Turrid Gastmpods from the Upper Pleistocene Moeshima Shell Bed : Molluscan Palaeontology of the Pleistocene Formations in Kyushu I

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Turrid Gastropods from the Upper Pleistocene Moeshima Shell Bed

(Molluscan Palaeontology of the Pleistocene Formations in Kyushu - I)

By

Tsugio SHUTO

Abstract

This is the first part of the monograph on the mollusca of the Upper Pleistocene Moeshima shell bed which is distributed on a small isle, Moeshima (N 31° 37', E 130° 43'), in Kagoshima bay, south Kyushu. It is the most prolific bed among the Pleistocene formations in southwest Japan and characterized by the faunule of the deep shelf in contrast with the embayment faunules of the ordinary Pleistocene beds in that province. Six turrid subfamilies comprise 25 genera and 33 species out of 184 total molluscan species from that bed. Many of them, especially Clavines, Mangeliines, and Daphnelines are new to science or rare in records of occurrence. They represent an important part of both the Japanese fossil and recent turrids. This report contains the detailed descriptions of the species and some revision of the classification of a few genera.

Introduction

The present report is the first part of the descriptive section of the molluscan palaeontology of the Pleistocene formations in Kyushu. It contains the descriptions of thirty-three species of gastropod family Turridae from the prolific shell bed at a small isle, Moeshima, off volcano Sakurajima in Kagoshima bay, Kyushu. The Upper Pleistoceme Moeshima shell bed is intercalated in the upper part of the pumiceous strata and consists of the ecologically different two parts. The one is represented by the faunule of the deep sandy shelf directly influenced by the oceanic warm current and the other contains the faunule of the shallow embayment water. The turrids comprise one of the most important groups of the deep shelf faunule of Moeshima showing a high occupation percentage of about 18 percent (33 turrid species in 184 total molluscan species). They cover the greater parts of the fossil turrids from West Japan together With the turrids already reported from the Mio-Pliocene Miyazaki group (T. SHUTO, 1961) and the Paleogene formations of north Kyushu (T. SHUTO and Y. UEDA, 1963).

Thirteen species out of thirty-three turrid species from the Moeshima shell bed are new to science and the majority of the remaining twenty species, although they have been already known, were reported with over-simplified descriptions, which

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causes the difficulty in identification. Hence I recognize the importance of the minute descriptions not only of the new species but also of the known ones on the basis of the shell morphology, especially of the morphological development.

Since H. and A. ADAMS subdivided the Turritidae (=Turridae) into three subfamilies, several malacologists mentioned their ideas on the classification and nomenclature of the family. The authors of early decades employed a single criterion to separate the family into subfailies (JEFFREYS, 1868, based on the protoconch; FISCHER, 1887, based on the opercula) and inevitably got the over-simplified and unnatural classification, although their classifications are the valuable steps for advancement. The authors in the twentieth century attached more or less great importance to the synthetic combination of several characters and tried to approach the natural classification. HEDLEY (1922) adopted FISCHER's scheme with some modification and tried the correlation between the characters of the protoconch and the teleoconch. THIELE's classification (1929) was based on the basal attachment of the radula teeth and on the presence or absence of the basal membrane. POWELL (1942), on one hand, recognized the basic importance of the radula teeth in turrid subdivision and on the other hand he mentioned of the insufficient data of radula teeth. He appreciated the features of the protoconch and the anal sinus for the taxonomic criteria, but did not so much evaluate the opercula. WENZ's classification (1944) is comprehensive and currently accepted by Japanese malacologists but it largely depends on THIELE's and is far from the satisfactory classification as mentioned below. It seems for me that the groups of *Borsonia* and its allies and *Clavus* and the allies in Brachytominae of WENZ are too characteristic to be dealt in a single and same subfamily. *Turricula*, *Cochlespira*, and *Conorbis* are also characteristic enough to be distinguished from the group of *Turris*. If these distinctive groups are separated one another and treated as subfamilies, each of the subfamilies will be sorted at the same level and featured by rather the homogenous characteristics within. From this point of view I prefer POWELL's classification (1942) which includes Turrinae, Turriculinae, Cochlespirinae, Clavatulinae, Conorbiinae, Clavinae, Borsoniinae, Mangeliinae, and Daphnelinae. In the present report I follow POWELL's in general. It is, of course, not a perfect one but contains somewhat artificial part. For instance the relation between *Horaiclavus* [Clavinae] and *Anacithara* [Mangeliinae] is one of the serious problems as mentioned in the next section. I also agree generally with the opinion of POWELL, who emphsizes that the gastropod protoconch does not serve for major grouping but for the separation of the phylogenetic units. I, however, can not agree with him, who recognizes only one style of protoconch for a genus and separates the allied species with quite similar morphology except for the polygyrate or paucigyrate character of the protoconch as distinct genera. His idea that the gastropod genera with polygyrate protoconch have longer geologic and wider geographic range than the allied genera with paucispiral protoconch is not also necessarily accepted because a few genera as *Anacithara* with paucigyrate protoconch show a long geologic and wide geographic range. Furthermore THORSON (1950) showed the examples indicating the highly adaptive tendency of the protoconch of the gastropods. Considering the above mentioned evidence I get the conclusion that the

polygyrate or paucigyrate protoconch of the allied species serves as a criterion for the separation at the subgeneric level, and not at generic level.

The fossil material treated in this report was collected by Dr. Y. UEDA of the Geological Survey of Japan and myself (1954), and by myself (1961 and 1963). All the registered specimens are stored at the Department of Geology, Faculty of Science, Kyushu University.

Acknowledgements

Many persons helped me in various ways in the course of this study and here I have the pleasure to express my cordial thanks to these persons.

I am deeply indebted to Professors Ryozo TORIYAMA and Tatsuro MATSUMOTO of Kyushu University for their necessary advices and suggestions on the general problems of the study including field and laboratory works. Professor TORIYAMA, moreover, gave me thorough criticisms at the type script.

I appreciate sincerely Dr. Tadashige HABE of National Museum of Natural Science of Tokyo who gave me comprehensive advices and necessary criticisms on the taxonomy of the Turridae and made me access to the necessary books and materials. I wish to express my hearty thanks to Drs. Tokubei KURODA of Kyoto University and Katura OYAMA of the Geological Survey of Japan for their advices and suggestions on the taxonomy. Dr. Yoshiro UEDA of the Geological Survey of Japan helped me through co-operation in collecting the material from the Moeshima shell bed in the summer of 1954.

I am also indebted to Mrs. K. KAWABATA of the Elementary School of Moeshima for her kind helps during the field survey in the summer of 1954, 1961, and 1963.

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Systematic Description

Family Turridae HEDLEY, 1922

Subfamily Turrinae, SWAINSON, 1840

Genus *Gemmula* WEINKAUFF, 1875

(type-species: *Pleurotoma gemmata* HINDS by subsequent designation, COSSMANN, 1896)

Subgenus *Gemmula* (s. s.)

Gemmula (*Gemmula*) *pulchella* SHUTO

Pl. 30, Fig. 1, Text-fig. 1.

1960, *Gemmula* cf. *G. granosa*, MacNEIL, *U.S. Geol. Surv. Prof. Pap. No. 339*, p. 102, pl. 5, fs. 10?, 11; pl. 14, f. 23.

1961, *Gemmula* (*Gemmula*) *granosa pulchella* SHUTO, *Mem. Fac. Sci. Kyushu Univ. Ser. D, Vol. 11, No. 2*, p. 80, pl. 10, fs. 1, 2, text-figs. 3, 4.

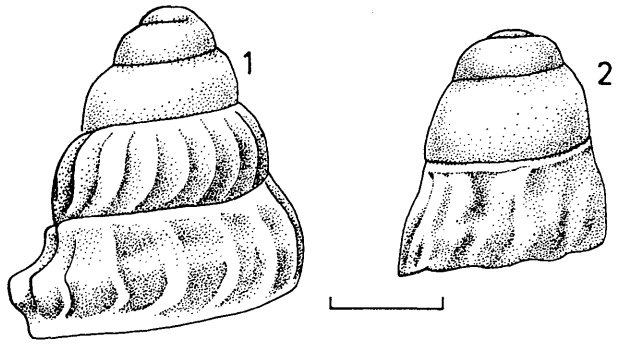
1964, *Gemmula pulchella*, POWELL, *Indo-Pacific Mollusca, Vol. 1, No. 5*. p. 255, pl. 195, fs. 4, 5.

Material.—GK-M 6274, 6276, 6675, 6678, and 8067 to 8075. Preservation is fairly good.

Measurements.—

specimen GK-M	H (mm)	W (mm)	Bd (mm)	W/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. gemmulations IV	V	VI	VII	VIII
6274	26.57	8.75	14.6	33.0	55.1	—	8	36.8	23.1	21	22	23	27	34
6275	21.0	7.3	11.3	34.8	53.8	—	7	40.3	22.2	19	20	24	29	—
6676	16.9	6.45	8.35	38.2	49.4	3.5	7	37.0	24.2	19	19	21	23	—
6677	14.1	5.4	7.6	38.3	53.9	4.0	6	38.6	21.8	19	19	24	—	—
6678	12.85	5.0	7.15	38.9	55.6	4.0	6	35.9	22.2	19	21	21	—	—

Remarks.—The present specimens quite conform with the type specimens from the upper part of the Miyazaki group (Lower Pliocene) except for the secondary spiral lines. The secondaries are discernible on the majority of the present specimens, while the type-specimens are devoid of them. This defference may be stratigraphic and have some connection to evolution, but is, of course, so slight to separate them into the different species.



Text-fig. 1. Protoconchs of *Gemmula (Gemmula) pulchella* SHUTO and *Turricula (Surcula) interrupta* (LAMARCK) from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Gemmula (Gemmula) pulchella*, GK-M 6677.
2. *Turricula (Surcula) interrupta*, GK-M 6319.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Sea-cliffs at the north east and north side of Moeshima isle, Kagoshima bay.

Geologic range.—Early Pliocene to Late Pleistocene.

Subgenus *Unedogemmula* MACNEIL, 1960

(type-species: *Pleurotoma unedo* KIENER by original designation)

Gemmula (Unedogemmula) unedo (KIENER)

Pl. 29, Fig. 12.

1839-40, *Pleurotoma unedo* KIENER, *Coquilles Vivantes, Tom. 5*, Pleurotome, p. 19, pl. 14, f. 1.

1843, *Pleurotoma unedo*, REEVE, *Conch. Icon. Vol. 1, Pleurotoma*, pl. 2, f. 12.

1884, *Pleurotoma unedo*, TRYON, *Manual Conch. Vol. 6*, p. 165, pl. 3, f. 20.
1910, *Turris invicta* MELVILL, *Ann. Mag. Nat. Hist., Ser. 8, Vol. 6*, p. 15, pl. 2, f. 27.
1951, *Turris unedo*, HIRASE (TAKI), *Handb. Illustr. Shells*, pl. 115, f. 2.
1954, *Gemmula unedo*, KIRA, *Colored Illustr. Shells Japan, No. 1*, pl. 35, f. 17.
1956, *Gemmula unedo*, KAICHR, *Indo-Pacific Sea Shells*, pl. 1, f. 11
1960, *Unedogemmula unedo*, MacNEIL, *U.S. Geol. Surv. Prof. Pap. No. 339*, p. 101.
1964, *Gemmula (Unedogemmula) unedo*, POWELL, *Indo-Pacific Mollusca, Vol. 1, No. 5*, p. 269, pl. 175, fs. 1, 6; pl. 208, fs. 1, 2.

Material.—GK-M 6282. A single specimen which is broken at the apex and the outer lip.

Measurements.—Height of the preserved part: 39.4 mm; calculated total height: 54.5 mm; maximum diameter: 14.8 mm; height of the body whorl: 27.5 mm; number of the whorls: 5.5+; pleural angle: 30.4 degrees.

Remarks.—The present specimen is featured by the bilirated peripheral carina which is at the lower one-third of the whorls, distinctly concave and wide shoulder, very obsolete suture, strong and sharply ridged subsutural cord which is at some distance from the suture, and numerous primary, secondary, and tertiary spiral lines on the whole surface of the whorls. Basing upon these characters it is identified to *Pleurotoma unedo* KIENER, which is one of the representative turrid species in the Japanese waters. This species is rather variable in the strength and arrangement of the spiral ornamentation, pleural angle, and the position of the peripheral angulation. The present specimen is included in the natural range of variation, although it shows somewhat differect appearance because of the abrasion effect.

The present specimen is somewhat similar to *Lophiotoma (Lophioturris) leucotropis* (ADAMS and REEVE) because its gemmulate early whorls are broken off, but is readily distinguished from the latter by the bi-lirated peripheral angulation, the much stronger subsutural cord, and stronger secondary threads than the latter.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Pliocene to Recent.

Genus *Kuroshioturris* SHUTO, 1961

(type-species: *Gemmula (Kuroshioturris) hyugaensis* SHUTO by original designation)

Kuroshioturris tigrinaeformis (NOMURA)

Pl. 29, Fig. 1, Pl. 32, Figs. 1, and 2;

1936, *Turris (Turris) tigrinaeformis* NOMURA, *Sci. Rep. Tohoku Imp. Univ. 2nd Ser. Vol. 18, No. 2*, p. 113, pl. 6, fs. 32-a and b.

Material.—GK-M 6277 to 6281, 6283, and 8046 to 8052.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. gemmulations 4-L***	3-L***	pen	bod
6277	43.4	12.1	23.4	28.1	53.9	—	11	35.6	13.4	27	30	31	34
6278	28.6	9.0	16.3	31.1	57.0	2.5	9	37.8	19.1	24	26	30	34
6279	42.2*	11.8	24.7	28.0	58.5	—	11	27.2	18.9	26	29	30	34
6693	35.9**	10.7	20.0**	29.8	55.7	2.5	8.2	37.9	21.1	23	26	27	35
8046	48.4	12.5	24.1	25.8	49.8	2+	12	39.7	15.6	24	25	32	37
8048	38.4	11.0	21.1	38.6	55.0	3.0	10	39.0	20.3	34	32	38	41
8049	33.9	10.05	19.6	30.0	57.8	2+	9	40.5	21.4	23	28	30	39
8051	41.7*	11.4	23.6	27.3	56.5	—	9	—	19.2	24	27	31	—

* slightly broken at the apex. ** slightly broken at the base. *** third last and fourth last respectively.

Remarks.—The preseut specimens perfectly confrom with NOMURA's species from the Byoritsu Bed of Taiwan (Formosa). The distinction of this species from *Pleurotoma tigrina* LAMARCK, which is, according to POWELL, the synonym of *P. acuta* PERRY and included in *Lophiotoma* CASEY, 1904, is based on the longer canal of the former species than the latter according to the original description. In my opinion, however, length of the canal of *K. tigrinaeformis* is rather variable and does not seem to serve for the criterion of specific distinction. The most apparent difference between the two is observed in the features of the spiral ornamentation. That is to say, the peripheral double carina of *tigrina* is extremely elevated and in consequence the surface between it and the subsutural cord is wide and gently sloped. While on the present species the peripheral double carina is not so produced and the subsutural cord is as stong as the peripheral one. Consequently the surface between them does not form the outward slope, but makes a vertical narrow and deep excavation. Besides the present species is provided with the peripheral gemmulations, although they tend to become close-set and obsolete on the full grown specimens. The anterior part of the canal which is frequently produced with fasciole is one of the characteristic features of the present species. Its protoconch is conical and consists of about two and a half volutions. The first protoconch-volution is small and smooth tip and the remainder ones are roundly convexed at the sides. It is not obvious because of abrasion whether the axial brephic ribs are developed on the latest part of the protoconch or not. The anal sinus is moderately deep with the asymmetrical arms. The upper arm is stretched forward horizontally in some distance and then curved upward, while the lower arm is gently sloped anteriorly. These features of the protoconch and the anal sinus of the present species apparently differ from those of *Gemmula* (s. s.) and *G.* (*Unedogemmula*). Concerning with these features it shows the closest relation to *Kuroshioturris* SHUTO, 1961, but is distinguished from the latter in having narrower V-shaped anal sinus, more conical protoconch, and more distinct sculptures on the teleoconch. It may represent a new subgenus of *Kuroshioturris*, but the establishment of the new subgenus is suspended because the detailed feature of the protoconch is not observed. Originally I proposed *Kuroshioturris* with the paucispiral protoconch as a subgenus of *Gemmula*, whlie POWELL (1964, 293) included it in *Ptychosyrinx* THIELE, 1925, the type species of which is provided with the polygyrate and axially costate protoconch. I prefer to separate *Kuroshioturris* from

both *Gemmula* and *Ptychosyrinx* as a distinct genus. *Kuroshioturris* seems to cover rather a wide range in shell-morphology.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Sea-cliffs at the northeast and north side of Moeshima isle, Kagoshima bay.

Geologic range.—Late Pliocene to Late Pleistocene.

Subfamily Turriculinae POWELL, 1942

Genus *Orthosurcula* CASEY, 1904

(type-species: *Pleurotoma longiforma* ALDRICH by subsequent designation, THIELE, 1931)

Orthosurcula pervirgo (YOKOYAMA)

Pl. 29, Fig. 6, Pl. 32, Fig. 6 and 7; text-figs. 2 and 3

1928, *Pleurotoma pervirgo* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 2, Pt. 7*, p. 340, pl. 66, fs. 7 and 8.
1952, *Orthosurcula mirabilis pervirgo*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ., 2nd. Ser., Spec. Vol. No. 3*, p. 232.
1959, *Turricula pervirgo*, MAKIYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 5*, pl. 64, fs. 7 and 8.
1959, *Turricula (Orthosurcula?) soyomaruae* OTUKA, *Venus Vol. 20, No. 3*, p. 246, f. 3.
1959, *Turricula (Orthosurcula) pervirgo*, OTUKA, ibid, p. 247, fs. 6 and 7.
1961, *Orthosurcula pervirgo*, SHUTO, *Mem. Fac. Sci. Kyushu Univ. Ser. D, Vol. 11, No. 2*, p. 92, pl. 6, f. 14, text-f. 6.

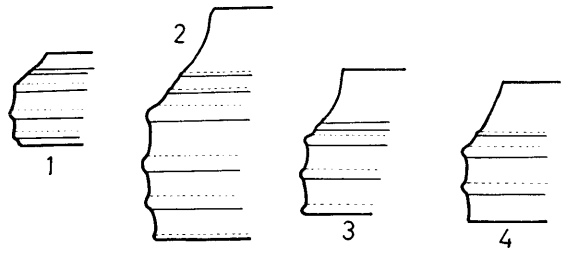
Material.—GK-M 6283, 8053, and 8054. The former two are broken at the apex and the labrum and the latter is broken at the apical part.

Measurements.—

specimen GK-M	Hm(Hc) (mm)	D (mm)	Bd (mm)	Ap (mm)	numb. whorls (PN)	<P (degrees)	prim. spirals pen	prim. spirals bod	second. spirals
6283	34.5(37)	9.8	24.45	19.9	5+	30.3	3	14+	absent
8053	33.9(44)	12.1	27?	21.5?	4.5+	29.5	4	17	on basal and lateral surface
8054	73.3(79)	20.75	49.2	43.5	6+	27.2	6	17	on basal surface

Hm: measured height; Hc: calculated height; Ap: length of the aperture.

Remarks.—The present specimens, came from a single and same locality, include typologically two named species. The characteristic features of *Orthosurcula pervirgo* (YOKOYAMA) are clearly observed on the specimen GK-M 6283, although it is not a fully grown one and imcomplete in preservation. Besides the typical features of *Orthosurcula* it shows the following characteristics: (1) moderately deep sinus with forwardly produced lower arm on the shoulder, (2) the apex of the anal sinus being situated at about one-third from the upper suture, (3) the stronger two of the spiral cords being situated at the peripheral angulations and a weaker one slightly above the angulation on each whorl. According to the original author *O. soyomaruae* has three distinct spiral lirae which coincide with the angulations instead of two lirae of *pervirgo*. The specimen GK-M 8054 is quite identical to *O. soyomaruae* with



Text-fig. 2. Whorl-profile of *Orthosurcula pervirgo* (YOKOYAMA).
1. GK-M 8054, early whorl; 2, same specimen, penultimate whorl;
3. GK-M 8055, penultimate whorl; 4. GK-M 6283, penultimate whorl.

triangulated profile of the early whorls. It, however, shows the fourth lira just above the lower suture on the penultimate whorl. The early whorls of GK-M 8053 are bi-angulated at the periphery, but the third distinct lira appears close to the lower suture on the late whorls. Furthermore the lira just above the upper lira of the periphery is remarkably large to assume a triangulate apperance even on the early whorls. These facts suggest that the number of the distinct lirae and cosequently the number of the peripheral angulations is not so stable but rather variable and does not serve for taxonomical criterion. Hence there is no definite distinction between *O. pervirgo* and *O. soyomaruae*. They may be conspecific. The fine crenulations on the spiral lirae, which are one of the generic diagnosis, are readily discernible on the body whorl, but are easily worn off and hardly recognized on the spire whorls.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Early Pliocene to Recent.

Genus *Turricula* SCHUMACHER, 1817

(type-species: *Turricula flammea* SCHUMACHER=*Murex javana* CHEMNITZ by monotypy)

Subgenus *Surcula* H. and A. ADAMS, 1853

(type-species: *Pleurotoma nodifera* LAMRCK=*Murex javana* LINNÉ by subsequent designation, COSSMANN, 1889)

Turricula (Surcula) interrupta (LAMARCK)

Pl. 30, Figs. 2, 8, and 9; text-figs. 1 and 3.

1822, *Pleurotoma interrupta* LAMARCK, *Anim. sans vert., Vol. 7*, p. 92.
1884, *Drillia interrupta*, TRYON, *Man. Conch. Vol. 6*, p. 181, pl. 6, f. 68.

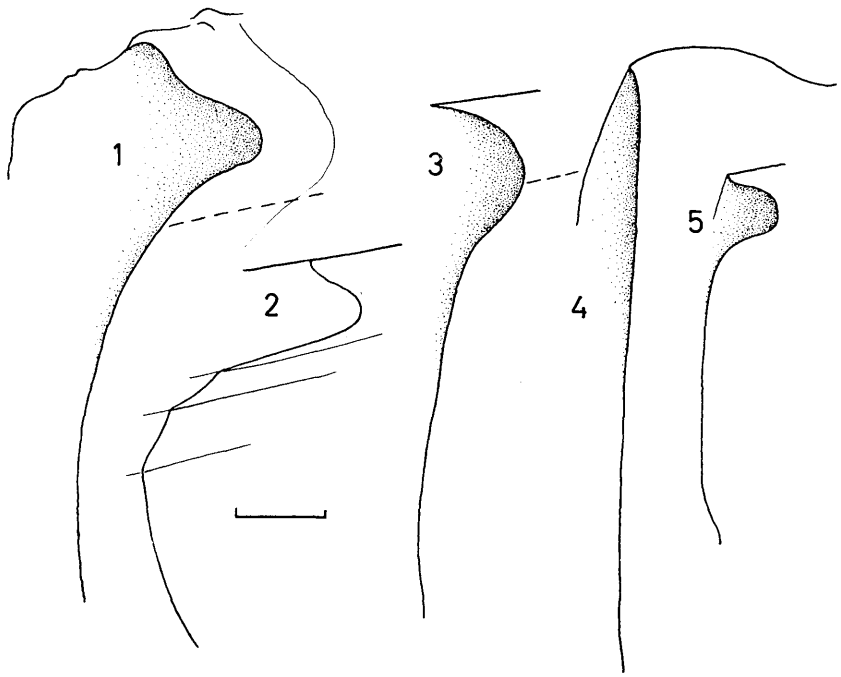
Material.—GK-M 6316 to 6322 and 6638. GK-M 6638 shows the typical features of the species and the others are more or less varietal.

Measurements.—

specimen GK-L	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)	<A (degrees)	<P
6316	34.45	10.2	16.6	12.0	29.6	48.1	34.8	28.8	17.2
6317	30.75	9.7	15.45	11.25	31.5	50.2	36.6	30.9	20.5
6319	20.9	7.2	10.85	7.8	34.7	51.9	37.6	32.3	24.3
6320	46.2	12.5	19.7	—	27.0	42.6	—	27.7	11.8
6322	19.4	6.85	9.75	—	35.3	50.2	—	32.9	24.7
6638	34.35	11.4	17.2	12.4	33.2	50.0	36.1	33.6	20.8

specimen GK-H	numb. whorls (N)	(PN)	numb. axials I	III	V	VII	IX	XI	inclination of axials (degrees)
6316	3.0	9.75	9	10	10	13	16	—	8
6317	2.8	9.5	—	10	11	13	19	—	15
6319	2.8	7.8	10	9	10	13	—	—	13
6320	1+	11.0	9	8	10	12	15	19	14.5
6322	3.0	8.5	9	8	9	11	—	—	20
6638	3.0?	9.0	8	10	10	13	17	—	16

Descriptive remarks.—The shell is moderate in size and turreted with the high and acute spire and the moderately short base. The test is rather thick. The



Text-fig. 3. Anal sinuses of some turrids from the Moeshima shell bed. Unit bar indicates 1 mm for 1, 4, and 5 and 2 mm for 2 and 3.

1. *Clavatula* (*Paradrillia*) *consimilis* (SMITH), GK-M 6635.
2. *Orthosurcula pervirgo* (YOKOYAMA), GK-M 6283 (based on the growth lines).
3. *Turricula* (*Surcula*) *interrupta* (LAMARCK), GK-M 6320.
4. *Horaiclavus splendidus* (A. ADAMS), GK-M 6645.
5. *Et remopa* ? cf. *subauriformis* (SMITH), GK-M 6286.

protoconch is high conical, smooth, and composed of three volutions, of which the first is depressed and very small and the second and the third are subcylindrical. The teleoconch whorls are bluntly angulated at the periphery, ornamented with axials and the spirals, and about nine in number. Eight spiral threads are visible on the first whorl and rather granular at the intersections with the axials. The lower five threads are stronger than the others which are situated on the concave slope and later become obsolete. A few secondaries are intercalated in the interspaces on the lower part of the fifth whorl. Furthermore on the sixth a few tertiaries are introduced. The axial plicae are protractly oblique, curved with retract upper part, elevated, rather prominent at the periphery, gradually weakened below, abruptly weakened above the angulation, and hardly reach the upper suture. They are faded away on the upper part of the basal slope. The suture is somewhat depressed, undulate, clasped by the succeeding whorl, and provided with the obsolete subsutural band. The aperture is pyriform with elongate and oblique canal anteriorly which is truncated at the end. The outer lip is simple, thin, sharp, and smooth inside. The inner lip is sigmoidally flexuous, covered by the obsolete callous matter, and devoid of the parietal callus pad. The anal sinus is moderately deep, V-shaped, almost symmetrical concerning with the apex, which is situated at the middle of the concave shoulder.

