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Recent and fossil Clinocardiinae (Bivalvia, Cardiidae) of the World. VII. Tribus Serripedini Kafanov, 1975

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Abstract

A taxonomic review of the tribus Serripedini Kafanov, 1975. In the modern fauna it is composed by *Serripes groenlandicus groenlandicus* (Mohr, 1786), *S. groenlandicus fabricii* (Deshayes, 1854), *S. laperousii* (Deshayes, 1839) and *Yagudinella notabilis notabilis* (G. B. Sowerby III, 1915). Neogene and Paleogene (Oligocene *S. squalidus* only), *Serripes chejsliensis* Sinelnikova in Gladenkov et Sinelnikova, 1990, *S. hataii* Noda, 1962, *S. japonicus* Noda, 1962, *S. joetsuensis* Kafanov, sp. nov., *S. kamtschaticus* Ilyina, 1963, *S. nodai* Kafanov, 1980, *S. ochotensis* Ilyina, 1963, *S. savizkyi* Kafanov, sp. nov., *S. squalidus* (Yokoyama, 1924), *S. triangularis* Noda, 1962, *S. uvutschensis* Ilyina, 1963, *Yagudinella makiyamai makiyamai* (Yokoyama, 1928), *Y. makiyamai nigamiensis* (Noda, 1962), *Y. notabilis nomurai* (Otuka, 1943), *Y. shiobaraensis* (Noda, 1962), *Y. takoyensis* Kafanov et Savizky, 1982 and *Y. yokoyamai* (Otuka, 1935) are described. Two species, *Serripes expansus* Hirayama, 1954 and *S. muraii* Noda et Tada, 1968, are referred to Serripedini conditionally. Keys for identification of all Recent and fossil species and subspecies are given.

Key words: Bivalvia, Cardiidae, Clinocardiinae, Serripedini, *Serripes*, *Yagudinella*, Recent, Cenozoic, Arctic Ocean, North Pacific, North Atlantic.

Tribus Serripedini Kafanov, 1975

Serripedini Kafanov, 1975: 147; 1980: 316.
Serripedinae Kafanov: Scarlato, 1981: 346.

Radial ribs and cardinal teeth strongly or completely reduced.

Two genera: *Serripes* A. A.Gould, 1841 and *Yagudinella* Kafanov, 1975.

Genus *Serripes* A. A. Gould, 1841 emend. Kafanov, 1975

Aphrodite Lea, 1837: 111 non Leske, 1775, nec Link, 1807, nec Hubner, [1819], nec Lendenfeld, 1886.
Aphrodita Leach in G. B. Sowerby II, [1840]: 70 (err. pro *Aphrodite* Lea, 1837) non Linnaeus, 1758.
Acardo Swainson, 1840: 374 (part.) non Bruguière, 1797, nec Roissy, 1805, nec Muhlfeldt, 1811, nec Menke, 1828, nec Herrmannsen, [1846].
Serripes A. A. Gould, 1841: 93 ex Beck, MS.
Aphroditha [-e] Paetel, 1875: 14 (err. pro *Aphrodite* Lea, [1837]).
Serripes Gould, 1841: Kafanov, 1975: 146 (part.).

Type-species (by monotypy): *Cardium groenlandicum* Mohr, 1786; Greenland, Recent.

Ethymology: The name is derived from the Latin *serra*, a saw, and *pes*, a foot.

Diagnosis: Shell medium-sized or fairly large (up to 120 mm and more), flattened, oblong-elliptical or truncate-trigonal, variously inequilateral; as a rule, anterior margin broader than posterior one. Posterodorsal margin smoothly joined with the posterior valve margin. Carina on the posterior valfe surface obsolete. Beaks moderately prosogyrate or nearly orthogyrate. Radial ribs obsolete or absent but their traces can usually be observed on the posterior and the anterior valve surfaces. Very rarely a weak radial ribs traces are shown on all surface of a valve. Hinge strongly reduced, frequently teeth completely absent. Bases of AI and AII teeth lie on outer side of the internal branches of hinge margin. Distal part of foot with longitudinal row of crests or denticles, ventral sulculus absent. Labial palps long and nearly equal in length to inner demibranch.

Cold and cold-temperate seas of the northern hemisphere. Oligocene to Recent in northern Pacific; in Later Pliocene and Early Pleistocene to England and the Netherlands (Fig. 1).

Key to the species[1]

1. Valve smooth or radial ribs traces are developed on the posterior and the anterior valve surfaces only 2
   Radial ribs or their traces well developed on all surface of a

[1] Problematic *Serripes expansus* Hirayama, 1954 and *S. muraii* Noda et Tada, 1968 not considered herein.

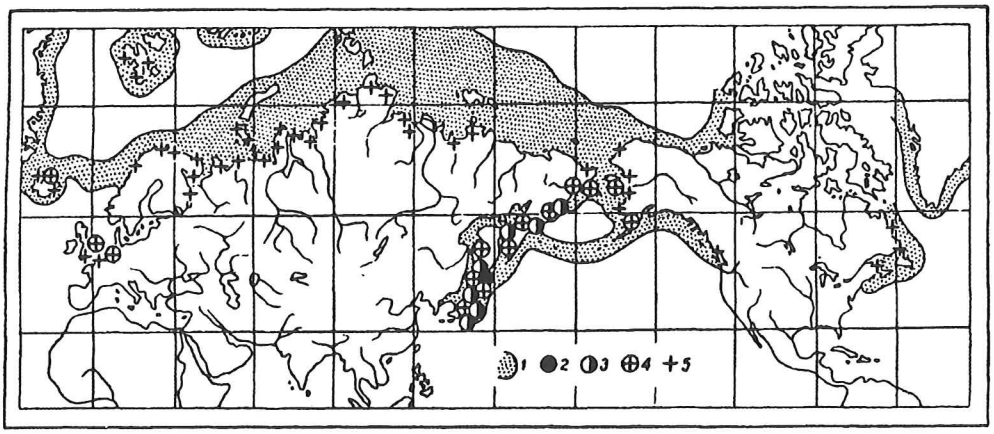

Fig. 1. Geographical and geological distribution of *Serripes* (from: Kafanov, 1980, fig. 9, corrected). 1- Recent, 2 - Oligocene, 3 - Miocene, 4 - Pliocene, 5 - Pleistocene.

valve 11

2. Valve smooth, without of any radial ribs traces ..... *Serripes squalidus* (Yokoyama, 1924).
   Radial ribs traces are developed on the posterior and the anterior valve surfaces 3
3. Average H/L ratio less than 0.80; shell slightly gaping posteriorly ..... *Serripes laperousii* (Deshayes, 1854).
   Average H/L ratio more than 0.80; shell not gaping 4
4. Average H/L ratio more than 0.95 5
   Average H/L ratio less than 0.95 9
5. Shell regularly triangular in shape; radial ribs traces are very poorly shown also on medial part of the valve surface ..... *Serripes triangularis* Noda, 1962.
   Other shell outline; any radial ribs traces, as a rule, are absent on medial part of the valve surface 6
6. Average A/L ratio more than 0.46 7
   Average A/L ratio less than 0.46 8
7. Shell subcircular in outline, average H/L ration about 1.01 ..... *Serripes hataii* Noda, 1962.
   Shell trigonal-suborbicular in outline, average H/L ration about 1.05 ..... *Serripes chejsliensis* Sinelnikova in Gladenkov et Sinelnikova, 1990.
8. Average B/L ratio about 0.27, average A/L ratio about 0.38 ..... *Serripes kamtschaticus* Ilyina, 1963.
   Average B/L ratio about 0.32, average A/L ratio about 0.45. ..... *Serripes nodai* Kafanov, 1980.
9. Average H/L ratio less than 0.88 ..... *Serripes japonicus* Noda, 1962.
   Average H/L ratio more than 0.88 10
10. Average H/L ratio about 0.89, average B/L ratio about 0.27 ..... *Serripes groenlandicus* (Mohr, 1786).
    Average H/L ratio about 0.92, average B/L ratio about 0.29 ..... *Serripes ochotensis* Ilyina, 1963.
11. Shell small-sized, elongate (average H/L ratio about 0.75), external valve surface covered by 35-40 plainly-convex radial ribs ..... *Serripes uvutschensis* Ilyina, 1963.
    Shell medium-sized, high (average H/L ratio more than 0.90), other ribs number, or ribs flattened 12
12. Radial ribs more than 60, separiting by relatively deep interspaces ..... *Serripes joetsuensis* Kafanov, sp. nov.
    Radial ribs less than 60, separiting by relatively shallow interspaces ..... *Serripes savizkyi* Kafanov, sp. nov.

Serripes groenlandicus (Mohr, 1786) [2]

(Pl. 1, figs. 1-15; pl. 5, figs. 1, 3-8)

English: Greenland smoothcockle, Japanese: ariso-tori-gai, Russian: zubchatonog grenlandskiy, Icelandic: krokskel, local in Greenland: ipiksaunak.

Cardium groenlandicum Chemn.: Grewingk, 1850: 350, Taf. 4, Fig. 4a, b; Yokoyama, 1929: 390, pl. 73, figs. 3 non 2; Khomenko, 1931: 75, pl. 4, figs. 7, 8; Khomenko, 1934: 52, pl. 12, figs. 2, 3.

Serripes groenlandicus var. *protractus* Dall, 1900: 1112 [invalid name as nom. infrasubsp. s.s.].

Mactra fujinensis Yokoyama, 1923: 5, pl. 2, figs. 2a, b.

Cardium modestum, non Adams et Reeve, 1850: Khomenko, 1931: 71, pl. 4, fig. 2.

Cardium groenlandicum unciangulare Khomenko, 1931: 75, pl. 10, fig. 21.

Cardium groenlandicum Gmelin: Khomenko, 1934: 52, pl. 12, figs. 2, 3.

Serripes laperousii, non Deshayes, 1839: Otuka, 1935: 602, pl. 2, figs. 1, 2; Noda H., 1962: 225 (part.), pl. 36, fig. 6.

Serripes fujinensis (Yok.): Otuka, 1935: 602; Otuka, 1943: 56.

Serripes vachrushevi "Evsseev": Korobkov, 1954, pl. 95, fig. 17 (nom. nud.).

Serripes vachruschevi Evseev, 1956 [1994]: 85, pl. 16, figs. 4, 5.

Serripes groenlandicus (Bruguière, 1789): Regteren Altena, 1937: 76, fig.

[2] Synonymy and bibliography herein is given for fossil specimens only, for Recent ones see distinct subspecies.

227; Simonova, 1941: 42, pl. 16, figs. 1-5; Heering, 1950: 108, pl. 11, figs. 13-16; Hirayama, 1954: 67, pl. 4, fig. 3; Ilyina, 1954: 224 (part.), pl. 17, figs. 2, 2a non figs. 1, 1a; Kanno and Matsuno, 1960, pl. 5, fig. 3; Merklin et al., 1962: 38, pl. 6, figs. 3-5; Noda, H., 1962: 223 (part.), pl. 36, figs. 1-5; pl. 37, figs. 1, 5 non 4; Ilyina, 1963: 75, pl. 14, figs. 8, 9; pl. 25, figs. 1-3; Zhidkova et al., 1968: 104 (part.), pl. 22, fig. 3; pl. 27, fig. 6; pl. 48, fig. 4 non pl. 18, fig. 2; pl. 25, fig. 6; pl. 48, figs. 5, 6; Mizuno et al., 1969, pl. 27, fig. 7; Zhidkova et al., 1972: 127, pl. 9, fig. 1; pl. 11, fig. 5; pl. 12, fig. 1 non pl. 40, figs. 4, 7; Noda H., 1973, pl. 5, fig. 9; Merklin et al., 1979: 41, pl. 7, figs. 1-5; Sinelnikova, 1979: 46, pl. 6, figs. 6, 7; Gladenkov et al., 1980: 44, pl. 8, figs. 4-8; Devjatilova and Volobueva, 1981: 77, pl. 37, fig. 8; Petrov, 1982: 105, pl. 19, figs. 9, 13; Amano, 1983, p. 48, pl. 4, fig. 5; Gladenkov et al., 1984: 212, pl. 49, fig. 7; pl. 50, fig. 5; Noda H. et al., 1984, pl. 4, fig. 1; Ogasawara et al., 1986, pl. 16, fig. 5; pl. 18, fig. 7; pl. 20, figs. 28a, b non fig. 30; Naumov et al., 1987: 248, fig. 155; Arkhipova et al., 1992: 207, pl. 34, figs. 14, 15; pl. 35, figs. 3a, b, 4; Gladenkov et al., 1992, pl. 12, fig. 10; Noda, Y., 1992: 74, pl. 3, figs. 2, 3, 5, 6 (see for synonymy in Japanese papers).

Serripes titthum L. Krishtofovich, 1969: 192, pl. 4, figs. 4, 5, 9, 12, 14.

Serripes karaginskiensis Barinov in Gladenkov et al., 1992: 124, pl. 1, figs. 21, 23.

Serripes similis Kafanov in Arkhipova et al., 1992: 208, pl. 34, figs. 12, 13.

Bibliography: Wood, 1874; Whiteaves, 1901; Dall, 1919, 1924; Schlesch, 1924; Grant and Gale, 1931; Soot-Ryen, 1932; Tesch, 1934; MacNeil et al., 1943; MacNeil, 1957; Löken, 1966; Durham and MacNeil, 1967; Gladenkov, 1972; Zhidkova et al., 1974; Simonarson et al., 1998; Kafanov et al., 1999, 2000, 2001.

Etymology: The name is derived from the type-locality, Greenland.

Type-materials:

Cardium groenlandicum Mohr, 1786 is based on the binominal name of Chemnitz (1782). Type specimens are unknown. Dr. G. Høpner Petersen (ZMK, in a letter of March 3, 1975) wrote to me: "I picked out some samples from our collection [ZMK] where one may expect type-specimens. I could not decide on their quality, but I dare now say, that we probably have not the type from Chemnitz. In Chemnitz book refers he to the collections, he got his animals from. He writes "ex museo nostro", for his own, and they are probably not here. They may have ended up somewhere in Germany. [The Chemnitz' collection after his death was sold from the auction (Cernohorsky, 1974)]. When Chemnitz writes "ex museo Spengleriano", we may have the shells in our collections. Chemnitz and Spengler worked close together [Mörch, 1871], and as Spengler wrote a paper on *Cardium* [Spengler, 1799] and as I found shells of *Cardium groenlandicum* from Spengler's collection, I had reasons to believe, that some types were among them". Type-locality: Julianehåb, Greenland [Chemnitz: "I have received infinite amount of these shells from Colonie Julianens Hofnung"]. Original figure dimensions [Chemnitz (1782: 203) writes "I have specimens which a little bit more than figured here". From this it is possible to conclude that figure is given full-scale]: L - 41. 3; H - 38. 6. Because Chemnitz' (1782) paper is bonbimominal and rejected for nomenclatural purpose, Bruguière (1789) or Gmelin (1791) are accepted as the authors for a long time. However Warén (1993) has shown that Mohr (1786) should be considered as the author.

Mactra fujinensis Yokoyama, 1923. Holotype - UMUT no. CM24557. Type-locality: Matsue, Fujina, Tamayu-mura, Yatsuka District, Shimane Prefecture, Honshu, Japan, Middle Miocene Fujina Formation.

Cardium groenlandicum unciangulare Khomenko, 1931. Lectotype (designated as "syntype" by Malchevskaya, 1985: 220) - CNIGRM no. 87/3456. Type-locality: Bol'shoy Garomay River, east Kamchatka, Russia, Pliocene "Nadnutovskaya Suite".

Serripes vachruschevi Evseev, 1956 [1994]. Lectotype (designated by Kafanov et al., 2000: 74) - CNIGRM coll. 7378. Type-locality: 1st inflow of Higashi-Sakutan [Gornaya] River, Makarov District, Sakhalin, Russia, Middle and Upper Miocene Kurasiyskaya Suite.

Serripes titthum L. Krishtofovich, 1969. Holotype - CNIGRM - no. 62/6780. Type-locality: near the mouth of the Talovaya River, Kronotskiy Reservation, east Kamchatka, Russia, Miocene Tyushevskaya Suite.

Serripes karaginskiensis Barinov in Gladenkov et al., 1992. Holotype - GIN no. 8751/15. Type-locality: 12 km south of Yun'yun'vayam River, southwest coast of Karaginsky Island, east Kamchatka, Russia, Miocene Pestrotsvetnaya Suite, Layer 10.

Serripes similis Kafanov in Arkhipova et al., 1992. Holotype - VNIGRI no. 174/825. Type-locality: Gornaya River, Makarov District, Sakhalin, Russia, Middle Miocene Ausinskaya Suite.

Description: Shell medium-sized or large (up to 112 mm), relatively high (average H/L ratio about 0.91), slightly subequilateral or almost equilateral (average A/L ratio about 0.45), medium convex (average B/L ratio about 0.31), faintly oblique and faintly bent, moderately tick-walled. Umbones prominent, orthogyrate or slightly prosogyrate. Radial striae present on anterior and posterior areas, especially evident in juvenile specimens. Cardinal teeth strongly reduced especially in old specimens; lateral tooth AIII weakened. Periostracum straw-colored to dark brown; interior white.

Comparison: Most similar *Serripes ochotensis* Ilyina, 1963 differs by relatively higher and more convex valves.

Taxonomical notes: Extremely expressed individual and geographical variability of *S. groenlandicus* has caused occurrence of set of synonyms and complicates identification of Recent and, especially, fossil specimens. On the other hand, it is possible that subsequent more careful biomethric study will allow to allocate among fossil *S. groenlandicus* a number of independent chrono-subspecies.

