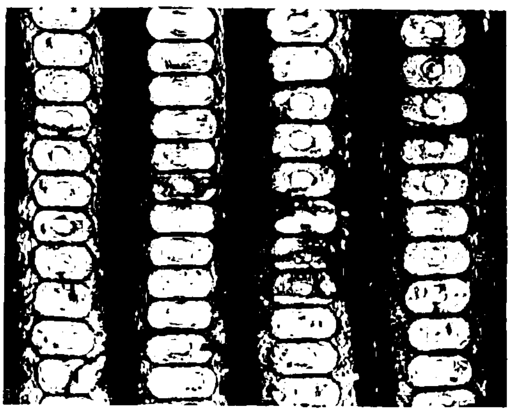
# 日本古生物学會 報告・紀事

# Transactions and Proceedings of the Palaeontological Society of Japan

New Series No. 47



日本古生物学会

Palaeontological Society of Japan

September 10th, 1962

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Geological Institute, Faculty of Science, University of Tokyo, Japan

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 47, pp. 273-276, Pl. 42, Sept. 10, 1962.

# 432. TRIGONIID FROM THE TETORI GROUP IN THE FURUKAWA DISTRICT, CENTRAL JAPAN*

SHIRO MAEDA

Geological Institute, Chiba University

飛驒，古川地域の手取層群産 Trigoniid： 海成杉崎砂岩から inoceramid, *Nucula* 等と共にやや多産する trigoniid を検討した結果，これは *Nipponitrigonia* の，新種であることを認めたので *Nipponitrigonia furukawensis* と命名し，記載した。なお，この機会に *Nipponitrigonia* の系統発生について若干の考察を加えた。 前 田 四 郎

Trigoniids bear importance for correlation of the Jurassic formations in Japan. Since S. IMAMURA (1933) had reported *Nipponitrigonia sagawai* from the upper Jurassic Kiritani formation, the occurrence of trigoniids was found in the Tetori group at various localities by the writer. Now, six species including Kiritani species are known as follows:

| | |
|---|---|
| *Nipponitrigonia sagawai* (YEHARA): Kiritani sandstone | Kiritani district |
| *Myophorella* (*Promyophorella* ?) *imamurai* KOBAYASHI: Kiritani sandstone | Kiritani district |
| *Latitrigonia tetoriensis* KOBAYASHI; Yambarazaka alternation | Kuzuryu district |
| *Latitrigonia orbicularis* KOBAYASHI; Yambarazaka alternation | Kuzuryu district |
| *Myophorella* (*Promyophorella*) *orientalis* KOBAYASHI and TAMURA: Yambarazaka alternation | Kuzuryu district |
| *Vaugonia yambarensis* KOBAYASHI; Yambara conglomerate | Kuzuryu district |

Lately the writer (1958) has carried out a stratigraphical study on the group in the central part of the Hida mountainland. As a result it was found that a new species of trigoniid occurs together with *Nucula*, ammonite and belemnite in the Sugizaki sandstone, north of Furukawa City, Gifu Prefecture. In this paper the new species, i.e. *Nipponitrigonia furukawensis*, is described and brief notes are given on the stratigraphy and phylogeny of *Nipponitrigonia*.

In the present study, the writer is much indebted Prof. T. KOBAYASHI of University of Tokyo who gave the writer constant advice and encouragement, and wishes to express his thanks to Dr. I. HAYAMI of the same University for his kind help.

## Note on the Stratigraphy

The Tetori group in the Hida mountainland can be classified as below.

| | |
|---|---|
| Itoshiro subgroup | Taic alternation of shale and sandstone (200-500 m. thick) |
| Kuzuryu subgroup | Sugizaki sandstone (150-200 m. thick) |
| | Numamachi alternation of shale and sandstone (150-350 m. thick) |
| | Tanemura conglomerate (250-500 m. thick) |

* Received Nov. 27, 1961; read at 79th Meeting of the Palaeontological Society of Japan on 24th September, 1961 at Kanazawa.

The facies change shows that group consists of two sedimentary cycles. The Numamachi and Taie alternations, composed of fine- to coarse-grained sandstone and mica-bearing black sandy shale, are non-marine deposits, and yield *Corbicula* (*Mesocorbicula*) *tetoriensis*, *Viviparus* (*Sinotaia*?) *onogoensis*, *Melanoides vulgaris minima* and other molluscs and fossil plants such as *Onychiopsis elongata*, *Cladophlebis denticulata*, *C. exiliformis*, *Podozamites lanceolatus*, *P. Reinii* and so on. The Taie alternation has been considered latest Jurassic in age. The lower part of the Sugizaki sandstone is characterized by the conglomerate and pebbly arkosic sandstone containing small subangular pebbles of granitic rocks, chert, Palaeozoic sandstone and shale. Its upper part is represented by coarse-grained arkose massive sandstone. The formation, which is a solitary marine deposit, yields *Nipponitrigonia furukawensis* n. sp., *Inoceramus furukawensis* (I. HAYAMI: 1960, pp. 311-312, pl. 16, fig. 8), *Nucula* sp., ammonite, belemnite and so on. *I. furukawensis* closely resembles the Makito species (HAYAMI, 1960). The formation has been correlated to the Mitarai shale (IWAYA: 1940, MAEDA: 1952) in the Makito area by the inoceramids and the sedimentary cycle, and is considered probably Oxfordian in age.

Although *Nipponitrigonia furukawensis* is contained in the lower as well as the upper part of the Sugizaki sandstone, it is very abundant in the lower coarse sandstone. There *N. furukawensis* is accompanied by *Nucula* sp. and other small pelecypods but inoceramid and ammonite are seldom found. It is presumed that the species of trigoniid preferred to shallow, conglomeratic or coarse sandy bottom under strong wave. From the occurrences of *Nipponitrigonia* in the Furukawa and Kiritani areas, it is thoroughly proved that the upper Jurassic Tetori sea extends in the inner side of the Eo-Nippon Cordillera (KOBAYASHI: 1941) from the Kuzuryu-Makito area to the Kiritani and Arimine areas through the Furukawa area.

## Description of Species

Family Trigoniidae LAMARCK

Genus *Nipponitrigonia* COX, 1952

*Nipponitrigonia furukawensis* MAEDA, new species

Plate 42, Figures 1-15

*Description*:—Shell small for genus, subquadrate, trigonal in outline, gently convex, a little longer than high, inequilateral, short and well rounded in front, produced behind; test thick. Postero-dorsal margin short, slightly curved, obliquely sloping, obtusely angulated with siphonal margin, which is fairly long and truncated; ventral margin long, gently arched, gradually merging with neighbouring margins; anterior margin rounded, shorter than siphonal margin; antero-dorsal margin oblique and passing into the anterior. Umbo high, elevated above hinge-margin, placed at a point about one-third of shell length from anterior extremity; beak distinct and orthogyrate. Disk wide and ornamented with concentric costae which are blunt, widely spaced, running from disk to area, and counted about 7 to 9; concentric fine lines seen in interspace; marginal angulation obtuse; escutcheon ill-defined and smooth. Hinge typical of *Trigoniae*. Inner side of shell markedly grooved on disk and area near marginal angulation, peciesally becoming stouter postero-ventrally.

*Measurement*:— Many undeformed specimens measure in mm as below:

| Specimen | Valve | Length | Height | Width |
|---|---|---|---|---|
| R. 6192101 | Left | 12 | 10 | 3 |
| R. 6192102 | Left | 12+ | 11 | 3. 5 |
| R. 6192103 | Left | 12+ | 10 | 3 |
| R. 6192104 | Right | 20+ | 19 | 5 |
| R. 6192105 | Right | 13 | 10. 5 | 3 |
| R. 6192106 | Right | 9 | 7 | 2 |
| R. 6192107 | Left | 15 | 13 | 4 |
| R. 6192108 | Right | 20+ | 17 | 5 |
| R. 6192109 | Right | 10 | 7. 5 | 2. 5 |
| R. 6192110 | Right | 14 | 11 | 3. 5 |
| R. 6192111 | Left | 11. 5 | 9 | 3 |

*Comparison*:—All the specimens are external and internal moulds. They greatly vary in outline, from oblong-ovate to rounded quadrangular. Most of them are, however, transversely quadrated trigonal. This species is a leading member of the Furukawa marine fauna. It closely resembles *Nipponitrigonia sagawai* (KOBAYASHI, 1957) from the upper Jurassic, and hardly differs from *N. sagawai* in internal mould. However, it is easily distinguishable from the species by concentric costae and fine concentric lines which the latter are in the anterior part of the disk, and by the little size. *Nipponitrigonia naumanni* (YEHARA, 1923) shows a wide variation in outline. The present species is similar to *naumanni*, especially by KOBAYASHI (1957) from Province Tosa in outline and aspects of concentric costae, but they differ in density of costae, outline and size of shell.

*Occurrence*:—Sugizaki sandstone in the Kuzuryu subgroup, the lower division of the Tetori group: the cliff east of Sugizaki, the valley south of Nonaka and the cliff north of Nakano in Furukawa City, Gifu Prefecture.

### Some Consideration on Phylogeny

Judging from the outline of shell, the development of costae in disc and the internal character, it is unquestionable that *sagawai* and *furukawensis* are the nearest relatives. *Sagawai* appeared earlier than *furukawensis*. Namely, *sagawai* ranges extensively from the Middle to the Upper Jurassic (KOBAYASHI: 1957), while *furukawansis* is limited to the Upper Jurassic (MAEDA: 1958). Therefore, *furukawensis* may have been derived from *sagawai* or *sagawai*-like form. Cretaceous *Nipponitrigonia* comprises smooth and costated forms. The former is represented by *kikuchiana* and *convexa*, and the latter by *naumanni* and *sakamotoensis*. KOBAYASHI (1957) pointed out already that "*kikuchiana* could be introduced from *sagawai*-like form by the loss of anterior costae". This opinion can be accepted from the character of the ornament in juvenile and adult stages. In another way, *convexa* smooth form may have been originated from the same *sagawai*-like form. A remarkable tendency for *Nipponitrigonia* is that the anterior costae were lost and the shell-size became larger in Cretaceous. On the other hand, it may be thought that *naumanni* and *sakamotoensis* were introduced from *furukawensis*-like form having concentric costae. Considered from another phylogenetic tendency of *Nipponitrigonia* it is certain that concentric costae on disk remained more or less distinct, number of its costae increased by degrees, and the shell size became larger in the Cretaceous period.

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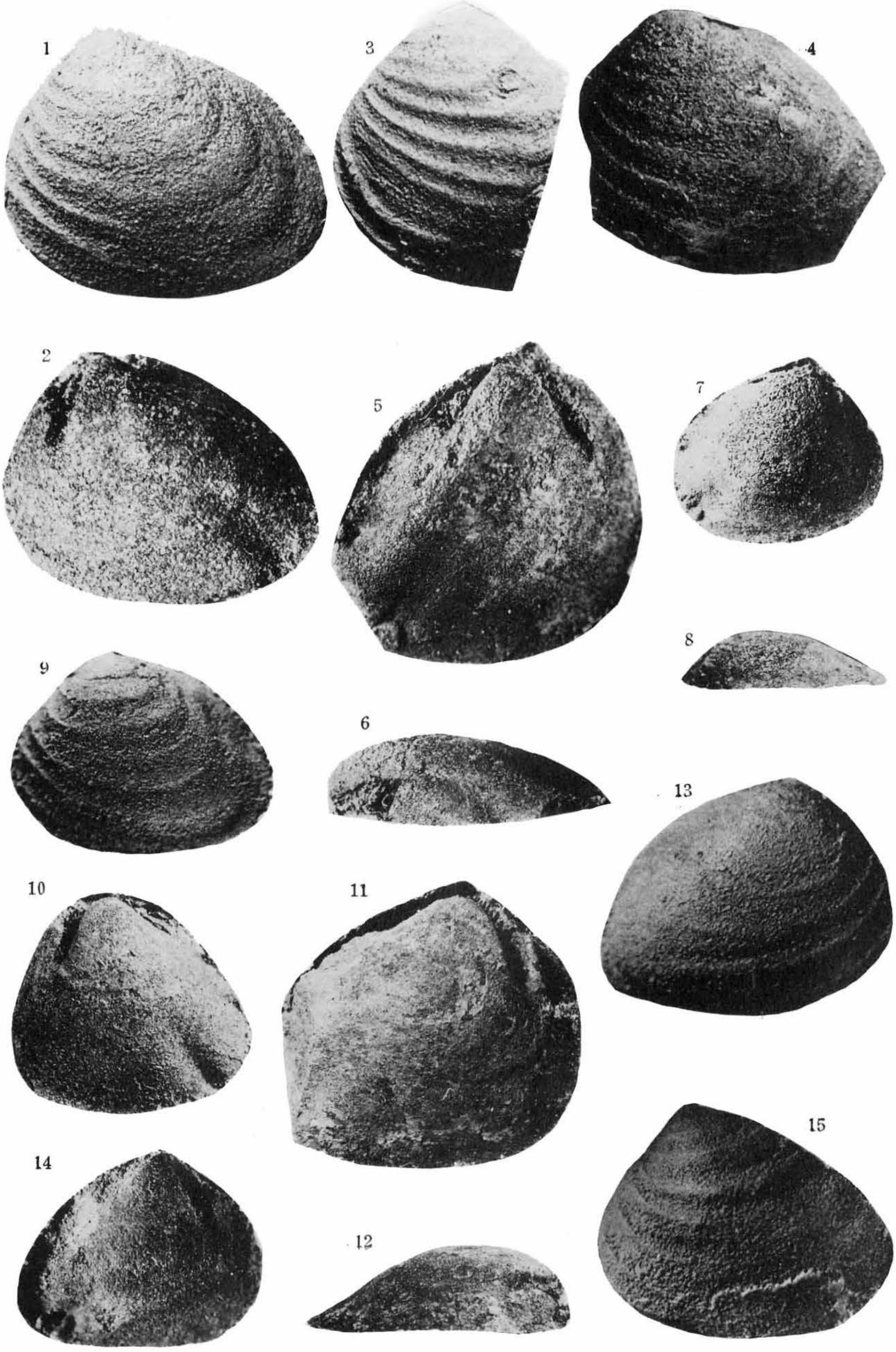
## Explanation of Plate 42

*Nipponitrigonia furukawensis* MAEDA, new species

Fig. 1. Clay cast of left valve, holotype (R. 6192101) ×4: Loc. Sugizaki (杉崎) in Furukawa City (古川市), Gifu Pref (岐阜県).
Fig. 2. Internal mould of left valve, holotype (R. 6192101) ×4, Loc. ditto.
Fig. 3. Clay cast of left valve, paratype (R. 6192102) ×4; Loc. ditto.
Fig. 4. Clay cast of left valve, paratype (R. 6192103) ×4; Loc. ditto.
Fig. 5. Internal mould of right valve, paratype (R. 6192104) ×2.5; Loc. ditto.
Fig. 6. Lateral view of the specimen shown in Fig. 5 (R. 6192104) ×2.5: Loc. ditto.
Fig. 7. Internal mould of right valve, paratype (R. 6192105) ×2.7; Loc. ditto.
Fig. 8. Lateral view of the specimen shown in Fig. 7 (R. 6192105) ×2.7; Loc. ditto.
Fig. 9. Clay cast of left valve, paratype (R. 6192106) ×4.5; Loc. ditto.
Fig. 10. Internal mould of left valve, paratype (R. 6192107) ×2.4; Loc. ditto.
Fig. 11. Internal mould of right valve, paratype (R. 6192108) ×2.5; Loc. ditto.
Fig. 12. Lateral view of the specimen shown in Fig. 11 (R. 6192108) ×2.5; Loc. ditto.
Fig. 13. Clay cast of right valve, paratype (R. 6192109) ×4.5; Loc. ditto.
Fig. 14. Internal mould of right valve, paratype (R. 6192110) ×2.7; Loc. South of Nonaka (野中) in Furukawa City, Gifu Pref.
Fig. 15. Clay cast of right valve, paratype (R. 6192111) ×4; Loc. Ditto.

All the illustrated specimens are kept in the Institute of Geology, College of Arts and Sciences, Chiba University, Chiba.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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 47, pp. 277-280, Pl. 43, Sept. 10, 1962.

