

Conacean Gastropods from the Miyazaki Group : Palaeontological Study of the Miyazaki Group IX

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Conacean Gastropods from the Miyazaki Group*
(Palaeontological Study of the Miyazaki Group—IX)

By

Tsugio SHUTO

Abstract

This is a part of the serial report entitled "Palaeontological Study of the Miyazaki Group" and includes the description of the toxoglossate gastropod family Turridae, Conidae, and Terebridae. Sixty-three species and six subspecies belonging to forty-one genera and subgenera were distinguished in the molluscan collection from the Miyazaki group. Such abundant occurrence of toxoglossate gastropods in a single stratigraphic unit as this occasion is very rare in our country. These toxoglossate species render the unique feature to the faunule of the Miyazaki group.

Introduction

Conacean gastropods make up a large group with numberless genera and species which are generally characterized by the specialized radulae, namely, by the toxoglossate radulae. The well known toxoglossate radulae consisting only of the slender marginals are common in the conids and part of the turrids and the terebrids. The remainder part of the turrids has the well developed central tooth besides the massive marginals or the prototype radulae and some of the terebrids are devoid of the radulae owing to degeneration. The radulae of the conacean gastropods, especially those of the turrids, however, are not only practically available for studying the fossil materials, but also hardly come to our hands even in the case of the living species. Accordingly the role of the detailed feature of the radulae in the classification on the generic and specific level has not been fully clarified yet. The classification of Toxoglossa is one of the most difficult problems in taxonomy on mollusca and its subdivisions were represented for long time until the end of the nineteenth century by *Pleurotoma*, *Conus*, and *Terebra* reflecting the difficulty in collecting samples in spite of enormous abundance of morphological "forms" or species. Although several hundreds of generic names and thousands of specific ones have been proposed in this taxa, the real taxonomic system has not been fixed yet and several problems and anomalies are left unsolved and being debated. On the classification of the turrids FISCHER (1887), MELVILLE (1917), DALL (1918), HEDLEY (1922), THIELE (1931), POWELL (1942, 1944), WENZ (1944), and LASERON (1954) respectively proposed their own criterion or criteria. Concerning the conid classification TOMLIN (1937) offered a valuable contribution. BELLARDI (1877), COSSMANN (1896), DALL (1908), BARTSCH (1923), THIELE (1931), IREDALE (1931), WENZ (1944) referred to the classification of the terebrids.

* Received December 1, 1960

The examination of these proposed classification suggests that the insistence on a single character of the shell or organs, even if it is really valuable in taxonomy, can not avoid an anomalous bias and can not reach the satisfactory result. The emphasis must be put on the synthetic classification based on the combination of all the available features including the characteristics of the radulae, protoconch, anal sinus, columellar plait, anterior notch, suture, axial and spiral sculptures, and profile of the shell etc. From this stand point the classification in the present report follows basically the proposals of POWELL on Turridae, TOMLIN on Conidae, and COSSMANN on Terebridae with necessary revisions.

The Conacean genera from the Miyazaki group occupy the large percent of total number of the genera of the faunule and this faunal composition gives the faunule an unique feature among the Japanese Miocene and Lower Pliocene faunas. These genera also reveal an interesting fact concerning with the geographic distribution.

Australia-New Zealand					GEN. SUBG.	Japan				
Eo	Oligo	Mio	Plio	Q(Rec)		Eo	Oligo	Mio	Plio	Q(Rec)
					<i>Turris</i>					
					<i>Optoturris</i>					
					<i>Gemmula</i>					
					<i>Bathytoma</i>					
					<i>Micantapex</i>					
					<i>Comitas</i> ss.					
					<i>Cosmasyrinx</i>					
					<i>Parasyrinx</i>					
					<i>Inquisitor</i>					
					<i>Pseudoinquisitor</i>					
					<i>Maidrillia</i>					
					<i>Splendrillia</i>					
					<i>Ateadrillia</i>					
					<i>Tomopleura</i>					
					<i>Filodrillia</i>					
					<i>Borsonia</i>					
					<i>Anacithara</i>					
					<i>Antiguraleus</i>					
					<i>Etrema</i>					
					<i>Puha</i>					
					<i>Kaweka</i>					

Text-fig. 1. Geologic ranges of the Conacean genera and subgenera in common with Australia-New Zealand region and south Japan. So far as the present knowledge concerns the majority of the genera and subgenera is traced back to older geologic age in Australia-New Zealand region than in south Japan.

Table 1. Geologic and geographic ranges of the Conacean genera and subgenera occurring in the Miyazaki group.

genera and subgenera	geographic range	geologic range
<i>Turris</i> <i>Optoturris</i> <i>Gemmula</i> ss. <i>G. (Kuroshioturris)</i> <i>G. (Ptychosyrinx)</i>	Indo-Pacific Australia* Red sea, Indo-Pacific Japan* Indian seas	Eo.-Rec. Mio. Eo.-Rec. Plio. Rec.
<i>Polystira</i> <i>Bathytoma</i> ss. <i>B. (Parabathytoma)</i> <i>Micantapex</i> <i>Orthosurcula</i>	Atlantic-West Indian, Indopacific Indo-Pacific, N. America* Japan* E. Asia to New Zealand E. Asia, N. America*	Mio.-Rec. Eo.-Rec. Mio.-Plio. Mio.-Rec. Eo.-Rec.
<i>Turricula</i> <i>Comitas</i> ss. <i>C. (Fusiturricula)</i> <i>Cosmasyrinx</i> <i>Ancistrosyrinx</i>	Indo-Pacific, S. Europe, Mid. America Australia Atlantic-West Indian, Pacific-Mid. America New Zealand* Atlantic-West Indian, E. Pacific	Senon.-Rec. Mio.-Rec. Eo.-Rec. (Oligo.)-Mio. Palaeoc.-Rec.
<i>Parasyrix</i> <i>Spirotropis</i> <i>Leucosyrinx</i> <i>Surculites</i> <i>Clavatula (Paradrillia)</i>	New Zealand* Deep sea Atlantic,* E. Asia Europe,* N. America* S. E. Asia	(Dan.)-Mio. Oligo.-Rec. Oligo.-Rec. Eo.-Mio. Plio.-Rec.
<i>Inquisitor</i> <i>Pseudoinquisitor</i> <i>Tomopleura</i> <i>Mauidrillia</i> <i>Aoteadrillia</i>	S. E. Asia to New Zealand S. E. Asia to New Zealand Indo-Pacific Australia-New Zealand New Zealand	Eo.-Rec. Mio.-Rec. Eo.-Rec. Up. Oligo.-Rec. Low. Plio.-Rec.
<i>Cymatosyrinx (Splendrillia)</i> <i>Borsonia</i> <i>Filodrillia</i> <i>Anacithara</i> <i>Antiguraleus</i>	S. E. Asia to New Zealand Warm seas Australia Australia-New Zealand New Zealand	Mio.-Rec. Eo.-Rec. Up. Mio.-Rec. Mio.-Rec. Up. Mio.-Rec.
<i>Bellaspira (Lyromangilia)</i> <i>Etrema</i> <i>Propebella</i> <i>Puha</i> <i>Thatcheria</i>	S. Europe (Mediterranean) Indo-Pacific Pacific New Zealand* S. Japan	Mio.-Rec. Mio.-Rec. Plio.-Rec. Low. Mio.-Low. Plio. Up. Mio.-Rec.
<i>Asprella</i> <i>A. (Endemoconus)</i> <i>Floraconus</i> <i>Myurella (Punctoterebra)</i> <i>M. (Triplostrephanus)</i>	Warm waters Indo-pacific Indo-Pacific Indo-Pacific Pacific	Rec. Mio.-Rec. Rec. Mio.-Rec. Plio.-Rec.
<i>Noditerebra</i> <i>Kaweke</i>	S. Europe to Indo-Pacific New Zealand*	Up. Oligo.-Rec. Mio.

* fossil occurrence

They include many Indo-Pacific and East Asian elements at high percent from the very nature of case that Miyazaki belonged (and belongs) to the Indo-Pacific biological province. It is very surprising that they also contain several elements of the Australia-New Zealand province at such high percentage as indicated in table 1. The Australia-New Zealand elements in the molluscan faunule of the Miyazaki group far exceed in number the sum of the Mediterranean-South European elements

and the West Indian-Middle American ones. This fact may offer an important basis for the consideration of the origin, migration, and evolution of the mentioned conacean genera. From this point of view I examined the geological range of the common genera in the Australia-New Zealand province and the Miyazaki group. These genera can be generally traced back to the older geological age in the former province than in south Japan area without any exception (table 1 and text-fig. 1).

The interesting fact that the majority of the turrid genera of the Miyazaki group is provided with the paucigyrate protoconch may be considered to have some relation to the fact about the geological and geographical range of the common genera in these two biological provinces. According to POWELL (1942) and other authors the genera and the species which have the polygyrate protoconch pass long period of free swimming larval stage and generally occupy the wide geographic ranges and long geologic ranges. While the genera and the species which are provided with the paucigyrate protoconch do not pass the free swimming stage; accordingly they are inferior in the ability of dispersal to those with the polygyrate protoconch and verify themselves to be the local and short-lived forms. If this is the case, the ancestors of the above mentioned common turrid genera and the species of the Miyazaki group must be traced among the forms of Australia-New Zealand province. This is, however, strikingly conflicting with the following fact. That is to say, in the faunule of the Miyazaki group there should be existent many indigenous genera with paucigyrate protoconch and local geographical range, if the genera under consideration really originated in Australia-New Zealand province, migrated in south Japan, and differentiated there as suggested above. In reality the indigenous genera of the Miyazaki group and south Japan are exceedingly few.

The problem concerning with the origin, migration, and evolution of a large group of the animals involves several difficult subjects and should be treated synthetically with circumspection on the basis of the full and sufficient data on the morphological diagnosis, geological and geographical range, and, if possible, ecology and physiology etc., of the individual species. Therefore I offer here only a few interesting evidences and I am inclined to leave the problems above brought forward for the concrete solution in future.

Acknowledgements

This report, I hope, has some bearing as a basic data on the difficult problem concerning with the classification of the Conacea. The result is owing much to many persons who kindly supported me with attentive advices and necessary criticisms on the course of the study. I wish to express here my cordial thanks to these persons.

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Systematic Description

Superfamily Conacea

Family Turridae

Subfamily Turrinae

Genus *Optoturris* POWELL, 1944

(type species: *Pleurotoma optata* HARRIS by original designation)

Optoturris kyushuensis n. sp.

Pl. 4, Fig. 12, Text-figs. 3, 4

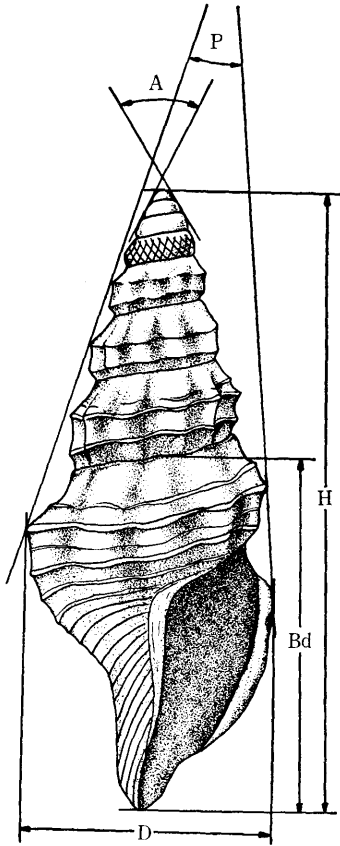
Material.—Holotype: GK-L 4933; A single specimen from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is favourable.

*Measurements.**—Measurable dimensions of the shell are here defined as indicated in text-fig. 2.

specimen	H	D	Bd	Bd/H	D/H	numb. whorls	<A	<P	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	
4933	16.9	5.15	9.55	56.5	30.5	1.75	6.5	26.9	20.8

Diagnosis.—The shell is moderately small in size and fusiform with very high and turreted spire and the moderately long base. The shell matter is thin and fragile. The protoconch is compressed, smooth, and paucigyrate composed of somewhat depressed, oblique, and small tip and the large and rather flat-sided second whorl. The latter is directly followed by the post-nuclear whorls which are provided with the arcuate axials and two median spiral lirae. The post-nuclear whorls are six in number and roundly angulated at the two-fifths from the lower suture. The shoulder is steeply sloping and slightly concave and the surface below the angulation is receding and almost flat. The post-nuclear whorls are ornamentated throughout by the numerous granules at the angulation, two primary spiral lirae just below the angulation, and a distinct subsutural lira. A few weak secondaries and tertiaries are visible on the shoulder and on the surface below the angulation. The peripheral granules are less distinct on the later whorls than on the early ones, while the V-shaped growth lines are

* H...height of the shell; D...diameter of the shell; Bd...length of the body whorl; N...nuclear whorls; PN...post-nuclear whorls; <A...apical angle; <P...pleural angle.



Text-fig. 2. Measurements of the shell (Figured specimen is holotype of *Puha japonica* n. sp.).

H ...height of the shell.

Bd...height of the body whorl.

D ...maximum diameter of the shell.

A ...apical angle.

Ppleural angle.

distinct on the later whorls. The suture is shallow and apressed. The body whorl is large, rounded at the periphery, rather abruptly contracted at the base producing a long and straight neck, and ornamented by a subsutural spiral lira, obsolete peripheral row of sixteen granules, subperipheral two primary spirals, regular seven spiral lirae of almost equal size on the basal slope, eight weak but regular spiral threads on the snout, and the distinct growth lines throughout. The columellar fasciole is fairly distinct. The aperture is elongate pyriform, sharply bended above forming an obsolete posterior notch, sinused at the periphery, narrowed below, and contracted continuously to the moderately long canal. The canal is moderately long, rather widely open, vertical, and truncated at the end. The inner lip is composed of the straight and vertical columellar one and the slightly oblique parietal one and covered by the wrinkling thick callus. The outer lip is thin with an anal sinus on the periphery. The sinus is V-shaped with symmetrical arms and moderately deep; its apex is sharply bended just at the peripheral angulation.

Comparison.—The present species conforms with the genus *Optoturris* POWELL, 1944 from the Lower and Middle Miocene of New Zealand in the following features. (1) the paucispiral smooth and subcylindrical protoconch; (2) V-shaped broad and not deep anal sinus, the

apex of which is on the peripheral row of granules; and (3) the peripheral angulations which is distinct on the early whorls and become obsolete later. *Optoturris* shows the closest resemblance to *Turris* BOLTON, 1798 in the subfamily as the original author pointed out in respect with its protoconch. The sculpture is also somewhat resembling between the two. The anal sinus and the peripheral costa, however, are much lower in *Optoturris* than in *Turris* and the spirals are weaker in the former.

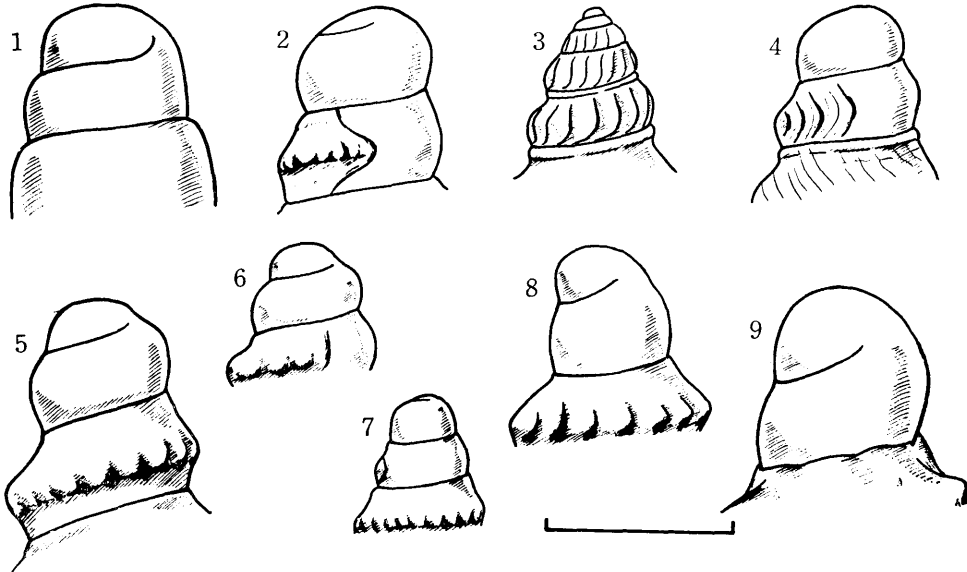
Optoturris paracanthus (TENISON-WOODS) (TENISON-WOODS, 1877, p. 105) from the Lower Miocene of South Australia is closely allied to the present new species, but the double carinae at the periphery are persistently present on the last whorl of the latter, and the peripheral crenulations are absent on the body whorl of the former.

O. editus POWELL (POWELL, 1944, p. 12, pl. 7, f. 3) is plainly distinguished from

the present species by its numerous spirals below the periphery, which is free from the crenulation except on the early whorls.

Horizon.—Lower part of the Takanabe member (Lower Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.



Text-fig. 3. Protoconchs of the species of Turrinae from the Miyazaki group.
Unit bar indicates 1 mm.

1. *Optoturris kyushuensis* n. sp.
2. *Polystira kurodai* (MAKIYAMA)
3. *Gemmula* (*Gemmula*) *granosa pulchella* n. subsp.
4. *G.* (*Kuroshioturris*) *hyugaensis* n. sp.
5. *G.* (*Ptychosyrinx*) *nipponicus* n. sp.
6. *G.* (*Kuroshioturris*) *totomiensis* (MAKIYAMA)
7. *G.* (*K.*) ? n. sp.
8. *Bathytoma* (*Parabathytoma*) *microgemma* n. sp.
9. *B.* (*P.*) *striatotuberculata* (YOKOYAMA)

Genus *Polystira* WOODRING, 1928

(type species: *Pleurotoma albida* PERRY by original designation)

Polystira kurodai (MAKIYAMA)

Pl. 8, Figs. 2, 3, 4, Text-figs. 3, 4

1927. *Turris kurodai* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 94, pl. 4, fs. 19, 20.
1952. *Turris kurodai*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 263.

Material and Measurements.—GK-L 4963 to 4972 and a few imperfect specimens. The matrix is fine unconsolidated sandstone. Preservation is perfect.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (degrees)	<P (degrees)	numb. carinae (peri)	numb. carinae (base)
GK-L										
4963	15.5	8.8	5.8	56.7	37.4	2	6.5	34.9	23.9	1 2
4964	11.7	6.5	4.2	55.5	35.9	2	6.5	32.0	19.4	1 2
4965	14.25	8.1	4.9	56.7	34.3	2	7.0	32.9	15.0	1 2
4966	10.3	6.35	4.15	61.6	40.2	—	6.0	32.1	32.5	1 2
4969	12.2	6.8	4.55	55.7	37.3	—	6.0	35.9	19.3	1 2
4970	9.1	5.5	3.4	60.5	37.4	—	5.5	34.7	26.2	1 2+(1)
4971	12.25	6.95	4.6	56.7	37.6	—	6.5	34.9	25.1	1 2

Remarks.—The present species was originally reported from the lower Kakegawa group (Lower Pliocene) of Shizuoka Prefecture as *Turris*. The present species, however, is featured by its smooth carine except on the earliest volutions and the V-shaped anal sinus with the round apex just on the peripheral carina, and accordingly it is included in *Polystyra* WOODRING, 1928. The close crenulations on the peripheral carina of the first and the second whorls suggest some phylogenetic relation between this species and the genus *Gemmula*, especially *Kuroshioturris*.

The present specimens show a slight difference from the type specimens of the original author, but this difference should not be considered to be of inter-species level but of intra-species one. That is to say, the original description indicates that the species has three carinae on the basal angulation. The specimens in hand include only one tricarinate specimen, eight bicarinate ones, and four intermediate ones, which possess two carinae on the basal angulation and a less distinct lira above the upper carina of the basal angulation. This indicates that the number of the basal carinae is rather fluctuating. The protoconch is composed of two smooth volutions and is followed by the carinated and crenulated post-nuclear whorl in the present specimens, although that of the type specimen is said to have three volutions. This divergence may be caused by the counting method which is rather difficult and delicate. At any rate they agree in having the paucispiral protoconch and are considered to be conspecific.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura; and south-east cliff of Kizukume Hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

Genus *Turris* BOLTEN, 1798

(type species: *Murex babylonius* GMELIN by subsequent designation, DALL, 1909)

Turris cf. *ugariensis* MAKIYAMA

1927, *Turris ugariensis* Makiyama, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 93, pl. 4, f. 18.

1952, *Turris ugariensis*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 263.

Material and Measurements.—GK-L 6050. Imperfect fractured specimens from the calcareous fine sandstone at Kariyabaru. They are, although fractured, almost quite identical to *Turris ugariensis* MAKIYAMA in size, outline, and ornamentation. Maximum diameter is 19 mm; height of the spire is about 21 mm.

Remarks.—The present specimen is probably included in *Turris ugariensis* MAKI-

YAMA from the Lower Pliocene Kakegawa group on the basis of the general character, although the peripheral angulation is somewhat sharper in the former than the latter. As the specimens are few and imperfect, the firm identification is withheld until enough specimens are collected.

Horizon.—Middle part of the Tano member (Middle Miocene).

Locality.—River side small cliff 200 mm. north of Kariyabaru, Tano machi, Miyazaki gun, Miyazaki Prefecture.

Genus *Gemmula* WEINKAUFF, 1875

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

Subgenus *Gemmula* WEINKAUFF, 1875

Gemmula (Gemmula) granosa (HELBLING)

Pl. 5, Fig. 7, Pl. 6, Figs. 4, 5, 6

- 1797, *Murex (Fusus) granosa* HELBLING, *Abhandl. Priv. Böhm. Math., Vol. 4*, p. 116, pl. 2, f. 16.
 1843, *Pleurotoma carinata*, REEVE, *Conch. Icon. Vol. 1, Pleurotoma* pl. 7, sp. 56.
 1884, *Pleurotoma (Gemmula) carinata*, TRYON, *Man. Conch. Vol. 6*, p. 173, pl. 4, f. 49.
 1887, *Pleurotoma carinata*, WEINKAUFF, *Syst. Conch. Cab. in MARTINI and CHEMNITZ, Vol. 4*, pl. 3, p. 15, pl. 3, f. 1.
 1895, *Pleurotoma (Pleurotoma) carinata* var. *woodwardi* MARTIN, *Fossilien von Java Bd. 1, Abt. 1, Moll.* p. 37, pl. 6, f. 91-96.
 1913, *Turris (Pleurotoma) carinata* var. *woodwardi*, SMITH, *Philippine Jour. Sci. Vol. 8, Sec. A, No. 4*, p. 260, pl. 5, f. 4.
 1915, *Pleurotoma (Pleurotoma) carinata* var. *woodwardi*, TESCH, *Palaeont. Timor Vol. 5*, p. 25, pl. 4, f. 38-45.
 1916, *Turris (Gemmula) granosa*, MELVILL, *Proc. Malac. Soc. London Vol. 12*, p. 145.
 1927, *Turris (Gemmula) granosa*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 95.
 1928, *Pleurotoma carinata* var. *woodwardi*, YOKOYAMA, *Imp. Geol. Surv. Japan Rep. No. 101*, p. 32, pl. 1, f. 17.
 1934, *Turris (Gemmula) granosa*, NOMURA and ZINBÔ, *Sci. Rep. Tohoku Imp. Univ. Ser. 2, Vol. 16, No. 2*, p. 132.
 1937, *Pleurotoma carinata* var. *woodwardi*, NOMURA, *Japan. Jour. Geol. Geogr. Vol. 14, Nos. 3-4*, p. 69.
 1954, *Gemmula granosa*, KIRA, Coloured illustrations of the shells of Japan. pl. 35, f. 18.

Material and Measurements.—A single perfect specimen (GK-L 4946) from the tuffaceous fine sandstone at Kizukume and an immature specimen from fine sandstone at Nihonmatsu. Preservation is almost perfect.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (PN)	<P (degrees)	axials pen. bod.
GK-L 4946	33.85	21.20	11.75	62.2	34.7	4	9	39.5	25.5 24 24

Horizon.—Middle and uppermost part of the Takanabe member (Lower Pliocene).

Locality.—Southeast cliff of the Kizukume Hill, Tonda machi; and road side cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Gemmula (Gemmula) granosa pulchella n. sp.

Pl. 10, Figs. 1, 2, Text-figs. 3, 4

Material and Measurements.—Holotype: GK-L 4945, paratypes: GK-L 6078, 6079. All the registered specimens and a few unregistered imperfect ones came from a single and same locality. The matrix is unconsolidated fine sandstone. Preservation is favourable.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P
GK-L 4945	10.2	5.6	3.75	54.9	36.8	4	6	36.2	24.0

Diagnosis.—The shell is small in size and fusiform with a high turreted spire and a very long base. The protoconch is relatively large, blunt, conoidal, and composed of four volutions; the first volution is depressed, smooth, and pan-shaped small tip; the second is also smooth, round, and depressed; the third and the fourth are swollen, ornamented by narrowly arcuated brephic axials, and bordered below by a distinct subsutural band. The fourth is followed by the medially carinated post-nuclear whorl without any sharp boundary. The post-nuclear whorls are about six in number and sharply carinated at the middle of the whorl height. The shoulder is slightly concave and moderately sloping below the strong subsutural band; the lateral surface below the carina is slightly concave and almost vertical. The body whorl is large occupying more than a half of the shell height, carinated at the periphery and abruptly contracted at the base to the straight and long neck. The shoulder is ornamented by the distinct spiral lirae and the dense and distinct growth lines; the lateral surface also possesses the distinct spiral lirae and the weak growth lines. The spirals on the shoulder are two on the first to third post-nuclear whorls and three on the later whorls. The lateral surface is provided with a lira close to the lower suture on the first to the penultimate whorl, and on the body whorl it has three distinct ones, of which the lower two form the basal angulation. The snout is covered by about fourteen threads, which are regularly spaced and weaker at the lower part than at the upper. The carina is also lirated by two distinct spirals and closely gemmulated. The gemmules are twenty-two and twenty-nine on the penultimate and the body whorl respectively. The aperture is small, pyriform, deeply sinused at the periphery, and abruptly contracted anteriorly to the long, open, and slightly oblique canal. The anal sinus is deep, narrowly U-shaped with the sub-parallel arms; the apex of the sinus is blunt and slightly wider than breadth of the carina. The columellar lip is covered by the thin callus.

Comparison.—The present subspecies is apparently a miniature of *Gemmula granosa* HELBLING. The former, however, is clearly distinguished from the latter in the following aspects. The former has much smaller protoconch than the latter consisting of almost same volutions; the apex of the anal sinus of the present subspecies is broader than the carina, although that of *G. granosa* is slightly narrower than the carina; secondary spirals are not developed on the present subspecies. That is to say, the present subspecies is not the immature specimens of *G. granosa*, but represents a distinct group within the species.

Horizon.—Middle part of the Takanabe member (Lower Pliocene).

Locality.—Road side small cliff at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Ptychosyrinx* THIELE, 1925

(type species: *Drillia (Subulata) bisinuata* MARTENS by original designation)

Gemmula (Ptychosyrinx) nipponicus n. sp.

Pl. 3, Figs. 7, 8, 13, 19, Pl. 7, Fig. 14, Text-figs. 3, 4

Material.—Holotype: GK-L 4921, paratypes: GK-L 4920, 4922-4927. All the type specimens came from the fine sandstone at Hagenoshita. Another specimen GK-L 4930, obtained from the fine sandstone at Yamaji, is slightly different from the types in its ornamentation.

Measurements.—

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P
GK-L 4920	12.95	7.25	4.6	56.0	35.5	1.6	6.0	39.7	22.0
4921	12.2	7.5	4.6	61.5	37.7	1.6	6.0	35.5	22.7
4923	11.1	6.3	3.9	56.6	35.2	1.6	5.5	35.5	19.5
4924	ca 15.6	7.8	5.6	50.0	35.9	—	5.5	40.4	24.4
4930	9.8	5.9	4.0	60.3	40.8	—	5.5	42.9	29.9

Diagnosis.—The shell is small in size, slender, fusiform with a high, turreted spire and a long base. The protoconch is rather large and composed of the depressed, rounded, and smooth first volution and the convex and inflated second one, which is smooth except for the last quarter whorl with the brephic axials. The post-nuclear whorls are six in number and carinated at the middle of the whorl height. The shoulder is distinctly concave and steeply sloping below the weak subsutural band. The surface below the angulation is also remarkably concave and almost vertical. The spire whorls are ornamented by a row of the large, obtuse granules on the carina, a weak subsutural lira, a strong suprasutural costa, and the fine and close growth lines. On some specimens a few additional obsolete spiral threads are discernible below the suture. The body whorl is large and bicarinated at the periphery and the basal slope. The basal carina shows the tendency for the outward expansion forming a wing-like fold or digitation on the mature specimens. Two strong spiral cords are developed on this basal carina and numerous weak but distinct spiral threads are discernible on the shoulder and the basal surface. The basal fasciole is not strong. The aperture is pyriform, rather small, attenuated below and continues to the widely open and moderately long canal. The outer lip is thin with a moderately deep but wide U-shaped anal sinus at the periphery and a irregular wing-like fold or digitation at the extremity of the forwardly produced part. The inner lip is almost vertical and the columella is rather short and covered by a thin callus.

Comparison.—The present species is featured by its *Gemmula*-like shell with the peculiar wing-like fold at the labrum. This is nothing but the characteristics of the "genus" *Ptychosyrinx* THIELE, 1952. Judging from the ontogeny *Ptychosyrinx* is better to be included in the genus *Gemmula* as a subgenus.

Ptychosyrinx bisinuata (MARTENS) (MARTENS, 1903, p. 82, pl. 1, f. 8), the type species of the genus, resembles the present species, but the former has much larger shell which possesses more distinct spiral threads on the shoulder, a distinct spiral lira on the lateral surface close to the carina, and finer gemmulations on the carina than the latter.

Comparison of the morphogenesis and geological range between *Gemmula* and *Ptychosyrinx* suggests that the latter may be the specialized off shoot of the former.

The specimen from Yamaji (GK-L 4930) slightly differs from those from Hagenoshita in having larger pleural and apical angles and the minute spiral lines on the lateral surface below the carina. Whether this difference represents the evolutionary change or the mere fluctuation is not decidable because of the paucity of specimen from Yamaji.

Horizon.—Uppermost part of the Kawabaru member and lower part of the Takana member (lower Upper Miocene to Lowest Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaye mura; and entrance cutting of the tunnel 400 m. north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Subgenus *Kuroshioturris* n. subgen.

(type species: *Kuroshioturris hyugaensis* n. sp.)

Diagnosis.—The shell is moderately small in size, fusiform with a slender and high spire and a moderately produced snout. The protoconch is paucispiral with two or less volutions and bluntly rounded at the apex. The first volution of the protoconch is rather large, compressed, rounded, and smooth. The second one is somewhat convexed at the side and smooth. The post-nuclear whorls are carinated at about the middle of the whorl height, gemmated on the carina, and finely lirated on the whole surface. The growth lines are moderate on the late whorls but very distinct on the early ones, which succeed the protoconch whorls without exhibiting the brephic stage. The suture is rather canaliculate with a strong subsutural band on the early whorl but is only apressed with moderate subsutural band on the late whorls. The anal sinus is V-shaped and moderately deep. Its apex is wider than the breadth of the carina and its upper and lower arms are not parallel. The gemmulation on the carina is also catagenetic.

