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New Ostracodes from the Cretaceous and Paleogene Boundary Sediments in Southwestern Crimea

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Abstract—Seven new species of ostracodes are described in six genera. Representatives of the genus *Parapokornyella* are recorded for the first time in southwestern Crimea, from the Cretaceous/Paleogene boundary beds.

INTRODUCTION

There is little contemporary work on the ostracodes of the Cretaceous of Crimea, though those of the Berriasian (Rachenskaya, 1970; Tesakova and Rachenskaya, 1996a, 1996b) have been recently studied. Ostracodes of the Upper Cretaceous were covered by Scheremeta (1968, 1969). He studied sections in the areas of Inkerman, Kuibyshevo, Bakhchisarai, Belogorsk, and several sections in the Tarkhankut Peninsula. According to Scheremeta the Upper Maastrichtian and Paleogene ostracode assemblages are fairly representative, except for those from the lower part of the Danian where solitary individuals of transitional species are found. Ostracodes from the Paleogene of Crimea were also studied by Nikolaeva (1978, 1979, 1980, 1981). She treated material from three lower to middle Paleogene cores in Bakhchisarai Region. It was discovered that ostracodes appear in relatively small number within the whole section. The ostracodes found in the Danian are rare and represented by smooth forms belonging to the families Cytherellidae and Berdiidae.

I studied in detail the Cretaceous/Paleogene boundary beds of the sections of Peshchernyi Gorod, Baklinskaya Gryada, Korabel'naya Gryada, and Starosel'e (Fig. 1). The samples collected at the sections of Datskaya Gryada, the Bel'bek River valley, and Inkerman, the Chernaya River valley, and passed by M.V. Zheltonozhskaya (StPbSU) were involved in the analysis. In all above mentioned sections the Upper Maastrichtian sediments are represented by gray and yellow-gray calcareous fine-grained sandstones, bearing layers of phosphorized molds of bivalves and gastropods and oyster banks in its upper part. The sandstones contain diverse assemblage of benthic invertebrates, viz. belemnite rostra, bivalve shells and molds, rarer brachiopod shells etc. The roof of the Upper Maastrichtian deposits is uneven with shallow pockets and mud-eaters' burrows filled up with the overlain Danian sediments. There is a member of rather loose, poorly cemented glauconite-quartz heavily calcareous sandstones with detritus consisting of bivalves, crinoids, bryozoans, and sponge spiculae at the base of the Danian. The sandstones are not laminated, with phosphate nodules and phosphatized molluscan molds. At the base the sandstones contain fragments of the Maastrichtian rocks, small-sized pebble conglomerates (not thick), and redeposited belemnite rostra and oyster shells. The thickness is up to 0.5 m. Above are situated light-gray sandy and marly limestones with brachiopod and echinoderm remains. These limestones gradually transit into white solid recrystallized limestones with flint nodules in the upper part, with abundant organic detritus; sponge spiculae, bryozoan remains, and crinoid columnals are the most abundant (*Putevoditel'...*, 1971; Muzylev, 1980; Naidin, 1985; Mazarovich and Mileev, 1989; etc.). The samples were collected bed by bed, at intervals of 0.05 to 2 m. The samples are of sufficient weight (1000–2000 g) and have been elutriated, i.e., crushed, boiled, decanted, and dried. One hundred and fifty five samples have been studied. Ostracodes are recorded in all samples. The section situated near the village of Starosel'e is considered as typ-

Fig. 1. Map showing studied sections of the Cretaceous/Paleogene boundary deposits in Southwestern Crimea: I—Peshchernyi Gorod, II—Baklinskaya Gryada, III—Korabel'naya Gryada, IV—Starosel'e, V—Datskaya Gryada, the Bel'bek River valley, VI—Inkerman, the Chernaya River valley.

ical. This section had been studied and described in detail during the XII European colloquium on microfauna (*Putevoditel'*..., 1971), and was later redescribed by Muzylev (1980) during the study of nannoplankton.

