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Permian Bivalves from the Transbaikal Region

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Abstract—Permian bivalves of the Transbaikal Region are for the first time treated monographically. Seven biostratigraphic units ranked as beds with fauna are described and correlated with the Permian bivalve zonation for northeastern Asia. All 18 species identified from these units are figured and six new species, *Palaeoneilo postolegi, Polidevcia jamesi, P. zabaikalica, Leptodesma indistincta, Streblopteria alenae*, and *Cyrtorostra nana*, are described.

INTRODUCTION

To date, only very fragmentary data in the form of unpublished lists of Permian bivalves of the Transbaikal Region have been available. This article is the first to consider this fossil group, which is of great importance in solving biostratigraphic and other problems of the region. Permian bivalves are known from the eastern part of the Transbaikal Region, i.e., the Borzya and Chiron depressions (fields) (Fig. 1).

The Permian stratigraphy of the Transbaikal Region was studied by D.F. Maslennikow, M.F. Kulikov, B.I. Oleksiv, L.I. Popeko, G.V. Kotlyar, T.M. Okuneva, S.M. Sinitsa, and other specialists. The modern regional stratigraphic scheme, compiled by Kotlyar (Kotlyar *et al.*, 1990), consists of seven regional horizons that combine a number of formations within different structure-facies zones (Fig. 2). The horizons are based on biostratigraphic data, mainly on brachiopods and, to a lesser degree, on bryozoans, crinoids, mollusks, and fossil flora.

The Permian molluscan studies were initiated in this area by Maslennikow in 1952. He attributed almost all of these bivalves to the Early Permian, allowing, however, for the Late Permian age of the forms derived from the uppermost beds of the Borzya Field section. The results of his studies remain unpublished. During the late 1950s and the 1960s, Permian bivalves were identified by Kulikov and O.V. Lobanova. Very small collections were studied by T.M. Okuneva and M.M. Astafieva in the late 1980s. The fossils were collected from few separate localities. Unfortunately, the material has received monographic treatment, lists of taxa remain unpublished, and the early collections are apparently irretrievably lost. In their monograph, Muromzeva and Gus'kov (1984) figured a single species identified as *Streblopteria englehardti* (Eth. et Dun) and mentioned the presence of *Wilkingia verchojanica* (Murom.) in the Zhipkhoshi Formation of the Lower Permian.

During the late 1980s and early 1990s, I identified Permian bivalves from the collections of Kotlyar and

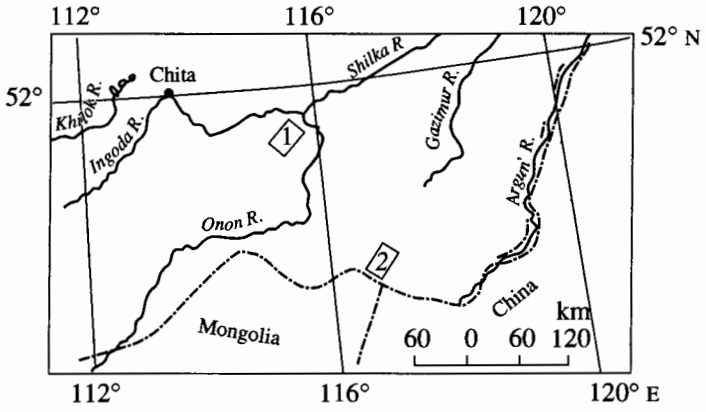


Fig. 1. Permian bivalve localities in the Transbaikalian Region. Designations: (*1*) Chiron Depression; (*2*) Borzya Depression.

