Gastropods from the Kwanmon Group (Inkstone Series) (Studies on the Molluscan Fauna of the Upper Mesozoic Kwanmon group. Part. 4)

By

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with 5 Text-figures and 3 Plates

ABSTRACT. Five species of non-marine gastropods from the Upper Mesozoic Kwanmon group are described. And also two new subgenera, *Yoshimonia* and *Kumania*, are proposed for the specimens from the Yoshimo and Kawaguchi formations (Ryoseki group).

Only a gastropod form, *Brotiopsis wakinoensis ryohoriensis*, was described by KOBAYASHI and SUZUKI (1936), and SUZUKI (1943) from the Wakino subgroup. Since then, many new paleontological criteria of the Kwanmon group have been added by the members of the research group on "The Late Mesozoic of Japan". The writer himself being a member of that group is working on the same subject. This report is essentially prepared for the gastropods of the Kwanmon group, but also touches upon those of the Yoshimo and Kawaguchi formations (Lower Cretaceous Ryoseki series) in order to make clear their relationships.

The following lines are the summarised conclusions:

1. *Brotiopsis wakinoensis ryohoriensis* is hardly be distinguished from *B. wakinoensis* s.s., because the two forms are intimately united to the same morphic series and they coexist in the same horizon.
2. Two new Thiarid subgenera, *Yoshimonia* and *Kumania*, are proposed for the specimens from the Yoshimo and Kawaguchi formations.
3. Gastropods from the Kwanmon group are as follows:
   1) *Brotiopsis wakinoensis* (KOBAYASHI and SUZUKI)
   2) *B. kobayashii kobayashii* SUZUKI
   3) *B. kobayashii sinsyuensis* SUZUKI
   4) *Melanoides* (*Yoshimonia*) *katsukiensis* OTA, n. subgen. and n. sp.
   5) *Viviparus onogoensis* KOBAYASHI and SUZUKI
4. There is no common gastropod species between the Wakino and the Ryoseki series (Yoshimo and Kawaguchi formations).

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Brotiopsis wakinoensis (KOBAYASHI and SUZUKI, 1936)

Pl. 1, figs. 1–23; Text-fig. 1

1936. *Brotia wakinoensis* KOBAYASHI and SUZUKI, *Japan. Jour. Geol. Geogr., vol. 13, nos. 3–4*, p. 256. pl. 29, figs. 14–15.

1943. *Brotiopsis wakinoensis* (KOBAYASHI and SUZUKI), *Jour. Sigen. Kenkyusyo, vol. 1, no. 2*, p. 206. pl. 15.

1943. *Brotiopsis wakinoensis ryohoriensis* SUZUKI, ditto, pl. 17. fig. 11, except A, B.

Description:— Shell medium in size, conically turreted in outline. Spire with an apical angle of about 15°, about two-times the height of the body-whorl, composed of more than 13 whorls; whorls regularly and gradually enlarging, rounded or subangulated in the nepionic stage, but distinctly angulated in the adult at about lower one-third, contracted at the suture, ramp slightly convex, scarcely contracted. Suture linear, tolerably well impressed and always well-defined by a sutural cord. Shoulder consisting of nodes, spines and a cord in the adult. Spiral sculpture consisting of a sutural, a shoulder cord, and basal cords 4 to 5 in number, close-set, interspaced by deep grooves, the uppermost basal strongest at the pheriphery and others gradually weakened below. Longitudinal ribs elevated along the growth lines, increasing strength with growth, those of the apical whorls oblique, curved, 6 to 8 in number, but in the later whorls prominently developed into more or less depressed 10 or more spines; in some specimens, the shoulder is fairly prominent with a row of contiguous nodes. Growth lines swing back from the suture, bent forward at a little above the angle and recurved backward describing semicircles. Aperture subvertical, oblong ovate, acutely angulated above and rather sharply rounded below, no canal; outer lip thin and entire; inner margin thickened making a moderate inner lip.

Remarks:— SUZUKI (1943) created the new genus *Brotiopsis* on *Brotia wakinoensis* which differs from *Doryssa*, *Pachychilas*, *Melanatria* and *Brotia* of the subfamily Melanatriinae in the surface ornamentation and apertures. Examining the specimens of the Wakino, the following characteristics are found besides those described by the former investigators; the apical angle of *Brotiopsis* is about 15°, though the four genera of the Melanatriinae are about 25°–30°. Furthermore, the body-whorl–spire ratio of *Brotiopsis* is smaller than those of four genera, namely the former is more highly conical than the latters. The problem that SUZUKI (1943) has noted whether *Brotiopsis* belongs to Melanatriinae or Thiarinae, is not settled. In the aperture features *Brotiopsis* is more closely related to *Melanoides* of the Thiarinae but more similar to *Brotia* of

the Melanatriinae in the surface ornamentation. The features around the aperture of this genus remind a closer relation to the type-genus of Thiarinae than that of Melanatriinae.

K. Suzuki (1943, p. 206) told the differences between *B. wakinoensis* s.s. and *B. wakinoensis ryohoriensis* as follows: "This subspecies differs from *B. wakinoensis* s.s. by the stronger spiral cords on the base and the stronger longitudinal ribs which are elevated into more marked tubercles or granules at the shoulder angle." These differences can not be marked off with the Wakino specimens as shown in the illustration (Text-fig. 1). *B. wakinoensis* occurs mainly in the lower formation and partly in the upper formation of the Wakino subgroup in Northern Kyushu, particularly making many fossiliferous beds at various horizons of the lower formation, and as it is well-preserved we can make clear the variation of the surface ornaments.