Comparison.—The present new genus is characterized by its (1) paucispiral protoconch without brephic stage, (2) moderately wide anal sinus, and (3) the catagenetic character of the ornamentation. In these features this genus is clearly distinguished from *Gemmula* WEINKAUFF, 1875. *Eoturris* FINLAY and MARWICK, 1937 has the carinal granulations which are axially elongated like as plicae. *Eugemmula* IREDALE, 1931 differs from the new genus in its protoconch with distinct brephic stage. *Xenuroturris* IREDALE, 1929 has the distinct brephic stage, and the adult shell is provided with the twisted columella and shorter canal than *Kuroshioturris*.

Gemmula (Kuroshioturris) hyugaensis n. sp.

Pl. 3, Figs. 2, 3, 4, Text-figs. 3, 4

Material and Measurements.—Holotype: GK-L 4939, paratype: GK-L 4938. The matrix is fine sandstone. Preservation is perfect.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P
GK-L									
4938	12.9	7.6	4.6	58.9	35.7	2	6	26.2	23.3
4939	13.55	7.85	4.7	57.9	34.7	1.75	6	35.7	19.4

Diagnosis.—The shell is small in size, fusiform with a high and turreted spire and a moderately long base, and rather thin. The protoconch is composed of about two volutions, of which the first one is depressed, small, bluntly rounded, and smooth and the second one is cylindrical, large, smooth, and separated from the first one by a appressed suture. The post nuclear whorls are carinated at about lower two-fifths of the whorl height and about six in number. The carina is blunt, rather broad, and closely and sharply gemmated with twenty seven—twenty eight gemmules at the crossings by some of the growth lines on the early whorls. The gemmation becomes later weak and decrease in number (seventeen-eighteen gemmules on the penultimate whorl) and finally it disappears to furnish a practically smooth and blunt carina. The shoulder is slightly convex, steeply sloped below the subsutural band, and ornamented by about eight weak threads and dense growth lines. The surface below the angulation is almost vertical, flat, and provided with three distinct spiral lirae, which are sometimes intercalated by a few fine threads. The body whorl is large, occupying about sixty percent of the shell height, abruptly contracted at the base forming a rounded basal angulation, which separates the lateral and the basal surfaces and is provided with two distinct threads. About twenty two weak threads are discernible on the basal surface and on the snout, which has the weak fasciole at the anterior end. The aperture is pyriform, rather broad, and abruptly contracted below to the canal. The outer lip is short with a anal sinus at the peripheral carina. The sinus is moderately deep, U-shaped, rather broad, and its upper and lower arms are symmetrically curving and not parallel each other. The inner lip is rather straight, slightly oblique, and covered by the distinct callus. The columella is weakly twisted. The canal is moderately long, slightly oblique, widely open, and obliquely truncated at the end.

Comparison.—Certain species of *Gemmula*, *Xenuroturris*, and *Eugemmula* as *Gemmula zimmermanni* (PHILIPPI), *Xenuroturris corona* LASERON, and *Eugemmula hawleyi* IREDALE resemble the present species in the outline and the sculpture of the shell, but quite differ in their protoconchs. There is no known species comparable to the present species with its characteristic protoconch and post-nuclear ornamentation.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Gemmula (Kuroshioturris) totomiensis (MAKIYAMA)

Pl. 6, Figs. 1, 2, 3, 10, Text-figs. 3, 4

- 1931, *Turris (Gemmula) totomiensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 7, No. 1, Art. 1*, p. 46, pl. 1, f. 10, 11.
 1952, *Turris (Gemmula) totomiensis*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Sec. 2, Spec. Vol., No. 3*, p. 263.

Material and Measurements.—GK-L 4940, 4941, 4942. Matrix is fine sandstone. Preservation is favourable.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P (degrees)
GK-L 4940	—	8.25	5.5	—	—	—	4+	—	35.1
4942	12.0	6.7	4.25	55.7	35.3	2	6	23.1	18.5

Remarks.—The present specimens are distinctly smaller in size than *Turris (Gemmula) totomiensis* MAKIYAMA from the Kakegawa group, but the former closely resembles the immature specimens of the latter. The former may be undoubtedly conspecific to the latter. *Turris (Gemmula) totomiensis* is provided with the paucispiral protoconch without brephic stage and with the sculpture of catagenetic character. These features are not the diagnosis of true *Gemmula* but of *Kuroshioturris*.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Gemmula (Kuroshioturris) ? n. sp.

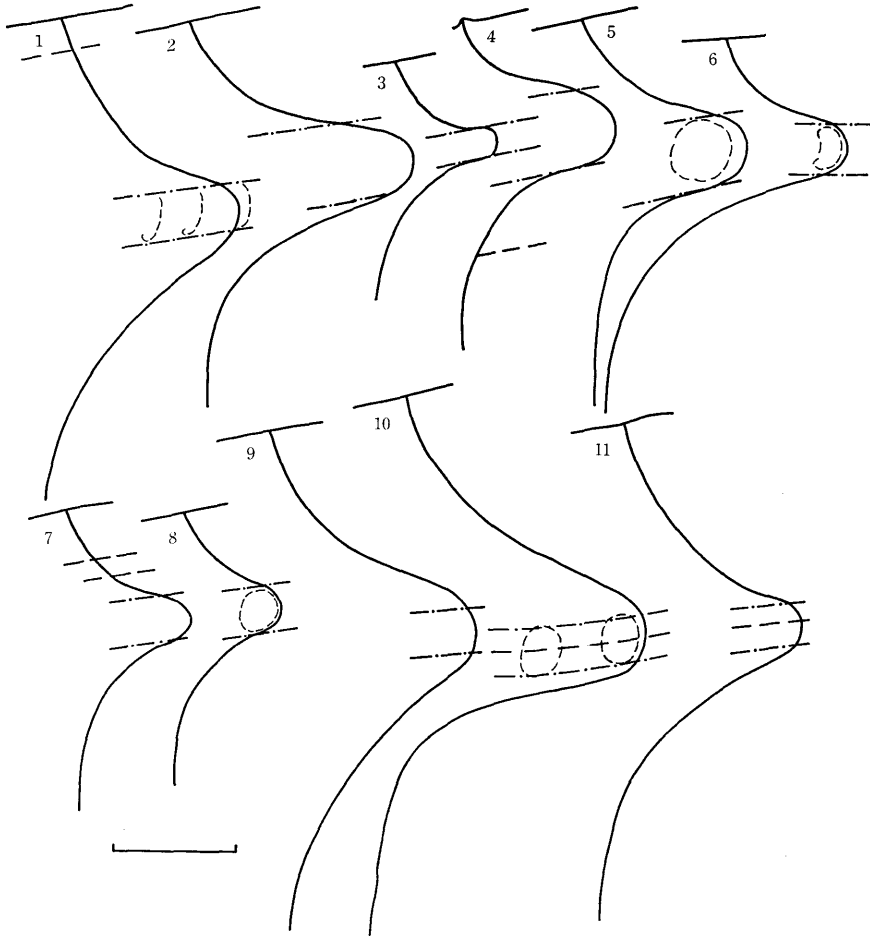
Pl. 6, Figs. 17, 18, Text-figs. 3, 4

Material and Measurements.—GK-L 4949; a single specimen from fine sandstone at Yamaji.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	(PN)	<A (degrees)	<P (degrees)	axials		
										1st	3rd	5th
GK-L 4949	9.0	5.7	3.8	63.3	42.2	2.0	4.5	43.5	31.0	30	14	7

Diagnosis.—The shell is small in size, and fusiform with the high spire and the long base. The protoconch is paucispiral with two volutions, which are round and smooth. The first volution is relatively large, globose, and separated by a shallow suture from the swollen and roundly convexed second one. The post-nuclear whorls are about four and a half in number and carinated at the middle of the whorl height. The shoulder is slightly concave and steeply sloping below the distinct subsutural band; the surface below the carina is almost flat and vertical. The body whorl is large occupying about two-thirds of the shell height, carinated at the periphery, and abruptly contracted at the base to the straight snout. The surface of the whorls is spirally sculptured. The threads on the shoulder are four and six respectively on the penultimate and ultimate whorl; those on the lateral surface are two on the spire whorls; besides above mentioned two threads another two distinct lirae are visible on the basal angulation of the body whorl; the basal slope and the snout are respectively covered by about ten threads. The peripheral carina also has distinct

two lirae and numerous granules throughout. The axials appear at first as the close and thin plicae on the first whorl. Thereafter they are abruptly shortened and decrease in number and finally become the blunt granules restricted on the carina on



Text-fig. 4. Anal sinuses of the species of Turrinae from the Miyazaki group. All the figures are based on the growth lines on the body whorls. The lines with dots and bars and brokeh lines represent respectively the position of the boundaries of the peripheral carina and those of the distinct spirals. Units bar indicates 1 mm.

1. *Optoturris kyushuensis* n. sp.
2. *Polystira kurodai* (MAKIYAMA)
3. *Gemmula (Gemmula) granosa pulchella* n. subsp.
4. *G. (Ptychosyrinx) nipponicus* n. sp.
5. *G. (Kuroshioturris) hyugaensis* n. sp.
6. *Micantapex matsumotoi* n. sp.
7. *Gemmula (Kuroshioturris) totomiensis* (MAKIYAMA)
8. *G. (K.) ?* n. sp.
9. *Bathytoma (Parabathytoma) striatotuberculata* (YOKOYAMA)
10. *B. (P.) microgemmata* n. sp.
11. *B. (Bathytoma) luehdorfi* (LISCHKE)

the second whorl. The aperture is small, pyriform, narrowly bended above, deeply sinused at the middle, and angularly contracted below. The anal sinus is V-shaped with the blunt apex at the peripheral carina. The canal is moderately long, widely open, and oblique.

Comparison.—This problematic specimen resembles *Epidirona* IREDALE, 1931 (type species; *Epidirona hedleyi* IREDALE) in the main features except for the long canal of the former. The short base, however, is the important characteristic of *Epidirona* and accordingly it is not reasonable to include the present species in *Epidirona*. The present species, which does not indicate the catagenetic character of the ornamentation, also slightly differs from *Kuroshioturris* in this respect.

Horizon.—Uppermost part of the Kawabaru member (lower Upper Miocene).

Locality.—Road side cutting 300 m. west of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Genus *Bathytoma* HARRIS and BURROWS, 1891

(type species: *Pleurotoma cataphracta* BROCHI by monotypy)

Subgenus *Bathytoma* HARRIS and BURROWS, 1891

Bathytoma (*Bathytoma*) *luedorfi* (LISCHKE)

Pl. 4, Figs. 5, 7, 13, Text-fig. 4

- 1872, *Pleurotoma* (*Genota*) *luedorfi* LISCHKE, *Malc. Blätt.* Vol. 19, p. 100.
 1874, *Pleurotoma luedorfi*, LISCHKE, *Japan. Meer. Conch.* Vol. 3, p. 23, pl. 1, f. 2, 3, 4.
 1887, *Pleurotoma luedorfi*, KÜSTER, *Conch. Cabinet*, Vol. 4, No. 13, p. 32, pl. 6, f. 8.
 1926, *Genotia luedorfi*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Ser. 2, Vol. 1, Pt. 9, p. 330.
 1927, *Genota luedorfi*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 3, No. 1, Art. 1, p. 97.

Material and Measurements.—GK-L 6044 from grey fine sandstone at Hagenoshita and GK-L 6045 from grey fine sandstone at Nihonmatsu. Preservation is perfect.

specimen	H	Bd	D	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(degrees)	
6044	44.2*	33.2*	16.0	24	20 for a whorl

Remarks.—The specimens from the Miyazaki group are rather variable in form. That is to say, the specimen GK-L 6045 is quite identical to the type with its characteristic shell-form and ornamentation, but the other specimen GK-L 6044, which came from the lower horizon than the former, is slightly slenderer than the type. I am inclined to include the latter in *B. (B.) luedorfi*, because the other characters as the features of the anal sinus, axials, spirals, and peripheral carina are quite identical. Although the protoconchs of the present specimens, lacking the apex can not be examined, those of the living specimens are really polygyrate. Accordingly the species, other characters of which such as profile of the shell, anal sinus, ornamentation etc. quite conform with the subgeneric diagnosis of *Bathytoma*, is naturally classified into this subgenus.

* The aperture is partly broken.

Horizon.—Lower and middle part of the Takanabe member (Lowest and Lower Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaye mura; and road side cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Parabathytoma* n. subgen.

(type species: *Pleurotoma striatotuberculata* YOKOYAMA)

Diagnosis.—The shell is moderate in size and biconical with the high spire and moderately long and tapering base. The protoconch is paucispiral with two or less smooth volutions, rather globular, and elevated but not pointed. The post-nuclear whorls are carinated close to the lower suture, gemmulated at the carina, and spirally lirated on the shoulder and on the lateral surface. The aperture is long occupying about a half of the shell length and narrowly pyriform with moderately deep and V-shaped anal sinus at the periphery, and is gradually narrowed below to the widely open canal.

Remarks.—*Bathytoma cataphracta* BROCHI, the type species of the genus *Bathytoma*, has a smooth conical, pointed, and polygyrate protoconch. The protoconch of the type species of the present new subgenus, *Parabathytoma striatotuberculata* (YOKOYAMA), is also smooth but is neither conical nor polygyrate. It is rather globular, elevated but not pointed, and paucispiral with two or less volutions. In other words the present species apparently differs from the true *Bathytoma*. Wherear it also differs from *Micantapex* IREDALE, 1936 with the type, *Bathytoma agnata* HEDLEY and PETTERD, which has the similar shell of biconical outline to *Bathytoma* but is characterized by a distinctly depressed, blunt, and paucispiral protoconch. Although the present species thus differs from both *Bathytoma* and *Micantapex*, the difference is not so great as to establish a new genus and I include it in *Bathytoma*, to which the present species shows closer affinity than to *Micantapex*.

Bathytoma (Parabathytoma) striatotuberculata (YOKOYAMA)

Pl. 4, Figs. 2, 3, 4, Pl. 5, Fig. 11, Pl. 8, Fig. 13, Pl. 9, Fig. 16, Text-figs. 3, 4

1928, *Pleurotoma subdeclivis* var. *striato-tuberculata* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 1, Pt. 7, p. 329, pl. 66, f. 6.

1925, *Turricula* ? *striato-tuberculata*, HATAI and HISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 233.

1959, *Bathytoma striatotuberculata*, MAKIYAMA, *Palaeont. Soc. Japan. Spec. Pap. No. 5, Pl. 64*, f. 6.

Material.—GK-L 4975, 4976, 4977, 4978, 4979, 4984 from grey siltstone at Hagenoshita, GK-L 4980, 4981, 4982, 4983 from the overlying fine sandstone at the same locality; GK-L 6076 from tuffaceous fine sandstone at Kizukume; GK-L 6077 from grey fine sandstone at Nihonmatsu. Preservation is perfect.

Measurements.—

The measurements of the selected specimens are given below.

specimen	H	Bd	D	Bd/H	D/H	numb.	whorls	<A	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)		4th 6th
4975	24.8	16.15	9.9	65.1	40.0	2	7	43.7	30.2	18 24
4976	8.3	5.25	4.4	63.3	53.1	1.75	4	41.2	43.8	19 —
4977	18.65	12.95	7.85	69.4	42.1	—	6	46.7	34.0	18 26
4978	16.1	10.5	6.4	66.9	42.3	1.75	6	41.3	28.4	17 18
4980	17.35	12.5	7.45	72.2	42.9	—	6	47.3	34.1	20 24
4981	17.5	12.65	7.2	72.3	41.2	—	6	45.8	28.6	21 25
4984	14.05	10.15	6.0	73.3	42.7	1.75	5	49.4	46.7	23 —

Remarks.—The specimens in hand include two forms, one of which is featured by somewhat swollen shell with rounded whorls and occurs in the siltstone and the other is characterized by the slender shell with angulated whorls and occurs in the sandstone. Although this fact is noticeable, it is not evident whether the morphological difference is really related to ecology or not. The reason is that the specimens from the siltstone contain a few angulated specimens together with the rounded ones and the specimens from the sandstone are not sufficient in number.

Horizon.—Lower to upper part of the Takanabe member (Lowest Pliocene to Lower Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaye mura; Nihonmatsu, Takanabe machi; and southeast cliff of Kizukume Hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

Bathytoma (Parabathytoma) microgemmata n. sp.

Pl. 9, Fig. 6, Text-figs. 3, 4.

Material.—Holotype: GK-L 6054. Slightly fractured holotype and other fragmental specimens from one and same locality. Matrix is silty sandstone.

specimen	H	D	numb.	whorls	<A	<P	Axials on
GK-L	(mm.)	(mm.)	(N)	(PN)	(degrees)		late whorls
6054	ca 20	8.5	2	5	47	28	35-38

Diagnosis.—The shell is moderate in size, biconical with a moderately high spire and a tapered base. The protoconch is highly elevated, round, smooth, and composed of two volutions, of which the first is somewhat oblique, roundly compressed, and separated from the subcylindrical second one by a shallow suture. The post-nuclear whorls are five in number, carinated, and lirated throughout. The finely and closely gemmulated carina is sharp, narrow, and situated at the middle of the whorl height on the early whorls and at the lower two-fifths on the late whorls. The carinal gemmulation is about thirty-five to thirty-eight in number for a whorl. The shoulder is somewhat concave and moderately sloping below the weak subsutural band. The surface below the carina is slightly concave and moderately receding to the lower suture. The suture is apressed with a weak but distinct subsutural band, on which three spiral threads are discernible on the penultimate and the ultimate whorls. The spiral ornamentation consists of twelve to fourteen fine threads on the shoulder, three threads on the carina, and two cords on the surface below the carina on the spire-whorls. The body whorl is large, sharply carinated at the periphery, shouldered above, and tapering below to the short snout with a obsolete and rounded basal

angulation. Rhythmically alternating distinct and weak ten threads are developed on the lateral surface, regularly spaced fifteen spirals of almost equal size are on the basal slope and the snout. The threads on the lateral surface and the basal slope are delicately beaded at the crossings by the growth lines. The aperture is pyriform, rather wide and weakly contracted below to the short canal. The outer lip is sharp. The anal sinus is V-shaped and moderately deep; its upper approach is gently curved and more apart from the carina than the lower one, which is subparallel to the carina for a considerable distance and then sharply bended downward at about right angle; the apex of the sinus is narrowly curved on the carina. The inner lip is composed of rather straight and vertical columellar lip and slightly bending and oblique parietal one and covered by the thin callus. The canal is short, widely open, and obliquely truncated at the end.

Comparison.—The present species is closely allied to *Bathytoma* (*Parabathytoma*) *striatotuberculata* (YOKOYAMA) and these make up a distinct group in the known species of *Bathytoma*. The present species, however, is distinguished from it by the carina which is sharper, narrower, more closely gemmulated, and situated at higher position in the new species than in the latter.

Horizon.—Upper part of the Tano member (Middle Miocene).

Locality.—Road side cutting at Kano, Takaoka machi, Higashi-morogata gun, Miyazaki Prefecture.

Genus *Micantapex* IREDALE, 1936

(type species: *Bathytoma agnata* HEDLEY and PETERD by original designation)

Micantapex matsumotoi n. sp.

Pl. 4, Fig. 6, 9, Text-fig. 4

Material and Measurements.—Holotype: GK-L 6047. A single specimen from the grey fine sandstone at Hagenoshita. Preservation is almost perfect.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)		pen. bd.		
6047	50.2	32.6	20.5	64.8	40.8	2.5	6	52.0	29.5	21	18

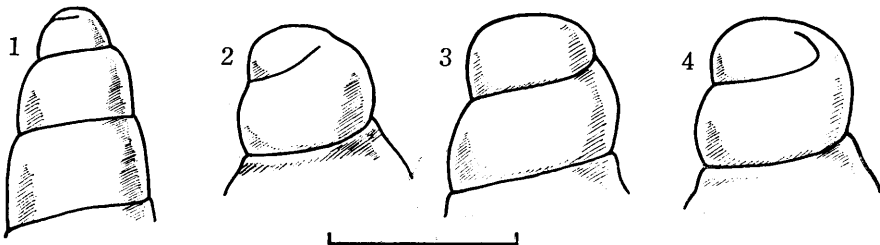
Diagnosis.—The shell is moderately large in size, moderately thick, and elongatedly biconical with rather the high spire and the long base. The protoconch is blunt, smooth, compressed, and composed of two and a half volutions. The post-nuclear whorls are six in number, carinated, strongly granulated, distinctly lirate and separated from one another by the apressed suture with the finely crenulated subsutural band. The carina is at one-third of the whorl height from the lower suture on the early whorls and at about the middle on the late ones. The carina is rather wide and heavily studded with numerous granules, which are twenty-one, seventeen, fifteen, fourteen, eighteen, and twenty-one in number respectively on the first, second, third, fourth, fifth, and sixth whorl. The shoulder is remarkably concave and steeply sloping below the taenioid subsutural band, which is irregularly and conspicuously crenulated at the crossings by the growth lines. The surface below the carina is almost vertical and flat. The body whorl is large, occupying about two-thirds of the

height of the shell, carinated at the periphery, gradually rounded and contracted at the base to the short snout. The subsutural band is heavily produced and clasping upward on the preceding whorl. The primary spirals are two on the shoulder just above the angulation and a strong subcarinal one on the third whorl*. On the fourth whorl another spiral, weaker than the primary lirae, appears between the above mentioned subcarinal lira and the lower suture and becomes strong to be equal to the primaries on the fifth whorl. A few secondaries are intercalated on the space between the primaries on the fifth whorl. Thus the body whorl is spirally ornamented by five weak lirae of almost equal strength on the shoulder, by regularly alternating four large costae and four small lirae on the lateral surface, and by regularly spaced fourteen distinct lirae on the basal surface. The growth lines are distinct on all the post-nuclear whorls and slightly beaded at the crossings by the spirals. The aperture is large, long, somewhat wide, gradually contracted anteriorly. The outer lip is sharp and sinused at the periphery. The approach of the sinus is not symmetrical to the carina; the upper arm makes larger angle to the carina than the lower arm does, which is produced far forward. The inner lip is oblique, bended, and covered by a distinct callus. The canal is short, widely open, and slightly oblique.

Comparison.—The present species is closely related to *Micantapex agnata* HEDLEY and PETERD (1906, p. 220, pl. 37, f. 3), which is the type species of the genus and living in the Australian seas, but is easily distinguished from latter by the features that the former has weaker granulations on the carina and crenulations on the subsutural band than the latter.

M. murdochi (FINLAY) (POWELL, 1942, p. 55, pl. 13, f. 1) from the Lower to Middle Pliocene of New Zealand is also an ally to the present species, but the latter has slender shell with weaker basal contraction than the former.

Turris (Pleurotoma) andaënsis SMITH (1913, p. 260, pl. 3, f. 5) has the biconical shell with paucispiral protoconch and is naturally classified in *Micantapex*. It resembles the present species in the general contour, but the former is distinguished from



Text-fig. 5. Protoconchs of the species of Turriculinae from the Miyazaki group.
Unit bar indicates 1 mm.

1. *Orthosurcula soyomaruuae takanabensis* OTUKA
2. *Comitas (Fusiturricula) habeii* n. sp.
3. *C. (F.) miyazakiensis* n. sp.
4. *C. (Comitas)* sp.

* The first and the second whorls are abraded and the spirals are not observed.

the latter by finer and closer granules on the peripheral angulation.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subfamily Turriculinae

Genus *Orthosurcula* CASEY, 1904

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

Orthosurcula soyomaruae takanabensis OTUKA

Pl. 4, Fig. 8, Text-figs. 5, 6

1959, *Turricula* (*Orthosurcula*) *soyomaruae takanabensis* OTUKA, *Venus*, Vol. 20, No. 3, p. 247, f. 4, 5.

Material and Measurements.—Two specimens (GK-L 4362 and 6040) from the tuffaceous sandstone at Tôriyama with the association of the warm open water mollusks of middle neritic depth.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (N)	(PN)
GK-L 4362	56.9	33.4	13.4	58.7	23.5	22	—	8
6040	65.3	39.0	14.9	59.9	22.8	24	2	10

Description.—The shell is moderately large attaining more than sixty mm. in height and fusiform with a very high and turreted spire and a long canal. The protoconch is paucispiral with two smooth volutions, of which the first one is very small tip and the second is swollen but depressed. The post-nuclear whorls are about ten in number, weakly bicarinated, and spirally costated. The two carinae are situated close to the middle of the whorl height on the early whorls and thereafter they gradually apart each other. On the penultimate whorl they are at the upper two-fifths and lower third of whorl height respectively. The surface above the upper carina is moderately convex at the lower half and concave at the upper half which is clasping upward on the preceding whorl. The surface between the carinae is distinctly concave and almost vertical. The surface below the lower carina is almost flat and slightly receding. The spirals on the penultimate whorl consist of two strong smooth carinal cords, two distinct close-set costae at the middle of the upper slope, one strong costa just above the lower suture, and a weak lira between the supra-sutural costa and the lower carina. The basal slope of the body whorl are provided with about six strong costae of almost equal size and the distinct interstitial threads of equal number. The lirae on the snout are distinctly weaker than those on the basal slope and about nine in number. The growth lines are close and distinct throughout the entire surface. The body whorl is large occupying about sixty percent of the shell height, almost rounded at the side, and moderately contracted below to the very long snout. The basal fasciole is distinct but not strong. The aperture is rather small with a deep anal sinus and a very long canal. The

outer lip is thin, sharp, forwardly produced below the sinus. The sinus is deep and U-shaped with the blunt apex on the upper slope closer to the suture than the upper carina. The canal is long, straight, and vertical. The columellar lip is straight.

Remarks.—The present subspecies was described by OTUKA in 1959 on the foundation of the specimens from Tōriyama together with the species based on the living form from off Miyazaki. The subspecies is clearly distinguished from the species in having wider spiral cords, and much more distinct secondary spirals between the strong cords.

Orthosurcula australis (ROISSY), which is one of the living representatives of the genus and distributed in the east Asian seas from off China to Philippines, resembles the present species and subspecies in the general feature. The latter two, however, are distinguished from the former in having much slenderer shell than the former and in spacing of the spiral cords. The upper two cords of the present subspecies are smaller than the lower ones and the interspace between the second and the third cord from the uppermost one is wider on *O. australis* than on *O. soyomaruæ*. Furthermore all the spirals of the present species and subspecies, which are considered not to have suffered the critical erosion, are smooth on tops instead of the microgranulated cords of *O. australis*. According to Thiele the minute granulation on the spirals is one of the characteristic features of the genus. As regards the present subject OTUKA offered a question that *O. soyomaruæ* may have been included in *Protosurcula* CASEY with the type species *Surcula gabbi* CONRAD which seems to have smooth spiral lirae according to COSSMANN's figure (1906, pl. 14, f. 22). Unfortunately I have not had an opportunity to examine the protoconch of *Protosurcula*. Accordingly I am inclined to suspend to include the present species in *Protosurcula* on the basis of a few characters of the post-nuclear whorls.

The protoconchs of the present specimens are apparently paucispiral and quite different from the polygyrate one of *Turricula* and *Surcula*, although the morphological feature of the post-nuclear shell is rather gradational between *Orthosurcula* and *Surcula* as COSSMANN pointed out (1906, p. 221). This is the very reason why I treat the former as a particular genus.

The difference between *soyomaruæ* and *takanabensis*, however, is rather slight and accordingly seems to be of intraspecific significance.

Horizon.—Uppermost part of the Takanabe member (Lower Pliocene).

Locality.—Small cliff of the entrance of a ravine at Tōriyama, Kawaminami mura, Koyu gun, Miyazaki Prefecture.

Orthosurcula pervirgo (YOKOYAMA)

Pl. 6, Fig. 14, Text-fig. 6

- 1928, *Pleurotoma pervirgo* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sect. 2, Vol. 2, Pt. 7*, p. 340, pl. 66, f. 7, 8.
 1952, *Orthosurcula mirabilis pervirgo*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p.
 1959, *Turricula pervirgo*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 5*, pl. 64, f. 7, 8.

Material and Measurements.—A single imperfect specimen from the type locality, Hagenoshita. Though it is imperfect, it shows the full features of the species and enables the identification. GK-L 6046. Height of the broken shell is about fourteen mm. Post-nuclear whorls are seven in number.

Remarks.—YOKOYAMA compared this species to *Pleurotoma virgo* WOOD. The latter, however, has the anal sinus at the peripheral keel and is now classified in the genus *Polystira* WOODRING, 1929. The present species has a moderately deep sinus on the shoulder close to the suture in spite of the superficial resemblance to *Polystira virgo* (WOOD), and agrees with *Orthosurcula* CASEY, 1904 in the general characters including the anal sinus except that the spiral cords of “*pervirgo*” are not minutely granulated but is smooth like as in *O. soyomaruuae takanabensis* OTUKA.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Turricula* SCHUMACHER, 1817

(type species: *Turricula flammea* SCHUMACHER = *Murex tornatus* DILLWYN by monotypy)

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

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

Turricula (Surcula) sobrina (YOKOYAMA)

Pl. 7, Fig. 9, Text-fig. 6

- 1922, *Drillia sobrina* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo. Vol. 45, Art. 2*, p. 5, pl. 1, f. 1.
 1927, *Turricula (Surcula) ? sobrina*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 100.
 1952, *Turricula (Surcula) sobrina*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 199.
 1957, *Turricula (Surcula) sobrina*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 3*, pl. 9, f. 1.

Material.—A few imperfect specimens and abundant fragmental ones from the calcareous fine sandstone at Tonogôri. The shell matter is more or less removed on the greater part of the specimens. GK-L 6039 (figured specimen).

Remarks.—The figured specimen has apparently weaker axials and spirals than the type specimen of original author, but many of the broken specimens show the quite identical sculpture to the type. That is to say the sculpture is rather variable in the present species.

Horizon.—The Tonogôri member (Upper Miocene).

Locality.—Road side, north slope of Tonogôri hill, Saito city, Miyazaki Prefecture.



Text-fig. 6. Anal sinuses of the species of Turriculinae from the Miyazaki group. Unit bar indicates 1 mm. for fig. 2, 4, 5, 6 and 2 mm. for fig. 1 and 3. Lines with dots and bars and broken lines represent respectively the position of the boundary of the peripheral angulation and those of the distinct spirals.

1. *Orthosurcula soyomaruuae takanabensis* OTUKA
2. *O. pervirgo* (YOKOYAMA)
3. *Turricula (Surcula) sobrina* (YOKOYAMA)
4. *Comitas (Comitas)* sp.
5. *C. (Fusiturricula) habei* n. sp.
6. *C. (F.) miyazakiensis* n. sp.

Genus *Comitas* FINLAY, 1926

(type species: *Surcula oamavutica* SUTER=*Drillia fusiformis* HUTTON
by original designation)

Subgenus *Comitas* FINLAY, 1926

Comitas (Comitas) sp.