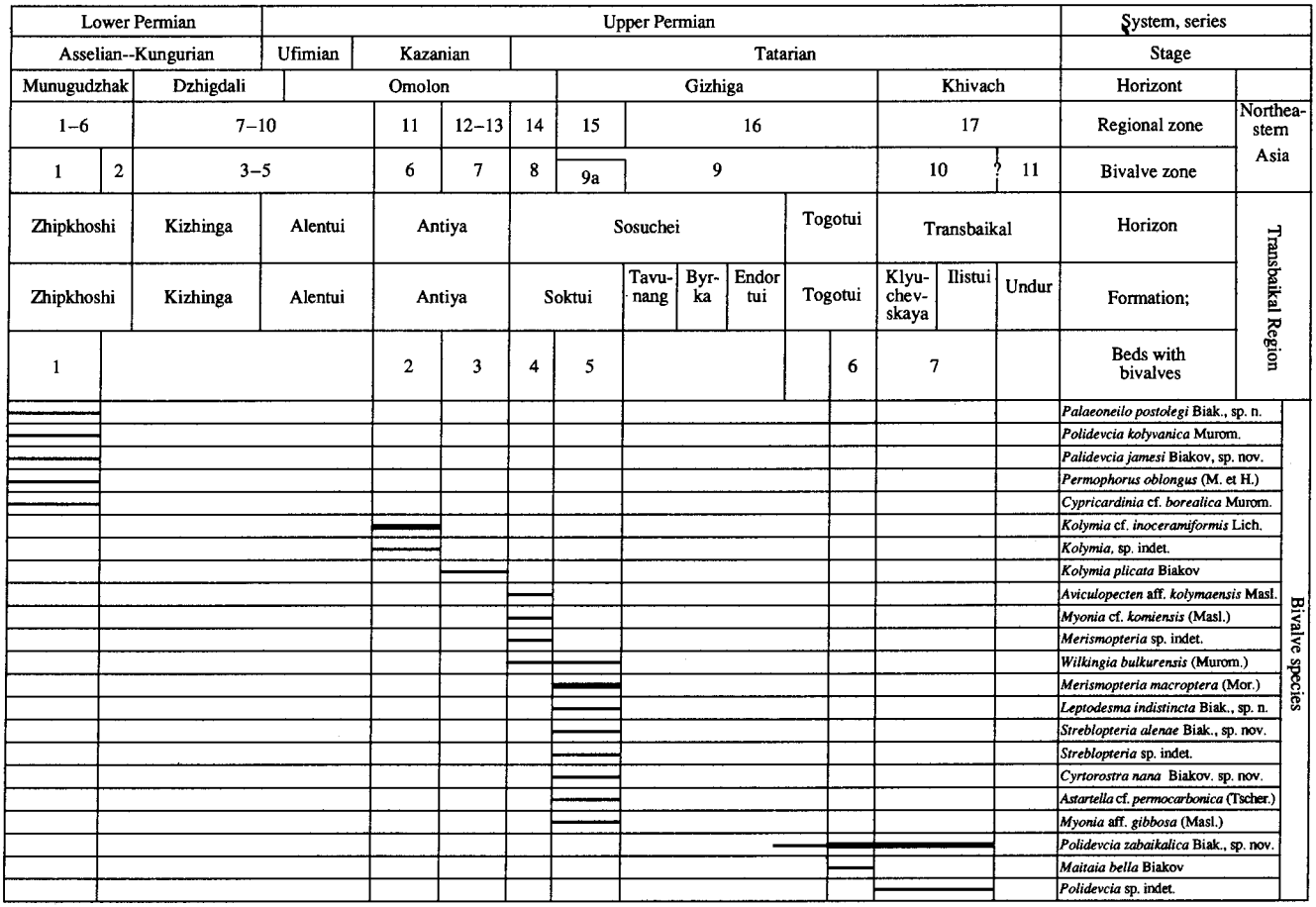


Fig. 2. Stratigraphic ranges of the Permian bivalves of the eastern Baikal Region. Regional zones of northeastern Russia: (1–6) *Jakutoproductus mirandus–J. burgaliensis*, (7–10) *Anidanthus aagardi–Mongolosia russiensis*, (11) *Omolonia snjatkovi*, (12, 13) *Terrakea borealis–T. korkodonensis*, (14) *Magadania bajkurica*, (15) *Cancrinelloides obrutschewi*, (16) *C. curvatus*, (17) *Stepanoviella paracurvata*; the bivalve zones of northeastern Asia: (1) *Palaeoneilo parenica*, (2) *Lithophaga gigantea*, (3–5) *Aphanaia lima–A. dilatata*, (6) *Kolymia inoceramiformis*, (7) *K. plicata*, (8) *K. multiformis*, (9) *Maitaia bella*: (9a) beds with *Merismopteria macroptera*, (10) *Maitaia tenkensis*, (11) *Intomodesma costatum*; the beds with bivalves of the Transbaikalian Region: (1) *Polidevcia jamesi*, (2) *Kolymia* cf. *inoceramiformis*, (3) *K. plicata*, (4) *Aviculopecten* aff. *kolymaensis*, (5) *Merismopteria macroptera*, (6) *Maitaia bella*, and (7) *Polidevcia zabaikalica*. Abundance of fossils: — denotes one to four specimens, ▬ denotes five and more specimens.

Sinitsa. These data were used as the basis for The Permian Stratigraphic Scheme for the Transbaikal Region adopted in 1991 by the Fourth Interdepartmental Stratigraphic Regional Conference (*Resheniya...*, 1994). The same collection provides material for the present work. The Permian bivalves of the eastern Transbaikal Region have been studied from the Zhipkhoshi Formation of the Chiron Depression and the Antiya, Soktui, Togotui, Klyuchevskaya, and Ilistui formations of the Borzya Depression. In total, 18 species (including 6 new species), belonging to 11 families and 14 genera, have been identified. The Lower Permian bivalves of the Zhipkhoshi Formation have been studied from the tectonic blocks on the left slope of the Zun-Shiveya Ravine. The presence of the majority of previously identified species has been confirmed, and the taxonomic composition of the assemblages has been determined more accurately. The monographic treatment has provided no support for the presence of the genera *Glyptoleda, Vorkutopecten*, and *Oriocrassatella*, which were previously tentatively reported by the author from these deposits.

Of species that are absent from our collection, the most interesting are *Shizodus subobscurus* Lich., *Leibeia septifer* (King.), and *L.* cf. *hausmanni* Goldf., which are characteristic of the Zechstein in Western and Central Europe. They were previously reported by Kulikov from the upper Byrka Subformation; thus, their absence may be due to the fact that this stratigraphic unit is not represented in the collection. Of other genera, noteworthy are *Cyrtorostra* and *Leptodesma*, characteristic of warm-water Tethyan associations, and bipolar *Maitaia, Merismopteria*, and *Myonia*.