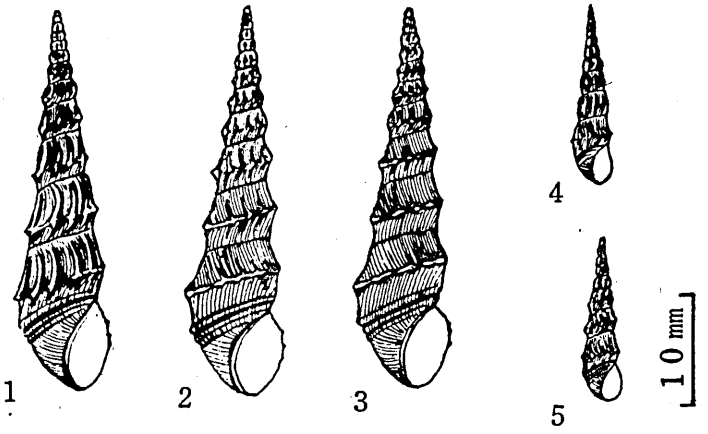

Fig. 1. Showing the variation of ornamentations of *B. wakinoensis*. (4, 5 immature form)

The ontogeny of *B. wakinoensis* can be traced from the early whorls to the last one by referring to the following features: the longitudinal rib, node or spine, spiral cord and the whorl shape.

The protoconch is not preserved in many cases but the early whorls are less eroded than the recent Melanatriinae.

1. *Longitudinal ribs and nodes*:— The sigmoidal longitudinal ribs parallel to the growth-lines are relatively high situating at the middle of whorl in the early stage, but descend to the lower one-third on the later whorls; and they vanish near both the sutures above and below. The ribs are well-marked even on the early whorls of the individuals obtained from the basal part of the Wakino subgroup. *B. wakinoensis* has strong longitudinal ribs from the very early stage of development. The strength gradually increases on the later whorls, changing into the nodes or the spines upon the shoulder.

The stage in which the nodes or the spines appear first, is variable. In some individuals they are only in the last whorl, but often they appear considerablly earlier. It is noticeable that the nodes or the spines are not always confined in specimens from the upper horizons.

2. *Shoulder cords*:— The shoulder cords are generally weaker than the ribs on the earlier whorls but they become distinct later. The individuals furnished with strong nodes or spines have the shoulder cords of increasing strength. Some strong shoulder cords on the later whorls consist of conjoined nodes. Some Asagadani specimens have distinct shoulder cords from the earlier whorls. Such a form is predominant in the upper horizone of the lower formation.

So-called *B. wakinoensis wakinoensis* has distinct shoulder cords from the very early whorls to the last, but no strong longitudinal ribs. Some figured specimens of SUZUKI (1943, pl. XV) show the longitudinal ribs with the nodes or spines upon the shoulder angle of the earlier whorls. Therefore, some Asagadani specimens look like *B. wakinoensis wakinoensis* rather than *B. wakinoensis ryohoriensis*. However, these two forms were coexistent and their ornamentations are intimately connected in one morphic series by transitional forms in the Wakino formation. It is more reasonable that they are joined into a taxon and not divided into the separate subspecies. Presumably *B. wakinoensis ryohoriensis* represents an ontogenic stage of this species, and *B. wakinoensis wakinoensis* is rather an advanced form within the range of fluctuation.

Measurement in mm.			Height	Diameter
TGWl. D	6008	(Pl. 1, fig. 1)	31	8
//	6011	(// , fig. 5)	25	7.5
//	6012	(// , fig. 8)	28	8
TGWl. S	5025. b	(// , fig. 9)	39	9
//	421	(// , fig. 10)	26	6
//	5021	(// , fig. 16)	17	5
//	4213	(// , fig. 17)	12	3
//	71212	(// , fig. 18)	{14 {10	{4 {3
//	71210	(// , fig. 20)	{18 {20	{5 {6
//	5026	(// , fig. 21)	15	3
//	71211	(// , fig. 22)	{14 {12	{3.5 {3
TGWl. A	108	(// , fig. 19)	18.5	6

Occurrence:— *Brotiopsis wakinoensis* occurs abundantly from the many beds of the lower formation of the Wakino subgroup in North Kyushu. The following map indicates its main localities. The sign × indicates the locality of *B. wakinoensis*.

(The sign • indicates the localities of *B. kobayashii kobayashii*, *B. kobayashii sinsyuensis*, *Yoshimonia katsukiensis* and *Viviparus onogoensis* which is described on the later pages.)

