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PLIOCENE PECTINIDS FROM SOUTHWEST HOKKAIDO, JAPAN
—*Chlamys islandicus* group—

by

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(with 5 text-figures and 12 plates)

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Introduction

Typical Pliocene deposits in Southwest Hokkaido, Japan, are represented by the Setana Formation. This formation is composed mainly of coarse grained sand and sandy silt containing a marine molluscan fauna, the "Setana Fauna", which is Pliocene in age (T. Nagao and Y. Sasa 1934; K. Kanehara 1942; K. Kubota 1950; K. Masuda 1961, 1962 etc.). Pliocene sediments can be traced from southwest Hokkaido, through the Akita, Niigata, Sado, and Nagano districts, to Ishikawa Prefecture. This formation contains abundant Pectinids which are associated with other types of molluscs. The writers have collected about 3,000 specimens of Pectinids from the Setana Formation developed in the Imagane, Hanaishi, Yakumo and Kuromatsunai areas. They include *Ch. islandicus* group, *Ch. cosibensis* group, *Ch. daishakaensis* and *Patinopecten yessoensis.*

The present article is mainly devoted to the description of the *Ch. islandicus* group.

Pectinids are chosen for study because;

(1) Abundant specimens are available.
(2) They are morphologically variable.
(3) Pectinid fauna appear to be composed of living species of the Northern Pacific as well as extinct species.

The morphological characters of *Ch. islandicus* group are—

(1) The length of the anterior auricle is about twice that of the posterior, but the anterior auricle is not conspicuously large.
(2) Valves are decorated with prominent, distinctly scaled radial ribs. The width of the radial ribs is regular.
(3) Valves with finely scaled intercalary threads and fine concentric growth lines.

Acknowledgement

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Classification of the Setana Formation species

Genus ***Chlamys*** Röding 1798
Subgenus ***Chlamys*** (s.s.)

Ch. islandicus (Müller)
Ch. kuromatsunaiensis Uozumi and Akamatsu n.sp.
Ch. kuromatsunaiensis nakazatoensis Uozumi and Akamatsu n.subsp.
Ch. kuromatsunaiensis utasaiensis Uozumi and Akamatsu n.subsp.
Ch. pilicaensis Kubota
Ch. erythrocomatus (Dall)
Ch. albidus (Dall)
Ch. coatsi MacNeil
Ch. hastata hericius (Gould)
Ch. strategus (Dall)
Ch. toshibetsuensis Uozumi and Akamatsu n.sp.
Ch. pseudislandica MacNeil
Ch. osugii Kubota
Ch. toshibetsuensis chinkopensis Masuda and Sawada
Ch. kinoshitai Kubota
Ch. rubidus (Hinds)

Morphology

A. Shell

Very small ..... less than 15 mm. in height.
Small ..... between 15 mm. and 40 mm. in height.
Moderate ..... between 40 mm. and 80 mm. in height.

Large..... between 80 mm. and 120 mm in height.
Very large..... exceeding 120 mm. in height.
B. Auricle
Small..... hinge-length/height less than 1/3
Moderate..... hinge-length/height between 1/3 and 1/2
Large..... hinge-length/height exceeding 1/2
C. Convexity
Slight..... depth/height less than 1/10
Moderate..... depth/height between 1/10 and 1/5
Great..... depth/height exceeding 1/5

(K. Masuda 1962)

Chlamys islandicus (Müller)

pl.1, figs.1,2,3.

1776. *Pecten islandicus* Müller, Prodomus Zoologiae Danicae, Vol. 32, p.248.
1906. *Pecten (Chalamys) islandicus* Müller, U.S. Geol. Survey Prof. paper 47, p.113, pl.45, fig.1.
1931. *Pecten islandicus* Müller, San Diego Soc. Nat. History Mem., Vol.1, p.161, pl.11 (in part).
1967. *Chlamys (Chlamys) islandica islandica* (Müller), U.S. Geol. Survey Prof. Paper 553, p.33, pl.18, fig.8, pl.19, figs.2,5, pl.24, figs. 12,13.

Valves moderately inflated, ranging from subrounded to higher than long, apical angle 97°–103°. Anterior dorsal margins shorter than posterior margins. Byssal notch narrow and angulate. The ribs finer, more frilled, and have less tendency to divide terminally, although some ribs may divide in an early growth stage. The number of the ribs is 36 to 45.

The living species ranges from white to dark red in color.

Comparisons: The so-called *Chlamys islandicus* in the Northern Pacific have troubled systematists for years. Several distinct species of *Chlamys* that have been included in *Ch. islandicus* group are now living.

One type has the ribs which range from moderately split to strongly split and sometimes multiple. This type includes *Ch. pseudislandica, Ch. kinoshitai,* and *Ch. rubidus.*

The other type has ribs which range from strongly fasciculate to fasciculate in part. This type includes *Ch. hastata hericius, Ch. albidus, Ch. strategus, Ch. erythrocomatus,* and a new species *Ch. tosibetsuensis.*

Repository: Holotype,?

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20000	54	60	13	99°	35	35

20001	66	70	15	102°	38	39
20002	50	52	9	100°	35	35
20003	56	63	17	100°	37	37

Occurrence: Right floor of the Neppu River, about 3 km, Northeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.
Geological age: Pliocene to Recent
Hokkaido specimens: U.H. Reg. No. 20000, 20001, 20002, 2003.

Chlamys kuromatsunaiensis Uozumi and Akamatsu n.sp.
pl.1, figs.4,5, pl.2, figs. 1-5.

Shell moderately thick, moderately inflated, right valve with 27 to 30 flatly round-topped smooth radial ribs, smooth intercalary threads, fine concentric growth, radial ribs somewhat broader than their interspaces, remain undivided or rarely divide into two subequal riblets by a shallow longitudinal furrow towards ventral margin, intercalary threads usually appear at about half of disc. Byssal area broad, byssal sinus moderately broad. Left valve nearly equally convex of right valve, with sculpture nearly similar to right valve.
Comparisons: This species may be related *Ch. otukae* from the Imagane Formation, Southwest Hokkaido (Upper Miocene). The present species is probably a direct linear descendant of *Ch. otukae.* But the former differs from the latter by having a large, more inflated shell, and in the width of radial ribs.
Repository: U.H. Reg. No. 20004a,b (Holotype); 20005, 20006, 20007, 20008 (Paratype).
Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20004a	35	39	5	93°	21	21
b	35	39	6	93°	19	19
20005	35	41	5	91°	22	22
20006	48	56	7	91°	30	30
20007	35	38	6	96°	21	21
20008	41	47	7	90°	25	25

Occurrence: Holotype, Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province. Paratype; Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.
Geological age: Pliocene

Chlamys kuromatsunaiensis nakazatoensis Uozumi and Akamatsu n.subsp.

pl.2, figs.6,6a,7,7a,8, pl.3, figs.1,2.

The external sculputure of the present subspecies is nearly similar to *Ch. kuromatsunaiensis.*

Shell moderately thick, moderately inflated, somewhat contorted, right valve with 28 to 35 flatly round-topped smooth radial ribs, smooth intercalary threads, fine concentric growth lines, radial ribs somewhat broader than their interspaces, strongly fasciculate or fasciculate in part. Intercalary threads usually appear at about half of disc. Byssal area broad, byssal sinus moderately broad. Left valve nearly equally convex of right valve, with sculpture nearly similar to right valve. Apical angle 98°–102°.

Comparisons: The present subspecies is probably a direct linear descendant of *Ch. kuromatsunaiensis.* However, the former differs from the latter by having a contorted shell, and fasciculate bundless of radial ribs.

Repository: U.H. Reg. No. 20009 (Holotype); 20010, 20011, 20012 (Paratype).

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20009	61	65	6	99°	29	32
20010	53	54	5	102°	26	31
20011	52	57	5	98°	22	32
20012	53	56	6	98°	27	32

Occurrence: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Geological age: Pliocene

Chlamys kuromatsunaiensis utasaiensis Uozumi and Akamatsu n.subsp.

pl.3, figs.3,3a,3b,4,4a,4b,5.

The external sculputure of the present subspecies is nearly similar to *Ch. kuromatsunaiensis nakazatoensis,* but differs from *Ch. kuromatsunaiensis nakazatoensis* by having a higher shell, and lower apical angle (Figs.1,2).

Repository: U.H. Reg. No. 20013 (Holotype); 20014, 20015, 20016 (Paratype)

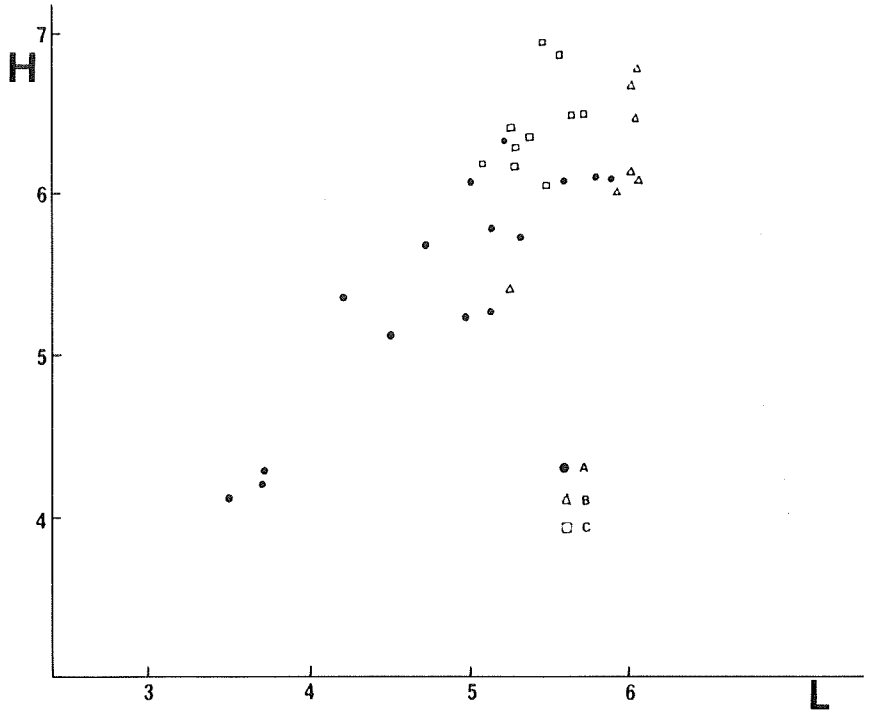

Fig. 1. Diagram showing the size of species of *Chlamys kuromatsunaiensis* group.
L: Length
H: Height

A. *Ch. kuromatsunaiensis* Uozumi and Akamatsu n.sp.
B. *Ch. k. nakazatoensis* Uozumi and Akamatsu n. subsp.
C. *Ch. k. utasaiensis* Uozumi and Akamatsu n.subsp.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20013	54	65	10	86°	30	36
20014	55	61	11	93°	28	35
20015	49	60	10	90°	28	32
20016	52	63	10	91°	30	33

Occurrence: Nakazato, upper straem of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.
Geological age: Pliocene

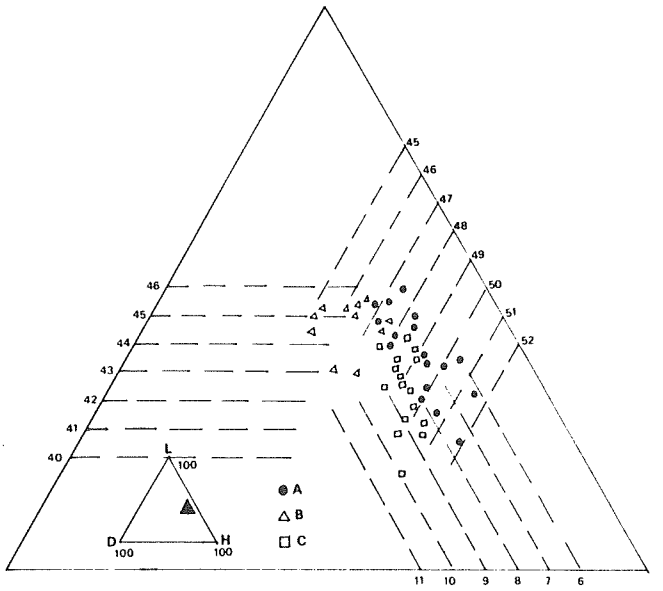

Fig. 2. Tri-angle diagram showing the size of species of *Chlamys kuromatsunaiensis* group.
L: Length
H: Height
D: Depth

A. *Ch. kuromatsunaiensis* Uozumi and Akamatsu n.sp.
B. *Ch. k. nakazatoensis* Uozumi and Akamatsu n.subsp.
C. *Ch. k. utasaiensis* Uozumi and Akamatsu n.subsp.

