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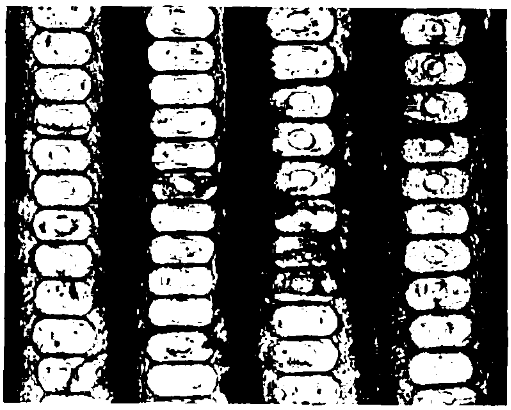

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427. LOWER CARBONIFEROUS BRYOZOA FROM THE HIKOROICHI SERIES, JAPAN*

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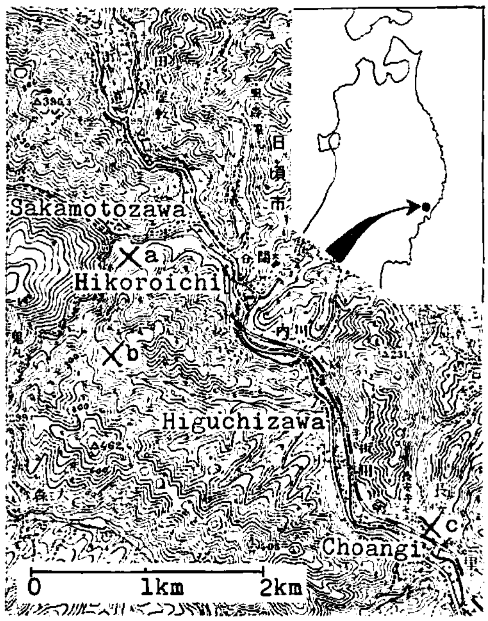
日頃市統産下部石炭紀蘚虫化石：　長安寺，樋口沢及び坂本沢の三地点から日頃市世蘚虫化石 12 属 21 種 (11 新種，6 鑑定不能種，2 既知種，2 類似種）を識別記載した。属の組合せからこの蘚虫群は米国及びソ連のものとではそれぞれ異った関連性が認められるが，個々の種について検討すると北米，ソ連，オーストラリアの同時代蘚虫群と類似性を示している。

坂　上　澄　夫

Introduction and Acknowledgements

The Hikoroichi Series distributed near and in the vicinity of Hikoroichi, Ofunato City, Kitakami massif, northeastern Japan is well known because of the yield of its Etroeungtian fauna. Among the fauna little has been known of the Bryozoa, and in this article some bryozoan fossils are described from three localities which are shown in the Text-fig. 1. Many bryozoans from Choanji and Higuchizawa occur in association with abundant brachiopods, corals, crinoids, gastropods and trilobites which were already described or reported by M. OKUBO (1951), M. MINATO *et al.* (1953) and others who have also worked on the stratigraphy of the area. The bryozoans from Sakamotozawa are rather few in individual member and rarely associated with other fossils.



Text-fig. 1. Map showing the localities of the Hikoroichian Bryozoa. a: Sakamotozawa, b: Higuchizawa, c: Choanji.

The writer here records his gratituds to Drs. M. K. ELIAS and T. G. PERRY of the United States of America, Drs. V. P. NEKHOROSHEV, V. B. TRIZNA, G. G. ASTROVA and I. R. MOROZOVA of U. S. S. R. for their kindness in sending the necessary literatures. The writer also wishes to express his thanks to Prof. Haruyoshi FUJIMOTO of the Yamagata University, Prof. Teiichi KOBAYASHI of the Tokyo

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University, Prof. Wataru HASHIMOTO of the Tokyo University of Education and Prof. Kotora HATAI of the Tohoku University for their kind advices and encouragements.

All of the specimens treated in the present article are preserved in the collection of the Department of Geology, Hakodate school of the Hokkaidô Gakugei University.

Remarks on the Bryozoan Fauna

Abundant bryozoans were found in a bluish black slate but the majority of them are weathered and ill-preserved, therefore, the ones described in the present article comprise only a part of them.

The writer discriminated the following 21 species distributed among 12 genera from the Hikoroichi Series, namely:

Choanji:

Fistulipora sp. indet.
Cheilotrypa choanjiensis SAKAGAMI, n. sp.
Meekopora cf. *approximata* ULRICH
Fenestella sokolskayae SHULGA-NESTERENKO
Rhombopora exigua ULRICH
Rhombopora sp. indet. A
Streblotrypella amicula SAKAGAMI, n. sp.

Higuchizawa:

Fenestella aff. *cribriformis* (CROCKFORD)
Fenestella buguniensis higuchizawaensis SAKAGAMI, n. subsp.
Fenestella hikoroichiensis SAKAGAMI, n. sp.
Fenestrellina japonica SAKAGAMI, n. sp.
Penniretepora decora SAKAGAMI, n. sp.
Penniretepora sp. indet.
Nematopora sp. indet.
Rhombopora sp. indet. B

Sakamotozawa:

Leioclema kobayashii SAKAGAMI, n. sp.
Fenestella crassistereoma SAKAGAMI, n. sp.
Fenestella ofunatoensis SAKAGAMI, n. sp.
Polypora polyclada SAKAGAMI, n. sp.
Acanthocladia peculiaris SAKAGAMI, n. sp.
Rhombopora sp. indet. B
Streblotrypella sp. indet.

The three localities mentioned above are considered to correspond to about the same stratigraphic horizon, even though, the bryozoan assemblages have different compositions.

From the generic assemblage of the bryozoans, the present fauna seems to be somewhat different from those of Soviet Russia and the United States of America, for example, the genus *Nematopora* occurs from the lower Carboniferous of Russia but not from that of the United States of America, and the genus *Cheilotrypa* which is known only from the United States of America has not been recorded from Soviet Russia.

Among the 21 species discriminated from the bryozoan specimens, 11 species are new (one is new subspecies) to science, six are indeterminable, two are identical with previously known foreign species and two show resemblance with known forms.

Fenestella sokolskayae from Choanji resembles the type specimen reported from the upper Tournaisian* of the Russian Platform. *Rhombopora exigua* ULRICH from Choanji was described originally from the Burlington Group of the United States of America and reported from the upper Tournaisian of Kazakhstan, Russia. *Meekopora* cf. *approximata* and *Fenestella* aff. *cribriformis* seem to be related to the named species. *M. approximata* was reported from the Chester Group of the United States of America and from the uppermost Tournaisian of Russia, and *Fenestella cribriformis* was recorded from near the base of the lower Kuttung Series. The other species described as new are more or less related

* The Etroeungtian is not used by the Russian geologists, and the Tournaisian indicates the lowest Carboniferous in Russia.

to some previously known North American or Russian species.

From the above mentioned features, it is concluded that the Hikoroichian bryozoan fauna is related to the North American fauna, Russian and Australian faunas.

Description of Species

Genus *Fistulipora* M'COY, 1850

Fistulipora sp. indet.

Plate 35, figure 2.

A single longitudinal section. Zoarium probably laminar, its thickness about 1.5mm. Diameter of zooecial tube 0.18mm to 0.21mm in inner zone of zoarium, but larger near surface, being 0.27 mm to 0.30 mm in diameter. Vesicular tissue generally longitudinally elongated and quadrilateral in section; one to two rows of vesicles occur in interspace between zooecial tubes. No diaphragms observed. Lunarium very weak.

Remarks:—The present form is only one belonging to the genus *Fistulipora* in the Hikoroichi bryozoan fauna. The specific decision must wait until a larger number of specimens accumulate.

Locality:—Choanji.

Reg. no. 11011-A.

Genus *Cheilotrypa* ULRICH, 1884

Cheilotrypa choanjiensis SAKAGAMI, new species

Plate 35, figures 3-5.

Only one specimen in a thin section. Zoarium ramose and branching with an axial tube about 0.8 mm. Ratio of axial tube to diameter 1:3.5 to 1:4. Zooecial tubes run for a short distance along contact with axial tube, but curve gradually outward, forming with outer surface of zoarium an angle of about 90°. Zooecial tube in tangential section oval in shape, its larger diameter 0.48 mm to 0.52 mm and shorter diameter 0.32 mm to 0.36 mm. Apertures usually arranged in regular diagonal rows, three apertures in 2 mm along one row. Interspace between zooecial tubes filled by well developed vesicular tissue which is scale-like or rounded quadrilateral in longitudinal section and irregular polygonal in tangential section, 0.16 mm to 0.24 mm in diameter. One to three rows of vesicles in interspace between zooecial tubes. Lunaria moderate, occupying about one third of zooecial circumference. Usually attached at proximal side of zooecial tubes. Thickness of lunarium 0.10 mm to 0.11 mm in maximum. Usually no dark fibrous tissue covering vesicular tissue. Diaphragms in irregular spaces; narrowest space between diaphragms 0.2 mm, no diaphragms in some tubes.

Remarks:—ELIAS (1957, p. 395) showed that in *Cheilotrypa* the number of apertures per 2 mm and the ratio of axial tube to diameter becomes larger from the Devonian species to the upper Mississippian. The present form is nearest to *Cheilotrypa distans* ELIAS which was reported from the Redoak Hollow formation (upper Mississippian) of Oklahoma in the above mentioned measurements. However, the present form differs from the ELIAS's species by the larger diameters of zoarium and of axial tube.

Locality:—Choanji.

Reg. no. 11002.

Genus *Meekopora* ULRICH, 1889

Meekopora cf. *approximata* ULRICH

Plate 35, figure 1.

1890 *Meekopora approximata*, ULRICH, *Geol. Surv. Ill., Vol. VIII*, p. 484, pl. LXXVII, fig. 5.

1956 *Meekopora approximata*, NEKHOROSHEV, *Trudy VSEGEI, New Ser., Vol. 13*, p. 103, pl. 6, fig. 6, text figs. 11a, b.

1958 *Meekopora approximata*, TRIZNA, *Trudy VNIGRI, No. 122*, pp. 47, 48, pl. V, figs. 1, 2; pl. VI, fig. 2.

Zoarium bifoliate, growing irregularly as thin expansion, about 1.5 mm in thickness. Median laminae forming a rugosely wrinkled plane. Zooecium tublar, proximally parallel to mesotheca, making large angle in mature region, oblique, subcircular in tangential section and about seven in 3 mm along thin section. Diameter of zooecial tube 0.18 mm to 0.24 mm. Interspaces between zooecial tubes filled by vesicular tissue, which is rounded quadrilateral in longitudinal section. Arrangement of vesicles rather irregular. Dense tissue cover on surface lacking or extremely thin. Diaphragms may occur at intervals as zooecial diameter but indistinct.

Remarks:—*Meekopora approximata* ULRICH which was reported originally from the Chester Group of the United States of America has also been recorded from the lower Fominskian (uppermost Tournaisian) and the Verkhotomskian (upper Visean) by the Russian students.

The original illustration by ULRICH (1890) which is a single surface specimen cannot be compared accurately with the present form by thin section.

One of the most important characters of *M. approximata* is the presence of the median laminae forming a rugosely wrinkled plane and the closely approximated apertures, thickness of zoarium and diameter of zooecial aperture and so the present form may belong to *M. approximata*.

Among the Russian forms belonging to *M. approximata*, TRIZNA's form which from the Lower Fominskian of the Kuzunetz basin most resembles the present form in the general characters except for the slightly coarser vesicular tissue.

Locality:—Choanji.

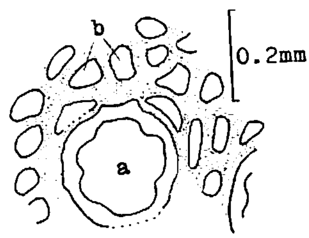
Reg. no. 11010.

Genus *Leioclema* ULRICH, 1882

Leioclema kobayashii SAKAGAMI, new species

Plate 36, figures 3, 4, text-figure 2.

Zoarium consisting of cylindrical stem, 2.6 mm to 3.6 mm in diameter. Zooecial tube circular but with somewhat irregular margin, its diameter 0.21 mm to 0.29 mm. Apertures usually arranged in longitudinal intersecting rows, three apertures in 2 mm along one row. Inner margin of zooecial tubes near surface developed of irregularly formed materials. Zooecial tubes gently curved outward in immature zone, but straight and opening perpendicularly to surface in mature zone.



Text-fig. 2. Enlarged part of the tangential section near surface of *Leioclema kobayashii* SAKAGAMI, n. sp. a: Zooecium, b: Mesopores.

Interspaces between zooecial tubes 0.32 mm to 0.40 mm, filled by many relatively large mesopores. Mesopores with diaphragms, relatively uniform; 0.06 mm to 0.08 mm inmediater, varying in form, round or polygonal with rounded corners. Very thin, numerous diaphragms occur in mesopores, developed at intervals about equal to diameter of mesopore. Diaphragms in zooecial tubes not observed. Minute acanthopores rarely developed.

Remarks:—The present form is quite unlike any previously described species in its internal structure. Relatively large branching stem, no diaphragm in the zooecial tube and acanthopore rarely developed may be important characters of the present species.

The specific name is dedicated to Prof. Teiichi KOBAYASHI of the Tokyo University for his sincere guidance and encouragement.

Locality:—Sakamotozawa.

Reg. nos. 11151 (holotype), 11153.

Genus *Fenestella* LONSDALE, 1839

Fenestella crassistereoma SAKAGAMI, new species

Plate 37, figure 1, text-figure 3a.

Single specimen of a flat fragment without proximal part, about 30 mm long and 30 mm wide, consisting of internal mold of zooecial chambers viewed from reverse side, but, in part, external mold of obverse side observable. Branches covered with very thick stereom, occupying medial and distal parts of found; straight, parallel and bifurcate infrequently. Width of branch wider than fenestrule, usually 0.27 mm to 0.29 mm, before a bifurcation 0.36 mm to 0.40 mm; above, 0.18 mm to 0.22 mm. 22 to 24 branches in 10 mm, horizontal. Fenestrules oval to elongated elliptical in outline, its width and length 0.13 mm to 0.19 mm and 0.30 mm to 0.34 mm, respectively, 21 in 10 mm length of branch. Dissepiments relatively strong. Width of dissepiment approximately one-half that of branches, 0.14 mm to 0.16 mm. Zooecial apertures circular, their diameter about 0.06 mm, 22 to 23 in 5 mm length of one row, and almost perfectly stabilized position of aperture in relation to dissepiments, usually 2 apertures per fenestrule. Interspaces between zooecial apertures 0.11 mm to 0.14 mm. Outline of zooecial chamber pentagonal at base. Carina and nodes not observed accurately, but about 25 in 5 mm length of branch. In external mold of reverse, 5 to 7 fine, parallel striations developed along the length of branch.

Meshwork formula:—22-24/21//22-23/abt. 25.

Remarks:—The present form is near to *Fenestella taxata* SHULGA-NESTERENKO from the Steshevskii horizon (C_1^{st}) (lower Carboniferous) of the Russian Platform in the meshwork formula, but can be distinguished therefrom by the narrow width of fenestrule. Very thickened stereom is one of the most important characters by which it is distinguished from the previously described species. The present form may be included in the Group XIII (*F. spinulosa* Group) established by ELIAS and CONDRA (1957).

Locality:—Sakamotozawa.

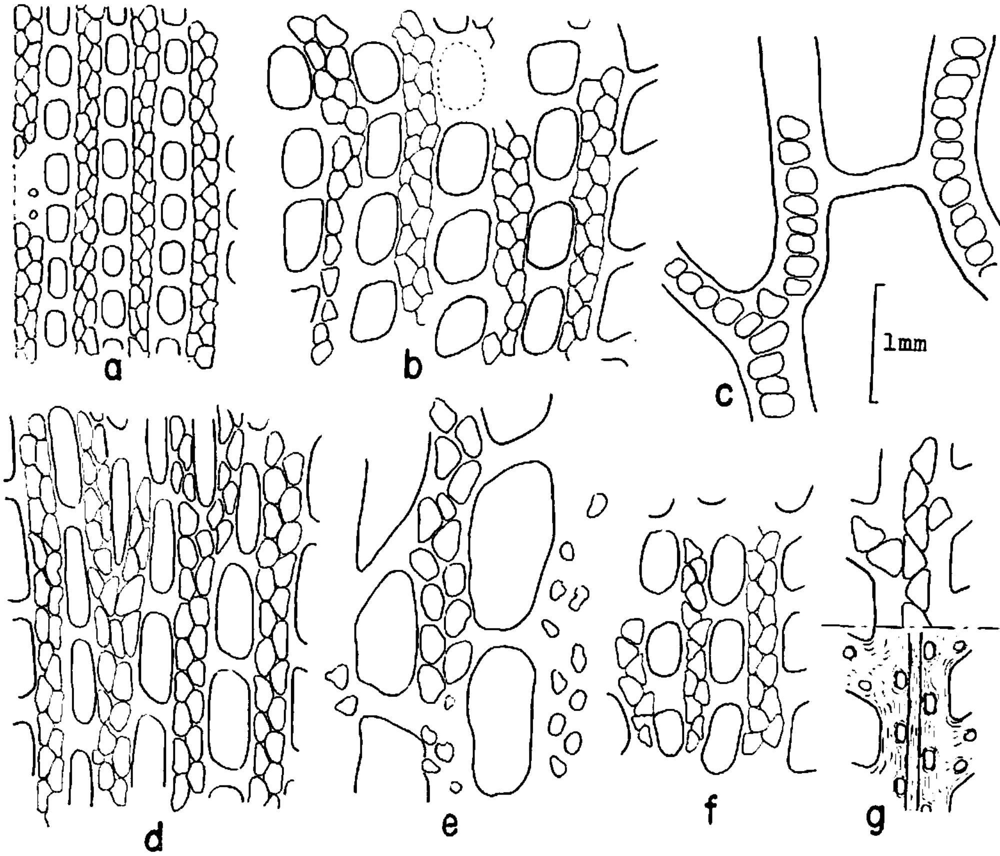
Reg. no. 111 (surface specimen, holotype).

Fenestella aff. *cribriformis* (CROCKFORD)

Plate 37, figure 4, text-figure 3d.

1947 *Fenestrellina cribriformis*, CROCKFORD, *Proc. Linn. Soc. N. S. W., Vol. lxxii, pts. 1-2*, pp. 36, 37, text-fig. 48.

Surface specimen nearly flat fragment of weathered zoarium without proximal part, about 25 mm long and 15 mm wide, consisting of internal mold of zooecial chambers viewed from reverse side. Branches straight parallel, bifurcate at wide intervals, slightly narrower than width of fenestrules. Width of branch 0.24 mm to 0.27 mm, below a bifurcation about 0.48 mm. 20 to 22 branches in 10 mm. Two rows of zooecia in a branch, increase to three rows only immediately before bifurcation. Fenestrules elongated rectangular with rounded corners, their



Text-fig. 3. Sketches of the surface specimens.

a-f : Internal molds of reverse sides. g : Internal mold of reverse side (upper part) and external mold of obverse side (lower part).

a : *Fenestella crassistereoma* SAKAGAMI, n. sp.
b : *Fenestella hikoroichiensis* SAKAGAMI, n. sp.
c : *Fenestrellina japonica* SAKAGAMI, n. sp.
d : *Fenestrellina* aff. *cribriformis* (CROCKFORD)
e : *Fenestella buguniensis higuchizawaensis* SAKAGAMI, n. subsp.
f : *Fenestella sokolskayae* SHULGA-NESTERENKO
g : *Penniretepora decora* SAKAGAMI, n. sp.

width and length 0.26 mm to 0.32 mm and 0.64 mm to 0.80 mm, respectively, and 10 to 11 in 10mm length of branch. Width of dissepiment relatively narrow, measures 0.11 mm to 0.14 mm. Zooecial apertures circular and small, their diameter about 0.07mm measured on external mold, 17 to 18 in 5 mm length of one row, usually 3 to 4 apertures per fenestrule. Interspaces between zooecial apertures 0.14mm to 0.16 mm. Outline of zooecial chamber pentagonal at base. Many fine parallel striations developed along the length on reverse surface of branch. Nodes not observed.

