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217. AN INTERESTING RELATION BETWEEN *STOMATORBINA*
DORREEN, 1948, AND *MISSISSIPPINA* HOWE, 1930, OF
FORAMINIFERA

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Pulvinulina concentrica は *Discorbina*, *Eponides*, *Mississippina* などの属に帰せられたが、その特徴は *Epistomina* か *Mississippina*, 特に *Epistomina* に近い。最近ヨーロッパ学派の有孔虫学者は小型有孔虫の内部構造を研究して新属を発表して、*Epistomina* の或る種は新属 *Höglundina* に改められ、また *Pulvinulina concentrica* も新属 *Stomatorbina* に改められた。

筆者は伊豆半島南部の竹麻村浜および八丈島の海岸砂中の現生有孔虫群の同一資料中に *Stomatorbina concentrica* の成長段階を示す標本を発見した。この種の幼形はアメリカのミシシッピ地方の漸新世の *Mississippina monsourei* と外形が似ており、完全に *Mississippina* 属の特徴をもっている。*Stomatorbina* と *Mississippina* の中間的標本の共存を考慮して、筆者は *Stomatorbina* が *Mississippina* の同物異名と考えるが、*Stomatorbina* の属模式である *S. torrei* と *S. concentrica* との間に僅かな差があることを指摘しておく。 内尾高保

The writer obtained a few specimens of the so-called "*Pulvinulina concentrica* PARKER & JONES" showing the growth stages from recent beach sands at Minato, Chikuma-mura, Kamo-gun, Shizuoka Prefecture (southern end of the Izu Peninsula) and also at Yaene, Ogago-mura, Hachijo Island, Tokyo Prefecture.

Some species of genus "*Epistomina*" TERQUEM, 1883 have been transferred to new genus "*Höglundina*" BROTZEN, 1948; and *Pulvinulina concentrica* PARKER & JONES has been included in new genus "*Stomatorbina*" DORREEN, 1948. After examining the description of these two genera closely the writer however found that *Pulvinulina concentrica* should be included in either *Mississippina* or *Stomatorbina*.

The original description of *Stomatorbina* is as follows.

"Low trochoid spire, dorsal sutures broad and limbate; ventral sutures sharp and depressed; periphery usually subacute; aperture ventral, an elongate slit at base of last chamber; supplementary apertures, or clear spaces, on ventral side of each chamber, just below periphery, elongated spirally, depressed below surrounding surface and closed by smooth shell material, usually of slightly different colour from that of the rest of the ventral surface. Family Rotaliidae; subfamily Siphoninidae (DORREEN, 1948, Journ. Pal. vol. 22).

The genotype is *Stomatorbina torrei* (CUSHMAN & BERMUDEZ) = *Lamarckina torrei* CUSHMAN & BERMUDEZ, 1937. DORREEN included *Pulvinulina concentrica* in *Stomatorbina*. The last mentioned has more prominent supplementary apertures and shows world-wide distribution than *S. torrei*. Nevertheless he selected *S. torrei* as the genotype by

1) Read Feb. 14, 1951; received April 14, 1952.

the following reason.

"In their description of *S. torrei*, CUSHMAN & BERMUDEZ do not mention the supplementary apertures, which are hard to see in some poorly preserved specimens. As *Eponides concentricus* (or *Pulvinulina concentrica*) this, or closely allied species, have been recorded from the Tropical Pacific, the Indo-Pacific, Australia, the Kerimba Archipelago and the Mediterranean by various authors. I am indebted to Mrs. PLUMMER for supplying me with Recent specimens from the Shetlands, which possess limbate dorsal sutures, but also *Eponides*-like apertures without supplementary apertures and which are not related to *Pulvinulina concentrica* as figured by BRADY in the Challenger Report (plate CV, figures 1 a, b). Hence it is apparent that two different genera have been called *Pulvinulina concentrica* P. & J. Although the one figured in the Challenger Report seems to have been adopted as typical by most subsequent authors, yet, obviously, confusion exists and *S. torrei* is here adopted as the genotype.....Another genus which must be considered here is *Mississippina*. CHAPMAN (1941, Trans. Roy. Soc. South Australia, vol. 65, pt. 2) recorded *Mississippina concentrica* from the Philippines, from south of Cape Wiles, and from the Lower Miocene of Port Phillip. PARR (1945, Proc. Roy. Soc. Victoria, vol. 56, pt. 2) recorded *Eponides concentricus* from the Victorian coast and states that the characters of the species suggest that it might be referred to *Mississippina*. Dr. HOWE kindly sent specimens of his *Mississippina monsouiri*, the ventral face of which shows great similarity to the ventral face of *Stomatorbina*. However, in *Mississippina* the whorls embrace both dorsally and ventrally and the aperture extends from the ventral side, across the periphery, to the dorsal side. Dorsal sutures are not limbate, as in *Stomatorbina*, but are depressed and the supplementary apertures are on both dorsal and ventral surfaces. Therefore, while I can not accept *Mississippina* and *Stomatorbina* as being congeneric, the two are clearly related and I suggest that *Mississippina* has arisen as an offshoot from *Stomatorbina* (DORREEN, 1948, Journ. Pal. vol. 22).

From Dr. DORREEN's generic descriptions and explanation above cited, the writer thinks that the main difference between *Mississippina* and *Stomatorbina* is that the former has supplementary apertures on both dorsal and ventral surfaces and the latter on ventral surface only, although there is a difference in the position of aperture.

The writer's young specimens of *Pulvinulina concentrica* P. & J. are very similar to the original description and figure of *Mississippina monsouiri* HOWE, and the writer has tried whether the two are conspecific or not and compared the young specimens of the former with the topotype of the latter which was kindly sent to him from Dr. Alfred R. LOEBLICH, Jr. of the U.S. National Museum, and some differences are observed, but the former more resembles the figure of holotype than the topotype specimen, therefore the writer sent the specimens of the former showing growth stages from young to adult to Dr. A. R. LOEBLICH asking him to examine and compare with the holotype of Dr. Howe's *Mississippina monsouiri*.

Dr. LOEBLICH's detail and careful observations on them in his private letter, on March 10, 1952, is read.

"The holotype of *Mississippina monsouiri* has 7 chambers in the last whorl, as does the paratype in the U.S. National Museum collections. A specimen on your slide of a slice comparable to that of the type of *M. monsouiri* has 6 chambers in the last whorl. The sutures of *P. concentrica* is much more limbate, distinct, and raised than are those of *M. monsouiri* which are depressed. The aperture of *P. concentrica* is much more conspicuous than that in *M. monsouiri* and the umbilical flap is much more conspicuous in *P. concentrica* extending further into the umbilicus than *M. monsouiri*... I believe them to be specifically distinct and that one should not be called merely a "varie-

ty" of the other. The specimens you sent of *P. concentrica* are certainly similar to specimens figured by PARKER & JONES,

For reference, original description of *Mississippina monsouri* HOWE (Jour. Pal., vol. 4, 1930, p. 330) is as follows.

"Test in early stages trochoid, later becoming almost planispiral, convex on the dorsal side, somewhat umbilicate on the ventral side, all whorls visible on the dorsal side and most of the preceding whorls visible on the ventral side; distinctly umbilicate. Sutures depressed on both dorsal and ventral sides; periphery rounded. Apertures of two sorts, one kind at the base of the last formed chamber at the periphery, the other kind being supplementary apertures elongated in the axis of coiling on both the dorsal and ventral sides of the periphery of each chamber. Diameter 0.50 mm. Holotype from the Byram marl at Byram, Mississippi." (see Pl. 18, Figs. 2a-c).

As H. B. BRADY said, the peculiar and very characteristic feature of "*Pulvinulina concentrica*" is a broad band of clear exogenous shell substance bordering the chamber and concealing, to greater or less extent, their lateral faces. (see Pl. 18, Figs. 1a-c).

The description of this species is as follows;

Mississippina concentrica (PARKER & JONES)

Plate 18. Figures 3 a-c, 4 a-c, 5 a-c

1880. *Discorbina vestita*. SEGUENZA, Mem. Roy. Acad. dei Lincei, ser. 3, vol. 6, p. 148, pl. 13, fig. 39.
1884. *Pulvinulina concentrica* P. & J., BRADY, Rep. Voy. Challenger Zool. vol. 9, p. 686, pl. 105, figs. 1 a-c.
1915. *Pulvinulina concentrica* P. & J., CUSHMAN, U. S. Nat. Mus., Bull. 71, pt. 5, p. 51, pl. 28, fig. 4.
1921. *Pulvinulina concentrica* P. & J., CUSH-

MAN, U. S. Nat. Mus., Bull. 100, p. 327, pl. 68, figs. 4 a-c.

1929. *Eponides concentrica* (P. & J.), CUSHMAN, U. S. Nat. Mus., Bull. 104, pt. 8, pl. 9, figs. 4, 5.
1948. *Stomatorbina concentrica* (P. & J.), DORREEN, Journ. Pal., vol. 22, p. 295.
1951. *Stomatorbina concentrica* (P. & J.), PHILEGER & PARKER, Geol. Soc. Amer. Mem., 46, pt. II, p. 22, pl. 12, figs. 2 a, b.
1952. *Epistomina concentrica* (P. & J.), UCHIO, Japan. Journ. Geol. Geogr., vol. 22.

Description:—"Test biconvex, oral; chambers comparatively few, five to seven in the last-formed coil, carinate; sutures covered by a clear shell material joining with the carinal border and often covering a large portion of the test, both above and below; aperture near the peripheral border on the ventral side. Diameter up to 2 mm. (CUSHMAN, 1915, U. S. Nat. Mus., Bull. 71, pt. 5, p. 51)."

At both Minato, Chikuma-mura, Shizuoka Prefecture and Yaene, Hachijo Island, Tokyo Prefecture, the growth stages of this species are observed in detail.

1. In early stages (see Pl. 18, Figs. 5 a-c), this species shows the character of *Mississippina* HOWE, and it is very similar to *M. monsouri* HOWE, Oligocene species of Mississippi, America, namely, test partially involute ventrally and evolute dorsally; the last whorl has 9 chambers which are slightly inflated, having clear but opaque band of shell materials parallel to periphery on both ventral and dorsal sides.

2. In the next stages (see Pl. 18, Figs. 4 a-c), the characteristic opaque band expands irregularly in each chamber on dorsal side, but simple elongate band as in early stages on ventral side; unilobed

flap much more conspicuous than in early stages, extending further into umbilicus, therefore test becomes completely involute ventrally, the last whorl has 6-7 chambers which are more inflated than in early stages.

