Ruthenica, 2020, vol. 30, No. 3: 173-182.
Published online 03.07.2020.

http: ruthenica.net

Status of the genus *Dallicordia* and composition of deep-sea carnivorous bivalves of the genus *Policordia* (Bivalvia, Verticordioidea, Lyonsiellidae)

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ABSTRACT. The family Lyonsiellidae comprises carnivorous bivalve molluscs, distributed worldwide from sublittoral to ultraabyssal depths. One of the key anatomical characters of lyonsiellids is the reduction of the gill filaments in size and number and an increase of amount of muscles and connective tissue in gills, so their ctenidia represent an intermediate stage between eulamellibranch and septibranch conditions. The family Lyonsiellidae presently includes four genera: *Lyonsiella*, *Allogramma*, *Policordia* and *Dallicordia*. Taxonomy of the family is still problematic at both generic and species levels. The genus *Dallicordia*, typified by *Lyonsiella alaskana* was established on the assumption that it has no gills but possesses a muscular septum pierced by ostia, in contrast to the other lyonsiellids that have filamentous gills. Additionally, *Lyonsiella uschakovi* and *Policordia ochotica* were tentatively assigned to the new genus. Later *P. ochotica* was synonymized with *P. media*. In this paper we show that actually the *Dallicordia* was typified by an undescribed species misidentified as *Lyonsiella alaskana* which we describe here as *D.* ***bernardi*** sp. nov. Taxonomic position of the genus is dubious and could be clarified only after additional anatomical data on its type species becomes available. On the basis of examination of the type material of *P. ochotica* and images of the holotype of *P. media*, we reinstate the species *P. ochotica*. For the first time photographs of the holotype of *L. uschakovi* are provided for this specimen that was previously considered lost. Given the current state of knowledge we propose to consider species *L. alaskana*, *L. uschakovi* and *P. ochotica* in frame of the genus *Policordia*, for which we provide a list of all 29 species described up to date.

Zoobank registration: urn:lsid:zoobank.org:pub:87DCC73A-D070-4509-835C-942E81A9BBF5

Статус рода *Dallicordia* и состав глубоководных хищных двустворчатых моллюсков рода *Policordia* (Bivalvia, Verticordioidea, Lyonsiellidae)

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РЕЗЮМЕ. Семейство Lyonsiellidae включает хищных двустворчатых моллюсков, распространенных по всему Мировому океану от сублиторальных до ультраабиссальных глубин. Одним из наиболее существенных анатомических признаков лионсиеллид является специфическая структура жабр, состоящих из немногочисленных жаберных филаментов и содержащих относительно большое количество мышечной и соединительной тканей. Вследствие этого ктенидии лионсиеллид представляют собой промежуточную стадию трансформации пластинчатых жабр в мышечную септу, представленную у септибранхиальных двустворчатых моллюсков. В настоящее время в семействе Lyonsiellidae выделяют четыре рода: *Lyonsiella*, *Allogramma*, *Policordia* и *Dallicordia*. И на родовом, и на видовом уровнях в семействе много неразрешенных таксономических проблем. Род *Dallicordia* с типовым видом *Lyonsiella alaskana* был выделен на основании данных о том, что у него отсутствуют жабры, а вместо них развита мышечная септа с 4 парами пор, в отличие от всех прочих лионсиеллид, имеющих жаберные филаменты. Наряду с типовым видом, к новому роду предположительно были отнесены также *L. uschakovi* и *Policordia ochotica.* Позднее *P. ochotica* была синонимирована с *P. media.* В этой работе мы показываем, что род *Dallicordia* был типизирован неописанным видом, ошибочно определённым как *L. alaskana*, и описываем его как *D.* ***bernardi*** sp. nov. Таксономическое положение рода не ясно и может быть определено только после получения дополни-

тельных данных по анатомии типового вида. На основании изучения типового материала *P. ochotica* и фотографий голотипа *P. media* мы восстанавливаем видовую самостоятельность *P. ochotica*. В работе впервые приведено фото голотипа *L. uschakovi,* считавшегося утерянным. Виды *L. alaskana, L. uschakovi* и *P. ochotica* предлагается рассматривать в пределах рода *Policordia.* Приводится список всех 29 видов, которые в настоящий момент относятся к роду *Policordia.*

Introduction

Representatives of the family Lyonsiellidae Dall, 1895 are carnivorous bivalve molluscs recorded worldwide from 38 m to 9583 m, however the majority of species occur in the depth range from 500 m to 6000 m [Ivanova, 1977; Poutiers, Bernard, 1995; Linse, 2002; Allen, 2008; Janssen, Krylova, 2014; Kamenev, 2019]. One of the key anatomical characters of lyonsiellids is the reduction of the size and number of the gill filaments and an increase of amount of muscles and connective tissue in gills, so their ctenidia represent an intermediate stage between eulamellibranch and septibranch conditions [Allen, Turner, 1974; Morton, Machado, 2019]. The Lyonsiellidae presently comprise four genera: *Lyonsiella* G.O. Sars, 1872 (18 species), *Allogramma* Dall, 1903 (3 species), *Policordia* Dall, Bartsch et Rehder, 1938 (26 species), and *Dallicordia* Scarlato et Starobogatov, 1983 (2 species). Due to rarity of these molluscs and uniformity of fragile shells, taxonomy of the family is problematic at both generic and species levels. The family obviously needs a revision with the use of anatomical and molecular characters [Safonova, Barwick, 2016].