In particular, it concerns to *Serripes fujinensis* (Yokoyama, 1923), originally erroneously referred to *Mactra* and nowadays practically by all authors considered as a synonym of *S.groenlandicus*. Whereas, the repeated gang of diagnostically significant characters forces to add *Serripes fujinensis* the status, at least, of independent subspecies. It is remarkable, that the Russian authors (e.g. Korobkov, 1954, and numerous hand-written reports) for a long time distinguish this form under the name of *Serripes vachruschevi*

Evseev, 1956 [1994].

In a comparison with true *S. groenlandicus*, *S. fujinensis* differs by rather more convex shell (average B/L ratio 0.34 instead of 0.26-0.27 for fossil *S. groenlandicus*), more narrowed anterior margin of valve, by high, wide and protruding beaks and by frequently well expressed rudiments of radial costae on anterior area of valve. Miocene *S. fujinensis*-like forms are known from: Fujina Formation in Shimane Prefecture, Kurosawa Formation of the Akita oil-field, Togeshita Formation in Rumoi District, Hokkaido, Uglegorskaya Suite and lower Maruyamskaya sub-Suite of South Sakhalin, Nutovskaya Suite of North Sakhalin; possibly Kuluvenskaya Suite of Western Kamchatka. The analysis of an intraspecific variability of Recent *S. groenlandicus* from all area of the species (Figs. 2, 3) shows, that specimens rather similar with *S. fujinensis* are dated usually for regions of a penetration of warm currents. Therefore, despite a boreal-Arctic character of Recent *S. groenlandicus*, remains of *S. fujinensis* (as also Recent *S. groenlandicus fabricii*) specify faster a relatively warm climate. So, the distribution of *S. fujinensis* dated for intervals of more or less expressed Neogene climatic optima in the northwest Pacific (see Kafanov and Volvenko, 1997). Noda (1962: 225) and many subsequent authors wrongly consider *S. fujinensis* as a synonym of *S. laperousii* (Deshayes, 1839).

Cardium groenlandicum unciangulare Khomenko, 1931 may be considered as nom. infrasubsp. s.s. that shown by original description: "Form described here represents the extreme degree of inequilaterality of lower forms of *Cardium groenlandicum*...". Moreover, according to the faunal lists in Khomenko's paper it frequently occurs together with the typical *Serripes groenlandicus*.

Possibly synonym may be also *Mactra semmiana* described by Yokoyama (1929: 368, pl. 74, fig. 10; reproduced: Makiyama, 1959, pl. 72, fig. 10) from the Lower Pliocene Nutovskaya Suite ["beds I (grey sandstone, "*Mactra*-zone")"] off Paromai River, North Karafto [Paromay River, between 53° and 52°50' N, Okha District], Sakhalin, Russia.

Two subspecies, *Serripes groenlandicus groenlandicus* (Mohr, 1786) and *Serripes groenlandicus fabricii* (Deshayes, 1854), may be distinguished among Recent *S. groenlandicus*.

Ecology: Commonly inhabits subtidal zone from 10 m up to 700 m preferably on silts, sandy silts and sands but often occurs on mixed soils and on pebbles. In bottom communities almost always accompanies to *Ciliatocardium ciliatum* (Fabricius, 1780). Most frequently distrubutes on depth 30-150 m at near-bottom temperatures from negative up to +3 ℃ during August and September. In southern parts of area the lower border of vertical distribution is gradually displaced on the increasing depths. Easily maintains lowered salinity and in the White Sea occurs up to 24 ‰ and abnormal high summer near-bottom temperature (ut to 22℃ in Onega Bay).

Near northwestern Greenland it is a leading species in *Macoma calcarea* - *Serripes groenlandicus* community on the depth 30-40 m where maximal total biomass 3500-4000 g/m^2 is observed. It is rather usual on shallow-water (12-16 m on mud) off Franz Josef Land representing one of leading species in *Strongylocentrotus* sp. - *S. groenlandicus* - *Tridonta montagui* community. In Barents Sea forms more or less plentiful settlements only in east and southeast portions of the sea, in other areas is rather rare. It is rather usual on muddy and mud-and-sandy soils in all Arctic seas of Russia on depths 20-200 m.

It dominates in *Serripes groenlandicus* community in east half of the Bering Sea where the influence of warm Alaskan current strongly has an effect and near-bottom temperature the most part of summer make 2-3 ℃; in western half of the sea meets much less often, mainly on depth up to 100 m on sand and large aleurolite. In Kamchatka and Kronotsky Gulfs and also off southeastern Kamchatka and north Kurile Islands it is one of the most usual and mass representatives of Bivalvia. In Japan Sea abundance appreciablly decreases southward, and in Peter the Great Bay there are mainly only empty valves.

One of the main components in a diet of walruses, whales, crabs and benthophagous fishes. It is quite edible for the man but is not used.

Geographical distribution (Figs. 2, 3): One of the most usual Bivalvia species in cold (Arctic Ocean) and cold-temperate waters of the northern hemisphere. Southern limits of distribution: North Atlantic - ? Portsmouth, south England (see type-localities of synonymous *Mactra radiata* Donovan 1903 and *Cardium edentula* Montagu, 1808; see also Römer, 1869), east Finnmarken (according to old data, Friele and Grieg, 1901, alive specimens in Norway meet only in Varanger-Fjord), Färöer Islands, Denmark (at the depth more than 400 m only - Høpner Petersen, 1968), Iceland (it is usual at northern, northwestern, and eastern coasts, at southwestern one is rare, at southern is absent - Jensen, 1912; Madsen, 1949), along northeast North America up to Cape Cod, Massachusetts, or Stonington, Connecticut; North Pacific - Japan Sea coast of Korea, Honshu (along Japan Sea side to Tajima, Hyogo Prefecture, along Pacific side to Iwate Prefecture), Aleutean Islands, Puget Sound, Washington, U.S.A. Circumpolar in Arctic.

Geochronological distribution: The earliest fossil occurrences of *S. groenlandicus* are Lower Miocene Kuluvenskaya Suite in western Kamchatka, Verkhneduyskaya Suite in Sakhalin and lower part of Chikubetsu Formation in Haboro coal-field, Hokkaido. It is very widely distributed in Neogene deposits of western and eastern Kamchatka (Il'inskaya, Enemtenskaya, Tyushevskaya, Pestrotsvetnaya, Ust'-Limimtevayamskaya Suites), Sakhalin (Kurasiyskaya, Mayamrafskaya, Uranayskaya, Maruyamskaya, Nutovskaya Suites), Kurile Islands (Golovinskaya, Parusnaya, Okeanskaya, Alekhinskaya, Kamuyskaya, Okruglovskaya Suites) and Japan (Kobana, Fujina, Kurosawa, Kanomatazawa, Ogino, Takahoko, Hongo, Utsutoge, Magaribuchi, Shin-uryu Formations). In Pacific coast of North America the earliest fossil remains are known from Upper Miocene or Lower Pliocene Yakataga Formation, Yakataga District, Gulf of Alaska (MacNeil in Miller, 1971). It is frequent also in Lower Pliocene, Eopleistocene and Lower Pleistocene deposits of Alaska and Pribiloff Islands (Beringian Layers and their analogues), Iceland (Tjörnes, *Serripes groenlandicus* zone), England (Red and

Icenian Crags) and the Netherlands (Amstelian, Dutch Icenian). Pleistocene formations of Arctic coast of Russia, Spitzbergen, Norway, Chukotka and Kamchatka.

Serripes groenlandicus groenlandicus (Mohr, 1786)

(Pl. 2, figs. 1-13; pl. 3, figs. 1-12; pl. 4, figs. 1-2)

Venus islandica Fabricius, 1780: 411 non Linnaeus, 1767: 1131, no. 124.

Cardium groenlandicum Chemnitz, 1782: 202, Taf. 19, Fig. 198 - nonbinom. (Official Index..., 1958: 5, Direction 1); Schroeter, 1788: 19; Odhner, 1910:18.

Cardium groenlandicum Mohr, 1786: 129 ex Chemnitz, 1782; Warén, 1993: 198.

Cardium groenlandicum Bruguière, 1789: 222, pl. 300, fig. 7 ex Chemnitz, 1782; Gmelin, 1791: 3252; G. B. Sowerby II, [1840]: 67; Reeve, 1845, sp. 53, pl. 10; Hancock, 1846: 336; Middendorff, 1849: 41 (part), Taf. 16, Figs. 8, 9 non Figs. 6, 7; Carpenter, 1864: 561; Schrenck, 1867: 516; Leche, 1878: 21; Dall, 1884: 347; Herzenstein, 1885: 653 (an part.?); Posselt, 1895: 70; Odhner, 1915: 115; Sasaki, 1933: 15, pl. 3, figs. 2a-b; Pirozhnikov, 1937: 83, pl. 38, fig. 2; Thorson, 1951: 79 (part.).

Mactra radiata Donovan, 1803, pl. 161 et text non Spengler, 1802: 107.

Cardium edentula Montagu, 1808: 29 non Deshayes, 1838: 57, pl. 3, figs. 3-5; Fleming, 1813: 92.

Cardium radiatum Donovan: Gray, 1824: 244 non Dujardin, 1837: 224 nec Reeve, 1845, sp. 89, pl. 18.

Aphrodite columba Lea, 1837: 111, pl. 18, fig. 54.

Acardo edentulum auct.: Swainson, 1840: 374.

Cardium boreale Reeve, 1845, sp. 131, pl. 22 non Broderip and Sowerby, 1829: 368.

Cardium (*Aphrodite*) *groenlandicum* Bruguière: Sutherland, 1852: 202.

Cardium (*Serripes*) *groenlandicum* Bruguière: Adams H. and Adams A., 1858: 456; Carpenter, 1864: 584; Römer, 1869: 97, Taf. 7, Fig. 10, Taf. 14, Fig. 7-9; Woodward, 1875: 454; Krause, 1885: 27; Krause, 1892: 343; Posselt and Jensen, 1898: 55; Grieg, 1909: 16; Dautzenberg and Fischer, 1912: 455 (a complete synonymy before 1901); Jensen, 1912: 85, pl. 3, figs. 12a, b; Thiele, 1928: 577.

Cardium (*Aphrodite*) *groenlandicum* var. *album* Verkrüzen, 1877: 53 [invalid name as nom. infrasubsp. s.s.].

Aphrodite groenlandica (Bruguière): Sars, 1878: 49 (part.) non pl. 5, figs. 3a, b; Leche, 1883: 443; Tryon, 1884: 194, pl. 116, figs. 79-81; Kobelt, 1888: 361.

Serripes groenlandicus (Bruguière): Packard, 1867: 280; Dall, 1900: 111; Dall, 1901: 388; Friele and Grieg, 1901: 34; Whiteaves, 1901: 129; Baker, 1919: 498; Rogers, 1920: 360; Oldroyd, [1925]: 145, pl. 8, fig. 3; Johnson, 1926: 25; Soot-Ryen, 1932: 14; Jensen and Spärck, 1934: 110, text-fig.; McLean, 1939: 171 (part.) non pl. 26, figs. 7-8; Clench and Smith, 1944: 28 (part.) non pl. 13, figs. 5-7; Filatova, 1948: 431, pl. 108, fig. 12; Madsen, 1949: 59 (part.); Habe, 1951: 151; Gorbunov, 1952: 247; Morris, 1952: 42, pl. 10, fig. 8; Óskarsson, 1952: 76 (part.), text-fig. 67 (reproduced from Jensen and Spärck, 1934) ; Ushakov, 1953: 267; Ockelmann, 1958: 113; Soot-Ryen, 1958: 21, text-fig. 2; MacGinitie, 1959: 176 (part.) non pl. 26, fig. 5; Abbott, 1960: 401 (part.), pl. 32, fig. *d*?; Bousfield, 1960: 28, pl. 6, fig. 71; Shikama, 1964: 72, pl. 43, fig. 7; Allen, 1965: 983; Habe and Ito, 1965: 133 (part.), pl. 44, fig. 11 non fig. 12; Golikov and Scarlato, 1967: 107, pl. 7, fig. 4; Abbott, 1968: 228, text-fig. 8; Keen, 1969: N590, text fig. E87, 1a-c; Nordsieck, 1969: 97, pl. 14, fig. 54. 10; Habe, 1977: 174 (part.) non pl. 32, figs. 9, 10; Høpner Petersen, 1978, text-fig. 1B; Bernard, 1979: 46, text-figs. 76, 77; Lubinsky, 1980: 39, pl. 8, fig. 2; Scarlato, 1981: 347, figs. 318, 319; Higo and Goto, 1993: 617 (part.); Kwon et al., 1993: 365, fig. 85-7; Higo et al., 1999: 474 (part.); Yavnov, 2000: 49, text-fig.; Kwon et al., 2001: 249 (part.) non text-fig. 1005.

Serripes groenlandicus fabricii, non Deshayes, 1854: Gorbunov, 1952: 247 (part.).

Serripes groenlandicus groenlandicus (Bruguière): La Rocque, 1953: 64.

Serripes (*Serripes*) *groenlandicus* (Mohr, 1786): Coan and Scott, 1997: 13; Lutaenko, 1999: 268, pl. 2, fig. 5; Coan et al., 2000: 355, pl. 74.

Bibliography: Jensen, 1901; Deryugin, 1915, 1928; Ushakov, 1927; Mesyatsev, 1931; Marukawa, 1933; Thorson, 1933, 1934, 1936; Razin, 1935; Zenkevich and Brotskaya, 1937; Brotskaya and Zenkevich, 1939; Gurvich and Ivanov, 1939; Vibe, 1939; Gorbunov, 1946; Zenkevich, 1947, 1951; Gordeeva, 1948; Popova, 1948; Mikulich, 1949; Vibe, 1950; Kuroda and Kinoshita, 1951; Galkin, 1953; Kun and Mikulich, 1954; Kulichkova, 1955; Filatova, 1957; Thorson, 1957; Kudersky, 1958; Miloslavskaya, 1958a, b; Eyerdam, 1960; Kuznetsov V., 1960, 1961; Neyman, 1960; Kuznetsov A., 1961, 1963; Lus and Kuznetsov, 1961; McLaughlin and Hebart, 1961; Savilov, 1961; Zatsepin and Filatova, 1961; Zatsepin, 1962; Brotskaya et al., 1963; Filatova and Neyman, 1963; McLaughlin, 1963; Skalkin, 1963; Zenkevich, 1963; Filatova and Barsanova, 1964; Galkin, 1964; Bernard, 1967; Høpner Petersen, 1968, 1978; Andrews, 1972; Kaufman, 1974, 1976, 1977; Tarverdieva, 1976, 1978; Kafanov, 1978a, b, 1981; Feder and Jewett, 1981; Jewett and Feder, 1982; Finley and Evans, 1983; Carey et al., 1984; Engelhardt et al., 1985; Fukuyama and Oliver, 1985; Fedyakov, 1986; Jewett et al., 1990; Ozolinsh and Klimova, 1991; Trukhin et al., 1991; Siferd and Velsh, 1992; Feder et al., 1994; Oganesyan, 1996; Denisenko, 1997; Zelenkov et al., 1997; Nadtochiy et al., 1998; Gillis and Bllantyne, 1999; Levin, 2001; Lutaenko, 2002.

Type-materials:

Venus islandica Fabricius, 1780. Possible syntypes may be stored in ZMK. Type-locality: Iceland.

Mactra radiata Donovan, 1803. Type material unknown. Type-locality: "Landston Beach, near Portsmouth, after a severe storm...".

Cardium edentula Montagu, 1808. Possible syntypes may be stored in Exeter Museum, Great Britain. Type-locality: "On the shore near Portsmouth, after a storm".

Aphrodite columba Lea, 1837. Possible syntypes may be stored in the American Museum of Natural History, New York, or in Philadelphia Academy of Natural Sciences. Type-locality not given, nor was it given subsecuently; Lea listed only "Hab. ..."; on p. 111-112 under Remarks he said: "Its habitat I am not acquainted with, having purchased my specimens at a dealer's in Europe, who could not inform me from what country they came".

Cardium boreale Reeve, 1845. Holotype - BMNHno. 1879. 2. 26. 235. Type-locality: Greenland.

Description (also see Table 1): Shell medium-sized or large (up

to 112 mm), relatively high (average H/L ratio about 0.89), subequilateral (average A/L ratio about 0.40), medium convex (average B/L ratio about 0.27), faintly oblique and bent, moderately tick-walled.Umbo medium height and medium wide, slightly grosoryrate. Other attributes coincide with those of *S. groenlandicus* s. l.

Comparison: *Serripes groenlandicus fabricii* (Deshayes, 1854) differs by more narrowed anterior margin of valve, by high, wide and protruding umbones and by frequently well expressed rudiments of radial costae on anterior area of valve.

Taxonomic notes: Many authors marked extremely wide individual and geographical variability of *Serripes groenlandicus*. Sowerby (1840) specified var. *edentula* Sowerby from Greenland. Middendorff (1849) informs presence of two forms of this species at coasts of European North. Packard (1867) comparing specimens from Greenland and Labrador supposes an opportunity of subdivision of *S. groenlandicus* on two independent species. Krause (1885) distinguishes f. *typica* and f. *globosa* in the Bering Sea. Posselt and Jensen (1898: 56) write the following: "Usual at Iceland var. *oblonga* meets and at southern Greenland; another variety which meets there is *Cardium boreale* of Chemnitz" [it a mistake: Chemnitz at all does not mention *Cardium boreale*]. Gorbunov (1952) in details assorts questions of geographical variability of *S. groenlandicus*. Contrary to Jensen' (1912) opinion he recognizes its regular character and speaks about existence at least of two independent subspecies.

Really, the biometric analysis shows that in limits of geographical range some independent groups are distinguished among *S. groenlandicus*, and these groups formally deserve of the subspecies status (Table 2). The geographical variability of *S. groenlandicus* quite reminds those in *Ciliatocardium ciliatum* (Fabricius, 1780). In High Arctic Region high and flattened forms are distributed, whereas in northern parts of the Atlantic and Pacific Oceans the rather lengthened and convex shells prevail. However, these distinctions clearly come to light only at the biometric analysis of a mass material. The difficulties with a choice of diagnostic attributes force me to refuse allocation of any new subspecies and in scope of Recent *S. groenlandicus* I consider only nominative subspecies and *S. groenlandicus fabricii* (Deshayes, 1854).