Pl. 7, Figs. 4, 5, Text-figs. 5, 6

Material and Measurements.—GK-L 4957. A single specimen from the unconsolidated fine sandstone at Hagenoshita. Preservation is almost perfect.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (degrees)	<P (degrees)	axials 1st pen. bd.			
GK-L 4957	10.0	6.05	4.1	60.5	41.0	1.5	5	32.2	35.9	9	8	9

Description.—The shell is small and rhomboidally fusiform. The spire is slightly extraconical and turreted with a blunt apex; the base is abruptly contracted below the peripheral angulation to the straight and moderately long canal. The protoconch is large, smooth, globose, and composed of two volutions, the first of which is depressed and separated by a shallow suture from the globose and swollen second one. The post-nuclear whorls are five in number, sharply angulated at the lower third of the whorl height, axially plicated, and spirally lirated. The shoulder is somewhat

concave and steeply sloped below the weak subsutural band, which is slightly clasping upward on the preceding whorl. The surface below the angulation is convex and receding. The axials are somewhat thin and axially elongated folds on the early whorls and gradually become short on the later whorls. Finally on the body whorl they are gentle folds, stronger on the peripheral angulation, and abruptly weakened above and below. The spirals consist of two distinct lirae on the angulation and numerous threads on the shoulder and the lateral surface. The threads on the shoulder are eight and ten in number respectively on the penultimate and the body whorl and weaker than those on the lateral surface. The threads on the base are almost equal in size, regularly spaced, and about fourteen in number. The aperture is pyriform, bluntly angled posteriorly, and contracted anteriorly. The anal sinus is moderately shallow and V-shaped; its apex is broadly rounded and situated at the lower two-fifths on the shoulder. The canal is widely open, slightly oblique, and truncated at the end. The inner lip consists of the obliquely bended parietal one and the straight and vertical columellar one.

Comparison.—*Daphnella* (*Favriella*) *weberi* HORNING, the type species of *Favriella* HORNING, 1923, resembles the present species in the outline of the shell and the adult ornamentation. The former, however, has the high, small, and pointed protoconch and the characteristic axials which almost reach the upper suture, and accordingly it is readily distinguished from the present species. The present species is naturally classified into *Comitas* on the basis of the general character including the protoconch. There is no species of *Comitas* comparable to the present species.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subgenus *Fusiturricula* WOODRING, 1928

(type species: *Turris* (*Surcula*) *fusinella* DALL by original designation)

Comitas (*Fusiturricula*) *habei* n. sp.

Pl. 7, Figs. 15, 19, Pl. 9, Fig. 1, Text-figs. 5, 6

Material.—Holotype: GK-L 4990, paratype: GK-L 4991. There are a few fragmental specimens besides the registered ones. All the specimens came from one and the same locality, road side cutting at Hagenoshita. The matrix is unconsolidated fine sandstone.

Measurements.—

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (degrees)	<P (degrees)	axials 1st pen. bd.	
GK-L 4990	29.0	15.75	9.55	54.3	32.9	1.6	9	31.7	21.2	8 10 13

Diagnosis.—The shell is moderate in size, typically fusiform with high and acute spire and a long base. The test is rather thin. The protoconch is small, smooth, and composed of a depressed oblique tip and the globose second whorl. The post-nuclear whorls are narrowly and distinctly angulated at about the middle of the whorl height. The surface above the angulation is moderately sloping and remarkably

concave with a narrow subsutural band which is somewhat clasping on the preceding whorl; the surface below the angulation is gently convex and receding. The body whorl is large occupying slightly more than a half of the shell height, narrowly angled at the periphery, and weakly angled at the base. The basal contraction is rather weak and the basal slope continues rather gradually to the long canal. The axial plicae are slightly oblique and as wide as the interspaces. They are strong and nodulous on the angulation, gradually weakened below to the suture, and abruptly disappear on the shoulder far beyond the upper suture. They are eight, ten, and thirteen in number respectively on the first, penultimate, and ultimate whorl. The spiral threads are generally weak except for the peripheral ones. A spiral on the angulation starts on the first whorl and other one thread is added on the fourth whorl. The spirals on the body whorl consist of two distinct and broad lirae on the peripheral angulation, two distinct and narrow threads on the basal angulation, two weak threads on the surface between two angulations, and about ten obsolete threads on the snout. The aperture is pyriform, rather narrow, and gradually contracted below to the canal, which is narrowed medially and widely open anteriorly and subtruncated at the end. The anal sinus is V-shaped, moderately deep, occupying the entire surface of the shoulder. Its apex is narrowly bended and somewhat closer to the angulation than to the suture. The arms of the sinus are asymmetrical to the apex; the upper arm is narrowly rounded to merge to the upper suture at large angle of about seventy degrees; the lower arm is broadly curved and far extended forwardly. The outer lip is thin, antecurrent, and has a shallow sinus at the anterior part. The inner lip is arcuated at the upper part and straight at the lower two-thirds and covered by a thin and narrow callus.

Comparison.—The present species is closely related to *Fusiturricula panola* WOODRING from the Miocene beds of Boden, Jamaica (WOODRING, 1928, p. 167, pl. 6, f. 5, 6), but the latter has the axials of less number (six on the penultimate whorl) and more numerous spirals (seven primaries and a few interstitial secondaries on the penultimate whorl) than the former.

Pleurotoma (Surcula) breviplicata SMITH (1901, pl. 9, f. 3, 3a) is considered to be *Fusiturricula* on the basis of the fusiform shell with the paucigyrate protoconch. It almost agrees with the present new species, but is distinguished from the latter in the following features. That is to say, *C. (F.) habeii* has slightly shorter body whorl, more concave shoulder, and more upwardly clasping subsutural band than *C. (F.) breviplicata*.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cuttidg at Hagenoshita, Uwaye, mura, Koyu gun, Miyazaki Prefecture.

Comitas (Fusiturricula) miyazakiensis n. sp.

Pl. 5, Fig. 1, 4, Pl. 10, Fig. 16, Text-fig. 5, 6

Material.—Holotype: GK-L 6055; paratype: GK-L 6080. The holotype specimen and other fragmental ones came from the unconsolidated fine sandstone at the road

side cutting at Nihonmatsu; paratype specimen came from the tuffaceous siltstone at southeast cliff of Kizukume Hill. The preservation of the type specimens is perfect.

Measurements.—

specimen	H	Bd	D	Ap	Bd/H	D/H	Ap/H	numb.	whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(mm.)	(%)	(%)	(%)	(N)	(PN)	(degrees)		1st	pen.	bd.
6055	22.6	13.6	7.1	9.8	60.1	31.4	43.3	2	7	30	28	8	10	11

Diagnosis.—The shell is moderately small in size, very slender, and typically fusiform with an acute and high spire and a long base. The protoconch is moderately inflated, as wide as high, paucispiral with smooth and round two volutions; the first volution is slightly depressed, relatively large, and separated by the distinctly depressed suture from the large and swollen second one. The post-nuclear whorls are seven in number, angulated at about the middle of the whorl height, axially plicated, and spirally costated. The shoulder is somewhat concave, steeply sloping, and almost smooth except for the dense growth lines and a few spiral striae. The surface below the angulation is slightly convex and receding. The slightly oblique axial plicae are strong on the angulation, abruptly disappear on the shoulder, and weakened below to the lower suture. They are eight, ten, and eleven in number respectively on the first post-nuclear whorl, penultimate, and the ultimate one. The spiral cords are four in number on the third to sixth whorl, and spaced on the angulation and on the surface below it. The body whorl is large occupying about sixty percent of the total height of the shell, roundly angulated at the periphery, subangularly contracted below at the base to the long and slightly bended snout. The axials are limited on the periphery and abruptly weakened above and below the peripheral angulation. On the body whorl the spiral cords are also four in number but a few secondaries are intercalated between them. Eight spiral threads, rhythmically alternating distinct and weak, are discernible on the basal slope, and almost equidimensional eleven threads are developed on the snout. The aperture is rather small but long occupying about forty-five percent of the total height of the shell, rhomboidal in outline, and distinctly contracted below to the canal, which is slightly bended and obliquely truncated at the end. The outer lip is thin, deeply sinused posteriorly, and extended forward medially. The anal sinus is broadly U-shaped, deep, and asymmetrical to the apex; its apex is on the shoulder somewhat closer to the angulation than to the suture. The columella is weakly twisted and covered by the thin callus.

Comparison.—The present species so extoadinally resembles the genus *Fusinus* in its outline that they are hardly distinguished each other without examining the protoconch and anal sinus.

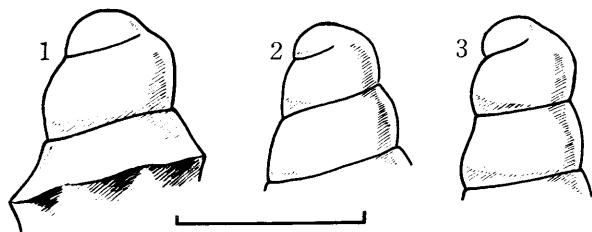
Comitas (Fusiturricula) iole (WOODRING) from the Miocene beds of Boden, Jamaica (WOODRING, 1928, p. 167, pl. 6, f. 4) is a close ally to the present species, but the former has higher and slenderer shell with more distinct basal angulation and less numerous axials than the latter.

Surcula moulinsii GRATELOUP from the Miocene beds of Aquitania (PEYROT, 1931, p. 119, pl. 8, f. 67-68) is not *Surcula* but *Fusiturricula* on the basis of the paucispiral protoconch. This is also closely allied to the new species in general character, but

the former is more than twice as large as the latter, and furthermore the spiral cords of *S. moulinsii* are five on the penultimate whorl, while those of the present species are four. The two may be in close phylogenetic relation.

Surcula lathyriiformis BELLARDI from the Tortonian of North Italy (Bellardi, 1877,

p. 72, pl. 2 f. 23) is also *Fusiturricula* and resembles the present new species in the general character and in size. The former, however, is distinguished from the latter in having one more spiral cord than the latter and the narrow aperture markedly contracted at the middle.



Text-fig. 7. Protoconchs of the species of Cochlespirinae from the Miyazaki group. Unit bar indicates 1 mm. for fig. 1 and 2 mm. for fig. 2 and 3.

1. *Cosmasyrinx makiyamai* n. sp.
2. *Leucosyrinx coreanica* (A. ADAMS and REEVE)
3. *Spirotropis subdeclivis* (YOKOYAMA)

Surcula (Pleurofusua) scala VREDENBURG from the Aquitanian of Burma (VREDEN-

BURG, 1921, pl. 12, f. 10) is quite agree with the present species in general character except for the protoconch, which is missing on the specimen of *S. (P.) scala*.

Horizon.—Middle and upper part of the Takanabe member (Lower Pliocene).

Locality.—Road side small cutting at Nihonmatsu, Takanabe machi; and south-east cliff of Kizukume Hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

Subfamily Cochlespirinae

Genus *Cosmasyrinx* MARWICK, 1931

(type species: *Cosmasyrinx monilifera* MARWICK by original designation)

Cosmasyrinx makiyamai n. sp.

Pl. 7, Figs. 6, 10, 16, Text-figs. 7, 8

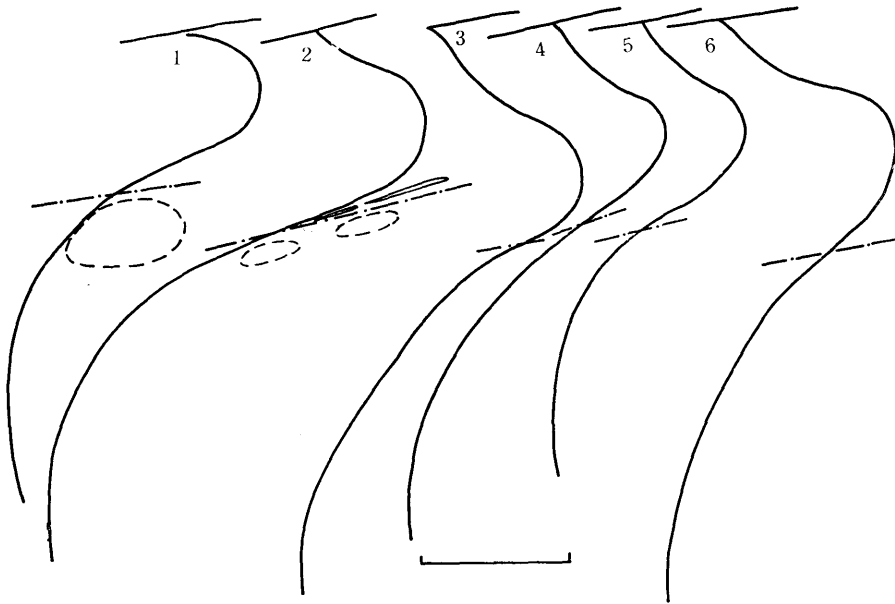
Material.—Holotype: GK-L 4935, paratypes: GK-L 4935, 4936. Matrix is unconsolidated grey fine sandstone. Preservation is perfect.

Measurements.—

Specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (degrees)	<P (degrees)	axials 1st	axials 3rd	
GK-L 4935	10.3	6.1	3.4	59.2	33.0	1.5	6	29.6	23.6	8	9
4936	8.2	5.0	3.1	60.9	37.8	1.5	5	31.6	24.2	9	10

Diagnosis.—The shell is small in size, slender fusiform with a high turreted spire and a produced long base, and rather fragile. The protoconch is remarkably large, bluntly rounded, smooth, and composed of two volutions. The first volution is somewhat small, slightly oblique, roundly depressed, and separated by a depressed suture from the second one which is large and inflated. The last one-quarter of the second volution has many, oblique, and coarse brephic axials. The post-nuclear whorls are

six in number and all the whorls are definitely carinated at about the middle of the whorl height. The first whorl has on its first one-quarter oblique and distinct axial folds, which are succeeded by shorter and sharper ones on the following whorls. Then they become a spiral row of the coarse granules restricted on the carina and finally on the body whorl they join one another forming a smooth, prominent, and produced spiral cord on the carina. The surface above the carina forms the steeply sloped, moderately concave, and almost smooth shoulder being devoid of the ornamentation except for the growth lines and a weak or obsolete subsutural band. The surface below the carina is almost vertical, slightly concave, and ornamented by a few spirals. On the second to fourth whorl two distinct spiral cords are developed on the lateral surface between the carina and the lower suture. The interspaces between these cords are much narrower than cords themselves, which become narrower and more numerous on the late whorls, numbering about six. The body whorl is large, sharply carinated at the periphery, and roundly subangulated at the base. The weak six spirals on the lateral surface are somewhat wider than the interstices. About six obsolete spiral threads and another eighteen weak threads are discernible on the basal slope and on the snout. The canal fasciole is not distinct. The aperture is



Text-fig. 8. Anal sinuses of the species of Cochlespirinae from the Miyazaki group. All the figures except for fig. 3 are based on the growth lines on the body whorls: fig. 3 shows the gerontic apertural margin. Unit bar indicates 1 mm. for fig. 1, 0.5 mm. for fig. 2, and 2 mm. for fig. 3, 4 and 5. The lines with dots and bars represent the position of the upper boundary of the peripheral carina.

1. *Cosmasyrinx makiyamai* n. sp.
2. *Ancistroyrinx osawanoensis* TSUDA
- 3, 4. *Spirotropis subdeclivis* (YOKOYAMA)
5. *S. subdeclivis acuticarinata* n. subsp.
6. *Leucosyrinx coreanica* (A. ADAMS and REEVE)

pyriform, long, narrow, gradually contracted below to the long and widely open canal, which is not notched at the end, but obliquely truncated. The outer lip is sharp with an anal sinus posteriorly; the sinus is moderately deep, wide, asymmetrical to the broadly and regularly arcuated apex with the short upper arm and the forwardly produced lower arm, and occupies the upper three-fourths of the shoulder. The inner lip is rather straight and covered by a distinct and wide callus. The columella is rather short and slightly twisted at the lower part.

Comparison.—*Cosmasyrinx* MARWICK, 1931 is one of the typical Oceanian middle Tertiary turrids ranging from Upper Oligocene to Middle Miocene.

Cosmasyrinx tereumera MARWICK from the lower Miocene of New Zealand (MARWICK, 1931, p. 139, pl. 16, f. 295) is closely allied to the present species, and especially quite agrees with the immature shell of the latter. However the carinal tuberculation of the present species is catagenetic and its carina becomes smooth and flush on the mature specimens. Concerning with this feature the present species is rather resembles *C. semilirata* POWELL from the Upper Oligocene of New Zealand (POWELL, 1942, p. 70, pl. 14, f. 9), but the latter has a less turreted shell ornamented with weak carinal nodules.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Ancistroyrinx* DALL, 1881

(type species: *Ancistroyrinx elegans* DALL by original designation)

Ancistroyrinx osawanoensis TSUDA

Pl. 4, Fig. 14, Text-fig. 8

1959, *Ancistroyrinx osawanoensis* TSUDA, *Jour. Fac. Sci. Niigata Univ. Ser. 2, Vol. 3, No. 2*, p. 99, pl. 6, fs. 7a, 7b, 8.

Material.—GK-L 6005. A single specimen from the calcareous silty sandstone at Kakoi. Although the specimen is not perfect, the general characters quite agree with the type specimens from the Yatsuo group.

Measurements.—

specimen	max. H (mm.)	max. D (mm.)	numb. whorls (PN)	<P (degrees)	carinal tubercles for a whorl
GK-L 6005	10.3	5.5	5	45.5	22

Remarks.—The present species has the general outline and the peripheral keel characteristic to *Ancistroyrinx* as TSUDA described (1959, 99-100), however, it has not the lamella on the shoulder, which is another important character of the genus. The examination of the specimen from the Miyazaki group clarified that the lamella of the typical *Ancistroyrinx* is replaced on the present specimens by the sublamellate costa, which do not continue spirally but is separated into a few pieces by interruption. The sinus occupies fully the area between this sublamellate costa and the upper suture. This feature differs remarkably from the sinus of the typical *Ancistroyrinx*, which is situated at the upper part of the same surface. Above mentioned features

of the present species rather resemble those of *Coronasyrinx* POWELL, 1944 with the type *Coronasyrinx venusta* POWELL, especially to the type species. The two, however, are easily distinguished by the sinus, the upper arm of which ascends almost vertically to the upper suture in *Coronasyrinx* but it merges with an acute angle in the present species. As the specimen in hand unfortunately lacks the apex, the details of the protoconch is unknown. Under the present status I preliminarily classify it as *Ancistrosyrinx* according to the original author of the species.

Horizon.—Upper part of the Kawabaru member (Middle Miocene).

Locality.—Brook side cliff, south of Kakoi, Mino mura, Koyu gun, Miyazaki Prefecture.

Genus *Parasyrinx* FINLAY, 1924

(type species: *Pleurotoma alta* HARRIS by original designation)

Parasyrinx sp. (n. sp. ?)

Pl. 8, Fig. 16

Material and Measurements.—GK-L 6049. A single outer mould specimen from the calcareous silty sandstone. Preservation is favourable.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls		<P
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)
6049	24.4	15.1	7.8	61.8	31.9	2	7	32.5

Diagnosis.—The shell is moderately small in size and fusiform with a high turreted spire and a long canal. The apical angle is smaller than the pleural angle and this renders to the spire an extra-conical outline. The protoconch is smooth, cylindrical, and composed of about two volutions, of which the first is globose and the second is somewhat rounded at the side. The first post-nuclear whorl is carinated just above the lower suture and the carina is more sharply developed on the later whorls. The suture is very oblique and appressed without any sutural band. The body whorl is large, occupying about sixty percent of the height of the shell, carinated at the periphery, and roundly contracted below at the base. The shoulder is moderately concave and smooth except for the fine growth lines. The surface below the carina above the basal angulation is slightly convex, receding, and ornamented only by the growth lines. The aperture is rhomboidal and narrow; the detail is unknown. The canal is open, very long, and straight. The anal sinus is V-shaped, narrow, and moderately deep with the apex at the lower part of the shoulder. There is no spirals except for the above mentioned strong and smooth peripheral carina.

Comparison.—The specimen in hand is only a single one and imperfect, but the general characters indicate that the specimen belongs *Parasyrinx* FINLAY, 1924, which ranges from Upper Oligocene to Middle Miocene of New Zealand. It fairly resembles the type species of the genus, *P. alta* (HARRIS) from Middle Miocene (SUTER, 1914, p. 28, pl. 2, f. 12; POWELL, 1942, p. 68), but the latter is much slenderer than the former. The other known species of the genus, *P. subalta* from Upper Oligocene beds (MARSHALL and MURDOCH) (POWELL, 1942, p. 69) is weakly but apparently ornamented by the spiral lirae.

Surcula clara MARTENS (1880, p. 35, pl. 8, f. 1a-d) resembles the present species in general contour, but the former is provided with the spirals on the surface below the peripheral keel and its shell is broader than the latter. The present species is probably a new species, but I hesitate to establish a species because of its imperfect preservation.

Horizon.—Upper part of the Tano member (Middle Miocene).

Locality.—Road side cutting at Kano, Takaoka machi, Higashi-morogata gun, Miyazaki Prefecture.

Genus *Spirotropis* G. O. Sars, 1879

(type species: *Spirotropis carinata* PHILIPPI by monotypy)

Spirotropis subdeclivis (YOKOYAMA)

Pl. 9, Figs. 2, 3, 8, 9, 11, 12, Text-figs. 7, 8

1926. *Pleurotoma subdeclivis* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo Sec. 2, Vol. 1, Pt. 9*, p. 329, pl. 38, f. 8.
 1926. *Pleurotoma subdeclivis*, YOKOYAMA, *ibid.* p. 367, pl. 42, f. 4.
 1952. *Spirotropis subdeclivis*, KURODA and HABA, *Check list and bibliogr.* p. 87.
 1952. *Spirotropis subdeclivis*, HATAI and NISUYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 233.
 1958. *Spirotropis subdeclivis*, MAKIYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 4*, pl. 50, f. 8, and pl. 54, f. 4.

Material.—GK-L 6011 to 6026, 6053 from unconsolidated fine sandstone at Hagenoshita; GK-L 6035, 6036, 6041 to 6043 from tuffaceous fine sandstone at Kizukume. Preservation is perfect.

Measurements.—

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	whorls (PN)	<A (degrees)	<P (degrees)	remarks
GK-L 6011	32.05	19.45	13.2	60.6	41.2	—	6+	48.0	27.0	
6012	29.1	15.5*	12.6	53.3*	43.2	—	8	36.6	27.3	
6013	26.55	14.85	10.2	56.8	38.4	2.5	8	35.5	29.1	
6014	24.55	14.0	9.9	56.9	40.3	2.5	8	34.2	26.9	
6017	21.7	11.4	9.45	52.4	43.5	2.5	7	35.7	23.7	
6019	35.3	22.6	14.5	64.2	41.1	—	6+	40.2	37.5	carinate
6023	12.35	7.5	5.85	60.7	47.4	2.5	4	24.1	38.2	
6024	26.85	14.6	10.5	54.4	37.7	2.5	7	32.7	24.9	
6026	21.4	12.0	9.7	56.2	45.3	2.5	6	33.2	32.4	
6035	31.1	17.3	11.2	55.6	36.1	2.5	8	27.4	28.2	carinate
6041	27.4	15.6	11.5	56.9	42.0	2	7	35.1	32.6	subangulate
6042	21.9	13.0	9.4	59.4	42.9	—	7	33.5	29.1	angulate
6043	32.7	19.3	13.1	59.0	40.2	2	8	31.2	32.7	carinate and lobulate

* fractured at the end of the canal.

Remarks.—The specimens, included in the present species by several authors, involve two types. One of the types including the type species from the Kakegawa group (YOKOYAMA, 1926, p. 329, pl. 38, f. 8) is characterized by the roundly angulated whorls, especially almost round side of the body whorl and by the relatively short canal. The other type (YOKOYAMA, 1926, p. 367, pl. 42, f. 4) is featured by the

sharply carinate periphery of the whorls, strong basal contraction, and by the long canal and occurs in the Tonohama group in Shikoku. The specimens from the Miyazaki group also include two types. On one hand the specimens from Hagenoshita consist almost wholly of the type having the roundly angulated whorls (pl. 6, f. 8, 9) with only one exception of the carinated specimen, GK-L 6019. On the other hand all the specimens from Kizukume are carinated on the whorls (pl. 6, f. 11) and furthermore on certain gerontic specimen as GK-L 6043 the carinal cord becomes a row of the blunt nodules on the body whorl (pl. 6, f. 12). A few intermediate forms between these two are, however, included respectively among the specimen group of Hagenoshita and Kizukume; the latter locality is somewhat higher in stratigraphic horizon than the former. The protoconch and the anal sinus are quite identical between the two types. Under these situation it may be reasonable to include the two in a single species, although it is not quite clear whether they are geological subspecies or not.

It is said that the prototypic radula of *Spirotropis* indicates the remote origin of this genus. This is suggestive for the consideration of the phylogenetic relation between the carinate form of *Spirotropis subdeclivis* and *Parasyrinx* FINLAY and between the former and *Cosmasyrinx* MARWICK.

Horizon.—Throughout the Takanabe member (Lowest to Lower Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaye mura; South cliff of Kizukume hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

Spirotropis subdeclivis acuticarinata n. subsp.

Pl. 9, Fig. 7, Text-fig. 8

Material.—Holotype: GK-L 6008, paratypes: 6006, 6007, 6009, 6010. Matrix is calcareous grey silty fine sandstone. Preservation is perfect.

Measurements.—

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorl (PN)	<P (degrees)
GK-L							
6006	14.9*	9.2	10.0	61.8	67.2	4+	28.8
6007	12.9*	7.7	7.9	59.7	61.2	6	38.8
6008	ca 18.3	11.7	8.4	64.0	45.9	6	30.2
6009	12.9*	8.9	8.6	68.8	66.6	3	30.1
6010	17.2	10.0	10.2	58.1	59.4	5	28.9

* The apex and the anterior part of the canal are broken.

Diagnosis.—The shell is moderate in size and rhomboid-fusiform with a high, acute, slightly extraconical spire and a long base. The apex is broken. The post-nuclear whorls are six in number, carinated at the lower fifth of the whorl, and ornamented only by growth lines. The shoulder is slightly concave and steeply sloped below the simply appressed suture. The surface below the carina slightly convex and remarkably receding. The body whorl is large occupying about sixty percent of the height of the shell, carinated at the periphery, and contracted anteriorly to the straight and moderately long canal. A smooth cord or a obsolete granular cord is developed on the carina. The aperture is small, pyriform with antecurrent

labrum, and markedly contracted below. The anal sinus is moderately deep and wide and its blunt apex is broadly arcuated at the middle of the shoulder. The canal is narrow, straight, and truncated at the end.

Comparison.—The present subspecies is closely allied to the species, especially to the carinate form, but the former is distinguished from the latter in having the much smaller shell, relatively larger body whorl, and larger pleural angle than the latter. The stratigraphic position is much lower than that of *S. subdeclivis subdeclivis*. The position of the carina is so close to the lower suture that the profile of the shell of the present subspecies seems to be rather flat-sided. This together with the smoothness of the surface makes it distinctive from *Cosmasyrinx*, which has the carina at about the middle of the whorl and weak spiral threads.

Horizon.—Middle part of the Kawabaru member (upper Middle Miocene).

Locality.—Brook side cliff, south of Kakoi, Sanzai mura, Koyu gun, Miyazaki Prefecture.

Genus *Leucosyrinx* DALL, 1889

(type species: *Pleurotoma verrilli* DALL by original designation)

Leucosyrinx coreanica (A. ADAMS and REEVE)

Pl. 8, Fig. 12, Pl. 9, Figs. 5, 13, Text-figs. 7, 8

- 1850, *Pleurotoma coreanica* ADAMS and REEVE, *Zool. Voy. H. M. S. Samarang. Moll.* p. 40, pl. 10, f. 8.
 1926, *Pleurotoma shimomatana* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 1, Pt. 7*, p. 330, pl. 38, f. 6, 7.
 1928, *Pleurotoma subdeclivis* var. *glabra*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 2, Pt. 7*, p. 339, pl. 66, f. 5.
 1931, *Turricula shimomatana*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 7, No. 1, Art. 1*, p. 46.
 1934, *Turricula coreanica*, KURODA, *Venus, Vol. 4, No. 6*, p. 386, f. 15, 16.
 1952, *Leucosyrinx coreanica*, KURODA and HABE, *Check list and bibl.* p. 62.
 1952, *Leucosyrinx coreanica*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 233.
 1955, *Leucosyrinx coreanica*, TSUCHI, *Rep. Liberal Arts Fac., Shizuoka Univ. (Nat. Sci.) No. 8*, p. 49, pl. 1, f. 16, 17.
 1958, *Leucosyrinx coreanica*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 4*, pl. 50, f. 6, 7.

Material and Measurements.—A number of well preserved specimens from various localities. The matrix is fine sandstone at all the localities. The measurements of the selected specimens are given below.

specimen	locality	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. (N)	whorls (PN)	<A (degrees)	<P (degrees)	axials 3rd pen.	bd.
6027	Hagenoshita	31.25	19.2	12.6	61.4	40.3	—	7.5	38.9	26.3	14	19 18
6028	"	32.35	19.25	12.5	59.6	38.7	—	7	39.3	28.4	14	15 15
6029	"	23.8	13.7	10.7	57.6	45.0	2	7	44.1	27.5	10	14 13
6030	"	17.05*	11.05	8.2	64.9	48.1	—	5	40.7	39.2	11	12 12
6033	Kizukume	20.6	12.8	9.2	62.1	44.7	2	6	44.7	41.3	13	15 14
6034	Nihonmatsu	34.6	21.5	13.9	62.1	40.2	—	7	43.3	34.1	—	15 11

* The apex is broken.

Remarks.—The specimens in hand are quite identical to the living species. On the specimens of the species, both living and fossil, the number of the peripheral granules, pleural angle, and the length of the canal are rather variable.

Horizon.—Throughout the Takanabe member (Lowest to Lower Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaya mura; road side small cutting at Nihonmatsu, Takanabe machi; and southeast cliff of Kizukume hill, Tonda mura, Koyu gun, Miyazaki Prefecture.

Subfamily Clavatulinae

Genus *Clavatula* LAMARCK, 1801

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

Subgenus *Paradrillia* MAKIYAMA, 1940

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

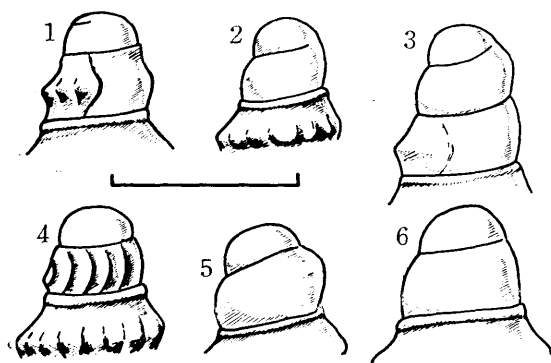
Clavatula (Paradrillia) dainichiensis (YOKOYAMA)

Pl. 6, Figs. 7, 8, 11, Text-gs. 9, 10

- 1923, *Drillia dainichiensis* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 45, Art. 2, p. 5, pl. 1, f. 2.
 1927, *Clavatula patruelis dainichiensis*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B*, Vol. 3, No. 1, p. 102, pl. 4, f. 14, 15.
 1940, *Clavatula (Paradrillia) dainichiensis*, MAKIYAMA, *Trans. Palaeont. Soc. Japan*, No. 102, p. 25.
 1952, *Clavatula dainichiensis*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 198.
 1957, *Clavatula (Paradrillia) dainichiensis*, MAKIYAMA, *Palaeont. Soc. Japan Spec. Pap. No. 3*, pl. 9, f. 2.