Scarlato and Starobogatov [1983] established the new genus *Dallicordia,* with *Lyonsiella alaskana* Dall, 1895 as a type species, on the assumption that it possesses a septum with four pairs of ostia according to the description of Bernard [1974], in contrast to the other lyonsiellids that have filamentous gills. Moreover, Scarlato and Starobogatov [1983] separated the genus *Dallicordia* in the new family Dallicordiidae. Scarlato and Starobogatov [1983] tentatively assigned two more species, *Lyonsiella uschakovi* Gorbunov, 1946 and *Policordia ochotica* Scarlato, 1981, to the new genus although the presence of the septum was not proven for any of them. Later, *P. ochotica* was synonymized with *P. media* (Okutani, 1962) [Huber, 2010]. Currently the genus *Dallicordia* with the two species, *D. alaskana* and *D. uschakovi*, is accepted in WoRMS (accessed on 20.02.2020) as member of the family Lyonsiellidae.

Here we aim to resolve the status of the genus *Dallicordia* and species *Policordia ochotica* on the basis of the analysis of all available literature data, images of the type material of *D. alaskana* and *P. media*, and examination of type material of *D. uschakovi* and *P. ochotica.*

Material and methods

In this study we examined the holotypes of *Lyonsiella uschakovi* Gorbunov, 1946, and *Policordia ochotica* Scarlato, 1981; both presented by dry valves and stored in ZIN (Table 1). Additionally we used the photos of the holotype of *Lyonsiella alaskana* Dall, 1895 (USNM 123500; http://n2t.net/ark:/65665/395110137-ad1e-49b1-a19b-5db353acb490). For comparative analysis we examined images of the specimen USNM 679071 (mistakenly referred to as *Dallocardia alaskana* at the database of NMNH) anatomically studied by Bernard [1974] as *L. alaskana*. Soft parts of this specimen were used for histological study and were destroyed in that process [Bernard, 1974]. Furthermore, we examined photos of the holotype of *P. media* stored in NMNS (Tokyo).

Abbreviations

NHMD – National History Museum of Denmark, Copenhagen, Denmark

NMNS – National Museum of Nature and Science, Tokyo, Japan.

NSCMB – A.V. Zhirmunsky National Scientific Center of Marine Biology of FEB RAS, Vladivostok, Russia

NMNH – National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

USNM – United States National Museum (now NMNH); used in the collection catalogue numbering

ZIN – Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia.

Results and discussion

Lyonsiella alaskana Dall, 1895: discrepancy of published morphological data

Morphology of shells and soft bodies of mol-

Table 1. Material used in the study.

Табл. 1. Материал, использованный в работе.

Species	Source of material
Lyonsiella uschakovi Gorbunov, 1946	ZIN, №1/201, RV *Sadko*, 1938, st. 98, 80°58'N, 142°50'E, 1475–1510 m
Policordia ochotica Scarlato, 1981	ZIN, №1/9981, RV *Gagara*, 06.08.1932, st.228, 55°13'N, 152°35'W, 664 m

luscs identified as *L. alaskana* from three different locations, including the type locality, was described by three authors: initially by Dall [1895] and later by Knudsen [1970] and Bernard [1974] (Table 2).

Originally *L. alaskana* was described from the lower bathyal zone of the Gulf of Alaska, northern Pacific [Dall, 1895]. The holotype of *L. alaskana* (USNM 123500; L=24 mm) is characterized by a nearly trapezoidal shell with the widely rounded postero-ventral margin and flattened posterior angle, slightly delimited from the umbo (Fig. 1A).

Knudsen [1970] studied 14 specimens with shell lengths varying from 3.5 mm to 18.3 mm, that he identified as *Policordia* cf. *alaskana,* from the abyssal depths of the Pacific off Costa Rica. The larger specimens are nearly subtriangular and differ from the holotype of *alaskana* by their more oblique antero- and postero-ventral margins (Figs 2 A–B). The outline of a smaller one (L appr. 4 mm) is similar to that of the holotype of *alaskana*, but the shell is more flattened and possesses a smaller and more incurved beak (Fig. 2C).

Later Bernard [1974] studied a specimen from the lower bathyal depth off the British Columbia, northern Pacific, which he identified as *L. alaskana* Dall, 1895 [Bernard, 1974: p. 107; fig. 11] (USNM 679071). Bernard [1974] did not show a shell of the specimen, which he studied histologically, but the right valve of it was imaged by Allen and Turner [1974: fig. 92e] (USNM 679071; L=23 mm). We have obtained a photo of both valves of this specimen (Fig. 1B). The shell differs from that of the holotype of *alaskana* by more oblique antero- and postero-ventral margins and tapering ventral margin. As a whole, the shell shape of the holotype of *alaskana* is trapezoidal (Fig. 1A) while the shell of specimen USNM 679071 is subtriangular (Fig. 1B).

When describing *L. alaskana* as a new species, Dall [1895: 704] did not indicate the absence of gills but gave a rather detailed description of ctenidia. According to his depiction, gills started from under the mouth and extended to the siphonal septum. The gills “are attached by their outer margins to an infolded nephridial lamina”; “their inner margins are bordered by a rather wide smooth membrane, with crenulated edge” appeared to be attached to that of the opposite gill behind the foot. A narrow free membrane corresponding to the ascending limb of

Table 2. Size and some morphological characters of the holotype of *Lyonsiella alaskana*, *L.* cf. *alaskana* and *Dallicordia* ***bernardi*** sp.nov.

