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452. *TRIGONIOIDES* FROM THE LATE MESOZOIC TETORI GROUP, CENTRAL JAPAN*

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後期中生代手取層群産 *Trigonioides*: *Trigonioides* は手取層群では下部白亜紀赤岩亜層群中の北谷互層にのみ産出が知られ，他の諸層からは未だ発見されていない。これを検討した結果，それらは *T. kodairai* に近似の 2 新種で，*T. tetoriensis* と *T. kitadaniensis* と命名し，ここに記載した。 前 田 四 郎

Introduction

Trigonioides, *Plicatounio* and *Nippononaia* are all important genera in the non-marine Cretaceous fauna of Eastern Asia, and are widely distributed in Indochina, North China, Korea and Japan. They have the characteristic V-shaped sculpture or radial plication. It is interesting that *Nippononaia* was found from the Lower Cretaceous non-marine formation of the Pacific side of North America by REESIDE (1957). Now ten species of *Trigonioides* including the two new species from the Tetori group are known in Eastern Asia as follows:

Trigonioides kodairai KOBAYASHI and SUZUKI, 1936
Trigonioides kobayashi HOFFET, 1937
Trigonioides laoliae HOFFET, 1937
Trigonioides trigonus HOFFET, 1937
Trigonioides diversicostatus HOFFET, 1937
Trigonioides paucisulcatus SUZUKI, 1940
Trigonioides matsumotoi KOBAYASHI and SUZUKI, 1941
Trigonioides paucisulcatus suzuki OTA, 1959
Trigonioides tetoriensis MAEDA, n. sp.
Trigonioides kitadaniensis MAEDA, n. sp.

Nine species of *Plicatounio* and five of *Nippononaia* have been described. *Trigonioides* was studied by KOBAYASHI and SUZUKI (1936, 1940, 1941), HOFFET (1937), MATSUMOTO (1938), SUZUKI (1943, 1949), COX (1955), KOBAYASHI (1956) and OTA (1959); *Plicatounio* by KOBAYASHI and SUZUKI (1936), HOFFET (1937), YABE and HAYASHI (1938), SUZUKI (1943, 1949), KOBAYASHI (1956), OTA (1959), HASE (1960) and the writer (1962), and *Nippononaia* by SUZUKI (1941, 1943, 1949), KOBAYASHI (1956), REESIDE (1957), OTA (1959), HASE (1960) and the writer. The important criteria for the classification of these genera are the hinge character and surface ornamentation as discussed in detail by KOBAYASHI (1936). The relationships among these genera are summarized as follows:

1) The surface ornament of *Trigonioides* is very similar to that of *Nippononaia*, but the former differs from the latter in hinge structure, namely in the presence of a median tooth and the aspect of crenulation.

2) The hinge nature of *Nippononaia* is most related to that of *Plicatounio*, but the former is characterized by the

* Received July 17, 1962; read at 81st Meeting of the Palaeontological Society on 3rd June, 1962 at Kumamoto.

V-shaped sculpture, and the latter by radial plication.

3) *Trigonioides* is distinguishable from *Plicatounio* by hinge nature and ornamentation.

The two new species of *Trigonioides* from the Tetori group and *T. kodairai* from the Lower Cretaceous Naktong-Wakino series are closely allied to one another, but the former two differ from the latter by broad and deep grooves and the number of ribs on the anterior half of the disk.

Brief notes are given in this paper on the mode of occurrence of *Trigonioides tetoriensis* and *T. kitadaniensis*.

The writer expresses his sincere thanks to Emeritus Prof. T. KOBAYASHI of the University of Tokyo for his valuable advices, to Dr. I. HAYAMI of Kyushu University, Dr. SUZUKI of the Research Institute for Natural Resources and Dr. Y. OTA of the Fukuoka University for helpful suggestions.

Occurrence

Trigonioides was found from the Lower Cretaceous Kitadani alternation of the Akaiwa subgroup, but no occurrence has hitherto been known from any other formation of the group. On account of the sedimentary facies prime importance for the alternation is the presence of reddish or greenish tuffaceous rock closely resembling the Lower Cretaceous Inkstone of Chugoku region in West Japan. The heavy minerals of the alternation, characterized by brown tourmalines, hyacinth, reddish and colourless zircons, garnet, biotite and so on, are presumed to have been derived from the Hida gneiss produced by the Akiyoshi orogeny. Thus *Trigonioides* together with *Plicatounio*, *Nakamuranaia* and *Viviparus* have lived in such an environment as a lake or a lagoon surrounded by the land of the Hida gneiss. Because the climate was warm temperate (KOBAYASHI, 1942) and land plants flourished at that time, these non-marine molluscs occur together with many plant remains (MAEDA, 1958). Among these molluscs *Trigonioides* occurs in arkosic sandstone, *Plicatounio* in arkosic sandstone or sandy shale, *Nakamuranaia* and *Viviparus* in micaceous black shale. It is a general tendency for these molluscs to be contained abundantly in shaly facies and rarely in sandstone facies. Shells of *Trigonioides* form thin fossiliferous lenses in which opened valves are most common while separate valves are uncommon and closed ones rare. These valves are settled irregularly on the bedding plane with their concave side downward. From the above stated occurrences it is presumed that *Trigonioides* was not buried in situ at its habitat but it is probably embedded at places not far from the habitat. The water current was presumably not strong.

Systematic description

Family Trigonioidae COX, 1952

Genus *Trigonioides* KOBAYASHI and SUZUKI, 1936

1936. ***Trigonioides***, KOBAYASHI and SUZUKI, *Japan. Jour. Geol. Geogr., Vol. 13*, p. 248.
1937. *Trigonioides*, HOFFET, *Bull. du Serv. Geol. de L'Indochine, Vol. 24*, p. 8.
1938. *Trigonioides*, MATSUMOTO, *Jour. Geol. Soc. Japan, Vol. 45*, p. 15.
1940. *Trigonioides*, SUZUKI, *Japan. Jour. Geol. Geogr., Vol. 17*, p. 228.
1941. *Trigonioides*, KOBAYASHI and SUZUKI, *Bull. Geol. Inst. Manchoukuo, No. 101*, p. 78.
1955. *Trigonioides*, COX, *Geol. Mag., Vol. 92*,

p. 348.
1956. *Trigonioides*, KOBAYASHI, *Japan. Jour. Geol. Geogr., Vol. 27*, p. 80.
1959. *Trigonioides*, OTA, *Trans. Palaeont. Soc. Japan. N.S., No. 34*, p. 100.

Diagnosis:—Shell medium, usually subtrapezoidal, ovate or subtrigonal in outline, moderately convex, subequilateral, rounded near the anterior end, subquadrate in posterior: test thick. Umbo prominent, incurved, generally prosogyrous or orthogyrous, ligament external. Surface marked by V-shaped ribs and weak concentric growth lines. Posterior ridge distinct. Hinge well developed: principal teeth three on each valve and a bifid median tooth on the each valve; a simple median one on the left: crenulation of the teeth distinct. Pallial line simple. Inner surface smooth or ornamented; ventral margin clearly crenulated.

Type species:—*Trigonioides kodairai* KOBAYASHI and SUZUKI, 1936.

Remarks:—Since this genus had been established in 1936 by KOBAYASHI and SUZUKI, the shells belonging to this genus were reported by HOFFET (1937), MATSUMOTO (1938), SUZUKI (1949), KOBAYASHI and SUZUKI (1941), SAKAGUCHI (1943) and OTA (1959) from several localities. The classification of this genus has been repeatedly discussed. SUZUKI (1940) pointed out that HOFFET's form differs from the Koreo-Japanese ones by having small median cardinal teeth. COX (1952) stated that *Trigonioides* belongs probably to the Unionacea, instead of the Trigoniacea judging from the hinge structure. Recently KOBAYASHI (1956) confirmed some remarkable facts by the further investigation of *Trigonioides* and its allied forms as follows:

1) *Trigonioides* has "a few subumbonal or median small teeth."

2) "*Hoffetrigonia* SUZUKI, 1941 is synonymous with *Trigonioides* KOBAYASHI and SUZUKI, 1936."

3) "Because the regular vertical crenulation of these teeth is the most distinct speciality of the Trigonian teeth, *Trigonioides* is considered to be an offshoot from the Trigoniacea, if not of the Trigoniidae, s. str. It represents an independent family of the Trigoniacea for which the Trigonioididae are accepted."

As a study in further detail OTA (1959) arrived at the same conclusion as KOBAYASHI's. The shell-outline is variable, but mostly subtrapezoidal, ovate or subtrigonal and the elliptical form is uncommon. This genus is generally inequilateral or subequilateral, but it comprises such an equilateral form as *trigonus* from the Senonian in Lower Laos. The umbo of the genus is mostly prosogyrous or orthogyrous, but it happens to be opisthogyrous as in the Laos species. It is a remarkable fact that the Laos species is extraordinarily variable in the outline of shell and umbonal aspects if compared with other species.

Distribution:—Limnic and paralic facies of the Cretaceous system in Eastern Asia: Talatzu series in Southeastern Manchuria; Cretaceous formation at Sanhsing in Eastern Manchuria; Keishu or Kyongji formation, Siragi series and Shinshu or Chinju formation, Naktong series in South Korea; Tetori group in Central Japan; Wakino group in Northern Kyushu; Goshonoura group in the Amakusa Island, Kyushu; Senonian formation of Muong Phalane, in Lower Laos.

Trigonioides tetoriensis MAEDA, n. sp.

Pl. 12, figs. 1-9.

Description:—Shell small in size, subtrigonal in outline, about 1.5 times as long as high, inequilateral, relatively short and broadly rounded in front, prolonged and subpointed behind, well inflated: test rather thick. Postero-dorsal margin long, nearly straight or gently curved, oblique to ventral, gradually sloping into posterior margin; posterior margin weakly curved, truncated and then bent forward into ventral margin with acute angle near the base-line; ventral margin long, broadly arched, gradually going over into anterior margin which is well rounded; antero-dorsal margin short, obliquely sloping and weakly arched. Umbo prominent, incurved and directed forward, projected above the hinge-margin and placed at a point about one-third of the length of the shell measured from the anterior extremity. Posterior ridge distinct, extended from the umbo to the postero-ventral corner; posterior area narrow and lanceolate. Surface ornamented with concentric wrinkles and many radial ribs forming acute Vs; radial ribs in anterior half of disk fine, narrowly

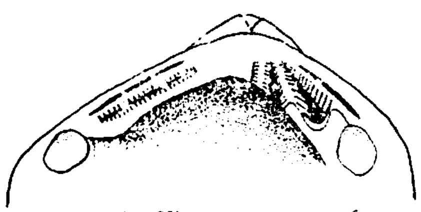


Fig. 1. Hinge structure of *Trigonioides tetoriensis*

spaced and counted about 15, but ribs in posterior half strong, widely spaced and about 10; ribs on the antero-dorsal area very fine and branching off downwards from anterior weak ridge; ribs on the posterior area strong and branching off from posterior ridge to postero-dorsal and posterior margins; concentric wrinkles somewhat strong and irregularly spaced. Hinge teeth well developed, characteristic of the genus:

$$\frac{(5a)^{*}\quad 3a\quad 1a\quad 1b\quad 3b}{4a\quad 2a\quad 1'\quad 2b\quad 4b}$$

4a along hinge margin, fairly strong and regularly crenulated on lower side, but the crenulation on the upper side is unknown. 2a strong, crenulated on both sides, and oblique to hinge margin with about 30°. 1′ short, crenulated on both sides, and oblique to hinge margin (about 60°). 2b fairly long, parallel to hinge margin, regularly crenulated on both sides; the crenulation on the lower side somewhat fine and ill-developed, whereas on the upper side fairly strong and well developed. 4b lamellar, long and crenulated only on the lower side.

Anterior adductor scars subovate in outline, fainly impressed; posterior one nearly equal to anterior and indistinct. Pallial line simple. Inner side of the

* 5a is not observable because of ill-preservation.

Measurements:—

Rg. number	Valve	Length	Height	Width
R. 61121701 (Holotype)	Left	33+	24	9
R. 61121702	Left	36	24	9
R. 61121703	Right	27+	24	9
R. 61121704	Left, Right	32+	23	17
R. 61121705	Right	30+	22	6+
R. 61121706	Left	30	21	5+

shell ornamented by V-shaped radial ribs; and ventral margin distinctly crenulated.

Comparison:— Most specimens are more or less imperfect and often strongly deformed by rock pressure. The principal teeth on each valve are well preserved, but a median tooth below the umbo is ill-preserved. Of the hinge structure it is an interesting fact that the posterior principal tooth is fairly longer than the anterior one.

This new species resembles *Trigonioides kodairai* KOBAYASHI and SUZUKI (1936, 1941) in general aspect, but it is easily distinguishable therefrom by anteriorly situated umbo, density of ribs on the antero-half disk and widely spaced grooves on the postero-half disk. It is also related to *Trigonioides kobayashi* HOFFET (1937) from Muong Phalane in Indochina, but can be distinguished from this species by the sculpture and outline. The sculpture of this species is fairly similar to that of *Nippononaia ryosekiana* SUZUKI (1941) and *N. asinaria* REESIDE (1957), but the two genera are different in the hinge structure.

Occurrence:—Kitadani alternation of the Akaiwa subgroup, the upper division of the Tetori group: a point on the right bank of the Nakanomata River, north of Sugiyama, Kitadani Village, Fukui Prefecture.

Trigonioides kitadaniensis MAEDA, n. sp.

Pl. 12, figs. 10-16.

Description:—Shell small in size, ovate or subtrapezoidal in outline, nearly as long as high, subequilateral, gently rounded in front, subtruncated behind, well inflated; test more or less thick. Postero-dorsal margin relatively short, nearly straight, oblique to ventral, gradually sloping into posterior margin which is gently curved, truncated and bent into ventral margin with acute angle near the base-line; ventral margin long, broadly arched and slightly sinuated in middle, gradually transmitting into anterior margin which is well rounded; antero-dorsal margin short, obliquely sloping and weakly curved. Umbo prominent, opisthogyrous, incurved, placed at a point about two-fifths length of the shell measured from the anterior extremity and fairly projected above the hinge line. Posterior ridge well marked, especially distinct in the earlier stage but somewhat obtuse in the later. Posterior area narrowly triangular. Surface ornamented with radial ribs, crossed by concentric wrinkles; several ribs in middle converged to form acute Vs on a line through umbo; radial ribs in anterior half of disk fine, especially so and narrowly spaced towards the anterior end, and counted about 19, but the ribs in posterior half fairly strong, widely spaced and counted about 9; ribs on the antero-dorsal area very fine and branching off downwards from anterior weak ridge to antero-dorsal and anterior margins; ribs on the posterior area as strong as those in posterior half of disk and branching off from posterior ridge to postero-dorsal and posterior margins; concentric wrinkles obtuse and unequally spaced. Hinge well developed;

$$\frac{5a\quad 3a\quad 1a\quad 1b\quad 3b}{4a\quad 2a\quad 1'\quad 2b\quad (4b)^*}$$

4a along hinge margin, strong and crenulated. 2a short, strong, crenulated on both sides, and oblique to hinge margin (about 30°). 1′ short, crenulated on posterior side, but invisible on anterior

* 4b is not observable on the ill-preserved specimens.

side by ill-preservation. 2b long and crenulated. Anterior adductor scars subovate in outline, indistinct; posterior one nearly equal to anterior.

Measurement:—

Rg. number	Valve	Length	Height	Width
R. 61121711	Right	36	18	8
R. 61121712	Right	32	20	7
R. 61121713	Right, Left	30	20	14
R. 61121714	Left	27+	22	7
R. 61121715	Right	26	19	6
R. 61121716 (Holotype)	Left	25	18	5

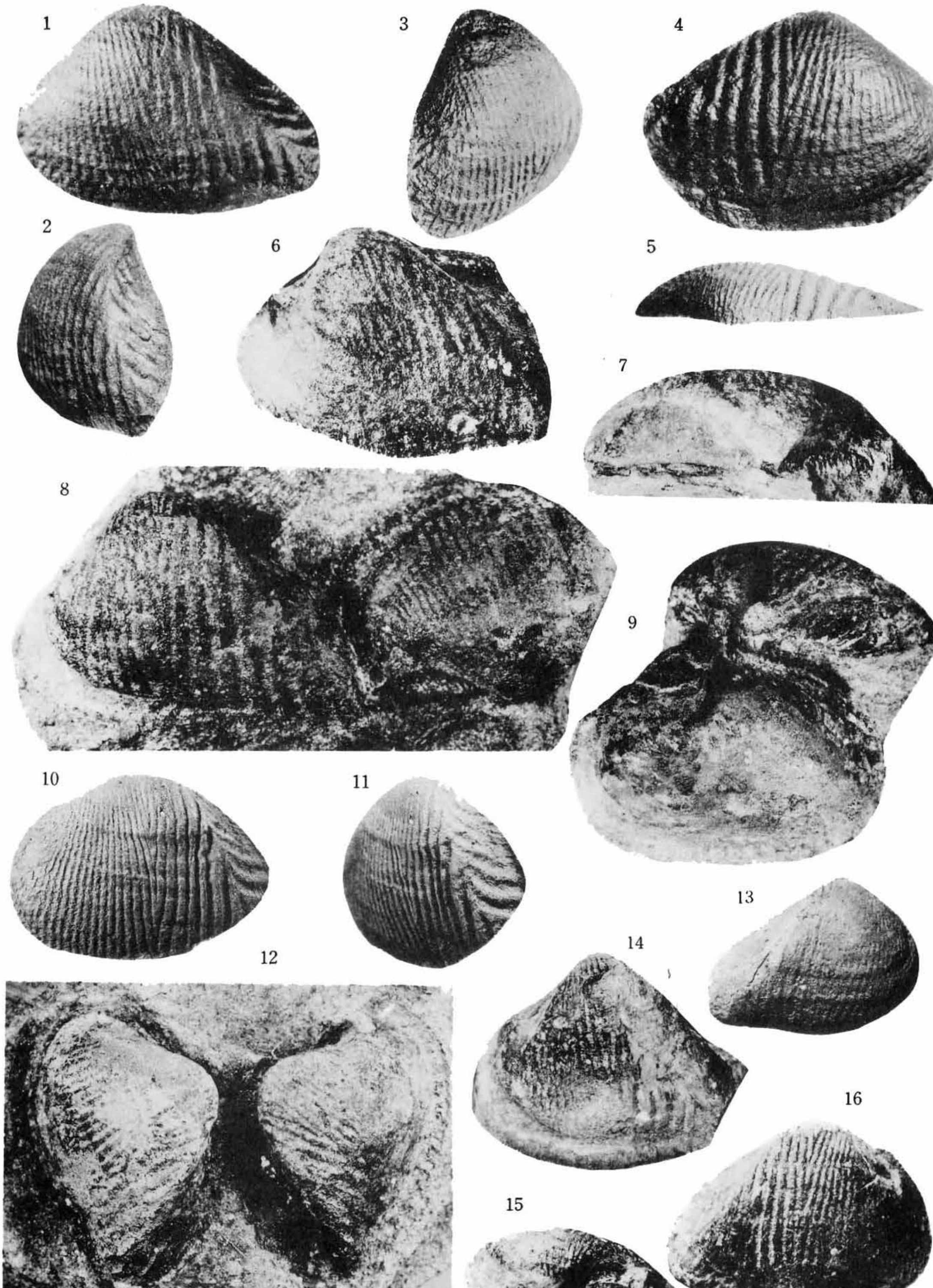
Comparison:—The radial ribs and shell-outline of this species closely resemble those of *T. kodairai*, especially KOBAYASHI and SUZUKI's form from the Naktong series in South Korea (1936), but the former differs from the latter by the anteriorly situated umbo, deep and somewhat broadly spaced grooves in the posterior half of the disk and the number of ribs. This new species is also related to *T. tetoriensis* from the same locality, but the former is easily distinguishable from the latter by the outline of the shell and the number of