Table 1. Statistical values of basic morphometric characters in Recent *Serripes groenlandicus* groenlandicus (Mohr, 1786).

N = 222; y = L = 51.6±4.3; σy = 20.2±1.7; Asy = +0.011; Ey = -0.372;

Parameters	H	A	B
x	45.3±3.5	20.6±1.6	13.6±1.1
σ_x	16.3±2.5	7.5±1.1	5.4±0.8
As_x	+0.016	+0.109	+0.127
E_x	−0.343	−0.199	−0.268
r	0.985±0.002***	0.985±0.001***	0.952±0.002***
r_{ln}	0.992±0.001***	0.991±0.001***	0.973±0.001***
a	0.868	2.207	3.679
b	1.070±0.003	1.040±0.008	1.011±0.007
x/y	0.89±0.00	0.40±0.00	0.27±0.00
$\sigma_{x/y}$	0.05±0.00	0.03±0.00	0.02±0.00
$As_{x/y}$	−0.100	−0.044	+0.167
$E_{x/y}$	−0.247	−0.277	−0.321

Notation admitted here is as follows: **N** - sampling volume; **y(L)** and **x** (H, A, B) - values of the argument and functions (mean±SD); **As** and **E** - coefficients of asymmetry and excess; for significant differences of **As** and **E** from the parameters of normal (Gaussian) distribution and for significance of **r** and r_{ln}: *P<0.1, ** P<0.01, ***P<0.001; **r** - paired Pearson's correlation coefficient between the values of **x** and **y**; r_{ln} - paired Pearson's correlation coefficient between the logarithms of **x** and **y**; **a** and **b** - constants of the power functions **ln y = ln a + b • ln x**; quotation of the type **x/y** = 0.89±0.00 denotes that SD<0.005.

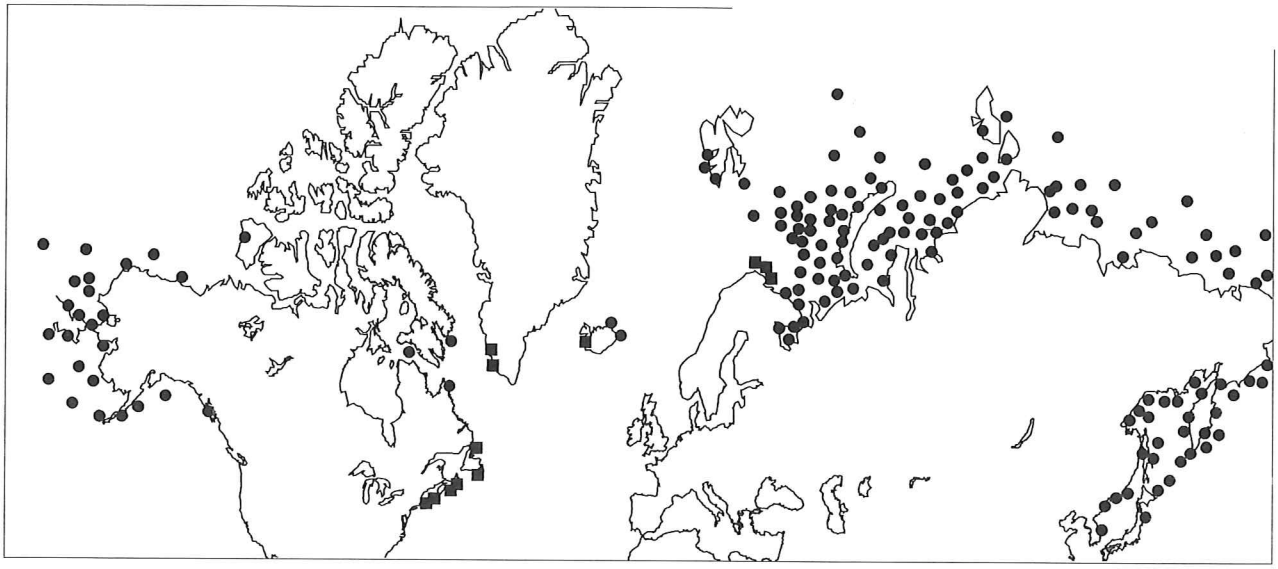

Fig. 2. Geographical distribution of Recent *Serripes groenlandicus groenlandicus* (Mohr, 1786)(●) and *Serripes groenlandicus fabricii* (Deshayes, 1854)(■).

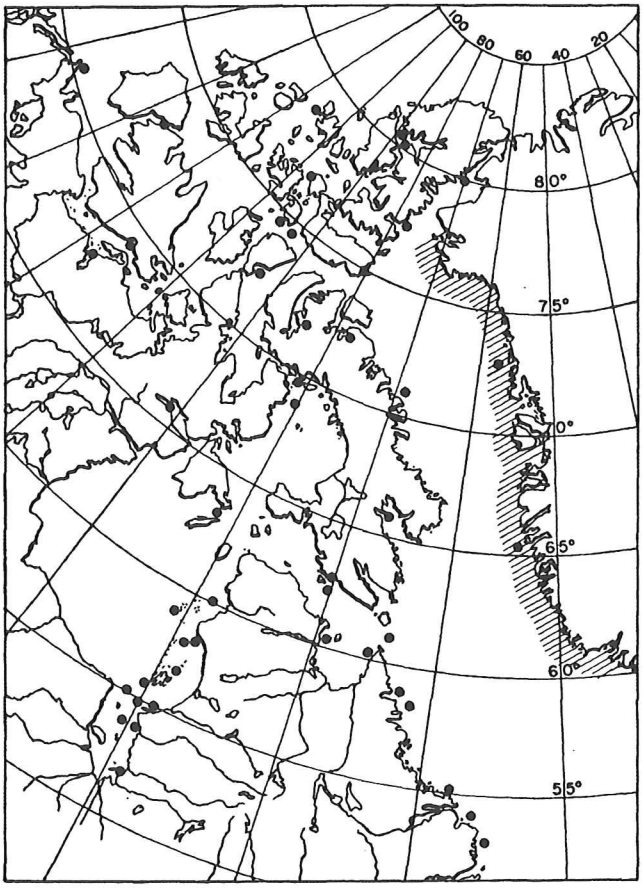

Fig. 3. Geographical distribution of *Serripes groenlandicus groenlandicus* (Mohr, 1786) in Canadian central and eastern Arctic (From: Lubinsky, 1980, map 31).

Distribution (Figs. 2, 3): Cold and cold-temperate waters of the northern hemisphere. In northern Atlantic it is partially replaced by *S. groenlandicus fabricii* (Deshayes, 1854).

Material: More than 200 lots and 600 specimens (ZIsp, CAS, LACM, SBMNH).

Serripes groenlandicus fabricii (Deshayes, 1854)

(Pl. 4, figs. 3-13)

Cardium fabricii Deshayes, 1854: 333.

Cardium groenlandicum Bruguière: DeKay, 1843: 206, pl. 23, fig. 250; Middendorff, 1849: 41 (part.), pl. 16, figs. 6, 7 non figs. 8, 9.

? Aphrodite groenlandica (Bruguière): Sars, 1878: 49 (part.), pl. 5, figs. 3a-b.

? Serripes groenlandicus (Bruguière): McLean, 1939, p. 171, pl. 26, figs. 7, 8.

Serripes groenlandicus (Bruguière): Clench and Smith, 1944, p. 28, pl. 13, figs. 5-7; Voskuil, 1989, p. 275, text-figs. 1(10), 25.

Type material: Holotype (based on the illustration of *Cardium groenlandicum* in Middendorff, 1849, pl. 16, figs. 6, 7) - ZIsp no. 1/13460.

Type-locality: Iceland, Recent (labelled as: "*Card. Grönlandicum* Chemn. Island. Steenstrup. [18]46).

Holotype dimensions: L - 44.3; H - 41.2; B - 15.3; A - 21.5.

Description: Shell angularly-suboval, rather large (up to 85.0 mm and more), high (average H/L ratio about 0.93), equilateral (average A/L ratio about 0.49), medium convex (average B/L ratio about 0.35), faintly oblique and bent, moderately thick-walled. Posterior margin it is a little bit wider than anterior one. Posterior branch of hinge margin passes in posterior margin by an appreciable angulation. Growth lines are rather smoothed but well appreciable. Radial ribs traces are well developed on the posterior and the anterior valve surfaces. Anterior umbonal cavity well marked. Umbo medium wide or slightly tapering, moderate height. Compared with nominative subspecies, hinge is less reduced and the tooth AIII quite often is distinct.

Comparison: *Serripes groenlandicus groenlandicus* (Mohr, 1786) differs by more elongate and more depressed shell (see Table 2).

Distribution (Fig. 2): Northwestern Atlantic southward up to southwestern Iceland, Faroer Islands, Denmark, Cape Cod, Massachusetts, or Stonington, Connecticut. It replaces *S. groenlandicus groenlandicus* in a zone of the influence of warm Northatlantic Current and its branches.

Material: 33 lots and 42 specimens (ZIsp).

Table 2. Overlapping percents for ratios distribution in different geographical populations of Recent *Serripes groenlandicus* (Mohr, 1786).

	Ratios	I	II	III	IV
I	H/L		64.7	**94.2**	53.5
	B/L		42.7	**97.8**	21.3
	A/L		21.0	78.8	11.5
II	H/L	52.1		89.9	22.2
	B/L	26.0		**91.2**	85.3
	A/L	7.7		46.6	39.0
III	H/L	71.0	67.7		88.8
	B/L	72.1	69.9		**96.2**
	A/L	51.1	30.0		67.2
IV	H/L	34.4	10.9	54.4	
	B/L	17.0	64.0	73.8	
	A/L	9.4	27.2	51.0	

I - *Serripes groenlandicus fabricii* (Deshayes, 1854); *Serripes groenlandicus groenlandicus* (Mohr, 1786) from: II - eastern portion of Barents Sea; III - Kara and Laptev Seas; IV - Bering Sea.

It is calculated on the CD-coefficients (Mayr in Oliver, 1943; Mayr et al., 1953) and overlapping percents appropriate by them (Gèry, 1962). The meanings exceeding 90 % are bolded. The data in the top right half corres pond to fiducial probability of 97 %, the data in the bottom left half - to fiducial probability of 99.94 %.

Power coefficients in exponential functions between conchometric parameters are close to 1; ratios distributions are well approximated as Gaussian (see Table 1).

Serripes chejsliensis Sinelnikova in Gladenkov et Sinelnikova, 1990

(Pl. 5, fig. 9)

Serripes chejsliensis Sinelnikova in Gladenkov et Sinelnikova, 1990: 72, pl. 17, fig. 3.

Type-material: Holotype - GIN no. 286/85-1. Type-locality: Kavrano-Utkholokskaya Bight, between the mouthes of Bezymyannaya and Kheysheveem Rivers, western Kamchatka, Russia, Kakertskaya Suite, layer with *Macoma optiva*, Middle Miocene.

Holotype dimensions: L - 62.6, H - 66.1; B - 14.5, A - 30.3.

Description: Shell trigonally-suborbicular, medium-sized, extended in height (average H/L ratio about 1.05), equilateral (average A/L ratio about 0.48), medium convex (average B/L ratio about 0.23), non-oblique and unbent, covered by rough concentric growth lines near ventral margin. The traces of wide radial ribs in the greater degree are advanced on anterior area of valve. Anterior, ventral and posterior margins form correct semi-oval outline. Anterior and posterior umbonal cavities are poorly distinct. Umbo rather tapering, moderate height.

Comparison: Most similar *Serripes hataii* Noda, 1962 differs by more wide valves and by less expressed radial ribs traces.

Distribution: Middle Miocene Kakertskaya Suite in western Kamchatka, Russia.

Material: 3 lots, 14 specimens (GIN).

? *Serripes expansus* Hirayama, 1954

(Pl. 12, figs. 5-6)

Serripes expansus Hirayama, 1954: 66, pl. 4, figs. 1, 2; Noda, H., 1962: 223.

Type-material: Probably is missing. The holotype was keept in TUE no. 10136. Dr. Y. Kurihara (Institute of Geoscience, The University of Tsukuba) informs me (E-mail message of November 8, 2002): "Tokyo Kyoiku Daigaku (Tokyo University of Education) was abolished in 1970's and was reorganized as the Univerisity of Tsukuba. During the reorganization, a lot of fossil specimens were lost". Also Prof. H. Noda (Institute of Geoscience, The University of Tsukuba) especially interested in *Serripes* (see: Noda, 1962) writes (E-mail message of November 9, 2002): "When I examined the all specimens stocked at Tokyo University of Education, we could not find the Hirayama's type specimen".Type-locality: Nanatsuishi, Oyamada-shimogô, Oyamada-mura, Tochigi Prefecture, Honshu, Japan, Lower Miocene Kobana Formation.

Description (from: Hirayama, 1954: 66-67): "Shell very large, much swollen, equivalve, inequilateral, sides expanded, surface with faint radials at anterior side and with those disc covered with rough concentric growth lines, elongate subcircular in shape. Anterior and posterior sides rounded, expanded, pass into ventral margin with more or less shape angulation anteriorly; ventral border broadly rounded. Postero-dorsal margin roundly sloping into posterior side, the antero-dorsal margin nearly straight for a short distance, then sharply sloping into protruded anterior extremity. Beaks swollen, directed anteriorly, almost touching. Shell greatly swollen, the maximum convexity lying dorsal of center, therefrom gradually lessening to ventral margin and more sharply into umbo. Anterior one-fifth provided with weak radial sculpture, which is obliterated elsewhere; whole surface covered with rough concentric growth lines, several which stand out periodically. Escutcheon or ligamental area longly ovate, not deeply incised. Dimensions of holotype (in mm), height 97.0, length 120.0, thickness of intact valves 54.0. Somewhat deformed specimen of paratype, height 78.0, length 101.0, thickness of intact valves 40.0".

Comparison: "This species will be distinguished by its expanded sides, much swollen shell, subcircular outline, very weak radials on the anterrior part of the valve and rather periodically situated rough concentric growth lines" (Hirayama, 1954: 67). The similar forms among Serripedini are not known.

Taxonomical notes: Since the description it is not revealed of any other specimens of this species. Any attributes do not specify its accessory to *Serripes* or in general to Cardiidae. The illustration of the type specimens looks insufficient to make its generic assignment. Therefore before reception of additional materials I conditionally consider this species in composition of *Serripes*.

Distribution: Known from the type-locality only.

Serripes hataii Noda, 1962

(Pl. 5, figs. 10-11)

Serripes hataii Noda, 1962: 224, pl. 37, fig. 3.

Type-material: Hototype - IGPS no. 74593. Type-locality: Iwaigawa, Kamikurosawa, Hagihana-mura, Nishiiwai District, Iwate Prefecture, Honshu, Japan, lower part of the Nishikurosawa Formation, Lower Miocene.

Holotype dimensions: L - 85.5; H - 86.6; B - 19.5; A - 40.9.

Description: Shell subcircular, large, slightly extended in height (average H/L ratio about 1.01), equilateral (average A/L ratio about 0.48), medium convex (average B/L ratio about 0.23), non-oblique and unbent. Anterior and posterior margins broadly rounded, dorsal margin sloping into both extremities with nearly straight margin for a short distance. Ventral margin strongly rounded. Valve surface covered with concentric regular lines of growth but densely at ventral margin. Faint radial ribs traces cross growth lines at both sides of shell, radial ribs or their traces indistinct in middle area of valve. Anterior and posterior umbonal cavities are poorly distinct. Umbo rather tapering, moderate height.

Comparison: Most similar *Serripes chejsliensis* Sinelnikova in Gladenkov et Sinelnikova, 1990 differs by triangular valve outlines and by more expressed radial ribs traces on the anterior valve area.

Distribution: Lower Miocene Nishikurosawa Formation in Iwate Prefecture, Honshu, Japan. Very similar forms are known from Makarov District, Sakhalin, in upper part of Gastellovskaya Suite, Upper Oligocene.

Material: 2 lots, 2 specimens (IGPS).

Serripes japonicus Noda, 1962

(Pl. 5, figs. 12-13)

Serripes fujinensis, non Yokoyama, 1923: Otuka, 1937: 168 (part.), pl. 16, fig. 9 non fig. 10; Kanno and Matsuno, 1960, pl. 4, fig. 6.

Serripes japonica Noda, 1962: 225, pl. 39, fig. 4.

Type-material: Holotype - IGPS no. 78680. Type-locality: Mukai, Sakekawa-mura, Mogami District, Yamagata Prefecture, Honshu, Japan, Upper Miocene Sakekawa Formation.

Holotype dimensions: L - 80.0; H - 69.6; B - 17.5; A - 31.2.

Description: Shell suborbicular, rather large, high (average H/L ratio about 0.87), subequilateral (average A/L ratio about 0.39), medium or moderately convex (average B/L ratio about 0. 22), moderately oblique and moderately bent. Anterior and posterior margins rounded. Anterior branch of hinge margin slightly concave and short; posterior branch of hinge margin long and broadly arcuated; ventral margin concave and broadly rounded. Rude concentric growth lines are on whole valve surface. Anterior area bears faint radiating ribs, indistinct on posterior area. Anterior umbonal cavity is rather expressed. Umbo medium wide and moderate height. Hinge margin evenly arcuated with lateral teeth.

Comparison: Most similar *Serripes laperousii* (Deshayes, 1854) differs by more elongated and more equilateral shell.

Distribution: Miocene Magaribuchi, Chikubetsu and Sakekawa Formations of Honshu, Japan; lower part of Maruyamskaya Suite in Makarov District, Sakhalin, Russia, Upper Miocene.