3. In adult stages (see Pl. 18, Figs. 3 a-c), each opaque band on dorsal side expands much more and occupies whole area of each chamber, therefore each chamber seems to be opaque and not transparent and also seems as if there is no characteristic feature, while simple elongate band exists on the ventral side as in early stages; the last whorl has about 6 chambers, and the other characters as in transitional stages. The specimen of this adult stages is the typical "*Pulvinulina concentrica*."

Considering the writer's observation, Dr. A. R. LOEBLICH's comparative observations and Dr. DORREEN's description and illustrations, the writer reached the following conclusions;

(1) *Pulvinulina concentrica* PARKER & JONES does not belong to *Eponides*, *Epistomina*, *Höglundina* but should be included in *Mississippina*.

(2) *P. concentrica* is distinct from *Mississippina monsouiri*, the genotype of *Mississippina* HOWE, 1930.

(3) Adult form of *P. concentrica* and *Stomatorbina torrei* have almost the same generic character except that the aperture of *P. concentrica* extends from the ventral side, across the periphery, to the dorsal side but that of *S. torrei* ventral, an elongate slit at base of last chamber.

(4) Therefore if adult form of *P. concentrica* is not included in *Stomatorbina*, then the genus *Stomatorbina* is valid, but if included, then the genus *Stomatorbina* DOREEN, 1948 is a synonym of the genus *Mississippina* HOWE, 1930.

The writer's specimens showing

growth stages of *Mississippina concentrica* (PARKER & JONES) are deposited in the following repositories;

1. Specimens from Recent beach sands at Minato, Chikuma-mura, Kamogun, Shizuoka Prefecture (Reg. No. CF 3030), are deposited in the Geological Institute, Faculty of Science, University of Tokyo, Japan.

2. Specimens from Recent beach sands at Yaene, Ogago-mura, Hachijo Island, Tokyo Prefecture are deposited in the United States National Museum, Washington, U.S.A.

Distribution:—This is the very characteristic species of wide distribution but usually not occurring in any considerable numbers.

According to H. B. BRADY, this species occurs at two Challenger Stations in the North Atlantic, namely, off Bermuda, 435 fathoms, and west of the Azores, 1000 fathoms; also off Shetland, 75 to 90 fathoms; in the Farøe Channel, 155 fathoms; and off the coast of Norway, 15 to 40 fathoms; in the Bay of Biscay, and in the Mediterranean. The South Atlantic has furnished specimens from off Tristan d'Acunha, 100 to 150 fathoms; and the South Pacific, from off Kandavu, 210 fathoms; off Raine Island, 155 fathoms.

CUSHMAN recorded this from Albatross stations D4087 in 44 fathoms and D4922 in 60 fathoms, bottom temperature 79.2° F., both stations off Japan and he also recorded from D5151, D5172, D5179, D5217, D5424, D5469, D5569, D5572 in the Philippine and adjacent seas, namely, east coast of Luzon; Verde Island Passage; between Buris and Luzon; off Romblon; and numerous stations in the Sulu Sea about Jolo and Tawi. The range of depth at the stations is from 23 to 500 fathoms (42 to 914 meters), the average depth 204 fathoms (373

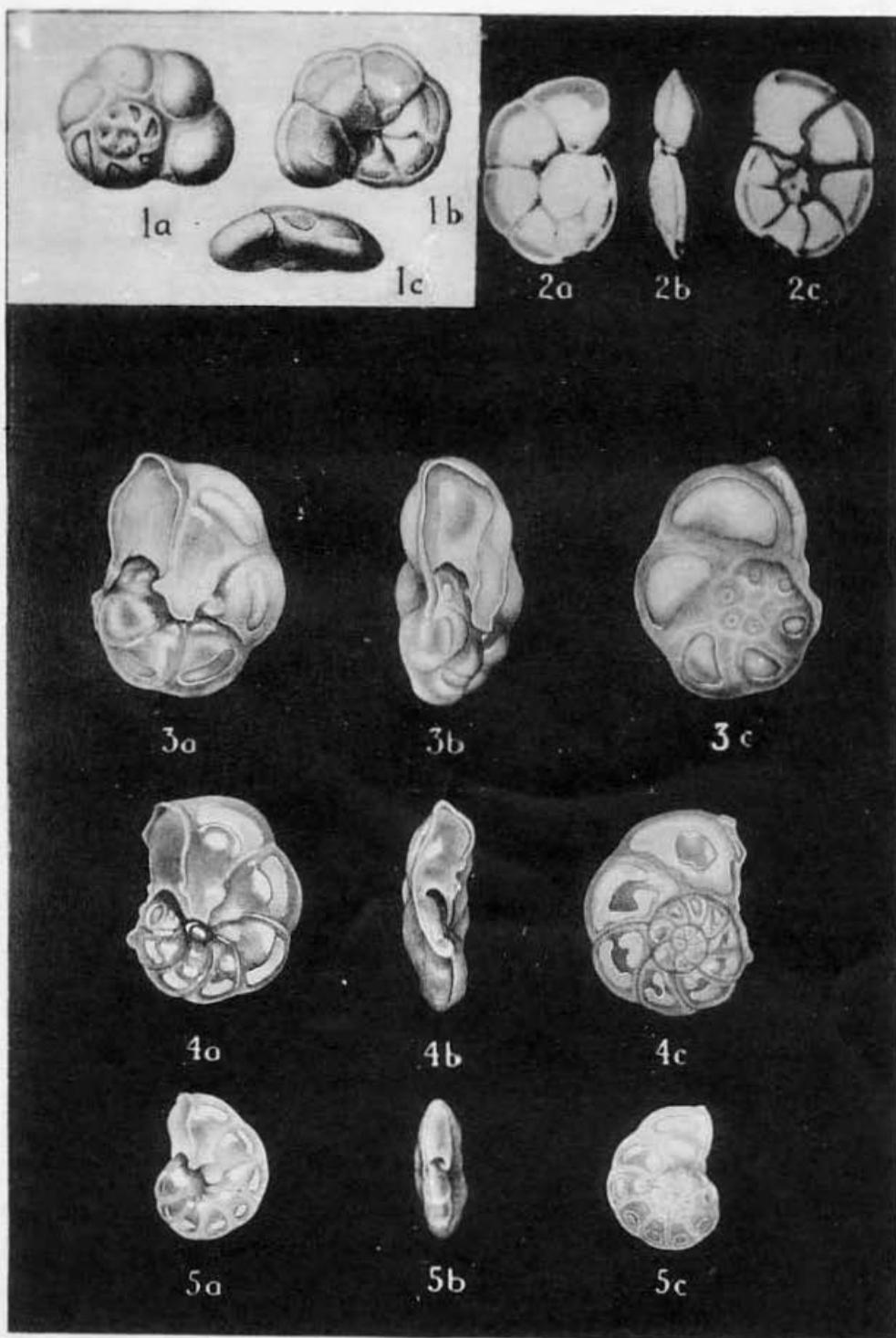
meters). Bottom temperatures are given at but five of the numerous Stations as follows: 50.4°, 52.3°, 52.3°, 63, 1°, and 75.7° F. (10.2°, 11.2°, 11.2°, 17.2° and 24.2°C). PARR recorded this from the Victorian coast, and CHAPMAN from the Philippines, from south of Cape Wiles and from the Lower Miocene of Port Phillip. Under the name *Discorbina vestita*, SEGUENZA figured an unmistakable specimen of this species, obtained from the Miocene formation of southern Italy.

The writer wishes to express his most sincere thanks to Dr. Remington KEL-

LOGG (Director), Dr. G. Arthur COOPER (Curator), Dr. Alfred R. LOEBLICH, Jr. (Associate Curator) of the United States National Museum; Dr. Hurbert G. SCHENCK, Professor of Stanford University; Dr. K. UWATOKO, Professor of Tokyo University; Dr. K. ASANO, Professor of Tohoku University, Sendai, Japan and Dr. Leo W. STACH for their kindness, advice and encouragement. Especially the writer is greatly indebted to Dr. Alfred R. LOEBLICH, Jr. Thanks are also due to Mr. J. KUGA for delineation of Foraminifera.

Explanation of Plate 18

- Figs. 1 a-c. *Mississippiina concentrica* (PARKER & JONES).
adult stages. (reproduction from H. B. BRADY, 1884, pl. CV, figs. 1 a, b.).
- Figs. 2 a-c. *Mississippiina monsouri* HOWE.
(reproduction from HOWE, 1930, Journ. Pal. vol. 4 pl. 27 fig. 4).
- Figs. 3-5. *Mississippiina concentrica* (PARKER & JONES).
showing growth stages (Specimens from Minato, Chikuma-mura, Kamo-gun, Shizuoka Prefecture).
- Figs. 3 a-c. Adult stages, typical *M. concentrica* showing the similar feature of
genus *Stomatorbina*. ×45.
- Figs. 4 a-c. Intermediate stages. ×54.
- Figs. 5 a-c. Young stages showing the feature of genus *Mississippiina*. ×55.



218. A MIOCENE CRAB, *TYMOLUS KAMADAI* N. SP. FROM
THE NUMANOUCHI FORMATION OF THE JOBAN
COAL-FIELD¹⁾

RIKIZO IMAIZUMI

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福島県石城郡沼之内層産カマダノマメヘイケ：鎌田泰彦が福島県石城郡高久村小登堤東岸及江名町三崎の中新統沼之内層から採集したカマダノマメヘイケは幼年のヘイケカニ等と間違われるほど小さいがあきらかにマメヘイケ属に入れられる。近縁の現生種は暖流系に属するがその北限は函館にまで及ぶ。今泉力蔵

The fossil crab which is considered to be a new species, was collected by Mr. Y. KAMADA from the Miocene Numanouchi formation at Kosuganotsutsumi, Takaku-mura and Misaki, Ena-machi, both in Iwaki-gun, Fukushima Prefecture. It seems to represent a mature specimen belonging to the genus *Tymolus*.

The writer wishes to express his hearty thanks to Mr. KAMADA who collected and offered the fossil crab and also to Dr. H. YABE, Professors S. HANZAWA, and K. ASANO and Dr. K. HATAI of the Institute of Geology and Paleontology, Tohoku University for their encouragement.

Family *Dorippidae* DANA 1852

Subfamily *Tymolinae* ALCOCK 1896

Genus *Tymolus* STIMPSON 1858

Genotype, *Tymolus japonicus* STIMPSON.
Type locality, Hakodate Bay, Japan. SAKAI, T., 1937, *Sci. Rep. Tokyo Bunrika Daigaku*, Sec. B, vol. 3, p. 68.

Tymolus kamadai IMAIZUMI, n. sp.

Text-figs. 1, 2.

Preservation :—Mould of the carapace embedded in the gray tuffaceous sandstone.

