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Cambrian Bradoriida (Arthropoda) of the Malyi Karatau (Kyr-Shabakty Section)

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Abstract—*Beyrichona taylori* sp. nov., *Beyrichona? angularis* sp. nov., *Euzepaera foveata* sp. nov., *Monasterium tchizhovi* sp. nov., *Anabarochilina karatauensis* sp. nov. and the new genera *Almazina* with the type species *A. proprius* sp. nov. and *Karatachona* with the type species *K. ignorata* sp. nov. are described from the Middle and Upper Cambrian of the Kyr-Shabakty section in the Malyi Karatau, southern Kazakhstan. Additionally, six partially identified forms are depicted.

Key words: Bradoriida (Arthropoda), Cambrian, Kazakhstan, Malyi Karatau.

INTRODUCTION

In southern Kazakhstan, bradoriids have been recorded in a section on the Kyr-Shabakty River (Melnikova, 1990; Cook *et al.*, 1991) and even depicted (Melnikova *et al.*, 1997); however, descriptions of new taxa have never been published. The present paper seeks to correct this fault.

The Middle and Upper Cambrian and the lower part of the Lower Ordovician outcrop on the Kyr-Shabakty River, on the northeastern slope of the Malyi Karatau, 28 km east of the city of Zhanatas. In general, the section is composed of carbonates and carbonate-terrigenous rocks. A complete description of this section and its paleontological characteristics were given by Ergaliev (1979, 1980). The numbers of bradoriid samples correspond to the numbers of faunal localities pointed by Ergaliev (1980. p. 8, text-fig. 2).

The material on Cambrian bradoriids was collected by the author during her fieldwork in 1977 and a joint Soviet–American fieldwork in 1987, in cooperation with colleagues from the Satpaev Geological Institute (GIN, Almaty, Kazakhstan) and American colleagues H. Cook (Menlo Park, California) and M. Taylor (Denver, Colorado). Additionally, some samples were donated in different years by M.K. Apollonov, G.Kh. Ergaliev, and S.P. Koneva (GIN), to whom the author is grateful. The collection of bradoriids is deposited in the Paleontological Institute of the Russian Academy of Sciences (PIN), no. 4343.

Bradoriid remains were extracted by dissolving limestone in a weak (3–5%) acetic acid. A small number of variously preserved specimens were found on the rock surface. Quantitatively, bradoriids are rather scarce and represented by the previously known genera *Anabarochilina, Beyrichona, Euzepaera, Monasterium, Neoduibianella* Shu, 1990 (Pl. 11, fig. 17), and the new genera *Almazina* and *Karatachona*. Additionally, generic identification of some speciments was questionable, e.g., *?Liangshanella* Huo was, 1956 (Pl. 11, figs. 9, 10) and *?Parahipponicharion* Shu, 1983 (Pl. 11, fig. 18); some forms cannot be identified (Pl. 11, figs. 4, 7, 8, 11).

Within the studied section, the stratigraphical range of bradoriid species is narrow (Fig. 1). The exception is *Euzepaera foveata* sp. nov., which is recorded from the Mayaian (Middle Cambrian) to the Aksaian (Upper Cambrian). Earlier, the genus *Euzepaera* was recorded in the Upper Cambrian of China (Shu, 1990).

