Paleontological Journal, Vol. 37, No. 2, 2003, pp. 170–173. Translated from Paleontologicheskii Zhurnal, No. 2, 2003, pp. 65–68.

The First Beetles (Permosynidae, Coleoptera) from the Upper Tatarian of European Russia

A. G. Ponomarenko

Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya ul. 123, Moscow, 117997 Russia
e-mail: gushat@paleo.ru
Received February 13, 2002

Abstract—Isolated beetle elytra from the upper Tatarian of the Aristovo locality (Vologda Region) are described as *Permosyne dentata* sp. nov. and *P. europaea* sp. nov. (organ-family Permosynidae). This is the first find of beetles in the upper Tatarian of European Russia. The distribution of beetles in the uppermost Permian and the composition of the family and genus are discussed.

Key words: Permosynidae, Coleoptera, upper Tatarian, European Russia.

INTRODUCTION

The finds of beetles in the Upper Permian of northeastern European Russia are quite rare (Ponomarenko, 2000). The relative abundance of Coleoptera in the insect assemblages of this region is almost a hundred times lower than in the Kuznetsk Basin, eastern Kazakhstan, or Mongolia. In the Kuznetsk Basin, the proportion of beetles increased during the Late Permian by several dozen times; thus, virtually all localities contain beetles. In European Russia it is much more likely that the share of beetles diminished during this time. Beetles occur rarely but regularly in the late Early Permian, but the Ufimian of the Pechora Basin and the Cis-Ural region have yielded no beetles. In the Kazanian of European Russia the beetle finds are nearly as rare as in the Lower Permian. During the Kazanian and early Tatarian the beetles of European Russia were dominated by the family Permocupedidae, whereas more advanced beetles were quite rare and their share did not increase during this time interval. In a few upper Tatarian insect localities discovered in European Russia, no beetles have been recorded.

All fossil finds from the terminal Permian are especially interesting, because the processes that took place in the biosphere of that time resulted in the greatest extinction in the Earth's history. The beetles from the terminal Permian were previously known from three regions: central Siberia (Tunguska and Kuznetsk Basins), eastern Kazakhstan, and Australia. The succession of Late Permian faunas of the Kuznetsk Basin shows a gradual shift in dominance from cupedoid to schizophoroid archostematans (Ponomarenko, 1969). Elytra of the beetles with punctate striae (for their Permian representatives an organ-family, Permosynidae, was proposed) occur very rarely and only in the youngest localities. In the Kuznetsk Basin they are restricted to the Erunakovo Subseries, constituting there less than 5% of the beetle fauna. The localities of the Tunguska Basin (including those admittedly assigned to the Triassic) are dominated by schizophoroids, whereas cupedoids and permosynids are represented by a single find each. In the oryctocoenosis of the locality of Karaungir in eastern Kazakhstan, permocupedids markedly prevail over schizophoroids. In the same locality a single elytron with large spots on the weakly developed striae and with a long deep depression in the region where schizophoroids have a "schiza" (projection for coupling with the abdomen) has been found; another elytron of this type was described from the Kazankova-Markina Formation of the Kuznetsk Basin as *Schizocupes* Rohdendorf, 1961. Thus, the beetle assemblage of Karaungir shows no features characteristic of beetles from the end of the Permian. The oryctocoenosis of the Belmont Beds (Newcastle Coal Measures) in Australia markedly differs from all others in the composition of both beetles and insects. The four isolated beetle elytra found in the beds were described as four species of *Permosyne* belonging to the monotypic family Permosynidae. In fact, all of them differ significantly. One species (*P. pincombeae*) was first transferred to the genus *Karakanocoleus* of the family Schizocoleidae (Rohdendorf, 1961) and then to the family Rhombocoleidae (Ponomarenko, 1969). The others could be treated as members of different organ-genera in the organ-family Permosynidae understood as an assemblage of isolated elytra with punctate striae. To split the genus *Permosyne*, the systematic position of the other forms placed in the family should be revised, which is beyond the scope of this paper. Moreover, such a split requires reexamination of the types, in addition to the photographs published by Tillyard. Thus, the genus *Permosyne* is accepted at present in the sense of Tillyard, excluding *Permosyne pincombeae*.