The Upper Maastrichtian deposits outcropped in the sections in question contain an ostracode assemblage that is represented by 85 species in 38 genera. *Bythoceratina hispida* (Veen, 1936), *Mosaeleberis macrophtalma* (Bosquet, 1847), *Planileberis spinosa* (Szczechura, 1965), *P. eximoides* (Veen, 1936), *Spinoleberis macerrima* (Veen, 1936), *Cythereis incerta* Szczechura, 1965, *C. latebrosa* Szczechura, 1965, *Golcocythere elegans* (Bosquet, 1847), *Phacorhabdotus fillicosta* (Marsson, 1880), *Eopaijenborchella marssoni* (Triebel, 1940), *Oertliella binkhosti* (Veen, 1936), *Curfsina hoffmani* (Veen, 1936), *Praecaudites sagittata* (Bosquet, 1854), and some others are the most often found. This assemblage is very similar to the contemporary assemblage of the north of Western Europe and may be correlated with Deroo's Zone "4", being distinguished in the stratotype area of the Maastrichtian (Southern Limbourgh, Holland) (Szczechura, 1965; Deroo, 1966; Babinot, 1970, 1980; Clark, 1983; etc.). *Oertliella horridula* (Bosquet, 1854), *O. omatoidea* Deroo, 1966, *O. multifora* (Szczechura, 1965), *Echinocythereis subulosa* (Nikolaeva, 1971), *Schuleridea maculata* (Apostolescu, 1954), *S. acutalis* Mandelstam, 1960, *Cytherelloidea* ex gr. *marginata* Scheremeta, 1968, *Mosaeleberis agatae* (Szczechura, 1965), *M. curfsensis* Deroo, 1966, *Hornibrookella bilamellosa* Marliere, 1958, and some others are characteristic of the Lower Danian. This may be in part correlated with the *Cytherelloidea* Zone distinguished by Marliere for Ziplie Tufa in the stratotype area of the Mons stage in Belgium (Marliere, 1958; *Zonal'naya stratigrafiya*..., 1991). *Cytherella ovata* (Roemer, 1840), *Longocytherella lagenalis* (Marliere, 1958), *Bairdoppilata simplicatilis* (Mandelstam et Luebimova, 1960), *Xestoleberis pergensi* Veen, 1936, and *Krithe bonnemai* Deroo, 1966 dominate in the both stages.

The genus *Parapokornyella* described by Babinot (1980) from the Upper Cretaceous of Provence, France, have been recorded in the Cretaceous of Crimea for the first time.

The material studied is housed in the Museum of the Department of Historical Geology of St. Petersburg State University (DHG StPbSU), collection no. 372. The SEM photos were taken under JSM-35c microscope in the Botanical Institute, RAS (BIN) by Kartseva and the photos were printed by Petrova (BIN).

In the species descriptions the author follows the terminology adopted for the Mesozoic and Cenozoic ostracodes (*Prakticheskoe rukovodstvo*..., 1989). There are four gradations of shell size, viz. "small" for shells being less than 0.5 mm, "medium" for those being from 0.5 to 1 mm, "relatively large" for those being from 1 to 1.5 mm, and "large" for shells being from 1.5 to 2 mm long.

SYSTEMATIC PALEONTOLOGY

Order Platicopida Sars, 1865

Family Cytherellidae Sars, 1865

Genus *Cytherelloidea* Alexander, 1929

***Cytherelloidea marlierei* Savelieva, sp. nov.**

Plate 7, fig. 1

Cytherelloidea sp. indet. (aff. *spinigera* van Veen): Marliere, 1958, p. 11, pl. 1, fig. 6.

Etymology. In honor of micropaleontologist R. Marliere.

Holotype. DHG StPbSU, no. 372/5, female carapace; section Starosel'e; Lower Paleogene, Lower Danian, 0.1 m above the Maastrichtian/Danian border.