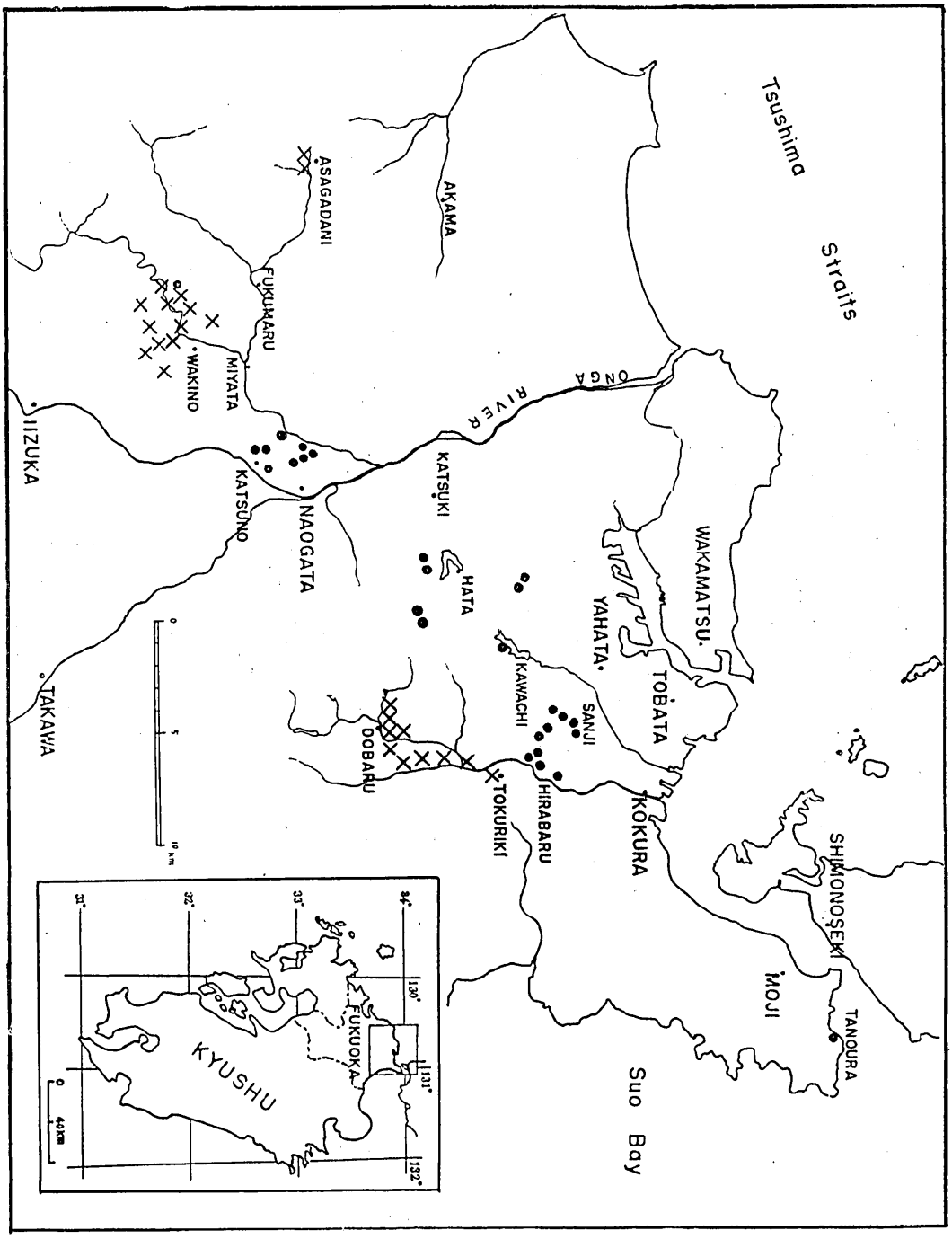

FIG. 2. Index map showing localities of gastropods from the Upper Mesozoic Kwanmon group in North Kyushu.

Brotiopsis kobayashii SUZUKI

Pl. 1, figs. 24–35

1943. *Brotiopsis kobayashii* SUZUKI, *Jour. Sigenkagaku Kenkyusyo, vol. 1 no. 2*, p. 207. pl. 17, figs. 10, b. 11 (B).

Measurement in mm.			Height	Diameter
TGWu. K	505	(Pl. 1, fig. 24)	13	3
〃	401	(〃 , fig. 25)	17.5	4.5
TGWu. N	301	(〃 , fig. 26)	12	3

Occurrence:— Lower Wakamiya formation (Upper formation) of the Wakino subgroup: about 1 km northwest of Katsuno station, Naogata city, and about 200 m north of Hirabaru, Kokura city; about 1 km south of Hata-reservoir, Hata-Kwannon, Katsuki-machi and east side of Kawachi-reservoir, Kawachi, Yahata city. Middle formation in the Wakino subgroup: cutting at the sea side near Tanoura, Moji city, Fukuoka Prefecture. (see Text-fig. 2)

Remarks:— Although many specimens from the above localities were examined, the details of surface ornaments cannot be seen. This species is hardly distinguishable from *Yoshimonia katsukiensis*, n. subgen. and n. sp. in outline and longitudinal ribs, but the cancellate sculpture and the fairly strong spiral cords of the latter cannot be seen. Generally the cancellate sculpture and the spiral cords of *Y. katsukiensis* are also ill-defined, except for well preserved specimens. These specimens under examination may be related to *Y. katsukiensis* as an opinion for the both species coexist in the same fossiliferous beds. The writer, however, makes them refer to *B. kobayashii*, for seemingly they have not the sculpture of *Y. katsukiensis*.

Brotiopsis kobayashii sinsyuensis SUZUKI

Pl. 2, figs. 1, 2.

1943. *Brotiopsis kobayashii sinsyuensis* SUZUKI, *Jour. Sigenkagaku Kenkyusyo, vol. 1, no. 2*, p. 208, pl. XVI, figs. 11, 12 and 13.