Nearly all bradoriid genera of the Kyr-Shabakty Assemblage, except for the new *Almazina* and *Karatachona*, are cosmopolitans. Thus, anabarochilins are known from the Middle and Upper Cambrian of Siberia (Abushik, 1960), the Lower and Middle Cambrian of North America (Siveter and Williams, 1997), the Middle Cambrian of Scandinavia (Siveter *et al.*, 1993; Melnikova *et al.*, 1997), from the entire Cambrian of Britain (Williams and Siveter, 1998), and also from Australia (Opik, 1961; Hinz-Schallreuter, 1993) and northwestern Kazakhstan (Melnikova, 1990). *Beyrichona* is known from the Lower and Middle Cambrian of North America, Morocco, Scandinavia, and China (Wiman, 1905; Ulrich and Bassler, 1931; Shu, 1990; Hinz-Schallreuter, 1993) and the Upper Cambrian of Belarus (Melnikova *et al.*, 1997). In the Malyi Karatau, beyrichons are found in the Upper Cambrian as well. *Liangshanella* is recorded in the Lower Cambrian of China and Transbaikalia (Melnikova, 1988; Huo *et al.*, 1991). In North America, it is known from the Middle Cambrian (Siveter and Williams, 1997). *Monasterium* is recorded in the Lower Cambrian of China (Zhang, 1987), the Middle Cambrian of Australia (Fleming,

1973; Jones and McKenzie, 1980), and in the Upper Cambrian of the northwest of Central Kazakhstan (Melnikova, 1990). *Neoduibianella* was first described from the Lower Cambrian of China (Shu, 1990). Its range is now increased due to finds in the Middle Cambrian of the Kyr-Shabakty section, *Leiopyge armata* Zone. *?Parahipponicharion* is known from the Lower Cambrian of China (Huo *et al.*, 1991).

SYSTEMATIC PALEONTOLOGY

Superorder Bradoriamorphes Kozur, 1972

Order Bradoriida Raymond, 1935

Family Beyrichonidae Ulrich et Bassler, 1931

Genus *Beyrichona* Matthew, 1886

***Beyrichona? angularis* Melnikova, sp. nov.**

Plate 11, fig. 12

Beyrichona? sp. nov. D: Melnikova *et al.*, 1997, pl. 4, fig. 10.

Etymology. From the Latin *angularis* (angular).

Holotype. PIN, no. 4343/43, incomplete shell; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1360-2.

Description. The shell is medium-sized, slightly postplete, and moderately convex; its maximum length is closer to the dorsal edge. The anterior end is straight, nonprotruding over the dorsal edge, and connects at an angle with the anteroventral edge. The ventral edge is narrowly rounded and attenuated downwards. A wide depression bordered anteriorly by a short, high, and tubercle-like lobe is developed in the dorsal part closer to the anterior end. The maximum convexity of the shell is in the posterior half of the shell closer to the dorsal edge; toward the ventral edge, it becomes substantially smaller. The shell surface is smooth.

Measurements, mm: L, 2.29; H, 1.9.

Comparison. The new species desplays a certain resemblance to *B. tinea* Matthew, 1886 from the Lower Cambrian of North America (Mattew, 1886, p. 66, pl. 6, fig. 21), being distinguished by the larger tubercle-like lobe and a relatively lower shell.

Remark. The new species has a large tubercle-like lobe, which is not characteristic of *Beyrichona*; therefore, it is assigned to this genus with reservation.

Material. Holotype.

***Beyrichona taylori* Melnikova, sp. nov.**

Plate 11, figs. 5 and 6

Beyrichona? sp. nov. C: Melnikova *et al.*, 1997, pl. 4, fig. 6.

Etymology. In honor of M. Taylor, American researcher.

Holotype. PIN, no. 4343/58, left valve; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1362.

Description. The shell is medium-sized, very high, nearly triangular, and strongly convex. The dorsal edge is short. The ventral edge is strongly attenuated downwards. The anterior end only slightly projects beyond the dorsal edge. A long, shallow, and oblique groove is developed closer to the anterodorsal edge. A narrow flattening is developed along the posterior and posteroventral edges. The maximum convexity is in the middle part of the shell.

Measurements, mm: holotype: L, 2.86; H, 2.5.

Comparison. The new species differs from *B.? angularis*, which is similar in shell outline, in the flattening developed along the posterior and posteroventral edges, its greater convexity, and in the absence of a tubercle-like rib.

Material. Two satisfactorily preserved valves (samples 1362 and 1379-III).