Description. The carapace is medium sized, rounded-rectangular, with the maximum height above the central pit and maximum convexity in the posterior third. The anterior end is broad evenly rounded, higher than the posterior one. The dorsal margin is arch-like rounded, the ventral margin has rather deep excavation in its posterior third. The genital tubercles are well developed, notably prominent and projecting over the line of the dorsal margin; the upper tubercle is about 2 times smaller than the lower one.

The carapace is characterized by well-developed ventral ridge, which extends for two thirds of the carapace length and is allied to the lower genital tubercle at obtuse angle. Two diagonal dorsal ribs present as well. A not particularly large, thin rib borders the central pit from below.

Measurements in mm:

Specimen no.	Length	Height	Width
372/5 (holotype), female	0.62	0.37	0.3
372/7, female	0.6	0.32	0.25
372/8, female	0.65	0.4	0.27
372/9, female	0.6	0.35	0.3

Comparison. The new species differs from *C. spinigera* (Veen), which is similar in shape and placement of the ribs (Marliere, 1958, p. 9–11, pl. 1, fig. 5; Belgium, Mons), in more expressed ribs and in the genital tubercles notably projecting over the line of the dorsal margin.

Occurrence. The Lower Danian of Crimea.

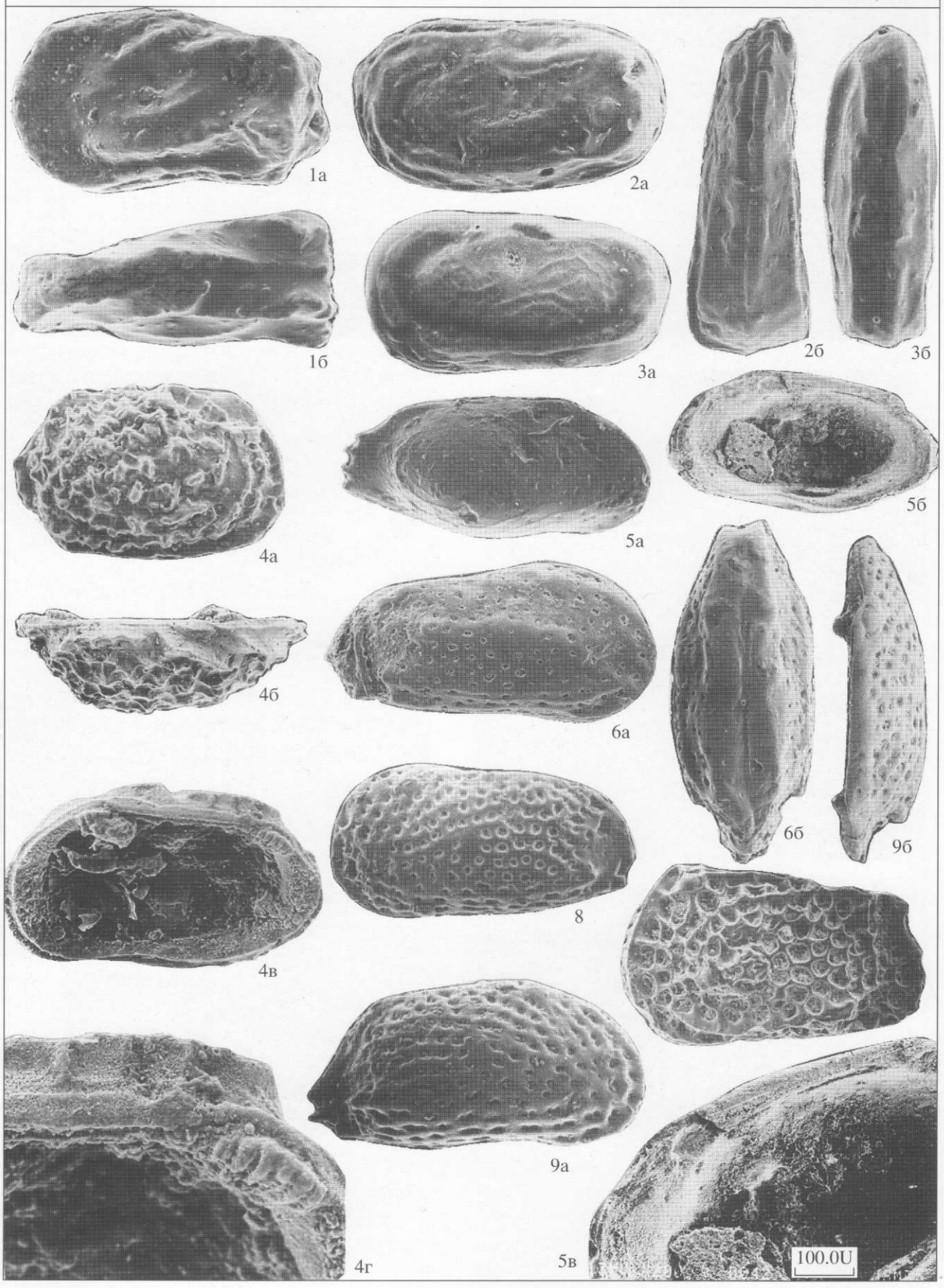
Material. Six complete carapaces and one well-preserved right valve from the localities of Peshchernyi Gorod, Starosel'e, and Inkerman.