The bivalve fauna under study is most similar to the assemblages of northeastern Russia and the Verkhoyansk Region (12 species in common) and, to a lesser

extent, to those of the western boreal basins (5 species in common). The Transbaikalian bivalve assemblages are characterized by considerable endemism (six endemic species). By the mode of life, the studied assemblages are dominated by benthic sessile forms (eight species); the other forms belong to free-swimming and borrowing benthos.

Based on bivalves, the strata under consideration can be subdivided into seven stratigraphic units ranked as beds with fauna (Fig. 2). The species that are poorly preserved or somewhat differ from known species are identified in open nomenclature.

1. Beds with *Polidevcia jamesi* constitute a part of the Zhipkhoshi Formation. In addition to the abundant fossils of the index species, these beds contain *Palaeoneilo postolegi* sp. nov., rare *Permophorus oblongus*, and single specimens of *Polidevcia kolyvanica* and *Cypricardinia* cf. *borealica*. The fossils are confined to fine-grained sandstones and siltstones.

2. Beds with *Kolymia* cf. *inoceramiformis* correspond to the lower part of the Antiya Formation. The assemblage is formed exclusively by abundant representatives of the index species that occur in siltstones and mudstones.

3. Beds with *Kolymia plicata* correspond to the upper part of the Antiya Formation. The assemblage consists exclusively of the index species, fossil remains of which occur sporadically in siltstones.

4. Beds with *Aviculopecten* aff. *kolymaensis* correspond to the base of the Soktui Formation. In addition to single finds of the index species, these beds contain rare finds of *Wilkingia bulkurensis* and single finds of *Myonia* cf. *komiensis* and *Merismopteria* sp. indet. Except for *Wilkingia*, which was discovered in sandstones, all fossils were recorded from siltstones.

5. Beds with *Merismopteria macroptera* are equivalent to the remaining part of the Soktui Formation. In addition to abundant finds of the index species, there are single finds of *Leptodesma indistincta* sp. nov., *Cyrtorostra nana* sp. nov., *Myonia* aff. *gibbosa*, and *Astartella* cf. *permocarbonica*; rare finds of *Wilkingia bulkurensis*; and abundant finds of *Streblopteria alenae* sp. nov. Thus, this assemblage is most diverse taxonomically. The fossils are confined to siltstones (*Streblopteria* and *Merismopteria*) and sandstones and gravelstones (*Merismopteria, Streblopteria, Leptodesma, Cyrtorostra, Wilkingia, Myonia*, and *Astartella*).

6. Beds with *Maitaia bella* correspond to the upper part of the Togotui Formation. The assemblage is characterized by rare finds of the index species that are confined to sandstones and gravelstones and by abundant finds of *Polidevcia zabaikalica* sp. nov. that occur in siltstones, sandstones, clayey concretions, and, less frequently, mudstones.

7. Beds with *Polidevcia zabaikalica* correspond to the Klyuchevskaya and Ilistui formations. In addition to rare fossil remains of the index species, there are single small specimens of *Polidevcia* sp. indet. The fossils are confined to concretions and siltstones.

The beds are reliably correlated with the bivalve zones of other regions. The beds containing *Polidevcia jamesi* are correlated with the *Palaeoneilo parenica* Bivalve Zone of northeastern Asia, which corresponds to the larger, lower part of the Munugudzhak Regional Horizon (Fig. 2). This zone is correlated with the Asselian–lower half of the Artinskian (Biakov, 2000).

The beds containing *Kolymia* cf. *inoceramiformis* are correlated with the bivalve zone of the same name in northeastern Asia. The zone is defined in the middle part of the Upper Permian Omolon Horizon and corresponds to the *Omolonia snjatkovi* Local Zone. In the light of the finds of ammonoids of the genus *Sverdrupites* in the stratotype area (Leonova *et al.*, 2002), the zone apparently corresponds to the lower part of the upper Kazanian Substage.

The beds with *Kolymia plicata* are correlated with the northeastern Asia bivalve zone of the same name (*Terrakea borealis–T. korkodonensis* local zones) and embrace, most likely, the remaining part of the Kazanian Stage.

According to their stratigraphic position, the beds containing *Aviculopecten* aff. *kolymaensis* can be correlated with the bivalve *Kolymia multiformis* Zone of northeastern Asia, which was defined in the upper part of the Omolon Horizon, and are dated to the early Tatarian.

The beds containing *Merismopteria macroptera* are correlated with the northeastern Asia beds of the same name. The latter were defined in the lower part of the bivalve *Maitaia bella* Zone and approximately (excluding the upper part) correspond to the *Cancrinelloides obrutschewi* Local Zone of the Gizhiga Horizon. The lower boundary of the beds is considered to be equivalent to the base of the upper Tatarian Substage.

The beds containing *Maitaia bella* correspond to the upper part of the northeastern Asia bivalve zone of the same name, which corresponds to the entire Gizhiga Horizon. However, finds of the index species occur in abundance in the upper part of the horizon, whereas only single specimens are known from its lower half. Judging by paleomagnetic records (*Opornyi...*, 1990), the beds are probably equivalent to the middle part of the upper Tatarian Substage.