Explanation of Plate 12

Trigonioides tetoriensis MAEDA, n. sp. .... Page 81
- Fig. 1. Modeling cast of left valve, paratype (R. 61121706). ×1.5
- Fig. 2. Posterior view of the preceding specimen. ×1.5
- Fig. 3. Anterior view of the preceding specimen. ×1.8
- Fig. 4. Modeling cast of right valve, paratype (R. 61121705). ×1.5
- Fig. 5. Umbonal view of the preceding specimen. ×1.5
- Fig. 6. Internal mould of the holotype (R. 61121701). ×11.5
- Fig. 7. Umbonal view of the holotype. ×2.0
- Fig. 8. Internal mould of left valve, paratype (R. 61121702). ×1.5
- Fig. 9. Internal mould of the paratype (R. 61121704). ×1.5

Trigonioides kitadaniensis MAEDA, n. sp. .... Page 83
- Fig. 10. Clay cast of left valve, holotype (R. 61121716). ×1.5
- Fig. 11. Posterior view of holotype. ×1.5
- Fig. 12. Internal mould of paratype (R. 61121713). ×1.5
- Fig. 13. Clay cast of right valve, paratype (R. 61121712). ×1.0
- Fig. 14. Internal mould of imperfect left valve, paratype (R. 61121714). ×1.5
- Fig. 15. Umbonal view of the preceding specimen. ×1.2
- Fig. 16. Internal mould of right valve, paratype. ×1.5

All of the illustrated specimens are kept in the Institute of Geology, College of Arts and Sciences, Chiba University, Chiba. Locality: Kitadani alternation of sandstone, shale and tuffaceous rock in the Akaiwa subgroup, the upper division of the Tetori group, in Kitadani-village, Ono county, Fukui Prefecture.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ribs. Though *Nippononaia ryosekiana* by SUZUKI in 1941 from the Ryoseki group and *N. tetoriensis* by the writer (1962) from the Itoshiro subgroup, the middle division of the Tetori group, show some resemblances to this new species in sculpture, this differs from the others by the hinge nature and shell-outline.

Occurrence:—Rarely occurs with *T. tetoriensis* in the Kitadani alternation of the Akaiwa subgroup, the upper division of the Tetori group: a point on the right bank of the Nakanomata River, north of Sugiyama, Kitadani Village, Fukui Prefecture.

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Amakusa Island	天草島
Kitadani Village	北谷村
Nakanomata River	中ノ俣川
Ono County	大野郡
Sugiyama	杉山

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 51, pp. 86-90, pl. 13, Sept. 10, 1963

453. SOME LOWER ORDOVICIAN TRILOBITES FROM FRANKLIN MOUNTAINS, TEXAS*

CHUNG-HUNG HU

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テキサス州 Franklin 山脈産奥陶紀前期三葉虫：El Paso limestone の中で 5 属 5 種及び 1 種不明の三葉虫を採集した。その時代は Utah 州の Garden City formation 及び Nevada 州の Pogouip formation の中にある Zone G-2 及び Zone J に対比する事が出来る。 胡 忠 恒

Introduction

The materials of this small report were collected from the Franklin Mountains, El Paso, Texas. In the spring of 1958, Drs. G. HENNINGSMOEN, C. L. BALK and the writer had a chance to visit this area for a few hours. The Lower Ordovician El Palso limestone crops out along the road side of the Scenic Drive, at the south end of the Franklin Mountains. The Franklin Mountains contain a very important stratigraphic and paleontologic Lower Paleozoic section for the southern part of the United States.

Edwin KIRK (1934), P. E. CLOUD, Jr. and V. E. BARNES (1946), and R. H. FLOWER (1953) have made detailed stratigraphic studies in this section. The total thickness of this section, from their measurements, is about 1590 feet; but there may be slight variations in different positions as Dr. FLOWER points out. Lithologically the formation contains limestone, dolomites and thin layers of dolomitic sandstone. CLOUD and BARNES (1946) divided the formation into five units as A, B1, B2a, B2b and C. It overlies the Bliss sandstone (Ord. ?) and is overlain by the Montoya group of Upper Ordovician age. The materials described in this report were collected from two different localities; Locality No. 1, is down from the Telescope position about 80 m., along the left side of the Scenic Drive, in calareous shales in unit 5 of FLOWER (1953); Locality No. 2, is in unit 2 of FLOWER (1953), in the low cliff approximately 15 m. above the Telescope position. All of these localities may be located in the middle part of B2b and lower part of B2a of CLOUD and BARNES' divisions. The lithologic and the paleontologic studies of this two localities listed as follows:

Loc. No. 2, Dark gray sandy limestone, about one foot in thickness, has abundant fossils.

Aponileus latus HU, n. gen. et sp.
Isoteloides franklinensis HU, n. sp.
Ptyocephalus declivatus (ROSS)
Goniotelina cf. *G. brighti* (HINTZE)

Loc. No. 1, Dark colored calcareous shale, about one foot in thickness, contains fossil fragments.

Ptyocephalus sp.
Protopliomerella contracta (ROSS)

* Received Aug. 15, 1962; read Sept. 29, 1962.

Of the geologic age of this formation, Dr. FLOWER states (1953), "The El Paso extends throughout the Canadian interval. The basal beds are known to be equivalent of the Tanyard and Gasconade, the highest beds are the equivalent of the Black Rock of Missouri and the Odenville of Alabama." In this report, the fauna of loc. No. 1, correlates with ROSS' (1951) and HINTZE's (1952) Zone G-2 of the Garden City formation of NE. Utah, and the Pogonip formation of W. Utah and E. Nevada. The fauna from loc. No. 2, is certainly correlated with ROSS' and HINTZE's Zone J, in the same formations and localities as above.

Acknowledgments:—The writer is greatly indebted to Dr. C. L. BALK, the professor of N. M. Institute of Mining and Technology, for her supervision. Thanks to Dr. T. P. KÊ, the professor of Taiwan Normal University, for his personal help during my stay in Taiwan, China, doing this work in 1960.

Systematic Descriptions

Genus *Aponileus* HU, n. gen.

Description:—Cranidium is largely occupied by the glabella, which is strongly expanded and convex in the anterior, without anterior brim. Eye located backward from the middle line of the cranidium, with broad palpebral lobe. Glabellar furrows faint. Occipital and dorsal furrows are rather wide and shallow. Posterior lateral lobes are narrow and slender.

Free cheek is strongly convex and narrow, with rounded spineless genal angle.

Associated pygidium is approximately semicircular in outline and convex; surface smooth or finely impressed by dorsal and pleural furrows. No marginal spine or pygidal spine.

Surface is smooth or covered by wrinkles.

Comparison:—This genus is most like *Nileus*, but the glabella seems to be wider at both ends than the middle, while in *Nileus* it is broad and of the same width throughout. The posterior lateral lobes are larger. The pygidium has a less prominent axis.

Type species:—*Aponileus latus* HU, n. sp.

Aponileus latus HU, n. gen. et. sp.

Pl. 13, figs. 27-31

Barrandia? sp. HINTZE, 1952, p. 137, pl. 26, figs. 15, 16.

Description:—This species is represented by several incomplete cranidia, free cheeks, and a few well preserved pygidia, found at locality No. 2. The cranidium is convex and strongly expanded anteriorly. Glabella wider at the both ends than in the middle, without or with very fine marked glabellar furrows. Dorsal furrows are very shallow, broad, and fine impressed. Occipital furrow well defined. Frontal margin curving down, somewhat abruptly in front, and surrounded by a fine marked ridge.

Fixed cheek narrow, characterized by broad, medium in height, and steeply sloping palpebral lobes. Anterior facial suture diagonal, cutting the fixed cheek with a rounded angle. Posterior lateral lobe rather slender.

Free cheek narrow, convex, marked by a wire-like ridge along the lateral margin, which becomes obsolete as it rounds the genal angle. Eyes are largely rounded.

Pygidium is semicircular in outline, convex, with fairly defined axis. Pleural furrows are not observed. No pygidal spine.

Surface marked by fine wrinkles along the frontal margin of the cephalon and posterior margin of the pygidium.

Remarks:—HINTZE (1952) figured two small and incomplete cranidia, which he assigned to WALCOTT's *Barrandia*? sp. The cranidia show a shallow occipital furrow and clearly defined dorsal furrows, and are very similar to the writer's specimen in figure 30. They may quite possibly represent immature forms of this species.

Holotype:—Cranidium, U.S.N.M. 143342
Paratype:—Cranidium, U.S.N.M. 143343a
Free cheek, U.S.N.M. 143343b
Pygidia, U.S.N.M. 143343c, d

Genus *Isoteloides* RAYMOND, 1910

Isoteloides franklinensis HU, n. sp.

Pl. 13, figs. 1-9

Diagnosis:—Cephalon and pygidium are low, with flattened marginal border. Dorsal furrow shallow. Glabella broad, low but distinct, slightly expanded anteriorly and posteriorly. Eye situated at about transverse mid-line of cephalon. Palpebral lobe medium or small in size. Free cheek flat and with a genal spine of medium length. Hypostoma with broadly rounded lateral margin, and broad notch in posterior margin. Pygidium rounded to triangular in outline, with well defined axis.

Comparison:—In general features, this species closely resembles *I. polaris* POULSON (in HINTZE, 1952), but some of the minor characteristics can be distinguished: the anterior facial sutures are slightly diagonal; the hypostoma wider and shorter; the pygidium somewhat triangular in outline, while that of *I. polaris* is rounded.

Remarks:—This is a quite common species at loc. No. 2. The whole shield seems larger than any other species known at this locality. The largest cranidium is about 2.3 cm. in length (sag.), the pygidium about 2.1 cm. in length (sag.), and the free cheek about 3.5 cm. long.

Holotype:—Cranidium, U.S.N.M. 143344
Paratype:—Cranidium, U.S.N.M. 143345a
Pygidia, U.S.N.M. 143345b, c, d
Free cheek, U.S.N.M. 143345f
Hypostoma, U.S.N.M. 143345e

Genus *Ptyocephalus* WHITTINGTON, 1948

Ptyocephalus declivatus (ROSS)

Pl. 13, figs. 10-14

Kirkella declivita ROSS, 1951, p. 91, pl. 21, figs; 1-12, pl. 22, figs. 4, 5 and pl. 23, figs. 1-3.
Kirkella declivita, HINTZE, 1952, p. 183, pl. 15, figs. 3, 4, 9-12.

Remarks:—A few small and well preserved specimens were collected from loc. No. 2. The largest cranidium is about 6.2 mm. in length (sag.), and the pygidium about 4.5 mm. in length (sag.). ROSS (1951) and HINTZE (1952) figured two incomplete cranidia, several free cheeks and pygidia. In this paper the best preserved cranidium is figured. The specimens are all small.

Figured specimens:—Cranidia, U.S.N.M. 143346a, b
Pygidia, U.S.N.M. 143346c, d

Ptyocephalus sp.

Pl. 13, figs. 24-26

Remarks:—Several well preserved pygidia are found from locality No. 1, but no cranidium and free cheek are known. The pygidium is quadrangular in outline, with a clearly defined axial lobe and broad marginal rim. This looks more like a species of *Ptyocephalus* than *Aulacoparia* or *Asaphellus*. The specimens of this unknown species are much larger than *P. declivatus*.

Figured specimens:—Pygidia U. S. N. M. 143347a, b

Genus *Goniotelina* WHITTINGTON, 1953

Goniotelina cf. *G. brighti* (HINTZE)

Pl. 13, figs. 15–20

Goniotelus brighti HINTZE, 1952, p. 158, pl. 26, figs. 1–6.

Discussion:—This species is represented by quite a few cranidia, free cheeks and pygidia, found at locality No. 2. Unfortunitely, all of the specimens are partly broken, so that some of the minor features can not be well compared with HINTZE's figures (1952).

HINTZE (1952) has put this species in the genus of *Goniotelus*, because "the terminal spine is an extension of the pleural platform and brim, not of the axis as in *Fleutherocentrus*" i. e. *Goniotelina*. The general features of *Goniotelus* as compared to those of *Goniotelina* are; (1) the eye lobe is smaller and situated a little forward, (2) the glabella is expanding forward with distinct lateral furrows, (3) the pygidium has a shorter and more slender pygidal spine, (4) the occular platform of the free cheek is narrower. These characteristics are quite easily distinguished between these two genera. As a result, the writer would like to propose that HINTZE's species should be placed in *Goniotelina* rather than in *Goniotelus*.

Goniotelina cf. *G. brighti* differs from the type species *G. williamsi* in having slightly more forward palpebral lobes, broader posterior lateral border, and the pygidinm deeply marked by two pairs of pleural furrows, and the posterior axial furrow distinctly impressed.

Figured specimens:—Cranidia, U.S.N.M. 143348a, b
Free cheek, U. S. N. M. 143348c
Pygidia, U. S. N. M. 143348d, e

Genus *Protopliomerella* HARRINGTON, 1957

Protopliomerella contracta (ROSS)

Pl. 13, figs. 21–23

Protopliomerops contracta ROSS, 1951, p. 136, pl. 33, figs. 15–19.
Protopliomerops aff. *contracta* ROSS in HINTZE, 1952, p. 207, pl. 22, figs. 11, 18–20.
Protopliomerella contracta (ROSS), HARRINGTON in MOORE 1959, p. 443, figs. 4a–c.

Remarks:—This species is represented by a few poorly preserved specimens found at locality No. 1. All of the features are most similar to those of *P. contracta* (ROSS). However, the glabella appears slightly subquadrangular in outline, and not as in ROSS' or HINTZE's specimens with a truncato-concial shape, but this might be due to deformation.

The associated pygidium has a weathered surface, but does show the same feature.

