak all around the carapace with the maximum at VB; AB with quite large radius of curvature for the genus; AVB straight and horizontal; acratian beak clear but not pronounced; VB slightly convex to straight on the RV, straight to gently concave on the LV; PB tapering; PDV and ADB straight on both valves; carapace thin, biconvex with a maximum of width at mid L.

Remarks. *Acratia symmetrica* HAO, 1992 and *Macrocypris* cf. *menardensis* HARLTON *sensu* SHI & CHEN, 1987 have the same reversed overlap but have a different outline. *Acratia oliverifera* CHEN *sensu* HAO, 1994 (the species figured by HAO (1994) is not *A. oliverifera* CHEN, 1958) has a similar outline but here the acratian beak is less pronounced. *Acratina goemoeryi* KOZUR, 1970 from the Upper Anisian is the closest species but has a straighter DB and a smaller radius of curvature at AB. *Acratia* n. sp. 1 *sensu* CRASQUIN *et al*. 2004 from the Upper Permian of Turkey (Western Taurus) is questionably included in the new species. The uncertainty comes from the fact that the Turkish specimens are not so well preserved.

Size. L = 660–730 μm, H = 260–280 μm.

Occurrence. ? Late Permian, Wuchiapingian, Pamucak Formation, Cürük dağ section, Western Taurus, Turkey; latest Permian, Changhsingian, uppermost part of the "Bituminous Limestone" Formation, Komirić Section; Jadar Block, Vardar Zone, NW Serbia; samples MS 1203/1 and MS 1203/3 (see Fig. 2).

Superfamily Cytheroidea BAIRD, 1850
Family Cytherideidae SARS, 1925

Genus ***Basslerella*** KELLETT, 1935
Type species. *Basslerella crassa* KELLETT, 1935

Basslerella jadarensis n. sp.
Pl. 2, figs. 20–24

Derivation of the name. From the Jadar Block (NW Serbia) where the type locality is located.

Holotype. One complete carapace figured on Pl. 2, fig. 20; collection number MS 1203/1.05.

Paratype. One complete carapace figured on Pl. 2, fig. 21, collection number MS 1203/2.13.

Type locality. Komirić Section, Komirić Village, southern slope of the Vlašić Mt., NW Serbia.

Type level. Bed 1, sample MS 1203/1, 1.5 m at the base of the "Bituminous Limestone" Formation exposed in the Komirić Section, uppermost Permian, Changhsingian.

Material. 12 complete carapaces and 1 broken one.

Diagnosis. A species of *Basslerella* with a relatively high carapace (H/L = 0.72), small radius of curvature at AB and straight DB.

Description. Carapace relatively high (H/L = 0.72); DB straight at RV and convex at LV; AB rounded with a quite small radius of curvature and a maximum convexity located at the lower third of H; VB nearly straight; PB relatively angular with postero-dorsal part quite vertical; maximum H located a little anterior of mid-L; LV overlaps RV all around the carapace; dorsal view biconvex with a maximum thickness located in the posterior part.

Remarks. *Basslerella annesophieae* CRASQUIN, 2010 from the Early–Late Permian of South China and South Alps is quite close to the new species but has an AB with a larger radius of curvature.

Basslerella firma KELLETT, 1935 and *B. obesa* KELLETT, 1935 from the Early Permian of Kansas (USA; KELLETT 1935) both have a more elongate carapace (H/L = 0.60) and a more narrowly rounded AB.

Size. L = 315–675 μm, H = 235–425 μm (Fig. 3).