# 433. INFLUENCE OF ENVIRONMENT ON THE VARIATION OF *BATILLARIA MULTIFORMIS* (LISCHKE)*

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ウミニナの変異に及ぼす環境の影響： 前回の論文で著者は縫合下帯に生ずる疣の発育程度によってウミニナを A, B, C の三型に分類した。全国的にみると、同一環境下にある同一産地から採集したウミニナとホソウミニナの型の出現頻度は同一傾向を示している。この点は地理的分布上においても同じである。それで疣の発育は環境に支配されるものと推定した。しかしホソウミニナの方が環境の変化に敏感である。疣の発育を促す原因は海水の温度よりも寧ろやや大きい塩分濃度に関係があるものと推定される。 永 沢 譲 次

## Introduction and Acknowledgements

The writer in his previous paper (NAGASAWA, 1961) classified *Batillaria multiformis* (LISCHKE) into three types according to the grade of development of the subsutural tubercles on their shells.

It is considered that variation in the shell of *B. multiformis* may result from its environment or inherited characters.

There is reason to believe that the variation of the shell may be a reflection of the environment as the writer explains in this paper.

The writer expresses his thanks to many students of Tokyo Gakugei University, Messrs. Masaharu ISHIKAWA and Kanji ABE who kindly submitted to him the samples for study.

Particular thanks are due to Professor Kotora HATAI of the Institute of Geology and Paleontology of Tohoku University for his advice and encouragement.

## Frequencies of types of *B. multiformis* and *B. cumingi*

The accompanying table shows the frequency of each type of the Recent *B. multiformis* and the closely related species: *Batillaria cumingi* (CROSSE) which always found living in association with the former species in the low tidal zone of Japan.

It may be noticed from the table that both the frequencies of the types of *B. multiformis* and *B. cumingi* collected from the same locality and influenced by the same environment show the same tendency e.g. parallel change.

This phenomenon can easily be understood to be an effect of the influence of the same environment on both species.

If the frequency of the types is not influenced by environment but by inherited characters, both species collected from the same locality would be expected to have no relation each other.

As may be known from the annexed map, the frequency of the types of both species shows also the same tendency or

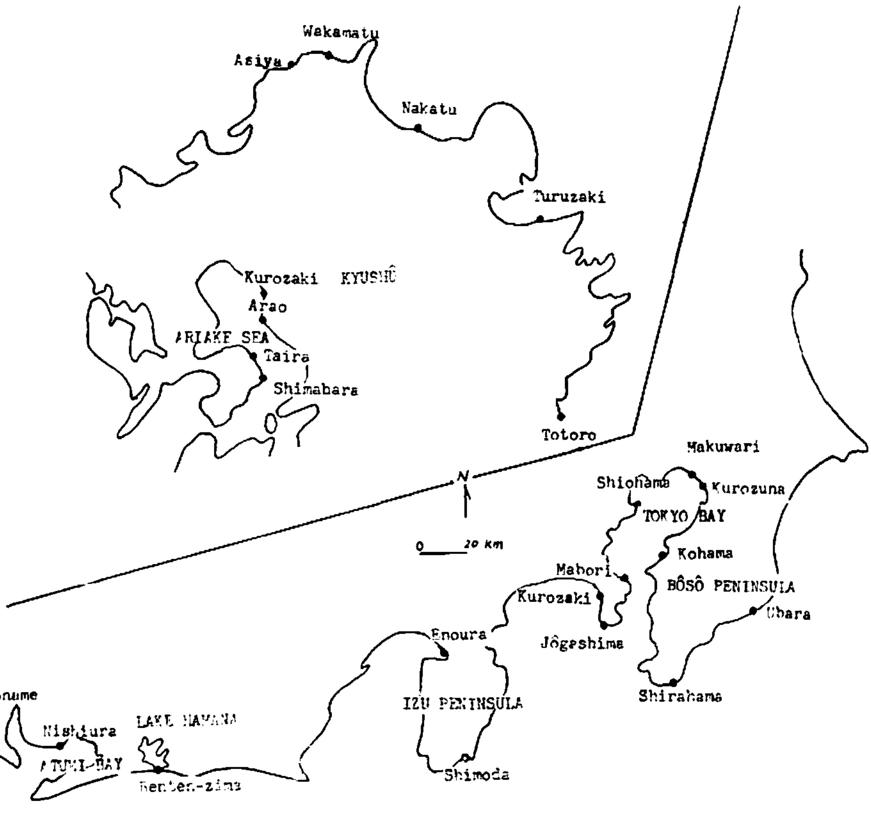
* Received Jan. 24, 1962; read Jan. 20, 1962.

Table 1. Frequencies of types of *Batillaria multiformis* (LISCHKE) and *B. cumingi* (CROSSE).

| Localities | Frequencies of types of *B. multiformis* | | | No. of indiv. | Frequencies of types of *B. cumingi* | | | No. of indiv. |
|---|---|---|---|---|---|---|---|---|
| | Type A | Type B | Type C | | Type A | Type B | Type C | |
| No. 1 | | | | | 100% | | | 12 |
| No. 2 | | | | | 75% | 21% | 4% | 24 |
| No. 3 | | | | | 50% | 43% | 7% | 30 |
| No. 4 | | | | | 33% | 67% | | 3 |
| No. 5 | | | | | 60% | 20% | 20% | 20 |
| No. 6 | 50% | | 50% | 2 | | | | |
| No. 7 | | | | | 50% | 50% | | 2 |
| No. 8 | | | | | 100% | | | 49 |
| No. 9 | 100% | | | 2 | | | | |
| No. 10 | | | | | 100% | | | 3 |
| No. 11 | 80% | 20% | | 25 | 100% | | | 1 |
| No. 12 | 100% | | | 10 | 100% | | | 2 |
| No. 13 | 100% | | | 30 | 87% | 13% | | 30 |
| No. 14 | 100% | | | 28 | 100% | | | 28 |
| No. 15 | 67% | 33% | | 100 | 52% | 48% | | 100 |
| No. 16 | 83% | 17% | | 42 | 5% | 58% | 37% | 40 |
| No. 17 | 100% | | | 1 | 14% | 56% | 30% | 82 |
| No. 18 | 82% | 18% | | 22 | 60% | 38% | 2% | 95 |
| No. 19 | 100% | | | 2 | 23% | 65% | 12% | 17 |
| No. 20 | | | | | 16% | 57% | 27% | 30 |
| No. 21 | 50% | 50% | | 6 | 27% | 60% | 13% | 100 |
| No. 22 | | 100% | | 1 | 10% | 36% | 54% | 50 |
| No. 23 | 40% | 55% | 5% | 20 | 13% | 37% | 50% | 40 |
| No. 24 | 100% | | | 8 | | | | |
| No. 25 | 100% | | | 47 | 100% | | | 30 |
| No. 26 | 7% | 63% | 30% | 60 | | | | |
| No. 27 | 64% | 33% | 3% | 33 | | 30% | 70% | 10 |
| No. 28 | 7% | 93% | | 20 | | | 100% | 14 |
| No. 29 | 19% | 50% | 31% | 16 | | | 100% | 30 |
| No. 30 | 100% | | | 2 | | | | |
| No. 31 | 87% | 13% | | 42 | 100% | | | 50 |
| No. 32 | 100% | | | 23 | 100% | | | 25 |
| No. 33 | 4% | 31% | 65% | 138 | | | 100% | 20 |
| No. 34 | | | | | 50% | 50% | | 10 |
| No. 35 | | | 100% | 1 | | | | |
| No. 36 | | 69% | 31% | 16 | 23% | 33% | 44% | 9 |
| No. 37 | 12% | 63% | 25% | 76 | 17% | 22% | 61% | 23 |
| No. 38 | | | | | | 33% | 76% | 18 |
| No. 39 | 100% | | | 18 | | | | |
| No. 40 | | 9% | 91% | 55 | | 50% | 50% | 4 |
| No. 41 | | | | | 60% | 40% | | 5 |

Locality Number:

1. Lake Akkeshi, Hokkaido. 2. Samukawa, Hakodate City, Hokkaido. 3. Yamasedomari, Hakodate City. 4. Tachimachi-misaki, Hakodate City. 5. Moheji, Kamiiso-gun, Hokkaido. 6. Shikutotsu-misaki, Muroran City, Hokkaido. 7. Etomo, Muroran City. 8. Noheji, Kamikita-gun, Aomori Prefecture. 9. Ashizaki, Ôminato, Aomori Prefecture. 10. Ôma, Shimokita Peninsula, Aomori Prefecture. 11. Shiohama, Kawasaki City, Kanagawa Prefecture. 12. Makuwari, Chiba Prefecture. 13. Kurozuna, Chiba City. 14. Kohama, Kisarazu City, Chiba Prefecture. 15. Northeast of Mabori, Yokosuka City. 16. Kurozaki, southwest of Miura




Text-fig. 1. Map showing localities.

Peninsula. 17. Southwest of Jôgashima, Miura Peninsula. 18. Southeast of Jôgashima. 19. Harada, Shirahama, Chiba Prefecture. 20. Harada, Shirahama, Chiba Prefecture. 21. Ubara, Chiba Prefecture. 22. Enoura, south of Numazu, Shizuoka Prefecture. 23. South of Kakizaki, Shimoda, Shizuoka Prefecture. 24. Tokoname, Chita Peninsula, Aichi Prefecture. 25. Akogigaura, Tsu City, Mie Prefecture. 26. Inô, Nishiura, Aichi Prefecture. 27. 1km south of Inô, Nishiura, Aichi Prefecture. 28. Takahama, Ishikawa Prefecture. 29. Ashiya, Fukuoka Prefecture. 30. Wakamatsu, Fukuoka Prefecture. 31. Nakatsu, Ôita Prefecture. 32. Tsuruzaki, Ôita Prefecture. 33. Totoro Bay, Miyazaki Prefecture. 34. Kurozaki, north of Ômuda City, Fukuoka Prefecture. 35. Arao City, Kumamoto Prefecture. 36. Taira, Nagasaki Prefecture. 37. Shimabara, Nagasaki Prefecture. 38. Northern coast of Aoshima, Miyazaki Prefecture. 39. Miyajima, Hiroshima Prefecture. 40. Uwajima, Ehime Prefecture. 41. Lake Hamana (near Benten-Zima), Shizuoka Prefecture.

similar change in their geographical distribution, namely, the type of both species collected from the inner part of the bay is generally A (estuary type), but that from the center or outer part of the bay or low tidal zone facing the open sea is generally of the types designated as B or C as in the case of Tokyo Bay and Uraga Strait, the Ise Bay and the Atumi Bay, and the Ariake Sea.

But, *B. cumingi* is liable to change more sensitively its form than *B. multiformis*, for the former species produces many individuals of B or C type under the same condition at the same locality.

Such examples were collected from the following localities: Kurozaki near Shimomiyata, Miura Peninsula, Harada at Shirahama and Ubara, Bôsô Peninsula, south of Kakizaki at Shimoda, Izu Peninsula and 1 km south of Inô, Nishiura, Aichi Prefecture.

The above facts suggest that the morphological changes of both species correspond with the change of environment and the cause by which B-C or C type is concerned is considered to be the rather highly saline water rather than the water temparature, because the type of *B. multiformis* collected from Takahama-machi in Ishikawa Prefecture where the water temperature is not so high, is B, and the type of *B. cumingi* is C and also the writer found B type and C type of *B. cumingi* in Hokkido where the water temperature is low and the type of *B. multiformis* collected from the Prehistoric Tokyo Bay whose water temperature was rather higher than that of Tokyo Bay, is generally A.

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NAGASAWA, J. (1961): The Stratigraphical Significance of the Variation of Fossil *Batillaria multiformis* (LISCHKE). *Trans. Proc. Palaeont. Soc. Japan*, N. S., *No. 43*. pp. 102-107.

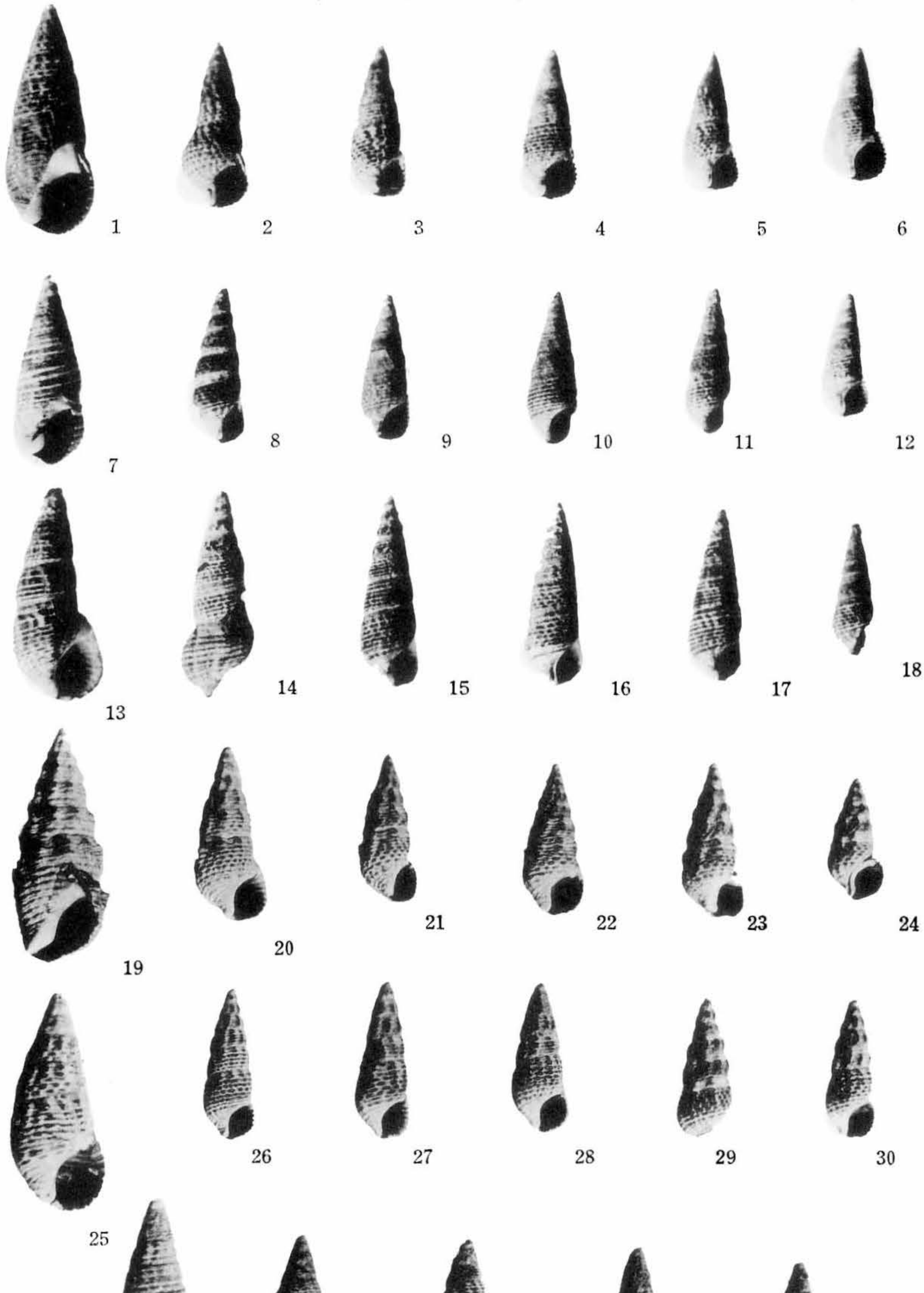
## Explanation of Plate 43

*Batillaria multiformis* (LISCHKE)

Fig. 1. Type A, Southeast of Jôgashima, Kanagawa Prefecture.
Fig. 7. Type A, Nakatu, Ôita Prefecture.
Fig. 13. Type A, Kurozuna, Chiba Prefecture.
Fig. 19. Type C, Totoro Bay, Miyazaki Prefecture.
Fig. 25. Type B, Takahama-mati, Ishikawa Prefecture.
Fig. 31. Type A, Harada at Shirahama, Chiba Prefecture.

*Batillaria cumingi* (CROSSE)

Figs. 2- 6. Type A. Southeast of Jôgashima, Kanagawa Prefecture.
Figs. 8-12. Type A, Nakatu, Ôita Prefecture.
Figs. 14-18. Type A, Kurozuna, Chiba City.
Figs. 20-24. Type C, Totoro Bay, Miyazaki Prefecture.
Figs. 26-30. Type C, Takahama-mati, Ishikawa Prefecture.
Figs. 32-35. Type B, Harada at Shirahama, Chiba Prefecture.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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 47, pp. 281-290, Pl. 44, Sept.. 10, 1962

# 434. THE FOSSILS AND THEIR HABITATS IN THE NEOGENE KATSURAGAWA GROUP, IN THE SOUTH KWANTO REGION*

MUNEMITSU SUGITA

Geological Institute, University of Tokyo

丹沢山地北縁の新第三紀層桂川層群の化石（主として二枚貝化石）を調査し，その化石産出層の堆積時における環境を論ずる。 杉田宗満

## I. Introduction

The Katsuragawa group forms a strip extending from Kawaguchi Lake to Sagami Lake for about 40 kilometers along the Katsuragawa valley which runs easterly between the Kwanto and Tanzawa Mountainlands. This paper mainly concerns with the portion of the group from Fujino** to Saruhashi***. It is composed of mudstone and various conglomerates partly known as "Iwatonoyama conglomerate bed" or "Katsuragawa conglomerate bed". It can be classified into the Shimada, Iwatonoyama, Otsuru and Nakamagawa formations in ascending order. Their lithology is shown in table 1. The fossils are found in the Shimada and Iwatonoyama formations besides some in the basal part of the Otsuru formation, although these fossils are not well preserved. The fossils and their localities are shown in Table 2 and 3.

