Buccinacean and Volutacean Gastropods from the Miyazaki Group : Palaeontological Study of the Miyazaki Group X

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https://doi.org/10.5109/1526205

出版情報：九州大學理學部紀要 : Series D, Geology. 12 (1), pp.27-85, 1962-03-25. Faculty of Science, Kyushu University
バージョン：
権利関係：

Mem. Fac. Sci. Kyushu Univ., Ser. D, Geology, Vol. XII, No. 1,
pp. 27-85, text-figs. 1-15, pls. 6-13, March 25, 1962

Buccinacean and Volutacean Gastropods from the Miyazaki Group
(Palaeontological Study of the Miyazaki Group—X)

By

Tsugio SHUTO

Introduction

The present report is the tenth part of the serial contributions to the molluscan palaeontology of the Miyazaki group entitled "Palaeontological Study of the Miyazaki Group". Among the molluscan fossils of that group collected by T. MATSUMOTO et al. in 1938 and by myself since 1948 I distinguished fifty-nine species and subspecies of Buccinacean and Volutacean group. The present paper deals with the descriptions and neccessary revisions of twenty-three genera and twenty-six subgenera and forty-eight species and subspecies belonging to Columbellidae, Buccinidae, Nassariidae, Fasciolariidae, Galeodidae, Mitridae, Volutidae, Cancellariidae, and Marginellidae, and three species of *Granulifusus* (Fasciolariidae) already reported and eight species of Olividae are excluded here.

Many of the species and subspecies here described have been refered to their critical importance in biostratigraphy by several authors. The detailed examination of the morphology and ontogeny of the available species clarified that some of them are very useful for a refined stratigraphy exhibiting the successive development in ornamentation by species rather in the short duration. For example the morphologic development from *Nassaria sanzaiana* n. sp. to *N. acuminata gendinganensis* (MARTIN) proceeded rather in the short lapse of time from the middle Miocene to the uppermost Miocene, from *Fulgoraria* (*Psephaea*) *cancellata koyuensis* n. subsp. to *F.* (*P.*) *cancellata cancellata* KURODA and HABE in the upper Miocene, and from *Lyria* (*Paralyria*) *mizuhonica koyuana* (YOKOYAMA) to *L.* (*P.*) *m. mizuhonica* (MAKIYAMA) in the transition between Miocene and Pliocene.

Concerning with the general geographical distribution of Buccinacea and Volutacea obtained from the Miyazaki group an apparently different tendency from that of Conacea is shown. That is to say, many Indonesian elements are contained at remarkably high percentage among the subgenera and species described here, but Oceanian elements are much less than in the case of Conacea. Since the solution of all the problems of the biogeography, though it is primarily important, is beyond the scope of this paper, some of the problems are only offered and not fully discussed here.

I wish to express my cordial thanks to Drs. Katura OYAMA of Geological Survey of Japan, Tadashige HABE of Kyushu University, and Tokubei KURODA of Kyoto University, who gave me attentive advices and criticisms concerning with the subject and made me access to the necessary specimens and papers.

I am deeply indebted to Professors Tatsuro MATSUMOTO and Ryuzo TORIYAMA of Kyushu University for giving me necessary advices on the course of the general study. Professor TORIYAMA also gave me careful criticisms on the typescript. I am also indebted to Professor Fuyuji TAKAI of the University of Tokyo and Susumu MATSUSHITA of Kyoto University for giving me access to necessary books and material.

Miss Chizuko OKAMURA helped me in preparing the type script.

The study was partly financed by a grant from the scientific fund by the Ministry of Education.

Systematic Description

Superfamily Buccinacea

Family Pyrenidae

Genus *Mitrella* RISSO, 1826

(type species: *Mitrella flaminea* RISSO=*Murex scripta* LINNÉ by subsequent designation, COX, 1927)

Subgenus *Indomitrella* OOSTINGH, 1940

(type species: *Columbella puella* SOWERBY by original designation)

Mitrella (*Indomitrella*) *lischkei* (SMITH)

Pl. 8, Fig. 2

1879, *Mitrella* (*Atilia*) *lischkei* SMITH, *Proc. Zool. Soc. London*, p. 207, pl. 20, f. 41.
1879, *Mitrella* (*Atilia*) *niveomarginata* SMITH, *Proc. Zool. Soc. London*, p. 208, pl. 20, f. 42.
1922, *Columbella* (*Atilia*) *praecursor* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 44, Art. 1, p. 61, pl. 2, f. 25.
1952, *Pyrene lischkei*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 81.
1954, *Mitrella* (*Indomitrella*) *lischkei*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap.* No. 2, p. 21, pl. 22, f. 25.

Material and measurements.—GK-L 6086 and 6090. The specimens came from the unconsolidated fine sandstone at Hagenoshita. GK-L 6068 (coll. T. MATSUMOTO et al.) is almost perfect in preservation and 6090 (coll. T. SHUTO) is fragmental.

Specimen GK-L	H* (mm.)	Bd* (mm.)	D* (mm.)	Bd/H (%)	D/H (%)	<P* (degrees)	numb. whorls (N)*	(PN)*
6086	5.8	3.6	2.7	62.1	46.5	37.5	2	4

Remarks.—*Columbella* (*Atilia*) *lischkei* SMITH having a high spire and short aperture is not *Columbella* LAMARCK, 1799 nor *Pyrene* (BOLTEN) RÖDING, 1898 both of which have an ovoid shell with a very low spire, the large body whorl, and the long aperture. SMITH's species is reasonably included in *Mitrella* RISSO, 1826 in the broad sense. It is, however, characterized by the smooth conical protoconch of two volutions, the longitudinal axials on the early post-embrionic whorls, and by the strong exterior

* H..height of the shell, Bd..length of the body whorl, D..maximum diameter, <P..pleural angle, (N)..nuclear whorls, and (PN)..post-nuclear whorls.

varix and the interior subtubercular lirae of the labrum. These features are not of *Mitrella* (s. s.) but of *Indomitrella* OOSTINGH, 1940. SMITH distinguished in his original paper "*C.* (*A.*) *lischkei*", the figured type specimen of which is slender with high spire, from the allied "*C.* (*A.*) *niveomarginata*". The latter is featured by more swollen and rounded outline of the shell than the former. Recently KURODA and HABE united these species under a single specific name, *lischkei*, on the basis of the perfect gradation of the morphological characters among the individuals of these two "species" after examining the variation in morphology at a large number of specimens. The present specimens quite agree with "*C.* (*A.*) *niveomarginata*". Accordingly it is included in *Mitrella* (*Indomitrella*) *lischkei* (SMITH) in the broad sense revised by KURODA and HABE.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Mitrella (*Indomitrella*) *smithi* (YOKOYAMA)

Pl. 10, Figs. 7 and 11

1922, *Columbella* (*Atilia*) *smithi* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 44, Art. 1, p. 60, pl. 2, f. 24.

1954, *Mitrella* (*Indomitrella*) *smithi*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap.* No. 2, p. 21, f. 24.

Material and measurements.—GK-L 6087, 6088, and 6089. Three specimens came from the unconsolidated fine grey sandstone at Nihonmatsu. Coll. T. SHUTO. Preservation is almost perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (N)	(PN)
6088	4.3	2.85	1.9	66.3	44.2	30.5	2	5

Remarks.—The present species is characterized by the distinct subsutural thread, the longitudinally costated sharp angulation at the boundary between the peripheral and the basal surface of the body whorl, and by the abrupt contraction on the basal surface to the neck. Being provided with these features the present specimens are quite identical to *Mitrella* (*Indomitrella*) *smithi* (YOKOYAMA), though the former is remarkably smaller than the latter.

Horizon.—Middle part of the Takanabe member (fifth fossil horizon of the Miyazaki group), Lowest Pliocene.

Locality.—Road side cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Zemitrella* FINLAY, 1927

(type species: *Lachesis sulcatus* HUTTON by original designation)

Mitrella (*Zemitrella*) *bicinctella* (YOKOYAMA)

Pl. 8, Figs. 5 and 6, Text-fig. 1

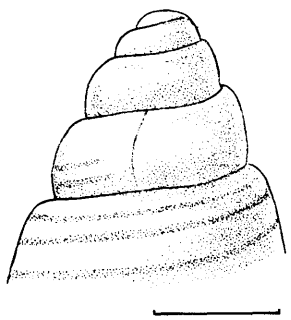
1928, *Columbella (Atilia) bicinctella* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 2, pt. 7, p. 345, pl. 67, f. 6.
1952, *Mitrella bicinctella*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* 2nd Ser. Spec. Vol. No. 3, p. 192.
1952, *Pyrene bicinctella*, KURODA and HABE, *Check List and Bibiogr. Rec. Mar. Moll. Japan*, p. 81.
1959, *Pyrene bicinctella*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap.* No. 5, pl. 65, f. 6.

Material and measurements.—GK-L 6091 to 6095. 6091 (coll. T. SHUTO), 6092 and 6093 (coll. T. MATSUMOTO et al.) came from Hagenoshita; 6094 and 6095 (coll. T. SHUTO) from Nihonmatsu, type locality of the species. Matrix is unconsolidated grey fine sandstone at both localities. Preservation is almost perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap* (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P (degrees)	numb. whorls (N)	whorls (PN)
6091	8.9	6.1	4.4	4.45	68.5	49.4	50.0	51.5	45.1	3	4
6092	8.55	5.9	4.25	4.25	69.0	49.7	49.7	55.8	37.7	3	4

Remarks.—The present species was originally described by YOKOYAMA in 1928 on the basis of a single imperfect specimen. The detailed characters, however, were well recognized through the examination of the additional several specimens containing the perfect ones, and the description is given here in an abbreviate note.

The shell is small in size, rather solid, and ovoid-fusiform with the conoidal and somewhat low spire for the genus and with the contracted long base. The protoconch is small, smooth, conical, and composed of three whorls which are separated from one another by the depressed suture. The post-embryonic whorls are four in number, separated one another by the somewhat deep suture, moderately rounded at the sides, and ornamented by several spiral costae. The costae are weak and about seven in number on the spire whorls and nine on the lateral surface of the body whorl and separated by the narrow and shallow grooves. On the basal slope and on the snout they are round-topped, somewhat elevated, and remarkably broader than the U-shaped interstices. The number is seven to eight on the respective parts. The spirals are in many cases abraded at the middle of the peripheral surface of the whorls. The aperture is rhomboid, bluntly pointed posteriorly to the weak parietal channel, and gradually narrowed anteriorly to the very short canal, which is sinously truncated at the end. The outer lip is provided with about twelve subgranular lirae inside and moderately varicose outside slightly behind the margin and the margin itself is rather thin. The columellar lip is composed of the oblique upper two-fifths and vertical straight lower three-fifths and covered by the distinct callous material with almost free edge. Wrinkle-like irregular four teeth are developed at the lower part of the columellar lip.



Text-fig. 1. Protoconch and the early post-nuclear whorl of *Zemitrella bicinctella* (YOKOYAMA)
Unit bar indicates 0.5mm.

The above mentioned diagnosis of the present species almost generally coinsides

* Ap..length of the aperture.

with that of *Zemitrella* FINLAY, 1927 except for a few slight differences. The differences observed are in that the present species has the protoconch of three volutions instead of four volutions of the type species, and is provided with longer aperture and more ovoid outline than the type species of *Zemitrella*. While some specimens of the present species show the indication of the weak axial folds on the penultimate and the earlier whorls. This character, though it is not presented on all the specimens, together with the ovoid outline and the spiral ornamentation comprises the important part of the diagnostic features of *Sundamitrella* OOSTINGH, 1940 with the type species *Mitrella* (*Sundamitrella*) *martini* OOSTINGH (1940, p. 46-47, pl. 17, f. 303a, b). In other words, the present species represents a transitional form from *Zemitrella* to *Sundamitrella*, although it is closer to *Zemitrella* than to *Sundamitrella*.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lowest Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; and road side cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Family Buccinidae

Genus *Ancistrolepis* DALL, 1894

(type species: *Chrysodomus eucosmia* DALL by original designation)

Subgenus *Clinopegma* GRANT and GALE, 1931

(type species: *Buccinum unicum* PILSBRY=*Chrysodomus magnus* DALL by original designation)

Ancistrolepis (*Cliopegma*) *unica* (PILSBRY)

Pl. 9, Fig. 8, Pl. 10, Fig. 5

1895, *Chrysodomus* (*Ancistrolepis*) *magnus* DALL, *Proc. U. S. Nat. Mus.* Vol. 17, p. 709, pl. 29, f. 5.
1905, *Buccinum unicum* PILSBRY, *Proc. Acad. Nat. Sci. Philad.* Vol. 57, p. 102.
1907, *Buccinum unicum*, PILBRY, ibid, Vol. 59, p. 244, pl. 20, f. 7.
1907, *Chrysodomus* (*Ancistrolepis*) *unicus*, DALL, *Smithsonian Misc. Coll.* Vol. 50, pl. 2, p. 157.
1921, *Ancistrolepis magnus*, DALL, *Bull. U. S. Nat. Mus. No.* 112, p. 92.
1927, *Ancistrolepis magnus*, OLDROYD, *Stanford Univ. Publ. Geol.* Vol. 2, pt. 1, p. 203, pl. 25, f. 5.
1931, *Neptunea* (*Clinopegma*) *magna*, GRANT and GALE, *Mem. San Diego Soc. Nat. Hist.* Vol. 1, p. 660.
1931, *Ancistrolepis unicus*, KURODA, *Venus* Vol. 2, No. 5, p. 221, f. 11, 11a.
1944, *Ancistroplepis* (*Clinopegma*) *unica*, WENZ, *Handb. Palaeozool.* p. 1161, f. 3302.
1951, *Ancistrolepis unicus*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 102, f. 5.
1952, *Ancistrolepis unicus*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 38.
1954, *Ancistrolepis* (*Clinopegma*) *unicus*, KIRA, *Japan. Shells in Natural Color* pl. 27, f. 5.

Material and measurements.—GK-L 6107 and 6108 (coll. T. SHUTO). Preservation is not perfect. Part of the shell material was removed. Matrix is calcareous fine sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (PN)
6107	32.75	22.5	17.3	68.7	52.8	38.8	5+
6108	—	23.2	18.1	—	—	39.2	3+

Remarks.—Although the present specimens are imperfect in preservation, they show such characteristic features diagnostic to *Ancistrolepis* (*Clinopegma*) as the excavated step-like shoulder below the grooved suture. Featured by the distinct subsutural keel, about eight distinct spirals on the lower half of the body whorl, and by the relatively high position of the keeled angulation at the outer edge of the shoulder, the present specimens indicate the closest relation to *A.* (*C.*) *unica* (PILSBRY) and are safely identified to it.

The present species forms the typical *Lucinoma-Conchocele* assemblage together with *Lucinoma acutilineata* (CONRAD), *Conchocele nipponica* YABE and NOMURA, *Delectopecten peckhami* (GABB), and *Portlandella japonica* (ADAMS and REEVE) at the relatively deep muddy bottom in front of the elevated fault-block, on which the molluscan assemblage is characterized by the sand dwellers of shallow neritic zone.

Horizon.—Upper part of the Boroishi member (first-α fossil) horizon of the Miyazaki group), Middle Miocene.

Locality.—Small cliff at the entrance of a small lane of the right bank of Kayeda river, 600 m. south-east of Takeuchi, Kibana, Miyayaki City.

Genus *Jumala* FRIELE, 1882

(type species: *Fusus turtoni* BEAN by original designation)

Jumala sp.

Pl. 11, Fig. 2

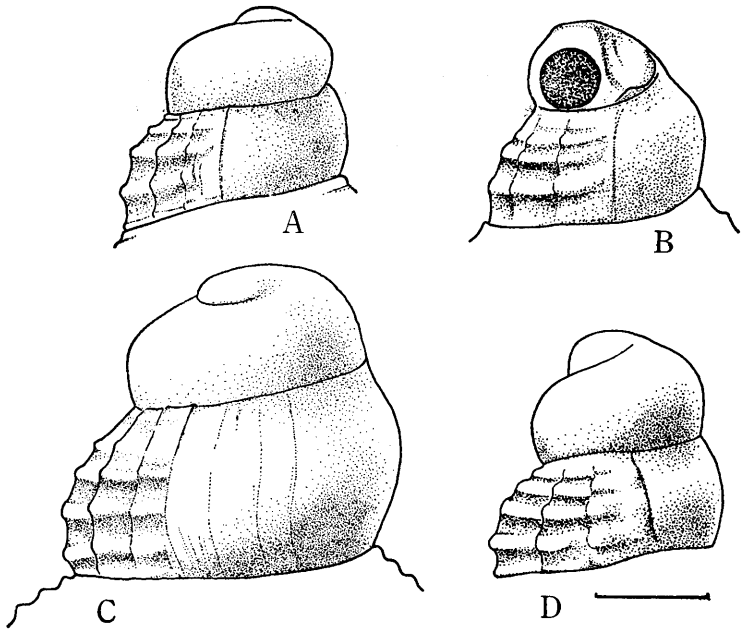
Material and measurements.—GK-L 6240. A single imperfect specimen from the siltstone at Hagenoshita (coll. T. SHUTO). The specimen lacks both the apex and the base. max. height=45.5 mm., max. dia.=31 mm.

Description.—The shell is moderate in size and ovoid-fusiform in outline. The test is porcheraneous, thick, and solid. The spire is distinctly extraconical, moderately high, and composed of about five whorls. The first to third whorls are rather regularly rounded and steeply sloped at the sides and ornamented by about seven spiral threads. The spirals are weak but well marked, of equal strength, regularly spaced, and much broader than the shallow interspaces. The fourth and the fifth whorls are abruptly and narrowly rounded at the middle of the whorl. The lower half of the lateral surface is slightly receding or almost vertical. The surface of these later whorls is ornamented by strong growth lines. The columellar lip is gently concave and covered by a thick callus. The outer lip is simple and almost vertical.

Remarks.—Although the present specimen is partly fractured at the aperture, it is readily identified to *Jumala* FRIELE with characteristic features. It shows the close resemblance to *Jumala frielei* DALL, but the specific identification will be brought out after more favourable specimens become available.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.



Text-fig. 2. Protoconchs and the early post-nuclear whorls of the selected species of *Siphonalia* from the Miyazaki group.
A—*S. declivis* YOKOYAMA
B—*S. tonohamaensis delicatula* n. subsp.
C—*S. cassidariaeformis* (REEVE)
D—*S. tosensis* MAKIYAMA
Unit bar indicates 0.5 mm.

Genus *Siphonalia* A. ADAMS, 1863

(type species: *Buccinum cassidariaeformis* REEVE, by subsequent designation, COSSMANN, 1889)

Siphonalia mikado MELVILL

Pl. 6, Fig. 4, Text-fig. 3

1888, *Siphonalia mikado* MELVILL, *Jonr. Conch.* Vol. 5, p. 348.
1895, *Siphonalia hyperodon* PILSBRY, *Cat. Mar. Moll. Japan*, p. 30, pl. 2, f. 6.
1905 *Siphonalia mikado*, PILSBRY, *Proc. Acad. Nat. Sci. Philad.* p. 103.
1927, *Siphonalia mikado*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B., Vol. 3, No. 1, Art. 1, p. 118.
1941, *Siphonalia mikado*, MAKIYAMA, ibid. Vol. 16, No. 2, pl. 3, f. 8.
1954, *Siphonalia mikado*, KIRA, *Japan. Shells in Natural Color*, pl. 26, f. 15.

Material and measurements.—A single specimen came from the tuffaceous silty fine sandstone. GK-L 4897 (coll T. SHUTO). Preservation is almost perfect but the canal is broken.

Specimen GK-L	H (mm.)	D (mm.)	Sp (mm.)	Sp/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	numb. axials I*,	II*,	pen*,	bod*.
4897	24.8	12.4	8.9	36	50	47.5	39.5	2	5.5	9	10	9.5	10

* I..first whorl, II..second whorl, pen..penultimate whorl; and bod..body whorl.

Remarks.—The present specimen is characterized by rather large protoconch of two smooth volutions, very strong five primary spirals, sharply angulated profile of the whorls, slightly extraconical spire of large pleural angle, and by sharply bended canal. On the basis of these features it is safely identified to *S. mikado* MELVILL, which differs from *S. spadicea* (REEVE) in having the extraconical spire of large pleural angle and the catagenetic spirals of less number. Concerning with the last mentioned point the present specimen does not accurately agree with the typical form. That is to say, the present specimen has five prominent primaries on the first post-embryonic whorl and the spirals continue to the body whorl without marked decrease in the number and the strength. This gives to it the resembling appearance to *S. spadicea* and leaves some doubts on the classification. While the examination of number of specimens of *S. spadicea* clearly indicates that the species shows anagenetic development of the spirals without any exception. Accordingly the identification of the present specimen to *S. mikado* is rather reasonable considering that the specimen does not exhibit distinct catagenetic decrease of the spiral sculpture reflecting the immature growth stage.

Horizon.—Upper part of the Takanabe member (sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—South-east cliff of Kizukume hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

Siphonalia hyugaensis n. sp.

Pl. 7, Figs. 12, 13 and 15; Text-fig. 3

Material and measurements.—Holotype GK-L 6112 (loc. Hagenoshita), paratypes GK-L 6111 and 6128 (loc. Nihonmatsu). Type specimens came from the unconsolidated grey fine sandstone at Hagenoshita and Nihonmatsu (coll. T. SHUTO). Preservation is almost perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P (degrees)	numb. whorls (N)	numb. whorls (PN)
6111	4.35	3.4	2.5	78.1	57.4	51	——	2	2
6112	21.8	16.0	11.8	73.4	54.1	48	60.5	2.25	4.75

Diagnosis.—The shell is moderately small in size and rhomboid-fusiform in outline with the moderately high spire and somewhat long base. The test is rather thick but not so solid. The protoconch is composed of about two smooth volutions, of which the first is small, depressed, and slightly oblique tip and the second is swollen and globose volution separated by the deep suture from the preceding one. The post-embryonic whorls are ornamented by the strong axials and spirals and number about five on the fully grown specimens. The profile of the whorl is rather rounded on the early whorls but it is distinctly angulated at the upper fourth and at about the middle of the late whorl. The surface above the upper angulation forms the well defined shoulder and is slightly concave and gently sloping; the peripheral surface between two angulations is almost flat and moderately sloping; The lateral surface below the lower angulation is slightly convex and markedly receding especially at the lower part. The body whorl is large occupying about three-fourths

of the total height of the shell, remarkably contracting at the base to form the abrupt angle between the base and the snout. The primary spirals appear just at the beginning of the first post-embryonic whorl and hold their strength throughout whole growth stages. On the first whorl they are elevated, round topped, well continuous spirally, and six in number of which the supra-sutural and the subsutural one are weak and the second and the third one from the lowest are strongest. They keep the relative strength, disposition, and number untill the third to fourth whorl, on which the weak and narrow secondaries are intercalated in the interstices on the lateral surface and the shoulder and the primaries are marked by pale brown color. On the body whorl the spirals consist of twelve primaries (two weak ones on the shoulder, four strong ones on the lateral surface including the angulation, four on the basal slope, and two on the snout above the edge of the fasciole) and ten secondaries (one on each interstice except on the snout). The axials are elevated, sharply rounded at the top, and separated by roundly excavated much broader interspaces. They are about ten in number on the first whorl and gradually increased in number to twelve on the body whorl. On the early three whorls they clearly reach both the upper and the lower suture, although they are strongest at the angulation, but on the later whorls they gradually recede from the upper suture as the shell grows. Finally on the body whorl they abruptly disappear on the shoulder near the angulation and are weakened below to the basal slope. The crossings of the axials by the primary spirals show the subgranular appearance. The suture is apressed and wavy with slight subsutural clasp. The aperture is large, more than half of the height of the shell, and rhomboidal with the posterior sinus. The outer lip is sharp, and slightly sigmoidal in profile and has the obsolete indication of the spiral groove inside. The inner lip consists of the oblique parietal one and the vertical columellar one and is covered by the thin callus. The canal is rather long, remarkably oblique, slightly recurved outwards, and shallowly sinused at the end. The siphonal fasciole is distinct but not umbilicate and bordered by a slight rim along its upper margin.

Comparison.—The present species is apparently a representative of *S. mikado* group having six primary spirals, long and bended canal, and moderately high spire. *S. "tonohamaensis totomiensis"* MAKIYAMA, which in reality is not the subspecies of *S. tonohamaensis* NOMURA as mentioned in the following pages, is an ally, but the present new species has broader shell with more produced shoulder, stronger spirals, weaker siphonal fasciole, and thinner columellar callus than *S. totomiensis*. Furthermore in this species the axials are slightly oblique instead of the vertical one of *S. totomiensis*.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lowest Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, Hagenoshita, Uwaye mura; cutting along the high-way at the foot of the hill, Nihonmatsu-Takanabe machi, Koyu gun, Miyazaki Prefecture.

