idae have been described earlier (Ponomarenko, 1963, 1969, 2000, 2003). One species has been described from the Kargala locality (Lower Tatarian) as *Curculiopsis ellipticus* Martynov, 1937 and placed into a separate family only on the basis of its Paleozoic age. The genus was renamed *Rossocoleus* by homonymy (Rohdendorf, 1961). The distribution of the Permian elytra over formal families has been discussed earlier (Ponomarenko, 1969).

Most of the specimens described below originate from the Novo-Aleksandrovka locality (Southern Urals, Orenburg region, left bank of the Kuplya River, 100 m downstream of the bridge near the village of Novo-Aleksandrovka; Upper Permian, Severodvinian).

Family Permocupedidae Martynov, 1933

Genus *Tatarocupes* gen. nov.

Etymology. From Tatarian Stage and genus *Cupes*.

Type species. *T. granulatus* sp. nov.

Diagnosis. Elytron with three rows of cells in first and third spaces (from outer margin), and with six rows at the base of fourth space; penultimate principal vein terminating one-third elytron length from apex.

Composition. Type species.

Comparison. Distinct from most genera in the retention of six rows of cells at the base of the fourth elytral space and from genera with this character in having three rows of cells in the third elytral space from the outer margin.

Tatarocupes granulatus Ponomarenko, sp. nov.

Plate 11, fig. 1

Etymology. From Latin *granula* (grain).

Holotype. PIN, no. 3700/34, right elytron (part and counterpart); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is weakly convex, elongate, 4.3 times as long as it is wide, tapered in the apical third; the apex is obliquely truncate; the sutural margin is bordered. The epipleural border is narrow, without conspicuous cells. The elytron is entirely covered with large tubercles. The cells are shaped like irregular polygons. The first principal vein (counting from the outer margin) differs only slightly from the adjacent intermediate veins; the basal part of the third principal vein is markedly oblique; the next abbreviated vein is distinct, running toward the preceding vein. Both rows of cells beyond the last unabbreviated vein nearly reach its apex. The abbreviated scutellar vein does not reach the sutural margin of the elytron.

Measurements, mm: elytron length, 8; width, 2.1.

Material. Holotype.

Family Rhombocoleidae Rohdendorf, 1961

Genus *Karakanocoleus* Rohdendorf, 1961

Karakanocoleus europeus Ponomarenko, sp. nov.

Plate 11, fig. 2

Etymology. From Europe.

Holotype. PIN, no. 3700/36, right elytron, apparently somewhat compressed during fossilization (incomplete part and counterpart); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is weakly convex, nearly three times as long as it is wide, with its base wide and the basal two-thirds almost not widened distally (so that the elytron was weakly convex in life), tapered in the apical third; the apex is acute; the sutural

Explanation of Plate 11

Fig. 1. *Tatarocupes granulatus* sp. nov., holotype PIN, no. 3700/34, ×12.5: (a) part and (b) counterpart of the right elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 2. *Karakanocoleus europeus* sp. nov., holotype PIN, no. 3700/36, ×18.2, right elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 3. *Erunakicupes brevis* sp. nov., holotype PIN, no. 3700/46, ×38.1, left elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 4. *Rossocoleus altus* sp. nov., holotype PIN, no. 1366/372, ×17.7, right elytron; Kirov region, Kityak locality; Upper Kazanian, Belebei Formation.

Fig. 5. *Schizocoleus longus* sp. nov., holotype PIN, no. 3700/40, ×26.4, elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 6. *Schizocoleus glabrus* sp. nov., holotype PIN, no. 3700/41, ×25, elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 7. *Palademosyne ovum* sp. nov., holotype PIN, no. 3700/42, ×38.7, left elytron; Southern Urals, Novo-Aleksandrovka locality; Upper Tatarian, Severodvinian.

Fig. 8. *Palademosyne elongatum* sp. nov., holotype PIN, no. 4048/16, ×13.3, right elytron; Yaroslavl region, Tikhvinskoe locality; Olenekian, Rybinsk Horizon.

Fig. 9. *Palademosyne latum* sp. nov., holotype PIN, no. 4811/21, ×13.3, part and counterpart of the right elytron; Vologda region, Nedubrovo locality; Induan, Vokhmian Horizon, Nedubrovo Member.

