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New Beetles (Insecta, Coleoptera) from the Nedubrovo Locality, Terminal Permian or Basal Triassic of European Russia

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Abstract—Recently collected fossil remains of Asiocoleidae, Taldycupedidae, Schizocoleidae, and Permosynidae, Cupedidoidea incertae familiae are described from the Nedubrovo locality (terminal Permian or basal Triassic of European Russia). The beetles are represented by isolated elytra and their position in the natural system often cannot be established; they are therefore described in the formal system. Schizicoleids are dominant in the oryctocoenosis. Permosynids, which codomitated with schizocoleids at the end of the Permian (Upper Vyatkian), are no longer codominant in this locality. Cupedidoidea are unexpectedly abundant; their elytra are very similar to those described from the Severodvinian locality Isady.

Keywords: Coleoptera, Permian, Triassic, the European Russia, Permian–Triassic crisis

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INTRODUCTION

The locality of fossil animals and plants Nedubrovo was discovered recently, but has already attracted much attention from paleontologists and stratigraphers. It is situated in Nedubrovo village, Kich-Gorodetskii District, Vologda Region, on the left bank of the Kichmenga River (left-bank tributary of the Yug River). The deposits of this locality were believed to represent the lower part of the Astashikha Member of the Vokhma Formation, i.e., basal Triassic deposits (Lozovsky et al., 2001). However, the results of the first studies on fossil plants of this locality immediately showed that most of these plants were Permian rather than Triassic (Krassilov et al., 1999; Karasev and Krassilov, 2010). Subsequently, these deposits were considered transitional Permian–Triassic (Lozovsky et al., 2001) and then, more recently, Permian (Lozovsky and Korchagin, 2013; Aristov et al., 2013).

The collection amassed by expeditions of the Arthropoda Laboratory, Borissiak Paleontological Institute, Russian Academy of Sciences (PIN), in 1999, 2007, and 2011 comprises about 200 specimens. Representatives of eight insect orders have been collected: Psocoptera, Hemiptera, Palaeomanteida, Coleoptera, Panorpida, Blattida, Grylloblattida, and Orthoptera. The dominants are Hemiptera (25%) and Blattida (21%), followed by the less abundant Grylloblattida (17%), Panorpida (14%), and Coleoptera (14%). Psocoptera, Palaeomanteida, and Orthoptera are rather scant. Because of the considerable level of diversity, a large part of the collection has not yet been processed. A study of the family-level diversity of insects (Aristov et al., 2013) has revealed that the intermediate aspect of this diversity, which includes both Permian and Triassic forms, with Permian forms dominant in some groups and Triassic forms dominant in others. Compared to other deposits with intermediate insect assemblages (intertrappean deposits in the Tunguska Basin and the Babii Kamen' locality in the Kuznetsk Basin), the Nedubrovo assemblage includes a somewhat greater proportion of insects of mostly Permian connections. More recently, most paleoentomologists tend date these localities as Permian. Assessment of localities of the intermediate assemblage is strongly hindered by the almost complete lack of insect fossils known from the Lower Triassic: only three Lower Triassic localities are known worldwide (Entala, Zalazna, and Tikhvinskoe), and the number of fossils collected in these localities is extremely small. Representatives of 21 insect families have been found to date in Nedubrovo; all these families appeared in the Permian. The latest known representatives of three families have been recorded in this locality; the latest representatives of five families have been recorded in both Nedubrovo and the intertrappean deposits of the Tunguska Basin; 13 families are also known from the Mesozoic; and none of the records from Nedubrovo is the earliest known record of any family. Thus, analysis of the composition of insect families collected in Nedubrovo has revealed no specific connections of these families with Triassic insects, while all these families existed in the Permian and a third of them are known only from localities with

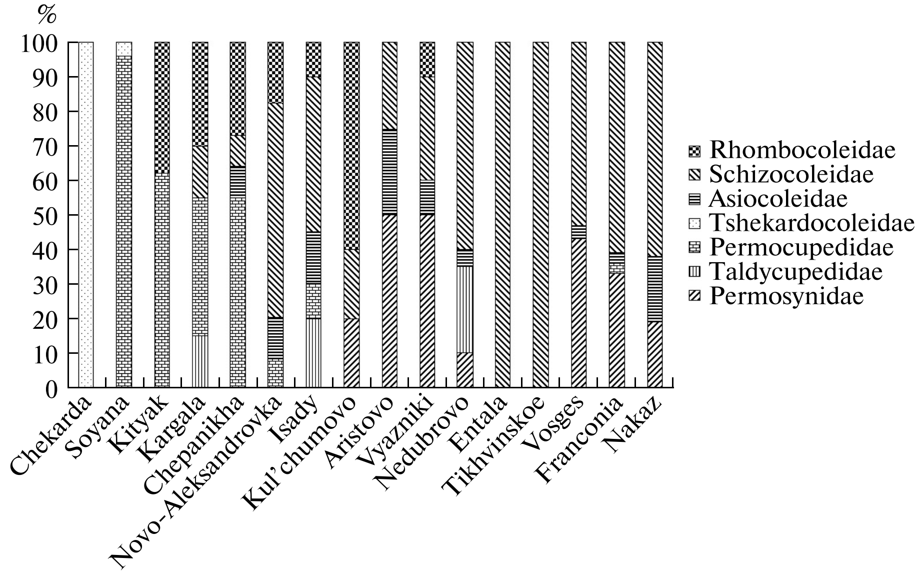


Fig. 1. Changes in compositions of beetle elytra in oryctocenoses of European localities from the terminal Lower Permian to the middle of the Triassic. It can be seen that the Nedubrovo oryctocenosis has a composition transitional between those of Permian and Triassic localities, but visibly closer to the Permian type.

intermediate faunas. In addition to insects, fossils collected in Nedubrovo include many disperse phytoleims, megaspores, miospores, ostracodes, fishes, and the labyrinthodont *Tupilakosaurus*.