Elytra with punctate striae are more common in beetles from the higher suborders Polyphaga and Adephaga. Beetles with smooth or nearly smooth elytra repeatedly originated in different lineages of these taxa, most probably as an adaptation to aquatic habitats, because latticed elytra of lower Archostemata result in turbulence that hinders aquatic locomotion. Most of the advanced Archostemata, including extant Myxophaga, have smooth elytra. Archostematans possessing punctate striae on elytra (Ademosynidae Ponomarenko, 1968) are restricted in number and placed in this suborder with some reservations due to their considerable similarity to some members of the suborder Polyphaga. Therefore, the presence of beetles with permosynid-type elytra indicates expansion of more advanced beetles among either Archostemata or Coleoptera as a whole. This expansion took place already in the latest Permian, thus preceding the mass extinction at the Permian–Triassic boundary.

The beetles described below were collected by S.V. Meyen and A.V. Gomankov during paleobotanical studies at the Aristovo locality (right bank of the Malaya Severnaya Dvina River[1] 100 m upstream of the village of Aristovo, Velikii Ustyug District, Vologda Region). The deposits belong to the Komaritsa Beds, Vyatka Horizon, Tatarian. This is the youngest of the Permian insect localities in European Russia. The plants found in this locality belong to the *Tatarina* flora, the last flora of the Subangaran Permian (Gomankov and Meyen, 1986). The vertebrate remains belong to the Sokolki assemblage and subassemblage of the Northern Dvina assemblage (Ivakhnenko *et al.*, 1997). About 50 insect remains have been collected in the locality: cockroaches and paraplecopterans dominate; beetles, scorpionflies, and stoneflies are approximately half as abundant; two homopterans have been found; nearly half of the remains are too fragmentary to identify their ordinal position. Quite interesting is the find of the genus *Tomia* (Paraplecoptera), characteristic of the Permian–Triassic boundary beds and the first half of the Triassic and previously unknown in the Permian of European Russia (Aristov, 2003). The beetles are represented by three specimens, two elytra, and one incomplete set of abdominal sternites. One elytron and many other fragments of insects have been obtained by the method of bulk-maceration and put into microscopic slides. This is the first time that identifiable pterygote fossils have been obtained using the bulk-maceration of Paleozoic rocks. Along with this elytron some fragments of cockroach forewings have been acquired, which in the structure of archedictyon correspond to the forewings found in the same locality as impressions in the rock. The elytron is of excellent preservation, except for being compressed into a film; thus, the degree of its convexity can be judged exclusively from the extent of the area tucked under the humeral part. The numerous setigerous pores of the elytron are clearly seen, they are situated both on and between striae, and some of them still retain long, stiff setae in the central part of the elytron. During the beetle's life the entire surface of the elytron was apparently covered with them. This character is very important: this is the oldest elytron completely covered with setae. Beetles covered with such setae are known only among Polyphaga. As always for materials obtained with bulk-maceration, the possibility of modern contamination still exists, but we failed to find a living beetle with a similar structure of elytron. Similar to the first elytron, the second elytron has been preserved as an organic film on the rock; its preservation is poorer, because the film is deformed or even broken by large grains of rock matrix. After bulk-maceration this specimen would be similar to the first specimen, though less complete. The structure of the elytra described below is typical for Permosynidae; thus, Aristovo is the first locality in the northern hemisphere that contains permosynid beetles only.

[1] An occasional name for the Northern Dvina River upstream of the confluence with the tributary Vychegda River.

SYSTEMATIC PALEONTOLOGY

Family Permosynidae Tillyard, 1924

Genus *Permosyne* Tillyard, 1924

D i a g n o s i s. Formal assemblage of isolated beetle elytra with the following characters. Elytra with 11 longitudinal punctate striae, including a short scutellar stria and submarginal striae. The first stria, counting from sutural margin,[2] composite, formed by scutellar stria and subsequent stria, base of subsequent stria retained as a short stria either joining the composite stria or ending blind in the basal part of the elytron; composite stria reaching elytron apex. One or three striae following short stria either join stria bordering sutural margin or terminate blindly in interstices. Remaining striae enter either the elytron apex or the eleventh stria bordering the anteapical margin.