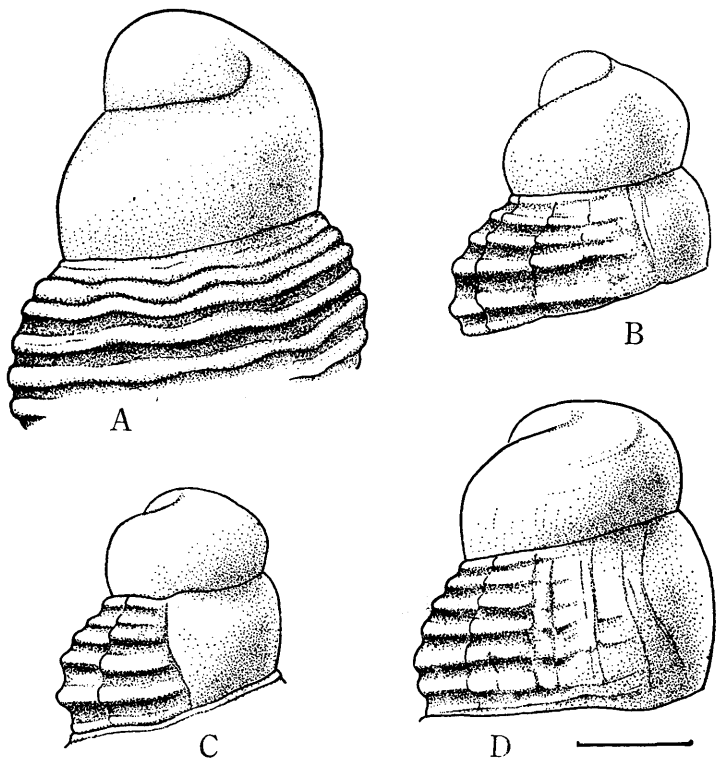
Siphonalia spadicea fuscolineata (PEASE)

Pl. 7, Figs. 5 and 9

1860, *Buccinum fuscolineatum* PEASE, *Proc, Zool. Soc. London*, p. 189.
1934, *Siphonalia spadicea fuscolineata*, KURODA, *Venus*, Vol. 4, p. 207.
1941, *Siphonalia spadicea fuscolineata*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 16, No. 2, p. 92, pl. 4, f. 10.
1952, *Siphonalia spadicea* (part), KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 86.

Material and measurements.—GK-L 4891. A single specimen came from the unconsolidated grey fine sandstone at Hagenoshita (coll. T. MATSUMOTO et al.). It is broken at the anterior end of the canal. max. height=41.25mm., max. dia.=18.8mm., height of spire=12.4 mm., number of axials=11 (body whorl), 12 (penultimate whorl), pleural angle=41 degrees.

Remarks.—So far as the type is concerned *S. spadicea fuscolineata* (PEASE) is



Text-fig. 3. Protoconchs and the early post-nuclear whorls of the selected species of *Siphonalia* from the Miyazaki group.
A—*S. mikado* MELVILL
B—*S. hyugaensis* n. sp.
C—*S. hyugaensis* n. sp.
D—*S. spadicea* (REEVE), Pleistocene fossil from the Moyeshima formation in Kagoshima Prefecture.
Unit bar indicates 0. 5 mm.

readily distinguished by its straight canal from *spadicea spadicea* (REEVE) which has the remarkably bended canal. The two, however, are rather continuously linked together by the transition forms which are less in number than the end forms. Accordingly it is not reasonable to consider them as different species or as being perfectly synonymous with each other, but is better to treat the former as a subspecies of the latter.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Siphonalia declivis YOKOYAMA

Since *Siphonalia declivis* YOKOYAMA was first described on the basis of the specimens from the lower Kakegawa group in 1926, many subspecies and the related species have been reported from various Neogene formations of Japan and Formosa. They are not only interesting from the biostratigraphical point of view, but also very important for the consideration of evolution. However some of the subspecies verified itself that it does not belong to *S. declivis* stock but to other. That is to say, the examination of the material from the Miyazaki group clarified that *S. declivis tosensis* MAKIYAMA really belongs to *S. modificata* REEVE stock.

Siphonalia declivis declivis YOKOYAMA

Pl. 6, Figs. 2 and 10, Pl. 9, Fig. 5, Pl. 11, Fig. 7, Text-fig. 2

1923, *Siphonalia cassidariaeformis*, YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 45, Art. 2, p. 9, pl. 1, f. 13, 14, 15.
1926, *Siphonalia declivis* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 1, pt. 9, p. 337, pl. 38, f. 19, 20, 21.
1941, *Siphonalia declivis declivis*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 16, No. 2, p. 83, pl. 5, f. 19, 22, 26, pl. 6, f. 30.
1952, *Siphonalia declivis*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. B, Spec. Vol. No. 3, p. 245.
1957, *Siphonalia declivis*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap.* No. 3, pl. 9, f. 13, 14, 15.
1958, *Siphonalia declivis*, MAKIYAMA, ibid. No. 4, pl. 50, f. 19, 20, 21.

Material and measurements.—GK-L 4898 and 6100. An adolescent eroded specimen, GK-L 4898, came from Hagenoshita (coll. T. MATSUMATO et al.). Another juvenile one, GK-L 6110, was collected by myself at Nihonmatsu. The lithology of both localities is unconsolidated grey fine sandstone. A few imperfectly preserved specimens GK-L 6265, 6266, etc. from the calcareous fine sandstone at Tonogôri are probably identified to *S. declivis* on the basis of the general features.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (N)	(PN)	axials I	II	III	IV	spirals III	IV
4898	20.6	17.5	13.6	84.9	65.9	64.5	—	3.5+	—	13	12	12	5	7
6110	9.6	7.7	5.8	80.2	60.4	68.0	2	3	15	13	12	—	5	

Remarks.—The protoconch of *S. declivis declivis* is composed of the small tip of the first volution and rather the large and subcylindrical second one. The post-embryonic whorls are provided with the distinct spirals and axials. On the first post-embryonic whorl the spirals consist of a weak or obsolete subsutural one and three distinct ones, which are situated respectively at the lower angulation, peripheral angulation, and at a little higher position from the foregoing one. Another weak spiral is visible close to the lower suture on some specimens. The axial plicae on the first whorl are about fifteen in number and apparently reach both the upper and the lower sutures. On the second whorl the spirals hold the same design as the preceding whorl, while the axials abruptly decrease in number to thirteen. On the third and the later whorls a few apparent tendencies in ornamentation are demonstrated; that is to say, the spirals are gradually increased in number by the intercalation of the secondary and of lower order ones, the axials are shortened axially resulting the elongate blunt granulations at the angulation, and the peripheral angulation gradually approach to the lower suture.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lowest Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; small cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Siphonalia cf. *signum* (REEVE)

Pl. 6, Fig. 3

1845, *Buccinum signum* REEVE, *Conch. Icon.* Vol. 3, *Buccinum* sp. 6.
1941, *Siphonalia signum*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 16, No. 2, p. 73, 83, text-fig. 4, pl. 3, f. 6, 7.
1952, *Siphonalia signum*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 86.
1952, *Siphonalia signum*, HIRASE (TAKI), *Illust. Handb. Shells*, pl. 103, f. 9.
1954, *Siphonalia signum*, KIRA, *Japanese Shells in Natural Color*, pl. 26, f. 16.

Material and measurements.—GK-L 6264, 6271, 6272, and 6273. The specimens, collected by myself, are more or less fractured except for 6264. Matrix is calcareous hard very fine sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	whorls (PN)	axials pen	axials bd
6264	18.1	14.2	12.4	78.4	68.5	3.5	9	10

Remarks.—The present specimens, having the quickly increasing tube and the extremely weak spirals, closely resemble *Siphonalia signum* (REEVE). The former, however, have at the juvenile stage the narrow but sharp axials extending above to the suture and below to the neck, although at the gerontic stage the axials are very weak and limited to the peripheral angulation. While the living form of *S. signum* has rather weak axials even at the juvenile and the earlier stages. Under these circumstances the concrete identification of the specimens is suspended until the perfect specimens come in hand.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

Locality.—Small cliff on the brook, southwest of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Siphonalia tosensis MAKIYAMA

Pl. 6, Fig. 1; Pl. 7, Fig. 3, Pl. 10, Fig. 9, Pl. 11, Fig. 1, Text-fig. 2

1928, *Siphonalia fusoides*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol, 2, pt. 7, p. 345, pl. 47, f. 4.

1941, *Siphonalia declivis tosensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.*, Ser. B, Vol. 16, No. 2, p. 86, pl. 4, f. 12.

Material and measurements.—GK-L 4892 to 4896, 6126, 6127, and other imperfect unregistered ones. All the specimens came from the unconsolidated grey fine sandstone at Hagenoshita (coll. 4892-96, T. MATSUMOTO et al; 6126 and 6127, T. SHUTO). Preservation is favourable.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	V
4892	25.1	19.6	14.1	78.1	56.2	—	59	—	5	13	14	12	10	11
4893	23.5	17.8	11.8	75.7	50.2	—	47.5	—	5.5	10	10	9	10	11
4894	ca 28	20.4	14.3	72.8	51.1	—	54	—	6	—	—	10	11	11
4896	11.9	9.0	6.4	75.6	54.6	49	55	2	4	10	10	11	11	
6126	16.6	12.7	9.5	76.5	57.2	—	56	—	5	—	12	12	11	11

Remarks.—According to the original author "*S. declivis tosensis*" is characterized by its narrow outline, thinner test, and much lower position of the peripheral angulation on the adult whorls than *S. declivis declivis*, and by the catagenetic ornamentation decreasing in strength with growth stages, and pale brown color markings on the late whorls at the position corresponding to that of the primary spirals of early woorls. Indispite of these differences "*S. declivis tosensis*" has the typical spirals showing the ontogenetic development of the same design to *S. declivis declivis* in the early stage of growth. My conclusion on the classification of it, however, does not necessarily conform with his. As indicated in the text-figures the early development of the primary spirals of "*S. declivis tosensis*" is apparently of the same type as *S. cassidariaeformis* group and furthermore it may not be far from reality that "*S. declivis tosensis*" has the same design of the spirals as *S. declivis declivis* as MAKIYAMA described. The juvenile development of the spirals and the profile of the whorls of "*S. declivis tosensis*", however, does not resemble that of *S. declivis declivis* but of *S. modificata* (REEVE) having much more round angulation of much higher position, more numerous spirals, and axially more elongated plicae than *S. declivis declivis*. After adolescent stage is reached the spirals and the axials of "*S. declivis tosensis*" gradually become weak and pale brown color markings take the place of the primary spirals. On the basis of these facts I am inclined to consider that "*S. declivis tosensis*" is much more closely allied to *S. modificata* than to *declivis declivis* and accordingly it should be treated as an independent species from *S. declivis*.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Mi-

yazaki group) Mio-Pliocene transition.

Locality.—Cutting along the highway on the south slope of the hill at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Siphonalia tonohamaensis delicatula n. subsp.

Pl. 7, Figs. 6 and 7, Text-fig. 2

Material and measurements.—Holotype: GK-L 4899 (coll. T. SHUTO), paratype, GK-L 4900 (coll. T. MATSUMOTO et al.). Type specimens came from the unconsolidated grey fine sandstone at Hagenoshita. The holotype is perfect in preservation, but the paratype specimen is fractured at the canal.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I, pen, bod	spirals primary
4899	20.4	16.7	14.4	11.9	81.8	70.6	58.3	56	73	2	4.5	16 14 15	3

Diagnosis.—The shell is moderately small, ovoid-fusiform with the relatively low spire and the long base. The spire is slightly extraconical, much shorter than the aperture. The protoconch is small, smooth, and composed of about two volutions. The first volution, which is broken off, may be a small tip judging from the fractured portion and the second one is relatively high in proportion to the diameter and regularly convex at the sides. The post-embryonic whorls are about five in number, angulated a little above the middle and ornamented by the axials and the spirals. The angulation is rather rounded on the early whorls and become sharper on the later whorls. The shoulder is moderately sloping and concave at the upper three-fifths and slightly convex at the lower two-fifths on all the whorls; the surface below the angulation is almost vertical except for the lowest part which is remarkably receding. The body whorl is large occupying more than eighty percent of the whole height of the shell, sharply angulated at the periphery, and moderately contracted at the base to the snout. The primary spirals are three in number on the first whorl; they are two distinct spirals respectively at the lower fourth and about the middle of the whorl and another weak one close to the angulation on the lower part of the shoulder. On occasion another distinct one is visible close to the lower suture and on the other occasion it is covered under the succeeding whorl. On the second whorl a weak lirae appears just below the upper suture and on the third whorl a few weak secondaries are intercalated in the interspaces on the lateral surface and the upper part of the shoulder. In consequence of the intercalation of the secondaries and the tertiaries the body whorl is ornamented by the close and numerous spirals, which consist of about twenty subequal ones on the lateral and the basal surface, five on the snout, and nine on the shoulder. They are somewhat wavy but regularly spaced except on the snout and almost equidimensional except for the distinct primaries at the angulation and at the lower part of the shoulder. The axials are about sixteen on the first whorl, abruptly decrease to thirteen on the second, and then gradually increase to fourteen to fifteen on the body whorl. They are stronger at the middle and slightly weaker at the ends but apparently reach both the upper and the lower suture on the early whorls. In the juvenile stage they are weakened on the shoulder,

especially at its upper half. Finally on the body whorl they hardly reach the upper suture, rather angularly plicated at the peripheral angulation and gradually disappear on the basal slope. The axial plicae are sharp, elevated, narrower than the regularly concave interspaces and crossed by the spirals. The aperture is large, pyriform with a distinct posterior sinus and gradually narrowed anteriorly to the canal. The outer lip is rather thin, simple, and almost vertical in profile. The inside of the outer lip is perfectly smooth and does not show any indication of the spiral ridges. The inner lip consists of the oblique parietal one and the vertical columellar one, which is slightly longer than the former. The columellar and the parietal callus is moderately thin with weak axial ridge near the posterior sinus and does not exhibit a free edge. The siphonal fasciole is distinct but not umbilicate and bordered by the sharp edge along its upper margin. The canal is rather short, moderately bended outward and deeply notched at the end.

Comparison.—*S. tonohamaensis* NOMURA was described on the basis of the specimen from the upper part of the Tônohama group. MAKIYAMA considered that it is a representative of *S. mikado* group and described his *totomiensis* as a subspecies of *S. tonohamaensis*. As indicated in the figure and description *S. tonohamaensis* has quite different design of the ornamentation from *S. mikado* and suggests rather the close relation to *S. declivis* group.

The present subspecies differs from the species in a few important characters. *S. tonohamaensis* is featured by the semicircular aperture with the outwardly developed outer lip, strong spiral ridge inside of the outer lip, and the heavy columellar callus with the free edge. In other words *S. tonohamensis* seems to be a specialized form. The present subspecies, as described above, has the pyriform aperture which is gradually contracted below, smooth inside of its labrum, and covered only by thin callus on the columellar lip. Furthermore the latter has many secondary and tertiary spirals on the body whorl but the former is provided with only the primaries which are quite the same as those of the former. Although the stratigraphic horizon of the present subspecies is a little lower than that of the species, it is not necessarily clear whether the morphological differences is a real reflection of the difference in the stratigraphic position or not.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group).

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Siphonalia ikebei TSUDA

Pl. 6, Fig. 9, Pl. 11, Fig. 10, Text-fig. 4-c

1959, *Siphonalia ikebei* TSUDA, *Jour. Fac. Sci. Niigata Univ.* Ser. 2, Vol. 3, No. 2, p. 91, pl. 5, f. 1a, 1b.

Material and measurements.—GK-L 6131 and 6132 (coll. T. SHUTO). Matrix is calcareous fine sandstone. Preservation is imperfect. Dimensions measured on GK-L 6131 are given below; max. height (apex is broken off)=27.7 mm., length of the body

whorl=18.9 mm., max. diameter=14.8 mm., pleural angle=42 degrees.

Remarks.—*S. ikebei* TSUDA is characterized by slender outline with the high spire which is much longer than the aperture, by the close spirals, and by the overlapping suture. The present specimens, although they are imperfect, clearly show these characteristics.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

Locality.—Cutting along road 300 m. north of Yamaji, Mino mura, Koyu gun, Miyazaki Prefecture.

Siphonalia praedeclivis ITOIGAWA

Pl. 9, Fig. 4, Pl. 10, Figs. 8 and 14, Text-fig. 4-d

1953, *Siphonalia praedeclivis* ITOIGAWA, *Venus*, Vol. 17, No. 4, p. 217, f. 1, 2.

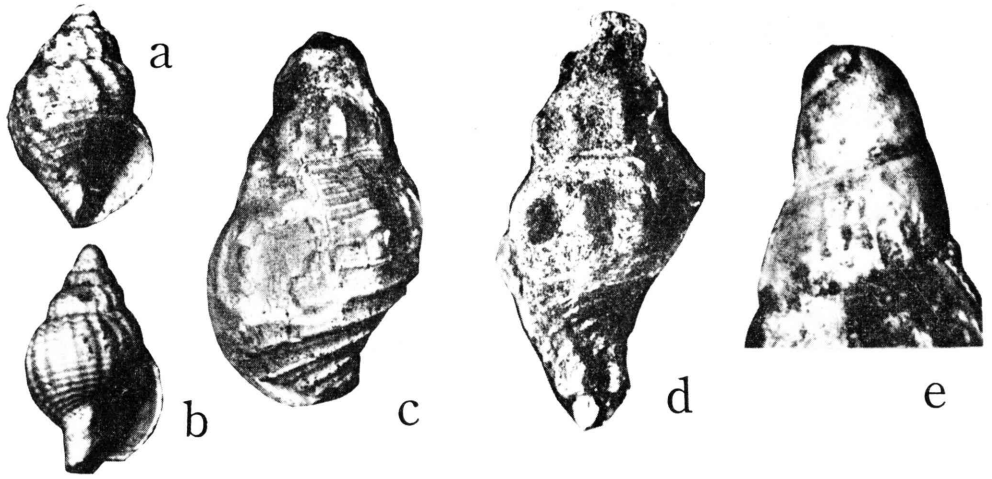
Material and measurements.—GK-L 6113 (loc. Horiguchi), 6114 to 6117 (loc. Hôkôbô), 6129, 6130 (loc. Haigano) and the unregistered numerous imperfect specimens from various localities. All the specimens were collected by myself. The registered specimens are more or less fractured or deformed. Matrix is grey, slightly calcareous silty sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<P (degrees)	numb. whorls (PN)	axials pen.	axials bod.
6113	24.4	15.9	13.7	13.8	65.1	56.1	56.6	54.6	6	10	11

Remarks.—The original author described *S. praedeclivis* on the basis of the holotype specimen from the upper part of the Tano sandstone-conglomerate member of the Miyazaki group at Kurawa. The specimens in hand, came from various localities of almost the same horizon as the holotype, are quite identical to it. *S. praedeclivis* is featured by the rhomboidal outline, varicose stout plication at the end of the last whorl, and numerous spirals which consist of alternative weak and distinct ones. The ontogenetic development of the spiral sculpture seems to be remarkably invariable in this species. That is to say, the primaries on the early whorls are four in number and spaced in the resembling design as in *S. declivis* YOKOYAMA. The number of the spirals are counted five to six distinct and four to five weak ones on the penultimated whorl and ten distinct and nine to ten weak ones on the body whorl excluding on the snout. It closely resembles *Siphonalia mekranica* BREDENBERG from the Mio-Pliocene Mekran beds of Pakistan (1925, p. 190, pl. 9, f. 8a, b) in the general characters except for size and the spiral ornamentation of the body whorl. In other words the Pakistan species, comparing with the present species, attains somewhat larger size and has closer spiral threads on the lateral and basal surface where the secondaries are as large as the primaries.

The present species has a prominent and extraordinary large varicose plica at the end of the body whorl and this character is apparently beyond the generic diagnosis of *Siphonalia*. It may probably represent a particular group, a subgenus of *Siphonalia*, but the establishment of a new subgenus is suspended until additional materials exhibiting more detailed features including the protoconch come to hand.

Horizon.—Upper part of the Boroishi and Tano member (first-α fossil horizon of



Text-fig. 4.
a—*Cancellaria* (*Merica*) *reevei laticostata* (LÖBBECKE), GK-L 6204, loc. Nihonmatsu, H=7.1mm.
b—*Nassarius* (*Zeuxis*) *miyazakiensis* n. sp., paratype GK-L 6162, loc. Nihonmatsu, H=5. 6 mm.
c—*Siphonalia ikebei* TSUDA, GK-L 6267, loc. Yamaji, H=12. 5 mm.
d—*Siphonalia praedeclivis* ITOIGAWA, GK-L 6114, loc. Hôkôbô, H=20. 4 mm.
e—*Fulgoraria* (*Psephaea*) *cancellata* KURODA and HABE, GK-L 6197, loc. Tôriyama, H=6 mm.

the Miyazaki group), Middle Miocene.

Localities.—Cliff on the right bank of Kayeda river, 3200 m. southwest of Maruno, (Kayeda-b), Kibana, Miyazaki City; river side cliff 800 m. southeast of Hôkôbô; small cliff of the tributary of Tano river, 700 m. south of Haigano; road side 300 m. south of Horiguchi, Tano machi, Miyazaki gun; small cliff along the high-way at the southwestern extremity of Kano village; cutting along the high-way at the eastern extremity of Akatani village, Takaoka machi, Higashi-morogata gun, Miyazaki Prefecture.

Genus *Babylonia* SCHLÜTER, 1838

(type species: *Eburna spirata* LAMARCK by original designation)

Subgenus *Babylonia* SCHLÜTER, 1838

Babylonia (*Babylonia*) *elata* (YOKOYAMA)

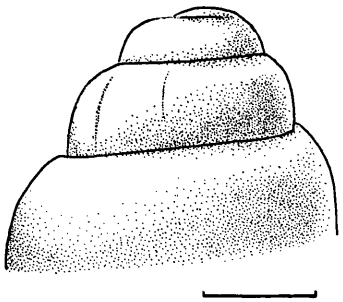
Pl. 6, Figs. 7 and 8, Pl. 7, Fig. 14, Text-fig. 5

1923, *Eburna elata* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 45, Art. 2, p. 9, pl. 1, f. 16, 17.
1943, *Babylonia elata*, SHIKAMA, *Illustr. Japan. Fossils*, p. 243, pl. 40, f. 5.
1952, *Babylonia elata*, HATAI and NISIYAMA, *Sci. Res. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 199.
1957, *Babylonia elata*, MAKIYAMA, *Palaeont. Soc. Japan. Spec. Pap.* No. 3, pl. 9, f. 16, 17.

Material and measurements.—GK-L 6120, 6121 (loc. Tôriyama), 6122, 6123 (loc. Hagenoshita), 6124 (loc. Tonogôri). 6120 and 6121 were collected by T. MATSUMOTO et al. and the others by myself. All the specimens are more or less fractured. Matrix is grey fine sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P (degrees)	numb. whorls (N)	whorls (PN)
6120	81. 2	66. 2	51. 0	81. 5	62. 7	57	65	—	7
6121	60. 3*	50. 3	37. 1	——	——	—	65	—	4+
6122	38. 8	32. 9	24. 5	84. 8	63. 1	74	70	2	5
6123	14. 4	12. 0	9. 7	83. 3	67. 3	74	70	2	4. 5

Remarks.—An apparent relation between the stratigraphic occurrence and the development of some ornament of the specimens are readily recognized through the comparison of the several specimens from various fossil horizons. The present species is characterized by its defined shoulder, which is almost horizontal and markedly concave on the full grown individuals as was described by original author. The early whorls, however, are regularly rounded and do not show any indication of the shoulder. The flush shoulder begins to develop on the fifth whorl (diameter 10 mm.) of the specimens from Tôriyama (sixth fossil horizon). While it appears respectively on the fourth-fifth whorl (diameter 8-9 mm.) of the specimens from Hagenoshita (fourth fossil horizon) and on the third-fourth whorl (diameter 5-6 mm.) of those from Tonogôri (third fossil horizon). In other words the lower the stratigraphic position of the fossil specimens, the earlier the development of the shoulder.



Text-fig. 5. Protoconch and the early post-nuclear whorl of of *Babylonia elata* (YOKOYAMA) Unit bar indicates 0.5 mm.

Horizon.—The Tonogôri member (third fossil horizon), and lower and upper part of the Takanabe member (fourth and sixth fossil horizon of the Miyazaki group), Upper Miocene to Lower Pliocene.

Localities.—Cliff at the entrance of the gorge 600 m. south of Tôriyama, Kawaminami mura; cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; road side small cutting, north slope of Tonogôri Hill, Tonogôri, Saito City, Koyu gun, Miyazaki Prefecture.

Babylonia (*Babylonia*) *areolata* (LINK)

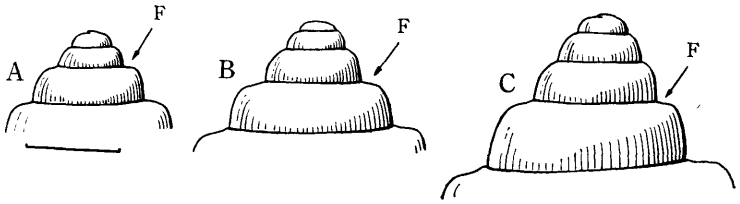
Pl. 7, Fig. 10

1849, *Eburna areolata*, REEVE, *Conch. Icon.* Vol. 5, *Eburna* sp. 6.
1941, *Babylonia areolata*, KURODA, *Mem. Fac. Sci. Agri. Taihoku Imp. Univ.* Vol. 12, No. 4, p. 116, pl. 2, f. 17.
1952, *Babylonia areolata*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Mall. Japan* p. 40.