Chlamys pilicaensis Kubota

pl.4, figs.1,1a,2,3, pl.5, fig.1.

1950. *Chlamys islandica* var. *pilicaensis* Kubota, Shinseidai-no kenkyu (Cenozoic Research), no.6, p.97, figs.56,69-71.

Shell subrounded and moderate in thickness, apical angle about 100°, byssal area and byssal sinus moderate, dorsal margin more concave than anterior margin, anterior margin slightly longer, right valve a more inflated than left, right valve with equal radial ribs which tend to gather into several fascicular bundless, smooth intercalary threads, fine concentric growth lines and obutse network. The fascicular bundless with 3 to 9 radial ribs, the width of radial ribs divided into 2 or 3 subequal riblets by a shallow longitudinal furrows towards ventral margin or rarely remain undivided.

Left valve with 7 to 9, very unequal ribs, radial ribs divided 3 or 4 subequal riblets towards ventral margin.

Comparisons: This species seems to be related *Chlamys erythrocomatus, Ch. cosibensis* group. *Ch. erythrocomatus,* which was originally described without a figure, is distinguished from the present one by the width of radial ribs and intercalary threads. Further study of this problem is necessary. *Ch. kinoshitai* can be distinguished from the present one by the width of radial ribs which are divided into 2 or 3 subequal riblets by shallow longitudinal furrows towards ventral margin. *Ch. cosibensis cosibensis* is distinguishable from the present one by the larger shell, more radial ribs and much less distinct concentric constrictions.

Repository: U.H. Reg. No. 13544 (Holotype); 20017, 20018, 20019 (Paratype)

Dimensisons (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
13544	76	83	15	100°	41	40
20017	72	76	20	103°	39	39
20018	57	63	11	98°	36	35
20019	83	90	16	101°	49	49

Occurrence: Cliff of the Toshibetsu River, southeast of the Daikoku Mine, Pirika, Imagane Machi, Setana Gun, Hiyama Province.

Geological age: Pliocene

Chlamys erythrocomatus (Dall)

pl.5, figs.2,3,4.

1907. *Pecten (Chlamys) erythrocomatus* Dall, Smithonian Misc. Colln., Vol. 50, p.170, pl.2.
1967. *Chlamys islandica erythrocomata* (Dall), U.S. Geol. Survey Prof. Paper 553, p.36, pl.21, figs.8,9.

Since the morphological characters of Dall's species remain unknown, the writers can not conclude any subsequent reference to this species. However, the species figured by MacNeil (1967) from the photograph of the holotype of this species, has a much inflated right valve with radial ribs which tend to gather into several fascicular bundles.

This form, from the Setana Formation, is characterized by-

Shell subrounded and moderate in thickness, apical angle about 98°, byssal area and byssal sinus moderate, dorsal margin slightly straight and anterior margin slightly longer, valves with fascicular bundles.

Comparisons: This species seems to be related *Ch. pilicaensis* and *Ch. albidus. Ch. albidus* can be distinguished from the present one by its shell which is

longer than high, and the anterior margin is longer than the dorsel margin. *Ch. pilicaensis* is also distinguishable by the width of radial ribs which tend to gather into fascicular bundles.

Repository: The holotype (U S N M 110462) measures 69 mm in height and 70 mm in length.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20020	67	72	15	98°	35	34
20021	53	56	12	99°	30	27
20022	47	52	12	93°	27	26

Occurrence: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.

Geological age: Pliocene to Recent

Hokkaido specimens: U.H. Reg. No. 20020, 20021, 20022.

Chlamys albidus (Dall)

pl.5, fig.5, pl.6, figs.1,2.

1904. *Pecten (Chlamys) hericius* var. *albidus* Dall, (cited in Arnold 1906, p.36).
1906. *Pecten (Chlamys) hastatus* var. *albidus* Dall, U.S. Geol. Survey Prof. Paper 47, p.136, pl.2, fig.2.
1931. *Pecten (Pecten) hastatus albidus* Dall, San Diego Soc. Nat. History Mem., Vol.1, p.168.
1967. *Chlamys (Chlamys) islandica albida* (Dall), U.S. Geol. Survey Prof. Paper 553, p.36.

Shell subrounded and moderate in thickness, apical angle about 90°, anterior margin slightly longer than dorsal margin, right valve with equal radial ribs which tend to gather into 4 to 5 fascicular bundles, smooth intercalary threads. Left valve with 3 to 4 fascicular bundles.

Comparisons: This form is more closely related to *Ch. erythrocomatus.* Grau (1959) combined this eastern Aleutian subspecies with *Ch. islandica erythrocomata* from the Okhotsk Sea, but the writers prefer to regard them as separate species because this form is more higher and less angulate than *Ch. erythrocomatus* (Fig.3).

Repository: Holotype (U S N M 150207) has a height of 45 mm.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20023	59	73	9	90°	34	34
20024	61	70	11	90°	37	36
20025	58	66	12	92°	31	32

Occurrence: Nakazato, upper stream of the Shubuto River, about 6 km,

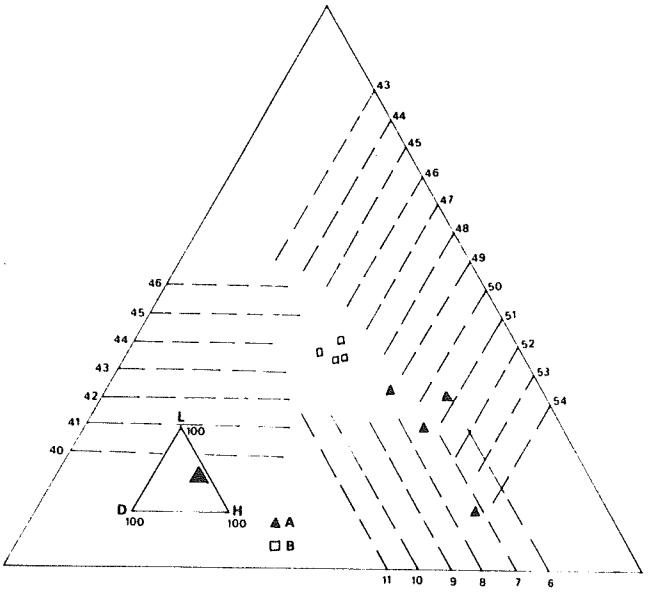

Fig. 3. Tri-angle diagram showing the size of *Ch. albidus* and *Ch. erythrocomatus.*
L: Length
H: Height
D: Depth

A. *Ch. albidus* (Dall)
B. *Ch. erythrocomatus* (Dall)

southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.
Geological age: Pliocene to Recent
Hokkaido specimens: U.H. Reg. No. 20023, 20024, 20025.

Chlamys coatsi MacNeil

pl.6, figs.3,4,5, pl.7, fig.1

1967. *Chlamys (Chlamys) coatsi* MacNeil, U.S. Geol. Survey Prof. Paper 553, p.17-18, pl.14, figs.6,7, pl.15, figs.1,2,5-7.

This form by MacNeil (1967) is characterized—
Shell of medium to moderately large size, rotund, moderately inflated. Anterior ear of right valve large and broad, byssal area broad: byssal sinus

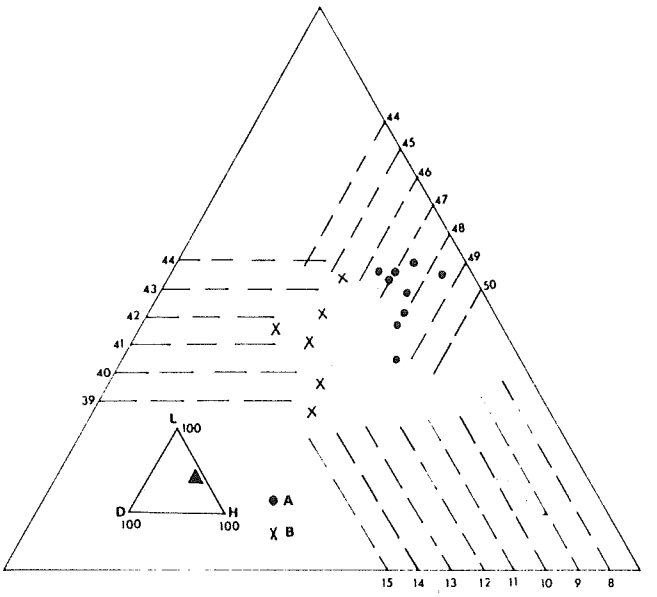

Fig. 4. Tri-angle diagram showing the size of *Ch. coatsi* and *Ch. pilicaensis*.

L: Length
H: Height
D: Depth

A. *Ch. pilicaensis* Kubota
B. *Ch. coatsi* MacNeil

moderately broad, moderately concave. Anterior ear of left valve moderately large and broad, anterior margin weakly sinuous. Dorsal margin of about equal length, straight or very weakly concave. Dorsal slopes moderately broad, those of the left valve broader than those of the right valve, weakly undercut. Sculputure consisting of broad plicae or fascicles centrally and finer riblets near the anterior and posterior margins; interplicae with secondary and tertiary riblets that develop earlier than the riblets on the plicae; plicae broader than interplicae on right valve, interplicae broader than plicae on left valve. Tops of plicae and riblets with concentric growth lines only; interspaces between riblets with reticulate or metal lathelike microsculputure.

Comparisons: This form is closely related to *Ch. pilicaensis*. Although *Ch. pilicaensis* has more regular ribs, especially on its right valve, the thickness of this form from the Setana Formation, is greater than it of *Ch. pilicaensis* (Fig.4).

Repository: The holotype (U S N M 644908), a left valve, has a height of 95 mm and a length of 90 mm, the paratype (U S N M 644909), a right valve measures 70 mm in height, 68 mm in length.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20026	67	75	20	95°	30	30
20027	52	62	18	86°	32	25
20028	60	71	16	97°	28	31
20029	56	60	17	100°	25	28

Occurrence: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.