Meshwork formula:— 20-22/10-11// 17-18.

Remarks:—The present form agrees with *Fenestella cribriformis* which CROCKFORD reported from the lower Kuttung Series of New South Wales in the meshwork formula except for some differences recognized in the delicate parts. Generally, the Australian form shows some variations in the meshwork, but the present form is more regular in the arrangements. The preservation of present form favors its reference to *F. cribriformis* with affinity.

Locality:—Higuchizawa.

Reg. no. 101 (surface specimen).

Fenestella sokolskayae SHULGA-NESTERENKO

Plate 37, figure 2, text-figure 3f.

1951 *Fenestella sokolskayae*, SHULGA-NESTERENKO, *Akad. Nauk SSSR., Trudy Paleont. Inst., Tom XXXII*, pp. 109-110, pl. 22, fig. 4, text-fig. 43.

Surface specimen is a fragment of weathered reverse side of zoarium without proximal part, 17 mm long and 13mm wide. Zoarium flat, fan shaped, gradually expanded to distal part. Branches bifurcate at intervals of about 6 mm to 7 mm. Branches straight, parallel, about as wide as fenestrules. Width of branch below a bifurcation 0.48 mm to 0.54 mm; above, 0.20 mm to 0.24 mm; it increases rapidly above a bifurcation and soon attains a width of 0.27 mm to 0.37 mm. 16 to 18 branches in 10 mm. Fenestrule ellipsoidal in outline, its width and length 0.24mm to 0.37 mm and 0.40 mm to 0.56 mm, respectively, and 13 to 15 in 10 mm length of branch. Width of dissepiment 0.20mm to 0.24 mm. Zooecial aperture circular, about 0.13 mm measured in tangential section of upper part of zooecium, 17 to 20 in 5 mm length of one row, usually 2.5 to 3 apertures per fenestrule. Outline of zooecial chamber subpentagonal at base, but sharply pentagonal at middle level of branch. Interspaces between zooecial apertures about as wide as or slightly narrower than width of aperture. Nodes not observed.

Meshwork formula:— 16-18/13-15// 17-20.

Remarks:—The surface specimen is represented by only internal mold of zooecial chambers viewed from the reverse side. Thus, the ornamentations of both sides and arrangement of zooecial apertures are unknown. However, the internal structures and arrangement of zooecial apertures near the surface can be observed.

There is no question as to the identification of this species because they coinside with the description and illustration by SHULGA-NESTERENKO (1951) of the specimens from the Tschernyshinskii horizon of the upper Tournaisian, Russian Platform except for the slightly larger zooecial aperture.

Locality:—Choanji.

Reg. no. 121 (surface specimen).

Fenestella ofunatoensis SAKAGAMI, new species

Plate 37, figure 9.

A single proximal part without initial portion, consisting of internal mold of zooecial chambers viewed from reverse side, but in part, external mold of obverse side. Zoarium fan shaped, somewhat concave from reverse side. Branches lax, slender, bifurcate frequently at intervals of about 4mm to 6mm. Width of branches usually 0.32 mm to 0.38 mm, before a bifurcation 0.38 mm to 0.40 mm; above, 0.20 mm to 0.28 mm. Number of branches in 10 mm 13 to 15, horizontally. Fenestrules generally elongated rectangular with rounded corners but frequently irregular in shape, their width and length very variable, 0.40 mm to 1.04 mm and 1.20 mm and 2.6 mm, respectively, 4 to 5 in 10 mm length of branch. Width of dissepiments 0.20 mm to 0.28 mm. Zooecial apertures circular, their diameter about 0.13 mm, 17 to 19 in 5 mm length of one row. Number of apertures per fenestrule very variable, varying from 5 to 10, rarely up to 12. Interspaces between zooecial apertures 0.13 mm to 0.16 mm. Outline of zooecial chamber triangular or pentagonal at base. Carina and nodes not observed.

Meshwork formula:—13-15/4-5//17-19.

Remarks:—The present form resembles *F. oblongata* KOENIG (1958) from the Chouteau Group (the age of this group is considered by KOENIG to be Kinderhookian) in the form of zoarium and meshwork formula. However, the present form differs from *F. oblongata* in the ratio of branches and fenestrules in 10 mm. The variability of meshwork of *F. oblongata* shown in his Table 4 (p. 133) suggests that the ratio of branches and fenestrules in 10 mm is about 1 : 2, but the ratio of the present new form is about 1 : 3. The present form also resembles *F. balkhashensis* NEKHOROSHEV (12-13/5//16) from the lower Carboniferous of the northeastern part of Balkhasia in the meshwork formula, but differs by the wider branches.

Locality:—Sakamotozawa.

Reg. no. 112 (surface specimen).

Fenestella hikoroichiensis SAKAGAMI, new species

Plate 37, figure 7, text-figure 3b.

Surface specimen is flat fragment of zoarium without proximal part, about 10 mm long and 13 mm wide, relatively rapidly expanding growth form, consisting of internal mold of zooecial chambers viewed from reverse side, but, in part, external mold of obverse side observable. Branches gently curved (probably from straight axial branch to both sides, the right side broken off). Width of branch is narrower than fenestrule, usually 0.29 mm to 0.32 mm, before a bifurcation about 0.40 mm ; above, 0.24 mm to 0.26 mm. Number of branches in 10 mm 14 to 15, horizontal. Fenestrules rectangular with rounded corners, their width and length 0.38 mm to 0.48 mm and 0.48 mm to 0.61 mm, respectively, and 12 to 14 in 10 mm length of branch. Dissepiment rather weak, 0.13 mm to 0.15 mm. Zooecial apertures circular, and its diameter about 0.08 mm, 17 to 18 in 5 mm length of one row, usually 2.5 to 3 apertures per fenestrule. Interspaces between zooecial apertures 0.11 mm to 0.13 mm. Outline of zooecial chamber sharply pentagonal at base, rounded pentagonal at middle to upper level of zooecial tube. Carina and nodes not observed.

Meshwork formula:— 14-15/12-14//17-18.

Remarks:—In the meshwork formula, the present form resembles some Russian and North American species, for example, *F. maximovae* TRIZNA (15.5-16/12-13//16.5-17) and *F. parallela* HALL in KOENIG (15-17/12-14//15-20) and others. However, the present from differs apparently from *F. maximovae* by the generally wider fenestrule and from *F. parallela* in KOENIG by the shorter length of fenestrules.

The more wider fenestrule than that of the branches is an important character of the new species.

Locality:—Higuchizawa.

Reg. no. 102 (surface specimen, holotype).

Fenestella buguniensis higuchizawaensis SAKAGAMI, new subspecies

Plate 37, figure 8, text-figure 3c.

Surface specimen is a flat fragment of zoarium without proximal part, 12 mm long and 8 mm wide, consisting of internal mold of zooecial chambers viewed from obverse side, but in part, shell of obverse side attached. Branches straight, robust, narrower than width of fenestrules. Width of branch about 0.40 mm. In the only one bifurcated branch observed, width below a bifurcation 0.72 mm; above 0.32 mm to 0.36 mm. Number of branches in 10 mm 11 to 12, horizontally. Fenestrule rectangular with rounded corners, its width and length 0.52 mm to 0.68 mm and 1.12 mm to 1.32 mm, respectively, and 7 to 8 in 10 mm length of branch. Dissepiments rather weak, 0.16 mm to 0.18 mm. Zooecial apertures circular, and their diameter 0.11 mm, 14 to 15 zooecia in 5 mm length of one row, usually 4.5 to 5 apertures per fenestrule. Interspaces between zooecial apertures about 0.2 mm. Outline of zooecial chamber triangular or pentagonal at base and middle level of zooecial tube. Carina seem to be developed; nodes not observed.

Meshwork formula:—11-12/7-8//14-15.

Remarks:—The present form agrees with *F. buguniensis* NIKIFOROVA from the lower Visean of Kara-Tai and from the lower Tournaisian of Kazakhstan in the meshwork formula, however, it differs from the Russian forms in the number of zooecia in 5 mm length of one row and number of zooecia to each fenestrule, and by the somewhat wider branches and more regular fenestrules in size and form. Therefore, the present form is considered to be a new subspecies.

Locality:—Higuchizawa.

Reg. no. 104 (surface specimen).

Genus *Fenestrellina* D'ORBIGNY, 1849

Fenestrellina japonica SAKAGAMI, new subspecies

Plate 37, figure 3, text-figure 3c.

A single fragment of zoarium without proximal part, flat about 20 mm long and 10 mm wide, consisting of internal mold of zooecial chambers viewed from reverse side, but in part, external mold of obverse side observed. Branches lax, slender, bifurcate frequently, sometimes anastomosing. Width of branches relatively uniform, 0.44 mm to 0.53 mm, straight except for just above bifurcation or just before anastomosing; 5 to 6 branches in 10 mm, horizontally. Fenestrules surrounded by two dissepiments usually elongated rectangular, fenestrules surrounded by one dissepiment and bifurcated or anastomosed stem usually elongated pentagonal, and fenestrules surrounded by bifurcated and anastomosed stems usually elongated hexagonal. Width of fenestrules varying from 0.93 mm to 1.68 mm, and length relatively uniformed, 3.0 mm to 3.2 mm. Usually 3 fenestrules in 10 mm length of branch. Width of dissepiments 0.11mm to 0.15mm. Zooecial apertures circular, their diameter about 0.07 mm, 12 to 14 in 5 mm length of one row. Number of apertures per fenestrule 7 to 15. Interspaces between zooecial apertures about 0.24 mm. Outline of zooecial chamber strongly intersected, trapezoidal or rectangular with rounded corners at base, and it seems to arrange at one row. Carina and nodes not observed.

Meshwork formula:—5-6/3//12-14.

Remarks:—There was some confusion between the genera *Fenestella* LONSDALE and *Fenestrellina* D'ORBIGNY untill a paper had been published by CONDRA and

ELIAS (1941). ELIAS (1957) discussed that the branches and dissepiments are at uniform intervals in *Fenestella* but not so in *Fenestrellina*, which is restricted to the Mississippian. The present form is apparently included in the genus *Fenestrellina*. Sometimes anastomosing branch is one of the most important characters recognizable for a new species.

Locality:—Higuchizawa.

Reg. no. 103 (surface specimen).

Genus *Polypora* M'COY, 1844

Polypora polyclada SAKAGAMI, new species

Plate 37, figure 10.

A single fragment of zoarium without proximal part, flat about 20 mm long and 13 mm wide, consisting of internal mold of zooecial chamber viewed from reverse side, but, in part, external mold of obverse side observed. Branches rather strong, somewhat flexible and bifurcate frequently. Width of branches 0.84 mm to 0.96mm; 4 to 5 branches in 10 mm, horizontal. Fenestrules very large variable in shape; rectangular, pentagonal or hexagonal with rounded corners, their width and length also very variable, about 1.0 mm to 2.0 mm and about 3 mm, respectivery, 2 to 3 in 10 mm length of branch. Width of dissepiment about 0.40 mm. Zooecial apertures circular and their diameter 0.13 mm to 0.16 mm, 13 to 14 in 5 mm length of one row. Number of rows of zooecial apertures usually 5, before a bifurcation 5 to 6, above 4 to 5. Interspaces between zooecial apertures 0.20 mm to 0.24 mm, longitudinally; 0.08 mm, diagonally. Outline of zooecial chamber variable in shape, generally triangular in inner rows and trapezoidal or rhomboidal in outer rows at base, but regularly rhomboidal at middle level.

Meshwork formula:—4-5/2-3//13-14/5.

Remarks:—The present form is near to *Polypora* aff. *sibirica* YANISCHEVSKI which NEKHOROSHEV (1953) described from the Kassinskii and Perekhodnye Series (Tournaisian) of Kazakhstan, U. S. S. R. in the meshwork formula. However, the present form differs from the Russian form by the somewhat flexible and frequently bifurcated branches, more irregular fenestrules.

Locality:—Sakamotozawa.

Reg. no. 113 (surface specimen).

Genus *Penniretepora* D'ORBIGNY, 1849

Penniretepora decora SAKAGAMI, new species

Plate 38, figure 5, text-figure 3g.

Zoarium slender, pinnate; straight midrib, with a strong rounded carina on obverse face elevated, and fine striate on reverse. Midrib in proximal part only slightly wider than the distal part, 0.51 mm to 0.61 mm in width. Lateral branches also carinate, 1.5 mm to 2.5 mm long and 0.32 mm to 0.40 mm wide, almost opposite on two sides, 10 in 10 mm, given off at an angle of 60° to 90°. Distances between lateral branches 0.60 mm to 0.76 mm. Zooecial apertures oval, their longer diameter 0.14 mm to 0.16 mm and shorter diameter 0.10 mm to 0.13 mm, surrounded by slight peristomes, 10 in 5 mm length of one row, and spaced regularly in twos per interval between lateral branches. Interspaces between zooecial apertures about 0.32 mm, longitudinal. Outline of zooecial chamber arranged in two alternating rows, triangular at base.

Remarks:—Recently ELIAS discussed some species of *Penniretepora* which have the apertures spaced regularly in twos per the interval between the lateral branches in the description of *P. ardmo-*

rensis ELIAS (1957). The species outside the United States of America, *Penniretepora osbornei* CROCKFORD (1947) from the lower Burindi of New South Wales, *Penniretepora stellata* (NEKHOROSHEV) (1956) and its variety from the lower Carboniferous of Altai, *Penniretepora striata* (NEKHOROSHEV)* (1948) from the middle Carboniferous of the northeastern Balkhashia, *Penniretepora laxa* var. *kasakhstanica* (NEKHOROSHEV), and the present new species are included into this group.

The present form is near to *Penniretepora youngi* ULRICH from the Keokuk Group of Kentucky and Iowa, but differs by the more slender lateral branches.

Locality:—Higuchizawa.

Reg. no. 105 (surface specimen).

Penniretepora sp. indet.

Plate 37, figure 6.

Zoarium pinnate; straight midrib striate on reverse. Midrib observed only reverse side and 5 mm long, and 0.8 mm wide. Lateral branches 0.32 mm to 0.40 mm wide, alternately arranged on two sides, 10 in 10 mm, given off at an angle of 60° to 85°. Distances between lateral branches 0.40 mm to 0.56 mm. Ornamentations on obverse and inner structures observed. Outline of zooecial chamber on lateral branches observed in two alternating ranges, triangular at base, and round at near obverse surface.

Remarks:—The present form differs apparently from the above described species in the external characters, especially, its width of midrib is larger than that of *P. decora* n. sp..

Locality:—Higuchizawa.

Reg. no. 106 (surface specimen).

* *P. striata* NEKHOROSHEV on p. 45 (1948) is preoccupied by *P. striata* ULRICH, 1890, it should be proposed a nomen nudem for the homonym.

Genus *Acanthocladia* KING, 1849

Acanthocladia peculiaris SAKAGAMI, new species

Plate 37, figure 11.

Only one specimen of large zoarium, with straight midrib, 40 mm long. Width of midrib in proximal part only slightly wider than distal part, 1.40 mm to 1.60 mm. Lateral branches diverged to only one side, parallel to each other, given off at an angle of about 30° to 35° and usually 5 lateral branches in 20 mm length of midrib. Secondary lateral branches sometimes diverged from lateral branches. Width of lateral branches 0.80 mm to 0.96 mm. Distances between lateral branches measured at right angle 1.40 mm to 1.80 mm. Zooecial apertures oval, 0.14 mm long and 0.10 mm to 0.11mm wide, surrounded by slight peristomes, arranged in 6 intersecting longitudinal rows, 9 to 10 in 5 mm length of one row. Interspaces between zooecial apertures 0.27 mm to 0.32 mm longitudinally, 0.08 mm to 0.16 mm diagonally. Outline of zooecial chamber usually rhomboidal but in part, irregular at base. Both obverse and reverse sides finely striated.

Remarks:—No species of the genus *Acanthocladia* has been known from the Mississippian of the United States of America, but in Soviet Russia, two or more species were described from the lower Carboniferous by NEKHOROSHEV (1953, 1956). One is *A.* aff. *granulosa* NEKHOROSHEV from the upper Visean of Kasahkstan and the other is *A. antiqua* NEKHOROSHEV from the upper Tournaisian of Altai. The present form can be easily distinguished from the previously described Acanthocladian species.

Locality:—Sakamotozawa.

Reg. no. 114 (surface specimen).

Genus *Nematopora* ULRICH, 1888

Nematopora sp. indet.

Plate 36, figure 5.

Only a few longitudinal sections. Zoarium ramose, slender, dichotomously branching, about 1 mm to 1.1 mm in diameter. Zooecial apertures may be arranged in eight to ten longitudinal series. Zooecial tubes arise radially from an axis which measures about 0.04 mm in diameter, short and stream-lined chimney-shaped in longitudinal section, oval near surface in tangential section, their shorter diameter 0.13 mm to 0.16 mm and longer diameter about 0.24 mm. Usually one diaphragm attached in a zooecial tube. Interspaces between zooecial tubes in mature zone about 0.22 mm, and filled with numerous very minute pores.

Remarks:—The genus *Nematopora* had been known only from the Ordovician to Devonian rocks, but since the discovery of the Lower Carboniferous species from the northeast of the Balkhashian lake by NIKIFOROVA (1948), several species of Carboniferous *Nematopora* were described and illustrated by the Russian authors but the records are limited to Soviet Russia.

Locality:—Higuchizawa.

Reg. no. 11103-A.

Genus *Rhombopora* MEEK, 1872

Rhombopora exigua ULRICH

Plate 38, figures 1, 2.

1890 *Rhombopora exigua*, ULRICH, *Geol. Surv. Ill.*, *Vol. VIII*, p. 651, pl. LXX, figs. 10–10a.

1953 *Rhombopora exigua*, NEKHOROSHEV, *Rkad. Nauk SSSR, Trudy VSEGEI*, p. 147, pl. 21, figs. 4a–c.

Typical longitudinal and a few oblique sections. Zoarium consisting of slender cylindrical stem, from 0.6 mm to 1 mm in diameter, not observed to branch. Zooecial apertures may be regularly arranged in longitudinal row and diagonally intersecting one another. Zooecial tube oval in tangential section, but rhomboidal in immature part, its longer diameter 0.10 to 0.11 mm and shorter one 0.06mm to 0.07 mm, and slightly curved in S-shape in longitudinal section. Interspaces between zooecial tubes about 0.15 mm along longitudinal row and 0.06 mm along diagonal row. Wall thickened in mature

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Explanation of Plate 35

Fig. 1. *Meekopora* cf. *approximata* ULRICH
Oblique longitudinal section, ×20, Loc.: Choanji, Reg. no. 11010.

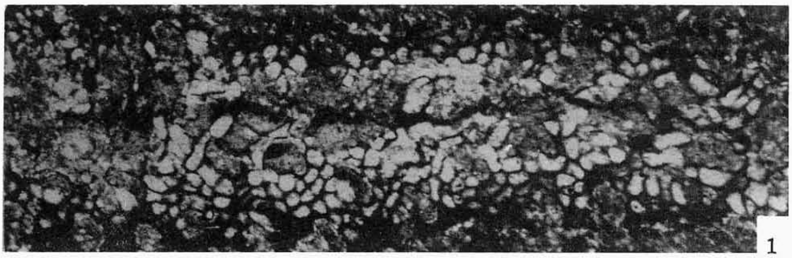
Fig. 2. *Fistulipora* sp. indet.
Longitudinal section, ×20, Loc.: Choanji, Reg. no. 11011-A.

Figs. 3–5. *Cheilotrypa choanjiensis* SAKAGAMI, n. sp.
3. Longitudinal section of holotype, ×10, 4, 5, enlarged typical longitudinal and tangential parts of Fig. 3, ×20, Loc.: Choanji, Reg. no. 11002.

Fig. 6. *Streblotrypella*? sp. indet.
Transverse section, ×20, Loc.: Sakamotozawa, Reg. no. 11158-A.