Genus *Karatachona* Melnikova, gen. nov.

Etymology. From the Karatau and the generic name *Beyrichona*.

Type species. *K. ignorata* sp. nov.

Diagnosis. Shell nearly triangular, high, and weakly convex. Short and oblique groove developed closer to anterodorsal corner. Dorsal corners with small spines at end.

Species composition. Type species.

Comparison. The new genus is similar to *Beyrichona* in the triangular shape of the shell and in the short groove and differs from the latter genus in the spines developed in the dorsal corners.

***Karatachona ignorata* Melnikova, sp. nov.**

Plate 11, fig. 14

Beyrichona sp. nov. A: Melnikova *et al.*, 1997, pl. 3, fig. 5.

Etymology. From the Latin *ignoratus* (unknown).

Holotype. PIN, no. 4343/57, left valve; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1348.

Description. The shell is medium-sized, nearly triangular, high, and moderately convex. The dorsal edge is straight and long, nearly as long as the shell. The anterior end is low, the anteroventral edge is strongly beveled. The posterior end is widely rounded. The anterior and posterior ends nearly equally project over the dorsal edge. A shallow and oblique groove is developed closer to the anterodorsal corner. The anterodorsal corner has a thin and short spine at its apex, which is directed slightly upwards. The posterodorsal spine is directed rearwards, continuing the dorsal edge. The shell surface is smooth.

Measurements, mm: L, 1.9; H, 1.45.

Material. Holotype.


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Explanation of Plate 11

All specimens come from the Malyi Karatau locality on the Kyr-Shabakty River.

Figs. 1–3. *Euzepaera foveata* sp. nov.: (1) holotype PIN, no. 4343/44, right valve; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1347-3; (2) specimen PIN, no. 4343/46, incomplete shell, left lateral view, L = 0.71 mm; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1361-4; (3) specimen PIN, no. 4343/45, right valve, H = 0.6 mm; Upper Cambrian, Aksaian Stage, *Eolotagnostus scrobicularis* Zone, sample 1414-2.

Fig. 4. Genus et sp. 1 indet.; specimen PIN, no. 4343/63, right valve, L = 3.05 mm, H = 2.2 mm; Middle Cambrian, Mayaian Stage, *Lejopyge armata* Zone, sample 1346-4.

Figs. 5 and 6. *Beyrichona taylori* sp. nov.: (5) specimen PIN, no. 4343/59, right valve, L = 2.05 mm, H = 3.8 mm; Upper Cambrian, Batyrbaian Stage, *Oncagnostus ovaliformis* Zone, sample 1379-III; (6) holotype PIN, no. 4343/58, left valve; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1362.

Figs. 7 and 11. Genus et sp. 2 indet.: (7) specimen PIN, no. 4343/62, left valve, L = 0.6 mm, H = 0.45 mm; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1367-III; (11) specimen PIN, no. 4343/64, ? left valve, H = 2.5 mm; Upper Cambrian, Sakian Stage, *Pseudagnostus "curtare"* Zone, sample 1359-2.

Fig. 8. Genus et sp. 3 indet.; specimen PIN, no. 4343/72, ? left valve, L = 0.61 mm, H = 0.42 mm; Middle Cambrian, Mayaian Stage, *Lejopyge armata* Zone, sample 1346-1.

Figs. 9 and 10. *?Liangshanella* sp.: (9) specimen PIN, no. 4343/65, right valve, L = 0.95 mm, H = 0.72 mm; (10) specimen PIN, no. 4343/49, left valve, L = 1.48 mm, H = 1.02 mm; Upper Cambrian, Batyrbaian Stage, *Oncagnostus ovaliformis* Zone, sample 1381=1373.

Fig. 12. *Beyrichona? angularis* sp. nov., holotype PIN, no. 4343/43, left valve; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1360-2.

Fig. 13. *Almazina proprius* sp. nov., holotype PIN, no. 4343/48, left valve: (a) lateral view and (b) enlarged fragment of lateral surface with siftlike pores visible; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1361-4.