K. HATAI identified the following fossils which were attached to the same specimen.

Tellina vestaloides YOK. n. subsp.

Macoma cf. *tokyoensis* MAK.

Nassarius sp.

Nuculana sp.

Description :—carapace subcircular, almost as long as broad. Width of orbital border about 1/2 of carapace. Gastric, cardiac and branchial region well delimited and convex. Antero-lateral borders characterized by having two tubercles; last one sharp. Posterior border concave in the middle or intestinal region.

Meso- and meta-gastric region triangular in shape, cardiac region somewhat acute in the posterior part. Proto-gastric region U-shaped, with a pustule on the outer anterior side. Tips of rostrum obscure, lateral frontal teeth of rostrum projecting outwards. External orbital teeth thin and its projecting tip broken.

Dimensions :—

carapace, length 10mm., width 12mm.

width of the posterior border 6.5mm.

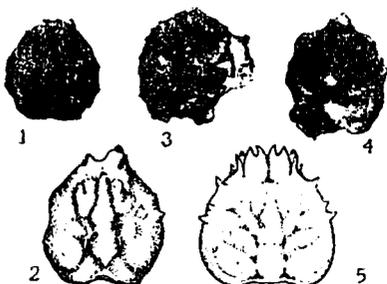
width of the base of the rostrum 4.5mm.

Holotype :—IGPS coll. no. 74002.

Locality and geological horizon :—IGPS

1) Read June 30, 1951; received Feb. 5, 1952

loc. no. Fs-14; east cliff of Kosugano-tsutsumi, Takaku-mura, Iwaki-gun, Fukushima Prefecture, (Taira sheet), Lat. 37°1' 16".2 N., Long. 140°57' 45".2 E., Numanouchi formation, Miocene, Y. KAMADA coll., 1948.



Text-figs. 1-4, *Tymolus kamadai* n. sp.

Text-fig. 1, holotype, nat. size.

Text-fig. 2, the figure of the holotype, $\times 6/5$.

Text-fig. 3, the referred specimen, the mould of the carapace, $\times 8/5$.

Text-fig. 4, the cast of the carapace, the same specimen as text-fig. 3, $\times 8/5$.

Text-fig. 5, *Tymolus japonicus* STIMPSON after SAKAI's Fig. 4, 1937, nat. size.

Referred specimen :—IGPS coll. cat. no. 74308, text-figs. 3, 4.

Locality and geological horizon :—Mitsuki, Ena-machi, Iwaki-gun, Fukushima Prefecture, (Onahama), IGPS loc. no. Fs-21, Lat. 36°55' 56".8 N., Long. 140°55' 19".3 E., Numanouchi formation, Miocene, Y. KAMADA coll., 1952.

Preservation :—a mould and its cast of the carapace embedded in the yellowish gray soft tuffaceous sandstone.

Dimensions :—

- carapace, length 13mm., width 13mm.
- width of the posterior border 7mm.
- width of the base of the rostrum 5mm.
- width of the gastriccardiac region 4mm.
- U-shaped proto-gastric region, length 3mm., width 3mm.

2 or 3 pustules of the antero-lateral border of the referred specimen are dis-

inct. The right outer orbital spine can be obscurely seen at the base of the rostrum.

Geographical distribution of the living species :—the genus *Tymolus* contains eight species, of which two are known from Havana in Cuba (232-441m.), one from Australia and the others from the Indo-Pacific, Barbades (365m.), West Indies (212 and 216m.). Two species have been reported from Japan; they are (SAKAI, 1937, p. 68, EDWARDS et BOUVIER, 1902, p. 94)

Tymolus japonicus STIMPSON, 1858, type loc., Hakodate Bay, Japan.

Tymolus uncifer (ORTMANN), 1892, type loc., Sagami Bay, Japan.

The distribution of the Japanese Recent species of *Tymolus* is as follows.

Tymolus japonicus is found in depths of 50-350m. on muddy or sandy bottoms, it ranges from Hokkaido to Kyushu, and has been recorded by Y. YOKOYA from the following localities (YOKOYA, 1933, pp. 105-107).

1. Between Shiriya-zaki, Aomori Prefecture and Todosaki, Iwate Prefecture, in 86, 91m.
2. Near Todo-saki, Iwate Prefecture in 130, 135, 150, 152, 154, 190m.
3. Between Todo-saki, Iwate Prefecture and Kinkazan, Miyagi Prefecture in 165m.
4. East of Kinkazan, Miyagi Prefecture in 320-344m.
5. South of Kinkazan, Miyagi Prefecture in 146m.
6. South of Shiwoya-zaki, Fukushima Prefecture in 99m.
7. South of Inubô-saki, Chiba Prefecture in 123, 238m.
8. Coast of Bôshu Chiba Prefecture in 130m.
9. Sagami Bay, Kanagawa Prefecture in 165m.
10. Near Maisaka, Shizuoka Prefecture in 192m.
11. Suruga Bay, Shizuoka Prefecture in 110, 123, 128m.

12. South of Toba, Mie Prefecture in 207, 291m.
13. East of Owase, Mie Prefecture in 132m.
14. South of Atsumi, Aichi Prefecture in 91m.
15. West of Ashizuri-zaki, Kōchi Prefecture in 296m.
16. West of Tanegashima Isls. in 203m.
17. South of Koshiki Isls., Kagoshima Prefecture in 132m.
18. South of Gotō Isls., Fukuoka Prefecture in 324m.
19. West of Tsushima Isl., Fukuoka Prefecture in 115m.
20. North of Nagato, Yamaguchi, Prefecture in 130m.
21. East of Mishima, Yamaguchi Prefecture in 93m.
22. Wakasa Bay, Fukui Prefecture in 101m.
23. North of Noto Peninsula, Ishikawa Prefecture in 132m.
24. Toyama Bay, Toyama Prefecture in 135m.
25. West of Lake Jyūsangata, Aomori Prefecture in 115m.
26. Tsuruga Strait, Aomori Prefecture in 44, 108m.

Tymolus uncifer (ORTMANN), found in depths of 50-300m. on muddy bottoms.

1. South of Shiriya-zaki, Aomori Prefecture in 55m.
2. Between Todo-saki, Iwate Prefecture and Kinkazan, Miyagi Prefecture in 141, 177m.
3. North of Kinkazan, Miyagi Prefecture in 106, 123m.
4. South of Kinkazan, Miyagi Prefecture in 146m.
5. East of Shioya-saki, Fukushima Prefecture in 104, 132, 201m.
6. Between Shioya-saki and Inubō-zaki, Chiba Prefecture in 102, 124, 141m.
7. Inubō-saki, Chiba Prefecture in 95m.
8. Sagami Bay, Kanagawa Prefecture in 135, 170, 452m.
9. Kii Strait, east of Shikoku in 128-159m.
10. North of Ashizuri-saki, Kōchi Prefecture in 348m.
11. South of Koshiki Isls. in 243m.
12. North of Noto, Ishikawa Prefecture, Japan Sea in 123m.

Other records are:—Sansibar Kanal, Lat. 5°27'.4 S., Long. 39°18'.8 E. in 463m. East African coast, Lat. 0°27'.4 S., Long. 42° 47'.3 E. in 638m., Andaman, in 400-800m (DOFLEIN, 1904, p. 35).

Remarks:—The fossil species herein described may be a juvenile specimen of the *Dorippe*. The subfamily *Dorippinae* and *Tymolinae* are divided as follows.

	<i>Dorippinae</i>	<i>Tymolinae</i>
external maxillipeds	not long, incompletely cover the buccal cavern.	long, almost completely cover the buccal cavern.
afferent branchial openings	situated either immediately or shortly in front of the chellipeds.	may or may not be situated near the base of the chelliped.

Such critical parts as above listed can not be seen in the fossil specimen, which is similar also to the genus *Ethusa* of the *Dorippinae*.

Ethusa and *Tymolus* are distinguished from each other by the following feature. The front of *Tymolus* is provided with four teeth while that of *Tymolus* is entire, bidentate or four-dentate.

The shape of the carapace is more subglobose in *Tymolus*. *Tymolus kamadai* is similar to *Tymolus japonicus*, but can be distinguished by the proto-gastric region and number of and position of the pustules.

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219. THE DISCOVERY OF NEW MIOCENE FAUNA IN THE NORTHERN PART OF NISHITAGAWA COAL-FIELD, YAMAGATA PREFECTURE, JAPAN.¹⁾

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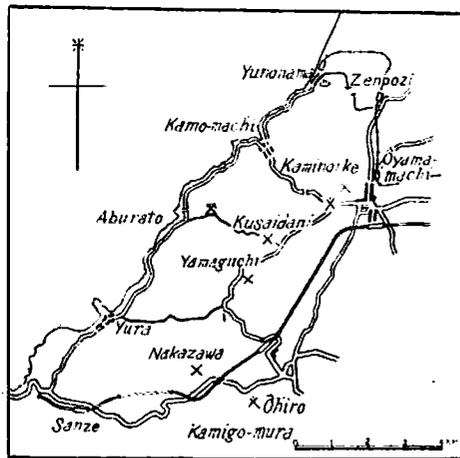
山形県西田川炭田産の中新世化石動物群に就て：西田川炭田の北部に於て、上郷累層大山五層の凝灰質淤泥岩から、多数の貝化石が産出することは既に概報したが、今回その詳細を報告する。これらの貝化石は保存は余りよくないが、同定できたものは13属19種である。これらの中で、Veneridae 及び Tellinidae に属するものが大半を占め、しかも Tellinidae の *Apolymelis*, *Angulus* が個体数も種数も豊富なことは特徴的である。この化石動物群に対比できるものは、現在までに殆んど見当たらないが、たゞ富山県第三系の八尾層群掛畑層からの化石動物群に類似しており、6種が共通している。しかし、筆者等はこの西田川炭田産の化石動物群は、八尾層群のものよりは稍古く、中新世中～初期（むしろ初期）の双六階を代表するものと考えたい。小笠原謙三・棚井敏雅

In the Nishitagawa district of Yamagata Prefecture along the coast of Japan Sea, the coal-bearing Tertiary deposits with abundant pyroclastic materials and extrusive rocks develop on the basement of grano-diorite. As already reported by the senior writer, at the western side of the mountain range the Tertiary deposits can be divided into two formations—the Sanze as the lower and the Kamo as the upper; and the Kamigo formation which is very tufaceous and thought to be an equivalent of the Sanze formation is distributing at the eastern side.