Geological age: Pliocene

Hokkaido specimens: U.H. Reg. No. 20026, 20027, 20028, 20029.

Chlamys hastata hericius (Gould)

pl.7, figs.2,3, pl.8, fig.1.

1850. *Pecten hericius* Gould, Boston Soc. Nat. Hist. Proc., Vol.3, p.345.
1906. *Pecten (Chalamys) hastatus* var. *hericius* Gould, U.S. Geol. Survey Prof. Paper 47, p.110, pl.43, fig.3.
1967. *Chlamys (Chlamys) hastata hericius* (Gould), U.S. Geol. Survey Prof. Paper 553, p.14, pl.21, figs.1,3.

Typical *Ch. hastata* ranges from Monterey to San Diego, Calif., whereas *Ch. hastata hericius* ranges from the Gulf of Alaska to Santa Barbara, Calif. (MacNeil 1967).

Valves with radial ribs which tend to gather into several fascicular bundles with all the riblets and equally scabrous. The bundles consists of about 10 low rounded smooth radial ribs, and the dorsal margin is longer and more concave than the anterior margin. Apical angle is about 100°.

Comparisons: Fig. 5 shows the triangle diagram of the length, height, depth in *Ch. toshibetsuensis,* and *Ch. hastata hericius.* This species is a similar tendency as in *Ch. toshibetsuensis,* but *Ch. toshibetsuensis* can be distinguished from the present one by the width of radial ribs which gather into fascicular bundles, and the number of fascicular bundles.

Repository: U S N M 5955

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20030	75	83	17	98°	40	43
20031	74	77	21	107°	30	35
20032	71	75	19	104°	30	35

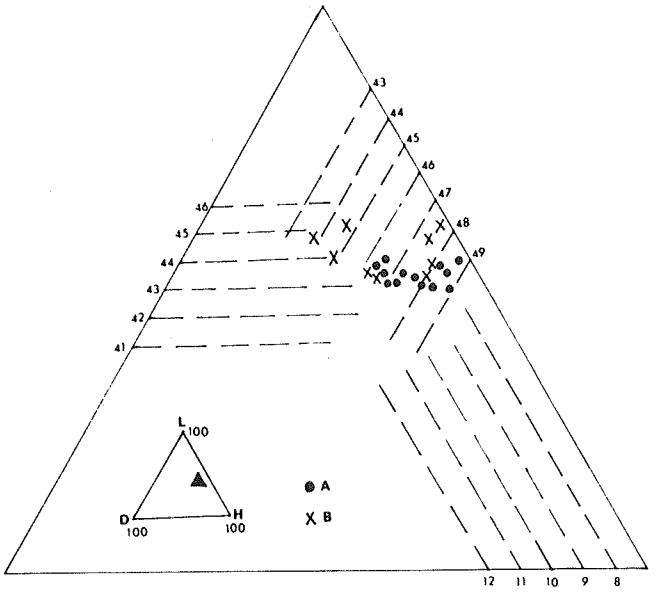

Fig. 5. Tri-angle diagram showing the size of *Ch. hastata hericius* and *Ch. toshibetsuensis.*
L: Length
H: Height
D: Depth

A. *Ch. toshibetsuensis* Uozumi and Akamatsu n.sp.
B. *Ch. hastata hericius* (Gould)

Occurrence: Kaigarabuchi, upper stream of Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.
Geological age: Pliocene to Recent
Hokkaido specimens: U.H. Reg. No. 20030, 20031, 20032.

Chlamys strategus (Dall)

pl.7, fig.4, pl.8, fig.4.

1898. *Pecten hericius* var. *strategus* Dall, Wagner Free Inst. Sci. Trans., Vol.3, p.709, pl.4.
1967. *Chlamys (Chlamys) berigana strategus* (Dall), U.S. Geol. Survey Prof. Paper 553, p.26.

Shell moderate thick, moderately inflated, valves with fascicular bundles and plicae, the bundles consisting of 4 to 6, byssal area and byssal sinus moderate, dorsal margin nearly straight and anterior margin slightly longer,

auricles moderate in size.

This form may be closely related to *Ch. beringana.*

Repository: Holotype?

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20033	45	49	8	90°	28	26
20034	41	46	7	91°	26	26

Occurrence: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.

Geological age: Pliocene to Recent

Hokkaido specimen: U.H. Reg. No. 20033, 20034.

Chlamys toshibetsuensis Uozumi and Akamatsu n.sp.

pl.8, figs.2,3, pl.9, figs.1,1a,3,3a,4,4a.

1950. *Chlamys islandica* var. *erythrocomata* (Dall), Sinseidai no Kenkyu (Conozoic Research) no.6, p.16, figs. 72, 73.

1965. *Chlamys hericius* (Gould), Shells of the World in color, Vol.1, p.120, pl.39, fig.1.

This species is confused by the procedure of Kubota's description (1950), based on Kinoshita and Isahaya's figure (1934).

The photographs reproduced here, are the holotype of this species to be published. The writers newly redefined this species and suggests a new name *Ch. toshibetsuensis* for it.

The holotype of Kubota's photograph is characterized–

Shell subrounded and moderate in thickness, higher than longer, apical angle about 100°, dorsal margin slightly longer and more concave than anterior margin, byssal area and byssal sinus moderate, auricle moderate in size, anterior auricle larger than posterior, sculptured with several finely scaled radial threads, intercalary threads and concentric lines, posterior similar to anterior in sculpture. Valves with radial ribs which tend to gather into several fascicular bundles, right valve with 5 to 8 undivided radial ribs, left valve 6 to 8.

Comparisons: This species is closely related to *Ch. erythrocomata.* Kubota's description compared with Kinoshita and Isahaya's *erythrocomata* (1934) having the radial ribs which do not gather fascicular bundles.

The original *Ch. erythrocomata* has radial ribs which tend to gather into several fascicular bundles, but it is distinguished from the original *Ch. erythrocomatus* in having larger and higher shell and in the number of the fascicular bundles.

Repository: U.H. Reg. No. 30035 (Holotype), 30036, 30037, 30038 (Para-

type)

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
30035	70	76	15	97°	34	35
30036	77	79	14	103°	37	38
30037	70	76	16	102°	35	36
30038	93	104	19	101°	40	41

Occurrence: Holotype; Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province. Paratype; Kaigarabuchi, upper stream of Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiriveshi Province.

Geological age: Pliocene to Recent

Chlamys pseudislandica MacNeil

pl.10, figs. 1,1a,2.

1931. *Pecten (Pecten) islandicus* Müller, San Diego Soc. Nat. Hisotory Mem., Vol.1, p.161, in part.
1959. *Chlamys islandica* (Müller), U.S. Nat. Museum Proc., Vol. 109, p.155, pl.19, fig.4.
1967. *Chlmys (Chlamys) pseudislandica* MacNeil, U.S. Geol. Survey Prof. Paper 553, p.31-32, pl.19, fig.7, pl.20, fig.8, pl.23, figs.1,2.

Valves moderately inflated, ranging from subrounded to higher than long. Anterior ear of right valve moderately short and broad; byssal notch narrow and angulate. Anterior ear of left valve moderately short with sinuous anterior margin. Both posterior ears short with moderately sloping concave margins. Anterior dorsal margins shorter than posterior margins. Anterior slopes moderately broad, those of left valve broader and more undercut than those of right valve. Sculpture moderately coarse, the ribs ranging from moderately broad to medium sized, roughened by crude growth lines. Ribs of right valve usually splitting evenly in adult stage and strongly divided at margin in full-grown specimens, interspaces usually with a single moderately strong interstitial riblets. Ribs of left valve narrower, split, and with a strong interstitial riblets; usually three ribs are slightly stronger and lighter colored than the rest. A reticulate or metal lathelike microsculpture is present in interspaces, both primary and secondary; tops of ribs have concentric sculpture.

Comparisons: This species is characterized by having split ribs in full-grown specimens, and is allied to *Ch. islandicus* in general outline of shells. But the ribs of *Ch. pseudislandica* are coaser, plainer, and have a strong tendency to

divide toward the margin; the ribs of *Ch. islandicus* are finer, more frilled, and have less tendency to divide terminally (MacNeil 1967).

Repository: The holotype (C A S 12612) measures 73.5 mm in height and 69.5 mm in length.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
30039	73	82	16	99°	34	32
30040	71	78	15	100°	32	31

Occurrence: Right floor of the Neppu River, about 3 km, northeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Geological age: Pliocene to Recent

Hokkaido specimens: U.H. Reg. No. 20039, 20040.

Chlamys osugii Kubota

pl.9, fig.2.

1950. *Chlamys islandica* var. *osugii* Kubota, Shinseidai no Kenkyu (Cenozoic Research), no.6, p.16, pl.8, fig.57.

Kubota described this species, based on a single valve lacking anterior auricle, and unfortunately the characters of a left valve remain unknown.

Shell of medium, moderately inflated, valve with about 45 scabrous radial ribs. Some of the radial ribs spliting abruptly towards the margin, interspaces having interstilal riblets.

Comparisons: The writers could not examine this form in detail. However, further study may be needed to clearly illustrate this species.

Repository: U.H. Reg. No. 13543 (Holotype)

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
13543	54	59	11	90°	35	31

Occurrence: Upper stream of Yuno-sawa, a tributary of the Nakano River, about 11 km, northeast of Kuromatsunai station, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Geological age: Pliocene

Chlamys toshibetsuensis chinkopensis Masuda and Sawada

pl.10, figs.3,4, pl.11, figs.1,4.

1961. *Chlamys chinkopensis* Masuda and Sawada, Japanese Jour. Geology Geography, Vol.32, no.1, p.21, figs.6,7.

1967. *Chlamys (Chlamys)* cf. *picoensis chinkopensis* Masuda and Sawada, U.S. Geol. Survey Prof. Paper 553, p.28-29, pl.11, figs. 1-3,5,6,10.

This form is characterized (Masuda and Sawada 1961)–

Shell moderate in size, somewhat contorted, subequivalved, right valve with about 30 rather low, round-topped, subequal, finely and densely scaled radial ribs which sometimes gather obscurely into several fascicular bundles, finely scaled intercalary threads. left valve with the radial ribs which are usually subequal in strength and sometimes divide into a few riblets, finely and densely scaled intercalary threads.

Comparisons: This subspecies is closely related to *Ch. toshibetsuensis,* but it is distinguishable from *Ch. toshibetsuensis* in having the contorted, subequivalved shell and the radial ribs with fascicular bundles in part.

It is our belief, however, that *Ch. toshibetsuensis* is a direct linear descendant of *Ch. toshibetsuensis chinkopensis.*

Repository: D.G.S. Reg. No. 3896 (Holotype), 3897, 3898 (Paratype)

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20041	62	71	13	96°	33	30
20042	56	63	12	98°	31	27
20043	55	59	10	94°	28	32
20044	47	56	12	97°	28	32
20045	58	67	12	94°	35	36

Occurrence: Right river cliff of the Toshibetsu-gawa, about 1.5 km, southeast of Chinkope-toge, Imagane Machi, Setana Gun, Hiyama Province. (Type locality) Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Geological age: Pliocene

Hokkaido specimen: U.H.Reg. No. 20041, 20042, 20043, 20044, 20045.

Chlamys kinoshitai Kubota

pl.11, figs.2,3,3a, pl.12, figs. 1,2.