Fig. 14. *Karatachona ignorata* sp. nov., holotype PIN, no. 4343/57, left valve; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1348.

Figs. 15 and 16. *Anabarochilina karatauensis* sp. nov.: (15) specimen PIN, no. 4343/56, right valve, L = 6.2 mm, H = 4.7 mm; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1348; (16) holotype PIN, no. 4343/55, right valve; Middle Cambrian, Mayaian Stage, *Lejopyge armata* Zone, sample 1346-4.

Fig. 17. *Neoduibianella* sp.: specimen PIN, no. 4343/50, right valve, H = 0.55 mm; Middle Cambrian, Mayaian Stage, *Lejopyge armata* Zone, sample 1345.

Fig. 18. *?Parahipponicharion* sp.: specimen PIN, no. 4343/53, right valve, L = 0.65 mm; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1361-4.

Fig. 19. *Monasterium tchizhovi* sp. nov., holotype PIN, no. 4343/51, right valve; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1360-6.

Family Zhexiellidae Shu, 1990

Genus *Euzepaera* Shu, 1990

Euzepaera foveata Melnikova, sp. nov.

Plate 11, figs. 1–3

Monasterium seletiensis (part.): Melnikova, 1990. pl. 32, fig. 2.

Euzepaera? sp. nov.: Melnikova *et al.*, 1997, pl. 4, fig. 1.

Etymology. From the Latin *foveatus* (pitted).

Holotype. PIN, no. 4343/44, right valve; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1347-3.

Description. The shell is small, amplete, nearly round, moderately and evenly convex. The anterior and posterior ends are equally high and broadly rounded. The median groove is oblique, shallow, short, unclear, and situated close to the anterodorsal corner. The maximum convexity is in the middle part of the shell. The shell surface is covered by regularly scattered pits.

Measurements, mm: holotype: L, 0.75; H, 0.6.

Comparison. It differs from the type species *E. hunanensis* from the Upper Cambrian of China (Shu, 1990, p. 45, pl. 2, fig. 5, text-fig. 20) in the shorter and indistinctly outlined median groove.

Occurrence. Middle and Upper Cambrian of Kazakhstan.

Material. Three ill-preserved valves and several valve fragments (samples 1347-3, 1361-4, 1414-2, 1401).

Genus *Almazina* Melnikova, gen. nov.

Etymology. In honor of Aleksandr Mazin, an employee of the Paleontological Institute of the Russian Academy of Sciences, Moscow.

Type species. *Almazina propria*, sp. nov.

Diagnosis. Shell amplete and moderately convex. Hinge line straight. Anterior and posterior ends similar in outlines. Large muscle scar located near anterodorsal corner. Valve surface porous.

Species composition. Type species.

Comparison. The new genus is similar to *Euzepaere* in the shell outline and porous surface, being distinguished by a large muscular scar.

Almazina propria Melnikova, sp. nov.

Plate 11, fig. 13

Gen. et sp. nov.: Melnikova *et al.*, 1997, pl. 4, fig. 9.

Etymology. From the Latin *proprius* (unusual).

Holotype. PIN, no. 4343/48, left valve; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Upper Cam-

brian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample no.1361-4.

Description. The shell is small, high, and evenly convex. The anterior and posterior ends are equal in height. The muscular scar is oblong. The valve surface is covered by closely spaced sievelike pores.

Measurements, mm. L, 1.00; H, 0.75.

Material. Holotype.

Family Monasteriidae Jones et McKenzie, 1980

Genus *Monasterium* Fleming, 1973

***Monasterium tchizhovi* Melnikova, sp. nov.**

Plate 11, fig. 19

Monasterium sp. nov.: Melnikova *et al.*, 1997, pl. 4, fig. 11.

Etymology. In honor of D. Tchizhov, former member of the staff of the Paleontological Institute of the Russian Academy of Sciences.