As it has been reported that the Miocene flora had occurred in this area, here we report the occurrences of several molluscan fossils, being collected from the tufaceous siltstone of the Oyama member of the Kamigo formation. Main localities of them are following two, namely the bank of Kaminoike and the road-cutting near the Kagayama Park, Oyama-machi. The similar molluscan fossils are found in the similar rocks at

Hirohama, Kamigo-mura. (Fig. 1)

Fig. 1. Map showing the fossil localities in the Nishitagawa Coal-field.



x plant fossils X molluscan fossils

This fossil fauna contains several new species and abundantly many specimens belonging to the family Tellinidae, but most of them are ill-preserved. The shelly materials scarcely reserved on the moulds and the hinge part usually unobserved.

1) Read Feb. 9; received March 15, 1952.

Table 1. List of Molluscan Fossils

	A	B	C	D	E
<i>Chicoreus (Rhizophorimurex) tiganouranus</i> (NOMURA)		x		x	
<i>Striarca (Estellacar) uetsukiensis</i> (HATAI & NISHIYAMA)	x				
<i>Joannisiella</i> aff. <i>takeyamai</i> OTUKA	x				
<i>Clementia papyracea</i> GRAY	x	x	x	x	x
<i>Cyclina mitsuchii</i> OYAMA (MS)		x	x	x	
<i>Chione (Leukoma)</i> cfr. <i>tayaensis</i> (NOMURA & HATAI)			x	x	
<i>Paphia</i> sp.				x	
<i>Sanguinolaria (Soletellina)</i> sp.	x	x			
<i>Apolymetis (Leporimetis) nipponica</i> OYAMA (MS)	x			x	
<i>Apolymetis (Leporimetis) takaii</i> sp. nov.	x				
<i>Angulus (Moerella)</i> aff. <i>donacinus</i> (LINNE)	x				
<i>Angulus (Moerella) kagayamensis</i> sp. nov.	x				
<i>Angulus (Moerella)</i> sp.	x				
<i>Angulus (Fabulina?)</i> sp.	x				
<i>Angulus (Tellinides) timorensis</i> (LAMARCK) var.	x			x	
<i>Tellina (Scissulina)</i> cfr. <i>disper</i> CONRAD	x				
<i>Glaucanome</i> sp.				x	
<i>Cultellus otukai</i> sp. nov.	x				
<i>Cultellus oyamensis</i> sp. nov.	x				

Horizon and locality :

Oyama member of Kamigô formation

A: Kagayama park, Ôyama-machi, Yamagata Prefecture.

B: Kaminoike, " "

C: Ôhiro, Kamigô-mura " "

Yatsuo group

D: Kakebata formation in Toyama Prefecture.

E: Kashio formation " "

The total number of distinguished forms and their respective localities are given in the list. (Table 1)

At present it has never been reported on the Miocene fauna comparable with the Oyama fauna in this area. But the fossils of the Yatsuo group in Toyama Prefecture includes several forms identical to those of the Oyama member. The Kakebata and Kashio formations of the Yatsuo group yield abundant molluscs, among which those from the lower member of the Kakebata formation show the nearest resemblance to the Oyama fauna in the present field. Between the

both faunas 6 species are common. They are as following :

Chicoreus (Rhizophorimurex) tiganouranus (NOMURA)*Striarca (Estellacar) uetsukiensis* (HATAI & NISHIYAMA)*Cyclina mitsuchii* OYAMA (MS)*Clementia papyracea* GRAY*Apolymetis (Leporimetis) nipponica* OYAMA (MS)*Angulus (Tellinides) timorensis* LAMARCK var.

Otherwise, *Clementia papyracea*, *Chicoreus tiganouranus* and *Joannisiella takeyamai* are common to the middle-lower

Miocene fauna, for instance, Tsukiyoshi, Tsuyama, Shiogama and Kadonosawa faunas. In the present field, the Oyama member containing these molluscs is overlain by the Zenpozi member, from which many plant fossils, such as *Comptoniphyllosum Naumanni* NATH., *Liquidambar formosana* HANCE, *Cyclobalanopsis Mandralisca* (GAUDIN), *Zelkova Ungerii* (ETT.) and others are yielded. The geological age of the flora is considered to be middle~lower Miocene. The Kakebata member, whose fauna is comparable only to the Oyama fauna for the present, also contains *Miogypsina* and *Operculina*, or locally *Comptoniphyllosum* and *Liquidambar*.

From the above-mentioned facts the writers intend to consider the geological age of the Oyama fauna to be "lower Miocene".

The writers wish to express their gratitude to the late Prof. Y. OTUKA, Dr. F. TAKAI, Dr. K. OYAMA and Dr. R. SAITO, for their kind directions and many suggestions in this study.

Description of the noteworthy Species

Family Murcidae

Chicoreus (Rhizophorimurex) tiganouranus (NOMURA)

Pl. 19, fig. 1

1935. *Murex tiganouranus*, NOMURA: Saito Ho-on Kai Mus. Bull. Geol., No. 3, p. 225, pl. XVI, fig. 18.
 1950. *Chicoreus (Rhizophorimurex) tiganouranus*, OYAMA: Rep. Geol. Surv. Jap. No. 132

Height ca. 30mm., Diameter 19mm.

Remarks: This species is not so well preserved and the aperture and canal are lacked, but is rather identical to NOMURA's species from the Shiogama bed in the vicinity of Shiogama bay.

Family Arcidae

Striarca (Estellacar) uetsukiensis (HATAI and NISHIYAMA)

Pl. 19, fig. 2

1949. *Barbatia (Barbatia) uetsukiensis*, HATAI and NISHIYAMA: Jour. Paleont. 23, p. 89, pl. 23, figs. 6, 7.

Length 10mm., Height 6.5mm.,
Thickness 3mm.

Remarks: A few outer moulds of this species, found at Oyama-machi, do not preserve ligamental area which is transversely striated, but the general shape is quite identical to OYAMA's well-preserved specimens gained from the Kakebata formation of the Yatsuo group.

Family Ungulinidae

Joannisiella aff. *takeyamai* OTUKA

Pl. 19, fig. 3

- Comp. 1938. *Joannisiella takeyamai* OTUKA: Jour. Fac. Sci., Imp. Univ. Tokyo, vol. v, pt 2, p. 29, pl. IV, figs. 32-34, 37

Description: Shell small, inequilateral or nearly equilateral, ovoidal or circular in shape, rather inflated; beak small, more or less prominent; postero-dorsal margin slightly convex, posterior end roundly truncated, antero-dorsal margin concave, anterior end narrowly rounded, ventral margin moderately round; surface ornamented with fine concentric striae separated by concentric interspaces which are irregular in breadth; ligamental area never marked.

Length	Height	Thickness
15.5mm.	14.0mm.	5.5mm. (fig. 3)
10.5	9.5	—
18.0	16.0	6.0

Remarks: The most allied species to this specimen is *J. takeyamai* OTUKA having been described from the Uetsuki-

Tsuyama group of the Shobara basin in Chugoku, western Japan.

Family Veneridae

Clementia papyracea GRAY

Pl. 19, figs. 4, 5.

1855. *Clementia papyracea*. SOWERBY: Thes. Conch. vol. II, p. 700, pl. CLI, fig. 155
 1880. *Clementia papyracea*. K. MARTIN: Die Tertiaerschichten auf Java. Th. I, S. 99, Tab. XVIII, Fig. 6.
 1940. *Clementia papyracea*, OYAMA & SAKA: Res. Inst. Nat. Resouc. vol. 1, No. 2. pp. 137-144, pl. 15, fig. 15 a, b; 16

Length	Height	Thickness	H/L
52mm.	41mm.	21.5mm.	0.796 (fig. 5)
28	22	12.0	0.785 (fig. 4)

Remarks: A few specimens are obtained. Their general shape and ornament on the surface are identical to those of *C. papyracea*. The species is reported to live in a warm or tropical water, south of Formosa.

Cyclina mitsuchii OYAMA (MS)

Pl. 19, figs. 6a, b, 7

Length	Height	Thickness	H/L
32mm.	39mm.	22mm.	1.21

Remarks: Our specimen is identical fairly well to OYAMA's specimen. *Cyclina sinensis* GMELIN is the most allied species to this, but the latter is distinctly higher and more strongly inflated than the former.

Chione (Leukoma) cfr. tayaensis

(NOMURA & HATAI)

- Comp. 1939. *Venus (Chione) tayaensis*. NOMURA & HATAI: Jap. Jour. Geol. Geogr., vol. 16, p. 59.

Description: Shell small, triangular, with marked radiating riblets, crossing these riblets there are distant concentrically raised lamellae; anterior extremity round, posterior end subangulate; antero-dorsal margin slightly excavated, postero-

dorsal margin more or less convex; ligamental area not so long but well marked; hinge and pallial line not observed.

Length	Height	H/L
7.0mm.	5.0mm.	0.71
8.5	6.5	0.76

Remarks: This species is closely allied to *Chione tayaensis* in the above described characters, but on account of its ill-preservation, it can not be perfectly identified.

Paphia sp.

Pl. 19, fig. 8

Descriptions: Shell large, ovally elongated, compressed vertically; surface ornamented with very distinct concentric ribs which become wider posteriorly and narrower anteriorly; beak not prominent, antero-dorsal margin slightly concave, anterior extremity produced, narrowed, or rounded; antero-ventral margin a little arcuated with a curve at an obtuse angle a little anteriorly below the beak; posterior extremity not preserved; pallial line not observed.

Length	Height	Thickness
55mm. (at least)	37mm.	5mm.

Remarks: The characteristics having been observed in this specimen, are the general outline, especially concaved antero-dorsal margin and distinct concentric ribs. As the fossil species of the genus comparable to the present material is never found, it seems to be probably a new species of *Paphia*. But on account of its ill-preservation we give no specific name to it.

Sanguinolaria (Soletellina) sp.

Pl. 19, fig. 9

Description: Shell elongated, closed, a little longer posteriorly; surface sculptured with concentric irregular wrinkles and striae with irregular, radial, slightly flexures; rather convex at the umbonal

area, umbo more or less produced, situated a little anteriorly near the mid-length; antero-dorsal margin slightly convex, postero-dorsal margin concave, ventral margin slightly arcuated. Hinge teeth and inside of the valve not observed.

Length	Height	H/L
42mm.	18.0	0.428 (fig. 9, right valve)
21	9.5	0.432 (left valve)

Remarks: The present specimen is closely similar to *Soletellina adamsi* DESHAYES, but it is more round at the anterior end and has not marked wrinkles on the surface than the latter. *Soletellina minoensis* YOKOYAMA is easily distinguishable from the present specimen by its height.