The beds containing *Polidevcia zabaikalica* can be correlated with the lower part of the Khivach Horizon of northeastern Asia based on their stratigraphic position and the similarity of the *Polidevcia* specimens to *P. magna* (Popow), a characteristic element of the late Khivach assemblages.

MATERIAL

The collection no. 1019 is housed at the Museum of GGUP Chitageols"emka (MCGS), Chita.

SYSTEMATIC PALEONTOLOGY

The following abbreviations: (H) shell height, (TH) shell thickness, (THRV) thickness of the right valve, (MD) length of the main shell diagonal, (L) shell length, (HL) hinge line length, (AM) length of the anterior margin, (AL) length of the anterior auricle, (PB) posterior hinge line branch, (AA) apical angle, (AB) anterior hinge line branch, and (SO) shell obliquity angle.

Superorder Protobranchia Pelseneer, 1912

Order Ctenodonta Douville, 1912

Family Malletiidae H. Adams et A. Adams, 1857

Genus *Palaeoneilo* Hall et Whitfield, 1869

***Palaeoneilo postolegi* Biakov, sp. nov.**

Plate 5, fig. 1

Etymology. Latin *post* (after) and the species name *P. olegi* (Tschern.). By this is meant that the former appeared after the latter.

Holotype. MCGS, no. 27/1019; cast of the right valve; Chiron Depression, left slope of the Zun-Shiveya Ravine; Lower Permian, Zhipkhoshi (?) Formation (tectonic block), outcrop 1487/7 of 1991, collected by Sinitsa.

Description. The shell is small, 6.3 mm long, triangular to oval (L : H = 1.47). The anterior hinge line branch is shorter than the posterior branch (AB : L = 0.59) and weakly convex and grades into the short, strongly rounded anterior margin. The ventral margin is long and arched and grades into the anterior and posterior margins. The short convex posterior margin is connected with the relatively long and slightly convex posterior branch of the hinge line at an angle of about 140°. The angle between the posterior and anterior branches of the hinge line is 150°. The valves are very inflated (TH : H = 0.42), the highest convexity occurs in the upper one-third of the valves equidistantly from the anterior and posterior margins. The beaks are of median size, wide, low, and nonoverhanging; the beak apex is rounded.

The external ornamentation is represented by fine concentric growth lines. The anterior branch of the hinge line shows eight fine elongate triangular teeth; the posterior branch bears about 15 still smaller teeth of the same form. No other characters are preserved.

Measurements, mm, and ratios:

Specimen	L	H	TH	AM	Teeth		AA	L : H	TH : H	AM : L
					AB	PB				
27/1019 Holotype	6.3	4.3	1.8	3.7	~8	~15	150°	1.417	0.42	0.59

Comparison. Similar to *P. olegi* (Tschern., 1947) from the Upper Carboniferous deposits of the Donetsk Basin (Tschernyschew, 1947) in the small size and form of the shell; it differs in having a slightly smaller ratio of L : H (1.47 against 1.54 in *P. olegi*) and fewer teeth on both branches (*P. olegi* has about 35 teeth on the posterior branch and 10 teeth on the anterior branch). Similar in shell form, this species is distinguished from *P. anthraconelloides* (Chao) from the Middle Carboniferous of the Donets Basin (Fedotov, 1932) by having a smaller size (2 to 2.5 times) and slightly smaller ratio of L : H (that of *P. anthraconelloides* is 1.5–1.6).

Material. Cast of the right valve and two broken casts of both valves from the same locality.