Since HANAI had proposed the name, Katsuragawa conglomerate bed for the conglomerate and mudstone formation in 1927, many papers were published on their stratigraphy. The molluscan fossils in this group, however, have been little studied but SEKI's work (1937). From the lithology and molluscan palaeontology he reached the conclusion that the group was deposited in brackish water or inland sea. The habitats of the fos-

* Received Jan. 26, 1962; read June 2, 1962.

** Fujino Town, Tsukui District, Kanagawa Prefecture.

*** Otsuki City, Yamanashi Prefecture.

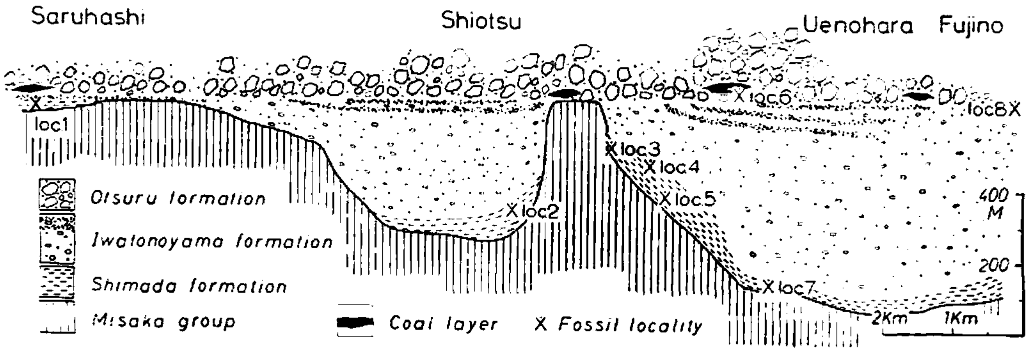


Fig. 1. Stratigraphical position of fossils.

Table 1.

| | | |
|---|---|---|
| Nakamagawa formation | 600 m+ | Conglomerate similar to that of the Otsuru formation, but with many large boulders of fresh pyroxene andesite. |
| Otsuru formation | max. 1200 m+ | Conglomerate brownish, with thin intercalations of mudstone: pebbles angular to subangular, ill-sorted and 20 to 30 cm in diameter: mudstone bluish to brownish and sometimes very coaly; cross-bedding common. |
| Iwatanoyama formation | 600 m+ to 3 m | Uppermost part: Alternation of conglomerate; change of pebbles in magnitude.<br>Main part: Monotonous conglomerate, resembling that of the upper Shimada formation. |
| Shimada formation | max. 100 m+ | Upper part: Alternation of conglomerate and mudstone; conglomerate grey to black; its pebbles well rounded, flat, 2 to 3 cm in diameter and sorted well: mudstone similar to that of the lower part.<br>Lower part: Mudstone black to grey and somewhat bituminous. |

Table 2. Localities of fossils.

| | |
|---|---|
| locality 1 | Jakotsuzawa, Otuki City, Yamanashi Prefecture |
| locality 2 | Hinate, Uenohara Town, Yamanashi Prefecture |
| locality 3 | Yassawa, Uenohara Town, Yamanashi Prefecture |
| locality 4 | do. |
| locality 5 | do. |
| locality 6 | do. |
| locality 7 | Shisseizi, Uenohara Town, Yamanashi Prefecture |
| locality 8 | Shibata, Fujino Town, Kanagawa Prefecture |

sils of this group are the main subject to be discussed in this paper.

The Katsuragawa group is nearly synonymous with the Nishikatsura group by FUKUDA and SHINOKI (1952) in Yamura and Otsuki areas and with the Katsuragawa series by KOBAYASHI et al. (1943) in Uenohara area. Because the materials in hand are not efficient for chronology, the writer follows FUKUDA and SHINOKI for the time being to refer the lower half of this group to the Middle Miocene.

The writer thanks Professors T. KOBAYASHI, and T. KIMURA, Assistant Professors T. HANAI and T. SATO, and Doctors T. HAMADA, K. CHINZEI, I. HAYAMI and A. TOKUYAMA of the University of Tokyo for their kind guidance.

## II. Fossils and their occurrence in the lower Shimada formation

The lower Shimada mudstone formation is generally rich in molluscan fossils as seen at locs. 1, 2, 3, 4 and 7.

Locality 1 (Jakotsuzawa)

*Species*:—*Anadara* (*Scapharca*) sp., *Acar* sp., *Ostrea* (*Crassostrea*) sp., *Trapezium* sp., *Joanisiella* sp., *Lucina* cf. *stearnsiana*, *Pitar*? sp., *Venerupis* sp., *Paphia* sp., *Clementia nakamurai*, *Clementia vatheleti*, *Macoma* sp., *Tellinides* sp., *Diodora* sp., Dendritic coral.

*Preservation*:—Often deformed.

*Frequency*:—Most numerous in number of shells, if compared with other localities of the formation. *Ostrea* sp. is dominant. *Lucina* cf. *stearnsiana*, *Trapezium* sp., and *Clementia vatheleti* are common. The other species are rather rare.

Table 3. List of the fossils from the Katsuragawa group.

| species | locality | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| *Acila* (s. s.) *divaricata* (HINDS) | − | − | + | − | − | − | − | − |
| *Ennucula* sp. | − | − | + | − | − | − | − | − |
| *Nuculana* sp. | − | − | + | − | − | − | − | − |
| *Portlandia* (*Megayoldia*) *tsuruensis* SUGITA, n. sp. | − | − | + | − | + | − | − | − |
| *Portlandia* (*Portlandella*) *ovata* (TAKEDA) | − | − | + | − | − | − | − | − |
| *Acar* sp. | + | − | − | − | − | − | − | − |
| *Anadara* (*Scapharca*) sp. | + | − | − | − | − | − | − | − |
| *Glycymeris* sp. | − | − | + | − | − | − | − | − |
| *Chlamys* ex. gr. *kaneharai* (YOKOYAMA) | − | − | − | + | − | − | − | − |
| *Palliolum* (*Delectopecten*) *peckhami tairanum* (YOKOYAMA) | − | − | + | − | − | − | − | − |
| *Ostrea* (*Crassostrea*) sp. | + | − | − | − | − | + | − | + |
| *Crassatellites* (*Eucrassatella*) sp. | − | − | + | − | − | − | − | − |
| *Corbicula* (s. s.) *matusitai* SUZUKI | − | − | − | − | − | + | − | − |
| *Trapezium* sp. | + | − | − | − | − | − | − | − |
| *Joanisiella* sp. | + | − | − | − | − | − | − | − |
| *Laptaxnus* ? sp. | + | − | − | − | − | − | − | − |
| *Lucina* cf. *stearnsiana* OYAMA | + | − | − | − | − | − | − | − |
| "*Cardium*" sp. | − | − | + | − | − | − | − | − |
| *Pitar*? sp. | + | − | − | − | − | − | − | − |
| *Venerupis* sp. | + | − | − | − | − | − | − | − |
| *Paphia* sp. | + | − | − | − | − | − | − | − |
| *Clementia* (s. s.) *nakamurai* OTUKA | + | − | − | − | − | − | − | − |
| *Clementia* (s. s.) *vatheleti* MABILLE | + | − | − | − | − | − | − | − |
| *Raeta* sp. | − | − | + | − | − | − | − | − |
| *Macoma optiva* (YOKOYAMA) | − | + | + | − | − | − | ? | − |
| *Macoma* sp. | + | − | − | − | − | − | − | − |
| *Macoma* ? sp. | − | − | − | − | − | + | − | − |
| *Tellinides* sp. | + | − | − | − | − | − | − | − |
| *Dentalium* (*Fissidentalium*) *vernedei* SOWERBY | − | − | + | − | − | − | − | − |
| *Diodora* sp. | + | − | − | − | − | − | − | − |
| *Cocculina* (s. s.) n. sp. ? | − | − | + | − | − | − | − | − |
| *Turcicula* (*Ginebis*) cf. *crumpii* (PILSBRY) | − | − | + | − | − | − | − | − |
| *Fusitriton oregonesis* (REDFIELD) | − | − | + | − | − | − | − | − |
| Gastropod gen. et sp. indet. | − | − | + | − | − | − | − | − |
| *Cyclammina cancellata* BRADY | − | + | + | − | + | − | − | − |
| *Cyclammina* aff. *ezoensis* ASANO (n. sp. ?.) | − | − | + | − | + | − | − | − |
| *Flabellum japonicum* MOSELEY | − | + | + | − | − | − | − | − |
| Ahermatypic simple coral | − | − | + | − | − | − | − | − |
| Dendritic coral | + | − | − | − | − | − | − | − |
| Rhynchonellidae, gen. et sp. indet. | − | − | + | − | − | − | − | − |
| Echinoid, gen et sp. indet. | − | − | + | − | + | − | − | − |
| Dicotyledoneae a sp. | − | − | + | − | − | − | − | − |
| Dicotyledoneae b sp. | − | − | − | − | − | + | − | − |

*Mode of occurrence* :—*Ostrea* sp. forms several banks in four horizons. Most remarkable is the top one, 50 to 60 cm thick and associated with a few individuals of *Anadara* sp., *Acar* sp., *Diodora* sp., and some fragments of various molluscan shells and dendritic corals. The other species are assemblaged with many broken shells in lenticular form. Intact shells are generally rare but some of *Trapezium*, *Pitar*, and *Clementia vatheleti* remain bivalved.

*Lithology* :—Bluish gray mudstone or pebbly mudstone. Sand pipes (1 to 2 cm in diameter) are found frequently just beneath the uppermost *Ostrea* bank.

Locality 2 (Hinate)

*Species*—*Macoma optiva*, *Cyclammina cancellata*, *Flabellum japonicum*.

*Preservation* :—Foraminifers are well preserved.

*Frequency* :—Much reduced in number of fossils, in comparison with locality 1. *Cyclammina cancellata* is dominant.

*Mode of occurrence* :—Widely scattered. Shell fragments are rare.

*Lithology* :—Homogeneous, gray and somewhat bituminous mudstone.

Locality 3 (Yassawa)

Two types of assemblage are discriminated, namely *Portlandia-Cyclammina* and *Acila-Palliolum* assemblages.

" *Portlandia-Cyclammina* assemblage "

*Species* :— *Portlandia* (*Megayoldia*) *tsuruensis* n. sp., *Portlandia* (*Portlandella*) *ovata*, *Raeta* sp., *Macoma optiva*, *Cyclammina cancellata*, *Cyclammina* aff. *ezoensis* (n. sp.?), Echinoid gen. et sp. indet.

*Preservation* :—Foraminifers are well preserved.

*Frequency* :—Less numerous than at locality 1 and also in *Acila-Palliolum* assemblage of locality 3. Dominant species are *Portlandia tsuruensis*, *Cyclammina cancellata* and *Cyclmmina* aff. *ezoensis*.

*Mode of occurrence* :—Widely scattered. Shell fragments are rare. A few specimens of pelecypods are bivalved.

*Lithology* :—Homogeneous, gray and somewhat bituminous mudstone.

" *Acila-Palliolum* assemblage "

*Species* :—*Acila divaricata*, *Ennucula* sp., *Nuculana* sp., *Portlandia tsuruensis*, *P. ovata*, *Glycymeris* sp., *Palliolum* (*Delectopecten*) *peckhami tairanum*, *Crassatellites* (*Eucrassatella*) sp., "*Cardium*" sp., *Raeta*? sp., *Macoma optiva*, *Dentalium* (*Fissidentalium*) *vernedei*, *Cocculina* n. sp., *Turcicula* (*Ginebis*) cf. *crumpii*, *Fusitriton oregonensis*, *Flabellum* sp., ahermatypic simple coral, Rhynchonellidae gen. et sp. indet., Echinoid gen. et sp. indet., Dicotyledoneae a sp.

*Frequency* :—Much more numerous than in the homogeneous mudstone (*Portlandia-Cyclammina* assemblage) and less so that at loc. 1 (Jakotsuzawa). *Dentalium vernedei*, *Palliolum peckhami tairanum*, *Macoma optiva* and *Acila divaricata* are common.

*Mode of occurrence* :—This assemblage occurs in lenses. Shell fragments are common. Most pelecypods are univalved, except *Macoma optiva*. Several specimens of this species remain bivalved.

*Lithology* :—Dirty, grey mudstone bearing a small quantity of granules of sandstone and shale, besides volcanic detritus and other rock fragments. The mudstone forms several lenticular beds (about 1 m in diameter) which are intercalated in homogeneous mudstone.

Locality 5 (Yassawa)

*Species* :—*Portlandia tsuruensis*, *Cyclammina cancellata*, *C.* aff. *ezoensis*, Echinoid.

*Frequency* :—Less numerous than at locality 3.

*Mode of occurrence and lithology* :—

Similar to those of *Portlandia-Cyclammina* assemblage at locality 3.

Locality 7 (Shisseizi)

Several thin layers of limestone (10 to 20 cm thick) are intercalated in homogeneous mudstone of similar lithology to that of locality 3. The limestone is impure, somewhat muddy, microcrystalline and bears some foraminifers including *Globigerina*. An indeterminable pelecypod is also found in the mudstone.

### III. The habitats of the fossils in the lower Shimada formation

In summarizing the above facts, it is evident that the lower Shimada formation in the eastern area (from Hinate to Shibata) is quite different in facies from that of the western area. In the eastern area the *Portlandia-Cyclammina* assemblage is commonly found in homogeneous mudstone, while at loc. 1. (Jakotsuzawa) such an assemblage is absent.

The horizontal and vertical distribution of the living species in the eastern area are as follows:

*Acila divaricata*:— Pacific Ocean: North-Latitude 30°-35°, Japan Sea: N35°-45° (KURODA and HABE, 1952), euneritic to subneritic zone (TAKI and OYAMA, 1954).

*Dentalium vernedei*—P: N23°-34°

*Turcicula crumpii*—P: N31°-41°, J:-N42°

*Fusitriton oregonensis*, P: N38°-59°, J: N36°-50°, euneritic to subneritic zone

*Cyclammina cancellata*—Indo-Pacific Ocean, 140-5000 m (ASANO, 1951)

*Portlandia, Nuculana, Palliolum* and *Cyclammina* show maximum development in outer neritic zone. Ahermatypic corals are also inhabitants near the margin of the continental shelves (J.W. WELLS, 1957). The salinity of the sea allows corals to dwell. Further the *Globigerina*-bearing limestone at Shisseizi probably indicates open sea condition. The fossiliferous bituminous mudstone suggests that the sea water was not strongly agitated. Considering the above facts it may be concluded that the area in question has been an open sea in a subneritic zone or near to it.

In the western area occur *Ostrea (Crassostrea), Trapezium, Joanisiella* and *Lucina*. *Lucina stearnsiana* lives now in the tidal to euneritic zone. The broken shells are abundant there. These facts suggest a shallow sea bottom under the influences of waves or currents for the site of deposition. In brief, it is reasonable to consider that this area was in a littoral or euneritic zone.

### IV. Fossils and their occurrence in the upper Shimada formation

The upper Shimada formation consists of conglomerate and mudstone in alternation. Pebbles of the conglomerate are well sorted, rounded, flat and 2 to 3 cm in diameter. Only one water-worn valve of *Chlamys* sp. ex gr. *kaneharai* was found to lie on a bedding plane in the conglomerate at locality 4; it was presumably transported by current together with flat pebbles.

### V. Fossils and their occurrence in the Iwatonoyama and Otsuru formation

Several valves of *Ostrea (Crassostrea)* sp. are found in the conglomerate of the upper part of the Iwatonoyama formation at Shibata (loc. 8).

Molluscan fossils are found in the coaly mudstone in the basal part of the Otsuru formation at Yassawa (loc. 6).

Locality 6 (Yassawa)

*Species*:—*Ostrea (Crassostrea)* sp., *Corbicula matusitai, Macoma* sp., Dicotyledoneae b sp.

*Preservation*:—Often deformed.