The present species is featured by its profile; that is to say, by distinctly angulated periphery and remarkably contracted base. Moderately long canal without any umbilical fasciole indictes that the present species is not included in *Drillia* GRAY, 1838, but in *Turricula* (s. l.) SCHUMACHER, 1817. On the basis of the spiral threads on the whole surface except for the protoconch it is identified to the subgenus *Surcula* H. and A. ADAMS, 1853. It also shows the affinity to *Fusiturricula* WOODRING, 1928, but is readliy distinguished from the latter by the polygyrate protoconch.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—East and north sea-cliffs of Moeshima, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

Subfamily Clavatulinae H. and A. ADAMS, 1853

Genus *Clavatula* LAMARCK, 1801

(type-species: *Clavatula coronata* LAMARCK by monotypy)

Subgenus *Paradrillia* MAKIYAMA, 1940

(type-species: *Drillia dainichiensis* YOKOYAMA by original designation)

Clavatula (Paradrillia) consimilis (SMITH)

Pl. 29, Fig. 11; Pl. 30, Figs. 11 and 13; Pl. 34, Fig. 12; text-figs. 3 and 4.

1879, *Pleurotoma consimilis* SMITH, *Proc. Zool. Soc. London*, for 1879, p. 188, pl. 19, f. 11.
1961, *Paradrillia patruelis*, HABE, *Colored Illustr. Shells Japan, No. 2*, p. 76, pl. 38, f. 7.
1961, *Clavatula (Paradrillia) elachystoma convexiuscula* SHUTO, *Mem. Fac. Sci. Kyushu Univ. Ser. D, Vol. 11, No. 2*, p. 109, pl. 6, f. 15 and pl. 10, f. 18, text-fs. 9 and 10.

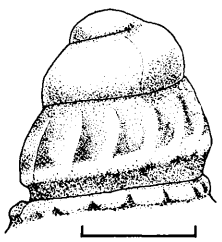
Material.—GK-M 6628 to 6636, 8076, and 8094 to 8100. Preservation is favourable.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	number of the axials I	II	III	IV	V	VI	VII	VIII	IX
6628	20.0	7.2	9.7	36.0	48.5	2.0	9.25	35.4	20.7	12	13	13	13	13	12	13	14	14
6629	18.5	6.3	9.4	34.0	50.8	1.8	8.25	35.2	23.2	14	13	14	14	14	13	14	14	—
6630	14.45	5.2	7.55	36.0	52.2	2.0	8.0	33.2	22.9	14	14	14	14	14	14	14	15	—
6631	26.2	8.7	13.0	33.2	49.6	1+	9.0	33.1	21.3	14	14	15	13	14	14	15	17	19
6632	19.2	6.85	10.3	35.6	53.6	2.0	8.0	36.5	21.1	13	15	15	14	14	15	16	17	—
6633	17.9	6.3	9.3	35.2	51.9	2.25	9.0	35.7	22.4	—	—	12	14	13	13	14	12	15
6636	20.45	7.4	10.0	36.1	48.9	2.0	9.0	37.2	20.0	15	15	15	15	14	14	14	14	15
8094	20.4	7.8	10.5	38.2	51.4	2.0	8.6	41.6	24.5	17	15	14	14	14	13	15	16	—
8097	12.1	4.7	6.8	38.8	56.2	2.25	7.1	40.8	29.9	13	13	13	14	14	14	13	—	—
8099	19.15	7.0	10.0	36.5	52.2	2.25	8.6	44.1	26.2	14	13	13	13	12	13	12	14	—
8100	18.8	6.75	9.8	35.9	52.1	1.5+	8.5	39.7	25.1	15	14	15	14	13	13	13	13	—

Remarks.—The present specimens, on one hand, are fairly constant in the measurable characteristics as indicated in the measurements, but on the other hand they show a remarkable variation in such innumerical characteristics as the strength, arrangement, and density of the sculptures. The majority of the specimens conforms in the general features with *Clavatula (Paradrillia) elachystoma convexiuscula* of the Miyazaki group (Lowest Pliocene) reported by myself. The specimen GK-M 6635 is provided with stronger spirals of almost equal strength below the angulation of the body whorl and the intersections of the spirals and the axials form the regular small granules. This results that the specimen is quite similar to *C. (P.) consimilis* (SMITH), which is living in Japanese waters. The close examination of the plenty specimens indicates that they are remarkably variable in the mentioned character. Herein it is better to include "*C. (P.) elachystoma convexiuscula*" in *C. (P.) consimilis*. Then it is still a question whether *C. (P.) elachystome* MARTENS (1901, p. 17 and 1903, p. 81, pl. 2, f. 13) from off east Africa is conspecific with *consimilis* or not.

The present specimens show some resemblance to *C. (P.) patrualis* (SMITH) (1979, p. 188, pl. 19, f. 10) in having white coloration band on the peripheral angulation, but is clearly distinguished from the latter, because the latter has weaker and more numerous axials and spirals than the former. Under such circumstance I presume that they, including all above mentioned, form a natural group grading and fusing one another. I sustain, however, the revision and grouping of these species untill I have a chance to examine the plenty of specimens belonging to these species.



Text-fig. 4. Protoconch of *Clavatula (Paradrillia) consimilis* (SMITH), GK-M 6630. Unit bar indicates 0.5 mm.

The present species show a tendency to become umbilicate and for outward bending of the lower part of the labrum. That is to say the straight columella is tightly fused with the snout on the young specimens and then a slit is formed and becomes distinct gradually druing growth stages. Finally a definite false-umbilicus is seen on the fully grown one as shown in the specimen GK-M 6631. Keeping the pace with this enlarging of

the umbilical slit, rather smoothly curved lower part of the labrum becomes contracted and the lowest part below the contraction is outwardly bended. A further distinct tendency observed is formation of a parietal notch bordered by the weak parietal tuberculation. These features observed on the fully grown specimen may suggest an intimate phylogenetic relation between *Paradrillia* and Clavinae.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Sea-cliffs of Moeshima isle, Kagoshima bay.

Geologic range.—Early Pliocene to Recent.

Subfamily Clavinae POWELL, 1942

Genus *Horaiclavus* OYAMA, 1954

(type-species: *Mangelia splendida* A. ADAMS by original designation)

Horaiclavus splendidus (A. ADAMS)

Pl. 29, Figs. 13, 14, and 15; text-figs. 3 and 5.

1867, *Mangelia splendida* A. ADAMS, *Proc. Zool. Soc.* for 1867, p. 309, pl. 19, f. 24.
1952, *Clavus splendidus*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 47.
1954, *Horaiclavus splendida* OYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 2*, p. 52.
1961, *Horaiclavus splendidus*, HABE, *Colored Illustr. Shells Japan, No. 2*, p. 77, pl. 38, f. 13.

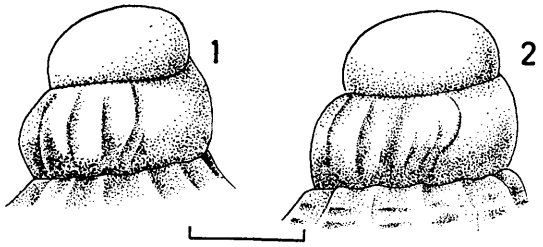
Material.—GK-M 6642 to 6654 and 8061 to 8065. Preservation is favourable or perfect.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials					spirals
GK-L	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		I	III	V	VII	IX	pen
6642	29.2	9.35	12.25	32.0	41.9	1.66	9.5	29.8	18.9	13	11	—	19	20	—
6643	27.1	9.0	13.1	33.2	48.3	1.66	9.0	35.7	20.1	14	12	13	17	21	13
6644	25.45	8.5	11.85	33.4	46.5	—	9.0	40.1	17.7	—	11	12	15	19	15
6645	23.25	8.3	11.55	35.6	49.6	1.66	9.0	35.3	20.8	13	11	12	16	20	16
6646	17.2	5.7	8.85	33.1	51.4	1.66	7.5	39.9	15.6	14	13	14	15	—	—
6647	29.75	10.35	15.2	34.7	51.1	—	9.0	36.2	21.5	—	11	13	17	19	17
6648	26.1	8.9	12.5	34.1	47.9	1.66	9.0	35.4	18.9	13	10	11	14	17	13
6649	24.4	8.0	11.8	32.8	48.3	—	9.0	37.3	18.8	—	13	13	14	19	—
6650	23.1	7.65	11.25	33.1	48.7	1.66	8.66	37.6	19.2	13	11	13	17	—	17
6651	28.8	9.0	13.65	31.2	47.4	—	9.33	35.2	15.3	—	13	13	17	17	17
6652	28.4	9.1	13.6	32.0	47.9	—	8.5	33.1	17.6	—	11	15	20	—	—
6654	25.8	8.95	12.9	34.7	50.0	1.5	9.0	38.3	18.2	14	11	13	13	21	—
8062	25.4	8.7	12.3	34.3	48.4	2.0	9.0	38.6	18.7	14	12	11	16	20	14

Remarks.—The present species has a blunt and rounded protoconch, composed of one and two-thirds smooth volutions. The first volution is rather large and dome-shaped and the second is globose. The protoconch is followed by the first post-nuclear whorl with brephic axial riblets. The labrum is almost straight and vertical without any distinct sinus at the anterior and the posterior part.

The genus *Horaiclavus* OYAMA, 1954, was established on the basis of *Mangelia splendida* A. ADAMS as the type species. It is characterized by the following diagnosis: (1) slender shell of moderate size with the outline of elongated bucciniform, (2) dome-



Text-fig. 5. Protoconchs of *Horaiclavus splendidus* (A. ADAMS) and *Anacithara* (*Anacithara*) *moeshimaensis* n. sp. from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Horaiclavus splendidus*, GK-M 6645.
2. *Anacithara* (*Anacithara*) *moeshimaensis*, GK-M 6669.

shaped paucispiral smooth protoconch followed by the short brephic stage, (3) ornamentation consisting of narrow but distinct axial ribs and obsolete spiral lines, (4) rather wide and rhomboid aperture with very short, widely open, and very shallowly notched canal, without apparent anal sinus and stromboid notch, and (5) prominent varix outside the labrum and distinct callus on the inner lip especially at the upper part of the parietal lip.

These characteristics especially the features of the protoconch, aperture, and outline remind us of the Australian genus, *Anacithara* HEDLEY, 1922, with the type-species, *Mangilia naufraga* HEDLEY. The differences between the two are (1) *Anacithara* being smaller in size, (2) its spiral threads being more distinct, and (3) its parietal callus being weaker than in *Horaiclavus*. These differences are less significant than the common characteristics. Here we are confronted with a difficulty that the two genera, inspite of their intimate morphologic similarity, belong to different subfamilies. *Horaiclavus*, in reality, has some features of Clavinae such as the distinct columellar callus showing a tendency for detouched edge and consequently a tendency for a umbilical fasciole. It may be a representative between Clavinae and Mangeliinae, but the definite systematic position should be settled after examination of the soft part.

The genus represents rather a small group in the subfamily Clavinae including a few species, *H. splendidus* A. ADAMS, *H. madurensis* (SCHEPMAN) (1913, p. 419, pl. 27, f. 4), and other inconcretely identified ones. *H. madurensis*, which was reported as *Drillia* originally, is a very close ally to the present species. They resemble each other in the coloration, ornamentation, and protoconch besides the generic characteristics. The criteria of distinction of them are that the present species is slenderer in outline, larger in size, and more round at the side of the whorls than *H. madurensis*. Under such circumstances I am inclined to consider that the difference is not of specific rank but of subspecific.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

Genus *Turridrupa* HEDLEY, 1922

(type-species: *Pleurotoma acutigemmata* SMITH by original designation)

Turridrupa kagoshimaensis n. sp.

Pl. 31, Figs. 4, 5, and 18; Text-fig. 6.

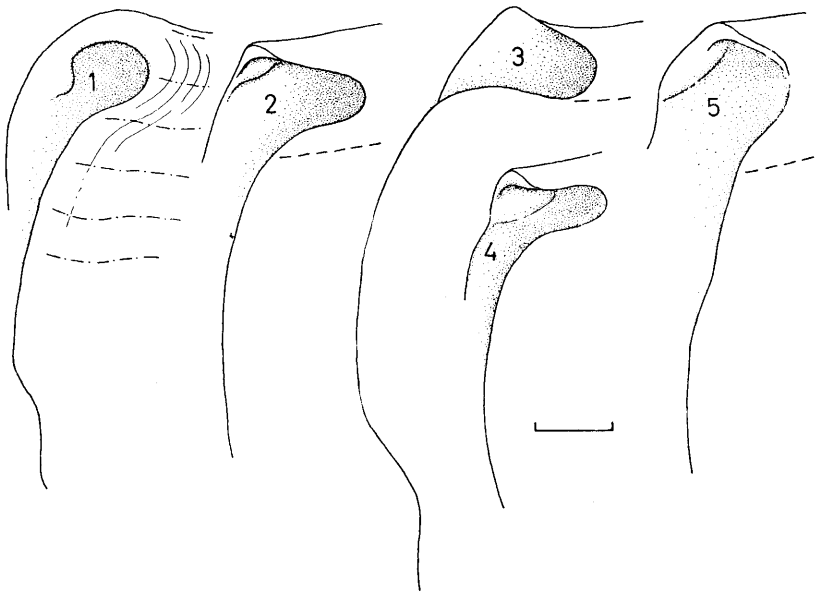
Material,—Holotype: GK-M 6666. A single specimen which is broken at the apex.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls	<A	<P	numb. axials				prim. spirals				
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)	II	III	VI	V	I	II	III	IV	V
6666	12.95	5.25	7.55	40.5	58.3	—	ca 5	42.7	21.5	12	13	14	0	3	4	4	5	—

Diagnosis.—The shell is moderately small and turreted with the high conoidal spire and the shorter base. The test is thick and solid. The early whorls including the protoconch are missed and the preserved whorls are five in number. They are ornamented by the axial folds and the spirals which consist of the primary ribs, a secondary thread, and many tertiary threads. The spirals predominate over the axials. Three primaries appear at first respectively close to the upper suture (I_s) at the middle of the whorl (I_m), and closely above the middle one (I_2). The last mentioned one is somewhat smaller than the others and the middle one forms the median peripheral keel. These two spirals gradually apart from each other during growth stages as a result of the change of the position. That is to say the keel-forming (I_m) changes its postition downward and (I_2) upward. This also renders to the profile of the whorl a distinct tendency for round-sidedness. On the next whorl a fourth primary (I_4) is added close to the lower suture and a weak secondary appears at the middle of the concave sinus-area which is bordered by the subsutural rib above and the second primary (I_2) below. On the third whorl the interspaces between the primaries and the secondary are covered by numerous minute spiral lines. On the penultimate whorl the primaries increase to five in number as the result of addition of another one at the lowest part of the whorl. They are regularly spaced with the interspaces of equal width except for the uppermost one on the sinus band which is one and a half times as large as the others. The axials are rather weak or moderate and slightly oblique. On the first whorl they are twelve in number, moderate in relief, and wider than the interspaces. They reach the lower suture but fade away on the shoulder. They, on one hand, slightly increase in number to fourteen on the penultimate whorl, and on the other hand they are weakened. Consequently they hardly reach the lowest primary spiral thread downward and also the second one (I_2) upward on this whorl. Further on the body whorl they are only discernible as the faint undulation or trace of undulation. Corresponding with the strength of the axial folds the primary spirals at the middle part of the whorls are distinctly crenulated.

The body whorl is large occupying about a half of the shell height. The shoulder is steeply sloped and concave; the peripheral surface is almost vertical; the basal surface is gradually contracted to the straight and short snout. The primaries are seventeen in number, regularly spaced with the intercalation of regular and equal interspaces except for the uppermost one which is wider and fully occupies the anal



Text-fig. 6. Anal sinuses of some turrids from the Moeshima shell bed. Unit bar indicates 1 mm for 1 and 2 and 2 mm for 3, 4 and 5.

1. *Turridrupa kagoshimaensis* n. sp., GK-M 6666.
2. *Inquisitor japonicus* (LISCHKE), GK-M 6305.
3. *I. jeffreysii* (SMITH), GK-M 6637.
4. *Pseudoinquisitor pseudoprinciparis* (YOKOYAMA), GK-M 6302.
5. *Clathrodrillia moeshimaensis* n. sp., GK-M 6655.

band and for the narrower one at the boundary between the basal surface and the snout.

The aperture is rhomboid with a short but defined canal anteriorly and a subtubular anal sinus posteriorly. The outer lip is sharp at the edge, swollen to form a varix outside, smooth inside, and provided with a stromboid notch at the lower part. The inner lip consists of the short, curved, and oblique parietal one and the vertical and straight columellar one and covered with a distinct callus, the edge of which is sharply bordered but not free from the snout. The parietal tubercle is elevated and solid rendering a typical subtubular feature to the U-shaped anal sinus. The anal sinus is moderately deep and asymmetrical; its upper arm is short and converges to the upper suture with a half of the right angle and the lower arm is forwardly produced. The sinus band is transversed by a distinct secondary spirals at the position slightly below the apex of the sinus. The canal is slightly oblique, straight, short, and bordered by a moderate swell at she lower part of the inside of the outer lip.

Comparison.—The present specimen is included in the Clavinae on the basis of the subtubular anal sinus with the parietal tubercle and the stromboid sinus at the anterior part of the labrum, although the protoconch is not known. Further it is characterized by the distinct spiral rib transversing the area of the anal band and by the crenulations on the peripheral keels corresponding with the axial folds. This feature is the most important generic diagnosis of *Turridrupa* HEDLEY, 1922, with

the type species *Pleurotoma acutigemmata* SMITH, as mentioned by the original author and by POWELL.

Turridrupa maoria POWELL (1942, p. 117, pl. 11, f. 10) is a resembling species to the present one, but the latter is distinguished from the former in having longer shell, more numerous primary spirals, lower position of the spiral cord of the anal sinus band, and more distinct axials.

The present species is closely allied to the Indonesian species "*Drillia*" *timorensis* and "*D*". *kwandangensis* reported by SCHEPMAN (1913, p. 415, pl. 26, f. 10 and p. 414, pl. 26, f. 9 respectively). These are considered to be included also in *Turridrupa* on the basis of the same characteristics just mentioned above. The present species is distinguished from *T. timorensis* in having larger shell with weaker axials and more numerous primary spirals. It is also distinguishable from *T. kwandangensis* in larger size and much weaker and more numerous axials than the latter, on which the axial folds are apparently visible even on the body whorl.

Horizon.—The Moeshima shell bed (Upper Pleistocene)

Locality.—Sea-cliff, northeast of Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Clathrodrillia* DALL, 1918

(type-species: *Pleurotoma gibbosa* REEVE=*P. gibbosa* KIENER by original designation)

Clathrodrillia moeshimaensis n. sp.

Pl. 31, Figs. 8, 9, and 10; Text-fig. 6.

Material.—Holotype: GK-M 6655. A single specimen Which is slightly broken at the protoconch and the labrum but characteristic enough to serve for identification.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials					numb. spirals(bod)		
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		II	V	VIII	pen	bod	AB*	LS*	snout
6655	40.0	33.9	15.5	57.3	38.8	—	10	38.7	24.2	14	16	18	19	18	16	33	13

*AB: anal band, LS: lateral surface

Diagnosis.—The shell is moderate in size, turreted with the moderately high spire and rather the short base. The test is thick and solid. The protoconch is not preserved. The teleoconch whorls are about ten in number, almost twice wider than high, and roundly angled at the middle with a distinct concave surface above and a gently convex surface below. The surface is ornamented with the distinct axial ribs and the numerous fine spiral threads and lines. The axials are distinct and rather sharp, but very narrow. They reach both the upper and the lower suture, separated by twice wider interspaces, and retrocurrently oblique. The upper one-third of the axials, which is on the anal band, is concave oralward and the lower two-thirds are weakly flexuous and somewhat stronger than the upper part on the anal band. The axial ribs are counted by fourteen, sixteen, eighteen, nineteen and eighteen respectively on the second, fifth, eighth, nineth, and the last whorl. The

spirals are not precisely observed on the early whorls because of abrasion. On the fourth and fifth whorls the distinct spiral lines separated by wider interspaces are counted by fourteen to fifteen and widely spaced on the lower surface and narrowly arranged on the upper. On the sixth whorl several secondaries are intercalated in the interspaces in rather irregular pattern. The body whorl is large occupying more than half of the shell-height, concavely shouldered at the upper part, roundly angulated at the periphery, gradually cotracted below to the straight snout. The axials disappear on the basal slope. An irregular axial swell, which looks like a varix, is observed on the body whorl somewhat apart from the very margin of the labrum. The spirals on the body whorl consist of the finest sixteen lines on the concave anal band, moderately spaced thirty-three threads on the convex lateral surface, and strongest thirteen threads on the snout. The suture is depressed without any subsutural cord or band.

The aperture is rhomboid with the pointed posterior end and the wide and short anterior canal. The outer lip is slightly broken at the posterior margin. It is smooth inside and simple at the very edge. The anal sinus is moderately deep, occupying the entire concave shoulder, v-shaped with the blunt apex and the subsymmetrical upper and lower arms, of which the upper one converges to the upper suture with a half of right angle and the lower one is forwardly developed forming a retrocurrent curve. The inner lip consists of the oblique and short parietal one and the vertical and long columellar one, both of which are covered by a heavy callus. The edge of the columellar callus is free from the surface of the snout to form a shallow and narrow false umbilical slit between them. The parietal tubercle is heavy and situated close to the suture. The anterior sinus of the labrum is stromboid but very weak.

Comparison.—The present specimen belongs to Clavinae on the basis of the characteristics of the aperture. The narrow axial ribs extending from the upper suture to the lower one, fine spiral lines, and lack of the subsutural band are the sufficient basis for identification of it to *Clathrodrillia* WOODRING, 1928, although the protoconch is not examined.

The present species closely resembles *Clathrodrillia rutteni* OOSTINGH from the Pliocene beds of Sumatra (OOSTINGH, 1938, p. 36, pl. 2, figs. 36, 37), but the former is distinguished from the latter by its one and a half times larger shell, more numerous and more curved axials, and much closer spiral lines than the latter. They may be, though separated as different species, in close phylogenetic relation. There is no other species comparable with them in Japan and elsewhere.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast cliff at Moeshima, Kagoshima bay.

Geologic range.—Late Pleistocene.

Clathrodrillia sp.

Pl. 33, Figs. 4, 5, and 9. Text-fig. 7.

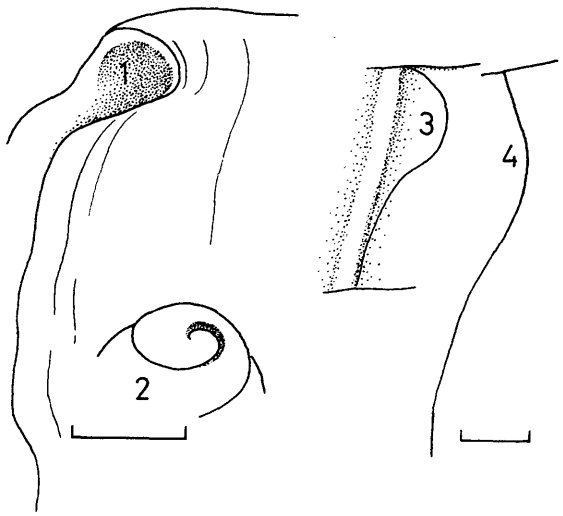
Material.—GK-M 8066. The specimens is broken at the apex but the other part is almost perfectly preserved.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)	numb. whorls (PN)	<P (degrees)	axials atp*	axials pen	axials bod	spirals pen	spirals bod
8066	24.7	8.8	13.8	10.0	35.6	55.9	40.5	8.5+	25	11	12	14	18	38

* antipenultimate whorl.

Description.—The shell is moderate in size and fusiform with high conical multigyrate spire and somewhat long base. The test is thick and solid. The protoconch and the earliest part of the teleoconch are unknown. The preserved whorls are eight and a half, separated by the slightly appressed and somewhat oblique sutures one another, moderately concave at the anal band, and roundly convex at the periphery below the anal band. The concavity at the anal band becomes distinct gradually as the shell grows and consequently it is marked by the remarkable constriction on the body whorl. The body whorl is large occupying about a half of the total height, markedly contracted below the suture, narrowly rounded at the periphery, then gently curved and again distinctly contracted at the base to the rather long and straight snout. The sutures are remarkably clasped upward by the succeeding whorl, but devoid of the subsutural band. The ornamentation consists of the narrow but sharply elevated axial ribs and close and fine spiral threads. The axials are moderately oblique and reach both the upper and the lower suture, but are most prominent at the periphery and somewhat weakened near the lower suture and the anal band, where the axials are curved with the concave face oralward in line with the growth lines. On the body whorl they apparently reach the snout. The number of the axials gradually increases on later whorls and counted twelve and fourteen respectively on the penultimate and the body whorl. A few spiral threads are observed at the lower



Text-fig. 7. Anal sinus (1) and protoconch (2) of *Agladrillia oyamai* n. sp., GK-M 8116, and growth line (3, on 4th whorl; 4, on 5th whorl) of *Clathrodrillia* sp., GK-M 8066. Unit bar indicates 1 mm respectively.

surface of the preserved third whorl; on the next whorl several minute lines are added at the upper half of the anal band. This pattern is kept until on the body whorl. On the penultimate whorl about ten on the lateral surface are distinct and one-third as wide as the interspaces, and another eight to ten on the upper part of the anal band are extremely fine and close. On the body whorl the distinct ones are about twenty-eight, of which those on the snout are somewhat stronger than the others. The aperture is elongately rhomboid with rather the long canal. The anal sinus is moderately deep, regularly curved occupying the contracted anal band on the nepionic whorls and gradually becomes shallower later. In consequence they are very shallow on the last part of the body whorl. The labrum is slightly antecurrent, smooth inside, and markedly variced outside slightly apart the very margin. The inner lip is composed of the short and oblique parietal one and the straight and vertical columellar one. It is heavily covered by the callus, which is especially thick at the upper part of the parietal lip close to the suture to form a tubercle and conjoined with the anal sinus. The columellar callus is also solid and has free edge at the lower half and shows a tendency for week *Drillia*-like umbilicus and heavy fasciole on the snout. The canal is rather long, almost in line with axis of coiling, widely open, and obliquely truncated at the end.

Comparison.—The present species is characterized by fusiform outline, narrow but sharply elevated axial ribs, fine and close spiral threads, rather long and open canal, heavy callus, shallow anal sinus, and distinct varix of the labrum. These features almost completely coincide with those of *Clathrodrillia*, except for being devoid of the distinct stromboid notch at the labrum.