Occurrence. Latest Permian, Changhsingian, uppermost part of the "Bituminous Limestone" Formation; Komirić Section, Jadar Block, Vardar Zone, NW Ser-

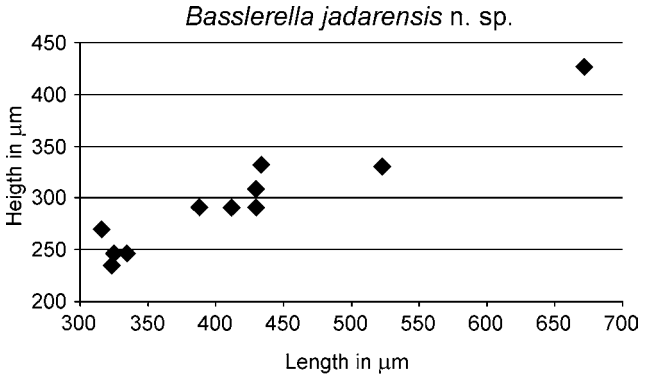

Fig. 3. Height/length diagram of *Basslerella jadarensis* n. sp.

bia; samples MS 1203/1, MS 1203/2, MS 1181, MS 1183, MS 1184, MS 1186/1 and MS 1203/3 (see Fig. 2).

Comments on the ostracode fauna

Three species present here are known in other areas.

Acratia visnyoensis KOZUR, 1985 is known in the Wuchiapingian, the late Permian of the Bükk Mountains in Hungary (KOZUR 1985), in the Wordian–Wuchiapingian of western Taurus, Turkey, (CRASQUIN-SOLEAU *et al.* 2004) and in the Changhsingian, Late Permian of the Meishan Section, Zhejiang Province, South China.

Bairdia deweveri CRASQUIN, 2010 occurs in the late Changhsingian of the Dolomites, Italy (CRASQUIN *et al*. 2008) and of the Meishan Section, South China (CRASQUIN *et al*. 2010).

?*Paraparchites chenshii* CRASQUIN, 2010 is known from the latest Changhsingian of the Meishan Section in South China (CRASQUIN *et al*. 2010). The presence of these three common species demonstrates the palaeobiogeographical links between south-eastern, central and northern parts of the Palaeo–Tethys during the Late Permian.

Ostracodes are predominantly benthic inhabitants and, therefore, reflect sea-floor conditions. Different families had specific palaeoecological preferences. All the forms recognized here are characteristic of intertropical warm waters. Almost all specimens are represented by closed carapaces. This indicates limited transport and/or burial in a soft substratum (OERTLI 1971). Such preferences of the Late Palaeozoic–Early Triassic ostracode families may be summarized as follow (LETHIERS 1982; MELNYK & MADDOCKS 1988):

– internal zone with variations of palaeoenvironmental conditions (bathymetry, salinity), Kloedenelloidea, Kirkbyoidea, Hollinoidea (group 3 in Fig. 4);

– median zone with euryhaline environments in shallow to very shallow waters: Paraparchidoidea, Cytherideidae, Cavellinoinidae (group 2 in Fig. 4);

– external zone, open carbonate environments with normal salinity: Bairdioidea (group 1 in Fig. 4).

The respective percentages of the three groups are presented in Fig. 4. This representation shows that all the assemblages analysed here are, on the whole, typical of a platform environment with a depth of less than 50–100 m. Four levels contain ostracode assemblages that group three families, which testify to a more internal zone (samples MS 1203/1, MS 1181, MS 1184 and MS 1186/1).