*Frequency*:—*Ostrea* sp., *Corbicula matusitai* and Dicotyledoneae b sp. are abundant.

*Mode of occurrence*:—*Ostrea* sp. forms several banks. *Corbicula matusitai* often bivalved and *Macoma* sp. are scattered widely. Leaves Dicotyledoneae b sp. are gregarious and sometimes accumulated with *Corbicula* or *Ostrea*.

*Lithology*:—Black coaly mudstone bearing coal patches or lenses and pyrite grains.

The occurrence of *Ostrea* (*Crassostrea*) and *Corbicula* in the coaly mudstone indicates brackish condition for this part. No animal fossils are found in the other part of the Otsuru formation.

## VI. Summary

Molluscs are main fossils in the lower half of the Katsuragawa group. The lowest formation or the Shimada has been deposited in a subneritic zone in the eastern area, but in a littoral zone in the the western area insofar as can be judged from the fossils and the lithology. The Iwatonoyama formation above the Shimada formation bears *Ostrea* rarely. The lowest part of the Otsuru formation is rich in *Corbicula* and *Ostrea* at Yassawa. In view of the fossils and their mode of occurrences, this area may be said to have been in brackish condition.

## VII. Description of Species

### Genus *Dentalium* LINNÉ 1758

### Subgenus *Fissidentalium* FISCHER 1885

### *Dentalium* (*Fissidentalium*) *vernedei* SOWERBY

Plate 44, Figure 1

1842. *Dentalium vernedei* SOWERBY, Thes. Conch. vol. 3, p. 101, pl. 223, fig. 3.

1928. *Dentalium vernedei* SOWERBY, YOKOYAMA, *Imp. Geol. Surv. Rep., no. 101*, p. 68, pl. 5, fig. 12, pl. 6, fig. 6, 6a.

1953. *Dentalium* (*Fissidentalium*) *vernedei* SOWERBY, HABE, Gen. Japan. Shells, (Pel. & Scaph.) p. 293, figs. 741, 742, 743.

1960. *Dentalium* (*Fissidentalium*) *vernedei* SOWERBY, MAKIYAMA, *Paleont. Soc. Japan, Sp. Pap. 6*, pl. 92, fig. 6.

*Dimensions*:—(On a comparatively well preserved specimen)

| | |
|---|---|
| length: | 7.6 cm |
| diameter: | 1.05 cm (max.), 0.28 cm (min.) |

*Remarks*:—All specimens are fragmentary except for a nearly complete one. Compared to *D. yokoyamai* MAKIYAMA, the shell is more strongly curved and possesses finer sculpture and its diameter increases more slowly. The shell is thick and bent abruptly in a point near the apex. In view of these features, the writer identified this specimen with *D. vernedei*. It is a common member of the recent fauna of Japan, but rare among fossils.

*Occurrence*:—Middle Miocene, Shimada formation at the locality 2 (*Acila-Palliolum* assemblage) at Yassawa on dirty mudstone associated with *Acila divaricata*, *Ennucula* sp., *Palliolum peckhami tairanum* and *Crassatellites* sp.

### Genus *Portlandia* MÖRCH 1897

### Subgenus *Megayoldia* VERILL et BUSH 1897

### *Portlandia* (*Megayoldia*) *tsuruensis* SUGITA, n. sp.

Plate 44, Figures. 2–6

*Description*:—Shell of medium size for genus, inequilateral, moderately inflated, usually slightly taller than a half length. Umbonal profile obtusely angular; umbones slightly incurved, very slightly opisthogyrous and a little anterior in position. Postero-dorsal profile rather strongly concave. Antero-dorsal profile gently slant, straight from umbo, describing a semi-ellipse with anterior and antero-ventral margins. Ventral margin strongly convex. Posterior end somewhat truncated. Surface ornamented with fine, weak, regularly spaced concentric threads.

Hinge, which is comparatively well preserved in one specimen consists of a straight anterior row of 25 or 26 denticles and a concave posterior row of 21 denticles. Chevron-shaped teeth form a slightly obtuse angle below the umbo. Adductor scars and pallial line obscure.

*Dimensions* :—

| Specimen | length | height | inflation |
|---|---|---|---|
| holotype | 2.55 cm | 1.34 cm | 0.30 cm |
| no. 2 | 2.36 | 1.23 | 0.23 |
| no. 3 | 1.36 | 0.65 | 0.20 |

*Remarks* :— This species is distinguished from *Portlandia* (*Megayoldia*) *gratiosa* (YOKOYAMA) by the postero-dorsal profile bent up.

The present collection contains 15 specimens, 2 of which are bivalved, 3 specimens occurred in *Acila-Palliolum* assemblage at loc. 2 at Yassawa and the others in *Portlandia-Cyclammina* assemblage. Most of them are internal moulds.

*Occurrence* :-Middle Miocene, Shimada formation at the following localities; locality 2 (*Cyclammina-Portlandia* assemblage) at Yassawa—the holotype and several other specimens in homogeneous mudstone in association with *Raeta* sp., *Macoma optiva*, *Cyclammina cancellata* and *Cyclammina* aff. *ezoensis* (n. sp.?); loc. 2 (*Acila-Palliolum* assemblage)—3 specimens in dirty mudstone yielding *Acila divaricata*, *Ennucula* sp., *Glycymeris* sp., *Pallioum peckhami tairanum*, *Crassatellites* sp., *Macoma optiva*, *Dentalium vernedei* etc.; loc. 4 at Yassawa—2 specimens in homogeneous mudstone associated with *Cyclammina cancellata*, *Cyclammina* aff. *ezoensis*, Echinoid gen. et sp. indet.

Genus *Palliolum* MONTEROSATO 1884

Subgenus *Delectopecten* STEWART 1930

*Palliolum* (*Delectopecten*) *peckhami tairnum* (YOKOYAMA)

Plate 44, Figures 7-9

1925. *Pecten tairenus* YOKOYAMA, *Jour. Coll. Sci., Imp. Univ. Tokyo, vol. 45, art. 7*, p. 8, pl. 1, figs. 8, 9.

1934. *Pecten* (*Pseudamussium*) *peckhami* GABB. OSE. *Jour. Geol. Soc. Japan, vol. 41, no. 486*, pp. 125-130, pl. 4, figs. 1-2.

*Dimensions* :—

| Specimen | length | height |
|---|---|---|
| no. 1 (left) | 1.05 cm | 0.97 cm |
| no. 2 (left) | 1.07 | 0.97 |
| no. 3 (left) | 1.35 | 1.11 |
| no. 4 (right) | ? | 1.07 |

*Remarks* :—5 specimens, including a right valve, are at hand. Their ill preservation does not admit any detailed observation. The right valve, however, shows irregular concentric undulations and seemingly lacks radiating lines. The left valves are similar to the right except for the flat anterior ear. They are a little longer than high. These specimens closely resemble the type specimen of *Pecten tairanus* YOKOYAMA. They are longer than *Palliolum peckhami* (GABB) of North America.

Typical *Palliolum peckhami* (GABB) occurs in the Pacific Coast of North America. The materials of "*Palliolum peckhami*" and the species allied to it abundantly occur also in Japan. For these materials several species were proposed (ex. *Pecten tairanus* YOKOYAMA, *Pecten peckhami* GABB, *Pecten watanabei* YOKOYAMA, *Pecten beshoensis* KURODA), while OMORI and UTASHIRO (1951) contended that they must be united into one species. The writer regards tentatively *Pecten tairanus* YOKOYAMA as a subspecies of *peckhami*.

## Genus *Lucina* LAMARCK 1799

### *Lucina* cf. *stearnsiana* OYAMA

Plate 44, Figuress 10-11

cf. 1927. *Loripes philippiana* (REEVE), YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo. ser. 2. vol. 1. pt. 10*, p. 434, pl. L, figs. 1-2. (non REEVE)

cf. 1954. *Lucina stearnsiana* OYAMA, in TAKI and OYAMA, *Pal. Soc. Japan Sp. Pap. 2*, p. 52, pl. 47, figs. 1, 2.

cf. 1959. *Lucina stearnsiana* OYAMA, KIRA, Col. Ill. Shells, Japan, p. 134, pl. 53, fig. 7.

*Dimensions* :—

| specimen | length | height | inflation |
|---|---|---|---|
| no. 1 | 2.6 cm | 2.2 cm | 0.7 cm |
| no. 2 | 2.8 | 3.0 | 1.2 |
| no. 3 | 2.5 | 2.7 | 0.7 |
| no. 4 | 2.8 | 3.4 | 1.35 |

*Remarks* :—Many specimens were collected, most of which are, however, so strongly deformed that their exact identification is difficult to be made. Their common characteristics are as follows. The shell is rather strongly inflated. The postero- and antero-dorsal margins are subhorizontal. The straight antero-dorsal margin forms a right angle with the anterior margin and merges with it in a rather sharp curve. From these aspects the specimens are provisionally called *Lucina* cf. *stearnsiana*.

*Occurrence* :—Middle Miocene, Shimada formation at the locality 1 (Jakotsuzawa) on pebbly mudstone associated with *Joanisiella* sp., *Pitar*? sp., *Venerupis* sp., *Paphia* sp., *Clementia nakamurai*, *Clementia vatheleti*, etc.

## Genus *Clementia* GRAY 1847

### *Clementia* (s. s.) *nakamurai* OTUKA

Plate 44, Figure 12

1925. *Clementia speciosa* YOKOYAMA, *Jour. Fac. Sci. Imp. Univ. Tokyo, sec. 2, vol. 1. pt. 3*, p. 119, pl. 14, fig. 7. (non YOKOYAMA, 1923)

1938. *Clementia nakamurai* OTUKA, *Jour. Fac. Sci. Imp. Univ. Tokyo, sec. 2, vol. 5, pt. 1*, p. 14, pl. 1, fig. 4.

*Dimensions* :—

| length | height | inflation |
|---|---|---|
| 4.5 cm | 4.9 cm | 1.5 cm |

*Remarks* :—A solitary specimen at hand is similar to Clementia *vatheleti* MABILLE. In this specimen, however, the postero-dorsal margin forms a smaller angle with the antero-dorsal margin than in *C. vatheleti*. The postero-dorsal margin is arcuate in *C. vatheleti*, but straight in this specimen. The latter is more produced in the ventral side if compared with the former. These char-acteristics are all common to *C. nakamurai*. By this reason this specimen can safely be identified with *C. nakamurai*.

*Occurrence* :—Middle Miocene, Shimada formation at the locality 1 (Jakotsuzawa) on pebbly mudstone associated with *Joanisiella* sp., *Pitar*? sp., *Venerupis* sp., *Paphia* sp., *Clementia vatheleti*, etc.

## Genus *Cyclammina* H.B. BRADY, 1876

### *Cyclammina* aff. *ezoensis* ASANO (n. sp.?)

Plate 44, Figures 13-15

*Description* :—Test large, compressed, planispiral, composed of two or three volutions, evolute-penultimate volution well exposed in the umbilical region; periphery sharply angulated in apertural view, remarkably lobulated in side view; chambers eleven or so in the last whorl, sutures distinct, depressed, sigmoidal; last chamber especially large; wall arenaceous, surface smooth; aperture inobservable because apertural faces are broken in all specimens at hand.

*Dimensions* :—

| specimen | number of chambers | larger diameter | smaller diameter |
|---|---|---|---|
| no. 1 | 12 | 5.3 mm | 3.5 mm |
| no. 2 | 13 | 4.8 | 3.4 |
| no. 3 | 11 | 4.5 | 3.8 |
| no. 4 | 11 | 4.8 | 3.5 |

*Remarks* :—These specimens are distinguished from the various species of *Cyclammia* by its lobulated periphery and its evolute test. *C. ezoensis* is evolute, but this form is more evolute.

*Occurrence* :—Middle Miocene, Shimada formation at the following localities; loc. 2 (*Portlandia-Cyclammina* assemblage) in Yassawa on homogenous mudstone associated with *Portlandia tsuruensis*, *Raeta* sp., *Macoma optiva*, *Cyclammina cancellata*; loc. 4 in Yassawa on homogenous mudstone associated with *Portlandia tsuruensis*, *C. cancellata*, Echinoid sp.

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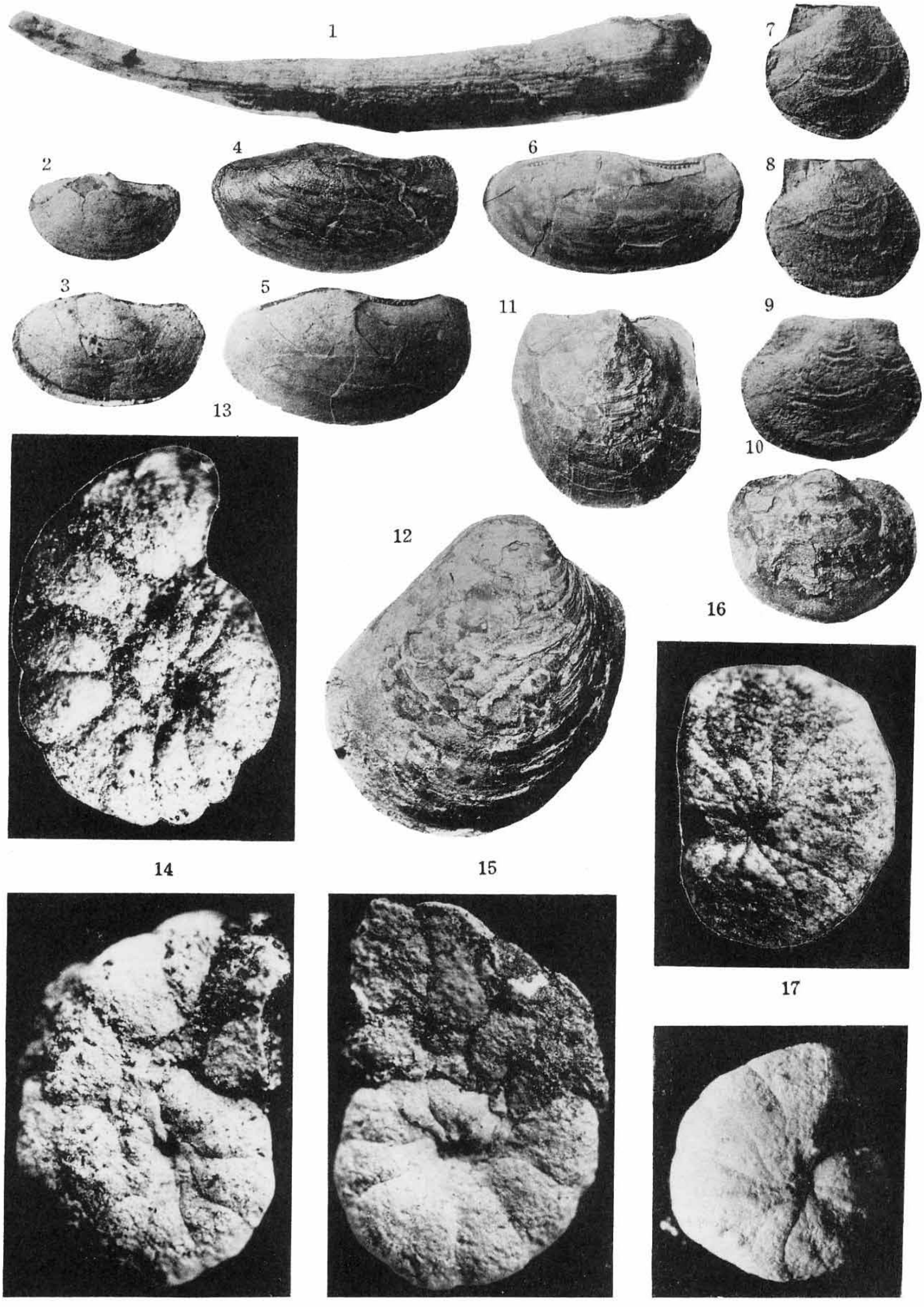
## Explanation of Plate 44

Fig. 1. *Dentalium* (*Fissidentalium*) *vernedei* SOWERBY
loc. 2, Yassawa, ×1.5
Figs. 2-6. *Portlandia* (*Megayoldia*) *tsuruensis* SUGITA, n. sp.
2, 3 ; loc. 4, Yassawa, ×2
4, 5, 6 ; loc. 2, Yassawa, ×1.5 (4, 5 ; holotype)
Figs. 7-9. *Palliolum* (*Delectopecten*) *peckhami tairanum* (YOKOYAMA)
loc. 2, Yassawa, ×2
Figs. 10-11. *Lucina* cf. *stearnsiana* OYAMA
loc. 1, Jakotsuzawa, ×1
Fig. 12. *Clementia nakamurai* OTUKA
loc. 1, Jakotsuzawa, ×1
Figs. 13-15. *Cyclammina* aff. *ezoensis* ASANO (n. sp. ?)
loc. 2, Yassawa, ×10
Figs. 16-17. *Cyclammina cancellata* BRADY
loc. 2, Yassawa, ×10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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 47, pp. 291-297, Pl. 45, Sept. 10, 1962.