It is also similar in some degrees to *Horaiclavus* in the general features, but the former is readily distinguished from the latter in having deeper anal sinus, much more constricted anal band, and longer anterior canal. *Darbya* BARTSCH, 1934, from the deep water of Atlantic Ocean is another ally to the present species, but the former has more turreted spire, distinct subsutural band, and deep semitubular anal sinus.

The present species is readily distinguished from *Splendrillia* POWELL, 1942, in being provided with the labrum varix, distinct spiral threads, and axials extending from suture to suture and devoid of the stromboid notch. It also differs from *Cymatosyrinx* DALL, 1889, in being provided with the labrum varix, shallow anal sinus, and distinct spirals and devoid of the subsutural band and stromboid notch at the labrum.

The present species resembles *Pleurotoma bilineata* REEVE (1843, pl. 25, sp. 225) from Philippines, but the latter has more nodulous axials and somewhat larger pleural angle than the former. It may be a new species, but the establishment is suspended because the specimen is only a single and incomplete in preservation.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Agladrillia* WOODRING, 1928

(type species: *Agladrillia callothyra* WOODRING, by original designation)

Agladrillia oyamai n. sp.

Pl. 33, Figs. 1, 2, 3, and 8; Text-figs. 7 and 17.

Materials—Holotype: GK-M 8116; paratypes: GK-M 8117, 8118, and 8119. Preservation is almost perfect but GK-M 8116, 8117, and 8118 are slightly worn at the surface of the later whorls and GK-M 8119 is slightly abraded at the apex.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)
8116	12.0	4.0	6.85	4.9	33.3	57.1	40.8
8117	11.7	4.25	6.75	5.15	36.3	57.7	44.0
8119	7.8	3.0	4.7	3.35	38.5	60.3	43.0

specimen	numb. whorls		<A	<P	axials				spirals		
GK-M	(N)	(PN)	(degrees)		I	II	III	IV	I	II	bod
8116	3.0	5.5	39.2	16.3	11	13	12	13	2	7	49
8117	3.0	5.3	42.1	18.6	11	12	11	12	2	8	62
8119	3.0	4.3	41.0	16.6	12	11	12	15	2	7	20

Diagnosis.—The shell is small attaining about 12 mm in height, slender, and fusiform with tall spire and rather long base. The test is remarkably thick and solid. The protoconch is blunt and dome-shaped, consisting of three smooth volutions, of which the first is very small and partly sunk in the succeeding volution forming concavity at the very apex, and the remainder ones abruptly increase in size and roundly convexed at the side. The protoconch is ended by a sinusigera ridge. The teleoconch whorls are about five, convexed at the side, and ornamented by the distinct subsutural lira, the slightly oblique axial plicae, and the distinct spiral threads which override the axials. The body whorl is large occupying about sixty percent of the total height of the shell, emarginate at the suture, slightly concave at the anal band, bluntly angulated at the periphery below the anal band, gradually contracted at the base to the short and straight snout. The suture is overlapping with the distinct subsutural lira. The peripheral angulation, which separates the concave anal band and the convexed lateral surface, is very sharp and situated at the lower one-third on the first teleoconch whorl; thereafter it changes gradually its position posteriorly, and in consequence it is at the upper one-third to two-thirds on the fourth whorl. In keeping pace with the change its position, it becomes slightly weaker later. The axial plicae are antecurrently oblique, slightly curved with the convex face oralward, rather prominent, and much wider than the interspaces. They apparently reach the lower suture without any reduction in strength but weakened at the anal band and hardly reach the subsutural lira on the early whorls. They become gradually weak and close as the shell grows. On the body whorl of the fully grown specimen they are about thirteen in number, wider than the interspace, but not prominent and faded away on the basal surface and the anal band. The spiral ornamentation starts as one thread (I_m) on the peripheral angulation, soon after a second primary (I_2) is added on the surface between (I_m) and the lower suture. Three

secondaries, which are somewhat weaker than the primaries, appear on the anal band of the first whorl. The other primaries appear from the overlapping part of the succeeding whorl one after another on the later whorls and counted five to seven on the penultimate whorl and more than twenty on the body whorl. The crossings of the spirals and axials are granularly elevated. The aperture is elongately rhomboid with almost parallel lips. The canal is short but distinct, widely open, defined by the thickened buldge at the anterior part of the inner surface of the labrum, and anteriorly truncated. The anal sinus is moderately deep with round apex and gently sloped lower arm. The outer lip is almost vertical with shallow stromboid sinus anteriorly, thickened inside, varicose outside. The varix is some distance from the sharp edge on the specimen GK-M 8116 and 8117, and close to the edge on 8118 and 8119. The parietal entering callus is strong rendering the semitubular appearance to the anal sinus. The inner lip consists of the oblique and short parietal one and the vertical columellar one and covered by a distinct callus.

Comparison.—The present species is characterized by the distinct subsutural band which is clasping upward on the preceding whorl, deep subtubular anal sinus with strong parietal entering callus, and stromboid sinus at the anterior part of the labrum. These features indicate that the specimens belong to Clavinae. Among the genera of Clavinae it is closest to *Agladrillia* WOODRING, 1928, with the type-species *Agladrillia callothyra* WOODRING, with typical features including slender outline, long and narrow aperture, stout and smooth protoconch, and other characters. The detailed examinations of the present specimens, however, clarifies some differences from *Agladrillia*. All the protoconchs of the present specimens have a slight concavity at the very apex, which is resulted from upward coiling of the early part of the second volution as is shown in text-fig. 7. The varix of the outer lip is lightly distant from the very edge of the labrum on the fully grown specimens, but it is close to the edge on the other ones. Furthermore the ornamentation of the present specimens becomes weak at the mature stage although it is distinct throughout growth stages on the type species of *Agladrillia*. In spite of these differences I am inclined to consider the present specimens are better to be included in *Agladrillia*, because the former is closest in relation to the latter among Clavinae.

Mangilia arcta SMITH from Indian Ocean and South China Sea is considered to be included in *Agladrillia* basing upon the original description (SMITH, 1884, p. 325) and subsequent one with figure (MELVILL, 1917, p. 168, pl. 9, figs. 10, 10a). The present species is very closely allied to *A. arcta*, but the former is distinguished from the latter in more oblique and less numerous axials than the latter.

Mangilia glaclenta REEVE (Conch. Icon. Vol. 1, *Pleurotoma* pl. 14, sp. 114) is, according to MELVILL, a close ally to *A. arcta*, but the present species is quite different from *P. glacilenta* in having slightly arcuate ribs with the convex face oralward which are faded away on the anal band. While the axials of *P. glacilenta* are sigmoid and reach apparently the upper suture.

The present species is readily distinguished from *A. callothyra* WOODRING (1928, p. 158, pl. 5, fig. 7), the type species of the genus, in having slenderer body whorl, less contracted base, weaker ornamentation on the later whorls, and more conoidal

spire with blunt apex. It also differs from *A. leptalea* WOODRING (1928, p. 158, pl. 5, fig. 8), which is more convexed at the periphery, more distinctly contracted at the base, and ornamented with stronger axials and spirals even on the body whorl.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities—East and northeast sea-cliffs at Moeshima, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Cymatosyrinx* DALL, 1889

(type species: *Pleurotoma lunata* LEA by original designation)

Subgenus *Cymatosyrinx* (s. s.)

Cymatosyrinx (Cymatosyrinx) laevis n. sp.

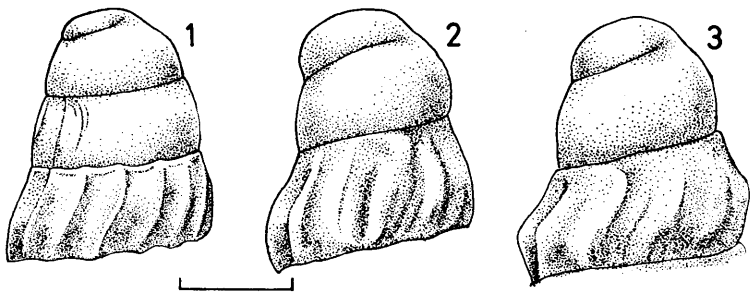
Pl. 29, Fig. 9; Pl. 33, Figs. 6, 7, and 11; Text-figs. 8 and 9.

Material.—Holotype; GK-M 6315; paratype: GK-M 8101.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	VI	VII	VIII	XI
6315	27.6	8.4	12.85	30.4	46.6	2.25	9.0	32.6	16.9	12	12	13	14	14	15	16	15	16
8101	23.3	7.6	11.85	32.6	50.9	2.30	9.0	36.8	19.0	10	12	13	15	16	17	18	18	18

Diagnosis.—The shell is moderately small and turreted with the very high spire and the rather short base. The test is thick and solid. The protoconch is smooth and composed of about two and one-fourth volutions, of which the first is depressed, cap-shaped, and oblique; the early half of the second is roundly convexed at the side and the remainder part is subcylindrical. They are separated by weakly depressed suture one another. The teleoconch whorls are nine in number, gradually increase their size forming sharp pleural angle of about seventeen to nineteen degrees, convexed with obsolete angulation at the periphery, and obliquely plicated. The peripheral angulation is situated at the lower two-fifths on the early whorls and then gradually changes its position upward to slightly above the middle of the whorl-height on the penultimate whorl. The surface above the angulation is moderately concave and steeply sloped; the surface below the angulation is slightly convex and receeded to the lower suture. The suture is slightly depressed, somewhat clasped by the succeeding whorl, but devoid of the subsutural band. The body whorl is moderately large occupying slightly less than a half of the shell height, concave and steeply sloped below the suture, bluntly angulated at the periphery, and gradually contracted below to the short snout. The axials are moderately elevated, narrower than the interstices, remarkably oblique, and slightly sigmoid with the oralwardly concave upper part and retrocurrent middle and lower part. They extend from the upper suture to the lower one, although somewhat stronger on the angulation than on the remainder part. They are ten to twelve for one whorl at first and gradually increase in number to sixteen to eighteen on the body whorl. The spiral ornamentation is not developed on the spire whorls, but about fifteen close and distinct lines are discernible on the snout and the lowest part of the basal slope, where the spirals are abruptly weakened upward and entirely diminished.



Text-fig. 8. Protoconchs of *Cymatosyrinx* from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Cymatosyrinx* (*Cymatosyrinx*) *laevis* n. sp., GK-M 6315.
2. *C.* (*Splendrillia*) *solicitata* (SOWERBY), GK-M 6284.
3. *C.* (*S.*) *constricta* n. sp., GK-M 6674.

The aperture is elongately rhomboid with very wide and short anterior canal. The outer lip is sharp, simple, smooth inside, and not swollen outside. The anal sinus is U-shaped close to the upper suture, very deep, remarkably narrowed at the entrance by a heavy parietal entering callus together with the extremely produced lower arm of the sinus. The upper and the lower arm on the anal sinus are symmetrical; the former converges to the upper suture with 70 to 50 degrees and the latter curves slightly upward and extends oralward. The stromboid sinus at the lower part of the labrum is sharp. A varix-like vertical swell is developed a little behind the labrum, extending from the upper suture to the basal slope. The inner lip is coverved by a distinct callus, the outer margin of which is free and detouched from the snout.

Comparison.—The present specimens are quite identical to *Cymatosyrinx* DALL, 1889, except for the hardly defined fasciole band on the snout which is very prominent on the type species of *Cymatosyrinx*. The present specimens are considered to be in close relation to *Elaeocyma* DALL, 1918, but the former is readily distinguished from the latter by the smooth protoconch devoid of the peripheral keel which is discernible on the last volution of the protoconch of the latter. I am inclined to consider the present species is included in *Cymytosyrinx* and mentioned difference is not of generic value.

The present species shows close affinity to "*Elaeocyma*" *attalia* DALL (DALL, 1919, p. 10, pl. 18, fig. 7) from west coast of Mexico which was originally described on the basis of an imperfect specimen being broken at the apex. It is not certain whether the Mexican species belongs to *Cymatosrinx* or to *Elaeocyma*. The present species is distinguished from "*E*". *attalia* in having much larger shell, somewhat closer axials, and slightly longer base.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Subgenus *Splendrillia* HEDLEY, 1922

(type-species: *Drillia weesi* BEDDOME by original designation)

Cymatosyrinx (*Splendrillia*) *constricta* n. sp.

Pl. 7, Figs. 10, 11, and 12; Text-figs. 8 and 9.

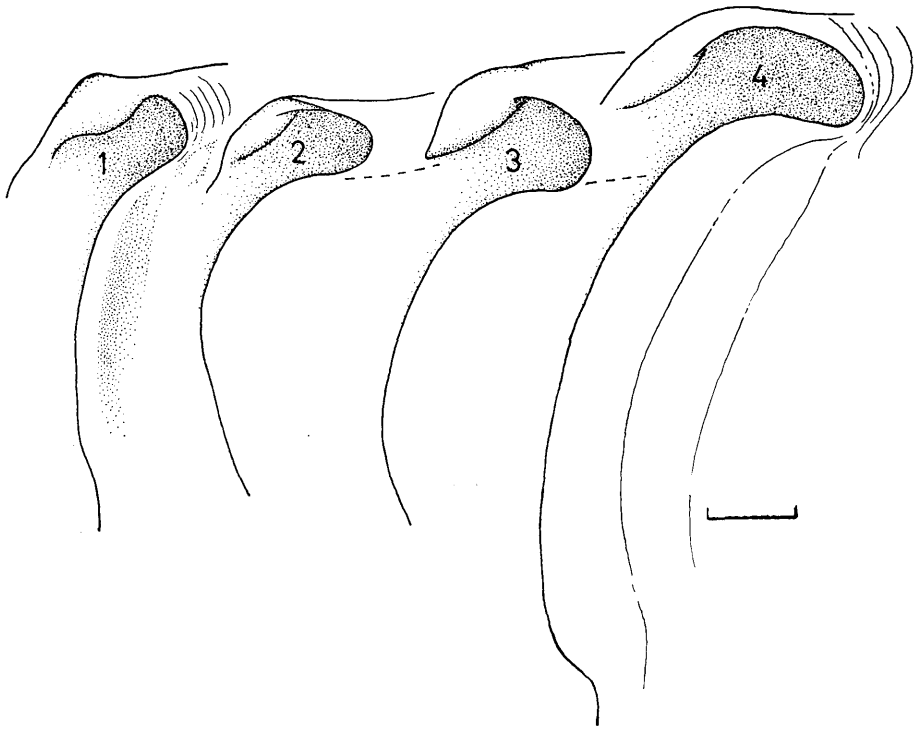
Material.—Holotype: GK-M 6672; paratypes: GK-M 6673, 6674, 8123, and 8134. Preservation is suitable.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	VI	VII
6672	15.15	5.4	7.7	35.6	50.8	1.75	7.0	35.6	17.6	10	10	11	11	11	12	13
6673	14.45	5.4	8.0	37.4	55.4	—	7+	36.9	20.1	?	10	10	10	11	11	13
6674	10.85	3.8	5.6	35.0	51.6	1.66	6.25	37.6	16.0	10	9	10	10	11	12	—
8123	14.05	5.0	6.85	35.6	48.8	2.0	7.0	36.7	18.4	9	10	10	11	11	12	12
8134	14.95	5.5	7.8	36.8	52.2	2.0	7.0	37.6	19.1	9	10	10	10	11	11	13

Diagnosis.—The shell is small in size and turreted with moderately high spire and rather the short base. The protoconch consists of one and two-thirds to two smooth volutions, of which the first one is a oblique and depressed dome and the second is tall with regularly convexed sides and separated from the first by the slightly depressed suture. The teleoconch whorls are about seven in number, angulated at the periphery, and axially plicated. The blunt but distinct peripheral angulation is situated at the lower one-fourth of the whorl height on the first to second whorl, then changes its position gradually upward to about the middle of the whorl height on the fifth and later whorls. Corresponding to this upward change of the position of the angulation during growth stages, the shoulder becomes more concave and less steeply inclined. The lateral surface below the angulation is slightly convex and receded. The suture is hardly depressed and devoid of the subsutural band, but is overlapped by the succeeding whorl. The axial plicae are counted about ten on the first to third whorl, then gradually increased to thirteen on the body whorl. They are moderately oblique and elevated, especially on the angulation, where the plicae are sharply ridged. The axials are as broad as the deep interspaces, gradually weakened below to the lower suture and abruptly faded away just above the angulation. The irregular fine striae are discernible on the shoulder and on the lateral surface between the plicae. Those on the lateral surface are closer than those on the shoulder. The body whorl is large occupying about a half of the shell height, distinctly concave below the suture to form steeply sloping shoulder, bluntly angulated at the periphery, distincty contracted at the base and discontinuous to the straight snout. The axials are faded away at the middle of the basal surface; the spirals on the lower part of the snout consist of about seven apparent lines.

The aperture is rhomboid with the pointed posterior end and the somewhat oblique and short anterior canal. The outer lip is sharp, smooth inside, not swollen outside, and sigmoid in profile with distinct anal sinus and the weak stromboid anterior sinus. The anal sinus is v-shaped, moderately deep with the apex at a little above the middle of the concave shoulder; the upper arm converges to the upper



Text-fig. 9. Anal sinuses of *Cymatosyrinx* and *Inquisitor* from the Moeshima shell bed. Unit bar indicates 1 mm.

1. *Cymatosyrinx* (*Splendrillia*) *constricta* n. sp., GK-M 6672.
2. *C.* (*S.*) *solicitata* (SOWERBY), GK-M 6284.
3. *Inquisitor japonicus* (LISCHKE), GK-M 6627.
4. *Cymatosyrinx* (*Cymatosyrinx*) *laevis* n. sp., GK-M 6315.

suture with a half of the right angle and the lower arm extends forwards (oralward) beyond the forward limit of the upper arm. The inner lip consits of the curved and short parietal one and the vertical and somewhat twisted columellar one, both of which are covered by the thin callous material. The parietal entering callus is distinct but hardly tuberculate. The canal is widely open, slightly oblique, bluntly truncated at the anterior end and definitely bordered by the labrum-constriction at the posterior end. The fasciole is not markedly developed.

Comparison.—The present specimens are identical to *Splendrillia* HEDLEY, 1922, on the basis of the features of the aperture, the axials faded away just above the peripheral angulation, and the blunt protoconch. They are closely allied to *Splendrillia cristata* POWELL (1942, p. 102, pl. 12, fig. 4), but the former is distinguished from the latter by the much more prominent contraction and the base of the body whorl.

Drillia aquatilis REEVE (Conch. Icon. Vol. 1, *Pleurotoma*, pl. 21, sp. 177) is considered to be included in *Splendrillia* on the basis of the general features especially of the aperture and ornamentation. The present specimen somewhat resembles *S. aquatilis*, but the former differs from the latter in the much more distinct basal contraction and sharper peripheral angulation.

Horizon.—The Moeshima shell bed (Upper Pleistocene).
Localities.—Northeast and north sea-cliffs at Moeshima isle, Kagoshima bay.
Geologic range.—Late Pleistocene.

Cymatosyrinx (Splendrillia) solicitata (SOWERBY)

Pl. 29, Figs. 2, 3, 4, and 5; Text-figs. 8 and 9.

1913, *Drillia solicitata* SOWERBY, *Ann. Mag. Nat. Hist. Ser. 8, Vol. 12*, p. 234, pl. 3, f. 2.
1952, *Clavus solicitatus*, KURODA and HABE, *Check list and bibliogr. rec. mar. moll. Japan*, p. 47.

Material.—GK-M 6284, 6285, 6622 to 6626, 6681, and 8120 to 8122.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	VI	VII	VIII
6284	15.4	5.0	7.15	39.0	46.4	2	7.5	37.0	13.1	11	11	10	11	11	12	12	—
6285	13.25	4.7	6.4	35.4	48.3	—	7	37.1	15.9	10	10	10	10	10	12	12	—
6622	17.8	ca5.5	7.6	30.9	42.7	2.2	8.5	31.6	11.2	10	9	9	9	10	10	12	11
6623	14.3	4.9	6.7	34.3	46.9	2.2	7.25	34.8	16.9	11	9	10	11	11	13	14	—
6624	13.1	4.5	6.3	34.4	48.1	2	7	34.2	13.3	9	9	9	9	10	11	8	—
6626	14.45	4.9	7.15	33.9	49.5	—	7+	33.8	16.7	10	9	9	9	10	11	12	—
8120	17.55	5.6	7.75	31.9	44.2	2.3	8.2	36.5	14.7	11	10	10	10	10	11	13	13
8122	21.75	4.4	6.05	34.5	47.5	2.2	7.2	34.5	11.8	10	9	9	9	10	11	11	—

Remarks.—The original author pointed out the characteristic features of the sinus of this species, which is "rather narrow at the entrance and then roundly expanded." That is to say it is subtubular on account of the extraordinary development of the parietal callus pad. Such deep and peculiar sinus as figured by SOWERBY is not observed on the present specimens except for GK-M 6284 and 6625; it is considered to be a gerontic feature.

Horizon.—The Moeshima shell bed (Upper Pleistocene).
Localities.—Northeast and north sea-cliffs at Moeshima isle, Kagoshima bay.
Geologic range.—Late Pleistocene to Recent.

Genus *Pseudoinquisitor* POWELL, 1942

(type-species: *Pseudoinquisitor problematicus* POWELL by original designation)

Pseudoinquisitor pseudoprincipalis (YOKOYAMA)

Pl. 30, Figs. 4, 6, and 12; Text-figs. 6 and 10.

1920, *Pleurotoma (Drillia) pseudoprincipalis* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo, Vol. 39, Art. 6*, p. 37, pl. 1, f. 21.
1928, *Drillia pseudoprincipalis*, YOKAYAMA, *Rep. Imp. Geol. Surv. Japan, No. 101*, p. 32, pl. 1. f. 15.
1935, *Clavus (Brachytoma) pseudoprincipalis*, NOMURA, *Sci. Rep. Tohoku Imp. Univ. 2nd. Ser., Vol. 18, No. 2*, p. 124, pl. 6, f. 38.
1952, *Clavus (Brachytoma) tuberosus*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. 2nd. Ser. Spec. Vol. No. 3*, p. 232.
1954, *Inquisitor (Pseudoinquisitor) pseudoprincipalis*, TAKI and OYAMA, *Palaeont. Soc.*

Japan, Spec. Pap. No. 2, p. 25, pl. 2, f. 21.

1960, *Crassispira pseudoprincipalis*, MacNEIL, *U. S. Geol. Surv. Prof. Pap. No. 339*, p. 112, pl. 5, f. 30; pl. 6 f. 1.

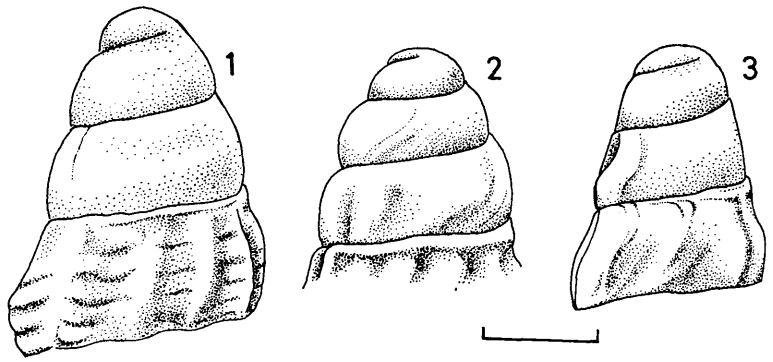
Material.—GK-M 6301 to 6304, 6308 to 6314, 6691 to 6694, 8124 to 8131, and many other unregistered specimens. The registered specimens are good in preservation.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	pen	bod	inclination of axials
6301	41.8+	12.2	20.3	28.6	47.6	—	10+	35.2	16.4	—	—	15	15	22
6302	30.15	8.45	14.75	28.0	48.9	3.2	10.5	30.9	15.6	9	9	15	15	15
6303	23.2	7.05	11.8	30.4	50.9	3	9	32.7	17.5	10	10	14	14	20
6304	29.7	9.1	14.8	30.6	49.8	3	10.5	33.1	15.8	9	9	15	15	17
6692	32+	9.2	15.7	28.0	47.8	1+	10.5	32.9	14·8	9	11	16	17	15
8125	30.1	8.65	14.6	28.7	48.5	3.2	10.0	32.5	14.2	11	11	13	14	23
8126	20.25	6.2	10.8	30.6	53.3	2.8	8.6	36.8	24.5	11	10	14	15	20
8127	33.9	9.55	15.7	28.3	46.3	3.0	11.5	31.5	18.0	11	10	15	15	24

Remarks.—The specimens from the Moeshima shell bed show rather the constant character in morphology and almost perfectly conform with the figured type specimen of the species from the Naganuma formation except for a slight difference in having larger shells with deeper anal sinus and more numerous axials than the latter. The anal sinus is generally elliptical with extremely narrow entrance caused by the prominent parietal entering callus pad and upwardly expanding lower arm of the sinus. Rather the shallow sinus like that of the figured type of the original author is exceptional among the specimens in hand. In spite of these differences they are considered to be within the normal range of variation.

The protoconch of the present species is roundly conical and smooth and consists of three volutions. This is rather the intermediate feature between *Inquisitor* HEDLEY, 1918, and *Pseudoinquisitor* POWELL, 1942, although the present species is closer to *Pseudoinquisitor* which has atypical, paucigyrate, smooth, and globose protoconch of about two and a half volutions instead of the high conical polygyrate one of *Inquisitor.*



Text-fig. 10. Protoconchs of *Inquisitor* and *Pseudoinquisitor* from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Inquisitor jeffreysii* (SMITH), GK-M 6637.
2. *Pseudoinquisitor pseudoprinciparis* (YOKOYAMA), GK-M 6303.
3. *Inquisitor japonicus* (LISCHKE), GK-M 6305.

The secondary spiral threads appear on the fourth or fifth teleoconch whorl and the tertiary ones on the eighth or nineth whorl, on which the secondaries are almost equal in size to the primaries. It should be added that two narrow white bands are discernible respectively at the periphery of the later whorls and at the medial part of the base on the favourably preserved specimens.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Sea-cliffs around Moeshima isle, Kagoshima bay.

Geologic range.—Late Pliocene to Recent.

Genus *Inquisitor* HEDLEY, 1918

(type-species: *Pleurotoma sterrha* WATSON by original designation)

Inquisitor jeffreysii (SMITH)

Pl. 30, Figs. 3, 5, 10, and 14; Text-figs. 6 and 10.