Fig. 7. *Rhombopora* sp. indet. A
Tangential section, ×20, Loc.: Choanji, Reg. no. 11011-B.

Fig. 8. *Rhombopora* sp. indet. B
Typical transverse section, ×20, Loc.: Sakamotozawa, Reg. no. 11158-B.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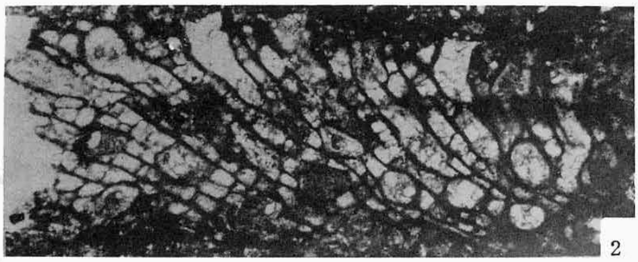
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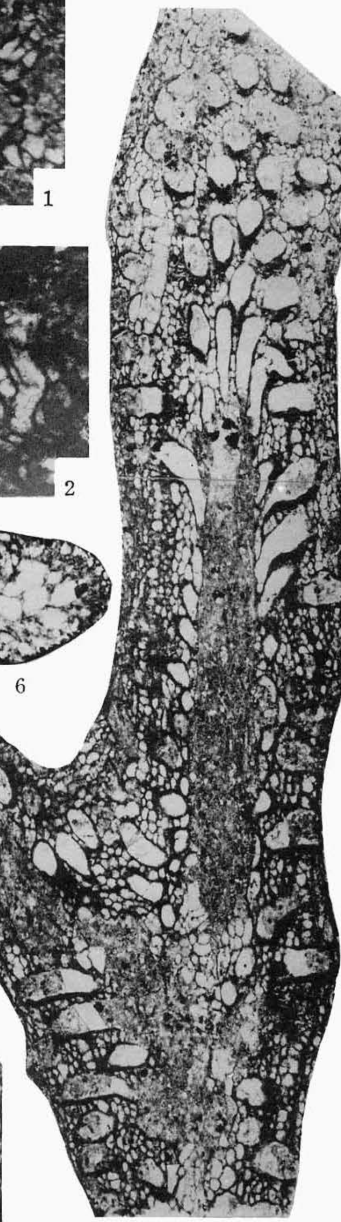
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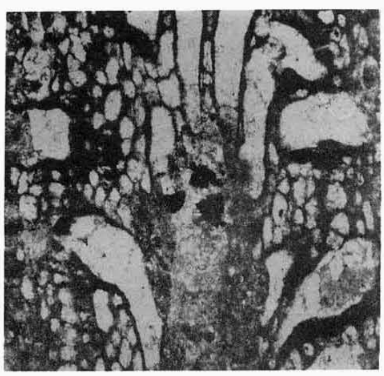
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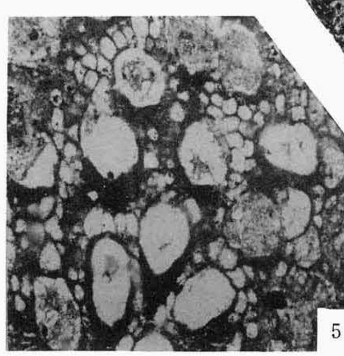
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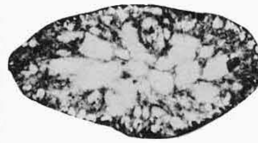
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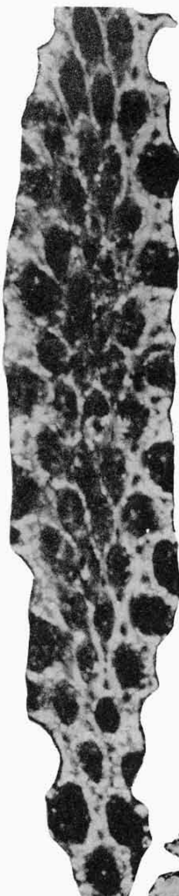
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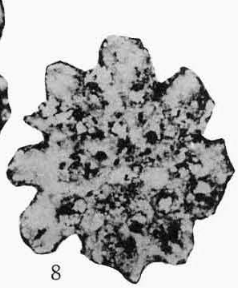
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zone, distinguishable from very thin immature wall. Superior hemiseptum well developed at posterior end of mature zone, and inferior hemiseptum disposed at opposite side of slightly inner part of superior hemiseptum. Two kinds of acanthopores—megacanthopores 0.016mm to 0.032 mm in diameter, usually disposed at distal edge of each zooecium, and micracanthopores around zooecial tube arranged in one row. Diaphragms indistinct.

Remarks:—Rhombopora exigua was described originally from the Burlington Group, Burlington, Iowa in the United States of America by ULRICH (1890). His illustrations are of only two external features of the zoaria and do not reveal the internal structures. However, the present form may be identified with *Rhombopora exigua* from the original description.

The Soviet Russian form of *R. exigua* which was reported from the upper Tournaisian of Kazakhstan by NEKHOROSHEV (1953) well agrees with the present form in the internal structures and measurements, especially in the well developed hemisepta. The following table is for comparition of these forms of *R. exigua* ULRICH.

Form of	Diameter of Zoarium (in mm)	Diameter of Zooecium (in mm)	
		Long	Short
Burlington	0.6-0.8	0.11	——
U.S.S.R.	about 1	0.11-0.14	0.06-0.07
Japan	0.6-1.0	0.10-0.11	0.06-0.07

Locality:—Choanji.
Reg. nos. 11008-A, 11008-B.

Rhombopora sp. indet. A

Plate 35, figure 7.

A single tangential section. Diameter of zoarium not observed, but probably about 1.5 mm to 2 mm. Zooecial tube oval in the section, arranged in longitudinal row, three zooecia in 2 mm, and longer diameter 0.27 mm to 0.37 mm and shorter diameter 0.16 mm to 0.21 mm. Longitudinal interspaces between zooecial tubes 0.30 mm to 0.45 mm. Mesopores seldom occur almost lacking, 0.03 mm to 0.08 mm in diameter. Usually two megacanthopores disposed at distal and proximal edges of each aperture. A few micracanthopores also disposed in one row in interspace between megacanthopores.

The large diameter of zooecium and two megacanthopores disposed at the distal and proximal edges of each aperture are characters of this form. The present form can be distinguished from the described species from the Hikoroichi bryozoan fauna in the above mentioned chracters.

Locality:—Choanji.
Reg. no. 11011-B.

Rhombopora sp. indet. B

Plate 35, figure 8; plate 36, figure 6.

One specimen in each thin section from Sakamotozawa and Higuchizawa. Slight differences between these two specimens are recognized, especially in the diameters of zoaria, but the two may be included into the same species in the essential characters. The Sakamotozawa specimen is a typical transverse section, measures 1.4 mm diameter: and the Higuchizawa one is an obliquely transverse section, 1.0 mm in diameter. Zooecial tube arise radially from an axis, slightly curved in S-shaped. Diameter of zooecial tube of Higuchizawa specimen slightly narrower than that from Sakamotozawa, measure 0.13mm to 0.16mm and

0.16mm to 0.18 mm, respectively. Zooecial wall thin in immature zone, expanded rapidly but smoothly and consisting of fine fibrous tissue in mature zone. The thickest part of wall about 0.24 mm in Sakamotozawa specimen. Acanthopores indistinct but present. Diaphragms frequently present, at intervals of about one-third to as wide as diameter of zooecium.

Locality:—Sakamotozawa and Higuchizawa.

Reg. nos. 11158-B (Sakamotozawa) and 11103-B (Higuchizawa).

Streblotrypella amicula SAKAGAMI, new species

Plate 36, figures 7-9.

Zoarium consisting of slender cylindrical stem, from 1 mm to 1.5 mm in diameter, not observed to branch. Zooecial apertures arranged quite regular in longitudinal row, measuring longitudinally, 6 to 7 zooecial tubes in 2 mm near surface. Zooecial tube nearly straight, but slightly bending outward in mature zone from an axis. Wall of inner zone very thin. In tangential section, zooecial tube circular, its diameter 1.1 mm to 1.8 mm. Longitudinal interspaces between succeeding zooecial tubes 0.14 mm to 0.16 mm, occupied by mesopores, usually arranged in two rows, occasionally in three rows. Diameter of mesopores 0.024 mm to 0.040 mm. Superior hemiseptum developed at posterior end of mature zone of tube and inferior hemiseptum attached at opposite side of slightly inner part of superior hemiseptum. Diaphragm lacking.

Remarks:—The genus *Streblotrypella* was separated from the genus *Streblotrypa* ULRICH by A.I. NIKIFOROVA in 1948, with *Streblotrypa major* ULRICH as a type species. These two genera are quite similar in the general features except for their axial zone of zoaria. The most important character of the genus *Streblotrypella* and by which it is distinguishable from *Streblotrypa* is the presence of an axis of zoarium.

The present form somewhat resembles *Streblotrypella major* (ULRICH) from the Keokuk Group of the United States of America in the general appearance,

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Explanation of Plate 36

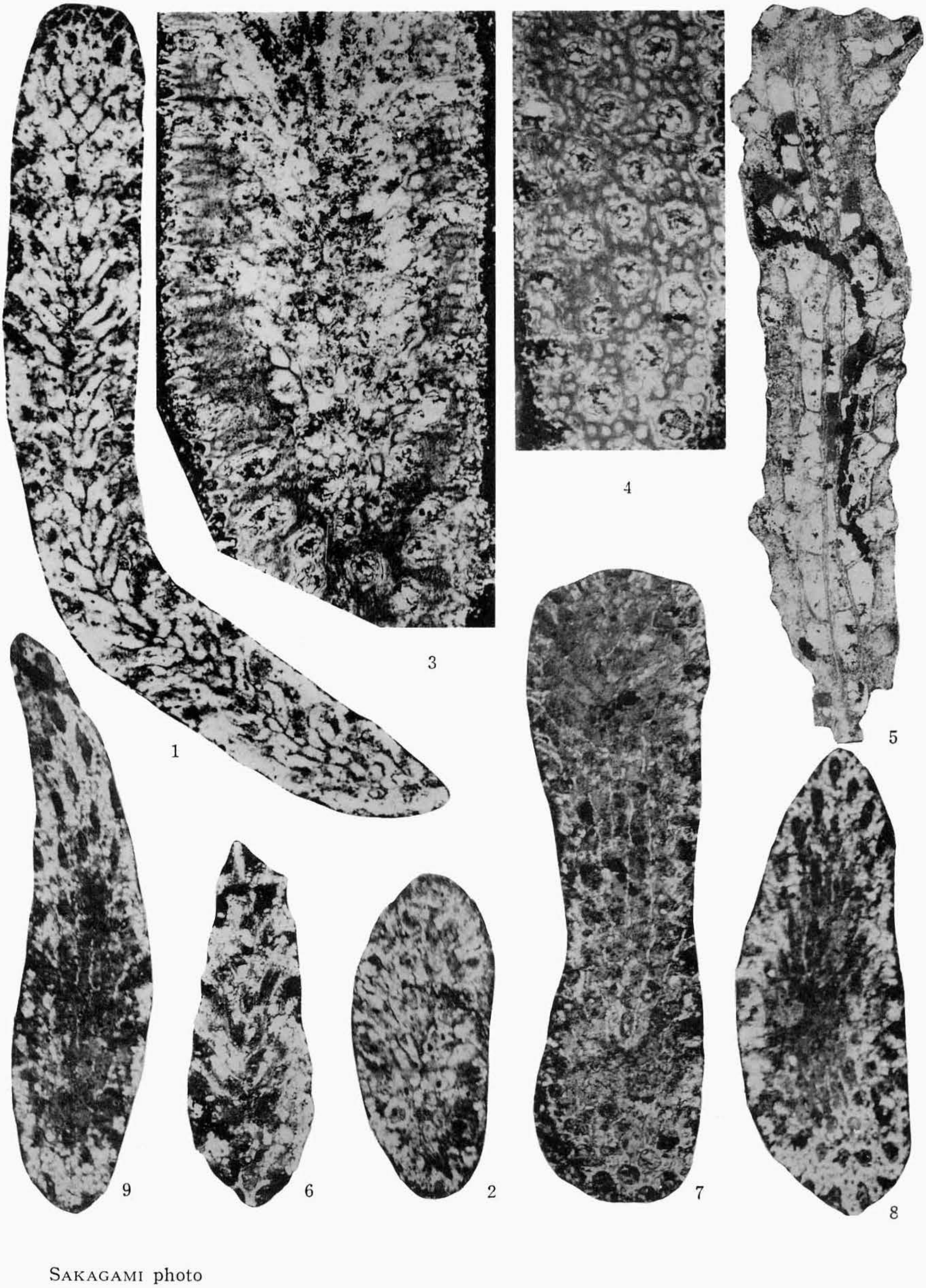
Figs. 1, 2. ***Rhombopora exigua*** ULRICH
1, Typical longitudinal section, 2, oblique transverse section, ×20, Loc.: Choanji, Reg. nos. 11008 and 11008-B, respectively.

Figs. 3, 4. ***Leioclema kobayashii*** SAKAGAMI, n. sp.
3, Longitudinal section (holotype), 4, tangential section (paratype), ×20, Loc.: Sakamotozawa, Reg. nos. 11151 and 11153, respectively.

Fig. 5. ***Nematopora*** sp. indet.
Longitudinal section, ×20, Loc.: Higuchizawa, Reg. no. 11103-A.

Fig. 6. ***Rhombopora*** sp. indet. B
Oblique section, ×20, Loc.: Higuchizawa, Reg. no. 11103-B.

Figs. 7-9. ***Streblotrypella amicula*** SAKAGAMI, n. sp.
7, Longitudinal but slightly tangential section (holotype), 8, 9, oblique sections (paratypes), ×20, Loc.: Choanji, Reg. nos. 11001, 11004 and 11010, respectively.



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but differs by the smaller size of zooecial aperture. *S. major* was also recorded from the lower Tournaisian to lower Visean of U. S. S. R. by NEKHOROSHEV (1953) and TRIZNA (1958). The Russian specimens have slightly smaller zooecial apertures than those of the United States specimens but are larger than those of the present forms. *Streblotrypella variopitata* TRIZNA (1958) in having rather small apertures differs distinctly from the present form in the arrangements of mesopores.

The present specimens, especially in the peripheral zone of zoarium, are replaced by secondary mineralization.

Locality:—Choanji.

Reg. nos. 11001 (holotype), 11004, 11010 (paratypes).

Streblotrypella ? sp. indet.

Plate 35, figure 6.

Only a few transverse sections in a thin section. Diameter of zoarium 0.9 mm to 1.2 mm. Zooecial tube circular, 0.14 mm to 0.16 mm in diameter. Mesopores relatively large.

The genera *Streblotrypa*, *Streblascopora* and *Streblotrypella* are distinguished from one anothers only in the structures of their axial zone but show the same structures in their mature zones. The present form cannot be observed clearly as to whether it has a central axis. However, the present form is referred to the genus *Streblotrypella*. The specific decision must wait until a large number of specimens accumulate.

Locality:—Sakamotozawa.

Reg. no. 1158.

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Explanation of Plate 37

Fig. 1. *Fenestella crassistereoma* SAKAGAMI, n. sp.
Internal mold of reverse side, ×5, Reg. no. 111.

Fig. 2. *Fenestella sokolskayae* SHULGA-NESTERENKO
Internal mold of reverse side, ×5, Reg. no. 121.

Fig. 3. *Fenestrellina japonica* SAKAGAMI, n. sp.
Internal mold of reverse side, holotype, ×5, Reg. no. 103.

Fig. 4. *Fenestella* aff. *cribriformis* (CROCKFORD)
Internal mold of reverse side, ×5, Reg. no. 101.

Fig. 5. *Penniretepora decora* SAKAGAMI, n. sp.
Internal mold of reverse side, showing in part, external mold of obverse side, holotype, ×4, Reg. no. 105.

Fig. 6. *Penniretepora* sp. indet.
External mold of reverse side, ×5, Reg. no. 106.

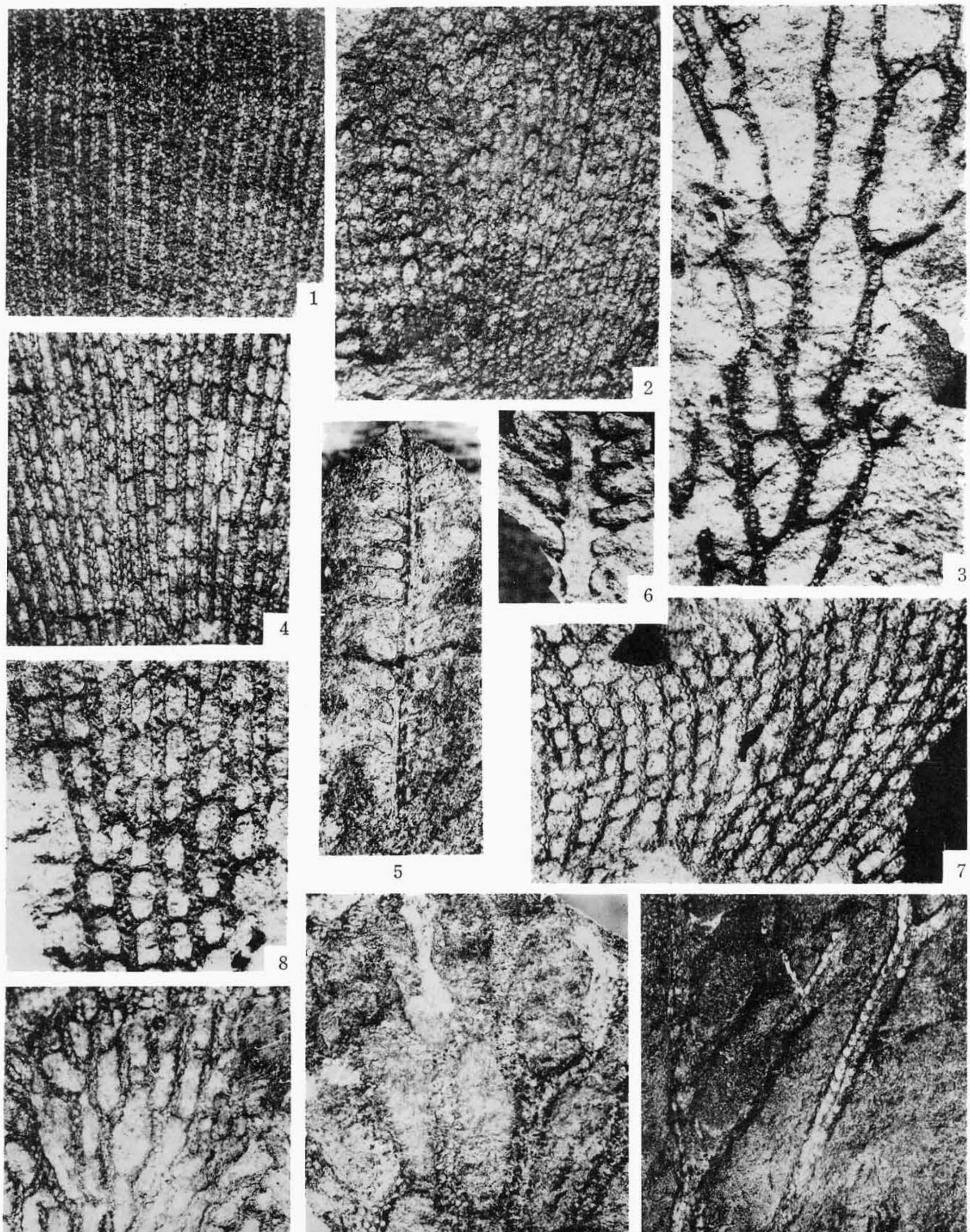
Fig. 7. *Fenestella hikoroichiensis* SAKAGAMI, n. sp.
Internal mold of reverse side, holotype, ×5, Reg. no. 102.