# 435. CHEVRONS OF GLYCYMERID SHELLS*

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タマキガヒ類の靱帯稜（溝）について：本邦産化石 *Glycymeris* の数種について，靱帯稜（溝）の形態的特徴と，殻の成長に伴なう靱帯稜の数のふえ方とを調べた結果，靱帯稜のふえ方は殻形の増大率とは無関係で，むしろ貝の年令に対応していることがわかった。そしてこのことは，産地毎に異る成長率の把握に役立ち，古生態学的な解析の手がかりになり得ることを指摘した。

早　坂　祥　三

## Introduction and Acknowledgements

It is known that some of the formations of Pleistocene age in the Boso Peninsula, Chiba Prefecture, yield abundant glycymerid shells. Among them, the specimens of *Glycymeris yessoensis* (SOWERBY) from the Nagahama Gravel at the sea-cliff of Sasage, Ôsawa-cho, Kimitsu-gun, Chiba Prefecture have fairly large and thick shells with peculiar ligamental chevrons. For paleoecological consideration it is of importance to understand whether the large size of the Sasage specimens is due to the extraordinary growth of normal form (unusual longevity) or represents merely the normal adult stage of gigantic form caused by the unusual rate of shell development. For this purpose, discrimination of the age determining characters, for example, the genuine annual rings excluding the other rings such as "disturbance rings" of ORTON (1926, *fide* HAYASHI, 1955) is most convenient. It is usually difficult, however, to distinguish them near the shell margin on the outer surface and in thin section, of the *Glycymeris* shells. In this regard, the writer has paid particular attention to examining the "chevron-type" (OWEN, 1959) ligamental ridges.

In this article are given the results of observations on the ligamental chevrons as an important character of glycymerid shells: by means of these observations the peculiarity of the Sasage specimens has been understood. Special emphasis is given to that the increase in number of ridges is independent of the rate of increase in shell size but is closely related with the age of shell-fishes, and consequently the number of chevron-type ridges can be taken up as an age-determining character.

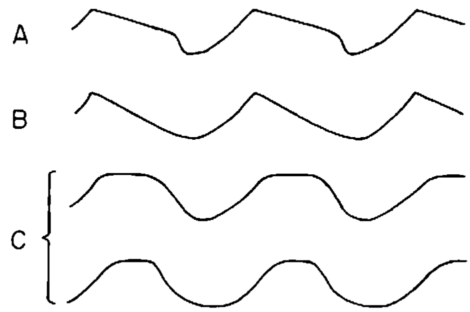
Here the writer expresses his hearty thanks to Professor Kotora HATAI of the Institute of Geology and Paleontology, Tohoku University, for kindly supervising the present work. Acknowledgements are also due to Drs. Tamio KOTAKA and Koichiro MASUDA, both of the Tohoku University, for their valuable advices and suggestions, and to the writer's father, Dr. Ichiro HAYASAKA of the Shimane University for his encouragement and criticism.

* Received Jan. 10, 1962; read at 79th Meeting of the Palaeontological Society on 24th Sept., 1961 at Kanazawa.

### Observations on the ligamental chevrons

Chevron-type ridges or grooves on the triangular ligamental area between the beak and the hinge line of the glycymerid shells have usually been accepted as one of the fundamental specific characters. Generally, however, they have been taken into account only as to number and strength observed in the apparently adult specimens; there are only a few authors who paid attention to their morphogenetical significance, such as variability, mode of development, origin of the chevron-type ligament and so on (MAKIYAMA, 1930, 1952; OWEN, 1959).

Observing the morphological features of the ligamental area, the following several points have been recognized. Except for *vestita*, *albolineata*, *reevei*, *nakamurai* and *cisshuensis* of which triangular ligamental areas are flat and smooth after the removal of the chevron-type ligament materials, the line connecting the apices of the chevron-type ridges is usually biassed posteriorly in accordance with the degree of lateral asymmetry of shell outline, and therefore, the ligamental ridges are not equal in number in the anterior and posterior ligamental areas. For example, in most specimens of *rotunda*, *yessoensis* and *pilsbryi* the ligamental ridges on the anterior part are one more in number than those on the posterior. In the Pliocene species *nipponica*, a rather small and highly triangular shell, the above-mentioned median line is extremely biassed posteriorly, and the number of ridges is quite different in the two parts of area (Pl. 45, figs. 4, 5). This does not seem to have any relation to the asymmetry of the shell-outline, but seems to be an fundamental character of this species, because some of the topotype specimens and all the specimens from the three different localities in the Northeast Honshu have this very character.




Text-fig. 1. Diagram showing the three types of profile of the ligamental chevrons (ridges and grooves).

Table 1. The breadths of ligamental chevrons and the types of profile of ligamental area in eight different species of *Glycymeris*.

| Species | Breadth (mm) of chevron | Type of profile* |
|---|---|---|
| *gorokuensis* | 1.0± | A? |
| *matumoriensis* | 0.7–0.8 | A? |
| *nipponica* | 0.3–0.4 | C |
| *pilsbryi* | 0.3± | C–A |
| *rotunda* | 0.4–0.5 | B, C |
| *totomiensis* | 0.4± | A–C |
| *yamasakii* | 0.4–0.5 | A–C |
| *yessoensis* | 0.6–1.0 | B–A |

The breadths of the ligamental chevrons in the species concerned are shown in Table 1. For convenience, the breadth of each set of ridge and groove was measured. So far as the specimens dealt with here are concerned, the breadth ranges from 0.3 to 1 millimeter, and appearing to be rather constant in each species. Generally speaking, the breadth varies correspondingly to the shell size

* Diagrammatically shown in Text-fig. 1.

of each species in the adult stage.

Of the shape in profile of ligamental area of the treated species, three different but mutually related types are recognized (Text-fig. 1). The type of profile seen in each species is shown in Table 1. Generally, two types are observed in each species. This character is rather variable according to growth stage and specimen-group(population) among others even in the same species. It is noticeable, however, that the most fundamental is the type A, from which the other two types, B or C, are derived.

As the result of the foregoing observations, it should be noticed that although there are hardly any perceptible morphological feature of each species, the breadth of the ligamental chevron and the shape in profile of ligamental area are criteria worthy to note in the specific description of the glycymerid shells.

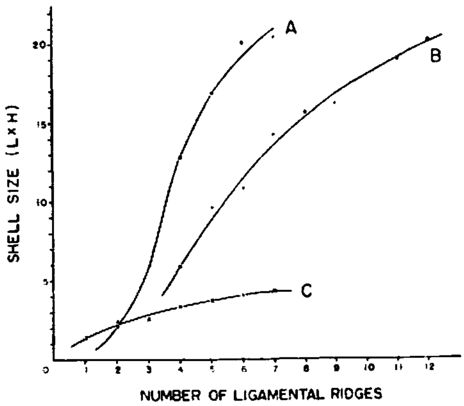
**Developemnt of ligamental chevrons**

(1) Ontogenetic significances of the ligamental ridges.

It is well known that the number of ligamental ridges increases with the growth of shells. MAKIYAMA (1930), who first studies the correlation between the shell size (length) and the number of ridges forming the ligamental chevrons of glycymerid shell, pointed out that there is a case where the correlation appears to differ in two specimen-groups of the same species from two different localities.

The writer attempted to make a graph showing the relation between shell size and number of ridges of the specimens at hand representing a few different species. To avoid the factor resulting from the difference in proportion of shell outline due to the difference in species, the shell size is represented by the value of length×height (both in mm). The number of ligamental ridges is represented by the number in the anterior half of the ligamental area. The assembly of the points obtained by such a procedure can be considered to represent the "growth series" of each species from each locality. The specimens here treated are of *G. pilsbryi*, *G. rotunda* and *G. yessoensis*, and all are from two consecutive formations of Pleistocene age at three different localities in the Boso Peninsula.

As shown in Text-fig. 2, 1) the rate of increase of ligamental ridges referring to shell-size development is fairly differ-




Text-fig. 2. Graph showing the relationships between the number of ligamental ridges and the shell size in three different species of *Glycymeris*.

A - *G. yessoensis* (SOWERBY) from the Pleistocene Yabu Formation at Azu, Ichihara-gun, Chiba Prefecture. (N=43)

B - *G. rotunda* (DUNKER) from the Pleistocene Jizôdô Formation at Izumiyatsu, Ichihara-gun, Chiba Prefecture. (N=25)

C —*G. pilsbryi* (YOKOYAMA) from the same Formation as above at Jizôdô, Fukuta-cho, Ichihara-gun, Chiba Prefecture. (N=47) ent from species to species, that is, in the order of *pilsbryi*>*rotunda*>*yessoensis*, but 2) each curve on the graph assumes the formof the typical or sigmoid growth-curve, and shows that there exist, in the growth process of each species, two phases, namely self-accelerating and self-inhibiting; and at the same time the limit of shell growth is shown. The growth limit seems to be consistent with the habit of growth lines which become closer towards the ventral margin of the adult shell.

It rarely occurs that the point representing the correlation between shell size and number of ridges extremely deviates in position on the graph from the general tendency of the species concerned. In all cases, however, it indicates the relation that the number of ridges is extremely large in comparison with the shell size, and no inverse relation has been encountered. Through the examination on each specimen showing such a deviation, it has been recognized that the growth lines are much more closely developed than in the other specimens of nearly the same sizes (Pl. 45, figs. 8, 9), and consequently the shell development of it might have been abnormally suppressed for some reason. Therefore, it seems plausible to assume that the above-mentioned deviation is the result from that the ligamental ridges had increased in number independently of the suppressed rate of shell development.

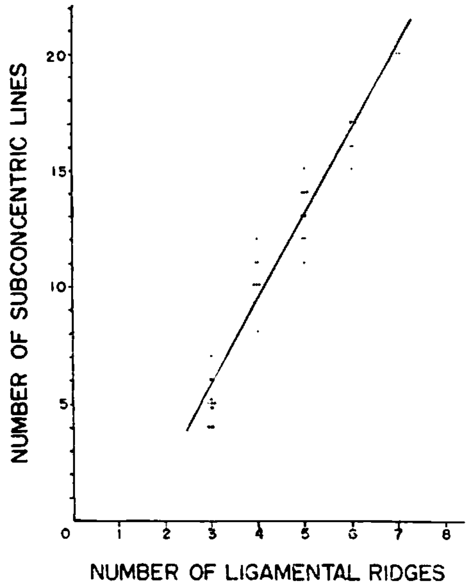
Judging from the foregoing, it can be considered that the rate of increase in number of ligamental ridges is rather constant in comparison with that of shell size, and is assumed to be nearly parallel to the age of the shell-fishes. To scrutinize whether it is correct, it is necessary to examine the correlaiton between the number of ridges and the true annual rings. But unfortunately, the descrimination of true annual rings is usually difficult as already mentioned. Thereupon, the writer has used the "sectioning method" of HAYASHI (1955) for age determination (Pl. 45, fig. 6). According to HAYASHI, the number of subconcentric lines observed in the thin section of the molluscan cardinal plate corresponds to that of the annual rings of the shell, and it can therefore be regarded as one of the age determining characters. For this observation, staining by water soluble eosin is effective. The results are graphically shown in Text-fig. 3,* where the correlation between them is represented by a straight line (correlation coefficient: 0.96). Consequently, the number of limamental ridges can be regarded as of age-parallel and to be an indicator of growth stages of glycymerid shells.

(2) Shell-size of each specimen-group in relation to the number of ligamental ridges.

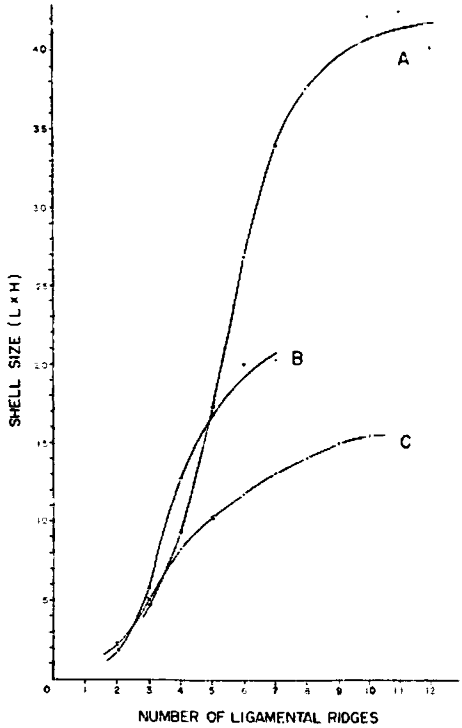
As it has been made clear that the number of ligamental ridges is an indicator of the growth stages, the curves on the graph showing the relation between the shell-size and the number of ridges can be regarded as the so-called growth curves.

Between several specimen groups of *G. yessoensis* from various localities and horizons, considerable differences in the rate and limit of shell-growth are recognized (Text-fig. 4; Pl. 45, figs. 1-3). On the other hand, however, in the self-accelerating phase of shell-development all the specimen-groups represent

* Although it is unknown, concerning *Glycymeris*, whether the lines observed in the cardinal plate are of annual origin or of the seasonal, it can be safely regarded as a biological scale of growth stages.




Text-fig. 3. Graph showing the relationship between the number of ligamental ridges and the number of subconcentric lines of growth observed in thin section of cardinal plate (see Pl. 45, fig. 6). *Glycymeris yessoensis* (SOWERBY) from the Pleistocene Yabu formation at Azu, Ichihara-gun, Chiba Prefecture. (N=33)




Text-fig. 4. Graph showing the relationships between the number of ligamental ridges and the shell size in three different specimen-groups of *G. yessoensis*.

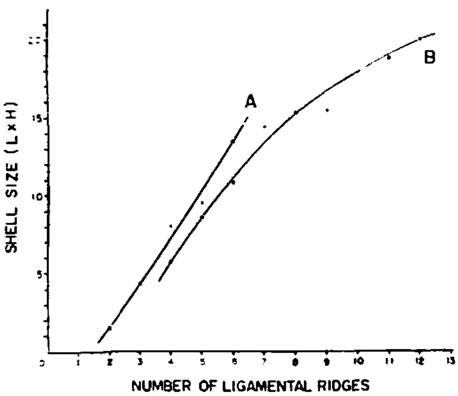
A—Sasage Coast, Ôsawa-cho, Kimitsu-gun, Chiba Prefecture, Nagahama Gravel, Pleistocene. (N=41)

B—Azu, Ichihara-gun, Chiba Prefecture, Yabu formation, Pleistocene. (N=43)

C—Anden Coast, Oga City, Akita Prefecture, Shibikawa Formation, Upper Pliocene. (N=75)

nearly the same value of the shell-size against the number of ligamental ridges, i.e., similar courses of development. And the same relation is also recognized in specimen-groups of *G. rotunda* (Text-fig. 5). Consequently the relation between the shell-size and the number of ligamental ridges is considered peculiar to the species as the self accelerating phase is concerned.

Among the four specimen-groups shown in Text-fig. 4, the Sasage specimens represent the extremely high limit of shell development in comparison with the other three. But the numbers of ligamental ridges near the growth-limit are nearly equal (10-11) to that of the Shibikawa specimens which have a lowest rate of growth and the smallest sizes. Therefore, the large size of the Sasage specimen is judged to be due not to the large longevity as seen in the case of bank-building *Ostrea gigas* THUNBERG (HAYASAKA, 1960) but to the much more rapid rate of shell development which seems to be consistent with the great thickness of the shell. Because of the deficiency of specimens, the above-stated




Text-fig. 5. Graph showing the relationships between the number of ligamental ridges and the shell size in two different specimen-groups of *G. rotunda*.

A—Ninomiya, Naka-gun, Kanagawa Prefecture, Ninomiya Formation, Upper Pliocene. (N=25)

B—Izumiyatsu, Ichihara-gun, Chiba Prefecture, Jizôdô Formation, Pleistocene. (N=25)

results can not be examined in comparison with the Recent ones, but a comparison with them from various localities or environments will serve as a basis for considering their paleoecological meaning.

(3) Relation between the convexity of shells and the rate of shell-development.