1934. *Chlamys erythrocomata* (Dall), Hokkaido Fish. Exp. Sta. Rept. Aquatic. Products, Vol.33, no.1, pl.11, fig.75.

1950. *Chlamys islandica* var. *kinoshita* Kubota, Shinseidai no Kenkyu (Cenozoic Research), no.6, p.16.

1962. *Chlamys hanaishiensis* Masuda, Tohoku Univ. Sci. Repts., 2nd ser. (Geology), Vol.33, no.2, p.166, pl.22, figs.1,2.

Kubota only suggested this name and did not provide a figure or a description. Kubota's name is based on Kinoshita and Isahaya's *erythrocomata*

with rather broad ribs which do not make fascicular bundles, and he contrasted it with his *Ch. islandica* var. *osugii*.

Masuda (1962) combined this form with his *Ch. hanaishiensis*. According to the International Code of Zoological Nomenclature, Kubota's name meets all the requirements of the Code.

Shell moderate in thickness and convexity, higher than long, apical angle 96°-105°. Right valve with about 28-36, distinct, roundly flat-topped, finely scaled radial ribs, finely scaled intercalary threads, concentric growth lines; radial ribs somewhat broader than their interspaces, subequal or sometimes unequal to each other, usually divide into two, subequal riblets by a shallow longitudinal furrow near ventral margin, or sometimes remain undivided; auricle moderate in size, anterior larger than posterior, with conspicuous byssal notch and moderate byssal area. Left valve with flatly round-topped, finely imbricated radial ribs, finely scaled intercalary threads, concentric growth lines, radial ribs narrower than their interspaces, sometimes unequal to each other, usually divide into two or three or rarely more riblets towards ventral margin.
Comparisons: This species seems to be related *Ch. pseudislandica*. But it is distinguishable from in having subequal and unequal ribs which are divided by a shallow longitudinal furrow near ventral margin.
Repository: Holotype, Hokkaido Fish Experiment Station, Reg. No.?
Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20046	78	81	19	104°	36	34
20047	69	71	11	98°	34	32
20048	59	63	9	97°	34	33
20049	72	75	15	102°	35	35
20050	59	65	10	95°	33	33
20051	67	71	9	100°	35	35

Geological age: Pliocene to Recent
Hokkaido specimen: U.H. Reg. No. 20046, 20047, 20048, 20049, 20050, 20051.

Chlamys rubidus (Hinds)

pl.12, figs.3,4.

1845. *Pecten rubidus* Hinds, Zoology of the Voyage of H.M.S. Sulphur, Mollusca, pt.3, p.61, pl.17, fig.5.
1906. *Pecten (Chlamys) hastatus* var. *hindsii* Carpenter, U.S. Geol. Survey Prof. Paper 47, p.111, pl.43, fig.2.
1931. *Pecten (Pecten) islandicus* var. *hindsii* Carpenter, San Diego Soc. Natl. History Mem., Vol. 1, p.163, (in part)

1967. *Chlamys (Chlamys) rubida* (Hinds), U.S. Geol. Survey Prof. Paper 553, p.21, pl.21, figs.7,9, pl.17, fig.5.

Shell moderate and subrounded in thickness, apical angle about 100°, byssal area and byssal sinus moderate, dorsal margin longer and anterior margin more concave. Right valve with split ribs, left valve with scabrous three-parted ribs.

Comparisons: This species is somewhat allied to *Ch. rubida hindsii* in general outline, but it easily distinguishable from *Ch. r. hindsii,* which has coaser, more solid ribs.

Repository: The holotype of the specimen figured by Hinds, was in the British Museum, but according to Grau (1959, p.78), it is now missing.

Dimensions (in mm):

	Length	Height	Depth	Apical angle	Anterior margin	Dorsal margin
20052	66	70	13	100°	35	39
20053	66	71	14	98°	38	38

Occurrence: Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province.

Geological age: Pliocene to Recent

Hokkaido specimen: U.H. Reg. No. 20052, 20053.

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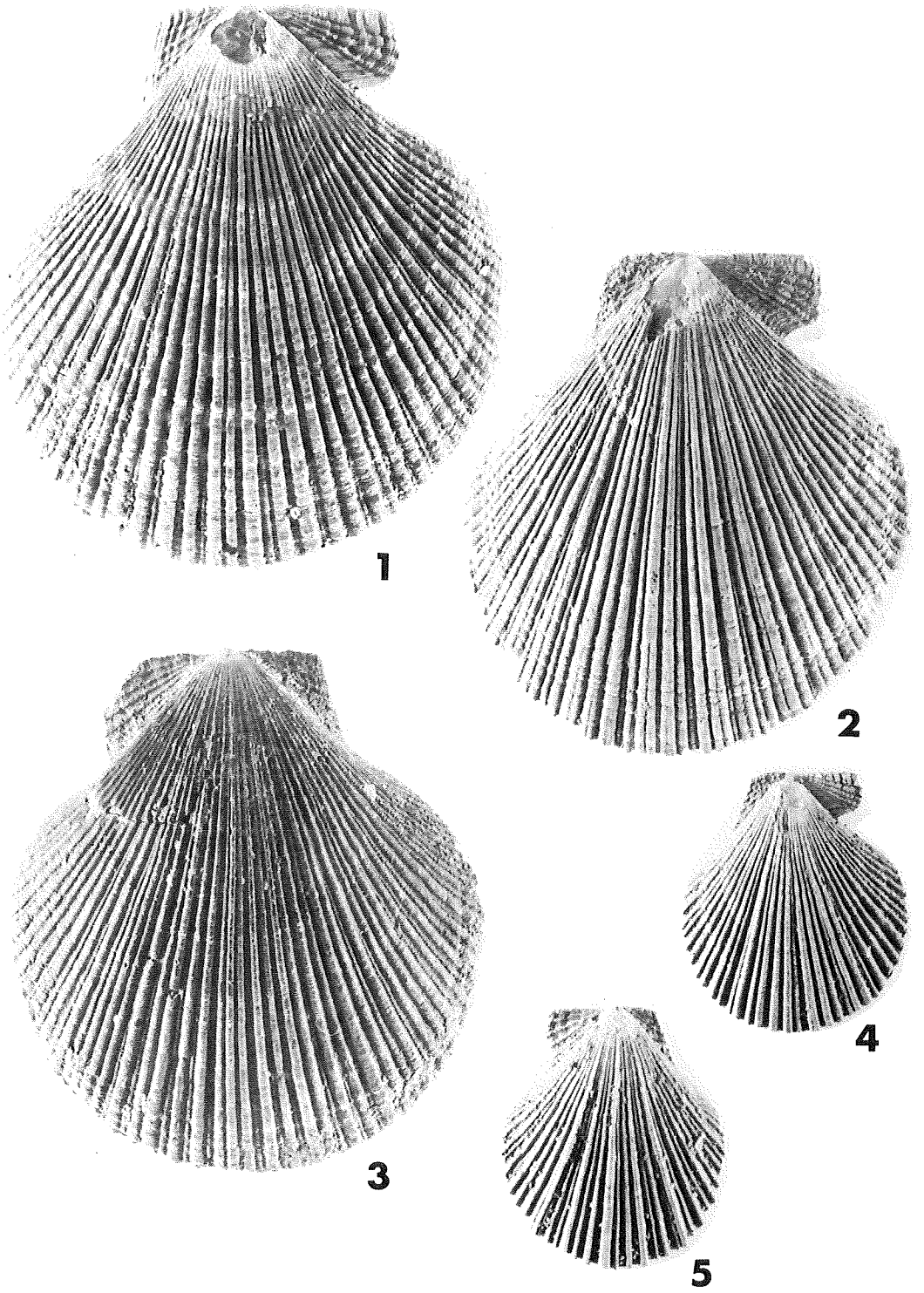
(Received Oct. 31, 1974)

Explanation of Plate 1
(All figures natural size unless otherwise denoted)

Figs. 1,2,3. *Chlamys islandicus* (Müller). 1:U.H. Reg. No. 20000, exterior right valve; 2:U.H. Reg. No. 20002, exterior right valve; 3:U.H. Reg. No. 20003, exterior left valve. X1.2
Locality: Right floor of the Neppu River, about 3 km, northeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 4,5. *Chlamys kuromatsunaiensis* Uozumi and Akamatsu n.sp. 4:U.H. Reg. No. 20004a, exterior right valve of holotype; 5:U.H. Reg. No. 20004b, exterior left valve of holotype.
Locality: Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province.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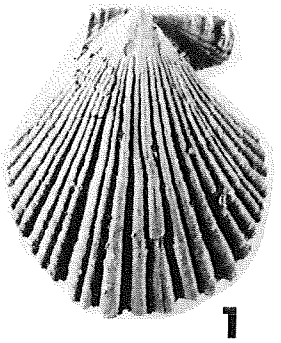
Explanation of Plate 2
(All figures natural size)

Figs. 1,2,3,4,5. *Chlamys kuromatsunaiensis* Uozumi and Akamatsu n.sp. 1:U.H. Reg. No. 20005, exterior right valve of paratype.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.
2:U.H. Reg. No. 20007, exterior left valve of paratype.
Locality: same as above.
3:U.H. Reg. No. 20004a,b, convex of right valve and left valve of holotype; 4:U.H. Reg. No. 20004a, interior right valve of holotype; 5:U.H. Reg. No. 20004b, interior left valve of holotype.

Figs. 6,6a,7,7a,8. *Chlamys kuromatsunaiensis nakazatoensis* Uozumi and Akamatsu n.subsp. 6,6a:U.H. Reg. No. 20009, exterior and interior right valve of holotype; 7,7a:U.H. Reg. No. 20011, exterior and interior left valve of paratype; 8:U.H. Reg. No. 20010, exterior right valve of paratype.
Locality: same as above.