Material: 3 lots, 4 specimens (IGPS, VNIGRI).

Serripes joetsuensis Kafanov, sp. nov.

(Pl. 6, figs. 1-3)

Etymology: Named in honour of Joetsu University of Education which employee, Dr. Kazutaka Amano, has specified to me presence of this species.

Type-material: Holotype and paratypes - Joetsu University of Education, without reg. no. Type-locality: a small outcrop along the Koide River in Shibata City, Niigata Prefecture, Honshu, Japan, Middle Pliocene Kuwae Formation.

Holotype dimensions: L - 76.2, H - 72.3, B - ca. 25.0, A - 34.9.

Description: Shell suborbicular, medium-sized or rather large, high (average H/L ratio about 0.95), equilateral (average A/L ratio about 0.46), medium convex (average B/L ratio about 0.33), moderately oblique and moderately bent. Posterior margin little bit wider than anterior one. Ventral and anterior margins connected as a wide correct arch. Posterior margin straighted. Regular growth lines smoothed but well marked. Medium height and medium wide umbo well marked by anterior and posterior umbonal cavities. All valve surface covered with precise radial ribs (about 70 in number) shared by rather deep interspaces. The ribs are higher and more widely on anterior and posterior areas. The tooth 3b is rather advanced. Nymphe is long.

Comparison: The close forms are not found out. This species finds out some similarity with *Yagudinella yokoyamai* Otuka, 1935 which differs well by shell outlines and by absence of radial ribs on medial and posterior valve areas. The latter species originally described as Serripes concerns undoubtedly to *Yagudinella* that the author of a species emphasized also (Otuka, 1935: 603): "Phylogenetically, *Serripes yokoyamai* Otuka may be closely connected with *Serripes* [*Yagudinella*] *notabilis* Sowerby".

Distribution: Known from the type-locality only.

Serripes kamtschaticus Ilyina, 1963

(Pl. 8, figs. 5-6)

Serripes kamtschaticus Ilyina, 1963: 102, pl. 43, figs. 2, 3.

Etymology: Named after the type-locality, Kamchatka.

Type-material: Holotype - CNIGRM no. 249/6338. Type-locality: between Moroshechnaya and Kovachina Rivers, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.

Holotype dimensions: L - 76.4, H - 80.7, B - 20.6, A - 29.3.

Description: Shell trigonally suboval, medium-sized or large, extended in height (average H/L ratio about 1.06), subequilateral (average A/L ratio about 0.38), medium convex (average B/L ratio about 0.27), moderately oblique and moderately bent. Umbo is badly marked by anterior and/or posterior umbonal cavities, medium height and medium wide. External valve surface covered by rare but rather rough concentric growth lines. Radial rib traces are badly shown on all surface of valves.

Comparison: Most similar *Serripes nodai* Kafanov, 1980 differs by shell outlines and by less protruded umbones.

Distribution : Middle Miocene Etolonskaya Suite of western Kamchatka, Russia.

Material: 4 lots and 6 specimens (CNIGRM, VNIGRI).

Serripes laperousii (Deshayes, 1839)

(Pl. 6, figs. 4-6; pl. 7, figs. 1-6; pl. 8, figs. 1-4)

English: broad smoothcockle, Japanese: naga-uba-tori-gai, Russian: zubchatonog Laperuza.

Cardium laperousii Deshayes, 1839: 360; 1941, pl. 48; Dall, 1871: 148; Carpenter, 1872: 29.

Serripes laperousei (Deshayes): Dall, 1900: 391; 1916: 31.

Serripes laperousii (Deshayes): Grant and Gale, 1931: 314; Soot-Ryen, 1932: 20; Habe, 1951: 151, figs. 339, 340; Fischer-Piette, 1977: 84; Habe, 1977: 174; Higo and Goto, 1993: 617 (part.); Higo et al., 1999: 474 (part.); Kwon et al., 2001: 249, text-figs. 1006, 1, 2.

Serripes groenlandicus, non Mohr, 1786: MacGinitie, 1959: 176 (part.), pl. 26, fig. 5; Noda, 1962, pl. 37, figs. 4a-b non figs. 6, 7; Habe, 1977: 174 (part.), pl. 32, figs. 9, 10.

? *Serripes groenlandicus laperousii* (Deshayes): Zhidkova et al., 1972: 128, pl. 28, fig. 1.

Serripes (*Serripes*) *laperousii* (Deshayes): Coan et al., 2000: 357, pl. 74.

Serripes laperosi [sic!] (Deshayes): Yavnov, 2000: 51, text-fig.

Non

Serripes laperousii (Deshayes): Nomura, 1935: 114, pl. 7, figs. 1-3; Noda, 1962: 225, pl. 36, figs. 6a, b; pl. 37, figs 2a, b, 6, 7; pl. 38, figs. 5,6; Uozumi et al., 1966, pl. 15, fig. 5;. Zinbo, 1973, pl. 14, fig. 5; Habe, 1977: 174; Honda, 1978, pl. 2, fig. 21.

Bibliography: Kafanov, 1978a, b; Vermeij et. al., 1990; Buyanovskiy, 1994.

Etymology: Named in honour of Jean-François de Galaup La Pérouse, eminent French navigator who conducted wide-ranging explorations in the Pacific Ocean.

Type-material: Possible syntype of *Cardium laperousii* Deshayes, 1839 - CERPAB, without reg. no. (Mme E.Fatton in lettre of 8 April, 1975). Type-locality was given as "Mers de Californie" in the original description. Kafanov (1980: 319) restricted the type-locality as Kodiak Island, Gulf of Alaska; this species is absent near the coast of true California, and Deshayes most likely meant "Russian California" in the Russian-American Company, Russian trading monopoly that established colonies in North America (primarily in California and Alaska) during the 19th century.

Description: Shell elongate-ovate, large (up to 130 mm and more), moderate oblong (average H/L ratio about 0.79), equilateral (average A/L ratio about 0.48), medium convex (average B/L ratio about 0.25), non-oblique and unbent, rather thick-walled. Periostracum dull brown or olive in color, interior white. Shell slightly gaping posteriorly. Growth lines smoothed. Umbo low-sized, wide, slightly marked by anterior and posterior umbonal cavities. Weakened radial rib traces are shown mainly on the posterior valve area only, but juveniles with a few radial striae on posterior and anterior areas. Long and wide nymphe bears dense and powerful ligament. Muscle scars large, pressed.

Comparison: Most similar *Serripes japonicus* Noda, 1962 differs by rather higher shell.

Taxonomical notes: This species very often confuse to the lengthened specimens of *S. groenlandicus* (Mohr, 1786).

Habitat: 2-260 m on sandy mud.

Distribution: From Japan Sea coasts of Korea, Tsugaru Strait in Pacific coast of Honshu, Japan, Petersburg, Alaska (56.8° N), northwards to Point Barrow in Chukchi Sea. In ZIsp collection (reg. no. 32/13176) there is a kept in alkohol specimen labelled "Vrangel Island, off Rogers Bight, A. Klyuge, 1938". This locality requires confirmation. Authentic Neogene finds are not known. With known reserve to this species can be referred specimen figured by Zhidkova et al. (1972, pl. 28, fig. 1) from Golovninskaya Suite of Kunashir Island, Kurile Islands. Grant and Gale (1931) cite a record of Dall indicating that it occurs in the Pleistocene of the Aleutian Islands.

Material: 46 lots, 112 specimens (ZIsp, LACM, CAS, SBMNH).

? *Serripes muraii* Noda et Tada, 1968

(Pl. 10, fig. 1)

Serripes muraii Noda and Tada, 1968: 202, pl. 22, fig. 22.

Etymology: In honour of Prof. Sadamasa Murai, Iwate University.

Type-material: Holotype - IGPS no. 88058. Type-locality: small tributary of the Kakkonda River, about 4 km NNW of the Takinoue Spa, Shizukuishi-machi, Iwate Prefecture, Honshu, Japan, Yamatsuda Formation, upper Middle Miocene.

Holotype dimensions: L - 65.3, H - 79.5, B - ca. 19.0, A - 26.4.

Description: Shell trigonally suboval, medium sized, very extended in height, subequilateral, medium convex, non-oblique and unbent. Anterior margin acutely rounded, posterior margin elongated acute, ventral margin narrowly rounded. Anterior and posterior umbonal cavities are absent. Umbo tapering, moderate height. External valve surface covered by rather regular concentric growth lines and by bluntly elevated radial ribs on anterior and posterior areas but indistinct on medial area. Posterior radial ribs dustinct compared with anterior one. Cardinal teeth obscure.

Comparison: Most similar *Serripes hataii* Noda, 1962 differs by lower shell and by less expressed radial rib traces on anterior and posterior valve areas.

Taxonomical note: In shell outlines this species resembles some Limidae. As hinge details are unknown I previously attribute this species to *Serripes*.

Distribution: Known from the type-locality only.

Material: 1 specimen (IGPS).

Serripes nodai Kafanov, 1980

(Pl. 10, figs. 2-6)

Serripes nodai Kafanov, 1980: 319 nom. nov. pro *Cardium pauperculum* Yokoyama, 1923: 6, pl. 1, figs. 2a-c non Meek, 1871: 306 nec Yokoyama, 1925: 121, pl. 14, figs. 12, 13 nec Yokoyama, 1926: 243, pl. 30, fig. 3.

Etymology: In honour of Japanese paleontologist Prof. Hiroshi Noda.

Type-material: Holotype - UMUT no. CM24574. Type-locality: Kami-Ichiba, Shimane Prefecture, Honshu, Japan, Middle Miocene Fujina Formation.

Holotype dimensions: L - 46.0, H - 47.1, B - 14.5, A - 20.7.

Description: Shell subcircular, medium-sized, slightly extended in height (average H/L ratio about 1.02), equilateral (average A/L ratio about 0.45), medium convex (average B/L ratio about 0.32), faintly oblique and unbent. Posterior branch of hinge margin and posterior valve margin form a correct arch. Growth lines not numerous, rough. Umbo badly expressed, tapering, low-sized. Very weak radial ribs traces are sometimes shown on medial area of valve.

Comparison: Most similar *Serripes kamtschaticus* Ilyina, 1963 differs by shell outlines and by more protruded umbones.

Taxonomical notes: Yokoyama described and figured three different forms called *Cardium pauperculum*: 1) the holotype, a specimen which slightly resembles *Serripes kamtschaticus* Ilyina, 1963 and is much different in shell outlines from all Recent and fossil *S. groenlandicus* (Mohr, 1786); 2) a specimen from the Oligocene Akahira Beds in central Honshu (Yokoyama, 1925: 121, pl. 14, figs. 12, 13) for which Hatai and Nisiyama (1952: 39) suggest a new name, *Cardium arakawaense*; 3) a specimen from Wakkanai

Formation of southwestern Honshu (Yokoyama, 1926: 243, pl. 30, fig. 3) which may be identified with *S. groenlandicus*. Noda (1962: 223) in comparing *Cardium paupe rculum* Yokoyama with *S. groenlandicus* apparently took into account the third form mentioned above, because he cites the name in Yokoyama's paper of 1926 in synonymy with S. groenlandicus, but he does not mention the original description and figure of *Cardium pauperculum* Yokoyama, 1923. Both Hatai and Nisiyama (1952) and Ogasawara (2001) do not give it. According to my opinion the information does not justify the recognition of *Cardium pauperculum* Yokoyama, 1923 as a synonym of *Serripes groenlandicus* (Mohr, 1786), and *Cardium pauperculum* Yokoyama, 1923 can retain its rank of an independent species.

Distribution: Middle Miocene Fujina Formation in Shimane Prefecture, Honshu, Japan.

Material: 2 lots, 2 specimens (UMUT, PIN).

Serripes ochotensis Ilyina, 1963

(Pl. 9, figs. 5-8)

Serripes ochotensis Ilyina, 1963: 102, pl. 42, figs. 1, 2.

Etymology: Named after the type-locality, coast of the Okhotsk Sea.

Type-material: Holotype - CNIGRM no. 248/6338. Type-locality: coast of the Okhotsk Sea, between Nepropusk Point and the Etolona River mouth, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.

Holotype dimensions: L - 84.0, H - 77.1, B - 24.3, A - 33.0.

Description: Shell oblong-elliptical, large, high (average H/L ratio about 0.92), subequilateral (average A/L ratio about 0.39), medium convex (average B/L ratio about 0.29), moderately oblique and faintly bent. Anterior branch of hinge margin short and under a blunt corner incorporates with rather short and convex anterior valve margin; the last smoothly passes into long and flattened ventral margin; posterior branch of hinge margin short, oblique, smoothly incorporates with same oblique long posterior valve margin. External valve su rface covered by numerous rough growth lines. Umbo wide, medium height, marked mainly by anterior umbonal cavity. Radial ribs traces are better shown on anterior valve area.

Comparison: Most similar *Serripes groenlandicus* (Mohr, 1786) differs by relatively lower and less convex valves.

Distribution: Middle Miocene Etolonskaya Suite in western Kamchatka, Russia.

Material: 2 lots, 2 specimens(CNIGRM).

Serripes savizkyi Kafanov, sp. nov.

(Pl. 8, fig. 7; pl. 9, figs. 1-3)

Serripes shiobaraensis, non Noda, 1962: Kafanov and Savizky, 1982: 44, figs. 5. 1z, i.

Etymology: Named in honor of Soviet geologist and paleontologist Viktor O. Savizky (1937-1988).

Type-material: Holotype - PIN no. 22/3962. Type-locality: sea cliff, near the mouth of Geran' River, Poronaysk District, Sakhalin, Russia, Middle Miocene Uranayskaya Suite.

Holotype dimensions: L - 53.8, H - 51.7, B - 15.1, A - 22.5.

Description: Shell trigonally-suborbicular, medium-sized (up to 55 mm), high (average H/L ratio about 0.96), sligtly subequilateral (average A/L ratio about 0.42), medium convex (average B/L ratio about 0.28), non-oblique and unbent. Growth lines smoothed. Umbo moderate height, tapering, rather well marked by anterior umbonal cavity. Radial ribbing is advanced on all surface of a valve. It is formed by rather distinct interspaces separating wide and low ribs, about 40 in number. Ribs are better expressed on an terior and posterior valve areas.

Comparison: Most similar is *Serripes uvutschensis* Ilyina, 1963 differs by small-sized shell with more elongated valves and by higher ribs on their surface.

Distribution: Lower and Middle Miocene Daginskaya, Okobykayskaya and Uranayskaya Suites in Sakhalin, Russia.

Material: 7 lots, 57 specimens (Sakhalin Territorial Geological Administration, Yuzhno-Sakhalinsk, and PIN).

Serripes squalidus (Yokoyama, 1924)

(Pl. 9, figs. 9-10)

Cardium (*Laevicardium*) *squalidum* Yokoyama, 1924: 16, pl. 3, figs. 1, 1a.

Serripes squalidum Yokoyama : Makiyama, 1957, pl. 13, figs. 1, 1a ; Oyama et al., 1960: 177, pl. 55, figs. 6a-b; Noda, 1962: 228.

Etymology: The name is derived from the Latin *squalidus*, rough.

Type-material: Holotype - UMUT no. CM22084. Type-locality: Dodaira, Misawa, Nakoso-shi, Fukushima Prefecture, Honshu, Japan, Upper Oligocene Iwaki Formation.

Holotype dimensions: L - 50.6, H - 47.2, B - 12.0, A - 22.6.

Description: Shell suborbicular, medium-sized, high (average H/L ratio about 0.93), equilateral (average A/L ratio about 0.45), medium convex (average B/L ratio about 0.24), non-oblique and faintly bent. Anterior margin more bluntly rounded than posterior one. Umbo moderate height, wide, well marked by anterior umbonal cavity. External surface smooth with rude growth lines.

Comparison: This species differs from others *Serripes* by absence of radial ribs traces.

Distribution: Upper Oligocene Iwaki Formation in Fukushima Prefecture, Honshu, Japan.

Material: 1 specimen (UMUT).

Serripes triangularis Noda, 1962

(Pl. 9, fig. 4)

Serripes triangularis Noda, 1962: 229, pl. 39, figs. 2, 3.

Etymology: The name is derived from the Latin *triangularis*, triangular.

Type-material: Holotype - SHM no. 8410. Type-locality: Itanoki-sawa, Araki-mura, Mogami District, Yamagata Prefecture,

Honshu, Japan, Upper Miocene Mitsumori Formation.

Holotype dimensions: L - 88.0, H - 84.8, B - 23.5, A - 38.1.

Description: Shell triangular ovate, large, high (average H/L ratio about 0.96), rather equilateral (average A/L ratio about 0.43), medium convex (average B/L ratio about 0.27), faintly oblique and unbent. Anterior part of ventral margin long but shorter than postero-dorsal one, nearly straight. Posterior branch of hinge margin long and nearly straight. Ventral margin rounded, both sides of border rounded with slightly high angle. Umbo moderate height, wide or medium wide, not marked by anterior and/or posterior umbonal cavities. External surface ornamented by radial ribs which are wider than interspaces, low, rounded, flat topped on both slopes but radial ribs on medial valve area narrower than at anterior and posterior valve areas. Radial ribs cross faint concentric growth lines.

Comparison: This species differs well by regularly triangular shell outlines.

Distribution: Upper Miocene Mitsumori Formation in Yamagata Prefecture, Honshu, Japan.

Material: 2 lots, 2 specimens (SHM).

Serripes uvutschensis Ilyina, 1963

(Pl. 10, fig. 9)

Serripes (?) *uvutschensis* Ilyina, 1963: 76, pl. 25, fig. 5.

Etymology: Named after Uvuch Mountain situated near the type-locality.

Type-material: Holotype - CNIGRM no. 103/6338. Type-locality: cliff of the Kovachinskaya Bay near the mouth of Moroshechnaya River, western Kamchatka, Russia, Middle Miocene Il'inskaya Suite.