Measurement in mm.			Height	Diameter
TGWum. H	204	(Pl. 2, fig. 1)	14	3.8
TGWum. H	201	(〃 , fig. 2)	13	3.5
TGWum. H	201	(〃 , 〃)	12.5	3

Occurrence:— Upper formation of the Wakino subgroup: road cutting at south side of the 130 m hill, Hirabaru, Kokura city, Fukuoka Prefecture. (see Text-fig. 2)

Remarks:— A considerable amount of specimens was found in the sandstone. Although their detailed ornamentations are ill-defined, it is evident at least that the longitudinal ribs disappear on the last or last two whorls. Therefore, the shells may

be referred to *B. kobayashii sinsyuensis*.

Subfamily Thiarinae

Genus *Melanoides* Olivier, 1804

Subgenus *Yoshimonia*, new subgenus

Diagnosis:— Shell medium or small in size, conically turreted; test not thick. Spire high turreted; apex bluntly pointed. Whorls more than 8 in number, regularly and gradually increasing in width, rounded and having no angulation at the periphery; suture shallowly impressed; last whorl moderately inflated; base convex, not umbilicated. Surface ornament consists of several conbinations of spiral cords and longitudinal ribs, besides the fine longitudinal lines of growth. Aperture subvertical, ovate in outline, more or less acutely angled above and rather sharply rounded below, but not canaliculated. Inner lip more or less thickened, outer lip rather thin and simple; columella fairly strong and concave.

Type:— *Yoshimonia yoshimoensis*, sp. nov. (described below)

Distribution:— Brackish facies in the Upper Mesozoic of Eastern Asia: Yoshimo formation of the Toyonishi group in Yamaguchi Prefecture; Upper formation of the Wakino subgroup in Fukuoka Prefecture, North Kyushu.

Remarks:— With the general shape and the apertural features, this subgenus may safely fit to the subfamily Thiarinae in Thiaridae. The general features of this subgenus remind rather a close relation to *Melanoides* s. str. than to *Pseudopyrgular*, *Stenomelania* and *Pirenopsis*, but it can be safely distinguished from *Melanoides* by the more ovate aperture and the sculpture of the surface. This subgenus bears also some resemblances to the Japanese *Brotiopsis* Suzuki (Lower Cretaceous Naktong-Wakino series) in subfamily Melanatriinae and *Semisulcospira* in subfamily Pleurocerinae. Nevertheless, its surface ornament especially differs from that of *Brotiopsis*, and its aperture differs from *Semisulcospira*, being not expanded and angulated.

Melanoides (*Yoshimonia*) *yoshimoensis*, new species

Pl. 2, figs. 12–15; Text-fig. 3

1939. *Semisulcospira* (?) sp. *Japan. Jour. Geol. Geogr., vol. 16, nos. 3–4.* p. 224.

Description:— Shell medium in size, conically turreted in outline, about 4 times as high as broad, not umbilicated; test thin. Spire high conic, higher than a double of the body-whorl; apex bluntly pointed, apical angle 10°–15°. Whorls more than 8 in number, regularly and gradually increasing in width, fairly rounded; suture shallow; last whorl fairly inflated, rounded, tapering towards the lower end; base fairly convex. Surface sculptured with longitudinal ribs and spiral cords, besides the fine lines of growth; longitudinal ribs considerably elevated, parallel to the lines of growth, curved and not especially elevated at the shoulder, being in equal strength from suture to

suture, about 10 in number on the last whorl; spiral cords 8 on the spire whorls, roundly topped, broader than the interspace and make fine cancellate sculpture with the longitudinal ribs and the lines of growth; spiral cords on the lower half of the base are not well preserved; sutural cord, tolerably well impressed, and always well-defined by a subsutural cord. Aperture subovate, more or less acute above and sharply rounded below; inner lip fairly strong, outer margin rather simple and thin.

Measurement (in mm.):— The holotype specimen (TGTu. Y. 682 (a)) measures 22.5 mm in height and 7 mm in diameter.

Occurrence:— Yoshimo formation of the Toyonishi group: coastal region near Yoshimo, Shimonoseki city, Yamaguchi Prefecture.

Remarks:— The general shape and the ornamentation suggest that this species is closely related to *Brotiopsis kobayashii*, but it can be distinguished from the latter by the size, the not-so-strong ornamentation, the less number of ribs and the distinct cancellate sculpture. This cancellate sculpture distinctly appears upon the last three whorls. The variation, however, is not very clear, for it is not sufficiently preserved. The cancellate sculpture of this species is similar to those of the recent species, *Semisulcospira libertina* (GOULD), and the Mesozoic species, *S. recticancellata* KOBAYASHI and SUZUKI from the Lower Cretaceous Shiroi group in the Sanchu-Graben, Kwanto mountainland, but the present species differs from the latter two in the outline, the details of ornamentation and the apertural features. In the cancellate sculpture some species of *Goniobasis* and *Melanoides* (?) *whiteavesi* from the Upper Cretaceous and Eocene of North America are similar to this species, but it differs from them in having the nonsinuate ovate apertural feature and well rounded whorls. And also this species is distinguished from *Melanoides vulgaris* KOBAYASHI and SUZUKI, in having the whorls well rounded in the middle and the distinct cancellate sculpture.