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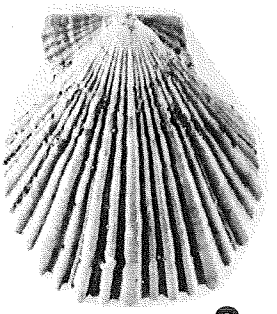

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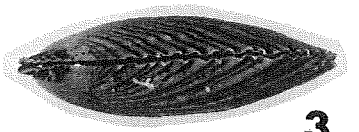

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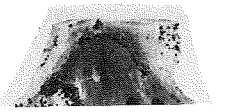

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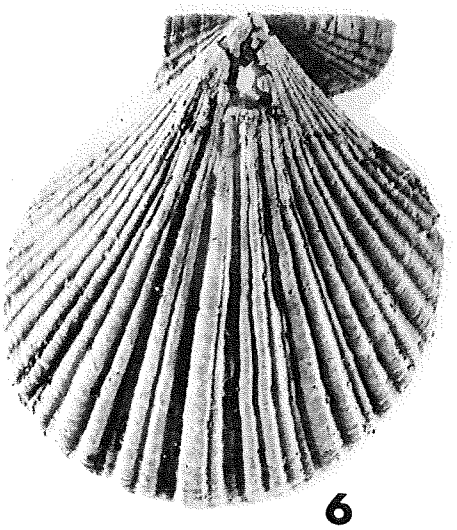

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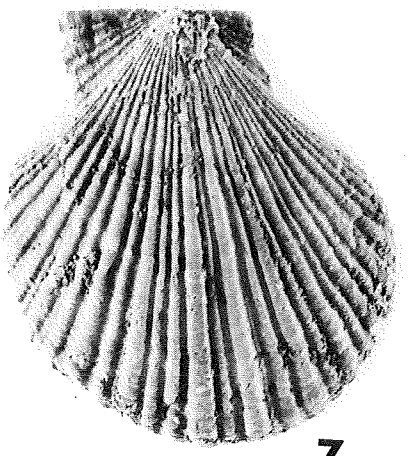

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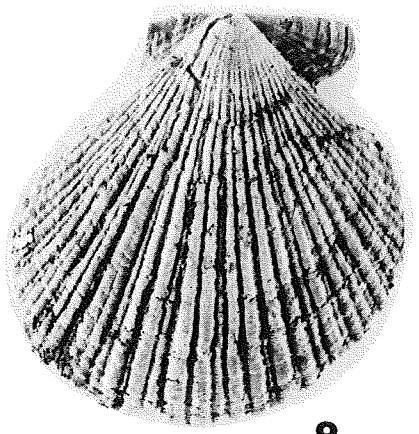

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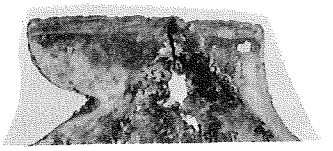

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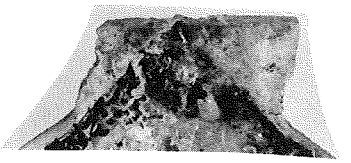

7a

Explanation of Plate 3
(All figures natural size)

Figs. 1,2. *Chlamys kuromatsunaiensis nakazatoensis* Uozumi and Akamatsu n.subsp. 1:U.H. Reg. No. 20009, convex of right valve of holotype; 2:U.H. Reg. No. 20011, Convex of left valve of paratype.

Figs. 3,3a,3b,4,4a,4b,5. *Chlamys kuromatsunaiensis utasaiensis* Uozumi and Akamatsu n. subsp. 3,3a,3b:U.H. Reg. No. 20013, exterior, interior and convex of right valve of holotype; 4,4a,4b.U.H. Reg. No. 20016, exterior, interior and convex of left valve of paratype; 5.U.H. Reg. No. 20014, exterior right valve of paratype.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

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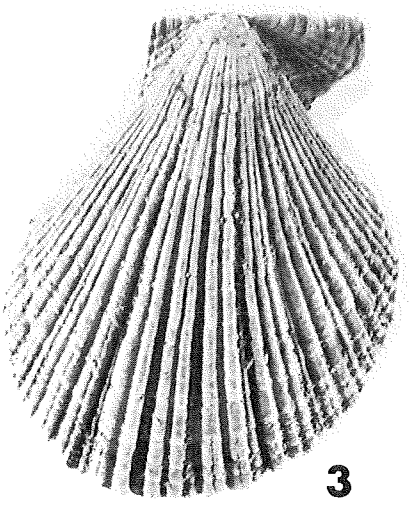

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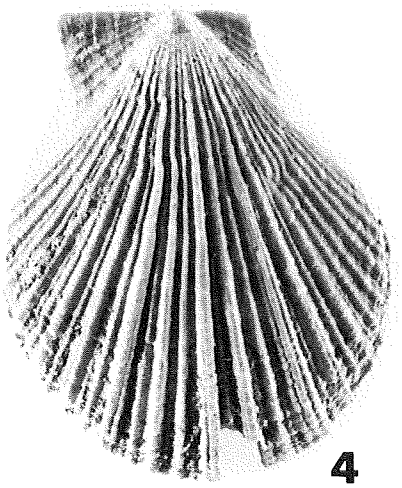

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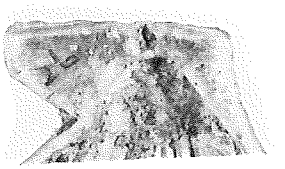

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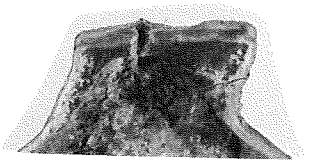

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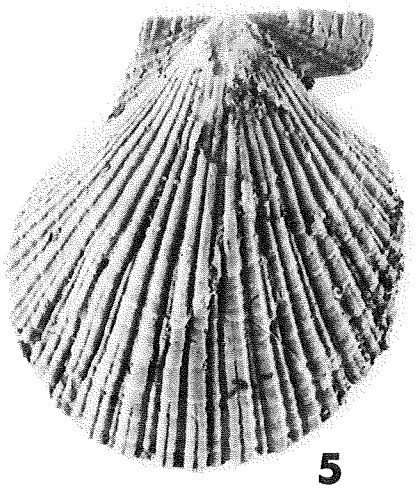

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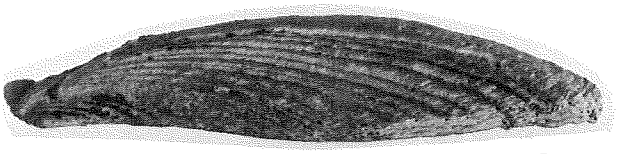
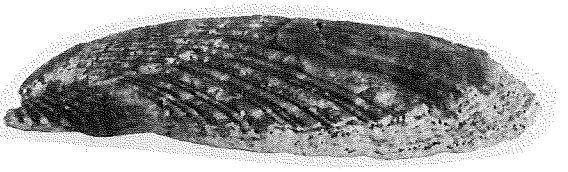


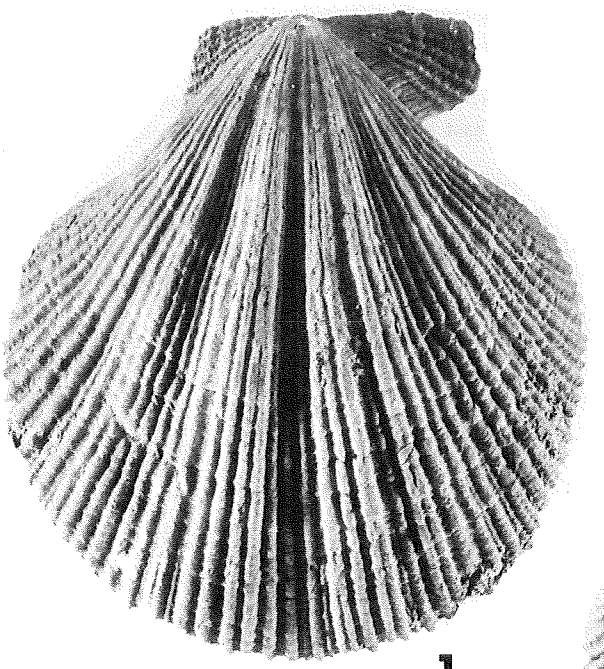
3b



4b

Explanation of Plate 4
(All figures natural size)

Figs. 1,1a,2,3. *Chlamys pilicaensis* Kubota. 1,1a:U.H. Reg. No. 13544, exterior and interior of right valve of holotype; 2:U.H. Reg. No. 20018, exterior left valve of paratype; 3:U.H. Reg. No. 20019, exterior left valve of paratype.
Locality: Cliff of the Toshibetsu River, southeast of the Daikoku Mine, Pirika, Imagane Machi, Setana Gun, Hiyama Province.



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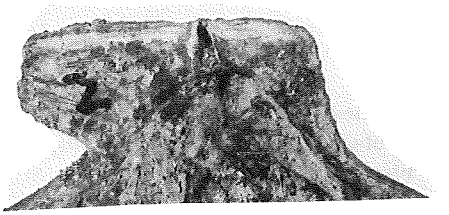

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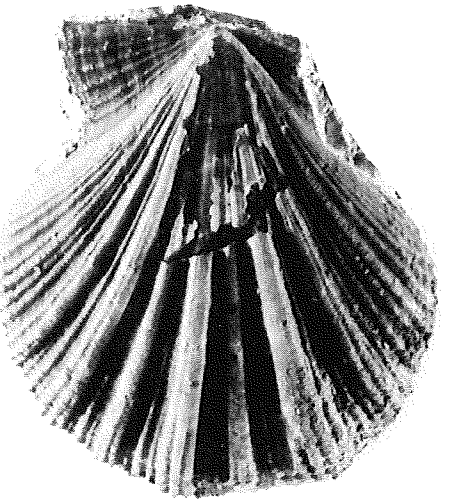

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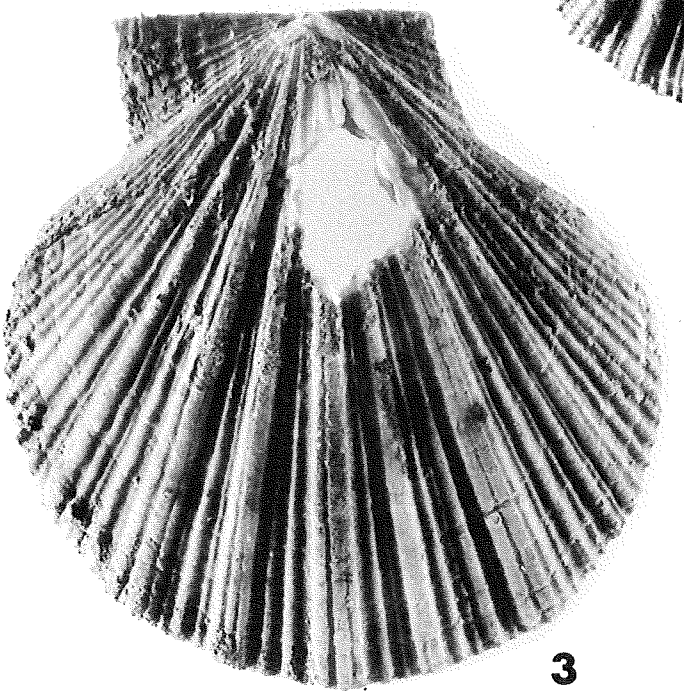


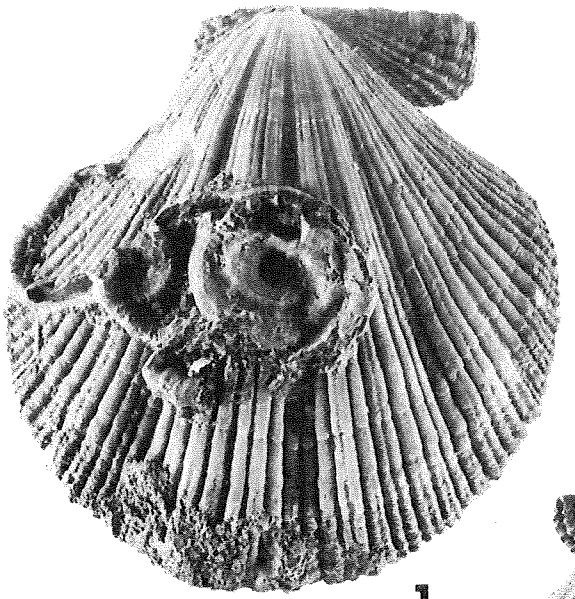
3

Explanation of Plate 5
(All figures natural size)

Fig. 1. *Chlamys pilicaensis* Kubota. U.H. Reg. No. 20017, exterior right valve of paratype. Locality: Cliff of the Toshibetsu River, southeast of the Daikoku Mine, Pirika, Imagane Machi, Setana Gun, Hiyama Province.