Material and measurements.—GK-L 6125. A single imperfect specimen from the pale grey sandy siltstone at Koda, Sadowara machi. Coll. T. SHUTO. max. height= 48.8 mm., max. diameter=29.6 mm.

Horizon.—Uppermost part of the Tonogôri member (between the third and the fourth fossil horizon of the Miyazaki group), Upper Miocene.

* Fractured at the apex.



Text-fig. 6. Development of the flush shoulder of *Babylonia elata* (YOKOYAMA) at different stages of growth in the specimens from the different horizons.

A—specimen from Tonogôri (third fossil horizon)
B—specimen from Hagenoshita (fourth fossil horizon)
C—specimen from Tôriyama (sixth fossil horizon)
Unit bar represents 5 mm.
The notation F indicates the begining of the flush shoulder.

Locality.—Road side cutting 15 m south of the crossing of the Tsuma high-way by the road to Koda-numa, Sadowara machi, Koyu gun, Miyazaki Prefecture.

Genus *Nassaria* LINK, 1809

(type species: *Buccinum niveum* GMELIN by monotypy)

Subgenus *Nassaria* LINK, 1809

Nassaria (*Nassaria*) *acuminata gendinganensis* (MARTIN)

Pl. 6, Figs. 6, 11 and 12, Pl. 7, Fig. 11, Pl. 9, Figs. 1 and 7, Text-fig. 7, 8 and 9

1906, *Hindsia gendinganensis* MARTIN, *Fossilien von Java*, Bd. 1, Abt. 1, p. 313, pl. 22, f. 330a, b. c.
1939, *Nassaria acuminata gendinganensis*, OOSTINGH, *De Ingenieur in Ned.-Indië* for 1939, No. 8, p. 112.
1950, *Nassaria acuminata* (part), ALTENA, *Leidse Geol. Meded.* Deel 15, p. 226.

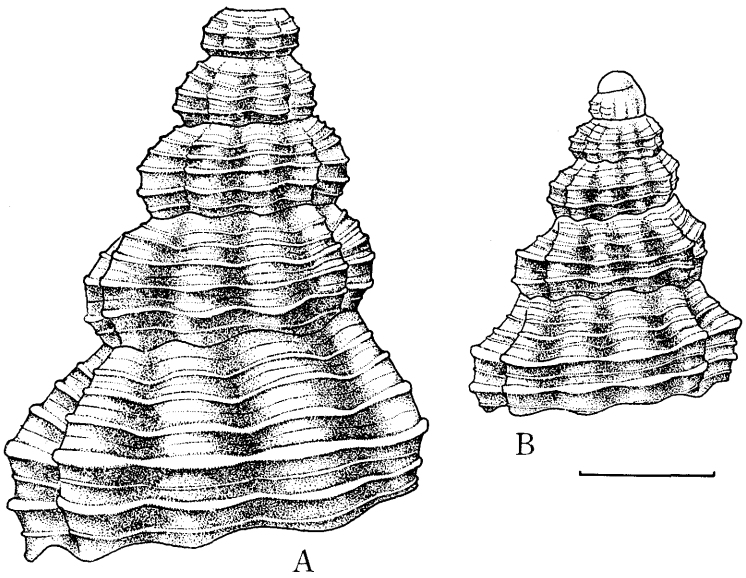
Material and measurements.—GK-L 6133 to 6139 (coll. T. SHUTO) and 6140 to 6145 (coll. T. MATSUMOTO et al.) came from Hagenoshita; GK-L 6234 to 6237 (coll. T. SHUTO) from Tonogôri; GK-L 6158 (coll. T. SHUTO) from Kizukume. Preservation is favourable. Matrix is unconsolidated grey fine sandstone at Hagenoshita and Tonogôri and tuffaceous silty sandstone at Kizukume.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	whorls (PN)	axials II	III	IV	V	VI	VII
6133	25.5*	16.4	13.6	64.4	53.3	49	38	—	6+	—	9	10	10	9	—
6134	27.8*	18.8	14.9	67.6	53.6	56	48	—	5.5+	12	11	11	10	—	—
6135	24.9*	16.9	12.6	67.8	50.6	—	42	—	6.5+	—	11	11	12	10	—
6139	10.9	7.2	5.5	65.9	50.4	—	45	2	5	—	—	10	11	—	—
6145	21.2*	14.3	10.2	67.4	48.2	—	45	—	6	—	11	11	12	12	—
6158	29.0	19.1	14.0	65.9	48.3	49	46	1.75	8	—	—	—	9	10	12

Remarks.—The present subspecies from the Upper Miyazaki group consists of the remarkably variable forms including the specimens being provided with the

* Slightly fractured at the apex.

extraordinarily convex whorls with the slightly convexed and gently sloping shoulder as an end form and the slender specimens with slightly concave and steeply sloping shoulder as the other end form. The majority of the specimens, however, show more or less identical features to the convexed form and is readily compared with the type of the subspecies from the Sonde Bed in Java, which has the extremely expanded aperture and whorls. As indicated from the above mentioned features, the specimens from the Upper Miyazaki group are generally somewhat less convexed at the side of the whorls and less developed at the outer lip except for the end form. Except for this slight difference the specimens from the Sonde Bed and the Miyazaki group quite agree with one another in the important features including the development design of the sculpture and the detailed character of the aperture.



Text-fig. 7. Early whorls of *Nassaria* (*N.*) *acuminata gendinganensis* (MARTIN) (A) and *N.* (*N.*) *sanzaiana* n. sp. (B).
Unit bar indicates 2 mm.

The early portion of the first post-embryonic whorl has two peripheral spiral cords respectively at the lower fourth and at the upper third and many weak axial ridges running from the upper suture to the lower one. On the later part of the first whorl the upper cord approaches to the lower one and another cord, which is somewhat weaker than the former two, appears on the shoulder. On the later whorls all the spirals including the primaries become fine and close and almost equal in strength on the shoulder, although they are different in strength on the lateral and the basal surfaces.

Horizon,—The Tonogôri member and the lower and the upper part of the Takanabe member (third, fourth, and sixth fossil horizon of the Miyazaki group), Upper Miocene to Lower Pliocene.

Localities.—Road side small cutting on the north slope of Tonogôri Hill, Tonogôri, Saito City; cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; southeast cliff of Kuzukume Hill, Tonda machi, Koyu gun, Miyazaki Prefecture.

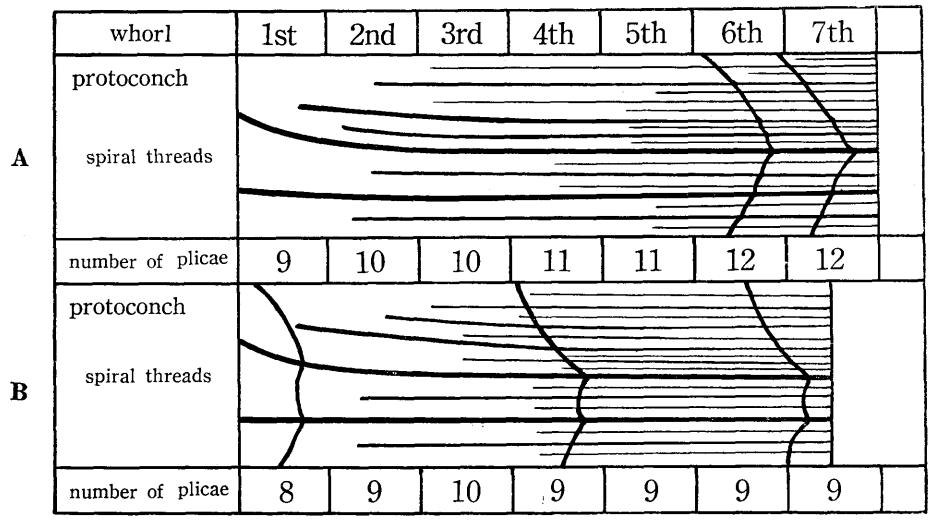
Nassaria (Nassaria) sanzaiana n. sp.

Pl. 7, Fig. 8, Pl. 9, Figs. 3 and 9, Text-fig. 7 and 8

Materirl and measurements.—Holotype: GK-L 6146, paratypes: GK-L 6147 to 6152. All the specimens came from the slightly calcareous grey silty sandstone at Kakoi (coll. T. SHUTO). Preservation is favourable, but the greater part of the detouched specimens lacks the apex or the canal as the result of unskillfulness in the technique.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials III	IV	V	VI	VII
4146	25.8*	17.0	14.3	65.9	55.4	—	47	—	7	—	—	10	9	9
4150	22.2	14.1	12.1	63.6	54.5	—	45	—	7	—	—	9	9	9
4151	10.4*	6.1+	6.0	——	57.6	48	39	2	5	9	9	9	—	—

Diagnosis.—The shell is moderately small in size, rhomboid-fusiform in outline, and rather solid. The spire is acuminate, slightly extraconical with varying pleural angle of 39 degrees at the juvenile stage to 47 degrees at the adult. The body whorl is large occupying about sixty percent of the total height of the shell, bicarinate at the periphery, and sharply contracted at the base to the neck. The protoconch is smooth, small, and composed of two volutions, of which the first is small and globose and



Text-fig. 8. Generalized diagram of the development of the ornamentation and the whorl-profile of *Nassaria (Nassaria) acuminata gendinganensis* (MARTIN) (A) and *N. (N.) sanzaiana* n. sp. (B).
The spiral threads are illustrated as broad and narrow lines corresponding to their strength.

* Partly fractured specimen.

the second is subcylindrical. The post-embryonic whorls are about seven in number, bicarinated, axially plicated, and spirally lirated. The first whorl is weakly bicariated by the distinct and elevated lirae at the lower fourth and at the upper third at the beginning. The shoulder is roundly convex and moderately sloping, the surface between the carinae is concave and almost vertical, and the surface below the lower carina is convex and receding. On the later part of the first whorl the upper carina approaches to the lower one and another lirae appears on the shoulder slightly closer to the carina. The secondaries appear altogether on the second whorl in each interspace between the primaries and the sutures, and the primaries become weak by and by on the shoulder in keeping pace with increase of the secondaries. The tertiaries appear almost all together on the fourth or fifth whorl. On the fifth whorl all the spirals on the shoulder are fine and almost equal in strength, though the primaries and the secondaries keep their strength on the lateral and the basal surface. The shoulder, which is concave on the fourth and succeeding whorls, is almost smooth except for fine spiral lines and growth lines on the seventh whorl. The primaries are counted six to seven on the lateral and the basal surface of the late whorls. The axials are nine on the early whorls, nine to ten on the juvenile to adolescent whorls, and eight to nine on the late whorls in number. They are blunt and thin ridge running from the upper suture to the lower one at the beginning of the first whorl and soon become prominent and elevated with rounded profile and are wider than the interspaces at the late part of that whorl. On the third to fourth whorl they become weak on the shoulder especially near the upper suture and much narrower than the interspaces. On the sixth and seventh whorl they abruptly disappear at the lower part of the shoulder and gradually lowered down on the basal surface. Consequently they exhibit the elongate nodules on the late whorls. The crossings of the plicae by the primary spirals form the sharp granules on the later whorls. The suture is wavy and apressed and subsutural part of the succeeding whorl is slightly clasping. The aperture is rhomboid-ovate in outline; the outer lip is varicosely plicated outside and lirated inside; the inner lip consists of the concave and oblique parietal one and the straight and vertical columellar one, and is covered by the callus with a few wrinkles. The canal is rather long and distinctly bended outwards.

Comparison.—Nassaria (*N.*) *magnifica* LISCHKE (1871, p. 148) resembles the present species, but the former is slenderer with small pleural angle and twice as large as the latter and has the round-sided whorls, which are provided with a strong lirae above the subequal peripheral two lirae.

N. (*N.*) *acuminata atjehensis* OOSTINGH (1939, p. 113, pl. 14, f. 238-240) also resembles the present species having weak plication and the peripheral carina of lower position, but the former has more roundly convexed shoulder ornamented by the distinct spirals and the more round periphery of the body whorl than the latter.

N. (*N.*) *acuminata gendinganensis* (MARTIN) is closely allied to the present species, but the former is carinated at higher position than in the present species and its axials and spirals on the adult whorls are stronger than those of the latter. Furthermore the shoulder of *gendinganensis* is slightly convex except for the latest

whorl, but that of the present species becomes concave on the fourth whorl. In other words, *S. acuminata gendinganensis* exhibits at its later stage of growth the morphological character of the young stages of *N. sanzaiana*. Considering the above mentioned facts it may be naturally concluded that *S. sanzaiana* may be the ancestor of *S. acuminata gendinganensis*.

Horizon.—Middle part of the Kawabaru member (first-β fossil horizon of the Miyazaki group), Middle Miocene.

Locality.—Brook side 350 m. south of Kakoi village, 100 m. east of the high-way, Sanzai mura, Koyu gun, Miyazaki Prefecture.

Nassaria (Nassaria) yokoyamai TSUCHI

Pl. 7, Figs. 1, 2 and 3, Text-fig. 9

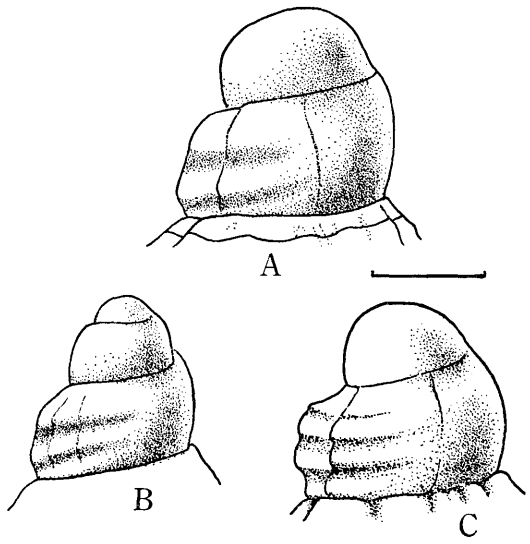
1955, *Nassaria magnifica yokoyamai* TSUCHI, *Rep. Liberal Arts Fac. Sizuoka Univ.* No. 8, pl. 1, f. 11.

Material and measurements.—GK-L 6096 to 6099 (loc. Hagenoshita, coll. T. SHUTO), 6100 to 6104, 6135 to 6157 (loc. Hagenoshita, coll. T. MATSUMOTO et al.), 6105 and 6106 (loc. Tôriyama, coll. T. SHUTO) and many other unregistered specimens. Matrix is grey siltstone at Hagenoshita and tuffaceous silty sandstone at Tôriyama. Preservation is perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	III	IV	V	VI	spirals primary
6096	18.1	11.2	8.55	61.7	47.2	47.9	29.0	1.66	6	11	—	13	11	9	3
6097	16.3	10.5	7.95	64.4	48.8	50.6	33.1	1.66	5.5	11	13	11	10	—	3
6098	14.15	9.75	7.4	69.1	52.4	54.8	42.2	1.66	5	11	14	12	10	—	3
6099	13.65	8.4	7.0	61.5	51.3	48.2	36.4	1.66	5	13	15	12	11	—	3
6100	19.1	12.35	9.65	64.3	50.6	50.1	34.3	1.4	6	12	—	13	12	10	3
6101	17.65	11.75	9.25	66.4	52.4	52.9	43.7	1.66	5.5	11	14	12	10	—	3
6102	16.5	11.05	8.55	67.0	51.8	53.9	39.2	1.66	5	—	14	12	11	—	3
6103	14.45	9.2	7.35	63.6	50.8	54.8	33.6	1.66	5	12	13	12	11	—	3
6105	17.5	11.0	9.3	62.8	52.3	52.6	28.2	1.5	6	10	—	13	12	10	3
6106	10.9	11.0	8.7	65.1	51.5	56.6	41.1	1.66	6	11	—	14	13	10	3

A distinct *Nassaria* species obtained from the Kakegawa group was named *N. magnifica yokoyamai* and figured by TSUCHI in the photograph-plate of the paper on the palaeoecology of late Pliocene mollusks. Since he did not give any description on that occasion, the full description of the species is given below.

Diagnosis.—The shell is small attaining about 18 mm. in the height and ovato-fusiform in outline with moderately acuminate spire and roundly contracted base. The test is rather thick but not solid. The protoconch is small, smooth, and composed of about 1.5 to 1.66 volutions, of which the first is globular and separated by the shallow suture from the subcylindrical second one. The post-embryonic whorls are about six in number, roundly convexed at the periphery, and ornamented by the prominent axial plicae and the regular spiral lirae. The suture is apressed, wavy, and has a weak subsutural lira on the third and the later whorls. The body whorl is large occupying more than sixty percent of the total height of the shell, tri-carinated at the periphery, shouldered above, and roundly contracted below to the neck. The



Text-fig. 9. Protoconchs and the early post-nuclear whorls of *Nassria* (*Nassria*) *acuminata gendinganensis* (MARTIN) (A and B) add *N.* (*N.*) *yokoyamai* TSUCHI (C).
Unit bar indicates 0.5 mm.

shoulder is slightly convex and moderately sloped. The spirals consist of the round-topped primaries, secondaries, and a few tertiaries. At the beginning of the first whorl three wide and elevated primary cords, separated by the V-shaped much narrower interspaces, occupy almost whole surface and thereafter they become narrower and sharper rather abruptly. On the second whorl they are sharp and elevated lirae and narrower than the interspaces with round bottom. The primaries keep the strength of the first order until the body whorl, though their relative strength to the secondaries and the tertiaries slightly decreases. The secondary threads appear on the fourth whorl and keep their relative strength and regular disposition throughout. The weak indication of a few tertiary lines appears on the peripheral surface and the shoulder of the later portion of the fourth whorl or of the early portion of the fifth whorl. They increase very gradually in number on the later whorls but they are obsolete and counted at most eight to nine on the body whorl, chiefly on the shoulder and on the peripheral surface. In consequence the body whorl is provided with four strong primaries, which are one fourth as wide as the interspaces, on the peripheral surface, four moderately strong primaries on the basal slope, five to eight obsolete tertiaries on the shoulder and the peripheral surface. The axial sculpture appears as the irregularly spaced broad folds at the beginning of the first whorl and soon becomes the regular plicae, which are broader than the interspaces. They are as wide as the interspaces on the second whorl and narrower than the latter on the third. The plicae extend from the upper suture to the lower one on all the whorls, though at the peripheral part they are stronger than at the upper and the lower part. The crossings of the plicae by the primaries make up the sharply elevated granules. The growth lines are distinct throughout the growth stages. The aperture is rather small, rhomboidal with indistinct posterior sinus and oblique and narrow anterior canal. The outer lip is rather thin at the margin, varicose outside, and provided inside with a few lirae which are rather denticulate at the end. The inner lip consists of the oblique and slightly convex parietal one and the vertical and slightly concave columellar one, and is covered by the thin callus with two weak parietal ridges. The canal is obliquely truncated at the anterior end and bordered at the posterior end by the low but sharp columellar fold and the granular tooth of the lowest part of the labrum.

The snout is rather long, slightly bended outward, and provided with weak fasciole at the lower part.

Comparison.—Although the original author considered the present form as a subspecies of *Nassaria* (*N.*) *magnifica* LISCHKE, the former remarkably differs from the latter in the following features. That is to say, the present species is less than half of *N. magnifica* in size, and has the lower spire of larger pleural angle and the longer base. The spire whorls of the present species are more roundly convexed at the side with definite three angulation than *N. magnifica* and in consequence the shoulder is very narrow and imperfectly defined on the former instead of the moderately developed shoulder of the latter. Furthermore the axial plicae of the former are prominent and reach the upper suture but on the latter they are moderate in strength and hardly reach the upper suture. The protoconch of the present species is small but globose consisting of 1.66 volutions. These differences are considered not to be of intra-species value but of inter-species significance. It is naturally better to deal the present form as an indipendent species to *N. magnifica*.

Nassaria sinensis SOWERBY (*Thes. Conch.* Vol. 3, p. 86, pl. 220, f. 8, 9) is closely allied to the present species, but the former has wider shell, lirated three angulations on the lateral surface at relatively higher position, closer spirals on the basal slope, and the stronger subsutural lira than the latter. Furthermore the former has the round aperture abruptly contracted anteriorly.

N. mekranika VREDENBURG (1925, p. 248, pl. 7, f. 1-3) from the Uppermost Miocene Mekran beds in Pakistan has the close resemblance in the similar size of shell and ornamentation of the present species, but in the former the axial plicae are stronger and wider than in the latter and the profile of the labrum is slightly retrocurrent instead of vertical one of the present species.

N. tambacana (MARTIN) (MARTIN, 1884, p. 133, pl. 7, f. 134; ALTENA, 1950, p. 225, f. 16a, b), especially the specimen reported from Poetjangan layers by ALTENA resembles the present species, but the former has more gradually contracted base and narrower aperture than the latter.

Horizon.—Lower and upper part of the Takanabe member (fourth and sixth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lower Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; cliff at the entrance of a gorge 600 m. south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Genus *Cantharus* (BOLTEN) RÖDING, 1798

(type species: *Cantharus globularis* (BOLTEN) RÖDING=*Buccinum tranquebaricus* GMELIN by subsequent designation, COSSMANN, 1889)

Subgenus *Hanetia* JOUSSEAUME, 1880

(type species: *Murex haneti* Petit de la SANSCAYE by original designation)

Cantharus (*Hanetia*) *bucklandi* (D'ARCHIAC)

Pl. 6, Fig. 13

1850, *Fusus Bucklandi* d'ARCHIAC, *Hist. des Progres d. l. Geol.* Vol. 3, p. 292.
1853, *Fusus ? Bucklandi*, d'ARCHIAC and HAIME, *An. Fossil de L'Inde* pt. 2, p. 308, pl. 29, f. 13, 13a.
1883, *Buccinum* (*Pollia*) *ventriosum* MARTIN, *Samml. Geol. Reichs-Mus. Leiden*, Ser. 1, Bd. 1, p. 204, pl. 9, f. 7.
1913, *Tritonidea* (*Pollia*) *ventriosa*, SMITH, *Philippin Jour. Sci.* Vol. 8, Sec. A, No. 4, p. 258, pl. 4, f. 16.
1935, *Cantharus wangwaensis* NOMURA, *Sci. Rep. Tohoku Imp. Univ.* Ser. 2, Vol. 18, p. 150, pl. 8, f. 18a, 18b.
1939, *Cantharus* (*Pollia*) *bucklandi*, OOSTINGH, *De Ingenieur in Ned.-Indie* for 1939, No. 4, p. 118, pl. 14, f. 245.

Material and measurements.—GK-L 6159. A single specimen collected by myself from the calcareous fine sandstone at Tonogôri. Preservation was almost perfect but the specimen was partly fractured in taking out from the matrix. max. height=32 mm., max. diameter=19.5 mm.; length of aperture=22 mm.; axial plicae=10 (body whorl), 8 (penultimate whorl); primary spirals=7 (body whorl).

Remarks.—According to OOSTINGH *Cantharus* (*Pollia*) *bucklandi* (D'ARCHIAC) is rather variable and *C.* (*P.*) *ventricosa* (MARTIN) from Pliocene beds of Java and Sumatra is included in the range of the morphologic variation of the former and any boundary can not be set between the two. *Cantharus wangwaensis* NOMURA from the Pliocene bed of Formosa is quite identical to *C. bucklandi* in this sense.

The specimens reported under the name of *bucklandi, ventriosa,* and *wangwaensis* are provided with definite umbilicus and smooth columellar lip except for the undulation reflecting the spiral lirae under the callus, and are naturally classified into *Hanetia* JOUSSEAUME, 1880.

The present specimen, though imperfect, is provided with the typical features and quite agrees with the paucispiral type of *C.* (*H.*) *bucklandi.*

Horizon.—The Tonogôri member (third fossil horizon of the Miyazaki group), Upper Miocene.

Locality.—Road side cutting on the north slope of Tonogôri Hill, Tonogôri, Saito City, Miyazaki Prefecture.

Family Nassariidae

Genus *Nassarius* DUMERIL in FRORIEP, 1806

(type species: *Buccinum arcularia* LINNÉ by monotypy)

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

(type species: *Buccinum olivaceum* BRUGUIÈRE=*B. taenia* LINNÉ by subsequent designation, COSSMANN, 1901)

Nassarius (*Zeuxis*) *caelatus dainitiensis* (MAKIYAMA)

Pl. 8, Fig. 13

1927, *Nassarius* (*Hinia*) *caelatus dainitiensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 3, No. 1, p. 122, pl. 5, f. 17, 18.
1952, *Nassarius* (*Hinia*) *caelatus dainitiensis*, HATAI and NISIYAMA, Check List Japan. Tert. Mar. Moll. *Sci. Rep. Tohoku Univ.* 2nd ser., Spec. Vol. No. 3, p. 218.