***Cytherelloidea striata* Savelieva, sp. nov.**

Plate 7, fig. 2–3

Etymology. From the Latin *striata* (striated).

Holotype. DHG StPbSU, no. 372/1, female carapace; section Korabel'naya Gryada; Lower Paleogene, Lower Danian, 0.4 m above the Maastrichtian/Danian boundary.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Explanation of Plate 7

Fig. 1. *Cytherelloidea marlieri* sp. nov., holotype DHG StPbSU, no. 372/5, female carapace: (a) from the left valve, (b) from the dorsal margin, ×90; Crimea, section Starosel'e; Lower Danian, bed 3 (*Putevoditel'...*, 1971).

Figs. 2 and 3. *Cytherelloidea striata* sp. nov.: (2) holotype DHG StPbSU, no. 372/1, female carapace: (a) from the left valve, (b) from the dorsal margin, ×95; (3) specimen no. 372/2, male carapace: (a) from the left valve, (b) from the dorsal margin, ×95; Crimea, section Korabel'naya Gryada; Lower Danian.

Fig. 4. *Physocythere andreevi* sp. nov., holotype DHG StPbSU, no. 372/35, right valve of female: (a) laterally, (b) from the dorsal margin, (c) from the inner side, ×110, (d) the right part of the hinge, ×280; Crimea, section Peshchernyi Gorod; Upper Maastrichtian, *Nephrolithus frequens* Zone.

Fig. 5. *Opimocythere ventroinflata* sp. nov., holotype DHG StPbSU, no. 372/38, right valve of male: (a) laterally, ×60, (b) from the inner side, ×55, (c) the hinge of the right valve, ×120; Crimea, section Peshchernyi Gorod; Upper Maastrichtian, *Nephrolithus frequens* Zone.

Fig. 6. *Mosaeleberis figurata* sp. nov., holotype DHG StPbSU, no. 372/48, carapace: (a) from the right valve, (b) from the dorsal margin, ×70; Crimea, section Korabel'naya Gryada; Upper Maastrichtian, *Nephrolithus frequens* Zone.

Fig. 7. *Oertliella bella* sp. nov., holotype DHG StPbSU, no. 372/72, left valve of female laterally, ×70; Crimea, section Peshchernyi Gorod; Lower Danian.

Figs. 8 and 9. *Parapokornyella nikolaevae* sp. nov.: (8) specimen no. 372/99, the left valve laterally, ×65; (9) holotype DHG StPbSU, no. 372/98, right valve: (a) laterally, ×70, (b) from the dorsal margin, ×65.