1875, *Drillia jeffreysii* SMITH, *Ann. Mag. Nat. Hist. Ser. 4. Vol 15*, p. 417.
1895, *Drillia principalis* PILSBRY, *Cat. Mar. Moll. Japan*, p. 17, pl. 2, fs. 9 and 10.
1906, *Pleurotoma (Drillia) principalis*, TOKUNAGA, *Jour. Coll. Sci. Imp. Univ. Tokyo. Vol. 21, Art. 2*, p. 14, pl. 1, f. 23.
1920, *Pleurotoma (Drillia) principalis*, YOKOYAMA, ibid, *Vol. 39, Art. 6*, p. 36, pl. 1, f. 20.
1942, *Drillia principalis*, KANEHARA, *Jour. Geol. Soc. Japan, Vol. 39, No. 581*, p. 130, pl. 3, fs. 7a, 7b.
1952, *Clavus jeffreysii*, KURODA and HABE, *Check list and bibliogr. rec. mar. moll. Japan*, p. 47.
1952, *Clavus (Brachytoma) flavidulus*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. 2nd. Ser. Spec. Vol. No. 3*, p. 233.
1954, *Inquisitor (Inquisitor) jeffreysii*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 2*, p. 25, pl. 2, f. 20.
1960, *Clathrodrillia* cf. *jeffreysii*, MacNEIL, *U. S. Geol. Surv. Prof. Pap. No. 339*, p. 113, pl. 14, f. 29.
1961, *Inquisitor jeffreysii*, SHUTO, *Mem. Fac. Sci., Kyushu Univ. Ser. D, Vol. 11, No. 2*, p. 116, pl. 7, f. 3.
1962, *Inquisitor jeffreysii*, HAYASAKA, *Sci. Rep. Tohoku Univ. 2nd. Ser. Vol. 33, No. 1*, p. 90, pl. 12, fs. 6a, b.

Material.—GK-M 6287 to 6300, 6306, 6307, 6637, 6679, 6680, 6682 to 6690, 8055 to 8060, and many other unregistered specimens. The registered specimens are good in preservation.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	numb. whorls (PN)	<A (degrees)	<P (degrees)	numb. axials I	numb. axials II	axials pen	axials bod	spirals pen	inclin. of axials (degrees)
6287	48.35+	14.3	22.1	29.0	44.8	—	12	27.9	18.6	9	8	16	17	9 pairs	22
6288	45.3	13.9	24.3	30.1	52.5	—	11	31.1	21.2	—	9	18	20	10 „	15
6289	40.3	12.4	19.7	30.7	48.8	—	10	30.3	20.1	—	—	14	18	6 „	14
6291	42.2	14.75	24.1	34.9	57.1	3	9.5	33.8	18.3	8	9	18	20	8 „	17.5
6292	49.0	14.0	22.3	28.5	45.5	—	12	32.6	16.4	10	9	17	19	— „	13
6299	31.6	9.8	16.55	31.0	52.3	3.25	10	34.0	19.1	9	9	15	17	— „	11.5
6639	42.2	12.85	20.0	30.4	47.4	3	10.5	33.6	18.7	10	10	19	20	9 „	18
6679	44.4	12.7	19.6	28.6	44.1	2	10.5	36.1	18.1	10	9	20	20	8 „	29
6683	36.8	11.2	15.8	30.4	42.9	3.4	11	33.4	17.3	10	8	14	15	7 „	25
8058	40.6	12.4	19.2	30.5	47.2	—	10.5	37.1	20.8	—	10	17	18	10 „	24

Remarks.—The specimens in hand are rather variable in the density and inclination of the axial ribs on the later whorls and in the density and pattern of the spiral ornamentation. The character of the stromboid anterior sinus of the labrum is also variable in spite of invariability of the anal sinus. On the basis of the general features they are identified to *Drillia jeffreysii* SMITH, which is distinguished from *Clavus flavidulus* LAMARCK in much more concave anal band, definite peripheral angulation below it, and shorter canal than the latter.

The protoconch of the present species is high conical, composed of smooth and round three volutions. While that of the type species of the genus is narrowly conical and polygyrate, consisting of smooth five volutions. Accordingly the present species represents an intermediate type between *Inquisitor* and *Pseudoinquisitor* concerning with the number of the protoconch volutions. This species has somewhat shorter canal and stronger constriction at the base than both *Inquisitor* and *Pseudoinquisitor*. Moreover majority of the specimens is provided at some distance from the labrum with a varix-like swollen fold, which is remarkably stronger and wider than the normal ribs, although it is also abruptly weakened and faded away just above the peripheral angulation like as the normal ribs. These features suggest some relationship between the present species and *Clathrodrillia* DALL, 1918, but the former is readily distinguished from the latter in the taller shell, much more constricted base, and more concave anal band. Under these circumstances it is a difficult problem to set up the concrete identification of the species with many intermediate features to any known genus. I am, however, inclined to include it in *Inquisitor* on the basis of the high conical protoconch and the general outline of the shell.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Sea-cliffs around Moeshima isle, Kagashima bay.

Geologic range—Early Pliocene to Recent.

Inquisitor japonicus (LISCHKE)

Pl. 32, Figs. 9, 10, and 11; Text-figs. 6 and 10.

1869, *Drillia japonica* LISCHKE, *Japan. Meer. Conch. Bd. 1*, p. 32.
1879, *Drillia japonica*, SMITH, *Proc. Zool. Soc. London* for 1879, p. 191, pl. 19, f. 15.
1884, *Drillia japonica*, TRYON. *Man. Conch. Vol. 6*, p. 202, pl. 11, f. 88.

Material.—GK-M 6305, 6627, 6694, and 8132. GK-M 6305 and 6627 are almost perfect and 8132 is slightly broken at the labrum.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials						inclin. of axials
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		I	III	V	VII	VIII	XI	(degrees)
6305	22.4	6.4	10.45	28.6	46.8	3.2	9.66	34.4	14.8	9	8	8	10	12	12	18.5
6627	17.7	5.7	8.3	32.2	46.9	3	8.0	31.6	17.7	9	8	8	10	11	—	20.5
6694	18.5+	6.6	9.9	35.6	53.5	—	6.5	—	15.5	—	—	8	10	11	—	9.5
8132	28.2	7.9	13.1	28.0	46.5	3	10.0	35.9	12.1	9	7	7	10	10	11	20.5

Desriptive remarks.—The shell is moderately small and turreted with high spire of small pleural angle and moderately long base. The test is solid. The protoconch is high conical, smooth, and polygyrate with a little more than three volutions, of which the first one is extremely depressed, horizontal small tip, the second is roundly convex

at the sides and illustrates the dome-shaped outline together with the first one, and the third is subcylindrical. The teleoconch whorls are about ten in number and bluntly bi-angulated slightly above the middle and close to the lower suture in the early stage and the upper and lower third on the penultimate whorl. The surface above the upper angulation is moderately concave and moderately sloped below the subsutureal band; the lateral surface between the angulations is flat and almost vertical; the surface below the lower angulation is slightly convex and receded to the lower suture. The suture is slightly appressed and clasped by the succeding whorl. The The subsutural lira is distinct at first, but gradually weakened during growth stages and in consequence it is hardly discernible on the body whorl. The ornamentation consists of the axial plicae and the spiral threads of which the former predominates over the latter. The axials are distinctly oblique, moderately sharp, and elevated but narrower than the interspaces. They are stronger on the lateral surface and gradually weakened above and below, but apparently reach both the upper and the lower suture on the early whorls. While on the latter whorls they are almost restricted on the lateral surface and faded away above on the concave shoulder and abruptly weakened below. The spiral ornamentation consists of the primary and secondary threads and the tertiary lines, of which the former two groups are subgranular on the plicae. The primary spirals are four in number and situated respectively on the two granulations, close to the upper and the lower suture. The interspaces on the lateral surface are narrower than the threads. On the third whorl three secondary threads are introduced in the interspaces. A few tertiary threads appear on the seventh whorl. The primaries and the secondaries are provided with blotches of dark coloration on the interspaces of the axials. The primaries and the secondaries on the body whorl are about eighteen. The body whorl is large occupying about fourty-five percent of the total height of the shell, distinctly angulated below the concave and moderately sloped shoulder, and contracted at the base to the straight snout. A dark-colored band is discernible at the upper part of the basal slope. The aperture is elongately and narrowly rhomboid with an oblique, straight, and short canal anteriorly and a deep U-shaped anal sinus close to the suture. The anal sinus is subtubular with a heavy parietal entering callus pad and the forwardly developed protract lower arm. The outer lip is thin and sharp at the margin and somewhat varicose behined at some distance from the oral margin, smooth within, and provided with the weak anterior sinus. The inner lip is covered by the moderately thick callus which is detouched at the edge of the lower part.

Comparison.—The present species is almost quite identical to *Drillia japonica* LISCHKE (LISCHKE, 1869, p. 32, SMITH, 1879, p. 191, pl. 19, fig. 15) in general character including coloration, but it is slightly different from the latter in having less nodules axials which are extended axially upward a trifle beyond the angulation and downward to the uppermost part of the snout. I, however, consider that the observed difference is not warrant for specific separation. The present species, likewise the preceding one, shows many intermediate features among *Inquisitor*, *Pseudoinquisitor*, and *Clathrodrillia* but I prefer to include it in *Inquisitor* by the same reason as the preceding species.

Horizon—The Moeshima shell bed (Upper Pleistocene).
Localities.—Northeast and east sea-cliffs at Moeshima isle, Kagoshima bay.
Geologic range.—Late Pleistocene to Recent.

Subfamily Mangeliinae FISCHER, 1887

Genus *Pseudoetrema* OYAMA, 1953

(type-species: *Drillia fortilirata* SMITH by original designation)

Pseudoetrema fortilirata (SMITH)

Text-fig. 11.

1879, *Drillia fortilirata* SMITH, *Proc. Zool. Soc. London* for 1879, p. 194, pl. 19, f. 22.
1882, *Drillia fortilirata*, DUNKER, *Index Moll. Mar. Japon.* p. 24.
1887, *Drillia fortilirata*, WEINKAUFF u. KOBELT (in MARTINI u. CHEMNITZ), *Syst. Conch. Cab. Vol. 4, Pt. 3*, p. 189, pl. 38, f. 10.
1927, *Drillia fortilirata*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. 2, Vol. 1, Pt. 10*, p. 410, pl. 46, f. 20.
1952, *Lienardia fortilirata*, KURODA and HABE, *Check list and bibliogr. rec. mar. moll. Japan*, p. 63.
1953, *Pseudoetrema fortilirata*, OYAMA, *Veuus Vol. 17, No. 3*, p. 154.
1954, *Pseudoetrema fortilirata*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 2*, p. 26, pl. 43, f. 20.
1961, *Pseudetrema fortilirata*, HABE, *Colored Illustr. Shells Japan*, No. 2, p. 76, pl. 38, f. 8.

Material.—GK-M 7705, 7706, and 8087 to 8091. The specimens 8089, 8990, and 8091 are almost prefect in preservation. The other specimens are slightly broken at the labrum.

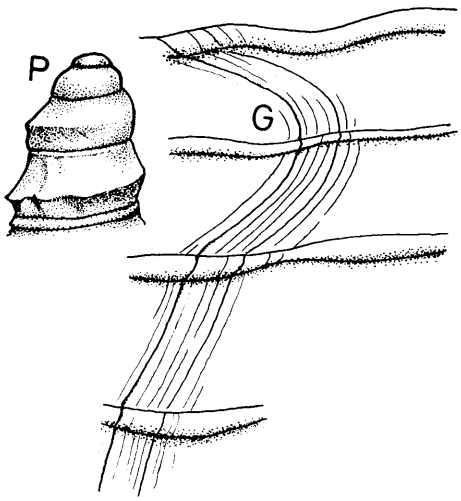
Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)
7705	14.3	4.3+	6.7	3.9	30.1+	46.8	27.2
7706	12.5	3.8+	5.7	3.7	30.4+	45.6	29.6
8088	12.9	3.9	6.55	3.35	30.2	50.8	26.0
8089	11.7	4.05	5.1	3.5	34.6	43.6	29.9
8090	12.4	5.15	5.3	3.55	33.2	42.4	28.4
8091	11.0	4.1	4.95	3.1	37.3	45.0	28.2

specimen GK-M	numb. whorls (N)	(PN)	<A (degrees)	<P (degrees)	numb. axials I	III	V	VII	XI	distinct spirals
7705	3	9	33.0	15.0	9	9	9	10	12	5
7706	3	8.5	30.5	16.5	8	9	8	9	—	5
8088	3	6.66	35.6	12.8	10	8	9	9	—	5
8089	3.2	8	36.4	16.7	9	9	8	9	—	5
8090	2.6	9	34.1	13.9	8	8	8	8		5
8091	2.8	8	34.3	14.3	8	8	9	8	—	5

Remarks.—The present specimens are featured by the small turreted shell with sharply elevated cancelate ornamentation, distinct basal constriction, and the deeply v-shaped anal sinus below the subsutural lira. They are quite identical to *Drillia fortilirata* SMITH.

The protoconch is conical and composed of about three volutions, of which the first is a smooth, low, and somewhat oblique dome and the remainder ones are provided with a sharp peripheral carina. The carina is rather obtuse at the begining,



Text-fig. 11. Protoconch (P) and growthlines (G) on the body whorl of *Pseudetrema fortilirata* (SMITH).

becomes sharper, and is continuously succeeded by the lower carina of the teleoconch. The first teleoconch whorl is distinguished from the last protoconch whorl by abrupt and simultaneous appearance of the two spiral threads close to the upper suture and at the middle of the ramp. An obsolete axial fold appears at the very early portion of the first whorl and the following ones become prominent abruptly. The crossings of the spirals and the axials are granular. On the fourth whorl the very fine fourth spiral appears on the lateral surface below the peripheral carina and becomes larger rather abruptly to be equal in size to the spiral on the ramp. A minute secondary line is intercalated in each interspace on the later whorls. The axial folds are almost vertical, elevated, wider than the interspaces, and reach both the upper and lower sutures. The aperture is rhomboid with the wide, short, but defined canal and moderately deep v-shaped anal sinus which is close to the subsutural lira and occupies the ramp. The anterior end of the canal is markedly notched. The callus is not developed both at the parietal and columellar lips.

The present species closely resembles *Acrista* HEDLEY, 1922, with the type species *Lienardia punctilla* HEDLEY, in the general features, but differs from the latter in being devoid of the columellar folds. It is also distinguishable from *Pseudoraphitoma* BOETTGAR, 1895, with the type species *Mangilia fairbanki* NEVILL, and *Etrema* HEDLEY, 1918, with the type species *Mangilia* (*Glyphostoma*) *alliciae* MELVILL and STANDEN, in being devoid of the labrumteeth.

Horizon.—The Moshima shell bed (Upper Pleistocene).

Localities.—Northeast and east sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Medial Pleistocene to Recent.

Genus *Etremopa* OYAMA, 1953

(type-species: *Drilla subauriformis* SMITH by original designation)

Etremopa ? cf. *subauriformis* (SMITH)

Pl. 30, Fig. 7; Text-figs. 3 and 12.

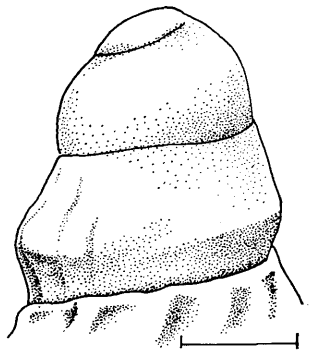
1879, *Drillia subauriformis* SMITH, *Proc. Zool. Soc. London*, for 1879, p. 195, pl. 19, f. 23.
1884, *Drillia subauriformis*, TRYON, *Man. Conch. Vol. 6*, p. 207, pl. 12, f. 35.
1922, *Drillia subauriformis*, YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo, Vol. 44, Art. 1*, p. 40, pl. 1, f. 30.
1953, *Etremopa subauriformis*, OYAMA, *Venus, Vol. 17, No. 3*, p. 155.
1954, *Etremopa subauriformis*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 26, pl. 21, f. 30.

Material.—GK-M 6286. A single specimen which is slightly fractured at the labrum.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	IV	V	VI	prim. spirals
6286	16.9	5.3	8.0	5.65	31.3	47.3	33.4	3	6.5	28.1	15.1	11	11	11	13	14	3

Remarks.—The present specimen has the high conical smooth protoconch of three volutions, of which the first is blunt and dome-shaped, the second is roundly convex at the side, and the third is carinated slightly below the middle. The carina is not so sharp because of abrasion. The anal sinus is moderately deep, v-shaped, and narrow and occupies fully the subsutural concave slope. The inner lip is covered by the very thin calluous material and devoid of the parietal callus pad. These features almost coincide with those of *Etremopa* OYAMA, 1953.* The latter, however, has the distinct varix outside the labrum, while it is not recognized on the present specimen on account of the fracturing of the labrum.



Text-fig. 12. Protoconch of *Etremopa*? cf. *subauriformis* (SMITH), GK-M6286. Unit bar indicates 0.3 mm.

The present specimen is characterized, furthermore, by four series of the prominent granules which are formed on the crossings of the prominent axial plicae and four primary spiral lirae. It is almost identical to *Drillia subauriformis* SMITH (1879, p. 195, pl. 19, f. 21) in general aspects except for less numerous spiral lirae and larger shell than the latter. Whether this difference is interspecific or intraspecific is a problem, which may be solved after plenty material is examined.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Medial Pleistocene to Recent.

Genus *Glyphostoma* GABB, 1873

(type-species: *Glyphostoma dentiferum* GABB by monotypy)

Subgenus *Glyphostoma* (s. s.)

Glyphostoma (*Glyphostoma*) *granulifera japonica* n. subsp.

Pl. 35, Figs. 3, 4, and 9; Text-figs. 13 and 14.

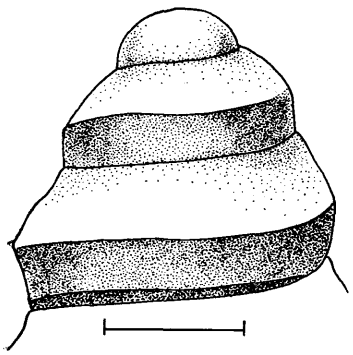
Material.—Holotype: GK-M 6659; paratypes: GK-M 6656, 6657, 6660, 6661, and 8079 to 8082.

* It is a matter of problem whether *Etremopa* really differs from *Glyphostomps* BARTCH, 1934, or not. I consider the possibility that the former is a synonym of the latter.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	VI	VI	prim. spirals III
6656	13.9	5.5	8.55	39.6	61.5	3	6.5	46.5	27.0	10	9	10	11	12	14	—	2
6657	12.7	5.2	8.1	40.9	63.7	3	6.5	49.5	29.3	10	9	10	11	12	14	—	2
6659	12.7	5.1	7.8	40.2	61.4	3	6.66	46.4	29.3	10	10	10	11	12	13	—	2
6660	12.05	4.75	7.4	39.5	61.4	2.66	6.5	46.9	25.2	10	9	10	10	12	14	—	2
6661	10.75	4.35	6.75	40.5	62.8	3	6.5	46.9	26.2	9	9	10	12	13	14	—	2
8079	12.45	4.1	7.8	32.9	62.7	2.66	6.66	47.9	32.7	9	10	9	10	11	13	—	2
8080	13.85	5.55	8.6	40.1	62.1	2.66	7.0	48.9	28.2	10	10	10	11	11	12	15	2
8082	10.15	4.45	6.2	43.8	61.1	2.7	6.0	45.0	32.8	10	9	8	9	12	13	—	2

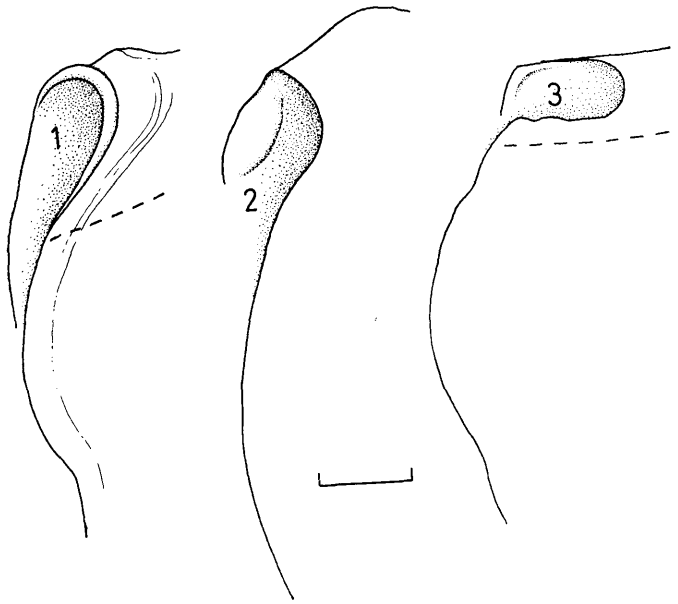
Diagnosis.—The shell is small in size, rhomboid-fusiform with high conical spire and the moderately long base. The test is solid. The protoconch is trochoid and consists of three volutions, of which the first is small, smooth, dome-shaped, and horizontal; the second is bluntly angulated at the periphery, and the third is sharply keeled slightly below the middle. They are separated from one another by the depressed simple suture and followed by the bi-carinated teleoconch whorls. The teleoconch whorls are about six and a half to seven in number, separated from one another by the appressed sutures, and prominently ornamented by the axial plicae and the spiral lirae. The body whorl is large occupying about two-thirds of the height of the shell, bluntly angled below the gently sloped narrow shoulder, slightly rounded at the periphery below the angulation, and gradually contracted at the base to the long and straight snout. On the first teleoconch whorl two peripheral angulations are discernible at the upper third and the lower fourth respectively. Of the two angulations the lower one is more defined than the upper. The surface between the upper angulation and the upper suture is somewhat concave and moderately sloped. The surface between the angulations is remarkably concave and steeply sloped; the surface below the lower suture is also concave and receded. The angulations are conjoined with the spiral cords, which are stronger on the axial plicae showing the granular aspect. On the second whorl a secondary lira (II_1) appears at the middle of the shoulder, and on the next whorl other secondary (II_2) is added between the foregoing one and the upper angulation. This secondary (II_2) soon becomes as strong as the primaries and consequently a third blunt angulation is formed on the shoulder close to the upper angulation. This renders to the whorl rather a round profile except for the narrow subsutural concave part. Another secondaries appear on the fourth or fifth whorl in the interspaces between the primaries. These secondaries also soon become promient and they are almost equal to the primaries on the latest part of the penultimate whorl and on the last whorl. On the body whorl subequal spiral lirae are counted eighteen to twenty-two. The axial plicae are almost vertical,



Text-fig. 13. Protoconch of *Glyphostoma (Glyphostoma) granulifera japonica* n. subsp., GK-M 6659. Unit bar indicates 0.3 mm.

very strong, and much wider than the interspaces at first and as wide as them later. They are most pronounced at the periphery, gradually weakened belew to the lower suture, and abruptly faded away on the shoulder. They are counted about ten on the first whorl and fourteen on the last whorl, where they diminish at the upper part of the snout. The growth lines are not discernible except at the last part near peristome and the anal band. The remainder part of the surface except for the top of the spirals are covered by the minute tesselation.

The aperture is narrow and elongately rhomboidal with rather a long and slightly bended canal. The outer lip is thin, sharp, and crenulated corresponding with the surface sculpture at the very margin and provided with three prominent teeth inside somewhat apart from the margin. The anal sinus is very deep, U-shaped, close to the suture with symmetrical arms which are subparallel each other. The parietal entering callus pad is heavy and narrows the anal sinus. The inner lip consists of the short and oblique parietal one and the long and vertical columellar one, both of which are covered by the distinct callus. The teeth on the inner lip are distinct; one at the middle of the parietal lip; about four on the columellar one. The lower the position of the tooth on the columellar lip, the weaker its relief. These teeth are exceptionally obsolete on the specimen GK-M 7659. The spire whorls have the dark-coloration at the lateral surface and light cololed narrow two bands at the anal band and close to the lower suture. On the body whorl other dark colored narrow band is seen on the basal surface.



Text-fig. 14. Anal sinuses of some turrids from the Moeshima shell bed. Unit bar indicates 1 mm.

1. *Brachycythara kyushuensis* n. sp., GK-M 6667.
2. *Cythara (Cytharella) robusticostata magna* n. subsp., GK-M 6324.
3. *Glyphostoma (Glyphostoma) granulifera japonica* n. subsp., GK-M 6667.

Comparison.—The present specimens are very closely allied to *Lienardia granulifera* SCHEPMAN from Madura Bay, India (1913, p. 437, pl. 29, f. 3) in general character including coloration. The former, however, is distinguished from the latter in the features that (1) the basal angulation is less defined and consequently the contraction at the boundary between the basal slope and the snout is weaker on the present specimens than SCHEPMEN's species; (2) the denticles inside of the labrum of the former are less in number than the latter; and (3) the protoconch is composed of three volutions in the former instead of two of the latter. Judging from such trifling difference it is better to include the present specimens in "*Lienardia*" *granulifera* as a subspecies. According to the original description this species has the "nuclears consisting of two convex, light brown whorls of which the upper one is smooth and shining, the second has a prominent keel". Although the original author classified it into the *Lienardia* JOURSSEAUME, 1884, with the type species *Clavatula rubidum* HINDS, the above mentioned protoconch differes from that of *Lienarida*. The latter has a protoconch consisting two volutions of which the second has a sharp thread on the shoulder instead of the peripheral keel. While *Etrema* HEDLEY, 1917, with the type species *Mangilia* (*Glyphostoma*) *aliciae* MELVILL and STANDEN is provided with the paucispiral protoconch of two to three volutions of which the last one has a peripheral keel. *Glyphostoma* GABB, 1873, with the type species *Glyphostoma dentifera* GABB has similar protoconch of three volutions to that of *Etrema*, but the former is characterized by the longer body whorl with less contracted base, stronger labial denticles than the latter and prominent growthlines on the anal band. Concerning with above mentioned characters the present specimens show closer affinity to *Glyphostoma* and I prefer to classify the present specimens into *Glyphostoma* (s. s.).

The present subspecies is also closely allied in general features to *Glyphostoma arctata* (REEVE) (Conch. Icon. Vol. 1 *Pleurotoma*, pl. 32, sp. 294) living in Philippines and Indonesia, but the former is distinguished from the latter in having longer snout and more vertical axials than the latter.

It is also similar to *Etrema rava* (HINDS) (REEVE, Conch. Icon. Vol. 1, *Pleurotoma*, pl. 28, sp. 250), but the former has shorter spire and longer base with less distinct constriction at the basal slope than the latter.

Horizon.—The Moeshima shell bed (Upper Pleistocene)

Localities.—Northeast, north, and northwest sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Anacithara HEDLEY, 1922

(type-species: *Mangilia naufraga* HEDLEY by original designation)

Subgenus *Anacithara* (s. s.)