Figuaed specimens:— Cranidium, U. S. N. M. 143349a
Pygidium, U. S. N. M. 143349b

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Explanation of Plate 13

Figs. 1-9. *Isoteloides franklinensis* HU, n. sp. From loc. No. 2.
- 1. Holotype, cranidium. ×3.5, U. S. N. M. 143344
- 2. Paratype, cranidium. ×2, U. S. N. M. 143345a
- 3, 5. Paratypes, dorsal views of three complete pygidia. ×1.4, ×2.7, ×4, U. S. N. M. 143345b, c, d
- 6. Paratype, an incomplete hypostoma. ×4, U. S. N. M. 143345e
- 7, 8. Side views of 1 and 3
- 9. Paratype, a poorly preserved free cheek. ×2.2, U. S. N. M. 143345f

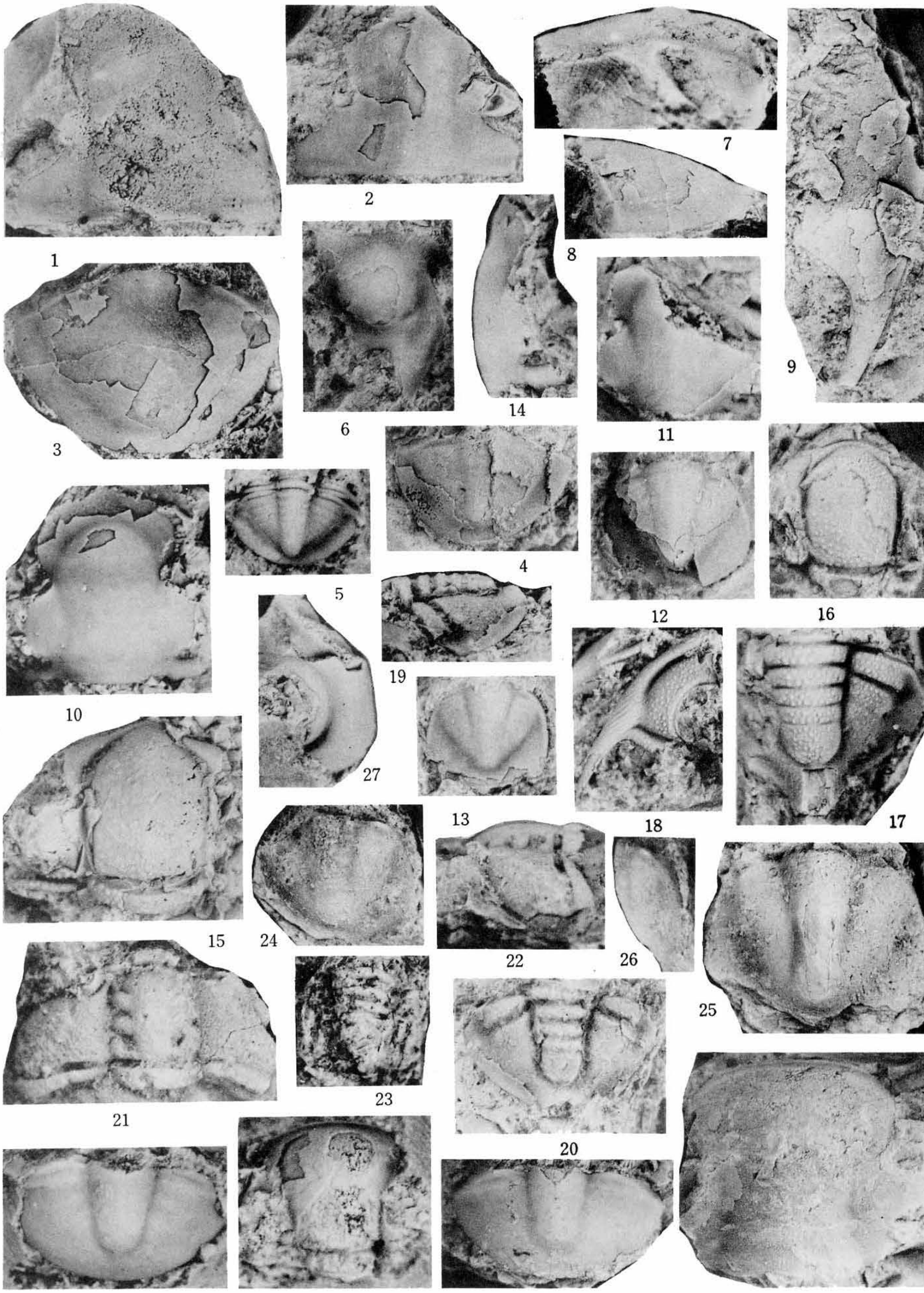
Figs. 10-14. *Ptyocephalus declivatus* (ROSS) From loc. No. 2.
- 10. A well preserved cranidium. ×5, U. S. N. M. 143346a
- 11. A broken cranidium. ×6, U. S. N. M. 143346b
- 12, 13. Dorsal views of two complete pygidia. ×3.5, ×4.5, U. S. N. M. 143346c, d
- 14. Side view of 10

Figs. 15-20. *Goniotelina* cf. *G. brighti* (HINTZE), From loc. No. 2.
- 15, 16. Dorsal views of two incomplete cranidia. ×3, U. S. N. M. 143348a, b
- 17. Top view of a broken pygidium. ×5, U. S. N. M. 143348d
- 18. Top view of a complete free cheek. ×5.5, U. S. N. M. 143348c
- 19, 20. Dorsal and side views of a pygidium. ×2.5, U. S. N. M. 143348e

Figs. 21-23. *Protopliomerella contracta* (ROSS), From loc. No. 1.
- 21, 22. Dorsal and side views of a slightly deformed cranidium. ×7, U. S. N. M. 143349a
- 23. Dorsal view of a poorly preserved pygidium. ×7, U. S. N. M. 143349b

Figs. 24-26. *Ptyocephalus* sp. From loc. No. 1.
- 24, 25. Top views of two nearly complete pygidia. ×2.5, U. S. N. M. 143347a, b
- 26. Side view of 24

Figs. 27-31. *Aponileus latus* HU, n. gen. et. sp. From loc. No. 2.
- 27. A broken free cheek, paratype. ×4, U. S. N. M. 143343b
- 28, 29. Paratypes, dorsal views of two well preserved pygidia. ×5, ×3, U. S. N. M. 143343c, d
- 30. Paratype, top view of a poorly preserved cranidium. ×6, U. S. N. M. 143343a
- 31. Holotype, a broken cranidium. ×2.7, U. S. N. M. 143342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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 51. pp. 91-101, pls. 14, 15, Sept. 10, 1963

454. *PSEUDAMIANTIS*, A PELECYPOD GENUS*

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Pseudamiantis と云う名の二枚貝：第三紀の *Pitar* に似て，殻表面に放射条を有する *Pseudamiantis* が石川県金沢付近の大桑層から産出することは，可成り古くから知られている。所謂「大桑一万願寺動物群」に属する種としては，不思議とその分布が限られて居り，他地域からの報告には，ついぞ接したことがなかった。ところが最近菅野三郎が北海道瀬棚層より報告した "*Saxidomus*" は，あらゆる点から判断して *Pseudamiantis* であると思われるふしが多々ある。一方，福島県下の棚倉化石層として有名な貝化石群の中からも，稀にではあるが産出することがわかった。他方，九州の白亜紀層から "*Callista*" (*Pseudamiantis*) *crenulatus* MATUMOTO が報告されている。幸いにして同種の模式標本及び保存良好な数個体をみる機会を得たが，白亜紀の種は第三紀のものに類似するよりも，むしろ相違する点の方が多く，同一のグループに含めるのはあまり好ましくないと結論するに至った。従って第三紀層産の三地域の標本と，黒田・波部の記載を比較検討して，あまりなじみのない同属について紹介すると共に，類似する *Pitar*, *Callista* の一部と若干比較してみる次第である。

岩崎泰穎

Introduction

A venerid pelecypod *Pseudamiantis tauyensis* (YOKOYAMA), originally called *Meretix tauyensis*, has long been known from the Pliocene formations in Ishikawa and Toyama Prefectures. Genus *Pseudamiantis* was proposed by KURODA in 1933 as a subgenus of *Callista*, and *M. tauyensis* was designated for the type species. Afterward, HABE (1951) raised it to the generic rank. In 1962, KANNO described *Saxidomus ezoensis* from the Setana formation of Hokkaidô. This, however, in reality belongs to the genus *Pseudamiantis*, and perhaps is conspecific with *P. tauyensis*. Another species of *Pseudamiantis* was recently found from the Higashi-Tanakura group of Fukushima Prefecture. Thus two forms of Tertiary *Pseudamiantis* have so far been known from three different localities.

There is a Cretaceous species called "*Callista*" (*Pseudamiantis*) *crenulatus* MATUMOTO from the Goshonoura (=Gosyonoura) group of Kyushu. However, the generic asignment of this Cretaceous species is doubtful since several essential morphological characters are quite different from those of the Tertiary species.

Thus it can be said that the occurrence of the genus is so far limited to the Neogene.

General information concerned with the genus and its occurrence, as well as description of a new species will be given in this paper.

The occurrence of *Pseudamiantis*

i) Ishikawa Prefecture.

The first occurrence of the genus was reported by YOKOYAMA (1927). He de-

* Received Sept. 27, 1962; read Dec. 1, 1962.

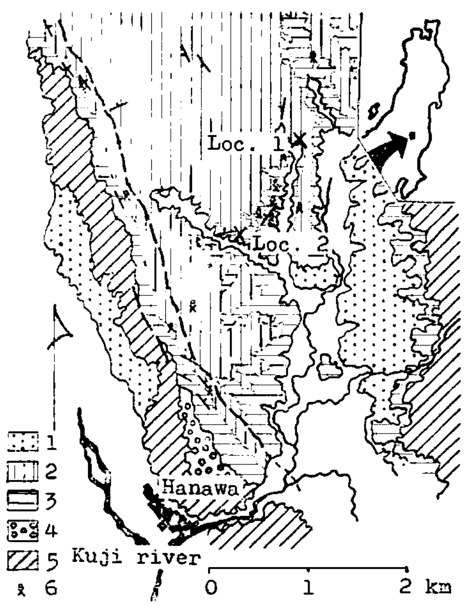
scribed it as a new species of *Meretrix*, and further noted that the species occurred in the loose sand beds distributed at Okuwa and Kami-Tauyé (=Kami-Tagami). These sand beds may be identical with those belonging to the Pliocene Omma formation. Abundant well-preserved molluscan fossils occur in the bluish fine sandstone of the lower part of the formation, though they do not form a definite horizon of fossils. *Pseudamiantis tauyensis* is common in some localities, Okuwa, Kami-Tagami and Nagae, near Kanazawa city. It is, however, rarely found in other localities. Among the associated species, *Turritella saishuensis*, *Acila insignis*, *Glycymeris yessoensis*, *Patinopecten kurosawensis*, *P. tokyoensis*, *Clinocardium fastosum*, *Angulus venulosa* and *Diplodonta usta* are prominent. These molluscs together with *Pseudamiantis* constitute the "Omma-Manganji fauna", one of the typical Tertiary faunas characteristic of the Pliocene of the Japan Sea coast area.

ii) Hokkaidô.

The second occurrence of *Pseudamiantis* was reported by KANNO, but he described it as *Saxidomus ezoensis* (1962). According to him, it occurs in muddy sandstone of the lower part of the Pliocene Setana formation, at Hanaishi, Imagane-machi, southwestern Hokkaidô. Though the formation is widely distributed and several fossil localities have been reported, this species is found only from one locality, where bluish muddy sandstone is exposed at the right side cliff of the Toshibetsu river, 200 m down-stream from the railway bridge of the Setana line. *Acila vigilia*, *Clinocardium chikagawaense*, *Turritella fortilirata habei*, *Natica severa* and *Ostrea* sp. are said to occur in association with *Pseudamiantis*. Numbers of the species and of individuals are rather small and furthermore specimens are often fragmental. However, KANNO correlated this fauna with those of the "Omma-Manganji".

iii) Fukushima Prefecture.

Recently, a new form of *Pseudamiantis* was found in the Kubota formation in Hanawa-machi, Higashi-Shirakawa-gun, Fukushima Prefecture. The Kubota formation constitutes the uppermost part of the Higashi-Tanakura group. The group, named by OMORI *et al* (1953), is divided by OMORI (1958) into three formations, the Akasaka, Nishigoto and Kubota in ascending order. Numerous



Text-fig. 1. Geological map showing the middle part of Hanawa-machi, where the lower to middle part of the Higashi-Tanakura group is distributed.
1. Terrace deposits; 2. Kubota formation; 3. Akasaka and Nishigoto formations; 4. Basement of the Higashi-Tanakura group, Tertiary conglomerate; 5. Basement of the Higashi-Tanakura group, Pre-Tertiary igneous and metamorphic rocks; 6. Other localities of molluscan fossils.

molluscan shells are found in the sandstone of the lower part of the formation. Molluscs form a shell bed which is traceable approximately 3km in distance. The fauna was studied previously by YOKOYAMA (1931) and later by NOMURA and HATAI (1936). The fauna of this area, characterized by large, inflated and thick shells, appear rather different from the faunas from the other areas noted above. *Pseudamiantis* is found from two localities indicated in Text-fig. 1.

At Loc. 1, the shell bed is being excavated by the Fujita Mining Co. to utilize them for animal foods. The sediment itself consists of micaceous medium sandstone containing pebbles of quartz and gneissose rocks. Foraminifers and ostracods are contained sparsely. The stratum containing molluscan shells attains some 10 m in thickness. Besides, some shark-teeth, and bones of fishes and whales. *Anadara ogawai*, *Dosinia kaneharai*, *D.* "*hataii*", *Trachycardium shiobarense*, *Lucinoma annulatum*, *Mercenaria yokoyamai*, *Diplodonta usta*, *Protothaca tateiwai*, *Ostrea gravitesta* and *Neverita kiritaniana* are found dominantly throughout the outcrop. *Psudamiantis* is very rare in comparison with the above listed molluscan species. Most of shells were probably transported a short distance, but more than half of the pelecypods are still preserved as intact valves.

At Loc. 2, only the upper part of the shell bed is exposed. It consists of somewhat weathered loose micaceous fine sandstone, containing a few foraminifers, and measured about 5 m in thickness. Although numbers of individuals as well as numbers of species are less than those observed at Loc. 1, *Trachycardium shiobarense*, *Anadara ogawai* and *Neverita kiritaniana* occur abundantly. Most of those pelecypod shells are found as conjointed valves. The fact suggests that the shells might be mostly autochthonous at this locality. *Pseudamiantis* is found scarsely.

The Kubota formation is fossiliferous except for its lower part. *Turritella tanagurensis*, *Dentalium yokoyamai*, *Lucinoma annulatum* etc. occur sporadically in the fine sandstone of the middle part. *Chlamys kaneharai*, *Patinopecten paraplebejus*, *Neptunea hukusimensis* etc. are commonly found at several localities in the coarse sandstone of the upper part. These molluscan association being characteristic of the formation are here called "the Tanakura fauna" provisionally. The faunas found in some Miocene to Pliocene formations of the northern Kantô region are in all respects similar to this fauna. Although the specific composition is not the same, the "Tatsunokuchi (=Tatunokuti) fauna" of the Sendai group also has close alliance to this fauna in having similar generic composition and large and thick forms of the shell.

Description

Family Veneridae

Genus *Pseudamiantis* KURODA, 1933

Type species: *Meretrix tauyensis* YOKOYAMA, 1927. (original designation)

HABE (1951, pp. 164, 165) defined the generic characters of *Pseudamiantis* as follows (originally in Japanese): "Shell large, thick; beak placed anteriorly, more or less prominent. Surface with fine radial riblets from umbo and distinct growth lines, with somewhat decussate appearance. Cardinal teeth, three in each valve; in right, anterior and middle cardinals parallel, posterior cardinal distinct and fairly long, anterior laterals two; in left, anterior cardinal narrow and middle cardinal large, posterior cardinai fairly long. Pallial line deeply concave. *Ventral margin crenulated.*"

Supplementary description:—Shell large, equivalve and inequilateral, transversely oval or trapezoidal shaped, not gaping posteriorly. Beak prosogyrous and placed one-third to one-fourth of length from anterior. Surface ornamented with concentric ribs and weak fine radial striae. Pallial sinus deep and wide. *Ventral margin smooth.*

Diagnosis:—*Callista*-like venerid pelecypod having radial striae on surface.

Remarks:—Generic remarks made by KURODA (1933, p. 63) (originally in Japanese) can be summarized as follows: "The type species of *Pseudamiantis* is *Meretrix tauyensis* YOKOYAMA, 1927. The general outline and hinge teeth are analogous to those of genus *Callista*. However, *Pseudamiantis* has numerous radial sculptures on concentric ribs. By this ornamentation it resembles *Venus* (*Antigona*), but its lunule is vague. The character of anterior lateral teeth indicate that *Pseudamiantis* is no doubt a subgenus of genus *Callista*."

In conclusion, the genus is characterized by the following diagnostic features:

i) Shell outline is *Callista* type. It resembles the genera *Amiantis*, *Pitar*, *Saxidomus*, *Mercenaria*, *Protothaca* etc.

ii) Surface is sculptured by concentric ribs with fine and weak radial striae. This is the outstanding feature of the genus.

iii) Dentition is not of *Pitar* but of *Callista* type. However, there are several species of "*Pitar*" in Japanese Tertiary, whose dentition can hardly be differentiated from that of *Pseudamiantis*.

iv) No lunule and escutcheon. Some specimens have weakly defined striation which gives appearance like a margin of lunule.

v) Inner sculpture of the shell: Pallial sinus is wide and deep. Ventral margin is smooth. HABE described that the ventral margin is crenulated. All specimens so far examined, however, including YOKOYAMA's type species, show no crenulations along the inner ventral margin.

"*Callista*" (*Pseudamiantis*) *crenulatus* MATUMOTO (Pl. 15, Figs. 4-7, in this paper) was reported from the Gyliakian Goshonoura group (upper Albian ? and Cenomanian) in Amakusa Islands, Kyushu (MATUMOTO 1938). The species is common in the formations of the same age throughout Shikoku and Kyushu (AMANO 1956). Reexamination of earlier descriptions and observations on the newly collected specimens revealed the following differences between this species and the Tertiary *Pseudamiantis*. Shell size of the Cretaceous species is much smaller in comparison with the Tertiary species. Dentition is rather similar to *Pitar*, that is, socket of the anterior lateral of right valve is continuous to socket between the anterior and the middle cardinals, and lateral tooth of left valve is almost parallel to the margin of hinge plate. Surface is ornamented at least with finer and less rugose concentric striae. MATUMOTO mentioned that "the shell is provided with subinternal fine radial ribs". On the other hand, AMANO noted that "in an external mould of the left valve, radial ribs are impressed more strongly than concentric ribs, numbering about 22 in 1 cm. near middle of ventral portion. But those two sets of ribs are variable in strength, that is, it is nearly same in one specimen, and in other only concentric ribs are preserved". Three well-preserved specimens examined do not show any radial ribs on the surface. Thus the writer has an opinion that so called radial ribs of this species are nothing but the impression of columnar ostracums which are exposed through the slight erosion of shell surface, for example noted by KUBOTA (1949b) and CHINZEI (1961) on *Mercenaria stimpsoni*. "*C*." (*P*.) *crenulatus* has distinct lunule but escutcheon is not distinctly impressed. Pallial sinus is wide and rather deep. Fine distinct crenulations are observed on the inner margin of ventral side.

The presence of marginal crenulation and the absence of distinct radial striae on surface are important criteria to distinguish *crenulatus* from the Tertiary species. Moreover, its dentition is rather close to that of *Pitar* than that of Tertiary *Pseudamiantis*. Further, its ornamentation is similar to that of *Mercenaria*. Therefore, the Cretaceous species could be excluded from *Pseudamiantis*, though no adequate genus to accomodate this species has been found in literatures.

Distribution and geological range:—Upper Miocene formation in Fukushima Prefecture and Pliocene formations in Ishikawa Prefecture and Hokkaidô.

Pseudamiantis will be expected to find from any other localities of the "Omma-Manganji fauna" or the "Tanakura fauna" such as Shiobara of Tochigi Prefecture or Itahana of Gumma Prefecture.

Pseudamiantis tauyensis (YOKOYAMA), 1927

Pl. 14, figs. 1-5

1927 *Meretrix tauyensis*, YOKOYAMA, *Jour. Fac. Sci., Imp. Univ. Tokyo, Sec. 2, Vol. 2, Pt. 4*, p. 178, Pl. 48, Figs. 1, 2.