Таблица 2. Размеры и некоторые морфологические признаки голотипа *Lyonsiella alaskana, L.* cf. *alaskana* и *Dallicordia* ***bernardi*** sp.nov.

Species	*alaskana* Dall, 1895, holotype	cf. *alaskana*	*Dallicordia* ***bernardi*** sp.nov. = *alaskana sensu* Bernard, 1974
Reference	Dall, 1895	Knudsen, 1970	Bernard, 1974
Repository	USNM 123500	NHMD	USNM 679071
Details of sampling	RV *Albatross*, st. 2859	RV *Galathea*, st. 716	n/a
Locality of collection	55°33'N, 136°33'W, 2869 m	9°23'N, 89°32'W, 3570 m	51°58'N, 132°50'W, 2547 m
Size	L=24 mm H = 24 mm	L= 18.3 mm H = 16.3 mm	L= 23 mm H = 24 mm
Tentacles of inhalant siphon	10 lateral pairs + 1 unpaired median: villous, flattened, subtriangular with 1 pair of barb-like points on the base sides.	Inner row: 11 lateral pairs + 1 unpaired median: flattened, papillate, with 1 -3 pairs of papillae; outer row: 2 pairs simple conical, between 5 and 6, 7 and 8 pairs of inner tentacles.	23 tentacles, the largest situated ventrally
Tentacles of exhalant siphon	3 large dorsal conical papillae, with the largest median	1 lateral pair + 3 dorsal tentacles: stout, pointed.	1 lateral pair + 1 dorsal very small tubercles
Gills	Outer edges attached to the mantle outgrowth, inner edges connected to each other and to the back of foot by a wide thin membrane with a serrated edge.	Not attached to the foot and to each other behind the foot.	Thin septum, covered by pavement epithelium, resembling adnate gills because of the orientation of muscle fibers; 4 pairs of microscopic ostia leading into the "aquiferous chamber".

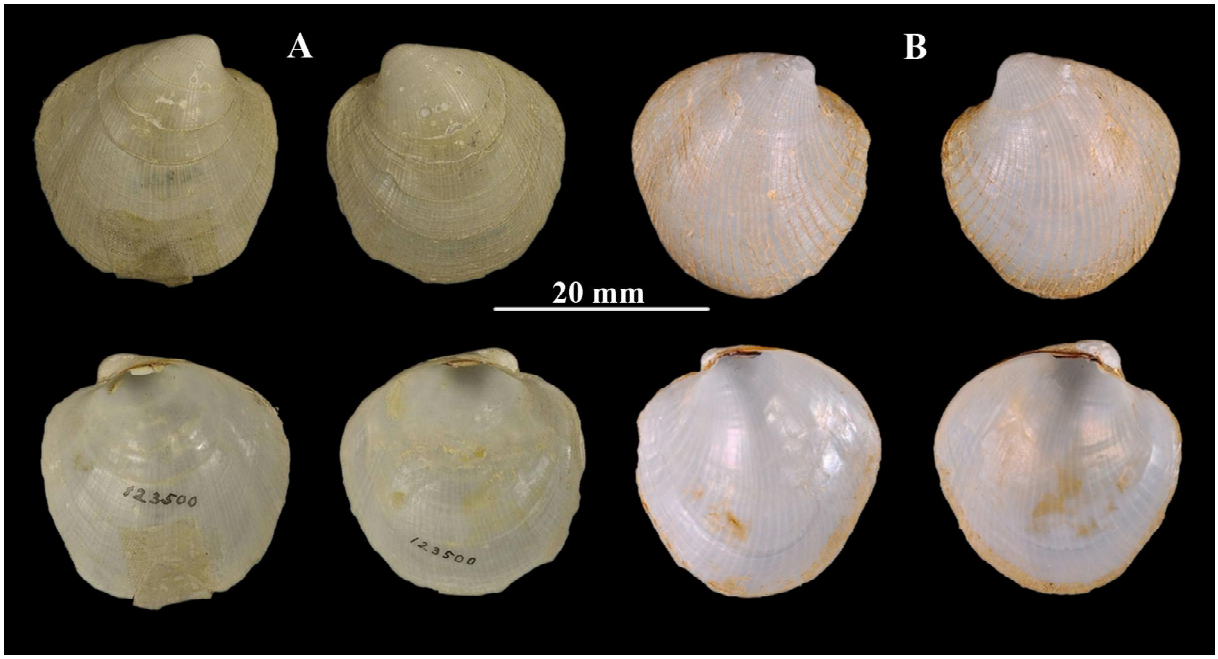

FIG.1. **A**. *Lyonsiella alaskana* Dall, 1895; USNM 123500, holotype, right and left valves, exterior view (upper row); right and left valves, interior view (lower row); photo made by B. Murphy. **B**. *Dallicordia* ***bernardi*** sp. nov.; USNM 679071, labelled as "*Dallocardia alaskana*", right and left valves, exterior view (upper row); right and left valves, interior view (lower row); photo made by E. Strong, NMNH.

РИС. 1. **A**. *Lyonsiella alaskana* Dall, 1895; USNM 123500, голотип, правая и левая створки, вид снаружи (верхний ряд); правая и левая створки, вид изнутри (нижний ряд); фото сделано Б. Мерфи. **B**. *Dallicordia* ***bernardi*** sp. nov.; USNM 679071, подписан как "*Dallocardia alaskana*", верхний ряд – правая и левая створки, вид снаружи; нижний ряд – правая и левая створки, вид изнутри; фото сделано Э. Стронг, NMNH.

the outer demibranch "had no lamellae, and was perfectly smooth. The main arterial stem of each gill extends to the siphonal septum to which both are anchored".