Material and measurements.—GK-L 6160. A single immature specimen collected by myself from the unconsolidated grey fine sandstone at Nihonmatsu. Preservation is favourable.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I,	pen,	bod.	spirals I,	pen.
6160	18.8	12.6	10.15	68.1	54.8	52	50	ca 3	5.5	15	23	22	3	5

Remarks.—Through the comparison of the type species, *Zeuxis* H. and A. ADAMS 1853 is readily distinguished from *Tritia* RISSO, 1826 (=*Hinia* GRAY, 1847) in a few characters. That is to say, in the former subgenus the spiral sulcae become obsolete on the body whorl, the distinct posterior canal is developed at the uppermost part of the aperture, and the snout of the body whorl is not well defined and continue to the basal slope without any angulation or groove at the boundary. While in the latter subgenus, the spiral sulcae are fine but distinct even on the body whorl, the posterior canal is weak, and the straight and vertical snout is sharply separated by a deep spiral groove from the basal slope.

Nassarius caelatus (A. ADAMS) has rather intermediate feature including these important characters. It exhibits the fine and distinct spiral sulcae on the body whorl, sharply defined posterior canal at the aperture, and the gradual continuation of the basal slope to the snout. Although it is a transitional form, it indicates closer relation to *Zeuxis* than to *Tritia* as suggested by the feature above noted. According to the original author, *N.* (*Zeuxis*) *caelatus dainitiensis* (MAKIYAMA) differs from the species in having the canaliculated suture. It is, furthermore, distinguished from the species in having much more oblique axial ribs of less numerous than in the latter.

Horizon.—Middle part of the Takanabe member (fifth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—Cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Nassarius (*Zeuxis*) cf. *crebricostata* (SCHEPMAN)

Pl. 8, Figs. 4 and 7

1911, *Nassa* (*Alectrion, Aciculina*) *crebricostata* SCHEPMAN, *Prosobranchia of the Siboga Expedition, Rachiglossa*, Monogr. 49, p. 318, pl. 20, f. 3.

Material and measurements.—GK-L 6165 to 6170. The detouched specimens are imperfect owing to unskillfulness, though the original state of preservation is favourable. Matrix is calcareous silty sandstone. Coll. T. SHUTO.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (PN)
6165	10.7*	——	6.5	——	60.7	64	43	4+
6166	ca 12.1	8.6	5.7	71.1	55.3	58	48	4+
6167	10.2	6.5	6.3	63.6	61.7	57	51	4+

Remarks.—The present specimens are featured by the small size, obconical outline with round-sided whorls, oblique and close axial ribs numbering about twenty on the

* Slightly fractured specimen.

penultimate whorl, and by the numerous fine spirals numbering about seven on the penultimate whorl. In these account it closely resembles *N.* (*Zeuxis*) *crebricostata* (SCHEPMAN), living in the Indonesian seas. The concrete identification is suspended until good examples are examined.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

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

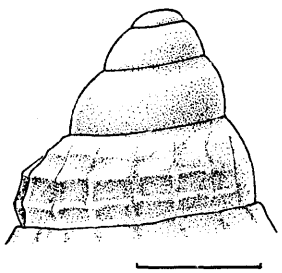
Nassarius (*Zeuxis*) *miyazakiensis* n. sp.

Pl. 8, Fig. 10, Text-figs. 4b and 10.

Material and measurements.—Holotype GK-L 6161, mature specimen; paratype GK-L 6162, immature specimen. All the specimen came from the unconsolidated grey fine sandstone at Nihonmatsu. Coll. T. SHUTO. Preservation is almost perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P (degrees)	numb. whorls (N)	(PN)
6161	11.6	8.0	6.4	68.9	55.2	50	52	3+	5
6162	5.6	4.2	3.4	74.9	60.6	51	—	3.5	3.66

Diagnosis.—The shell is small in size and ovately fusiform in outline with rather high conical spire and moderately round base. The test is moderate in thickness. The protoconch is smooth, polygyrate, and composed of about 3.5 volutions. The first volution is depressed small tip and the second and the third are slightly convexed at the side and almost two times wider than high. The post-embryonic whorls are about five in number, roundly convexed at the side, axially ribbed, spirally grooved, and separated by the subcanaliculated suture. The body whorl is large occupying more than seventy percent of the shell height, roundly convexed at the side, and gradually contracted below to the snout, which is not separated from the basal slope by any groove or channel. The axials are fourteen, fourteen, eighteen, twenty-one, and twenty-eight in number respectively on the first, second, third, fourth, and the last whorl. They are elevated, prominent, almost equal in width to the interspaces, and extend from the lower suture to the upper on the first whorl and wider than interspaces on the third; on the fourth and the later whorls they are separated by the shallow and narrow grooves and disappear on the basal slope of the body whorl. On the later part of the body whorl they are crowded and weak. The spirals on the first whorl are four in number and much narrower than the interspaces; the spirals consist of the subsutural and suprasutural lirae, and of the other two between the preceding ones; on the second whorl a secondary spiral is intercalated in the space between the lateral lirae; on the third another secondary



Text-fig. 10. Protoconch and the early postnuclear whorls of *Nassarius* (*Zeuxis*) *miyazakiensis* n. sp.
Unit bar indicates 0.5 mm.

lirae appear respectively above the suprasutural primary lira and below the subsutural one, and consequently the lirae are much wider than the interspaces although they do not change absolute strength. They are counted about fifteen on the body whorl and are separated by shallow grooves on the lateral surface and by relatively narrow and deep ones on the basal surface. The grooves run across the axial ribs, but the crossings do not exhibit the granular appearance except for the subsutural part reflecting the relatively small relief. The subsutural lira is well granulated in consequence of the intersection by the distinct axials and the cutting by the relatively wide and deep spiral furrow below. The aperture is roundly fan-shaped. The outer lip is sharp, slightly antecurrent, weakly varicose outside and almost smooth inside. The inner lip is sharply bended and composed of the oblique parietal one and the vertical columellar one, which has a few wrinkles on the middle and a sharp and oblique ridge at the lower end. The callus is rather thin at the parietal part and distinct on the columellar part, where the callus is abruptly margined by a slight rim. The canal is short, slightly twisted, oblique, and deeply sinused at the end. The siphonal fasciole is weak.

Comparison.—It may be possible that the holotype specimen GK-L 6161 is immature, because it is devoid of the posterior canal, the parietal ridge, and of the teeth like liration inside of the outer lip, although I described it as a mature specimen on the basis of the abruptly weakened and crowded axials on the later part of the body whorl. Considering this situation, I am inclined to compare the present species to *Nassarius* (*Alectrion*) *verbecki* (MARTIN) (MARTIN, 1895, p. 110, pl. 17, f. 247-255 as *N.* (*Hinia*)), which is very variable in form according to the original author. The two have almost the same feature of the protoconch and the ornamentation design of the early post-embryonic whorls and the difference lies only at the adult feature of the two.

The present species is readily distinguished from *N.* (*Zeuxis*) *caelatus dainitiensis* (MAKIYAMA), which is an ally to the present species, by the difference in the development of the sculpture of the two.

Horizon.—Middle part of the Takanabe member (fifth fossil horizon of the Miyazaki group), Lowest Pliocene.

Locality.—Cutting along the high way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Hima* (LEACH) GRAY, 1852

(type species: *Hima minuta* (PENNANT)=*Buccinum incrassata* STRÖM by the subsequent designation, A. and H. ADAMS 1853)

Hinia (LEACH) GRAY, 1847 (type designation by COSSMANN, 1901) is an absolute synonym of *Tritia* RISSO, 1826 (type designation by GRAY, 1847) having the same species, *Buccinum reticulata* LINNÉ as the type. Examining the type species, I am not able to set a definite boundary between *Tritia* (=*Hinia*) and *Hima* (LEACH) GRAY, 1852. The said difference between the two is only in the following features. The inner lip of *Tritia* is widened and not defined by a sharp boundary posteriorly,

whereas that of *Hima* is not widened but sharply defined. The siphonal fasciole of *Tritia*, furthermore, is bordered by a marginal ridge posteriorly, while that of *Hima* is devoid of the ridge. The most comspicuous difference, which, however, many authors seem to neglect, is in the parietal ridge. *Hima* is provided with the distinct parietal tooth like ridge but *Tritia* is devoid of it. If the significance of this feature is evaluated, the greater part of the species of "*Tritia*", which is actually provided with the parietal ridge, should be removed to a group under the name of *Hima*.

Nassarius (*Hima*) *festiva* (POWYS)

Pl. 8, Fig. 11

1835, *Nassa festiva* POWYS, *Proc. Zool. Soc. London*, p. 95.
1855, *Nassa festiva*, REEVE, *Conch. Icon.* Vol. 8, *Nassa*, pl. 13, f. 117.
1951, *Nassarius festivus*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 106, f. 10.
1954, *Tritia* (*Hinia*) *festivus*, KIRA, *Japanese Shells in Natural Color*, pl. 28, f. 18.

Material and measurements.—GK-L 6164. A single specimen collected by T. MATSUMOTO et al. from the unconsolidated grey fine sandstone at Hagenoshita. Preservation is not perfect; the specimen is slightly worn at the sides and fractured at the apex.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (PN)	axials bod	axials pen	spirals spire whorl
6164	15.0*	10.9	9.7	72.8	64.7	54	4.5	12	12	5

Remarks.—The present specimen quite agrees with the living one in having the solid and ovoid-fusiform shell ornamented by the coarsely granulated aixlas and spirals. Rather the flat-sided appearance of the specimen in the figure is a result of the erosion at the sides.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Nassarius (*Hima*) *dealbata* (A. ADAMS)

Pl. 8, Fig. 12

1851, *Nassa dealbata* A. ADAMS, *Proc. Zool. Soc. London*, p. 106.
1855, *Nassa dealbata*, REEVE, *Conch. Icon.* Vol. 8, *Nassa*, Pl. 16, f. 105.

Material and measurements.—A single specimen, GK-L 6163; coll. T. SHUTO. Matrix is grey fine sandstone. Preservation is perfect except for the protoconch.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (PN)	axials I,	axials pen,	axials bod	spirals spire whorl
6163	20.6	13.0	10.9	63.1	52.9	66	44	6.5	13	12	11	3

Remarks.—The present species is living on the sand bottom of the shallow sea of about ten fathoms in Philippines. It closely resembles *N.* (*H.*) *festiva* (POWYS) in general character except for the slender outline and in coloration. The design of the

* Slightly fractured at the apex.

ornamentation of the two species almost agrees with each other, but *N.* (*H.*) *dealbata* has another spirals in addition to the primary three spirals on the penultimate whorl, while *N.* (*H.*) *festiva* keeps three primaries throughout the spire whorls.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

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

Family Fasciolariidae

Genus *Fusinus* RAFINESQUE, 1815

(type species: *Murex colus* LINNÉ by monotypy)

Subgenus *Fusinus* RAFINESQUE, 1815

Fusinus (*Fusinus*) *perplexus* (A. ADAMS)

Pl. 8, Fig. 8

1863, *Fusus perplexus* A. ADAMS, *Jour. Linn. Soc. London, Zool.* Vol. 7, p. 106.
1905, *Fusus perplexus*, PILSBRY, *Catal. Mar. Moll. Japan*, p. 26.
1869, *Fusus perplexus*, LISCHKE, *Japan. Meer. Conch.* Bd. 1, p. 34, pl. 2, f. 1-6.
1871, *Fusus perplexus*, LISCHKE, ibid. Bd. 2, p. 26, pl. 3, f. 1-5.
1906, *Fusus perplexus*, TOKUNAGA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 21, Art. 2, p. 6, pl. 1, f. 6.
1920, *Fusus perplexus*, YOKOYAMA, ibid. Vol. 39, Art. 6, p. 50, pl. 2, f. 17.
1951, *Fusinus perplexus*, (HIRASE) TAKI, *Illust. Handb. Shells* p. 100, f. 8.
1952, *Fusinus perplexus*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan* p. 58.
1954, *Fusinus perplexus*, KIRA, *Japanese Shells in Natural Color* pl. 29, f. 2.
1954, *Fusinus perplexus*, TAKI and OYAMA, *Palaeont. Soc. Japan. Spec. Pap.* No. 2, p. 23, pl. 3, f. 17.

Material and measurements.—A single imperfect specimen; GK-L 6171 (coll. T. SHUTO). The apex and the canal are fractured on the specimen. Matrix is tuffaceous silty sandstone. max. height=52.5 mm., max. diameter=23.6 mm., pleural angle=45 degrees.

Remarks.—*Fusinus perplexus* (A. ADAMS) is rather variable in form, especially in its whorl-profile. Some of the living specimens show the remarkable angulation at the periphery at the juvenile stage, although majority of the living specimens has typically the round-sided whorls throughout the growth stages. The present specimen is a representative of the angulate form.

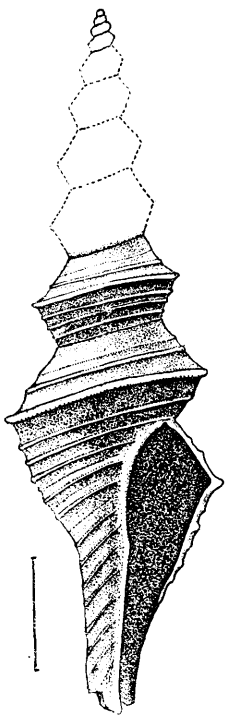
Horizon,—Upper part of the Takanabe member (sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—Cliff at the entrance of the gorge 600 m. south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Fusinus (*Fusinus*) sp. cf. *F.* (*F.*) *spectrum* (ADAMS and REEVE)

Text-fig. 11

Material and measurements.—A single fractured specimen; GK-L 6173. Matrix is calcareous fine sandstone. max. height=61 mm., max. diameter=16 mm., pleural



Text-fig. 11. *Fusinus* (*Fusinus*) sp. cf. *F.* (*F.*) *spectrum* (ADAMS and REEVE) GK-L 6173, loc. Yusunoki, Ikime mura. Unit bar indicates 10 mm.

angle=31 degrees.

Remarks.—The present specimen represents one half of the shell cut along the axis of coiling by the joint. It is characteristic enough to be compared with *Fusinus spectrum* (ADAMS and REEVE) (1846, p. 41 and 1847, *Conch. Icon.* Vol. 9, *Fusus* pl. 18, sp. 68), although it is imperfect in preservation. That is to say, it has the very elongately fusiform shell composed of the medially cariated whorls, which are distinctly plicated at the early stage and almost flat except for a few prominent spirals at the late stage. The body whorl is sharply carinated at the periphery; the shoulder is very slightly convex or almost flat and moderately sloping and the surface below the carina is slightly convex, remarkably receding and contracted to the long snout. The spirals on the body whorl consist of about six primary cords and a few secondary lirae. The primaries are regularly spaced and equidimensional, of which one is on the lower third of the shoulder and others on the lateral and the basal surface. Two of the secondaries are on the shoulder above the primary cord and the others are intercalated between the primaries of the basal surface. The aperture is elongate pyriform with a blunt ridge between the arcuate parietal and the straight columellar lip.

As above mentioned the present specimen agrees with *Fusinus spectrum* (ADAMS and REEVE) in many features, but the concrete identification is suspended until other well preserved specimens are examined.

Horizon.—Middle part of the Tano member (first-α fossil horizon of the Miyazaki group).

Locality.—Road side cutting at the northern extremity of Yusunoki village, Ikime mura, Miyazaki gun, Miyazaki Prefecture.

Genus *Buccinofusus* CONRAD, 1867

(type species: *Buccinofusus parilis* CONRAD by original designation)

Buccinofusus sp.

Pl. 6, Fig. 5

Material and measurements.—GK-L 6109 (loc. Tôriyama, coll. T. SHUTO) and 6238 (loc. Nihonmatsu, coll. T. MATSUMOTO et al.). Both specimens are fractured and the concrete identification can not be carried out. Matrix is tuffaceous silty sandstone at Tôriyama, and unconsolidated grey fine sandstone at Nihonmatsu. The measurements on GK-L 6109, fractured at the spire, are as follows: max. height=25 mm., length of body whorl=23 mm., max. diameter=15.5 mm., pleural angle=56.5 degrees,

axial plicae=12 on the body whorl, spiral lirae=5 on the penultimate whorl.

Description.—The shell is moderate in size, and fusiform with the conical spire and the oblong snout. The test is rather thick but not solid. The protoconch and the early post-embryonic whorls are not observed. The penultimate whorl is convex, roundly angulated at about the middle of the whorl height; the surface above the angulation forms the imperfectly defined shoulder, which is slightly concave at the middle and gently sloped; the surface below the peripheral angulation is slightly receding to the lower suture. The body whorl is large, imperfectly shouldered above, roundly convexed at the periphery, and moderately contracted at the base to the long snout. The suture is apressed. The axial plicae are rather weak and low even at the periphery, diminish abruptly above and below the peripheral angulation, and do not reach both the upper and lower sutures. The plicae are almost equal in breadth to the interspaces, and number twelve on the body whorl. The spiral lirae are flat-topped, narrow, one-third as wide as the roundly excavated interspaces, but sharply defined by the steep sides. They are seven on the penultimate whorl, and eighteen on the body whorl of which four are on the shoulder, five on the peripheral surface, five on the basal slope, and four on the snout. They are almost of equal size and regularly spaced except for subsutural two small lirae. The aperture is oblong pyriform, sharply angulated at the posterior end and gradually attenuated anteriorly to the moderately long canal, which is oblique, bended backward, and sinused at the end. The outer lip is almost vertical, not thickened outside, and regularly and finely lirated inside. The inner lip is sigmoidal and covered by the thin and smooth callus. The siphonal fasciole is indistinct.

Comparison.—The present species is safely identified to *Buccinofusus* CONRAD on the basis of the general feature, especially of the aperture and ornamentation, though the apex is not observed.

B. parilis CONRAD (COSSMANN, 1901, p. 33, pl. 1, f. 10) from the Miocene beds of Maryland has the large shell ornamented relatively closer lirae than the present species.

Horizon.—Middle and Upper part of the Takanabe member (fifth and sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Localities.—Cliff at the entrance of the gorge 600 m. south of Tôriyama, Kawaminami machi; cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Genus *Granulifusus* KURODA and HABE, 1952

(type species: *Fusinus niponicus* SMITH by original designation)

Three species of *Granulifusus*, *G. dualis* (YOKOYAMA), *G. matsumotoi* SHUTO, and *G. koyuanus* SHUTO, were already described in the paper entitled, "*Granulifusus* from the Miyazaki Group", and herein one species of the genus is added.

Granulifusus simplex pauciliratus n. subsp.

Pl. 8, Fig. 9

Fusinus simplex SMITH (SMITH, 1879, p. 204, pl. 20, f. 35) is characterized by its small size, and the pyriform aperture, which is gradually narrowed anteriorly to the moderately long canal without any abrupt contraction. The typical *Fusinus*, however, has the ovoid aperture which is abruptly contracted anteriorly to the very long canal. In other words "*Fusinus simplex*" is not a true *Fusinus* but is better to be classified into *Granulifusus* KURODA and HABE.

Material and measurements.—Holotype GK-L 6172. A single specimen came from the tuffaceous grey silty sandstone at Tôriyama. Preservation is almost perfect except for the apex. Coll. T. SHUTO.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<P (degrees)	numb. whorls (PN)	axials I,	pen,	bod	spirals primary
6172	17.9	11.7	6.2	65.4	34.7	32	6	9	9	9	4

Diagnosis.—The shell is small attaining about 18 mm. in height and elongate fusiform with the moderately turreted spire and the moderately long canal. The protoconch is unknown. The post-embryonic whorls are convex and roundly angulated at the periphery, about six in number, separated by the apressed suture one another, ornamented by the axials and the spirals, and rather gradually contracted at the base of the body whorl to the snout. The primaries consist of four lirae on the first whorl, of which the strongest one forming the peripheral angulation is at the lower two-fifths of the whorl, and the others are almost equal in strength, situated respectively just above the lower suture and above and below the strongest one. They keep the strength of the first order throughout all the whorls but are slightly removed to the upper position on the later whorls and form the spiraly elongate tuberculations at the crossings by the plicae. The secondary and the tertiary threads appear respectively on the second and the third whorl and the quaternaries start on the penultimate whorl. In consequence the body whorl is covered by the fine and close threads. The secondaries, tertiaries, and quaternaries are composed of the fine rows of the small dots. The axial plicae are slightly oblique, wider than the interspace on the early whorls, and narrower on the later whorls. Although they reach both the upper and the lower sutures on the early whorls, they are strongest at the periphery and gradually weakened above and below, and on the later whorls they fade out on the shoulder. On the body whorl they disappear rather abruptly on the shoulder and on the basal slope. The aperture is pyriform, bluntly pointed at the posterior end and gradually narrowed posteriorly to the canal. The outer lip is slightly retrocurrent, sharp, thin and simple. The inner lip is composed of the oblique and short parietal one and the vertical and long columellar one and covered with the thin smooth callus. The canal is slightly oblique and rather narrowly opened at the lower part, slightly bended backward, and truncated at the end. The snout is covered by the regular spirals. The siphonal fasciole is weak but distinct.

Comparison.—The present subspecies almost perfectly agrees with the species except that the former has the narrow primary spirals of less number than the latter.

G. musahinoensis (MAKIYAMA) (YOKOYAMA, 1922, p. 52, pl. 2, f. 11) has larger shell with lower spire and larger pleural angle and the vertical axials of greater number than the present subspecies.

Horizon.—Upper part of the Takanabe member (sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—Cliff at the entrance of the gorge 600 m. south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Family Galeodidae

Genus *Pugilina* SCHUMACHER, 1817

(type species: *Murex morio* LINNÉ by original designation)

Subgenus *Hemifusus* SWAINSON, 1840

(type species: *Fusus colossus* LAMARCK by original designation)

Pugilina (*Hemifusus*) *ternatanus* (GMELIN)

Pl. 8, Figs. 1 and 3

1791, *Murex ternatanus* GMELIN, *Syst. Nat.* ed. 13, p. 3554.
1843, *Murex ternatanus* GMELIN in LAMARCK's *Hist. Nat. Anim. san. Vert.* (DESHAYES ed.) Vol. 9, p. 513.
1847, *Pyrula ternatana*, REEVE, *Conch. Icon*, Vol. 4, *Pyrula* pl. 2, f. 6.
1928, *Hemifusus ternatanus*, YOKOYAMA, *Imp. Geol. Surv. Japan. Rep.* No. 101, p. 38, pl. 2, f. 12.
1942, *Hemifusus ternatanus*, YEN, *Proc. Mal. Soc. London*, Vol. 24, p. 231.
1951, *Hemifusus ternatanus*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 103, f. 10.
1954, *Hemifusus ternatanus*, KIRA, *Japan. Shells in Natural Color*, pl. 29, f. 13.

Material and measurements.—GK-L 6241 coll. T. MATSUMOTO et al. and 6327, coll. T. SHUTO. Fully grown shells. Preservation is favourable. Matrix is tuffaceous silty sandstone. max. height=152 mm., max. diameter=90 mm. on GK-L 6241.

Horizon.—Upper part of the Takanabe member (sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—Cliff at the entrance of the gorge 600 m. south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Pugilina (*Hemifusus*) cf. *tuba* (GMELIN)

1791, *Murex tuba* GMELIN, *Syst. Nat.* ed. 13, p. 3554.
1843, *Murex tuba*, GMELIN in LAMARCK's *Hist. Nat. Anim. san Vert* (DESHRYES ed.) Vol. 9, p. 507.
1838-40, *Fusus tuba*, KIENER, *Species général et iconography* Vol. 2.
1847, *Pyrula tuba*, REEVE, *Conch. Icon.* Vol. 4, *Pyrula*, pl. 9, f. 22.
1926, *Hemifusus ternatanus*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 1, Pt. 9, p. 372, pl. 43, f. 1.
1951, *Hemifusus tuba*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 103, f. 11.
1954, *Hemifusus tuba*, KIRA, *Japan. Shells in Natural Color*, pl. 29, f. 12.
1958, *Hemifusus tuba*, MAKIYAMA, *Palaeont. Soc. Japan. Spec. Pap.* No. 4, pl. 55, f. 1.

Material and measurements.—GK-L 6242. A single fractured specimen (coll. T. SHUTO). Matrix is calcareous fine sandstone. max. height=77mm., max. diameter=52 mm.

Remarks.—The specimen is characterized by its body whorl which has remarkably receding lateral surface below the prominently tuberculate peripheral carina, and may be safely identified to *P.* (*H.*) *tuba.*

Horizon.—Middle part of the Tano member (first-α fossil horizon to the Miyazaki group), Middle Miocene.

Locality.—Road side cutting at the northern extremity of Yusunokihashi village, Ikime mura, Miyazaki gun, Miyazaki Prefecture.

Superfamily Volutacea

Family Mitridae

Subfamily Mitrinae

Genus *Mitra* MARTYN, 1784

(type species: *Mitra tesselata* MARTYN by subsequent designation, DALL, 1905)

Subgenus *Nebularia* SWAINSON, 1840

(type species: *Mitra* (*Nebularia*) *contracta* SWAINSON=*Mitra abbatis* CHEMNITZ by original designation)

Mitra (*Nebularia*) *hanlayana* (DUNKER)

Pl. 13, Fig. 9

1877, *Mitra hanlayana*, DUNKER, *Malachoz. Blät.* Vol. 24, p. 70.
1951, *Mitra hanlayana*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 100, f. 10.
1952, *Mitra hanlayana*, KURODA and HABE, *Checklist and Bibliogr. Rec. Mar. Moll. Japan*, p. 67.
1954, *Mitra* (*Nebularia*) *inquinata*, KIRA, *Japan. Shells in Natural Color*, pl. 34, p, 5.