Fig. 8. *Fenestella buguniensis higuchizawaensis* SAKAGAMI, n. subsp.
Internal mold of observe side, holotype, ×5, Reg. no. 104.

Fig. 9. *Fenestella ofunatoensis* SAKAGAMI, n. sp.
Internal mold of reverse side, holotype, ×5, Reg. no. 112.

Fig. 10. *Polypora polyclada* SAKAGAMI, n. sp.
Internal mold of reverse side, showing in part, external mold of the obverse, holotype, ×5, Reg. no. 113.

Fig. 11. *Acanthocladia peculiaris* SAKAGAMI, n. sp.
Internal mold of reverse side, showing in part, external mold of the obverse, holotype, ×5, Reg. no. 114.



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Trans. Proc. Palaeont. Soc. Japan, N. S., No. 46, pp. 243-248, Pl. 38, June 10, 1962

428. ON THE OCCURRENCE OF *NIPPONONAIA* IN THE LATE MESOZOIC TETORI GROUP*

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手取層群産 *Nippononaia* について： 著者はかって手取層群から予察的に *Trigonioides* の産出を報告したが、その後の資料にもとづく検討の結果，これは *Nippononaia* で，かつ新種であることが判明したので，これを *Nippononuia tetoriensis* と命名し，記載した。

前　田　四　郎

I. Introduction

Nippononaia SUZUKI (1941) is an interesting genus in the non-marine Mesozoic fauna of Japan. Lately two species were reported from North America by J. B. REESIDE (1957).

Now eight species including one new species are known of the genus. Peculiar surface sculptures of this genus may have been produced by unusual environment. Because this genus closely resembles *Trigonioides* KOBAYASHI and SUZUKI (1936) in surface ornamentation, the writer has once reported (1949) the occurrence of *Trigonioides* in the Tetori group, but it was erroneous.

What I previously thought *Trigonioides* is described here as a new species of *Nippononaia*. It was procured from the Okurodani and Kuwajima alternations in the Itoshiro subgroup, the middle division of the Tetori group, probably latest Jurassic in age. On this occasion the Wakino forms of *Nippononaia* and their relationship to *Plicatounio* are discussed.

The writer expresses his sincere thanks to Prof. T. KOBAYASHI of the University of Tokyo for his kind guidance and his reading the manuscript, to Dr. I. HAYAMI of the same University for his kind help.

II. Historical review of *Nippononaia*

1) SUZUKI (1941) established this subgenus in describing *Unio* (*Nippononaia*) *ryosekiana* from the Early Cretaceous Ryoseki group. But its locality is uncertain whether it was Komō, Hanoura-machi, Naka-gun, Tokushima Prefecture, or somewhere in the Sanchu graben in the Kwanto mountainland. Judging from the outline of shell and hinge structure, he referred it to the Unioninae. And by the chracteristic V-shaped surface ornament and marked crenulation of the inner side of the ventral margin, he instituted a new subgenus.

2) SUZUKI (1943, 1949) brought *Nippononaia* to *Plicatounio* KOBAYASHI and SUZUKI (1936) as its subgenus, because "the hinge-teeth of the left valve of these two groups are identical" and "the distinct radial ribs on the surface and marginal crenation on the inner side of the shell have never been found in the other palaearctic naiad group".

3) KOBAYASHI (1956) pointed out that

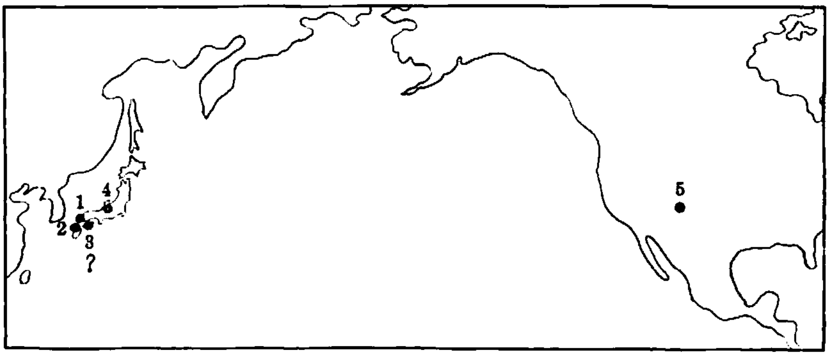
* Received Nov. 11, 1961; read Sept. 24, 1961.

"*Nippononaia* was derived from *Trigonioides* by the increase of the breadth and addition of a posterior tooth and at the same time by loosing the crenulation of the preexisting posterior tooth".

4) REESIDE (1957) reported the occurrence of *N. asinaria* from the Lower Cretaceous Burro Canyon formation of Colorado in North America, in promoting *Nippononaia* to the generic rank.

5) OTA (1959) described two new species, *wakinoensis* and *sengokuensis*, of "*Nippononaia*" from the Lower Cretaceous Wakino subgroup in North Kyushu. He pointed out that these faunas were distinguished from *Trigonioides* in the hinge structure, and that much obscurity was attached to the hinge structure of SUZUKI's species and that its taxonomic position was ambiguous.

6) HASE (1960) described two new subspecies and one new species of *Nippononaia* from the Wakino subgroup in West Chugoku and North Kyushu, their distinctions being in the degree of effacement of the radial ribs.



Text-figure 1. Map showing the distribution of *Nippononaia*.

1: Wakino subgroup, Lower Cretaceous.
2: Wakino subgroup, Lower Cretaceous.
3: Ryoseki group, Lower Cretaceous. Komō, Hanoura-machi.
4: Tetori group, Uppermost Jurassic.
5: Burro Canyon formation, Lower Cretaceous.

III. The Wakino species of "*Nippononaia*"

The followings were described by OTA (1959) and HASE (1960).

"*Nippononaia*" *sengokuensis* OTA
"*N.*" *wakinoensis wakinoensis* OTA
"*N.*" *wakinoensis intermedia* HASE
"*N.*" (?) *obsoleta* HASE

All of them closely resemble *N. ryosekiana*, *Trigonioides kodairai* and *T. paucisulcatus* in the ornament, but distinctly differ from *Trigonioides* in hinge structure.

OTA (1959) said, ""*Nippononaia*" is somewhat similar to *Plicatounio kwanmonensis* OTA (1958) in the hinge but fairly different from *P. naktongensis* which has many unionid features in the hinge nature". HASE (1960) also pointed out that there were distinct pseudocardinal teeth 2 on the right valve and 1 on the left, lateral teeth 1 on the right valve and 2 on the left.

The specimens figured by HASE (1960) on plate 37, figs. 1 and 2, have coarsely crenulated teeth. *N. ryosekiana* and

"*Nippononaia*" from the Wakino subgroup disagree in the number of teeth and the mode of crenulation. Therefore "*Nippononaia*" from the Wakino subgroup should be excluded from what is the generally recognized genus, *Nippononaia*.

IV. Distinction between *Nippononaia* and *Plicatounio*

Left valves of *Plicatounio* and *Nippononaia* described by SUZUKI (1941) have two short, finely crenulated pseudocardinal and two long lateral teeth. Though these genera closely resemble each other in dentition, lateral teeth of *Plicatounio* are smooth or crenated, while those of *Nippononaia* are smooth. The most distinctive difference is in the ornamentation on the disk. Namely, the surface of *Plicatounio* is ornamented with many regular strong radiating ribs and numerous concentric growth lines, whereas the radial ribs of *Nippononaia* are connected in the middle part to form acute Vs.

V. The occurrence of *Nippononaia* from the Tetori group

The Tetori group is divisible, in ascending order, into the Kuzuryu, Itoshiro and Akaiwa subgroups and the Omichidani formation. The Itoshiro subgroup is the widest among the subgroups and reveals a cycle of sedimentation. Its basal part is marine, but all others are non-marine.

The lower part consists mainly of coarse rocks such as conglomerate, and conglomeratic or coarse-grained sandstone, while the upper part is rich in micaceous black shale.

The black shale facies is seen in the Kuwajima alternation in Hakusan district, the Itsuki alternation in Kuzuryu district and the Okurodani alternation in Makido district.

The present species of *Nippononaia* is associated with *Unio ogamigoensis*, *Corbicula (Tetoria) antiqua*, *C. (Mesocorbicula) tetoriensis*, *Melanoides vulgaris*, *M. vulgaris minima*, *Viviparus (Sinotaia ?) onogoensis* and others (KOBAYASHI and SUZUKI, 1937) and many plants such as *Equisetites ushimarensis*, *Gleichenites nipponensis*, *Coniopteris burejensis*, *C. hymenophylloides*, *Onychiopsis elongata*, *Cladophlebis denticulata*, *C. distans*, *C. exiliformis*, *C. lobifolia*, *Nilssonia Kotoi*, *N. nipponensis*, *N. orientalis*, *Ginkgoites digitata*, *Ginkgoidium Nathorsti*, *Podozamites lanceolatus* and *P. Reinii* beside erect stumps of *Xenoxylon latiporosum* (OGURA, KOBAYASHI and MAEDA, 1951) in the Kuwajima alternation and Okurodani alternation.

Most shells are found scattered in the black shaly facies with their valves uncraked and concave side downward. Pyrite is often met with on their tests. Judging from the occurrence and preservation of the fossils and the existence of pyrite, the sedimentary environment was in stagnant fresh water in the inner side of Eo-Nippon Cordillera (KOBAYASHI, 1941). The peculiar sculpture of *Nippononaia* reveals the adaptation to such a particular condition.

VI. Systematic description

Family Unionidae

Genus *Nippononaia* SUZUKI, 1941

Type species:—*Unio (Nippononaia) ryosekiana* SUZUKI.

Nippononaia tetoriensis MAEDA, new species

Plate 38, figures 1-14.

Description:—Shell medium in size, transversely elongated subelliptical in outline, about twice as long as high, inequilateral, relatively short and subround in front, prolonged behind, subtruncated at the end and moderately inflated; test rather thick. Postero-dorsal margin fairly long, almost straight, subparallel to ventral, and obtusely angulated with posterior margin, which is shorter than postero-dorsal and very slightly curved; ventral margin long, gently arched, or more or less straightened, gradually merging with neighbouring margins; anterior margin well rounded; antero-dorsal margin relatively short, obliquely sloping and weakly arched. Beak large, fairly prominent, but not high, incurved and distinctly prosogyral, somewhat projected above the hinge-margin and placed at a point about one-third to two-fifths of the length of the shell measured from the anterior extremity. Posterior ridge very distinct; posterior area triangular and slightly concave. Surface ornamented with many radiating ribs and numerous concentric growth lines; radial ribs fine, close and counted about 8 to 11 in antero-half disc, but strong, widely spaced, more or less curved backwards, and counted about 8 to 12 in postero-half disc; several ribs in the middle of the disc form acute Vs with apices on a line through beak; ribs on the antero-dorsal area fine, close, and branching off downwards; ribs on the postero-dorsal area strong, broadly spaced and branching off downwards from a line running from beak to postero-ventral margin; growth lines very fine. Hinge of left valve well developed; pseudocardinal teeth 2, short, narrow, smooth; upper one much stronger than the lower and parallel to antero-dorsal margin; lateral teeth 2, fairly long, lamellar, smooth, upper one parallel to postero-dorsal margin.

$$\frac{{}^{*}(5a)\quad 3a\quad\quad 3b\quad (5b)}{4a\quad 2a\ 2b\quad 4b}$$

* It means that 5a and 5b are not observable on the ill-preserved specimens.

Adductor scars situated close to the extremities of the laterals but weakly impressed. Pallial line simple. Postero-half of inner side ornamented with many weak radiating ribs. Internally, anterior, posterior and ventral margins distinctly crenulated, especially in posterior half.

Measurements:—12 specimens scarcely deformed are selected in the collection and measured in mm as follows:

Number	Valve	Length	Height	Width
R. 61801	Left	40	21	5
R. 61802	Right Left	41	26	11
R. 61803	Right	37	19	5
R. 61804	Right	25+	24	5
R. 61805	Right	38	21	5
R. 61806	Left	33	16+	4.5
R. 61807	Right	23+	20.5	4.5
R. 61808	Left	28+	21.5	5
R. 61809	Right	28	14.5	4
R. 61810	Right	24	12.5	3
R. 61811	Left	24	10.5	3
R. 61812	Left	23	12+	3

Comparison:—Several specimens were obtained from two formations, but most of them are more or less imperfect and often considerably deformed by rock pressure. They are variable in outline. Usually their shells are transversely elongated subelliptical in outline, subtruncated in posterior. The beak is placed in front of the middle, and the dorsal margin is gently sloping from the beak to both sides. Internal moulds are fairly variable in ornamentation.

The specimens at hand are most similar to "*N.*" *wakinoensis wakinoensis* described by Y. OTA (1959) and A. HASE (1960) from the Lower Cretaceous Wakino subgroup in North Kyushu and West Chugoku, Japan, in outline and ornament, but they are easily distinguishable by non-crenulated teeth, radial ribs and number of teeth.

This species is also related to *N. ryosekiana* by K. SUZUKI (1941) from the Lower Cretaceous Ryoseki group, but they differ from each other in features of radial ribs and outline of shell.

Though *N. asinaria* described by J. B. REESIDE (1957) from the Lower Cretaceous Burro Canyon formation of Colorado, North America, shows some resemblances with this new species in general aspects, the two species do not agree in radiating ribs and outline of shell. This new species is also similar to *Trigonioides kodairai* by KOBAYASHI and SUZUKI (1936) from the Lower Cretaceous Naktong-Wakino series in ornamentation, but differs in the hinge structure.

Formation and locality:—The Okurodani alternation of shale and sandstone in the Itoshiro subgroup, probably uppermost Jurassic, the middle division of the Tetori group: The bed of the Okurodani river, a tributary of the Ogamigo river, in Shokawa-mura, Ōno-gun, Gifu Prefecture. The Kuwajima alternation of shale and sandstone in the Itoshiro subgroup (holotype locality): The bed of the Yanagidani river, a tributary of the Tetori river, in Shiramine-mura, Ishikawa-gun, Ishikawa Prefecture.

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Explanation of Plate 38

Nippnonaia tetoriensis MAEDA, new species

Fig. 1. Internal mould of right valve, paratype (R. 61803) ×1.5; Loc. Kuwajima alternation (桑島互層), Yanagidani (柳谷), Shiramine-mura (白峰村), Ishikawa-gun (石川郡), Ishikawa Pref. (石川県).

Fig. 2. Internal mould of left valve, holotype (R. 61801) ×1.5; Loc. ditto.

Fig. 3. Right valve, paratype (R. 61805) ×1.5; Loc. Okurodani alternation (大黒谷互層), Okurodani (大黒谷), Shokawa-mura (荘川村), Ōno-gun. (大野郡), Gifu Pref. (岐阜県).

Fig. 4. Left valve, paratype (R. 61802) ×1.5; Loc. ditto.

Fig. 5. Right valve, paratype (R. 61810) ×1.5; Loc. Kuwajima alternation, Yanagidani, Shiramine-mura, Ishikawa-gun, Ishikawa Pref.

Fig. 6. An incomplete left valve, paratype (R. 61808) ×1.5; Loc. ditto.

Fig. 7. Right valve, paratype (R. 61802) ×1.5; Loc. Okurodani alternation, Okurodani, Shokawa-mura, Ōno-gun, Gifu Pref.

Fig. 8. Right valve, paratype (R. 61809) ×1.5; Loc. Kuwajima alternation, Yanagidani, Shiramine-mura, Ishikawa-gun, Ishikawa Pref.

Fig. 9. Umbonal view of the specimen shown in Fig. 8 (R. 61809) ×1.5; Loc. ditto.

Fig. 10. Clay cast of left valve, paratype (R. 61806) ×1.5; Loc. ditto.

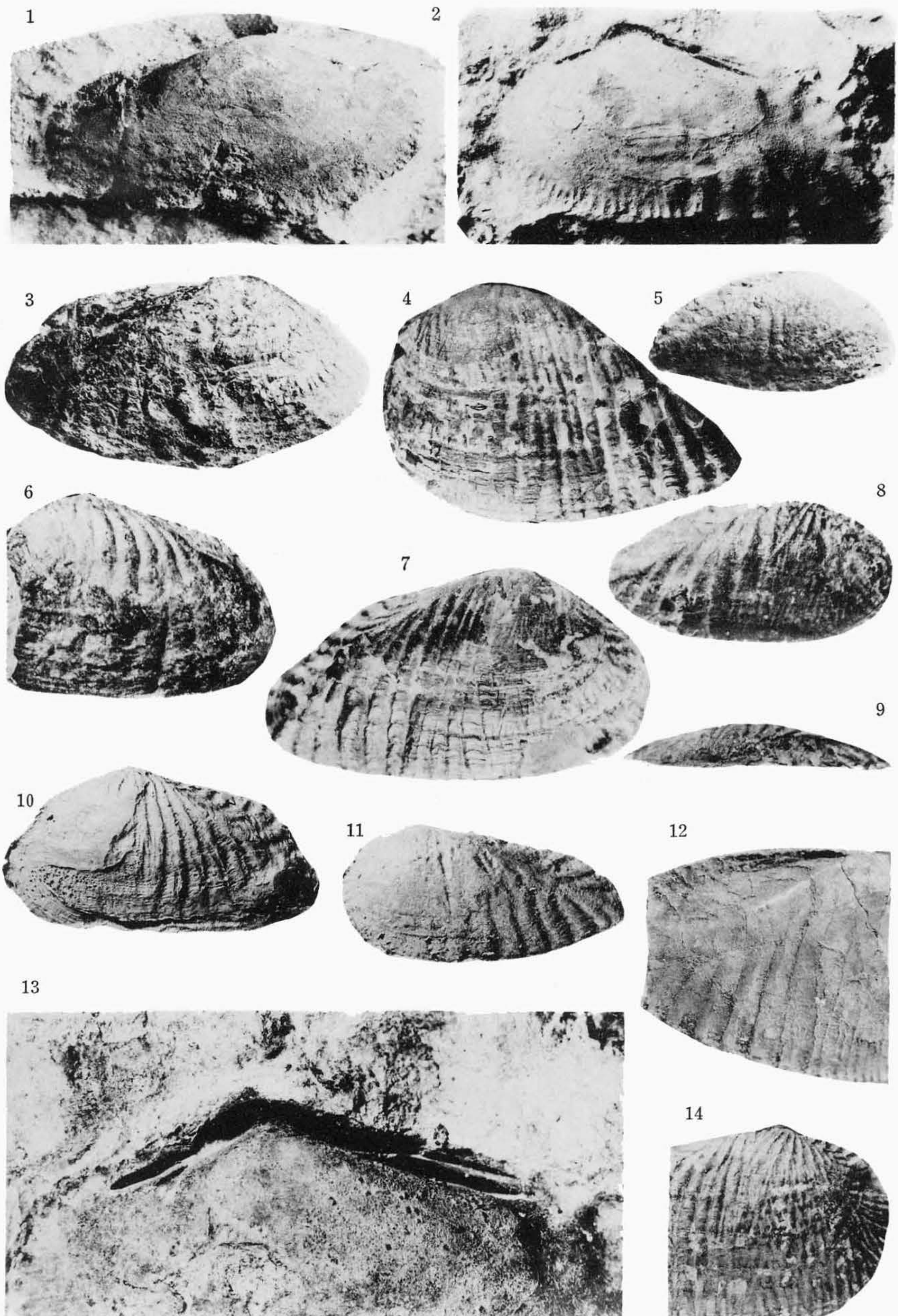
Fig. 11. Clay cast of left valve, paratype (R. 61811) ×1.5; Loc. ditto.

Fig. 12. An incomplete internal mould of right valve, paratype (R. 61804) ×1.5; Loc. ditto.

Fig. 13. Character of teeth structure of holotype (R. 61801) ×3; Loc. ditto.

Fig. 14. An incomplete right valve, paratype (R. 61807) ×1.5; Loc. Okurodani alternation, Okurodani, Shokawa-mura, Ōno-gun, Gifu Pref.