Fig. 10. Incomplete elytron of schizophoroid beetle, specimen PIN, no. 4811/24, ×25.3; Vologda region, Nedubrovo locality; Induan, Vokhmian Horizon, Nedubrovo Member.

margin is nearly straight, bordered. The epipleural border is weakly widened in the basal third of the elytron, otherwise narrow. The "schiza" is as long as one-tenth of the elytron length, situated proximal to the elytron midlength at about one-third of its width. The elytron surface bears large shallow depressions in the striae, the most distinct being in the adsutural half of the elytron. The punctate striae in the adsutural area join the marginal stria running along the sutural margin.

Measurements, mm: elytron length, 4–4.5; width, 1–1.3.

Comparison. Distinct in the punctate striae nearest to the suture joining the adsutural stria instead of running parallel to the sutural margin of the elytron.

Material. Besides the holotype, elytra PIN, nos. 3700/35 and 3700/43 from the same locality; they are narrower and more convex than the holotype, possibly due to changes during fossilization.

Genus *Erunakicupes* Rohdendorf, 1961

***Erunakicupes brevis* Ponomarenko, sp. nov.**

Plate 11, fig. 3

Etymology. Latin *brevis* (short).

Holotype. PIN, no. 3700/46, left elytron (positive impression); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is weakly convex; three times as long as it is wide; with its base wide and oblique; with the basal two-thirds almost not widened distally (so that the elytron was weakly convex in life) and tapered in the apical third; the apex is acute, slightly asymmetrical, and displaced to the sutural margin; the sutural margin is nearly straight and bordered. The epipleural border is narrow. The "schiza" is as long as one-tenth of the elytron length, situated proximal to the elytron midlength at about one-quarter of its width. The surface of the elytron exhibits small, shallow punctures in the striae. The additional punctate striae in the basal part of the elytron are very short, consisting of only several punctures, almost not extended onto the disc of the elytron. The punctate striae in the adsutural area run parallel to the sutural margin.

Measurements, mm: elytron length, 2.1–2.3; width, 0.7–0.9.

Comparison. Distinct in the very short additional striae in the basal part of the elytron.

Material. Besides the holotype, two isolated elytra PIN, no. 3700/47, possibly belonging to the same beetle specimen; they are conspicuously wider than the holotype, possibly due to changes during fossilization.

Genus *Rossocoleus* Rohdendorf, 1961

***Rossocoleus altus* Ponomarenko, sp. nov.**

Plate 11, fig. 4

Etymology. Latin *altus* (ancient).

Holotype. PIN, no. 1366/372, right elytron (part and counterpart); Kirov region, Malmyzh district, former Akbatyr mine near the village of Bol'shoi Kityak, Kityak locality; Upper Permian, Upper Kazanian, Belebei Formation.

Description. The elytron is elongate, 3.5–3.7 times as long as it is wide, with wide base and the basal half very feebly widened distally (so that the elytron was weakly convex in life), tapered in the apical third; the apex is acute; the sutural margin is nearly straight up to the elytron midlength and bordered. The epipleural border is widened in the basal third of the elytron, distally not wide. The "schiza" is as long as one-fifth of the elytron length, situated proximal to the elytron midlength at about one-third of its width. The surface of the elytron is covered with large shallow depressions that are most distinct near the schiza.

Measurements, mm: elytron length, 4.5–4.8; width, 1.3.

Comparison. Distinct from most species in the larger and more elongate elytron: it differs from other species with similar proportions in the elytron being feebly widened beyond the base, i.e., flattened in life.

Material. Besides the holotype, on the same rock slab, there is a second elytron PIN, no. 1366/371 of somewhat smaller size; thus, one cannot be sure that it belongs to the same beetle specimen.

Family Schizocoleidae Rohdendorf, 1961

Genus *Schizocoleus* Rohdendorf, 1961

***Schizocoleus longus* Ponomarenko, sp. nov.**

Plate 11, fig. 5

Etymology. Latin *longus* (long).

Holotype. PIN, no. 3700/40, elytron (incomplete part and counterpart); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is convex, more than three times as long as it is wide, with its base wide and the basal two-thirds almost not widened distally, tapered in the apical third; the apex is acute; the sutural margin is nearly straight and bordered. The epipleural border is narrow. The "schiza" is as long as one-tenth of the elytron length, situated proximal to the elytron midlength at about one-third of its width. The surface of the elytron is densely covered with small tubercles.

Measurements, mm: length of the preserved part of the elytron in the holotype, 2.2; estimated full length, about 4; width, 1.2.