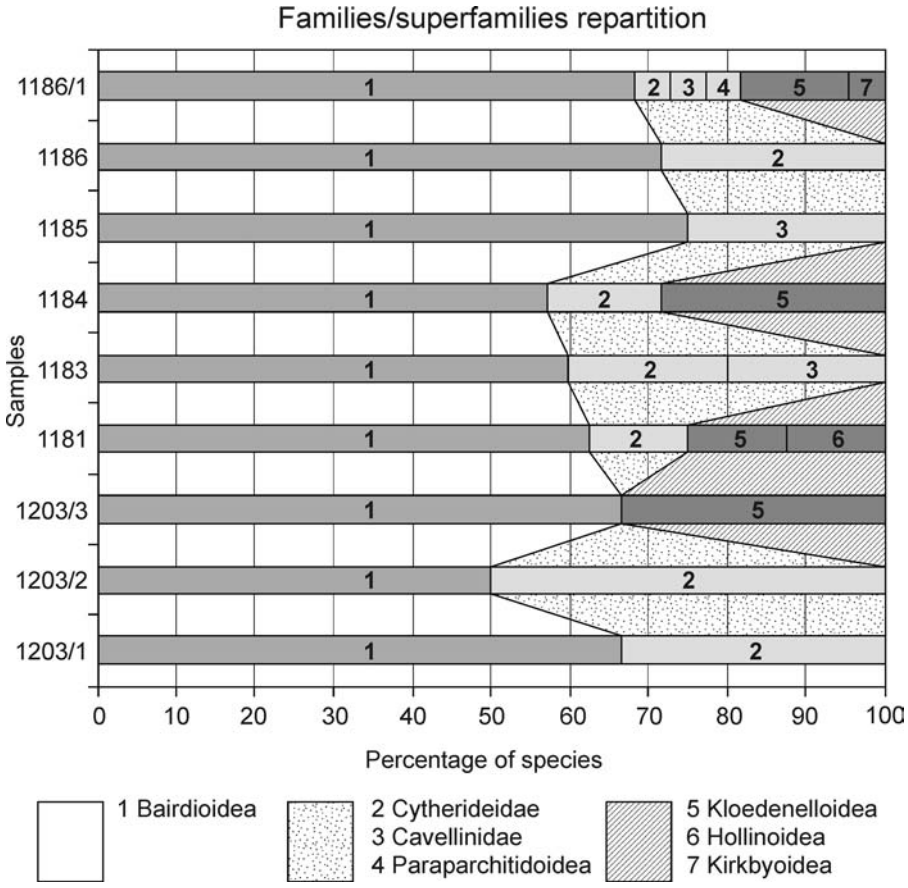

Fig. 4. Repartition of families and/or superfamilies in the samples. Three groups are distinguished, related to their palaeoecological affinities, from distal (1), median (2) and proximal (3) zones.

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Резиме

Горњопермски остракоди Јадарског блока (Вардарска зона, СЗ Србија)

Међу седиментима пермске и тријаске старости, веома распрострањеним у области Јадарског блока (СЗ Србија), нарочито су интересантни они који припадају граничном интервалу перм–тријас (P–T). Представљени су плитководним маринским карбонатима у којима су присутне специфичне асоцијације фосила јединствене у Србији. Амонити нису нађени, али стене обилују различитим горњопермским макро и микроасоцијацијама (брахиоподи, шкољке, пужеви, алге, фораминифери и др.), док су микрофосилне асоцијације доњотријаске старости сиромашне, и углавном су представљене фораминиферима и остракодима.

Један од локалитета на ком су опробовани и детаљно палеонтолошки, биостратиграфски и седиментолошки обрађени седименти P–T интервала је у селу Комирић. Стуб се налази на северној страни пута Ваљево–Лозница, на јужним падинама планине Влашић (x 4918588, y 7985697). Дебљине је око 78 m, али је само 19 m узорковано због микрофауне. У доњем делу стуба дебљине 7 m су тамно сиви и црни, дебело слојевити до масивни биокластични кречњаци формације „битуминозних кречњака“ горњег перма. Обилују фораминиферима, алгама, остракодима, конодонтима, криноидима, ехиноидима и др. Следи расед маркиран бречом дебљине 15 cm, па 12 m сивих дебело до танко услојених, спорадично ламинираних финокристаластих кречњака са стилолитима (wackestones) и са ретким неодредљивим остракодима као и фораминиферима доњотријаске старости формације Свилеуве.

Стуб је у почетној фази истраживан ради одређивања конодоната карактеристичних за P–T интервал. Каснијим изучавањима нађена је фораминиферска и остракодска фауна горњопермске старости. Налазак остракода, и других наведених микрофосила, из горњег перма на овим просторима је јединствен у целој Србији као и у централном делу Балканског полуострва.