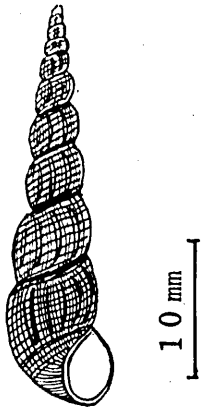

FIG. 3. *Yoshimonia yoshimoensis*

Melanoides (*Yoshimonia*) aff. *yoshimoensis* OTA

Pl. 2, figs. 3–11

Measurement in mm.			Height	Diameter
TGTu. Y	655	(Pl. 2, fig. 6)	32	8
〃	658	(〃 fig. 11)	30	8
〃	656	(〃 fig. 3)	29	7
〃	657	(〃 fig. 8)	29	8
〃	656	(〃 fig. 4)	28	8
〃	654	(〃 fig. 10)	27	7
〃	652	(〃 fig. 9)	21	5

Occurrence:— Common in silty black shales of the Yoshimo formation of the Toyonishi group: coastal region near Yoshimo, Shimonoseki city, Yamaguchi Prefecture.

Remarks:— A considerable amount of specimens was found in many fossiliferous beds in association with the species of *Corbicula*, *Polymesoda*, *Astarte*, *Bakevelia*, *Anomia*, *Ostrea* and *Corbula*. This species is identical or very closely allied with *Yoshimonia yoshimoensis* in the general shape, the longitudinal ribs and the apertural features except in the cancellate sculpture of the latter. The cancellate sculpture of *yoshimoensis* can be seen only in well preserved specimens. Therefore, it is highly probable that this species is represented as *yoshimoensis* whose sculpture partly has been lost, having many common features with *yoshimoensis* and also coexisting each other in the same beds. Inasmuch as the morphological relationship between them is obscure at present, this form cannot be decidedly named. The present species somewhat resembles *Melanoides vulgaris* KOBAYASHI and SUZUKI, but differs from it in the general outline and the apertural features. The general shape and the ornamentation suggest that this species is closely related to *Brotiopsis kobayashii*, but it can be distinguished from the latter by the not-so-strong ornaments and the less number of ribs.

Melanoides (*Yoshimonia*) *katsukiensis*, new species

Pl. 2, figs. 16–17; Text-fig. 4

Description:— Shell small in size, narrowly pyramidal in outline, much higher than broad; test thin. Spire turreted, much higher than the body-whorl and having straight outline. Whorls more than 8 in number, regularly and very gradually increasing in width, gently convex; suture very shallow; last whorl moderately inflated, rounded, tapering towards the lower end; base fairly convex. Surface cancellated with longitudinal ribs and spiral cords, besides the fine longitudinal lines of growth; longitudinal ribs distinctly elevated along the lines of growth, roundly topped, narrower than the interspace, oblique and curved, and not especially elevated at the shoulder, being in equal strength from suture to suture. Spiral cords on the spire whorls fine, numerous, not stronger than the growth-lines; in addition to more or less strong 7–8 cords roughened at regular interval, the peripheral one being the strongest, the others weak by degrees, and often elevated into granules at intersections with longitudinal ribs; the cords and growth lines make fine cancellate sculpture; basal cords 8, narrow and low, but fairly well-marked, roundly topped, uppermost cord placed just beneath the periphery, most elevated, the others becoming weak below. Aperture subvertical and subovate; inner lip fairly strong, somewhat expanded and slightly reflected.

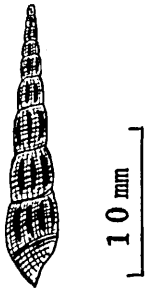

FIG. 4. *Yoshimonia katsukiensis*

Measurement:— The holotype (TGWu. K 811, pl. 2, fig. 16) is measuring 18.5 mm in height and 3 mm in diameter.

Occurrence:— Upper formation of the Wakino subgroup: about 1 km south of Hata-reservoir, Katsuki machi, Yahata city, Fukuoka Prefecture. (see Text-figure 2)

Remarks:— The general shape and ornament of these specimens are similar to *Micromelania*? *katoensis* SUZUKI and *Itomelania basicordata* SUZUKI from the Lower Cretaceous Rakuto series, but differ in size and ornaments. With the general shape and the ornamentation this species is in a close relation to *Brotiopsis kobayashii* s.s. from the Upper Naktong and Wakino formations; but the new species can easily be distinguished from the akin by the ornaments. This species also differs from *Yoshimonia yoshimoensis* in the acutely apical form, the smaller size and in the stronger spiral cords which are roughened at regular interval.

Subfamily Thiarinae

Genus *Melanoides* OLIVIER, 1804

Subgenus *Kumania*, new subgenus

Diagnosis:— Shell large in size, conically high turreted; test moderately thick. Spire high conic; apex bluntly pointed. Whorls more than 10 in number, regularly and gradually increasing in width, rounded; suture shallowly impressed; last whorl not so inflated, rounded, tapering towards the lower end; base fairly convex. Surface ornamented with longitudinal ribs and spiral cords besides the fine longitudinal lines of growth; longitudinal ribs rather pillar-shaped, and often elevated into nodes at the intersection with spiral cords. Aperture subvertical, broad in outline, sharply angled above and well rounded below, inner lip thick, moderately dilated.

Type:— *Kumania kawaguchiensis*, sp. nov. (described below)

Occurrence:— Limnic facies in the Lower Cretaceous Ryoseki group: Kawaguchi formation in South Kyushu.