Figs. 2,3,4. *Chlamys erythrocomatus* (Dall). 2:U.H. Reg. No. 20021, exterior right valve; 3:U.H. Reg. No. 20022, exterior left valve; 4:U.H. Reg. No. 20020, exterior right valve. Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Fig. 5. *Chlamys albidus* (Dall). U.H. Reg. No. 20023, exterior right valve.
Locality: same as above.



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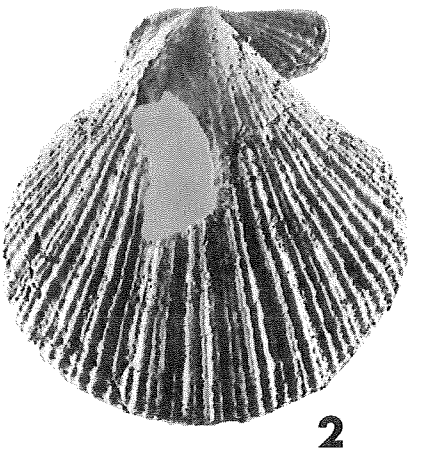

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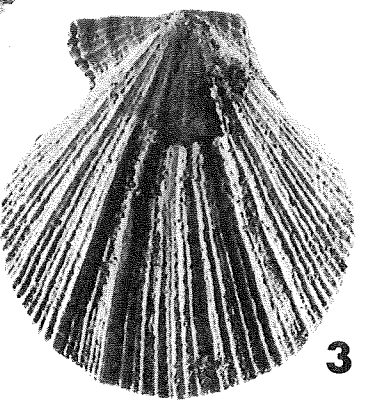

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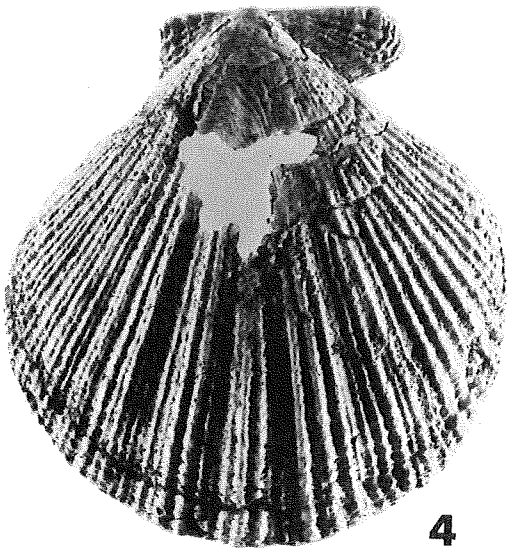

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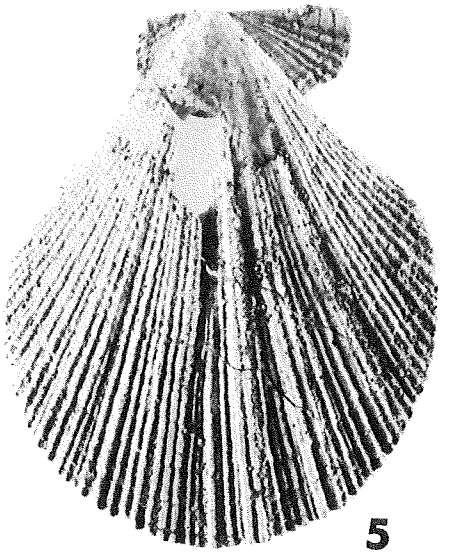
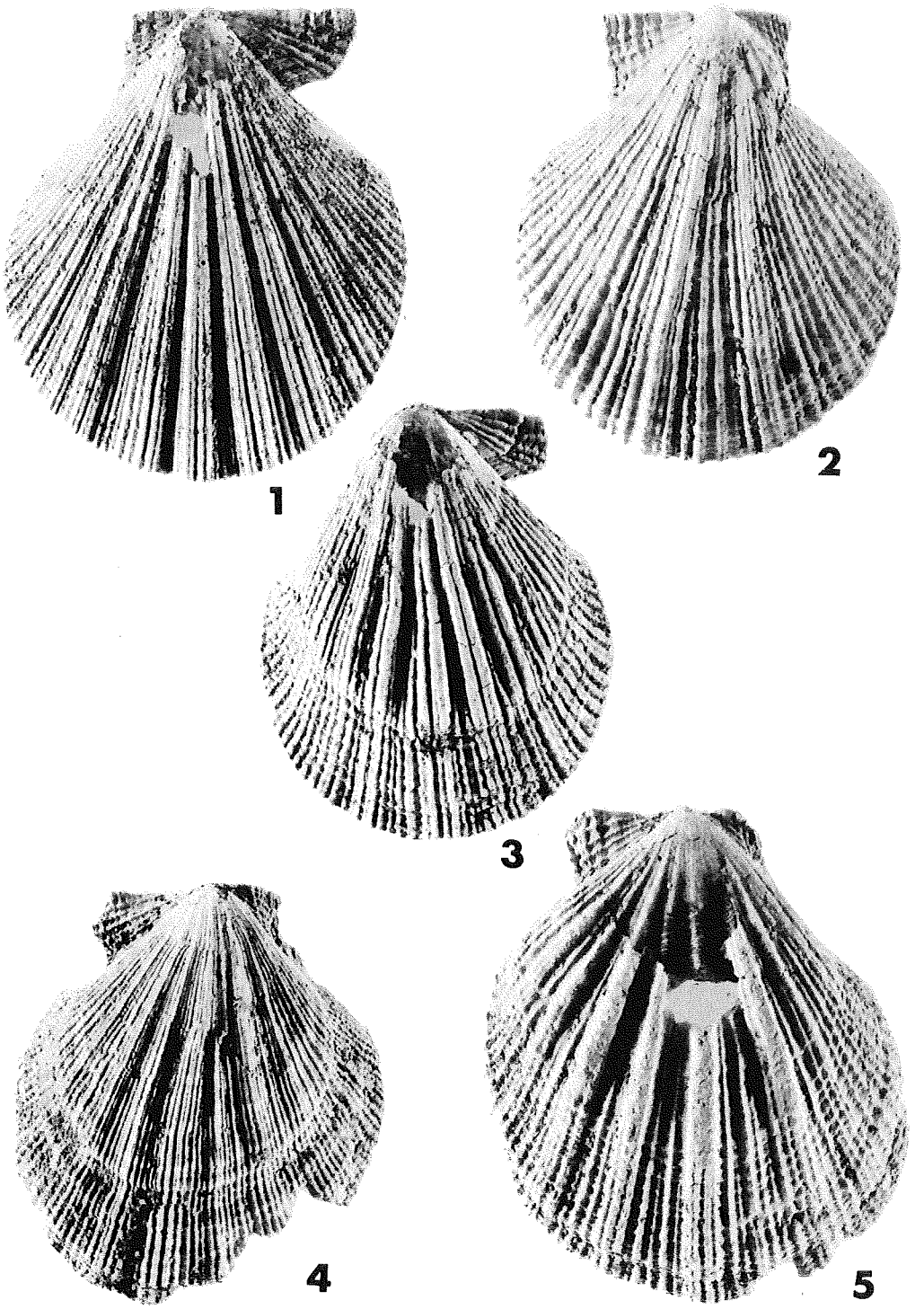


5

Explanation of Plate 6
(All figures natural size)

Figs. 1,2. *Chlamys albidus* (Dall). 1:U.H. Reg. No. 20024, exterior right valve; 2:U.H. Reg. No. 20025, exterior left valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 3,4,5. *Chlamys coatsi* MacNeil. 3:U.H. Reg. No. 20027, exterior right valve; 4:U.H. Reg. No. 20029, exterior left valve; 5:U.H. Reg. No. 20028, exterior left valve.
Locality: same as above.


1
2
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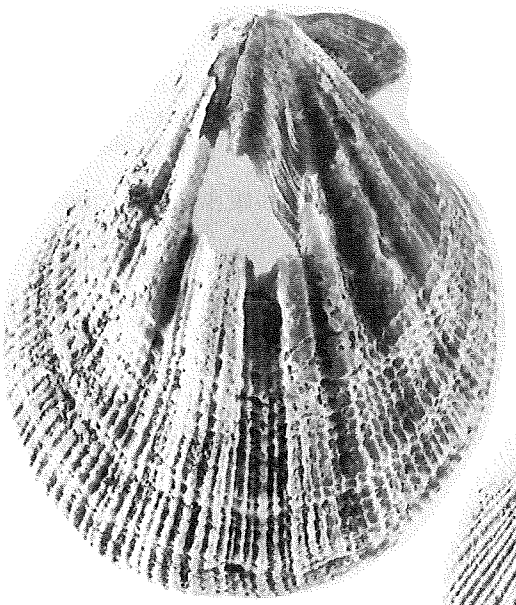
5

Explanation of Plate 7
(All figures natural size)

Fig. 1. *Chlamys coatsi* MacNeil. U.H. Reg. No. 20026, exterior right valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 2,3. *Chlamys hastata hericius* (Gould). 2:U.H. Reg. No. 20030, exterior right valve; 3:U.H. Reg. No. 20031, exterior left valve.
Locality: Kaigarabuchi, upper stream of the Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Fig. 4. *Chlamys strategus* (Dall). U.H. Reg. No. 20033, exterior right valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.



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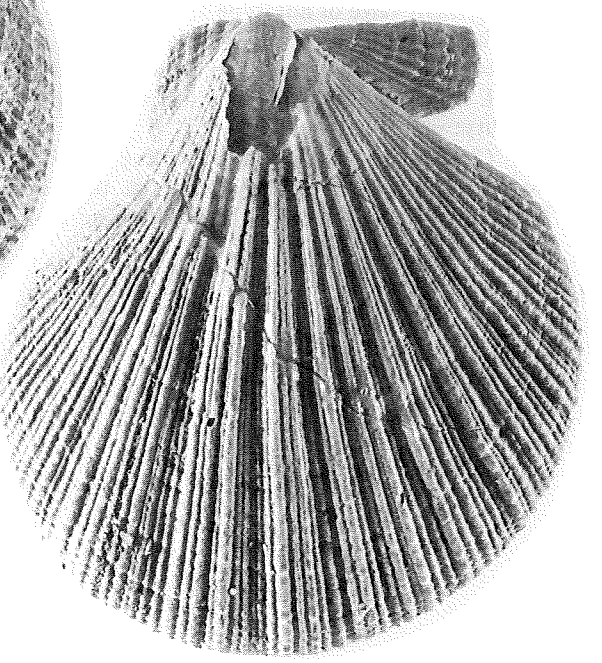

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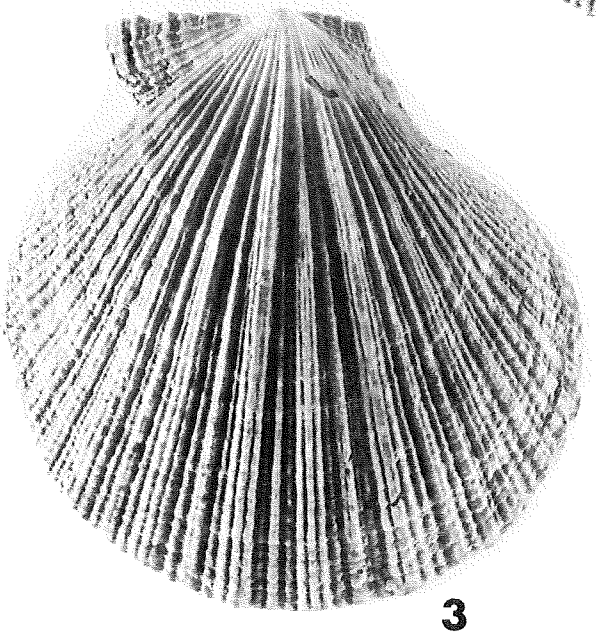