Description: Shell suborbicular, small-sized, moderately oblong (average H/L ratio about 0.75), rather equilateral (average A/L ratio about 0.43), moderately convex (average B/L ratio about 0.18), non-oblique and unbent. Anterior branch of hinge margin short, little bit concave, smoothly passes in convex and short anterior valve margin. Ventral margin poorly convex, slightly raised by the forward end. Umbo narrow, low-sized, not clearly marked by anterior and posterior umbonal cavities. External valve surface covered by 35-40 plainly-convex radial ribs with narrow interspace s and by rough concentric growth lines.

Comparison: Most similar *Serripes savizkyi* sp. nov. differs by medium-sized shell with higher valves and by flat radial ribs on their surface.

Distribution: Middle Miocene Il'inskaya Suite in western Kamchatka, Russia.

Material: 3 lots, 6 specimens (CNIGRM).

Genus *Yagudinella* Kafanov, 1975

Yagudinella Kafanov, 1975: 147; Kafanov, 1980: 320.
Serripes (*Yagudinella*) Kafanov: Coan et al., 2000: 357.

Type-species (OD): *Cardium* (*Serripes*) *notabile* G. B. Sowerby III, 1915; Wakasa Bay, Honshu, Japan, Recent.

Etymology: In honor of Saida I. Yagudina (1908-1996), the oldest technichian of the Mollusca Section, Zoological Institute, Russian Academy of Sciences (see about her: Kafanov et al., 1998).

Description: Shell medium-sized or fairly large (up to 100 mm and more), convex, truncated, looks as obviously inequilateral. Anterior valve margin much narrower than posterior one. Posterior branch of hinge margin passes into posterior valve margin at an marked angle. Postwerior valve surface, as a rule, with pronounced carina. Umbones strongly inclined forward, prosogyrate. Clear traces of radial ribs are on the anterior and posterior valve areas; sometimes radial ribs traces cover all surface of a valve. Cardinal teeth somewhat reduced. Bases of the anterior lower lateral teeth lie on the ventral side of anterior part of hinge margin and their proximal parts extended posterodorsally toward umbones. Distal part of foot with longitudinal row of closely spaced combs but not denticles, which are high, inflated on the sides; ventral sulculus absent. Labial palps long and near equal in length to the inner demibranch.

Northern Pacific, southwards to Korea, Japan and Alaska Peninsula. Middle Miocene to Recent in the northern Pacific.

Key to the species and subspecies

1. Radial ribs traces are developed on the posterior and the anterior valve surfaces only ·····2
   All valve surface covered by radial ribs traces or by true radial ribs ····· *Yagudinella shiobaraensis* (Noda, 1962)
2. Average H/L ratio more than 0.90. ·····4
   Average H/L ratio less than 0.90 ·····3
3. Umbo very protruded, anterior valve area wist distinct radial ribs traces, average A/L ratio about 0.37
   ····· *Yagudinella makiyamai nigamiensis* (Noda, 1962)
   Umbo not protruded, anterior valve area smoothed, average A/L ratio about 0.46··· *Yagudinella notabilis nomurai* (Otuka, 1943)
4. Umbo is a little displaced to the posterior valve margin, average A/L ratio more than 0.50··· *Yagudinella yokoyamai* (Otuka, 1935)
   Umbo is displaced to the anterior valve margin, average A/L ratio less than 0.50 ·····5
5. Average B/L ratio more than 0.32, average A/L ratio more than 0.42··· *Yagudinella notabilis notabilis* (G. B. Sowerby III, 1915)
   Average B/L ratio less than 0.32, average A/L ratio less than 0.42·····6
6. Anterior portion of valve is put strongly forward, posterior branch of hinge margin passes into posterior valve margin with an appreciable corner
   ····· *Yagudinella makiyamai makiyamai* (Yokoyama, 1928)
   Anterior portion of valve is put moderately forward, posterior branch of hinge margin and posterior valve margin form a smooth arch····· *Yagudinella takoyensis* Kafanov et Savizky, 1982.

Yagudinella notabilis notabilis (G. B. Sowerby III, 1915)

(Pl. 11, figs. 1-4; pl. 12, figs. 1-4)

English: oblique smoothcockle, Japanese: uba-tori-gai, Russian: zubchatonog primechatelinyi.

Cardium (*Serripes*) *notabile* G. B. Sowerby III, 1915: 169, pl. 10, fig. 9.

Serripes notabilis (Sowerby): Hirase, 1934: 17, pl. 31, fig. 1; Otuka, 1935: 602 (part.); Habe, 1951: 151; Noda H., 1962: 227 (part.), pl. 38, fig. 7; Habe, 1964: 187, pl. 57, fig. 26; Habe and Kosuge, 1967: 147, pl. 55, fig. 1; Ito, 1967: 69; Fischer-Piette, 1977: 84, pl. 9, figs. 3a-d.

Serripes groenlandicus, non Mohr, 1786: Scarlato, 1955: 193 (part.) non pl. 51, fig. 11; Shikama, 1964: 72 (part.) non pl. 43, fig. 7; Habe and Ito, 1965: 133 (part.), pl. 44, fig. 12, non fig. 11; Golikov and Scarlato, 1967: 107 (part.), non pl. 7, fig. 4; Habe and Igarashi, 1967: 36 (part.); Habe, 1977: 174 (part.); Kwon et al., 2001: 249 (part.), text-fig. 1005.

Serripes laperousii, non Deshayes, 1839: Kotaka, 1962: 152 (part.), pl. 35, figs. 12, 13; Noda, 1962: 225 (part.), pl. 37, fig. 2 non fig. 4,

Yagudinella notabilis (Sowerby): Scarlato, 1981: 348, figs. 321, 322.

Serripes (*Yagudinella*) *notabilis* (Sowerby): Coan et al., 2000: 357, pl. 74.

Yagudinella notabilis (Kafanov, 1975) [sic!]: Yavnov, 2000: 57, text-fig.

Etymology: The name is derived from the Latin *notabilis*, outstanding.

Type-material: Holotype - BMNH no. 1919.12.31.38. Type-locality: Wakasa Bay, Japan Sea coast of Honshu, Japan, Recent.

Holotype dimensions: L - 85.7, H- 81.5, B - 30.9, A - 38.5.

Description: Shell subquadrate-ovale, large (up to 90 mm and more), high (average H/L ratio about 0.98), equilateral (average A/L ratio about 0.48), convex (average B/L ratio about 0.36), faintly oblique and unbent. The anterior margin slightly concave, while the posterior is nearly straight for a short distance from the beak and truncated down to the lower part of posterior ma rgin meeting the ventral margin with acute angle; ventral margin broadly arcuated. External valve surface with brown zigzag markings, especially in juvenile specimens. Growth lines smoothed. Umbo prominent, wide, medium height, well marked by anterior umbonal cavity. Radial ribs traces clearly evident on anterior and posterior valve surface. Anterior lateral teeth set off by deep cleft. The muscle scars are rather large. The pallial line is slightly truncate behind and round in front.

Comparison: A Miocene subspecies, *Yagudinella notabilis nomurai* (Otuka, 1943), differs by more elongate shell with less prominent umbones.

Habitat: 40-220 m on sandy mud. About linear growth and life duration see Kafanov (1978a).

Distribution: From Korea, Japan Sea coast of Honshu and Alaska Peninsula (55.2 °N) northwards to Anadyr Bay and Prince William Sound. The earliest fossil records are known from Upper Miocene Oya tuffaceous sa ndstone member, Hongo Formation in Yamagata Prefecture, Honshu, Japan.

Material: 68 lots, 139 specimens (ZIsp, LACM).

Yagudinella notabilis nomurai (Otuka, 1943)

(Pl. 13, fig. 5)

Serripes notabilis nomurai Otuka, 1943: 231, pl. 3(2), fig. 10.

Serripes notabilis (Sowerby): Noda H., 1962: 227 (part.).

Etymology: In honor of the eminent Japanese paleontologist Prof. Sitihei Nomura.

Type-material: Holotype - UMUT no. CM13233. Type-locality: Nakanango, Saunai-mura, Hiraga District, Akita Prefecture, Honshu, Japan, Miocene Kurosawa Formation.

Holotype dimensions: L - 66.0, H - 57.1, B - 24.5, A - 30.6.

Description: Shell suborbicular, medium-sized, rather high, equilateral, rather convex. Comparing with the nominative subspecies, it differs by more elongate shell, suborbicular in shape and by less prominent umbones. Radial ribs traces are smoothed because of poor preservation of the shell.

Taxonomical note: Noda (1962) considers this form identical with *Serripes* [*Yagudinella*] *notabilis*. However, the numerous Recent specimens of the latter are distinguished well by their more angulate outlines and more truncated valves. I therefore finds it quite possible that this form should retain its rank of a separate subspecies.

Distribution: Known from the type-locality only.

Material: 1 specimen (UMUT).

Yagudinella makiyamai makiyamai (Yokoyama, 1928)

(Pl. 13, figs. 1-2)

Mactra (?) *makiyamai* Yokoyama, 1928: 360, pl. 69, fig. 3.

Serripes makiyamai (Yokoyama): Nomura and Zinbo, 1935: 10, pl. 1, fig. 13; Itoigawa, 1958: 261, pl. 1, fig. 11; Makiyama, 1959, pl. 67, fig. 3; Kanno and Tomizawa, 1959: 10, pl. 2, figs. 6a-b; Nomura, 1962: 226; Kafanov, 1980: 321.

Etymology: In honor of the eminent Japanese paleontologist Prof. Jiro Makiyama.

Type-material: Holotype - UMUT no. CM25352. Type-locality: Nagaoka, river side at Hanzogane, Hanzogane-mura, Koshi District, Niigata Prefecture, Honshu, Japan, Upper Miocene Ushigakubi Formation.

Holotype dimensions: L - 97.3, H - 91.2, B - 27.0, A - 36.3.

Description: Shell ovate-trigonal, large, high (average H/L ratio about 0.94), subequilateral (average A/L ratio about 0.37), medium convex (average B/L ratio about 0.28), moderately oblique, faintly bent. Anterior part of hinge margin short and concave; ventral margin and posterior branch of hinge margin nearly straight. There are rather rough growth lines. Umbo wide or extremely wide, medium height, marked by distinct anterior umbonal cavity. Well developed radial ribs traces shown on anterior and medial valve areas.

Comparison: Most similar *Yagudinella takoyensis* Kafanov et Savizky, 1982 differs by shell outlines and by less prominent umbo. Another subspecies, *Yagudinella makiyamai nigamiensis* (Noda, 1962), differs by more inequilateral shell, more arcuated posterior margin and by characteristically incurved umbo.

Distribution: Middle Miocene to Lower Pliocene in Honshu, Japan: Teradomari and Ushigakubi Formations in Niigata Prefecture, Furukuchi Formation in Yamagata Prefecture, Ogawa Forma-

tion in Nagano Prefecture, Urushikubo Formation in Fukushima Prefecture. Noda (1962) reports this species from Kinseido Formation in Korea.

Material: 3 lots, 6 specimens (UMUT and Department of Geology and Mineralogy, Faculty of Science, Kyoto University).

Yagudinella makiyamai nigamiensis (Noda, 1962)

(Pl. 13, fig. 3)

Serripes makiyamai nigamiensis Noda, 1962: 227, pl. 39, figs. 1a-c.

Etymology: Named after the type-locality, Nigami.

Type-material: Holotype - IGPS no. 78684. Type-locality: Nigami, Ooshima-mura, Higashikubiki District, Niigata Prefecture, Honshu, Japan, Upper Miocene Shiiya Formation.

Holotype dimensions: L - 120.6, H - 105.7, B - 27.5, A - 44.7.

Description: Shell ovate-trigonal, large, moderately high (average H/L ratio about 0.88), subequilateral (average A/L ratio about 0.37), medium or moderately convex (average B/L ratio about 0.23), oblique, moderately bent, rather thin-walled. Anterior branch of hinge margin very short and concave; posterior margin very long compared with anterior one and broadly arcuated, sloping into ventral margin; the latter nearly straight. Most convex part of shell dorsal to center, gradually decrease in convexity to ventral margin and sharply into umbo. Umbo incurved foreward, wide, moderate or medium height, well marked by anterior umbonal cavity. External surface covered by very fine concentric growth lines. Low, rounded-squarish topped, radial ribs indistinct on medial valve surface but distinct on anterior and posterior areas. Cardinal teeth obsolete, lateral teeth especially posterior one rather well developed. Lunule makes about one third of anterior branch of hinge margin.

Comparison (according to Noda, 1962: 227): Although this subspecies is allied to *Yagudinella makiyamai makiyamai* (Yokoyama, 1928), the former differs from the latter in having a more inequilateral shell, more arcuated posterior margin and characteristically incurved umbo, while the latter resembles the former in its faint radiating striae in the medial valve area but has no lunule.

Distribution: Upper Miocene Shiiya Formation in Niigata Prefecture, Honshu, Japan.

Material: 2 lots, 3 specimens (IGPS).

Yagudinella shiobaraensis (Noda, 1962)

(Pl. 13, fig. 4)

Serripes shiobaraensis Noda, 1962: 228, pl. 39, fig. 5.

Yagudinella shiobaraensis Noda: Kafanov, 1980: 320.

Etymology: Named after the type-locality, Shiobara-machi.

Type-material: Holotype - IGPS no. 78687. Type-locality: cliff facing the Hokigawa Electric Power Station along the Hoki River, Sekiya, Shiobara-machi, Shioya District, Tochigi Prefecture, Honshu, Japan, Middle Miocene Kanomatazawa Formation.

Holotype dimensions: L - ca. 83.4, H - 82.1, B - 22.5, A - 43.9.

Description: Shell angularly-ovate, large, high, equilateral, medium convex, faintly oblique, unbent. Anterior branch of hinge margin nearly straight and meets the anterior valve margin with acute angle; posterior margin slightly arcuated but posterior branch of hinge margin nearly straight. Ventral margin broadly rounded. Umbo tapering, rather low-sized, not clearly marked by anterior umbonal cavity, a little displaced backward. All valve surface covered by 35-40 radial ribs flatly rounded on top and separated by wider interspaces. On anterior and posterior valve areas ribs are more expressed. Growth lines somewhat elevated and dense near ventral margin. Ligamental area long, not incised.

Comparison: There are no similar forms of *Yagudinella*.

Distribution: Known from the type-locality only.

Material: 1 specimen (IGPS).

Yagudinella takoyensis Kafanov et Savizky, 1982

(Pl. 5, fig. 2; pl. 11, figs. 5-7)

Serripes groenlandicus, non Mohr, 1786: Ilyina, 1954: 224 (part.), pl. 17, figs. 1, 1a non figs. 2, 2a.

Yagudinella takoyensis Kafanov and Savizky, 1982: 41, figs. 1g, d.

Etymology: The name is derived from the type-locality, Malyi Takoy River.

Type-material: Holotype - PIN no. 10/3962. Type-locality: Malyi Takoy River, Dolinsk District, Sakhalin, Russia, lower sub-Suite (stratotypical section) of Maruyamskaya Suite, Upper Miocene.

Holotype dimensions: L - 68.1, H - 65.7, B - 19.9, A - 24.2.

Description: Shell roundly trigonal, medium-sized (up to 78 mm), high (average H/L ratio about 0.95), subequilateral (average A/L ratio about 0.38), medium convex (average B/L ratio about 0.29), moderately oblique and faintly bent. Anterior branch of hinge margin and anterior valve margin form an abrupt correct arch; it smoothly passes in widely rounded ventral margin. The latter passes into posterior margin with an appreciable corner. Umbo wide, medium height, slightly marked by anterior umbonal cavity. Radial ribs traces expressed on anterior valve area and much less distinct on the posterior one. Numerous growth lines smoothed.

Comparison: Most similar *Yagudinella makiyamai makiyamai* (Yokoyama, 1928) differs in shell outlines having anterior portion of valve putted strongly forward, and posterior branch of hinge margin passed into posterior valve margin with an appreciable corner.

Distribution: Lower sub-Suite of Maruyamskaya Suite, Members I and II in Sakhalin, Russia, Upper Miocene.

Material: 9 lots, 32 specimens (Sakhalin Territorial Geological Administration, Yuzhno-Sakhalinsk, and PIN).

Yagudinella yokoyamai (Otuka, 1935)

(Pl. 10, figs. 7-8)

Serripes yokoyamai Otuka, 1935: 603, pl. 2, figs. 3-6; Noda H., 1962: 229, pl. 39, fig. 6.

Yagudinella yokoyamai (Otuka): Kafanov, 1980: 322.

Etymology: In honor of the eminent Japanese paleontologist

Prof. Matajiro Yokoyama.

Type-material: Holotype - UMUT no. CM13029. Type-locality: Ogino, Yamanogo-mura, Yama District, Fukushima Prefecture, Honshu, Japan, Miocene Hitosao Formation.

Holotype dimensions: L - 79.0, H - 73.6, B - 23.0. A - 44.7.

Description: Shell roundly trigonal, medium-sized or rather large, high (average H/L ratio about 0.93), rather equilateral with umbo slightly displaced backward (average A/L ratio about 0.57), medium convex (average B/L ratio about 0.29), non-oblique and unbent. Valve rounded in front and vertically truncated behind, with broadly rounded ventral margin. Umbo wide, medium height, well marked by anterior umbonal cavity, striated in the middle part of the dorsal margin. External valve surface where its material preserved shows numerous blunt radial ribs traces, distinct on the anterior valve area, but indistinct on the medial and probably also on the posterior valve area.

Comparison: This species differs from other *Yagudinella* by umbones displaced backward and by general valve outlines.