Description. The carapace is medium sized, rounded-rectangular, with its maximum height at the mid-length. The anterior and posterior ends are evenly rounded.

The marginal rib extends along the anterior, ventral, and posterior ends. On the dorsal side it is shifted from the margin, curved above the central pit, and running obliquely toward the center of the anterior end. There is a short ridge-like rib below the central pit. The upper genital tubercle is fused with the marginal rib, the lower tubercle is small, symmetrical, shifted from the edge, and bordered by the marginal rib posteroventrally. The surface is covered with thin subparallel striated ribs being obliquely oriented.

Sexual dimorphism is well expressed. The male carapace is somewhat longer and less convex; its posterior end is slightly oblique in the lower half. Unlike in females, the finest striation is slightly curved below the central pit, bearing thin transverse septae that form poorly defined reticulation in males.

Measurements in mm:

Specimen no.	Length	Height	Width
372/1 (holotype), female	0.6	0.3	0.25
372/2, male	0.67	0.35	0.2
372/3, male	0.67	0.37	0.3
372/4, male	0.7	0.35	0.25

Comparison. The species differs essentially from all previously known representatives of the genus *Cytherelloidea* in the marginal rib and fine striation bearing vestigial transverse septae.

Occurrence. The Lower Danian of Crimea.

Material. Five carapaces and seven valves from the localities of Peshchernyi Gorod, Korabel'naya Gryada, Starosel'e, and Inkerman. All material is well preserved.

Order Podocopida Sars, 1865

Suborder Cytherocopina Gründel, 1967

Family Progonocytheridae Sylvester-Bradley, 1948

Genus *Physocythere* Kaye, 1963

***Physocythere andreevi* Savelieva, sp. nov.**

Plate 7, fig. 4

Etymology. In honor of micropaleontologist Yu.N. Andreev.

Holotype. DHG StPbSU, no. 372/35, right valve; section Peshchernyi Gorod; Upper Cretaceous, Upper Maastrichtian, 4.45 m below the Maastrichtian/ Danian boundary, nannoplankton Zone *Nephrolithus frequens*.

Description. The carapace is small, strongly shortened, rounded-rectangular. The anterior and posterior ends are rounded, of subequal height. The posterior end projects less over the dorsal margin. The ventral and dorsal margins are subparallel. The carapace is convex in its central part and flattened in both anterior and posterior parts.

The surface of the valves is covered with short lamellate spines situated on facets of irregular reticulation. The lamellate spines join along the anterior, ventral, and posterior ends and form three rows of flat concentric ribs. The hinge is merodont, the ridge is situated in the left valve, the hinge weakly subdivided in its central part, and subdivided into five to six elements in the terminal parts.

Measurements in mm:

Specimen no.	Length	Height	1/2Width
372/35 (holotype)	0.45	0.3	0.2
372/36	0.47	0.32	0.25
372/37	0.45	0.3	0.15

Variability. The carapace height, as well as the degree of development of cells and ribs is somewhat variable.

Comparison. In general appearance and sculpture the species is similar to *Ph. infrequens* (Mandelstam), comb. nov., originally described as *Orthonotacythere infrequens* Mandelstam (Luebimova *et al.*, 1960, p. 255–256, pl. 23, fig. 13) from the Senomanian of Mangyshlak and Maastrichtian of Western Siberian Lowland. The new species differs in the posterior end being shorter, in the dorsal and ventral margins being subparallel and in the ribbing being expressed in the ventrolateral part.

Occurrence. The Upper Maastrichtian of Crimea.

Material. Thirty valves of different preservation from the localities of Peshchernyi Gorod, Baklinskaya Gryada, Korabel'naya Gryada, and Datskaya Gryada.

Superfamily Trachyleberidacea Sylvester-Bradley, 1948

Family Brachycytheridae Puri, 1954

Genus *Opimocythere* Hazel, 1968

***Opimocythere ventroinflata* Savelieva, sp. nov.**

Plate 7, fig. 5

Etymology. From the Latin *venter* (belly) and *inflatus* (inflated).