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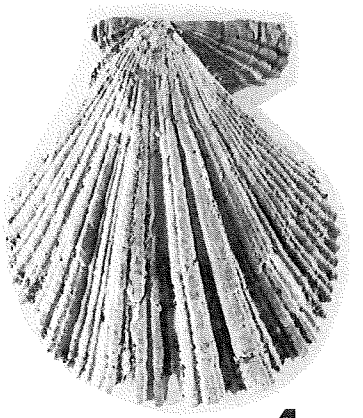


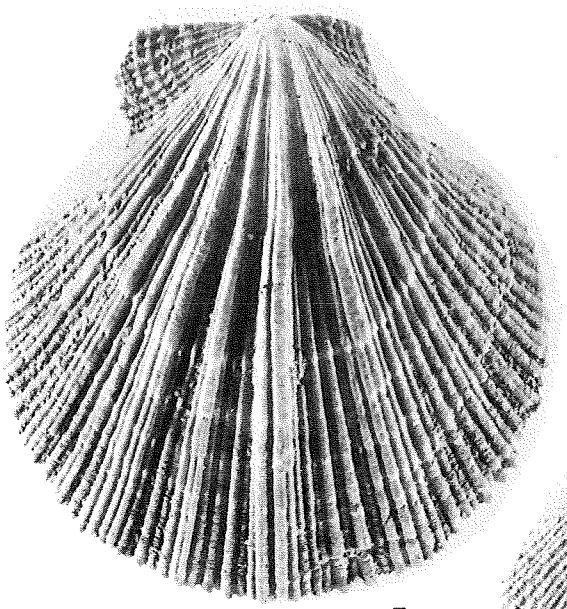
4

Explanation of Plate 8
(All figures natural size)

Fig. 1. *Chlamys hastata hericius* (Gould). U.H. Reg. No. 20032, exterior left valve.
Locality: Kaigarabuchi, upper stream of the Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 2,3. *Chlamys toshibetsuensis* Uozumi and Akamatsu n.sp. 2:U.H. Reg. No. 20035, exterior right valve of holotype.
Locality: Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province.
3:U.H. Reg. No. 20036, exterior left valve of paratype.
Locality: same as above.

Fig. 4. *Chlamys strategus* (Dall). U.H. Reg. No. 20034, exterior left valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.



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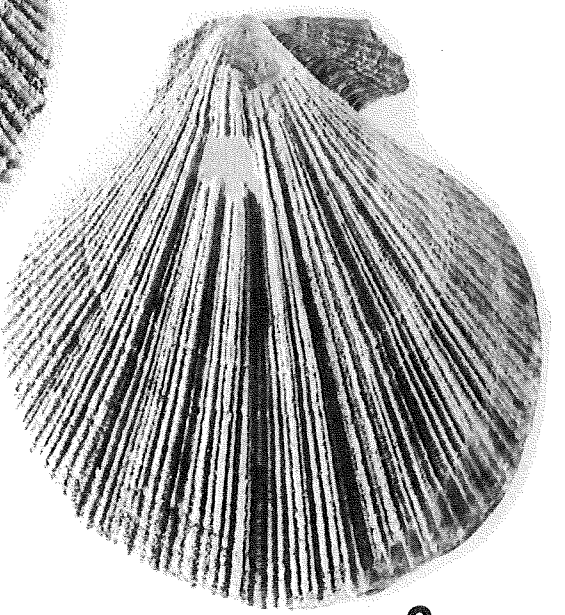

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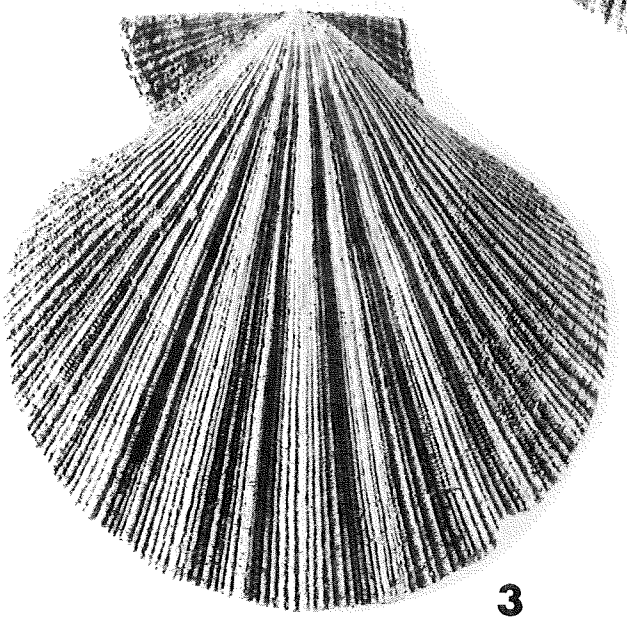

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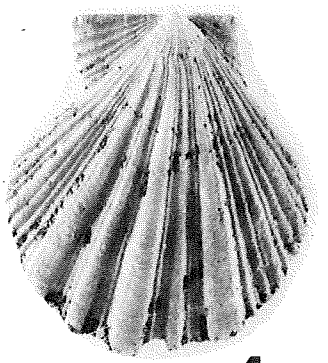
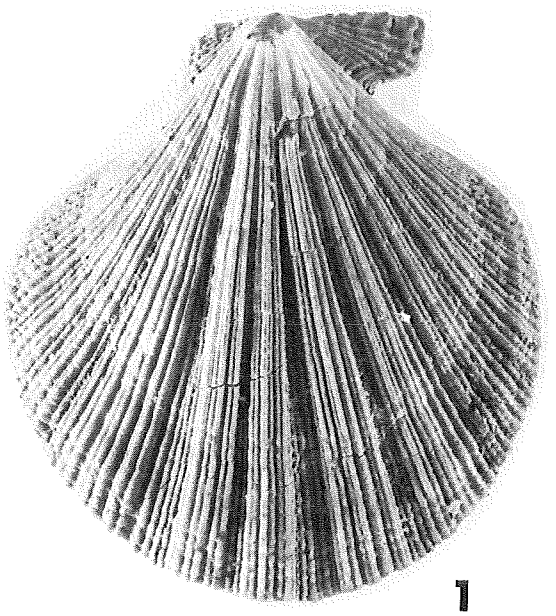


4

Explanation of Plate 9
(All figures natural size)

Figs. 1,1a,3,3a,4,4a. *Chlamys toshibetsuensis* Uozumi and Akamatsu n.sp. 1,1a. U.H. Reg. No. 20037, exterior and interior right valve of paratype;
Locality: Kaigarabuchi, upper stream of the Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.
3,3a. U.H. Reg. No. 20035, interior and convex of right valve of holotype; 4,4a. U.H. Reg. No. 20036, interior and convex of left valve of paratype.

Figs. 2. *Chlamys osugii* Kubota. U.H. Reg. No. 13543, exterior right valve of holotype.
Locality: Upper stream of Yuno-sawa, a tributary of the Nakano River, about 11 km, northwest of Kuromatsunai station, Suttsu Gun, Shiribeshi Province.



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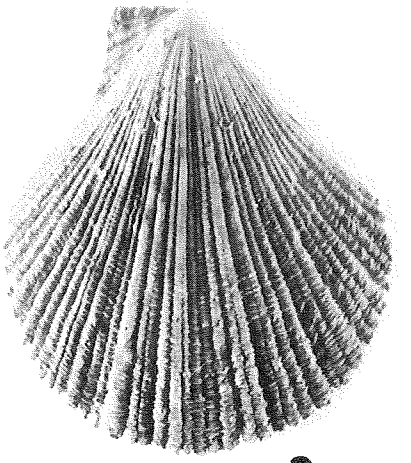

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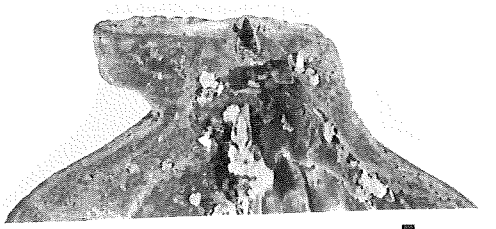

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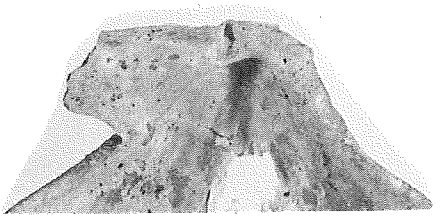

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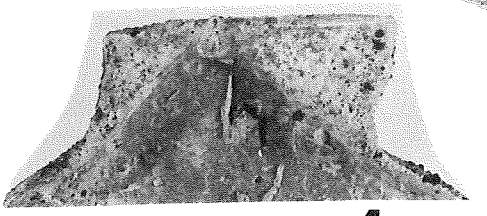
3a



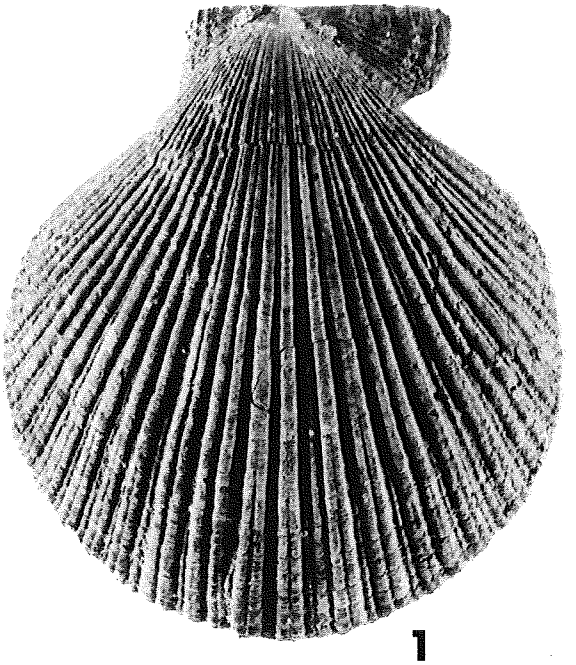
4

4a

Explanation of Plate 10
(All figures natural size)

Figs. 1,1a,2. *Chlamys pseudislandica* MacNeil. 1,1a. U.H. Reg. No. 20039, exterior and interior right valve; 2:U.H. Reg. No. 20040, exterior left valve.
Locality: Right floor of the Neppu River, about 3 km, northeast of kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 3,4. *Chlamys toshibetsuensis chinkopensis* Masuda and Sawada. 3:U.H. Reg. No. 20042, exterior right valve.
Locality: Right floor cliff of the Toshibetsu River, about 1.5 km, southeast of Chinkope-toge, Imagane Machi, Setana Gun, Hiyama Province.
4:U.H. Reg. No. 20045, exterior left valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.