Family Tellinidae

Apolymetis (Leporimetis) nipponica

OYAMA (MS)

Pl. 19, figs. 10 a, b

Length	Height	Thickness	H/L
43mm.	33mm.	8mm.	0.786 (fig. 10)
23	17	3	0.738
39	30	-	0.770
36	28	-	0.778
34	27	-	0.750

Remarks: The present specimens are fairly well identified to the type-specimen from the Yatsuo group. This species is one of the most characteristic and common fossils in the present field.

Apolymetis (Leporimetis) takaii

sp. nov.

Pl. 19, fig. 11

Description: Shell large, high, subtriangular or subquadrate, nearly equilateral, strongly inflated in the anterior half part; beak prominent, incurved, nearly mesial. Ornamentation of the surface and radial folding are quite as well as *Apolymetis nipponica*. Antero-dorsal margin slightly convex, moderately long;

anterior end rounded; postero-dorsal margin short, posterior end obtusely truncated (or rounded); ventral margin not well observed, but more or less straight with a contraction near the posterior end. Surface ornamented with numerous fine concentric striae and wrinkles which become obscure near the posterior end. Ligament narrow but distinctly marked, hinge not well observed.

Length	Height	Thickness	H/L
ca. 40mm.	ca. 34mm.	-	ca. 0.850 (fig. 11)
32	23	5mm.	0.878
38	32	-	0.847

Remarks: This species is comparatively common in our field and very similar to *Apolymetis (Leporimetis) nipponica*, but rather higher and more inflated than the latter.

Angulus (Moerella) aff. donacinus

(LINNE)

Pl. 19, fig. 12

Comp.

1767. *Tellina donacina*, LINNE: Syst. Nat. ed. 12, p. 1128. No. 59
1847. *Tellina donacina*, SOWERBY: Thes. Conch. vol. 1, p. 232, pl. LVI. fig. 12; pl. LXVI. figs. 5a, b.
1853. *Tellina donacina*, WOOD: Mono. Crag Moll. vol. II. p. 233, pl. XXII. figs. 5a, b.
1909. *T. (Moerella) donacinus*, COSSMAN & PEYROT: Conch. Néog. Aquit., p. 230, pl. VIII. figs. 13-18.

Description: Shell small, elongate, rather compressed, moderately convex, subtrapezoidal, inequilateral, anterior end round; postero-dorsal margin also nearly straight but short, posterior end obtusely angulated; ventral margin slightly arcuated: surface ornamented with fine concentric striae, and an obtuse radial ridge observed from beak to postero-ventral edge. Ligamental area, hinge teeth and pallial line not observed.

Length 17mm., Height 9mm.

Remarks: LINNE's species, *Angulus (Moerella) donacinus* is the nearest approach to this specimen in the above described characters, but the latter is too ill-preserved to be perfectly determined. This species is ranging from Miocene to recent and the living one found in Britain and the other part of Europe.

Angulus (Moerella) kagayamensis
sp. nov

Pl. 19, fig. 13

Description: Shell ovals elongated, dorsal slopes rather straight, ventral margin nearly straight but slightly convex; anterior side shorter, obtusely angulated; beak pointed incurved; lunular region distinct, anteriorly situated, observed along the whole length of the antero-dorsal margin; surface ornamented with fine concentric striae, even concentric undulation and fine radial striae, presenting a faint crosswork fabric near the ventral margin; an obsolete radial flexure seen from beak to posterior end of ventral margin; pallial sinus deeply elongate, elliptical and attains anterior one-third of the length.

Length	Height	H/L
35mm.	22mm.	0.628 (fig. 13)

Remarks: The present specimen is similar to *Tellina (Moerella) aldrechi* DALL in the general outline, but in the latter a flexure runs from beak to postero-ventral corner, postero-dorsal margin concave, posterior end truncated, and rather smaller in height. *Tellina (Moerella) hendersoni* DALL is more broadly rounded in anterior and posteriorly longer than the present new species. This species also resembles *Tellina (Moerella) jedoensis* LISCHKE which is figured by Y. OTUKA from the Miocene formation of Shobara, but differs in that the anterior and posterior extremities are more round, and antero-dorsal

margin is slightly more convex.

Angulus (Moerella) sp.

Pl. 19, figs. 14, 21

Description: Shell oval, inequilateral, ventral margin more or less convex, antero-dorsal margin nearly straight or straight, posterior side shorter, its extremity subangulate below; beak pointed, not much incurved; surface ornamented with numerous fine concentric striae and in a specimen faint radial ones are found; ligament large, fold obsolete, teeth and pallial sinus not distinctly observed.

Length	Height	H/L	(fig. 21, left, valve)
27mm.	19mm.	0.703	(fig. 14,)
18	10	0.666	
12	8	0.555	

Remarks: The most allied species to this specimen is *Tellina lata* GMELIN, but the latter is distinct from the former by the more roundness of the antero-dorsal margin and anterior end.

Angulus (Fabulina?) sp.

Pl. 19, figs. 15

Description: Shell suborbicular, slightly triangular, subequilateral, more or less ventricose; ventral margin arcuated; antero-dorsal and postero-dorsal margins nearly straightly convex, the both adjacent to the prominent beak, and the former shorter and less sloping than the latter; anterior side rounded, posterior side rather angular; surface ornamented with numerous very fine closely concentric striae; fold and flexure obsolete (only a faint sign of flexure seen at anterior area), lunule and escutcheon sharp, lateral teeth not observed.

Length.	Height	H/L
9.5mm.	8mm.	0.842

Remarks: The present specimen is rather characteristic to *Angulus* in the outline of anterior half, which is slightly convex in antero-dorsal margin, and ro-

unded in anterior end. But its posterior side is different from that of subgenera *Moerella* and *Tellinides*, and rather close to *Fabulina*.

Angulus (Tellinides) timorensis
(LAMARK) var.

Pl. 19, figs. 16a, b, 17

Comp.

1847. *Tellina timorensis*, PHILIPPI: Abbild. Tellina. Tab. IV, fig. 2
1847. *T. (Tellinides) timorensis*, SOWERBY: Thes. Conch. vol. 1, p. 292, Pl. LXI, figs. 153, 172.
1920. *Tellina timorensis*, TESCH, P.: Palaontologie von Timor, 8, s. 105 Tab. CXL, fig. 278
1941. *T. (Tellinides) timorensis*, KURODA: Catal. Moll. Taiwan, pl. XII, fig. 87

Length	Height	Thickness	H/L
43mm.	30mm.	12(6)mm.	0.697 (fig. 17)
39	28		0.718

Remarks: In the present field this species is rather abundant, and almost identical to *Angulus (Tellinides) timorensis* a living species of Indian Archipelago, Philippine and etc. in the general shape and ornamentation of surface. *Psammobia vespertina* CHEMNITZ is almost similar in its outline, but *Psammobia* has a wider ligament and conspicuous gaping.

Tellina (Scissulina) cfr. dispar CONRAD

Pl. 19, fig. 18

Comp.

1857. *Tellina dispar*, SOWERBY: Thes. Conch. vol. I, pl. LIX, fig. 108

Description: Shell small, ovate, slightly elongate, subequilateral, subventricose; beak pointed, rather incurved, situated at the midlength of the shell; anterodorsal margin short, not much sloping; anterior extremity rounded; posterodorsal margin nearly straight, posterior edge obtusely angulate, ventral margin slightly convex; fold and flexure obso-

lete; surface ornamented with numerous fine concentric striae; ligamental area narrow but sharp; two lateral teeth long.

Length	Height	H/L
13.5mm.	8mm.	0.592
15.0	10	0.666

Remarks: The present specimens are closely similar to *Tellina (Scissulina) dispar* in their outlines, but the former is rather shorter and more rounded.

As the right valve is not found, the subgeneric character of the oblique striae on shell surface is not ascertained.

Cultellus otukai sp. nov.

Pl. 19, fig. 19

Description: Shell thin, long; surface ornamented with fine concentric wrinkles; posteriorly elongate, terminal margin subtruncate (nearly square), situated near the anterior one-fifth, a little gaping at both ends; teeth not observed.

Length	Height	H/L
4mm.	15mm.	0.340 (fig. 19, right valve)

Remarks: The present species is most allied to *Cultellus hanleyi* DUNKER, but the latter is longer. This species is named in honor of the late Prof. Y. OTUKA of Geological Institute of Tokyo University.

Cultellus oyamensis sp. nov.

Pl. 19, fig. 20

Description: Shell elongate, compressed, a little gaping at each end, rather straight; surface ornamented with fine concentric striae and irregular wrinkles; posterior side narrow and elongate, rounded at the end; dorsal margin straight, ventral margin slightly contracted near the midlength; anterior side short, attenuated at the end; umbo very small, not prominent; ligament narrow but well marked near the umbo.

Length	Height	H/L
45mm.	12mm.	0.266

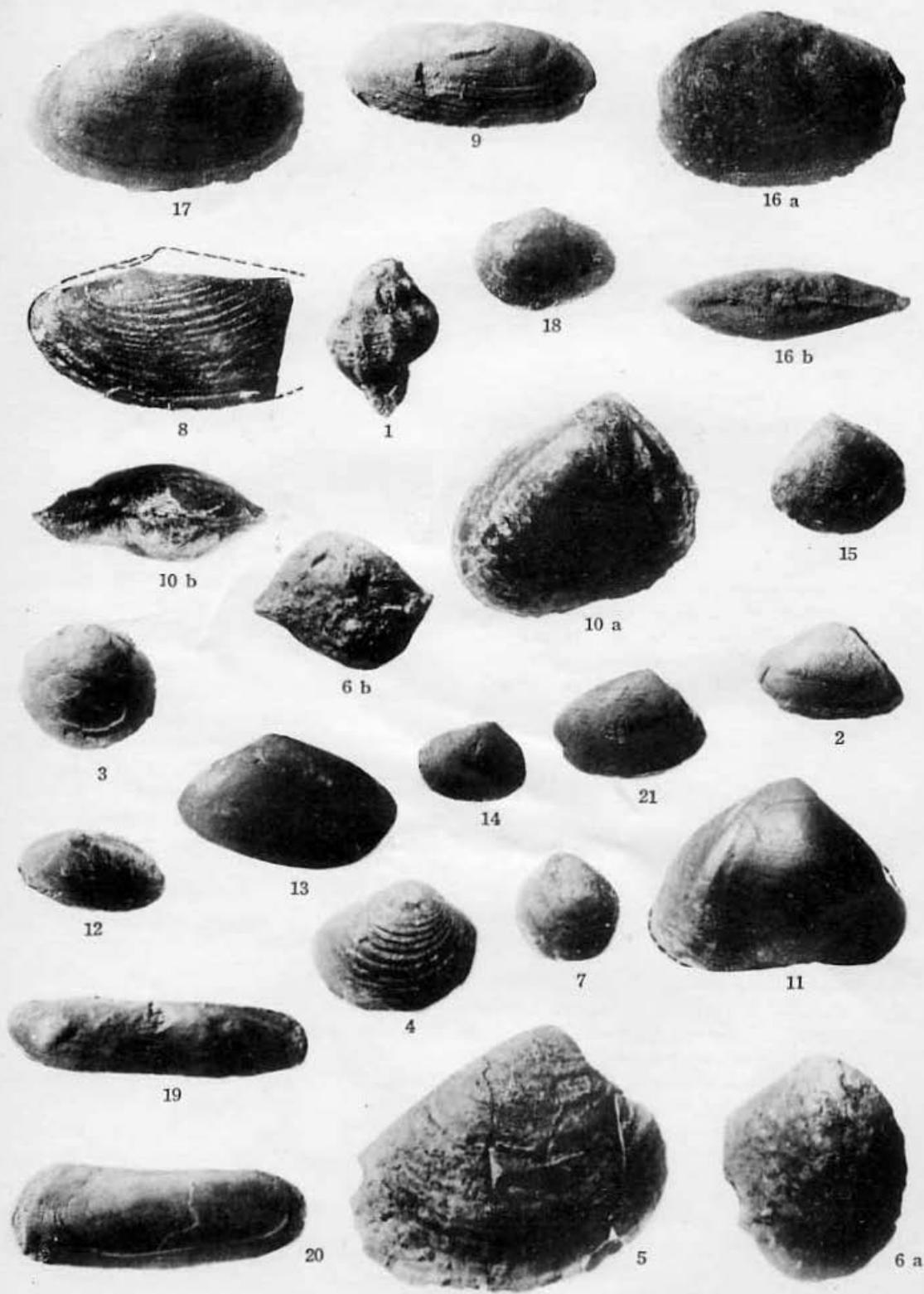
Remarks: This species is more narrow-bladed than the preceding new species.