Holotype. PIN, no. 4343/51, well-preserved shell; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Upper Cambrian, Sakian Stage, *Ivshinagnostus ivshini* Zone, sample 1360-6.

Description. The shell is small, high, strongly convex, and preplete. The dorsal edge is straight, a little shorter than the shell. The anterior end is higher than the posterior one, only slightly projects over the dorsal edge, and is slightly beveled in the anteroventral part. A hornlike rib is developed in the anterior part of the shell just off the anterodorsal corner. This rib is round in cross section, starting near the dorsal edge, running along the anterior edge, curving crescent-like toward the posterior end approximately in the midheight of the shell, and nearly reaching the shell center. At both ends, this rib is slightly acuminate and directed upwards and rearwards. The rib borders a wide and moderately deep groove. A narrow flattening is developed along the free edge of the shell; it is most distinct at the posterior end. The maximum convexity is in the middle of the shell. The shell surface is covered by closely spaced and large pits. These pits are widely spaced and poorly developed on the hornlike rib.

Measurements, mm: L, 1.00; H, 0.68.

Comparison. From the type species *M. opiki* (Fleming, 1973, p. 8, pl. 2, figs. 6–12), the new species differs in the absence of a posterodorsal spinelike projection and the marginal rib and in the pitted rather than reticulate surface. The hornlike rib differs in structure, it is more distinct and raises upwards and rearwards above the shell surface. From *M. ivshini* (Melnikova, 1990, p. 174, pl. 32, fig. 1), the new species differs in the development of the hornlike rib.

Remarks. The holotype shell surface seems to be large and porous. However, a detailed investigation of valve fragments, which are less treated by the acid, reveals that the shell surface is covered by blind pits rather than pierced by foramina.

Material. Holotype and several fragments from the type locality.

Family Svealutidae Opik, 1968

Genus *Anabarochilina* Abushik, 1960

***Anabarochilina karatauensis* Melnikova, sp. nov.**

Plate 11, figs. 15 and 16

Etymology. From the Malyi Karatau Mountain Ridge.

Holotype. PIN, no. 4343/55, right valve; Kazakhstan, Malyi Karatau, Kyr-Shabakty River; Middle Cambrian, Mayaian Stage, *Lejopyge laevigata* Zone, sample 1346-6.

Description. The shell is large, elongated, amplete, and strongly convex. The anterior end is lower than the posterior one. The posterior end is broadly rounded and considerably projects over the dorsal edge. A low and wide tubercle only weakly differentiated from the rest of the lateral surface is situated in the anteroventral part of the shell. This tubercle is posteriorly contoured by a shallow crescent-like groove. A wide and weakly convex rib is developed along the posterior and ventral edges. The shell surface is smooth.

Measurements, mm: L, 8.0; H, 5.5.

Comparison. From the closest species *A. australis* from the Middle Cambrian of Australia (Jones and McKenzie, 1980, p. 207, text-fig. 2; Hinz-Schallreuter, 1993, p. 437, text-figs. 19.1–3), the new species differs in the low and only weakly outlined tubercle.

Material. Two valves from sample 1346-6 and one valve from sample 1348.

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REFERENCES

Abushik, A.F., The First Findings of Leperditaceans in the Cambrian of the Siberian Platform, *Vestn. Leningr. Gos. Univ., Ser. Geol. Geogr.*, 1960, vol. 6, no. 1, pp. 93–98.

Cook, H. and Taylor, M., Apollonov, M., *et al.*, Comparison of Two Early Paleozoic Carbonate Submarine Fans—Western United States and Southern Kazakhstan, Soviet Union, *Soc. Econ. Paleontol. Mineral. Pacific Sect.*, 1991, vol. 67, part 2, pp. 847–872.