The purpose of this study was to analyze the fossil remains of beetles (Coleoptera) collected in Nedubrovo. All these fossils are fragmentary and have been affected by considerable transfer. They are very small (usually about 1 mm), which is typical of intermediate localities, and therefore had to be studied under an electron microscope: details of their morphology cannot be discerned with certainty under a light microscope. A total of 21 specimens of the 23 specimens collected have been examined; two specimens are abdominal segments and cannot be identified. The identifiable specimens represent four families, five or six genera, and eight or nine species; i.e., one species is represented on average by 2.5 specimens. This average value gives evidence of a rather low diversity, lower than usual in the Permian, but probably higher than in the Early Triassic. Families are represented in the following proportions: Schizocoleidae 62%, Taldycupedidae 25%, Permosynidae 9%, and Asiocoleidae 4% (Fig. 1). All families are also known from earlier Vyatkian localities, but only the formal family Schizocoleidae is also known from Lower Triassic localities. Permosynids are dominant in Upper Vyatkian localities, whereas in Nedubrovo they are the second least abundant family. Thus, the beetles of Nedubrovo also demonstrate mostly Permian connections, but at the same time they display some Early Triassic features: compared to Vyatkian deposits, the beetles are approximately half as big, the proportion of schizophoroids is higher, and the proportion of permosynids is lower. The most abundant genus is *Pseudochrysomelites* Handlirsch, 1906, especially typical of the Early Triassic, but occurring also in the Permian.

SYSTEMATIC PALEONTOLOGY

Superfamily Cupedidoidea Laporte, 1836

Cupedidoidea incertae familiae

Several specimens of beetles with cellulate elytra have been described from the Severodvinian locality Isady and assigned to the genus *Simmondsia* Dunstan, 1924 of the family Taldycupedidae Rohdendorf, 1961, because they had no additional short rows of cells at the base of the cubital space, and the main and intermediate longitudinal veins were almost equal in thickness. The beetles were very small (their elytron length was little more than 2 mm) and had wide bodies, atypical of cupedoids. Similar elytra have also been found in Nedubrovo, but in these elytra the difference in thickness between main and intermediate veins is much more pronounced, and the size is even smaller. Based on the difference in thickness between main and intermediate veins, formally they should belong to the family Cupedidae Laporte, 1836. The elytra of the other species of the genus *Simmondsia*, both the type species from the Triassic of Australia and the second species from the Upper Permian of the Kuznetsk Basin, are elongate and dissimilar from the elytra collected in Isady and Nedubrovo. It is possible that the elytra from Isady and Nedubrovo represent a separate taxon. The situation is further complicated by the elytra collected in the Anisian of Franconia, very similar in size and shape, with the main and intermediate veins clearly different, but also with additional rows of small cells clearly visible at the base of the elytron. Therefore, it appears best to describe for the cupedoid elytra from Isady and Nedubrovo a special genus in Cupedidoidea incertae familiae.

Genus *Proterocupes* Ponomarenko, gen. nov.

Etymology. From the Latinized Greek *proteros* (former) and the generic name *Cupes*.

Type genus. *Simmondsia permiana* Ponomarenko, 2004, Severodvinian Substage, Isady.

Diagnosis. Small beetles. Elytron convex basally and flattened apically, wide. Main and intermediate veins rather similar; intermediate veins straight; all veins reaching apical part of elytron independently (*Moltenocupes* morphotype). Elytron medially with ten rows of rounded rectangular cells. Cells surrounded with rounded tubercles; identical tubercles set in two or three rows on narrow epipleural rim.

Species composition. Type species and two new species from Nedubrovo.

Comparison. The new genus differs from all other members of the superfamily in the small size and wide elytra. It differs from permocupedids and most taldycupedids in the absence of shortened cell rows at the base of the elytron.

Proterocupes nedubrovensis Ponomarenko, sp. nov.

Plate 8, figs. 1–3

Etymology. From the Nedubrovo locality.

Holotype. PIN, no. 4811/64, part and counterpart of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

Description (Fig. 2). Small beetle. The elytron is strongly convex, 2.5–3 times as long as wide, strongly dilated from the base to the middle, narrowed in the apical third, with the apex symmetrical. The epipleural rim is rather narrow. The cells are rounded tetragonal, rarely almost oval, much wider than the veins, arranged in ten rows on each elytron. The main veins are slightly wider than the intermediate veins.

Measurements, mm. Elytron length, 1.3–1.5; elytron width, 0.5–0.6.

Comparison. The new species differs from all congeners in the very small size and in the elytral cells visibly elongate longitudinally.

Material. In addition to holotype, isolated elytra PIN, nos. 4811/65, 66, and 68 from the same locality.

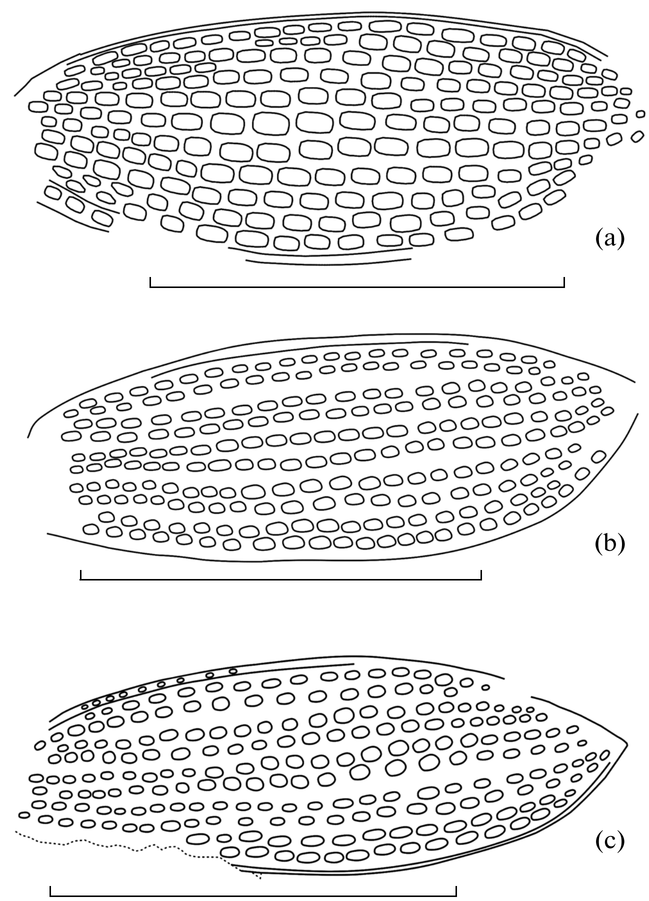


Fig. 2. *Proterocupes nedubrovensis* sp. nov.: (a) holotype PIN, no. 4811/64; (b) paratype PIN, no. 4811/65; (c) paratype PIN, no. 4811/66; Nedubrovo. Scale bars in Figs. 2–14, 1 mm.