Remarks:— Seeing the general shape and apertural features of the shell, this subgenus is included in the subfamily Thiarinae. With the characteristic surface ornamentation, especially the pillar-shaped ribs, it can easily be distinguished from the southern Asia genera *Stenomelania* and *Pirenopsis* and from the African *Melanopsis* and *Nyassia*. This subgenus bears also some resemblances to the Burman *Brotia* (*Antimelania*) of the subfamily Melanatriinae in the general shape and the surface ornamentation. The aperture, however, having neither canal nor sinuation, shows a closer relation to Thiarinae rather than to Melanatriinae. If it belongs to the latter subfamily, it may represent a new subgenus of the genus *Brotia*. It differs from all the other subgenera in its apertural features and the detailed characteristics of the surface ornaments.

Kumania kawaguchiensis, new species

Pl. 2, figs. 18–24; Text-fig. 5.

Description:— Shell large, thin, conically turreted in outline, about 6-times as high

as broad; not umbilicated. Spire high conic, far more than 4 times of the body-whorl in height; apex bluntly pointed, apical angle 10°–15°. Whorls more than 13 in number, regularly increasing in width, fairly rounded; suture shallow; last whorl not so inflated, rounded, tapering towards the lower end; base fairly convex. Surface ornament consisting of axial ribs and spiral cords besides the fine growth-lines; longitudinal ribs distinctly elevated at the middle of whorls along the lines of growth, pillar-shaped, almost as broad as the interspace, not extending from suture to suture, remaing two flat zones both above and below sutures, about 10 in number on the last whorl. Spiral sculpture consisting of several periphero-basal costae, sutural costa and some basals; sutural costa distinct, fairly wide and slightly elevated; periphero-basal costae only on the lower half of the whorl, three in number distinctly elevated above the surface, and prominently developed into more or less depressed nodes at the points of intersection with longitudinal ribs; basal cords and aperture not well observable. Inner lip fairly strong, somewhat expanded.

Measurement:— The holotype (GK.K 711. a, pl. 2, fig. 18) is 60 mm in length and 10 mm in width.

Occurrence:— Upper member of the Kawaguchi formation: Shimomatsukuma-mura, Yatsushiro-gun, Kumamoto Prefecture.

Remarks:— As this species is recorded as *Brotiopsis kobayashii* SUZUKI var. *elegans* MATSUMOTO (MS), it is more or less resembled to *Brotiopsis kobayashii* in the longitudinal ribs; but it can easily be distinguished from that form by the size, the ornamentation and the general shape. Some *Yoshimonia yoshimoensis* having longitudinal ribs too, are apparently similar to this species, but it differs from the present species in the general outline, size and the ornamentation.

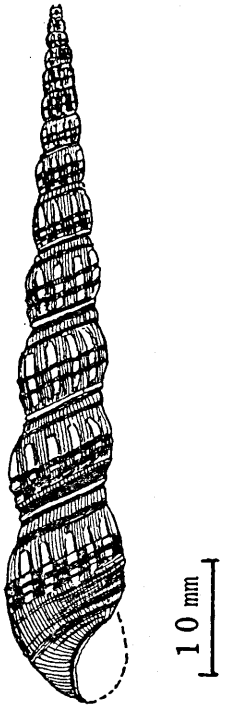

FIG. 5. *Kumania kawaguchiensis*

Viviparus onogoensis KOBAYASHI and SUZUKI

Pl. 3, figs. 1–26.

1937. *Viviparus onogoensis* KOBAYASHI and SUZUKI, *Japan. Jour. Geol. Geogr., vol. 14. nos. 1–2.* p. 48 pl. 5. figs. 13a, b.

1943. *Viviparus (Sinotaia) keisyoensis* SUZUKI, *Jour. Shigen. Kenkyusyo. vol. 1. no. 2*, p. 199. pl. 14, figs. 1–16.

Description:— Shell medium in size, conically ovate in outline, about 1.5 times higher than broad; shell substance thin. Spire conical, almost as high as the aperture, having a little convex outlines, with an apical angle of 55°–65°. Whorls more than

6, moderately or fairly rapidly increasing in width, convex, somewhat contracted at the lower suture; suture shallow but distinct; last whorl inflated, tapering towards the lower end, with round periphery; base convex; umbillicus very narrow, but distinct and deep. Surface ornamented with somewhat oblique, irregularly roughened lines of growth, often with irregular, obsolete spiral striae. Aperture not well preserved, probably subvertically ovate in outline, narrow above and round below; peristome continuous; outer lip thin and simple; inner lip slightly expanded.

Measurement in mm.			Height	Diameter
TGWu. K	1122	(Pl. 3, fig. 2)	17	13
TGWu. K	1121	(〃 , fig. 1)	14	8
TGWu. K	1323	(〃 , fig. 10)	18	13
TGWu. N	1325	(〃 , fig. 12)	17	9
TGWu. N	1321	(〃 , fig. 8)	12	11
TGWu. O	1413	(〃 , fig. 15)	20	10
TGWu. O	1411	(〃 , fig. 13)	17	9
TGWm. Y	1514	(〃 , fig. 20)	23	14
TGWm. Y	1512	(〃 , fig. 18)	22	11
TGSl. S	1611	(〃 , fig. 24)	20	14
TGWu. S	1213	(〃 , fig. 5)	17	12
TGWu. S	1212	(〃 , fig. 6)	12	9
TGWu. N	1322	(〃 , fig. 9)	18	10
TGWu. N	1324	(〃 , fig. 11)	14	8
TGWu. O	1412	(〃 , fig. 14)	23	18
TGWu. O	1414	(〃 , fig. 16)	20	10
TGWm. Y	1511	(〃 , fig. 17)	31	17
TGWm. Y	1515	(〃 , fig. 22)	22	14
TGWm. Y	1516	(〃 , fig. 23)	21	16