Distribution: H. Noda (1962) reports this species from numerous Middle Miocene to Lower Pliocene formations of Japan (Wakkaenbetsu F. in Hokkaido, Shimokurosawa F. in Iwate Prefecture, Kurosawa F. in Akita Prefecture, Ginzan, Kusanagi, Hongo, Matsumae, Nobesawa, Tazawa, Utsutoge and Yonago Formations in Yamagata Prefecture, Ishikura, Hamada and Utsuno Formations in Miyagi Prefecture, Hitosao, Ogino and Urushikubo Formations in Fukushima Prefecture, Kanomatazawa F. in Tochigi Prefecture, Tokawa F. in Aomori Prefecture, Nishiyama and Haizume Formations in Niigata Prefecture). However, all these records need further confirmation.

Material: 3 lots, 3 specimens (UMUT, IGPS).

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Plate 1

Figs. 1-15. *Serripes groenlandicus* (Mohr, 1786).

Original figure reproduction of *Cardium groenlandicum* (Chemnitz, 1782, Taf. 19, Fig. 198); right valve exterior (fig. 1); Greenland, Recent. Original figure reproduction of *Mactra fujinensis* Yokoyama, 1923 (pl. 2, figs. 2a, b); left valve exterior (fig. 2) and above (fig. 3); Matsue, Fujina, Tamayu-mura, Yatsuka District, Shimane Prefecture, Honshu, Japan, Middle Miocene Fujina Formation.

Original figures reproduction of *Serripes vachruschevi* Evseev, 1956 ([1994], pl. 16, figs. 4, 5); lectotype, latex imprint of internal cast of left valve (fig. 4) and paralectotype, external cast of right valve (fig. 5); re-drawing (fig. 6) of the last figure by Korobkov (1954, pl. 95, fig. 17); 1st inflow of Higashi-Sakutan [Gornaya] River, Makarov District, Sakhalin, Russia, Middle and Upper Miocene Kurasiyskaya Suite.

Holotype (fig. 7, CNIGRM - no. 62/6780) and paratype (fig. 8, CNIGRM - no. 63/6780) of *Serripes titthum* L. Krishtofovich, 1969; external casts of right (fig. 7) and left (fig. 8) valves; near the mouth of the Talovaya River, Kronotskiy Reservation, east Kamchatka, Russia, Miocene Tyushevskaya Suite.

Reproduction of original figure of *Cardium groenlandicum unciangulare* Khomenko, 1931 (pl. 10, fig. 21); external cast of right valve (fig. 9); Bol'shoy Garomay River, east Kamchatka, Russia, Pliocene "Nadnutovskaya Suite".

Holotype (fig. 10, GIN - no. 8751/15) and paratype (fig. 11, GIN - coll. 8751) of *Serripes karaginskiensis* Barinov in Barinov et al., 1992; external casts of right valves; 12 km south of Yun'yun'vayam River, southwest coast of Karaginsky Island, east Kamchatka, Russia, Miocene Pestrotsvetnaya Suite, Layer 10.

Holotype of *Serripes similis* Kafanov in Arkhipova et al., 1992 - VNIGRI - no. 174/825; external cast of right valve (fig. 12); Gornaya River, Makarov District, Sakhalin Russia, Middle Miocene Ausinskaya Suite.

Sea cliff, Makarov District, Sakhalin, Russia, lower part of Maruyamskaya Suite, Member III, Upper Miocene; external cast of left valve (fig. 13).

Lectotype of *Cardium groenlandicum unciangulare* Khomenko, 1931 - CNIGRM no. 87/3456; external cast of right valve (fig. 14); Bol'shoy Garomay River, east Kamchatka, Russia, Pliocene "Nadnutovskaya Suite".

Shakhtnaya River, Makarov District, Sakhalin Russia, lower part of Maruyamskaya Suite, Member I, Upper Miocene; external cast of left valve (fig. 15).

All figures in natural size.

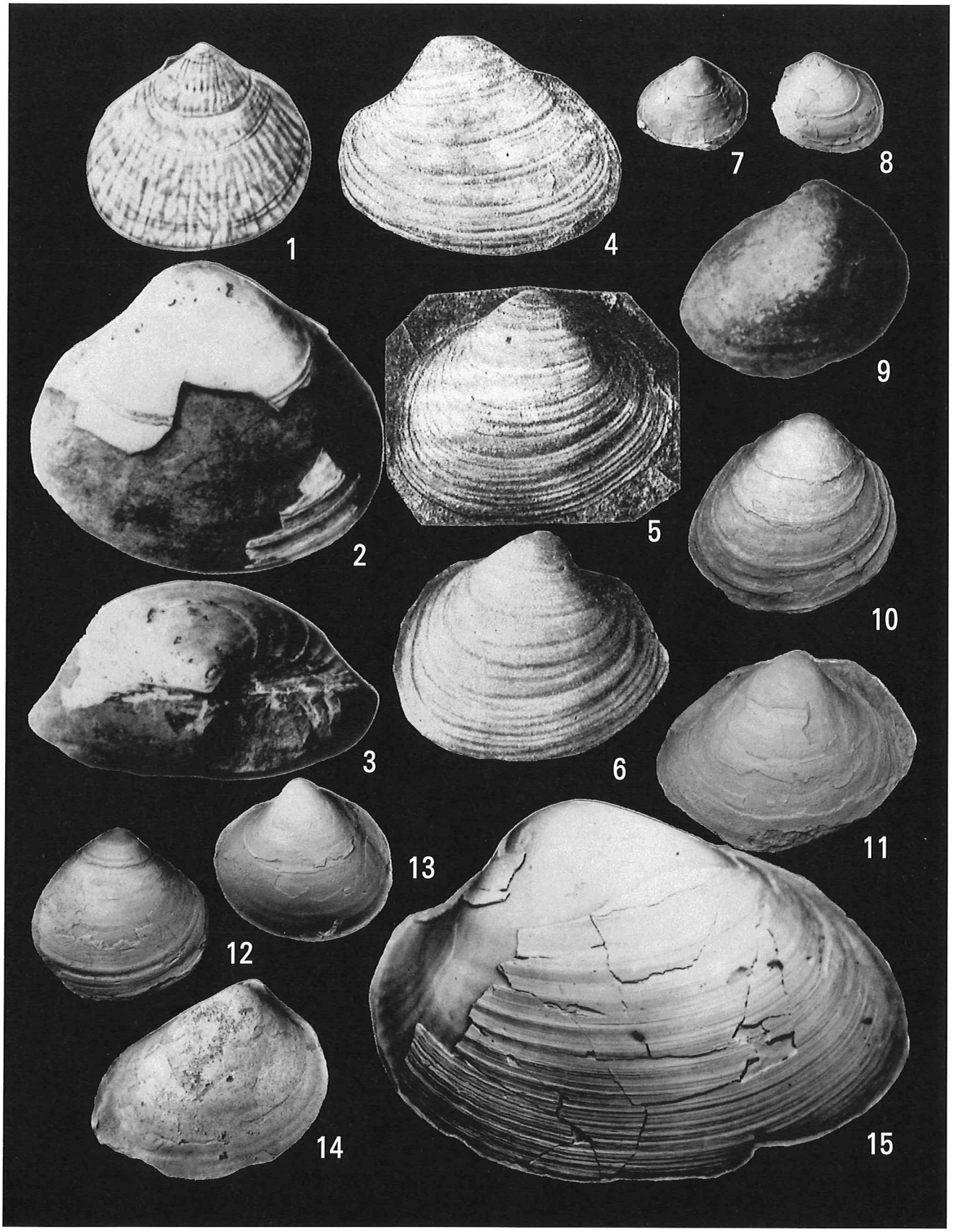
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Plate 2

Figs. 1-13. *Serripes groenlandicus groenlandicus* (Mohr, 1786).

Holotype of *Cardium boreale* Reeve, 1845 - BMNH no. 1879.2.26.235; right valve exterior (fig. 1), left valve exterior (fig. 2) and interior (fig. 3). Greenland; Recent.

Southwestern part of Laptev Sea; ZIsp - no. 116/12594; right (fig. 4) and left (fig. 5) valves exterior.

Porcupine Cape, Labrador; ZIsp - no. 71/12549; right (fig. 6) and left (fig. 7) valves exterior.

Point Barrow, Arctic coast os Alaska; ZIsp - no. 35/13280; left (fig. 8) and right (fig. 9) valves exterior.

Varneka Bight, Kara Sea; ZIsp - no. 128/12606; right (fig. 10) and left (fig. 11) valves exterior.

Between Heis and Fersmann Islands, Franz-Josef Land; ZIsp - no. 281/12759; right (fig. 12) and left (fig. 13) valves exterior.

All figures in natural size.


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Plate 3

Figs. 1-12. *Serripes groenlandicus groenlandicus* (Mohr, 1786).

Andersons Bay, Storfjord, Spitzbergen; ZIsp - no. 38/12516; left valve exterior (fig. 1).

Northwestern part of the Bering Sea, depth 41 m; ZIsp - no. 1/12764; left valve exterior (fig. 2) and interior (fig. 3), right valve exterior (fig. 4) and interior (fig. 5).

Peter the Great Bay, Japan Sea; ZIsp - no. 56/13301; right (fig. 6) and left (fig. 7) valves exterior.

Provideniya Bight, Bering Sea; ZIsp - no. 32/13277; left valve exterior (fig. 8).

Aniwa Bay, Sakhalin, southern part of Okhotsk Sea; ZIsp - no. 46/13291; left valve exterior (fig. 9).

Southrn part of Chikchi Sea; ZIsp - no. 77/13322; left (fig. 10) and right (fig. 11) valves exterior.

Kodiak Island, Gulf of Alaska; ZIsp - no. 153/13398; left valve exterior (fig. 12).

All figures in natural size.

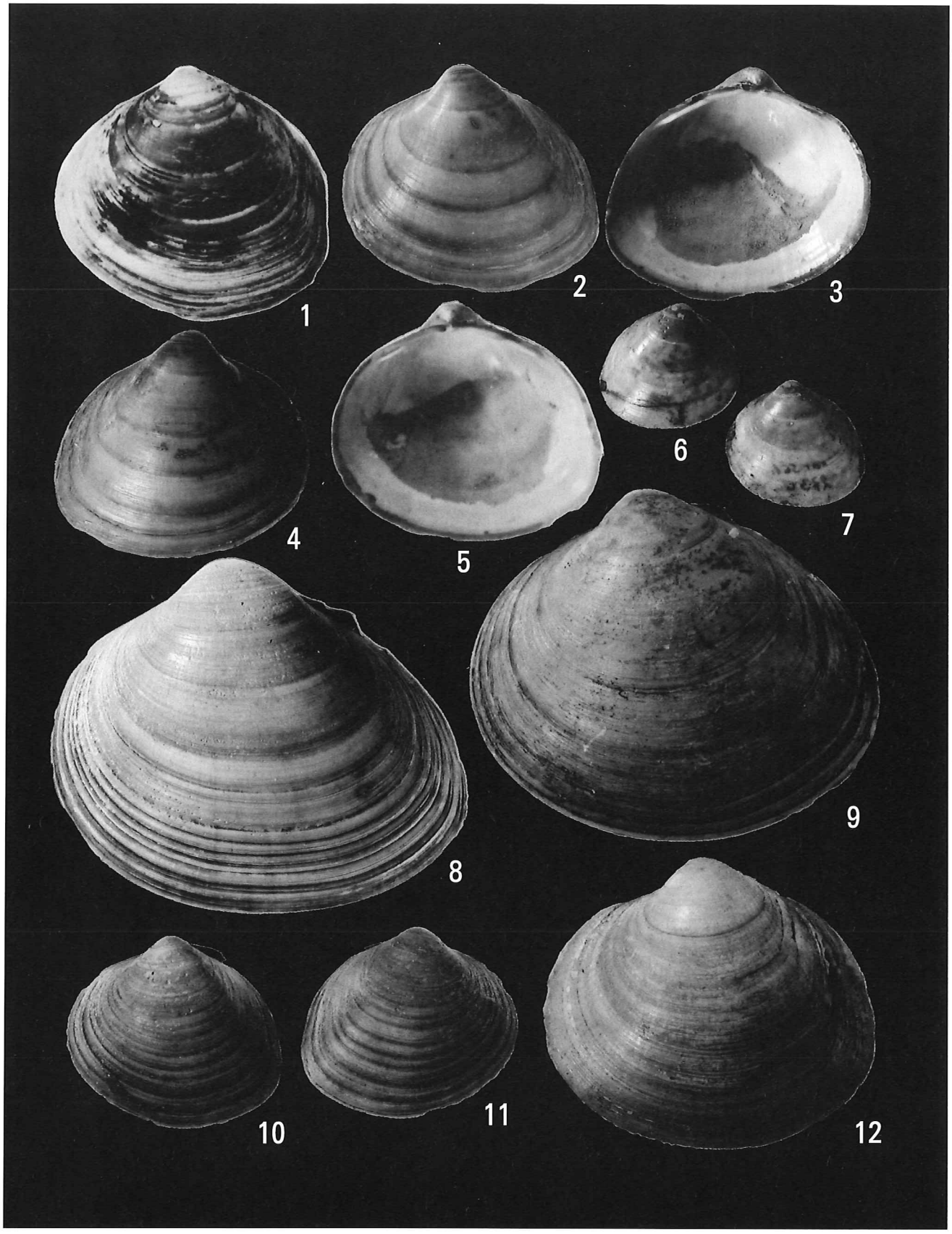
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Plate 4

Figs. 1-2. *Serripes groenlandicus groenlandicus* (Mohr, 1786).
Anadyr Bay, Bering Sea; ZIsp no. 21/13266; left (fig. 1) and right (fig. 2) valves exterior.

Figs. 3-13. *Serripes groenlandicus fabricii* (Deshayes, 1854).
Holotype of *Cardium fabricii* Deshayes, 1854 - ZIsp no. 1/13460; rigt valve exterior (fig. 3) and interior (fig. 4), left valve exterior (fig. 5) and interior (fig. 6); Iceland, Recent.
Northwestern extremity of the Svyatoy Nos Cape, Barents Sea; ZIsp no. 6/13465; left valve exterior (fig. 7).
Matamek, Quebek; ZIsp no. 3/13462; left valve exterior (fig. 8) and interior (fig. 9), right valve exterior (fig. 10) and interior (fig. 11).
Off Greenland (no exact locality given); ZIsp no. 2/13461; left (fig. 12) and right (fig. 13) valves exterior.

All figures in natural size.

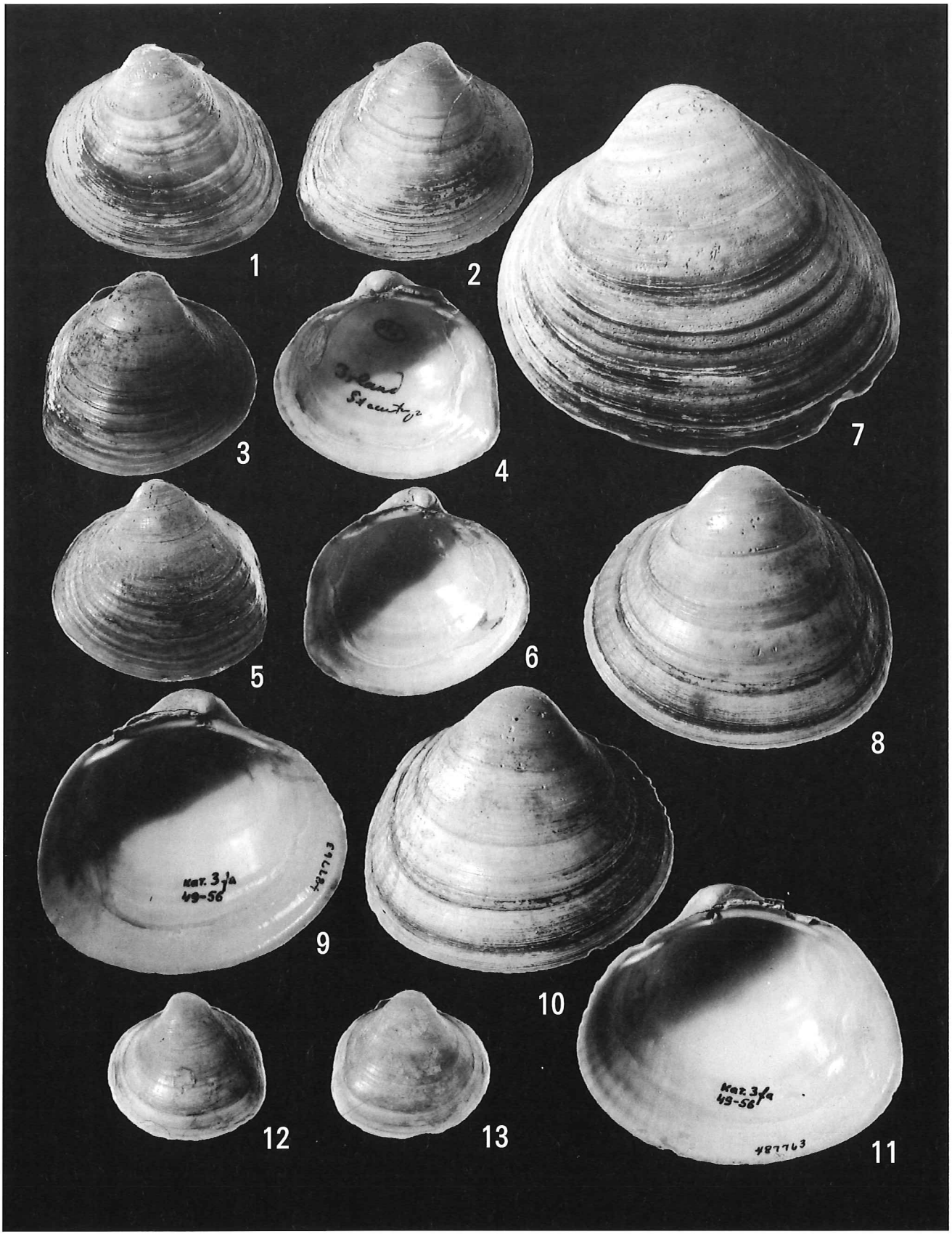
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Plate 5

Figs. 1, 3-8. *Serripes groenlandicus* (Mohr, 1786).