1959 *Pseudamiantis tauyensis*, MAKIYAMA, *Palaeont. Soc. Japan, Spec. Papers No. 5*, Pl. 59, Figs. 1, 2.

1961 *Pseudamiantis tauyensis*, A Guidebook of Geologic Excursion in the Vicinity of Kanazawa City, Japan. Edited by Hokuriku Branch, Geol. Soc. Japan, Pl. 2, Figs. 25, 32.

1962 *Saxidomus ezoensis*, KANNO, *Sci. Rep., Tokyo Kyoiku Daigaku, Sec. C, No. 73*, p. 60, Pl. 5, Figs. 7a, b, c.

Measurement in mm:—

Reg. No.	valve	length	height	thickness
Kf 4334ab	Right (lectotype) with slightly damaged left valve	87	67	26
82a	〃 (syntype)	ca84	66	24
CM 8779	〃 (hypotype)	68	57	19
CM 8780	〃 (〃)	72	58	20
CM 8782	Left (hypotype)	70	56	19
CM 8783	〃 (〃)	58	47	15
CM 8784	〃 (〃)	66	51	18
CM 8785	〃 (〃)	67	51	18

Remarks:—*Saxidomus ezoensis* KANNO was reported from the Setana formation in southwestern Hokkaidô. Although the main part of the hinge teeth is lacking in the type specimen, *S. ezoensis* might be identical with *P. tauyensis*, because outline, proportions among length, height and thickness, surface ornament and shape of pallial sinus of the two species closely resemble each other.

P. tauyensis is easily distinguishable from other *Callista*-like pelecypods by radial striae on outer surface.

Distribution and geological range:—Kami-Tagami, Okuwa, Nagae and several other localities of the Omma formation in Ishikawa and Toyama Prefectures, Pliocene. Hanaishi in Imagane-machi of the Setana formation in Hokkaidô, Pliocene.

The "Omma-Manganji fauna" is widely distributed in the Pliocene formations on the Japan Sea coast area. But the occurrence of *P. tauyensis* is extremely limited. However, it might be adapted to some environment of restricted areas.

Pseudamiantis pinguis IWASAKI, n. sp.

Pl. 15, figs. 1-3

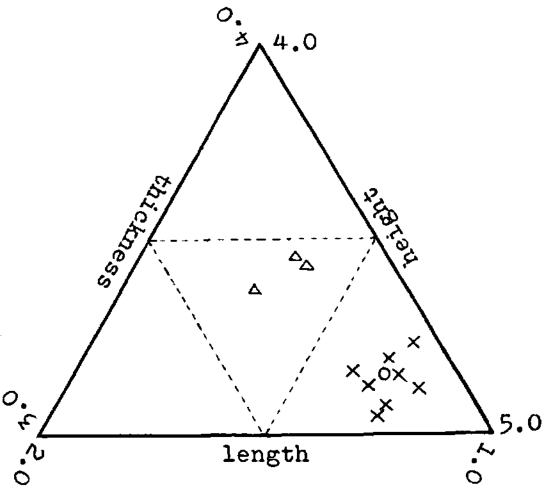
Diagnosis:—*Pseudamiantis* with large and heavy test, with large proportion of thickness against length and height and with roughly striated surface.

Description:—Shell large, strongly inflated, heavily thick, inequilateral and equivalve, ovate in outline but slightly angular at postero-dorsal margin, rather obliquely truncated in posterior. Anterior margin well swollen, slightly concave in front of beak and sharply rounded at end. Ventral margin arcuated. Beak prominent and situated at one-third to one-fourth from anterior. Surface ornamented with distinct concentric ribs. Fine radial striae running from the beak can be seen on the concentric ribs. The striae indistinct on anterior and posterior margins and on ventral margin in mature stage. Concentric ribs become more platy toward anterior and posterior margins. Lunule and escutcheon absent. A shallow depression similar to lunule exists in front of beak. Three cardinal teeth are found in each valve; in left valve, anterior cardinal thin and slightly curved forward, middle cardinal large, thick and triangularly shaped, posterior cardinal rather thin and long, running along the nymph. Anterior lateral tooth conical in form, prominent and stretching its base toward beak: In right valve, anterior and middle cardinals parallel and vertical, posterior cardinal rather thick and bipartite in its top, anterior lateral teeth weak, but socket between them deeply concave. Pallial sinus conspicuous, deep, and rounded in its end. No crenulations on inner ventral margin.

Measurement in mm:—

Reg. No.	valve	length	height	thickness
CM 8776	Left (holotype)	90	76	33
CM 8777	Right (paratype) with incomplete left valve	86	72	ca31
CM 8778	Left („) with incomplete right valve	57	45	21
CM 8781	„ („) with incomplete right valve	88	77	33

Comparison and remarks:—The large, thick and swollen shell characterizes the new species. Difference between the two species of the genus is found in the proportion among length, height and thickness as seen in Text-fig. 2, where



Text-fig. 2. Diagram showing the difference between *Pseudamiantis tauyensis* (YOKOYAMA) and *P. pinguis* IWASAKI.
× *P. tauyensis*; △ *P. pinguis*; ○ "*Saxidomus ezoensis* KANNO"; L+H+T=10.

the difference in thickness is the most important criterion to distinguish the two species. *P. pinguis* is named for one group having extremely inflated and thick shell. It is, however, also reasonable to consider that the new species may have close relationship to an abnormal form of *P. tauyensis*. The geological evidences of the Higashi-Tanakura group indicate that the group was deposited in an embayment. Thus the new species might be a dweller of the shallow water of some embayments. The inflated shell of *P. pinguis* might be formed under the influence of such an environment.

NOMURA and HATAI (1936) reported one form from the Tanagura (=Tanakura) bed, which contains the "Tanakura fauna", under the name *Pitar itoi* (MAKIYAMA). The species is so ill-preserved that the surface of the shell cannot be examined, but its inflated shape suggests that it is not *Pitar itoi* but may be conspecific with *Pseudamiantis pinguis*.

The new species can be distinguished from other allied species of *Pitar* and *Callista*, for example, from *Pitar sendaica* NOMURA, by its radial striae on shell surface.

Distribution and geological range:—Nishigoto and Hattomaki in Hanawa-machi, Higashi-Shirakawa-gun, Fukushima Prefecture. The species occurs in the lower part of the Kubota formation which is considered to be upper Miocene in age. It is rare but is one of the important constituent of the "Tanakura fauna".

Supplementary notes

The two species of *Pseudamiantis*, *tauyensis* and *pinguis*, are easily distinguishable from the allied species of *Pitar* and *Callista* by their radial striation of the shell surface. However, in other characters *Pseudamiantis* is almost identical with the species listed below.

Pitar itoi (MAKIYAMA), 1926: Lower to middle Miocene formations in Korea and Japan; often associated with the "*Vicarya* fauna".
P. okadana (YOKOYAMA), 1932: Middle to upper Miocene formations in Hokkaidô; accompanied by the "Takinoue fauna" and the "Togeshita fauna".
P. hokkaidoensis NOMURA, 1935: Upper Miocene formations in Hokkaidô; accompanied by the "Togeshita fauna"; closely resembles with *P. okadana*.

P. sendaica NOMURA, 1938: Pliocene formation in Miyagi Pref.; a member of the "Tatsunokuchi fauna".

Callista yamamotoi KUBOTA, 1949: Pliocene formations in Akita Pref.; associated with the "Omma-Manganji fauna".

Meisenia tateiwai MAKIYAMA, 1936: Miocene formation in Korea. This is omitted in the following discussions, because of scarcity of data.

Common characters among these species and *Pseudamiantis* are as follows:

i) Dentition.

$$\frac{\text{AII} \qquad 2a \quad 2b \quad 4b}{\text{AIII} \quad \text{AI} \quad 3a \quad 1 \quad 3b}$$

3a: short and parallel or nearly parallel to 1.

1: large and subvertical.

3b: long, strong and feebly bifid on top.

AI, AIII: small, tubercular of almost obsolete, a deep socket places between AI and AIII.

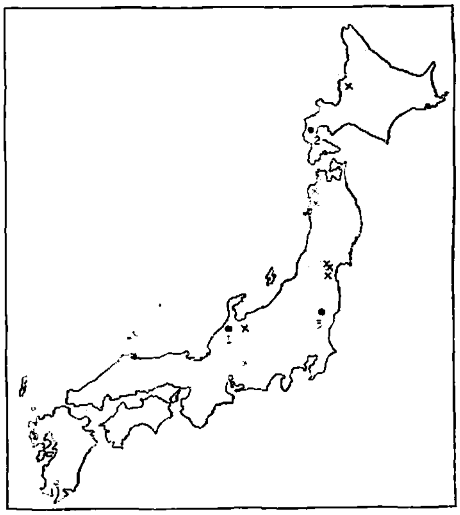
2a: rather small, vertical and platy.

2b: stout and apparently continuous to 2a beneath the beak.

4b: close to the nymph, long and thin.

AII: conical, its base stretches toward the beak.

ii) Shell surface: numerous, rough, irregularly disposed growth lines; lunule usually not recognized; escutcheon indistinct; ventral margin smooth; pallial sinus deeply incremented.



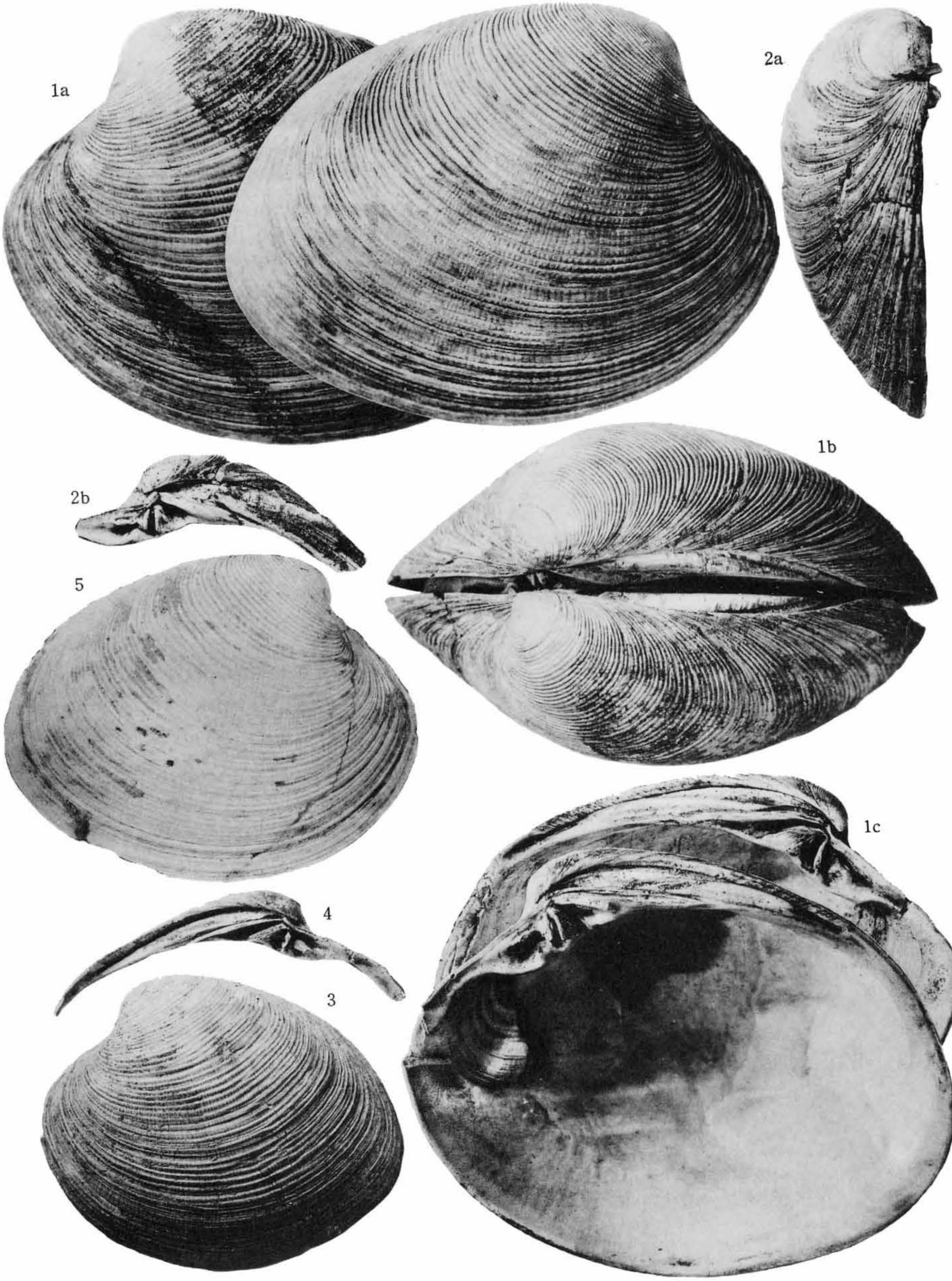
Text-fig. 3. Map showing three localities of *Pseudamiantis*. (1, Omma formation; 2, Setana formation; 3. Kubota formation) and localities of several allied Neogene species to *Pseudamiantis*.

Explanation of Plate 14

(All figures are natural size)

Figs. 1-5. *Pseudamiantis tauyensis* (YOKOYAMA)

1. Right and left valves, Lectotype, Kami-Tagami, Kf 4334ab. Coll. by OZAWA or KOBAYASHI;
   1b. dorsal view
   1c. inner view
   Illustrated by YOKOYAMA, 1927, Pl. 48, Figs. 1, 2.
2. Right valve. Syntype, Okuwa, 82a, Coll. by OZAWA or KOBAYASHI;
   2a. anterior view
   2b. hinge area
3. Left valve, Hypotypo, Okuwa, CM 8783, Coll. by TANABE
4. Hinge area of left valve, Hypotype, Okuwa, CM 8785, Coll. by TANABE
5. So called *Saxidomus ezoensis* KANNO, Right valve, Hanaishi, No. 6125, Coll. and photo by KANNO;
   Illustrated by KANNO, 1962, Pl. 5, Fig. 7a.


1a
2a
1b
2b
5
1c
4
3

iii) Outline: generally ovate or ovate-trigonal, and well inflated. There is considerable variation in outline within a species.

P. tauyensis and *P. pinguis* are allied to *Callista yamamotoi* and *Pitar sendaica* respectively. If the striae will be vanish from the surface, *Pseudamiantis pinguis* is hardly distinguishable from *Pitar sendaica*, the same is true between *Pseudamiantis tauyensis* and *Callista yamamotoi*. The former two species, *pinguis* and *sendaica*, are members of the faunas which are characterized by thick, inflated large shells, whereas the latter two species, *tauyensis* and *yamamotoi*, are members of the Pliocene "Omma-Manganji fauna".

Thus *Pitar*, *Callista* and *Pseudamiantis* mentioned above are similar to one another in many characters. Therefore, in order to settle their taxonomic position one should make detailed observation on the shell surface in addition to the study on the hinge structure. Restudy of these species might prove that some of the so called Tertiary "*Pitar*" would shear their generic position with *Pseudamiantis*.

The study was carried out under the direction of Prof. F. TAKAI of the Geological Institute, University of Tokyo, to whom the writer is greatly indebted. The writer wishes to express many thanks to Drs. T. HANAI and K. CHINZEI of the same institute, and Dr. I. HAYAMI of the Department of Geology, Kyushu University who encouraged him by helpful suggestions and discussions. Thanks are also due to Dr. S. KANNO of the Geol. and Mineral. Inst., Tokyo University of Education, for the opportunity to examine specimens and photographs.

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Explanation of Plate 15

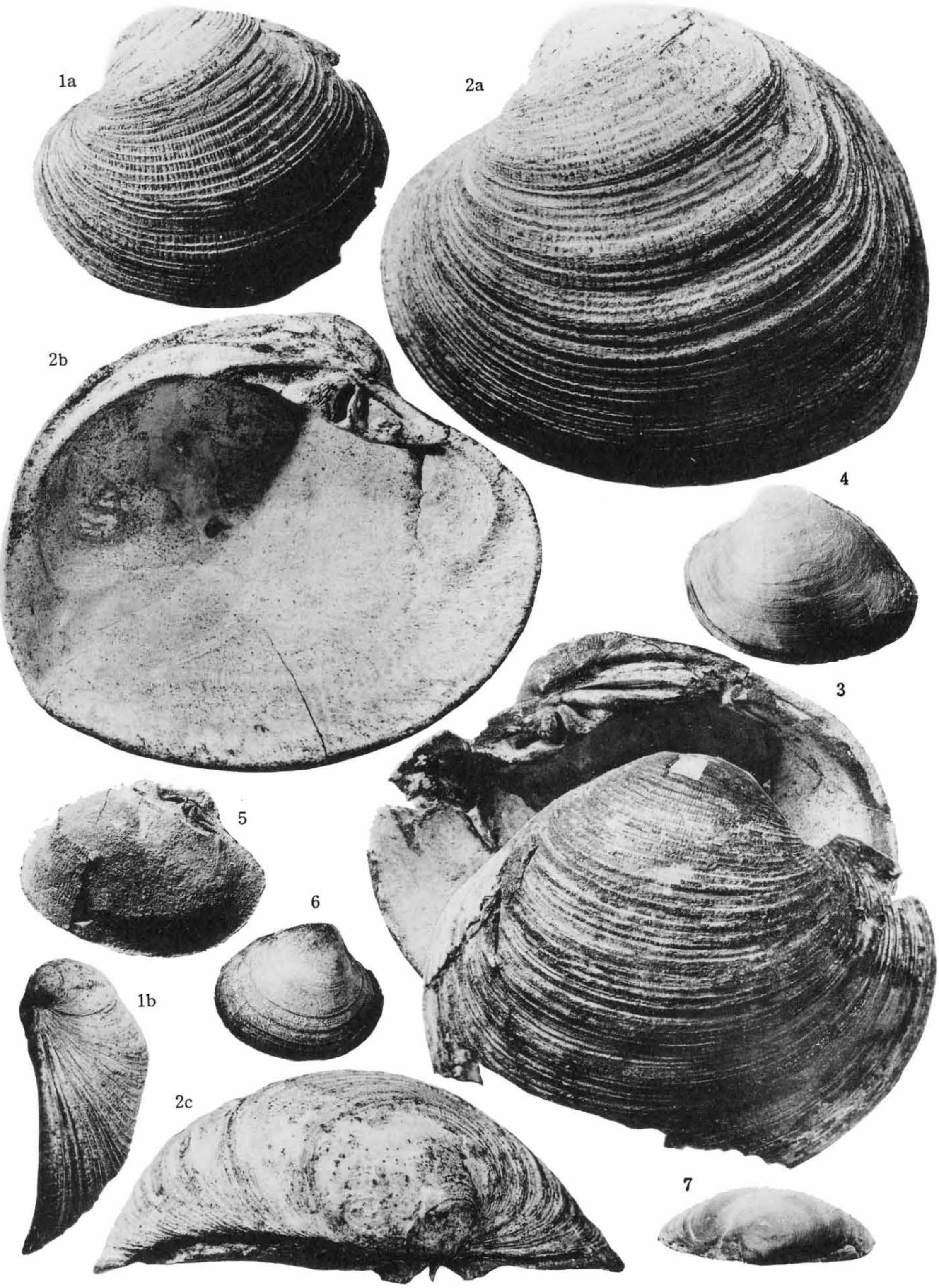
(All figures are natural size)

Figs. 1-3. *Pseudamiantis pinguis* IWASAKI, n. sp.