Knudsen [1970: 130] also examined major anatomical structures and noted that "the gills are not united with the foot and appear to be free posteriorly".

Bernard [1974: 107] performed a histological investigation of his specimen and described a thin septum, without any ciliated portions, completely isolating the upper, or suprabranchial cavity. The septum consisted of muscle bundles and its upper and lower surfaces were "covered with a thin pavement epithelium". The septum had "the appearance of an adnate gill" with four pairs of very small septal ostia discernable on the histological sections of this specimen. Inside the suprabranchial cavity there was an "aquiferous chamber" forming by a one-layer epithelium and connecting the ostia with the exhalant siphon. This gill structure principally differs not only from the structure of ctenidia of *L. alaskana,* described by Dall [1895], and *P.* cf. *alaskana* of Knudsen [1970] but also from ctenidia of other lyonsiellid species such as *L. abscicca* Pelseneer, 1911 and *P. pilula* (Pelseneer, 1911) [Pelseneer, 1911].

In addition to the shell shape and gill structure, the molluscs studied differ from each other by the shape and number of siphonal tentacles (Table 2). Bernard [1974] suggested that the obvious anatomical differences from the description of Dall [1895] could be a result of different stages of ontogenetic development of his specimen and the holotype of *L. alaskana*. However, the specimens studied by Dall [1895] and Bernard [1974] are very close in their size (Table 2) and it would be problematic to explain their anatomical discrepancy by the different ontogenetic stages of the same species.

Thus, we can conclude, that specimens described by Knudsen [1970] and Bernard [1974] differ from the holotype of *L. alaskana* anatomically and conchologically and are not conspecific with *L. alaskana.* We believe that *Policordia* cf. *alaskana* of Knudsen [1970] and *L. alaskana sensu* Bernard [1974] are still unnamed species that need an additional study.

Status of the genus *Dallicordia* Scarlato et Starobogatov, 1983 and taxonomy of species that were assigned to it

When establishing the genus *Dallicordia*, Scarlato and Starobogatov [1983] indicated that the main diagnostic feature of the genus was the absence of gill filaments and the presence of a septum

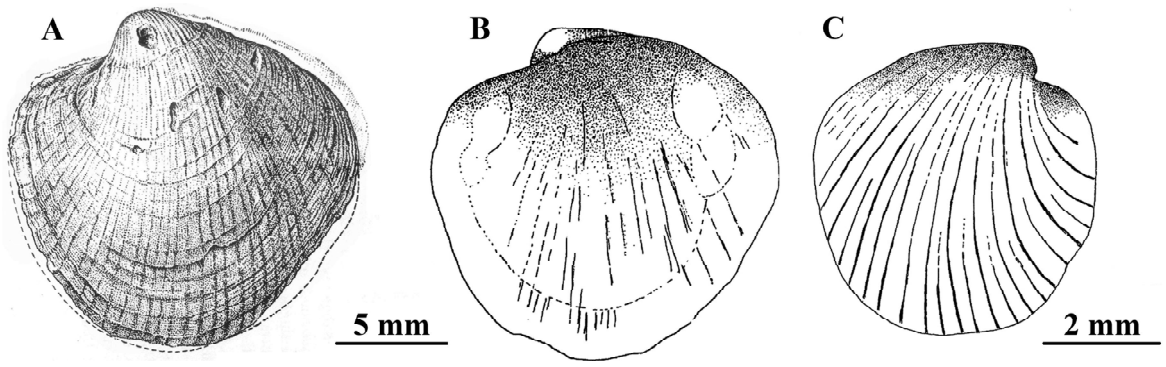

FIG. 2. *Lyonsiella* cf. *alaskana*, images from Knudsen [1970]. **A**. Left valve, exterior view, Knudsen [1970: fig. 87A]. **B**. Right valve, interior view, Knudsen [1970: fig. 88A]. **C**. Right valve, exterior view, Knudsen [1970: fig. 88B].

РИС. 2. *Lyonsiella* cf. *alaskana,* изображения из Knudsen [1970]. **A**. Левая створка, вид с наружной стороны [Knudsen,1970: fig. 87A]. **B**. Правая створка, вид с внутренней стороны [Knudsen,1970: fig. 88A]. **C**. Правая створка, вид с наружной стороны [Knudsen,1970: fig. 88B].

with 4 pairs of ostia, which was similar to a septum of Cuspidarioidea. They typified the genus *Dallicordia* by *Lyonsiella alaskana* Dall, 1895. However, in their description Scarlato and Starobogatov [1983] used data of Bernard [1974] instead of the original description of *L. alaskana* [Dall, 1895]. So actually, the type species of *Dallicordia* is *L. alaskana sensu* Bernard, 1974 (non Dall, 1895).

Since the genus *Dallicordia* was typified by misidentified and still undescribed species, we apply for the sake of taxonomic stability the provisions of the Article 70.3.2 of ICZN and are describing the species *L. alaskana sensu* Bernard, 1974 as *Dallicordia* ***bernardi*** sp. nov. and fix it as the type species of the genus *Dallicordia*.