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. 46, pp. 249-253, Pl. 39, June 10, 1962

429. A NEW SPECIES OF *TEREBRATALIA* FROM THE OLIGOCENE SARI SANDSTONE IN THE KARATSU COAL FIELD OF NORTHWESTERN KYUSHU, JAPAN*

EIJI INOUE

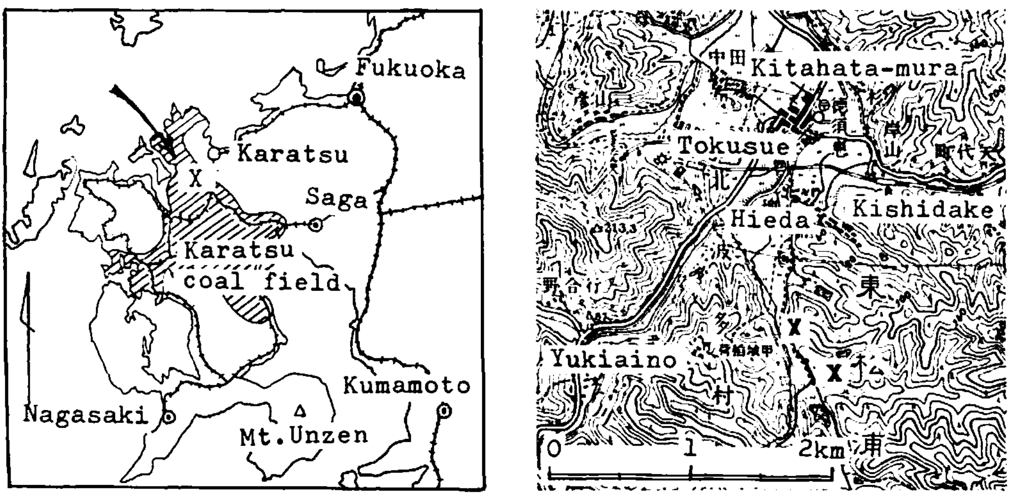
Fuel Department, Geological Survey of Japan

唐津炭田佐里砂岩層産の腕足類 *Terebratalia* 属の 1 新種： これまでに松下久道の "*Terebratula*" sp. をのぞいて腕足類が北部九州の漸新統から産出することは，ほとんど知られなかった。筆者は唐津炭田北部を調査中，杵島層群の佐里砂岩層（漸新統）から腕足類を採集した。この腕足類は本州の中新統産の *Terebratalia innaiensis* および *T. sendaica* に類似するが，比較検討の結果，新種であることが判明し，これを *Terebratalia karatsuensis* と命名して記載した。また，本種の産状・貝化石群の構成・岩相から佐里砂岩層の堆積環境について簡単に言及した。 井 上 英 二

Introduction and Acknowledgements

No brachiopod has so far been described from the Oligocene of northern Kyushu, except for H. MATSUSHITA's report (1949) of an occurrence of "*Terebratula*" sp. in the Meinohama formation at Fukuoka city. During his geological survey in the Karatsu coal field in 1955, the writer has collected some brachiopod specimens from the Oligocene Sari Sandstone at Hieda in the northern part of the coal field (Text-fig. 1).

The brachiopod of the Sari Sandstone is known to be a new species of *Terebratalia*. Brief notes are given on the Sari Sandstone and its faunule.



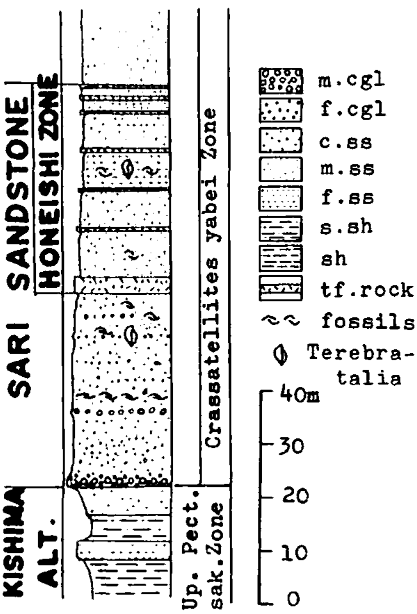
Text-fig. 1. Maps showing the geographic position of the fossil locality.

* Received Nov. 1, 1961; read Nov. 18, 1961.

Here the writer wishes to express many thanks to Prof. Kotora HATAI of the Tohoku University for supervising the present work. Thanks are also due to Prof. Teiichi KOBAYASHI of the University of Tokyo, Prof. Hisamichi MATSUSHITA, Prof. Ryuzo TORIYAMA and Mr. Jyuichi YANAGIDA of the Kyushu University, for their encouragements.

The Sari Sandstone

The Tertiary formation in the northern part of the Karatsu coal field is limited by normal faults from granitic rocks of the basement. It can be divided into the Ouchi and Kishima groups.



Text-fig. 2. Columnar section of the Sari Sandstone in the northern district of the Karatsu coal field. Illustrates horizones occurring *Terebratalia karatsuensis*.

The lower or Ouchi group consists mainly of non-marine deposits which bear many workable coal measures. The upper or Kishima group is composed of marine fossiliferous sediments at the time of the late Oligocene Ashiya transgression. Generally the sediments become coarser northwards, and show nearshore features. The stratigraphical sequence of the Kishima group in the northern district is shown in the Table.

The Sari Sandstone which yielded the new brachiopod is in the lower part of the group. It corresponds to the Hieda formation of H. MATSUSHITA, and is correlated with the Kurokawa sandstone in the southern district. The lower part of the Sari Sandstone consists of fine- to coarse-grained, glauconite-bearing sandstones interbedded with conglomerates. Sandstones which are remarkably cross-bedded near the basal part, contain many carbonized plant fragments and marine molluscan shells. The grain of sandstone becomes finer upwards. The upper part is composed of fine to medium grained sandstones with thin intercalations of tuffaceous rock called Honeishi. The part characterized by tuffaceous beds is called the Honeishi zone. Molluscan fossils become sparse to the upper from the lower part.

The Sari Faunule

The brachiopod specimens occur in two horizons of the Sari Sandstone. In the lower part, brachiopods are common in coarse-grained green sandstones including carbonized fragmental plants and organic remains. Molluscs are poorly preserved and mostly deformed or broken into fragments. In the upper part, the brachiopod and other fossils are better preserved than in the lower part, and are found in fine- to medium-grained sandstones alternating with thin tuffaceous rocks.

The important fossils associated with

Table. The stratigraphical sequence of the Kishima group in the northern district of the Karatsu coal field.

Geological age	Faunal zone by A. Mizuno	Faunal zone by T. Nagao	Division: Major	Division: Minor	General lithology and lithofacies	Division in the southern district	
Oligocene	*Venericardia vestitoides* Zone	*Crassatellites yabei* Zone	Kishima Group	Hatatsu Shale	Alternation of dark grey shale and grey fine-grained sandstone. Fossils rare.	Daitō Formation	
				Hatatsu Sandstone	Blue fine-grained sandstone intercalated with shale. Fossils few.	Haiki Formation	
				Komanaki Sandstone	Green, coarse-grained sandstone and granule conglomerate. Fossils abundant.	Shingyōe Member	Mikawachi Form.
				Yukiaino Sandstone	Massive bluish grey, fine- to medium-grained sandstone. Fossils few.	Zōshuku Member	
						Kihara Member	Magarikawa Formation
				Sari Sandstone (Honeishi zone)	Greenish grey and grey, glauconite-bearing sandstone intercalated with conglomerate in the lower part, and tuffaceous rocks in the upper part. Fossils abundant. The new brachiopod occurs.	Haruake Member	
						Kurokawa Member	
... ? ...	*Venericardia yoshid.* Zone	Upper *Pecten sakitoensis* Zone		Kishima Alternation	Alternation of dark grey shale, sandy shale and sandstone. Fossils abundant.	Kishima Formation	
			Ouchi Group	Yoshinotani Formation	Alternation of arkose sandstone and shale interbedded with coal seams.	Yoshinotani Formation	

the brachiopods are as follows:

Coral	f
Aturia yokoyamai NAGAO	r-f
Glycymeris sp.	f
Solamen subfornicatum (NAGAO)	r
Septifer nagaoi OYAMA	f
Ostrea lunaeformis NAGAO	c
Crassatellites inconspicuus NAGAO	c
Venericardia vestitoides MIZUNO	a
Callista hanzawai (NAGAO)	a
Salenia novemprovincialis NISHIYAMA	r
Charcharodon cf. *augstidens* AG.	r

(a: abundant, c: common, f: few and r: rare.)

The above fossils are mostly characteristic members of the *Crassatellites yabei* zone of T. NAGAO (1928) or the *Venericardia vestitoides* zone of A. MIZUNO (1956), some of which suggest warm sea or littoral zone.

The fauna of the Kurokawa sandstone in the southern district, which is correlated to the Sari Sandstone, is somewhat different from the above fauna, as represented by the followings;

Coral	f
Turritella infralirata NAGAO	r
Crassatellites inconspicuus NAGAO	f
Venericardia vestitoides MIZUNO	a
Callista hanzawai (NAGAO)	a
Macoma sp.	r
Angulus cf. *maximus* (NAGAO)	r
Echinoid	r

(a: abundant, c: common, f: few and r: rare.)

These fossils are found in green medium-grained sandstones. The brachiopod and littoral shells, such as *Septifer* and *Ostrea*, are absent in this fauna.

Therefore it is reasonable to conclude that the difference between the northern and southern faunas depends on the environment. At the Sari times the northern part was near-shore and the palaeo-Karatsu sea was expanded and at the same time becames deeper southwesterly. The writer infers further that the brachiopod is a sandy bottom dweller in the shallow littoral zone under the influence of warm current.

Description of Species

Family Terebratellidae,
Subfamily Dallininae

Genus *Terebratalia* BEECHER, 1893

Terebratalia karatsuensis new species

Plate 39, figures 1a-c, 2a-c.

Description:—Shell moderate in size, more or less transversely orbicular, as long as wide; widest near or at a point slightly posterior to mid-length of shell, and considerably convex, ventral valve nearly twice of dorsal valve in convexity; beak swollen and truncated by an incomplete foramen; surface with concentric growth lines only. Umbo swollen, forming strongly convex curve, inflated ventrally and abruptly truncated by beak which is pierced with incomplete foramen permesothyrid in position and bordered by weak deltidial plates. Hinge-line terebratulid with the expanded lateral extremities which forms a rather distinct angle with lateral margin. Lateral and anterior commissures apparently straight. Concentric growth lines becoming stronger and apparently somewhat corrugated anteriorly.

Interior of ventral valve with strong

Explanation of Plate 39

Terebratalia karatsuensis new species.

Figs. 1a-c: Holotype. a: pedicle, b: brachial and c: lateral views, ×1.5. Loc.; A quarry near Hieda, Kitahata-mura, Higashimatsura-gun, Saga Prefecture; Sari Sandstone of Kishima group.

Figs. 2a-c: Paratype, internal mould of both valves. a: pedicle, b: brachial and c: lateral views, 1.5. Loc.; same as above.

septal ridge and muscular impressions and narrow grooves extending up into the beak, septal ridge bifurcated; grooves for genital sinuses obsolete. Interior of dorsal valve with narrow blade-like median septum with two lateral deeply sunken muscular scars bordered by longitudinal grooves and ridges. Cardinal process blunt, transversely expanded, low. Crural processes very short.

Dimensions (*in mm*):—

	Length	Width	Thickness
Holotype	+38	39	23
Paratype, internal mould	+35	37	18

Remarks:—This species resembles *Terebratalia innaiensis* (HAYASAKA), 1922, and *Terebratalia sendaica* HATAI, 1936, two Miocene species of Honshu, Japan in general outline, but it can be distinguished by the following features. From *Terebratalia sendaica*, it differs particularly in the features of the septal ridge, median septum and muscular scars.

From *Terebratalia innaiensis*, the present one is readily distinguished by its more inflated shell, lack of radial sculpture at and near the beak and by the blade-like median septum, bifurcated septal ridge and stronger muscular scars.

Some specimens derived from the Meinohama formation of the Fukuoka coal field and reported as "*Terebratula*" sp. by H. MATSUSHITA, are identifiable with this species.

Syntypes:—Preserved in Geological Institute, Kyushu University, Fukuoka.

Type locality:—A quarry about 1000 meters south of Hieda, Kitahata-mura, Higashimatsura-gun, Saga Prefecture.*

Geological horizon:—Sari Sandstone, Kishima group; Upper Oligocene.

* 佐賀県東松浦郡北波多村稗田

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430. MEGAFOSSILS FROM NEAR HIGASHI-MATSUYAMA CITY, SAITAMA PREFECTURE, JAPAN*

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埼玉県東松山市周辺の大型化石：埼玉県東松山市附近の第三紀層から採集した大型化石について研究し，土塩層には長野県の備動物群に類似した化石が含まれていることを指摘した。更に中新世後期と考えられる都幾川層から，二枚貝一種と巻貝三種の新種を記載した。

畑 井 小 虎・増 川 孝 一 郎

Introduction

The stratigraphy of the Tertiary deposits developed and distributed in the environs of Higashi-Matsuyama City, Saitama Prefecture, Central Japan was first studied by M. KOBAYASHI (1935) and subsequently by K. WATANABE *et al.* (1950). The writers collected many megafossils from the Tertiary deposits developed and distributed in the environs of Higashi-Matsuyama City, and concerning them some discussions are given on their geological significance as a contribution to our knowledge on the present area. Some species of molluscs thought to be undescribed forms are also given in this article.

Outlines of Stratigraphy

WATANABE *et al.* (1950) distinguished in the environs of Higashi-Matsuyama City the following formations in ascending order: Yorii conglomerate, Tatsugase formation, Ozono formation, Arakawa formation, Shichigo (Tokigawa) formation, Fukuda formation, Tsuchishio formation and Yagii formation and considered the Yorii to be Oligo-Miocene, the Tatsugase to be Early Miocene and the upper or younger formations to be Middle Miocene in age.

The Megafossil fauna treated in the present article was collected from the Ozono, Arakawa, Tokigawa and Tsuchishio formations. According to WATANABE *et al.* the Tokigawa formation which has yielded abundant megafossils in the area south of Higashi-Matsuyama City corresponds to the Shichigo formation in the area northwest of Higashi-Matsuyama.

Notes on Paleontology

The megafossil fauna from the present area consists of molluscs, brachiopods, echinoids, fishes, etc. Among them

* Received Nov. 18, 1961; read Nov. 18, 1961.

the molluscs are most abundant and usually rather well preserved.

In the following lines the writers will describe the faunal characters of the formations from the lower to the upper.

a) Ozono formation

The molluscs collected from the carbonaceous, coarse-grained sandstone of the Ozono formation at the left cliff of the Arakawa River below Nakakomaeda, Yorii-machi, Ôsato-gun, Saitama Prefecture are:

Ostrea gravitesta YOKOYAMA	F*
Corbicula sp.	F
Diplodonta ferruginata MAKIYAMA	F
Pillucina sp.	R
Siratoria siratoriensis (OTUKA)	R
Lamelliconcha kawadai AOKI	F
Katherinella cf. *iizukai* (YOKOYAMA)	C
Pitar cf. *itoi* (MAKIYAMA)	A
Cyclina japonica KAMADA	F
Meretrix arugai OTUKA	C
Corbula nisataiensis OTUKA	F
Soletellina minoensis (YOKOYAMA)	A
Macoma aomoriensis NOMURA	F
Macoma cf. *optiva* (YOKOYAMA)	A
Macoma cf. *tokyoensis* MAKIYAMA	F
Solen cf. *gouldi* CONRAD	F
Vicarya callosa japonica YABE and HATAI	F
Vicaryella tyosenica YABE and HATAI	C

These molluscs are usually found closely accumulated in the coarse-grained sandstone layer. Among the molluscs given in the above list, *Corbicula*, *Cyclina*, *Soletellina*, etc. occur with both valves intact but the others are found as isolated valves, though they are all rather well preserved. The occurrence of the brackish water genera as *Vicarya*, *Vicaryella*, *Corbicula*, *Ostrea* and others indicate that the Ozono formation may have been deposited under the influence of warm and shallow brackish water conditions.

b) Arakawa formation

The molluscan shells from the Arakawa formation are found to occur sporadically in the tuffaceous sandy siltstone at the south of Nishi-Furusato, Obusuma-mura, Ôsato-gun, Saitama Prefecture. They are rather unfavorably preserved and the following were identified:

Ostrea cf. *gravitesta* YOKOYAMA	R
Chlamys cf. *kaneharai* (YOKOYAMA)	R
Patinopecten kimurai (YOKOYAMA)	R
Lima goliath (SOWERBY)	F
Clinocardium sp.	F
Balanus sp.	F

c) Tokigawa formation

Numerous megafossils occur from the Tokigawa formation distributed in the area south of Higashi-Matsuyama City and consist of molluscs, brachiopods, echinoids, fishes, etc. Among them the molluscs are the most predominant and were collected from 11 fossil localities. Of the total 65 species and 11 indetermined molluscs four species are thought to be new to science and they are described in this article. The faunal list is shown in Tables 1-2.

The shells bearing deposits of localities 1-5 consist of granule conglomerate to fine-grained sandstone, while those of localities 6-11 mainly comprise siltstone. The former localities represent the lower horizon and the latter ones the upper stratigraphically. In general, the megafossils from the lower horizon are more abundant than those from the upper horizon in number of individuals and species.

The representative genera from the lower horizon are *Acila*, *Ennucula*, *Nuculana*, *Saccella*, *Portlandia*, *Limopsis*, *Solamen*, *Macoma*, *Cuspidaria*, *Dentalium*, *Lischkeia*, "*Solariella*", *Minolia*, *Otolithus*, etc. While in the upper horizon there

* Abbreviation: A..abundant; C..common; F..few; R..rare.

Table I.

Specific Name \ Locality	1	2	3	4	5	6	7	8	9	10	11
Acila divaricata (HINDS)	F	F	F	·	R	F	·	·	·	·	F
A. insignis (GOULD)	·	R	·	·	F	·	·	·	·	·	·
Ennucula tenuis (MONTAGU)	C	·	C	A	·	·	·	·	·	·	·
Nuculana robai KURODA	C	F	·	C	A	·	·	·	·	·	·
Saccella confusa (HANLEY)	A	·	A	A	A	·	·	·	F	·	·
S. gordonis (YOKOYAMA)	·	·	R	A	·	·	·	·	·	·	·
S. konnoi HATAI and MASUDA, n. sp.	·	C	·	·	·	·	·	·	·	·	·
Portlandia japonica (ADAMS)	A	·	C	F	A	A	·	·	·	·	·
Anadara sp.	·	R	·	·	·	·	·	·	·	·	·
Limopsis tokaiensis YOKOYAMA	A	R	C	A	A	·	·	C	·	·	·
L. cumingi A. ADAMS	·	·	·	·	·	F	·	F	·	·	·
Modiolus dificilis (KURODA and HABE)	·	R	·	·	·	·	·	·	·	·	·
M. sp.	·	·	·	·	·	·	·	·	R	·	·
Solamen diaphana (DALL)	F	R	R	F	C	·	·	·	·	·	·
Chlamys sp.	·	·	·	·	R	R	·	·	·	·	R
Polynemamussium intuscostatum (YOKOYAMA)	F	R	·	C	C	·	·	·	·	·	·
Ostrea sp.	R	F	·	·	·	·	·	·	·	·	·
Limatula kurodai OYAMA	·	·	·	·	R	·	·	·	·	·	·
Promantellum hirasei (PILSBRY)	C	·	·	R	F	·	·	·	·	·	·
Vesicomya katsuae KURODA	·	·	·	·	F	·	·	·	·	·	·
Trapezium liratum (REEVE)	·	·	·	·	·	R	·	·	·	·	·
Felaniella usta (GOULD)	·	·	R	·	·	·	·	·	·	·	·
Lucinoma acutilineatum (CONRAD)	C	R	·	F	C	A	C	·	C	C	C
Venericardia ferruginea CLESSIN	·	R	·	·	·	·	·	·	·	·	·
"*Cardium*" sp.	·	·	·	·	·	F	·	·	·	·	·
Cyclina orientalis (SOWERBY)	·	R	·	·	·	·	·	·	·	·	·
Venus toreuma (GOULD)	·	R	·	·	·	·	·	·	·	·	·
Mercenaria cf. *yokoyamai* MAKIYAMA	·	R	R	·	·	·	·	·	·	·	·
Dosinia sp.	·	·	·	·	·	·	·	·	F	·	·
Macoma nipponica (TOKUNAGA)	·	·	·	A	·	·	·	·	·	·	·
M. praetexta (v. MARTENS)	C	·	·	C	A	·	F	·	·	·	·
M. tokyoensis MAKIYAMA	C	C	F	·	·	·	·	·	·	·	F
Fabulina iridella (v. MARTENS)	·	·	F	·	·	·	·	·	·	·	·
F. nitidula (DUNKER)	C	·	·	F	·	·	·	·	F	·	·
Cryptomya busoensis YOKOYAMA	·	·	·	·	·	·	·	R	·	·	·
Teredo sp.	·	F	·	·	·	R	·	·	·	·	·
Periploma cf. *pulchellum* HATAI and NISIYAMA	·	·	·	C	·	·	·	·	·	·	·
Cuspidaria gouldiana septentrionalis KURODA	·	F	F	·	·	·	·	·	·	·	·
C. nobilis (A. ADAMS)	R	R	·	·	·	·	·	·	·	·	·
C. japonica KURODA	F	·	·	R	A	·	·	·	·	·	·

Loc. 1: Road-side exposure, about 450 m. southeast of Ôkura, Sugaya-mura, Hiki-gun, Saitama Prefecture (tuffaceous medium-grained sandstone).