1. Left valve, Paratype, Nishigoto, CM 8778;
   1b, anterior view
2. Left valve, Holotype, Nishigoto, CM 8776;
   2b, inner view
   2c, dorsal view
3. Right valve, Paratype, Hattomaki, CM 8777.

Figs. 4-7. So called "*Callista*" (*Pseudamiantis*) *crenulatus* MATUMOTO

4. Left valve, Hypotype, *Desmoceras kosmati* bed of the Goshonoura group at Tateishi, Shishijima Island, Izumi-gun, Kagoshima Pref., MM 3823, Coll. by HAYAMI
5. Inner cast of right valve, Holotype, G-64, Kobunenosako, NE of Enokuchi, Goshonoura Island, Amakusa-gun, Kumamoto Pref., MM 7751/1, Coll. by MATUMOTO; Illustrated by MATUMOTO, 1938, Pl. 1, Fig. 5.
6. Right valve, Hypotype, *D. kosmati* bed, Tateishi, MM 3824, Coll. by HAYAMI.
7. Dorsal view of right valve, Hypotype, Ditto, MM 3825, Coll. by HAYAMI.


1a
2a
2b
4
3
5
6
1b
2c
7

Amakusa-gun	天草郡	Izumi-gun	出水郡
Amakusa Islands	天草諸島	Kami-Tagami	上田上
Enokuchi	江ノ口	Kobunenosako	小舟迫
Goshonoura Island	御所浦島	Nagae	長江
Hanaishi	花石	Nishigoto	西河内
Hanawa-machi	塙町	Ôkuwa (Omma)	大桑
Hattomaki	八斗蒔	Shiobara	塩原
Higashi-Shirakawa-gun	東白川郡	Shishijima	獅子島
Imagane-machi	今金町	Tateishi	立石
Itahana	板鼻		

Postscript

After the present manuscript had been completed, HASHIMOTO *et al* (1963) mentioned in the following paper that *Saxidomus ezoensis* KANNO is identical with *Pseudamiantis tauyensis* (YOKOYAMA). (p. 234, foot-note)

HASHIMOTO, W., KANNO, S., SHINADA, Y. and OSHIMA, K. (1963): Geology of the Imagane, Kun'nui and Yakumo Districts, Oshima Peninsula, Hokkaido. *Jour. Geol. Soc. Japan, Vol. 69, No. 812*, pp. 228-238, Pl. 3.

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 51, pp. 102-114, pl. 16, Sept. 10, 1963

455. UPPER CARBONIFEROUS FUSULINIDS FROM THE NAKAHATA FORMATION OF THE HIDA MASSIF—WITH SPECIAL REFERENCE TO FUSULINIDS SIMILAR TO *FUSULINELLA PSEUDOBOCKI* (LEE AND CHEN)

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飛騨山地に発達する上部石炭系中畑層産の fusulinids—特に *Fusulinella pseudobocki* (LEE and CHEN) 類似の fusulinids について：飛騨山地—岐阜県大野郡丹生川村中畑附近に発達する上部石炭系中畑層の fusulinids を検討し，その fauna を記載する。また，この fauna の中に *Protriticites* に属する fusulinids のあることを指摘し，上部石炭系の国際的対比の有用性を吟味する。 石 崎 国 熙

Introduction and Acknowledgements

Studies on the stratigraphy and the paleontology of the Hida Massif in central Japan have been undertaken by IGO (1957, 1956), KANUMA (1953, 1954, 1958a, 1958b), HAMADA (1959a, 1959b), KAMEI (1952, 1955), FUJIMOTO and IGO (1958), MINATO and KATO (1957), and ISOMI and NOZAWA (1957) and others. According to them, the fusulinids from the Carboniferous and the Permian limestone range from the *Millerella* zone to the *Yabeina* zone. The Devonian strata of the massif are characterized by *Favosites*.

The writer had an opportunity to study some thin sections of fusulinids prepared by NISHINO from the Carboniferous Nakahata formation distributed at Nakahata, Niugawa Village, Ono County, Gifu Prefecture in the Hida Massif, and found some interesting features of the spirothecal structure of the fusulinids which occurred in association with the *Fusulinella-Fusulina* assemblage. That is to say, the structure does not appear to be the so-called mural pores which extend through all layers of the spirotheca as in fusulinellids but rather more distinct alveolar keriothecal structure in the outermost volution of the shell at hand.

The writer is inclined to consider that some specimens which have been reported as *Fusulinella pseudobocki* (LEE and CHEN) may have such keriothecal structure in the outermost or even in the penultimate volutions, and consequently, should be assigned to *Protriticites* and not to *Fusulinella*.

In the present paper, brief accounts are given on the stratigraphic relationship of the Carboniferous Nakahata formation with the Permian Junigatake formation based upon paleontologic evidence.

* Received Oct. 1, 1962; read at 82nd meeting of the Society at Tokyo, Sept. 29, 1962.

A total of six species of fusulinids distributed among *Eoschubertella*, *Fusulinella*, *Fusulina* and *Protriticites* are described and one of them is considered to be a new species. An attempt has been made to compare the fusulinid fauna from the present area with those of other regions in Japan, North America, and Russia and determine the time when *Protriticites* first began to appear in association with *Fusulinella* in Japan.

The writer is deeply indebted to Dr. Shoshiro HANZAWA, Professor Emeritus of the Tohoku University for his guidance and suggestions during the course of the present work. Acknowledgements are also extended to Professor Kotora HATAI of the Institute of Geology and Paleontology, Tohoku University, for his critical reading of the manuscript and kind permission to use his extensive library and Professors Kiyoshi ASANO and Jun-ichi IWAI for their encouragement in many ways.

Stratigraphy and Paleontology

In the area near the southern foot of Junigatake, Nakahata, Niugawa Village, Ono County, Gifu Prefecture, the Upper Carboniferous Nakahata formation is of lenticular shape as if due to having been squeezed out and up along the sheared zone whereas the Permian Junigatake formation is extensively distributed in nearly east to west direction dipping at about 60 degrees to the south. Near Nakahata, the Junigatake formation consists mainly in the lower of slate intercalated with an about one meter thick sandstone layer, and the upper comprises slate intercalated with schalstein layers less than three to four meters in thickness.

From the limestone lenses intercalated in the Junigatake formation, *Neoschwagerina* cfr. *margaritae* DEPRAT, *N.* sp., *Verbeekina verbeeki* (GEINITZ), *Parafusulina* aff. *japonica* (SCHWAGER), *P.* sp., *Schwagerina* spp., *Pseudofusulina* cfr. *vulgaris* (SCHELLWIEN) and *P.* sp. were reported. These fossils indicate the upper Sakmarian to the upper Socioian or the Basleoian in age.

On the other hand, from the Nakahata formation, the following fusulinid fossils occurred, namely, *Fusulinella* cfr. *pseudobocki* (LEE and CHEN), *Fusulinella* cfr. *bocki* MÖLLER and *Fusulina* cfr. *cylindrica* FISCHER. In addition to the above, according to ISOMI and NOZAWA (1957), some curious fusulinids, morphologically intermediate between *Fusulinella* or *Fusulina* and *Schwagerina*, and characterized by strong fluted septa, large shell size, thick keriotheca and fusulinellid wall structure in the immature volutions but rather of the schwagerinid type wall structure in the outer volution were found.

The writer is of the opinion that *Protriticites nakanohatensis* described in this article may be identical with the species cited above and with the specimen reported as *Fusulinella pseudobocki* (LEE and CHEN) as stated later.

As the result of studies on the materials stated above, the writer recognized some important bio-characters, such as, the apparent fibrous structure found in the outer volutions do not coincide with the so-called mural pores which extend through all layers of the spirotheca, namely, the four layers—tectum, diaphanotheca and upper and lower tectoria in fusulinellids. Namely, the spirothecal structure is essentially within the keriotheca and does not extend to the tectum.

The difference between the mural pores and typical keriothecal structure is shown in detail by SKINNER and WILDE (1954), the former (fusulinellid) should extend through all four layers whereas the latter only within the keriotheca.

As the conclusion, therefore, the writer is inclined to consider them to be nearer to the schwagerinids than to the fusulinellid.

Forms intermediate between schwagerinids and fusulinellids can be found in Russian and Chinese literatures, and probably *Triticites matsumotoi* KANMERA may be included. Such forms are treated as *Protriticites* in accordance with the Russian and Chinese paleontologists.

Discussion on the Upper Carboniferous

Since the genus *Protriticites* was proposed by PUTRJA, in 1948 for the primitive fusulinids, many congeneric ones have been reported in Russia, China and probably in Japan. Judging from the available data, the genus may be summarized as: Shell medium size, thickly fusiform, with nearly straight axis of coiling. Spirotheca moderately thick, composed of a tectum, diaphanotheca, and upper and lower tectoria in inner volutions, but of only two layers of a tectum and a keriotheca in outer volutions. Rather thick keriotheca usually penetrated by numerous pores as in schwagerinids. Septa rather weakly fluted. Chomata well developed as in *Triticites montiparus* (MÖLLER).

From the summary of the characters, the so-called curious specimen at hand is near to the genus *Protriticites*, especially in the keriothecal structure of the outer volutions.

The species described in this article as *Protriticites nakanohatensis* well coincides with *Fusulinella pseudobocki* (LEE and CHEN) described by IGO (1957) from the Fukuji district, southeastern part of the Hida Massif. The materials at hand show rather discernible alveolar structure in the outermost volution or even in the penultimate volution. Therefore, it is not assignable to *Fusulinella* which is characterized by four layers, a diaphanotheca, tectum, and upper and lower tectoria in most of the volutions.

Concerning *Fusulinella pseudobocki* (LEE and CHEN), IGO described as follows. "Spirotheca thin, composed of tectum, diaphanotheca and upper and lower tectoria. Spirotheca of last volution consists only of tectum and underlying layer, probably diaphanotheca. Lower and upper tectoria different in thickness in several parts of volutions. In some specimens alveoli-like fine dark pillars developed throughout each layers." These features, the writer believes, are near to the genus *Protriticites* and the present specimens.

Concerning the spirothecal structure, *Triticites matsumotoi* KANMERA and its two subspecies recently described by SUYARI (1962) from Shikoku are near to the genus under consideration.

Stratigraphically, the *Fusulinella* zone and/or *Fusulina* zone and *Pseudoschwagerina* zone have wide distribution in Japan. On the contrary, the *Triticites* zone which is situated between the *Fusulinella* zone and/or *Fusulina* zone, and the *Pseudoschwagerina* zone has been hardly known in Japan to date. Because the *Triticites* zone has not been found at many places, some authors, for example MINATO (1942) and YABE (1958), believed that there was a faunal break related with regression or non-deposition, change in the physical condition and both due to the orogenic or epeirogenic movements throughout larger part of the Japanese Islands. Nevertheless, the zone of *Triticites* is known from several areas, especially from the Hida massif, Yayamadake in Kyushu, Okuchichibu in Saitama Prefecture, and Shikoku in Japan.

In North America, a rich fauna mainly of *Triticites* is known from the rocks older than the zone of *Pseudoschwagerina*. This fauna is called the zone of *Triticites*, and characterized by the predominance of elongate forms in the lower part and considerably thick ventricose forms in the upper part. The ventricose thick shell forms seem to be considerably advanced compared with those of the former. Consequently, it seems to be evident that abundant advanced forms of *Triticites* appear prior to the first appearance of *Pseudoschwagerina*. This is good harmony with the Russian succession in terms of fusulinids.

On the other hand, in Japan, the forms of *Triticites* hitherto reported from horizons lower than the zone of *Pseudoschwagerina* consist of primitive forms characterized by thin wall and of four layers in the inner volutions or so, although of two layers in the outer volutions and have distinct chomata, and feebly fluted septa. And the forms comparable with those from the upper part of the *Triticites* zone in Russia and North America are found in Japan in the zone of *Pseudoschwagerina*.

The forms of *Triticites* in Japan that are known from rocks older than the beginning of the zone of *Pseudoschwagerina* comprise comparatively small size individuals which are primitive types. Thus, from such evidence, the Japanese *Triticites* zone so far as known to date, is to be correlated with only the subzone of *Triticites montiparus* (MÖLLER) which is situated in the lowest part of the *Triticites* zone in the Russian platform. Since the upper part of the *Triticites* zone is not developed, we may explain as if there were a hiatus between the *Pseudoschwagerina* zone and the horizon indicated by the subzone of *Triticites montiparus*, in the Russian succession.

The forms of *Pseudoschwagerina* are, as well known, very light looking with thin spirotheca and septa, wide rooms, and have very extensive distribution, much wider than any other genus of fusulinids. Judging from the reason stated above, as already pointed out by BEEDE and KNIKER (1924), they may have led a planktonic life (ROSS, 1961; GORDON, 1962).

The usage of the first appearance of *Pseudoschwagerina* for determination of beginning of the Permian is a universal accepted fact.

In Japan, as accepted by most Japanese authors, the *Triticites* from rocks older than the horizon of *Pseudoschwagerina* comprise primitive types and may indicate the zone of *Triticites* of Japan. The Japanese *Triticites* zone seems to be characterized by the following rather primitive forms of *Triticites*: *Triticites nakatsugawensis* MORIKAWA, *T. nakatsugawensis hemmii* MORIKAWA, *T. opparensis* KANUMA, *T. kiyomiensis* KANUMA, *T. irasensis* KANUMA, *T. yayamadakensis* KANMERA, *T. uemurai* MORIKAWA, *T. exsculptus* IGO, *T. exsculptus naviforme* IGO, *T. hidensis* IGO, *T. saurini* IGO, and *T. sakagamii* IGO. *Triticites matsumotoi* KANMERA is considered to belong to *Protriticites*.

Therefore, it is problematical whether the *Triticites* species in Japan should be employed for correlation of the upper Carboniferous of Japan with foreign countries.

In Russia, *Fusulinella* is reported in association with *Triticites*. That is to say, the range of *Fusulinella* is restricted to the *Fusulinella* zone or Desmoinesian in North America, whereas it extends up to the horizon represented by *Triticites* in Russia. In this concern, MOORE and THOMPSON (1949) explained that in the Russia, the primitive *Triticites* occurs in association with advanced forms of *Fusulina* or *Quasifusulina*. And although the equivalent has not been found in North America, very probably, it corresponds to the hiatus between the Desmoinesian and the Missourian.

However, recent published Russian literatures give the range of *Fusulinella* from the Moscovian to the middle part of the zone of *Pseudoschwagerina* or Sakmarian in Russia. The time span represented by the above is so long that the discordance of them could not be explained by such a simple assumption.

Under the circumstances cited above, *Protriticites* seems to be valuable detail correlation of the Japanese upper Carboniferous and for further discussion.

According to IVANOVL and HVOROVA (1955), in the Russian platform, *Fusulinella pseudobocki* (LEE and CHEN) appears in the lower horizon of the Mjachkov bed (NOVLIN) and *Protriticites* aff. *ovatus* PUTRJA in association with *Fusulinella pseudobocki* in the upper horizon of the former (PESKOV).

Moreover, according to GROZDILOBA and LEBEDEBA (1960), on the western slope of Ural and Timan, *Fusulinella pseudobocki* occurred from the upper part of the Moscovian (Podol bed) from where it ranges up to their *Protriticites* zone which is situated between the so-called *Fusulinella-Fusulina* zone and the zone of *Triticites*. The forms of *Protriticites* were said to be restricted to their *Protriticites* zone.

In Japan the subzone of *Triticites matsumotoi* KANMERA in the Yayamadake area, Kyushu may be correlative with the *Protriticites* zone cited above or, to a horizon higher than the upper part of the Mjachkov bed (Peskov) in Russia.

The horizon in the Hida Massif which yielded the fusulinids described in this article also may be correlative with the horizon stated above, judging from the fusulinid assemblage. Moreover, extending this inference, the subzone of *Fusulinella asiatica* IGO in the Fukuji district of the Hida Massif and the zone of *Triticites* in Shikoku (SUYARI, 1961, 1962) should be correlated with the same horizone or one near to it. The fauna most similar to the one from the present horizon is found in the Akiyama formation and this has been described by KANUMA (1958).

Should our knowledge of *Protriticites* from the Japanese upper Carboniferous be increased, the problems on the correlation using *Fusulinella*, *Fusulina*, and *Triticites* may become more definite and near to the faunal succession of Russia.

Systematic Description

Family Fusulinidae MÖLLER, 1878

Subfamily Schubertellinae SKINNER, 1931

Genus *Eoschubertella* THOMPSON, 1937

Eoschubertella obscura (LEE and CHEN)

Pl. 16, fig. 3.