Material and Measurements.—GK-L 4915, 4916, 4917, 4918 and other imperfect unregistered specimens. All the specimens came from the unconsolidated fine sandstone at Hagenoshita.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (PN) (degrees)	axials 1st pen. bd.
4916	11.7	6.1	4.2	42.2	35.8	1.5	7	16 16 15
4917	9.9	5.2	4.1	42.5	41.4	1.5	7	16 15 15



Text-fig. 9. Protoconchs of the species of *Paradrillia* from the Miyazaki group. Unit bar indicates 1 mm.

1. *Clavatula (Paradrillia) dainichiensis* (YOKOYAMA)
2. *C. (P.) astuoides* n. sp.
3. *C. (P.) astuta* (YOKOYAMA)
4. *C. (P.) djocjocartae serrana* (FISCER)
5. *C. (P.) minoensis* n. sp.
6. *C. (P.) elachystoma convexiuscula* n. subsp.

Remarks.—*Paradrillia* MAKIYAMA, 1940, as the original author already pointed out, apparently differs from the genus *Clavatula* LAMARCK, 1801 in the features of the subsutural band and the axial plicae in spite of the marked resemblance in the general character. That is to say, the type species of *Clavatula* has the exceedingly large subsutural and suprasutural band and the surface between these two band is somewhat concave. The axial plicae clearly reach the upper and lower sutures. While on *Paradrillia* the suprasutural band is not developed and the axials are faded out on the shoulder beyond the upper suture. Furthermore a few additional small axials are irregularly intercalated between the primary axials on the lateral and basal surface of the body whorl. Therefore it is naturally considered to be valid for a subgenus of *Clavatula*. The present specimens from the Miyazaki group are quite identical to *C. (P.) dainichiensis* from the Kakegawa group.

Horizon.—The lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Clavatula (Paradrillia) astuta (YOKOYAMA)

Pl. 3, Figs. 11, 12, Text-figs. 9, 10

- 1928, *Drillia astuta* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 2, Pt. 7*, p. 341, pl. 66, f. 14, 15.
 1952, *Cryptogemma astuta*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 198.
 1959, *Clavatula (Paradrillia) astuta*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 5*, pl. 64, f. 14, 15.

Material and Measurements.—Topotype GK-L 4950, 4951, and 4852. Preservation is perfect. Matrix is unconsolidated fine sandstone.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)	(degrees)	pen.	bd.	
4950	10.25	5.2	3.8	50.7	39.1	2.6	5.5	44.1	28.2	11	9+
4951	8.75	5.25	3.6	60.0	41.2	2.6	4.5	37.5	23.1	13	12

Remarks.—The specimens in hand are identical to *Clavatula (Paradrillia) astuta* (YOKOYAMA) in general character. They verify rather variable in the sculpture. That is to say, on some specimen the axials consist of the tuberculose granulations on the peripheral carina, but on the other specimens they are the fold-like elevations along the growth lines which are granular on the carina. Furthermore the shoulder is almost smooth on some specimen and weakly but distinctly lirate on the other specimens. The spirals on the lateral surface below the carina are variable in strength and number.

The description of the protoconch is given below because the original author did not describe it.

The protoconch is small, tall, smooth, and composed of about two and two-thirds whorls. The first is small, depressed and hardly produced; the second is small and globose; the third is subcylindrical and followed by the distinctly carinate post-nuclear whorl.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Clavatula (Paradrillia) astutoida n. sp.

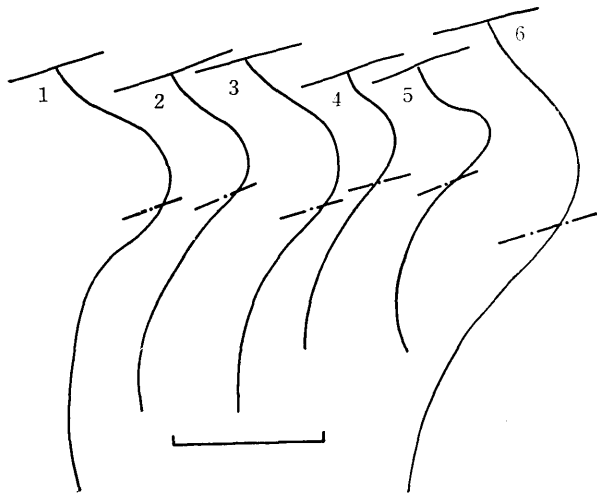
Pl. 5, Fig. 2, 3, Text-figs. 9, 10

Material.—Holotype: GK-L 4962. A single specimen from the fine sandstone at Nihonmatsu, a little higher horizon than Hagenoshita. Preservation is perfect.

Measurements.—

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials				
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)		1st	2nd	pen. bd.		
4962	10.8	6.05	4.05	55.8	37.5	2	7	39.1	22.4	14	11	11	12

Diagnosis.—The shell is small in size and fusiform with high spire and rather short base. The protoconch is small, smooth, and composed of two volutions. The first is small, depressed, round, and separated by a shallow apressed suture from the second, which is rather swollen and globose. The post-nuclear whorls are seven in number, sharply angulated at about two-fifths of the whorl height from the lower suture, ornamented by the sharp axial plicae and weak spiral threads, and separated one another by the shallow suture with a distinct sub-sutural cord and a weak supra-sutural lirae. The shoulder is slightly concave and steeply sloping. The surface below the suture is almost flat and remarkably receding. The body whorl is large occupying more than a half of the shell height and sharply angulated at the base. The surface below the basal angulation is abruptly contracted to the short and straight snout. The spirals consist of the distinct threads on the subsutural band, those on the angulation, week threads on the shoulder, those on the lateral surface, and those on the basal surface. A thread appears on the subsutural band of the second whorl and gradually increases



Text-fig. 10. Anal sinuses of the species of *Paradrillia* from the Miyazaki group. All the figures are based on the growth lines on the body whorls. The lines with dots and bars represent the position of the upper boundary of the peripheral angulation. Unit bar indicates 1 mm.

1. *Clavatula (Paradrillia) dainichiensis* (YOKOYAMA)
2. *C. (P.) astuta* (YOKOYAMA)
3. *C. (P.) astutoida* n. sp.
4. *C. (P.) minoensis* n. sp.
5. *C. (P.) djocjocartae serrana* (FISCHER)
6. *C. (P.) elachystoma convexiuscula* n. subsp.

A thread appears on the subsutural band of the second whorl and gradually increases

in number to three threads of the penultimate whorl. The first whorl is provided with a thread on the peripheral angulation, to which other one thread is added on the second, and another one is added on the fifth whorl. The threads of the shoulder appear on the third whorl and thereafter increase in number to four on the later whorls. A thread appears on the lateral surface of the fourth whorl and increases in number to three on the penultimate one. Four, five, and seven weak thread are discernible respectively on the lateral surface, basal slope, and on the snout of the body whorl. The axial plicae are fourteen in number on the first whorl, eleven on the following spire whorls, and twelve on the body whorl. They are acute, sharp, and granular on the angulation and apparently reach both the lower and the upper suture. On the body whorl they abruptly faded out below the basal angulation, on which some interstitial plicae are added to the primary axials, forming a row of closely spaced small granules. The aperture is pyriform and contracted below. Anal sinus is broad and shallow and its broadly rounded apex is on the shoulder somewhat closer to the angulation. The columellar lip is covered by a shallow callus. The canal is vertical, narrow, rather short, and obliquely truncated at the end.

Comparison.—The present species is closely related to *C. (P.) astuta* (YOKOYAMA) in general character, but the former is slightly but apparently different from the latter in the narrower protoconch of two volutions, distinct and more numerous spiral threads, and the marked tuberculations on the basal angulation.

Pleurotoma (Surcula) agalma SMITH, living in the Bay of Bengal (SMITH, 1909, pl. 21, f. 4, 4a) is considered to be one of the representatives of *Paradrillia* with characteristic features. It also closely resembles the present new species, but the former is distinguished from the latter in having the axials which are distinct even on the shoulder near the upper suture.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Clavatul (Paradrillia) minoensis n. sp.

Pl. 4, Fig. 15, Pl. 6, Figs. 16, 17, Text-figs. 9, 10

Material and Measurements.—Holotype: GK-L 4958; paratypes: GK-L 4949, 4960, 6061. Preservation is almost perfect. Matrix is fine sandstone.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	4th	5th	
4958	6.8	3.9	2.95	57.3	43.3	2	5	42.9	27.1	9	12	12
4959	9.0	5.3	3.45	58.9	38.3	2	5.5	36.1	23.9	13	12	12

Diagnosis.—The shell is very small in size, and fusiform with the high turreted spire and the moderately long base. The test is relatively thick. The protoconch is very blunt, globose, smooth, and composed of two volutions. The first whorl is small mammillate tip and the second is swollen and globose. The post-nuclear whorls are about five in number, angulated at the lower two-fifths of the whorl, and ornamented by the axial plicae and the spiral lirae. The shoulder is slightly concave and steeply sloping below a distinct subsutural band, which is very strong on the early whorls.

and becomes weak later. The surface below the angulation is slightly concave and almost vertical. The body whorl is large occupying about sixty percent of the height of the shell, sharply angulated at the periphery and roundly angulated at the base; the base below the basal angulation is contracted abruptly to the short and straight snout. The primary spirals are composed of two on the peripheral angulation and another one at a little below the middle of the surface below the peripheral angulation. The secondaries are very fluctuating in number and strength. On some specimens they are quite absent throughout the whorls except for the body whorl. On the other specimens three distinct secondaries appear on the shoulder of the third whorl and on the fourth a lira is added respectively on the shoulder and on the lateral surface. The body whorl has about fifteen spirals on the basal surface together with the carinal-, shoulder-, and lateral lira. The axials are about twelve in number on the late whorls and not the simple plication but rather the granular ones. They abruptly faded out on the shoulder and the lateral surface and hardly reach the lower and the upper suture. The aperture is pyriform, somewhat small, and abruptly contracted below. The anal sinus is broad and shallow and its blunt apex with symmetric arms is on the shoulder at a little closer to the angulation than to the suture. The inner lip is bended at the anterior part and covered by a narrow but distinct callus. The canal is short, slightly oblique, moderately narrow, and obliquely truncated at the end.

Comparison.—The present species is related to *Clavatula (Paradrillia) astuta* (YOKOYAMA) in the general outline, but the former has the globose protoconch of two volution, blunt nodules at the angulation, distinct lirae on the shoulder, and weaker lirae on the basal angulation than the latter.

C. (P.) astutoida n. sp. is also related to the present species, but the protoconch is more globose in the latter than in the former, and the former has strong basal angulation which is provided with small but sharp granules.

Horizon.—Uppermost part of the Kawabaru member (lower Upper Miocene).

Localities.—Immediate south of tunnel, north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Clavatula (Paradrillia) elachystoma convexiuscula n. subsp.

Pl. 6, Fig. 15, Pl. 10, Fig. 18, Text-fig. 9, 10

Material and Measurements.—Holotype: GK-L 4915. A single specimen from the unconsolidated grey fine sandstone at Hagenoshita. Part of the body whorl is fractured.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls		A	axials	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	pen. bd.
4915	16.8	9.1	5.9	54.1	35.2	2	8	34.9	13	17 18

Diagnosis.—The shell is moderately small, rather solid, and fusiform with the very high and acute spire and the moderately long base. The protoconch is small, conical, smooth, paucispiral with two volutions. The post-nuclear whorls are eight in number, sharply angulated at the periphery, sharply plicated by the axials, mark-

edly lirated by the elevated spirals, and separated one another by the appressed suture with the strong subsutural band. The shoulder is clearly defined by the peripheral angulation below and the subsutural band above, somewhat concave, and moderately sloping. The surface below the peripheral angulation is almost flat and vertical. The body whorl is large occupying more than half of the height of the shell, narrowly angulated at the periphery, and abruptly contracted to the short and straight snout at the lower end of the basal slope, which is broadly rounded. The axial sculpture consists on the first post-nuclear whorl of thirteen granules on the median angulation, which are abruptly faded out above and below the angulation. They are gradually elongated axially and increased in number as the shell grows and seventeen and eighteen narrow but sharp plicae respectively on the penultimate and the body whorl, where the axials reach the upper suture and diminish at the lower end of the basal surface. The spiral sculpture starts with two distinct lirae on the angulation of the first whorl, then a weak thread is added on the lateral surface of the third whorl. Another one weak thread is added on the shoulder of the fourth whorl. Thereafter the threads on the shoulder and the lateral surface are successively increased in number and size. Thus the spirals on the body whorl consists of the prominent two lirae on the angulation, a few weak threads on the shoulder, prominent lira on the lateral surface, a less distinct thread between the angulation and the lira on the lateral surface, five moderate lirae on the basal slope, and five threads on the snout. The crossings of the plicae and the spirals on the lateral and basal surface are heavily beaded. The aperture is rhomboidal, sharply bended at the posterior end, broadly sinused on the shoulder, and abruptly contracted below to the canal, which is short, remarkably oblique, and truncated at the end. The sinus is moderately deep, V-shaped with broadly rounded apex on the shoulder close to the angulation; the upper arm is short and merged to the upper suture at an acute angle of about forty-five degrees. The inner lip consists of the oblique and short parietal one and the straight and vertical columellar one and covered with thin callus.

Comparison.—*Drillia elachystoma* MARTENS, living in Indian Ocean (MARTENS, 1903, p. 81, pl. 2, f. 13) is considered to be *Para-drillia* with some of the typical characters of the subgenus. Although the present subspecies is closely allied to *elachystoma*, the former is distinguished from the latter in having more definitely angulated periphery giving more convex profile to the whorl, large pleural angle, and stronger subsutural band.

C. (P.) danichiensis (YOKOYAMA) is another ally to the present subspecies, but the former differs from the latter in the more produced peripheral angulation, weaker and more numerous spirals, and much stronger basal angulation than the latter.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Clavatula (Paradrillia) djocjocartae serrana (FISCHER)

Pl. 8, Fig. 7, Text-figs. 9, 10

1927, *Clavatula djocjocartae serrana* FISCHER, *Paläontologie von Timor, Lief. 15*, p. 98, pl. 3, f. 77.

Material and Measurements.—GK-L 4953. A single specimen from the unconsolidated fine sandstone at Hagenoshita. The specimen is partly fractured at the base.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (PN) (degrees)	<P (degrees)	axials 1st pen. bd.
4953	7.2	4.2	3.0	58.3	41.7	2	5	41.7 21.7	12 12 14

Remarks.—The present specimen, although only a single, is provided with the full characters identical to FISCHER'S subspecies from the Pliocene bed in Timor. The subspecies, on one hand, comparable with *Paradrillia* with the typical sculpture and on the other hand the former slightly differs from the latter in the features of the protoconch. The protoconch of *Paradrillia* consists of a few smooth volutions. That of the present subspecies, however, is composed of the depressed, pan-shaped, and smooth first volution and the swollen second one with the coarse brephic axials. Accordingly there is some doubt in classifying the present subspecies in *Paradrillia*. It is probably a intermediate form between *Paradrillia* and *Compsodrillia* WOODRING, 1928 with the type *Compsodrillia ureceola* WOODRING. The present subspecies, however, is included here in *Paradrillia* because it shows slightly closer resemblance to *Paradrillia* than to *Compsodrillia*.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subfamily Conorbiinae

Genus *Surculites* CONRAD, 1865(type species: *Surcula (Surculites) annosus* CONRAD by monotypy)*Surculites siogamensis* NOMURA

Pl. 9, Figs. 14, 15, Text-fig. 11

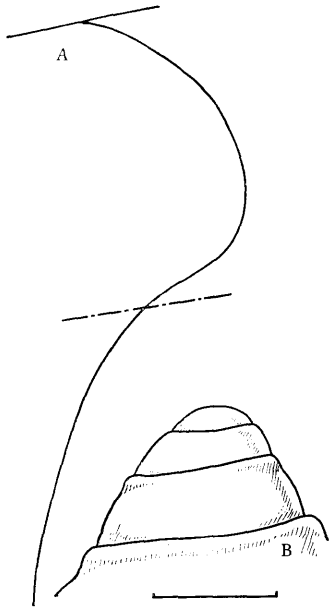
- 1935, *Surculites (Megasurcula) siogamensis* NOMURA, *Saito Ho-on Kai Mus. Res. Bull. No. 6*, p. 223, pl. 17, f. 3, 4.
 1940, *Surculites (Megasurcula) siogamaensis**, NOMURA, *Sci. Rep. Tohoku Imp. Univ. Ser. 2, Vol. 21, No. 1*, p. 44, pl. 3, f. 9a, 9b.
 1952, *Megasurcula siogamensis*, HATAI and NOMURA, *Sci. Rep. Tohoku Univ. Spec. Vol., No. 3*, p. 251.

Material and Measurements.—GK-L 6006, 6007. The specimens came from one and same locality. Matrix is somewhat calcareous silty fine sandstone. Preservation is suitable.

* This is misspelling of *siogamensis*.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls		<A	<P	axials	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	(degrees)	pen.	bd.
6006	19.6	13.2	10.9	67.4	55.6	2	4	76.5	63.3	13	12
6007	16.2	11.5	9.6	70.8	59.2	—	3.5	42.4	39.2	11	13

Remarks.—The present species shows the intermediate characters among *Surculites* CONRAD, 1865, *Megasurcula* CASEY, 1904 (type species: *Pleurotoma* (*Surcula*) *carpenteriana* GABB by subsequent designation, GRANT and GALE, 1931), *Marshallena* ALLAN, 1926 (type species: *Daphnella neozelanica* SUTER by monotypy), and *Marshallaria* FINLAY and MARWICK, 1931 (type species: *Verconella spiralis* ALLEN by original designation).



Text-fig. 11. *Surculites siogamensis* NOMURA from the lower Miyazaki group. Unit bar indicates 1 mm.

A...anal sinus.
B...protoconch.

The present species resembles *Marshallena* in the features of the protoconch and the profile of the post-nuclear whorls, but differs from the latter in its anal sinus of moderate depth. The sinus of the present species conforms with that of *Marshallaria* but the former species is readily distinguished from the latter, which has a strong lira on the last whorl of the protoconch. Comparing with *Megasurcula* the present species has more produced peripheral angulation, stronger nodes on the angulation, and the lower spire. The present species also slightly differs from *Surculites* in having the lower spire and the peripheral angulation at much lower position. It may probably be better to include the present species and other Japanese allis in the new genus. The material, known hithertofore, however, is so meager that the establishment of a new genus is

not now supported by plentiful foundation. Under such circumstance as this I am inclined to include it in *Surculites*, which shows the closest affinity to it.

The present specimen almost agrees with *Surculites siogamensis* NOMURA, but the former has slightly more produced and excavated shoulder and less numerous axials than the latter. In this respect, the former rather resembles "*Surcula pulchre*" SCHEPMEN from East Banda sea (1913, p. 426, pl. 28, f. 2), which is better to be classified in *Surculites* in the sense just mentioned. *S. pulchra*, however, is provided with more oblique axials than the present specimen. That is to say the present specimen represents a transitional form between *S. siogamensis* and *S. pulchra*.

Horizon.—Upper part of the Kawabaru member (lower Upper Miocene).

Locality.—Road side small cutting at Kushiki, north of Kushiki bridge, Kami-Hokita mura, Koyu gun, Miyazaki Prefecture.

Subfamily Clavinae

Genus *Pseudoinquisitor* POWELL, 1942

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

Pseudoinquisitor pseudoprincipalis (YOKOYAMA)

Pl. 7, Fig. 12, 17, Text-fig. 12

- 1920, *Pleurotoma* (*Drillia*) *pseudoprincipalis* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 39, Art. 1, p. 37, pl. 1, f. 21a, 21b, 21c.
- 1927, *Inquisitor pseudoprincipalis*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B*, Vol. 3, No. 1, Art. 1, p. 104.
- 1928, *Drillia pseudoprincipalis*, YOKOYAMA, *Imp. Geol. Surv. Japan, Rep. No. 101.*, p. 32, pl. 1, f. 15.
- 1935, *Clavus* (*Brachytoma*) *pseudoprincipalis*, NOMURA, *Sci. Rep. Tohoku Imp. Univ. Ser. B*, Vol. 18, p. 124, pl. 6, f. 38.
- 1952, *Clavus* (*Brachytoma*) *tuberosus*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 232.
- 1956, *Pseudoinquisitor pseudoprincipalis*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 25, pl. 2, f. 21.

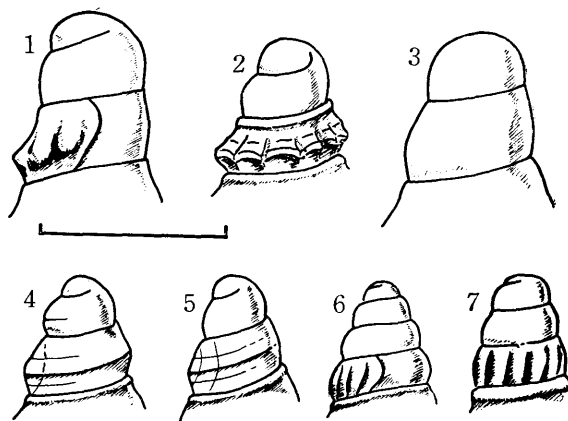
Material and Measurements.—GK-L 4989, 4995. Matrix is unconsolidated fine sandstone (GK-L 4989) and siltstone (4995) at Hagenoshita. The specimens are slightly broken.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A <P (degrees)	axials pen. bd.	primary spirals
GK-L 4989	14.15	6.65	4.5	47.0	31.8	2	27.9 18.4	9 10	3
4995	12.85	6.4	4.1	49.9	31.8	—	28.3 16.6	10 10	3

Remarks.—The present specimens conform the type species except that the former has the whorls of less number, which are provided with wider and shorter axials of less number than the latter. The examination of the numerous reports indicates that the species is rather variable in the characters in question and the present specimens are safely included in the range of variation.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.



Text-fig. 12. Protoconchs of the selected species of Clavinae from the Miyazaki group. Unit bar indicates 1 mm.

- 1. *Pseudoinquisitor totomiensis* (MAKIYAMA)
- 2. *Mauidrillia granulosa* n. sp.
- 3. *Pseudoinquisitor hyuganus yamajiensis* n. subsp.
- 4, 5. *Aoteadrillia longiplicata* n. sp.
- 6. *Tomopleura yokoyamai* (MAKIYAMA)
- 7. *T. difficilis* (SMITH)

Pseudoinquisitor totomiensis (MAKIYAMA)

Pl. 7, Fig. 13, Pl. 10, Fig. 14, Text-figs. 12, 13

1931, *Inquisitor totomiensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 7, No. 1, Art. 1*, p. 48, pl. 1, f. 6.1952, *Drillia (Clathrodrillia) totomiensis*, HATAI and NISIIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 207.

Material and Measurements.—GK-L 4954, 4955, 4956 and a few fragment specimens. Matrix is grey siltstone.

specimen	H	Bd	D	Bd/H	D/H	numb.	whorls	<A	<P	axials		spirals	
GK-K	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)		1st pen. bd.	10	10	6 18
4955	12.2	5.75	3.9	47.1	31.9	2.5	6.5	28.1	14.1	9	10	10	6 18
4956	10.15	5.1	4.9	50.3	35.4	2.5	6	29.7	17.2	9	9	10	6 14

Remarks.—The present specimens are quite identical to “*Inquisitor*” *totomiensis* MAKIYAMA from the Kakegawa group (Lower Pliocene) of Shizuoka Prefecture. The protoconch of this species including type specimen, which is bluntly rounded and composed of two and a half whorls, is quite different from the narrowly conical and polygyrate protoconch of true *Inquisitor*. It is reasonably classified into *Pseudoinquisitor*.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Pseudoinquisitor totomiensis ugariensis (MAKIYAMA)

Pl. 7, Fig. 18

1931, *Inquisitor totomiensis ugariensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 7, No. 1, Art. 1*, p. 48, pl. 1, f. 5.1952, *Drillia (Clathrodrillia) totomiensis ugariensis*, HATAI and NISIIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 207.

Material and Measurements.—GK-L 4994. A single specimen from grey siltstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb.	whorl	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)		(PN)	(degrees)		4th pen. bd.	10	11 10
4994	15.9	8.15	4.5	51.3	28.3		8	29.9	13.3	10	11	10

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

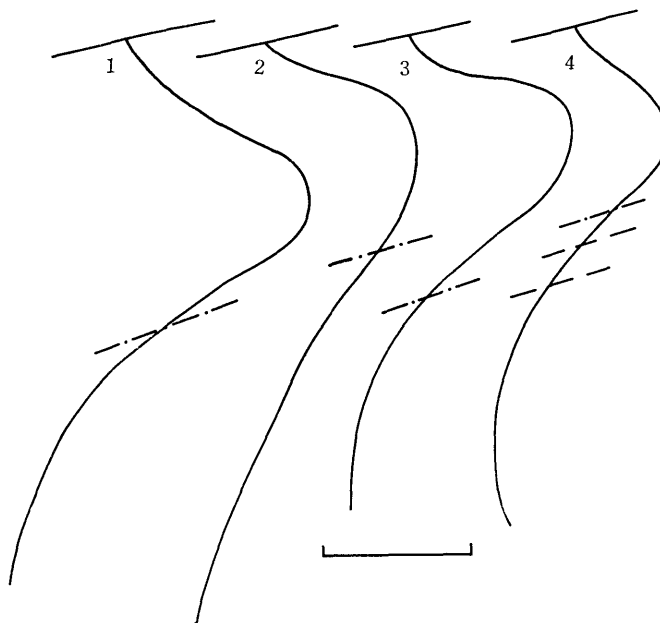
Pseudoinquisitor hyuganus yamajiensis n. subsp.

Pl. 7, Fig. 1, 2, Pl. 8, Fig. 18, Text-figs. 11, 12

Material and Measurements.—Holotype: GK-L 4932. A single specimen came from fine sandstone at Yamaji.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials	primary	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)	(degrees)	1st pen. bd.	spirals	
4932	11.8	6.9	3.9	58.4	33.0	2	6.5	32.8	21.4	8 8 8	3

Diagnosis.—The shell is small in size, and fusiform with acute and high spire and a long and gradually contracted base. The test is rather solid. The protoconch is moderate in size, smooth, much higher than wide, composed of two volutions. The first whorl is mammilate and separated by a oblique and appressed suture from the second one, which is moderately rounded early and weakly subangulated later. The post-nuclear whorls are six in number, angulated at the middle of the whorl height, axially plicated, spirally lirated, and separated one another by the appressed suture with a distinctly clasping subsutural band. The axial plicae are almost vertical, much wider than the interstices, very strong at the periphery, and slightly weakened anteriorly and posteriorly but apparently reach the lower suture and the upper subsutural band. Three primary spirals appear on the peripheral part of the third whorl and keep their strength until the last whorl. A distinct secondary thread appears on the shoulder close to the angulation on the fourth whorl and later it becomes almost as strong as the primaries. The shoulder is almost smooth except for the



Text-fig. 13. Anal sinuses of the selected species of Clavinae from the Miyazaki group. The lines with dots and bars and broken lines represent respectively the position of the upper boundary of the peripheral angulation and that of the distinct spirals. All the figures are based on the growth lines on the body whorls.

1. *Pseudoinquisitor hyuganus yamajiensis* n. subsp.
2. *P. pseudoprincipalis* (YOKOYAMA)
3. *P. totomiensis* (MAKIYAMA)
4. *Mauidrillia granulosa* n. sp.

above mentioned secondary and the dense growth lines. The body whorl is large occupying about sixty percent of the shell height, very roundly angulated at the periphery and tapered below gradually to the ill-defined canal. The basal surface is covered by fifteen alternating, weak and distinct, spiral threads on the upper slope and by eighteen threads of almost equal size on the snout. The aperture is long and narrow; the outer lip is thickened but abruptly sharpened to its forwardly produced margin. The anal sinus is moderately deep, V-shaped, and almost symmetrical concerning the regularly rounded apex, which is situated on the shoulder slightly closer to the peripheral angulation than to the suture. The columellar lip is slightly beaded. The canal is vertical, widely open, and truncated at the end. The parietal entering callus is very strong.

Comparison.—The present species was ever classified into *Turricula* SCHUMACHER, 1817 (type species: *Turricula flammea* SCHUMACHER=*Murex javana* CHEMNITZ) or *Clathrodrillia* DALL, 1918 (type species: *Pleurotoma gibbosa* REEVE). The former, however, is clearly distinguished from *Turricula* which is provided with a high conical, polygyrate protoconch and from *Clathrodrillia* which has a notched short canal, polygyrate protoconch, strong spirals, and labrum varix.

The present subspecies is distinguished from the type specimen of the species by the axials and the spirals of lesser number. The stratigraphic occurrence is also quite different between the two; that is to say, the subspecies occurs in the upper part of the Kawabaru member (lower Upper Miocene) and *P. hyuganus hyuganus* (YOKOYAMA) was reported from the Takanabe member (Lower Pliocene).

Pseudoinquisitor problematicus POWELL, the type of the genus, from the Middle Miocene of New Zealand (POWELL, 1942, p. 96, pl. 3, f. 3) is closely allied to the present new subspecies, but the former is distinguished from the latter in having the slenderer and much larger shell with more numerous and less convexed whorls. There is no significant difference in sculpture between the two.

"*Drillia (Brachytoma) pinfoldi*" VREDENBURG from the Middle Oligocene beds of Burma (VREDENBURG, 1921, p. 110, pl. 13, f. 4), the apex of which is missing, is another ally to the present subspecies. The former differs from the latter in its large size (two and a half times larger) and the coarse and prominent spiral threads on the basal slope and snout.

Horizon.—Upper part of the Kawabaru member (lower Upper Miocene).

Locality.—Road side cutting north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Genus *Inquisitor* HEDLEY, 1918

(type species: *Pleurotoma sterrhe* WATSON by original designation)

Inquisitor jeffreysi (SMITH)

Pl. 7, Fig. 3

1855, *Drillia jeffreysi* SMITH, *Ann. Mag. Nat. Hist.* 1875, Vol. 15, p. 417.

1884, *Drillia jeffreysi*, TRYON, *Man. Conch.* Vol. 1, p. 77, pl. 0, f.

1895, *Drillia jeffreysi*, PILSBRY, *Cat. Mar. Moll. Japan*, p. 18.

- 1906, *Pleurotoma (Drillia) principalis*, TOKUNAGA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 21, Art. 2, p. 14, pl. 1, f. 2, 3.
 1920, *Pleurotoma (Drillia) principalis*, YOKOYAMA, *ibid.* Vol. 39, Art. 6, p. 36, pl. 1, f. 20.
 1954, *Inquisitor jeffreysi*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 25, pl. 2, f. 20.