Locs. 2 and 3: River cliff, about 600 m. southeastsouth of Ôkura, Sugaya-mura, Saitama Prefecture(2: granule conglomerate to very coarse-grained sandstone; 3: tuffaceous fine-grained sandstone).

Loc. 4: River cliff, about 600 m. west of Gôdo, Higashi-Matsuyama City, Saitama Hiki-gun, Saitama Prefecture (tuffaceous fine-grained sandstone).

Loc. 5: River-side small cliff, western end of Gôdo, Higashi-Matsuyama City, Saitama Prefecture (tuffaceous fine-grained sandstone).

Loc. 6: River clff, southeastern end of Shôgunzawa, Sugaya-mura, Hiki-gun, Saitama Prefecture (siltstone).

Loc. 7: Road-side exposure, about 500 m. southwest of Shôgunzawa, Sugaya-mura, Hiki-gun,

Table II.

Specific Name \ Locality	1	2	3	4	5	6	7	8	9	10	11
Puncturella hirasei OTUKA	F	C	·	C	R	·	·	·	·	·	·
P. nobilis A. ADAMS	·	·	·	F	·	·	·	·	·	·	·
Lischkeia crumpi (PILSBRY)	C	C	R	A	C	·	·	·	·	·	·
Calliostoma unicum (DUNKER)	·	R	·	·	F	·	·	·	·	·	·
Gibbula saitamensis HATAI and MASUDA, n. sp.	·	·	·	·	R	·	·	·	·	·	·
Minolia pseudobscura (YOKOYAMA)	C	F	C	A	·	·	·	·	·	·	·
"*Solariella*" *musashiana* HATAI and MASUDA, n. sp.	A	C	A	A	·	·	·	·	·	·	·
Leptothyra pseudotransenna (OZAKI)	C	·	·	F	A	·	·	·	·	·	·
Turbo cf. *coreensis* RECLUZ	·	·	·	C	·	·	·	·	·	·	·
Cocculina japonica DALL	R	·	·	·	R	·	·	·	·	·	·
Cerithium exelsum (YOKOYAMA)	C	·	C	R	·	·	·	·	·	·	·
Neverita didyma (RÖDING)	·	·	·	A	C	·	·	·	·	·	·
Tectonatica janthostomoides (KURODA and HABE)	C	F	·	C	F	·	·	·	·	·	·
Trophonopsis candelabrum (REEVE)	·	·	·	·	·	R	·	·	·	·	·
Beringius sp.	R	·	·	·	·	·	·	·	·	·	·
Volutopsius konnoi HATAI and MASUDA, n. sp.	C	R	·	R	R	·	·	·	·	·	·
Ancistrolepis trochoideus (DALL)	·	R	·	·	·	·	·	·	·	·	·
Siphonalia fusoides (REEVE)	R	·	R	·	·	·	·	·	·	·	R
Buccinum sp.	·	R	·	·	F	·	·	·	·	·	·
Fulgoraria prevostiana (CROSSE)	·	·	·	R	R	·	·	·	·	·	·
Cancellaria limata YOKOYAMA	R	·	·	·	·	·	·	·	·	·	·
Aforia nojimensis (YOKOYAMA)	·	·	·	R	·	·	·	·	·	·	·
Etremopa cosibensis (YOKOYAMA)	·	·	F	·	·	·	·	·	·	·	·
Turris leucotropis (ADAMS and REEVE)	·	·	R	·	·	·	·	·	·	·	·
Propebela candida (YOKOYAMA)	·	·	·	F	·	·	·	·	·	·	·
Oenopota cf. *kagana* (YOKOYAMA)	·	·	·	·	F	·	·	·	·	·	·
Pyrunculus tokyoensis HABE	C	C	·	·	F	·	·	·	·	·	·
Leucotina sp.	·	·	·	R	·	·	·	·	·	·	·
Liloa cura (A. ADAMS)	·	·	·	·	F	·	·	·	·	·	·
Semiretusa cf. *globosus* (YAMAKAWA)	·	·	·	·	C	·	·	·	·	·	·
Acteocina cf. *delicatulus* (A. ADAMS)	·	·	·	R	·	·	·	·	·	·	·
Dentalium yokoyamai MAKIYAMA	C	A	A	A	A	A	C	·	·	·	·
D. weinkauffi DUNKER	·	·	·	F	·	·	·	·	·	·	F
D. septentrionale OYAMA	R	·	·	·	F	·	·	·	·	·	·
Aturia sp. (n. sp. ?)	·	·	·	·	·	R	·	·	·	·	·
Laqueus rubellus (SOWERBY)	R	R	F	C	R	·	·	·	·	·	·
Linthia sp.	F	·	·	·	·	·	·	·	R	·	·
Otolithus spp.	C	·	C	F	·	C	·	·	·	·	·
Fish scale	A	F	·	·	·	·	·	·	·	·	·
Cetacea sp.	C	·	·	F	F	·	·	·	·	·	·
Isurus hastalis AGASSIZ	·	R	·	·	·	·	·	·	·	·	·
Sardinia sp.	·	·	·	·	·	·	·	·	C	C	F
Makiyama sp.	·	·	·	·	·	·	·	C	C	C	F

Saitama Prefecture (siltstone).

Loc. 8: Road-side exposure, west of Shimo-Gôdo, Higashi-Matsuyama City, Saitama Prefecture (siltstone).

Loc. 9: Road-side cliff, about 150 m. south of Loc. 8, about 250 m. southwest of Shimo-Gôdo, Higashi-Matsuyama City, Saitama Prefecture (siltstone).

Loc. 10: Road-side cliff, about 500 m. southwest of Shimo-Gôdo, Higashi-Matsuyama City, Saitama Prefecture (siltstone).

Loc. 11: Road-side exposure at Izui, Kamei-mura, Hiki-gun, Saitama Prefecture (siltstone).

is recognized an increase in individuals of *Lucinoma acutilineatum* and *Makiyama* sp. The occurrence of *Aturia* is noteworthy.

From the above given accounts it is considered that the lower horizon of the Tokigawa formation may have been deposited under the influence of rather warm water of an off shore environment and the upper horizon of the formation under the influence of rather deeper water condition.

d) Tsuchishio formation

Abundant molluscs were found from the alternation of very fine-grained sandstone and siltstone at Tsuchishio, Namekawa-mura, Ôsato-gun, Saitama Prefecture, associated with some sand-pipes. These molluscs occur as molds or casts but their morphological characteristics are rather well preserved. The following species were determined.

Acila divaricata (HINDS)	F
Nuculana sp.	C
Yoldia naganumana (YOKOYAMA)	C
Anadara cf. *amicula* (YOKOYAMA)	C
Limopsis cf. *nipponica* YOKOYAMA	R
Aequipecten sp.	R
Clinocardium cf. *ciliatum* (FABRICIUS)	F
Polynemamussium sp.	R
Astarte cf. *hakodatensis* YOKOYAMA	F
Dosinia cf. *japonica* (REEVE)	R
Macoma cf. *incongrua* (v. MARTENS)	R
Sanguinolaria sp.	C
Cadella delta (YOKOYAMA)	R
Cultellus attenuatus DUNKER	F
Cryptomya busoensis YOKOYAMA	F
Ophiodermella ogurana (YOKOYAMA)	R
Searlesia cf. *fuscolabiata* (SMITH)	C
Turritella saishuensis motidukii OTUKA	C
Polinices sp.	C
Fusinus perplexus (A. ADAMS)	R
Cancellaria cf. *laticosta* LOBBECKE	C
Cancellaria spengleriana DESHAYES	R

From the list it may be considered that the present fauna may have been deposited under the influence of a rather cool to moderate shallow water condition. The occurrence of *Anadara* cf. *amicula*, *Astarte* cf. *hakodatensis*, *Turritella saishuensis motidukii*, etc. which are common in the Late Miocene deposits distributed in North Honshu are noteworthy because they extend the distribution of the Late Miocene fauna of Japan.

Molluscan shells and fish scales are found sporadically in the granule to pebble bearing massive siltstone at the right cliff of the Arakawa River, Honda, Motohata-mura, Ôsato-gun, Saitama Prefecture. They are as follows.

Solemya elongata AOKI	R
Nucula sp.	R
Malletia sp.	F
Nuculana sadoensis (YOKOYAMA)	R
Yoldia cf. *hurukutiensis* NOMURA and ZINBO	C
Portlandia japonica (A. ADAMS)	F
Arca cf. *boucardi* JOUSSEAUME	R
Crenella sp.	F
Lucinoma acutilineatum (CONRAD)	C
Macoma cf. *incongrua* (v. MARTENS)	F
Mya japonica JAY	R
Solariella ? sp.	R
Tectonatica janthostomoides (KURODA and HABE)	F
Dentalium septentrionale OYAMA	R
Fish scales	C

Among the molluscs in the above list *Yoldia*, *Portlandia*, *Lucinoma*, etc. mainly consist of intact valves. Judged from the molluscan assemblages and lithological characters the deposition of the present fauna may have been under the influence of a rather deep water condition.

Correlation and Geological Age

From the occurrence of *Ostrea gravitesta*, *Siratoria siratoriensis*, *Cyclina japo-*

nica, *Soletellina minoensis*, *Vicarya callosa japonica*, *Vicaryella tyosenica*, etc. it is evident that the fossil fauna of the Ozono formation can be correlated with the Early Miocene fauna of extensive distribution in Japan and Korea (HATAI, 1960). The fauna of the Heiroku formation of Korea, the Yatsuo of Toyama, Higashi-Innai of Ishikawa, Shobara of Hiroshima, Uetsuki of Okayama, Mizunami of Gifu, Ajiri of Miyagi, Shiratori of Iwate Prefectures, etc. are all thought to be correlative with the present fauna.

The molluscan fauna from the Arakawa formation may also be correlated with the Early Miocene fauna of Japan.

The fossil fauna from the Tokigawa formation may be Late Miocene in age. Although the Late Miocene megafossil fauna in the Kwanto Region has hitherto not been known sufficiently, it is considered that the Tokigawa fauna may correspond to the Genjigawa and Isozaki formations in Ibaraki Prefecture (OZAKI and SAITO, 1954, SAITO, 1956) from the characteristics of the molluscan assemblages.

The occurrences of *Anadara* cf. *amicula*, *Turritella saishuensis motidukii* from the Tsuchishio formation are very interesting from the view point of faunal assemblages, because the faunal characters are closely related with those of the Shigarami fauna in Nagano Prefecture (TOMIZAWA, 1958) but not with those of the Kwanto Region.

Description of New Species

Family Nuculanidae

Genus *Saccella* WOODRING, 1925

Saccella konnoi HATAI and MASUDA, new species

Plate 40, figures 3, 4, 5.

Holotype:—DGS,* Reg. No. 4235.

Shell small, rather thin, moderately inflated, transversely elongated; inequilateral, anterior side somewhat shorter than posterior; anterior margin rather sharply rounded; posterior margin obtusely pointed. Ventral margin broadly rounded. Surface with ridge running from beak to posterior end and with obsolete one extending from beak to lower part of posterior portion; lower ridge tends to become very faint near postero-ventral margin; surface sculptured with rather coarse, irregular concentric growth lines which tend to obsolete near antero- and posterior sides and narrower than their interspaces. Escutcheon rather wide, lanceolated, with faint, fine growth lines, sharply bounded by upper radiating ridge. Characteristics of interior surface remain unknown.

Dimensions (*in mm.*):— Holotype, height 5.3, length 7.9, depth 2.5; paratypes, height 6.4, length 10.2, depth 2.8; height 5.2, length 8.0, depth 2.3.

Remarks:—This new species is named in honor of Prof. Enzo KON'NO of the Institute of Geology and Paleontology, Faculty of Science, Tohoku University.

The present new species resembles *Saccella confusa* (HANLEY) (SUZUKI and ISHIZUKA, 1943, p. 53, pl. 1, figs. 1-7), but it can be distinguished from the latter by its small shell and surface sculpture consisting of coarse irregular concentric growth lines which tend to become obsolete towards the antero- and posterior sides. *Saccella gordonis* (YOKOYAMA) (1920, p. 177, pl. 19, figs. 4, 5) differs from the present one by its lower shell and regularly spaced concentric growth

* Abbreviation for Department of Geology, Faculty of Education, Tohoku University, Sendai.

lines.

Type locality, Geological formation and Age:—Locality 4 (Lat. 36°04'56"N., Long. 139°19'16"E.). Tokigawa formation. Late Miocene.

Distribution:—Known only from the present area.

Family Trochidae

Genus *Gibbula* RISSO, 1826

Gibbula saitamensis HATAI and MASUDA, new species

Plate 40, figures 23 a-c.

Holotype:—DGS, Reg. No. 4247.

Shell moderate in size, rather thick, trochoid; younger whorls lost; spiral angle about 120°. Shell consisting of about five whorls separated by obscure sutures, sculptured with four, distinct spiral cords of which lower two more distinct than upper two, very faint, fine spiral threads between spiral cords and fine incremental lines; spiral cords much narrower than their interspaces. Base of whorl moderately inflated, with about 13, faint, unequal, nearly equally spaced spiral threads and fine incremental lines. Umbilicus deep, funnel shaped, with several spiral threads.

Dimensions (*in mm.*):—Height ca. 15, max. diameter 21, min. diameter 18.

Remarks—Only one rather imperfect specimen is found in the collection.

Gibbula japonica (A. ADAMS) (DUNKER, 1882, p. 144, figs. 17, 18), a living species of western Japan, can be distinguished from the present one by its smaller shell, more number of somewhat granulated spiral cords and channeled sutures.

Type locality, Geological formation and Age:—Locality 5 (Lat. 36°04'50"N., Long. 139°19'34"E.). Tokigawa formation. Late Miocene.

Distribution:—Known only from the type locality.

Family Trochidae

Genus *Solariella* WOOD, 1842

"*Solariella*" *musashiana* HATAI and MASUDA, new species

Plate 40, figures 14-17.

Holotype:—DGS, Reg. No. 4241.

Shell small, thin, nearly discoidal; surface smooth, polished, ornamented by faint, fine incremental lines and very faint, fine spiral threads. Whorls about four, rapidly enlarging, separated by rather distinct, impressed sutures. Body whorl ventricose. Aperture nearly circular; outer and inner lips simple and sharp. Umbilicus rather large and deep.

Dimensions (*in mm.*):— Holotype, height 7.5, maximum diameter 11.5, minimum diameter 8.5; paratypes, height 6.5, max. diameter 15, min. diameter 10.3; height 6, max. diameter 11.5, min. diameter 8.5.

Remarks:—*Solariella fulgens* DALL (1925, p. 20, pl. 36, figs. 2, 10), a Recent species of Japan, can be distinguished from the present one by the subcircular shell and rather small aperture.

Type locality, Geological formation and Age—Loc. 2 (Lat. 36°05'06"N., Long. 139°19'05"E.). Tokigawa formation. Late Miocene.

Distribution:—Known only from the present area.

Family Buccinidae

Genus *Volutopsius* MÖRCH, 1857

Volutopsius konnoi HATAI and MASUDA, new species

Plate 40, figures 19a-b, 20a-b.

Holotype:—DGS, Reg. No. 4244.

Shell rather small, thin, fusiform; provided with five whorls; nucleus rather large, rounded; spiral angle about 50°. Whorls rapidly enlarging; shoulders rounded; separated from each other by well defined sutures; sculptured with weak, longitudinal ribs, incremental lines and spiral threads; longitudinal ribs subvertical, numbering about 15 on body whorl, rather distinct on upper part but tend to become obsolete and disappear towards base, separated by interspaces broader than ribs themselves. Body whorl very large, roundly shouldered above and contracted below. Basal fasciole rather faintly defined by shallow groove. Aperture long, narrow, much more than one-half of shell length; outer lip thin and simple; inner lip smooth with thin callus.

Dimensions (*in mm*):— Holotype, height 15.5, diameter 7.5; paratype, height ca. 31, diameter 17.

Remarks:—This species is named in honor of Prof. Enzo KONNO. This is a rare genus in the Tertiary strata of Japan. The present new species can be distinguished from *Volutopsius middendorfi* DALL (1891, p. 186), a Recent species of the Northern Pacific, by its small shell, longitudinal ribs on upper part of whorls.

Type locality, Geological formation and Age:—Loc. 5 (Lat. 36°04′50″N., Long. 139°19′34″E.). Tokigawa formation. Late Miocene.

Distribution:—Known only from the present area.

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Explanation of Plate 40

Figs. 1, 2. *Nuculana (Nuculana) robai* KURODA. 1. Left valve. ×1.6. 2. Right valve, ×1.6. DGS, Reg. No. 4234. Loc. 5. Tokigawa Miocene.

Figs. 3-5. *Saccella konnoi* HATAI and MASUDA, n. sp. 3, Left valve. ×1.6. Holotype, DGS, Reg. No. 4235. Loc. 4. Tokigawa Miocene. 4, Right valve, ×1.6. 5, Left valve, ×1.6. Paratype, DGS, Reg. No. 4236. Loc. 2. Tokigawa Miocene.

Figs. 6, 7. *Portlandia japonica* (A. ADAMS.) Right valve. ×1.2. DGS, Reg. No. 4237. Loc. 5. Tokigawa Miocene.

Fig. 8. *Yoldia* sp. Right valve. ×1.2. DGS, Reg. No. 4238. Loc. 5. Tokigawa Miocene.

Figs. 9-11. *Limopsis tokaiensis* YOKOYAMA. 9, Left valve, ×1.2. 10, 11, Right valve, ×1.2. DGS, Reg. No. 4239. Loc. 5. Tokigawa Miocene.

Figs. 12, 13. *Cuspidaria japonica* KURODA. Right valve, ×1.2. DGS, Reg. No. 4240. Loc. 5. Tokigawa Miocene.

Figs. 14a-c, 15, 16, 17a-b. "*Solariella*" *musashiana* HATAI and MASUDA, n. sp. 14a, Apical view, ×1.35. 14b, Umbilical view, ×1.35. 14c, Apertural view, ×1.35. Holotype, DGS, Reg. No. 4211. Loc. 4. Tokigawa Miocene. 15, 16, Apical view, ×1.35. 17a, Apical view, ×1.35. 17b, Umbilical view of 17a, ×1.35. Paratype, DGS, Reg. No. 4242. Loc. 4. Tokigawa Miocene.

Figs. 18a-b. *Lischkeia crumpi* (PILSBRY). a, Apertural view, ×1.2. b, Dorsal view of 18a, ×1.2. DGS, Reg. No. 4243. Loc. 4. Tokigawa Miocene.