Genus *Polidevcia* Tschernyschew, 1943

***Polidevcia jamesi* Biakov, sp. nov.**

Plate 5, fig. 3

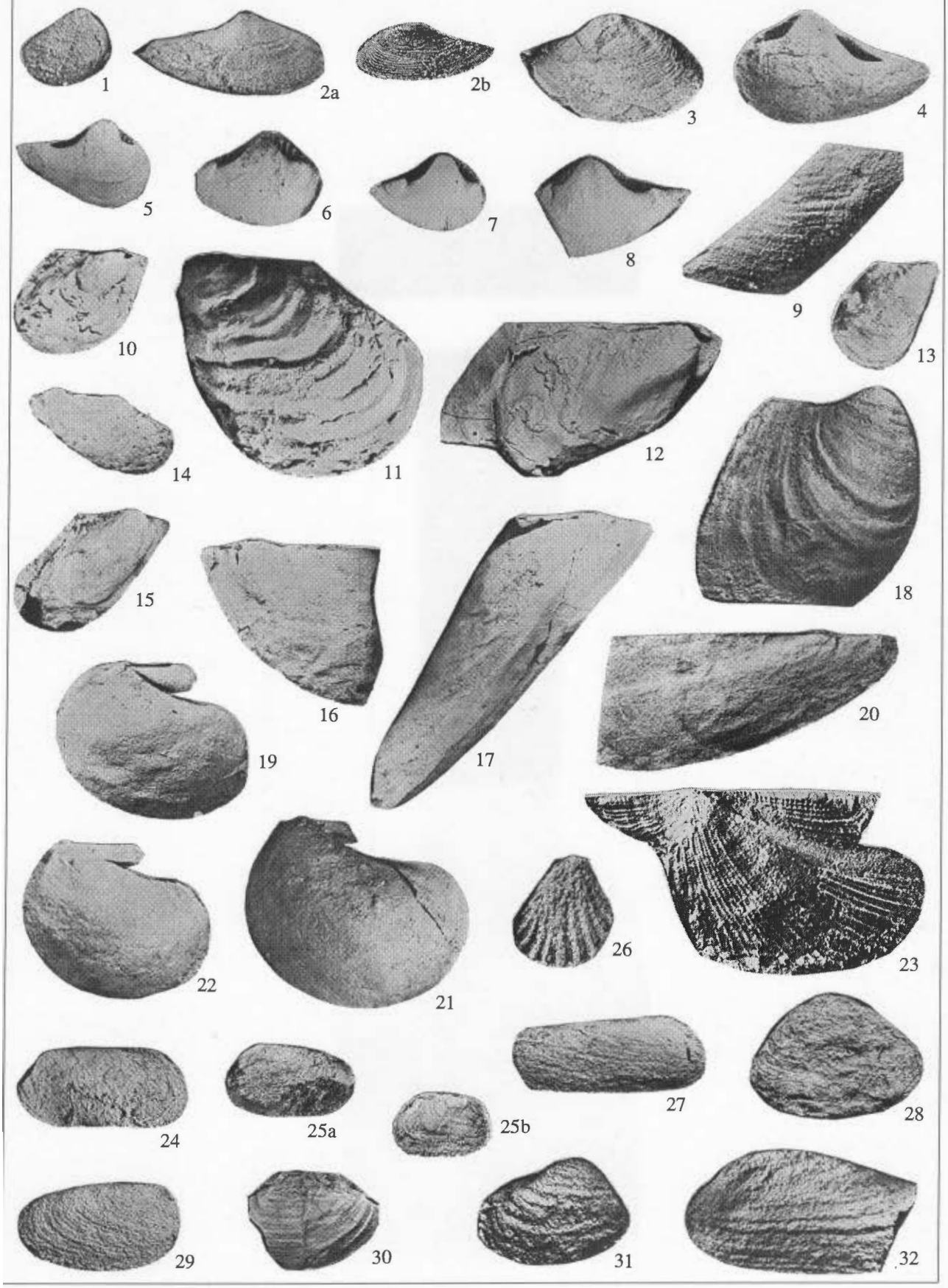
Etymology. In honor of the distinguished Australian paleontologist James M. Dickins.

Holotype. MCGS, no. 29/1019; cast of the right valve; Chiron Depression, left slope of the Zun-Shiveya Ravine; Lower Permian, Zhipkhoshi (?) Formation (tectonic block), outcrop 1487/7 of 1991, collected by Sinitsa.

Description. The shell is small (up to 20 mm long), from elongate oval to triangular oval (L : H = 1.78–1.25). The anterior hinge line branch is moderately long and convex; the anterior margin is short and sharply rounded; the ventral margin is very long and moderately convex. Their junctions are rounded. The ventral margin is connected to the weakly convex posterior branch of the hinge line by a sharply turning low-radius arch. The posterior margin is tapered to form a moderately pronounced rostrum. The apical angle is about 130°. The valves are moderately inflated (TH : H = 0.27). The maximum convexity occurs in the middle part of the valves or slightly anteriorly. The beaks are large, high, broad, and overhanging the hinge line; the beak apex is slightly pointed.

The external sculpture is represented by distinct concentric ribs, which are slightly narrower than intercostae. The posterior margin bears three ribs per 1 mm. The total number of ribs is about 30. Some of the anterior ribs are curved. The anterior branch of the hinge line bears about ten small oval to triangular teeth, and the posterior branch bears at most ten teeth. Other characters are not preserved.

Plate 5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Explanation of Plate 5

All sizes except for those specially mentioned are natural.

Fig. 1. *Palaeoneiolo postolegi* Biakov, sp. nov., holotype no. 27/1019, cast of the right valve, ×2.5; Chiron Depression, left bank of the Zun-Shiveya Ravine, Site 1487/7; Lower Permian, Zhipkhoshi(?) Formation.

Fig. 2. *Polidevcia kolyvanica* Muromzeva, 1974, specimen no. 28/1019, locality and age as in Fig. 1: (a) cast of the right valve, ×2, (b) impression of the right valve of the same specimen, ×1.5.

Fig. 3. *Polidevcia jamesi* Biakov, sp. nov., holotype no. 29/1019, cast of the right valve, ×1.7; locality and age as in Fig. 1.

Figs. 4–9. *Polidevcia zabaikalica* Biakov, sp. nov.: (4–6, 9) Borzya Depression, Biliktui–Borzya divide, Site 105; Upper Permian, upper Togotui Subformation: (4) specimen no. 3/1019, cast of the left valve, (5) holotype no. 1/1019, cast of the right valve, (6) specimen no. 5/1019, cast of the right valve, Site 413-2, (9) specimen no. 34/1019, shell sculpture, ×5; (7) specimen no. 6/1019, cast of the right valve; Borzya–Shonostui divide, Site 6/7; Upper Permian, lower Togotui Subformation; (8) specimen no. 7/1019, incomplete cast of the left valve; Biliktui–Borzya divide, Site 410/7; upper Klyuchevskaya Subformation.