Последњим истраживањима утврђено је 38 врста остракода (међу њима су 3 нове) које су сврстане у 18 родова. Како су детерминисани облици углавном лоше очувани, у раду су описане само нове врсте: *Knoxiella vardarensis* n. sp., *Acratia serbianella* n. sp. и *Basslerella jadarensis* n. sp. Три врсте: *Acratia visnyoensis* KOZUR, *Bairdia deweveri* CRASQUIN и ?*Paraparchites chenshii* CRASQUIN су познате и у другим областима а представљају палеобиогеографску везу са југоисточним, централним и северним деловима Палеотетиса током најмлађег перма. Испитивани остракоди су преовлађујуће бентоски организми, карактеристични

за међутропске топле воде, и представљени су примерцима са затвореним капцима. То упућује на закључак да су кратко транспортовани и/или су били похрањени у мекој подлози. Испитиване горњопермске-доњотријаске остракодске фамилије се могу сврстати у: *интерну зону* променљивих услова палеосредине (дубина, салинитет) којој припадају: Kloedenelloidea, Kirkbyoidea, Hollinoidea (група 3 на сл. 4), *средњу зону* еухалинске средине плитких до врло плитких вода (Paraparchitidea, Cytherideidae, Cavellinoidea, група 2 на сл. 4) и *екстерну зону* отворено карбонатне средине нормалног салинитета (Bairdiidae, група 1 на сл. 4). Анализирајући све три групе у целини сматра се да су типичне за платформну средину дубине мање од 50–100 m.

PLATE 1

Ostracodes from the Komirić Section, Jadar Block, Vardar Zone, NW Serbia; uppermost part of the "Bituminous Limestone" Formation, uppermost Permian, Changhsingian. Scale bars represent 100 μm.

Figs. 1, 2. *Oliganisus*? sp. 1. 1. Left lateral view of a complete carapace; MS 1183.25. 2. Right ateral view of a complete carapace; MS 1186/1.41.

Figs. 3–6. *Knoxiella vardarensis* n. sp. 3. Holotype, left lateral view of a complete carapace; MS 1181.21. 4. Paratype, left lateral view of a complete carapace; MS 1186/1.39. 5. Left lateral view of a complete carapace; MS 1184.27. 6. Left lateral view of a broken carapace; MS 1186/1.40.

Fig. 7. *Indivisia* cf. *symmetrica* KOZUR, 1985. Left lateral view of a complete carapace; MS 1186/1.42.

Fig. 8. *Indivisia* cf. *pelikani* KOZUR, 1985. Left lateral view of a complete carapace; MS 1203/3.14.

Fig. 9. *Knightina*. sp. 1. Left lateral view of a complete carapace; MS 1186/1.55.

Figs. 10, 11. *Hollinella* sp.10. Left lateral view of a damaged carapace; MS 1186.35. 11. Left lateral view of a damaged carapace; MS 1181.18.

Fig. 12. ?*Paraparchites chenshii* CRASQUIN, 2010. Left lateral view of a complete carapace; MS 1186/1.57.

Fig. 13. *Bairdia* cf. *altiarcus* CHEN, 1958. Right lateral view of a complete carapace; MS 1184.28.

Fig. 14. *Bairdia* cf. *bassoni* CRASQUIN, 2010. Right lateral view of a complete carapace; MS 1186/1.49.

Fig. 15. *Bairdia* cf. *deweveri* CRASQUIN, 2010. Right lateral view of a complete carapace; MS 1186.37.

Figs. 16, 17. *Bairdia* cf. *gaelleae* CRASQUIN, 2010. 16. Right lateral view of a complete carapace; MS 1186/1.45. 17. Right lateral view of a broken carapace; MS 1184.32.

Fig. 18. *Orthobairdia* cf. *lilinensis* CHEN, 2002 (in SHI & CHEN, 2002). Right lateral view of a damaged carapace; MS 1181.17.

Fig. 19. *Bairdia* cf. *paussi* CRASQUIN, 2010. Right lateral view of a complete carapace; MS 1186/1.50.

Figs. 20–22. *Bairdia deweveri* CRASQUIN, 2010. 20. Right lateral view of a quite complete carapace; MS 1186/1.43. 21. Right lateral view of a broken carapace; MS 1186/1.44. 22. Right lateral view of a complete carapace; MS 1184.31.

Fig. 23. *Bairdia* sp. 1. Right lateral view of a complete carapace; MS 1183.22.