Material and measurements.—GK-L 6174; a single slightly fractured specimen (coll. T. MATSUMOTO et al.). Matrix is unconsolidated grey fine sandstone. max. height=54.5 mm., length of body whorl=34.6 mm., max. diameter=17.0 mm., spiral furrows=5 on each spire whorls.

Remarks.—The present specimen quite identical to *M.* (*N.*) *hanlayana* (DUNKER) except for the slight difference that the former has somewhat shorter body whorl and less numerous spiral furrows on the spire whorls. The former is within the range of variation of the species, because the species is rather variable concerning with the mentioned respects.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Subfamily Vexillinae

Genus *Uromitra* BELLARDI, 1887

(type species: *Mitra cupressina* BROCCHI by subsequent designation, COSSMANN, 1899)

Uromitra makiyamai n. sp.

Pl. 10, Figs. 3 and 4

Material and measurements.—Holotype GK-L 6233 (coll. T. SHUTO). A single almost perfect specimen from the unconsolidated grey fine sandstone at Yamaji.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P	whorls (N)	(PN)	axials I	II	III	IV	spirals pen.
6233	10.8*	7.1	5.7	3.6	65.7	52.8	33.3	37	27	2+	4	10	11	11	12	7

Diagnosis.—The shell is small in size attaining a little more than 10 mm. and oblong fusiform with the high and acute spire and the attenuated long base. The test is moderately thick. The protoconch is high and polygyrate, but the apex is fractured; the last two volutions are smooth and subcylindrical. The post-embryonic whorls are about four in number, slightly constricted below the suture, somewhat convexed roundly at the peripheral sides, and ornamented by the axial ribs and several spiral threads. The suture is slightly wavy and incised but neither channeled nor grooved. The body whorl is large, occupying about two-thirds of the total height, weakly constricted below the suture, somewhat convexed at the periphery, and gradually attenuated at the base to the long snout. The ornamentation is quite catagenetic. The axial ribs number ten, eleven, eleven, and twelve respectively on the first, second, third, and fourth whorl. They are strong and regularly spaced on the early whorls but are abruptly weakened and become irregular and crowded on the fourth whorl. On the early whorls they are strongest at the periphery and gradually weakened both upward and downward and almost disappear at the subsutural constriction. The ribs are wider than the interspaces on the early two whorls, narrower than the latter on the third, and again wider on the fourth. The spiral threads on the spire whorls are seven in number, of which the subsutural one (i.e. the thread just above the constriction) is the strongest and bordered by a deep groove below. They are much wider than the interspaces and cover the interspaces of the axials. On the body whorl they are hardly discernible except for a subsutural one due to the weakening. The aperture is long and narrow, occupying more than one half of the shell-height, obtusely flexured at the posterior end and very gradually attenuated anteriorly to the widely open canal, which is slightly retrocurrent. The inner lip is obliquely concave at the upper, almost vertical at the middle and the lower part, and covered by the narrow but distinct callus. The columellar plaits are four in number, of which the uppermost one is strong and horizontal, others decrease in size downward, and the lowest one is very oblique. The siphonal fasciole is not developed.

Comparison.—*Uromitra nakamurai ugariensis* MAKIYAMA (1931, p. 50, pl. 1, f. 8, 9) from the lower Kakegawa group is a close ally to the present species, but the former has somewhat higher spire and much more numerous axial ribs.

U. syntomum WOODRING (1928, p. 247, pl. 14, f. 19) from Boden, Jamaica remarkably resembles the present species, but the former is almost twice as large as the latter, and its body whorl is relatively small and ornamented by the distinct axials. Fur-

* Slightly fractured at the apex.

thermore its columellar plaits are stout and spirally extend outward to the neck.

U. cupressina (BROCCHI), the type species of the genus (COSSMANN, 1899, p. 169, pl. 8, f. 32, WENZ, 1944, p. 1289, text-f. 3671), from the Plaisancian of Bologna and other areas of Mediterranean region is also a close ally to the present species, but the former has slenderer shell and relatively small body whorl with more contracted base than the latter.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

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

Genus *Vexillum* (BOLTEN) RÖDING, 1798

(type species: *Vexillum plicatum* (BOLTEN) RÖDING=*Voluta plicarium* LINNÉ by subsequent designation, WOODRING, 1928)

Subgenus *Waimatea* FINLAY, 1927

(type species: *Mitra inconspicuum* HUTTON by original designation)

Vexillum (*Waimatea*) *kurakiensis* (HATAI and NISIYAMA)

Pl. 12, Fig. 5

1920, *Mitra fusiformis*, YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo* Vol. 39, Art. 6, p. 47, f. 6.
1952, *Mitra kurakiensis* HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser 2, Spec. Vol. No. 3, p. 215.
1954, *Mitra kurakiensis*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap.* No. 2, p. 23, pl. 3, f. 6.

Material and measurements.—GK-L 6175. A single fractured specimen collected by T. SHUTO. It is available for specific identification being provided with the important characteristics, although the part of the shell is fractured. max. height= 21 mm., max. diameter=8.5 mm.

Remarks.—"*Mitra kurakiensis*" HATAI and NISIYAMA from the Koshiba formation of Kanagawa Prefecture is quite identical to the present specimen. The revised description based on YOKOYAMA's specimen and my own one is given below:

The shell is moderate in size, fusiform, equally attenuated upward and downward. The spire is acutely high conical. The whorls are slightly and roundly convex and separated by the narrowly impressed suture. The body whorl is large and regularly rounded at the side and attenuated at the base to the moderately long snout, where any fasciole is not developed. The aperture is narrow, long, weakly channeled at the posterior end, and slightly narrowed below to the widely open short canal. The outer lip is vertical, thin, sharp, simple, and smooth both inside and outside. The inner lip is somewhat oblique especially at the upper part and covered by the thin callus. The columellar plaits are four in number at the upper part of the columella and they are equally spaced and decrease in size downward. The surface is almost smooth and polished except for the obsolete spiral lines at the snout of the body whorl and the minute lines of growih on the remainder surface.

Being devoid of the siphonal fasciole the present species is readily distinguished from any subgenus of *Mitra*, which has distinct basal fasciole.

Comparing with the type species of *Waimatea*, the present specimen has weaker columellar plaits and higher spire but there is no doubt that the latter belongs to this subgenus, which is the Australo-New Zealandian element, on the basis of the resemblance in the general character, especially in the outline of the shell, surface ornamentation, and in the columellar plaits.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Family Volutidae

Subfamily Volutinae

Genus *Fulgoraria* SCHUMACHER, 1817

(type species: *Fulgoraria chinensis* SCHUMACHER=*Voluta rupestris* GMELIN by subsequent designation, GRAY, 1847)

Subgenus *Psephaea* CROSSE, 1871

(type species: *Voluta concinna* BRODERIP by monotypy)

Fulgoraria (*Psephaea*) *cancellata cancellata* KURODA and HABE

Pl. 12, Figs. 1, 2 and 8

1950, *Fulgoraria cancellata* KURODA and HABE, *Illust. Catalogue Japan. Shells*, No. 5, p. 34, pl. 5, f. 11.
1952, *Fulgoraria cancellata*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 58.
1954, *Fulgoraria cancellata*, KIRA, *Japan, Shells in Natural Color*, pl. 32, f. 7.

Material and measurements.—GK-L 6176 to 6178; coll. T. MATSUMOTO et al.; 7199-80, coll. T. SHUTO. The adult specimens were more or less fractured in collecting from the beds, but the immature ones are almost perfect in preservation. Matrix is unconsolidated grey fine sandstone at Hagenoshita and tuffaceous silty sandstone at Tôriyama.

Specimen GK-L	H (mm.)	W (mm.)	<P (degrees)	numb. whorls (N)	(PN)	axials I	II	III	IV	V	spirals I
6176	84.3*	39.4	33	—	4	—	—	—	—	29	—
6177	64.5	25.9	40	2+	4	12	12	14	22	—	—
6178	121.0	41.4	34	2.5	6	15	15	18	20	29	8
6180	29.4	13.4	41	2.5	3	13	13	15	—	—	8

Remarks.—Although the morphologic character of *Fulgoraria* and *Psephaea* quite agrees with each other as is well known, their protoconchs does not necessarily conform. The protoconch is extremely large and dome-shaped in *Fulgoraria* and moder-

* Fractured at the spire.

ately large and cylindrical in *Psephaea* so far as the type species is concerned. Evaluating this feature, I can not agree with the opinion that *Psephaea* is a synonym of *Fulgoraria* or that, on the contrary, the two represent quite different genera respectively. I am inclined to consider that *Psephaea* is a subgenus of *Fulgoraria*.

The present species is an ally of *F.* (*P.*) *hirasei* (SOWERBY), but the former is distinguished easily from the latter by its smaller size and more numerous and elevated axials. The two differ not only in morphology but also in geographical distribution in the sea water at present day; that is to say, on one hand *F.* (*P.*) *hirasei* dwells in the area from off Kôchi northernly to off Shizuoka, and on the other hand *F.* (*P.*) *cancellata* lives in the sea off Kôchi and the south. There is probably some relation between the morphological differentiation and the habitat separation.

Horizon.—Lower and upper part of the Takanabe member (fourth and sixth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lower Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; cliff at the entrance of the gorge 600 m south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Fulgoraria (*Psephaea*) *cancellata koyuensis* n. subsp.

Pl. 11, Figs. 3 and 6, Text-fig. 12

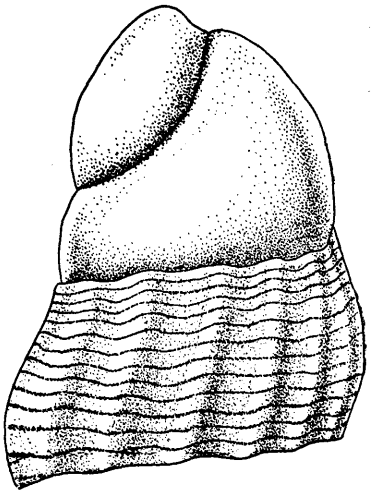
Material and measurements.—Holotype GK-L 6182 (loc. Tsuma, coll. T. SHUTO); paratype GK-L 6181 (loc. Tsuma, Coll. T. SHUTO). Perfect specimen GK-L 6182 is designated as the holotype, although it is young, because the mature specimen GK-L 6181 is fractured.

Specimen GK-L	H (mm.)	D (mm.)	D/H (%)	numb. whorls (N)	(PN)	axials I	II	III	spirals I
6181	46.5*	20.8	——	——	4.5+	10	11	13	13
6182	17.6	8.1	46.0	2.25	1.5	12	—	—	13

Diagnosis.—The shell is moderately large in size attaining about 70 mm. in height and elongate fusiform in outline. The spire is about a quarter of the total height of the shell and high conical. The protoconch is smooth, moderately large, subcylindrical, composed of two and one quarter volutions. The first volution is very small, cap-shaped, and extremely oblique, the second is large globose, and the remainder part is low and subcylindrical. They are separated one another by the shallow and depressed suture. The post-embryonic whorls are separated from the embryonic one by the definite axial ridge, about five in number, axially plicated, and spirally lirated. The axials on the first whorls are sharp, slightly retrrcurrent, much narrower than the interstices, extending from the lower suture to the upper, and ten to twelve in number. They increase slightly in number on the later whorls and keep their relative strength untill the penultimate whorl. However they, thereafter, become abruptly weak and rather irregular on the last whorl, on which they hardly reach the upper suture and faded out on the upper part of the basal surface. The spirals are thirteen

* Fractured at the apex.

on the first whorl, of which the upper three just below the subsutural one are smaller. All the spirals are regularly spaced and wider than the interspaces on the early whorls, but on the later whorls they are narrower than the interspaces. The aperture is narrow, acutely pointed at the posterior end, and gradually narrowed anteriorly to the canal which is widely open, oblique, and short. The inner lip is covered by the distinct callus. One sharp columellar plait is at the lower part of the columellar lip.



Text-fig. 12. Protoconch and the early post-nuclear whorl of *Fulgoraria (Psephaea) cancellata koyuensis* n. subsp. holotype GK-L 6182, loc. Tsuma.
Unit bar indicates 0.5 mm.

Comparison.—The present subspecies differs from the species in having more numerous spirals, stronger and sharper axials of less number, and only one columellar plait. Except for these differences the two are quite identical in general morpholcgy. The stratigraphic position of the present subspecies is remarkably lower than the lowest horizon of *F. (P.) cancellata cancellata* in the Miyazaki group.

F. (P.) totomiensis MAKIYAMA (1927, p. 77, pl. 3, f. 17) is allied to the present subspecies especially in the features of columellar lip, but the latter is distinguished from the former which has the apparently shouldered whorls ornamented by much more numerous spirals than the latter.

Horizon.—Middle part of the Tsuma member (third fossil horizon of the Miyazaki group), Upper Miocene.

Locality.—Cutting at the approach to Tsuma bridge, Yamasumi, Saito City, Miyazaki Prefecture.

Fulgoraria (Psephaea) daviesi FULTON

Pl. 13, Figs. 8 and 10

1908, *Voluta megaspira*, HIRASE, *Conch. Mag.* Vol. 2, p. 215, pl. 33, f. 126.
1938, *Voluta (Psephaea) daviesi* FULTON, *Proc. Malach. Soc. London*, Vol. 23, No. 1, p. 56, pl. 3, f. 4, 4a.
1950, *Fulgoraria daviesi*, KURODA and HABE, *Illust. Catalogue Japan Shells*. No. 5, p. 33, pl. 7, f. 5.
1951, *Fulgoraria daviesi*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 112, f. 7.
1954, *Fulgoraria daviesi*, KIRA, *Japan. Shells in Natural Color*, pl. 32, f. 10.

Material and measurements.—A single specimen, GK-L 6183. The specimen was obtained from the calcareous nodule intercalated in the silty sandstone. Preservation is not perfect. Coll. T. SHUTO. max. height=90.5 mm., max. diameter=53.7 mm., number of spirals=16 on the penultimate whorl, number of axials=14 on the penultimate whorl.

Remarks.—Total height of the shell, judging from the preserved part, may be

about 125-130 mm. The large specimen, though imperfect in preservation, is characteristic enough to be compared with *F.* (*P.*) *daviesi* FULTON having about sixteen spirals and fourteen axial plicae on the penultimate whorl and rather convexed whorls.

Horizon.—Uppermost part of the Kawabaru member (second fossil horizon of the Miyazaki group), Middle Miocene.

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

Fulgoraria (*Psephaea*) *hyugaensis* n. sp.

Pl. 12, Figs 3, 4 and 6, Pl. 13, Fig. 2

Material and measurements.—Holotype GK-L 6183; paratypes GK-L 6184 and 4652. GK-L 6183 and 6184 came from the grey siltstone at Hagenoshita and GK-L 4652 was obtained from the silty sandstone at Kushiki (coll. T. SHUTO). The mature specimen GK-L 6184 is fractured and GK-L 4652 is deformed. This is the reason why the immature perfect specimen GK-L 6183 is selected as the holotype.

Specimen GK-L	H (mm.)	Sp (mm.)	D (mm.)	Sp/H (%)	D/H (%)	<P (degrees)	numb. whorls (N)	(PN)	axials I	II	III	columellar plaits
6183	21.1	4.2	8.6	19.9	40.8	42	2.25	3	15	15	15	1
6184	40.0*	10.7	12.7	26.8	31.8	38	2	3.5	15	15	15	1
4652	27.1	6.3	ca 10.1	23.4	36.9	43	2.5	3	14	14	14	1

Diagnosis.—The shell is moderately small in size and fusiform with the acute spire and the long base. The test is moderately thick but not solid. The protoconch is smooth, globular, and consists of about two to two and a half volutions, of which the first is very oblique, small, and cap-shaped tip, the second is large and globose, and the remainder is subcylindrical. They are separated one another by the shallowly impressed suture and the lateral boundary between the protoconch and the post-embryonic whorl is not sharp but rather gradual. The post-embryonic whorls are about four in number at the adult stage; they are roundly angulated at the upper third of the spire whorl and the shoulder is concave below the obsolete subsutural band; the surface below the angulation is slightly convex and slightly receding. The body whorl is large and gradually contracted below to the snout. The surface of the whorl is ornamented by the axial folds which are sharp and strong at the angulation, once weakened upward at the concave part of the shoulder and again distinct at the subsutural band showing rather the granulose appearance; They also weakened gradually downward to the lower suture and disappear on the basal surface of the body whorl. The axial folds keep their sharpness and strength at the periphery on all the whorls except for the latest part of the body whorl where they are somewhat weakened. They are somewhat narrower than the interspaces and numbered fourteen to fifteen on the spire whorls. The aperture is long, rather narrow, occupying more than half of the shell height, bluntly pointed at the posterior end,

* Fractured at the apex.

and gradually contracted anteriorly. The outer lip is sharp, almost vertical, and simple. The inner lip is slightly oblique at the parietal part and has one distinct spiral plait at the lower part of the columellar lip. The callus is thin but sharply margined. The canal is moderate in length, widely open, and truncated at the end. The spiral sculpture is not developed except for the numerous minute lines, which cross over the axials.

Comparison.—The present species resembles *Fulgoraria* (*Psephaea*) *kamakurensis* OTUKA (1949, p. 204, pl. 13, f. 7) from the Koshiba formation of Kanagawa Prefecture in size, ornamentation, and protoconch. The former, however, is readily distinguished from the latter in having the roundly angulated whorls and one columellar plait instead of the roundly convexed whorls and four columellar plaits of the latter species.

Besides the registered specimens another one GK-L 4499 collected at Nagano is probably identified to this species on the basis of the shouldered whorl and the resembling axials, although it is deformed and imperfectly preserved.

Horizon.—Upper part of the Kawabaru member (second fossil horizon) and lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Middle Miocene to Mio-Pliocene transition.

Localities.—Road side, 300 m. north of Kushiki bridge, Kushiki, Kamihokita, Saito City; Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Lyria* GRAY, 1847

(type species: *Voluta nucleus* LAMARCK by original designation)

Subgenus *Paralyria* n. subgen.

(type species: *Lyria mizuhonica* MAKIYAMA)

Concerning with the type species there is no vagueness between *Lyria* GRAY, 1847 and *Harpella* (GRAY) H. and A. ADAMS, 1858.

Lyria Gray with the type species *Voluta nucleus* LAMARCK is characterized by rather the low spire composed of the rounded whorls, close and fine axial ribs, and a few varices on the body whorl. While *Harpella* (GRAY) H. and A. ADAMS with the type *Voluta costata* SWAINSON has the high spire composed of the concavely and horizontally shouldered whorls, coarse and prominent axial ribs which are granulated at the angulation and do not reach the upper suture, and the distinct spiral threads on the peripheral surface and lirae on the basal slope.

Lyria mizuhonica MAKIYAMA, based on the Pliocene specimen from Shizuoka Prefecture, has, however, rather the high spire composed of roundly convexed whorls, the steeply sloped and slightly concave shoulder, the coarse and large axial ribs extending from the lower suture to the upper one, and no spirals except for the fine striation. In other words, it represents rather an intermediate form between *Lyria* and *Harpella*, but show somewhat closer relation to *Lyria*. Several species closely allied to *L. mizuhonica* are known from the Caenozoic formations in the Mediter-

ranean region, Pakistan, Indonesia, and Japan. They comprise a peculiar and tight group among the species of *Lyria* (s. l.) and the gap between it and *Lyria* (s. s.) or *Harpella* is not necessarily covered by the intermediate species. Under such situation I am inclined to consider that a new subgeneric name *Paralyria* should be introduced to this group.

Diagnosis of the subgenus.—The shell is moderate in size and ovoid-biconical with rather the high and acuminated spire and the attenuated base. The test is thick and solid. The protoconch is smooth, depressed, wider than high, and composed of about two volutions. The first one is very small, depressed, and horizontal, and the second is large and convexed at the side. The post-embryonic whorls are about five in number, weakly but definitely shouldered below the suture, and ornamented by the coarse and strong axial ribs and the fine spiral striae. The shoulder is slightly concave and the lateral surface is sloping outward. The axials are strongest at the rounded angulation and gradually weakened above to the suture and almost unchanged their size below to the suture. The suture is wavy and impressed or rather channeled and especially deeply channeled on the body whorl. The body whorl is large and concavely attenuated below. The axials disappear on the basal slope. The siphonal fasciole is definitely developed but not umbilicate. The aperture is long occupying more than sixty percent of the shell height, bluntly pointed and channeled at the posterior end and gradually attenuated to the widely open canal without any definite boundary. The outer lip is varicose outside, smooth inside, and slightly antecurrent. The inner lip is oblique, flexuous, and covered by the distinct callus with almost free edge. Many spiral plaits are developed on the columella, of which the second one from the lowest is strongest and the others are gradually weakened upward. The end of the canal is moderately sinused.

Lyria (*Paralyria*) *mizuhonica* MAKIYAMA

Two forms of *Lyria* (*Paralyria*) were obtained from the Miyazaki group; the one quite agrees with *Lyria mizuhonica* and the other conforms to *Voluta koyuana* YOKOYAMA, which was originally described on the basis of the juvenile specimen. These two forms, as indicated by the measurements and figures, are very closely allied to each other and only delicate difference is in the spiral ornamentation, which in *koyuana*, especially on the adult specimens, consists of the minute and close striae and widely spaced, more distinct grooves but in *mizuhonica* only of the obsolete striation. Herein I consider that "*Voluta koyuana*" is a subspecies of *L. mizuhonica* considering their stratigraphic occurrence besides the morphologic defference.

Lyria (*Paralyria*) *mizuhonica* (s. l.) is closely allied to *Lyria jugosa* (SOWERBY) (=*L. edwardsi* (D'ARCHIAC)) occuring in the Neogene formations of Indonesia and Pakistan, especially to the specimens having the rounded whorls. The former, however, is distinguished from the latter in its axials of smaller number and the body whorl, which is most convexed at higher position than in *L. jugosa*.

Lyria (Paralyria) mizuhonica mizuhonica (MAKIYAMA)

Pl. 12, Figs. 11 and 12

1927, *Lyria mizuhonica* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. 3, Vol. 3, No. 1, Art. 1, p. 76, pl. 3, f. 12, 13.

1952, *Lyria mizuhonica*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 212.

Material and measurements.—GK-L 6187 (coll. T. SHUTO). A single perfect specimen came from the tuffaceous silty sandstone at Tôriyama.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	V
6187	42.3	33.0	20.0	78.0	47.3	56	54	2.33	5.25	12	12	13	12	9

Horizon.—Upper part of the Takanabe member (sixth fossil horizon of the Miyazaki group), Lower Pliocene.

Locality.—Cliff at the entrance of the gorge 600 m south of Tôriyama, Kawaminami machi, Koyu gun, Miyazaki Prefecture.

Lyria (Paralyria) mizuhonica koyuana (YOKOYAMA)

Pl. 12, Figs. 7, 9 and 10, Text-fig. 13

1928, *Voluta koyuana* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 2, Pt. 7, p. 345, pl. 66, f. 13.

1952, *Volutocorbis (Ternivoluta) koyuana*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 282.

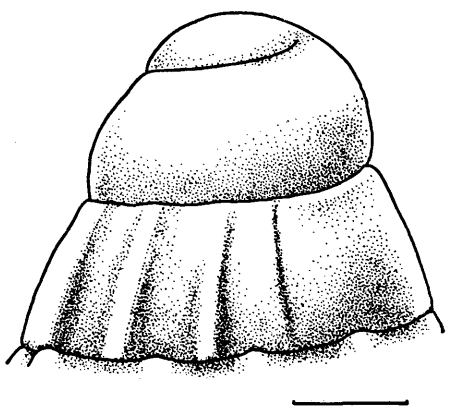
1959, *Lyria koyuana*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap.* No. 5, pl. 64, f. 13.

Material and measurements.—GK-L 6188 (mature), coll. T. MATSUMOTO et al. and 6189 (immature) coll. T. SHUTO. Preservation is favourable. Matrix is unconsolidated grey fine sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	V
6188	ca 39.5	31.1	19.3	80.9	48.8	—	56	——	3.5+	—	—	13	11	8
6189	30.5	24.6	13.8	80.8	45.2	59	55	2.25	4.5	11	14	13	12	

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.



Text-fig. 13. Protoconch and the early post-nuclear whorls of *Lyria (Paralyria) mizuhonica koyuana* (YOKOYAMA).
Unit bar indicates 0.5 mm.

Family Cancellariidae

Genus *Cancellaria* LAMARCK, 1799

(type species: *Voluta reticulata* LINNÉ by monotypy)

Subgenus *Merica* H. and A. ADAMS, 1854

(type species: *Cancellaria (Merica) melanostoma* SOWERBY by subsequent designation, COSSMANN, 1899)

Cancellaria (Merica) reevei laticostata (LÖBBECKE)

Pl. 13, Fig. 12, Text-fig. 4a

1855, *Cancellaria laticostata* LÖBBECKE, TRYON, *Man. Conch.* Vol. 7, p. 74, pl. 4, f. 52.
1936, *Cancellaria laticostata*, SUZUKI and ICHIMURA, *Trans. Palaeont. Soc. Japan*, No. 20, p. 725, pl. 40, f. 13, 13a.
1940, *Cancellaria reevei laticostata*, HATAI and NISIYAMA, *Saito-Hoonkai Mus. Res. Bull.* 19, p. 127, pl. 5, f. 5.
1952, *Cancellaria laticostata*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 43.
1954, *Cancellaria (Merica) laticostata*, KIRA, *Japan, Shells in Natural Color*, pl. 31, f. 22.