Figs. 10 and 11. *Kolymia* cf. *inoceramiformis* Licharew, 1934, Ust-Antiya Ravine, Site 1276; Upper Permian, lower Antiya Subformation: (1) specimen no. 22/1019, cast of the right valve, (11) specimen no. 23/1019, incomplete cast of the left valve.

Fig. 12. *Kolymia plicata* Biakov, 1999, specimen no. 24/1019, incomplete cast of the right valve, Borzya Depression, Borzya–Biliktui divide, Site 400/21, Upper Permian, upper Antiya Subformation.

Figs. 13 and 18. *Maitaia bella* Biakov, 1991, Biliktui–Borzya divide; Upper Permian, upper Togotui Subformation: (13) specimen no. 26/1019, cast of the right valve, Site G-6/1, (18) specimen no. 25/1019, cast of the right valve, Site 2114-8.

Figs. 14, 16, and 17. *Merismopteria macroptera* (Morris, 1845): (14) specimen no. 8/1019, cast of the left valve, Site G-23; Ilistui–Malyi Soktui divide, Upper Permian, lower Soktui Subformation; (16, 17) left bank of the Kinkiya Ravine, Site 22; Upper Permian, upper Soktui Subformation: (16) specimen no. 10/1019, cast of the left valve, (17) specimen no. 11/1019, incomplete cast of the right valve, ×0.8.

Fig. 15. *Merismopteria* sp. indet., specimen no. 9/1019, cast of the right valve, Site G-23a; Ilistui–Malyi Soktui divide, Upper Permian, lower Soktui Subformation.

Figs. 19, 21, and 22. *Streblopteria alenae* Biakov, sp. nov., casts of the right valve; locality and age as in Figs. 16 and 17: (19) holotype no. 13/1019, (21) specimen no. 14/1019, (22) specimen no. 15/1019.

Fig. 20. *Leptodesma indistincta* Biakov, sp. nov., holotype no. 12/1019, incomplete cast of the right valve, ×2; locality and age as in Figs. 16 and 17.

Fig. 23. *Aviculopecten* aff. *kolymaensis* Maslennikow, 1959, specimen no. 16/1019, mold of a deformed impression of the left valve; locality and age as in Fig. 15.

Figs. 24 and 25. *Permophorus oblongus* (Meek et Hayden, 1872), locality and age are the same as in Fig. 1: (24) specimen no. 31/1019, cast of the left valve, ×2, (25) specimen no. 32/1019: (a) cast of the left valve, ×1.4, (b) impression of the left valve.

Fig. 26. *Cyrtorostra nana* Biakov, sp. nov., holotype no. 17/1019, cast of the left valve, ×3; locality and age are the same as in Figs. 16 and 17.

Figs. 27 and 32. *Wilkingia bulkurensis* (Muromzeva, 1984): (27) specimen no. 35/1019, cast of the right valve; locality and age as in Figs. 16, 17, (32) specimen no. 20/1019, incomplete deformed cast of a two-valved specimen as seen from the left valve; locality and age as in Fig. 15.

Fig. 28. *Astertella* cf. *permocarbonica* (Tschernyschew, 1885), specimen no. 18/1019, deformed cast of the right valve, ×1.1; locality and age as in Fig. 16.

Fig. 29. *Cypricardinia* cf. *borealica* Muromzeva, 1984, specimen no. 33/1019, cast of a two-valved specimen as seen from the right valve; Site 927/1; locality and age as in Fig. 1.

Fig. 30. *Myonia* cf. *komiensis* (Maslennikow, 1935), specimen no. 19/1019, incomplete cast of the right valve; locality and age as in Fig. 15.

Fig. 31. *Myonia* aff. *gibbosa* (Maslennikow, 1959), specimen no. 21/1019, cast of the right valve, ×1.5; Borzya Depression, Borzya–Biliktui divide, Site 7/1; Upper Permian, Soktui Formation.

Measurements, mm, and ratios:

Specimen	L	H	TH	AM	Teeth		AA	L : H	TH : H	AM : L
					AB	PB				
28/1019 Holotype	19.2	10.8	2.9	8.9	≈10	>10	130°	1.78	0.27	0.46
30/1019	15.2	12.2	3.5	6.8	–	–	130°	1.25	0.29	0.45

Comparison. Very similar, if not identical (in size, outline, and, probably, ornamentation), to the specimens that were described by Dickins as *Phestia darwini* (Kon.) (Dickins, 1963, pp. 38–39, pl. 2, figs. 4–11) from the Lower Permian of western Australia (the Nura Nura Member of the Pool Sandstones Formation of the Fitzroy Basin). However, the Australian forms are more elongated. In addition, their indistinct ornamentation hampers identification. From Early Permian *"Nuculana" darwini* of eastern Australia (Fletcher, 1945), the species is distinguished by having a more triangular and, usually, less elongate shell. With a similar shell

configuration and half as many ribs, *"Nuculana" basedovi* (Eth.) from the Lower Permian of western Australia (Fletcher, 1945, pp. 310–311, pl. 22, figs. 6, 7) apparently represents a closely related form.