Fig. 24. *Bairdia* sp. 2. Right lateral view of a complete carapace; MS 1186/1.51.

Fig. 25. *Bairdia*? sp. 3. Right lateral view of a complete carapace; MS 1186.38.

Fig. 26. *Bairdia* sp. 4. Right lateral view of a broken carapace; MS 1185.33.

Fig. 27. *Bairdia* sp. 5. Right lateral view of a complete carapace; MS 1181.16.

Fig. 28. cf. *Bythocypris hongyanensis* WANG, 1978. Right lateral view of a complete carapace; MS 1186/1.53.

Fig. 29. *Liuzhinia* sp. 2. Right lateral view of a complete carapace; MS 1185.34.

Fig. 30. *Liuzhinia*? sp. 1. Left lateral view of a complete carapace; MS 1186/1.56.

Fig. 31. *Paramacrocypris schallreuteri* KOZUR, 1985. Right lateral view of a damaged carapace; MS 1181.19.

Fig. 32. *Paramacrocypris*? sp. 1. Right lateral view of a complete carapace; MS 1181.20.

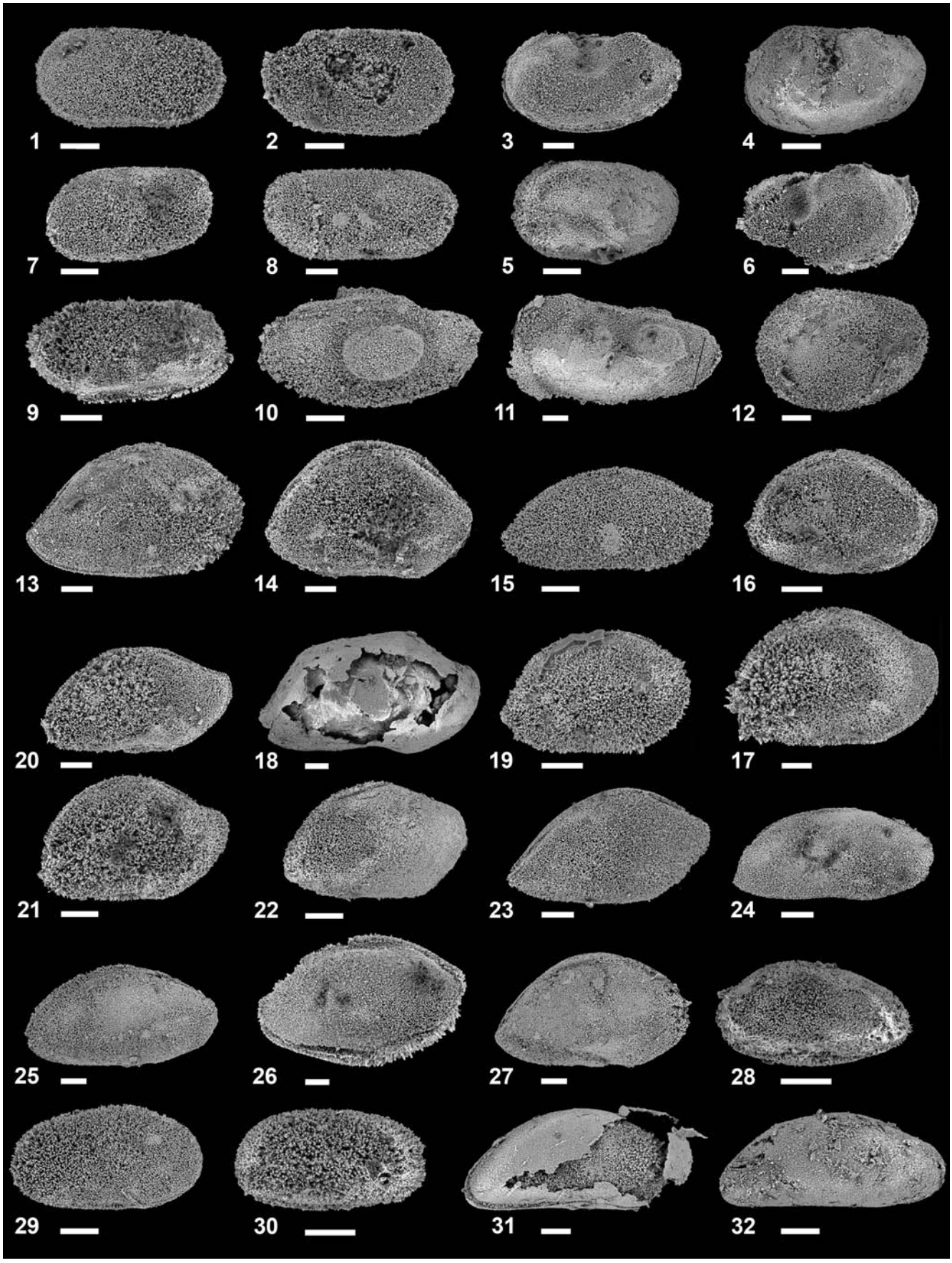
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PLATE 2