Anacithara (*Anacithara*) *fortistriata* (SMITH)

Pl. 34, Figs. 4, 5, and 7.

1888, *Pleurotoma* (*Mangilia*) *fortistriata* SMITH, *Ann. Mag. Nat. Hist. Ser. 6, Vol. 2*, p. 313.

1917, *Mangilia fortistriata*, MELVILL, *Proc. Malac. Soc. London, Vol. 12*, p. 170, pl. 8, fs. 12 and 12a.

Material.—GK-M 6670, 8105, 8106, and 8108. All the specimens are perfectly preserved.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	spirals pen	bod
6670	7.25	3.2	4.1	43.5	55.8	2.2	4.6	40.6	24.5	10	10	11	11	11	16	23
8105	8.05	3.95	4.5	49.1	55.9	2.5	4.6	41.5	22.1	10	10	11	11	—	9	17
8106	7.5	3.45	4.45	46.0	59.3	2.5	5.0	49.7	16.8	12	11	11	12	12	—	19

Descriptive remarks.—The shell is small attaining about eight mm in height, ovato-turreted with the turreted spire and the short base. The whorls are about seven in number, of which the earlier two to two and a half form the protoconch and the remainder ones are the teleoconch whorls. The protoconch whorls are smooth, low, dome-shaped, and followed by the short brephic stage. The teleoconch whorls are ornamented by the axial plicae and the close spiral threads. The axial plicae are distinct but not so elevated, almost vertical, slightly sigmoid, and much narrower than the interstices. They are counted by ten on the early two whorls and eleven on the later whorls. The beginning of the spirals is not clear on account of abrasion of the shell matter, but it is evident that the first whorl is provided with the spirals. On the second whorl they are counted by six and separated by much narrower (one-third breadth of the threads) interspaces. On the third the number of the spiral threads is equel to that of the preceding whorl but the interspaces become wider (two-thirds breadth of the threads). On the penultimate whorl, although the relative width is not changed, a secondary minute spiral line is set in each interspace rendering the alternating pattern of distinct and weak ones. The suture is wavy and impressed with weak subsutural band. The body whorl is also ornamented by the axials and spirals in almost same pattern as the penultimate whorl. The axial plicae are faded away on the basal slope and does not reach the snout, which is also ornamented by similar alternation of the distinct and weak spirals to that of the main surface. The aperture is rhomboid with bluntly truncated short canal anteriorly and a notch-like furrow at the posterior end. The labrum is almost vertical, very slightly sigmoid, smooth inside, varicose outside, and devoid of the definite anterior and posterior sinuses. The inner lip consists of the oblique parietal one and the vertical and straight columellar one, which are covered by the narrow but distinct callous material. A distinct parietal tubercle is partly continuous to the margin of the anal sinus rendering stout appearance. The lower part of the columellar callus is free-edged and detouched from the snout, resulting a small false umbilicus.

The present specimens almost perfectly conform with *Pleurotoma* (*Mangilia*) *fortistriata* SMITH from off Bombay, India, except only for less convexed profile of the whorls.

Mangilia ohjiensis of YOKOYAMA, 1922, not of TOKUNAGA, 1906, was included in *Horaiclavus* and renamed *H. shitoensis* by OYAMA (1954, p. 25). It is, however, much smaller than the type-species of *Horaiclavus* and provided with the distinct spiral threads and terminally truncated (not notched) short canal. Considering these

situation I prefer to include it in *Anacithara* HEDLEY, 1922, with characteristic features as already noted at the section on *Horaiclavus*. Judging from the descriptions and figures by Australian and New Zealander malacologists the genus shows remarkable variation concerning with the thickness of the parietal callus and tendency for detouched margin of the columellar callus, either of which is really observed in the Japanese species. *Anacithara* seems to be rather a large group distributed not only in Australo-New Zealand region but also Indian and Southwest Pacific.

The present specimens resembles *A. shitoensis* (OYAMA), (1954, p. 25, pl. 21, f. 33), but readily distinguished from the latter in broader outline with less defined peripheral angulation, smaller number of axial ribs which extend more anteriorly on the basal slope than on the latter.

A. decipiens (SMITH) (SMITH, 1888, p. 313; MELVILL, 1917, p. 169, pl. 8, fs. 14, 14a) from off Bombay is another ally to the present species. Distinction between *A. decipiens* and *fortistriata* is based on much weaker ornamentation, especially axials, of the former than that of the latter. This, however, may be secondary feature because all the described specimens of *A. decipiens* are water-worn and reduced the strength of the ornamentation. If this is the case, *A. fortistriata* is a synonym of *A. decipiens*.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Northeast and east sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

Anacithara (Anacithara) moeshimaensis n. sp.

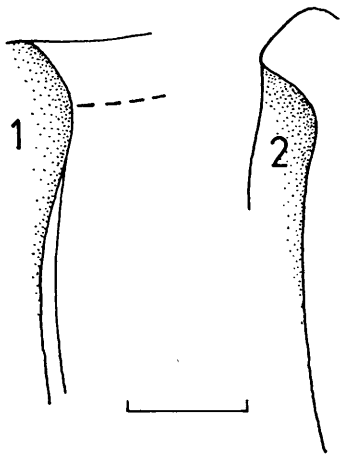
Pl. 31, Figs. 13 and 14; Pl. 34, Figs. 6, 9, 10, and 11; Text-figs. 5, 15, and 16.

Material.—Holotype: GK-M 8111; paratypes: GK-M 6669 and 8107. Perfectly preserved specimens came from one and the same locality.

Measurements.—

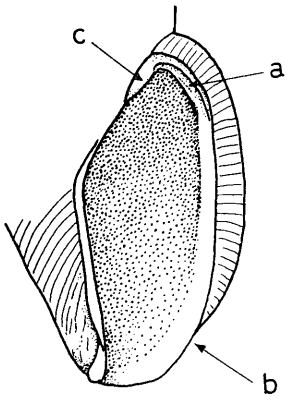
specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	spirals pen	bod
6669	8.1	3.6	5.1	44.4	62.9	1.66	5.5	46.4	20.6	11	10	11	12	11	23	54
8107	8.55	3.6	5.05	42.1	59.1	2.0	5.0	49.5	21.4	12	11	10	10	11	25	56
8111	7.9	3.25	4.25	41.1	53.8	1.8	5.0	44.2	19.2	11	12	12	13	11	25	65

Diagnosis.—The shell is small and turreted with tall spire and the shorter base. The test is rather thick and solid. The protoconch consists of one and two-thirds to two volutions, which are regularly dome-shaped, smooth, and separated by rather a deep suture each other. The protoconch is followed by the short brephic stage and then graded into the teleoconch whorls which are axially plicated and spirally lirated. The boundary between the protoconch and the teleoconch is sharply marked by the distinctly impressed sigmoid line. The teleoconch whorls consist of more than five whorls, of which the first one is sculptured by the longitudinal smooth plication at first and then about two spiral threads appear at two-fifths and two-thirds of the whorl height from the upper suture. The spirals are counted four at the end of the first whorl, ten at the end of the second one, twenty-three on the penultimate, and fourty-six on the body whorl. The spirals of the middle and later whorls are subequal in strength, slightly waving, and separated one another by very



Text-fig. 15. Anal sinuses of some Mangeliinae from the Moeshima shell bed. Unit bar indicates 1 mm.

1. *Vexiguraleus supercostata* (SMITH), GK-M 6688.
2. *Anacithara* (*Anacithara*) *moeshimaensis* n. sp., GK-M 6669.



Text-fig. 16. Aperture of *Anacithara* (*Anacithara*) *moeshimaensis* n. sp., showing a weak excavation (a) corresponded with the anal sinus, obsolete anterior sinus (b), and distinct parietal entering callus (c).

narrow grooves. The plicae show a tendency for slight sigmoidal curving, very slightly oblique, and reach both the upper and the lower suture. They are counted ten to twelve on each whorls. The profile of the spire-whorls are regularly rounded except for slightly concave subsutural part. The body whorl is large occupying about sixty percent of the height of the shell, roundly convexed at the periphery, regularly contracted below the periphery to the short and straight snout. The plicae are faded away on the basal surface and hardly reach the snout. The spirals are rather irregular on the snout but do not exhibit a fasciole. The aperture is moderate in size, rhomboid in outline with bluntly truncated anterior end. The outer lip is vertical, sigmoid without definite anal and anterior sinuses, smooth inside, and varised outside. Although the anal sinus is obscure, there is a weak but distinct excavation at the posterior part of the inner surface of the labrum corresponding to the anal sinus as is shown in the text-fig. 16. The inner lip consists of the oblique parietal one and the vertical columellar one, either of which is covered by a narrow but distinct callous material. A weak parietal tubercle renders a notch-like feature to the posterior part of the aperture. The canal is not defined.

Comparison.—The present species is closely allied to the preceding one in general character, but clearly distinguished from the latter in much closer and more regularly spaced spirals of subequl strength, sigmoidally curved stronger axial plicae, and slenderer outline than the latter.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.
Geologic range.—Late Pleistocene.

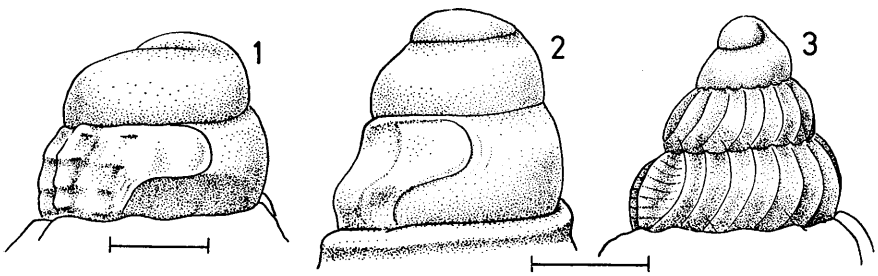
Subgenus *Anacitharoida* n. subgenus

(type species: *Anacithara* (*Anacitharoida*) *kurodai* n. sp., here designated)

Subgeneric diagnosis.—The shell is small and ovoid fusiform with high conical to slightly conoidal spire and moderately long base. The test is thick and rather solid. The protoconch is dome-shaped and paucispiral consisting of abruptly growing about two volutions, of which the first is depressed, smooth, and small tip and the second is grobose and smooth except for the last quarter which is bluntly carinated at the middle. The protoconch is separated by a distinct sinusigera ridge from the first teleoconch whorl, which has not brephic riblets but normal axial ribs and fine spiral threads even at the beginning. The teleoconch whorls are ornamented by the sharp axial ribs and the close and fine spiral threads. The suture is impressed and slightly emarginate but not provided with true subsutural band. The aperture is rather short and rhomboid with extremely short and widely open canal, which is obliquely truncated at the end. The anal sinus is close to the suture, very shallow, and reversed L-shaped. The outer lip is sharp at the very edge, prominently varicose outside at slight distance from the very margin, and smooth inside. The inner lip consists of the oblique parietal and the vertical columellar one and covered by the distinct callus, especially at the upper part of the parietal lip and lower part of the columellar one, where the snout shows a tendency for umbilical fasciole with slight depression (false umbilicus) on the snout close to the margin of the callus.

Comparison.—The present subgenus is a representative of a group of Mangeliinae, which has the rather short rhomboid aperture with extremely wide and short canal, smooth inside of the labrum, distinct varix, and very shallow anal sinus. It is distinguished from the genus *Anacithara* HEDLEY, 1922, in the different type of the protoconch. That is to say the protoconch of the present subgenus is provided with a peripheral carina at the latest part and is not followed by the brephic stage.

It is also distinguished from *Horaiclavus* OYAMA, 1954, in the features of the protoconch, distinct spiral threads, and obliquely truncated wide canal.



Text-fig. 17. Protoconchs of some turrids from the Moeshima shell bed. Unit bar for (1) indicates 0.3 mm, and for (2) and (3) 0.5 mm.
1. *Anacithara* (*Anacitharoida*) *kurodai* n. sp., GK-M 8109.
2. *Agladrillia oyamai* n. sp., GK-M 8116.
3. *Heterocithara habei* n. sp., GK-M 8115.

Anacithara (Anacitharoida) kurodai n. sp.

Pl. 34, Figs. 1, 2, 3, 8, and 13; Text-figs. 17 and 18.

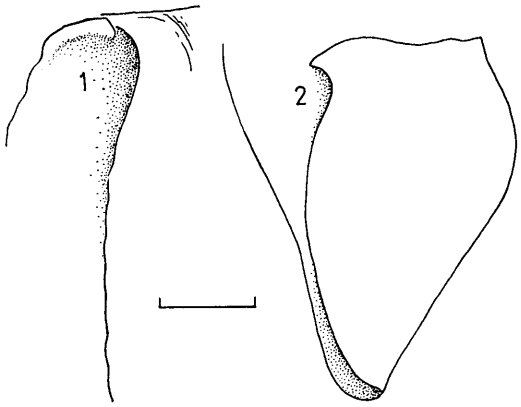
Material.—Holotype: GK-M 8109; paratype: GK-M 8110. The holotype specimen is perfect in preservation.

Measurements.—

specimen	H	D	Bd	Ap	D/H	Bd/H	Ap/H
GK-M	(mm)	(mm)	(mm)	(mm)	(%)	(%)	(%)
8109	9.1	3.85	5.05	3.45	42.3	55.5	37.9
8111	6.65	3.15	3.85	2.6	47.4	57.9	39.1

specimen	numb. whorls		<A	<P	axials				spirals		
GK-H	(N)	(PN)	(degrees)		I	III	V	VI	I	II	pen
8109	2.1	5.0	36.2	18.5	11	11	11	10	4	4	23
8110	2.2	6.0	39.3	26.4	10	10	12	—	4	6	18

Diagnosis.—The shell is small and ovoid-fusiform with moderately long base and high and very slightly conoidal spire. The test is thick and rather solid. The protoconch is dome-shaped and paucispiral consisting of abruptly growing about two volutions, of which the first is depressed, smooth, and small tip and the second is globose and smooth except for the last quarter which is bluntly carinate at the middle. The protoconch is separated from the first post-nuclear whorl by an extremely curved sinusigera ridge, of which the medial horizontal part coincides with the carina. The teleoconch whorls are sculptured by the axial plicae and the spiral lirae. The axials are slightly oblique and as wide as the interspaces at first and then rather abruptly become vertical and narrower than the interspaces. The axials are about eleven (10-12) and do not show marked change in number throughout the growth stages. They reach both the upper and the lower sutures on the spire whorls and faded away at the boundary between the base and the snout of the body whorl. They are overriden by the spirals. The spirals on the first and the second whorl are four lirae which are equally developed, regularly spaced, and separated by much narrower interspaces. At the later part of the second whorl the primary lirae become comparatively narrow and the weak secondary threads appear together in the interspaces and then the latter abruptly becomes distinct and is almost as large as the primaries on the fourth whorl. On the penultimate whorl the tertiary threads are intercalated. In consequence the body whorl is thickly covered with the alternative distinct and weak threads, which are somewhat stronger on the snout than on the other part. The suture is impressed with distinct subsutural lira. The body whorl is large occupying more than a half of the shell height, steeply sloped and slightly concave below the subsutural lira, narrowly rounded at the periphery, and gradually contracted at the base to the short snout. The aperture is wide, short, and rhomboid with subparallel lips. The anal sinus is very shallow, close to the suture, broadly arcuate with broad top, and smoothly continued to the vertical and gently recurved outer lip, which is simple and sharp at the very margin, smooth inside, and variced outside at some distance from the margin. The canal is not well-defined, very wide, open, and obliquely truncated at the extremity. The inner lip is bended and covered by the distinct callus, which is somewhat thickened at the parietal lip close to the



Text-fig. 18. Anal sinuses of some Mangeliinae from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Heterocithara habei* n. sp., GK-M 8115.
2. *Anacithara* (*Anacitharoida*) *kurodai* n. sp., GK-M 8109.

suture and at the lower part of the columellar lip. The margin of the columellar callus shows a tendency for detouching from the snout and a small and shallow concavity like umbilicus is observed close to it.

Comparison.—The present species is similar superficially to the species of *Anacithara*, but is readily distinguished from the latter in the feature of the protoconch as already noted above. It is also distinguished from other species of cytharoid genera in the protoconch and the aperture.

"*Mangilia*" *imperfecta* FOLIN, (TRYON, 1884, p. 250, pl. 28, f. 43) reported from Pacific Ocean has similar aperture to that of the present species. The two resembles each other in other characteristics such as in size, outline, and sculpture. In spite of these similarity I would suspend the concrete identification untill the features of the protoconch of *M. imperfecta* is clarified.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East cliff at the Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Heterocithara* HEDLEY, 1922

(type-species: *Clathurella bilineata* ANGAS by original designation)

Heterocithara habei n. sp.

Pl. 32, Figs. 13, 14, and 16; Text-figs. 17 and 18.

Material.— Holotype: GK-M 8115. A single perfect specimen.

Measurements.—

specimen	H	D	Bd	Ap	D/H	Bd/H	Ap/H	numb. whorls		<A	<P	axials			spirals	
GK-M	(mm)	(mm)	(mm)	(mm)	(%)	(%)	(%)	(N)	(PN)	(degrees)		I	II	III	I-II	III
8115	5.8	2.6	4.0	2.9	44.8	69.0	50.0	3.5	3.6	55.9	31.4	11	11	12	8	9

Diagnosis.—The shell is small attaining about six mm in height, rhomboid-fusiform with regularly high conical spire and gradually contracted base of equal length to

the spire. The test is moderately thick and rather solid. The protoconch is comparatively large, high conical, and consists of three and a half volutions. The first is small but elevated and mammilate and the second and later volutions are high and moderately convexed at the sides. The first and the succeeding half volutions are smooth and the remaining ones are provided with close, curved, protractive brephic thin axial riblets. They are more curved on the later volutions than on the early one and much narrower than the interspaces, which are subequal in breadth throughout the entire stages. Another series of very weak, irregular, and short retractive axials is observed on the lower fifth of the brephic volutions. They are much weaker and so irregular in arrangement that it is a question whether they are real brephic axials or upward continuation of the riblets of the succeeding whorl. The protoconch is sharply separated by the distinct ridge from the teleoconch whorls, which are spirally lirated even at the beginning. The teleoconch whorls are three and a half, bluntly angled below the gently sloping shoulder, remarkably convexed with broadly rounded lateral side, separated by the simple and wavy sutures, and ornamented by the sharply elevated axial plicae and the distinct and regular spirals which override the axials. The body whorl is large occupying more than two-thirds of the shell height, narrowly rounded at the upper part below the gently sloped shoulder and gradually attenuated at the base to the straight and vertical snout. The axials are sharply elevated and reach both the upper and lower sutures without practical reduction. On the body whorl they, however, are weakened at the base and faded away on the snout. They are moderately oblique and two-thirds as wide as the interspaces on the early half of the first whorl and then gradually become vertical and wider. In consequence they are almost vertical and as wide as the interspaces on the second whorl. The spirals are eight at the beginning, of which upper four on the slope below the suture are weaker than the lower four on the lateral surface. On the second and later whorls the difference in strength of these groups of spirals become distinct. In consequence the threads on the lateral surface are three times as large as those on the ramp on the penultimated whorl. The faint secondary lines are intercalated in the interspaces of the strong spirals on the penultimate and body whorl, the latter has eighteen distinct and five weak primaries besides numerous secondaries. The distinct spiral threads at the crossings of the axials are twice as wide as those at the interspaces of the axials and show the granular appearance. The anal sinus is close to the suture, very shallow, broadly rounded, and gradually reflected to the vertical and slightly rounded labrum, which has no stromboid sinus anteriorly and no varix outside. The inside of the labrum is provided with a few weak and irregularly spaced dentitions at the anterior and the posterior part. Of all the dentitions the uppermost one close to the anal sinus and the lowest one close to the canal are rather distinct. The inner lip is broadly curved and covered with weak callus, which is somewhat thickened at the upper part of the parietal lip and continues to the anal sinus. The canal is moderately short, widely open and not truncated at the end. There is no sharp boundary between it and the aperture proper.

Comparison.—The present species is characterized first by its high conical

protoconch, which is superficially resembles some of the diagonally cancellate daphnellin protoconch. The retractive faint axial-like ornamentation is extremely abnormal and irregular for the brephic axials which are generally regular on every known species. The retractive ones on the present species are considered to be mere upward continuation of the protractive brephic axials of the next whorl beyond the suture. Besides protoconch the present species is characterized by small size, the strong and elevated axial plicae, the coarse spirals overriding the plicae, the reversed L-like shallow anal sinus, and the irregular dentitions at the inner surface of the outer lip. These features are comparable to those of *Heterocithara* HEDLEY, 1922. The present species, however, slightly differs from the latter in being devoid of the varix outside the labrum and having somewhat longer aperture. In spite of these differences I consider that the present species is included in *Heterocithara*, because the former is much closer in the general characteristics to the latter than to any other genera of Mangeliinae.

It is closely allied to *Bela lyciaca* FORBES (TRYON, 1884, p, 221, pl. 27, f. 28) from Asia Minor, but the former has much more gradually contracted base and somewhat higher spire consisting of rounder whorls than the latter.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East sea-cliff at Moeshima, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Vexiguraleus* POWELL, 1942

(type-species: *Vexiguraleus clifdenensis* POWELL by original designation)

Vexiguraleus supercostata (SMITH)

Pl. 31, Figs. 1, 2, and 3; Pl. 32, Figs. 8, 12, and 15; Text-figs. 15 and 19.

1882, *Pleurotoma* (*Daphnella*) *supercostata* SMITH, *Ann. Mag. Nat. Hist., Vol. 10, Ser 5*, p. 301.

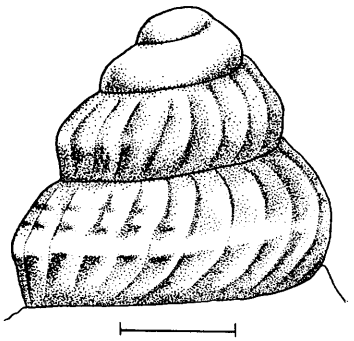
Material.—GK-M 6668 and 8112. Preservation is almost perfect.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials				
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		I	II	III	IV	V
6668	8.7	3.9	5.45	44.8	62.6	3.5	4.66	53.0	25.9	14	13	14	16	12+
8112	9.05	3.7	5.9	40.9	65.2	3.3	5.0	55.7	17.0	13	12	12	13	—

Remarks.—The protoconch of the present species is conical and composed of three and a half volutions. The first volution is small, smooth, and slightly inclined; the second is rounded at the side, smooth at the early half, and obsoletely ornamented with curved axials at the later half; on the third volution the axials become distinct and the profile becomes rather convexed at the periphery; the fourth volution is angulated at the periphery and two weak spirals are discernible at and above the angulation. The distinct peripheral angulation of the first whorl of the teleoconch succeedes continuously the angulation of the protoconch. The anal sinus is very shallow and cytharoid. These features almost perfectly conform to the generic diagnosis of *Vexiguraleus* POWELL, 1942, except for a slight discordance in that the type species of *Vexiguraleus* has four obsolete spirals on the last half volution of

the protoconch inspite of two on the present species. The latter, however, is provided with four spiral threads at the very beginning of the first teleoconch; two of the four threads are the continuation of the threads of the protoconch and the third is on the upper ramp and the fourth is below the angulation. This pattern of the development of the spirals indicates the close phylogenetic relation of the present species to *Vexiguraleus clifdenensis* POWELL.



Text-fig. 19. Protoconch of *Vexiguraleus supercostata* (SMITH) from the Moeshima shell bed, GK-M 6668. Unit bar indicates 0.3 mm.

The shell is rhomboid fusiform with moderately high spire and long base. The spire whorls are sharply angulated at the middle to lower two-thirds. The body whorl is bluntly angulated at the periphery and gradually attenuated to the straight snout. The axials are prominent at first and gradually weakened later; consequently they are rather low and much narrower than the interspaces, although they are rather sharp. They are stronger at the periphery, weakened both upward and downward, reach the upper suture, and faded away at the lowest part of the basal slope. Besides the axial ribs there are many, close, distinct, and raised growthlines, the strong primary threads, and weaker and closer secondary and tertiary spiral lines on the whole surface. The distinct and fine crenulations, sometimes rather spinose, are developed at the crossings of the axial and spiral ornamentation. In these respects the present specimens are quite identical to *Pleurotoma (Daphnella) superocosta* SMITH which was originally described on the basis of the Japanese material. This species is considered to be included in *Vexiguraleus*.

Pleurotoma senegarensis MALTZAN from West Africa (1883, pl. 3, f. 15) is an ally to this, but the latter is readily distinguished from the former in having the more numerous spiral lines and more distinct and finer reticulation on the whole surface.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima bay.

Geologic range.—Late Pleistocene to Recent.

Genus *Cythara* SCHMACHER, 1817

(type-species: *Cythara striata* SCHUMACHER=*Pterygia subterranea* [BOLTEN] RÖDING by monotypy)

Subgenus *Cytharella* MONTEROSATO, 1875

(type-species: *Murex costata* DONOVAN by subsequent designation, WOODRING, 1928)

Cythara (Cytharella) robusticostata magna n. subsp.