Comparison. In the proportions of its elytron, it is more similar to the type species than to the species described below and is distinct in its size being intermediate between these two species.

Material. Holotype.

***Schizocoleus glabrus* Ponomarenko, sp. nov.**

Plate 11, fig. 6

Etymology. Latin *glabrus* (smooth).

Holotype. PIN, no. 3700/41, elytron (incomplete part and counterpart); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is flattish, more than four times as long as it is wide, with a wide base and the basal two-thirds almost not widened distally, tapered in the apical third; the apex is acute; the sutural margin is nearly straight and bordered. The epipleural border is narrow. The "schiza" is short, situated about the elytron midlength very close to its outer margin. The surface of the elytron is densely covered with small tubercles.

Measurements, mm: elytron length, 3.4; width, 0.8.

Comparison. Distinct in the more elongate elytron and smaller size.

Material. Besides the holotype, elytra PIN, no. 3700/45 from same locality; only the apical half of the elytra is preserved, but, due to the similarity in surface structure and proportions, they can be assigned to the same species.

Genus *Palademosyne* Rohdendorf, 1961

Originally, this genus was placed in the family Permosynidae on account of the absence of "schiza," which in fact represents an outgrowth on the underside of the elytron. Such a structure occurs in several extant families, and, in the family Hydrophilidae, there are genera both with and without it. Since, in the Permian and Triassic, smooth beetle elytra with and without "schiza" are characteristic of schizophoroid Archostemata and Adephaga, whereas elytra with punctate striae are characteristic mainly of Polyphaga and related Ademosynidae, it appears more expedient to place the genera *Palademosyne* and *Stegosyne* in the family Schizocoleidae, all the more so as all these are second-rate "organ-taxa."

Palademosyne ovum Ponomarenko, sp. nov.

Plate 11, fig. 7

Etymology. Latin *ovum* (egg).

Holotype. PIN, no. 3700/42, left elytron (part and counterpart); Novo-Aleksandrovka locality; Upper Permian.

Description. The elytron is markedly convex, 2.3 times as long as it is wide, widened from the base up to the midlength, where is almost twice as wide than it is humerally, and abruptly tapered in the apical quarter; the apex is obtuse, asymmetrical, and displaced to the sutural margin; the sutural margin is nearly straight and widely bordered. The epipleural border is narrow. On account of the proportions of the elytron, the beetle body was markedly convex. The surface of the elytron is sparsely covered with small tubercles.

Measurements, mm: elytron length, 1.5–1.8; width, 0.7–0.8.

Comparison. Distinct from the type species in the asymmetrical elytral apex and smaller size.

Remarks. The size variability is slightly higher than the standard, but seems permissible for a formal taxon.

Material. Besides the holotype, paratypes PIN, nos. 3700/37, 3700/38, 3700/39, and 3700/51, isolated elytra from the same locality.

Palademosyne elongatum Ponomarenko, sp. nov.

Plate 11, fig. 8

Etymology. Latin *elongatum* (elongate).

Holotype. PIN, no. 4048/16, right elytron (positive impression); Yaroslavl region, Rybinsk district, right bank of the Volga River near the village of Tikhvinskoe, Tikhvinskoe locality; Lower Triassic, Olenekian, Rybinsk Horizon.

Description. The elytron is convex, 2.8 times as long as wide, almost not widened from the base up to the apical third where it is only slightly wider than humerally, and abruptly tapered in the apical quarter; the apex is obtuse, asymmetrical, and displaced to the sutural margin; the sutural margin is nearly straight and widely bordered. The epipleural border is narrow.

Measurements, mm: elytron length, 4.5; width, 1.6.

Comparison. Distinct in the elongate elytron and large size; from the type species, it differs additionally in the asymmetrical elytral apex.

Material. Holotype.

Palademosyne latum Ponomarenko, sp. nov.

Plate 11, fig. 9

Etymology. Latin *latum* (wide).

Holotype. PIN, no. 4811/21, right elytron (part and counterpart); Vologda region, Kichgorodetskii district, near the village of Nedubrovo, Nedubrovo locality; Lower Triassic, Induan, Vokhmian Horizon, Nedubrovo Member.

Description. The elytron is convex, twice as long as it is wide, widened from base up to the midlength, where it is almost twice as wide as it is humerally, abruptly tapered in the apical quarter; the apex is acute, asymmetrical, and displaced to the sutural margin; the sutural margin is convex.