Ostracodes from the Komirić Section, Jadar Block, Vardar Zone, NW Serbia; uppermost part of the "Bituminous Limestone" Formation, uppermost Permian, Changhsingian. Scale bars represent 100 μm.

Fig. 1. *Paramacrocypris*? sp. 2. Right lateral view of a complete carapace; MS 1186/1.46.

Fig. 2. *Pseudobythocypris* sp. Right lateral view of a complete carapace; MS 1186/1.58.

Fig. 3. *Bairdiacypris* cf. *caeca* SHI, 1987. Right lateral view of a complete carapace; MS 1186/1.52.

Fig. 4. *Pseudorayella hungarica* KOZUR, 1985. Right lateral view of a complete carapace; MS 1203/3.15.

Figs. 5, 6. *Pseudorayella* sp. 1. 5. Right lateral view of a complete carapace; MS 1186/1.59. 6. Right lateral view of a complete carapace; MS 1186/1.60.

Figs. 7, 8. cf. *Silenites zhejiangensis* FOREL, 2010 (in CRASQUIN *et al*. 2010). 7. Right lateral view of a complete carapace; MS 1184.29. 8. Right lateral view of a complete carapace; MS 1184.30.

Fig. 9. *Silenites*? sp. 1. Right lateral view of a complete carapace; MS 1186/1.61.

Figs. 10–13. *Acratia serbianella* n. sp. 10. Holotype, left lateral view of a complete carapace; MS 1203/1.09. 11. Paratype, right lateral view of a complete carapace; MS 1203/1.10. 12. Right lateral view of a complete carapace; MS 1203/1.11. 13. Dorsal view of a complete carapace; MS 1203/1.12.

Figs. 14–17. *Acratia visnyoensis* KOZUR, 1985. 14. Left lateral view of a complete carapace; MS 1203/1.01. 15. Left lateral view of a complete carapace; MS 1203/1.02. 16. Dorsal view of a complete carapace; MS 1203/1.03. 17. Dorsal view of a complete carapace; MS 1203/1.04.