Pl. 29, Figs. 7, 8, and 10; Text-figs. 14, 20, and 21

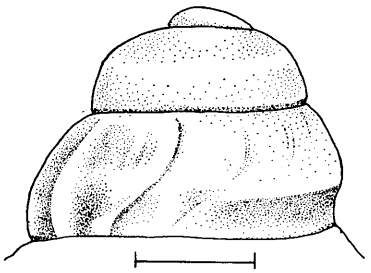
Material.—Holotype: GK-M 8083; paratypes: GK-M 6323 to 6326, 6639 to 6641, and 8084 to 8086. Preservation is generally favourable.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	numb. whorls (PN)	<A (degrees)	<P (degrees)	numb. axials I	II	III	IV	V	VI	inclin. of axials
6323	16.15	7.1	9.9	44.0	61.9	2.0	6.5	50.8	30.8	12	11	10	12	14	16	16
6324	14.4	6.6	9.2	45.8	63.9	2.2	6.0	49.4	32.3	11	10	9	11	12	12	18
6325	13.7	6.5	8.5	47.4	62.0	2.2	6.0	53.1	33.7	12	12	12	13	15	14	19.5
6326	10.3	4.95	6.5	48.1	63.1	2.2	5.2	50.1	34.2	12	12	12	12	12	—	12
6639	15.9	7.0	9.9	44.0	62.3	2.33	6.0	53.4	29.4	13	12	12	11	13	18	12.5
6640	11.45	5.45	7.65	47.6	66.8	2.25	5.5	51.7	36.7	11	11	11	12	13	—	20
6641	10.8	5.15	7.1	47.7	65.6	2.25	5.0	49.8	37.5	12	12	11	12	13	—	11
8083	17.8	7.8	11.4	43.8	64.0	2.3	6.2	61.0	32.4	14	12	12	13	14	16	19

Diagnosis.—The shell is small attaining about 16 mm in height and biconical with the moderately high spire and rather a long and swollen base. The test is moderately thick and solid. The protoconch is dome-shaped, smooth, and paucispiral with a little more than two volutions, of which the first is small and depressed tip, and the second is swollen, rounded, and dome-shaped. The last half volution is sharply keeled at the lower two-fifths. A few faint protractive riblets are discernible at the latest part of the protoconch of some specimens (Text-fig. 21-2). The suture is incised. The boundary between the protoconch and the teleoconch is aparently marked by a retrocurrent sigmoidal ridge. The teleoconch whorls are about six in number and sharply angulated peripherally. The angulation is at the upper one-third on the early whorls and is removed gradually upward to upper one-fifth on the later ones. The surface above the angulation is very slightly concave and gently sloped to form the anal band; the lateral surface below the angulation is roundly convex and moderately receded inward to the lower suture. All the whorls of the teleoconch are provided with the axial plicae. The axials are twelve on the first whorl, suddenly increased in number on the penultimate whorl, and counted about fifteen on the body whorl. They are moderately oblique, retrocurrent except for the antecurrent upper fourth to third, sharply elevated, but narrower than the interspaces, which are covered with dense inclemental lines. They are somewhat stronger at the periphery and gradually weakened above and below but reach both the upper and the lower suture. The spiral ornamentation is not developed on the spire-whorls, but several very obsolete lines are discernible on the lower part of the basal surface and rather distinct seven to eight threads are developed on the snout. The suture is appressed, simple, and slightly undulated. The body whorl is large occupying almost two-thirds of the total height of the shell, markedly contracted at the suture with gently sloped anal band, angulated at the periphery, gradually contracted at the base to the short and straight snout, where the axials are diminished. The aperture is rhomboid with a short and somewhat oblique anterior canal. The outer lip is sharp and thin at the very margin, variced outside at a distance from the margin, smooth inside, obsoletely sinused close to the suture, and somewhat contracted anteriorly to form a boundary between the outer lip and the canal. The anal sinus is very shallow and open with symmetrical upper and lower arms, but in the fully

grown specimens it is somewhat narrowed by the callous deposits along the margin of the sinus and the moderately thick parietal entering callus pad. The inner surface just behind the apex of the anal sinus is provided with an axially elongated bulge. Rather regularly curved and simple inner lip is also covered with the thin callus. The dark coloration is preserved; it is composed of a wide band on the anal band, three narrow lines on the lateral surface of the spire-whorls, and six narrow lines on the lateral and the basal surface of the body whorl.



Text-fig. 20. Protoconch of *Cythara (Cytharella) robusticostata magna* n. subsp. Typical one GK-M 6325. Unit bar indicates 0.25 mm.

Comparison.—The present specimens shows the typical cytharoid feature. It is readily distinguished from the type species of *Cythara* SCHUMACHER, 1817, in being devoid of the columellar folds in the aperture. It closely resembles *Murex costata* DONOVAN, the type species of *Cytharella* MONTEROSATAO, 1875, in the general outline of the shell, coloration, ornamentation, and sinus with the inner bulge behind it. The former, however, differs from the latter in the feature of the protoconch, although the profile of the paucispiral protoconch with about two volutions is similar between these two. The protoconch is dome-shaped composed of one and a half smooth ones and peripherally keeled last half volution in the present species, while in the latter the last volution of the protoconch is provided with many narrow axial riblets and the spiral lines on the surface between the axials. The present specimens somewhat resemble *Ithycythara* WOODRING, 1928, with quite similar protoconch and ornamentation. The former, however, is readily distinguished from the latter in more ovate outline and being devoid of the labrum teeth and columellar one. In other words the present specimens represent a transitional form between *Cytharella* and *Ithycythara*. At the present level of knowledge I can not mention which is ancestral, *Cytharella* or *Ithycythara*. The facts concerning similarity or diversity of the protoconchs and teleoconchs and the stratigraphic occurrence of these three groups suggest the hypothetical lineage from *Ithycythara* to *Cytharella* via a group including the present specimens. Under these circumstances I prefer to include the present specimens in *Cytharella* considering the closer morphological relation of the former to the latter than to *Ithycythara*.

The present specimens are closely allied to *Lachesis robusticostata* SMITH (1879, p. 198, pl. 19, f. 28). Distinction between the two is based on the following aspects: (1) the present specimens are more than twice as large as the species; (2) SMITH's species has sharper peripheral angulation than the present specimens; and (3) coloration. I consider these differences are not of interspecific level but of intraspecific. Accordingly the present specimens are treated here as a subspecies of *Cythara (Cytharella) robusticostata* (SMITH).

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Northeast, north, and northwest sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Upper Pleistocene.

Genus *Brachycythara* WOODRING, 1928

(type-species: *Cythara gibba* GUPPY by original designation)

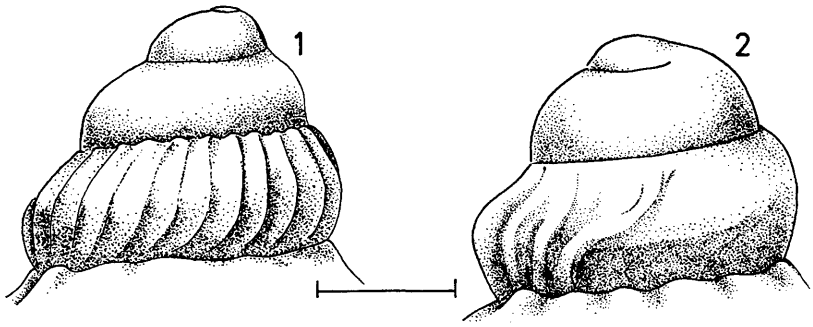
Brachycythara kyushuensis n. sp.

Pl. 31, Figs. 15, 16, and 17; Text-figs. 14 and 21.

Material.—Holotype: GK-M 6667. A single perfect specimen.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	V	VI	spirals I	II
6667	10.7	4.4	7.05	41.2	66.1	3.33	5.0	48.2	34.0	8	9	11	10	10	10	4	7+2



Text-fig. 21. Protoconchs of some Mangeliinae from the Moeshima shell bed. Unit bar indicates 0.3 mm.

1. *Brachycythara kyushuensis* n. sp., GK-M 6667.
2. *Cythara (Cytharella) robusticostata magna* n. subsp., atypical one, GK-M 6639.

Diagnosis.—The shell is small attaining a little more than ten mm in height and rhomboid-fusiform with high conical spire and gradually attenuated long base. The test is moderately thick. The protoconch is blunt and depressed conical with rapidly enlarged three and one-third volutions, of which the first is obliquely depressed small tip, the second is dome-shaped, the third and the fourth are roundly convexed at the side; the last one volution is ornamented by the brephic protractive close axial riblets. The volutions are separated from one another by the depressed sutures. The roundsided protoconch is followed by the angulated teleoconch whorls and the boundary between them is marked by a sharp arcuate ridge with concave face oralward. Rather the oblique first axial rib of the teleoconch comes against this ridge. The peripheral angulation is not sharp but well defined and situated at the lower third of the whorl-height on the first teleoconch whorl, and at the lower two-fifths on the penultimate whorl as a result of the gradual upward change of its position. The surface above the angulation is somewhat concave and steeply sloped forming the anal band, and the surface below the angulation is slightly convex and receded to the lower suture. The body whorl is large occupying about two-thirds of the shell-height, bluntly angulated at the periphery, and gradually attenuated

below the angulation to the straight and long snout. The ornamentation consists of the oblique and indistinct axial plicae and the fine and close spiral threads. The axials are counted eight, nine, eleven, ten, and ten respectively on the first, second, third, fourth, and fifth whorl. They are narrower than the interspaces and moderately strong on the angulation and abruptly weakened above and below it. In consequence they hardly reach the upper suture and diminish at the halfway on the basal slope. Six equidistant and subequal primary threads are discernible on the first whorl, of which the uppermost, the lowest, and the second lowest one are situated respectively close to the upper suture, close to the lower suture, and at the angulation. On the second whorl unequal ten threads are observed in consequence of the intercalation of a few secondaries. On the third whorl the tertiaries are intercalated in the interspaces on the lower part of the lateral surface and the uppermost primary becomes stronger to transform into a narrow but distinct subsutural band. On the penultimate whorl about twenty-four threads are counted and they are only separated from one another by the minute grooves. On the body whorl the secondaries become as large as the primaries to make up together with the tertiaries rather the regular alternation of the wide and narrow lines, which are readily observed under the microscope of moderate magnification. They are more elevated and distinct on the snout than on the main surface. The incremental lines are distinct and close on the whole surface except on the top of the axials. The aperture is long, narrow, pointed posteriorly, and gradually attenuated to the short canal. The outer lip is variced outside especially at the upper half and thickened inside with three blunt denticles, of which the uppermost one close to the anal sinus is broad and large and the other two are rather obsolete. The anal sinus is round, close to the suture, moderately deep with asymmetrical arms, the upper one of which converges to the suture by about sixty degrees and the lower one extends protractively. The stromboid posterior sinus is wide and very shallow. The flexuous inner lip is covered with the distinct callus pad. The canal is straight, slightly oblique, short, and truncated at the anterior end.

Comparison.—The present specimen is characterized by the rhomboid-fusiform shell with distinct peripheral angulation, rapidly increasing and bluntly conical protoconch of more than three volutions which are smooth at early and brephic later, ornamentation consisting of the weak axials and minute close spiral threads, long and narrow aperture with varix outside and mound-like blunt denticles inside the outer lip, and the callus of the inner lip with ridged border.

Some of these features are identical to a few known genera. That is to say, *Brachycythara* WOODRING, 1928, with the type species *Cythara gibba* GUPPY is a close ally to the present specimen. They are provided with closely resembling protoconchs and apertures, but the former is devoid of the varix of the outer lip and of the bordering ridge of the callus on the inner lip.

The present specimen is also allied to *Tenaturris* WOODRING, 1928, with the type species *Cythara guppyi* DALL, but the former is distinguished from the latter which has the protoconch of two and a half volutions and a few varices here and there on the furface of the teleoconch and is devoid of the bordering ridge of the callus on

the inner lip. In this situation the present specimen is surely in the closest relation to *Brachycythara*. Here it is rather a matter of question whether the former represents a new subgenus of the latter or is quite included in the latter.

The present specimen closely resembles morphologically *Pleurotoma elegans* REEVE (1846, p. 63) from Philippines, but the former is readily distinguished from the latter in being provided with more distinct and closer spiral threads and fewer labial denticles and devoid of the columellar denticles. They are apparently different at the generic level in spite of the superficial resemblance.

It is also similar to *Peurotoma stromboides* REEVE (1846, p. 63) from Philippines, but is distinguished from the latter in being devoid of such a sharp peripheral angulation and close and numerous denticles at the columella and labrum as in *P. stromboides*.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Subfamily Daphnellinae HEDLEY, 1922

Genus *Maoridaphne* POWELL, 1942

(type-species: *Daphnella clifdenica* LAWS by original designation)

Subgenus *Kuroshiodaphne* n. subgen.

(type-species: *Daphnella? fuscobalteata* SMITH, here designated)

Diagnosis of the subgenus.—The shell is small and fusiform. The protoconch is bluntly conical with about three volutions, of which the first one and one-third volutions form a depressed and smooth dome and the remainder ones are finely diagonally cancellated. The protracitive riblets reach both the upper and lower sutures and the retractive ones are confined to the lower half to lower two-thirds of each volution. The last one-third volution of the protoconch is angulated peripherally. The teleoconch whorls are distinctly angulated at the periphery and ornamented with marked reticulation of the raised spiral lirae and the vertical narrow but sharp axial ribs. The body whorl is large and remarkably contracted at the base to the straight snout. The aperture is long and narrow with moderately deep anal sinus posteriorly and widely open canal anteriorly. The outer lip is simple, thin, and vertical in profile. The collumellar lip is also smooth and simple.

Comparison.—The speciemens are clearly distinguished from *Philbertia* MONTEROSATO, 1884, with the species *Pleurotoma philberti* MICHARD on the basis of the protoconch which is provided with diagonal cancellation in these specimens and with the cancellation formed by the spirals and the protractive axials in *Philbertia.* The protoconch of the present specimens resemble that of *Kermia* OLIVER, but the latter is composed of the smooth initial volution, the second one with minute spiral striae, and the diagonally cancellate third one.

The present specimens resembles *Rimosodaphnella* STAADT (in COSSMANN), 1915, in the fusiform outline, reticulate sculpture, and the cancellate protoconch except for the sharp peripheral angulation of the last part.

Maoridaphne POWELL, 1942, with the type species *Daphnella* LAWS is also a close ally to the present specimens. They closely resemble each other in fusiform outline, distinct and granulated reticulation of the spiral lirae and the axial ribs, the elongate aperture with moderately deep anal sinus, simple labrum, smooth columella, and vertical labrum profile, and also in the diagonally cancellate protoconch which is sharply angulated at the last part. They differ slightly in that the protocohnch of the present specimens consists of less than three volutions inspite of four or more volutions of *Maordaphne* and also in the contraction of the base, which is more distinct in the present specimens than in *Maoridaphne*.

Maridaphne (Kuroshiodaphne) fuscobalteata SMITH

Pl. 33, Figs. 12, 13, 14, and 15; Pl. 35, Figs. 6 and 7; Text-figs. 22, 23, and 24.

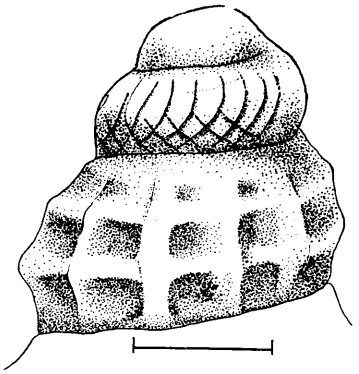
1879, *Daphnella? fuscobalteata* SMITH, *Proc. Zool. Soc. London* for 1879, p. 196, pl. 19, f. 26.
1884, *Clathurella fuscobalteata*, TRYON, *Man. Conch. Vol. 6*, p. 284, pl. 25, f. 59.

Material.—GK-M 6664, 8102, 8103, 8104, and 8150. Preservation is favourable.

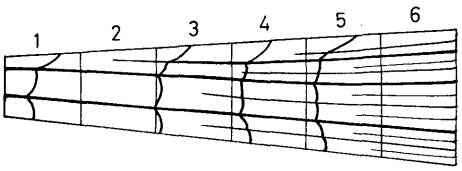
Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials					spirals	
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		I	II	III	IV	V	I	II
6664	10.95	4.25	7.0	38.8	63.9	2.66	5.0	52.9	25.5	11	10	11	13	13	2	3
8102	12.55	4.35	8.3	34.7	66.1	3.0	5.8	49.2	19.4	11	12	12	13	15	2	3
8103	10.8	4.10	7.25	38.0	67.1	2.75	5.5	46.5	23.5	10	11	11	14	15	2	3

Descriptive remarks.—The shell is small attaining about eleven to thirteen mm in height and fusiform with the high spire and the long base. The test is moderately thick but rather fragile. The protoconch is bluntly conial and paucispiral with three to two and two-thirds volutions, of which the first is depressed, smooth, and slightly oblique tip, the succeeding one-third volution is smooth and roundly convexed at the side, the remaining one volution is roundly convexed and finely diagonally cancellated, and the last one-third is featured by the peripheral angulation besides the diagonal cancellation. The cancellation consists of the very oblique and strongly curved fine and close protractive riblets which reach both the upper and the lower suture and weakly curved fine and close protractive ones. The latter is confined on the lower two-thirds to a half of the surface. The peripheral angulation is obsolete at the beginning and gradually becomes sharper. The teleoconch whorls are bluntly angulated peripherally and reticulated by the elevated sharp axial folds and distinct spiral lirae. The peripheral angulations are originally two very prominent ones at lower one-third and upper fourth respectively, which are overriden by the distinct spiral lirae. On the third whorl the angulations are three because of the new development of a lirated angulation above the upper primary one. It starts as a obsolete lirae at the lower third of the ramp on the second whorl and then strengthened to make an angulation. On the fourth whorl the third (uppermost) angulation becomes the most distinct and the others rather obsolete. In consequence the surface below the uppermost angulation is only moderately convex and does not show any angular profile. The body whorl is large occupying about two-thirds of the shell height and biangulated at the upper and the basal surface. The suture is somewhat clasped by succeeding whorl



Text-fig. 22. Protoconch of *Maoridaphne* (*Kuroshiodaphne*) *fuscobalteata* (SMITH) from the Moeshima shell bed, GK-M 6664. Unit bar indicates 0.3 mm.



Text-fig. 23. Schematical illustration of the development of the spiral ornamentation of *Maoridaphne* (*Kuroshiodaphne*) *fuscobalteata* (SMITH). The whorl-number is indicated by 1-6.

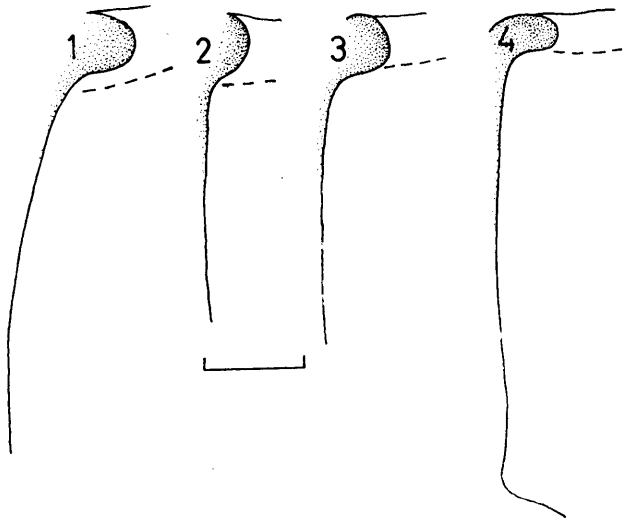
and slightly wavy. The primary spiral lirae are two at first and coincide with the peripheral angulations. A faint secondary thread appears on the lower part of the ramp of the second whorl and then abruptly becomes as strong as the primaries on the third whorl. On the fourth whorl the third primary lira appears from the overlapping part of the fifth whorl and a few secondaries are intercalated in the primary interspaces. In consequence that whorl has the regular alternation of four prominent and three somewhat weaker lirae on the lateral surface below the angulation, above which the surface is smooth except for growth lines. The body whorl is provided with about ten pairs on the lateral and basal surface and six to seven prominent lirae on the snout. The development of the spiral sculpture is schematically illustrated in the Text-fig 23. The axial plicae are sharply elevated but narrower than the interspaces, vertical, and granulated at the crossings by the spirals. They are stronger at the periphery and gradually weakened below to the snout on the body whorl and abruptly faded away on the anal band. The aperture is elongately rhomboid with a short and oblique canal. The outer lip is thin and sharp at the margin and smooth inside. Its profile is vertical and straight except for moderately deep, narrow, and v-shaped anal sinus close to the suture. The linner lip is covered with the thin callous material and parietal tubercle is not developed. A narrow whitish band occupies the lower one-third of each spire whorl and separates the upper and lower darker bands on the body whorl.

Comparison.—The present species is closely similar to the adolescent features of *Daphnella* ? *subzonata* SMITH, living in west Japan, but is readily distinguished from the latter in having vertical axials and distinct anal band which is moderately sloped, slightly concave, devoid of the distinct spirals, and separated from the peripheral part by the angulation. Furthermore the two differ in coloration.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Northeast and east sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.



Text-fig. 24. Anal sinuses of some Daphnellinae from the Moeshima shell bed. Unit bar indicates 1 mm.

1. *Asperdaphne peradmirabilis bulbosa* n. subsp., GK-M 6662.
2. *Kermia* cf. *lincta* (REEVE), GK-M 6665.
3. *K. moeshimaensis* n. sp., GK-M 6671.
4. *Maoridaphne* (*Kuroshiodaphne*) *fuscobalteata* (SMITH), GK-M 6664.

Genus *Kermia* OLIVER, 1915

(type-species: *Kermia benhami* OLIVER by original designation)

Kermia moeshimaensis n. sp.

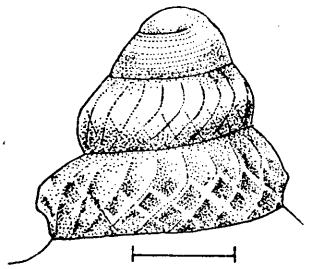
Pl. 35, Figs. 5 and 8; Text-figs. 24 and 25.

Material.—GK-M 6671. A single perfect specimen.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	D/H (%)	Bd/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P	numb. axials I	II	III	IV	spirals I	pen
6671	4.3	1.8	2.8	41.9	65.1	3.25	4.0	66.2	25.7	12	12	12	14	3	7

Diagnosis.—The shell is minute attaining only four mm in height and bucciniform with moderately high conical spire and rather long base. The protoconch is conical and composed of three and one-fourth volutions. The first volution is a blunt, depressed, and smooth tip and the succeeding two-thirds volution is provided with diagonal cancellation. The observation under the microscope of high magnification reveals that the spirals on the second volution are composed of close spiral rows of minute granules. The cancellation on the later volutions is visible on the lower two-thirds of each volution, because the protractive diagonals reach both upper and the lower suture but the retractive ones are faded away at the upper part of the volution. The protoconch is separated from the teleoconch by a sharp, curved, and very protoractively oblique line. The teleoconch whorls are four in number, sharply angulated at the upper part and ornamented by the distinct and regular reticulation



Text-fig. 25. Protoconch of *Kermia moeshimaensis* n. sp. from the Moeshima shell bed, GK-M 6671. Unit bar indicates 0.2mm.

by the sharp axial plicae and the raised spiral threads. The surface above the peripheral angulation is slightly concave and almost horizontal on the first whorl; its inclination increases gradually during growth stages and attains about thirty degrees on the body whorl. In keeping pace with this change of inclination of the ramp the convexity of the lateral side becomes greater. In consequence the profile of the whorls becomes rounder and rounder later. The spiral ornamentation consists of the primary and the secondary threads and the tertiary lines. Two primaries are observed respectively at upper third (I_1) and lower fourth (I_2) at the beginning of the first whorl and third primary (I_3) soon appears from the overlapping part of the lower suture as a result of the upward change of the relative position of all the primaries. On the second whorl two secondaries, which are a half as large as the primaries, appear on the interspaces between I_2 and I_3 and on the concave shoulder close to I_1 respectively. On the third whorl another finer secondary is added between the upper secondary thread and the upper suture. The secondaries soon become as strong as the primaries. The minute tertiary lines are intercalaled in the interspaces on the lateral and basal surface of the body whorl. The subequal primary and secondary threads on the body whorl are ten, of which upper two and the lowest one are somewhat smaller than the others. The spirals override the axial plicae and give rise to the granules at the crossings. Seven distinct lirae are developed and peculiarly granular on the snout. The axial plicae are vertical, sharply elevated but narrower than the interspaces. They are prominent at the periphery, gradually weakened below to the lower suture, abruptly weakened above, and hardly reach the upper suture. On the body whorl they are once obsolete at the boundary between the base and the snout, again distinct on the snout, where they make up the rows of the prominent granules. The suture is undulated and simple. The aperture is elongately rhomboid with short and oblique canal anteriorly. The outer lip is thickened both outside and inside but sharp at the very margin and distinctly contracted at the lower part to mark the boundary between the canal and the aperture proper. It is provided with seven denticles inside, of which the upper most one, just below the anal sinus, is prominent and the others are gradually weakened downward, but the lowest one is again prominent to form a boundary ridge of the canal. The denticles are almost regularly spaced with equal intersapces except for wider one between the second and third denticles. The anal sinus is moderately deep, v-shaped, close to the suture, remarkably asymmetrical with the upper arm converging to the upper suture with high angle (70 to 75 degrees) and the lower arm stretching almost horizontally. The inner lip is sigmoidally curved and covered with the thin callus at the parietal lip at the upper part of the collumellar one.

Comparison.—The present specimen is characterized first by it polygyrate conical protoconch which is ornamented by the minute spiral lines on the second volution

and diagonal cancellation restricted on the lower two-thirds of the third one. Secondly it is also featured by the moderately deep and reversed L-shaped anal sinus and the regularly reticulate ornamentation which consists of the narrow axials and the close spiral threads. On the basis of these diagnostic features the present specimen is reasonably included in *Kermia* OLIVER, 1915, with the type species, *Kermia benhami* OLIVER. Only a slight difference between the present specimen and the type-species of the genus is seen in the number of the protoconch volutions and the strength of the parietal callus. The protoconch consists of two and a half volutions in *Kermia benhami* instead of three and a quarter in the present specimen. *Kermia benhami* is provided with the parietal entering callus pad, which is devoid of on the present specimen.

The present specimen is allied to *Pleurotoma plicosa* C. B. ADAMS (TRYON, 1884, p. 277, pl. 30, fig. 98), but differes from the latter in having less numerous spirals and distinct parietal entering callus pad.

It is superficially similar to *Lienardia gainesi* PILSBRY from Japanese waters in the outline and ornamentation of the teleoconch but quite differs from the latter in the daphnellin protoconch instead of the keeked one of *Lienardia*.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Kermia cf. *tincta* (REEVE)

Pl. 31, Figs. 6 and 8; Text-figs. 24 and 26.

1846, *Pleurotoma tincta* REEVE, *Conch. Icon. Vol. 1, Pleurotoma*, sp. 347.
1884, *Clathurella tincta*, TRYON, *Man. Conch. Vol. 6*, p. 292, pl. 16, f. 76.

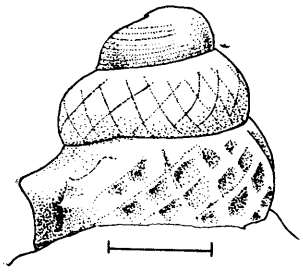
Material.—GK-M 6665. A single specimen. Preservation is almost perfect.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls	<A	<P	numb. axials						angulations		
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)	I	II	III	IV	V	VI	I	II	IV
6665	9.2	4.35	5.45	47.3	59.4	3.33	6.0	61.3	20.6	10	10	11	13	12	14	1-2	2	3

Remarks.—The present specimen quite conforms with *Pleurotoma tincta* REEVE from New Guinea and New Caledonia in the general features of the teleoconch. The concrete identification is, however, suspended untill I have an opportunity to examine the protoconch of *P. tincta*.