Schubertella obscura LEE and CHEN, 1930, *Mem. Nat. Res. Inst. Geol. China, no. 9*, pp. 112, 113, pl. 6, figs. 12-22.

Eoschubertella obscura TORIYAMA, 1941, *Jour. Geol. Soc. Japan, vol. 48, no. 579*, pp. 566, 567, text-figs. 10, 11; TORIYAMA, 1944, *Japan. Jour. Geol. Geogr., vol. 19, nos. 1-4*, pp. 77, 78, pl. 6, figs. 18-22; IGO, 1957, *Sci. Repts. Tokyo Kyoiku Daigaku, Sec. C, vol. 5, no. 47*, pp. 187, 188, pl. 3, figs. 9-11; TORIYAMA, 1958, *Mem. Fac. Sci., Kyushu Univ., Ser. D, vol. 7*, pp. 25-27, pl. 1, figs. 10-14.

Table 1. Measurements (in mm) of *Eoschubertella obscura* (LEE and CHEN).

Specimen	Reg. No.	Radius vector p.	1	2	3	H. L.	H. W.	F. R.
N101-1	78374	.044	.048	.112	.200	0.26	0.20	1.30
		Thickness of wall						
		?	.006	.012	.020			

Remarks:—The present specimen is closely allied to *Schubertella obscura* first described by LEE and CHEN from the base of the Huanglung limestone. on the northern slope of the Hunglungshan and Chuanshan of China in many important characters. However, since the present specimen shows three layers of tectum and lower and upper dense layers, they should be included in *Eoschubertella*.

Occurrence:—The present species was collected by NISHINO from the Carboniferous Nakahata formation near the southern foot of Junigatake, Nakahata, Niugawa Village, Ono County, Gifu Prefecture in association with *Fusulinella* aff. *elegantula* ISHII, *F.* cfr. *rhomboides* (LEE and CHEN), *F. jamensis* THOMPSON, PITRAT and SANDERSON, *Fusulina* sp., and *Protriticites nakahatensis* ISHIZAKI, n. sp.

Specimen:—IGPS coll. cat. no. 78374: sample no. N101-1.

Subfamily Fusulininae RHUMBLER, 1895

Genus *Fusulinella* MÖLLER, 1877

Fusulinella aff. *elegantula* ISHII

Pl. 16, fig. 1.

Compared with:

Fusulinella elegantula ISHII, 1962, *Jour. Geosci., Osaka City Univ., vol. 6, art. 1*, pp. 20–22, pl. 10, figs. 20–34.

Remarks:—The specimen at hand is closely allied to *Fusulinella elegantula* ISHII from the Carboniferous Itadorigawa group in Shikoku, but differs from the latter in that the former has the lateral slopes not so strongly convex as the latter, the less strongly tapered polar regions, and the somewhat larger

Table 2. Measurements (in mm) of *Fusulinella* aff. *elegantula* ISHII.

Specimen	Reg. No.	Radius vector p.	1	2	3	4	5	H. L.	H. W.	F. R.
N102-1	78375	.117	.100	.150	.200	.300	.405	1.05	0.45	2.3
		Thickness of wall								
		.010	.014	.016	.024	.020	.016			
		Tunnel angles								
			10	17	19	16	18			

proloculus. But both may be closely allied to one another in the general characters except for the somewhat smaller dimension of the proloculus, and shell shape.

The specimen is somewhat similar to IGO's *Fusulinella asiatica* IGO from the Fukuji district in the Hida Massif, but differs from the latter in the more elongate shell and shape of the chomata.

In the present specimen, the diaphanothecal structure is found even in the last volution and almost throughout the shell to maturity, except for the proloculus where it seems to be a rather thick homogeneous dense single layer. But in some parts of the specimen there seems to be three layers of tectum and upper and lower tectoria.

Specimen:—IGPS coll. cat. no. 78375; sample no. N102-1.

Fusulinella cfr. *rhomboides* (LEE and CHEN)

Pl. 16, fig. 2.

Compared with:—

Neofusulinella rhomboides LEE and CHEN, 1930, *Mem. Nat. Res. Inst. Geol., no. 9*, pp. 119-121, pl. 8, figs. 3-6.

Fusulinella rhomboides CHEN, 1934, *Mem. Nat. Res. Inst. Geol. vol. 14*, pp. 35, 36, pl. 6, figs. 14, 15.

Profusulinella rhomboides TORIYAMA, 1958 *Mem. Fac. Sci., Kyushu Univ., Ser. D, vol. 7*, pp. 33-35, pl. 2, figs. 18, 19.

Remarks:—The present specimen is closely allied to the species from Anshan, Hohsien, and Anhuei, although it is more vaulted and more closely coiled than the typical specimen reported from Huanglungshan, Lungtan. The present species expands more slowly, especially in the outer volution than LEE and CHEN's specimen, and is somewhat larger in shell size, but many of the important characters are similar with one another.

A diaphanotheca is distinct even in the outermost volution of the present specimen (essentially four-layered throughout shell); the keriotheca-like alveoli and other aspects of the spirothecal structure are hardly observable.

Once, TORIYAMA (1958) referred the species to *Profusulinella* from the presence of a spirotheca consisting of a tectum, a diaphanotheca, and outer tectorium. However, as well known, the genus *Profusulinella* RAUSER-CERNOUSSOVA and BELJAEV is characterized by a spirotheca consisting of a tectum and upper and lower tectoria. Namely, *Fusulinella* can be distinguished from *Profusulinella* by the presence of four layers in the spirotheca as compared to only three layers in the spirotheca of *Profusulinella*.

Specimen:—IGPS coll. cat. no. 78376; sample no. N103-1.

Table 3. Measurements (in mm) of *Fusulinella* cfr. *rhomboides* (LEE and CHEN).

Specimen	Reg. No.	Radius vector							Leng.	Width	F.R.
		p.	1	2	3	4	5	6			
N103-1	78376	.067	.067	.117	.183	.283	.417	.600	1.75	1.23	1.40
		Thickness of wall									
		?	.008	.020	.024	.028	.020	.048			

Table 4. Measurements (in mm) of *Fusulinella jamesensis* THOMPSON, PITRAT and SANDERSON.

Specimen	Reg. No.	p.	1	2	3	4	5	Leng.	Width	F.R.
		Radius vector								
N101-2	78374	.122	.100	.150	.220	.330	.520	2.36	1.26	1.90
N104-1	78377	.116	.100	.133	.216	.333	.500	0.97 (×2)	0.50 (×2)	1.90
		Thickness of wall								
N101-2	78374	.008	.008	.016	.024	.028	.044			
N104-1	78377	.016	.008	.012	.020	.027	.024			
		Tunnel angles								
N101-2	78374		24	24	21	23	32			
N104-1	78377		15	18	28	14				

Fusulinella jamesensis THOMPSON, PITRAT and SANDERSON

Pl. 16, figs. 4, 5.

Fusulinella jamesensis THOMPSON, PITRAT and SANDERSON 1953, *Jour. Paleont., vol. 27*, pp. 548-550, pl. 57, figs. 8-15 (non 16-31); IGO, 1957, *Sci. Repts., Tokyo Bunrika Daigaku, Sec. C, vol. 5, nos. 47-48*, pp. 206, 207, pl. 7, figs. 1-9.

Remarks:—The spirotheca of the present specimen has a diaphanotheca—viz. characterized by the four layers of a tectum, diaphanotheca, and upper and lower tectoria—at least, in part of the penultimate volution, but such features can hardly be observed in the last volution. There seem to be two layers consisting of a tectum and thicker transpalent layer.

THOMPSON, PITRAT and SANDERSON (1953) described the species from the Cache Creek limestone of Ft. St. James in Central British Columbia. According to those authors, the species shows some variations in shape, size, and characters of chomata, involving three different groups which may probably be separated from each other. The specimens at hand are closely allied to their second group which is the typical form and includes the holotype.

The present species is more or less similar to *Fusulinella simplicata* TORIYAMA but differs from the latter as already pointed out by TORIYAMA (1958).

Specimen:—IGPS coll. cat. no. 78374 and 78377; sample no. N101-2 and N104-1.

Genus *Fusulina* FISCHER DE WALDHEIM, 1829

Fusulina sp. indet.

Pl. 16, fig. 6.

Remarks:—Judging from the septal fluting and general wall structure the present specimen may be identified with *Fusulina*. The present specimen is ill oriented and therefore, specific identification is difficult.

In the present specimen, four layers are found in almost all volutions of the

Table 5. Measurements of *Fusulina* sp. in mm.

Specimen	Reg. No.				Radius vector					
		p.	1	2	3	4	5	Leng.	Width	F.R.
N102-2	78375	.010	.083	.150	.233	.383	.500	1.77	0.96	1.8
					Thickness of wall					
		.008	.008	.012	.024	.024	.040			

shell, but in part, there seems to be three layers of a thin tectum and rather thick upper and lower tectoria, and in the remaining part of the shell, two apparent layers but the fibrous structure of the spirotheca is almost indiscernible.

Specimen:—IGPS coll. cat. no. 78375; sample no. N102-2.

Genus *Protriticites* PUTRJA, 1948

Shell of medium size, thickly fusiform. Axis of coiling straight. Spirotheca moderately thick, composed of a tectum, diaphanotheca, and upper and lower tectoria in inner volutions of shell, but only a tectum and keriotheca in outer volutions. Keriotheca usually penetrated by numerous pores, but tectum is not essentially penetrated by pores throughout. Septa weakly fluted throughout shell. Chomata well developed.

Protriticites nakahatensis ISHIZAKI, n. sp.

Pl. 16, figs. 7-11.

Shell rather large, fusiform, having nearly straight axis of coiling, more or less thickened central portion and bluntly pointed polar ends. Mature specimen of six volutions 3.74? mm long and 1.96 mm wide, giving form ratio of 1.91. Shell subspherical in inner four or four and a half volutions, but rather vaulted fusiform in subsequent outer volutions.

Proloculus almost spherical, small for shell size, having outside diameter of 100 microns for one specimen. Rate of shell expansion very slow in inner one or one and a half volutions, but somewhat rapid from subsequent outer volution to fourth volution, and finally very loose in remaining outer volutions. Average radius vectors of first to outermost volutions for two specimens 70, 115, 195, 300, 475, 755 and 950 microns, respectively. Height of chambers nearly equal, except for polar regions where they are slightly higher than in median part of shell.

Spirotheca rather thin for size of shell, consisting of a diaphanotheca, thin tectum and upper and lower tectoria in innermost volutions but of tectum and keriotheca in remaining outer volutions. Alveolar structure distinct, especially in penultimate and outermost volutions. Average thickness of spirotheca of first to seventh volutions for two specimens 8, 9, 20, 24, 40, 58 and 68 microns, respectively. Proloculus wall seemingly structureless, consisting of a rather thick (12 microns) single dense layer.

Septa almost plane in central portion of shell, but rather strongly fluted in polar extremities, forming small septal loops.

Tunnel low to moderate in height and narrow throughout shell, except for

Table 6. Measurements (in mm) of *Protriticites nakahatensis* ISHIZAKI, n. sp.

Specimen	Reg. No.	Radius vector								Leng.	Width	F. R.
		p.	1	2	3	4	5	6	7			
N106-1	78379	.100	.080	.130	.220	.330	.530	.840		3.74?	1.96	1.91?
N106-2	78379		.060	.100	.170	.270	.420	.670	.950			
		Thickness of wall										
N106-1	78379	.012	.008	.010	.020	.020	.044	.040				
N106-2	78379			.008	.020	.027	.036	.096	.068			
		Tunnel angles										
N106-1	78379			22	23	26	31	40				

outer volutions where it becomes wider. Tunnel angles of second to sixth volutions for only one specimen 22, 23, 26, 31 and 40 degrees, respectively. Chomata rather strongly developed from first volution to maturity, asymmetrical with steeper tunnel side slopes overhanging in some cases, and gentle poleward slopes. Height of chomata a third to two thirds of height as chambers.

Remarks:—The present species is characterized by the spirotheca in the outer few volutions, consisting of a thin tectum and alveolar keriotheca, although of four layers of a thin tectum, diaphanotheca, and upper and lower tectoria in inner volutions. So far as the spirothecal structure is concerned, the species at hand is closely allied to *Triticites matsumotoi* KANMERA reported from the Yayamadake limestone of Kyushu. The writer considers that both, *Triticites matsumotoi* and the present species should be referred to the genus *Protriticites*.

In many important characters, the present species is more or less similar to the species previously reported from Japan as *Fusulinella pseudobocki* (LEE and CHEN). At least, some of them are thought to be the same as the new species described above.

Specimen:—IGPS coll. cat. nos. 78379, (holotype), 78377 and 78379; sample no. N106-1, N104-2 and N106-2.

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Hida massif	飛騨山地	Okuchichibu	奥秩父
Junigatake	十二ガ岳	Ono County	大野郡
Nakahata	中　畑	Yayamadake	矢山岳
Niugawa village	丹生川村		

Explanation of Plate 16

Fig. 1. *Fusulinella* aff. *elegantula* ISHII. Axial section, ×20, IGPS coll. cat. no. 78375, specimen no. N102-1.

Fig. 2. *Fusulinella* cfr. *rhomboides* (LEE and CHEN). Rather imperfect axial section, ×20, IGPS coll. cat. no. 78376, specimen no. N103-1.

Fig. 3. *Eoschubertella obscura* (LEE and CHEN). Imperfect axial section, ×20, IGPS coll. cat. no. 78374, specimen no. N101-1.

Figs. 4, 5. *Fusulinella jamesensis* THOMPSON, PITRAT and SANDERSON. Axial section, ×22, IGPS coll. cat. no. 78374, 78379, specimen no. N101-2, N104-1.

Fig. 6. *Fusulina* sp. Ill oriented specimen, ×22. IGPS coll. cat. no. 78375, specimen no. N102-2.

Figs. 7-11. *Protriticites nakahatensis* ISHIZAKI, n. sp.

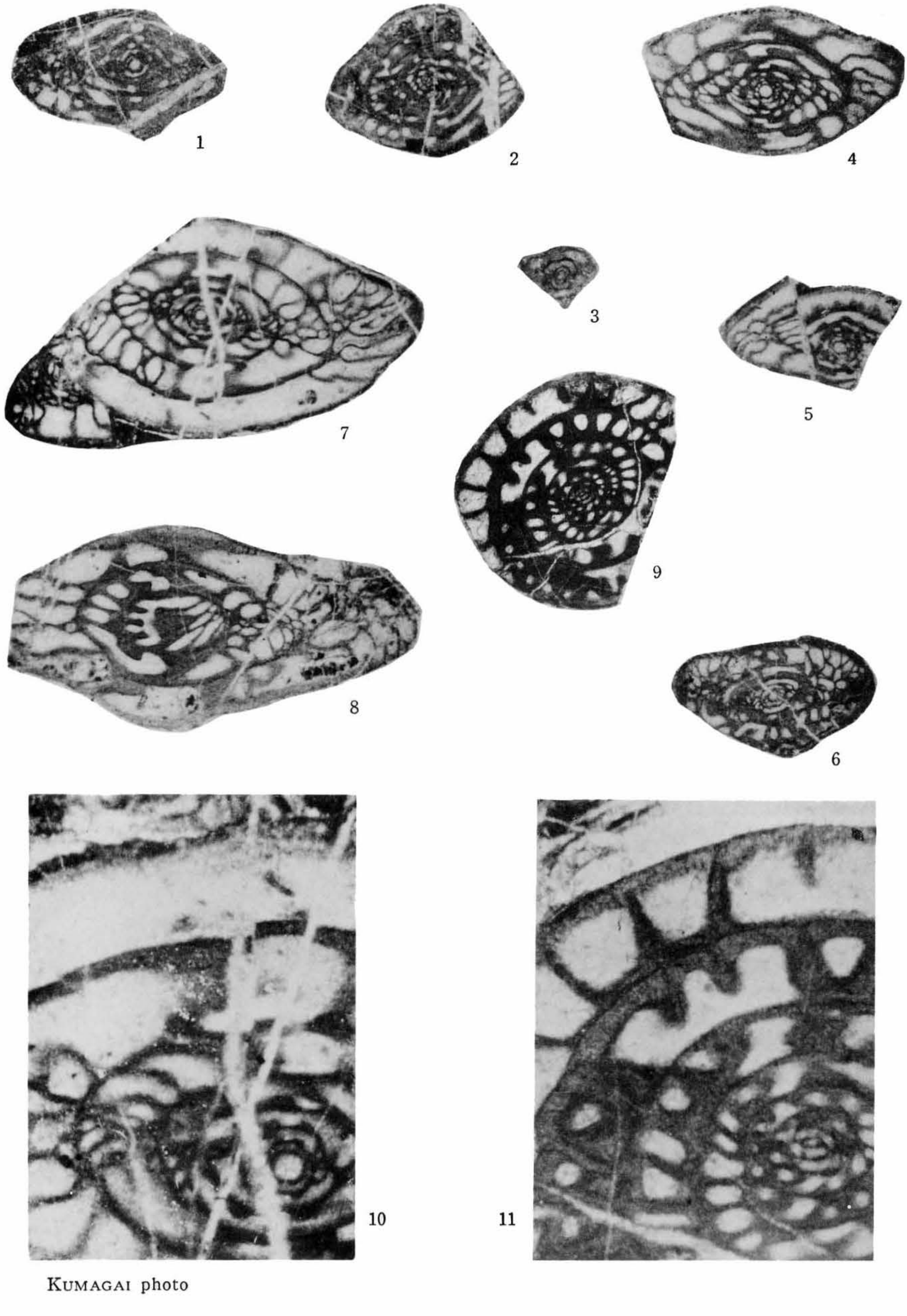
7-Axial section, holotype specimen, ×22. IGPS coll. cat. no. 78379, specimen no. N106-1.

8-Tangential section, paratype specimen, ×22. IGPS coll. cat. no. 78377, specimen no. N104-2.

9-Parallel section, paratype specimen, ×22. IGPS coll. cat. no. 78379, specimen no. N106-2.

10-Part of 7, showing the spirothecal structure in axial section, ×60. IGPS coll. cat. no. 78379.