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Explanation of Plate 19.

- Fig. 1. *Chicoreus (Rhizophorimurex) tiganouranus* (NOMURA)
- Fig. 2. *Striarca (Estellacar) uetsukiensis* (HATAI & NISHIYAMA)
- Fig. 3. *Joannisiella* aff. *takeyamai* OTUKA
- Figs. 4, 5. *Clementia papyracea* GRAY
- Figs. 6a, b, 7. *Cyclina* cfr. *mitsuchii* OYAMA
- Fig. 8. *Paphia* sp.
- Fig. 9. *Sanguinolaria (Soletellina)* sp.
- Figs. 10a, b. *Apolymetis (Leporimetis) nipponica* OYAMA
- Fig. 11. *Apolymetis (Leporimetis) takaii* OGASAWARA & TANAI
- Fig. 12. *Angulus (Moerella)* aff. *donacimus* (LINNE)
- Fig. 13. *Angulus (Moerella) kagayamensis* OGASAWARA & TANAI
- Figs. 14, 21. *Angulus (Moerella)* sp.
- Fig. 15. *Angulus (Fabulina?)* sp.
- Figs. 16, 17. *Angulus (Tellinides) timorensis* (LAMARCK) var.
- Fig. 18. *Tellina (Scissulina)* cfr. *dispar* CONRAD
- Fig. 19. *Cultellus otukai* OGASAWARA & TANAI
- Fig. 20. *Cultellus oyamensis* OGASAWARA & TANAI



220. *TEREBRATALIA* (?) *INNAIENSIS* (HAYASAKA) FROM
IWATE PREFECTURE, JAPAN¹⁾

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岩手県産の *Terebratalia* (?) *innaiensis*: ここに図示する本種は新第三紀中頃を示す。

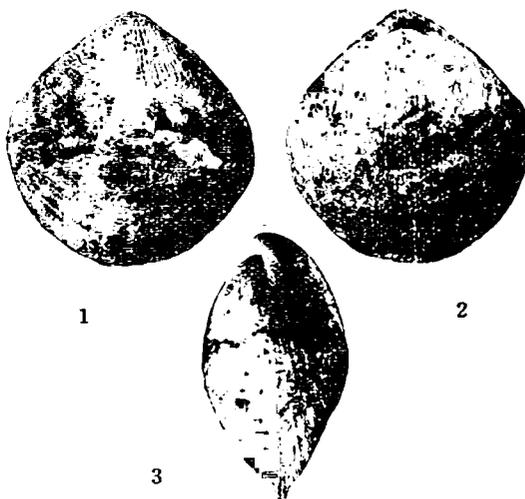
早坂一郎

In the collection of the Tertiary fossils of Northeastern Japan in the Department of Geology and Mineralogy, Hokkaidō University, there are two specimens of a brachiopod species in association with some molluscs from Suenomatsuyama, Iwate Prefecture. The brachiopods belong to the species which was described by the writer of this paper in 1922 as *Magellania lenticularis* DESHAYES var. *innaiensis* nov., because the specimens were obtained from the depth of about 200m. in a shaft in the Innai Mines, Akita Prefecture. Although the internal features were not examined because of the lack of sufficient material, the specimens were regarded to be a *Magellania* on account of some external characters. But, at the same time, a close affinity of the fossil to a certain species of *Terebratalia* was emphasized by the writer in the discussion on the affinities.

The most characteristic external feature of the fossil from Innai Mines is "that the two valves are in their umbonal region ornamented with distinct radial striae that hardly extend halfway from the beak." The whole surface is, in reality, covered by concentric growth lines, but in the area beyond the radially

striated visceral portion of the shell the latter alone occupy the surface.

In 1940, HATAI, in his comprehensive work, refers to this fossil, and calls it *Terebratalia innaiensis* (HAYASAKA). He examined the original material of "*Magellania lenticularis innaiensis*" preserved in the Institute of Geology and Paleontology, Tōhoku University, but the internal structures were not ob-



Terebratalia (?) *innaiensis* (HAYASAKA)
from the Suenomatsuyama series,
Iwate Prefecture, Japan.
Ventral (1), dorsal (2) and lateral
(3) views ($\times 2/3$)

1) Read June 22, 1952; received April 4, 1952

served. Because of the external affinities in certain respects it is regarded by him as probably a *Terebratalia*. It seems, therefore, better for me to put a ? as to the generic denomination.

Be it what it may, the original material was believed to have been obtained from the lowest Neogene formation in the Innai Mines region. According to HATAI, however, *Terebratalia* (?) *innaiensis* is "Upper Oligocene (?) to Lower Miocene" in age.

Now, the occurrence in Iwate Prefecture is to be taken into consideration. The specimens are in the collection of MATSUI from the Suenomatsuyama series in the northern part of Iwate Prefecture. According to Y. OTUKA the Suenomatsuyama series is rather lower Pliocene than in upper Miocene in age, as was concluded from his studies in the stratigraphy and palaeontology of the region.

The two localities of the brachiopod species being situated so closely to each other, and, in consequence, possibly within the same paleogeographical area, the occurrences seem to be chronologically not very remote if not strictly

contemporaneous. Then, the brachiopod species under discussion may have to be recognized as a form indicative of the lower Pliocene, or the upper Miocene, i. e., the middle Neogene, of the northern part of Japan.

As one of the specimens at hand, though not anything like a complete one, shows the characteristic feature very distinctly, and, as neither of the illustrations given by HAYASAKA and HATAI represent the striated pattern of the surface ornamentation in the visceral portion, pictures are here given to supplement the rather imperfect descriptions and discussions hitherto available.

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221. OCCURRENCE OF *GYMNOCODIUM*, A PERMIAN ALGA, IN JAPAN.¹⁾

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日本より二疊紀石灰藻 *Gymnocodium* の産出したこと： 福井県南条郡宅良村芋ヶ平石灰岩より本属の 1 新種を記載し、同時に本属の示準化石としての価値を論じた。 小西健二

In describing a new species of *Gymnocodium*, I wish to demonstrate the high value of the genus as an index fossil. The species was found in a piece of fusulinid-bearing limestone from Imogadaira, Takura-village, Fukui Prefecture (Prov. Echizen) (Lat. 35°48'38.7" N., Long. 136°20'17.7" E.), which had been presented to Prof. KOBAYASHI from an amateur. It was transferred to the writer for close examination because of its special interest that it came from an uncultivated region geologically.²⁾ The writer wishes to express his sincere thanks to Prof. KOBAYASHI for the continuous encouragement and supervision of this paper in manuscript, to Prof. Ryuji ENDO of the Saitama University at Urawa for his suggestion and assistance, and to Mr. Yoshitaka HORI, master of Koyo Middle School at Fukui, the collector of the specimen.

Through this study it is found that the limestone contains late Early Permian fossils among which an algal species similar to *Gymnocodium bellerophontis*

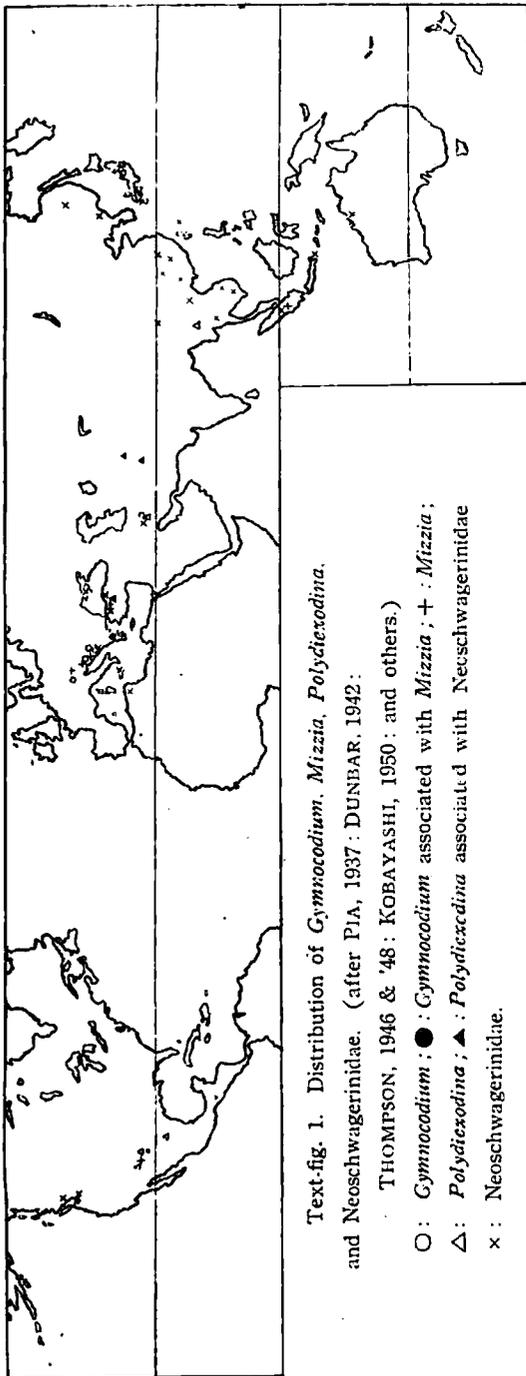
is found in profusion. A form from the Kitakami Mountains once referred to *Gymnocodium*, was later made the genotype of *Hikorocodium* by ENDO (1957 & '51). This is, therefore, the first occurrence of the genus in Japan. According to him *Mizzia* occurs in the mountains in the "Parafusulina" Zone where it is not accompanied by *Gymnocodium*. The co-existence of the two genera that were reported from several foreign localities, may indicate the age of the *Neoschwagerina-Verbeekina* Zone.