Figs. 19a-b, 20a-b. *Volutopsius konnoi* HATAI and MASUDA, n. sp. 19a, Apertural view, ×1.4. 19b, Dorsal view of 19a, ×1.4. Holotype, DGS, Reg. No. 4244. Loc. 5. Tokigawa Miocene. 20a, Apertural view, ×1.2. 20b, Dorsal view of 20a, ×1.2. Paratype, DGS, Reg. No. 4245. Loc. 2. Tokigawa Miocene.

Figs. 21, 22. *Turritella saishuensis motidukii* OTUKA. 21, Dorsal view, ×1.2. 22, Apertural view, ×1.2. DGS, Reg. No. 4246. Loc. Tsuchishio, Namekawa-mura, Ôsato-gun, Saitama Prefecture. Tsuchishio Miocene.

Figs. 23a-c. *Gibbula saitamensis* HATAI and MASUDA, n. sp. a, Apical view, ×1.4. b, Umbilical view of 23a, ×1.4. c, Apertural view of 23a, ×1.4. Holotype, DGS, Reg. No. 4247. Loc. 5. Tokigawa Miocene.

Figs. 24a-b. *Pyrunculus tokyoensis* HABE. a, Apertural view, ×1.2. b, Dorsal view of 24a, ×1.2. DGS, Reg. No. 4249. Loc. 1. Tokigawa Miocene.

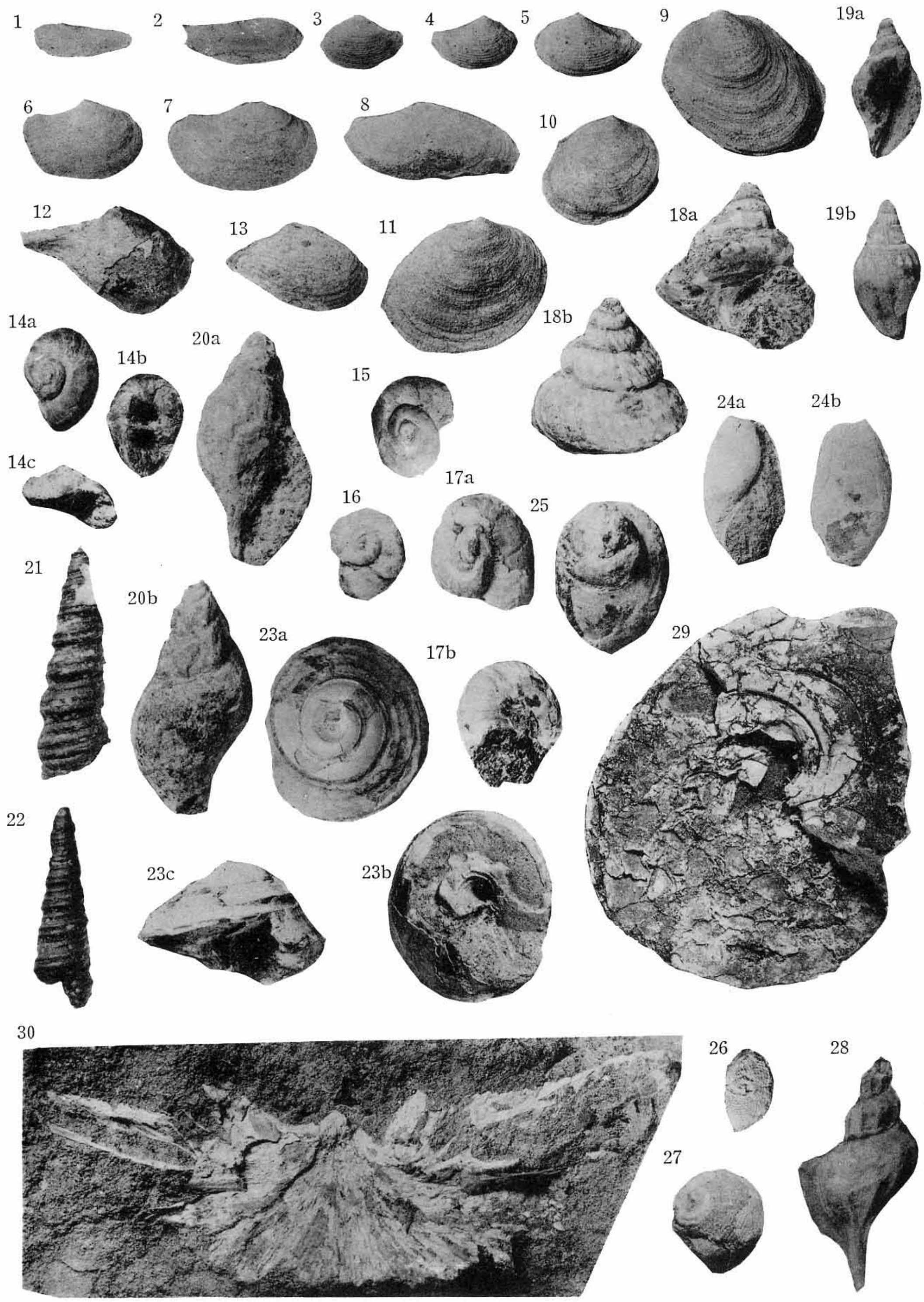
Fig. 25. *Neritopsis* sp. Apical view, ×1.35. DGS, Reg. No. 4250. Loc. 2. Tokigawa Miocene.

Figs. 26, 27. *Phanelolepida pseudotransenna* OZAKI. Apical view, ×1.35. DGS, Reg. No. 4251. Loc. 5. Tokigawa Miocene.

Fig. 28. *Trophonopsis candelabrum* (REEVE). Dorsal view, ×1.2. DGS, Reg. No. 4252. Loc, 6. Tokigawa Miocene.

Fig. 29. *Aturia* sp. (n. sp.?). ×1. DGS, Reg. No. 4253. Loc. 6. Tokigawa Miocene.

Fig. 30. Problematica, probably part of tail bone of some kind of fish. ×1. DGS, Reg. No. 4254. Loc. 1. Tokigawa Miocene.



K. MASUDA photo

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 46, pp. 263–271, Pl. 41, June 10, 1962

431. DIE SOGENANNTE „*FICUS*“ *TILIAEFOLIA* (AL. BR.) HEER*

KIYOSHI TAKAHASHI

und

IKUWO OBATA

Geologisches Institut der Universität Kyushu

いわゆる "*Ficus*" *tiliaefolia* (Al. Br.) Heer: 九州筑豊炭田古第三紀大焼層(日鉄上穂波坑)産のいわゆる *Ficus tiliaefolia* (Al. Br.) Heer の葉印化石を記載報告した。この種は汎世界的に産出し、その分類上の位置について論議されているので、この問題についても言及した。 高橋 清・小畠郁生

Einleitung

Die fossilen Blätter der sog. „*Ficus*“** *tiliaefolia* (Al. Br.) Heer wurden bis heute von vielen Forschern hinsichtlich ihrer taxonomischen Stellung verschieden beurteilt. Im Jahre 1845 hatte Alexander Braun zum ersten Mal die Form aus Oeningen als *Cordia* ? *tiliaefolia* beschrieben. Seitdem hat man ihr verschiedene Gattungsnamen, *Dombeyopsis*, *Pterospermum*, *Büttneria*, *Alangium* (= *Marlea*) u. a. gegeben. Auch jetzt sind die Meinungen darüber noch geteilt.

Einer der Verfasser, K. Takahashi, hat hier zwei Blätter der sog. „*Ficus*“ *tiliaefolia* (Al. Br.) Heer aus Kyushu genau beschrieben und seine Meinung über ihre taxonomischen Beziehungen ausgesprochen. Der andere Verfasser, I. Obata, hat die Geologie und Stratigraphie des betreffenden Bezirks mitgeteilt.

Bei dieser Arbeit sind die Verfasser Herren Dr. Seido Endo und Prof. Dr. Kazuo Huzioka an der Universität Akita, die ihnen wertvolle Hinweise gaben, zu herzlichem Dank verpflichtet. Ferner gebührt ihr Dank Herrn Prof. Dr. Hermann Weyland, Wuppertal-Elberfeld, der ihnen wertvolle Hinweise gab und ihren Schriftsatz korrigierte, und Herrn Dr. Razvan Givulescu, Cluj-Klausenburg (Rumänien), der ihnen seine wertvolle Meinung mitteilte. Herzlichen Dank schulden sie auch Herren Prof. Dr. Tatsuro Matsumoto, Prof. Dr. Hisamichi Matsushita, Prof. Dr. Ryuzo Toriyama und Toru Iwahashi, die mit ihrem Rat die Untersuchungen förderten.

Fundort und Stratigraphie

Zunächst erläutern die Verfasser den Fundort und die stratigraphische

* Received Jan. 5, 1962; read Nov. 18, 1961.

** Die Bezeichnung „——“ bedeutet hier folgendes: Die vorliegenden Blattreste sind identisch mit *Ficus tiliaefolia* (Al. Br.) Heer, die von O. Heer beschrieben wurde, aber es ist sehr zweifelhaft, ob diese Blattabdrücke den rezenten Gattungsnamen *Ficus* verdienen. Der Name *Ficus* wäre nur dann richtig, wenn die Zugehörigkeit dieser Blattabdrücke zu *Ficus* gesichert wäre.

Lage der Fundschicht von „*Ficus*" *tiliaefolia* (AL. BR.) HEER. Weiter werden die Geologie und Stratigraphie der Umgebung des Fundorts der betreffenden Art von dem einen der Verfasser, I. OBATA, kurz dargelegt.

Die betreffenden Blätter wurden im Jahre 1953 von I. OBATA, der damals Student der Universität Kyushu war, in der Grube von Kami-Honami des Nittetsu-Kaho-Kohlenbergwerkes im Chikuho-Kohlenfeld gesammelt und dem einen der Verfasser, K. TAKAHASHI, zur Bearbeitung gebracht.

Die Blätter sind ganz schwarz und liegen eingebettet in dem zum Teil sandigen dunkelgrauen Gestein. Sie sind nicht vollständig in der Form, aber sie

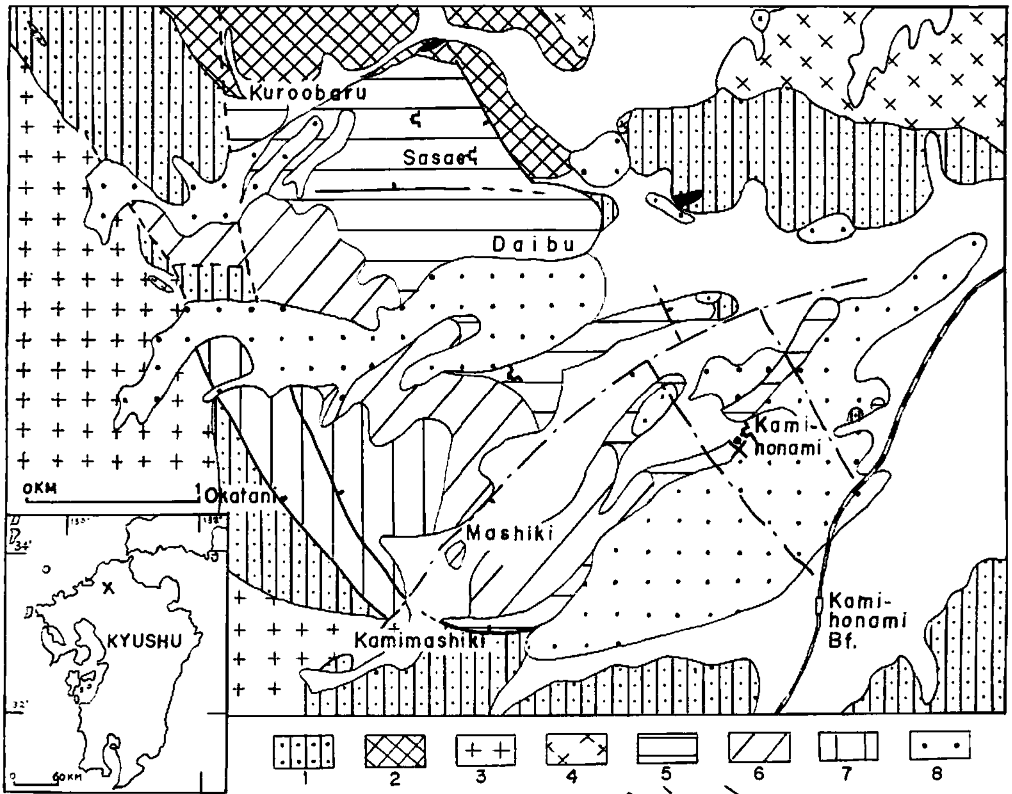


Abb. 1. Geologische Karte in der Umgebung von Daibu im Chikuho Kohlenfeld.
1: Biotit-Quarz-Semischiefer, Quarz-Hornblende-Semischiefer, Hornfels-Gesteine u. a. 2: Amphibolite, 3: Sawara-Granit, 4: Kaho-Granit, 5: Ooyake-Schichten, 6: Sanjaku-Goshaku-Schichten, 7: Takeya-Schichten, 8: Diluviale Sedimente, 9: Alluviale Sedimente, 10: Serpentinit, 11: Aplit, 12: Stelle der Grube, 13: Fundort von „*Ficus*" *tiliaefolia*, 14: Verwerfung, 15: Verwerfung, die in der Grube festgestellt wurde.

sind verhältnismäßig gut erhalten.

Im Bezirk von Daibu entwickeln sich die kohlenführenden alttertiären Schichten über der Diskordanz oder Verwerfung gegen die metamorphen Gesteine und den Granit (s. Abb. 1). Die alttertiären Schichten bestehen aus den Ooyake-, Sanjaku-goshaku- und Takeya-Schichten und sind etwa 410 m mächtig. Diese Schichten enthalten die Unterflözgruppe im Chikuho-Kohlenfeld.

Zu diesen Schichten ist das Folgende zu sagen:

1) Ooyake-Schichten (ca. 160 bis 195 m mächtig)

In der Umgebung von Kuroobaru bauen sich die Ooyake-Schichten auf den Amphiboliten diskordant auf und östlich von der Sasae-Grube grenzen sie an die Amphibolite. Die Ooyake-Schichten bestehen hauptsächlich aus groben bis mittelkörnigen Sandsteinen, Schiefertonen (oder zuweilen sandigen Schiefertonen), einigen Konglomeraten und ein paar Kohlenflözen. In den Sandsteinen kann man zuweilen „Zwiebel-struktur" bemerken. Die Kiesarten sind kugelförmige oder subkugelfömige Granite, Quarz-Semischiefer, hornfelsartige Gesteine usw. In den Kohlenflözen kommen viele Kieselhölzer vor, jedoch weniger als in den Sanjaku-Goshaku-Schichten. Das Liegende der Kohlenflöze bilden oft viel Al_2O_3 enthaltende Tone.

Die Ooyake-Schichten zeigen im allgemeinen die sehr bedeutende Veränderung der Sedimentfazies, die besonders in den Teilen auf und unter den Kohlenflözen hervortritt.

In diesem Bezirk wurde bis heute kein Muschelschalenrest angegeben. In dem Hangenden des Yonshaku- und Goshaku-Flözes in der Kami-Honami-Grube kann man ziemliche viele Blattabdrücke finden, und zwar wurden die vorliegenden Blattabdrücke von „*Ficus*" *tiliaefolia* (Al. Br.) Heer im Hangende des Goshaku-Flözes gesammelt.

Die folgende Übersicht zeigt die

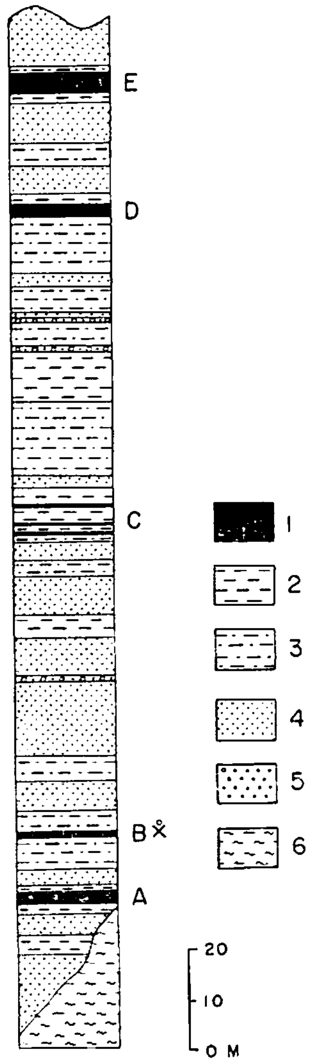


Abb. 2. Profil der Ooyake-Schichten in Daibu. 1: Kohlenflöz, 2: Schieferton, 3: Sandiger Schieferton, 4: Sandstein, 5: Konglomerat, 6: Metamorphe Gesteine, A: Yonshaku-Flöz, B: Goshaku-Flöz, C: Nishaku-Flöz, D: Sanjaku-Flöz, E: Hasshaku-Flöz, ×: Fundhorizont von „*Ficus*" *tiliaefolia*.

Sedimentfazies in den Teilen auf und unter dem Yonshaku- und Goshaku-Flöz (vgl. Abb. 2):

....

....

Sandstein (5.98 m)
Z. T. sandiges dunkelgraues Gestein mit „*Ficus*" u. a. (4.38 m)
Goshaku-Kohlenflöz (1.10 m)
Sandiger Schieferton (6.53 m)
Schwarzer Schieferton mit Blattresten (0.94 m)
Yonshaku-Kohlenflöz (2.04 m)
Schwarzer Schieferton und Sandstein (Wechsellagerung) (22.9+ m)

....

....

——Diskordanz oder Verwerfung——
Sawara-Granit oder metamorphe Gesteine

Die betreffenden pflanzenführenden Schichten entsprechen dem unteren Noogata-Pollenbild TAKAHASHIS (1961). Ihr geologisches Alter ist Obereozän.

2) Sanjaku-Goshaku-Schichten (ca. 140 bis 170 m mächtig)

Diese Schichten lagern auf den Ooyake-Schichten konkordant auf. Sie bestehen hauptsächlich aus groben bis feinkörnigen Sandsteinen und Schiefertonen, aber in ihrem oberen und unteren Teil sind Sandsteine überwiegend und im mittleren Schiefertone herrschend. Die Sandsteine zeigen oft " Zwiebelstruktur". Die betreffenden Schichten enthalten einige dünne Konglomerate und ein paar Kohlenflöze. In den Kohlenflözen kommen viele aufrechte Kieselhölzer vor, deren Wurzeln autochthon im Flöz oder Liegenden stehen. In diesem Bezirk kann man keinen Molluskenrest finden.

3) Takeya-Schichten (70m+mächtig)

Die Takeya-Schichten sind die obersten Ablagerungen in diesem Bezirk. Da man im Feld diese Ablagerungen nicht genau beobachten kann, kann man ihre Sedimente nicht genauer untersuchen. Sandsteine überwiegen, Schiefertone sind nur wenig vorhanden. Auch trifft man ein paar dünne Kohlenflöze an. Im grauweißgefärbten Schieferton nördlich von Kamimashiki haben die Verfasser einige Monokotyledonenreste gefunden und auch im schokoladefarbigen Schieferton östlich von Okatani einige Blattabdrücke.

Beschreibung der Art

? Moraceae

„*Ficus*" *tiliaefolia* (AL. BR.) HEER

Tafel 41, Figuren 1, 2.

1856 *Ficus tiliaefolia*, HEER, S. 68-69, Taf. 83, Fig. 3-12; Taf. 84, Fig. 1-6; Taf. 85, Fig. 14.
1934 *Ficus tiliaefolia*, WEYLAND, S. 64-65, Taf. 8, Fig. 2; Taf. 9, Fig. 1.
1957 *Ficus tiliaefolia*, NAGAI, S. 77-78, Text-Fig. 3-4; Taf. 1, Fig. 3-4.