Soft parts of the specimen, investigated by Bernard [1974], no longer exist because they were used for histological study. Bernard [1974: 181, table 34] mentioned four more specimens, collected at different sites from off Oregon and British Columbia, which he identified as *L. alaskana*, but he did not give any data on its anatomy and storage location.

According to the data of Bernard [1974], the genus *Dallicordia* critically differs from the other representatives of the family Lyonsiellidae by the absence of gills and the presence of a septum. Taxonomic position of the genus is uncertain. We presently retain it in the frame of the family Lyonsiellidae until additional anatomical data on its type species becomes available.

In addition to *L. alaskana*, two more species were tentatively assigned to the genus *Dallicordia*: *L. uschakovi* Gorbunov, 1946 and *Policordia ochotica* Scarlato, 1981 [Scarlato, Starobogatov, 1983], notwithstanding that the presence of the septum was not proven for any of them. All these species have fragile shells with thin hinge margins and an exterior sculpture consisting of radial ribs and commarginal growth lines without any granulation. These conchological characters fit to the diagnosis of the genus *Policordia* Dall, Bartsch et Rehder, 1938. With addition of *alaskana, uschakovi* and *ochotica,* the genus *Policordia* comprises 29 species (Table 4). Because of the high diversity of soft part features the genus obviously is in need of a revision using anatomical and molecular characters.

Systematics

Class Bivalvia Linnaeus, 1758
Subclass Heterodonta Neumayr, 1884
Superorder Anomalodesmata Dall, 1889
Superfamily Verticordioidea Stoliczka, 1870
Family Lyonsiellidae Dall, 1895

Dallicordia Scarlato and Starobogatov, 1983

Type species: *Dallicordia* ***bernardi*** sp. nov. (=*Lyonsiella alaskana sensu* Bernard, 1974 (non Dall, 1895)

Dallicordia ***bernardi*** sp. nov.
(Fig. 1B)

Zoobank registration: urn:lsid:zoobank.org:act:037EC04A-16F0-4FC5-8615-874D623B9703

Lyonsiella alaskana. – Bernard, 1974: 103 (partim), fig. 11, pl. 8 A–D, 9 A–H, non pl. 27, figs 1–4.

Policordia alaskana. – Allen, Turner, 1974: 501, fig. 92i.

? *Dallicordia alaskana*. – Coan, Valentich Scott, Bernard, 2000: 566 (partim), pl. 122.

Type material. Holotype USNM 679071, 2 dry valves of the same specimen.

Type locality. North Pacific, off British Colum-

Table 4. Species currently assigned to the genus *Policordia* Dall, Bartsch et Rehder, 1938 and their vertical ranges.

Табл. 4. Список видов, в настоящее время относящихся к роду *Policordia* Dall, Bartsch et Rehder, 1938, и глубины их обитания.

N	Species epithet	Reference	Original generic allocation	Vertical range, m
1.	*alaskana*	Dall, 1895	*Lyonsiella*	2869
2.	*angelika*	Linse, 2002	*Lyonsiella*	1444
3.	*atlantica*	Allen, Turner, 1974	*Policordia*	458-2775
4.	*cordata*	Verril, Bush, 1898	*Lyonsiella*	2601-3336
5.	*densicostata*	Locard,1898	*Verticordia*	2085-2503
6.	*diomedea*	Dall, Bartsch, Rehder, 1938	*Policordia*	519-580
7.	*extenta*	Ivanova, 1977	*Policordia* (*Angustebranchia*)	8220-8430
8.	*gemma*	Verril, 1880	*Lyonsiella*	73-4226
9.	*grandis*	Smith, 1885	*Lyonsiella*	3470
10.	*hispida*	Barwick, Safonova, 2016	*Policordia*	411-449
11.	*insolita*	Allen, Turner, 1974	*Policordia*	1546-4632
12.	*ivanovae*	Poutiers, Bernard, 1995	*Policordia* (*Latebranchia*)	3042
13.	*jeffreysi*	Friele, 1879	*Lyonsiella*	1600-3700
14.	*laevigata*	Ivanova, 1977	*Policordia* (*Angustebranchia*)	8160-8900
15.	*laevis*	Allen, Turner, 1974	*Policordia*	943-4632
16.	*lisbetae*	Knudsen, 1970	*Policordia*	2690
17.	*maculata*	Ivanova, 1977	*Policordia* (*Angustebranchia*)	9000-9050
18.	*media*	Okutani, 1962	*Lyonsiella*	710-1640
19.	*murrayi*	Knudsen, 1970	*Lyonsiella*	1350
20	*obliqueovata*	Ivanova, 1977	*Policordia* (*Latebranchia*)	1180-1640
21.	*ochotica*	Scarlato, 1981	*Policordia*	664
22.	*olivacea*	Poutiers, Bernard, 1995	*Policordia*	980-1080
23.	*ovata*	Ivanova, 1977	*Policordia* (*Latebranchia*)	5740-6040
24.	*papyracea*	Smith, 1885	*Lyonsiella*	1840-3570
25.	*pilula*	Pelseneer, 1911	*Lyonsiella*	1301
26.	*radiata*	Dall, 1889	*Lyonsiella*	270-821
27.	*rectangulata*	Ivanova, 1977	*Policordia* (*Angustebranchia*)	8175-9380
28.	*subrotundata*	Ivanova, 1977	*Policordia* (*Latebranchia*)	1050
29.	*uschakovi*	Gorbunov, 1946	*Lyonsiella*	1475-2377

bia, 51°58'N, 132°50'W, 2547 m; 5 August 1965 [Bernard, 1974].