Material and Measurements.—GK-L 6038 and other imperfect specimens from unconsolidated fine sandstone.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	(degrees)	pen. bd.
6038	ca 32.2	ca 17.9	11.1	56	35	8+	31.9	20.5	14 15

Remarks.—The axial plicae of the figured specimen is slightly weaker than SMITH'S species owing to the abrasion, but some of the other fragmental specimens really conform the original one concerning with the character in question. The other features except for the above mentioned plicae are quite identical between the present specimens and the original one.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Aoteadrillia* POWELL, 1942

(type species: *Pleurotoma wanganuiensis* HUTTON by original designation)

Aoteadrillia longiplicate n. sp.

Pl. 8, Figs. 8, 11, Text-figs. 12, 16

Material and Measurements.—Holotype: GK-L 6001; paratype: GK-L 6002. All the specimens came from the fine sandstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials	primary
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)	(degrees)	1st pen. bd.	spirals
6001	9.5	5.3	3.45	55.7	36.3	2.3 5	28.5	22.1	12 12 14	4
6002	9.4	5.05	3.35	53.6	35.7	2.3 5	30.3	19.0	11 11 12	3

Diagnosis.—The shell is small, and fusiform with the high spire and the moderately short base. The test is moderately thin. The protoconch is relatively large, globose, and composed of two and one-third whorls; the first whorl is a smooth, depressed, and small tip; the second one is swollen and weakly angulated at the middle, and the third is weakly carinated and has three distinct threads on the carina and immediate above and below it. The post-nuclear whorls are five in number, roundly convexed, weakly angulated at the upper third of the whorl height, and ornamented by the strong axial plicae and distinct spiral lirae. The shoulder is narrow, steeply sloping, distinctly concave below the moderate subsutural band. The lateral surface below the angulation is almost vertical or slightly receding. The body whorl is large occupying more than a half of the shell-height and subangularly contracted at the base to the moderately short neck. The axial plicae are almost vertical, abruptly faded out above the angulation, and gradually weakened below the angulation to the lower suture. The intersections of the axials and the spirals are

prominently beaded. The spiral lirae on the first post-nuclear whorl are three in number, and roughly correspond to the threads on the third nuclear whorl. They are four on the second and the third whorl and five on the penultimate one, and the lowest one is slightly weaker than the others. The axially plicated peripheral surface of the body whorl is almost vertical having three primary spirals and a few secondaries below. The spirals on the basal slope and the snout are respectively six and nine in number, weaker than the peripheral ones, and almost equal in size. The border area between the basal slope and the snout is almost smooth except for the fine growth lines furnishing a flush surface. The aperture is ovoid, rather small, angularly bended posteriorly, and contracted below to the canal, which is short, oblique, widely open at the lower part, and obliquely truncated at the terminal. The outer lip is thin and has a moderately deep and arcuate anal sinus posteriorly close to the suture; the apex of the sinus is bluntly bended with the asymmetrical arms; the short upper arm merges to the upper suture at an acute angle; the labrum is antecurrent. The inner lip is covered with the thin callus and has not the distinct incertion callus pad.

Comparison.—The present species readily classified into the “group A” of *Aoteadrillia* POWELL, 1942 by the characters of the shell, especially of the protoconch which is composed of papillate and glossy first and second whorls and the carinate and lirate third one. *Aoteadrillia wanganuiensis* (HUTTON), the type species of the genus, from the Pliocene beds of New Zealand (SUTER, 1914, p. 29, pl. 2, f. 13) is a close ally to the present species. The greater part of the described species of *Aoteadrillia* is provided with the short axials, which are rather granular and confined to and near the median angulation of the whorls, while the type species has the axially elongated plicae reaching upper and lower suture. The present species also has axially elongated plicae like as the type species, but the former is distinguished from the latter in having the larger pleural angle, less numerous axials, longer body whorl, and more abruptly contracted base.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Cymatosyrinx* DALL, 1889

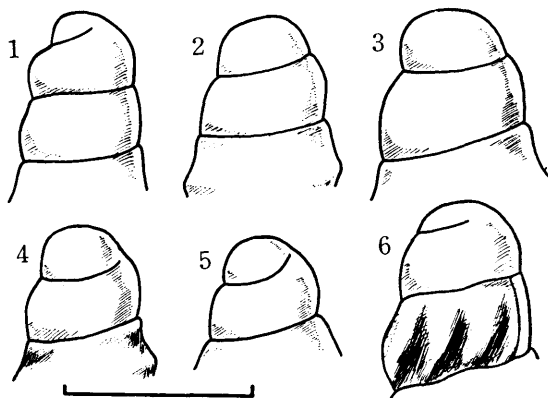
(type species: *Pleurotoma lunata* LEA by original designation)

Subgenus *Splendrillia* HEDLEY, 1922

(type species: *Drillia woodsi* BEDDOME by original designation)

MAKIYAMA pointed out that the Japanese species of “*Clavus*” of authors really belong to the genus *Cymatosyrinx* DALL, 1889 (MAKIYAMA, 1940, p. 12). *Clavus* MONTFORT, 1910 (type species: *Clavus flammulatus* MONTFORT) and *Cymatosyrinx* have the very weak spirals and represent a distinct group of Clavinae including several species. *Clavus* and *Austroclavus* POWELL, 1942 (type species: *Drillia tenuispiralis* MARSHALL), however, definitely distinguished from *Cymatosyrinx* by their polygyrate protoconchs. The following four genera having paucispiral protoconchs are closely

allied one another and make up the remainder half of the group. They are *Hauturua* POWELL, 1942 (type species: *Hauturua vivens* POWELL), *Splendrillia* HEDLEY, 1922 (type species: *Drillia woodsi* BEDDOME), *Syntomodrillia* WOODRING, 1928 (type species: *Drillia lissotropis* DALL), and *Cymatosyrinx*. The distinction among them are as follows. *Cymatosyrinx* is characterized by its protoconch, the second volution of which is carinate at the middle, by the strong axials reaching the upper and the lower sutures, and by the stromboid notch at the labrum which is strongly developed and leaves a distinct groove cutting across the ends of the axials on the neck. *Hauturua* is featured by the distinct basal angulation, by the axials restricted at the periphery, and by the simple suture devoid of the subsutural fold. On the shell of *Splendrillia* the axials are abruptly faded out on the shoulder and do not reach the upper suture. The strong axials reaching the upper and the lower sutures, weak basal angulation, and lack of the subsutural fold make the genus *Syntomodrillia* distinctive.



Text-fig. 14. Protoconchs of the species of *Splendrillia* from the Miyazaki group. Unit bar indicates 1 mm.

1. *Cymatosyrinx* (*Splendrillia*) *rinsuikawaensis* (NOMURA)
2. *C. (S.) osawanoensis pulchella* n. subsp.
3. *C. (S.) lincta hagenoshitaensis* n. subsp.
4. *C. (S.) cristata* POWELL
5. *C. (S.) praegracilis* (MAKIYAMA)
6. *C. (S.)* ? sp.

Strictly speaking the majority of the Japanese species of “*Cymatosyrinx*” is devoid of the typical *Cymatosyrinx* protoconch and the axial plicae and is better to be classified into *Splendrillia* having the typical feature. The difference among these “genera”, although distinctive, is not considered to be of generic level, and herein I treat *Splendrillia*, *Hauturua*, and *Syntomodrillia* as the subgenera of *Cymatosyrinx*.

Cymatosyrinx (*Splendrillia*) *rinsuikawaensis* (NOMURA)

Pl. 3, Figs. 1, 5, Pl. 9, Fig. 4, Text-figs. 14, 15

1935. *Clavus* (*Clavus* ?) *rinsuikawaensis* NOMURA, *Sci. Rep. Tohoku Imp. Univ. Ser. 2, Vol. 18*, p. 120, pl. 6, f. 45a, 45b.

Material and Measurements.—GK-L 4947 from fine sandstone at Nihonmatsu; GK-L 4948 from unconsolidated grey fine sandstone at Hagenoshita; and GK-L 6004 from grey sandy siltstone at Nishinobyu. Preservation is almost perfect.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls		<A (degrees)	<P	axials	
GK-L						(N)	(PN)			pen.	bd.
4947	18.1	8.35	5.6	46.1	30.9	2.5	8	27.2	15.3	10	2
4948	ca 20.2	9.6	5.95	49.6	29.4	2.5	8.5	31.0	11.7	10	7
6004	15.1	7.7	4.75	51.0	31.4	—	7.5	31.2	10.3	10	6

Remarks.—The present specimens are almost quite identical to NOMURA's species from the Byoritzu bed (Pliocene) of Formosa. The present species has a subcylindrical high protoconch consisting of two and a half volutions. The post-nuclear whorls have the depressed sinus area on the shoulder and the parietal callus pad is markedly developed. Concerning with these features it closely resembles *Splendrillia edita* POWELL (POWELL, 1942, p. 103, pl. 2, f. 3), but the latter has somewhat different axials, which are vertical and more numerous than those of *C. (S.) rinsuikawaensis*.

Horizon.—Lower and middle part of the Takanahe member (Lowest to Lower Pliocene).

Localities.—Road side small cutting at Nihonmatsu, Takanahe machi; road side cutting at Hagenoshita; and small cliff immediate north of Nishinobyu, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Cymatosyrinx (Splendrillia) osawanoensis pulchella n. subsp.

Pl. 3, Fig. 18, Text-figs. 14, 15

Material and Measurements.—Holotype GK-L 4993; paratypes 4996, 4997, 4998. All the perfectly preserved specimens came from one and the same locality. Matrix is grey siltstone.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls		<A (degrees)	<P	axials		
GK-L						(N)	(PN)			1st	pen.	bd.
4993	16.7	9.1	5.15	54.4	30.8	2	7	34.7	16.5	8	11	10
4996	13.0	7.1	4.7	54.6	36.2	2	7	38.4	17.7	8	10	12
4997	11.4	5.15	4.1	45.2	36.9	2	7	34.1	17.3	8	10	11

Diagnosis.—The shell is moderately small in size, slender, and fusiform with the turreted spire and rather the long base. The protoconch is smooth and composed of two volutions, of which the nuclear one is depressed and oblique and the second one is slightly inflated. The post-nuclear whorls are about seven in number, roundly angulated at about the middle of the whorl height on the early ones and at upper two-fifths to three-sevenths on the penultimate whorl, and axially plicated at the periphery. The surface above the angulation is moderately sloped and moderately concave forming a sinus band, and the surface below the angulation is somewhat convexed and slightly receding. The axial folds are eight to nine in number on the early whorls and ten to twelve on the penultimate and the last whorls. They are slightly oblique, as wide as the interspaces, abruptly diminished on the shoulder, and weakened below but reach the lower suture. They are strong on the early whorls and become weaker on the late whorls and almost disappear on the latest part of the body whorl. The spirals are not at all developed except for the obsolete striae on the body whorl of a few specimens. The body whorl is a little longer than the spire, roundly angulated at the periphery and at the base. The base is distinctly

contracted below the basal angulation and then gradually continued to the produced snout. The aperture is pyriform, small, and contracted below to the canal. The canal is not so long, open, slightly bended outwards, and obliquely truncated at the end. The inner lip is moderately bended at the upper third and is provided with the distinct entering callus. The sinus is moderately deep, broadly arcuated on the concave shoulder; the upper arm of the sinus is short and approach to the upper suture at an acute angle of about fifty degrees; the lower arm is extended forwardly forming an antecurrent labrum.

Comparison.—*Cymatosyrinx osawanoensis* TSUDA (1959, 98-99, pl. 5, f. 13a, 13b) from the Yatsuo group of Toyama Prefecture (Middle Miocene) is distinguished from the present new subspecies by the following aspects. The former has somewhat larger shell, slightly more numerous axials (thirteen on the penultimate whorl) of almost vertical arrangement.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Cymatosyrinx (Splendrillia) lincta hagenoshitaensis n. subsp.

Pl. 7, Fig. 11, Text-figs. 14, 15

Material and Measurements.—Holotype GK-L 4992. A single perfect specimen and a few fragmental ones from grey slitstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)	(degrees)	1st pen. bd.
4992	10.35	5.4	3.75	50.5	35.1	2	32.9	19.9	9
						6			10
									9

Diagnosis.—The shell is small in size, and fusiform with the turreted spire and rather the short base. The protoconch is smooth, globose, somewhat wider than high, and composed of the volutions, of which the first is depressed and horizontal and the second is somewhat swollen with the round sides and separated from the preceding one by a deep suture. The post-nuclear whorls are six in number, angulated at the lower two-fifths of the whorl height, and obliquely plicated at the periphery. The shoulder is wide, steeply sloped, and slightly concave and the surface below the angulation is almost flat and receding. The axial plicae are moderately weak, somewhat oblique, gradually weakened below to the suture, and abruptly disappear on the shoulder. The body whorl is large, occupying about fifty-five percent of the whorl height, roundly angulated at the periphery, and contracted at the base forming obsolete basal angulation. The snout is rather short and bended backwards. The aperture is pyriform, rather small, and contracted below to the canal. The outer lip is thin, sharp, produced forwards at the middle, and sinused above just below the suture. The sinus is wide, moderately deep, asymmetrical concerning with the apex, and occupies fully the shoulder. The columellar lip is slightly oblique, covered by the thin but distinct callus with minute folds, and continues to the parietal lip with a sharp bending. The parietal entering callus is distinct. The canal is short, widely open, and obliquely truncated at the end.



Text-fig. 15. Anal sinuses of the species of *Splendrillia* from the Miyazaki group. All the figures except for fig. 6 are based on the growth lines on the body whorls: fig. 3 shows the gerontic sinus. The lines with dots and bars represent the position of the upper boundary of the peripheral angulation.

1. *Cymatosyrinx* (*Splendrillia*) ? sp.
2. *C. (S.) rinsuikawaensis* (NOMURA)
3. *C. (S.) osawanoensis pulchella* n. subsp.
4. *C. (S.) lincta hagenoshitaensis* n. subsp.
5. *C. (S.) cristata* POWELL
6. *C. (S.) praegracilis* (MAKIYAMA)

Comparison.—*Splendrillia lincta* POWELL (1942, p. 101, pl. 12, f. 1) almost quite agrees with this new subspecies except for a few characters. That is to say, the former shell is one and two-thirds times larger than the latter, and the aperture is somewhat longer and the basal contraction is weaker in the former than in the latter.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Cymatosyrinx (*Splendrillia*) *praegracilis* (MAKIYAMA)

Pl. 5, Fig. 9, Text-figs. 14, 15

1927, *Cymatosyrinx praegracilis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 107, pl. 5, f. 5.

Material and Measurements.—GK-L 4999. Matrix is unconsolidated fine sandstone. Preservation is favourable.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	pen.	bd.	
4999	9.65	4.65	21.5	48.2	22.3	2	6.5	33.1	11.3	9	11	9

Remarks.—The present specimen quite agrees with *C. (S.) praegracilis* except for the axials which on the present specimen are slightly wider than the interspaces. The type specimens from the Lower Kakegawa group (Lower Pliocene) and the present one undoubtedly conspecific.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Cymatosyrinx (Splendrillia) cristata POWELL

Pl. 5, Fig. 5, 6, Text-figs. 14, 15

1942, *Splendrillia cristata* POWELL, *Auckland Inst. Mus. Bull. No. 2*, p. 102, pl. 12, f. 4.

Material and Measurements.—GK-L 5000. A single specimen from the unconsolidated grey fine sandstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	(degrees)	1st	pen.	bd.
5000	9.05	4.5	3.2	49.7	35.3	6.5	34.2	11.3	10	10	8

Remarks.—*Splendrillia cristata* POWELL was described on the foundation of the specimen from the Middle Pliocene bed of New Zealand and is characterized by the slender and smooth shell with many whorls, each of which is angulated above the middle, deeply excavated on the shoulder, and axially ornamented by nine to eleven upcurved plicae. The present specimen is quite identical concerning above noted features to the New Zealand species. It slightly differs in the details of the axials, that is to say, the axial plicae of the present specimen are slightly weaker at the periphery than those of the New Zealand species. The difference of this kind, however, is safely considered as an intraspecific one.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Cymatosyrinx (Splendrillia) ? sp.

Pl. 8, Fig. 6, Text-figs. 14, 15

Material and Measurements.—A single specimen from the fine sandstone at Yamaji. The shell is almost perfectly preserved except for the end of the canal.

specimen	H	Bd	Ap	D	Bd/H	Ap/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(mm.)	(%)	(%)	(%)	(N)	(PN)	(degrees)	1st	pen.	bd.	
6063	12.2	5.8	3.8	4.2	47.5	31.1	34.4	2	7	27	16	10	11	13

Description.—The shell is of small size, asymmetrically fusiform with the high and acute spire and rather the short base. The protoconch is small, smooth, rounded, and composed of two volutions, of which the first is a depressed small tip separated by a shallow suture from the swollen second one. The post-nuclear whorls are seven

in number, roundly angulated at a little below the middle on the early whorls and slightly above the middle on the late whorls, and axially and spirally ornamented. The shoulder is distinctly concave and sloping steeply below the moderately strong subsutural band. The surface below the angulation is angularly convexed. The axial plicae are very oblique, narrower than the interspaces, disappear abruptly on the lower margin of the shoulder, and slightly weakened below to the lower suture. They are ten, nine, nine, nine, ten, eleven, and thirteen in number on the first, second, third, fourth, fifth, sixth, and last whorl respectively. The spiral lirae are distinct, developed on the angulation and the lateral surface below it, and cross over the axials. They are three in number on the early four whorls and intercalated by a few obsolete threads on the fifth and sixth whorls. The body whorl is rather large, occupying about a half of the shell height, angulated at the periphery, and gradually contracted below to the moderately long snout. The spirals are composed of three distinct lirae on the peripheral surface, slightly weak four threads on the basal slope, and five weak ones on the snout. A few weak and obsolete threads are intercalated between the above mentioned spirals on the peripheral surface and basal slope. The axial plicae are faded out just below the peripheral angulation. The aperture is pyriform, narrowly bended above, and slightly contracted below to the oblique canal. The outer lip is thin and sharp. The sinus is on the shoulder, U-shaped, moderately deep, and the blunt apex is at about the middle of the shoulder. The inner lip is covered by a distinct callus, which is bordered by a low but sharp rim. The entering callus is absent.

Comparison.—The systematic position on the generic level of the present species is problematic. That is to say, it partly resembles and disagrees with *Splendrillia* and *Cymatosyrinx*. The present species has the primary spiral lirae crossed over the axials and is devoid of the parietal entering callus, and accordingly it differs from *Splendrillia* concerning with these aspects. The present species also differs from *Cymatosyrinx* s. s. in having the distinct spirals and axials fading on the shoulder, and in being devoid of the parietal entering callus. Any other genus or subgenus has not been known hitherto for which verifies the conformity with the present species. This may probably represent a new genus, however, I include it here preliminarily in *Splendrillia* because of paucity of the material.

Horizon.—Upper part of the Kawabaru member (lower Upper Miocene).

Locality.—Cutting at the entrance of the tunnel north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Genus *Mauidrillia* POWELL, 1942

(type species: *Mangilia praecophinodes* SUTER by original designation)

Mauidrillia granulosa n. sp.

Pl. 4, Figs. 10, 11, Text-figs. 12, 13

Material.—Holotype GK-L 4961. A single perfect specimen and a few fragmental ones from the fine sandstone at Yamaji.

Measurements.—

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)		1st	pen. bd.	
4961	7.50	4.05	3.25	54.1	43.3	2	5	41.6	26.4	12	12

Diagnosis.—The shell is small in size, obtusely fusiform with a high conical spire and a moderately long base. The protoconch is regularly rounded, smooth, slightly depressed, wider than high, and consists of two volutions. The post-nuclear whorls are five in number, carinated at the middle of each whorl, and ornamented by the short granulose axials and the distinct fine spiral threads. The shoulder is distinctly concave and moderately sloping below subsutural band, which is covered by a few spiral threads. The surface below the carina is almost vertical. The axials are about twelve per one whorl and almost restricted on the carina, hardly extending above and below it. The spiral threads are one in number on the first and the second whorls, two on the third, and three on the penultimate and ultimate whorls. Among the spirals those on the carina are the strongest. Another one distinct thread appears on the shoulder of the first whorl, and a supra-sutural one appears on the second whorl. Then the threads are increased in number and they are about six respectively on the shoulder and on the lateral surface and about twenty on the basal surface of the body whorl. They are almost equal in size and regularly spaced. The interspaces are wider than the threads. The aperture is rather small and contracted below to the slightly oblique, narrow, and short canal. The outer lip is simple; the anal sinus is wide and rather shallow on the shoulder; a weak stromboid sinus is formed anteriorly; and the middle part is extended forwards. The columellar lip is gently bending and covered by a distinct callus.

Comparison.—The present species looks like *Aoteadrillia* POWELL, 1942 with the type species *Pleurotoma wanganuensis* HUTTON in its outline and the sculpture, but the latter has a characteristic protoconch which consists of two to three bluntly carinate volutions and is devoid of the subsutural band on the post-nuclear whorls.

Mauidrillia supralaevis POWELL (1942, p. 86, pl. 1, f. 7) is closely allied to the present species, but the former is distinguished from the latter in the feature that the shoulder of the former is free from the spiral threads.

M. clavícula POWELL (1952, p. 86, pl. 1, f. 12) is another ally to the new species, but the former has the slenderer spire and much weaker subsutural band than the latter.

Horizon.—Upper part of the Kawabaru member (lower Upper Miocene).

Locality.—Road side cutting 300 m. north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Genus *Tomopleura* CASEY, 1904

(type species: *Pleurotoma nivea* PHILIPPI by original designation)

Tomopleura difficilis (SMITH)

Pl. 7, Fig. 14, Text-figs. 12, 16

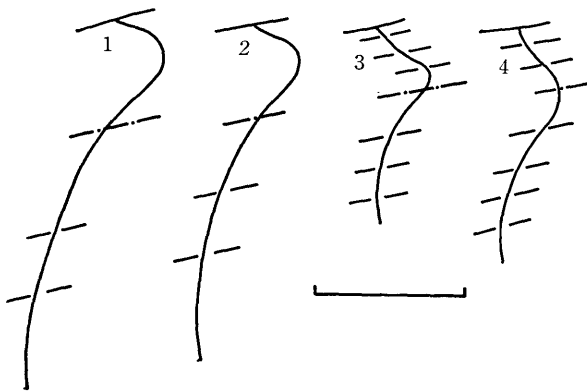
1879, *Pleurotoma difficilis* SMITH, *Proc. Zool. Soc. London*, p. 187, pl. 19, f. 8.

- 1884, *Pleurotoma difficilis*, TRYON, *Man. Conch. Vol. 6*, p. 173, pl. 32, f. 16.
 1889, *Pleurotoma difficilis*, WEINKAUFF, *Syst. Conch. Cab. in MARTINI and CHEMITZ, Vol. 4, Pt. 3*, p. 189, pl. 37, f. 5.
 1927, *Asthenotoma difficilis*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 96.
 1940, *Tomopleura difficilis*, MAKIYAMA, *Trans. Palaeont. Soc. Japan, No. 102*, p. 133.
 1952, *Microdrillia difficilis*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 66.

Material and Measurements.—GK-L 4919 and 4929. Matrix is grey fine sandstone.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (degrees)
GK-L							
4919	6.2	3.3	2.3	53.3	37.1	3.25	4.25
4929	6.7	3.5	2.5	52.3	37.3	3	5.5

Remarks.—The difference in form-characters between *T. difficilis* (SMITH) and the Pliocene species *T. subdifficilis* (MAKIYAMA) is rather delicate and gradational. The



Text-fig. 16. Anal sinuses of the species of *Aoteadrillia* and *Tomopleura* from the Miyazaki group. All the figures are based on the growth lines on the body whorls. The lines with dots and bars represent the position of the upper boundary of the peripheral angulation: the broken lines show the position of the distinct spirals. Unit bars indicates 1 mm.

- 1, 2. *Aoteadrillia longiplicata* n. sp.
3. *Tomopleura yokoyamai* (MAKIYAMA)
4. *T. difficilis* (SMITH)

typical form of the former, however, is readily distinguished from the latter in the following aspects. The polygyrate protoconch of *T. difficilis* is composed of smooth, glassy, and globose three whorls and a brephic one, but that of *T. subdifficilis* consists of two smooth whorls. On *T. difficilis* a coarse spiral costa is developed close to the upper suture besides two costae on the peripheral surface, while the subsutural costa is not formed at all on *T. subdifficilis*. The present specimens are apparently provided with the subsutural costa and naturally grouped into *T. difficilis*.

Horizon.—Lower to middle part of the Takanabe member (Lowest to Lower Pliocene).

Locality.—Road side cutting at Nihonmatsu, Takanabe machi; road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Tomopleura yokoyamai (MAKIYAMA)

Pl. 3, Fig. 14, Text-figs. 12, 16

- 1927, *Asthenotoma yokoyamai* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, Vol. 3, No. 1, Art. 1*, p. 95, pl. 4, f. 21, 22.
 1940, *Tomopleura yokoyamai*, MAKIYAMA, *Trans. Palaeont. Soc. Japan, No. 101*, p. 133.

1952, *Tomopleura yokoyamai*, HATAI and NISUYAMA, *Sci. Rep. Tokoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 170.

Material and Measurements.—GK-L 4931. A single specimen from the unconsolidated grey fine sandstone.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls (N)	<A (PN)	<A (degrees)
GK-L 4931	4.1	2.4	1.9	58.5	46.4	4	3.5	37

Remarks.—Although the present species has wider shell of larger diameter-height-ratio and weaker costae below the peripheral carina on the body whorl than the original species from the Kakegawa Pliocene beds, the former is undoubtedly included in the latter on the basis of the general features including sculpture, sinus, and protoconch except for the above mentioned slight difference.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Clavinae gen. and sp. indet. (*Austrodrillia* ? sp.)

Pl. 10, Fig. 12

Material and Measurements.—Imperfect three specimens from the silty fine sandstone. The dimensions of the figured specimen (GK-L 6081) are as follow : maximum height of the shell : 26 mm, maximum diameter : 12.4 mm., number of the axials on the penultimate whorl : 10, number of the strong spirals on the penultimate whorl : 4.

Remarks.—The present specimens are naturally included in Clavinae on the basis of the moderately shallow anal sinus on the defined shoulder and the distinctly tubular parietal entering callus. The profile and the ornamentation of the present specimens resemble those of *Austrodrillia* HEDLEY, 1918 with the type *Pleurotoma angasi* CROSSE. They, however, can not be identified generically and specifically on account of lack of the apex and the anterior part of the aperture.

Horizon.—Upper part of Kawabaru member (Upper Miocene).

Locality.—River side cliff north of Takajô bridge, Kijô mura, Koyu gun, Miyazaki Prefecture.

Subfamily Borsoniinae

Genus *Borsonia* BELLARDI, 1839

(type species : *Borsonia prima* BELLARDI by monotypy)

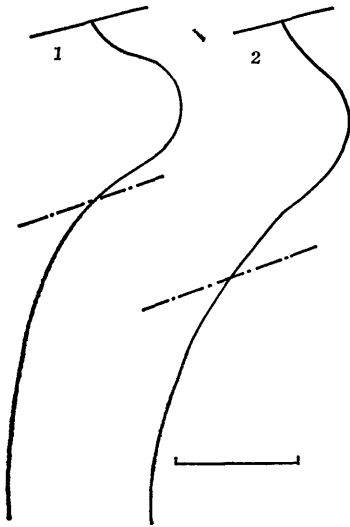
Borsonia miyazakiensis n. sp

Pl. 3, Fig. 6, Pl. 5, Fig. 8, Text-fig. 17

Material and Measurements.—Holotype : GK-L 6036, paratypes : GK-L 6037, and 6048. GK-L 6036 and 6037 came from the siltstone at Hagenoshita and 6048 from the overlying sandstone at the same locality.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)		1st	pen.	bd.
6036	38.0	21.2	11.7	55.8	30.2	2 9	40.4	21.8	9	12	12
6037	ca 29.0	17.4	8.9	59.8	30.7	— 7.5+	38.4	15.9	9	12	11

Diagnosis.—The shell is moderate in size, slender, fusiform with a very high turreted spire and a moderately long base, and somewhat solid. The protoconch is small, smooth, round, inflated, and composed of two volutions. The post-nuclear whorls are nine in number, distinctly angulated at about the middle of each whorl, and ornamented by the distinct axial plicae and the spiral lirae. The shoulder is



Text-fig. 17. Anal sinuses of *Borsonia miyazakiensis* and *B. smithi hagenoshita*. Figures are based on the growth lines on the body whorls. The lines with dots and bars represent the position of the upper boundary of the peripheral angulation. Unit bar indicates 1 mm.

1. *Borsonia miyazakiensis* n. sp.
2. *B. smithi hagenoshita* n. subsp.

steeply sloped, remarkably concave, and almost smooth except for a weak subsutural spiral lira and the close and fine growth lines. The surface below the angulation is slightly convex and receding, and covered by the spirals. The axials are slightly oblique, granular on the angulation, abruptly faded out on the shoulder, and suddenly weakened below the angulation to the lower suture. Number of the axials is nine, ten, twelve, and eleven on the first, fifth, penultimate, and ultimate whorl respectively. They are stronger and more granular on the early whorls and become weak or obsolete on the gerontic whorl. The spirals are primarily two on the angulation and a secondary is added between the angulation and the lower suture on the fourth whorl and increased in size later. On the seventh whorl a weak thread appears near the upper suture. The body whorl is large, occupying about fifty-six percent of the height of the shell, bluntly angulated at the periphery, gradually contracted below to the short snout. In consequence of increase in size and number the spirals on the periphery and the basal slope of the body whorl are distinct and nine in number; those on the snout are weak and thirteen in number. The aperture is long, rather narrow, and attenuated anteriorly to the very short canal which, however, is not very narrow even at the extremity of the canal. The outer lip is covered with distinct callus and has one plait on the upper third of the columella.

Comparison.—*Borsonia tatei* POWELL (1944, p. 42, pl. 3, f. 8) from the lower Miocene of Victoria, Australia is closely allied to the new species, but the former is smaller in size and has the axials of less number, more numerous fine spiral threads on the shoulder, and one more spirals on the lateral surface below the angulation, and its columellar plait is at remarkably lower position on the gently curved colu-

mella than that of new species.

The type species of the genus, *Borsonia prima* BELLARDI (COSSMANN, 1895, p. 96, pl. 6, f. 18, 20), from Helvetian of Turin, Italy is also resembles the present new species, especially in its ornamentation, but the latter is distinguished from the former by its longer and slender shell; more sharply angulated whorls and the deeper anal sinus.

Borsonia spigona MARTENS from Indian seas (1903, p. 91, pl. 2, 2, f. 2) is hardly distinguished from the adolescent shell of the present species, although it is distinguished from the adult shell of the latter which is provided with less distinct peripheral angulation, more numerous spirals, and larger shell than the former. The two probably have some phylogeneric relation.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Borsonia smithi hagenoshita n. sp.