The two fusulines are typical of the Tethian fauna like *Polydiexodina* in the Atlantic fauna (DUNBAR, 1942; THOMPSON, 1946, etc.). As discussed below, *Gymnocodium* is an inhabitant in the warm sea of the two provinces of the same age distinguished by the above-mentioned fusulines and possibly survived later for some time. *Gymnocodium bellerophontis* is its type species which is known from Southern Europe (Bellerophonkalk) and Iran. The occurrence of *Gymnocodium* is expectable in Afghanistan, Indochina, South China or elsewhere³⁾ in the Tethian province because the genus is known now in Japan. On account of the wide distribution of the genus in the limited age it may be comparable with *Mizzia* (JOHNSON,

1) Read, Oct. 20, 1951; received, March 25, 1952

2) A fusulinid limestone locality at Sugitani, near Imogadaira, is all what has been known since OHTSUKI and KIYONO's sheet survey (1919); last spring. HAYASAKA & MATSUO (1951) reported *Neoschwagerina craticulifera* (SCHWAGER) from Imogadaira.

3) JOHNSON (1946-a) noted the occurrence of this genus in East Indies.



Text-fig. 1. Distribution of *Gymnocodium*, *Mizzia*, *Polydiexodina*, and *Neoschwagerinidae*. (after PIA, 1937; DUNBAR, 1942;

THOMPSON, 1946 & '48; KOBAYASHI, 1950; and others.)

○ : *Gymnocodium* ; ● : *Gymnocodium* associated with *Mizzia* ; + : *Mizzia* ;
 △ : *Polydiexodina* ; ▲ : *Polydiexodina* associated with *Neoschwagerinidae* ;
 x : *Neoschwagerinidae*.

1942).⁴⁾ (See Text-fig. 1)

Description of Species

Genus *Gymnocodium* PIA, 1919

The type species of *Gymnocodium* is *Gyroporella bellerophontis* ROTHPLETZ (1874) which was discovered in Dolomiten, South Tirol. It was referred once to *Macroporella* by PIA (1912), but later he (1919, '26, '27 & '37) instituted *Gymnocodium* on the species when he described it from the Bellerophonkalk in the Linnaric Alps, because it can be distinguished from *Macroporella* and also from *Gyroporella* by the bifurcation of the thallus, pith-like structure of the central body and irregularly ramified and cone-shaped branches. The type localities of the species were investigated geologically and *G. nodosum* was added to it by OGILVIE-GORDON (1927 & '34). Her *Fusulinella itoi* (1934; Pl. 3, figs. 3 & 4h; Pl. 4, fig. 5) which was found in association with this species and some brachiopods and mollusks, looks like a minor foraminifer, *Hemigordius*(?), for example. In the Buekke Mountains in Hungary a black bituminous limestone yields *G. bellerophontis* with *Mizzia velebitana* (JABLONSKY, 1918).⁵⁾ In Yugo-Slavia it occurs at several places as reported by many authors; its coexistence with *G. nodosum*, *Vermiporella velebitana*, *M. velebitana* and *Neoschwagerina* sp.(?) is noteworthy.⁵⁾ (KOCH, 1932).

4) *Gymnocodium* attained its acmic prominence with the Sosio stage, as did *Mizzia* in the Artinskian and later on.

5) According to JOHNSON'S compilation (1942).

HERITSCH (1934) described it with *M. velebitana* and a few other fossils from the *Waagenophyllum indicum* bed of the "Upper Permian" limestone at Zazar and with *M. velebitana*, *Productus richt-hofeni* and minor foraminifers from "stratigraphically highest limestone beds" at Somj⁵). The most eastern locality (HERITSCH in KÜHN, 1933) is Isfahan-Saidabad basin, in Iran, where it is accompanied by *M. velebitana*, *Parafusulina* sp., *Amblysiphonella* sp., *Waagenophyllum* sp. nov. (HERITSCH), *Productus djulfensis* STROY. and some other fossils. *Parafusulina* sp. which is the solitary fusuline from the grey black limestone may be correctly placed in the genus, but the fact that another limestone closely set to the parafulinid limestone yields *Polydiexodina persica* KAHLER must not be overlooked. JOHNSON (1951) described several gymnocodians including two new species from the polydiexodines-bearing "Late Permian" formation in the Apache Mountains, Texas.

In summarizing these occurrences, *Gymnocodium* is almost restricted to the *Neoschwagerina* (-? *Yabeina*) Zone in the Tethian province and to the *Polydiexodina* Zone in the Atlantic province (THOMPSON, 1948), if the dubious Iranian one is ignored.

Gymnocodium japonicum KONISHI, sp. nov.

Plate 20

Materials; Beside a few individuals exposed on eroded surface specimens include numerous sections, longitudinal (11), cross (ca. 40), tangential (8) and oblique (ca. 100), all from Imogadaira limestone and stored in Geol. Inst., Univ. of Tokyo.

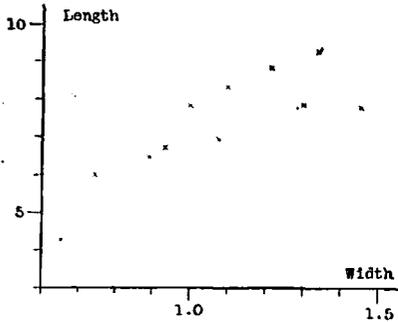
Description; Colony shrub-like, repeatedly ramified, composed of elongate, tubular to club-shaped thallus, all segmented, as recent *Halimeda* or *Galax-*

aura; each thallus subcylindrical, though somewhat constricted or expanded at places, terminating at a pointed or blunt tip, sometimes almost rectangularly dichotomizing and provided with protuberances of various size. Thallus 10 mm. at the longest and its width ranging from 0.75 mm. to 1.50 mm.; it is encrusted with lime around a pith-like central stem which is composed of branching and twisted filaments with greater thickness (0.024–0.050 mm.), if compared with the other species. Pith fairly thick (0.33–0.48 mm.), relative to the outer diameter of the thallus; grade of calcification, however, quite variable. Branches radiating from the pith obliquely to the axis of the thallus and open their outlets on surface; branches widened, generally from base to top, at first forking into very fine threads, abruptly thickened as much as scores times, and continue to expand constantly till they terminate at an elongate cone; some branches, however, irregularly constricted or expanded with irregular intervals. The angle between the branches and the axis of thallus 10–15 degrees at their branching point, 20 degrees at the thickened part of the branch, and 50–70 degrees when they reach at the outer layer of the calcified wall. Some branches repeat to bifurcate in a vertical plane from the vicinity of their junction with a pith, where no partition exists. Pores of the branches distribute on the surface with regular intervals; some 20 of them countable in 0.5 mm. square of surface. Sporangia spherical to oval, 0.27 to 0.48 mm. in diameter, located near the border between the calcified wall and pith. No other difference seen between fertile and sterile.

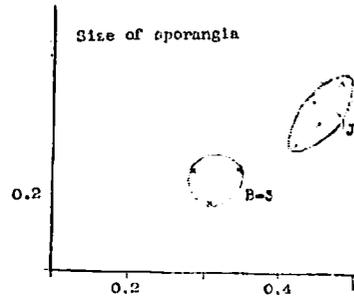
Observation; Although nothing can be mentioned definitely of the articulation among the thalli, several specimens are suggestive of segmentation as indicated

Measurement ; (in mm.)

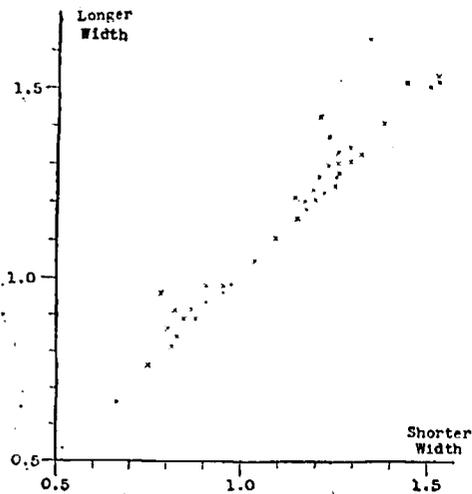
	Length	Width	L/W	Size of pores
PP 7201 (Holotype)	7.79	1.45	5.38	0.055±.01
PP 7198	6.51	0.89	7.32	0.080±.01
PP 7200	9.30	1.34	6.94	0.061±.01
PP 7197-a	6.77	0.93	7.28	0.075±.01
PP 7197-b	4.27	0.65	6.58	0.084±.01



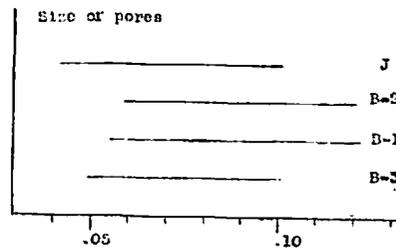
Text-fig. 2



Text-fig. 4



Text-fig. 3



Text-fig. 5

B-1; *G. bellerophontis* PIA (1926 & '27)

B-2; *G. bellerophontis* OGHVIE-GORDON (1927)

B-3; *G. bellerophontis* PIA (1937)

J; *G. japonicum*, new species.

in OGHVIE-GORDON'S illustration (Text-fig. 6). Moreover, a curious specimen shows that a tip of smaller segment is united with a pore, instead of a tip, of larger segment. (Plate 20, Fig. 9). Therefore, the segmentation and mode of growth may be similar to

those of recent Codiaceae. The thalli often dichotomize with an angle of 80-90 degrees (Figs. 7 & 9). Structure of the



Text-fig. 6. *Gymnocodium bellerophontis*
(OGILVIE-GORDON, 1927, Pt. 3, p. 70)
(\times ca. 4)

central pith is ill-preserved. The central body is frequently free from lime entirely and filled with transparent calcite crystals as seen in matrix. Thick, dark colored and tangled fibrils, sometimes bifurcate, transmit into the structure-less central body with impure and semi-transparent calcite filling. Vertically but irregularly bifurcated branches are observed in several longitudinal and tangential sections, while any horizontal one, as in *Verniporella* or *Anthracoporella*, both dasycladaceans, is not recognized in a whorl. Simple and ramifying branches are arranged without any regularity. Constriction of the branches is scarcely found. Number of branches on a whorl, countable in cross sections, varies from 19 to 42. The collection contains only four fertile specimens with obscure sporangia; in a few oval ones their narrower base is attached to a tangled filament. There are at least two pores on a sporangia, through which spores may get out.