Remarks. The absence of pallial sinus from all *Polidevcia*-like forms that were at my disposal allows me to attribute these forms to the genus *Polidevcia* considered to be synonymous with the genus *Phestia* Tschernyschew and the Paleozoic species described as belonging to the genus *Nuculana* Link.

Material. Satisfactorily preserved four casts and two impressions of the right and left valves from the same locality.

***Polidevcia zabaikalica* Biakov, sp. nov.**

Plate 5, figs. 4–9

Etymology. From the Transbaikalian Region.

Holotype. MCGS, no. 1/1019; cast of the right valve; Borzya Depression, Biliktui–Borzya divide; Upper Permian, Upper Togotui Subformation, outcrop 105 of 1984, collected by Kotlyar and Okuneva.

Description. The shell is of median generic size, up to 35 mm long, and triangular to oval (L : H = 1.61–1.67). The relatively short, almost straight anterior hinge line branch is connected with the short, strongly rounded anterior margin at an angle of about 160°. This margin gradually passes into the long arched ventral margin. The posterior branch of the hinge line is relatively long and weakly concave. The posterior cardinal angle is about 70°. The shell posterior is stretched backward to form a moderately pronounced rostrum. The apical angle is 80°–90°. The valves are noticeably inflated (TH : H = 0.36–0.41); the highest point is set in the upper one-third of the valve and slightly anteriorly. The beaks are large, slightly shifted anteriorly (AM : L = 0.35–0.39), high, broad, and overhanging the hinge line; the beak apex is rounded.

The external ornamentation is represented by fine (two or three per mm) poorly visible concentric lines, lost in casts. The anterior branch of the hinge line bears six to nine large elongated conical teeth, which diminish approaching the beak. The posterior line has 10 to 12 smaller teeth of similar shape. They also diminish near the beak. The chondrophore is small and rounded-triangular. The muscle scars are distinct, small, and oval; the pallial line locks the sinus.

Measurements, mm, and ratios:

Specimen	L	H	TH	AM	Teeth		AA	L : H	TH : H	AM : L
					AB	PB				
1/1019	23.4	14.0	5.8	8.1	6–7	11–12	90°	1.67	0.41	0.35
2/1019	>20.5	16.1	6.0	7.9	8	–	80°	–	0.37	–
3/1019	34.4	21.3	8.8	13.4	8–9	–	80°	1.61	0.41	0.39
4/1019	>28.8	21.8	8.0	10.6	–	–	80°	–	0.37	–
5/1019	>20	14.8	5.3	8.6	7	>10	90°	–	0.36	–
6/1019	>18.4	12.8	4.9	8.0	7–8	10	80°	–	0.38	–
7/1019	~30.5	18.7	6.7	11.0	8	12	90°	1.63	0.36	0.36

Comparison. Similar to *P. magna* from the upper part of the Khivach Horizon of northeastern Asia (Kashirtsev, 1959) in ornamentation and, partly, shell form, it differs in having a smaller (1.5–2.5 times) size and less elongate shell (in *P. magna*, L : H = 1.8–1.9). The shell resembles in form *P. wymensis* Kulikov, 1967, from the Kazanian (?) Stage of the northern Russian Platform (Kulikov, 1967), but has less rough ornamentation, larger beaks, and, usually, a larger size. Its most characteristic features are a triangular oval form of the shell, with the L : H ratio about 1.6–1.7, large broad beaks, fine smooth ornamentation, and a small number of large teeth in the hinge line.

Remarks. The similarity to *P. magna* (form and ornamentation of shell, large size, and few teeth) suggests that the species is ancestral to *P. magna*. This is also supported by its stratigraphic occurrence.

Occurrence. Upper Permian; Togotui, Klyuchevskaya, and Ilistui formations of the eastern Transbaikalian Region.

Material. More than 20 specimens, casts of both right and left valves and of shells, rare impressions from several localities.

Superfamily Pterioidea Gray, 1847

Family Pterineidae Miller, 1877

Genus *Leptodesma* Hall, 1883

***Leptodesma indistincta* Biakov, sp. nov.**

Plate 5, fig. 20

Etymology. Latin *indistincta* (indistinct).

Holotype. MCGS, no. 12/1019; cast of the right valve; Borzya Depression, left divide of the Kinkiya Ravine; Upper Permian, upper Soktui Subformation; Site G-22, collected by Kotlyar in 1990.

Description. The shell is small (MD is up to 30 mm long), oval to triangular, very elongated (L : H = 2.5), and heavily oblique (BA = 20°). The hinge line is straight; its length exceeds half of the shell length (HL : L = 0.69). The anterior margin is nearly straight and relatively short and grades into the long convex ventral margin, which has the form of an arch with a large radius. This margin is connected with the relatively long and weakly convex posterior margin by a sharp arch. The posterior margin forms an obtuse angle with the hinge line. The valves are slightly inflated (TH : H = 0.19); the highest point is located in the upper part of the valve near the beak equidistantly from the anterior and posterior margins. The beaks are very small, hardly noticeable, nonoverhanging, and flattened.

The external ornamentation (as judged from the impression) is represented by indistinct concentric growth lines. The anterior auricle is relatively large (AE : L = 0.23), lobe-shaped, weakly separated from the valve surface. The posterior auricle is large, elongate triangular, and well separated. In front of the beak, there is a small myophore rib. Other characters are not preserved.