Material and measurements.—GK-L 6190 and 6204. Two immature specimens came from the unconsolidated grey fine sandstone at Hagenoshita (6190) and Nihonmatsu (6204). Preservation is perfect. Coll. T. SHUTO.

Specimen GK-L	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	numb. whorls (N)	(PN)	axials I	II	III	spirals I
6190	9.5	7.2	6.3	75.7	66.3	65	2.5	3	10	11	13	5

Remarks.—The coarsely cancellate specimens at my hand are quite identical to the juvenile specimens of the living species.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lower Pliocen.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; small cutting along the highway, foot of the hill at Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Subgenus *Sydaphera* IREDALE, 1929

(type species: *Sydaphera renorata* IREDALE by original designation)

Cancellaria (Sydaphera) spengleriana (DESHAYES)

Pl. 11, Figs. 4 and 8. Pl. 13, Figs. 13 and 14, Text-fig. 14

1843, *Cancellaria spengleriana*, DESHAYES, *Anim. San Vert.* Vol. 9, p. 415.
1855, *Cancellaria spengleriana*, SOWERBY, *Thes. Conch.* Vol. 2, p. 429, sp. 2.
1856, *Cancellaria spengleriana*, REEVE, *Conch. Icon.* Vol. 10, *Cancellaria*, pl. 3, sp. 11.
1861, *Cancellaria spengleriana*, CROSSE, *Jour. de Conch.* Tom. 6, p. 235.
1871, *Cancellaria spengleriana*, LISCHKE, *Japan, Meer. Conch.* Bd. 2, p. 55.
1882, *Cancellaria spengleriana*, DUNKER, *Index Moll. Mar. Japon.* p. 103.
1885, *Cancellaria spengleriana*, TRYON, *Man. Conch.* Vol. 7, p. 67, pl. 1, f. 2, 3.
1886, *Cancellaria spengleriana*, WATSON, *Challenger Rep. Gastr.* p. 273.

1887. *Cancellaria spengleriana*, LÖBBECKE, *Syst. Conch. Cab. in* MARTINI and CHEMNITZ Vol. 4, Pt. 4, p. 25, pl. 7, f. 1-8.
1906, *Cancellaria spengleriana*, TOKUNAGA, *Jour. Coll. Sci. Imp. Univ. Tokyo* Vol. 21, Art. 2, p. 11, pl. 1, f. 15.
1920, *Cancellaria spengleriana*, YOKOYAMA, ibid. Vol. 39, Art. 6, p. 44, pl. 2, f. 15.
1922, *Cancellaria asprella* var. *reeveana*, YOKOYAMA, ibid. Vol. 44, Art. 1, p. 46, pl. 2, f. 2.
1927, *Cancellaria spengleriana*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 3, No. 1, Art. 1, p. 84.
1934, *Cancellaria spengleriana*, OTUKA, *Bull. Earthq. Res. Inst.* Vol. 12, No. 3, p. 632, pl. 50, f. 99.
1940, *Cancellaria spengleriana*, HATAI and NISIYAMA, *Saito Hoonkai Mus. Res. Bull.* No. 19, p. 128, pl. 5, f. 6.
1951, *Cancellaria spengleriana*, (HIRASE) TAKI, *Illust. Handb. Shells*, pl. 112, f. 1.
1952, *Sydaphera spengleriana*, KURODA and HABE, *Check List and Bibliogr. Rec. Mar. Moll. Japan*, p. 43.
1954, *Sydaphera spengleriana*, KIRA, *Japan, Shells in Natural Color*, pl. 31, f. 20.
1954, *Cancellaria* (*Sydaphera*) *spengleriana*, TAKI and OYAMA, *Palaeont. Soc. Japan Spec. Pap.* No. 2, p. 24, pl. 3, f. 2, 3.
1954, *Cancellaria* (*Merica*) *laticostata*, TAKI and OYAMA, ibid. p. 24, pl. 22, f. 2.

Material and measurements.—GK-L 6195 and 6196. Two specimens came from one and the same locality. Preservation is almost perfect. Matrix is unconsolidated grey fine sandstone. Coll. T. MATSUMOTO et al.

Specimen	loc.	H (mm.)	Bd (mm.)	D (mm.)	Bd/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	V	spirals primary
GK-L 6195	Hage.*	28.3	21.7	15.1	76.7	53.4	48	59	0.5+	4.5	19	18	18	16	—	4
G 25400-a	liv. Fuk.**	22.6	16.9	12.7	74.6	56.1	47	60	3	4	17	18	19	11	—	4
G 25400-b	liv. Fuk.	28.3	21.5	15.8	76.0	55.9	58	62	2	5	19	17	15	13	10	3-4

Remarks.—*Cancellaria spengleriana* DESHAYES is treated as *Sydaphera* by many authors, but the former has strong siphonal fasciole, which is not distinctly developed on the type species of *Sydaphera*. Except for his difference the two quite agree with each other and hereupon I am inclined to consider *C. spengleriana* is included in *Sydaphera*.

C. (*S.*) *spengleriana* is very variable in form; the typical specimens have the quadrate spire whorls with almost horizontal shoulder, very coarse, prominent, and oblique axials of small number; while a few specimens, both living and fossil, are characterized by the slender outline with sloping shoulder and by more numerous and less oblique axials than the typical forms (cf. G 25400-a, slender form; G 25400-b, typical form: see measurements and figures). The present fossil specimens from the Miyazaki group conform to the slender form. Considering the wide range of the variation of the species, I am inclined to include the present specimens into the species.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group). Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

* Hagenoshita.
** Genkai off Fukuoka.

Cancellaria (*Sydaphera*) *pristina pristina* (YOKOYAMA)

1923, *Mitra pristina* YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 45, Art. 2, p. 8, pl. 1, f. 8-12.
1927, *Cancellaria pristina*, MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B. Vol. 3, No. 1, Art. 1, p. 85, pl. 4, f. 3, 4.
1940, *Cancellaria pristina*, HATAI and NISIYAMA, *Saito Hoonkai Mus. Res. Bull.* No. 19, p. 125, pl. 5, f. 1, 4.
1952, *Cancellaria* (*Merica*) *pristina*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 183.
1957, *Cancellaria pristina*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap.* No. 3, pl. 9, f. 8-12.

Material and measurements.—GK-L 6199. A single imperfect specimen. Although it is imperfect, it is characteristic enough to be identified to the mentioned species having the delicately ornamented slender whorl and the half-moon shaped aperture with three columellar plaits. max. height=15.5 mm., max. diameter=9.6 mm. Coll. T. SHUTO.

Remarks.—I consider that the present species should be classified into the subgenus *Sydaphera* inspite of the apparent resemblance of the present species to *Merica*. The reason will be described in the next item.

Horizon.—The Tonogôri member (third fossil horizon of the Miyazaki group), Upper Miocene.

Locality.—Road side cutting on the north slope of Tonogôri hill, Tonogôri, Saito City, Miyazaki Prefecture.

Cancellaria (*Sydaphera*) *pristina acutiplicata* n. subsp.

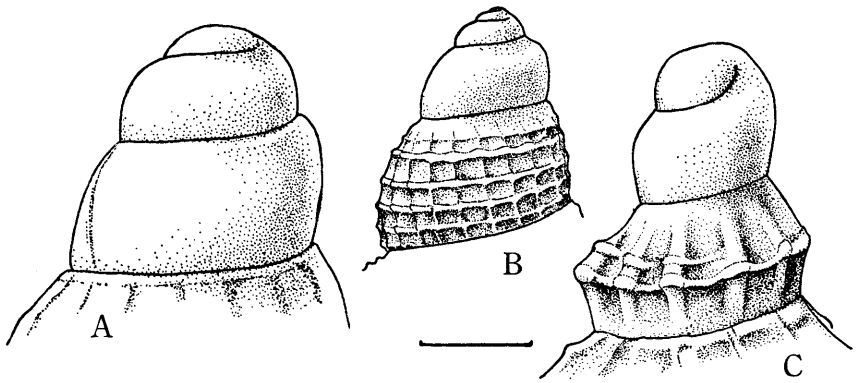
Pl. 10, Fig. 6, Pl. 13, Figs. 4 and 5, Text-fig. 14

Material and measurements.—Holotype: GK-L 6197; paratypes: GK-L 6198 and 6232. All the specimens came from the unconsolidated grey fine sandstone at Hagenoshita (coll. T. MATSUMOTO et al. 6197-6198, T. SHUTO 6232). Preservation is perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P (N)	numb. whorls (PN)	axials I	II	III	IV	spirals primary
6197	23.0	17.2	13.9	11.8	74.7	60.4	51.3	37	53	3.5	4	30	24	20	14	6
6198	18.4	13.3	10.6	9.0	72.3	57.6	48.9	44	50	3.5	3.75	23	21	16		6

Diagnosis.—The shell is moderate in size and fusiform with rather high and acute spire and the attenuated long base. The test is moderately thick, but not solid. The protoconch is smooth, conical, and composed of three and a half volutions. The first volution is very small and depressed tip; the second is small, round, and depressed; the third is large and regularly rounded at the upper third and subcylindrical at the remainder two-thirds. The end of the protoconch is not sharply defined by any ridge or furrow but rather obscurely bordered by the obsolete axials which indicate the beginning of the post-embryonic whorl. The post-embryonic whorls are about four in number, roundly convexed at the early stage, and sharply shouldered at the last stage. The body whorl is large occupying about seventy five percent of the shell height, distinctly shouldered below to the suture, and attenuated

at the base to the snout. The shoulder is almost flat; the peripheral surface below sharp angulation is slightly convex and vertical. The surface is ornamented by the the numerous axials and the spirals. The axials are very fluctuating in number and in disposition on the early whorls; that is to say, on the holotype specimen they are very weak, more than thirty undulations of low relief on the first whorl and become distinct on the second whorl numbering about twenty-four; while on the paratype specimen GK-L 6198 they are very distinct even on the first whorl numbering twenty-three. Thereafter they decrease in number gradually to fourteen to sixteen of the last whorl, but increase in strength becoming prominent and sharp. They are somewhat narrower than the roundly excavated interspaces. The primary spirals are almost equi-dimensional, distinct on the first whorl on all the specimens, and



Text-fig. 14. Protoconchs and the early post-nuclear whorls of *Cancellaria* (*Sydaphera*) *spengleriana* (DESHAYES) (A), *C.* (*S.*) *pristina acutiplicata* n. subsp. (B), and *Cancelrana lischkei pauciplicata* n. subsp. (C).
Unit bar indicates 0.5 mm for A and C and 1 mm for B.

stronger than the axials. The secondaries and the tertiaries appear respectively on the second and third whorl. The primaries cross over the axials forming the nodules at the crossings except on the peripheral angulation where they are rather tuberculose. The primaries are almost as equally strong as the axials on the third whorl but on the last whorl they are much weaker than the latter. The suture is definitely incised but not canaliculate. The aperture is half-moon shaped, weakly channeled at the posterior end, and attenuated below to the short and wide canal. The outer lip is thickened, slightly antecurrent, and provided with nine teeth inside. The inner lip is composed of the oblique parietal one and the vertical columellar one and covered by the distinct callus. The collumellar plaits are oblique and three in number, of which the lowest one is the weakest, situated close to the middle one, and defines the lower end of the columella. The siphonal fasciole is weak.

Comparison.—The present subspecies becomes ventricose at the latest stage of growth showing the ditinct shoulder and the prominent sharp axials. These are not diagnostic to *Merica* H. and A. ADAMS but to *Sydaphera* IREDALE. According to the original description *Sydaphera* has two columellar plaits, but the present species and other Japanese ones are provided with three plaits, of which the lowest one is the

weakest and forms the marginal ridge of the columella.

The present subspecies quite agrees with the species in the morphologic characters of the protoconch to penultimate whorl, but the former has at its latest stage of growth the distinct shoulder and prominent axials of small number. The detailed examination of many specimens, however, clarified that the populations of *C. pristina pristina* contain a few specimens indicating typical features of the present subspecies. Herein I am inclined to conclude that the species is better to be included in *Sydaphera*.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Trigonostoma* BLAINVILLE, 1827

(type species: *Delphinula trigonostoma* LAMARCK by tautonomy)

Subgenus *Scalptia* JOUSSEAUME, 1887

(type species: *Cancellaria obliquatum* LAMARCK by original designation)

Trigonostoma (*Scalptia*) *kurodai* (MAKIYAMA)

Pl. 13, Figs. 7 and 11

1923, *Cancellaria crispata*, YOKOYAMA, *Jour. Coll. Sci. Imp. Univ. Tokyo*, Vol. 45, Art. 2, p. 7, pl. 1, f. 3.
1926, *Cancellaria bocageana*, YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo*, Sec. 2, Vol. 1, Pt. 9, p. 333, pl. 38, f. 10.
1927, *Trigonostoma kurodai* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 3, No, 1, Art. 1, p. 85, pl. 4, f. 8.
1938, *Trigonostoma* (*Scalptia*) *thomasiana*, OOSTINGH, *De Ingenieur in Ned.-Indië*, for 1938, No. 7, p. 109, pl. 6, f. 121a, 121b.
1940, *Trigonostoma kurodai*, KANEHARA, *Imp. Geol. Surv. Japan Bull*, Vol. 27, No. 2, p. 18, pl. 5, f. 1a, b.
1940, *Cancellaria kurodai*, HATAI and NISIYAMA, *Saito Hoonkai Mus. Res. Bull.* No. 19, p. 122, pl. 5, f. 11.
1952, *Trigonostoma* (*Scalptia*) *kurodai*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 182.
1957, *Trigonostoma kurodai*, MAKIYAMA, *Palaeont. Soc. Japan Spec. Pap.* No. 3, pl. 9, f. 3.
1958, *Trigonostoma kurodai*, MAKIYAMA, ibid. No. 4, pl. 50, f. 10.

Material and measurements.—GK-L 6191 and 6192 (coll. T. MATSUMOTO et al.) and 6193 and 6194 (coll. T. SHUTO). All the specimens came from one and the same locality. Matrix is unconsolidated grey fine sandstone. Preservation is perfect.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	spirals
6192	13.3	10.5	7.8	——	78.9	58.6	——	—	64	3	3.5	13	13	12	—	3
6193	14.7	11.1	8.7	8.9	75.6	59.2	60.5	61	66	3	4	12	12	11	11	—
6194	7.3	5.5	4.2	4.8	75.3	57.4	65.6	—	62	3	3	13	12	12	—	3

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group). Mio-Pliocene transition.

Locatity.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Cancelrana* PALMER, 1937

(type species: *Pleurotoma* (*Taranis*) *finexa* G. HARRIS by original designation)

Cancelrana lischkei pauciplicata n. sp.

Pl. 9, Figs. 2 and 6, Pl. 11, Figs. 5 and 9, Text-fig. 14

Material and measuremens.—Holotype GK-L 6206 (loc. Hagenoshita, coll. T. MATSUMOTO et al.); paratypes GK-L 6200 and 6201 (loc. Nihonmatsu, coll. T. SHUTO), 6202 and 6203 (loc. Hagenoshita, coll. T. SHUTO). Preservation is perfect. Matrix is unconsolidated grey fine sandstone.

Specimen GK-L	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<A (degrees)	<P	numb. whorls (N)	(PN)	axials I	II	III	IV	V
6200	ca 7.9	4.7	2.9	4.1	59.5	36.7	51.9	50.0	32.9	—	4+	—	11	11	11	12
6201	5.9	3.55	2.2	3.4	60.2	37.3	57.6	50.7	41.9	2	4	10	11	11	11	—
6202	7.4	4.3	2.8	3.7	58.0	37.8	49.9	48.9	38.6	2	5	9	9	10	11	11
6203	5.7	3.35	1.95	3.2	58.6	34.8	56.1	47.9	37.7	2	4	11	11	11	11	—
6205	6.1	3.6	2.3	3.4	59.0	37.7	54.7	48.0	36.3	2	4	9	10	11	12	—

Diagnosis.—The shell is small in size and bucciniform with the high and acute spire and the moderately short base. The protoconch is small, smooth, subcylindrical, much narrower than high, and composed of about two volutions; the first one is globose and slightly oblique, and separated by rather the deep suture from the second, which is subcylindrical and forms axially elongated helicoid. The post-embryonic whorls are about five in number, convexed and biangulated at the periphery, ornamented by the axial plicae and the spiral lirae. The shoulder, between the upper suture and the upper angulation, is gently sloped and moderately convex on the early whorls but slightly convex on the later whorls; the surface between two angulations is almost vertical and concave; the surface below the lower angulation is concave and remarkably receding. The suture is apressed, slightly wavy, and defined by a supra-sutural lira. The body whorl is large occupying about sixty percent of the total height of the shell, triangulated at the side, and regularly and gradually attenuated at the base to the snout. The axial plicae are nine to ten in number on the first whorl and gradually increased later to eleven to twelve on the fifth whorl. They are sharply elevated and narrower than the roundly excavated interspaces. The spiral ornamentation on the penultimate (fourth) whorl consists generally of four lirae; They are moderate supra-sutural one, two strong ones on the angulations, and another moderate one on the shoulder. This ornamentation design starts on the second whorl. Some specimens, especially those from Nihonmatsu, have in addition to these lirae the interstitial moderate lira between the peripheral angulations, and a weak one on the shoulder below the suture. The aperture is rather small, half-moon shaped, bluntly angled at the posterior end, and gradually narrowed

to the very short, spoon-like canal. The outer lip is sharp, slightly recurrent, and provided with three to four small folds inside. The inner lip consists of the very short and oblique parietal one and the long and almost vertical columellar one. Distinct two plaits are developed at about the middle of the columella. The callus is very thin. The siphonal fasciole is not developed.

Comparison.—The present subspecies includes two populations; one is obtained at Hagenoshita (fourth fossil horizon) and the other at Nihonmatsu (fifth fossil horizon). The specimens of former population generally have not the interstitial lira between the peripheral angulations, while those of the latter are provided with it without any exception though other features quite conform. This additional interstitial lira appears on the second whorl. This difference probably reflects the evolution of the subspecies.

Cancellaria lischkei YOKOYAMA (1926, p. 264, pl. 32, f. 16, 17) reported from the Pliocene of Sado, Niigata Prefecture was identified to "*Admete japonica* (SMITH)" by HATAI and NISIYAMA (1952, p. 182) and to "*Cancellaria japonica lischkei*" by MAKIYAMA (1958, pl. 44, f. 16-17), but I consider it is neither *Admete* nor *Cancellaria* but is *Cancelrana* PALMER, 1935 on the basis of the elevated protoconch, bucciniform outline, angulated whorl, a few small folds inside of the outer lip, and the two columellar plaits.

The present subspecies, especially the specimens from Nihonmatsu is closely allied to the species, but the former is readily distinguished from the latter in having slenderer and smaller shell ornamented by the plicae of less number than the latter.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lower Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

Family Marginellidae

Genus *Gibberula* SWAINSON, 1840

(type species: *Gibberula zonata* SWAINSON=*Volvaria oryza* LAMARCK by monotypy)

Subgenus *Kogomea* HABE, 1951

(type species: *Erato novemprovincialis* YOKOYAMA by original designation)

Gibberula (*Kogomea*) *novemprovincialis* (YOKOYAMA)

Pl. 10, Figs. 10, 12 and 13

1928, *Erato novemprovincialis* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo* Sec. 2, Vol. 2, Pt. 7, p. 346, pl. 47, f. 7.

1951, *Kogomea novemprovincialis*, HABE, *Illust. Catalogue Japan. Shells*, No. 16, p. 103, text-f. 11.

1952, *Hyalina* (*Cystiscus*) *novemprovincialis*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2,

Spec. Vol. No. 3, p. 201.

1959, *Hyalina (Cystiscus) novemprovincialis*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Pap.* No. 5, pl. 65, f. 7.

Material and measurements.—GK-L 6223 to 6225 (coll. T. MATSMMOTO et al.), 6226 to 6228 (coll. T. SHUTO) and other unregistered imperfect specimens. All the specimens came from one and the same locality, where the lithology is unconsolidated grey fine sandstone. Preservation of the registered specimens is perfect.

Specimen GK-L	H (mm.)	Ap (mm.)	D (mm.)	Ap/H (%)	D/H (%)	<B* (degrees)	whorls	columellar plaits	labrum teeth
6223	3.45	3.1	2.5	89.9	72.4	52.9	3.0	4	12
6226	2.7	3.0	2.55	81.1	69.0	42.5	2.5	4	12
6227	3.5	3.0	2.4	85.8	68.6	45.0	2.5	4	13
6228	3.1	2.75	2.4	88.7	77.4	43.6	2.5	4	13

Remarks.—According to COSSMANN *Cystiscus* STIMPSON, 1865, based on *Cystiscus capensis* STIMPSON=*Marginella cystiscus* REDFIELD is quite identical to *Gibberula* SWAINSON, 1840 with the type species *Gibberula zonata* SWAINSON=*Volvaria oryza* LAMARCK except for the difference in the columellar plaits, which are four in number in *Marginella cystiscus* and three in *Volvalia oryza*. The upper columellar plaits, however, are always weak or obsolete and their numbers are rather fluctuating, and accordingly the slight difference in number of these plaits does not serve for a systematic criterion on the generic and subgeneric level. Herein I come to the conclusion that *Cystiscus* is the synonym of *Gibberula*. Comparison of the type species indicates that *Kogomea* is closely allied to *Gibberula* in the general feature, but the former is distinguished from the latter in having no dilation of the callous deposit on the columellar margin.

Gibberula cuneata (COSSMANN) from the Pliocene Bantam beds of Java (OOSTINGH, 1938, p. 126, pl. 9, f. 165a, b) closely resembles the present species and it is also one of the representatives of *Kogomea*. The only available distinction between the two is in that the former species has a little slenderer shell than the latter and five (or very rarely four) columellar plaits instead of four in the latter. Although it is no doubt that the two are in close relation, but they are not likely conspecific, for the original type specimen of *G. cuneata* from Pakistan described by COSSMANN is remarkably different from the present species being provided with five to six columellar plaits.

Horizon.—Lower part of the Takanabe member (fourth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Locality.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

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* Angle formed by the opposite tangents of basal slope.

Genus *Marginella* LAMARCK, 1799

(type species: *Voluta glabella* LINNÉ by monotypy)

Subgenus *Stazzania* SACCO, 1889

(type species: *Marginella* (*Stazzania*) *emarginata* BONELLI by original designation)

Marginella (*Stazzania*) *flaccida* (YOKOYAMA)

Pl. 10, Figs. 1 and 2, Pl. 13, Figs. 1 and 6

1928, *Mitra flaccida* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo* Sec. 2, Vol. 2, Pt. 7, p. 355, pl. 47, f. 1.

1931, *Marginella* (*Stazzania*) *totomiensis* MAKIYAMA, *Mem. Coll. Sci. Kyoto Imp. Univ.* Ser. B, Vol. 7, No. 1, Art. 1, p. 50, pl. 2, f. 13.

1952, *Marginella* (*Stazzania*) *flaccida*, HATAI and NISIYAMA, *Sci. Rep. Tohoku Univ.* Ser. 2, Spec. Vol. No. 3, p. 213 and 215.

1959, *Marginella* (*Stazzania*) *flaccida*, MAKIYAMA, *Palaeont. Soc. Japan. Spec. Pap.* No. 5, pl. 65, f. 1.

Material and measurements.—GK-L 6206 to 6209 (loc. Nihonmatsu, coll. T. SHUTO), 6210 to 6216 (loc. Hagenoshita, coll. T. SHUTO), and 6217 to 6222 (loc. Hagenoshita, coll. T. MATSUMOTO et al.). Matrix is unconsolidated grey fine sandstone at both localities. Preservation is perfect.

Specimen GK-L	loc.	H (mm.)	Bd (mm.)	Ap (mm.)	D (mm.)	Bd/H (%)	Ap/H (%)	D/H (%)	<P (degrees)	numb. whorls	columellar plaits
6206	Nihon-matsu	5.7	4.6	3.3	3.34	80.6	57.6	58.6	60.2	5	4
6208	〃	6.6	4.9	4.6	3.5	74.3	54.5	52.9	49.0	5	4
6209	〃	5.8	4.6	3.1	3.1	79.1	53.3	53.3	54.7	5	4
6210	Hageno-shita	6.35	4.95	3.55	3.05	77.9	55.8	48.0	45.9	4.75	4
6211	〃	6.2	5.1	3.8	3.4	82.1	61.3	54.7	56.9	4.5	4
6212	〃	5.9	4.65	3.25	3.15	78.5	54.9	53.3	52.4	4.5	4
6213	〃	5.8	4.75	3.3	3.25	81.8	56.9	56.0	54.7	4.5	4
6214	〃	6.9	5.45	4.0	3.5	78.9	57.9	50.7	49.8	4.75	4
6215	〃	5.8	4.5	3.1	3.1	77.5	53.4	53.4	52.5	4.5	4
6216	〃	5.5	4.3	3.1	3.1	78.2	56.4	56.4	47.6	4.5	4
6217	〃	7.7	6.1	4.6	3.6	79.1	59.6	46.6	51.0	5	4
6218	〃	6.55	5.1	3.7	3.1	77.8	56.4	47.3	42.8	5	4
6219	〃	5.8	4.2	3.1	3.25	72.3	53.4	56.0	59.0	4.5	4

Remarks.—The present species is naturally classified into *Stazzania* SACCO, 1889 on the basis of the biconical glazing shell of small size with blunt apex, flattened suture, thickened and smooth outer lip, and four columellar teeth, of which the lowest one is very oblique and the others are slightly oblique or almost horizontal. It is very interesting from the biogeographical and evolutional stand point that several species of *Stazzania* have been known from the Eocene to Miocene formations of South Europe, while a few occur in the lower Pliocene beds in the south east Asia.