Sea cliff north from the Krinka River mouth, Makarov District, Sakhalin, Russia, middle part of Maruyamskaya Suite, Upper Miocene; VNIGRI - no. 172/825; external cast of left valve (fig. 1).

Makarova River, Makarov District, Sakhalin, Russia, lower part of Maruyamskaya Suite, Member I, Upper Miocene ; VNIGRI - no. 168/825; external cast of right valve (fig. 3).

Shakhtnaya River, Makarov District, Sakhalin, Russia, lower part of Maruyamskaya Suite, Upper Miocene; VNIGRI - no. 171/825 (fig. 4), no. 170/825 (fig. 5); external casts of left valves.

Krinka River, Makarov District, Sakhalin, Russia, lower part of Maruyamskaya Suite, Upper Miocene; VNIGRI - no. 176/825; external cast of right valve (fig. 6).

Mozhayka River, Makarov District, Sakhalin, Russia, Middle Miocene Ausinskaya Suite; VNIGRI - no. 173/825; external cast of right valve (fig. 7).

Sea cliff, Makarov Distruct, Sakhalin, Russia, Maruyamskaya Suite, Member III, Upper Miocene; PIN no. 74/3962; external cast of left valve (fig. 8).

Fig. 2. *Yagudinella takoyensis* Kafanov et Savizky, 1982.

Lyutoga (Rudaka) River, Aniwa District, Sakhalin, Russia, Upper Miocene Maruyamskaya Suite; CNIGRM no. 79/6819; external cast of right valve (fig. 2).

Fig. 9. *Serripes chejsliensis Sinelnikova* in Gladenkov et Sinelnikova, 1990.

Holotype - GIN no. 286/85-1; external cast of right valve; Kavrano-Utkholokskaya Bight, between the mouthes of Bezymyannaya and Kheysheveem Rivers, western Kamchatka, Russia, Kakertskaya Suite, layer with *Macoma optiva*, Middle Miocene.

Figs. 10-11. *Serripes hataii* Noda, 1962.

Hototype - IGPS no. 74593; external cast of left valve (fig. 10); Iwaigawa, Kamikurosawa, Hagihana-mura, Nishiiwai District, Iwate Prefecture, Honshu, Japan, lower part of the Nishikurosawa Formation, Lower Miocene.

Serripes cf. *hataii* Noda, 1962 - Gornaya River, Makarov District, Sakhalin, upper part of Gastellovskaya Suite, Upper Oligocene; VNIGRI no. 169/825; external cast of right valve (fig. 11).

Figs. 12-13. *Serripes japonicus* Noda, 1962.

Holotype of *Serripes japonica* Noda, 1962 - IGPS no. 78680; external cast of right valve (fig. 12); Mukai, Sakekawa-mura, Mogami District, Yamagata Prefecture, Honshu, Japan, Upper Miocene Sakekawa Formation.

Shakhtnaya River, Makarov District, Sakhalin, Russia, lower part of Maruyamskaya Suite, Upper Miocene; VNIGRI no. 175/825; external cast of right valve (fig. 13).

All figures in natural size.

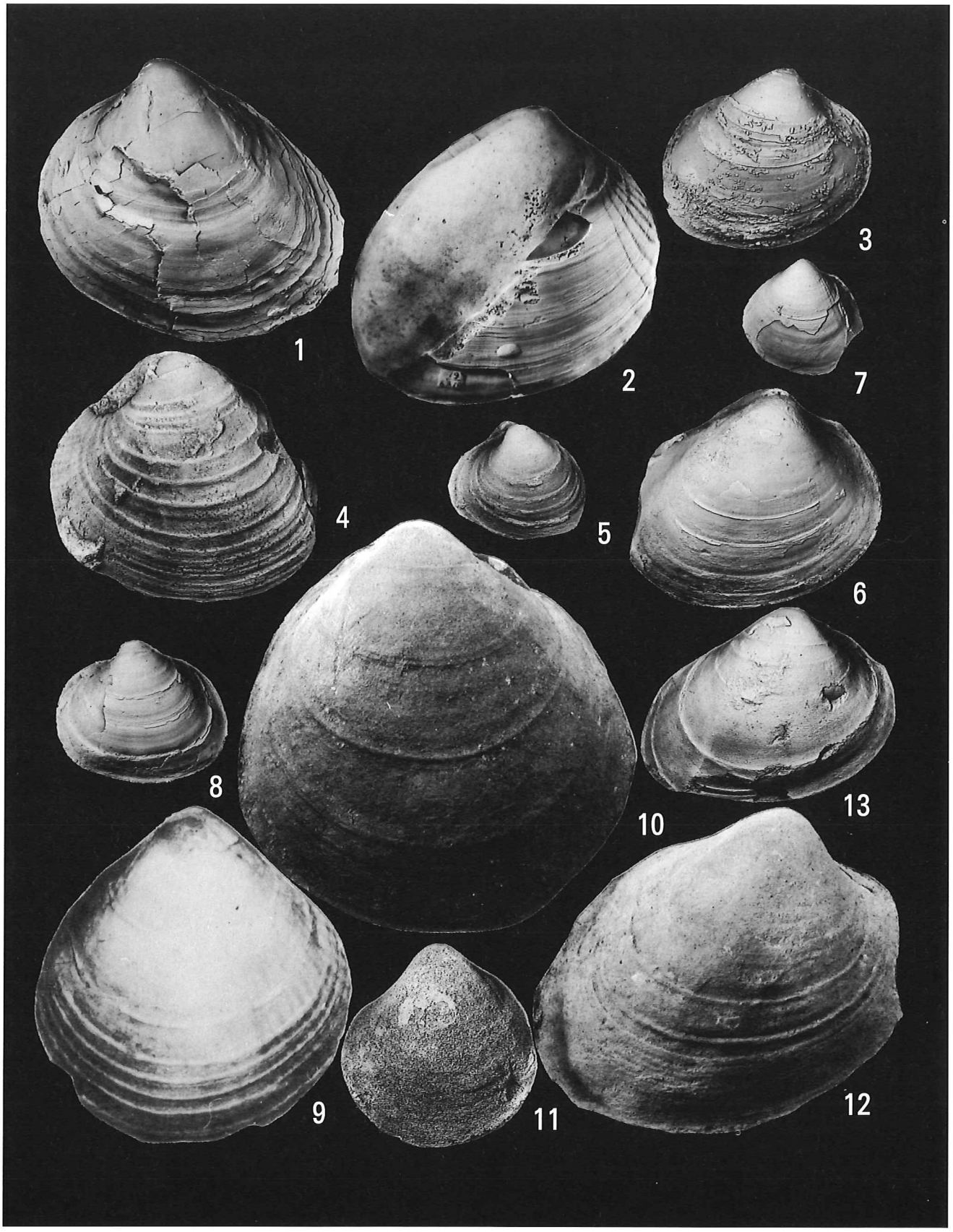
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Plate 6

Figs. 1-3. *Serripes joetsuensis* Kafanov, sp. nov.

Holotype - Joetsu University of Education, without reg. no.; external cast (fig. 1) and hinge (fig. 2) of right valve; a small outcrop along the Koide River in Shibata City, Niigata Prefecture, Honshu, Japan, middle Pliocene Kuwae Formation.

Paratype - the same locality; external cast of left valve (fig. 3).

Figs. 4-6. *Serripes laperousii* (Deshayes, 1839).

Possible syntype of *Cardium laperousii* Deshayes, 1839 - CERPAB, without reg. no.; right (fig. 4) and left (fig. 5) valves exterior; "Mers de Californie".

Original figure reproduction of *Cardium laperousii* (Deshayes, 1841, pl. 48); right valve interior (fig. 6); "Mers de Californie".

All figures in natural size.

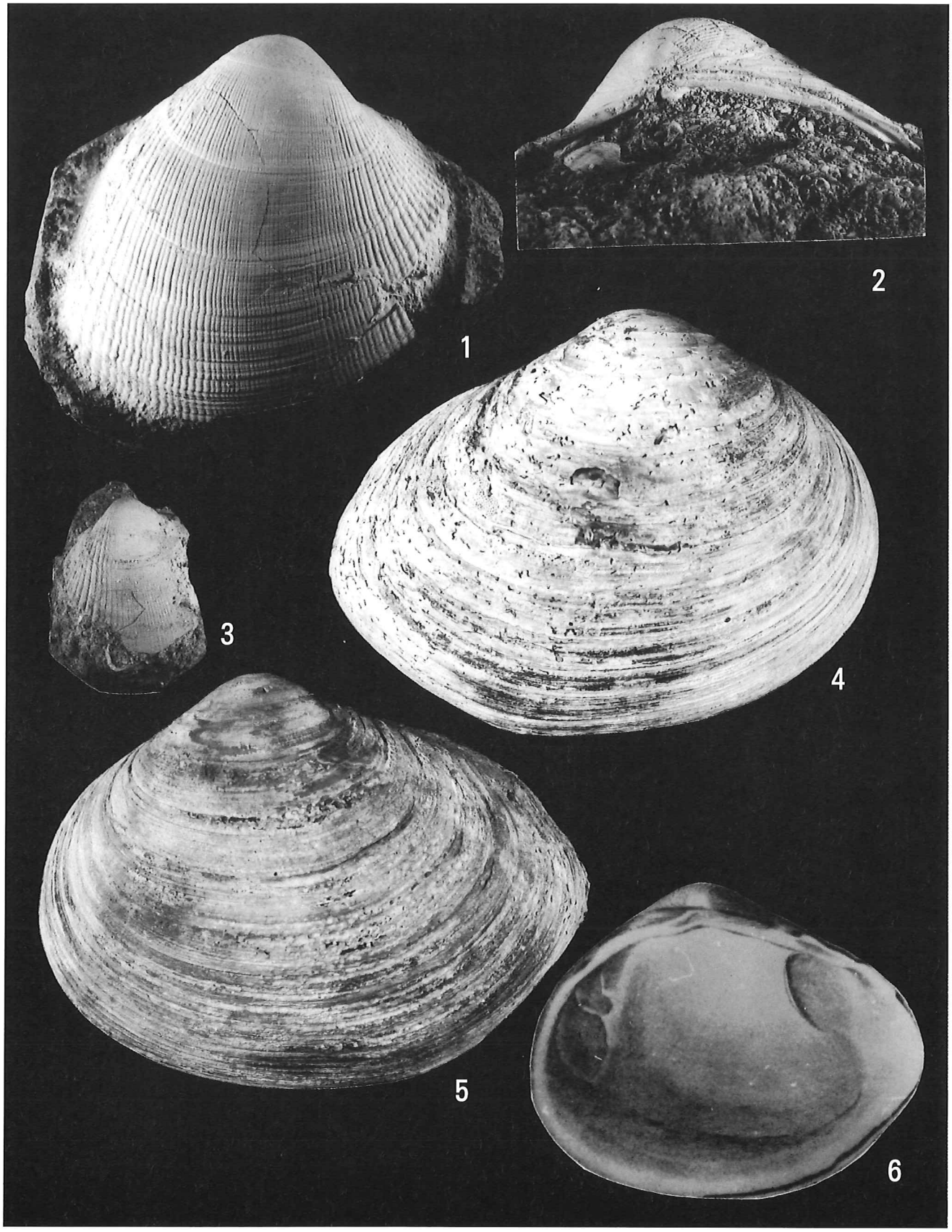
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Plate 7

Figs. 1-6. *Serripes laperousii* (Deshayes, 1839).

Possible syntype of *Cardium laperousii* Deshayes, 1839 - CERPAB, without reg. no.; right (fig. 1) and left (fig. 2) valves interior; "Mers de Californie".

Kodiak Island, Gulf of Alaska; ZIsp no. 9/13153; left valve exterior (fig. 3) and interior (fig. 4).

Off southwestern Sakhalin, Japan Sea; ZIsp no. 5/13149; right valve exterior (fig. 5).

Original figure reproduction of *Cardium laperousii* (Deshayes, 1841, pl. 48) ; right valve exterior (fig. 6) ; "Mers de Californie".

All figures in natural size.

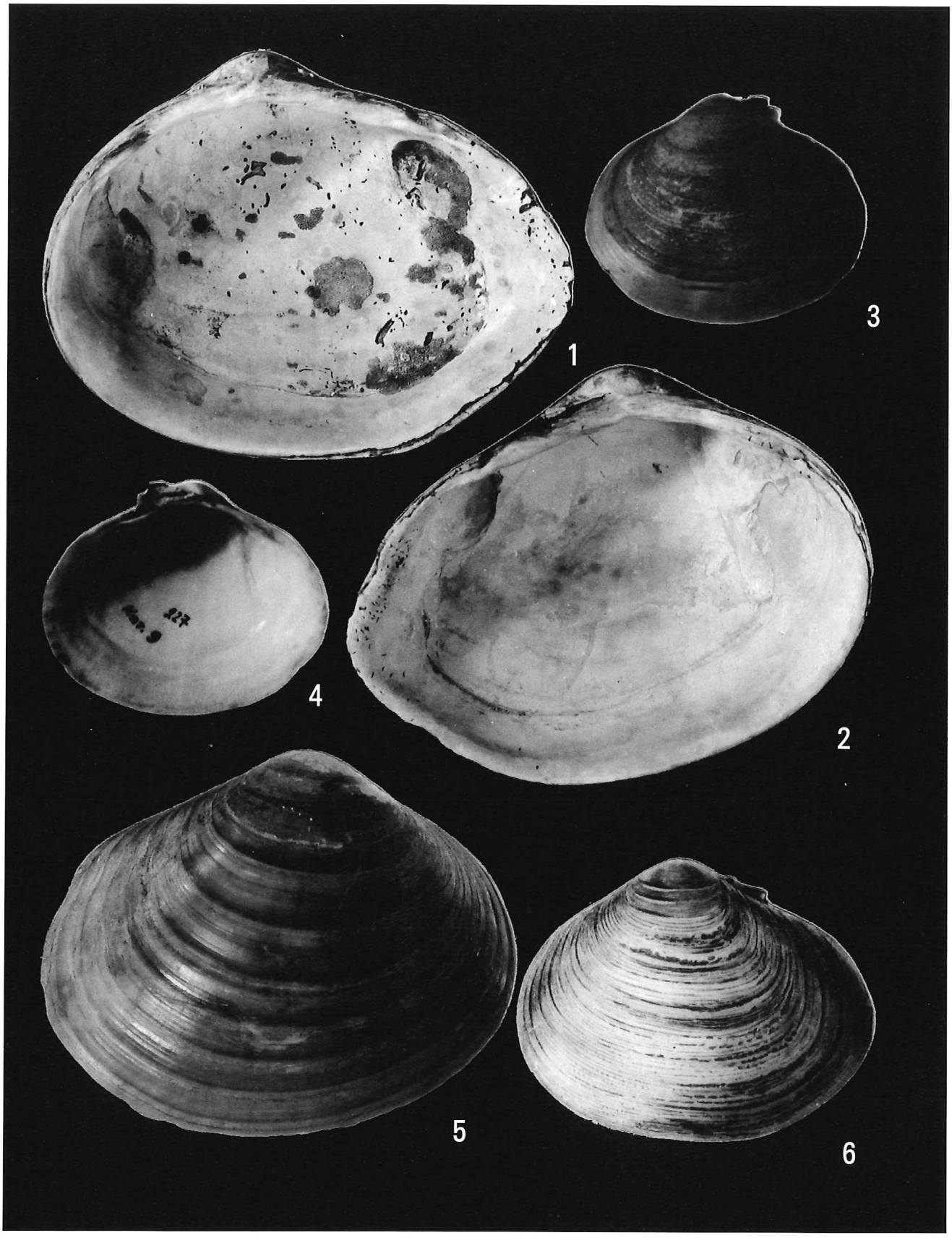
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Plate 8

Figs. 1-4. *Serripes laperousii* (Deshayes, 1839).
Kodiak Island, Gulf of Alaska; ZIsp no. 9/13153; right valve exterior (fig. 1) and interior (fig. 2).
Aniwa Bay, southern Sakhalin, Okhotsk Sea; ZIsp no. 14/13158; left valve exterior (fig. 3).
Intsova Point, Bering Strait; ZIsp no. 30/13174; right valve exterior (fig. 4).

Fig. 5-6. *Serripes kamtschaticus* Ilyina, 1963.
Holotype - CNIGRM no. 249/6338; external cast of left valve (fig. 5); between Moroshechnaya and Kovachina Rivers, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.
Paratype - CNIGRM no. 249a/6338; external casts of left and right valves (fig. 6); Amanina River, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.

Fig. 7. *Serripes savizkyi* Kafanov, sp. nov.
Holotype - PIN no. 22/3962; external cast of left valve (fig. 7); sea cliff, near the mouth of Geran' River, Poronaysk District, Sakhalin, Russia, Middle Miocene Uranayskaya Suite.

All figures in natural size.


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Plate 9

Figs. 1-3. *Serripes savizkyi* Kafanov, sp. nov.
Paratyres - PIN no. 23/3962 (fig. 1), no. 23a/3962 (fig. 2) and no. 23b/3962 (fig. 3); external casts of left (figs. 1, 2) and right (fig. 3) valves; sea cliff, near the mouth of Geran' River, Poronaysk District, Sakhalin, Russia, Middle Miocene Uranayskaya Suite.

Fig. 4. *Serripes triangularis* Noda, 1962.
Holotype - SHM no. 8410; external cast of left valve (fig. 4); Itanoki-sawa, Araki-mura, Mogami District, Yamagata Prefecture, Honshu, Japan, Upper Miocene Mitsumori Formation.