Pl. 3, Figs. 16, 17, Text-fig. 17

Material and Measurements.—GK-L 4943. The holotype specimen and a few imperfect ones (including GK-L 4494) came from the grey siltstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	2nd	pen. bd.	
4943	16.9	10.8	6.3	63.9	37.3	1.5	6	33.5	27.8	9	9	10 10

Diagnosis.—The shell is moderately small in size, thick, porcellaneous, and fusiform with a turreted spire and a long base. The protoconch is rather large, depressed, bluntly rounded, and composed of one and a half whorls. The post-nuclear whorls are six in number, roundly angulated at the lower two-fifths of the whorl height, and weakly ornamented by the axials and the spirals. The body whorl is large with rather long snout, occupying about sixty percent of the height of the shell. The peripheral angulation is more round on the body whorl than on the early ones. The shoulder is remarkably concave below the wide but weak subsutural band, and flush with no spirals but distinct growth lines. The axials are slightly oblique, rather granular on the angulation, and hardly extended above and below. They are stronger on the early whorls and become weak gradually on the later whorls, and finally they are mere obsolete axial folds on the body whorl. The number of the axials are nine and ten respectively on the early whorls and on the later ones. The spiral ornamentation consists of three weak cords, of which one is on the angulation and the other two are on the lateral surface between the angulation and the lower suture. On the body whorl weak but distinct eight spiral cords of almost equal strength and obsolete five threads are discernible on the lateral surface and on the snout respectively. The aperture is pyriform, long, and narrow. It gradually narrows below without distinct contraction to the slightly oblique, short, and wide canal. The anal sinus is wide and shallow on the shoulder and the outer lip is produced forwards sigmoidally. The inner lip is composed of the slightly twisted columellar lip and the obli-

que parietal one, covered with the distinct callus and has two plaits on the upper part of the columella, of which the upper one is stronger than the lower.

Comparison.—*Borsonia smithi* SCHEPMAN (1913, p. 420, pl. 27, f. 5) was established in 1913 on the basis of the specimen from Sabu sea in Makassar strait. It represents a specialized group of *Borsonia* featured by the smooth and polished later whorls. The present specimen almost perfectly conforms with the species except for the following slight difference. On the specimen of *B. smithi* the granular axials of the early whorls are remarkably oblique and very close and they perfectly disappear on the third and the later whorls. While the axials on the present specimens are coarser granules on the early whorls and discernible faintly even on the penultimate whorl. The present subspecies also closely resembles in general form and ornamentation *Pleurotoma (Surcula) symbiotes* WOOD-MASON and ALCOCK from the Bay of Bengal (1891, p. 444, f. 13a, 13b), which is not *Surcula* but *Borsonia* on the basis of the columellar plaits. The present new species is distinguished from *B. symbiotes* in having stronger columellar plaits and larger apex than the latter.

Horizon—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subfamily Mangeliinae

Genus *Antiguraleus* POWELL, 1942

(type species: *Antiguraleus otagoensis* POWELL by original designation)

Antiguraleus sp.

Pl. 3, Fig. 9, Text-figs. 18, 19

Material and Measurements.—GK-L 4985. Matrix is grey siltstone. Preservation is almost perfect.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	2nd	3rd	
4985	6.0	3.8	2.65	63.3	44.2	2	3.5	57.4	26.7	18	17	20

Description.—The shell is small in size and ovoid-fusiform with the slightly conoidal spire and the roundly tapering base. The test is rather thick. The protoconch is smooth and paucispiral with shallow suture; the first whorl is papillate, depressed, and slightly oblique; the second is inflated. The post-nuclear whorls are three and a half in number, weakly angulated at the upper third of the whorl, and ornamented by the fenestrate sculpture. The shoulder is narrow, slightly convex, and moderately sloped below the appressed suture; the surface below the angulation is almost vertical. The fenestrate sculpture on the spire-whorls consists of prominent four to five spiral lirae and distinct but narrow eighteen axial plicae. The axials reach the upper suture and gradually faded out below on the basal slope and the spirals are alternating distinct and weak ones and numbered nine and thirteen respectively on the lateral and the basal surface. The body whorl is large, about two-thirds of the total height of the shell, and gradually tapered anteriorly. The aperture is narrow, sub-

parallel, a little shorter than a half of the shell height, narrowly bended at the posterior end, and weakly contracted anteriorly. The outer lip is thick and almost vertical in profile. The anal sinus is shallow and gently curved close to the suture. The canal is very short, widely open, and shallowly notched at the end. The inner lip is sharply bended, composed of the oblique parietal lip and the vertical columellar one, and covered by a distinct callus.

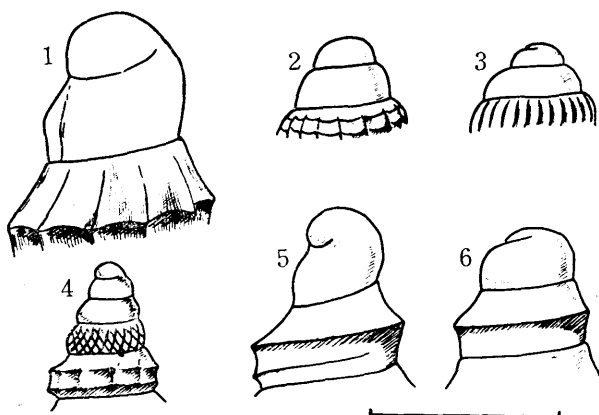
Comparison.—*Antiguraleus deceptus* POWELL (1942, p. 146, pl. 8, f. 7) resembles the present species, but the former

is readily distinguished from the latter by its more distinct peripheral angulation, slightly stronger sculpture, and less conoidal spire than the latter.

Lora viridula kurodai ONOYAMA (1938, p. 73, f. 3) from the Pliocene bed in Toyama Prefecture probably belongs to *Antiguraleus* judging from the description and the figure. It also resembles to the present species, but the former has more angular periphery of the whorls than the latter.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.



Text-fig. 18. Protoconchs of the species of Mangeliinae and Daphnellinae from the Miyazaki group. Unit bar indicates 1 mm.

1. *Etrema hyugaensis* n. sp.
2. *Antiguraleus* sp.
3. *Anacithara bulbosa* n. sp.
4. *Puha japonica* n. sp.
5. *Filodrillia oyamai* n. sp.
6. *Etrema hayasakai* (NOMURA)

Genus *Anacithara* HEDLEY, 1922

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

Anacithara bulbosa n. sp.

Pl. 3, Fig. 10, 15, Text-figs. 18, 19

Material and Measurements.—Holotype: GK-L 4986; paratype: GK-L 4987. The type specimens came from the fine grey sandstone at Nihonmatsu. Preservation is very favourable.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. (N)	whorls (PN)	<A (degrees)	<P (degrees)	axials 1st	pen. bd.	
GK-L 4986	3.65	2.55	1.95	69.8	53.4	2.6	3	83.1	39.9	17	15	15
4987	3.40	2.35	1.70	69.2	49.8	2.6	3	84.0	37.3	16	14	14

Diagnosis.—The shell is very small in size, ovoid-biconical with the moderately low conoidal spire and the long base. The protoconch is rather small, dome shaped, smooth, bluntly rounded, and composed of two and two-thirds whorls; the first is small tip and separated by the apressed horizontal suture from the second which is inflated and followed by the bryophic one. The post-nuclear whorls are about three in number, roundly angulated at the upper third of the whorl height, and ornamented by the distinct spiral lirae and the prominent axial plicae. The axial plicae are almost vertical, swollen, much wider than the interstices, weakly beaded on the angulation, hardly reduced on the shoulder, reach the upper and the lower suture, and abruptly faded out at the lower part of the basal slope. They are about fourteen to fifteen on the penultimate and the body whorls. The spiral lirae are distinct, crossed over the plicae, almost of equal size except for one on the shoulder. They are five in number respectively on the penultimate whorl and on the lateral surface of the body whorl and about eight on the basal surface. The body whorl is large occupying about seventy percent of the shell height. The aperture is rather large as long as a half of the height of the shell, pointed at the posterior end, narrowed below to the canal, and devoid of the teeth inside. The anal sinus is on the shoulder close to the suture, shallow, and broad. The labrum profils is almost vertical. The inner lip is gently bended and has a parietal callus. The canal is very short, and obliquely truncated at the end.

Comparison.—*Anacithara clifdenica* POWELL from the lower Miocene of New Zealand (POWELL, 1942, p. 155, pl. 5, f. 8) is a close ally to the present species, but the latter is distinguished from the former in the features that the latter has the larger aperture and the plicae of greater number than the former.

"*Bella willsi*" FRICKE (KÜSTER, 1887, p. 166, pl. 33, f. 14) almost conforms with the present species, but the axial plicae of the former are weakened on the body whorl.

Horizon.—Middle part of the Takanabe member (Lower Pliocene).

Locality.—Road side cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Genus *Etrema* HEDLEY, 1918

(type species: *Mangilia (Glyphostoma) aliciae* MELVILL and STANDEN by original designation)

Etrema hayasakai (NOMURA)

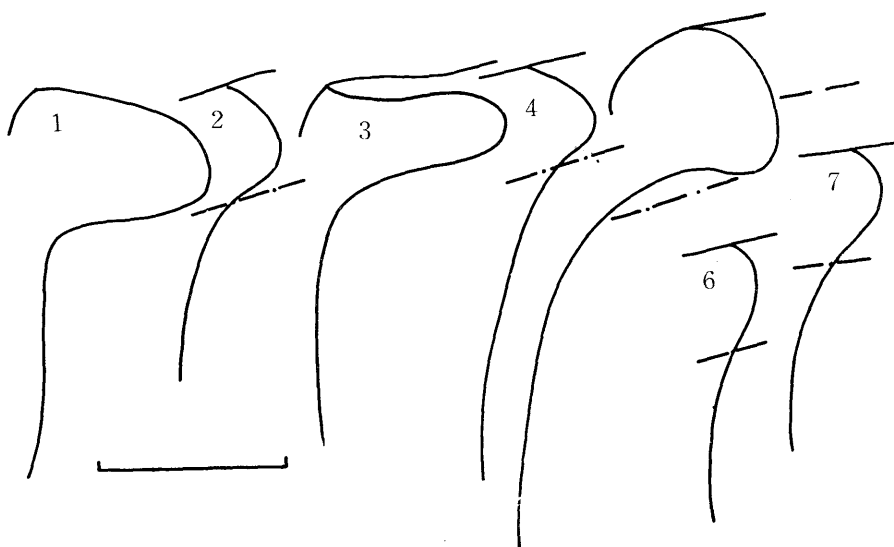
Pl. 6, Fig. 9, Pl. 9, Fig. 10, Text-figs. 18, 19

1935, *Lienardia (Lienardia) hayasakai* NOMURA, *Sci. Rep. Tohoku Imp. Univ. Ser. 2, Vol. 18*, p. 128, pl. 4, f. 52a, 52b.

Material and Measurements.—GK-L 4928 and 4937. GK-L 4928 came from the unconsolidated grey fine sandstone at Hagenoshita and 4937 from grey fine sandstone at Nihonmatsu. Preservation is favourable.

specimen	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	numb. whorls		<A (degrees)	<P (degrees)	axials	
GK-L						(N)	(PN)			pen.	bd.
4928	7.6	4.5	3.3	59.3	43.4	2	5	35.7	35.1	9	10
4937	7.1	4.5	3.0	63.4	42.3	2	4.5	31.4	32.9	9	12

Remarks.—The specimens in hand are quite identical to *Etrema hayasakai* (NOMURA) from the Pliocene beds of Byoritzu in Formosa except for the axial plicae, which are twelve on the latter. While the specimen from Nihonmatsu (GK-L 4937) has twelve axial plicae on the body whorl. The number of the axial plicae should be rather variable. The protoconch of the present species is composed of two volutions, of which the first and succeeding one half whorl are round and smooth but the last half whorl is sharply keeled at the middle. *Lienardia* JOUSSEAUME 1884, with the



Text-fig. 19. Anal sinuses of the species of Mangeliinae from the Miyazaki group. Fig. 2, 4, 6 and 7 are based on the growth lines on the body whorls: fig. 1, 3 and 5 are founded on the gerontic apertures. The lines with dots and bars represent the position of the upper boundary of the peripheral angulation. Unit bar indicates 1 mm.

- 1, 2. *Etrema hayasakai* (NOMURA)
- 3, 4. *E. hyugaensis* n. sp.
5. *Filodrillia oyamai* n. sp.
6. *Antiguraleus* sp.
7. *Anacithara bulbosa* n. sp.

type species *Clavatula rubida* HINDS has the protoconch of two volutions, of which the second one has a sharp thread on the shoulder and is quite different from the present species. *Etremopsis* POWELL 1942 with the type species *Drillia imperfecta* SUTER has polygyrate and carinate protoconch and *Etrema* typically has the smooth protoconch of two volutions. Accordingly the present species represents intermediate form between *Etremopsis* and *Etrema*. The present species, however, is apparently closer to *Etrema* than *Etremopsis* in the general characters of the post-nuclear whorls.

Horizon.—Lower to middle part of the Takanabe member (Lowest to Lower Pliocene).

Localities.—Road side cutting at Hagenoshita, Uwaye mura; and road side small cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Etrema hyugaensis n. sp.

Pl. 8, Fig. 5, Pl. 10, Fig. 10, Text-fig. 18, 19

Material and Measurements.—Holotype: GK-L 4973. A single specimen from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is perfect.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls		<A	axials	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)	1st	pen. bd.
4973	8.5	4.9	3.75	57.6	44.2	2	6	38.6	10	14 10

Diagnosis.—The shell is small in size and bucciniform with a high spire and rather the short base. The protoconch is large consisting of two volutions; the first one is oblique, smooth, globose, and separated from the second by a incised suture. The later half of the second whorl is bluntly carinated at the middle. The post-nuclear whorls are six in number, carinated, axially plicated, and spirally lirated. The first whorl is sharply carinated at the middle of the whorl-height and the remainder whorls are bi-angulated. The angulations are close to the middle of the whorl on the early whorls and thereafter they part gradually from each other and a distinct lira is intercalated between them on the penultimate whorl. The shoulder is slightly concave and steeply sloped. The surface between the peripheral angulations is vertical and somewhat concave on the early whorls and slightly convex on the later ones. The surface below the lower angulation is remarkably receding. Two weak spiral threads and an obsolete one are discernible respectively on the shoulder and on the surface below the lower angulation on the penultimate whorl. The body whorl is large, occupying about sixty percent of the height of the shell, weakly angulated at the upper part. The periphery is round and smoothly continuous to the gently contracted base. The snout is distinct but not long. The spiral lirae of the body whorl are four on the periphery, six on the basal slope, and eight on the snout. Of four peripheral lirae the second from the upper angulation is somewhat smaller than the others. The basal lirae are of almost equal strength and regularly spaced. The axial plicae are very oblique, narrower than the interspaces, and ten, eleven, eleven, twelve, fourteen, and ten in number respectively on the first, second, third, fourth fifth, and the last whorl. They are weakened above the upper angulation and hardly reach the upper suture, but clearly reach the lower suture, and become weak on the body whorl to result a undulating surface. The aperture is narrow, deeply sinused at the posterior part, and contracted anteriorly to the canal. The outer lip is variced with rather thick outer margin. The anal sinus is moderately deep and wide before adult stage is reached, and very deep with the subparallel arms at the adult stage. The inner lip is covered by the callus, which is distinct anteriorly. The canal is widely open, vertical, and truncated at the end.

Comparison.—The present species closely resembles *Etrema montrouzieri* (SOUBERBIE) (TRYON, 1884, p. 298, pl. 20, f. 77), but the latter has four distinct spirals on the spire-whorls and this results the narrower shoulder than in the present species.

Etrema d'orbigny (REEVE) (1846, pl. 39, f. 359)=*E. candidula* (REEVE) (1846, pl. 39, f. 358) is also an ally to the present species, but the former has weaker axials than the latter and the penultimate whorl of the former is provided with four spirals in stead of three lirae of the present species. No other species comparable to the present species, both living and fossil, has been reported in Japan and elsewhere.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Filodrillia* HEDLEY, 1922

(type species: *Drillia tricarinata* TENISON-WOODS by original designation)

Filodrillia oyamai n. sp.

Pl. 8, Fig. 1, Pl. 10, Fig. 11, Text-figs. 17, 18

Material and Measurements.—Holotype: GK-L 4974. A single perfect specimen from the unconsolidated grey fine sandstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls		<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(PN)	(degrees)		1st	pen.	bd.
4974	8.5	5.45	4.2	64.1	49.3	1.66	5	46.8	39.3	10	13	11

Diagnosis.—The shell is small in size and ovoid-fusiform with the conical high spire and somewhat long base. The protoconch is paucispiral with one and two-thirds smooth volutions and higher than wide; the first volution is small, depressed, oblique, are round tip, and separated by a shallow suture from the second one which is broadly rounded at the side and subcylindrical. The post-nuclear whorls are five in number and ornamented by two strong spiral carinae and by numerous weak axial plicae. The first whorl is carinated at the middle of the whorl height at first and immediately later other carina appears at the lower one-fourth of the whorl height. The bicarinate outline continues unchanged till the body whorl, but the relative position of the carinae changes slightly upwards resulting that the slope of the concave shoulder becomes more gentle than before. The surface between the carinae is almost vertical and remarkably concave and that below the lower carina is receding and steeply inclined. On the body whorl the primary carinae are four in number, of which the lower two are on the upper part of the basal slope and much weaker than the peripheral upper two ones. Regularly spaced eight spiral lirae are on the main part of the basal slope and the snout, which are gradually tapered and do not exhibit the distinct basal angulation. A secondary spiral appears on the shoulder near the upper carina on the second whorl. On the third whorl other secondary spiral is added on the shoulder between the above mentioned one and the upper suture. On the fourth and the fifth whorl a few tertiary threads appear on the shoulder. The axial plicae are rather weak but distinct at the periphery, abruptly faded out above and below the periphery, and do not reach the upper and lower sutures.

They are ten, thirteen, thirteen, thirteen, and eleven in number respectively on the first, second, third, fourth, and the last whorl; they are obsolete on the first and the second whorls, distinct on the third and the fourth, and again weak on the last whorl. The whole surface except for the tops of the spirals is provided with the close row of the minute granules. The aperture with subparallel lips is narrow and long occupying more than a half of the height of the shell. The outer lip is slightly thickened, deeply sinused posteriorly close to the suture, produced forwards resulting an antecurrent labrum, and gradually narrowed anteriorly. The inner lip is composed of the vertical and straight columellar lip and the oblique and slightly curved parietal one and covered by a thin callus. The parietal tubercle is distinct but not so strong. The canal is short, widely open, and its end is not known in details. The anal sinus is V-shaped, remarkably deep, and restricted on the shoulder.

Comparison.—The present species has characteristic protoconch and post-nuclear whorls and naturally classided to *Filodrillia* HEDLEY, 1922, which is not rare in Australia.

Filodrillia tricarinata intermissa LASERON (1954, p. 23, pl. 5, f. 94-96) from New South Wales is a close ally to the present species. The former is, however, easily distinguished from the latter in the features that the shell of the former species is higher than that of the latter; the protoconch of the former has a half whorl more than the latter; in the former species the bicarinate stage begins on the fourth whorl and three carinae are developed on the body whorl.

F. vitrea LASERON (1954, p. 25, pl. 5, f. 106, 107) from New South Wales closely resembles the new species having the similar protoconch and bicarinate spire whorls, but the shell of the former is higher and more weakly carinated than the latter.

F. delicatus LASERON (1954, p. 23, pl. 5, f. 100) also has bicarinate whorls, but its shell is higher and provided with much weaker spirals than the present new species.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Bellaspira* CONRAD, 1868

(type species: *Mangilia virginiana* CONRAD by motypy)

Subgenus *Lyromangilia* MONTEROSATO, 1817

(type species: *Pleurotoma taeniata* DESHAYES by monotypy)

Bellaspira (*Lyromangilia* ?) cf. *semicarinata* (PILSBRY)

Pl. 7, Fig. 7, 8

- 1904, *Mangilia semicarinata* PILSBRY, *Proc. Acad. Nat. Sci. Philadelphia*, Vol. 56, p. 8, pl. 1, f. 15.
 1920, *Pleurotoma* (*Mangilia*) *deshayesii*, YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 39, Art. 6, p. 41, pl. 1, f. 24.
 1952, *Mangilia deshayesii*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 231.
 1954, *Bellaspira* (*Lyromangilia*) *semicarinata*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 26, pl. 2, f. 24.

Material and Measurements.—GK-L 4988. A single imperfect specimen from the unconsolidated grey fine sandstone at Hagenoshita.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axials			primary
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	1st	2nd	4th	spirals
4988	5.8	3.45	2.65	59.5	45.7	4.5	26	23	11	10	3

Remarks.—The present specimen lacks its apex; therefore the generic identification can not be carried out strictly. The identification here presented is based only on the features of the post-nuclear whorls. The present specimen, comparing with the type specimen of *Bellaspira (Lyromagilia) semicarinata* (PILSBRY), has shorter body whorl with narrower canal, but the other character is quite identical.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Propebella* IREDALE, 1918

(type species: *Murex turricula* MONTAGU by original designation)

Propebella cf. *yokoyamai* OZAKI

Pl. 6, Figs. 12, 13

1958, *Propebella yokoyamai* OZAKI, *Bull. Nat. Sci. Mus. (Tokyo)*, No. 42, p. 164, pl. 15, f. 1, 2.

Material and Measurements.—GK-L 6003. A single specimen from grey siltstone at the hill side 300 m. west of Nishinobyu,

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials		
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N) (PN)	(degrees)	(degrees)	1st	pen.	bd.
6003	6.6	4.0	3.35	60.4	50.6	2 3.5	53.4	37.6	19	14	15

Remarks.—The present specimen is closely allied to *Propebella yokoyamai* OZAKI from the Iioka formation of Choshi City, but slightly differs from it in the protoconch and the profile of the post-nuclear whorls. That is to say, the protoconch of the present specimen is composed of two smooth volutions instead of one smooth whorl of that of *P. yokoyamai*. Furthermore the side of the whorl of the present specimen is more angular than the *P. yokoyamai*. Although the difference between the two is not so striking and the present specimen may probably be included in that species, the concrete identification is suspended until enough material come to my hand.

The present species also resembles *Propebela rugulata* (MOLL)=*P. turricula* (SARS) (TRYON, 1884, p. 211, pl. 33, f. 60), but the former has much smaller shell with relatively large protoconch and less numerous axials.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Hill side 300 m. west of Nishinobyu, Kawaminami mura, Koyu gun, Miyazaki Prefecture.

Subfamily Daphnellinae

Genus *Puha* MARWICK, 1931(type species: *Puha fulgida* MARWICK by original designation)*Puha japonica* n. sp.

Pl. 5, Fig. 10, Text-fig. 2, 18

Material.—Holotype: GK-L 6051. A single specimen from the unconsolidated grey fine sandstone at Nihonmatsu. Preservation is perfect.

Measurements.—

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<A	<P	axials			
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N)	(degrees)	(degrees)	1st	pcn.	bd.	
6051	4.6	2.9	2.05	63.0	44.6	4	4	43.9	26.3	9	9	10

Diagnosis.—The shell is very small and fusiform with an acute and high spire and a long contracted base. The protoconch is rather large, consisting of three smooth volutions and a cancellate one. The first volution is small, rounded, and depressed; the second one is moderately expanded and rounded; the third one is inflated with roundly convexed side; and the fourth is also roundly inflated and ornamented by the characteristic diagonal cancellation. The post-nuclear whorls are sharply bicarinated, axially plicated, and four in number. The carinae of the first post-nuclear whorl is slightly above the middle and at one-sixth of the whorl height. The surface between the carinae is almost vertical and slightly concave; the shoulder is somewhat concave and moderately sloping below the appressed suture; the surface below the lower angulation is concave and remarkably receding. Each carina is provided with a distinct costa on its top and another weak lira is discernible on the shoulder slightly closer to the carina than to the upper suture. On the succeeding whorls these carinae and the spirals are developed without any essential change. The body whorl is large occupying about two-thirds of the shell height, bicarinated at the periphery, and abruptly contracted at the base to the short and straight snout. The fasciole on the snout is moderately developed. There are one distinct costa on each carina, one distinct thread respectively on the shoulder and between the carinae, six distinct threads on the basal slope, and a few obsolete fine threads on the snout. The axial plicae are equally strong on all the whorls extending above and below the carinae, but do not reach the upper suture. They are nine, eight, nine, and ten in number respectively on the first, second, third, and fourth whorl. The surface above the lira of the shoulder forms the anal band, which is covered by the dense growth lines and a fragile carbonate material without lustre. The remainder area is polished and provided with the weak or obsolete growth lines. The aperture is pyriform, narrow, and abruptly narrowed anteriorly forming an anterior sinus. The outer lip is thin with a shallow and arcuate anal sinus close to the suture. The upper arm of the sinus is obliquely emarged to the suture with a moderate angle and the lower arm extends horizontally continuing to the antecurrent lip margin. The canal is short, straight, oblique, and open. The columellar lip is slightly bended and covered by a thin callus. There is no plait or fold on the columella.

Comparison.—On one hand the present species shows close affinity to *Puha* MARWICK, 1931 in the features of polygyrate protoconch with the diagonally cancellate “sinusigera” whorl and the bicarinate post-nuclear whorls. On the other hand it is also allied to *Maoridaphne* POWELL, 1942 with the type species *Daphnella clifdenica* LAWS in the features that the axials extend upwards on the shoulder beyond the upper carina, that the columellar lip is devoid of the plica, and that the carinae on the latter whorls are relatively weak for a *Puha*. In other words the present species is an intermediate from some what closer to *Puha* than to *Maoridaphne*.

Any species comparable to the present species has not been reported yet from New Zealand and elsewhere.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subfamily Thatcheriinae

Genus *Thatcheria* ANGAS, 1877

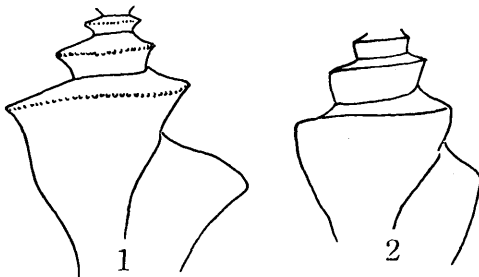
(type species: *Thatcheria mirabilis* Angas by monotypy)

Thatcheria mirabilis ANGAS

Pl. 4, Fig. 1, Text-fig. 20

- 1877, *Thatcheria mirabilis* ANGAS, *Proc. Zool. Soc.* 1877, p. 529, pl. 54, f. 12, 1b.
 1928, *Cochlioconus gradatus* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 2, Pt. 7*, p. 338, pl. 66, f. 3-4.
 1938, *Thatcheria mirabilis*, EALES, *Proc. Malac. Soc. London, Vol. 23*, p. 15, text-f. 1, 2.
 1942, *Thatcheria mirabilis*, POWELL, *Bull. Auckland Inst. Mus. No. 2*, p. 40, f. 20.
 1943, *Surculites (Clinura) gradatus*, BEET, *Leidsche Geol. Meded. Deel 13*, p. 361, pl. 36, f. 3-5.
 1943, *Surculities (Clinura) mirabilis*, BEET, *ibid.* p. 361, pl. 36, f. 1, 2.
 1944, *Conus (Cochlioconus) gradatus*, WENZ, *Handb. Palaeozool. Gastropoda*, p. 1471, text-f. 4154.
 1952, *Thatcheria mirabilis*, KURODA and HABE, *Check List Bibl. Rec. Mar. Moll. Japan*, p. 90.
 1952, *Thatcheria gradata*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 191.
 1959, *Thatcheria mirabilis*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 5*, pl. 64, f. 3, 4.

Material and Measurements.—GK-L 6056. A single specimen from the type locality of “*Cochlioconus gradatus* YOKOYAMA”. The specimen is broken at its apex and the anterior part of the aperture. The matrix is grey silty sandstone. maximum length=50 mm., diameter=32 mm., number of the preserved whorls=5.



Text-fig. 20. Profile of the shell of *Thatcheria mirabilis* ANGAS showing the difference in the detailed feature of the peripheral carina of the whorls between the living and the Miocene forms.

- 1....living form from south Japan.
 2....Miocene form from the Miyazaki group.

Remarks.—The fossil specimens including the present one and YOKOYAMA's slightly differ from the living specimens in the peripheral configuration. That is to say, the peripheral carina is acute in the living specimens and it is blunt in the specimens from the Miyazaki group. Furthermore in the former form the surface below the sharp carina of the body whorl is distinctly excavated and that of the latter is slightly convexed. The fact that these difference, although slight, is rather persistent may indicated the evolutionary meaning. The fossil specimens, however, is not treated here as a particular subspecies because of the slight difference and paucity of the specimens.

Horizon.—Upper part of the Kawabaru member (Upper Miocene).

Locality.—River side cliff 100 m. west of Takajô bridge, Takajô, Kijô mura, Koyu gun, Miyazaki Prefecture.

Family Conidae

Genus *Asprella* SCHAUFUSS, 1869

(type species: *Conus asper sulcatum* BRUGUIÈRE by original designation)

Subgenus *Asprella* SCHAUFUSS, 1869

Asprella (Asprella) comatosa (PILSBRY)

Pl. 8, Fig. 9, 10

1904, *Conus dormitor* PILSBRY, *Proc. Acad. Nat. Sci. Philadelphia Vol. 56*, p. 6, pl. 1, f. 9, 9a.

1904, *Conus comatosa* PILSBRY, *ibid. Vol. 56*, p. 550.

1956, *Asprella comatosa*, KURODA, *Japan. Jour. Malac. Vol. 19, No. 1*, p. 38.

Material and Measurements.—GK-L 6057, 6058, 6059, 6060. All the specimens came from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is almost perfect.

specimen	H (mm.)	D (mm.)	Ap (mm.)	D/H (%)	Ap/H (%)	<P (degrees)
GK-L	29.4	13.1	22.5	45.2	76.5	76
6057	29.4	13.1	22.5	45.2	76.5	76
6058	27.0	10.6	22.2	39.2	82.2	79
6059	24.2	11.1	17.6	45.8	72.9	77
6060	18.1	7.2	13.9	39.8	76.9	73

Remarks.—The present species was originally described as *Conus dormitor* by PILSBRY on the basis of the specimen from Kikai-shima of South Sea Islands of Kyushu. The name *dormitor*, however, had been preoccupied and he proposed a new name for that species, *comatosa*. The specimens in hand quite agree with the living ones.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subgenus *Endemoconus* IREDALE, 1931(type species: *Conus howelli* IREDALE by original designation)*Asprella* (*Endemoconus*) *toyamaensis* (TSUDA)

Pl. 8, Fig. 17

1959, *Conus* (*Asprella*) *toyamaensis* TSUDA, *Jour. Fac. Sci. Niigata Univ. Ser. 2, Vol. 3, No. 2*, p. 95, pl. 5, f. 11a, 11b, 12.

Material and Measurements.—GK-L 6061. A single specimen, broken at its apex, and a few fragmental ones from the calcareous sily sandstone at Azukino. maximum length=22 mm., diameter=11.5 mm., pleural angle=79 degrees

Remarks.—*Conus* (*Asprella*) *toyamaensis* TSUDA was reported from the Middle Miocene Yatsuo group in Toyama Prefecture. It is devoid of the granules on the angulation, which separate the shoulder and the lateral surface. Accordingly it is better to classify it into *Endemoconus* IREDALE, 1931.

Horizon.—Middle part of the Kawabaru member (lower Upper Miocene).