Es sind zwei Blätter gefunden worden, die dieser Art zuzurechnen sind. Beide sind verhältnismäßig gut erhalten. Die Form der Blätter ist mehr oder weniger eiförmig; das obere von ihnen ist mit einer sehr markierten Spitze versehen und der unterste Teil der Blattlamina ist zerstört, bei dem unteren ist die Blattbasis seitlich ungleichförmig, sehr schwach herzförmig order nierenförmich. Das Blatt ist ganzrandig. Die Breite beträgt bei dem in Fig. 1 abgebildeten Blatt 8 cm, bei dem in Fig. 2 abgebildeten etwa 9 cm. Der Leitbündelverlauf ist strahlig; eines verläuft seitlich an der einen und zwei seitlich an der anderen Seite des Hauptbündels in entsprechenden Winkel von der Basis aus aufwärts. Die Sekundärnerven laufen in einem nach aufwärts etwas konkaven, in der Nähe des Blattrandes zu schärfer werdenden Bogen. Die die Primär- und Sekundärnerven verbindenden Anastomosen entspringen unter einem rechten oder beinahe rechtem Winkel und zeigen den schwach aufwärts konvex gebogenen Verlauf.

In Japan ist „*Ficus*" *tiliaefolia* (Al. Br.) Heer in Hokkaido und Shikoku angetroffen worden. Weiter kennt man sie aus eozänen und oligozänen Ablagerungen Europas und Amerikas.

Taxonomische Bemerkungen

(Von K. Takahashi)

Seit langer Zeit hat der Verfasser die botanische Zugehörigkeit der sogenannten *Ficus tiliaefolia* (Al. Br.) Heer in Zweifel gezogen. R. Givulescu (1959) hat sich über ihre Taxonomie kritisch geäußert und einen neuen Formgattungsnamen vorgeschlagen. Dem Verfasser liegen jetzt zwei Blattabdrücke von „*Ficus*" *tiliaefolia* vor. Er hat daher ebenfalls über ihre Taxonomie Betrachtungen angestellt. Er neigt der Meinung Givulescus zu. Nachdem Alexander Braun (1845) das in Frage stehende Blatt als *Cordia* ? *tiliaefolia* beschrieben hatte, haben es viele Forscher unter verschiedenen Gattungsnamen, *Cordia* ?, *Dombeyopsis*, *Ficus*, *Pterospermum*, *Büttneria*, *Alangium* (=*Marlea*) u. a. beschrieben. Der Verfasser hat diese Namen tabellarisch zusammengestellt (s. Tabelle 1). Es wurden also verschiedene Gattungsnamen benutzt, aber es fehlt ein befriedigender Beweis, daß eine dieser Benennungen unbedingt richtig ist. Unter solchen Umständen kann man die Benützung eines bestimmten Gattungsnamens nicht erwarten.

H. Weyland (1934) hat folgende Meinung ausgesprochen: „Dem *Büttneria*-Typus gehören außer unseren und den schlesischen Blättern wohl auch diejenigen Heer's an (*Ficus tiliaefolia*, 1855/59, Taf. 53, Fig. 3-12; Taf. 54, Fig. 1-6), die Unger's von Sotzka (*Dombeyopsis tiliaefolia* Unger, 1851, Taf. 46, Fig. 4 u. 5; *Dombeyopsis grandifolia* Unger, Taf. 47, Fig. 1 u. 2) und die Friedrich's (*Ficus tiliaefolia* A. Br. sp., 1883, Taf. 11, Fig. 5 u. 6)".

W. Berger (1955) hat über die taxonomische Stellung dieser Blattreste die Meinung vertreten, die systematische Stellung derartiger Blattreste sei bis heute noch nicht befriedigend geklärt .... Da unter dem Namen *Ficus tiliaefolia* mitterweile aber alle möglichen ähnlichen Blatttreste beschrieben worden seien, die zum Teil sicher ganz anderer systematischer Stellung seien (darunter wohl auch einige echte *Ficus*-Reste) und zudem Ungeres Originalabbildungen nicht ganz eindeutig seien, sein Originalmaterial aber nicht nachgeprüft werden könne, werde, bis eine gründliche Spezialbearbeitung die ganze Frage endgültig geklärt habe, der zweideutige Namen *Ficus tiliaefolia* besser vermieden und sollten die Blattreste mit einigermaßen sicherer Sterculiaceen-natur mit Weyland als *Büttneria aequalifolia* bezeichnet werden.

R. Givulescu schließlich hat 1959 zu *Ficus tiliaefolia* (Al. Br.) Heer erklärt, daß ihre Zugehörigkeit zu *Ficus*, *Büttneria* oder *Alangium* (=*Marlea*) zweifelhaft sei, und dafür eine neue Formgattung *Büttneriophyllum* vorgeschlagen. Die von O. Heer *Ficus tiliaefolia* benannten fossilen Blätter, die dann in die Gattungen *Pterospermum*, *Büttneria* und *Alangium* versetzt wurden, gehören sehr wahrscheinlich keiner dieser Gattungen an. Vorläufig seien wir nicht in der Lage festzustellen, um was für eine Pflanze es sich handle. Es sei aber sehr wahrscheinlich, daß diese keinem rezenten Vertreter entspreche. Bis zur völligen Klärung dieser Frage wird die generische Benennung *Büttneriophyllum* vorgesch-

Tabelle 1. Liste des Namengebrauchs von *Ficus tiliaefolia*, *Büttneria aequalifolia* u. a.

Al. BRAUN	1845	*Cordia ? tiliaefolia*
Fr. UNGER	1851	*Dombeyopsis tiliaefolia*
H. GOEPPERT	1852	*D. tiliaefolia*
O. HEER	1856	*Ficus tiliaefolia* (vereinigt)
Fr. UNGER	1861	*Ficus tiliaefolia*
C. v. ETTINGSHAUSEN	1867	*Ficus tiliaefolia*
W. SCHIMPER	1871–72	*Ficus tiliaefolia*
G. SAPORTA	1886	*Pterospermum tiliaefolium*
K. A. ZITTEL	1890	*Ficus tiliaefolia*
F. H. KOWLTON	1899	*Ficus tiliaefolia* ?
Fr. MEYER	1918	(*Büttneria aequalifolia*) (vereinigt)
G. DEPAPE	1922	*Büttneria tiliaefolia*
S. ENDO	1932	*Ficus tiliaefolia*
H. WEYLAND	1934	*Ficus tiliaefolia* (*Büttneria aequalifolia*)
A. N. KRISTOFOVIC M. I. BORSUK	1939	(*Alangium aequalifolium*)
I. Z. BARBU	1947	*Ficus tiliaefolia*
S. OISHI	1950	(*Marlea aequalifolia*, *M. basiobliqua* u. a.)
W. BERGER	1950	*Ficus tiliaefolia*
W. BERGER	1953	„*Ficus*" *tiliaefolia*
W. BERGER	1955	(*Büttneria aequalifolia*)
T. TANAI	1955	(*Marlea aequalifolia* u. a.)
T. TANAI T. ONOE	1956	(*Marlea aequalifolia*, *M. basiobliqua*)
K. NAGAI	1957	*Ficus tiliaefolia*
T. TANAI T. ONOE	1959	(*Marlea aequalifolia*)
R. GIVULESCU	1959	*Büttneriophyllum* (vorgeschlagen)
R. GIVULESCU	1960	(*Büttneriophyllum aequalifolium*)
R. GIVULESCU N. FLOREI	1960	(*Büttneriophyllum aequalifolium*)
T. TANAI	1961	(*Alangium aequalifolium*)

lagen.

Der Verfasser schließt sich dieser Meinung an. Nun hat R. Givulescu seiner Formgattung *Büttneriophyllum* keine Diagnose gegeben. Solange er ihr aber keine morphographische Beschreibung beifügt, kann der Verfasser diesen Formgattungsnamen nomenklatorisch nicht als gültig annehmen. Daher hat er für die betreffenden Blattabdrücke die Benutzung des Formgattungsnamens *Büttneriophyllum* Givulescus noch vermieden und hier nur den alten Namen „*Ficus*" *tiliaefolia* (Al. Br.) Heer benutzt.

In Japan gab es bisher zwei Meinungen betreffs der benennung der vorliegenden Blattabdrücke; eine ist für *Ficus*, die andere *Marlea* (vgl. Tabelle 1).

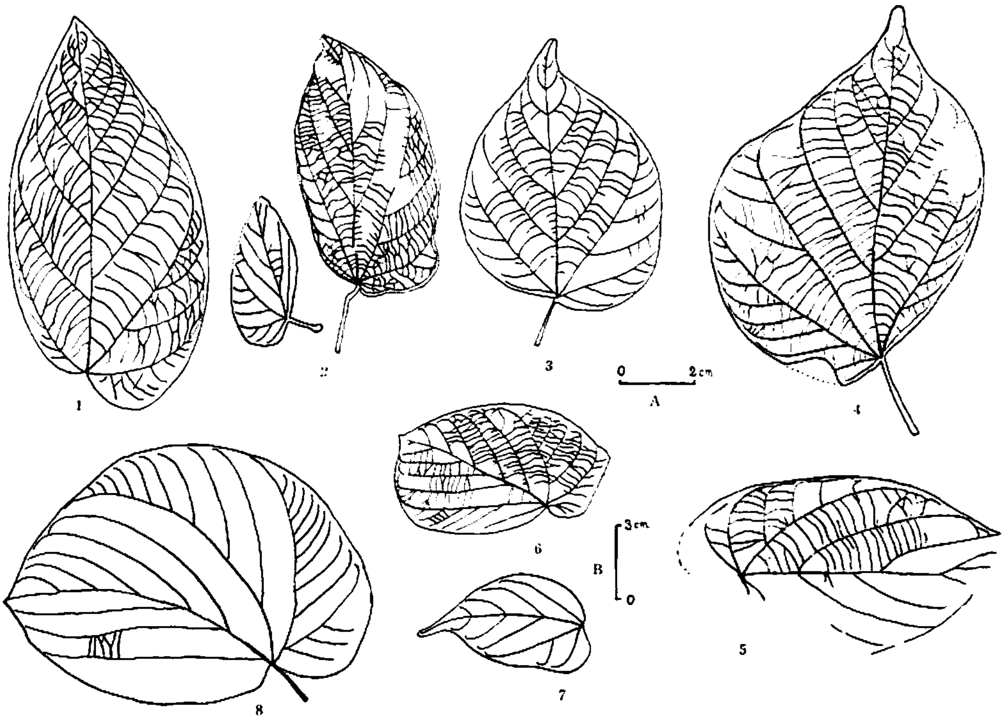


Abb. 3: Der morphologische Vergleich von *Ficus tiliaefolia*, *Büttneria aequalifolia* u. a.

1: *Büttneria aequalifolia* (Goepp.) Fr. Meyer (Mittel- bis Untermiozän, nach H. Weyland, 1934)
2: *Büttneria aequalifolia* (Goepp.) Fr. Meyer (Obermiozän, nach W. Berger, 1955)
3: *Ficus tiliaefolia* (Al. Br.) Heer (Eozän, nach K. Nagai, 1957)
4: „*Marlea*" *aequalifolia* (Goepp.) Oishi et Huzioka; Material aus den Ainoura-Schichten (Untermiozän) im Sasebo-Kohlenfeld von Kyushu.
5: *Büttneriophyllum aequelifolium* (Goepp.) Givulescu (pannonisch, nach R. Givulescu und N. Florei, 1960)
6: *Marlea aequalifolia* (Goepp.) Oishi et Huzioka (Miozän, nach S. Oishi 1950)
7: *Marlea basiobliqua* Oishi et Huzioka (Eozän, nach S. Oishi, 1950)
8: *Marlea aequalifolia* (Goepp.) Oishi et Huzioka (Miozän, nach T. Tanai, 1955)
A: Fig. 1-5, 8; B: Fig. 6, 7.

Diese beide Meinungen stehen kompromißlos nebeneinander. Es ist unklug, bei Blattformen mit ihren Konvergenz-Erscheinungen rezente Gattungsnamen nur auf morphologische Merkmale und oberflächliche Ähnlichkeit zu begründen. Wenn jeder Forscher von seinem Standpunkt aus jeden rezenten Gattungsnamen benutzt, wird das Problem der Benennung immer verwickelter werden. Man muß also bei der Nennung eines rezenten Gattungsnamens einen unbedingt gültigen Beweis für seine Richtigkeit haben. Wenn man keinen hat, soll man einen rezenten Namen vermeiden; man muß dann einen Organ- oder Formgattungsnamen wählen. Von diesem Standpunkt aus ist der Vorschlag GIVULESCUS berechtigt. Es ist nomenklatorisch erst dann richtig, einen rezenten Gattungsnamen zu benützen, wenn man einen gültigen Beweis vorbringen kann.

Vorläufig bleibt also das Problem um *Büttneria aequalifolia* (GÖPP.) F. MEYER (*Marlea aequalifolia* (GÖPP.) OISHI et HUZIOKA), *Marlea basiobliqua* OISHI et HUZIOKA u. a. auch weiter bestehen. In Japan hat man oft den Namen *Marlea aequalifolia* angenommen, in Europa *Büttneria aequalifolia*. Eine große morphologische Ähnlichkeit haben die alttertiäre Form *Ficus tiliaefolia* u. a. und die jungtertiäre *Büttneria aequalifolia* (oder *Marlea aequalifolia*) (vgl. Abb. 3). Mit anderen Worten: beide kann man derselben morphographischen Kategorie stellen. Da man aber die gleichen Blattabdrücke sowohl in alttertiären wie in miozänen Schichten in vershiedenen Gebietenvon Europa, Asien und Amerika finden kann, muß das Problem der Benennung sehr wichtig angesehen werden.

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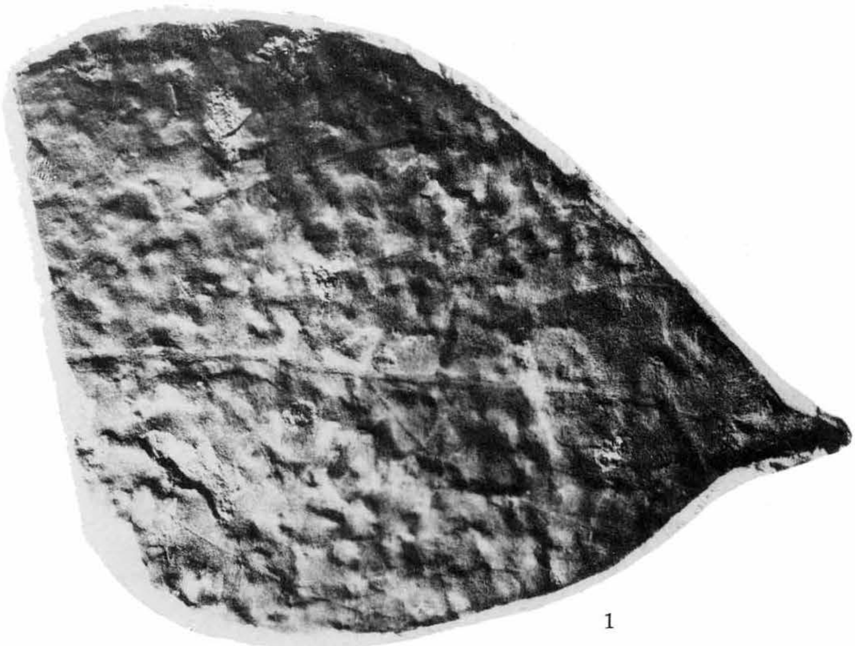
Erklärung zu Tafel 41

„*Ficus*" *tiliaefolia* (Al. BR.) HEER ×1.

Zwei Blattabdrücke aus dem Hangenden des Goshaku-Kohlenflözes, Ooyake-Schichten, Krmi-Honami-Grube des Nittetsu-Kaho-Kohlenbergwerkes, Chikuho-Kohlenfeld von Kyushu.



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SHORT NOTE

9. TWO NEW GASTROPOD GENERA, *NANNOTURRITELLA* AND *BENTHODAPHNE* FROM JAPAN*

KATURA OYAMA

Geological Survey of Japan

Molluscan remains are rich in Japanese Tertiaries, and many new forms have been reported by various authors. Still, there two new genera which have been not adequately known in the systematic position.

Nannoturritella, new genus

Shell rather small, high turreted; whorls flattish, almost smooth other than three spiral grooves; base flat, angulated on the periphery; aperture as in Turritellidae.

Type species:— *Cerithium tokudai* YOKOYAMA, 1930, Jour. Fac. Sci., Imp. Univ. Tokyo, Sect. II, Vol. II, Pt. 10, p. 414, pl. LXXVII, fig. 3.

This new genus is characterized by almost smooth whorls other than three spiral grooves near sutures like *Philippia*. The shape of the shell quite like *Turritella*, though this species has been considered Cerithiidae (*Cerithium* or *Bittium*), probably, by the presence of almost smooth part of the whorl.

Benthodaphne, new genus

Shell rather small, like *Spirotropis* or *Antiplanes* in general features; whorls rather flat, smooth other than fine growth lines which are the same type of that of *Daphnella*.

Type species:— *Pleurotoma* (*Bela*?) *glabra* YOKOYAMA, 1920, Jour. Coll. Sci., Imp. Univ. Tokyo, Vol. XXXIX, Art. 6, p. 43, pl. II, figs. 1 a-c.

This form differs from *Eubela* Dall, 1889, by lacking tubercles below suture. *Spirotropis* and *Antiplanes* have similar features though differing in growth lines.

* Received Oct. 25, 1961.

会　員　消　息

◎ 会員金谷太郎君は本年 4 月 California 州 Scripps 海洋学研究所より帰国した。

◎ 会員徳永重元君は本年 4 月 23 日より 27 日にわたり Arizona 州 Tucson で開催された International Palynological Conference に本会を代表して出席した。

◎ 会長小林貞一君は本年 6 月 1 日より 3 日にわたり Copenhagen で開催された International Union of Geologic Sciences の執行委員会に出席しタイ国経由帰京した。

◎ Berlin 工科大学 K. J. MÜLLER 教授は東京大学客員教授として本年 4 月下旬来日した。

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

News

◎ 第5回 Congres International de Stratigraphie et de Géologie du Carbonifère は 1963年9月9日より12日にわたり Paris で開催される。会議に関する問合せ先きは

Sécrétariat Général du 5e Congres International de Stratigraphie et de Géologie du Carbonifère, Charbonnages de France 9, Avenue Percier, Boite Postale 396. 08 Paris (8e), France. 申込は 1962年6月30日まで。

この会議の古生物学関係のテーマには次のごときものがある。

1) Stratigraphie et Paléontologie. 2) Sedimentologie, Pétrographie et Géochimie. 3) Pétrographie des charbons. 4) Microflore du Paléozoique. 5) Microfaune dans ses applications à la Stratigraphie Carbonifère. 6) Problèmes Géologiques Particuliers.

◎ 第6回 International Sedimentological Congress は 1963年5月27日より6月8日にわたり Amsterdam 及び Antwerp で開催される。会議に関する問合せ先きは

The Secretariat of the 6th International Sedimentological Congress, c/o Koninklijke/Shell Exploratie en Produktie Laboratorium Volmerlaan 6 —RIJSWIJK Z. H.— The Netherlands. 申込は 1962年4月1日まで。

この会議の研究発表は主に Deltaic and Shallow-marine deposits について行なわれる。

◎ 第22回 International Geological Congress は 1964年12月14日より22日にわたり New Delhi で開催される。会議に関する問合せ先きは

The Secretary General, XXII International Geological Congress, Geological Survey of India, 27, Chowringhee, Calcutta-13, India. 申込は 1962年12月1日まで。

この会議の古生物学関係のテーマには次のごときものがある。

1) Geology of Petroleum. 2) Cretaceous-Tertiary boundary including volcanic activity. 3) Tertiary Mammals. 4) Gondwanas. 5) Archaean and Pre-Cambrian Geology. 6) Himalayan and Alpine Orogeny. 7) Sedimentary geology and sedimentation.

購読御希望の方は本会宛御申込下さい

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