Proterocupes major Ponomarenko, sp. nov.

Plate 8, fig. 4

Etymology. The Latin *major* (greater).

Holotype. PIN, no. 4811/67, part and counterpart of right elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

Description (Fig. 3). Small beetle. The elytron is wide, almost not dilated from the base to the middle, narrowed in the apical third. The epipleural rim is rather wide, bears several rows of large tubercles. The cells are almost square, much wider than the veins, arranged in ten rows on each elytron. The main veins are visibly wider than the intermediate veins.

Measurements, mm. Elytron length, about 5; width, 1.6.

Comparison. The new species is distinguished by the size, very large for this genus, and by the almost square cells on the elytron.

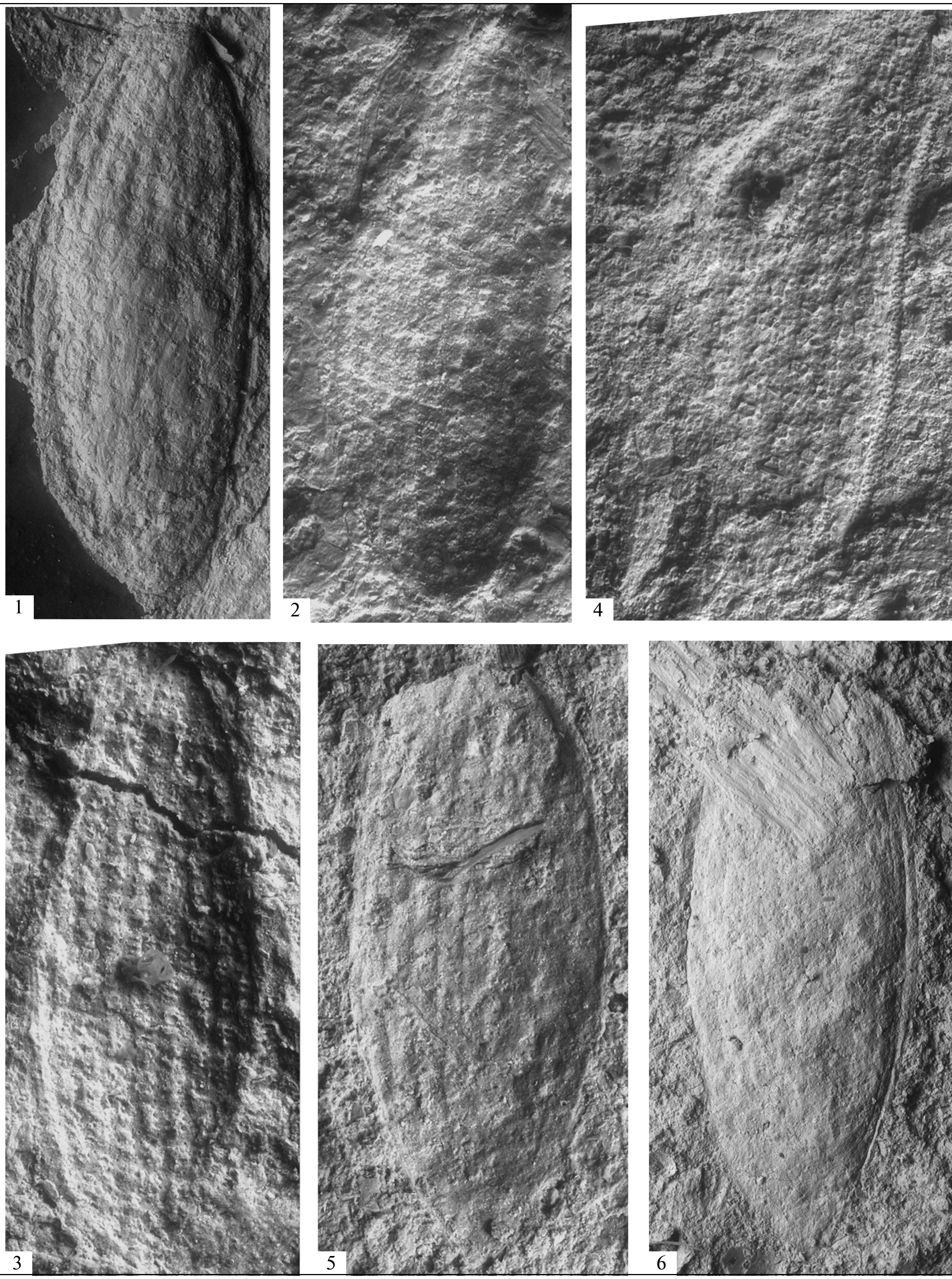
Material. Holotype.

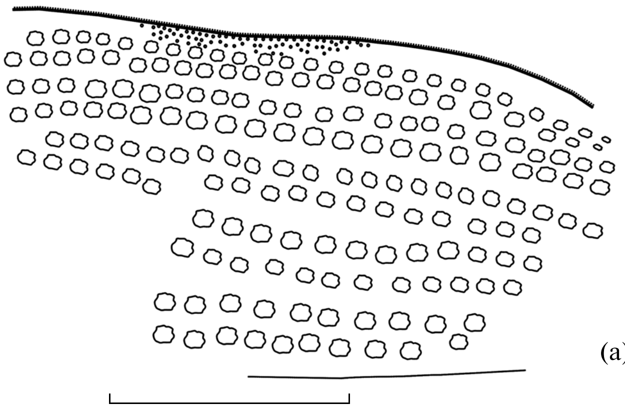
Family Permosynidae Tillyard, 1924

Genus *Artematopodites* Ponomarenko, 1990

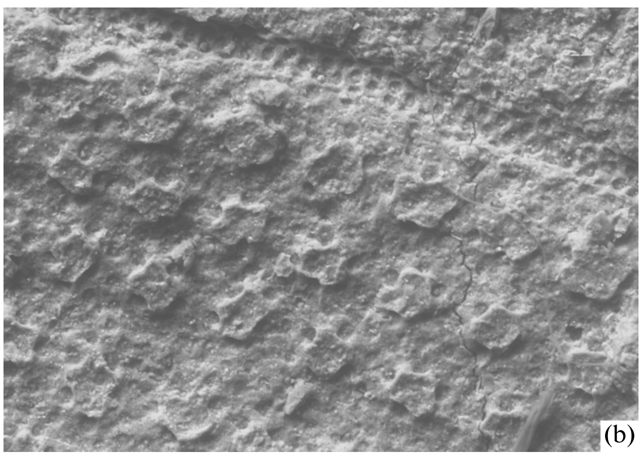
The genus was described as a formal taxon for isolated elytra with such grooves that the second and third grooves from the sutural margin wedge out near the