Holotype. DHG StPbSU, no. 372/38, right valve of male carapace; section Peshchernyi Gorod; Upper Cretaceous, Upper Maastrichtian, 1.7 m below the Maastrichtian/Danian boundary, nannoplankton Zone *Nephrolithus frequens*.

Description. The carapace is medium sized, elongated-oval, the anterior and posterior ends are subequal. The anterior end is symmetrically rounded. The posterior end is extended, bearing a poorly defined short ledge; four conical spines are below the ledge. A well-expressed convexity of the posterior half of the carapace slightly projects over the ventral margin. The posterior end is flattened.

The surface of the valves is smooth except for the ventral side, where the longitudinal striation is visible. The ocular spot is poorly defined.

Sexual dimorphism is present. The carapace is longer and narrower in male rather than in female. The posteroventral convexity is greater and more projecting over the ventral margin in the female.

Measurements in mm:

Specimen no.	Length	Height	Width
372/38 (holotype), female	0.82	0.5	0.5
372/39, male	0.95	0.45	0.45
372/40, female	0.85	0.45	0.55
372/41, female	0.72	0.4	0.47

Variability. The carapace height and the degree of the posteroventral convexity vary slightly. The number of spines at the posterior end varies from three to four.

Comparison. Differs from other representatives of the genus in the valve surface being smooth.

Remark. This species was allocated to the genus *Opimocythere* based on the oval shape of the carapace bearing expressed ventrolateral convexity and striation at the ventral margin.

Occurrence. The Upper Maastrichtian and Lower Danian of Crimea.

Material. More than 100 complete carapaces and isolated valves of well and satisfactory preservation from the localities of Peshchernyi Gorod, Baklinskaya Gryada, Korabel'naya Gryada, Starosel'e, and Datskaya Gryada.

Family Veeniidae Puri, 1974

Genus *Mosaeleberis* Deroo, 1966

***Mosaeleberis figurata* Savelieva, sp. nov.**

Plate 7, fig. 6

Etymology. From the Latin *figurata* (ornamented).

Holotype. DHG StPbSU, no. 372/48, carapace of a presumed female; section Korabel'naya Gryada; Upper Cretaceous, Upper Maastrichtian, 2.2 m below the Maastrichtian/Danian boundary, nannoplankton Zone *Nephrolithus frequens*.

Description. The carapace is medium sized, massive, rounded-rectangular. The anterior end is little higher than the posterior, rounded, more gently sloping in the upper third. The posterior end is subtriangular, flattened, with three conical spines in its lower part.

The carapace sculpture includes longitudinal dorsal, ventral, and medial rib-like folds. The medial fold joins with the central bulge. The whole surface of the valves except for the central bulge is covered with infrequent minute cells that are slightly extended parallel to the ventral edge at the ventral margin.

Measurements in mm:

Specimen no.	Length	Height	Width
372/48 (holotype)	0.87	0.4	0.37
372/49	0.8	0.42	0.4
372/50	0.77	0.37	0.4

Variability. The carapace height is somewhat variable. The rib-like folds are slightly smoothed down in some specimens.

Comparison. The species differs from *M. ajatensis* (Chochlova), comb. nov., originally described as *Cytheretta ajatensis* from the Maastrichtian/Danian of Western Siberia (Stratigraphy and Fauna..., 1960, pl. 50, figs. 9a and 9b, pp. 205–206) in the carapace being less extended and relatively high at the anterior end, and in less number of cells on the surface of the carapace.

Occurrence. The Upper Maastrichtian and Danian of Crimea.

Material. One carapace and eight well-preserved valves from the localities of Peshchernyi Gorod, Baklinskaya Gryada, Korabel'naya Gryada, and Starosel'e.