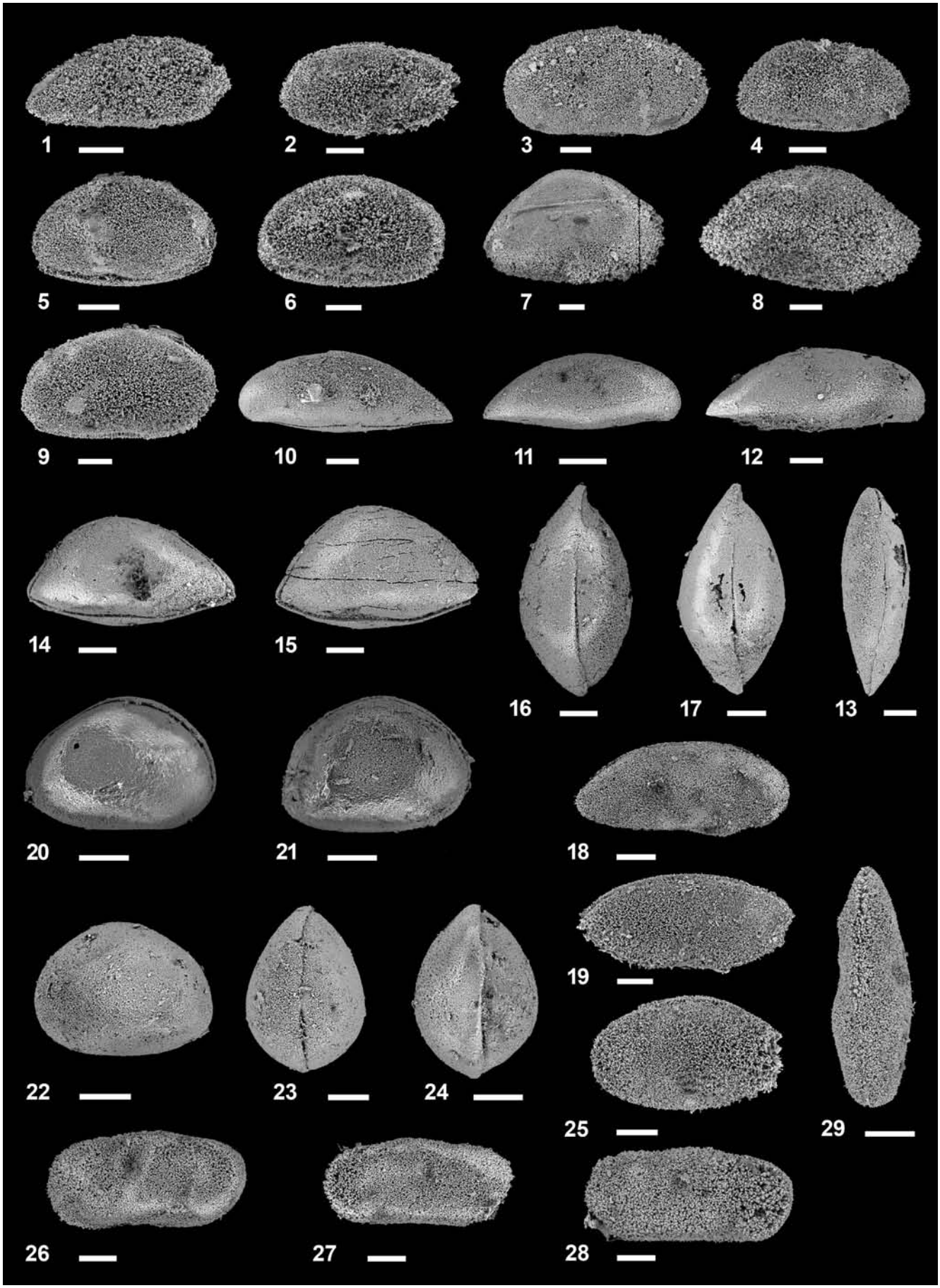
Fig. 18. *Acratia*? sp. 1. Right lateral view of a complete carapace; MS 1186/1.47.

Fig. 19. *Acratia* sp. 2. Right lateral view of a broken carapace; MS 1186/1.48.

Figs. 20–24. *Basslerella jadarensis* n. sp. 20. Holotype, right lateral view of a complete carapace; MS 1203/1.05. 21. Paratype, right lateral view of a complete carapace; MS 1203/2.13. 22. Left lateral view of a complete carapace; MS 1203/1.06. 23. Dorsal view of a complete carapace; MS 1203/1.07. 24. Dorsal view of a complete carapace; MS 1203/1.08.

Fig. 25. *Cavellina* sp. 1. Left lateral view of a complete carapace; MS 1186/1.54.

Figs. 26–29. *Sulcella suprapermiana* KOZUR, 1985. 26. Left lateral view of a complete carapace; MS 1184.26. 27. Left lateral view of a complete carapace; MS 1183.23. 28. Right lateral view of a complete carapace; MS 1186.36. 29. Dorsal view of a complete carapace; MS 1183.24.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