Plate 8





(a)



(b)

Fig. 3. *Proterocupes major* sp. nov., holotype PIN, no. 4811/67: (a) habitus; (b) area on anterior margin of elytron; Nedubrovo.

elytral apex between the first and fourth grooves. Elytra with this sculpture are abundant in the Middle to Upper Triassic and in the Jurassic and rare in the Lower Cretaceous. Very few of them have been described. This elytral sculpture is found in Triassic and Jurassic beetles of the families Ademosynidae and Lasiosynidae. Among extant beetles, similar elytral sculpture is found in some species of the families Artematopodidae and Throscidae. Such elytra are described here from the Permian for the first time. They have not been found among permosynids from either earlier localities or the Lower Triassic, but they are common in localities with entomofauna of the "intermediate type," in the Tunguska and Kuznetsk basins.

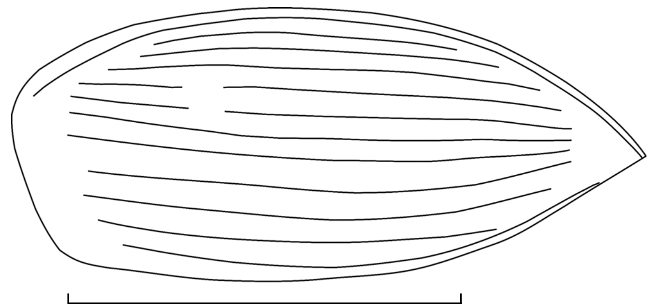


Fig. 4. *Artematopodites lozowskii* sp. nov., holotype PIN, no. 4811/192; Nedubrovo.

***Artematopodites lozowskii* Ponomarenko sp. nov.**

Plate 8, fig. 5

E t y m o l o g y. In honor of the eminent geologist V.R. Lozovsky, who has contributed considerably to the study of the Nedubrovo locality.

H o l o t y p e. PIN, no. 4811/192, part and counterpart of right elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 4). The elytron is convex, rather wide, 2.5 times as long as wide, roundly narrowed behind the middle, with the base convex, apically acute and symmetrical. The epipleural rim is not wide. The elytral grooves are narrow, impunctate; the spaces between the grooves are wide, flat. The first groove from the suture reaches almost until the very apex, the second until the apical third, and the third slightly farther. The other grooves run independently towards the external margin of the elytron in its apical part. The scutellar groove is absent.

M e a s u r e m e n t s, mm. Elytron length, 1.2; width, 0.6.

C o m p a r i s o n. The new species differs from all described congeners in the very small size. It is especially similar to *A. latus* Ponomarenko, 1990 and differs from it in the less shortened grooves.

M a t e r i a l. Holotype.

Genus *Dinoharpalus* Handlirsch, 1906

Dinoharpalus, the only available generic name for fossil elytra with more than 11 grooves, was proposed by Handlirsch (1906) for *Harpalus liasinus* Giebel, 1856 from the Lower Jurassic of England, because it clearly could not belong to a beetle of the genus *Harpalus*.

E x p l a n a t i o n o f P l a t e 8

Figs. 1–3. *Proterocupes nedubrovensis* sp. nov.: (1) holotype PIN, no. 4811/64, ×82; (2) paratype PIN, no. 4811/65, ×71; (3) paratype PIN, no. 4811/66, ×73; Nedubrovo.

Fig. 4. *Proterocupes major* sp. nov., holotype PIN, no. 4811/67, ×50; Nedubrovo.

Fig. 5. *Artematopodites lozowskii* sp. nov., holotype PIN, no. 4811/192, ×69; Nedubrovo.

Fig. 6. *Dinoharpalus latus* sp. nov., holotype PIN, no. 4811/193, ×45; Nedubrovo.

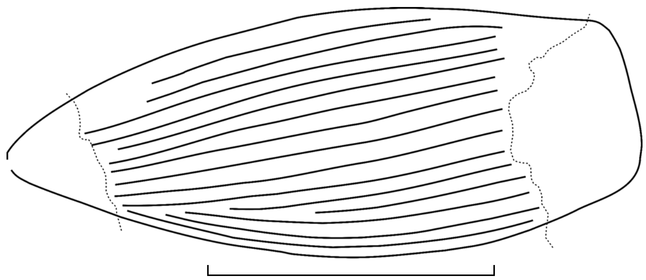


Fig. 5. *Dinoharpalus latus* sp. nov., holotype PIN, no. 4811/193; Nedubrovo.

Elytron of this type is for the first time recorded here from the Permian; such elytra are rare in the Mesozoic and rare among extant beetles. Some beetles of the family Coptoclavidae had elytra with many grooves. The elytron described below strongly differs from Mesozoic forms. It is very small, rather wide, and obviously could not belong to a beetle of the same natural genus as the Mesozoic forms, but in the formal system such assignment does not seem impossible.

Dinoharpalus latus Ponomarenko, sp. nov.

Plate 8, fig. 6

E t y m o l o g y. The Latin *latus* (wide, broad).

H o l o t y p e. PIN, no. 4811/193, left elytron without base; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 5). The elytron is weakly convex, wide, estimated 2.5 times as long as wide, dilated from the base to the basal third, gradually narrowed distal of the middle, with the sutural margin rimmed and the apex acute and almost symmetrical. The epipleural rim is absent. The elytron bears 15 longitudinal grooves; the grooves are fine; the spaces between them are flat. The shortened groove is absent. Most grooves run towards the sutural margin of the elytron in its apical part. The first groove from the suture runs along the suture until the apical quarter, where it meets the sixth groove; the second and third grooves are shorter than the first groove; the fourth groove ends blindly approximately in the middle of the elytron; the fifth groove is slightly longer.

M e a s u r e m e n t s, mm. Length, 2.24; width, 0.9.

C o m p a r i s o n. The new genus strongly differs from all described congeners in the small size, wide elytron, and pattern of grooves in the scutellar part of the elytron.