The mean values of the convexity of the shells in each specimen-group are shown in Table 2. In this table, the

Table 2. The mean values of the convexity of shells in each specimen-group.

| Species | Specimen-group | Mean value of shell-convexity |
|---|---|---|
| *yessoensis* | Sasage | 0.528 (N=41) |
| *yessoensis* | Azu | 0.661 (N=43) |
| *rotunda* | Izumiyatsu | 0.682 (N=25) |
| *yessoensis* | Shibikawa | 0.734 (N=75) |
| *pilsbryi* | Jizôdô | 1.566 (N=47) |

## Explanation of Plate 45

(All figures are in natural size except for the fig. 6)

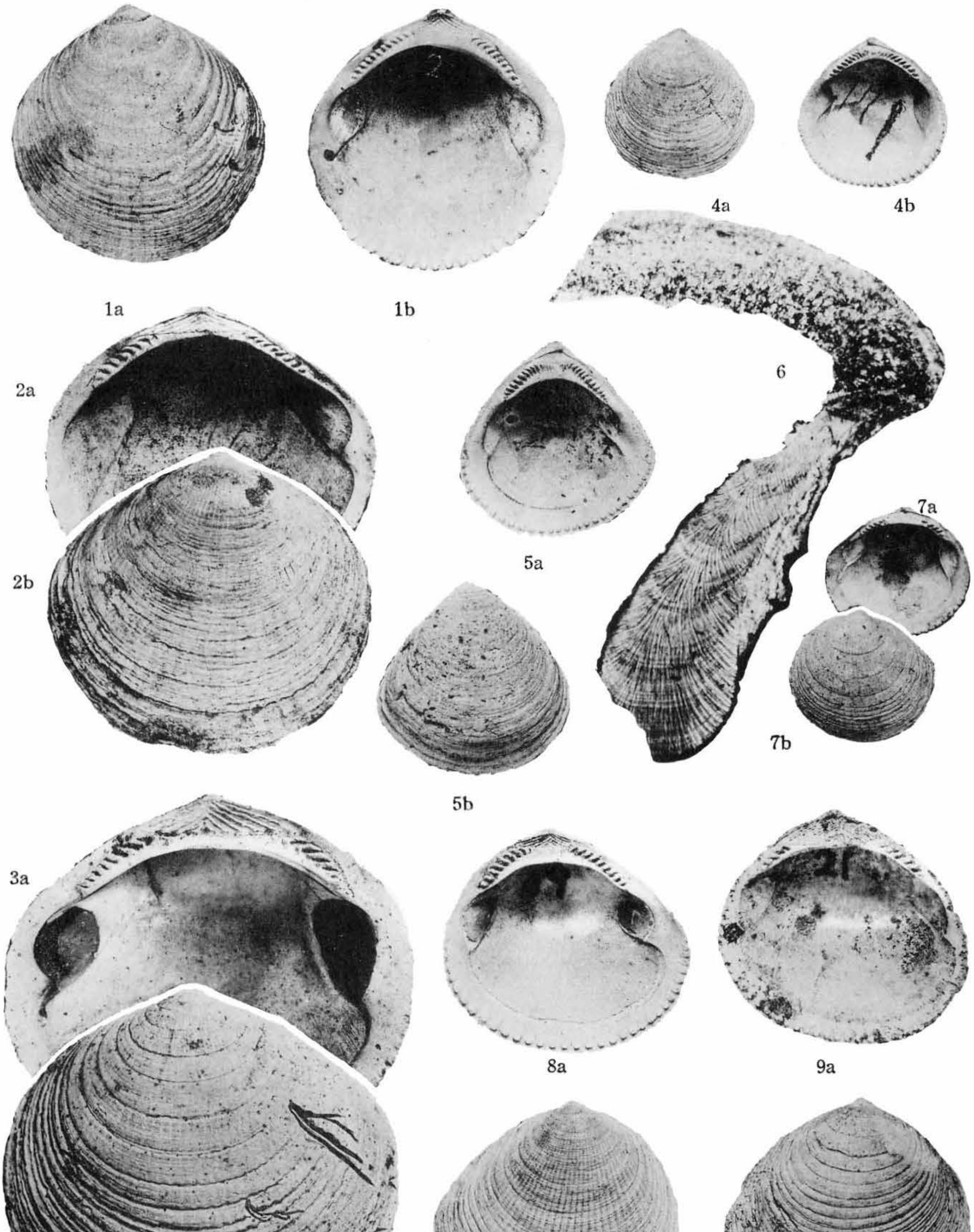
Figs. 1-3. *Glycymeris yessoensis* (SOWERBY). Showing the difference in size between the specimens representing the three different specimen-groups, which are equal in number of the ligamental chevrons with each other, and therefore, of nearly the same growth stages. 1a-b, Anden Coast, Oga City, Akita Prefecture, Shibikawa Formation, Upper Pliocene; 2a-b, Azu, Ichihara-gun, Chiba Prefecture, Yabu Formation, Pleistocene; 3a-b, Sasage Coast, Ôsawa-cho, Kimitsu-gun, Chiba Prefecture, Nagahama Gravel, Pleistocene.

Figs. 4-5. *Glycymeris nipponica* (YOKOYAMA). The median line of the ligamental chevrons is extremely biassed posteriorly and the number of ridges is quite different according to the area, anterior or posterior. 4a-b, Sawane, Sado Island, Niigata Prefecture, Sawane Formation, Pleistocene; 5a-b, Sea Coast at the south of Kanita, Higashi-tsugaru-gun, Aomori Prefecture, Pliocene.

Fig. 6. Thin section of cardinal plate of *Glycymeris yessoensis* (SOWERBY) from Azu, in which the sub-concentric lines of growth are observed. The results of observation on the Azu specimens are shown in the Text-figs. 1, 2 and 3. (×17)

Figs. 7a-b. *Glycymeris pilsbryi* (YOKOYAMA). Specimen from Jizôdô, Fukuta-cho, Ichihara-gun, Chiba Prefecture, Jizôdô Formation, Pleistocene.

Figs. 8-9. *Glycymeris rotunda* (DUNKER). Comparison between the normal (Figs. 8a-b) and abnormal (Figs. 9a-b) specimens of nearly the same sizes, showing the differences in concentric growth-lines and in number of ligamental ridges. Both specimens are from Izumiyatsu, Ichihara-gun, Chiba Prefecture, Jizôdô Formation, Pleistocene.




KUMAGAI photo.

convexity is represented by the value of Depth/Length×Height, and the specimen groups of the same or the different species are arranged according to the rate of shell-development.

From the above table, it is easily recognized that the more rapidly the shell-size increases, the less is the shell-convexity among either the same species or different species. This suggests that the mode of shell-secretion may change with the rate of shell growth.

### Summary

1) There has been recognized through the observation both of surface and in profile little difference in the morphology of the ligamental grooves and ridges, but the peculiarity to each species occur only in the breadth of grooves.

2) The rate of increase in number of ligamental ridges is nearly parallel to the age of the shells, and consequently it can be regarded as an indicator of the growth stages.

3) The specimen-groups of *Glycymeris yessoensis* from various localities and horizons have their own growth-limit of shell size, and the numbers of ligamental ridges are almost equal near the growth limit.

4) The growth curves of several specimen-groups of the same species from various localities appear to have branched off from a common trunk, and therefore, concerning the self-accelerating phase of shell-development, the relation between the shell-size and the number of ligamental ridges is peculiar to the species.

5) It is recognized that the more rapid the shell-size increase, the smaller the shell-convexity among either the same species or different species.

6) The large size of the "Sasage specimen" is judged to have been resulted not from longevity, but from the much more rapid rate of increase in shell-sizes which seems to be consistent with their striking thickness.

7) For lack of specimens, the above-stated results could not be compared with the Recent ones, but a comparison with them from various localities or environments will serve as a basis for considering their ecological meaning.

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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 47, pp. 298-300, Pl. 46, Sept. 10, 1962

# 436. ON THE GENUS *CARPINUS* WITH DESCRIPTIONS OF TWO NEW SPECIES*

SEIDO ENDO

Tokyo National Science Museum

「カルピヌス」属についておよび2新種の記載：「カルピヌス」の現生種は約40種あるがことごとく北半球に産し，その大部分はアジア州に現生し北米合衆国とヨーロッパ州に各々一種生きている。化石種は約80種あり新生代に限って産出し，古第三紀層には少なく中新世に最も多い。葉で種を識別することは困難であるが，種は小苞によって識別される。欧米産の二種の小苞は3葉になっているがアジア産のものは単葉のものが多い。日本の上部中新世頃の地層から3葉の小苞の化石が発見され，その形態は欧米産のものによく似ている。北海道の石狩統から新しく発見された小苞は非常に小さなもので祖先型と思われる。　遠藤誠道

The existing species of the genus *Carpinus* are about 40 in number, all of which are limited to the northern hemisphere in its distribution; many of them now exist in east Asia.** There are only two species now exist in North America and Europe. In well developed involucres, both of the American species, *Carpinus caroliniana*, and the European species, *Carpinus betulus* are trilobed, while in the many Asiatic species are generally simple with some of the exceptions, for examples, *Carpinus tientaiensis*, *C. londoniana*, *C. poilanei*, *C. lanceolata*, and *C. laxiflora*, etc. The geological records are about 80 species from the Eocene to the Pleistocene (BERGER, 1953; SARGENT, 1916; HU and CHUN, 1933; WINKLER, 1904), in age, and reached its maximum development in the Miocene age; and in the Palaeogene age, the reliable records are comparatively rare. The involucres of *Carpinus grandis* UNG. (KRÄUSEL, 1919, pl. 3, f. 4, pl. 9, f. 2) are similar to *Carpinus caroliniana*, and *Carpinus honshuensis* (ENDO, 1950, p. 56, pl. 6, f. 6) from the lower Pliocene formation of Kawanishi-mura, Yama-gun, Fukushima Prefecture is also similar to *Carpinus caroliniana*. Our Miocene species *Carpinus nipponica* (ENDO, 1950, p. 53, pl. 6, f. 8) from the upper Miocene of Nishizawa, Akiu-mura near Sendai, Japan, is rather similar to *Carpinus betulus* than *Carpinus caroliniana*.

In short, the similar fossils to *Carpinus caroliniana* and to *Carpinus betulus* existed in the Middle Tertiary period (the upper Miocene or the lower Pliocene) at the northern Honshu of Japan, while *C. caroliniana* now exists only in the southeastern North America, and *C. betulus* in

* Received Jan. 26, 1962; read Jan. 20, 1962.

** 22 species exist in China (Among these species, 3 species are common with Japan.)

5 species exist in Japanese Islands.

7 species exist in Korea. (Among these species, 2 species are common with Japan, one species is common with Manchuria and Northern China, respectively.)

5 species exist in Taiwan.

4 species exist in Central Asia.

1 species exists in Atlantic North America, Europe, Manchuria and Northern China, respectively.

the middle Europe to Persia.

### *Carpinus Takaoi* ENDO, n. sp.

Plate 46, Figure 6

*Description*:—Involucre ovate in shape, about 0.8 cm. long, and 0.4 cm. in maximum width, apex acute, base rounded; margins roughly serrated; stipe and seed not preserved. Texture coriaceous. Primary nerves 5 in number craspedodrome, secondary nerves thin and obscure. Areolation thin, meshes quadrate or polygonal.

*Remarks*:—It is not always easy to distinguish the every species from the fossil leaves of genus *Carpinus*, but it is sometimes easy to identify the species from the involucres. The involucres of *Carpinus japonica* BL. are somewhat similar to the present one, but the latter is smaller than the formers. Another allied one is the simple (not lobated) involucres of *Carpinus laxiflora* BL. but these are larger than the present one. Some of the simple (not lobated) involucres of *Carpinus caroliniana* WALT. are another likely one, but the present involucre is thinner and smaller than the formers.

As already stated, the fossils of genus *Carpinus* occur from the Eocene to Pleistocene in age. The present involucre may be the progenitor of *Carpinus japonica*, because its leaves occur from the same horizon of the Ishikari group, and because it is very simple, smallest and similar to the involucres of the Miocene *Carpinus protojaponica* (ENDO, 1950, p. 52, pl. 6, f. 2) which are also similar to those of *Carpinus japonica*.

*Locality*:—The river bank of the Yubari River, Shimizusawa, Yubari-city, Hokkaido, Japan.

*Horizon*:—Woodwardia formation.

### *Carpinus Shimokawarai* ENDO, n. sp.

Plate 46, Figure 8

*Description*:—Leaves oblong-ovate to long-ovate in shape, length 13 cm.±, width 3 cm.±; apex acuminated, base rounded, petiole not preserved; margins finely duplicate serrated, teeth extended into slender spines; midrib slender and straight, secondary nerves numerous, closely spaced, slightly curving upwards, parallel, 20 or more pairs, subopposite or alternate, arising at ca. 40° in the middle of the leaf, the angles slightly more acute below, extremities bearing 1 or 2 small abaxial branches, branches entering second order teeth; tertiary nerves irregularly percurrent; areolation rather coarse. Texture subcoriaceous.

*Remarks*:—The present material is somewhat similar to the existing *Carpinus japonica* BLUME, but the former much longer than the latter. Another allied species is *Carpinus fraterna* LESQUEREUX, which was described by LESQUEREUX (1883, p. 152, pl. 27, f. 12–14), from the Oligocene of Florissant, Colo., U.S.A. (MACGINITIE, 1953, p. 97, pl. 26, f. 1–3). It may be probably the progenitor of the existing *Carpinus japonica* BL., because the involucre of the *Carpinus Takaoi* ENDO occurs from the same horizon of another locality. The involucre of *Carpinus Takaoi* are somewhat similar to the young involucres of *Carpinus japonica* BLUME.

*Locality*:—The upper course of the Enhorokabetsu, a tributary of the Yubari river, Yubari-city, Hokkaido, Japan.

*Horizon*:—Woodwardia formation.

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## Explanation of Plate 46

Fig. 1. *Carpinus caroliniana* WALT. (Pennsylvania U. S. A.) ×1
Existing specimen, for comparison.
After W. BERGER: (Studien zur Systematik und Geschichte der Gattung *Carpinus* p. 16, Aff. 6, F, F. 1953.)

Fig. 2. *Carpinus grandis* UNG. ×1
After O.HEER. (HEER, O.: Flora fossilis Helvetiae II, p. 40, F. 12. Pl. LXXII, 1856.)

Fig. 3. 11. *Caryinus betulus* L. ×1
Existing specimen, for comparison. After W. BERGER. 3. (BERGER, W.: *op. cit.*, p. 11, F. D. Abb. 4. 1953.) 11. After A. ENGLER. (A. ENGLER: Das Pflanzenreich, IV, 61, Betulaceae (H. WINKLAR) p. 39, F. G. a. 1904.

Fig. 4. *Carpinus protojaponica* ENDO. ×1
After S. ENDO, (ENDO, S.: Icones of fossil plants. pl. 35, f. 16. 1955, and, On the fossil *Carpinus* from Japan and Korea, *Short Papers I. G. P. S. No. 2.* p. 52. 1950.)

Fig. 5. *Carpinus japonica* BLUME. ×1.
After S. ENDO (ENDO, S.: A Pleistocene Flora from Siobara, Japan, *Sci. Rept. Tohoku Imp. Univ. 2nd. Ser. Geology, vol. XXI, No. 1*, p. 55. pl. VI, F. 4. 1940.)

Fig. 6. *Carpinus Takaoi* ENDO, × ca. 2 (n. sp.)
Locality: The river bank of the river Yubari, Shimizusawa, Yubari-city, Hokkaido, Japan.

Fig. 7. *Carpinus nipponica* ENDO ×1
Locality: Nishizawa, Akiho-mura, Near Sendai, Japan. (Miocene Age) After S. ENDO: On the fossil *Carpinus* from Japan and Korea. *op. cit.*, p. 53, pl. 6, F. 8, 1950.

Fig. 8. *Carpinus Shimokawarai* ENDO. ×1 (n. sp.)
Locality: The upper course of the Enhorokabetsu river, a triburary of the river Yubari, Yubari-city, Hokkaido, Japan.

Fig. 9. *Carpinus honshuensis* ENDO. ×1
Locality: Maki, Kawanishi-mura, Yama-gun, Fukushima Prefecture, Honshu, Japan. (Lower Pliocene ?) After S. ENDO. (ENDO, S.: On the Fossil *Carpinus* from Japan, and Korea. *op. cit.*, p. 56. pl. 6, F. 6, 1950.)

Fig. 10. *Carpinus tientaiensis* CHENG. ×1
Existing specimen, for comparison. After W. BERGER. (BERGER, W.: Studien zur Syste matik und Geschichte der Gattung *Carpinus*. *op. cit.*, p. 16, Aff. 6, F. A. 1953.)