Comparison; PIA (1937) made specific distinction of *Gymnocodium* with reference to the shape of thallus, size of pores of branches, size of sporangium, grade of calcification and others, where the former two are also accepted by JOHNSON (1951). The known species⁶⁾ may tentatively be classified by their outline as follows;

- | | |
|--|--|
| 1. Cylindrical but somewhat constricted. | <i>G. bellerophontis</i> ? (PIA, 1912, and later authors)
<i>G. solidum</i> PIA (1937)
(?) <i>G. cfr. fragile</i> JOHNSON (1951) |
| 2. Strongly expanded and pinched. | <i>G. nodosum</i> OGILVIE-GORDON (1927)
<i>G. forcepinum</i> JOHNSON (1951) |
| 3. Spheric. | <i>G. fragile</i> PIA (1937)
<i>G. moniliforme</i> PIA (1937) |
| 4. Moderately bulged. | <i>G. tenellum</i> PIA (1937)
<i>C. texanum</i> JOHNSON (1951) |
| 5. Compressed. | <i>G. compressa</i> PIA (1937) |

The size of branches is not much different, except *G. bellerophontis*. *G. japonicum* closely resembles *G. bellerophontis*? in size of pores of branches, position of sporangia and also in general outline, but the former has the more slender and elongate outline of the

- 6) *G. caneum* PIA (1937) is omitted here because neither description nor illustration has as yet been published.
- 7) Because of ROTHPLETZ's (1874) original paper is inaccessible to the writer, the concept of *G. bellerophontis* is obtained from the PIA's description (1912 and later) which agrees with that of OGILVIE-GORDON. It is, however, noteworthy that according to her quotation (1927, p. 70), ROTHPLETZ's *bellerophontis* differs considerably from *Gymnocodium bellerophontis* PIA in size of pores, even when the former is ten times magnified. (See *postscript*, p. 220)

thallus, and has longer internodes and larger size of sporangia.

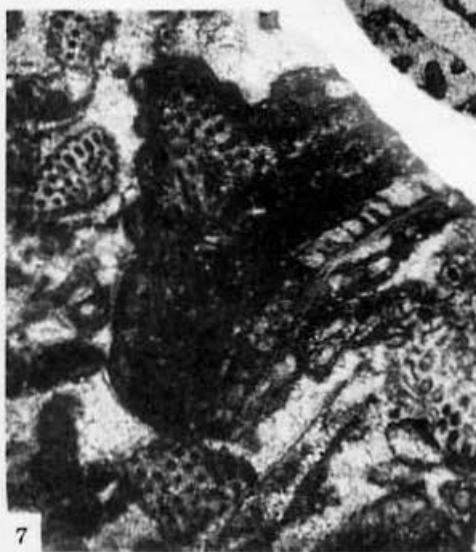
Occurrence; Beside indeterminable corals, gastropods and ostracods, the limestone of Imogadaira contains *Atractyliopsis* (?) sp., *Gymnocodium japonicum*⁸⁾, *Tetrataxis* cfr. *conica*⁺, *Cribrogenerina* sp., *Pachyphloia* sp.⁺, *Glomospira* cfr. *pusilla* of OZAWA (1925), *G.* sp., *Codonofusiella* sp., *Schwagerina* sp., *Neoschwagerina craticulifera*^{*}, *N. rotunda*⁺ and *Neoschwagerina margaritae* (?). Judging from the assemblage it must be late Early Permian to which roughly corresponds the age of Zone of *Neoschwagerina-Verbeekina*.

Postscript: Recently the writer had the opportunity to peruse the original description and illustration of the genotype of *Gymnocodium*. ROTHPLETZ described as: "Sie besteht aus langen, 1/2—1 mm. dicken, ungegliederten Röhrchen, die von einfachen, in Quincunx gestellten, etwas nach oben gerichteten Porenkanälen durch setzt werden, welche 2—3 μ dicke sind." (ROTHPLETZ, A. (1894): Ein Geologische Querschnitt durch die Ost-Alpe nebst Anhang über die sog. Glarner Doppelfalte. *Stuttgart*.)

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8) + and * indicate common or abundant, respectively.



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Explanation of Plate 20.

Gymnocodium japonicum KONISHI, new species.

- Fig. 1-a. Longitudinal section showing the outline of the thallus with central body which is free from lime. Branches bifurcate repeatedly near the center of the left wall.
- Fig. 1-b. Oblique cross-section with an uncalcified pith.
Both (Figs. 1-a & -b) are sterile. (No. PP7201 Holotype) ($\times 10$).
- Fig. 2. Longitudinal section of an imperfect thallus with a pointed tip and pith structure composed of twisted filaments. (No. PP7198) ($\times 10$).
- Fig. 3. Longitudinal section of an unusually slender specimen. It shows irregular disposition of bifurcating branches. (No. PP7200) ($\times 10$).
- Fig. 4. Fragmentary thallus with an uncalcified pith exposed on weathered surface. (\times ca. 5).
- Fig. 5. Longitudinal section of a fertile thallus with two oval sporangia.
They join with tangled thick filaments. (No. PP7197) ($\times 10$).
- Fig. 6. Two cross sections. Pores of branches are distributed irregularly.
The specimen on the lower side is coated by *Osagia*. (No. PP7195) ($\times 10$).
- Fig. 7. Obliquely longitudinal section of a ramified but ill-preserved thallus. Pores are regularly spaced on surface. (Fragments.) (No. PP7196) ($\times 10$).
- Fig. 8. Cross section. Elongately conical branches are seen on a whorl. (No. PP7202) ($\times 23$).
- Fig. 9. Obliquely tangential section of ramified thallus, the left branch of which is almost destructed. The disposition of the internodes of the right branch is suggestive of the segmentation. See page 218. (No. PP7199) ($\times 10$).

PROCEEDINGS OF THE PALAEOLOGICAL SOCIETY
OF JAPAN

「日本古生物学会第50回例会」昭和27年6月22日東京大学理学部地質学教室に於て開催す(参会者64名)。講演者並に講演題目次の如し。

- Palynological Study on the Kamikita Lignite, Aomori Prefecture, Japan. Shigemoto TOKUNAGA
千葉県検見川泥岩層の古植物組織学的研究..... 島倉己三郎
- The Fossil Flora from the Nishitagawa Coal-Field, Yamagata Prefecture, Japan.—II Toshimasa TANAI
北陸産新生代羊歯類の2, 3について(代説)..... 松尾秀邦
佐世保炭田産化石植物..... 遠藤誠道
来馬植物群の追加属について..... 高橋年次
山西晋太原産 *Shirakiopteris* (代説) 淺間一男
宮城県本吉郡岩井崎産石灰藻化石について..... 遠藤隆次
- A Fossil Palm in Kenroku park at Kanazawa Yudzuru OGURA
- Foraminiferal Assemblage of the so-called Sandy-Shale Formations in Japanese Oil Field of Japan Sea Side Takayasu UCHIO
New Records of some Foraminiferal Genera in Japan..... Takayasu UCHIO
- 北海道 釧路附近の更新世及び現世有孔虫群について..... 高柳洋吉
秋田県本荘地区 船川層の化石有孔虫について(代説)..... 岩佐三郎
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CONSTITUTION
of the
PALAEONTOLOGICAL SOCIETY OF JAPAN

ARTICLE 1. Name

The Society shall be known as the Palaeontological Society of Japan. The Society is a section of the Geological Society of Japan.

ARTICLE 2. Object

The object of the Society shall be to promote the study of palaeontology and related sciences.

ARTICLE 3. Achievement

The Society in order to execute Article 2 shall (a) issue the Society journal and other publications, (b) hold or sponsor scientific lectures and meetings, and (c) sponsor collecting or field trips, and lectures.

ARTICLE 4. Membership

The Society shall be composed of persons who are active or interested in palaeontology or related sciences, and shall be known as regular members, honorary members, and patrons.

ARTICLE 5. The members of the Society shall be obliged to pay annual dues to the Society, for which they shall enjoy the privilege of receiving the Society's journal and of submitting papers which have been read and discussed at the meetings for publication in the Society's journal.

ARTICLE 6. Administration

The Society shall have the following organizations for its administration.

- (a) General meeting. The general meeting shall be composed of the Society members. More than one tenth of regular members shall be present to hold general meetings. Administrative affairs shall be decided during the general meeting.
- (b) President. The president shall be elected from among the regular members. The president shall represent the Society and supervise its business matters.
- (c) Council. The council shall be composed of councillors who are elected from among the regular members. The council shall discuss administrative affairs.
- (d) Business council. The business councillors shall be elected from among the council members, and shall administer business affairs.
- (e) Officers shall be elected by vote of returned mail ballots, as a general rule.

ARTICLE 7. Amendments to the constitution shall be by decision of the general meeting.

By-Laws and Administration

ARTICLE 8. The Society's journal shall be issued three times a year.

ARTICLE 9. Regular members shall be persons who have knowledge, experience, or interest in palaeontology or related sciences.

ARTICLE 10. Patrons shall be selected individuals or organizations who give special support to the objectives of the Society.

ARTICLE 11. Honorary members shall be persons of distinguished achievement in palaeontology. The council shall nominate honorary members for decision by the general meeting.

ARTICLE 12. Applicants for membership to the Society shall submit their full name, mailing address, date of birth, occupation, and name of school from which they graduated.

Dues

ARTICLE 13. Rates for annual dues of the Society shall be decided during the general meeting. Annual dues for regular members is Yen 400.00 (domestic members) and U.S. \$2.00 (foreign members). Patrons are individuals or organizations donating more than Yen 10,000.00 annually. Honorary members are free from obligations.

ARTICLE 14. The Society income shall be from membership dues and bestowals.

ARTICLE 15. The Society shall have one chairman, fifteen councillors, and several business councillors, whose term of office shall be two years. They may be re-elected.

Addendum

ARTICLE 1. There shall be four business councillors for the present.

ARTICLE 2. The Society journal shall be issued three times a year for the present.