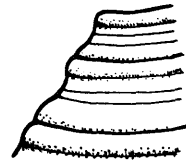
Locality.—Small cliff at the brook side, 300 m. north of Azukino, Sanzai mura, Koyu gun, Miyazaki Prefecture.

Genus *Floraconus* IREDALE, 1931(type species: *Conus anemone* LAMARCK by original designation)*Floraconus* sp.

Pl. 8, Fig. 15, Text-fig. 21

Material and Measurements.—GK-L 6064, 6065. The preservation is not favourable to furnish a basis for the specific identification. Dimensions of the specimen GK-L 6064 are as follow. maximum length=47.5 mm., diameter=27.4 mm., pleural angle=81 degrees.

Description.—The shell is moderately large attaining about fifty mm. in height of the shell and obconical in outline with the low but rather acute spire and the slightly tapering long base. The lateral side of the body whorl is almost straight or slightly convex and smooth on the upper half. The spire is acute and conical or slightly extra-conical. The suture is shallow, bounded by the cord-like bulge above and below, and accordingly the space between these bulge (shoulder) is remarkably concave and ornamented by two to three spiral threads. The aperture is long, narrow, parallel, and simple.



Text-fig. 21. *Floraconus* sp. showing the sculpture on the shoulder.

Remarks.—The present specimens agree with *Floraconus* IREDALE as is described above, but the specific identification can not be executed because of ill preservation.

Horizon.—Lower part of the Tano member (Middle Miocene).

Localities.—River side small cliff north of Kariyabaru, Tano machi, Miyazaki

gun; and Road side cutting at Kaichigo 1600 m. south of Maruno, Miyazaki City, Miyazaki Prefecture.

Family Terebridae

Genus *Myurella* HINDS, 1845

(type species: *Terebra myuros* LAMARCK by subsequent designation, DALL, 1908)

The type species of *Myurella* HINDS, 1845, *Strioterebrum* SACCO, 1891, and *Punctoterebra* BARTSCH, 1923 are apparently distinguishable one another, although they are very closely allied. That is to say, the whorls of *Myurella* and *Strioterebrum* are ornamented by a distinct subsutural band and the cancellation formed by the strong axials and moderate spirals. The distinction between the two lies in the feature of the columella, which is in *Myurella* provided with distinct two folds at the middle and in *Strioterebrum* with obsolete fold-like swell. *Punctoterebra* has a weak spiral groove which separates the subsutural band and the main part of the whorl, while in *Myurella* and *Strioterebrum* it is represented by a deep and distinct groove. The surface of the whorls of *Punctoterebra* is provided with the axial plicae and weak spiral striae, of which the spirals are developed only on the interstices of the axials. Although the type species of three groups are thus readily distinguished, various species included in them comprise rather the gradational series concerning the mentioned characters and form a particular group among the numberless species of "*Terebra*". Therefore it is better to unite three groups into a genus, *Myurella*, and *Strioterebrum* and *Punctoterebra* are treated as subgenera.

Subgenus *Punctoterebra* BARTSCH, 1923

(type species: *Terebra nitidum* HINDS by original designation)

Myurella (Punctoterebra) orthocostulata (NOMURA)

Pl. 10, Fig. 8

1935, *Terebra orthocostulata* NOMURA, *Sci. Rep. Tohoku Imp. Univ. Ser. 2, Vol. 18, No. 2*, p. 101, pl. 6, f. 20, 21.

1937, *Terebra (Punctoterebra) orthocostulata*, OTUKA, *Venus, Vol. 7, No. 3*, p. 139, f. 65.

Material and Measurements.—GK-L 6066. A single specimen from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is favourable.

specimen	H	Bd	D	Bd/H	D/H	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(degrees)	pen. bd.
6066	18.1	7.1	4.6	39.2	25.4	13.1	15 21

Remarks.—On the specimen in hand the axials are slightly weaker and the subsutural band is somewhat narrower than those of the specimens from the Pliocene Byoritzu beds in Formosa, but the character of rather roof-shaped axials quite agrees with the original one. *Terebra (Strioterebrum) tiurensis* SCHEPMEN (1913, p. 374, pl. 25, f. 10) is only distinguished from *M. (P.) orthocostulata* in having weaker and

more numerous axials than the latter. In this respect, the present specimen represent an intermediated form between the two.

The present species also shows close relation to *M. (P.) plumbea* (QUOY and GAIMARD), living in East China Sea to Indonesia, which has slightly more oblique and more curved axials than the former.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Myurella (Punctoterebra) cf. makiyamae (TSUDA)

Pl. 10, Fig. 7

1959, *Strioterebrum (Punctoterebra) makiyamae* TSUDA, *Jour. Fac. Sci. Niigata Univ. Ser. 2, Vol. 3, No. 2*, p. 103, pl. 6, f. 16a, 16b.

Material and Measurements.—GK-L 6070. A single specimen from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is favourable.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axial
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	pen. bd.
9070*	28.6	10.7	6.2	37.4	21.6	9	12.9	12 10

* The apex is broken.

Remarks.—The present specimen almost quite agrees with the type specimen except for the spiral groove below the subsutural band. It is somewhat stronger in the present specimen than in the type and accordingly its subsutural part is too constricted for a *Punctoterebra*. It is the reason why the concrete identification is suspended.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Myurella (Punctoterebra) sp.

Pl. 10, Fig. 17

Material and Measurements.—GK-L 6075. A single specimen from the unconsolidated grey fine sandstone at Nihonmatsu. Preservation is rather favourable.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	pen. bd.
6075	11.2	5.2	3.6	46.4	32.1	7+	20	12 9

Description.—The shell is small in size and turreted with a slender spire and a short base. The protoconch is unknown. The post-nuclear whorls are about eight in number, broader than high, and separated each other by the depressed and slightly oblique suture. The surface sculpture consists of a weak subsutural band, which is separated from the main surface by a shallow spiral furrow, and numerous axials. The axials are slightly oblique, hardly curved, narrower than the interspaces, strong on the early whorls, and weakened later. The body whorl is large occupying more than one-third of the shell height, slightly convex at the side, and abruptly con-

tracted below to the weakly twisted short snout. The lower part of the lateral surface and the basal one are spirally striated. The aperture is rhomboidal, small, sharply bended above, contracted below to the short and oblique canal, which is notched at the end. The outer lip is composed of the exceedingly oblique parietal lip and the vertical columellar one, which is devoid of the fold.

Comparison.—The present species is characterized by its axial plicae of small number. *Terebra* (*Strioterebrum*) *tjimapagensis* OOSTINGH from the Pliocene bed south of Bantam, Java (OOSTINGH, 1938, p. 56, pl. 5, f. 91) is better to be classified in *Punctoterebra* on the basis of lacking the spirals and strong subsutural groove judging from the description and the figure. It resembles the present species, but the former is half as large as the latter and has stronger and less numerous axials than the latter. Although the identical species to the present one has not been reported yet, the establishment of a new species is suspended because of the imperfection and paucity of material.

Horizon.—Middle part of the Takanabe member (Lower Pliocene).

Locality.—Road side small cutting at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Triplostrephanus* DALL, 1908

(type species: *Terebra triseriata* GRAY by original designation)

WOODRING (1928, p. 137) included in *Strioterebrum* the species which have the subsutural band consisting of two series of the small granulous costae and the short and twisted snout. These features, however, are quite different from the diagnosis of the type species of *Strioterebrum*, and nothing but the diagnosis of *Triplostrephanus* DALL, 1908. It is also an apparent fact that the difference is rather gradational between *Triplostrephanus* and certain forms of *Strioterebrum*, which are provided with the granulous subsutural band and the typically cancellated surface with strong spirals and the weak axials on the main surface of the whorl. I, however, prefer to the importance of the type species, and deal *Triplostrephanus* as a valid subgenus of *Myurella*.

Myurella (*Triplostrephanus*) *naumanni* (YOKOYAMA)

Pl. 10, Figs. 5, 6

- 1920, *Terebra naumanni* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 39, Art. 6*, p. 32, pl. 1, f. 12.
 1928, *Terebra naumanni*, YOKOYAMA, *Imp. Geol. Surv. Japan, Rep. No. 101*, p. 25, pl. 1, f. 3.
 1956, *Myurella* (*Strioterebrum*) *naumanni*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 27, pl. 2, f. 12.

Material and Measurements.—GK-L 6068. A single specimen came from the tuffaceous silty fine sandstone at Kizukume. Reservation is favourable.

specimen	H	Bd	D	numb. whorls	<P	axials	
GK-L	(mm.)	(mm.)	(mm.)	(PN)	(degrees)	pen.	bd.
6068*	20	7.1	5.2	9	12	26	20

* The apex is broken.

Horizon.—Upper part of the Takanabe member (Lower Pliocene).

Locality.—South-east cliff of Kizukume Hill, Tonda mura, Koyu gun, Miyazaki Prefecture.

Genus *Noditerebra* COSSMANN, 1896

(type species: *Terebra geniculata* TATE by original designation)

Pervicacia IREDALE, 1924 with the type species *Terebra ustulata* DESHAYES is hardly distinguished from *Noditerebra* COSSMANN, 1896 through examining the type species, and the two should be united under a generic name, *Noditerebra*. *Duplicaria* DALL, 1908 with the type species *Buccinum duplicata* LINNÈ is readily distinguished from *Noditerebra* in the broad subsutural band and the shallow spiral groove below it, in other words, *Duplicaria* exhibits rather smoothly and slightly convexed round side of the whorl comparing with the deeply excavated subsutural part of the whorls of *Noditerebra*. The Miocene species of "*Duplicaria*" from Burma cited by E. VREDBENBURG (1921, pp. 339-361, pl. 10, f. 1-5) are not *Duplicaria* but *Noditerebra* on the basis of the above mentioned feature.

Noditerebra recticostata (YOKOYAMA)

Pl. 10, Fig. 13

- 1920, *Terebra recticostata* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo, Sec. 2, Vol. 39, Art. 6*, p. 32, pl. 1, f. 11.
 1952, *Terebra recticostata*, HATAI and NISIYAMA, *Rep. Sci. Tohoku Univ. Ser. 2, Spec. Vol. No. 3*, p. 254.
 1954, *Myurella (Pervicacia) recticostata*, TAKI and OYAMA, *Palaeont. Soc. Japan, Spec. Pap. No. 2*, p. 27, pl. 2, f. 11.

Material and Measurement.—GK-L 6069. A single perfect specimen from the unconsolidated grey fine sandstone,

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(N) (PN)	(degrees)	pen. bd.
6069	16.1	6.8	4.7	42.2	29.2	2+ 6	23	15 15

Remarks.—The present specimen is quite identical to the original specimen with coarsely plicated and deeply furrowed whorls.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki, Prefecture.

Noditerebra sp.

Pl. 8, Fig. 3, 4

Material and Measurements.—GK-L 6069, 6071 Specimens came from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is favourable.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axials
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	pen. bd.
6069	22.3	8.9	5.4	39.9	24.2	9	15	14 15

Description.—The shell is of small size and turreted with the high spire and rather the short base. The protoconch is unknown. The post-nuclear whorls are about nine in number, angularly produced at the upper part of the side below the spiral furrow which separates the main surface from the granular subsutural band. The spiral furrow below the subsutural band gives a markedly excavated profile to the whorl. The axials are about fourteen and fifteen in number respectively on the penultimate and the body whorl and strongest on the angulation and gradually weakened below. They are rather prominent on the spire whorls and become weak on the body whorl. The interspaces are wider than the plicae. The body whorl is large occupying about two-fifths of the shell height, roundly convexed at the side, exceedingly constricted below the subsutural band, and abruptly contracted below to the short snout. The siphonal fasciole is distinct and separated from the basal surface by a slight ridge. The aperture is small, rhomboidal, and contracted below to the short, oblique, and widely open canal, which is notched at the end. The columellar lip is vertical at the upper and middle part and twisted at the lower part and devoid of the fold.

Comparison.—The present species is somewhat slender for a *Noditerebra* which shows typically the high conical profile.

Noditerebra longiscata (DESHAYES) (1859, p. 294) from Philippines is closely allied to the present species, but the former has the raised spiral lines on the interspaces of the axial plicae. The surface of the latter is practically smooth.

N. picta (HINDS) (1843, p. 156) also resembles the present species, but the former has somewhat more numerous axials than the latter.

N. evoluta (DESHAYES) (1859, p. 292) is another ally to the present species, and especially the adolescent specimen of the former is very closely allied to the latter, but the former is distinguished from the latter in having more numerous and more curved axials.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Kaweka* MARWICK, 1931

(type species: *Kaweka fulva* MARWICK by original designation)

Kaweka kyushuensis n. sp.

Pl. 10, Figs. 9, 15

Material and Measurements.—Holotype GK-L 6072, paratypes: GK-L 6073, 6074. All the specimens came from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is imperfect.

specimen	H	Bd	D	Bd/H	D/H	numb. whorls	<P	axials	
GK-L	(mm.)	(mm.)	(mm.)	(%)	(%)	(PN)	(degrees)	pen.	bd.
6072*	15.9	8.2	5.0	51.5	31.4	6	19	15	16

* The apex is broken.

Diagnosis.—The shell is small in size and oblong conical with a high conical spire and rather short base. The protoconch is unknown. The post-nuclear whorls are nine to ten in number, broader than high, and distinctly angulated slightly above the middle of each whorl. The suture is appressed with a granulous subsutural band, which is clasping upward on the preceding whorl and separated below from the main surface by a furrow. The ornamentation on the main surface consists of the sharp axial plicae, a distinct spiral line at the angulation, and the obsolete spiral striae. The axials are roof-shaped, sharp, and narrower than the interspaces. The axials are strongest at the angulation forming spinose projections, abruptly faded out above to the spiral furrow, and gradually weakened below to the lower suture. The body whorl is large with a small aperture and abruptly contracted below to the straight snout. The peripheral angulation and the spinose projections are weak on the body whorl. The siphonal fasciole is sharply bordered by a slight but distinct rim. The aperture is rhomboidal with the sharply angled upper end and the simple outer lip. The columellar lip is smooth without any fold or plait. The canal is very short, distinctly oblique, and truncated at the end.

Comparison.—Strictly speaking the present species represent the transitional form between *Kaweke* and *Strioterebrum*. The medially angulated whorls and the smooth columella, however, indicate that the present species has much closer relation to *Kaweke* than to *Strioterebrum*. *Kaweke fulta* MARWICK from the Miocene bed of New Zealand has more conical and broader shell than the present species. No other forms comparable to the present species has not been reported.

Horizon.—Lower part of the Takanabe member (Lowest Pliocene).

Locality.—Road side cutting at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

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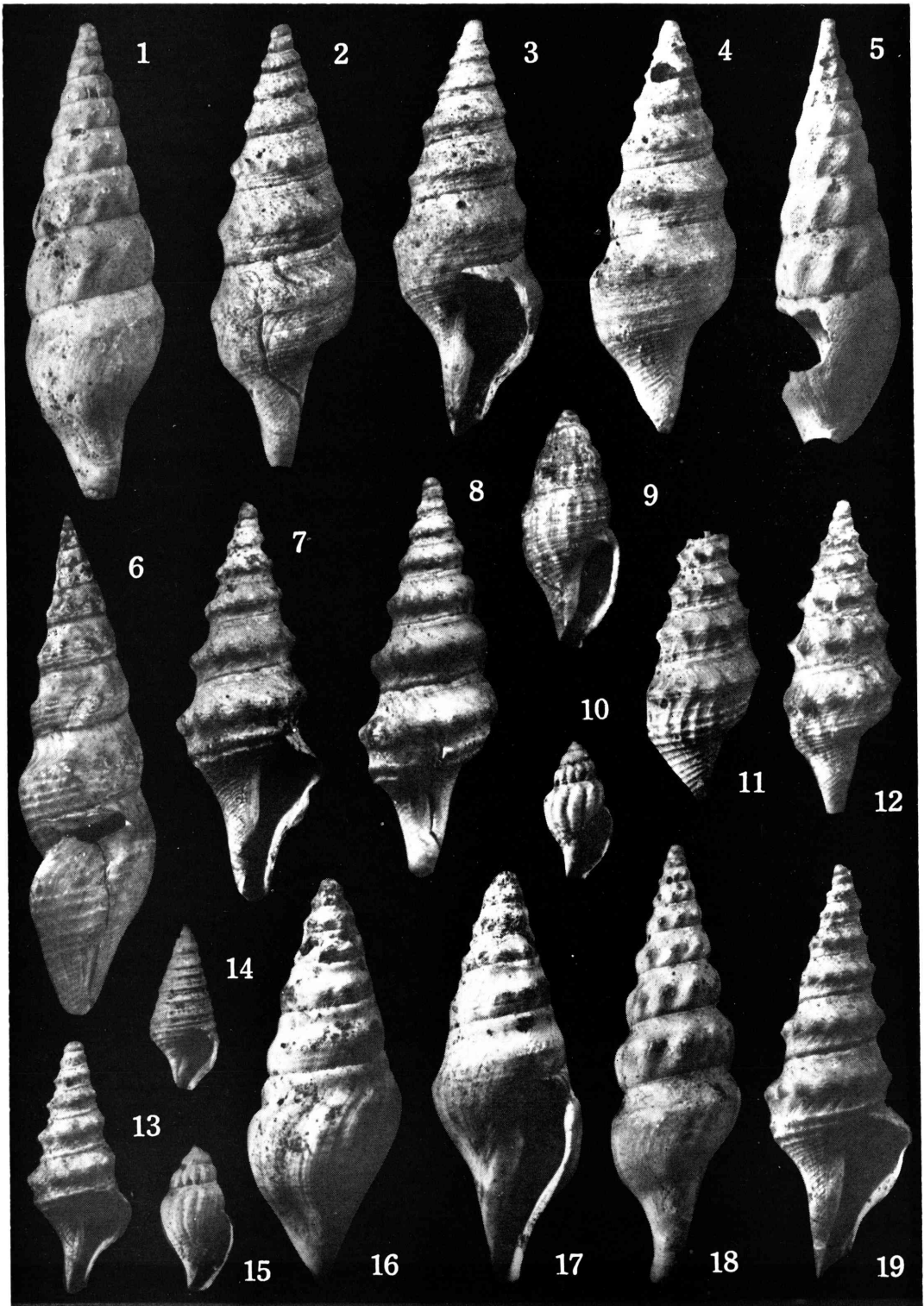
Conacean Gastropods from the Miyazaki Group
(Palaeontological Study of the Miyazaki Group—IX)

Plates 3—10.

Plate 3

Explanation of Plate 3

- Fig. 1, 5. *Cymatosyrinx (Splendrillia) rinsuikawaensis* (NOMURA).....p. 119
 1. (×4.5), GK-L 6004; loc. small cliff immediate north of Nishinobyu, Uwaye mura, Koyu gun.
 5. (×4), GK-L 4947; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 2, 3, 4. *Gemmula (Kuroshioturris) hyugaensis* n. subgen. and n. sp.....p. 83
 2. (×5), holotype: GK-L 4939; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 3, 4. (×5), paratype: GK-L 4938; loc. same as that of the holotype.
- Fig. 6. *Borsonia miyazakiensis* n. sp.p. 127
 6. (×2), holotype: GK-L 6036; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 7, 8, 13, 19. *Ptychosyrinx nipponicus* n. sp.p. 81
 7, 8. (×4), holotype: GK-L 4921; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 13. (×4), paratype: GK-L 4922; loc. same as that of the holotype.
 19. (×4), paratype: GK-L 4920; loc. same as the preceding one.
- Fig. 9. *Antiguraleus* sp.....p. 130
 9. (×6), GK-L 4985; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 10, 15. *Anacithara bulbosa* n. sp.p. 131
 10. (×6), paratype: GK-L 4987; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
 15. (×6), holotype: GK-L 4986; loc. same as the preceding one.
- Fig. 11, 12. *Clavatula (Paradrillia) astuta* (YOKOYAMA).....p. 106
 11. (×5), topotype: GK-L 4952, loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 12. (×5), topotype: GK-L 4950, loc. same as the preceding one.
- Fig. 14. *Tomopleura yokoyamai* (MAKIYAMA)p. 126
 12. (×6), GK-L 4931; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 16, 17. *Borsonia smithi hagenoshita* n. subsp.p. 129
 16, 17. (×3.7), holotype: GK-L 4943; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 18. *Cymatosyrinx (Splendrillia) osawanoensis pulchella* n. subsp.....p. 120
 18. (×4), holotype: GK-L 4993; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.

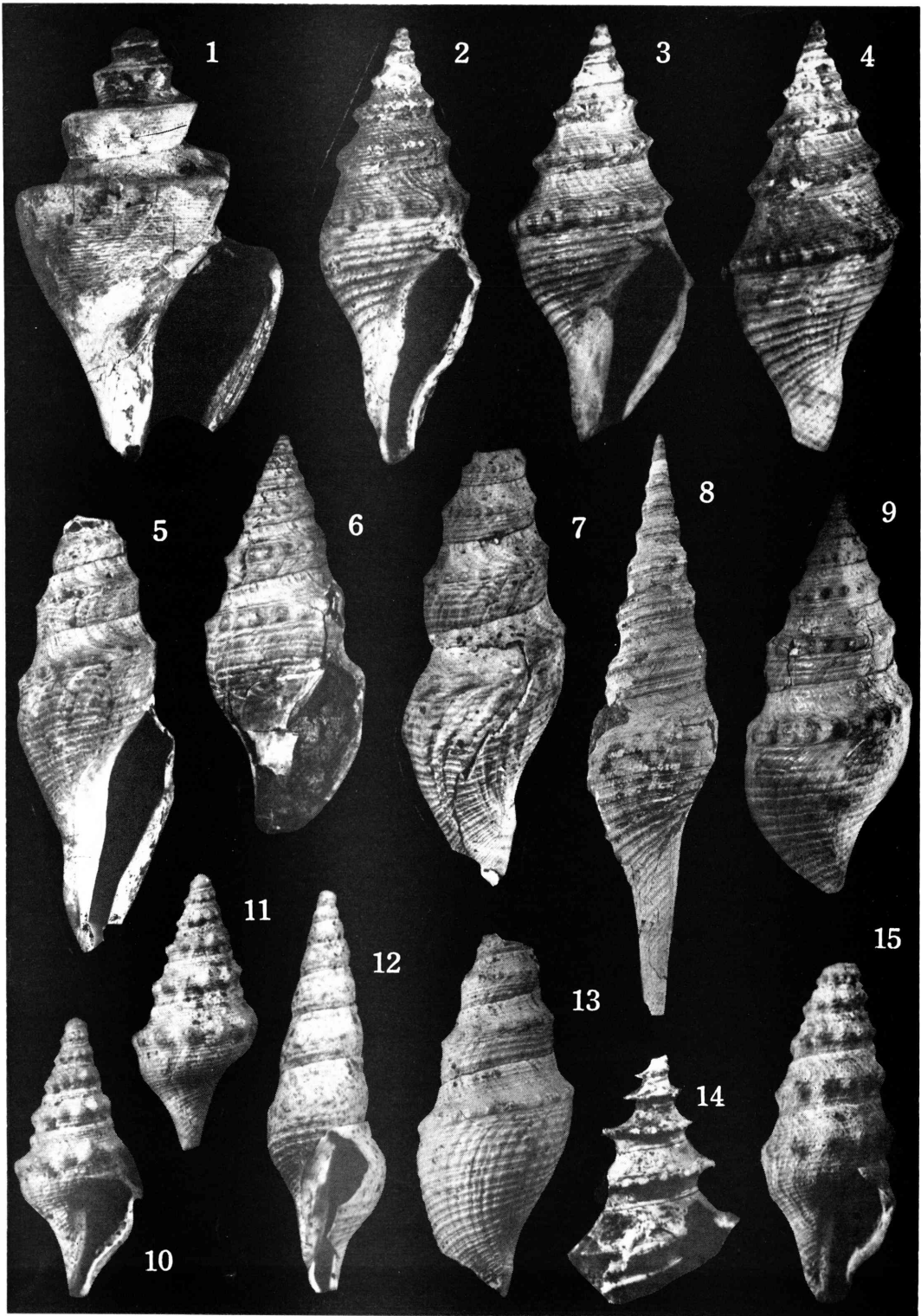


T. SIUTO: Conacean Gastropods from the Miyazaki Group

Plate 4

Explanation of Plate 4

- Fig. 1. *Thatcheria mirabilis* ANGASp. 139
 1. ($\times 1.5$), GK-L 6056; loc. river side small cliff, west of Takajō bridge, Kijō mura, Koyu gun.
- Fig. 2, 3, 4. *Bathytoma (Parabathytoma) striatotuberculata* (YOKOYAMA)p. 87
 2. ($\times 4$), topotype: GK-L 4981; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 3, 4. ($\times 4$), topotype: GK-L 4980; loc. same as the preceding one.
- Fig. 6, 9. *Micantapex matsumotoi* n. sp.p. 89
 6, 9. ($\times 1.2$), holotype: GK-L 6047; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 5, 7, 13. *Bathytoma (Bathytoma) luedorfi* (LISCHKE)p. 86
 5, 7. ($\times 2$), GK-L 6044; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 13. ($\times 2.5$), GK-L 6045; loc. road side small cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 8. *Orthosurcula soyomaruuae takanabensis* OTUKAp. 91
 8. ($\times 1.4$), holotype: GK-L 6040; loc. cliff at the entrance of a gorge 1200 m. south of Tōriyama-Hama, Kawaminami machi, Koyu gun.
- Fig. 10, 11. *Mauidrillia granulosa* n. sp.p. 124
 10, 11. ($\times 6$), holotype: GK-L 4961; loc. cutting approach to the tunnel, north of Yamaji, Mino mura, Koyu gun.
- Fig. 12. *Optoturris kyushuensis* n. sp.p. 75
 12. ($\times 3.7$), holotype: GK-L 4933; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 14. *Ancistroyrinx osawanoensis* TSUDAp. 100
 14. ($\times 4$), GK-L 6005; loc. brook side, 350 m. south of Kakoi, Sanzai mura, Koyu gun.
- Fig. 15. *Clavatula (Paradrillia) minoensis* n. sp.p. 108
 15. ($\times 6$), paratype: GK-L 4960; loc. road side small cutting 300 m. north of Yamaji, Mino mura, Koyu gun.

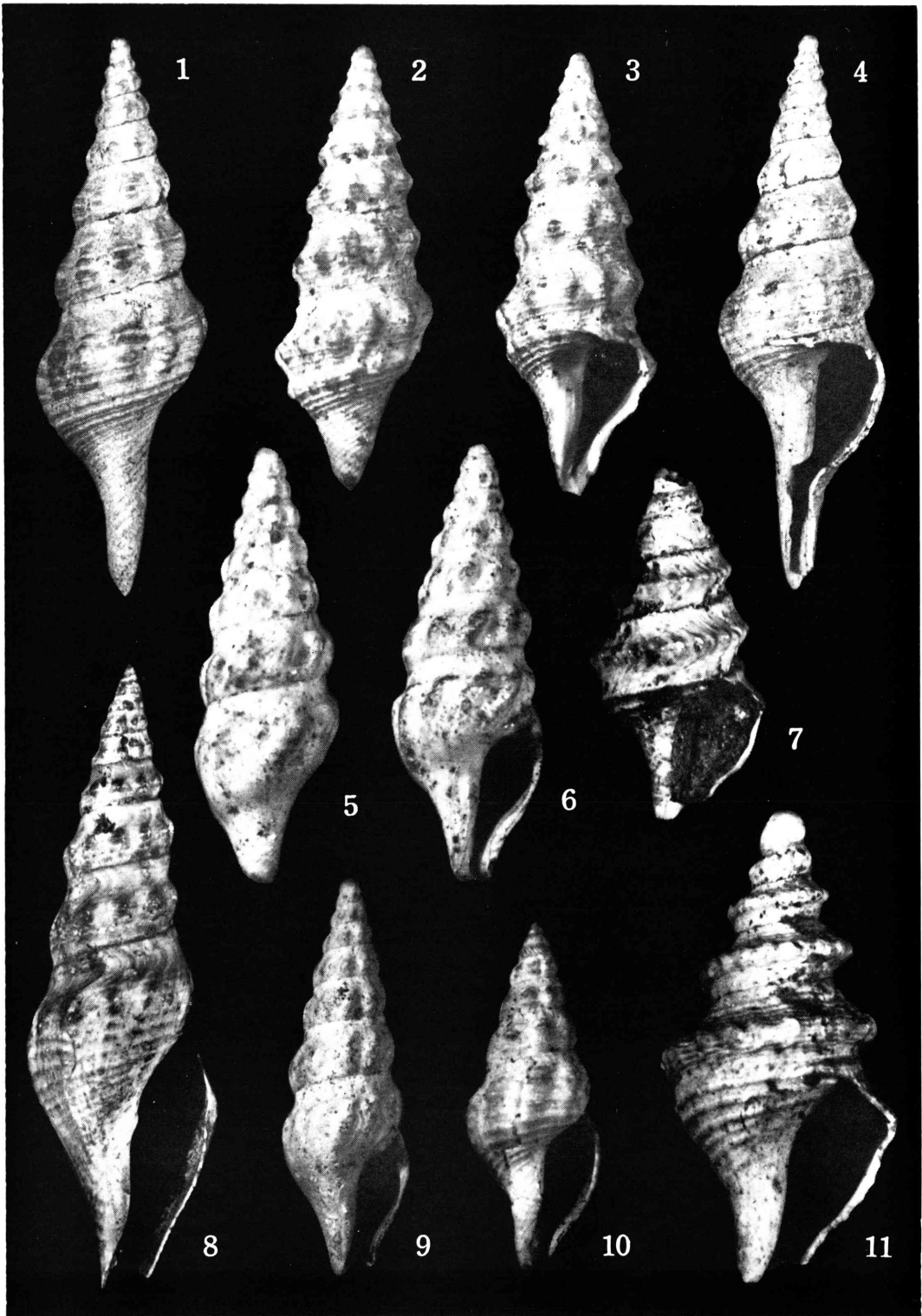


T. SHUTO: Conacean Gastropods from the Miyazaki Group

Plate 5

Explanation of Plate 5

- Fig. 1, 4. *Comites (Fusiturricula) miyazakiensis* n. sp.p. 96
1, 4. ($\times 3.8$), holotype: GK-L 6055; loc. road side small cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 2, 3. *Clavatula (Paradrillia) astutoidea* n. sp.p. 107
2, 3. ($\times 6$), holotype: GK-L 4962; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 5, 6. *Cymatosyrinx (Splendrillia) cristata* POWELL.....p. 123
5, 6. ($\times 7$), GK-L 5000; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 7. *Gemmula (Gemmula) granosa* (HELBLING).....p. 79
7. ($\times 10$), GK-L 6085; immature specimen showing the sculpture of the early stage of the growth; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 8. *Borsonia miyazakiensis* n. sp.p. 127
8. ($\times 2.5$), holotype: GK-L 6036; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 9. *Cymatosyrinx (Splendrillia) praegracilis* (MAKIYAMA)p. 122
9. ($\times 6$), GK-L 4999; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 10. *Puha japonica* n. sp.p. 138
10. ($\times 12$), holotype: GK-L 6051; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 11. *Bathytoma (Parabathytoma) striatotuberculata* (YOKOYAMA)p. 87
11. ($\times 9$), topotype: GK-L 4976; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.