Measurements, mm, and ratios:

L	H	TH	MD	HL	AL	SO	AA	L : H	TH : H	HL : L	AL : L
29	11.6	2.2	30	20	6.8	20°	30°	2.5	0.19	0.69	0.23

Comparison. By the shell form and ornamentation, this species most closely resembles *L. aviculaeformis* (Stuck., 1898), described by Muromzeva and Gus'kov (1984) from the upper Lower Permian (Kungurian Stage) of the Western Urals and from the lower Upper Permian (Ufimian Stage, Lekvorkuta Formation) of the Pechora basin. However, it has a more oblique shell (BA = 20° against 30°–35° in the European forms). In shell outline, it is also similar to *Leptodesma* sp., described by Nakazawa and Newell (1968) from the Upper Permian of Japan.

Material. Satisfactorily preserved cast and impression of the right valve.

Suborder Pteriina Newell, 1965

Superfamily Aviculopectinidae Meek et Hayden, 1864

Family Streblochondrinae Newell, 1937

Genus *Streblopteria* M'Coy, 1851

***Streblopteria alenae* Biakov, sp. nov.**

Plate 5, figs. 19, 21, and 22

Etymology. From the first name of geologist A.V. Kurilenko.

Holotype. MCGS, no. 13/1019, cast of the right valve; Borzya Depression, left divide of the Kinkiya Ravine; Upper Permian, upper Soktui Subformation, Site G-22, collected by Kotlyar in 1990.

Description. The shell is of median size, up to 38 mm long, elongated anteroventrally (L : H = 1.11–1.20), rounded to oval. The hinge line is straight and short; its length is less than one-half of the shell length (HL : L = 0.42). The relatively short convex posterior margin grades into the long arch-shaped ventral margin. The anterior margin is moderately long and concave. The cardinal angles are obtuse. The right valve is more inflated (TH : H = 0.18–0.19) than the left valve; the highest point is located either in the middle part of the shell or slightly dorsally in the central part of the valve or slightly anteriorly. The beaks are relatively broad, truncated, and overhanging the hinge line. The apical angle is 90°–95°.

The ornamentation of both valves is represented by fine concentric lines, lost in casts. The anterior auricle of the right valve is large, triangular to oval; the byssus is narrow and deep; the posterior auricle is small and elongate triangular. The anterior auricle of the left valve is relatively large and has the form of an isosceles triangle with a smoothed apex; the posterior auricle is similar to that of the right valve.

Measurements, mm, and ratios:

Specimen	L	H	THRV	HL	AA	L : H	TH : H	HL : L
13/1019 holotype	37.7	30.8	3.2	16.0	95°	1.20	0.18	0.42
14/1019	38.3	34.8	6.2	–	90°	1.11	0.18	–
15/1019	30.6	25.5	5.0	–	90°	1.20	0.19	–

Comparison. Resembles some central Taimyr specimens of *S. englechardti* described by Lyutkevich and Lobanova (1960) in the outline and elongated shell but differs in having an anteriorly stretched ventral margin and higher ratio of L : H (up to 1.2 as against 1.03–1.1 in the Taimyr specimens).

Material. Nearly ten casts and impressions of both right and left valves and one cast of the shell, all of good and satisfactory preservation.

Family Oxytomidae Ichikawa, 1958

Genus *Cyrtorostra* Branson, 1930, emend. Ciriacks, 1963

***Cyrtorostra nana* Biakov, sp. nov.**

Plate 5, fig. 26

Etymology. Latin *nana* (dwarf).

Holotype. MCGS, no. 17/1019, cast of the left valve; Borzya Depression, left divide of the Kinkiya Ravine; Upper Permian, upper Soktui Subformation; Site G-22, collected by Kotlyar in 1990.

Description. The shell is very small, 6.2 mm long and 7.4 mm high, oval, extended in height (L : H = 0.84), and oblique anteriorly. The hinge line is straight and short (less than one-half of the shell length, HL : L = 0.3). The moderately long and nearly straight anterior margin is connected at a very obtuse angle with the long, strongly rounded ventral margin. The latter gradually passes into the long convex posterior margin. The valves are moderately inflated (TH : H = 0.27), the highest point is in the upper one-third of the valve, being shifted toward the anterior margin. The beak is small, slightly overhanging the hinge line, and weakly sharpened. The ornamentation consists of 13 or 14 distinct radial ribs of the same order. Their width is subequal to that of intercostae. The cross sections of ribs and intercostae are rounded triangular. Bad preservation precludes the observation of the finer microsculpture. The sculpture becomes smoother near the posterior and anterior margins. The posterior auricle is rounded triangular; the anterior auricle is poorly pronounced, very small, and triangular.

Measurements, mm, and ratios:

L	H	TH	HL	AA	L : H	TH : H	HL : L
6.2	7.4	2.0	2.0	60°	0.84	0.27	0.3

Comparison. Similar in the form and ornamentation of the shell to *Cyrtorostra* sp. described by Muromzeva and Gus'kov (1984) from the Upper Permian (? Omolon Horizon) of the Penzhina River basin of the Omolon Massif, it differs in having a more oblique shell and smaller several times size. The small size may be explained by its young age.

Material. Cast and impression of the shell.

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