11-Part of 9, showing the spirothecal structure in sagittal section, ×60, IGPS coll. cat. no. 78370.



KUMAGAI photo

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 51, pp. 115-119, pl. 17, Sept. 10, 1963

456. SIGNIFICANCE OF THE VARIATION OF FOSSIL *BATILLARIA CUMINGI* (CROSSE) FROM QUATERNARY DEPOSITS OF SOUTH KANTO, JAPAN*

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南関東産化石ホソウミニナの変異の意味： 南関東産化石ホソウミニナの形態の変異から先史時代の古い沖積世における東京附近の海況の一端と房総・三浦半島の下部洪積世の海況の一端を推定した。 成田層上部が堆積した頃の海況については その一端にふれたが，なお今後資料の増加を待って報告したい。

永 沢 譲 次

Introduction

Though the writer had already made the reports on the stratigraphical significance of the variation of *Batillaria multiformis* and the influence of environment on the variation of *B. multiforms* and *B. cumingi*, he also wishes to report here on the relation between the variation of fossil specimens of *B. cumingi* which always found living in association with *B. multiformis* in the low tidal zone of Japan and the environment, especially salinity of the sea water during the Quaternary Period of South Kanto, Japan.

The writer divides the Recent and fossil *Batillaria cumingi* into three types according to the grade of development of the subsutural tubercles on their shells: type A without subsutural tubercles except for the body whorl, type C with prominent subsutural tubercles on almost all whorls, and intermediate type B.

As explained in the former paper, the frequency of these types of the shells is considerd to be the effects of a reflection of the environment, suggesting that A type is concerned with low salinity of sea water and C type with rather highly saline water.

Types of *Batillaria cumingi* in Tokyo Bay

Table 1 shows the frequencies of three types of the Recent *B. cumingi* collected from Tokyo Bay.

The type of *B. cumingi* of Tokyo Bay is generally A, and C type is only found in the area outside the bay.

Types of *B. cumingi* in Prehistoric Tokyo Bay

Table 2 shows the frequencies of types of *B. cumingi* from older Holocene deposits of the environs of Tokyo: Deposits of Prehistoric Tokyo Bay.

Many specimens belonging to C type have been collected from older Holocene deposits of Tokyo.

Their occurrence is of interest because

* Received Oct. 4, 1962; read at the 82nd Meeting of the Society, Sept. 29, 1962.

The northern border of the Miura Peninsula							
Low. part	Byobugaura	Totuka, Byobugaura			100	2	Med. f.
The southern part of the Miura Peninsula							
Low. part	Miyata	Okine	6	11	83	18	Med. f.

the contemporary deposits in the Miura Peninsula, the Byobugaura and Miyata formations, except for the Iriyamazu shell bed belonging to the upper deposits of the Narita group.

Their occurrence in the lower part of the Narita group suggests that the Paleo-Tokyo Bay facing the open sea may have been rather highly saline waters in the lower Pleistocene.

But, the types of the shells from the upper part of the Narita group, when considered from each locality, show that there were one location influenced by rather highly saline water and the other locations where salinity of the bay water was low, during the upper or middle Pleistocene.

The occurrence of C type shells in the lower Pleistocene of Miura Peninsula indicates the presence of rather highly saline water.

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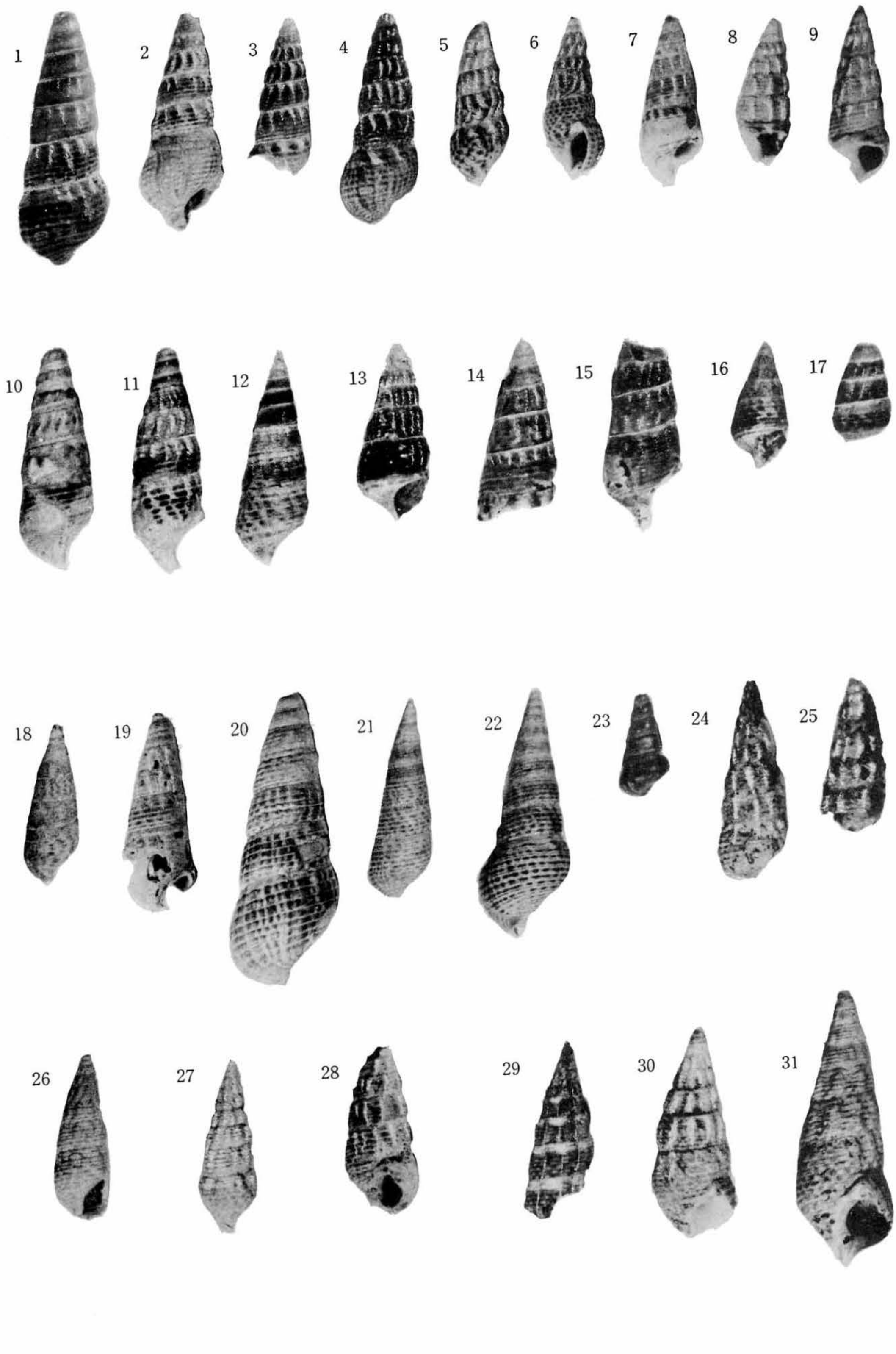
Explanation of Plate 17

Batillaria cumingi (CROSSE)

Figs. 1-3. Type C, sea cliff of Sanuki, Chiba Prefecture.
Fig. 4. Type C, Mizumoto, Nishiyatsu, Chiba Pref.
Figs. 5, 6. Type C, 500 m east of Atebi, Zizodo, Chiba Pref.
Fig. 7. Type C, Yabu, Chiba Pref.
Figs. 8, 9. Type C, Tatsunokuchi, near Yokoda, Chiba Pref.
Figs. 10, 11. Type C, Takata-no-seki, Chiba Pref.
Figs. 12-15. Type B, Takata-no-seki, Chiba Pref.
Fig. 16. Type A, Oyaru Chiba Pref.
Fig. 17. Type B, Oyaru Chiba Pref.
Fig. 18. Type A, Okido near Toke-machi, Chiba Pref.
Fig. 19. Type B, Ochishimo-shinden, Chiba Pref.
Fig. 20. Type B, Kuniyoshi, near Takata-no-seki, Chiba Pref.
Figs. 21, 22. Type A, Banba, near Semata, Chiba Pref.
Fig. 23. Type A. Matudo, Chiba Pref.
Figs. 24, 25. Type C, Totuka and Byobugaura, Kanagawa Pref.
Figs. 26, 27. Type C, Okine, near Shimo-miyata, Kanagawa Pref.
Figs. 28, 29. Type C, Koiwa-machi, Edogawa-ku, Tokyo City.
Fig. 30. Type C, Shiboguchi shellmound, Kanagawa Pref.
Fig. 31. Type C, near the Kohoku bridge, Adachi-ku, Tokyo City.
(Figs. 1-9, 18-31: ×1.3; Figs. 10-17: ×1.5)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Arakawa	荒川	Narita	成田
Adachi-ku	足立区	Nishiyatsu	西谷
Atebi	当日	Ochishimo-shinden	越智下新田
Banba	番場	Ojii	大椎
Boso Peninsula	房総半島	Okine	大木根
Byobugaura	屏風ヶ浦	Okido	大木戸
Edogawa-ku	江戸川区	Oyaru	大谷流
Honmoku	本牧	Sasage	笹毛
Iriyamazu	不入斗	Sanuki-machi	佐貫町
Kanto	関東	Semata-no-seki	瀬又の堰
Kiyokawa	清川	Shiboguchi	子母口
Koiwa-machi	小岩町	Shimo-miyata	下宮田
Kohama	小浜	Shio-hama	塩浜
Kohoku Bridge	江北橋	Takata-no-seki	高田の堰
Kurozuna	黒砂	Tatsunokuchi	竜の口
Kuniyoshi	国吉	Totsuka	戸塚
Mabori	馬堀	Toke-machi	土気町
Makuwari	幕張	Toyonari	豊成
Matsudo	松戸	Yamamoto-nanamagari	山本七曲
Miyata	宮田	Yabu	藪
Miura Peninsula	三浦半島	Yokoda	横田
Mizumoto	水元	Zizodo	地蔵堂

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457. POLLENFORMEN AUS DEN HITOMARU-SCHICHTEN IN DER YUYA-WAN GEGEND*

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油谷湾地域の人丸層の花粉：山口県大津郡油谷町浦の鉄道切割で採集したやや板状の炭質頁岩から多くの保存良好な花粉・胞子を検出し，花粉群の特徴によって花粉層位学的な検討を行い，この花粉群の特徴が佐世保花粉群の特徴と同じであることを明かにした。花粉の新しい種類を記載した。 高 橋 清

Einleitung

Geologische und paläontologische Untersuchungen der tertiären Ablagerungen in der Yuya-wan Gegend wurden bisher von S. IMAMURA & K. WADA (1956, 1958), S. IMAMURA & K. OKAMOTO (1959, 1962), K. OKAMOTO (1960, 1961) u. a. durchgeführt. Bis heute gibt es aber keinen Bericht über die Mollusken- und Foraminiferenreste aus den Hitomaru-Schichten. Von Pflanzenabdrücken kennt man nur die Daibo-Flora. Das Alter der Hitomaru-Schichten konnte also noch nicht sicher bestimmt werden. Unter diesen Umständen ist es sehr wichtig, daß der Verfasser zahlreiche Pollen und Sporen in den Hitomaru-Schichten gefunden und sie pollenstratigraphisch erforscht hat.

Hierbei ist der Verfasser Herren Prof. Dr. Tatsuro MATSUMOTO und Prof. Dr. Ryuzo TORIYAMA an der Universität Kyushu für wertvolle Hinweise und Herrn Dr. Kazuo OKAMOTO an der Universität Hiroshima für die Mitteilung seiner Ansichten zu herzlichem Dank verpflichtet. Ebenso muß er auch Herrn Prof. Dr. Hermann WEYLAND, Wuppertal-Elberfeld, der seinen Schriftsatz korrigierte, danken.

Fundort und Hitomaru-Schichten

Die Probe wurde neben der Eisenbahnlinie von San'in, bei Ura, Yuya-Machi, Provinz Yamaguchi gesammelt (s. Abb. 1). Sie ist ein dunkelgrauer bis schwarzer dünnbrettartiger Schieferton, der auf dem unteren Teil der Hitomaru-Schichten liegt. Dieser Schieferton wurde im Eisenmörser zerkleinert und mit Fluorwasserstoffsäure (HF) behandelt.

Nach K. OKAMOTO (1960, 1962) liegen die Hitomaru-Schichten konkordant auf der Hioki-Schichtengruppe. Sie sind etwa 450 m mächtig und bestehen hauptsächlich aus feinen Sandsteinen, Schiefertonen, Tuffen u. a. Sie werden von der Yuya-wan-Schichtengruppe diskordant bedeckt.

Man kann im unteren Teil der Hitomaru-Schichten eine *Corbicula* sp. finden. Einige Blattabdrücke wurden als Daibo-Flora veröffentlicht. Folgende Spezies wurden von S. ENDO bestimmt: *Populus* cf. *balsamoides* GOEPP., *Carpinus grandis*

* Received Oct. 29, 1962; Read Sept. 30, 1962.

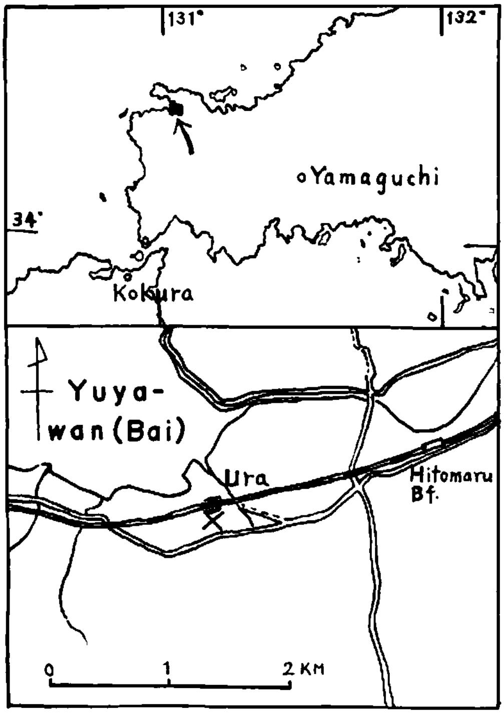

Abb. 1. Fundort der Probe aus den Hitomaru-Schichten bei Ura, Yuya-wan Gegend.

UNG., *Carpinus* cf. *grandis* UNG., *Koelreuteria* cf. *eointegrifolia* ENDO, *Planera* cf. *ungeri* ETT., *Liquidambar formosana* HANCE, *Liquidambar trilobatum* GOTH. & SAPP., *Ulmus longifolia* ETT., *Ulmus* sp., *Acer pictum* TH., *Acer* sp. (n. sp.), *Platanus* cf. *aceroides* GOEPP., *Ficus* sp., *Cornus* sp., *Pinus* ? sp. Er ist zu dem Schluß gekommen, daß das Alter dieser Flora unteres Miozän sei.

Die Blattabdrücke, die in Yamane und Daibo gesammelt wurden, sind nach K. HUZIOKA folgende: *Acer subpictum* SAP., *Acer* sp. (n. sp. ?), *Rhus* sp., *Ulmus* sp., *Cinnamomum Imamurae* HUZIOKA, *Pinus* sp., *Ulmus longifolia* GOEPP., *Ulmus daiboensis* HUZIOKA, *Zelkova Ungeri* (ETT.) KOV., *Liquidambar formosana* HANCE, *Liquidambar elegantifolia* HUZIOKA, Cf. *Platanus aceroides* GOEPP., *Cinnamomum* sp., *Magnolia* sp., *Celastrus* sp., *Acer hishikaiensis* HUZIOKA, Cf. *Marlea basiobliqua* OISHI & HUZIOKA. Ihr geologisches Alter ist Oligozän.

K. OKAMOTO (1962) hat die Hitomaru-Schichten mit den Waita-Schichten der Ashiya-Schichtengruppe verglichen. Aber er hat keinen sicheren Beweis dafür erbracht.

Pollen und Sporen

Die Pollen und Sporen sind verhältnismäßig gut erhalten. Hier in Hitomaru kann man Cupuliferen-Pollen von *Tricolpaten*-Form, die im Alttertiär viel beobachtet werden können, nur sehr selten finden. Ungeflügelter Koniferen-Pollen, *Inaperturopoll. pseudodubius* TAKAHASHI zeigt hier einen höheren Prozentsatz des Auftretens. *Alnipoll. eminens* (TAKAHASHI) von den dreieckigen und vieleckigen Pollen tritt mit höherem Prozentsatz auf. Der Verfasser findet es auffällig, daß *Tricolpopoll. meinohamensis* TAKAHASHI *rotundus* TAKAHASHI mit höchstem Prozentsatz vorkommt. Dieser Pollen ist aber pollenstratigraphisch nicht so wichtig. *Monocolpaten*-Pollen ist sehr selten. *Periporopoll. asiaticus* TAKAHASHI wurde zu 2.5 % beobachtet. Diese Eigentümlichkeiten der vorliegenden Pollengruppe unterscheiden sich nicht von denen des Sasebo-Pollenbildes.

Periporopoll. porulosus TAKAHASHI und *Microreticulatispor. pusillus* (TAKAHASHI) wurden von dem Verfasser (1962) in den eozänen Kohlenflözen von Ishizuchi gefunden. Der erstere Pollen tritt hier in Hitomaru mit verhältnismäßig hohem Prozentsatz auf, aber die letztere Spore sehr selten. *Tuberculatispor. parvierinaceus* TAKAHASHI wurde bei der Beschreibeung der Pollen und Sporen aus den Sakamizu-Schichten der Ashiya-Schichtengruppe veröffentlicht. Der Neuling, *Tricolporopoll. hitomaruensis* n. sp., wurde verhältnismäßig oft gefunden. *Subtriporopoll. consimilis* TAKAHASHI wird bei der Darstellung der Pollen und Sporen aus der Hioki-Schichtengruppe beschrieben.