R e m a r k s. Rohdendorf (1961) synonymized *Permosyne* under *Ademosyne* Handlirsch, 1906, but this appears to be incorrect, because the holotype of the type species of the latter genus is not an isolated elytron but a complete beetle and, therefore, should be treated within a natural classification. This holotype served as the type species of the family Ademosynidae Ponomarenko, 1968. In the same paper he described *Ademosyne sibirica* based on three isolated elytra. However, all three differ significantly in the arrangement of striae; the holotype is similar to the holotype of *Permosyne affinis* in having two or three striae approaching the sutural margin; one paratype is similar to *P. belmontensis*; another paratype shows a similar arrangement of striae but much larger spots on them (but it should be taken into account that the size of spots on the beetle elytra could change greatly during fossilization).

[2] Contrary to Tillyard (l.c.), it is better to number striae starting from the sutural margin, because some outer interstices could be tucked under so that the number of the same stria may vary depending on preservation.

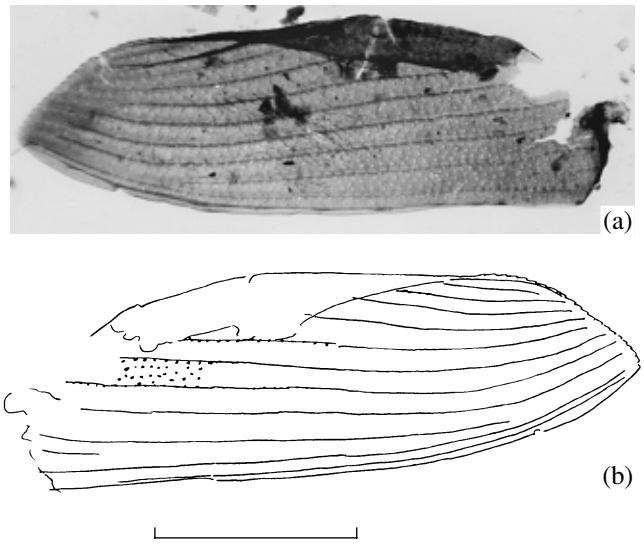

Fig. 1. *Permosyne dentata* sp. nov., holotype PIN, no. 3446/10: (a) general view, ×22.5; (b) scheme of the arrangement of striae on the elytron. Scale bar 1 mm for all figures.

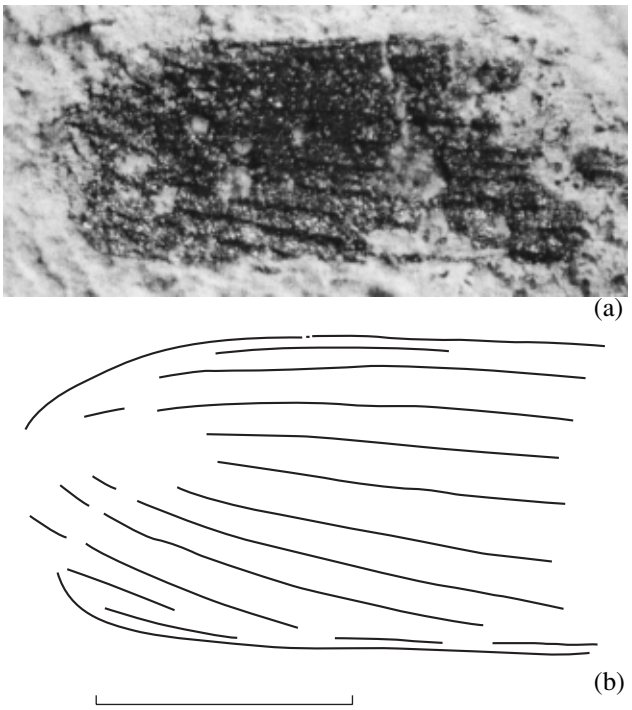

Fig. 2. *Permosyne europensis* sp. nov., holotype PIN, no. 3446/9: (a) general view, ×30; (b) scheme of the arrangement of striae on the elytron.

***Permosyne dentata* Ponomarenko, sp. nov.**

Etymology. Latin *dentata* (toothed).

Holotype. PIN, no. 3446/10, right elytron damaged in the humeral part and with the anteapical margin tucked under (in microscopic slide); northern European Russia, Aristovo; Upper Permian, upper Tatarian, Komaritsa Beds.