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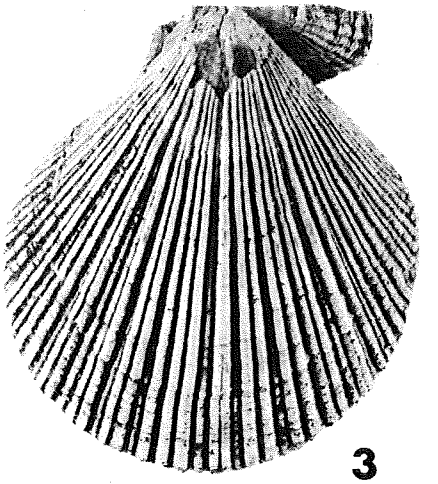

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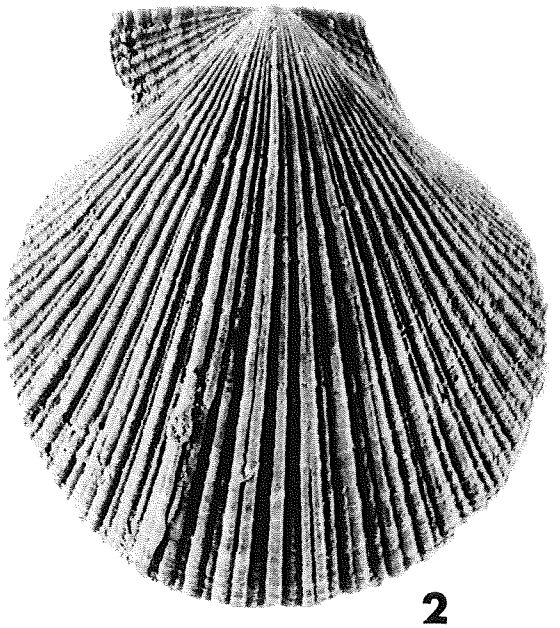

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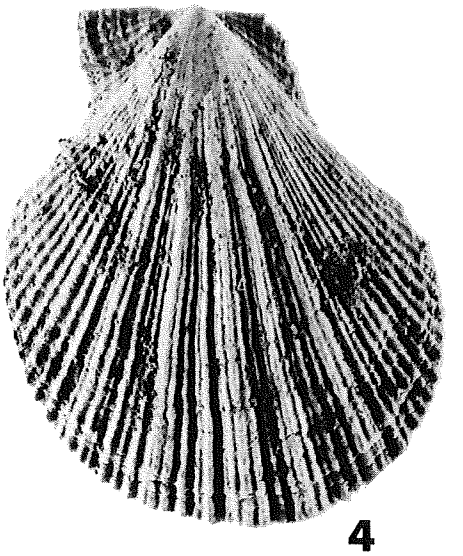
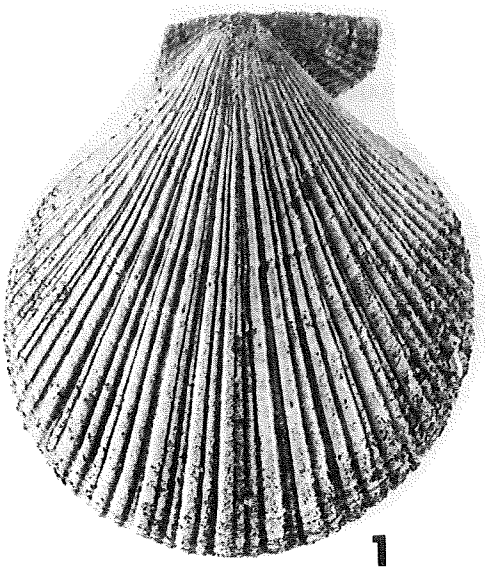


4

Explanation of Plate 11
(All figures natural size)

Figs. 1,4. *Chlamys toshibetsuensis chinkopensis* Masuda and Sawada. 1:U.H. Reg. No. 20041, exterior right valve; 4:U.H. Reg. No. 20044, exterior left valve.
Locality: Nakazato, upper stream of the Shubuto River, about 6 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 2,3,3a. *Chlamys kinoshitai* Kubota. 2:U.H. Reg. No. 20051, exterior left valve; 3,3a: U.H. Reg. No. 20047, exterior and interior left valve.
Locality: Kaigarabuchi, upper stream of the Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.



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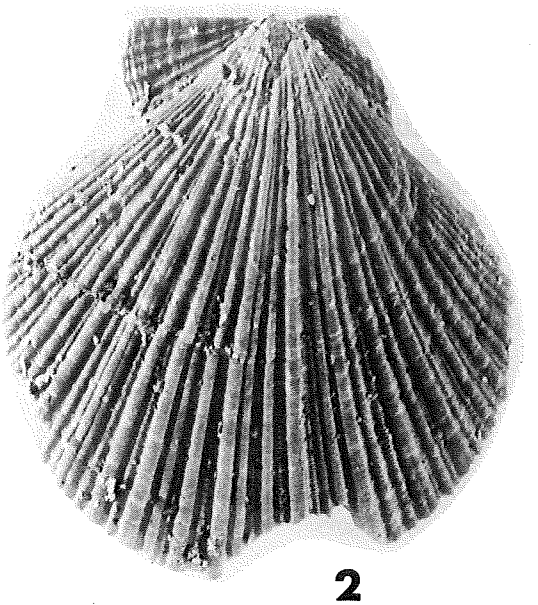

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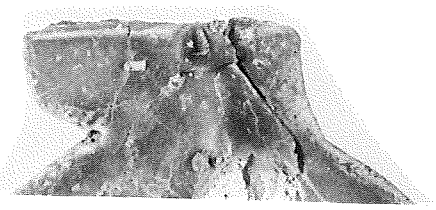
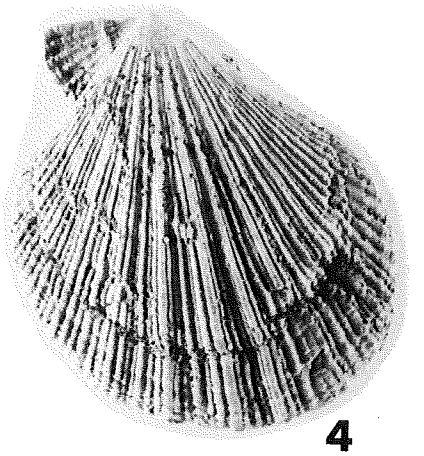


3a

3

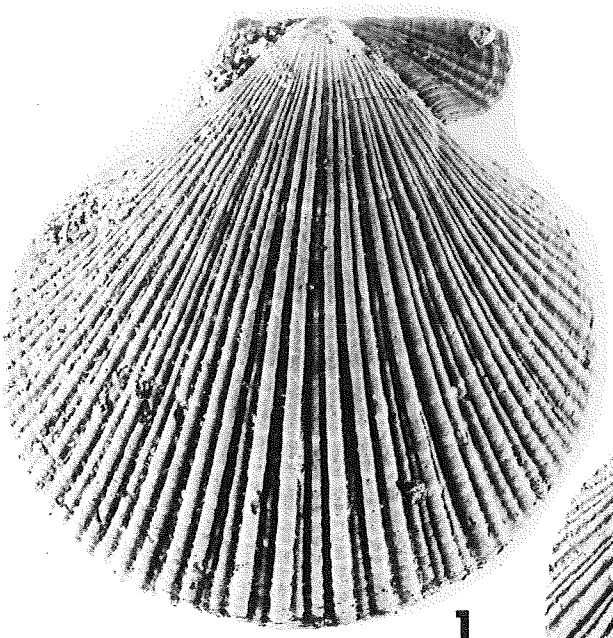


4

Explanation of Plate 12
(All figures natural size)

Figs. 1,2. *Chlamys kinoshitai* Kubota. 1:U.H. Reg. No. 20046, exterior right valve; 2:U.H. Reg. No. 20049, exterior left valve.
Locality: Kaigarabuchi, upper stream of the Shubuto River, about 8 km, southeast of Kuromatsunai station of the Hakodate Line, Kuromatsunai Machi, Suttsu Gun, Shiribeshi Province.

Figs. 3,4. *Chlamys rubidus* (Hinds). 3:U.H. Reg. No. 20052, exterior right valve; 4:U.H. Reg. No. 20053, exterior left valve.
Locality: Right floor of the Toshibetsu River, about 4 km, south of Hanaishi station of the Setana Line, Imagane Machi, Setana Gun, Hiyama Province.



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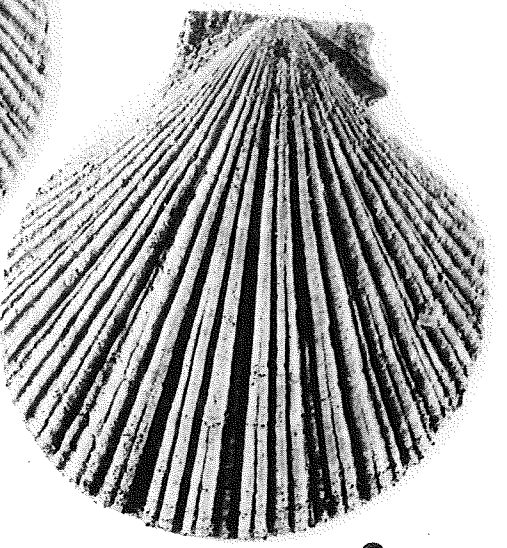

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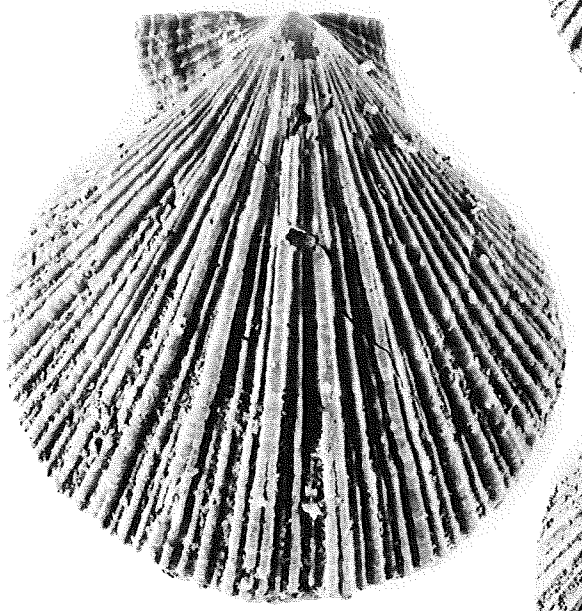

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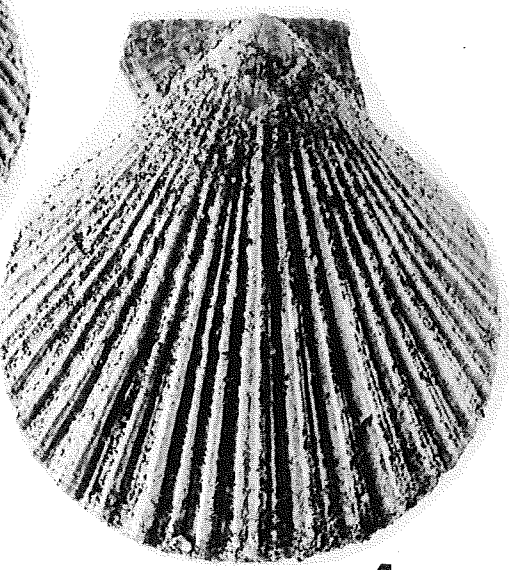

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