R e m a r k s. The base of the elytron has not been preserved, so that the scutellar groove is not visible.

M a t e r i a l. Holotype.

Family Asiocoleidae Rohdendorf, 1961
= Tricoleidae Ponomarenko, 1969, syn. nov.

The beetles described below have shown such a considerable diversity of venation that the hiatus between Asiocoleidae Rohdendorf, 1961 and Tricoleidae Ponomarenko, 1969 became insufficient for treating them as separate families. The family name Tricoleidae Ponomarenko, 1969 should be considered a junior subjective synonym of Asiocoleidae Rohdendorf, 1961.

Genus *Tetracoleus* Ponomarenko, 2009

The genus was described from the Triassic of the northern Cis-Uralia; two more species from the Upper Vyatkian localities Vyazniki (Ponomarenko, 2011) and Aristovo (Ponomarenko, 2013) were later assigned to this genus. Judging by the photograph provided by G. Beattie (pers. comm.), a similar elytron has been collected in the Late Permian Newcastle Group of Australia. That elytron probably does not belong to the same species as the specimens from Vyazniki and Aristovo. The species described below is placed in this genus because of the many cells (up to six rows) in some the elytral spaces.

Tetracoleus golubevi Ponomarenko, sp. nov.

Plate 9, fig. 1

E t y m o l o g y. In honor of the paleontologist V.K. Golubev, one of the organizers of complex studies of Permian–Triassic localities of European Russia.

H o l o t y p e. PIN, no. 4811/191, part and counterpart of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 6). The elytron is elongate, 3.5 times as long as wide, weakly dilated from the base,

E x p l a n a t i o n o f P l a t e 9

Fig. 1. *Tetracoleus golubevi* sp. nov., holotype PIN, no. 4811/191, ×34; Nedubrovo.

Fig. 2. *Uskatocoleus hirsutus* sp. nov., holotype PIN, no. 4811/194: (2a) habitus, ×51.4; (2b) part of elytron, ×257; Nedubrovo.

Figs. 3–5. *Uskatocoleus minor* sp. nov.: (3) holotype PIN, no. 4811/70, ×54.1; (4) paratype PIN, no. 4811/73, ×53.8; (5) paratype PIN, no. 4811/124, ×60; Nedubrovo.

Fig. 6. *Uskatocoleus artus* sp. nov., holotype PIN, no. 4811/63, ×48.7; Nedubrovo.

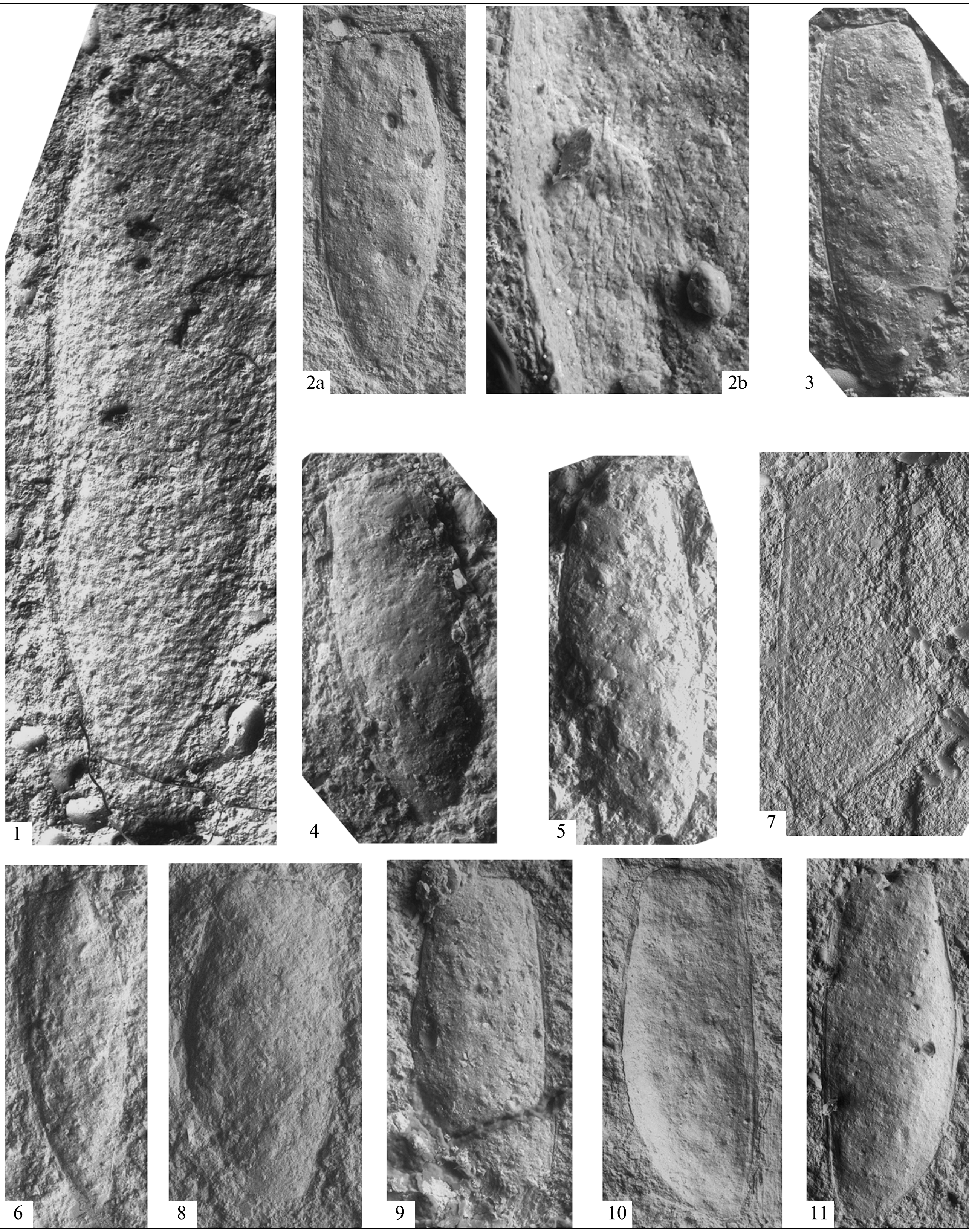
Fig. 7. *Pseudochrysomelites latus* (Ponomarenko, 2004), specimen PIN, no. 4811/51, ×17.8; Nedubrovo.