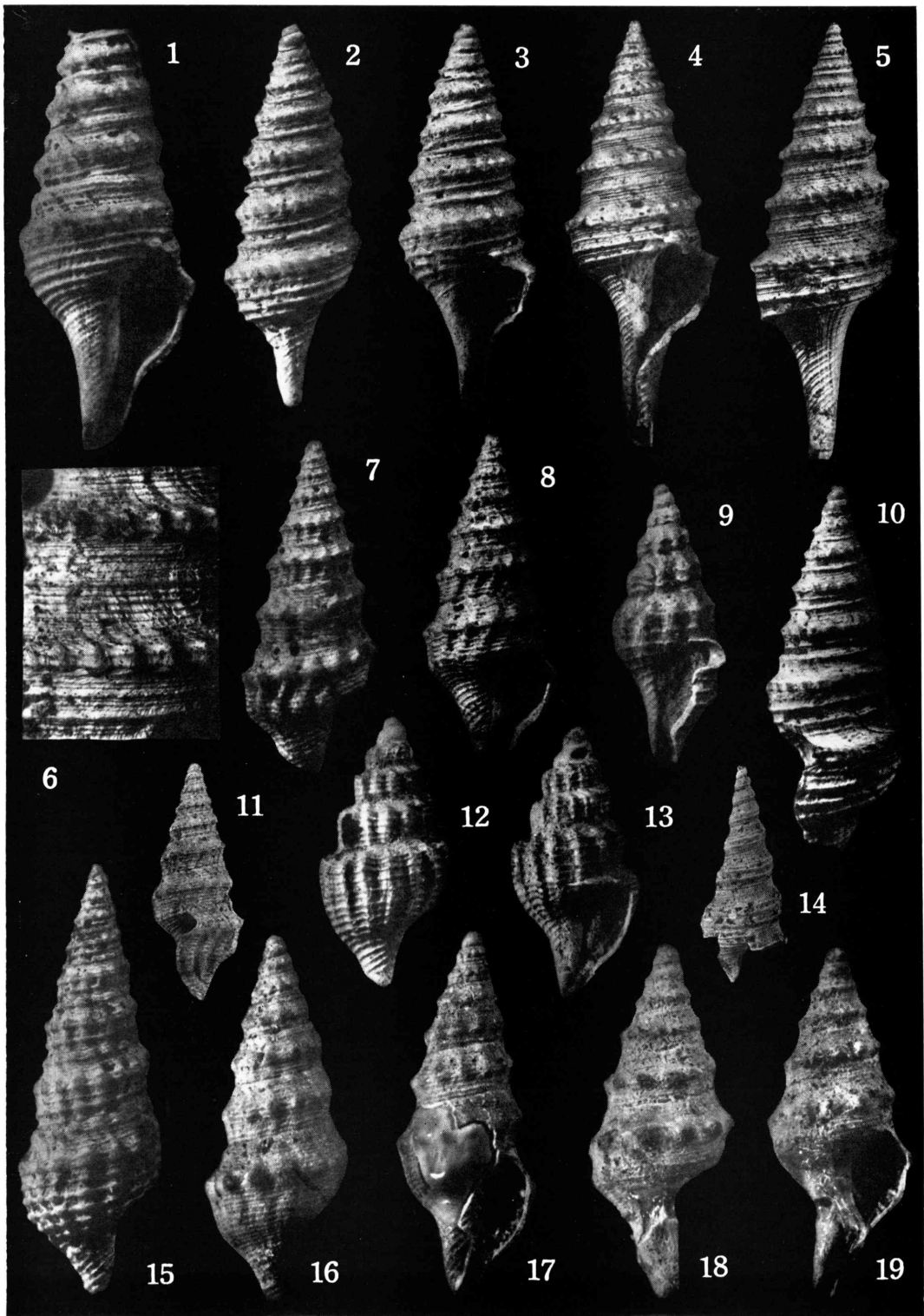


T. SHUTO: Conacean Gastropods from the Miyazaki Group

Plate 6

Explanation of Plate 6

- Fig. 1, 2, 3, 10. *Gemmula (Kuroshioturris) totomiensis* (MAKIYAMA)p. 84
 1. (×4), GK-L 4940; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 2, 3. (×4), GK-L 4942; loc. same as the preceding one.
 10. (×4), GK-L 4941; loc. same as the preceding one.
- Fig. 4, 5, 6. *Gemmula (Gemmula) granosa* (HELBLING)p. 79
 4, 5. (×2), GK-L 4946; loc. southeast cliff of Kizukume Hill, Tonda machi, Koyu gun.
 6. (×4), same specimen showing the adult sculpture.
- Fig. 7, 8, 11. *Clavatula (Paradrillia) daiichiensis* (YOKOYAMA)p. 105
 7, 8. (×4), GK-L 4917; loc. road side cutting at Hagenoshita, Uwaye machi, Koyu gun.
 11. (×2), same specimen as the preceding one.
- Fig. 9. *Etrema hayasakai* (NOMURA)p. 132
 9. (×6), GK-L 4937; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 12, 13. *Propebella* cf. *yakoyamai* OZAKIp. 137
 12, 13. (×6), GK-L 6003, foot of hill 600 m. west of Nishinobyu, Kawaminami machi, Koyu gun.
- Fig. 14. *Orthosurcula perrirgo* (YOKOYAMA).....p. 92
 14. (×1.5), topotype: GK-L 6046; loc. road side cutting ae Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 15. *Clavatula (Paradrillia) elachystoma convexiuscula* n. subsp.p. 109
 15. (×4), holotype: GK-L 4915; loc. raod side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 16, 17. *Clavatula (Paradrillia) minoensis* n. sp.p. 108
 16, 17. (×6), paratype: GK-L 4959; loc. cutting appraoch to the tunnel, north of Yamaji, Mino mura, Koyu gun.
- Fig. 18, 19. *Gemmula (Kuroshioturris) ?* n. sp.p. 84
 18, 19. (×6), GK-L 4949; loc. cutting approach to the tunnel north of Yamaji, Mino mura, Koyu gun.

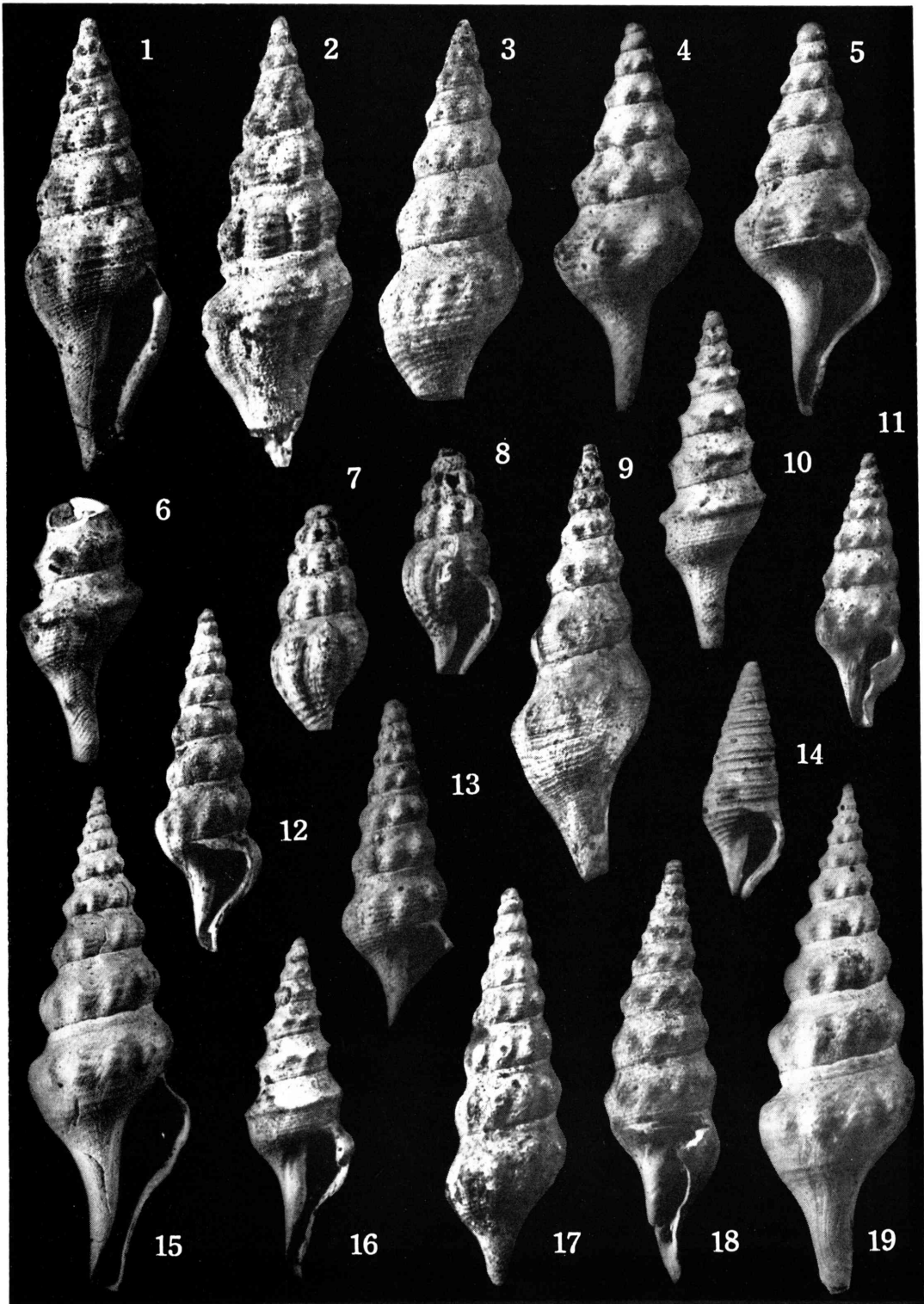


T. SHUTO: Conacean Gastropods from the Miyazaki Group

Plate 7

Explanation of Plate 7

- Fig. 1, 2. *Pseudoinquisitor hyuganus yamajiensis* n. subsp.p. 114
1, 2. (×6), holotype: GK-L 4932; loc. road side cutting 300 m. north of Yamaji, Mino mura, Koyu gun.
- Fig. 3. *Inquisitor jeffreysi* (SMITH)p. 116
3. (×2), GK-L 6038; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 4, 5. *Comitas (Comitas)* sp.p. 94
4, 5. (×6), GK-L 4957; loc. road side cutting at Hagenospita, Uwaye mura, Koyu gun.
- Fig. 6, 10, 16. *Cosmasyrinx makiyamai* n. sp.p. 98
6. (×5), paratype: GK-L 4934; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
10, 16. (×5), holotype: GK-L 4935; loc. same as the preceding one.
- Fig. 7, 8. *Bellaspira (Lyromangilia)* cf. *semicarinata* (PILSBRY)p. 136
7, 8. (×6), GK-L 4988; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 9. *Turricula (Surcula) sobrina* (YOKOYAMA)p. 93
9. (×2.5), GK-L 6039; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 11. *Cymatosyrinx (Splendrillia) tincta hagenoshitaensis* n. subsp.p. 121
11. (×4), holotype: GK-L 4992; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 12, 17. *Pseudoinquisitor pseudoprincipalis* (YOKOYAMA)p. 113
12. (×4), GK-L 5995; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
17. (×4), GK-L 4989; loc. same as the preceding one.
- Fig. 13. *Pseudoinquisitor totomiensis* (MAKIYAMA)p. 114
13. (×5), GK-L 4956; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 14. *Tomopleura difficilis* (SMITH)p. 125
14. (×6), GK-L 4919; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 15, 19. *Comitas (Fusiturricula) habei* n. sp.p. 95
15, 19. (×2.5), holotype: GK-L 4990; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 18. *Pseudoinquisitor totomiensis ugariensis* (MAKIYAMA)p. 114
18. (×4), GK-L 4994; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.

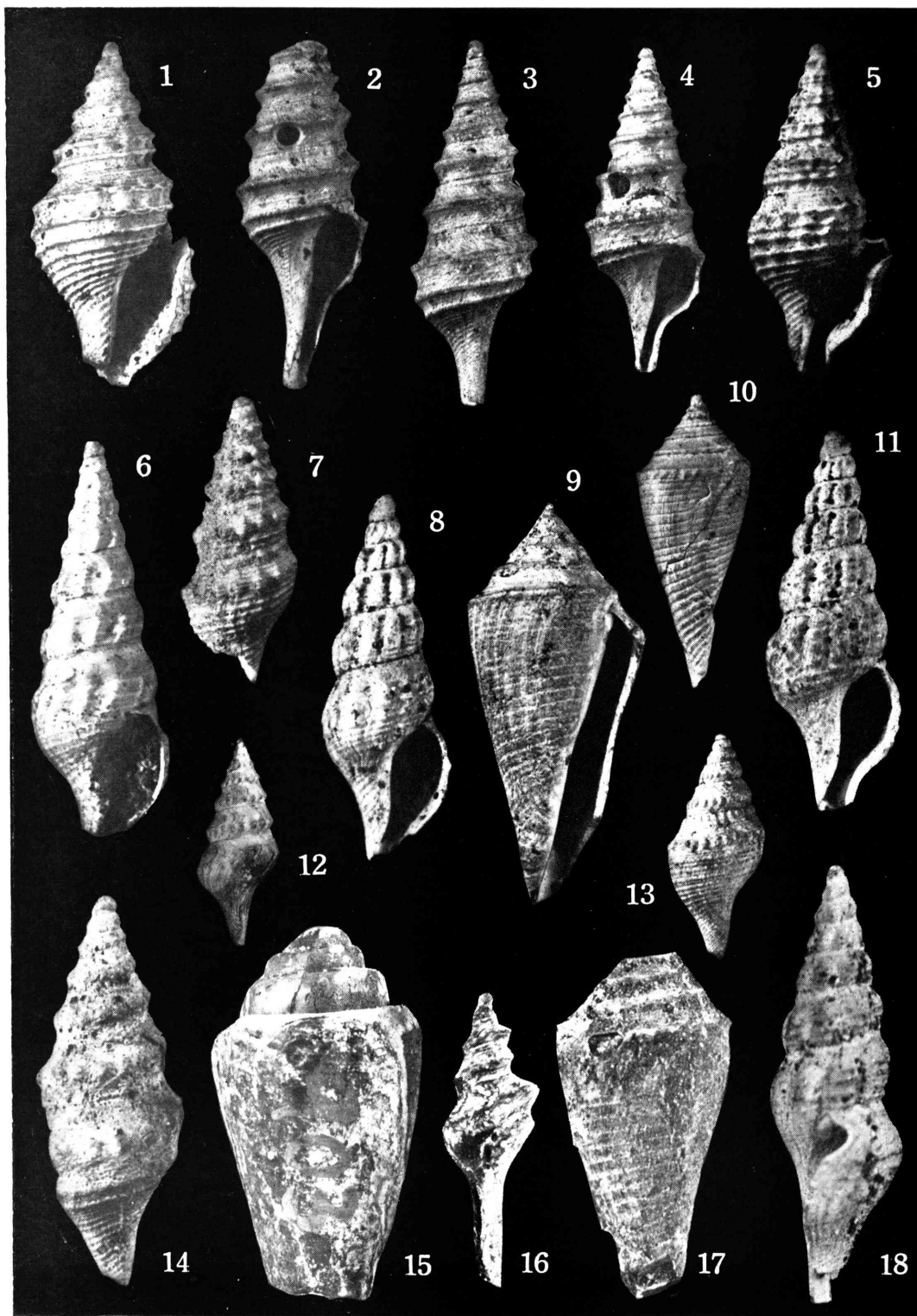


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Plate 8

Explanation of Plate 8

- Fig. 1. *Filodrillia oyamai* n. sp.p. 135
 1. (×6), holotype: GK-L 4974; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 2, 3, 4. *Polystira kurodai* (MAKIYAMA).....p. 77
 2. (×4.5), GK-L 4966; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 3. (×4), GK-L 4965; loc. same as the preceding one.
 4. (×4), GK-L 4971; loc. same as the preceding one.
- Fig. 5. *Etrema hyugaensis* n. sp.p. 134
 5. (×6), holotype: GK-L 4973; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 6. *Cymatosyrinx (Splendrillia) ?* sp.....p. 123
 6. (×5), GK-L 6063; loc. road side cutting 300 m. north of Yamaji, Mino mura, Koyu gun.
- Fig. 7. *Clavatula (Paradrillia) jococartae serrana* (FISCHER)p. 111
 7. (×6), GK-L 4953; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 8, 11. *Aoteadrillia longiplicata* n. sp.p. 117
 8. (×6), paratype: GK-L 6002; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 11. (×6), holotype; GK-L 6001; loc. same as the preceding one.
- Fig. 9, 10. *Asprella (Asprella) comatosa* (PILSBRY)p. 140
 9. (×2), GK-L 6057; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
 10. (×2.5), GK-L 6059; loc. same as the preceding one.
- Fig. 12. *Leucosyrinx coreanica* (A. ADAMS and REEVE)p. 104
 12. (×1), GK-L 6027; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 13. *Bathytoma (Parabathytoma) striatotuberculata* (YOKOYAMA).....p. 87
 13. (×2), GK-L 4984; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 14. *Ptychosyrinx nipponicus* n. sp.....p. 81
 14. (×6), GK-L 4930; loc. road side cutting 300 m. north of Yamaji, Mino mura, Koyu gun.
- Fig. 15. *Floraconus* sp.p. 141
 15. (×1.2), GK-L 6064; loc. river side cliff, north of Kariyabaru, Tano machi, Miyazaki gun.
- Fig. 16. *Parasyrinx* sp. (n. sp. ?)p. 101
 16. (×2), plaster cast for GK-L 6049; loc. road side cutting at the southwestern extremity of Kanō, Takaoka machi, Higashi-morogata gun.
- Fig. 17. *Asprella (Endemoconus) toyamaensis* (TSUDA)p. 141
 17. (×2.5), GK-L 6061; loc. brook side small cliff 350 m. south of Kakoi, Sanzai mura, Koyu gun.
- Fig. 18. *Pseudoinquisitor hyuganus yamajiensis* n. subsp.....p. 114
 18. (×6), holotype: GK-L 4932; loc. road side cutting 300 m. north of Yamaji, Mino mura, Koyu gun.

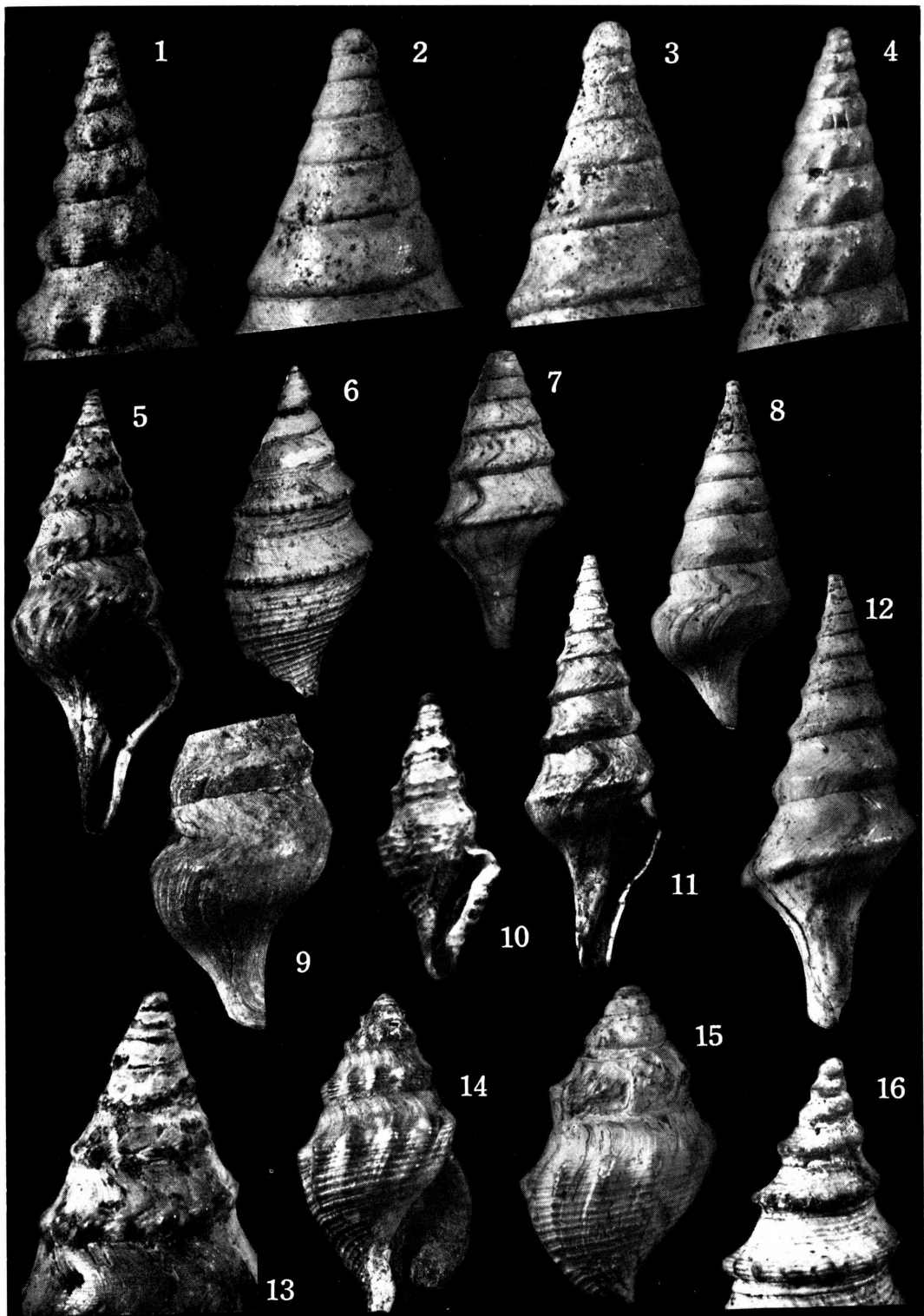


T. SIUTO: Conacean Gastropods from the Miyazaki Group

Plate 9

Explanation of Plate 9

- Fig. 1. *Comitas (Fusiturricula) habei* n. sp.p. 95
1. (×6), holotype: GK-L 4990; showing the apical part; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
- Fig. 2, 3, 8, 9, 11, 12. *Spirotropis subdeclivis* (YOKOYAMA).....p. 102
2. (×6), GK-L 6024; showing the apical part; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
3. (×6), GK-L 6026; showing the apical part; loc. same as the preceding one.
8. (×3), GK-L 6013; round-sided form; loc. same as the preceding one.
9. (×1.6), GK-L 6053; gerontic specimen with exceedingly round periphery of the whorl; loc. same as the preceding one.
11. (×2), GK-L 6035; carinated form; loc. southeast cliff of Kizukume Hill, Tonda machi, Koyu gun.
12. (×2.5), GK-L 6043; carinated and lobulated form; loc. same as the preceding one.
- Fig. 4. *Cymatosyrinx (Splendrillia) rinsuikawaensis* (NOMURA)p. 119
4. (×6), GK-L 4947, showing the apical part; loc. road side cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 5, 13. *Leucosyrinx coreanica* (A. ADAMS and REEVE)p. 104
5. (×2.5), GK-L 6027; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.
13. (×6), same specimen as the preceding, showing the apical part.
- Fig. 6. *Bathytoma (Parabathytoma) microgemma* n. sp.p. 88
6. (×2.5), holotype: GK-L 6054; loc. road side cutting at southwestern extremity of Kano, Takaoka machi, Higashi-Morogata gun.
- Fig. 7. *Spirotropis subdeclivis acuticarinata* n. subsp.p. 103
7. (×2.5), holotype: GK-L 6008; loc. brook side small cliff, 350 m. south of Kakoi, Sanzai mura, Koyu gun.
- Fig. 10. *Etrema hayasakai* (NOMURA)p. 132
10. (×6), GK-L 4937; loc. road side small cutting at Nihonmatsu, Takanabe machi, Koyu gun.
- Fig. 14, 15. *Surculites siogamensis* NOMURAp. 111
14. (×2.5). GK-L 6006; loc. road side cutting north of Kushiki bridge, Kamihokita, Saito City.
15. (×3), GK-L 6007; loc. same as the preceding one.
- Fig. 16. *Bathytoma (Parabathytoma) striatotuberculata* (YOKOYAMA).....p. 87
16. (×6), GK-L 4978; showing the apical part; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu gun.

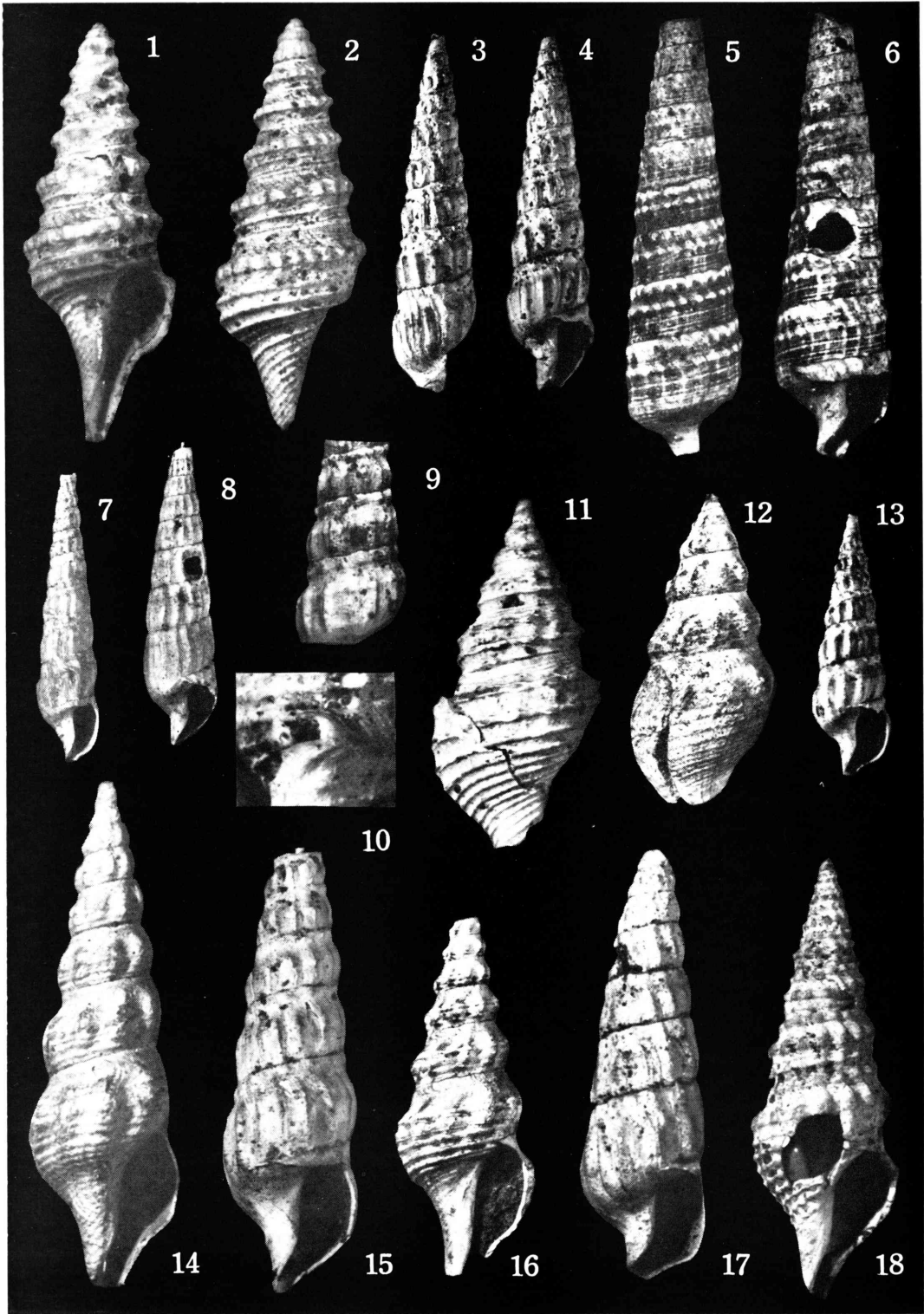


T. SHUTO: Conacean Gastropods from the Miyazaki Group

Plate 10

Explanation of Plate 10

- Fig. 1, 2. *Gemmula (Gemmula) granosa pulchella* n. subsp.p. 80
 1, 2. (×6), holotype: GK-L 4945; loc. road side cutting at Nihonmatsu, Takanabe
 machi, Koyu gun.
- Fig. 3, 4. *Noditerebra* sp.p. 145
 3, 4. (×2.5), GK-L 6069; loc. road side cutting at Hagenoshita, Uwaye mura,
 Koyu gun.
- Fig. 5, 6. *Myurella (Triplostephanus) naumanni* (YOKOYAMA)p. 144
 5, 6. (×3.5), GK-L 6069; loc. southeast cliff of Kizukume Hill, Tonda mura,
 Koyu gun.
- Fig. 7. *Myurella (Punctoterebra)* cf. *makiyamae* TSUDAp. 143
 7. (×1), GK-L 6070; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu
 gun.
- Fig. 8. *Myurella (Punctoterebra) orthocostulata* (NOMURA)p. 142
 8. (×2.5), GK-L 6066; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu
 gun.
- Fig. 9, 15. *Kaweka kyushuensis* n. sp.p. 146
 9. (×3.5), paratype: GK-L 6073; loc. road side cutting at Hagenoshita, Uwaye
 mura, Koyu gun.
 15. (×4.5), holotype: GK-L 6072; loc. same as the preceding one.
- Fig. 10. *Etrema hyugaensis* n. sp.p. 134
 10. (×10), anal sinus of the aperture of the holotype specimen.
- Fig. 11. *Filodrillia oyamai* n. sp.p. 135
 11. (×6), holotype: GK-L 4974; loc. road side cutting at Hagenoshita, Uwaye
 mura, Koyu gun.
- Fig. 12. *Clavinae* gen. and sp. indet. (*Austrodrillia* ? sp.)p. 127
 12. (×2), GK-L 6081; loc. river side cliff north of Takajō bridge, Kijō mura, Koyu
 gun.
- Fig. 13. *Noditerebra recticostata* (YOKOYAMA)p. 145
 13. (×2.5), GK-L 6069; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu
 gun.
- Fig. 14. *Pseudoinquisitor totomiensis* (MAKIYAMA)p. 114
 14. (×6.5), GK-L 4955; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu
 gun.
- Fig. 16. *Comitas (Fusiturricula) miyazakiensis* n. sp.p. 96
 16. (×2.5), paratype: GK-L 6080; loc. southeast cliff of Kizukume Hill, Tonda
 mura, Koyu gun.
- Fig. 17. *Myurella (Punctoterebra)* sp.p. 143
 17. (×6), GK-L 6075; loc. road side cutting at Hagenoshita, Uwaye mura, Koyu
 gun.
- Fig. 18. *Clavatula (Paradrillia) elachystoma convexiuscula* n. subsp.p. 109
 18. (×4), holotype: GK-L 4915; loc. road side cutting at Hagenoshita, Uwaye mura,
 Koyu gun.



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