The present species is very variable in morphology with the elongately fusiform specimen as an end form (Pl. 10, f. 1) and the rhomboid fusiform one as the other end form (Pl. 10, f. 2). The end forms, however, are perfectly connected by many intermediate forms of every grades and there is no indication to break up the species into two populations, although the end forms seem to belong to the separate species at first glance.

Horizon.—Lower and middle Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition to Lowest Pliocene.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura, Koyu gun, Miyazaki Prefecture.

Genus *Gibberulina* MONTEROSATO, 1884

(type species: *Marginella clandestina* BROCCHI by original designation)

Subgenus *Gibberulina* MONTEROSATO, 1884

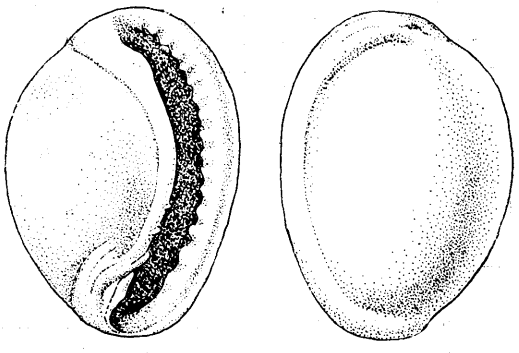
Gibberulina (*Gibberulina*) *pisum yokoyamai* n. subsp.

Pl. 13, Fig. 3, Text-fig. 15

Material and measurements.—Holotype GK-L 6229; paratypes GK-L 6230, 6231, and 6239. All the specimens except for GK-L 6239 which came from Hagenoshita were obtained from Nihonmatsu. Matrix is unconsolidated grey fine sandstone at both localities. Preservation is perfect. Coll. T. SHUTO.

Specimen GK-L	loc.	H=Ap (mm.)	W (mm.)	W/H (%)	labrum teeth	columellar teeth
6229	Nihonmatsu	2.15	1.55	72.1	14	4
6230	〃	2.2	1.55	70.4	15	4
6231	〃	1.9	1.4	73.7	14	4
6239	Hagenoshita	2.3	1.6	69.5	16	4

Diagnosis.—The shell is minute attaining a little more than 2 mm. in height, regularly ovoid in outline, and perfectly convolute. The maximum diameter is measured at a little above the middle of the shell; the base is regularly attenuated forming the slight concavity. The test is moderately thick. The surface is smooth, porcheraneous, and glazing. The aperture is narrow and long fully extending from the anterior to the posterior end and weakly channeled at the posterior end and widely subtruncated at the anterior end. The outer and the inner



Text-fig. 15. (*Gibberulina*) *pisum yokoyamai* n. subsp. holotype GK-L 6229, loc. Nihonmatsu, Takanabe machi. Unit bar indicates 1 mm.

lips are parallel eath other. The outer lip is vertical, thickened, and covered by the callous deposit outside and finely crenulated inside; the crenulations number about fourteen of which the lower four are stronger than the others. The inner lip is convexed, regularly curved, provided at it lower half with four columellar plaits, which decrease in size upward. The lowest and the second plait are respectively steeply and moderately sloped; the upper two are almost horizontal. The callus is distinct but narrow, and extends and widened both anteriorly and posteriorly continuing to the callus of the outer lip at both extremities.

Comparison.—*Gibberulina* (*Gibberulina*) *pisum* (REEVE), living in Australian water, (REEVE, 1866, *Conch. Icon.* Vol. 15, *Marginella* pl. 27, sp. 156) slightly differs from the present subspecies in having twice as larger shell, narrower columellar callus, and more distinct constriction at the base.

G. (*G.*) *cotamago* (YOKOYAMA) (1922, p. 49, pl. 2, f. 6) is also conspecific to pisum forming a particular subspecies, but is distinguished from the present subspecies by its slenderer shell and thinner callus than the latter.

Horizon.—Lower and middle part of the Takanabe member (fourth and fifth fossil horizon of the Miyazaki group), Mio-Pliocene transition.

Localities.—Cutting along the high-way on the south slope of the hill, at Hagenoshita, Uwaye mura; cutting along the high-way at the foot of the hill, Nihonmatsu, Takanabe machi, Koyu gun, Miyazaki Prefecture.

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Tsugio SHUTO

Buccinacean and Volutacean Gastropods from the Miyazaki Group

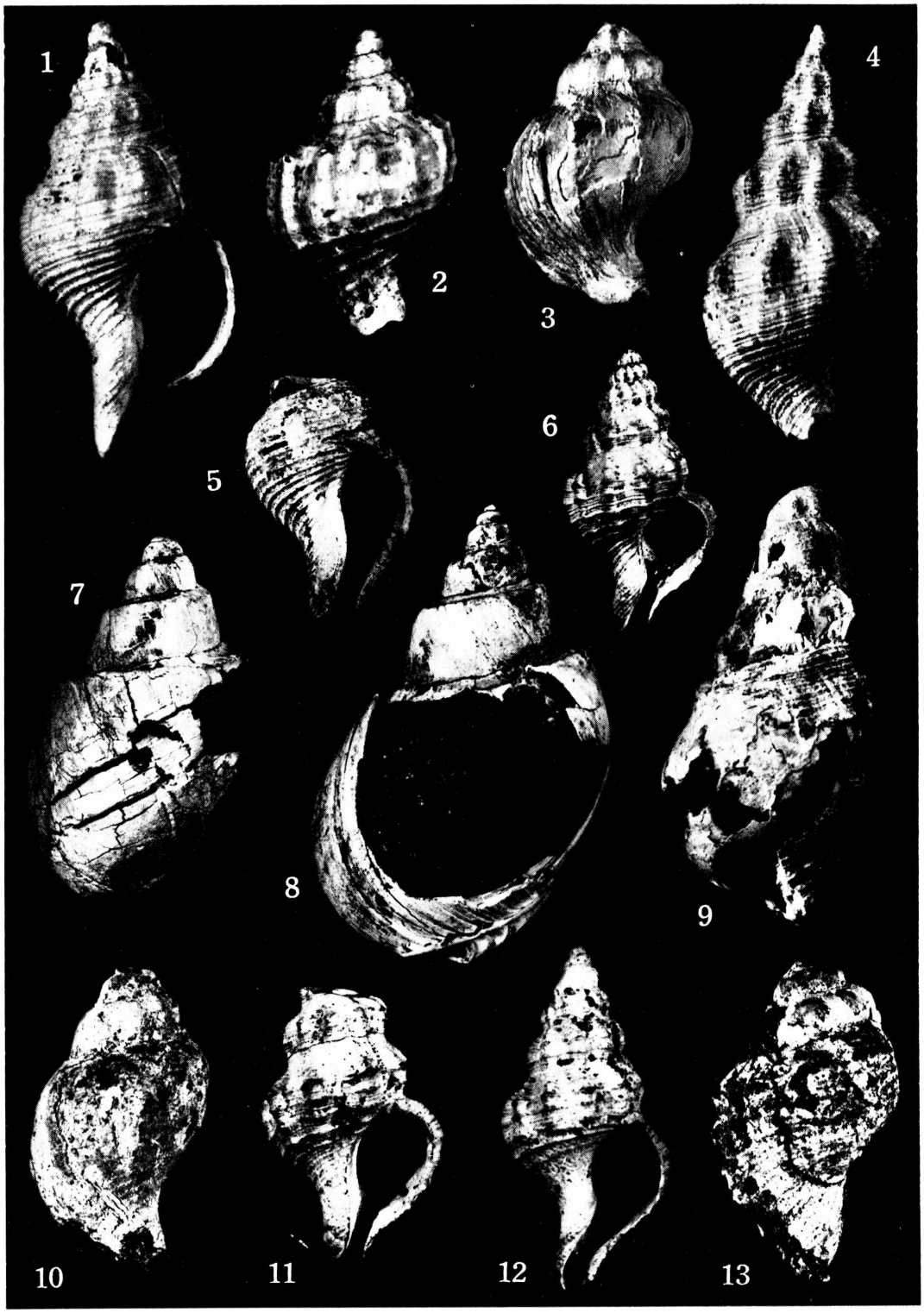
(Palaeontological Study of the Miyazaki Group—X)

Plates 6–13

Plate 6

Explanation of Plate 6

Siphonalia tosensis MAKIYAMA ..... p. 39
Fig. 1 (×5), GK-L 6127; immature specimen; loc. Hagenoshita, Uwaye mura, Koyu gun; coll. T. SHUTO.
Siphonalia declivis YOKOYAMA ..... p. 37
Fig. 2 (×5), GK-L 6110; immature specimen; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.
Fig. 10 (×2), GK-L, 6265; loc. Tonogôri, Saito City; coll. T. SHUTO.
Siphonalia cf. *signum* (REEVE) ..... p. 38
Fig. 3 (×5), GK-L 6264; loc. Yamaji, Mino mura; coll. T. SHUTO.
Siphonalia mikado MELVILL ..... p. 33
Fig. 4 (×2.7), GK-L 4887; loc. Kizukume, Tonda machi; coll. T. SHUTO.
Buccinofusus sp. ..... p. 58
Fig. 5 (×1.6), GK-L 6109; loc. Tôriyama, Kawaminami machi; coll. T. SHUTO.
Nassaria (*Nassaria*) *acuminata gendinganensis* (MARTIN) ..... p. 45
Fig. 6 (×1.6), GK-L 6134; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.
Fig. 11 (×2), GK-L 6140; loc. same as the preceding one; coll. T. MATSUMOTO et al.
Fig. 12 (×5), GK-L 6139; immature specimen; loc. and coll. same as the preceding one.
Babylonia elata (YOKOYAMA) ..... p. 43
Fig. 7 (×0.9), GK-L 6121; loc. Tôriyama, Kawaminami machi; coll. T. MATSUMOTO et al.
Fig. 8 (×0.9), GK-L 6120; loc. same as the preceding one; coll. T. SHUTO.
Siphonalia ikebei TSUDA ..... p. 41
Fig. 9 (×2.5) GK-L 6131; loc. Yamaji, Mino mura; coll. T. SHUTO.
Cantharus (*Hanetia*) *bucklandi* (D'ARCHIAC) ..... p. 51
Fig. 13 (×1.5), GK-L 6159; loc. and coll. same as the preceding one.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 7

Explanation of Plate 7

Nassaria (*Nassaria*) *yokoyamai* TSUCHI ..... p. 49

Fig. 1 (×3.2), GK-L 6101; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Fig. 2 (×2.7), GK-L 6100; loc. and coll. same as the preceding one.

Fig. 4 (×2.7), GK-L 6096; loc. same as the preceding one; coll. T. SHUTO.

Siphonalia tosensis MAKIYAMA ..... p. 39

Fig. 3 (×2.5), GK-L 4892; loc. same as the preceding one; coll. T. MATSUMOTO et al.

Siphonalia spadicea fuscolineata PEASE ..... p. 36

Fig. 5 (×1.5), GK-L 4891; loc. Tôriyama, Kawaminami machi; coll. T. SHUTO.

Fig. 9 (×1.5), same specimen as the preceding one, back view.

Siphonalia tonohamaensis delicatula n. subsp. ..... p. 40

Fig. 6 (×2.5), holotype GK-L 4899; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Fig. 7 (×2.5), same specimen as the preceding one, back view.

Nassaria (*Nassaria*) *sanzaiana* n. sp. ..... p. 47

Fig. 8 (×2.5), paratype GK-L 6151; loc. Kakoi, Sanzai mura; coll. T. SHUTO.

Babylonia areolata (LINK) ..... p. 44

Fig. 10 (×0.94), GK-L 6125; loc. Koda, Sadowara machi; coll. T. SHUTO.

Nassaria (*Nassaria*) *acuminata gendinganensis* (MARTIN) ..... p. 45

Fig. 11 (×1.3), GK-L 6134; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Siphonalia hyugaensis n. sp. ..... p. 34

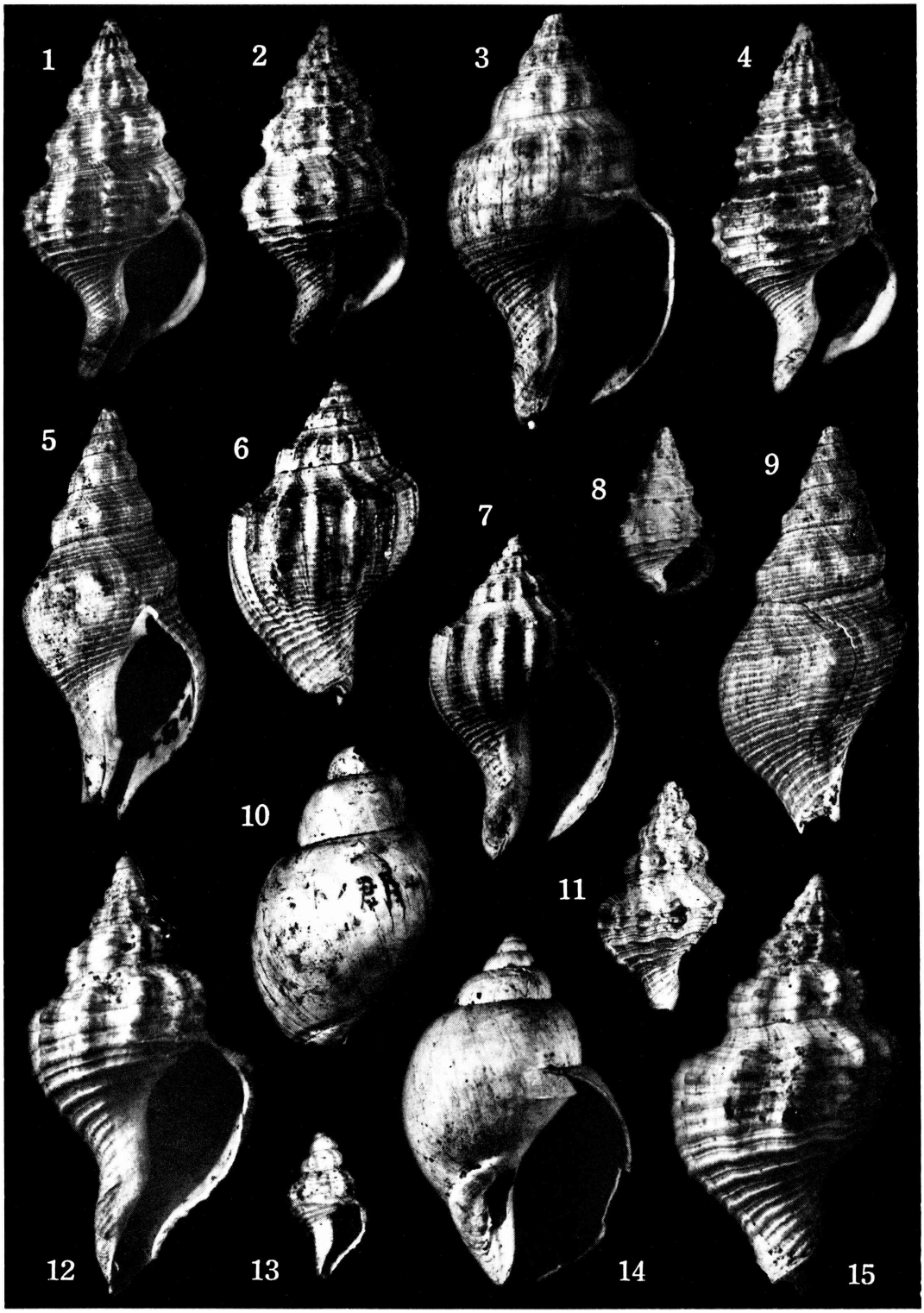
Fig. 12 (×3.1), holotype GK-L 6112; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Fig. 13 (×3), paratype GK-L 6111, young specimen; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.

Fig. 15 (×3), same specimen as Fig. 12, back view.

Babylonia elata (YOKOYAMA) ..... p. 43

Fig. 14 (×3.7), GK-L 6123, young specimen; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 8

Explanation of Plate 8

Pugilina (*Hemifusus*) *ternatanus* (GMELIN) ..... p. 61

Fig. 1 (×0.54), GK-L 6241; loc. Tôriyama, Kawaminami machi; coll. T. MATSUMOTO et al.

Fig. 3 (×0.55), same specimen as the preceding one.

Mitrella (*Indomitrella*) *lischkei* (SMITH) ..... p. 28

Fig. 2 (×6.2), GK-L 6086; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Nassarius (*Zeuxis*) cf. *crebricostata* (SCHEPMAN) ..... p. 53

Fig. 4 (×3.8), GK-L 6165; loc. Yamaji, Mino mura; coll. T. SHUTO.

Fig. 7 (×3.8), GK-L 6167; loc. and coll. same as the preceding one.

Mitrella (*Zemitrella*) *bicinctella* (YOKOYAMA) ..... p. 29

Fig. 5 (×6), GK-L 6092; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Fig. 6 (×6), GK-L 6091; loc. same as the preceding one; coll. T. SHUTO.

Fusinus (*Fusinus*) *perplexus* (A. ADAMS) ..... p. 57

Fig. 8 (×1), GK-L 6171; loc. Tôriyama, Kawaminami mura; coll. T. SHUTO.

Granulifusus simplex pauciliratus n. subss. ..... p. 60

Fig. 9 (×3), holotype GK-L 6172; loc. and coll. same as the preceding one.

Nassarius (*Zeuxis*) *miyazakiensis* n. sp. ..... p. 54

Fig. 10 (×4), holotype GK-L 6161; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.

Nassarius (*Hima*) *festiva* (POWYS) ..... p. 56

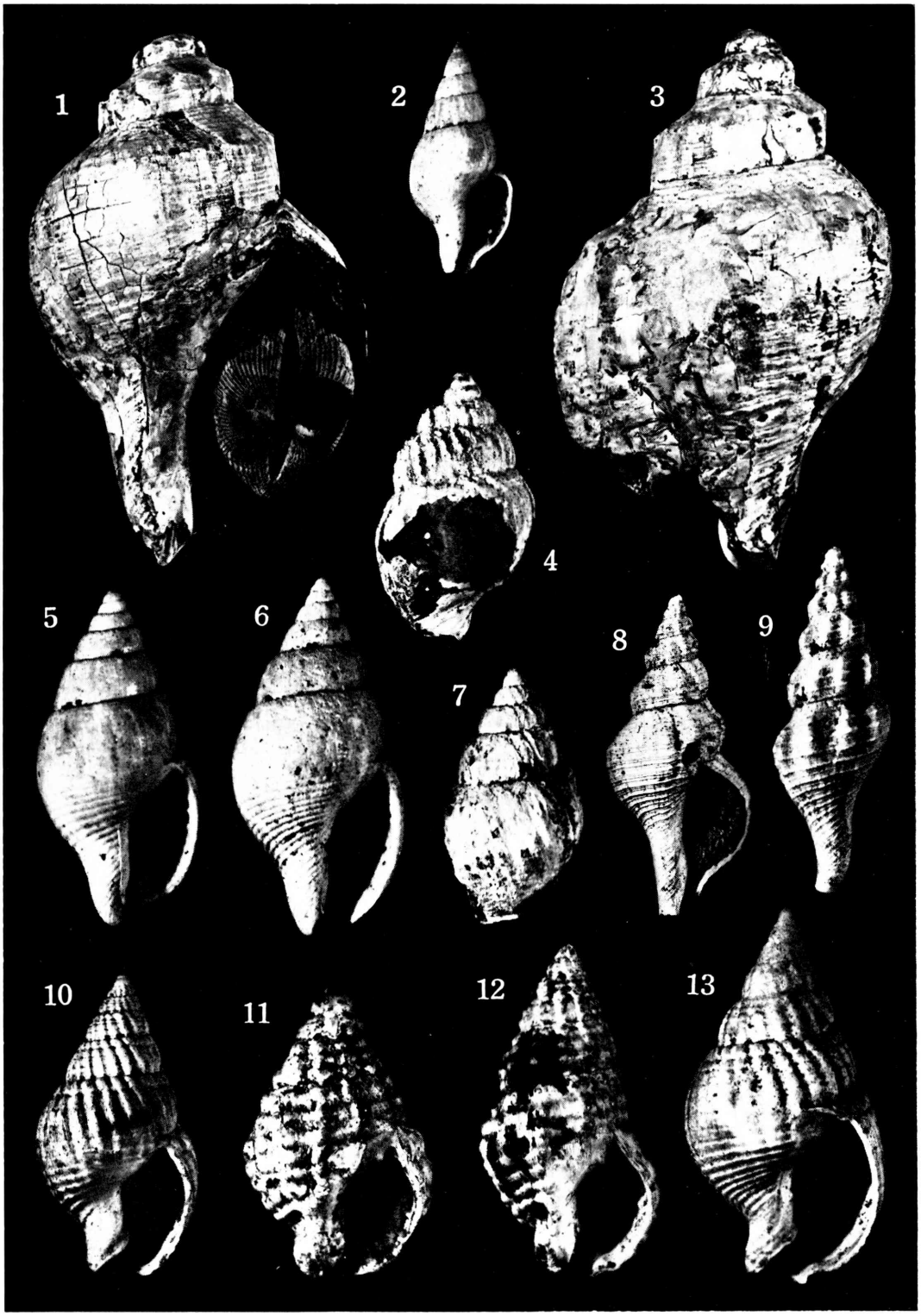
Fig. 11 (×3), GK-L 6164; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Nassarius (*Hima*) *dealbata* (A. ADAMS) ..... p. 56

Fig. 12 (×2.5), GK-L 6163; loc. Yamaji, Mino mura; coll. T. SHUTO.

Nassarius (*Zeuxis*) *caelatus dainitiensis* (MAKIYAMA) ..... p. 52

Fig. 13 (×3), GK-L 6160; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 9

Explanation of Plate 9

Nassaria (Nassaria) acuminata gendinganensis (MARTIN) ..... p. 45

Fig. 1 (×3), GK-L 6133; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Fig. 7 (×2.2), GK-L 6158, slender form; loc. Kizukume, Tonda machi; coll. T. SHUTO.

Fig. 7a (×11), same specimen as the preceding one, showing the protoconch.

Cancelrana lischkei pauciplicata n. subsp. ..... p. 77

Fig. 2 (×11.4), paratype GK-L 6201; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.

Fig. 6 (×8.8), paratype GK-L 6202; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Nassaria (Nassaria) sanzaiana n. sp. ..... p. 47

Fig. 3 (×3), holotype GK-L 6146; loc. Kakoi, Sanzai mura; coll. T. SHUTO.

Fig. 9 (×3), paratype GK-L 6150; loc. and coll. same as the preceding one.