Fig. 8. *Pseudochrysomelites latissimus* sp. nov., holotype PIN, no. 4811/50, ×70.7; Nedubrovo.

Fig. 9. *Pseudochrysomelites convexus* sp. nov., holotype PIN, no. 4811/69, ×51.8; Nedubrovo.

Figs. 10–11. *Pseudochrysomelites circumflexus* sp. nov.: (10) holotype PIN, no. 4811/74, ×47.3; (11) paratype PIN, no. 4811/71, ×45.4; Nedubrovo.

Plate 9



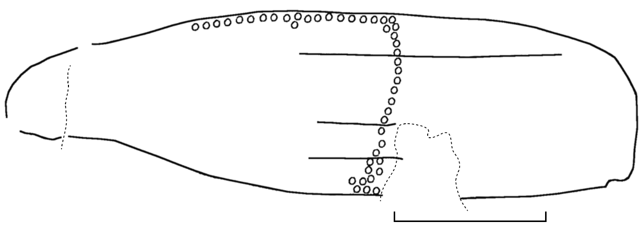


Fig. 6. *Tetracoleus golubevi* sp. nov., holotype PIN, no. 4811/191; Nedubrovo.

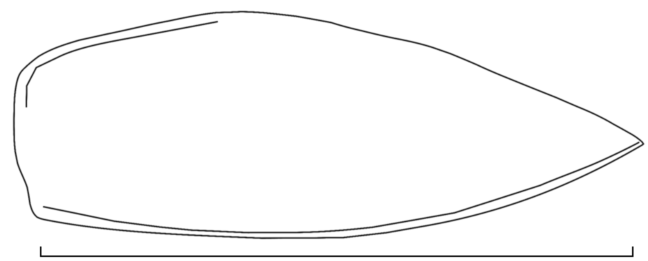


Fig. 7. *Uskatocoleus hirsutus* sp. nov., holotype PIN, no. 4811/194; Nedubrovo.

narrowed in the apical third, with the apex symmetrical, and the sutural margin rimmed. The epipleural rim is narrow. The anterior margin of the elytron has notches. One row contains about 60 small rounded cells. All main veins are free. The external space has five cell rows medially and four cell rows in front of the apical third; the next space is very wide and has six or seven rows; the next space has three rows; the sutural space has four rows. The cells alternate, not forming regular transverse rows.

M e a s u r e m e n t s, mm. Elytron length, 3.97; width, 1.15.

C o m p a r i s o n. The new species is distinguished by the small size, and great differences in the numbers of cell rows between elytral spaces: seven cell rows in the space next to the external space and only three rows in the next space.

M a t e r i a l. Holotype.

Family Schizocoleidae Rohdendorf, 1961

The family was described for isolated elytra with the disc bearing no grooves or rows of large punctures. Such elytra almost invariably have a short impressed groove termed "schiza" by the author of this family. R.A. Crowson pointed to me that in some water beetles the internal surface of the elytron has in this place a protrusion that locks with the margin of the abdomen and prevents the elytra from rising by force of the air bubble when the beetle is underwater. This is how this structure has been interpreted ever since. Being rigid, this structure is usually visible also on the external surface of fossil elytra, but sometimes it is absent in fossils very similar in all other respects to elytra with "schiza." It is possible that it is simply not visible because of fossilization conditions. The surface of the elytron can be smooth, transversely rugose, or punctate. An elytron of this type, bearing rather large sparse setae, is described below. Small ring-shaped structures are sometimes visible in such elytra; these structures probably represent sections of internal columns, columellae, which link the dorsal and ventral surfaces of the elytron. The general appearance of the elytron depends on fossilization conditions.

These fossils can be classified almost by no characters other than the general shape, which largely depends on the position of the elytron at the start of fossilization. An elytron that fossilized in an oblique position will have a different shape from an identical elytron that lay parallel to the bedding plane. Elytra preserved locked or attached to remains of the body often differ in shape from elytra preserved isolated. Thus, the system of schizocoleids, even viewed as formal, proves very unreliable, and we have to use it only in the absence of any other system, since analysis of changes in proportions of different types of elytra with time proves very informative. For instance, schizocoleids are the only beetles known from the Lower Triassic.

Genus *Uskatocoleus* Rohdendorf, 1961

The species described below are placed in the genus *Uskatocoleus* based on their compliance with the diagnosis of this genus: elytron rather wide, convex, visibly dilated towards middle, and evenly narrowed in apical half. The elytron is less than four times as long as wide.

Uskatocoleus hirsutus Ponomarenko, sp. nov.

Plate 9, fig. 2

E t y m o l o g y. The Latin *hirsutus* (hairy).

H o l o t y p e. PIN, no. 4811/194, part and counterpart of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 7). The elytron is small, widest in front of the middle, more distally evenly narrowed, apically acute and symmetrical, 2.9 times as long as wide, with the base straight, sutural margin weakly curved, and external margin curved almost to the base, showing that the elytron was strongly convex. The "schiza" is not visible. The surface of the elytron is covered with sparse short and strong setae.

M e a s u r e m e n t s, mm. Elytron length, 1.03; width, 0.36.

C o m p a r i s o n. The smallest species of the genus. It is especially similar in the shape of the elytron to *U. lutugini* Rohdendorf, 1961 and differs from it, in addition to size, in the narrower elytron.