Occurrence:— Upper formation of the Wakino subgroup: about 1.5 km south of Nakahata, Katsuki-machi; about 1 km north-east of Saruhami; about 1 km south of Sanji, all in Yahata city; Yamada, Kokura city; about 500 m east of Kamoda, Naogata city, Fukuoka Prefecture. Lower member of the Inakura formation: Yamaji, Inakura-mura, Okayama Prefecture. Middle formation of the Wakino subgroup: Kuroshima, near Yoshimo, Shimonoseki city, Yamaguchi Prefecture.

Shiohama formation of the Shimonoseki subgroup: about 500 m south of Sanji, Yahata city.

Remarks:— Unfortunately all the specimens at hand from the various localities cited above are not sufficiently preserved. The fossils in the shales are often deformed, while those in the sandstones are much better, though the ornaments are not sufficient, presumably were very delicate when alive. Therefore, an accurate examination of its variation in ornamentation and outline cannot be made. Excluding the various effects of the secondary deformation, still there are a fairly wide range of variation. In this connection, the following features should be marked: the apical angles and the hight-width ratios. The apical angles are between 50° and 75°, 60° being the

predominance. The height-width ratio has the range from 0.55 to 0.85. The holotype of *V. onogoensis* measures 70° in the apical angle and 0.83 in the height-width ratio. These values are included in the variation range of Kwanmon specimens. As K. SUZUKI (1943. p. 200) mentions, *V. keisyoensis* is hardly distinguished from *V. onogoensis* in shape only. Therefore, it may be reasonable to consider that *V. keisyoensis* is the synonyms of *V. onogoensis*.

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Explanation of Plate I

Brotiopsis wakinoensis (Kobayashi and Suzuki) ..... Page 2

Figs. 1, 5, 8, 23. Lower formation of the Wakino subgroup: Dobaru, Kokura city, Fukuoka Pref. ×1.

Figs. 2–4, 6, 7, 9–15. Lower formation of the Wakino subgroup: Sengoku, Miyata-machi, Kurate-gun, Fukuoka Pref. ×1.

Immature specimens of *B. wakinoensis*

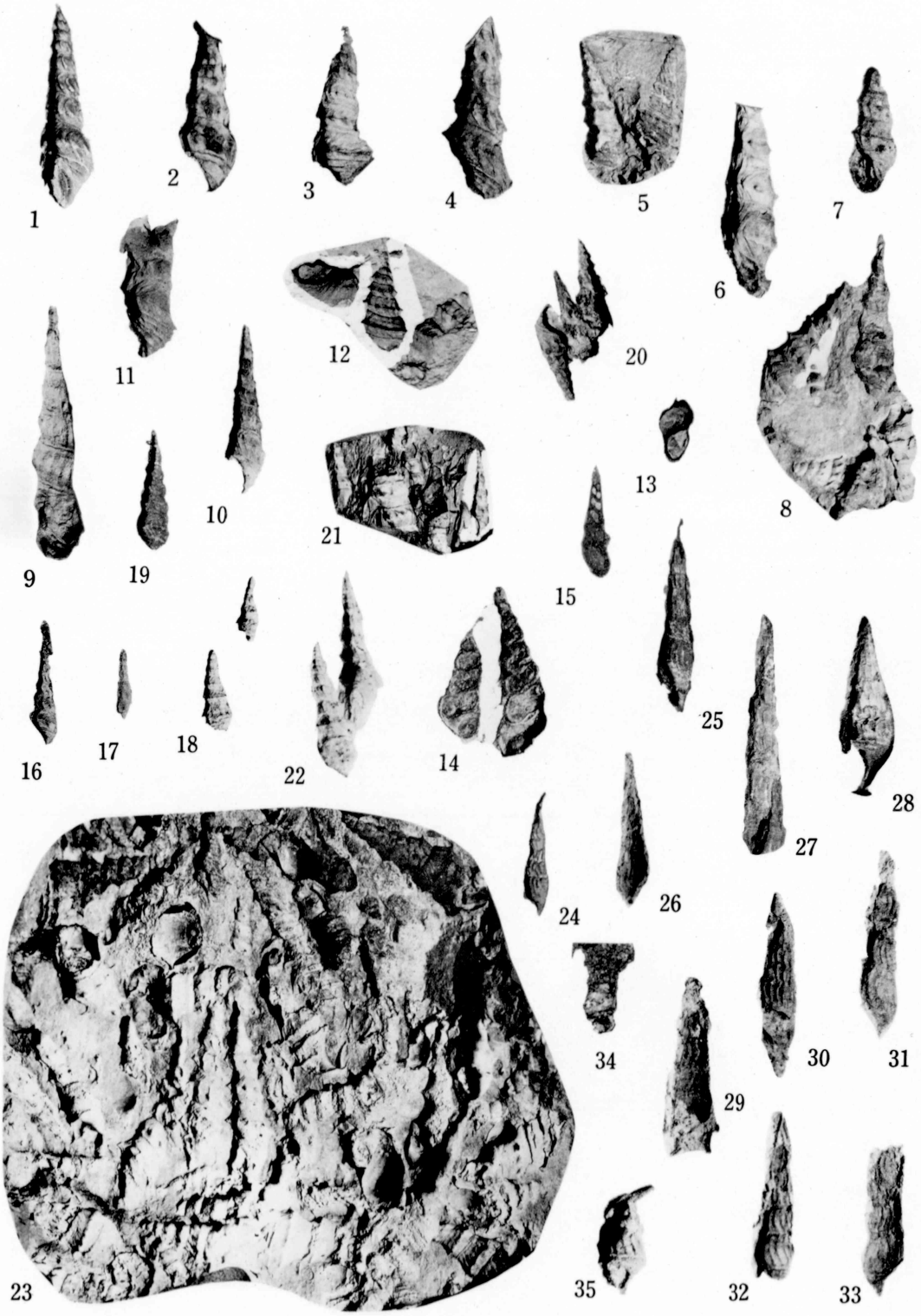
Figs. 16–18, 20–22. Lower formation of the Wakino subgroup: ditto. 22 ×2, the others ×1.