Siphonalia praedeclivis ITOIGAWA ..... p. 42

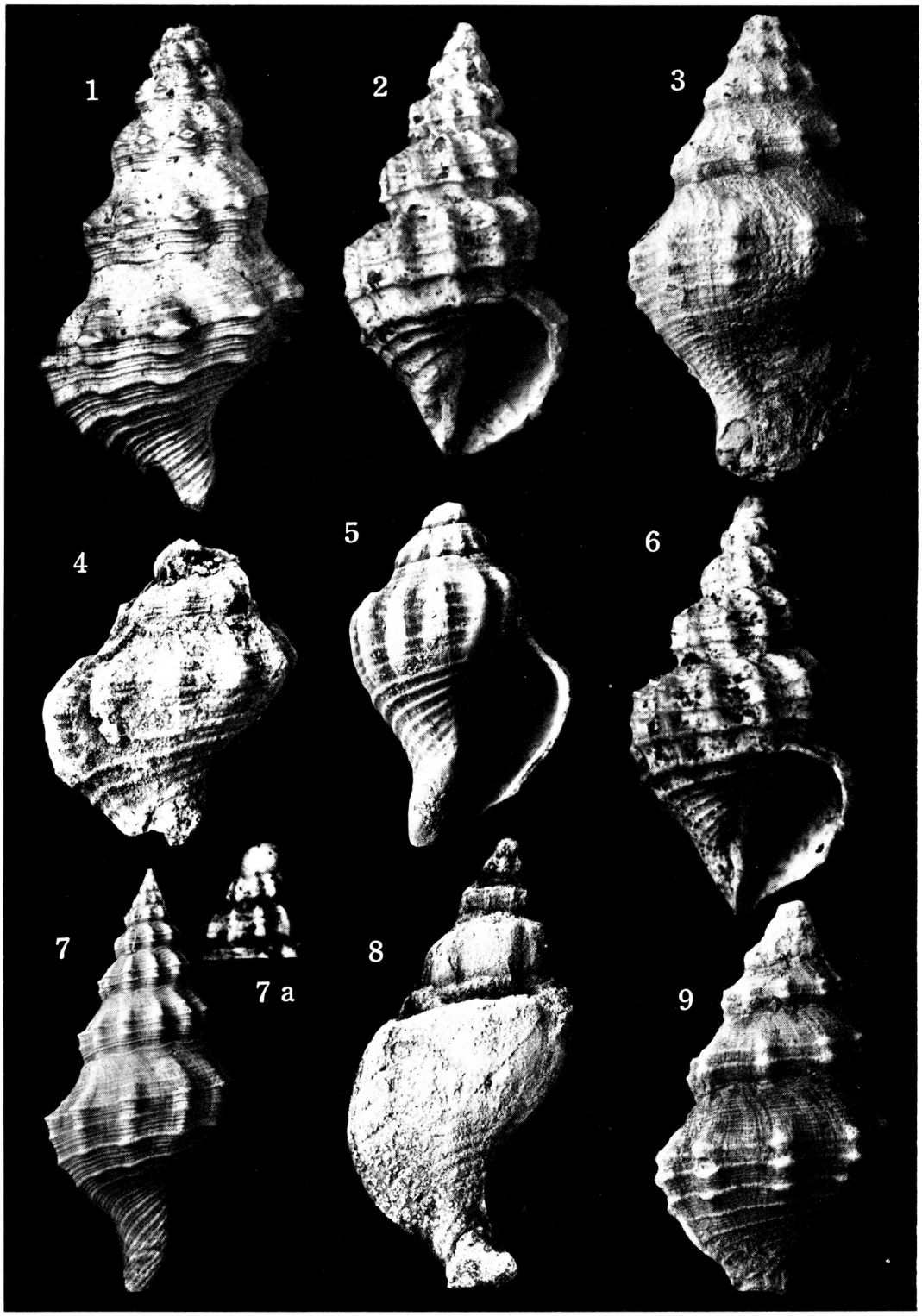
Fig. 4 (×2.4), GK-L 6129; loc. Haigano, Tano machi; coll. T. SHUTO.

Siphonalia declivis YOKOYAMA ..... p. 37

Fig. 5 (×2.5), GK-L 4898; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Ancistrolepis (Clinopegma) unica (PILSBRY) ..... p. 31

Fig. 8 (×2.1), GK-L 6107; loc. Takeuchi, Kibana, Miyazaki City; coll. T. SHUTO.

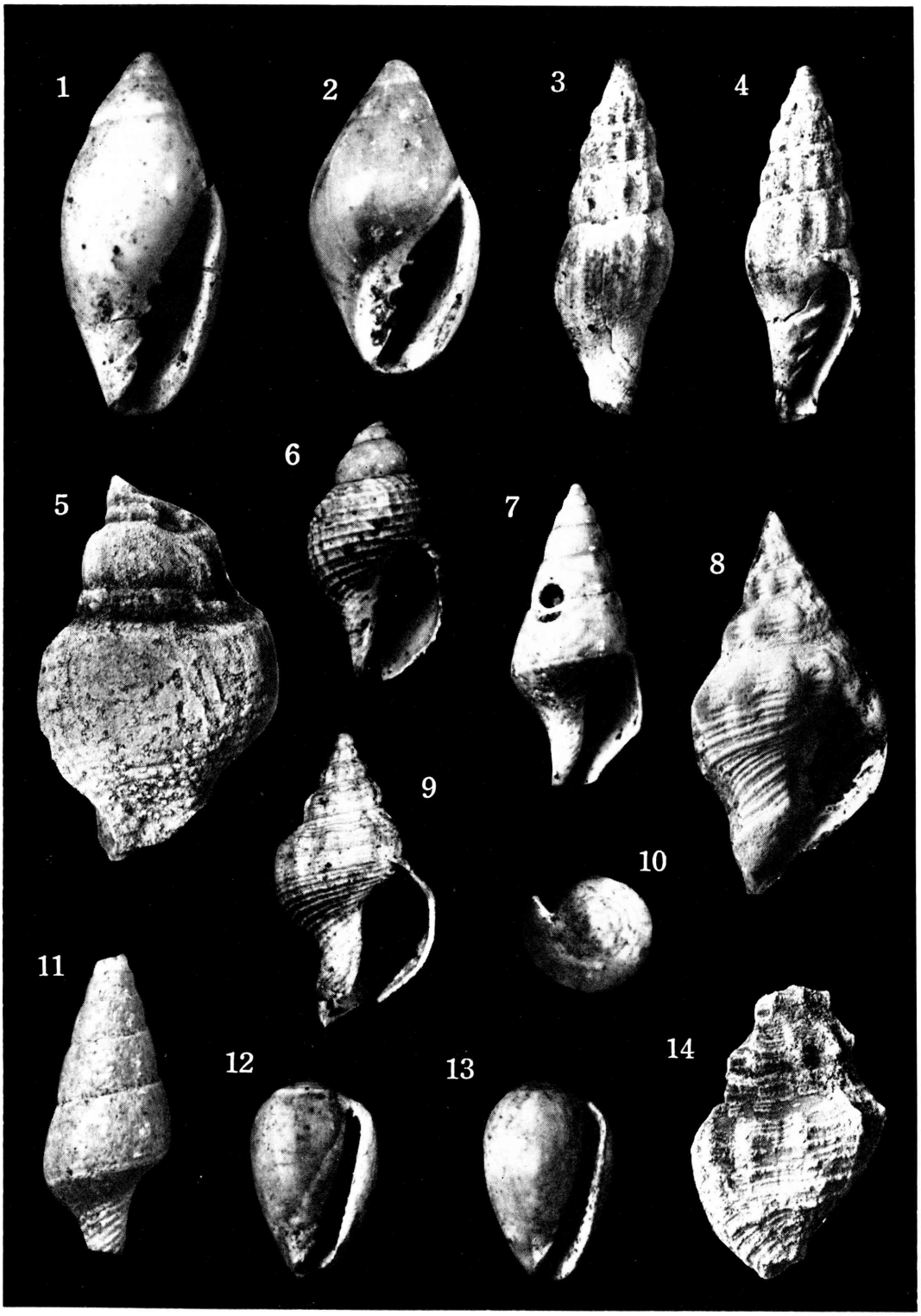


T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 10

Explanation of Plate 10

Marginella (*Stazzania*) *flaccida* (YOKOYAMA) ..... p. 80
Fig. 1 (×7.3), GK-L 6217; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.
Fig. 2 (×8.4), GK-L 6213; loc. same as the preceding one; coll. T. SHUTO.
Uromitra makiyamai n. sp. ..... p. 63
Fig. 3 (×5.1), holotype GK-L 6233; loc. Yamaji, Mino mura; coll. T. SHUTO.
Fig. 4 (×5.1), same specimen as the preceding one, back view.
Ancistrolepis (*Clinopegma*) *unica* (PILSBRY) ..... p. 31
Fig. 5 (×2), GK-L 6108; loc. Takeuchi, Kibana, Miyazaki City; coll. T. SHUTO.
Cancellaria (*Sydaphera*) *pristina acutiplicata* n. subsp. ..... p. 74
Fig, 6 (×8), paratype GK-L 6232, young specimen; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.
Mitrella (*Indomitrella*) *smithi* (YOKOYAMA) ..... p. 29
Fig. 7 (×11), GK-L 6088; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.
Fig. 11 (×8.3), GK-L 6087; loc. and coll. same as the preceding one.
Siphonalia praedeclivis ITOIGAWA ..... p. 42
Fig. 8 (×2.2), GK-L 6113; loc. Horiguchi, Tano machi; coll. T. SHUTO.
Fig. 14 (×2.5), GK-L 6130; loc. Haigano, Tano machi; coll. T. SHUTO.
Siphonalia tosensis MAKIYAMA ..... p. 39
Fig. 9 (×4), GK-L 4896, young specimen; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.
Gibberula (*Kogomea*) *novemprovincialis* (YOKOYAMA) ..... p. 78
Fig. 10 (×8), GK-L 6226; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.
Fig. 12 (×8), GK-L 6227; loc. some as the preceding one; coll. T. MATSUMOTO et al.
Fig. 13 (×8), same specimen as Fig. 10, top view.



T. SHUTO: Buccinccean and Volutacean Gastropods from the Miyazaki Group

Plate 11

Explanation of Plate 11

Siphonalia tosensis MAKIYAMA ..... p. 39

Fig. 1 (×1.9), GK-L 4894; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Jumala sp. ..... p. 32

Fig. 2 (×1), GK-L 6240; loc. and coll. same as the preceding one.

Fulgoraria (*Psephaea*) *cancellata koyuensis* n. subsp. ..... p. 66

Fig. 3 (×1.3), paratype GK-L 6181; loc. Tsuma, Saito City; coll. T. SHUTO.

Fig. 6 (×3.5), holotype GK-L 6182; loc. and coll. same as the preceding one.

Cancellaria (*Sydaphera*) *spengleriana* (DESHAYES) ..... p. 72

Fig. 4 (×2.5), G 25400-a; slender form characterized by the sloping shoulder and the close axials; living off Fukuoka.

Fig. 8 (×2.5), G 25400-b; standard form with flush shoulder and coarse axials; off Fukuoka.

Cancelrana yokoyamai pauciplicata n. subsp. ..... p. 77

Fig. 5 (×9.5), holotype GK-L 6205; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

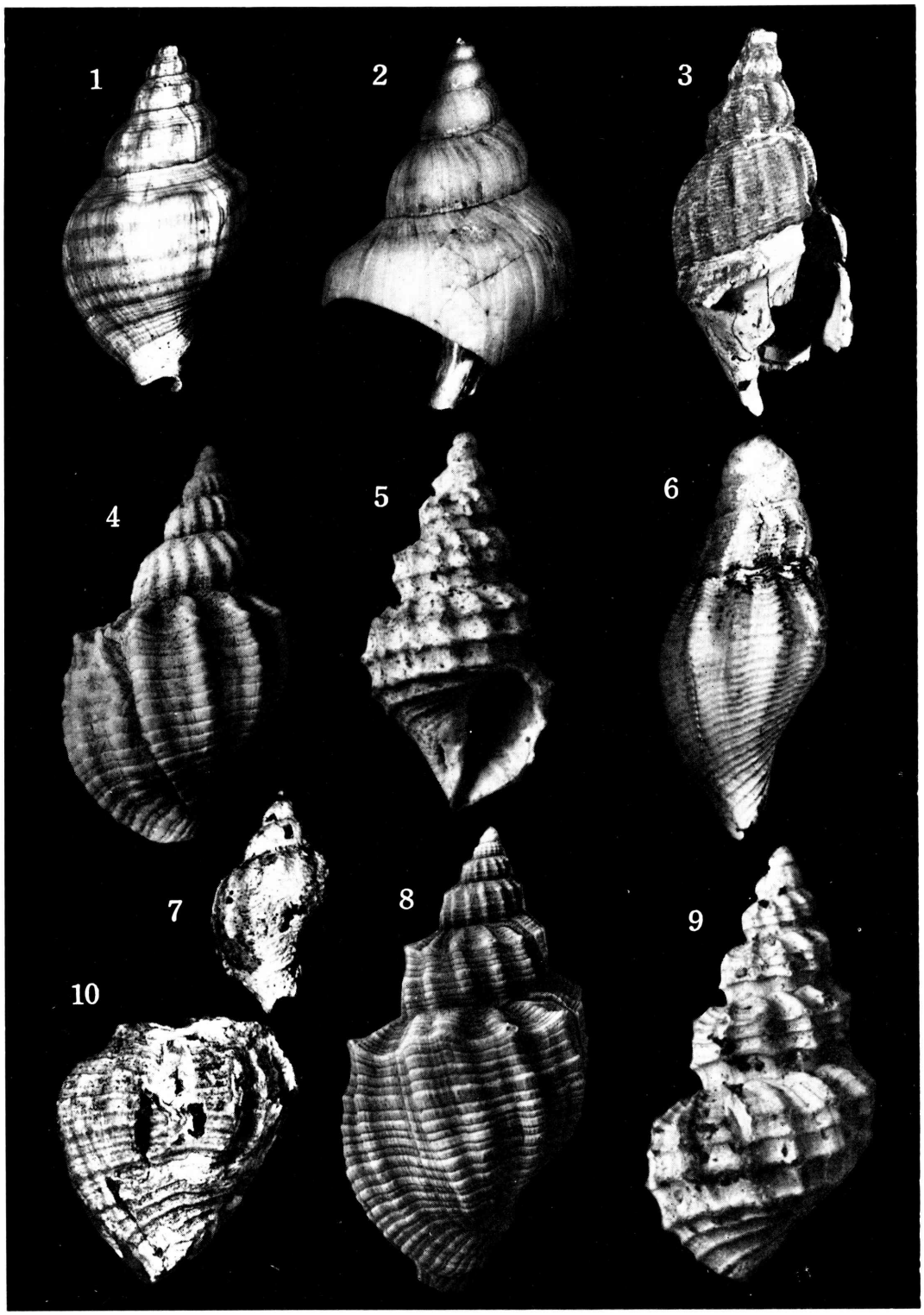
Fig. 9 (×9), paratype GK-L 6202; loc. and coll. same as the preceding one.

Siphonalia declivis YOKOYAMA ..... p. 37

Fig. 7 (×4), GK-L 6266; loc. Tonogôri. Saito City; coll. T. SHUTO.

Siphonalia ikebei TSUDA ..... p. 41

Fig. 10 (×2.5), GK-L 6268, showing the ornamentation of the body whorl; loc. Yamaji, Mino mura; coll. T. SHUTO.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 12

Explanation of Plate 12

Fulgoraria (*Psephaea*) *cancellata cancellata* KURODA and HABE .....p. 65

Fig. 1 (×1.3), GK-L 6178; loc. Toriyama, Kawaminami machi; coll. T. MATSUMOTO et al.

Fig. 2 (×2.5), GK-L 6180; loc. same as the preceding one; coll. T. SHUTO.

Fig. 8 (×1.5), GK-L 6177; loc. and coll. same as those of GK-L 6178.

Fulgoraria (*Psehaea*) *hyugaensis* n. sp. .....p. 68

Fig. 3 (×2.5), paratype GK-L 4652, somewhat deformed; loc. Kushiki, Kamihokita mura; coll. T. SHUTO.

Fig. 4 (×2.5), GK-L 4499, shell material being greatly removed; loc. Nagano, Mino mura; coll. T. SHUTO.

Fig. 6 (×2.6), holotype GK-L 6183; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Vexillum (*Waimatea*) *kurakiensis* (HATAI and NISIYAMA) .....p. 64

Fig. 5 (×2.5), GK-L 6175; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Lyria (*Paralyria*) *mizuhonica koyuana* (YOKOYAMA) .....p. 71

Fig. 7 (×2), GK-L 6189, juvenile specimen; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

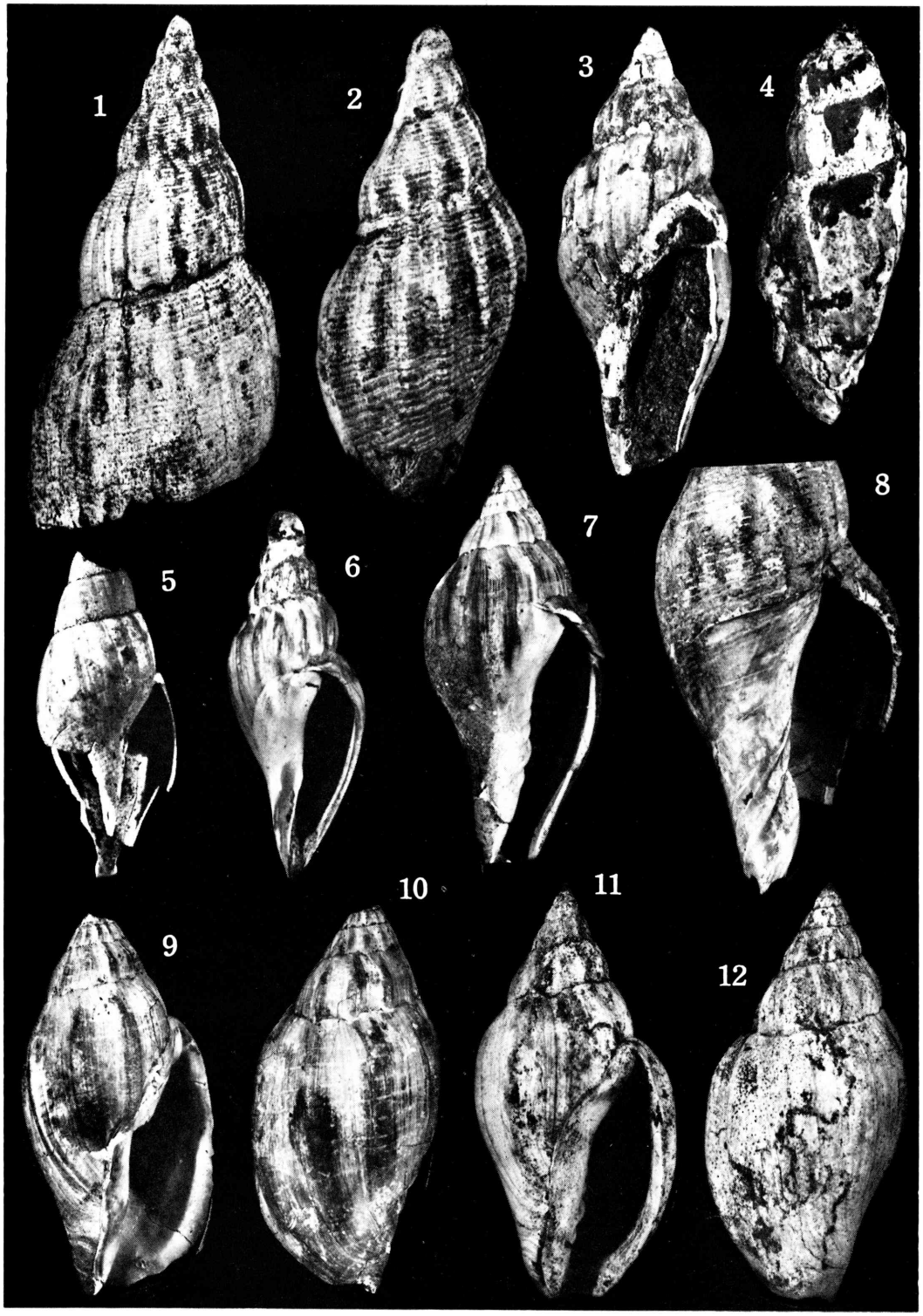
Fig. 9 (×1.5), GK-L 6188; loc. same as the preceding one; coll. T. MATSUMOTO et al.

Fig. 10 (×1.5), same specimen as the preceding one, back view.

Lyria (*Paralyria*) *mizuhonica mizuhonica* (MAKIYAMA) .....p. 71

Fig. 11 (×1.5), GK-L 6187; loc. Tôriyama, Kawaminami mura; coll. T. SHUTO.

Fig. 12 (×1.5), same specimen as the preceding one, back view.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group

Plate 13

Explanation of Plate 13

Marginella (*Stazzania*) *flaccida* (YOKOYAMA) ..... p. 80
Fig. 1 (×6.8), GK-L 6219; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.
Fig. 6 (×6), GK-L 6212; loc. same as the preceding one; coll. T. SHUTO.

Fulgoraria (*Psephaea*) *hyugaensis* n. sp. ..... p. 68
Fig. 2 (×1.6), paratype GK-L 6184; loc. and coll. same as the preceding one.

Gibberulina (*Gibberulina*) *pisum yokoyamai* n. subsp. ..... p. 81
Fig. 3 (×8), holotype GK-L 6229; loc. Nihonmatsu, Takanabe machi; coll. T. SHUTO.

Cancellaria (*Sydaphera*) *pristina acutiplicata* n. subsp. ..... p. 74
Fig. 4 (×2), paratype GK-L 6197; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.
Fig. 5 (×3), paratype GK-L 6198; loc. and coll. same as the preceding one.

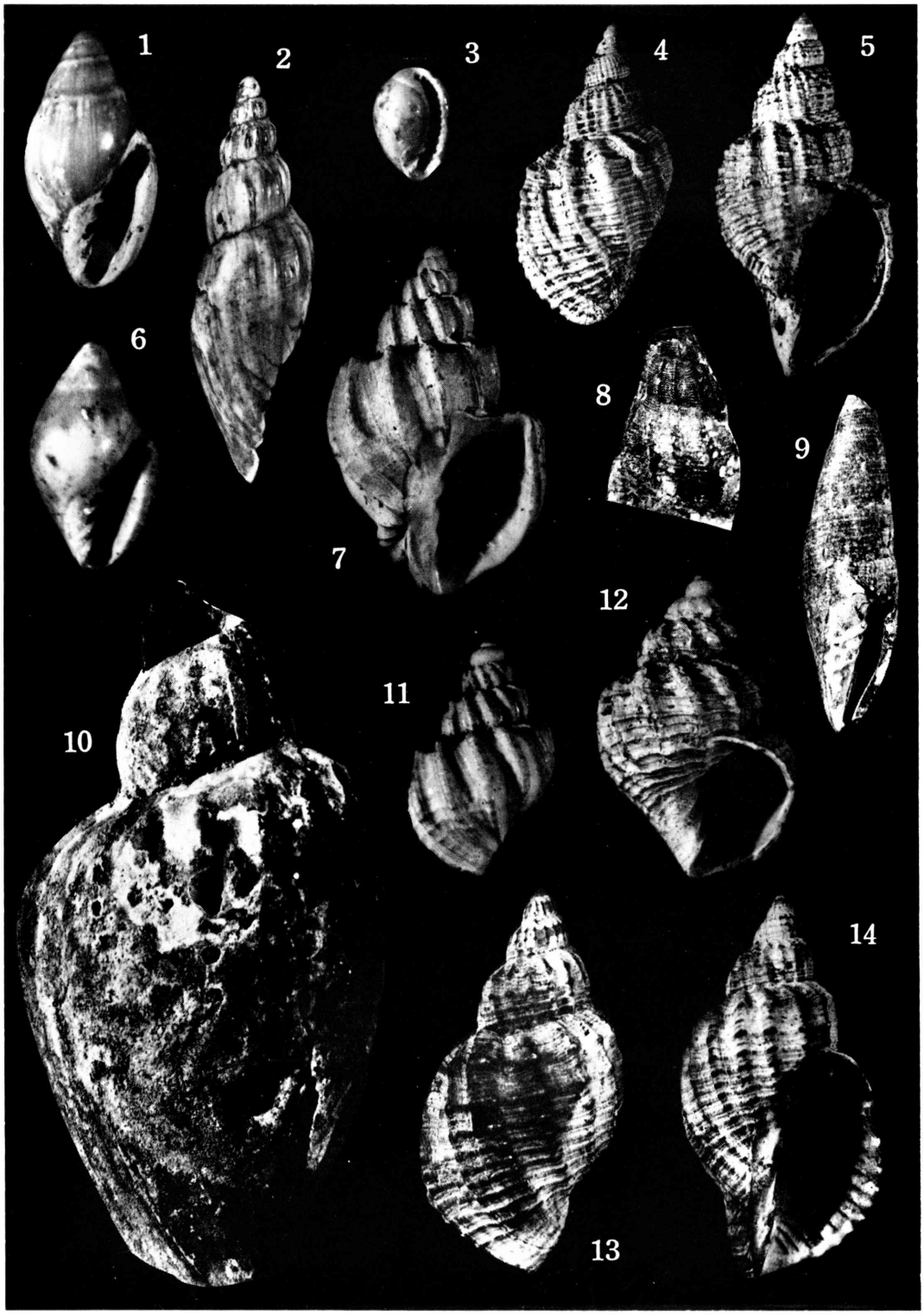
Trigonostoma (*Scalptia*) *kurodai* MAKIYAMA ..... p. 76
Fig. 7 (×3.7), GK-L 6193; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.
Fig. 11 (×5.2), GK-L 6194; loc. and coll. same as the preceding one.

Fulgoraria (*Psephaea*) *daviesi* FULTON ..... p. 67
Fig. 8 (×1.2), part of the outer mold of GK-L 6194.
Fig. 10 (×1.2), GK-L 6194; loc. Yamaji, Mino mura; coll. T. SHUTO.

Mitra (*Nebularia*) *hanlayana* (DUNKER) ..... p. 62
Fig. 9 (×1), GK-L 6174; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.

Cancellaria (*Merica*) *reevei laticostata* (LÖBBECKE) ..... p. 72
Fig. 12 (×5), GK-L 6190; loc. Hagenoshita, Uwaye mura; coll. T. SHUTO.

Cancellaria (*Sydaphera*) *spengleriana* (DESHAYES) ..... p. 72
Fig. 13 (×2), GK-L 6195; loc. Hagenoshita, Uwaye mura; coll. T. MATSUMOTO et al.
Fig. 14 (×2), same specimen as the preceding one, back view.



T. SHUTO: Buccinacean and Volutacean Gastropods from the Miyazaki Group