Figs. 5-8. *Serripes ochotensis* Ilyina, 1963.
Holotype - CNIGRM no. 248/6338; incomplete external cast of right valve (fig. 5); coast of the Okhotsk Sea, between Nepropusk Point and the Etolona River mouth, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.
Paratype - CNIGRM no. 248a/6338; external cast of the paired shell in front (fig. 6), external casts of left (fig. 7) and right (fig. 8); between Nepropusk Point and the Etolona River mouth, western Kamchatka, Russia, Middle Miocene Etolonskaya Suite.

Figs. 9-10. *Serripes squalidus* (Yokoyama, 1924).
Original figure reproduction of *Cardium* (*Laevicardium*) *squalidus* (Yokoyama, 1924, pl. 3, figs. 1, 1a); external cast of right valve in side (fig. 9) and in front (fig. 10); Dodaira, Misawa, Nakoso-shi, Fukushima Prefecture, Honshu, Japan, Upper Oligocene Iwaki Formation.

All figures in natural size.


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Plate 10

Fig. 1. *? Serripes muraii* Noda et Tada, 1968.
Holotype - IGPS no. 88058; external cast of rigt valve (fig. 1); small tributary of the Kakkonda River, about 4 km NNW of the Takinoue Spa, Shizukuishi-machi, Iwate Prefecture, Honshu, Japan, Yamatsuda Formation, upper Middle Miocene.

Figs. 2-6. *Serripes nodai* Kafanov, 1980.
Original figure reproduction of *Cardium pauperculum* (Yokoyama, 1923, pl. 1, figs. 2a-c); external casts of left (fig. 2), right (fig. 3) and paired shell above (fig. 4); Kami-Ichiba, Shimane Prefecture, Honshu, Japan, Middle Miocene Fujina Formation.
Kami-Ichiba, Shimane Prefecture, Honshu, Japan, Middle Miocene Fujina Formation; PIN - coll. 3962; external casts of left (fig. 5) and right (fig. 6) valves.

Figs. 7-8. *Yagudinella yokoyamai* Otuka, 1935.
Holotype (fig. 7, UMUT no. CM13029) and paratype (fig. 8, UMUT no. CM13030) of *Serripes yokoyamai* Otuka, 1935; external casts of left valves; Ogino, Yamanogo-mura, Yama District, Fukushima Prefecture, Honshu, Japan, Miocene Hitosao Formation.

Fig. 9. *Serripes uvutschensis* Ilyina, 1963.
Holotype of *Serripes* (?) *uvutschensis* Ilyina, 1963 - CNIGRM no. 103/6338; external casts of right and left valves (fig. 9); cliff of the Kovachinskaya Bay near the mouth of Moroshechnaya River, western Kamchatka, Russia, Middle Miocene Il'inskaya Suite.

All figures in natural size.

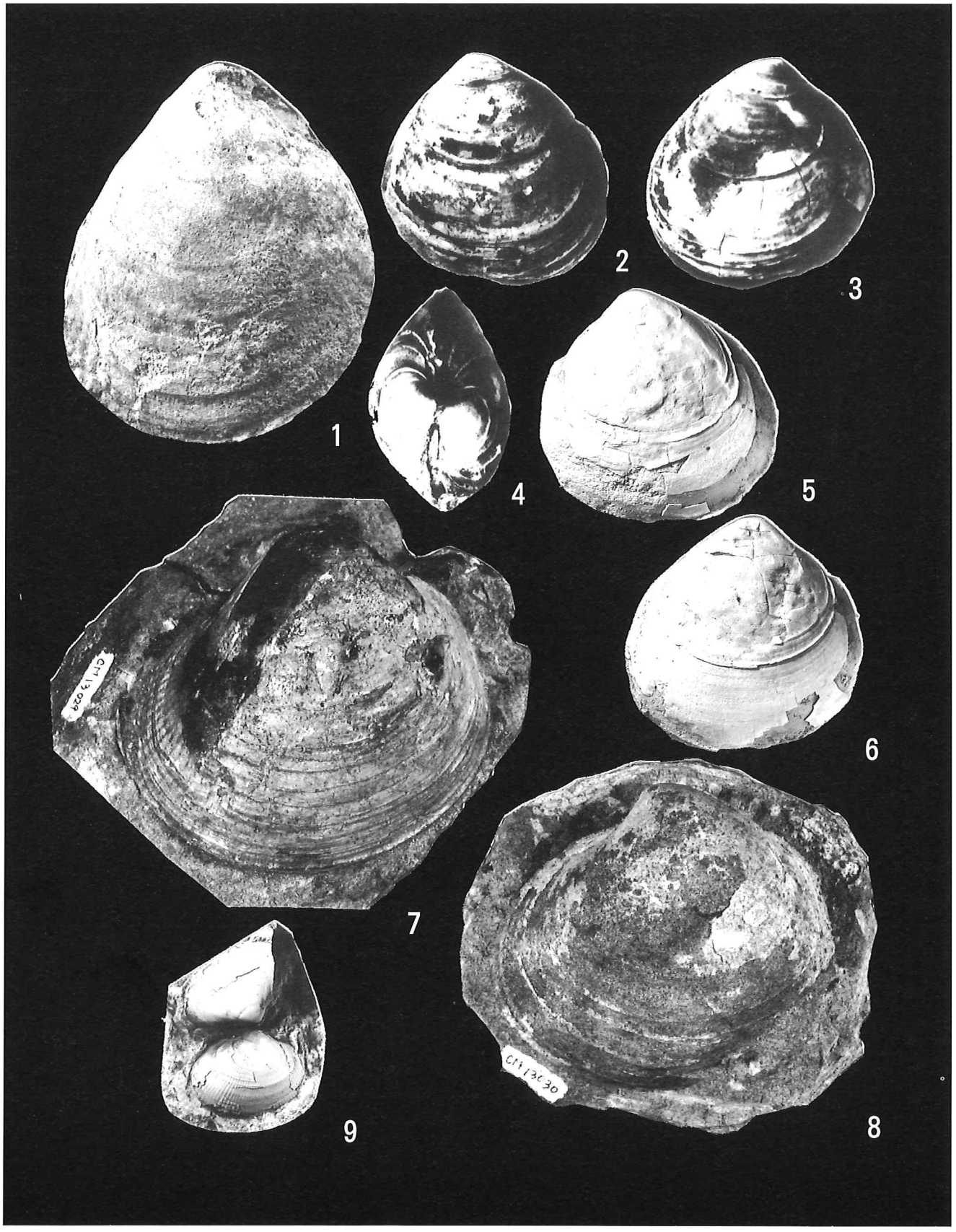
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Plate 11

Figs. 1-4. *Yagudinella notabilis notabilis* (G. B. Sowerby III, 1915).
Holotype of *Cardium* (*Serripes*) *notabile* (G. B. Sowerby III, 1915) - BMNH no. 1919.12.31.38; hinge of right valve (fig. 1), right valve exterior (fig. 2, × 0.6) and interior (fig. 3, × 0.6); Wakasa Bay, Honshu, Japan, Recent.
Japan Sea, off Povorotny Cape, Maritime Territory, Russia; ZIsp - no. 11/13191; left valve exterior (fig. 4).

Figs. 5-7. *Yagudinella takoyensis* Kafanov et Savizky, 1982.
Holotype (figs. 5, 6, PIN no. 10/3962) and paratype (fig. 7, PIN no. 11/3962); external casts of right (fig. 5) and left (figs. 6, 7) valves; Malyi Takoy River, Dolinsk District, Sakhalin, Russia, lower sub-Suite (stratotypical section) of Maruyamskaya Suite, Upper Miocene.

All figures in natural size. unless otherwise stated.

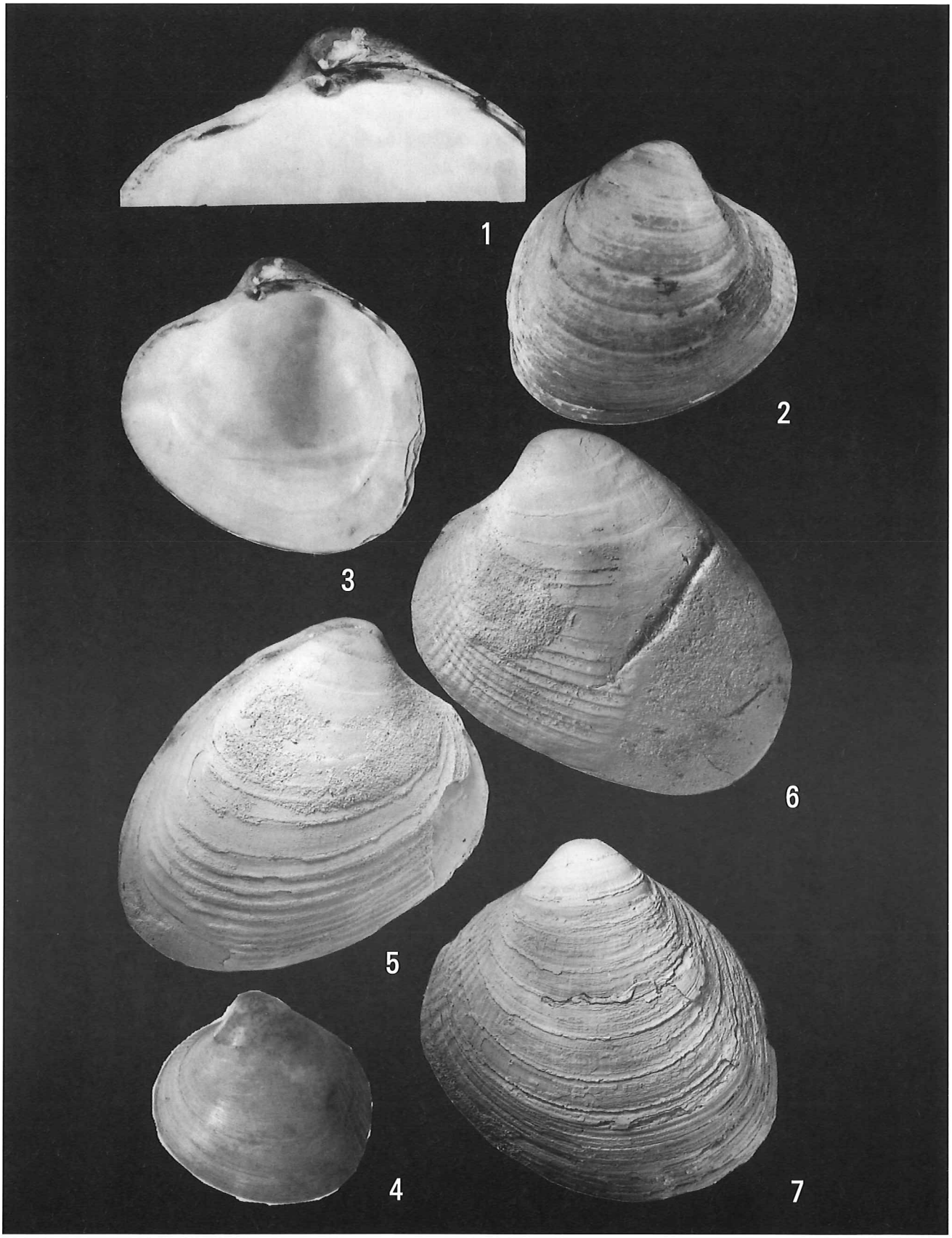
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Plate 12

Figs. 1-4. *Yagudinella notabilis notabilis* (G. B. Sowerby III, 1915).
West of Lopatka Cape, southern extremity of Kamchatka, Okhotsk Sea; ZIsp no. 6/13186; right valve exterior (fig. 1).
Off Sovetskaya Gavan', Tatarsky Strait, Japan Sea; ZIsp no. 8/13188; left valve exterior (fig. 2).
Off Bering Island, Commander Islands; ZIsp no. 27/13207; right valve exterior (fig. 3).
Nakhodka Bay, Japan Sea; ZIsp no. 7/13187; right valve exterior (fig. 4).

Figs. 5-6. ? *Serripes expansus* Hirayama, 1954.
Original figure reproduction of *Serripes expansus* (Hirayama, 1954, pl. 4, figs. 1, 2); external cast of right valve (holotype, × 2/3, fig. 5) and deformed external cast of left valve (paratype, × 2/3, fig. 6); Nanatsuishi, Oyamada-shimogo, Oyamada-mura, Tochigi Prefecture, Honshu, Japan, Lower Miocene Kobana Formation.

All figures in natural size. unless otherwise stated.

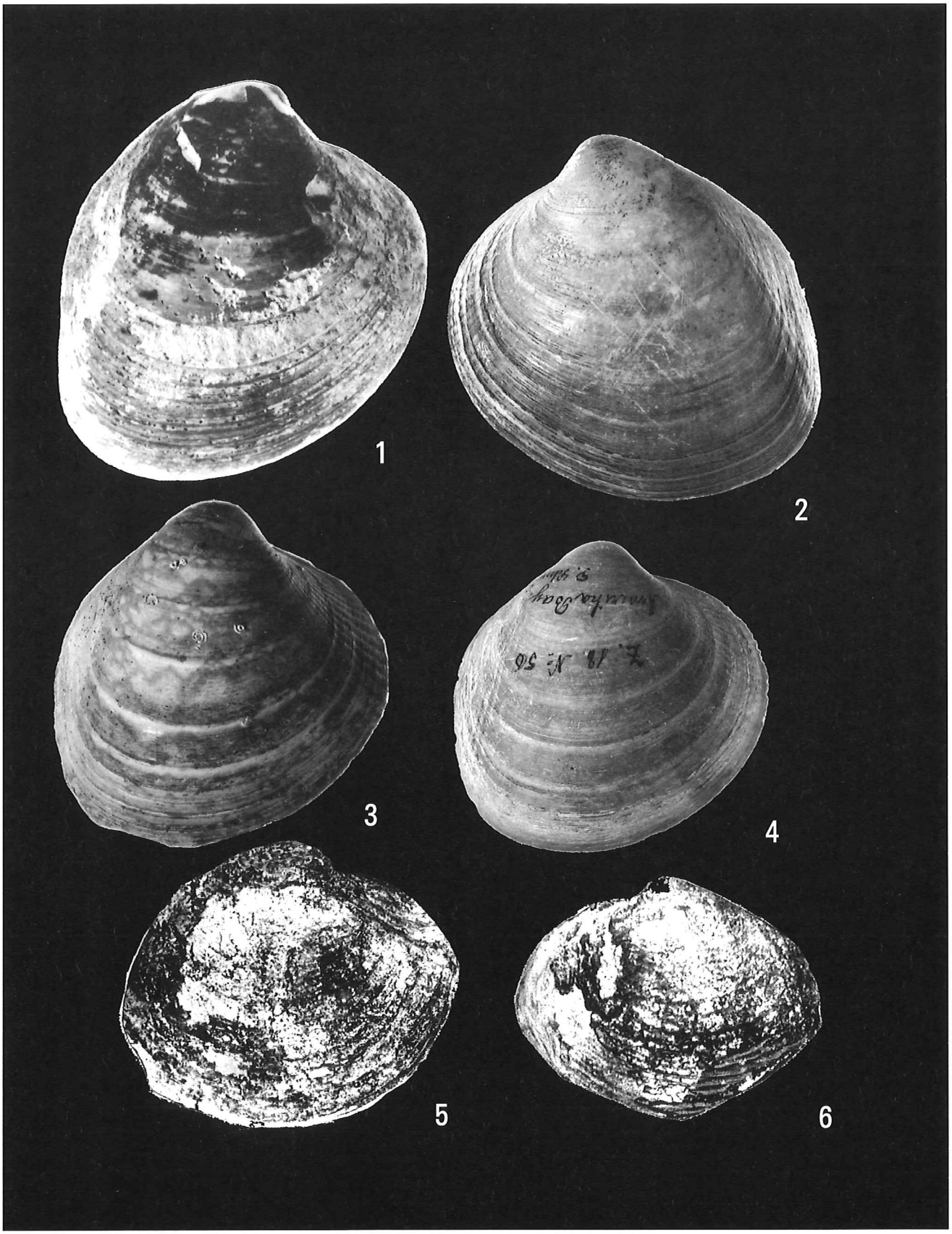
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Plate 13

Figs. 1-2. *Yagudinella makiyamai makiyamai* (Yokoyama, 1928).
Original figure reproduction of *Mactra makiyamai* (Yokoyama, 1928, pl. 69, fig. 3); external cast of right valve in side (fig. 1) and in front (fig. 2); Nagaoka, river side at Hanzogane, Hanzogane-mura, Koshi District, Niigata Prefecture, Honshu, Japan, Upper Miocene Ushigakubi Formation.

Fig. 3. *Yagudinella makiyamai nigamiensis* (Noda, 1962).
Holotype of *Serripes makiyamai nigamiensis* (Noda, 1962) - IGPS no. 78684; external cast of left valve (fig. 3); Nigami, Ooshima-mura, Higashikubiki District, Niigata Prefecture, Honshu, Japan, Upper Miocene Shiiya Formation.

Fig. 4. *Yagudinella shiobaraensis* (Noda, 1962).
Holotype of *Serripes shiobaraensis* (Noda, 1962) - IGPS no. 78687; external cast of right valve (fig. 4); cliff facing the Hokigawa Electric Power Station along the Hoki River, Sekiya, Shiobara-machi, Shioya District, Tochigi Prefecture, Honshu, Japan, Middle Miocene Kanomatazawa Formation.

Fig. 5. *Yagudinella notabilis nomurai* (Otuka, 1943).
Holotype of *Serripes notabilis nomurai* (Otuka, 1943) - UMUT no. CM13233; external cast of right valve (fig. 5); Nakanango, Saunai-mura, Hiraga District, Akita Prefecture, Honshu, Japan, Miocene Kurosawa Formation.

All figures in natural size.


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