Fig. 19. Lower formation of the Wakino subgroup: Asagadani, Wakamiya-machi, Kurate-gun, Fukuoka Pref. ×1.

Brotiopsis kobayashii Suzuki..... page 6

Figs. 24, 25, 27, 28, 30, 34, 35. Upper formation of the Wakino subgroup: Hata, Katsuki-machi, Yahata city, Fukuoka Pref. 24, 25, 34. ×1.5 27, 28, 30, 35. ×2.

Figs. 26, 29, 31, 32, 33. Upper formation of the Wakino subgroup: Katsuno and Yurino, Naogata city, Fukuoka Pref. ×2.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Explanation of Plate II

Brotiopsis kobayashii sinsyuensis Suzuki ..... page 6

Figs. 1, 2. Uppermost formation of the Wakino subgroup: Hirabaru, Kokura city, Fukuoka Pref. 1 ×2, 2×1.

Yoshimonia aff *yoshimoensis*, Ota ..... page 8

Figs. 3–11. Yoshimo formation of the Toyonishi group: Yoshimo, Shimonoseki city, Yamaguchi Pref. ×1.

Yoshimonia yoshimoensis n. subgen., n. sp. ..... page 7

Figs. 12–15. Yoshimo formation of the Toyonishi group: Yoshimo, Shimonoseki city, Yamaguchi pref. ×1. 15a (Holotype)

Yoshimonia katsukiensis, n. sp. ..... page 9

Figs. 16–17. Upper formation of the Wakino subgroup: Hata, Katsuki-machi, Yahata city, Fukuoka Pref. ×2. 16 (Holotype)

Kumania kawaguchiensis, n. subgen., n. sp. ..... page 10

Figs. 18–24. Kawaguchi formation: Shimomatsukuma-mura, Yatsushiro-gun, Kumamoto Pref. 18, 19. ×0.8, 20–24. ×1. 18 (Holotype), 19, 20 (Paratype)


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Explanation of Plate III

All natural size

Viviparus onogoensis Kobayashi and Suzuki ..... page 11

Figs. 1, 2. Upper formation of the Wakino subgroup: Hata, Katsuki-machi, Yahata city, Fukuoka Prefecture

Figs. 3–6. Upper formation of the Wakino subgroup: Saruhami, Yahata city, Fukuoka Pref.

Fig. 7. Upper formation of the Wakino subgroup: Yamada, Kokura city, Fukuoka Pref.

Figs. 8–12. Upper formation of the Wakino subgroup: Yurino, Naogata city, Fukuoka Pref.

Figs. 13–16. Lower member of the Inakura formation: Yamaji, Inakura-mura, Okayama Pref.

Figs. 17–23. Middle formation of the Wakino subgroup: Kuroshima, Yoshimo, Shimonoseki city, Yamaguchi Pref.

Figs. 24–26. Shiohama formation of the Shimonoseki subgroup: Sanji, Yahata city, Fukuoka Pref.


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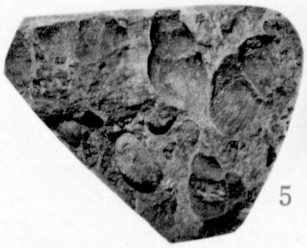
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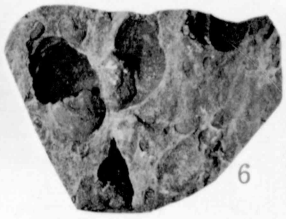
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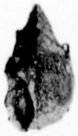
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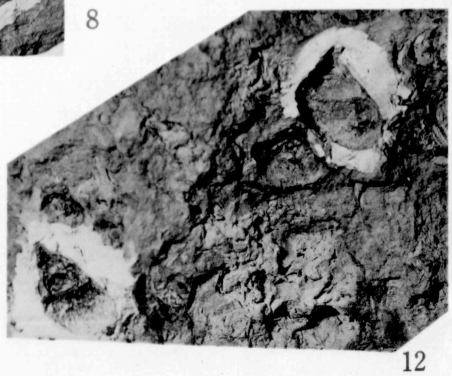
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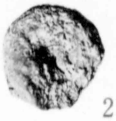
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