Ergaliev, G.Kh., Continuous Section of the Middle and Upper Cambrian and the Tremadocian of the Malyi Karatau, *Izv. Akad. Nauk Kazakh. SSR, Ser. Geol.*, 1979, nos. 4–5, pp. 41–52.

Ergaliev, G.Kh., *Trilobity srednego i verkhnego kembriya Malogo Karatau* (Trilobites from the Middle and Upper Cambrian of the Malyi Karatau), Alma-Ata: Nauka, 1980.

Fleming, P., Bradoriids from the *Xystridura* Zone of the Georgina Basin, Queensland, *Qld. Geol. Surv.*, 1973, publ. 356, pap. no. 31, pp. 1–9.

Hinz-Schallreuter, I., Ostracodes from the Middle Cambrian of Australia, *Neues Jahrb. Geol. Paläontol*, 1993, vol. 188, pp. 305–326.

Huo Shicheng, Shu Degan, and Cui Zhilin, *Cambrian Bradoriida of China*, Beijing: Geol. Publ., 1991.

Jones, P. and McKenzie, K., Queensland Middle Cambrian Bradoriida (Crustacea): New Taxa, Palaeontological Affinities, *Alcheringa*, 1980, vol. 4, pp. 203–225.

Matthew, G.F., Illustrations of the Fauna of the St. John Group Continued: 3. Descriptions of New Genera and Species, *Proc. Trans. R. Soc. Can.*, 1886, ser. 1, pp. 29–84.

Melnikova, L.M., Some Bradoriids (Crustacea) from the Botoman Stage of Eastern Transbaicalia), *Paleontol. Zh.*, 1988, no. 1, pp. 114–117.

Melnikova, L.M., The Early and Late Cambrian Bradoriida (Ostracodes) from Northeastern Central Kazakhstan, *Tr. Inst. Geol. Geofiz. Sib. Otd. Akad Nauk SSSR* (Novosibirsk), 1990, vol. 765 (Biostratigraphy and Paleontology of the Cambrian of Northern Asia), pp. 170–176.

Melnikova, L.M., Siveter, D.J., and Williams, M., Cambrian Bradoriida and Phosphatocopida (Arthropoda) of the Former Soviet Union, *J. Micropalaeontol.*, 1997, vol. 16, no. 2, pp. 179–191.

Opik, A., The Geology and Palaeontology of the Headwaters of the Burke River, Queensland, *Bull. Bur. Miner. Res., Geol. Geophys.*, 1961, vol. 53, pp. 1–249.

Shu Degan, *Cambrian and Lower Ordovician Bradoriida from Zhejiang, Hunan and Shaanxi Provinces*, Xian: NW Univ. Press, 1990.

Siveter, D.J. and Williams, M., Cambrian Bradoriid and Phosphatocopid Arthropods of North America, *Spec. Pap. Palaeontol.*, 1997, no. 57, pp. 1–69.

Siveter, D.J., Williams, M., Abushik, A.F., *et al.*, On *Anabarochilina primordialis* (Linnarsson), in *A Stereo-Atlas of Ostracod Shells*, Leicester: Depart. Geol., Univ., 1993, pp. 71–76.

Ulrich, E.O. and Bassler, R.S., Cambrian Bivalved Crustacea of the Order Conchostraca, *Proc. US Nat. Mus.*, 1931, vol. 78, no. 4, pp. 1–130.

Williams, M. and Siveter, D.J., *British Cambrian and Tremadoc Bradoriid and Phosphatocopid Arthropods*, London: Palaeontogr. Soc., 1998.

Wiman, C., Studien uber das Nordbaltische Silurgebiet: 1. Olenellussandstein, Obollussandstein und Ceratopygeschiefer, *Bull. Geol. Inst. Univ. Uppsala*, 1905, vol. 6, pp. 36–76.

Zhang, X., Moult Stages and Dimorphism of Early Cambrian Bradoriids from Xichuan, Henan, China, *Alcheringa*, 1987, vol. 11, nos. 1–2, pp. 1–19.