Distribution. Type locality only.

Diagnosis. Shell subtriangular, higher than long, about 40 raised radial periostracal lines present. Inhalant siphon with 23 conical tentacles. Exhalant siphon with 3 very small tubercles.

Septum looks like adnate gill with four pairs of very small septal ostia [Bernard, 1974].

[**Диагноз**. Раковина округло-треугольная, ее высота превышает длину, наружная скульптура состоит из около 40 радиальных периостракальных слегка приподнятых линий. Вводной сифон окружен 23 коническими щупальцами. Около выводного сифона имеется три мелких папиллы – одна расположена дорсально и пара - по латеральным сторонам сифона. Септа выглядит как сросшиеся жабры с 4 парами очень мелких септальных отверстий.]

Remarks. *Dallicordia* ***bernardi*** sp. nov. differs from *P. alaskana* by a subtriangular shell outline, a smaller number of radial periostracal lamellae (40 vs more than 60), an arrangement of siphonal tentacles, their number and shape (Table 2). Anatomy of the species is in need of additional study.

Policordia Dall, Bartsch et Rehder, 1938

Type species: *Policordia diomedea* Dall, Bartsch et Rehder, 1938 (by original designation).

Policordia alaskana (Dall, 1895)
(Fig. 1A)

Lyonsiella alaskana Dall, 1895: 703, pl. 25, fig. 2; Dall, 1921: 28 (partim); Bernard, 1974: 103 (partim), pl. 27, figs 1–4 (holotype), non fig. 11, pl. 8 A–D, 9 A–H.

Policordia alaskana.– Soot-Ryen, 1966: 21, pl. 2, fig. 20 (reversed image of the holotype from Dall, 1985); non Allen, Turner, 1974: 501, fig. 92i.

Policordia (Dallicordia) alaskana. – Poutiers, Bernard, 1995: 145, 156 (partim).

Dallicordia alaskana. – non Scarlato, Starobogatov, 1983: 12; Coan, Valentich Scott, Bernard, 2000: 566 (partim), non pl. 122.

FIG. 3. *Policordia uschakovi* (Gorbunov, 1946); ZIN RAS, №1/201, holotype, right and left valves, exterior (upper row) and interior (lower row) views; photo made by E.M. Chaban.

РИС. 3. *Policordia uschakovi* (Gorbunov, 1946); ZIN RAS, №1/201, голотип, правая и левая створки с наружной стороны (верхний ряд) и с внутренней стороны (нижний ряд); фото сделано Е.М. Чабан.

non *Policordia* cf. *alaskana.* – Knudsen, 1970: 129, figs 87, 88, pl. 14, fig. 7.
non *Dallicordia* cf. *alaskana.* – Suarez-Mozo *et. al*., 2018: 3, fig. 4c.

Type material. Holotype USNM 123500, 2 dry valves of the same specimen.

Type locality. Southwest of Sitka in the Gulf of Alaska, North Pacific, 55°33'N, 136°33'W, 2869 m, RV *Albatross*, St. 2859 [Dall, 1895].

Distribution. Type locality only.

Policordia uschakovi (Gorbunov, 1946)
(Fig. 3)

Lyonsiella uschakovi Gorbunov, 1946: 316, pl. I, figs 4 a–c.
Lyonsiella uschakovi. – Filatova, 1957: 57; Clarke, 1962: 69.
Lyonsiella (Policordia) uschakovi. – Bernard, 1979: 63, fig. 109.
Policordia jeffreysi. – Bouchet, Waren, 1979: 217 (partim).
Policordia (Dallicordia) uschakovi. – Poutiers, Bernard, 1995: 145, 168.
Policordia uschakovi. – Soot-Ryen, l966: 21, pl. 2., fig. 21.
? *Policordia uschakovi.* – Richling, 2000: 74, fig. 83, 84.

Type material. Holotype ZIN №1/201, 2 dry valves of the same specimen; paratype, 1 juvenile specimen, lost.

Type locality. Arctic basin, 80°58'N, 142°50'E, 1475–1510 m, RV *Sadko*, St. 98 (holotype); 81°13'N, 140°03'E, 1900–1630 m, RV *Sadko*, St. 99 (paratype).

Other localities. Beaufort Sea, 7l°19.3'N, l47°47.1'W, 2377 m, RV *Glacier*, OSU SMG 890 [Bernard, 1979].

Distribution. Arctic basin, 1475–2377 m.

Remarks. Original description of *P. uschakovi* was made on the basis of two damaged valves of

Table 3. Number and shape of tentacles of *P.* cf. *uschakovi* [Richling, 2000] and *P. jeffreysi*.

Табл. 3. Число и форма щупалец *P.* cf. *uschakovi* [Richling, 2000] и *P. jeffreysi*.