Family Trachyleberididae Sylvester-Bradley, 1948

Subfamily Trachyleberidinae Sylvester-Bradley, 1948

Genus *Oertliella* Pokorny, 1964

***Oertliella bella* Savelieva, sp. nov.**

Plate 7, fig. 7

Etymology. From the Latin *bella* (beautiful).

Holotype. DHG StPbSU, no. 372/72, left valve; section Peshchernyi Gorod; Lower Paleogene, Lower Danian, 0.15 m above the Maastrichtian/Danian boundary.

Description. The carapace is medium sized, subrectangular. The dorsal margin is nearly straight, in the posterior third it is hidden by a projecting longitudinal dorsal rib and spine-like projection. The anterior end is little higher than the posterior one, broadly-rounded. The posterior end has small ledge, below which it is rounded.

There is a thin rib that starts as the marginal and transforms into the ventral carinate one. The dorsal longitudinal rib is thin, oblique in the anterior part of the carapace, joins with a thin transverse commissure at a right angle in the posterior part. The terminal spines are poorly defined. The subcentral bulge is emphasized by surrounding large cells. The surface of the valves is covered with deep polygonal cells with thin walls. The eye tubercle is well expressed, joined to the subocular rib.

Measurements in mm: Holotype, Length—0.75, Height—0.45, 1/2Width—0.275.

Comparison. Differs from *O. alveoloalata* (Scharapova) described from the Paleocene of the Emba region (Sharapova, 1937, p. 76, pl. 1, fig. 2–3) in the more rounded posterior end, in the lower number of terminal spines, the subcentral bulge being less defined, and in the dorsal longitudinal rib being thinner.

Occurrence. The Danian of Crimea.

Material. Two well-preserved carapaces and three well-preserved valves from the localities of Peshchernyi Gorod, Starosel'e, and Inkerman.

Subfamily ? Hemicytherinae Puri, 1953

Tribe ? Aurilini Puri, 1974

Genus *Parapokornyella* Babinot, 1970

***Parapokornyella nikolaevae* Savelieva, sp. nov.**

Plate 7, fig. 8–9

Etymology. In honor of micropaleontologist I.A. Nikolaeva.

Holotype. DHG StPbSU, no. 372/98, right valve; section Peshchernyi Gorod; Upper Cretaceous, Upper Maastrichtian, 0.3 m below the Maastrichtian/Danian boundary, nannoplankton Zone *Nephrolithus frequens*.

Description. The carapace is medium sized, elongated-oval, with the dorsal margin weakly convex in the middle part and with a notable ventral depression at the anterior end. The posterior end is acute and flattened, bearing three terminal spines in its lower part.The ventrolateral rib bordering the ventrolateral bulging terminates with the short spine.The whole surface of the valves except for the edge of the posterior end is covered with slightly elongate shallow cells that are parallel to the valve margin. Cell walls are low, broad, forming ribbed-cellular mesosculpture. The area on the outer surface of a valve corresponding to the muscle area is devoid of cells, is not projecting, and is circled by a rosette of cells. The ocular spot is present and forms a fairly prominent rounded bulge. The hinge is holoamphidont.

Measurements in mm:

Specimen no.	Length	Height	1/2Width
372/98 (holotype)	0.85	0.42	0.22
372/99	0.95	0.5	0.25
372/100	0.95	0.45	0.3

Variability. The variability is expressed in the carapace height, the shape of the posterior end being rounded, aspinose to acute with large spines, the size and shape of cells being rounded to oval.

Comparison. The species differs from *P. triangulata* Babinot (Babinot, 1980, p. 207, pl. 42, fig. 4–9) in the absence of marginal thickenings at the anterior and posterior ends, the presence of low broad walls forming ribs in the central part of the valves. The central part of the muscle bulge is smooth and the cells are oriented longitudinally and subparallel to the anterior end whereas *P. triangulata* has regular cellular sculpture.

Material. One left and three right valves of good preservation from the locality of Peshchernyi Gorod.

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