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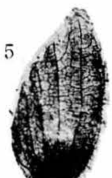

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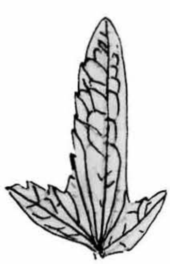

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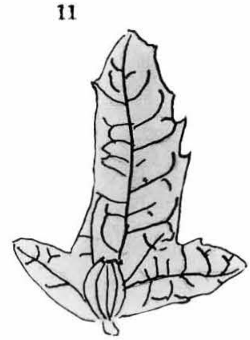

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 47, pp. 301-309, Pl. 47, Sept., 10. 1962

# 437. VARIATION AND DIMORPHISM OF *PACHYMELANIA* (GASTROPODA) FROM THE EOCENE OF BURMA*

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ビルマ始新統産 *Pachymelania* (巻貝) の変異と二型性： 北ビルマ, カレワ炭田の上部夾炭層より採集された淡水～汽水棲巻貝の変異, 個体発生を調べ, 二型性の存在をたしかめ, 新種 *Pachymelania kalewana* を提唱した。 小高民夫・魚住悟

## Introduction and Acknowledgements

A number of fossil organisms were discovered from the strata of Eocene age during the geological survey of the coal-fields of Burma at the request of the Mineral Resources Development Corporation in 1958, under the direction of Professor Rinji SAITO of the Geological Institute, Kumamoto University and Dr. Satoru UOZUMI. These strata are developed in the Kalewa coalfields in northern Burma. Among the specimens there was found a new species of thiarid gastropod, here described as *Pachymelania kalewana*.

The strata which yielded the present materials correspond to the shallow water deposits of the "Yaw Shales" or the Yaw Stage which is characterized by certain fossil remains indicating the Eocene age.

At a glance, the thiarid specimens seem to consist of two different types of surface sculpture, that is, one shows a smooth or spirally sculptured surface and the other a nodulous surface except on the knife edged spiral keel on the adapical margin of the whorls. However, the characteristics just mentioned show gradation from one specimen to the other. This may suggest a certain kind of the sexual dimorphism in one valid species.

The writers express their deep appreciation to Professor Rinji SAITO of the Geological Institute, Kumamoto University for his kind permission to study the fossil gastropod specimens and for the information concerning their occurrence.

Acknowledgements are also due to Professor Kotora HATAI of the Institute of Geology and Paleontology, Tohoku University and Professor Masao MINATO of the Department of Geology and Mineralogy, Hokkaido University for their encouragement and suggestions. They

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are also indebted to Mr. Kimiji KUMAGAI for the photographic work.

### Geological Setting

The name. Yaw Shales or Yaw Stage was first introduced by COTTER (1941a, b) for the fossiliferous rocks typically developed along the Yaw River, one of the principal tributaries of the Irrawaddy south of its confluence with the Chindowin River, of the Pakokku District. In this district the strata of the Yaw Stage are all marine in origin and characterized by marine molluscs and Nummulite foraminifers of Eocene age. The lithological characteristics of the "Yaw Shales" show remarkable change laterally, and in the northern- and the northern part of central Burma the strata contain coal-seams, and the marine deposits wedge out northwards and grade upwards into sandstone which has been called the Pegu coal-bearing formation, and can be thought to be of the marginal facies of the Tethyan sedimentation in the present region during the later Eocene Period.

In the district above mentioned, the strata of the Yaw Stage are subdivided into three stratigraphic units. These are informally called the upper coal-bearing formation, the middle sandstone, and the lower coal-bearing formation in descending order, and are underlain with conformity by the Eocene Pondaung Sandstone, mostly terrestrial in origin.

The new species is from the Kalewa Coal Mine in the Mawhataung area near the small tributary of the Mittha River, one of the tributaries of the Chindowin River. The exact horizon of the fossil gastropods is the upper coal-bearing formation (Eocene Yaw Stage) in the Kalewa coalfields of northern Burma.

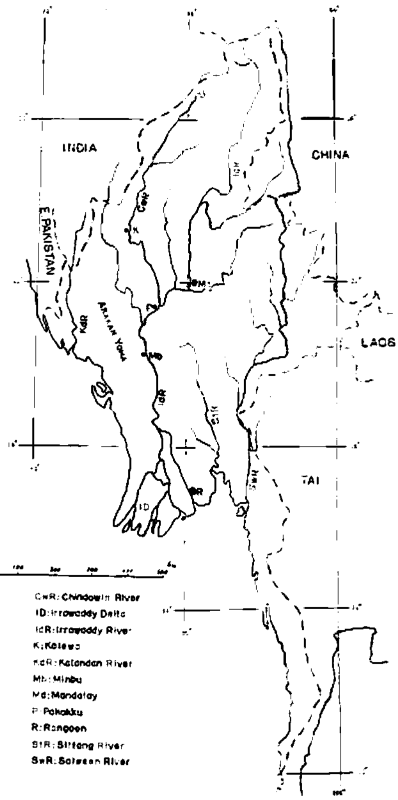


Fig. 1. Index Map of Burma.

### Systematic Paleontology

Family Thiaridae

Subfamily Thiarinae

Genus *Pachymelania* E. A. SMITH, 1893

*Type species* (Monotype):— *Nerita aurita* O. F. MÜLLER, 1776. Recent, Belgian Congo, Africa.

*Pachymelania* E. A. SMITH, 1893, *Conchologist, vol. 2*, pp. 141-142 (*non vidi, fide* WENZ, 1939, p. 717). (*non* WHITE, 1895; *non* COSSMANN, 1909).

*Claviger* HALDEMANN, 1841, *Amer. Jour Sci., vol. 41*, pp. 21-23 (*non* PREYSSLER, 1790).

*Vibex* GRAY, 1847. *Proc. Zool. Soc. London,* *vol. 15*, p. 192 (*non* OKEN, 1815).

*Hemipirena* ROVERETO, 1899, *Atti Soc. Lingustica, vol. 10* (*non vidi, fide* WENZ, *loc. cit.*).

*Clavigerina* MARTENS, 1903, *Wiss. Ergebn. Deutsch. Tiefsee-Exp., vol. 7* (*non vidi, fide* WENZ, *loc. cit.*).

*Itameta* IHERING, 1909, *Jour. Conchyl., vol. 57* (*non vidi, fide* WENZ, *loc. cit.*).

*Diagnosis*:— According to WENZ (1939), the diagnosis of the genus is as follows:

"Gehäuse mäßig groß bis ziemlich groß, festschalig, getürmt; Umgänge mit mehr order weniger kraftigen axialen Rippen und Spiralfäden, -reifen, -kielen oder Höcker- und Knotenreihen: Mündung klein, eiförmig, oben gewinkelt; Außenrand oben eingebuchtet, in der Mitte vorgezogen, unten mehr oder weniger kurz rinnenartig: Spindel verdickt: Spindelrand mehr oder weniger breit umgeschlagen, schwielig; Deckel schmal, mit fast geradem Spindelrand, pauci spiral, mit randlichem, der Basis genähertem Nukleus."

*Remarks*:—The genus *Pachymelania* has hitherto been known only from the west coast of Africa where it lives in the lagoons or estuaries. For the reason the discovery of the present new species, *Pachymelania kalewana* does not only extend the distribution of the genus, but also is the first fossil record of the genus. The species known from West Africa are thought to be direct descendants of *kalewana*, judging from their ontogeny and zoogeography as will be described in the following pages.

### *Pachymelania kalewana* KOTAKA and UOZUMI, n. sp.

Plate 47, Figures 1a-11b

*Diagnosis*:—Shell medium to large, solid and heavy, turreted. Protoconch rather small, but details unknown because in all examined specimens lack nucleus. Post-nuclear one or two whorls rapidly increasing in size and then gradually growing. Whorls straight, slightly convex to concave in profile except on knife edged main spiral keel on adapical margin of whorls. Spire rather straight-sided and composed of six to eight post-nuclear whorls. Whorl surface with spiral striae or/and more or less prominent spiral row of beads or granules on middle and adapical part of whorl and surface sometimes almost smooth. These beads or granules sometimes composed of more or less strong longitudinal riblets on younger whorls. Base of whorls with three to ten, fine but prominent spiral striae or cords. Aperture oval in shape, with more or less prominent anal canal on adapical margin of it or about main spiral keel, outer lip entire with no sinuous depression, inner lip with smooth callus, and without siphonal canal on abapical margin of aperture.

*Repository*:—Syntypes: IGPS* coll. cat. nos. 79323-1~11 and U.H.** Reg. Nos. 13696 (a-i).

*Comparison*:—Although the writers unfortunately could not refer to SMITH's original work, the diagnostic character presented by WENZ (1930) and NICKLÈS (1950), safely assign the present specimens to the genus *Pachymelania*.

The type species of the genus, *Pachymelania aurita* (MÜLLER), primarily allocated to the genus *Nerita* by the original author, described and illustrated from the coasts of Belgian Congo and Portuguese Angola by subsequent authors (PILSBRY and BEQUAERT, 1927, WENZ, 1939 and NICKLÈS, 1950) is distinguished from the present new species in the surface sculpture of the whorls. The shell of

* Abbreviation for the Institute of Geology and Paleontology, Tohoku University, Sendai, Japan.

** Abbreviation for the Department of Geology and Mineralogy, Hokkaido University, Sapporo, Japan.

Table 1. Measurements (in mm).

| Specimen No. | *forma* | | L | B | PB | PH | Remarks |
|---|---|---|---|---|---|---|---|
| IGPS 1 | *forma α* | ○ | 43.4 | 17.0 | 15.7 | 8.9 | |
| U. H. a | | ○ | 43.9 | 18.9 | 17.4 | 9.8 | |
| U. H. b | | ○ | 43.0 | 19.3 | 17.0 | 9.7 | younger whorls and base lacking |
| IGPS 2 | | ○ | 53.5 | 19.8 | 18.3 | 10.6 | |
| IGPS 3 | | ⊙ | 46.4 | 16.1 | 14.7 | 8.5 | |
| IGPS 4 | | ⊙ | 47.0 | 14.8 | 14.8 | 9.0 | aperture broken |
| U. H. c | | ⊙ | 52.8 | 19.0 | 17.0 | 9.7 | |
| U. H. d | | ⊖ | 47.0 | 18.0 | 12.4 | 9.6 | |
| IGPS 5 | | ⊖ | 62.4 | 20.0 | 20.2 | 10.7 | |
| U. H. e | Transition | ⊗ | 57.2 | 20.2 | 18.4 | 11.8 | |
| IGPS 6 | | ⊗ | 46.2 | 16.9 | 15.4 | 8.8 | |
| U. H. f | *forma β* | × | 40.8 | 16.0 | 14.2 | 8.5 | |
| IGPS 7 | | × | 47.1 | 20.6 | 18.2 | 10.0 | |
| U. H. g | | × | 52.9 | 18.5 | 17.3 | 11.5 | |
| IGPS 8 | | × | 38.4 | 16.0 | 15.0 | 8.1 | |
| IGPS 9 | | × | 42.0 | 18.7 | 18.4 | 9.9 | |
| IGPS 10 | | × | 38.5 | 14.3 | 13.4 | 6.8 | |
| U. H. i | | × | 37.3 | 14.6 | 13.1 | 8.4 | |
| IGPS 11 | | × | 65.2 | 21.2 | 20.5 | 10.0 | |
| IGPS 12 | | × | 37.6 | 12.3 | 12.3 | 7.1 | |

Symbols in the column of *forma*: See Table 2
L: Total length of shell
B: Maximum breadth of the body whorl
PB: Maximum breadth of the penultimate whorl
PH: Height of the penultimate whorl

the type species *aurita* is ornamented with a spiral row of strong nodes on about the middle of the whorl surface instead of the sharp spiral keel on the adapical margin and spiral cord or granule spiral rib on about middle of the whorl surface.

*Pachymelania bryonensis* (GRAY) reported from the Ivory Coast of Angola is a form allied to the present one, but Gray's species is ornamented with two spiral rows of prominent nodes.

*Pachymelania fusca* (GMELIN) described and illustrated by NICLÈS (1950) and reproduced here (Figure 2) and also from the Ivory Coast of Angola is a form most similar with the present one in the general shape of the shell and the surface ornamentation, but the former has different feature of the ontogeny during the course of the shell growth as is shown in the following pages. From the Ivory Coast, the variety *quadriserita* (GRAY) was recorded and illustrated in association with the species by the same author, but the variety shows the surface ornamentation of the young *fusca* and has no spiral cordings except on the base of the body whorl.

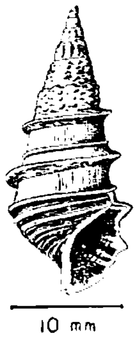

Fig. 2. *Pachymelania fusca* Gmelin. Recent, West Coast of Africa. (after NICKLÈS, 1950)

*Variation*:—The variations in the general shapes of the spire and the whorls are not so prominent as already shown in the specific diagnosis, however, the present species has considerably wide range of variation especially in the surface sculpture of the whorls.

Among the specimens examined, two are rather short and have the spire broader than the others; and two show nearly flat whorls profile whereas the others exhibit slightly convex to concave profiles.

All of the specimens now at hand are ornamented with the main spiral keel on the adapical margin of the whorls and the other parts of the whorls show sculptures which can be classified into three types in general.

The first type is here called the *forma* $\alpha$, and is further subdivided into three forms, that is those with, a) smooth surface, b) smooth or with very fine spiral stria on the adult whorls but with the spiral row of fine beads in the younger stage of shell growth, which changes into fine spiral stria or becomes obsolete and sometimes disappear in the adult stage, c) ornamented with one or two spiral cords throughout the whorls except on the protoconch.

The second one is the *forma* $\beta$, and is ornamented by the presence of a prominent spiral row of beads or granules continuing throughout the surface of the whorls. In two specimens belonging to this form, the beads or granules are very strong and form longitudinal riblets on the younger whorl surfaces.

The third type comprises forms transitional between the first and second types and is represented by specimens ornamented with beaded spiral cord.

The following table shows the composition of the variants in the surface sculpture of shell.

Table 2. Surface Sculpture and Dimorphism.

| *forma* | *forma* $\alpha$ | | | transition | *forma* $\beta$ |
|---|---|---|---|---|---|
| Symbol | ○ | ⦿ | ⊖ | ⊗ | × |
| Number of individuals | 4 | 3 | 2 | 2 | 11 |

Explanation of symbols:
- ○: Surface smooth
- ⦿: Surface with a spiral row of fine beads in the middle stages of the shell growth
- ⊖: Surface with one (or two) spiral cord(s)
- ⊗: Surface with beaded spiral cord
- ×: Surface with prominent spiral row of granules

The sculpture on the base of the body whorl consists of several spiral striae and cords which are also variable in number and strength, they range from three to ten in number.

*Ontogeny*:—The ontogenetic change of the surface sculpture of the present species can be divided into three types (I to III) from the characters of the spiral sculptures except on the knife edged main spiral keel. These types are idealized and diagramatically illustrated in Text-figure 3.

The third type or Type III is represented by the shells (considered to be variants) ornamented with more or less prominent spiral sculptures in the adult,

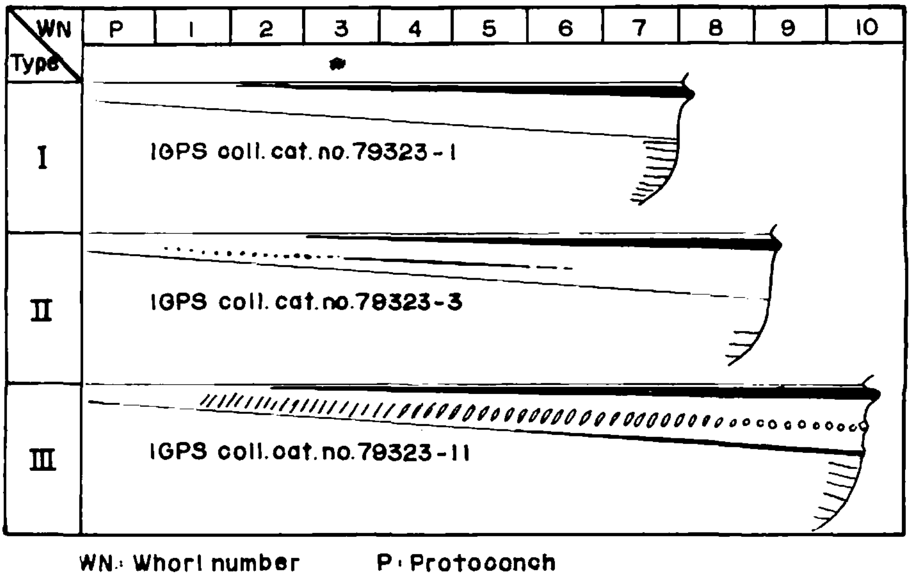


Fig. 3. Diaphragm showing Three Types of Ontogeny.

and belonging to the *forma β*, the transition form, and the variants of the *forma α* based upon the surficial ornamentation in the adult stage of shell growth. The ontogenetic change of this type is shown in the following way. On the first or second post-nuclear whorl, just preceding the appearance of the main spiral keel on the abapical margin of the whorl, more than 10 to 15 fine beads forming spiral row begin to occur at about a little adapical to the abapical suture of the whorl, and these continue to grow and become strong and increase their number in consequence with the growth of the volution. Sometimes, the spiral beads or granules appear immediately following the appearance of the main spiral keel, and further, the fine spiral cord appears to occur just adapical to the abapical suture in the middle or adult stage of growth. The numbers of the beads or granules on each whorl decrease with the shell growth.