	P. cf. *uschakovi*	*P. jeffreysi*
Reference	Richling, 2000 (as *P. uschakovi*)	Allen, Turner, 1974
Tentacles of inhalant siphon	Inner row: 8 pairs, villous; Outer row: 2 pairs, simple conical, between 5 and 6, 7 and 8 tentacles on the left margin and between 4 and 5, 6 and 7 tentacles on the right margin	Altogether about 14 pairs of squat papillate tentacles
Tentacles of exhalant siphon	1 pair lateral + 3 dorsal (as figured; in the text only 3 dorsal tentacles mentioned)	3 simple conical tentacles

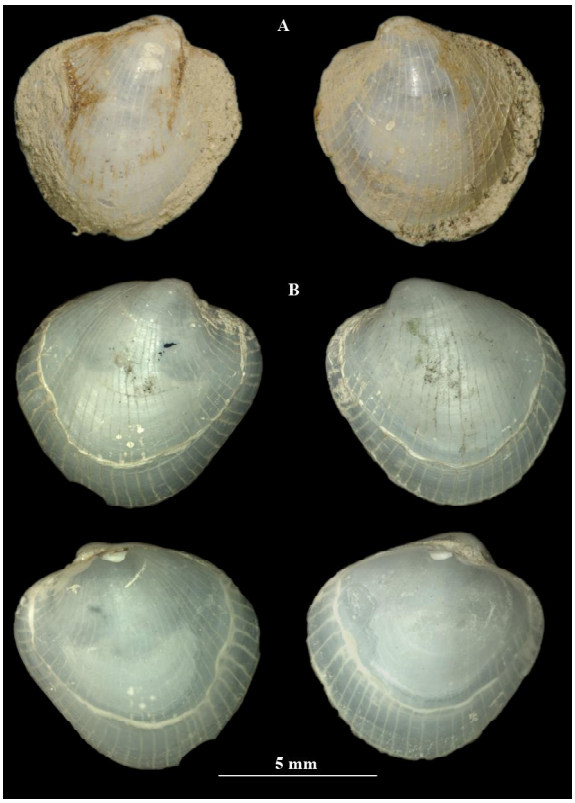

FIG. 4. **A**. *Lyonsiella media* Okutani, 1962; NMNS, holotype, right and left valves, exterior view; photo made by G.M. Kamenev. **B**. *Policordia ochotica* Scarlato, 1981; ZIN RAS, №1/9981, holotype, right and left valves, exterior (upper row) and interior (lower row) views; photo made by E.M. Chaban.

РИС. 4. **A**. *Lyonsiella media* Okutani, 1962; NMNS, голотип, правая и левая створки, вид с наружной стороны; фото сделано Г.М. Каменевым. **B**. *Policordia ochotica* Scarlato, 1981; ZIN RAS, №1/9981, голотип, правая и левая створки с наружной стороны (верхний ряд) и с внутренней стороны (нижний ряд); фото сделано Е.М. Чабан.

the same specimen (holotype, L=5.7 mm) and a juvenile specimen (paratype, L=2.4 mm). Although considered lost during the World War II [Bouchet, Warén, 1979: 212], the holotype was stored in the ZIN collection. The shell is quite solid for *Policordia*, possibly due to its shell repair during the lifetime [Bouchet, Warén, 1979]. Specific for the genus the exterior shell sculpture consisting of radial ribs is preserved only on the broken left valve. A paratype has not been found. According to the original description, the shell of the paratype was fragile and translucent, and "coincided in shape and structure" with the holotype [Gorbunov, 1946]. Specimens of *Policordia* of sizes similar to the holotype of *P. uschakovi* were recorded from the Beaufort Sea (L=6 mm) [Bernard, 1979] and from the Laptev Sea (L=5.6 mm) [Richling, 2000]. If the material from the Beaufort Sea we can identify as *P. uschakovi* with a high probability, species identity from the Laptev Sea is doubtful. The outline of *Policordia* from the Laptev Sea [Richling, 2000] resembles the shell shape of *P. pilula* in the sense of Okutani [1962] and Ivanova [1977] (not [Pelseneer, 1911]) in the presence of the straighter posterior-dorsal margin and the pronounced posterior angle.

The validity of the species *P. uschakovi* was widely discussed. Soot-Ryen [1966] and Bernard [1974] suggested that *P. uschakovi* and *P. alaskana* were probably synonyms. Later Bernard [1979] referred to *P. uschakovi* as a separate species. Bouchet and Warén [1979] synonymized *P. uschakovi* with *P. jeffreysi* (Friele, 1879). Actually, shell shapes of *P. alaskana* and *P. jeffreysi* are different from that of the holotype of *P. uschakovi*. The shell outline of *P. uschakovi* is almost rounded, while the shell of *P. alaskana* is subquadrate and of *P. jeffreysi* is elongated in dorso-ventral direction. Bouchet and Warén [1979: 218, fig. 5] showed the shell variability by illustrations of the shells of three young *P. jeffreysi* and suggested, that the holotype of *P. uschakovi* could be a damaged young specimen of *P. jeffreysi*. However, all valves of juveniles of *P. jeffreysi* [Bouchet, Warén, 1979] are elongated in dorso-ventral direction despite the differences in ventral margin outlines. The shell length of *P. uschakovi* is almost equal to its height.