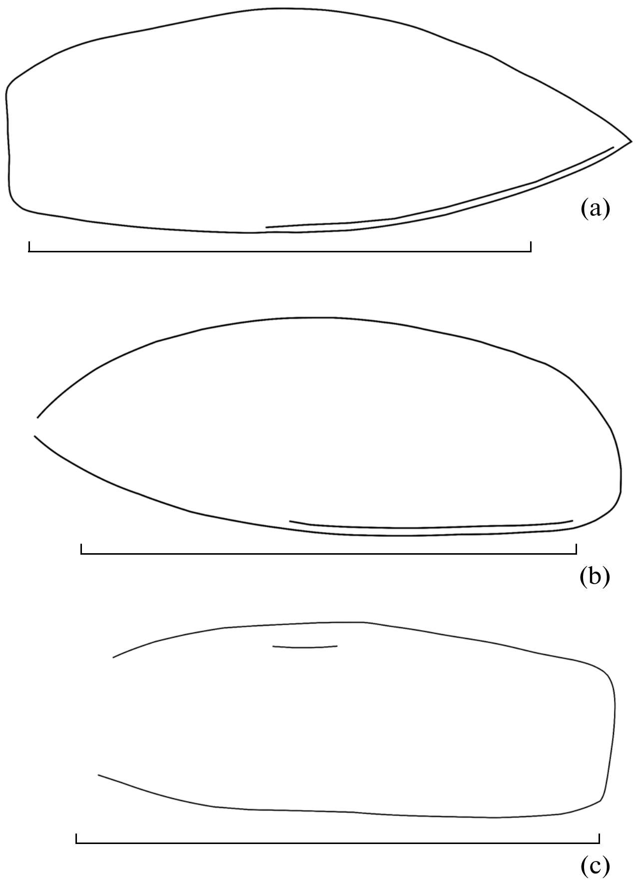


Fig. 8. *Uskatocoleus minor* sp. nov.: (a) holotype PIN, no. 4811/70; (b) paratype PIN, no. 4811/73; (c) paratype PIN, no. 4811/124; Nedubrovo.

Remarks. The presence of setae on the surface of the elytron is an extremely rare character for the elytra of Permian schizophoroids. Furthermore, the setae could be discerned only when the elytron was examined under a scanning electron microscope. Beetles with such elytra probably belonged to natural taxa very distantly related to the other schizocoleids.

Material. Holotype.

Uskatocoleus minor **Ponomarenko, sp. nov.**

Plate 9, figs. 3–5

Etymology. The Latin *minor* (smaller).

Holotype. PIN, no. 4811/70, direct impression of right elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

Description (Fig. 8). The elytron is small, widest in the middle, more distally evenly narrowed, apically acute and symmetrical, 3.0–3.2 times as long as wide, with the base straight, sutural margin almost straight in the basal half, and external margin curved almost from the base. The "schiza" is not visible in the holotype, but in the paratype PIN, no. 4811/73 a short "schiza" is situated near the external margin in front of the middle of the elytron. The surface of the elytron is smooth.

Measurements, mm. Elytron length, 1.2–1.3; width, 0.3–0.4.

Comparison. The new species is distinguished by the small size. Such elytra are not known from any locality other than the type locality. The new species is especially similar in shape to *U. kaltanicus* Rohdendorf, 1961 and differs from it, in addition to size, in the narrower elytron.

Material. Holotype and paratypes PIN, nos. 4811/73 and 4811/124.

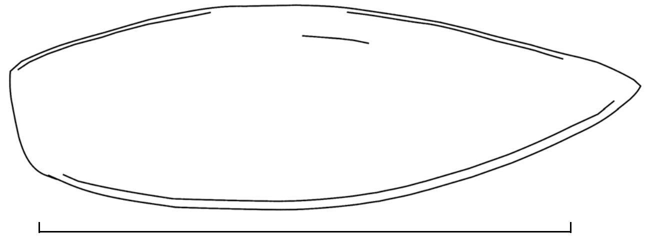


Fig. 9. *Uskatocoleus artus* sp. nov., holotype PIN, no. 4811/63; Nedubrovo.

Uskatocoleus artus **Ponomarenko, sp. nov.**

Plate 9, fig. 6

Etymology. The Latin *artus* (narrow).

Holotype. PIN, no. 4811/63, direct impression of right elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

Description (Fig. 9). The elytron is small, widest in the middle, more distally evenly narrowed, apically acute and symmetrical, 3.3 times as long as wide, with the base slanting, sutural and external margins curved almost from the base and rimmed. The short "schiza" is situated near the external margin in the middle of the elytron. The surface of the elytron bears rounded flat tubercles.

Measurements, mm. Elytron length, 1.23; width, 0.38.

Comparison. The new species is distinguished by the small size. It is especially similar in the shape of the elytron to *U. surijokovicus* Rohdendorf, 1961 and differs from it, in addition to size, in the elytron widest in the middle and "schiza" shorter and more distal.

Material. Holotype.

Genus *Pseudochrysomelites* Handlirsch, 1906

One species of the genus *Pseudochrysomelites*, *P. latus* (Ponomarenko, 2004; PIN, no. 4811/21) was described from Nedubrovo earlier. In the original description it was assigned to the genus *Palademosyne* Rohdendorf, 1961, but it differs considerably from the type species of that genus in the almost straight sutural margin and apex shifted towards this margin; there-

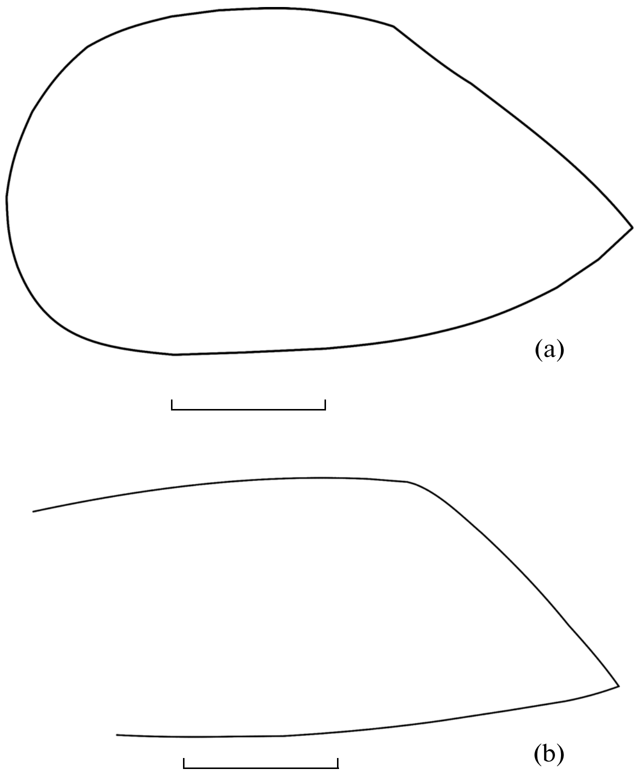


Fig. 10. *Pseudochrysomelites latus* (Ponomarenko, 2004): (a) holotype PIN, no. 4811/21; (b) specimen PIN, no. 4811/51; Nedubrovo.