The present specimen has a conical protoconch of three and one-third volutions, of which the first is depressed, smooth, and small tip, the second is dome-shaped and provided with minute spiral striae numbering about seven, and the remaining volutions are diagonally cancellated. The open cancellation does not reach the upper suture like-wise that of the preceeding species. The ornamentation of the teleoconch consists of the sharp reticulation by the axial plicae and the primary and the secondary raised threads. The primary threads are two on the peripheral angulation of the first whorl. Thereafter the spirals are increased in number by the intercalation of the secondaries, which are suddenly strengthened to be equal to the primaries. The



Text-fig. 26. Protoconch of *Kermia* cf. *tincta* (REEVE), GK-M 6665, from the Moeshima shell bed. Unit bar indicates 0.2 mm.

tertiary lines intercalated in the every interspaces of the distinct threads render the regular pattern of alternation of the distinct and weak ones. Seven alternate pairs are counted on the main surface of the body whorl and about ten equidimensional threads on the snout. They are markedly granular at the intersections with the plicae, which are ten to fourteen in number, vertical, elevated, narrower than the interspaces, faded away upward at the lower part of the anal band, and continued downward to the snout. The suture is wavy and somewhat overlapped by the succeeding whorl. The aperture is elongately rhomboid with the moderatly deep anal sinus and short but definite canal. The labrum is vertical, crenulated at the termination of the exterior spiral threads, moderately variced outside at slight distance from the very margin, and provided with four equally spaced crude denticles inside. The anal sinus is moderately shallow, reversed L-shaped with steep upper and gently inclined lower arms. Its apex is broadly rounded.

According to TRYON (1884, p. 292) *Pleurotoma albifuniculata* REEVE (1846, Proc. Zool. Soc. p. 6) and *Clathurella rubroguttata* H. ADAMS (1872, Proc. Zool. Soc. p. 14, pl. 3, fig. 25) are synonyms of *P. tincta*. If this is the case the species has very wide range of morphology.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—Northeast sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

Genus *Asperdaphne* HEDLEY, 1922

(type-species: *Daphnella versivestita* HEDLEY by original designation)

Asperdaphne peradmirabilis bulbosa n. subsp.

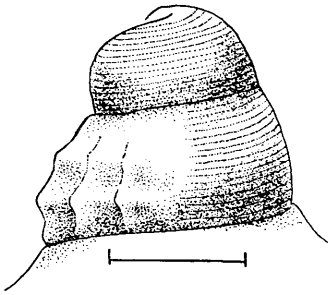
Pl. 33, Fig. 10; Pl. 35, Figs. 1, 2, and 13; Text-figs. 24 and 27.

Matieral.—Holotype: GK-M 6662; paratypes: GK-M 6663, 8092, and 8093.

Measurements.—

specimen	H	D	Bd	D/H	Bd/H	numb. whorls		<A	<P	numb. axials					
GK-M	(mm)	(mm)	(mm)	(%)	(%)	(N)	(PN)	(degrees)		I	II	III	IV	V	VI
6662	13.0	5.65	8.2	43.5	63.1	2.0	6.0	51.7	36.1	13	13	14	15	16	16
6663	9.85	4.35	6.6	44.2	67.0	2.0	5.0	55.5	27.7	13	14	15	15	17	—
8092	11.5	4.9	7.3	42.6	63.5	2.0	5.5	50.5	25.4	11	13	13	13	17	—
8093	11.35	4.85	7.15	42.7	63.0	2.0	5.5	52.6	29.3	12	13	13	13	14	—

Diagnosis.—The shell is small, measured 13 mm in height on the largest specimen, ovato-fusiform with slightly conoidal and moderately high spire and rather a long and contracted base. The test is moderately thick. The protoconch is blunt, dome-shaped, roundly convexed at the side, and consists of two volutions, of which the first is very small tip and the second is swollen. They are ornamented with minute spiral lines, which are composed of the spiral rows of the minute granules under the



Text-fig. 27. Protoconch of *Asperdaphne peradmirabilis bulbosa* n. subsp., GK-M 6662. Unit bar indicates 0.3 mm.

microscope of high magnification. The spiral lines are counted seventeen to eighteen on the second volution. The protoconch is ended at the moderately oblique and somewhat curved line. The teleoconch whorls are six in number, bluntly angulated at the upper part, roundly convexed at the periphery, and slightly concave below the suture. The ornamentation consists of the narrow axial plicae and the regular spiral lirae. The suture is depressed, slightly wavy, and very slightly clasped by the succeeding whorl. The body whorl is large occupying more than sixty percent of the shell-height, gently sloped below the suture, bluntly angulated below the ramp, broadly rounded at the sides, and distinctly contracted at the base to the long and straight snout. The axials are slightly retrocurrently oblique, especially at the upper part. They are elevated but narrow, about two-thirds to three-fifths of the interspaces in breadth. They are stronger on the third and fourth whorls and somewhat weaker on the early and especially on the late ones. They are distinct at the lateral surface and abruptly weakened on the concave anal band. The number of the axials on the first whorl is about thirteen and gradually increased in number later to sixteen to seventeen on the the last whorl. The spirals consist of the primary lirae, secondary threads, and the tertiary lines. Four primaries are visible on the first whorl of the holotype specimen close to the lower suture, (I_4), at the lower third, (I_3), at the upper two-fifths, (I_2), and at the upper fourth, (I_1), respectively. Whereas on the paratype specimens the lowest primary, (I_4), is hidden under the succeeding whorl. On all the specimens the uppermost one is somewhat weaker than the others and forms a blunt angulation, above which the surface is slightly concave and gently sloped. Three secondaries appear as obsolete lines at the lower two interstices and just above the uppermost primary of the early part of the second whorl. The fourth secondary appears slightly later at the interstice between I_1 and I_2. They are rapidly increased in size and attain three-fourths as large as the primaries on the third whorl. Fine tertiary lines are intercalated in almost every interspaces on the fifth whorl. On the last whorl (sixth) the primaries and the secondaries are subequal in size and numbered about fifteen on the lateral and basal surface and twelve on the snout, where any sign of intercalation of the smaller lines are not discernible. The crossings of the axials and the primary and secondary spirals are moderately granulated. The growth lines are distinct at the interspaces between the axials and the spirals. They are more elevated on the anal band forming the fine reticulation together with the close tertiary spirals. The aperture is elongately rhomboid with narrow and oblique canal anteriorly. The anal sinus is narrow and moderately deep, close to the suture, distinctly asymmetrical with the upper arm converging to the upper suture with steep angle more than sixty degrees and the lower arm forwardly stretching. The outer lip is sharp, smooth, and thin at the very margin, distinctly contracted anteriorly to the canal, and thickened inside at some distance from the margin but not denticulate.

The inner lip consists of oblique and short parietal one and the somewhat curved and almost vertical columellar one. The callous deposit is visible on the upper part of the columellar lip but is moderately thin.

The coloration is obsoletely preserved; dark bands occupy the upper half and lower fourth of each spire whorl and the third band is discernible at the lower part of the basal surface of the body whorl.

Comparison.—The present specimens are characterized basically by the protoconch which is blunt, paucispiral, and ornamented by the close spiral rows of microscopic granules. This feature together with the characteristics of the aperture verifies the specimens belong to *Asperdaphne* HEDLEY, 1922, with the type species *Asperdaphne versivestita* HEDLEY.

The present specimens are almost identical in the general feature including coloration to *Drillia peradmirabilis* SMITH (1879, p. 189, pl. 19, f. 12). According to the original description *D. peradmirabilis* is provided with the blunt and dome-shaped protoconch of one and a half smooth volutions instead of the striated one of *Asperdaphne*, while OYAMA (1957, *Asperdaphne*, fs. 11 and 12) verified the protoconch of *Asperdaphne* on the basis of his specimens.

Asperdaphne peradmirabilis (SMITH) is twice as large as the present specimens, slenderer in outline, and provided with much closer spiral ornamentation, and distinct varix outside the outerlip. These facts indicated that the present specimens, although very closely related, are not identical to SMITH's species. I prefer to consider it is a distinct subspecies of *A. peradmirabilis*.

It is closely allied to *A. laceyi* (SOWERBY) (1888, p. 567, pl. 28, f. 15) in general features, but the former has shorter canal and more distinct axials than the latter.

It is also similar to *Daphnella macandrewi* SMITH (1882, p. 302; MELVLL: 1917, p. 192, pl. 9, f. 11) from Persian Gulf in form-character except for protoconch, which was not described by both authors. The former, however, is two-thirds smaller and has more numerous axials than the latter.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Localities.—Northeast and east (type) sea-cliffs at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene.

Genus *Clathurina* MELVILL, 1917

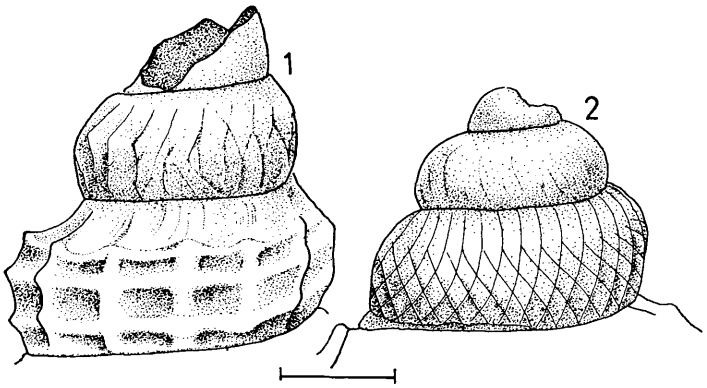
(type-species: *Pleurotoma foraminata* REEVE by original designation)

Clathurina foraminata (REEVE)

Pl. 34, Figs. 14, 15, and 16; Text-figs. 28 and 29.

1845, *Pleurotoma foraminata* REEVE, *Proc. Zool. Soc.* for 1845, p. 118.
1845, *Pleurotoma foraminata*, REEVE, *Conch. Icon. Vol. 1, Pleurotoma*, pl. 33, sp. 301.
1884, *Clathurella foraminata*, TRYON, *Man. Conch. Vol. 6*, p. 288, pl. 17, f. 7.
1917, *Clathurina foraminata*, MELVILL, *Proc. Malac. Soc. Vol. 12*, p. 186.

Material.—GK-M 8137. A single almost perfect specimen.



Text-fig. 28. Protoconchs of some Daphnellinae from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Clathurina foraminata* (REEVE), GK-M 8137.
2. *Venustoma lacunosa* (GOULD), GK-M 8114.

Measurements.—

specimen GK-M	H (mm)	D (mm)	Bd (mm)	Ap (mm)	D/H (%)	Bd/H (%)	Ap/H (%)
8137	11.3	3.85	7.0	5.3	34.1	61.9	46.9

specimen GK-M	numb. whorls (N)	(PN)	<A (degrees)	<P	axials I	III	V	VI	spirals I	II	V
8137	ca 3	6	42.3	19.1	12	16	23	23	3	4	10

Descriptive remarks.—The present specimen is quite identical to REEVE's species from the marginal seas of Indian Ocean except for more numerous axials of the former than the latter. The revised description is given here because the original description is very concise.

The shell is fusiform and small attaining a little more than eleven mm in height of the shell. The protoconch is broken at the early volutions. It is possibly composed of more than three volutions, of which the last one is sculptured by irregularly diagonal cancellation. The protractive riblets are distinct on the lower two-third of the volution and then abruptly weakened above. The retractive ones start at the upper third as distinct vertical riblets and them gradually curved antecurrently. In consequence the cancellation seems to be constructed by abruptly curved axial riblets and faint protractive one which are restricted on the lower two-thirds of the volution. The end marking of the protoconch is an almost vertical weak line, with which the initial oblique axial rib of the teleoconch is intersected. The teleoconch whorls are six in number. They are provided with narrow and slightly concave anal band below the suture, bluntly angulated below the ramp, broadly rounded at the sides, and ornamented with the fine but raised reticulation by close and vertical axials and coarse spirals. The axial plicae are twelve on the first whorl and gradually increased in number; consequently they are counted twenty-three on the body whorl. The axials are sharply elevated until on the penultimate one but somewhat reduced on the body whorl. They are one-third as wide as the interspaces on the first whorl then gradually become wider and

about one half as wide as the interspaces on the later whorls. They are stronger on the lateral surface and reach the lower suture without any reduction but abruptly weakened on the anal band and also faded away on the snout of the body whorl. The spirals appear as three elevated lirae at the angulation between the anal band and lateral surface, (I_1), at the middle of the whorl, (I_2), and at the lower one-fifth, (I_3), respectively on the first teleoconch whorl. On the second whorl a secondary (II_1) is added just above (I_1) and on the third whorl the secondary threads are intercalated at every interspaces of the primary spiral lirae. Thereafter the secondary spirals become stronger and in consequence on the penultimate whorl they are only somewhat weaker than the primaries. Weak tertiary spiral lines are intercalated in each interspace on the later part of the penultimate whorl and in concequence the body whorl has the regular alternation of sixteen pairs at the lateral and basal surface and eight ones at the snout. The crossings of the distinct spirals and axials, especially those on the early whorls, are remarkably granulose. The growth lines are distinct on the anal band forming crescentic figure. The suture is slightly oblique and slightly impressed with faint subsutural cord-like elevation. The body whorl is large occupying about sixty percent of the total height, distinctly contracted at the suture and at the base, roundly convexed at the side. The snout is straight and rather long. The aperture is a little less than a half of the shell height, elongately rhomboid with the posterior sinus and the anterior canal. The anal sinus is close to the suture, very deep, and regularly rounded at the apex. The lower arm of the anal sinus is horizontally stretched forwardly and then reflected anteriorly continuing to the vertical and straight outer lip. The entering callus pad is strong and conjoins to the sinus resulting subtubular feature. The outer lip is straight and vertical without any stromboid notch, thickened inside with distinct twelve dentitions, and sharply reflected at the boundary between it and the canal. The inner lip is simple and covered by the weak callus.

The present specimen is almost perfectly identical to *Pleurotoma foraminata* REEVE, which is the type species of *Clathurina* MELVILL, 1917, in general features except for more numerous axials than the latter. In this respect it is allied to *Clathurina foraminata pyrgodea* MELVILL (1917, p. 186, pl. 10, f. 13) from Persian Gulf, but the former has somewhat longer canal than the latter. Judging from that MELVILL included a few varieties in *C. foraminata*, it seems rather variable in morphological characters and the present specimen may be included safely in the normal range of variation of *C. foraminata* (REEVE).

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

Genus *Venustoma* BARTSCH, 1941

(type-species: *Venustoma harukoa* BARTSCH by original designation)

Venustoma lacunosa (GOULD)

Pl. 32, Figs. 3, 4, and 5; Text-figs. 28 and 29.

1860, *Clathurella lacunosa* GOULD, *Proc. Boston Soc. Nat. Hist. Vol. 7*, p. 338.
1884, *Clathurella lacunosa*, TRYON, *Man. Conch. Vol. 6*, p. 299.
1961, *Venustoma lacunosa*, HABE, *Colored Illustr. Shells Japan, No. 2*, p. 78, pl. 39, f. 6.

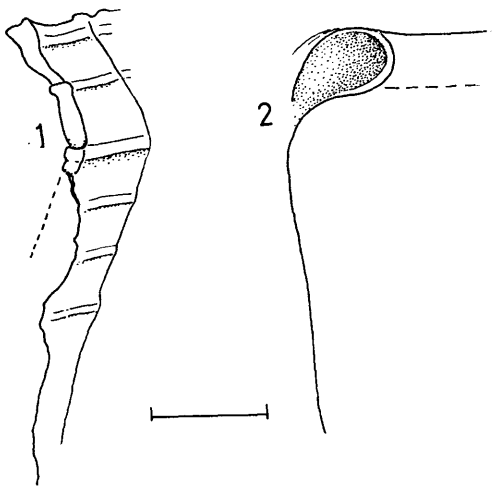
Material.—GK-M 8114. A single almost perfect specimen.

Measurements.—

specimen	H	D	Bd	Ap	D/H	Bd/H	Ap/H
GK-M	(mm)	(mm)	(mm)	(mm)	(%)	(%)	(%)
8114	6.8	3.75	4.75	3.7	55.1	69.9	54.4

specimen	numb. whorls		<A	<P	axials				spiral		
GK-M	(N)	(PN)	(degrees)		I	II	III	bod	I	II	III
8114	3.0	4.66	64.9	43.1	16	21	24	25	3	3	5

Descriptive remarks.—The protoconch of the present species is very small, conical, and composed of three volutions. The first volution is smooth, mammilate, and elevated; the second one is very convex at the side and ornamented by the retractive close axials at the early part and diagonally cancellated by the retractive and protractive riblets at the later; and the third one is moderately convex at the side and provided with regularly diagonal cancellation except for upper fifth, where only protractive ones are observed. The suture of the first teleoconch whorl is impressed with elevated subsutural cord, which gradually apart outward from thc suture and consequently somewhat horizontal terrace is formed between the suture and this cord. The terrace is emarginated later by a secondary lira close to the suture. The whorls are distinctly angulated at the middle; the lateral surface is slightly concave and moderately sloped above the angulation and slightly convex and almost vertical below it. The primary spiral lirae are three, of which the upper one is subsutural, the middle is on the peripheral angulation, and the lower one is at the lower fifth on the first to second whorl. Thereafter another primary lira appears close to the lower suture under the clasping part of the succeeding whorl and a weak secondary is intercalated on the upper sloped surface. The axial ribs are quite parallel to the growth lines, retractly oblique at the upper half and abruptly bended protractly at the angulation. They reach both the upper and the lower suture and faded away near the end of the snout on the body whorl. Distinct granulations are formed at the crossings of the spirals with the axials, especially at the subsutural band and peripheral angulation. The shorter axials are intercalated on the anal band, where they are as distinct as



Text-fig. 29. Anal sinuses of some Daphnellinae from the Moeshima shell bed. Unit bar indicates 0.5 mm.

1. *Venustoma lacunosa* (GOULD), GK-M 8114.
2. *Clathurina foraminata* (REEVE), GK-M 8137.

the primary axials and also very granular on the subsutural band, but abruptly weakened below, and hardly reach the peripheral angulation. The aperture is elongately rhomboid with shallow anal sinus and moderately short canal, which is widely open, subtruncated at the end and provided with the weak fasciole outside. The outer lip is simple; the inner lip is covered with very thin callus. The columella is straight.

The present species is characterized by the biconic small shell of purely white color, diagonally cancellated daphnellin protoconch, narrow but distinct flush suture with prominent cord, shallow anal sinus with straight upper and the lower arms and sharply angulated apex, which is on the peripheral angulation, and regularly reticulate ornamentation. On the basis of these features it is quite identical to *Clathurella lacunosa* GOULD, which was reported from Hong Kong, and included in *Venustoma* BARTSCH, 1941.

Horizon.—The Moeshima shell bed (Upper Pleistocene).

Locality.—East sea-cliff at Moeshima isle, Kagoshima bay.

Geologic range.—Late Pleistocene to Recent.

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Tsugio SHUTO

Turrid Gastropods from the Upper Pleistocene Moeshima Shell Bed
Molluscan Palaeontology of the Pleistocene Formations in Kyushu—I)

Plates 29—35

Plate 29

Explanation of Plate 29

Fig. 1 — *Kuroshioturris tigrinaeformis* (NOMURA) ..... p. 147
(×2), GK-M 6277

Figs. 2-5 — *Cymatosyrinx* (*Splendrillia*) *solicitata* (SOWERBY) ..... p. 168
2, 3: (×4.2), GK-M 6284; 4, 5: (×4.2), GK-M 6285.

Fig. 6 — *Orthosurcula pervirgo* (YOKOYAMA) ..... p. 149
(×2), GK-M 6283.

Figs. 7, 8, and 10 — *Cythara* (*Cytharella*) *robusticostata magna* n. subsp. ..... p. 187
7, 8: (×4.2), GK-M 6324, paratype; 10: (×4.2), GK-M 6324, paratype.

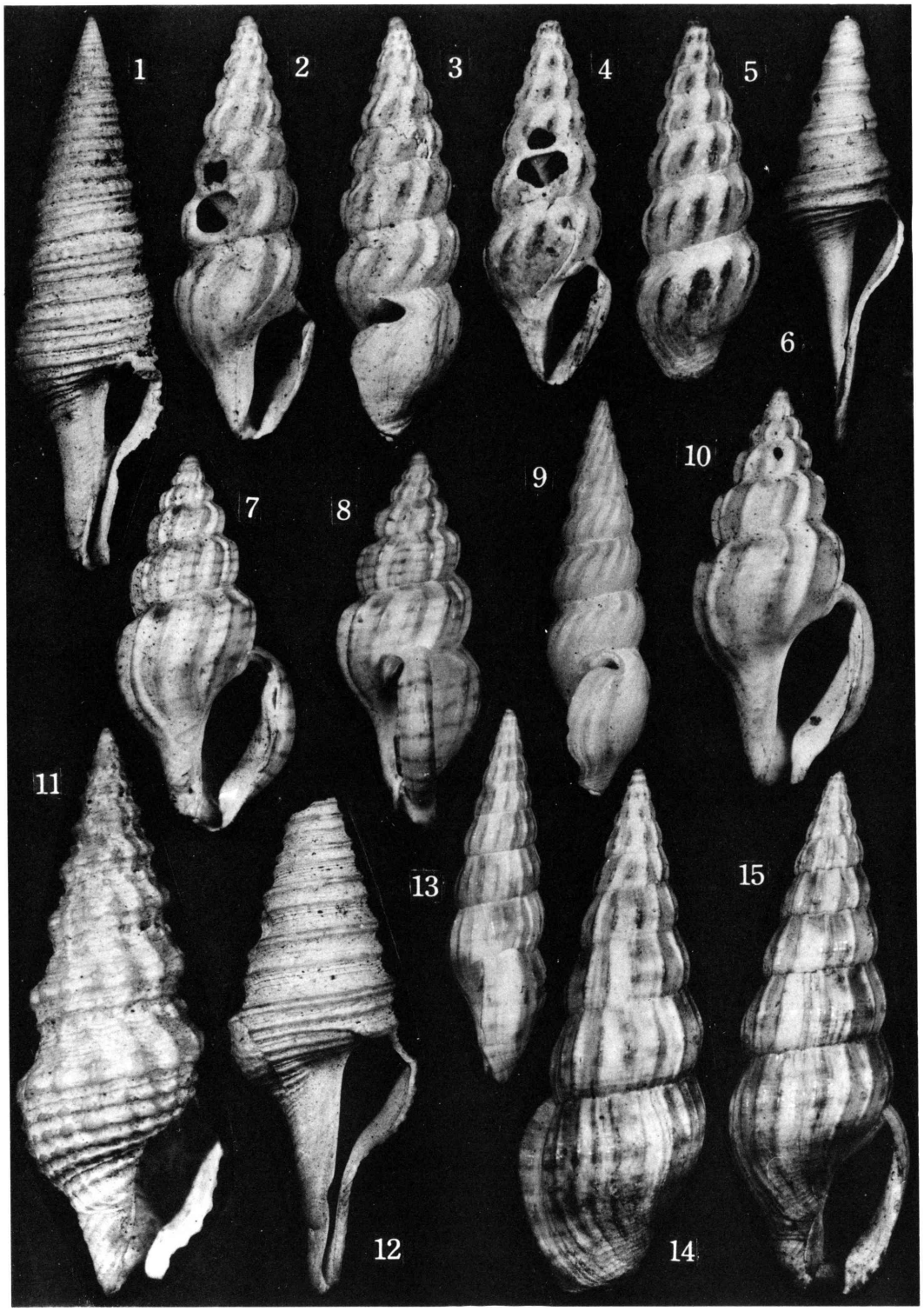
Fig. 9 — *Cymatosyrinx* (*Cymatosyrinx*) *laevis* n. sp. ..... p. 164
(×2.2), GK-M 6315, holotype.

Fig. 11 — *Clavatula* (*Paradrillia*) *consimilis* (SMITH) ..... p. 152
(×4), GK-M 6636.

Fig. 12 — *Gemmula* (*Unedogemmula*) *unedo* (KIENER) ..... p. 146
(×2), GK-M 6282.

Figs. 13-15 — *Horaiclavus splendidus* (A. ADAMS) ..... p. 154
13: (×2), GK-M 6651; 14, 15: (×3), GK-M 6654.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by. T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 30

Explanation of Plate 30

Fig. 1 — *Gemmula* (*Gemmula*) *pulchella* SHUTO ..... p. 145
(×3), GK-M 7374.

Figs. 2, 8, and 9 — *Turricula* (*Surcula*) *interrupta* (LAMARCK) ..... p. 150
2: (×3.5), GK-M 6319; 8 and 9: (×2), GK-M 6317.

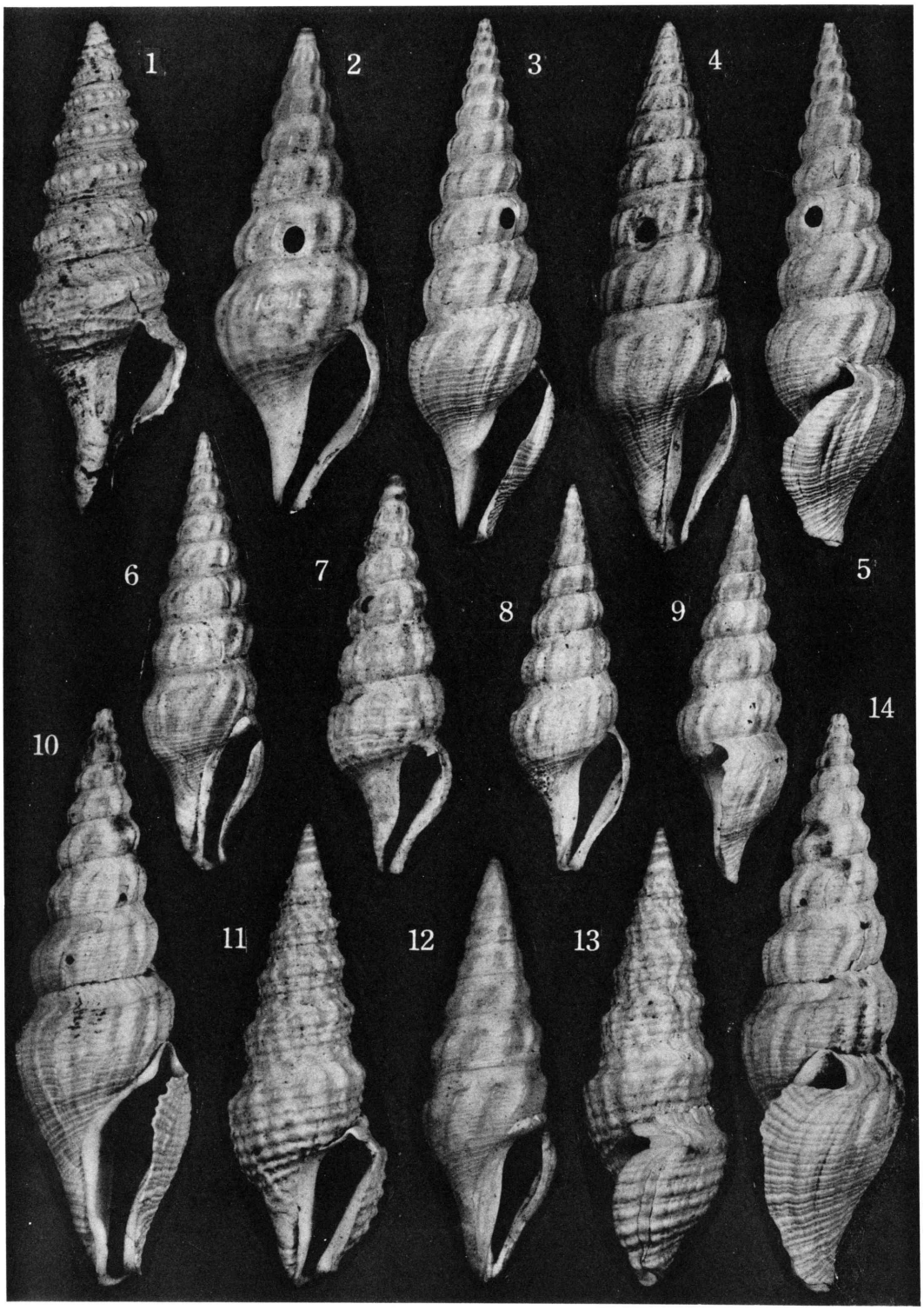
Figs. 3, 5, 10, and 14 — *Inquisitor jeffreysii* (SMITH) ..... p. 170
3 and 5: (×1.7), GK-M 6287; 10 and 14: (×2), GK-M 6288.