The noteworthy feature here is the diversity of soft body structures of species with quite similar shells (Table 3). Before obtaining additional anato-

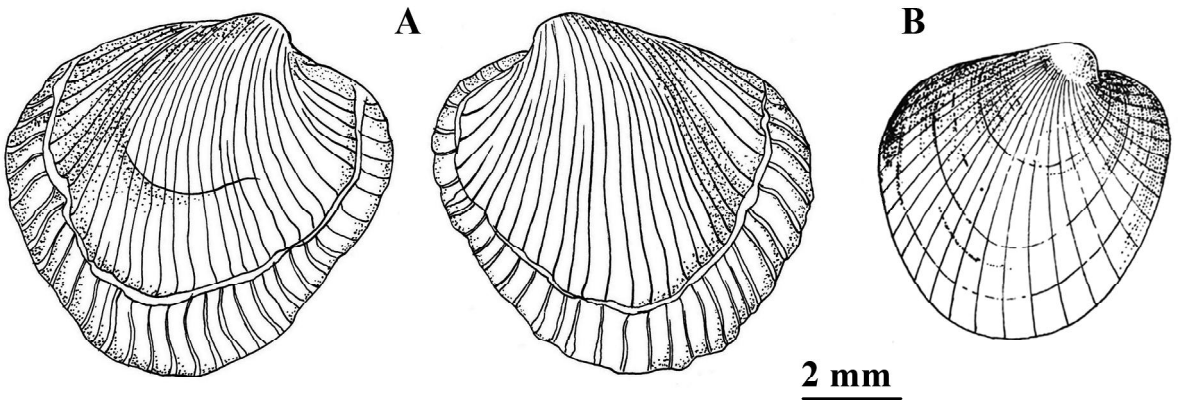

FIG. 5. **A**. *Policordia ochotica* Scarlato, 1981; ZIN RAS, №1/9981, holotype, right and left valves, exterior view. **B**. *Lyonsiella media* Okutani, 1962; NMNS, paratype from St. T29, right valve, exterior view, image from Okutani [1962, pl. IV, fig. 3].

РИС. 5. **A**. *Policordia ochotica* Scarlato, 1981; ZIN RAS, №1/9981, голотип, правая и левая створки, вид снаружи. **B**. *Lyonsiella media* Okutani, 1962; NMNS, паратип, ст. T29, правая створка снаружи, изображение из Okutani [1962, табл. IV, рис. 3].

mical data and molecular data we prefer to consider *P. uschakovi* as separate from *P. alaskana* and *P. jeffreysi* species.

Policordia ochotica Scarlato, 1981
(Fig. 4B)

Policordia ochotica Scarlato, 1981: 419, fig. 460.
Dallicordia ochotica. – Scarlato, Starobogatov, 1983: 12.
Policordia (*Dallicordia) ochotica.*– Poutiers, Bernard, 1995: 145.
Policordia media. – Huber, 2010 (partim).

Type material. Holotype ZIN №1/9981, 2 dry valves of the same specimen.

Type locality. Sea of Okhotsk, 55°13'N, 152°35'W, 664 m, RV *Gagara*, St. 228.

Distribution. Type locality only.

Remarks. Huber [2010] referred to *P. ochotica* Scarlato, 1981 as a synonym of *P. media* (Okutani, 1962), described from Sagami Bay and off Oshima Island, western Pacific, from depths of 620–1640 m [Okutani, 1962]. When describing *P. ochotica*, Scarlato [1981] noted in the diagnosis, that *P. media*, as well as *P. alaskana* and *P. pilula* (Pelseneer, 1911) are closely related species, but *P. ochotica* clearly is distinguished from them by the shell shape, in particular, straight anterior margin and less prominent beaks [Scarlato, 1981: 419]. We compared the holotype of *P. ochotica* with images of the holotype and paratype of *P. media* (Figs 4, 5) and revealed that *P. ochotica* has a longer antero-dorsal margin and tapering ventral margin. In addition, the shell of *P. ochotica* is longer than high (L=8 mm, H=7.5 mm), while the shell of *P. media* is elongated in dorso-ventral direction (L=7.4 mm, H=7.9 mm for holotype, L= 6.0 mm, H=6.5 mm for paratype). The anatomical characters of *P. ochotica* are unknown.

Conclusion

The genus *Dallicordia* Scarlato et Starobogatov, 1983 was typified by a species (specimen USNM 619071, labelled as "*Dallocardia alaskana*"), misidentified as *Lyonsiella alaskana* [Bernard, 1974], which we describe here as *Dallicordia* ***bernardi*** sp. nov.

So far, the monotypic genus *Dallicordia* is assigned to the family Lyonsiellidae until additional anatomical data on its type species becomes available. The species originally assigned to *Dallicordia, L. alaskana, L. uschakovi* and *P. ochotica,* are valid species and should currently be assigned to the genus *Policordia.* Diversity of the genus *Policordia* in the Arctic and North Pacific is obviously underestimated; some species identified as *P. alaskana* or *P. uschakovi* actually are still undescribed species.

Currently the genus *Policordia* includes 29 species. Because of the high diversity of anatomical characters, the genus is in need of a thorough revision including the use of anatomical and molecular characters.

Acknowledgements

We are grateful to V.V. Malakhov (MSU) for valuable advice. We want to thank G. P. Salkova (MSU) for her all-round assistance. We are deeply indebted to E. M. Chaban (ZIN RAS) for her help with images of holotypes of *Policordia uschakovi* and *P. ochotica*, to E. Strong (Department of Invertebrate Zoology, NMNH) for images of the specimen USNM 679071, and to G.M. Kamenev (NSCMB) for the photos of the holotype of *P. media* (NMNS). We used photos of the holotype of *Lyonsiella alaskana* (USNM 123500) made by Brian Murphy from the site of NMNH (http://n2t.net/ark:/65665/395110137-ad1e-49b1-a19b-5db353acb490). We thank P. Valentich Scott (SBMNH) and Y. I. Kantor (SIEE RAS) for their constructive criticism and

fruitful suggestions. This study was partly supported by Russian Foundation for Basic Research (project no. RFBR 19-04-00281-a) to EK.

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