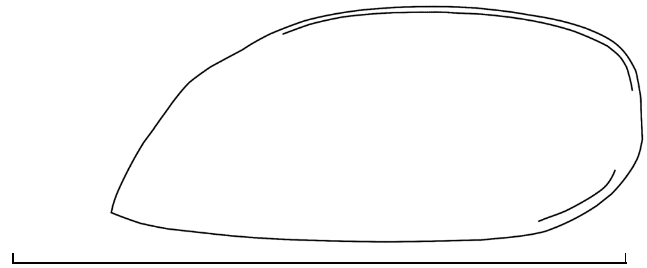


Fig. 11. *Pseudochrysomelites latissimus* sp. nov., holotype PIN, no. 4811/50; Nedubrovo.

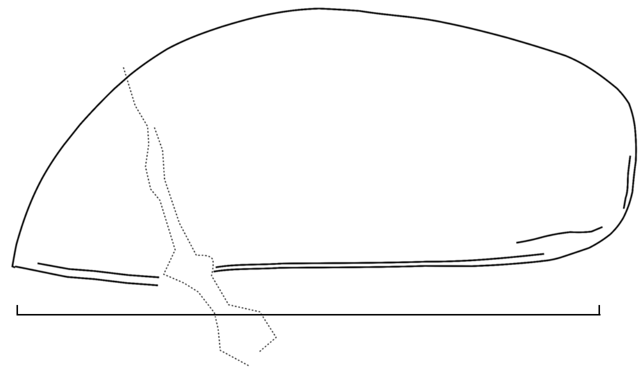


Fig. 12. *Pseudochrysomelites convexus* sp. nov., holotype PIN, no. 4811/69; Nedubrovo.

fore, it was transferred to the genus *Pseudochrysomelites* (Ponomarenko, 2011). The apical part of the incomplete elytron in specimen PIN, no. 4811/51 (Pl. 9, fig. 7), is similar in size and shape to this species (Fig. 10; Pl. 9, fig. 8).

Pseudochrysomelites latissimus **Ponomarenko, sp. nov.**

Plate 9, fig. 8

E t y m o l o g y. The Latin *latissimus* (widest, broadest).

H o l o t y p e. PIN, no. 4811/50, direct impression of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 11). The elytron is very small and wide, only twice as long as wide, dilated in the basal third and narrowed in the apical third, more strongly narrowed near the apex, where the external margin has a bend, which is typical of the genus; the sutural margin is straight in the basal half and weakly curved more distally.

M e a s u r e m e n t s, mm. Elytron length, 0.82; width, 0.40.

C o m p a r i s o n. The new species is distinguished by the very small size of the wide elytron.

M a t e r i a l. Holotype.

Pseudochrysomelites convexus **Ponomarenko, sp. nov.**

Plate 9, fig. 9

E t y m o l o g y. The Latin *convexus* (convex).

H o l o t y p e. PIN, no. 4811/69, direct impression of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

D e s c r i p t i o n (Fig. 12). The elytron is small and rather wide, 2.5 times as long as wide, dilated in the basal half and strongly narrowed in the apical half; the external margin has a humplike protrusion in the middle of the elytron; the apex is acute; the sutural margin is almost straight, rimmed.

M e a s u r e m e n t s, mm. Elytron length, 1.1; width, 0.4.

C o m p a r i s o n. The new species is distinguished by the small size and by the shape of the elytron, which has the external margin with a humplike protrusion.

M a t e r i a l. Holotype.

Pseudochrysomelites circumflexus **Ponomarenko, sp. nov.**

Plate 9, figs. 10–11

E t y m o l o g y. The Latin *circumflexus* (drawn around).

H o l o t y p e. PIN, no. 4811/74, direct impression of left elytron; Nedubrovo locality; Upper Permian, Upper Vyatkian Substage.

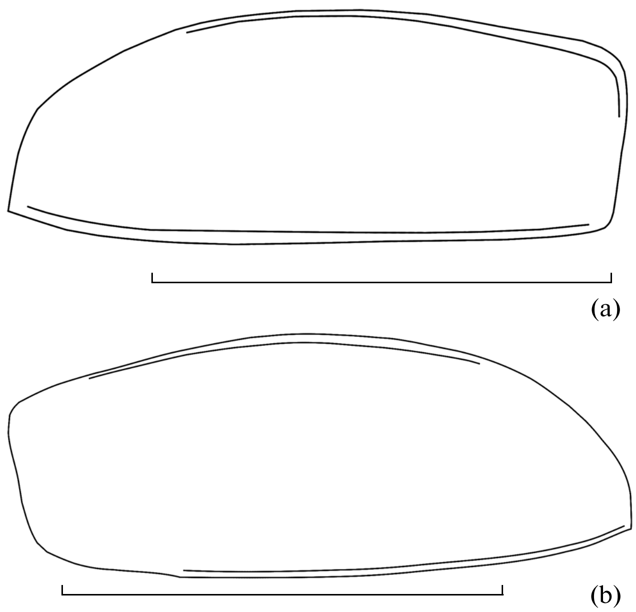


Fig. 13. *Pseudochrysomelites circumflexus* sp. nov.: (a) holotype PIN, no. 4811/74; (b) paratype PIN, no. 4811/71; Nedubrovo.

Description (Fig. 13). The elytron is small, not wide, 2.6 times as long as wide, widest in the middle, weakly dilated in the basal half and roundly narrowed more distally; the external margin is rimmed and has a visible bend near the apex, at approximately one tenth of the length, and distal to this bend runs almost perpendicular to the sutural margin; the sutural margin is almost straight and also rimmed.

Measurements, mm. Elytron length, 1.30–1.31; width, 0.5.

Comparison. The new species is distinguished by the small size and by the shape of the elytron, which has the external margin weakly roundly protruding and distal to the bend at approximately one tenth of the length running almost perpendicular to the sutural margin.

Material. Holotype and paratype PIN, no. 4811/71, right elytron. It is possible that the poorly preserved elytron PIN, no. 4811/72, which is smaller (about 1 mm long) belongs to the same species.

Schizocoleidae incertae sedis

Specimen PIN, no. 4811/23, which represents the basal half of an elytron, was described earlier (Ponomarenko, 2004) from Nedubrovo as Schizocoleidae incertae sedis. Judging by the morphology of the preserved part, it could belong to beetles of the genus *Schizocoleus* Rohdendorf, 1961 or the genus *Pseudochrysomelites* Handlirsch, 1906, but the former genus is absent in the new collection, and none of the described species of the latter genus fit this elytron in size and shape.

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