Measurements, mm: elytron length, 3.7; width, 1.8.

Comparison. Distinct in the very wide elytra; from the type species, it differs in the asymmetrical elytral apex and large size: from *P. elongatum* sp. nov., in the elytron markedly widened toward its midlength.

Remarks. The distal two-thirds of the elytron are covered with small transverse folds, but this appears to be due to changes during fossilization. In sediments of this type, the elytra are usually preserved as a thin

organic film, which possibly forms folds during the sediment contraction.

M a t e r i a l. Holotype.

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REFERENCES

1. A. S. Alekseev, V. Yu. Dmitriev, and A. G. Ponomarenko, "Evolution of Taxonomic Diversity," in *Ecosystem Rearrangements and Evolution of the Biosphere. Issue 5* (GEOS, Moscow, 2001) [in Russian].
2. D. E. van Dijk, "Insect Faunas of South Africa from the Upper Permian and the Permian–Triassic Boundary," Palaeontol. Afr. **34**, 43–48 (1997).
3. M. V. Durante and U. Luvsantseden, "Developmental Features of the Southern Branch of the Subangaran Paleofloristic Region," in *Collection of Papers in Memory of Vsevolod Andreevich Vakhrameev*, Ed. by M. A. Akhmetiev, A. B. German, M. P. Doludenko, and I. A. Ignatiev (GEOS, Moscow, 2002), pp. 247–261 [in Russian].
4. H. Geertsema and J. A. van den Heever, "A New Beetle *Afrocupes furmae* gen. et sp. nov. (Permocupedidae) from the Late Palaeozonic Whitehill Formation of South Africa," S. Afric. J. Sci. **92**, 497–499 (1996).
5. T. Hörnschemeyer, "Fossil Inects from the Lower Permian of Niedermoschel (Germany)," in *Proc. First Intern. Palaeoentomol. Conf., Moscow, 1998* (AMBA Projects, Bratislava, 1999), pp. 57–60.
6. Qi-Bin Lin, "Insecta," *Palaeontological Atlas of East China: II Volume of Late Palaeozoic* (Geol. Publ. House, Beijing, 1982), pp. 329–332 [in Chinese].
7. V. R. Losovskii, V. A. Krassilov, *et al.*, "On Recognition of a New Member within the Vokhminskaya Formation of the Lower Triassic of the Moscow Syneclise," Byull. Region. Mezhved. Stratigr. Komissii po Tsentru i Yugu Russkoi Platformy, No. 3, 239 (2001).
8. I. D. Pinto, "Permian Insects from Parana Basin, South Brazil IV Coleoptera," Pesquisas **19**, 5–12 (1987).
9. A. G. Ponomarenko, "Paleozoic Beetles Cupedidea in the European Part of the USSR," Paleontol. Zh., No. 1, 70–85 (1963).
10. A. G. Ponomarenko, "Historical Development of the Coleopteran Suborder Archostemata," Tr. Paleontol. Inst. Akad. Nauk SSSR **125**, 1–239 (1969).
11. A. G. Ponomarenko, "New Beetles from the Permian of European Russia," Paleontol. Zh. (Suppl. 3), 312–316 (2000).
12. A. G. Ponomarenko, "Superorder Scarabaeidaea Laichating, 1781: Order Coleoptera Linné, 1758," in *The Beetles*, Ed. by A. P. Rasnitsyn and D. L. J. Quicke (Kluwer Academic, 2002), pp. 164–176.
13. A. G. Ponomarenko, "The First Find of Fossil Beetles (Permosynidae, Coleoptera) in the Upper Tatarian Beds of the European Part of Russia," Paleontol. Zh., No. 2, 65–68 (2003).
14. B. B. Rohdendorf, "The Order Coleoptera: Coleopterans or Beetles," *Paleozoic Insects of the Kuznetsk Basin* (Akad. Nauk SSSR, Moscow, 1961), pp. 393–469 [in Russian].
15. R. J. Tillyard, "Upper Permian Coleoptera and a New Order from the Belmont Beds, New South Wales," Proc. Linnean. Soc. N.S.W. **49**, 429–435 (1924).
16. M. A. Zharkov and N. M. Chumakov, "Paleogeography and Depositional Environments during the Permian–Triassic Rearrangements of the Biosphere," Stratigr. Geol. Korrelyatsiya **9** (6), 29–54 (2001).