In the second type or Type II which is represented by the forms characterized by the surface ornamentation of the variant belonging to the *forma α*, the situation is somewhat different from Type III. The spiral row of fine beads is also present in the early stage of growth as in the case of Type III, but this row becomes obsolete and is changed into fine spiral stria and sometimes disappears with the growth of two or three volutions, and even the spiral stria disappears in the adult stages. The smooth form of the *forma α* is the first type or Type I. In this case no other spiral sculptures, except on the main spiral keel and sometimes very fine spiral striae on the adult whorls, appear during the course of the shell growth.

*Pachymelania fusca* (GMELIN) from the west coast of Africa is one of the forms most allied with present new species in the shape of the spire, and in sculpture. Especially the adult surface ornamentation is indistinguishable from the smooth variant of the *forma α* of the present species. The ontogenetic change of *fusca* is, therefore, described below in comparison with those of the forms belonging to the present species.

In the earliest stage of the shell growth of the second or third post-nuclear whorl, the surface is ornamented with fine longitudinal riblets about six or seven in number in the mentioned whorls. These riblets become granular with the shell growth and form three spiral rows of beads or granules. This feature of the surface ornamentation suddenly disappears in the middle stage, and more or less sharp, strong and weak spiral keels begin to occur on both sides of the adult whorls, just abapical to the adapical suture, and just adapical to the abapical one respectively. And the base of the body whorl is sculptured with about six spiral cords.

*Remarks on Dimorphism*:—As shown in the preceding pages, the specimens dealt with can be subdivided into eight groups from the adult features and ontogenetic changes of the surface ornamentations. Correlation of those groups is shown in Table 3, and although there may be some overlap of the groups in the classification, it adequately shows the relationships.

Table 3. Correlation between Surface Sculpture and Ontogeny.

| Surface Sculpture | *forma α* | | | transition | *forma β* |
|---|---|---|---|---|---|
| | ○ | ⊙ | ⊖ | ⊗ | × |
| Ontogeny | I | II | | III | |

At a glance, these seem to indicate the mixing up of two or three different species so far as the surface ornamentations are concerned. The results of the statistical analysis on the morphological parameters of the shell shown below (Table 4) and the surface characteristics exhibiting the gradual change without any gap between each grouping given above, however, suggest the intimate relationship between each specimen examined, and the difference in the surface sculpture may be from sexual difference.

Table 4. Result of Statistical Analysis. (Level of significance: 0.05)

| | | $B/L \times 100$ | $PH/PB \times 100$ |
|---|---|---|---|
| *forma α* | N | 7 | 8 |
| | M | 37.177 | 50.463 |
| | $u^2$ | 12.2145 | 54.8632 |
| | t | 2.447 | 2.365 |
| | Range | 38.046-46.308 | 31.409-69.517 |
| *forma β* | N | 9 | 9 |
| | M | 39.343 | 56.750 |
| | $u^2$ | 11.1172 | 35.7390 |
| | t | 2.306 | 2.306 |
| | Range | 31.243-47.443 | 42.396-71.104 |

The writers, therefore, consider that dimorphism exists in one valid species and thorough studies on the Recent form is necessary to confirm whether the dimorphism is sexual or due to some other phenomenon.

And to clarify the phylogenetic trend of this peculiar gastropod genus, the thiarid species of the Tethyan region during Cenozoic time should be restudied. The probability of this group as a good indicator of the sedimentary facies, paleogeographical reconstruction, and as material for faunal migration within the said region can be inferred from the evidence presented in this article.

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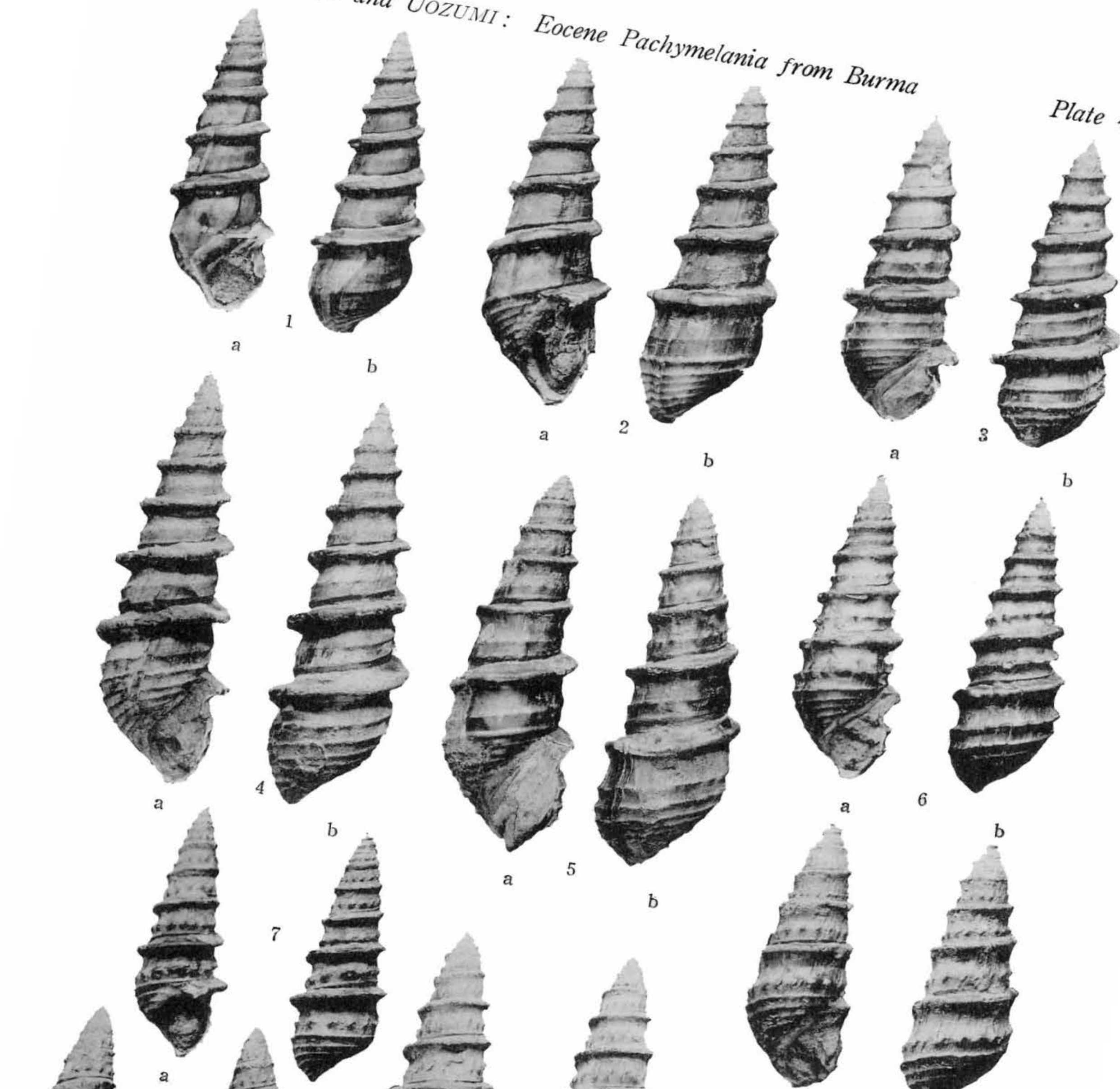
## Explanation of Plate 47

(All figures in natural size)

*Pachymelania kalewana* KOTAKA and UOZUMI, n. sp.

Figs. 1a-b. Syntype. IGPS coll. cat. no. 79323-3.
Figs. 2a-b. Syntype, U. H. Reg. No. 13696 (c).
Figs. 3a-b. Syntype, U. H. Reg. No. 13696 (d).
Figs. 4a-b. Syntype, IGPS coll. cat. no. 79323-5.
Figs. 5a-b. Syntype, U. H. Reg. No. 13696 (e).
Figs. 6a-b. Syntype, IGPS coll. cat. no. 79323-6.
Figs. 7a-b. Syntype. IGPS coll. cat. no. 79323-10.
Figs. 8a-b. Syntype, U. H. Reg. No. 13696 (f).
Figs. 9a-b. Syntype, U. H. Reg. No. 13696 (g).
Figs. 10a-b. Syntype, IGPS coll. cat. no. 79323-11.
Figs. 11a-b. Syntype, IGPS coll. cat. no. 79323-7.

All specimens were collected from the Kalewa Coal Mine in the Mawhataung area near the small tributary of the Mittha River, one of the tributaries of the Chindowin River, Northern Burma. (Coll. R. SAITO and S. UOZUMI, 1958)



KUMAGAI photo.

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# PPOCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第81回例会は，1962年6月2日熊本大学理学部地質学教室において開催された。(参会者27名)

## 個　人　講　演

Verbeeininae from the Inferred Wolfcampion Limestone in the West of Ryoseki. Kochi Prefecture, Japan. (代読) ........ .............................K. ISHIZAKI

Lower Carboniferous Bryozoa from the Omi limestone. Japan. Parts 1 & 2. (代読) .. ...........................S. SAKAGAMI

Brachiopods from the Late Jurassic Nakanosawa Formation in Fukushima Prefecture, Japan. (代読) ..............K. MORI

A Dibranchiate Cophalopoda from the Rifu Formation. (代読) ............Y. BANDO

Note on Some Triassic Gastropoda from the Rifu Formation at Hamada, Miyagigun, Miyagi Prefecture, Japan. (代読) ...... ...........................S. HAYASAKA

*Trigonioides* from the Tetori Group. (代読) ............................. S. MAEDA

Some molluscan fossils from the Upper Mesozoic Yoshimo Formation.....Y. OTA

*Chlamys* and *Venericardia* from the "Ashiya Group" in the Yuya-wan Yamaguchi Prefecture. Southwest Japan........... ............ M. NAKANO & K. OKAMOTO

人吉市球磨川原産の *Lima* (*Acesta*) sp. の転石について ........................田村　実

The Fossils and their habitats in the Neogene Katsuragawa Group in the South Kwanto Region. (代読)........M. SUGITA

On the Dentition Formulae of Heterodont Pelecypoda.....................I. HAYAMI

北海道雨竜添牛内産ウニ化石について ........ ................................ 橋本　亘

北海道常呂郡仁頃西方山地中生代化石について ...................... 橋本　亘・寺岡易司

New Species of *Gadus* from the Pliocene of Japan. (代読)....K. HATAI & T. KOTAKR

On the genus *Acer* with description of New Species..........................S. ENDO

## コロキユウム「海棲動物の古生態研究」

内湾生態の総合的研究と最近の海洋生態学の動向の紹介 ........................菊池泰二

長崎付近の現世堆積物と貝類遺骸群集 ..鎌田泰彦

有孔虫の生態 ........................氏家　宏

海洋古生態学の一二の問題 ............首藤次男

日本のジュラ紀二枚貝相 ..............速水　格

*Baculites* facies について....松本達郎・小畠郁生

太平洋底質表層の珪藻遺骸群集等の解析とそれに関聯する古生態学的諸問題 ......金谷太郎

shall call a Special Meeting at the written request of more than one-third of the members. The request shall be granted only if the written statement fully explains the reasons for assembly and items for discussion.

Article 19. Members unable to attend the General Meeting may give an attending member a written statement signed by himself trusting the bearer with the decision of business matters. Only one attending member may represent one absentee.

Article 20. The decision of the General Meeting shall be by majority vote. When the number of votes is equal, the President shall cast the deciding vote.

Article 21. The President and Councillors shall compose the Council. The dicision of the General Meeting concerning administration shall be considered and implemented by the Council.

Article 22. The Executive Council shall carry out the decisions of the Council.

Article 23. The fiscal year of the Society shall begin on the first of January each year and end on the thirtyfirst of December of the same year.

Article 24. The amendments to the Constitution of the Society shall be decided at the General Meeting and must be approved by more than two-thirds of those members who are in attendance.

Addendum 1) Voting in the Council shall be by unsigned ballot. (1962, Jan. 20)

## 例 会 通 知

| | 開催地 | 開催日 | 講演申込締切日 |
|---|---|---|---|
| 第82回例会 | 東京教育大学 | 1962年9月29·39日 | 1962年8月末日 |
| 第83回例会 | 広島大学 | 1962年12月1日 | 1962年10月末日 |

◎ 本年12月1日広島大学で開催される本会第83回例会には「中国地方を中心とした古生界の対比に関する問題」のシンポシウムが予定されている。

## 学 会 紀 事

◎ 常務委員会は各評議員にはかり次の事を決定し実行した。

1. 日本学術会議第6期会員（第4部 地質学 全国区）候補者として本会会長小林貞一君を推薦した。
2. 毎日学術奨励金に会員西山省三君の研究「日本及び近接地産海胆類動物群」を推薦した。
3. 借成学術奨励金に会員菅野三郎君の研究「本邦中新世・漸新世境界に関する古生物学的ならびに層序学的研究特に紅葉山・滝上層について」を推薦した。

購読御希望の方は本会宛御申込下さい


1962年9月5日 印刷
1962年9月10日 発行

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# CONSTITUTION
## of the
## PALAEONTOLOGICAL SOCIETY OF JAPAN

Article 1. The Society shall be known as the Palaeontological Society of Japan.

Article 2. The object of the Society is to promote the study and popularization of palaeontology and related sciences.

Article 3. The Society, to execute Article 2, shall undertake the following business:

1. Issue the Society journal and other publications.
2. Hold or sponsor scientific lectures and meetings.
3. Popularize the science by field trips, scientific lectures and other projects.
4. Aid and encourage research work; award outstanding contributions to the Society; carry out the objectives stated in Article 2.

Article 4. To attain the object of the Society, the Society may, by decision of the General Meeting, establish within it research committees.

Article 5. The Society shall be composed of members who are active or interested in palaeontology or related sciences.

Article 6. The members shall be known as Regular Members, Fellows, Patrons and Honorary Members.

Article 7. Persons desiring membership in the Society are requested to fill out the necessary application forms and receive the approval of the Council.

Article 8. Fellows are persons who have held Regular Membership in the Society for more than ten years, have contributed to the science of palaeontology, have been nominated by five Fellows and approved by the Council.

Article 9. Patrons are organizations supporting Article 2 and recommended by the Council.

Article 10. Honorary Members are persons of distinguished achievement in palaeontology. They shall be recommended by the Council and approved by the General Meeting.

Article 11. The members of the Society shall be obliged to pay the annual dues stated in Article 12. Members shall enjoy the privilege of receiving the Society journal and participating in the activities stated under Article 3.

Article 12. The rates for annual dues shall be decided by the General Meeting. Rates for annual dues are: Regular Members, Yen 800; Fellows, Yen 1,300; and Foreign Members, $ 5.00, for which they will receive special publications in addition to the Society journal; Patrons are organizations donating more than Yen 10,000 annually; Honorary Members are free from obligations.

Article 13. The budget of the Society shall be from membership dues, donations and bestowals.

Article 14. The Society, by decision of the Council, may expel from membership persons who have failed to pay the annual dues or those who have disgraced the Society.

Article 15. The officers of the Society shall be composed of one President and fifteen Councillors, among whom several shall be Executive Councillors. The term of office is two years and they may be eligible for re-election without limitation. The President may appoint several persons who shall be Secretaries and Assistant Secretaries. An Executive Council shall be nominated and approved by the Council. Councillors shall be elected from Fellows by vote of returned mail unsigned ballot.

Article 16. The President shall be a Fellow nominated and approved by the Council. The President shall represent the Society and supervise the business affairs. The President may appoint a Vice-President when he is unable to perform his duties.

Article 17. The Society may have the honorary president. The honorary President shall be recommended by the council and approved by the General Meeting. The honorary president may participate in the Council.

Article 18. The Society shall hold regularly one General Meeting a year. The President shall be Chairman and preside over the administrative affairs. The program for the General Meeting shall be decided by the Council. The President may call a special meeting when he deems it necessary. The General Meeting requires the attendance of more than one-tenth of the members. The President