Figs. 4, 6, and 12 — *Pseudoinquisitor pseudoprincipalis* (YOKOYAMA) ..... p. 168
4: (×2), GK-M 6301; 6: (×2.2), GK-M 6302; 12: (×3.6), GK-M 6314.

Fig. 7 — *Etremopa* ? cf. *subauriformis* (SMITH) ..... p. 174
(×3), GK-M 6286.

Figs. 11 and 13 — *Clavatula* (*Paradrillia*) *consimilis* (SMITH) ..... p. 152
(×3), GK-M 6635.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 31

Explanation of Plate 31

Figs. 1, 2, and 3 — *Vexiguraleus supercostata* (SMITH) ..... p. 186
(×5), GK-M 6668.

Figs. 4, 5, and 18 — *Turridrupa kagoshimaensis* n. sp. ..... p. 156
(×5), GK-M 6666, holotype.

Figs. 6 and 7 — *Kermia* cf. *tincta* (REEVE) ..... p. 197
(×5), GK-M 6665.

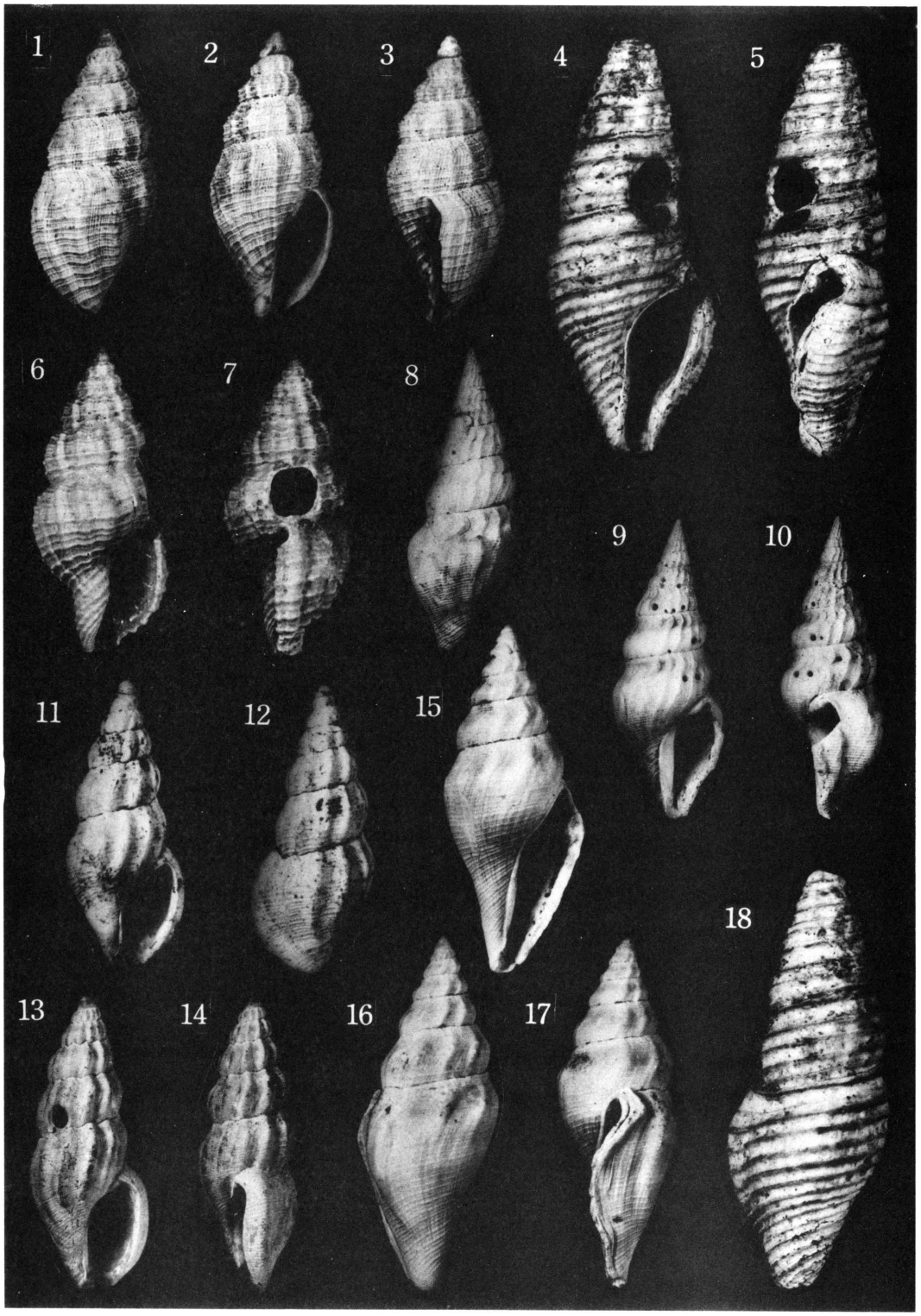
Figs. 8, 9 and 10 — *Clathrodrillia moeshimaensis* n. sp. ..... p. 158
(×1.15), GK-M 6655, holotype.

Figs. 11 and 12 — *Anacithara* (*Anacithara*) *fortistriata* (SMITH) ..... p. 178
(×6), GK-M 6670,

Figs. 13 and 14 — *Anacithara* (*Anacithara*) *moeshimaensis* n. sp. ..... p. 180
(×5.5), GK-M 6669, paratype.

Figs. 15, 16, and 17 — *Brachycythara kyushuensis* n. sp. ..... p. 190
(×5), GK-M 6667, holotype.

Locality of all the specimens; Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 32

Explanation of Plate 32

Figs. 1 and 2 — *Kuroshioturris tigrinaeformis* (NOMURA) ..... p. 147
(×1.5), GK-M 8046.

Figs. 3, 4, and 5 — *Venustoma lacunosa* (GOULD) ..... p. 202
(×7), GK-M 8114.

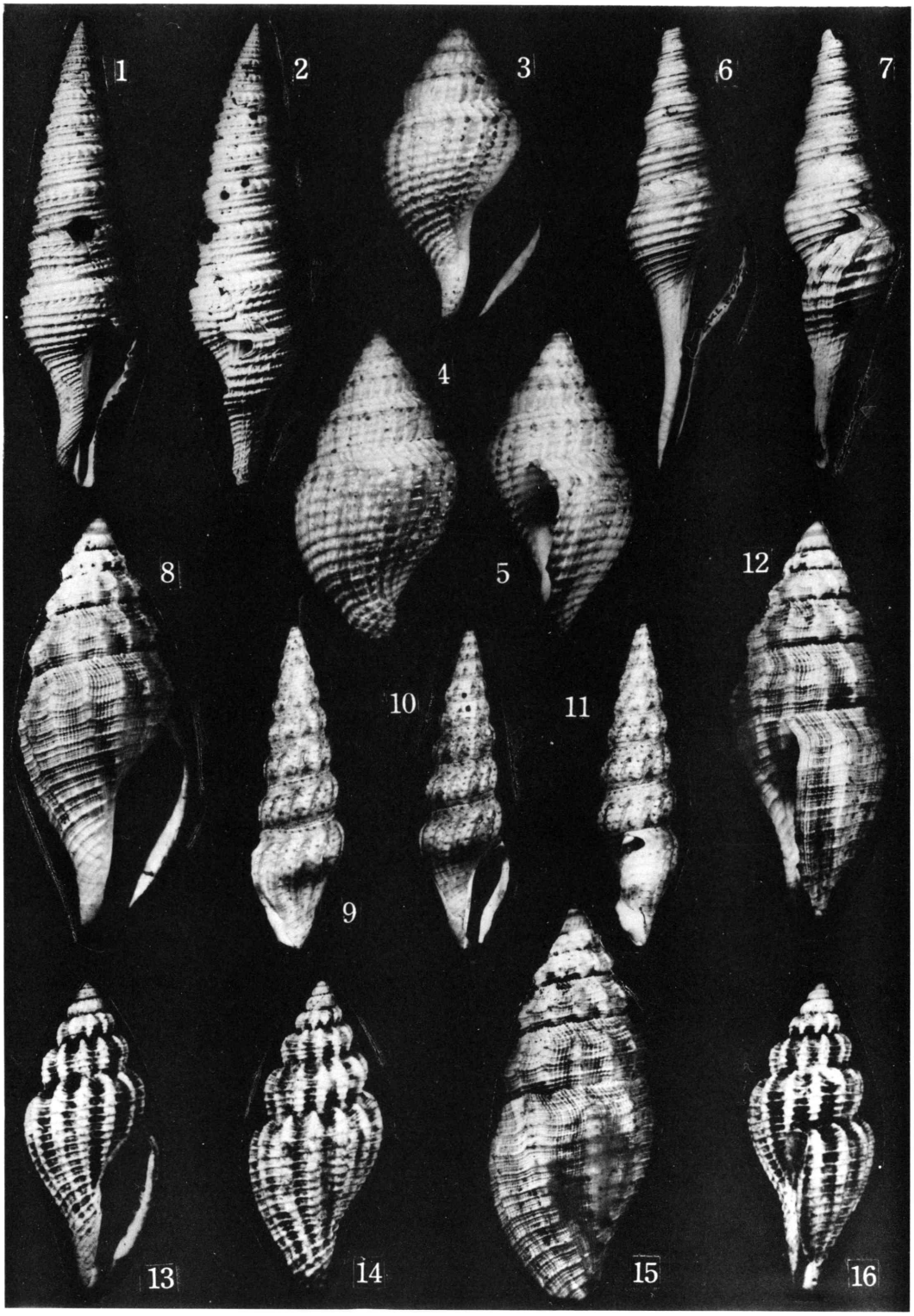
Figs. 6 and 7 — *Orthosurcula pervirgo* (YOKOYAMA) ..... p. 149
(×0.96), GK-M 8054.

Figs. 8, 12, and 15 — *Vexiguraleus supercostata* (SMITH) ..... p. 186
(×7), GK-M 8112.

Figs. 9, 10, and 11 — *Inquisitor japonicus* (LISCHKE) ..... p. 171
(×2.2), GK-M 8305.

Figs. 13, 14, and 16 — *Heterocithara habei* n. sp. ..... p. 184
(×8.3), GK-M 8115, holotype.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 33

Explanation of Plate 33

Figs. 1, 2, 3, and 8 — *Agladrillia oyamai* n. sp. ..... p. 162
1, 2, and 3: (×6), GK-M 8116, holotype; 8: (×6.1), GK-M 8119, paratype.

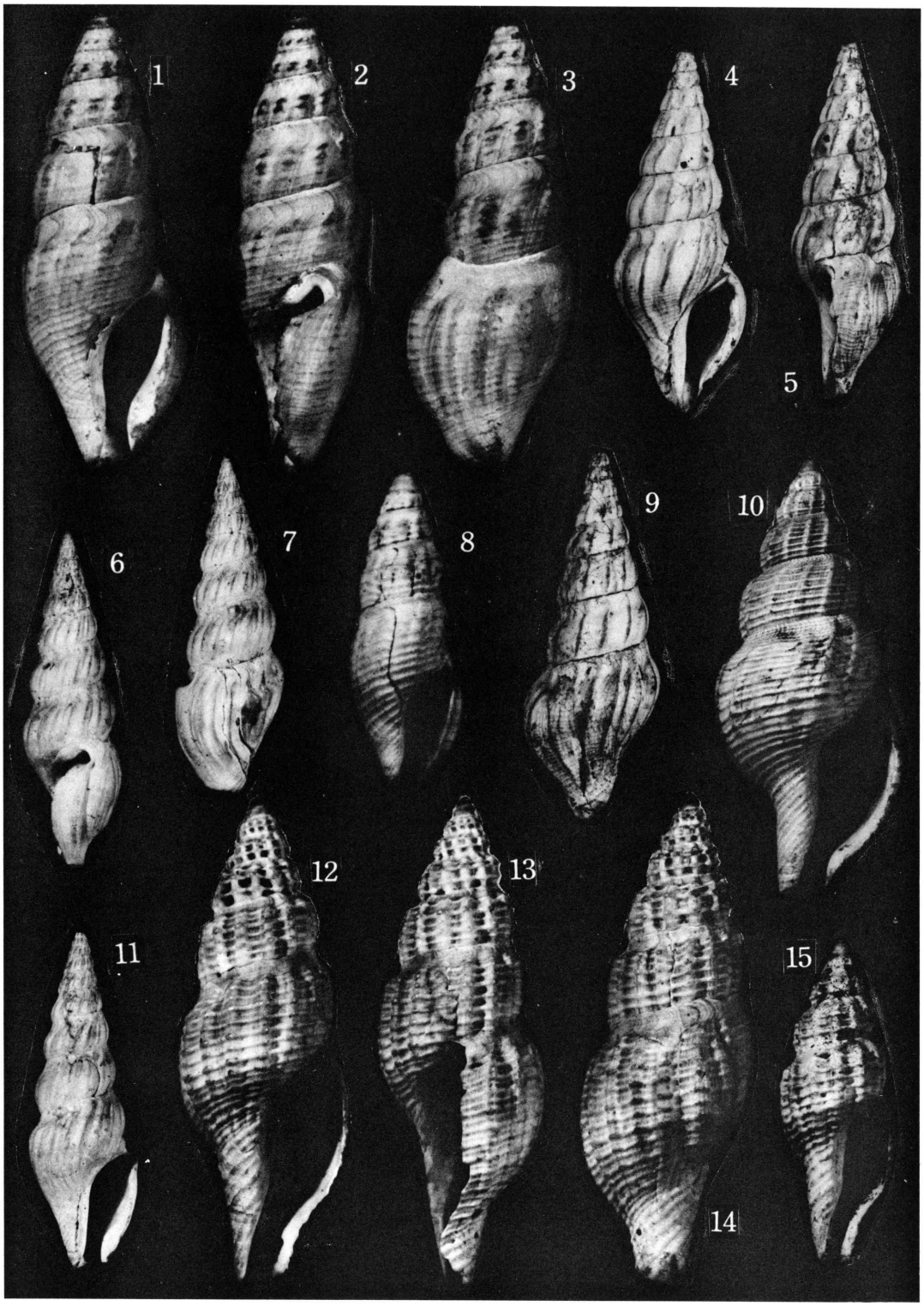
Figs. 4, 5, and 9 — *Clathrodrillia* sp. ..... p. 159
(×2.4), GK-M 8066.

Figs. 6, 7, and 11 — *Cymatosyrinx* (*Cymatosyrinx*) *laevis* n. sp. ..... p. 164
(×2.3), GK-M 8101, paratype.

Fig. 10 — *Asperdaphne peradmirabilis bulbosa* n. subsp. ..... p. 198
(×6), GK-M 8092, paratype.

Figs. 12, 13, 14, and 15 — *Maoridaphne* (*Kuroshiodaphne*) *fuscobalteata* (SMITH) ..... p. 193
12, 13, and 14: (×6), GK-M 8102; 15: (×6), GK-M 8104.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu. Photos by T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 34

Explanation of Plate 34

Figs. 1, 2, 3, 8, and 13 — *Anacithara* (*Anacitharoida*) *kurodai* n. subgen. & n. sp. ..... p. 183
1, 2, 3: (×6), GK-M 8109, holotype; 8, 13: (×6), GK-M 8110, paratype.

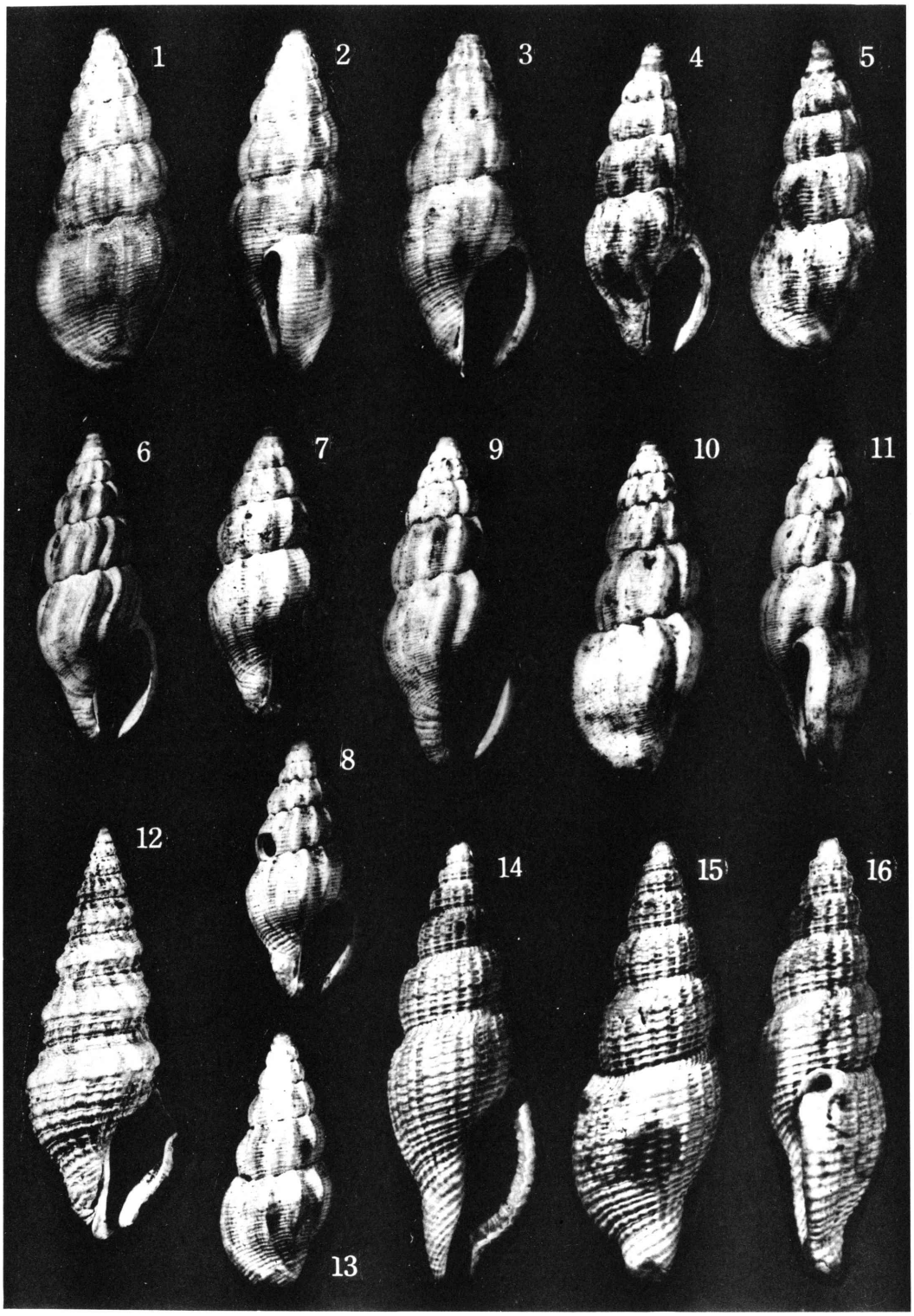
Figs. 4, 5, and 7 — *Anacithara* (*Anacithara*) *fortistriata* (SMITH) ..... p. 178
4 and 5: (×6), GK-M 8105; 7: (×6), GK-M 8106.

Figs. 6, 9, 10, and 11 — *Anacithara* (*Anacithara*) *moeshimaensis* n. sp. ..... p. 180
6: (×6), GK-M 8111, holotype; 9, 10 and 11: (×6), GK-M 8107, paratype.

Fig. 12 — *Clavatula* (*Paradrillia*) *consimilis* (REEVE) ..... p. 152
(×3.2), GK-M 8094.

Figs. 14, 15, and 16 — *Clathurina foraminata* (REEVE) ..... p. 200
14, 15, and 16: (×6), GK-M 8137.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by T. SHUTO



T. SHUTO: Turrid gastropods from the Moeshima shell bed

Plate 35

Explanation of Plate 35

Figs. 1, 2, and 13 — *Asperdaphne peradmirabilis bulbosa* n. subsp. ..... p. 198
1 and 2: (×5), GK-M 6662, holotype; 13: (×5.1), GK-M 6663, paratype.

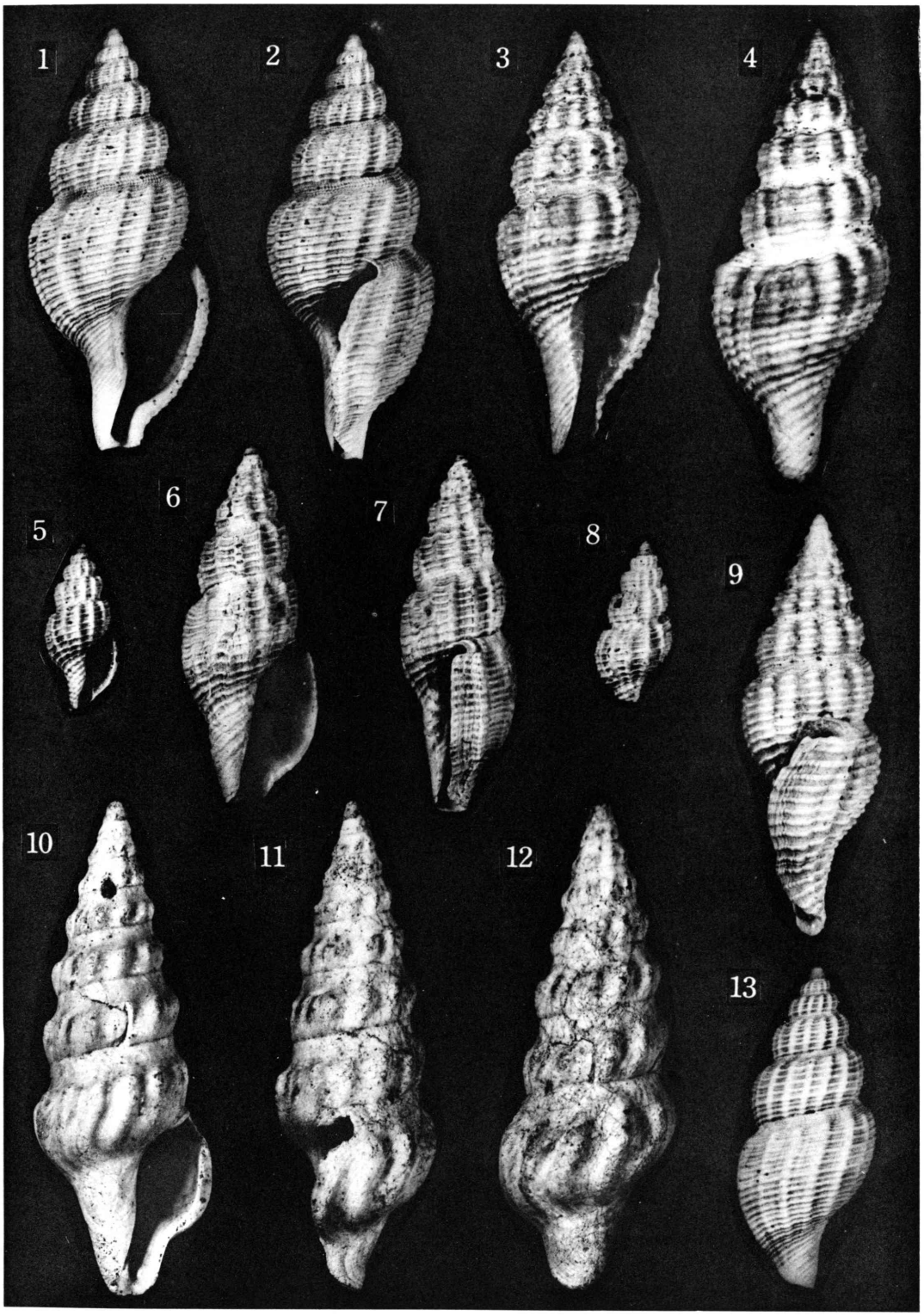
Figs. 3, 4, and 9 — *Glyphostoma* (*Glyphostoma*) *granulifera japonica* n. subsp. ..... p. 175
3: (×5), 4: (×5.4), GK-M 6657, paratype; 9: (×4.6), GK-M 6656, paratype.

Figs. 5 and 8 — *Kermia moeshimaensis* n. sp. ..... p. 195
5 and 8: (×6), GK-M 6671, holotype.

Figs. 6 and 7 — *Maoridaphne* (*Kuroshiodaphne*) *fuscobalteata* (SMITH) ..... p. 193
6 and 7: (×5), GK-M 6664.

Figs. 10, 11, and 12 — *Cymatosyrinx* (*Splendrillia*) *constricta* n. sp. ..... p. 166
10, 11, and 12: (×5), GK-M 6672, holotype.

Locality of all the specimens: Sea-cliffs at Moeshima isle, Kagoshima bay, Kyushu, Japan. Photos by T. SHUTO



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