Description (Figs. 1a, 1b). The elytron is convex, three times as long as it is wide, narrowed beyond its midlength, obliquely truncate and finely toothed apically; the sutural margin is curved in the apical one-third and bordered. The epipleural border is absent; the epipleuron is not wide. The punctate striae are narrow; the interstices are wide, flat, with large spots, which are spaced more widely than those on the striae; there are three or four spots across the interstice. The spots represent setigerous pores; the setae are about as long as the interstice width. The same setigerous pores are situated on the denticles of the apical margin of the elytron. The shortened stria is only about 1/15 of the elytron length. The next stria ends blindly about the apical one-fifth of the elytron. All the other striae independently enter the truncate apical margin of the elytron.

Measurements, mm: elytron length, 3.0; elytron width, 1.0.

Comparison. Being most similar to the type species (*P. belmontensis* Tillyard, 1924), differs from it in the denticulate apical margin of the elytron, the third stria ending blindly, and the large spots on the interstices. From the paratype of *P. sibirica* Rohdendorf, 1961, to which it is similar in elytron structure, differs in being twice the paratype size.

Material. Holotype.

***Permosyne europaea* Ponomarenko, sp. nov.**

Etymology. From Europe.

Holotype. PIN, no. 3446/9, basal two-thirds of the right elytron are preserved as an organic film on the rock matrix; northern European Russia, Aristovo; Upper Permian, upper Tatarian, Komaritsa Beds.

Description (Figs. 2a, 2b). The elytron is weakly convex (judging from the weak curvature of the striae), more than three times as long as wide, narrowed almost from the base; the sutural margin is bordered. The epipleural border is absent; the epipleuron is not wide. The punctate striae are wide; the interstices are flat with large spots, which are spaced more widely than those on the striae. Most of the striae run obliquely from the basal to the sutural margin. The shortened stria is short. Three following striae join the stria bordering the sutural margin in the basal one-half of the elytron.

Measurements, mm: length of the preserved portion of the elytron, 2.3; length of the complete elytron, about 3; elytron width, 1.0.

Comparison. Being most similar to *P. affinis* Tillyard, 1924 and to the holotype of *P. sibirica* Rohdendorf, 1961, differs from both of them in the flatter elytron and the shorter third, fourth, and fifth striae, counting from the sutural margin, that end before the elytron midlength, and from the second species, in being twice its size.

Material. Holotype.

ACKNOWLEDGMENTS

The author is grateful to D.E. Shcherbakov (PIN) who drew my attention to these interesting fossils and made the photographs and valuable comments on the manuscript. The study was supported by the Russian Foundation for Basic Research, project no. 01-04-48925.

REFERENCES

Aristov, D.S., Revision of the Family Tomiidae (Insecta: Grylloblattida), *Paleontol. Zh.*, 2003, no. 1, pp. 31–38.

Gomankov, A.V. and Meyen, S.V., The *Tatarina* Flora (Composition and Distribution in the Late Permian of Eurasia), *Tr. Geol. Inst. Akad. Nauk SSSR* (Moscow), 1986, issue 401, pp. 1–174.

Ivakhnenko, M.F., Golubev, V.K., Gubin, Yu.M., Kalandadze, N.N., Novikov, I.V., Sennikov, A.G., and Rautian, A.S., Permian and Triassic Tetrapods of Eastern Europe, *Tr. Paleontol. Inst. Ross. Akad. Nauk* (Moscow), 1997, vol. 268.

Ponomarenko, A.G., Historical Development of the Archostemata (Coleoptera), *Tr. Paleontol. Inst. Akad. Nauk SSSR* (Moscow), 1969, vol. 125, pp. 1–239.

Ponomarenko, A.G., New Beetles from the Permian of European Russia, *Paleontol. Zh.*, 2000, vol. 34, Suppl. 3, pp. S312–S316.

Rohdendorf, B.B., The Order Coleoptera: Coleopterans or Beetles: Paleozoic Insects of the Kuznetsk Basin, *Tr. Paleontol. Inst. Akad. Nauk SSSR* (Moscow), 1961, vol. 85, pp. 393–469.

Tillyard, R.J., Upper Permian Coleoptera and a New Order from the Belmont Beds, New South Wales, *Proc. Linn. Soc. N.S.W.*, 1924, vol. 49, pp. 429–435.