A) Ungeflügelte Koniferen-Pollen = 20.5%
1. *Inaperturopoll. pseudodubius* TAKAHASHI 20%
2. *Inaperturopoll. laevigatus* TAKAHASHI 0.5%

B) Dreieck- und Vieleckpollen = 23.5%
3. ? *Triporopoll. festatus* TAKAHASHI (Betulaceae) 0.5%
4. ? *Triporopoll. kasuyaensis* TAKAHASHI (cf. Betulaceae) 0.5%
5. *Subtriporopoll. kyushuensis* TAKAHASHI (*Carya* ?) 3%
6. *Subtriporopoll. consimilis* TAKAHASHI 0.5%
7. *Alnipoll. eminens* (TAKAHASHI) 13.5%
8. *Ulmipoll. grandis* TAKAHASHI (Ulmaceae) 1%
9. *Polyporopoll. undulosus* WOLFF (*Ulmus* u. *Zelkova*) 4.5%

C) *Tricolpaten*-Pollen
10. *Tricolpopoll. ditis* TAKAHASHI (Cupuliferae) 2.5%
11. *Tricolpopoll. vulgaris* TAKAHASHI (Cupuliferae) 0.5%
12. *Tricolpopoll. meinohamensis* TAKAHASHI *meinohamensis* TAKAHASHI 1%
13. *Tricolpopoll. meinohamensis* TAKAHASHI *rotundus* TAKAHASHI .. 26%
14. *Tricolpopoll. microreticulatus* TAKAHASHI (*Salix*, *Platanus* u. a.) 1%
15. *Tricolpopoll. striatellus* TAKAHASHI 0.5%

D) *Monocolpaten*-Pollen
16. ? *Monocolpopoll. kyushuensis* TAKAHASHI (Palmae, Ginkgoinae) .. 0.5%

E) *Tricolporaten*-Pollen
17. *Tricolporopoll. incertus* TAKAHASHI 1%
18. *Tricolporopoll. castaneoides* TAKAHASHI (*Castanea*-Form) 0.5%
19. *Tricolporopoll. microreticulatus* THOMSON & PFLUG 0.5%
20. *Tricolporopoll. nagatoensis* TAKAHASHI 2%
21. *Tricolporopoll. hitomaruensis* TAKAHASHI 8%

F) 22. *Periporopoll. asiaticus* TAKAHASHI 2.5%

G) 23. *Periporopoll. porulosus* TAKAHASHI (*Persicaria* u. a.) 6.5%

H) Sporen = 3%

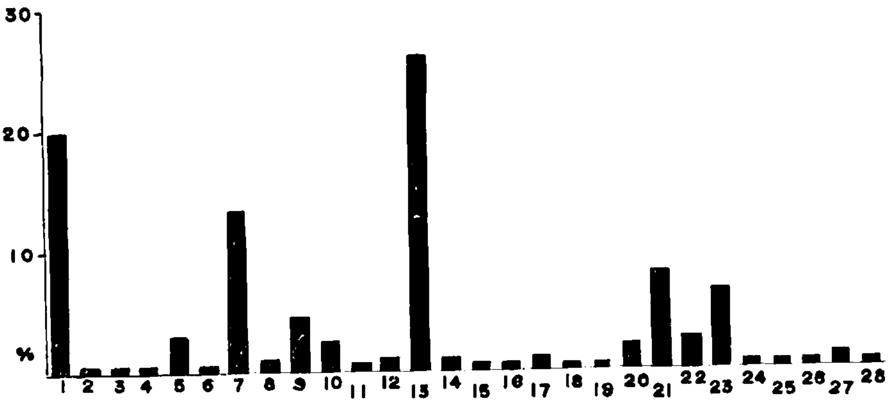

Abb. 2. Pollendiagramm der Hitomaru-Schichten.
(Nummer 1–28 siehe oben Tabelle im Text)

24. ? *Cicatricosispor.* sp. 0.5%
25. *Microreticulatispor. pusillus* (TAKAHASHI) 0.5%
26. ? *Microreticulatispor.* sp. 0.5%
27. *Tuberculatispor. parvierinaceus* TAKAHASHI 1%
28. *Tuberculatispor.* sp. 0.5%

Pollenstratigraphisch gehört die Sasebo- und Ashiya-Schichtengruppe zum Sasebo-Pollenbild. Deshalb bestehen für die Hitomaru-Schichten die beiden Möglichkeiten, daß man sie mit einem Teil der Ashiya- und Sasebo-Schichtengruppe vergleichen kann. Eine bestimmte Stellung zu dieser Frage kann der Verfasser jetzt aber noch nicht einnehmen.

Beschreibung der neuen Sporomorphae

Oberabteilung: **Sporites**
H. POTONIÉ, 1893

Abteilung: Triletes (REINSCH)
IBRAHIM, 1933

Formgattung: *Cicatricosisporites*
R. POTONIÉ & GELLETICH, 1933

? *Cicatricosisporites* sp.

Taf. 18, Fig. 1.

Diese Art, die ungenügend erhalten ist, ist sehr groß, ihre Exine canaliculat. Diese Muri verlaufen ± parallel und kreuzen sich ± unter spitzem Winkel. Y-Marke ?.

Die vorliegende Spezies ist der mitteleuropäischen alttertiären Art, *Cicatricosispor. dorogensis* R. POT. & GELL. (THOMSON & PFLUG, 1953, Taf. 1, Fig. 1-12), ähnlich. F. THIERGART (1940, Taf. 6, Fig. 1; Taf. 7, Fig. 25; Taf. 8, Fig. 1, 2, 5, 6, 9) hat dieselben Formen als *Mohria*-Typ abgebildet. Morphologisch ähnliche kretazeische Formen, *Cicatricosispor. hallei* DELCOURT & SPRUMONT und *Cicatricosispor. sewardi* DELCOURT & SPRUMONT, haben DELCOURT und SPRUMONT (1955, S. 17, Taf. 1, Fig. E1, Abb. 1; S. 19, Abb. 2) aus der unteren Kreide von Hainaut, Belgien beschrieben.

N. A. BOLKHOVITINA (1961) hat einige ähnliche Arten unter dem Gattungsnamen *Pelletieria* beschrieben: *Pelletieria mediostriata* BOLKHOVITINA (S. 66, Taf. 19, Fig. 3a, b; Taf. 21, Fig. 1a-c), *Pelletieria tersa* (KARA-MURSA) BOLKHOVITINA (S. 66-67, Taf. 19, Fig. 4a-e; Taf. 21, Fig. 4a-d; Taf. 22, Fig. 1a-s): *Pelletieria mutabila* (BOLKHOVITINA) (S. 67, Taf. 19, Fig. 15); *Pelletieria clara* (BOLKHOVITINA) (S. 67-68, Taf. 19, Fig. 6a, b); *Pelletieria volgensis* BOLKHOVITINA (S. 19, Fig. 7a, b); *Pelletieria minutaestriata* BOLKHOVITINA (S. 68, Taf. 20, Fig. 1a-f; Taf. 21, Fig. 3a-d); *Pelletieria minor* (BOLKHOVITINA) (S. 68, Taf. 19, Fig. 8; Taf. 21, Fig. 3a-d); *Pelletieria pacifica* BOLKHOVITINA (S. 69, Taf. 22, Fig. 2a-g; Taf. 22, Fig. 2a-d).

Formgattung: *Microreticulatisporites*
(KNOX) POTONIÉ & KREMP, 1955

? *Microreticulatisporites* sp.

Taf. 18, Fig. 2.

Die vorliegende Art ist 32.5 μ groß. Äquatorkontur kreisförmig. Y-Marke nicht erkennbar. Muri treten etwas an der Oberfläche hervor. Netz vieleckig oder lang. Sie ist der westjapanischen miozänen Spezies, *Reticulatispor. saseboensis* TAKAHASHI (1961, S. 282-283, Taf. 15, Fig. 1-3), sehr ähnlich. Bei der ersteren kann man eine Y-Marke nicht erkennen. Auch kann die erstere nach der Form des Netzes von der letzteren unterschieden werden.

Die botanische Zugehörigkeit ist fraglich.

Oberabteilung: **Pollenites**
R. POTONIÉ, 1931

Abteilung: Longaxones PFLUG 1953

Formgattung: *Tricolporopollenites* THOMSON & PFLUG, 1953

Tricolporopollenites hitomaruensis n. sp.

Taf. 18, Fig. 19-23.

Diagnose:—Ca. 27-30μ groß. Figura breit-ellipsoidisch bis kugelig. Breitenlängenindex 0.74 bis 1. Polkappenkontur halbkugelig bis unterhalbkugelig. Drei Colpen konvergieren polwärts. Cavernae reichen fast von Pol zu Pol, sie sind verhältnismäßig tief. Der Hauptporus ist verhältnismäßig klein und rundlich. Der Porus greift seitlich etwas über die Caverna hinaus. Exine sehr dünn, chagrenat.

Holotypus:—Ca. 27μ groß; Taf. 18, Fig. 23; Präparat GK-V 1576.

Locus typicus:—Untere Hitomaru-Schichten, Ura, Yuya-Machi, Provinz Yamaguchi.

Stratigraphisches Verhalten:—Diese neue Spezies wurde bisher nur im Schieferton der Hitomaru-Schichten gefunden. Die Pollengruppe gehört zum Sasebo-Pollenbild.

Beziehungen:— Die betreffende neue Spezies ist den anderen japanischen tertiären Arten. *Tricolporopoll. incertus* TAKAHASHI (1961, S. 322-323, Taf. 24, Fig. 50-52), *Tricolporopoll. microporifer* TAKAHASHI (1961, S. 323-324, Taf. 24, Fig. 57-58) und *Tricolporopoll. asperatus* TAKAHASHI (1961, S. 324, Taf. 25, Fig. 1-3), ähnlich. Die erstere kann nach Größe und Form der Poren von den drei letzteren unterschieden werden. Die erstere ist auch der miozänen Art aus den Ainoura-Schichten (Sasebo-Kohlenfeld), *Tricolporopoll. yoshinouraensis* TAKAHASHI (1961, S. 324-325, Taf. 25, Fig. 4), sehr ähnlich. Die letztere ist kleiner als die erstere.

Die botanische Zugehörigkeit ist fraglich.

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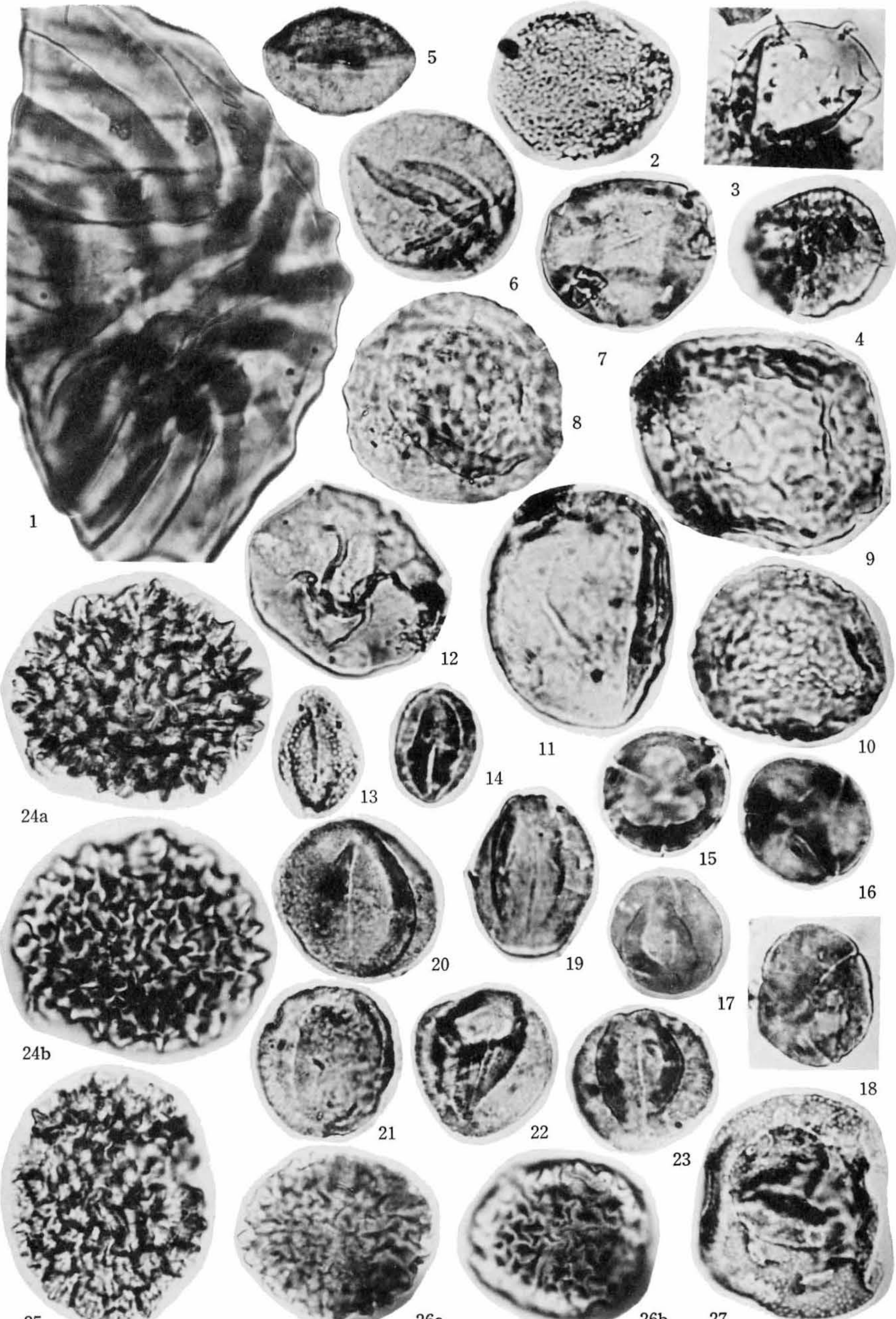
Erklärung zu Tafel 18

(ca. 832 fach vergr.)

Fig. 1. ? *Cicatricosispor.* sp. Präparat GK-V 1576.
Fig. 2. ? *Microreticulatispor.* sp. Präparat GK-V 1576.
Fig. 3. *Tuberculatispor.* sp. Präparat GK-V 1576.
Fig. 4. *Tuberculatpor. parvierinaceus* TAKAHASHI Präparat GK-V 1576.
Fig. 5. ? *Monocolpopoll. kyushuensis* TAKAHASHI Präparat GK-V 1575.
Fig. 6. *Inaperturopoll. pseudodubius* TAKAHASHI Präparat GK-V 1575.
Fig. 7. *Alnipoll. eminens* (TAKAHASHI) Präparat GK-V 1576.
Fig. 8-10. *Ulmipoll. undulosus* WOLFF
Fig. 8: Präparat GK-V 1575; Fig. 9: Präpart GK-V 1576; Fig. 10: Präparat GK-V 1577.
Fig. 11. *Subtriporopoll. consimilis* TAKAHASHI Präparat GK-V 1576.
Fig. 12. *Polyporopoll. grandis* TAKAHASHI Präparat GK-V 1575.
Fig. 13. *Tricolpopoll. microreticulatus* TAKAHASHI Präparat GK-V 1576.
Fig. 14. *Tricolpopoll. vulgaris* TAKAHASHI Präparat GK-V 1575.
Fig. 15-18. *Tricolpopoll. meinohamensis* TAKAHASHI *rotundus* TAKAHASHI
Fig. 15, 16: Präparat GK-V 1576; Fig. 17: Präparat GK-V 1575. Fig. 18; Präparat GK-V 1577.
Fig. 19-23. *Tricolporopoll. hitomaruensis* n. sp.
Fig. 19, 21, 23: Präparat GK-V 1576; Fig. 20, 22: Präparat GK-V 1575; Fig. 23: Holotypus.
Fig. 24-26. *Periporopoll. porulosus* TAKAHASHI
Fig. 24: Präparat GK-V 1575; Fig. 25, 26: Präparat GK-V 1576.
Fig. 27. *Periporopoll. asiaticus* TAKAHASHI Präparat GK-V 1576.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Daibo	大坊	Yamane	山根
Hitomaru	人丸	Yuya-machi	油谷町
Ura	浦	Yuya-wan	油谷湾

PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第84回例会および日本新第三系に関するシンポジウムは1963年6月1,2日東北大学理学部生物学教室講議室において開催された(例会参会者31名)。

個　人　講　演　(6月1日)

北海道石狩統産「セクオイア」の新種について(代読)……………………遠藤誠道

Additonal Microplankton from the Mio-Pliocene Wakura Diatomaceous Mudstone Member in Noto Peninsula, Central Japan (代読)…………………Norio FUJI

Note on the Eocene Larger Foraminifera from Amakusa, Kyushu, Japan……………Shoshiro HANZAWA and Hideo URATA

瑞浪層群の有孔虫について…………大嶋一精

房総半島清澄層からの中新世有孔虫(代読)……………………………………青木直昭

On the Wall-structure of Some Planktonic Foraminifera…………Hiroshi UJIIE

Remarks on the Foraminiferal Genus *Pseudocibicidoides*……………Hiroshi UJIIE

Diphyphyllum from Itoshiro, Fukui Prefecture, Japan (代読)………Hisayoshi IGO

Bryozoa from Pulau Jong, the Langkawi Islands, Malaya (代読)..Sumio SAKAGAMI

太白山地方のカンブリヤ紀化石群の輪郭……………………………………小林貞一

Permian Bryozo from the Yamanba Limestone, Sakawa Basin, Shikoku, Japan (代読)……………Sumio SAKAGAMI

On the Jurassic Trigoniids from the Tetori Group in the Arimine District, Central Japan (代読)……………Shiro MAEDA

On the Variation of Fossil and Recent *Rapana thomasiana* in Japan……………Saburo KANNO and Takashi OHARA

Two Species of Fossil *Coronula* from the Japanese Tertiary……….Hiroshi UJIIE

化石アキシマ鯨について……尾崎 博, 西脇昌治

〔シンポジウム〕日本新第三系に関する討論会(6月2日, 参会者46名)

学　会　記　事

◎　本会誌の出版は一部文部省研究成果刊行費補助金による。

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

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

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

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

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

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

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

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

例会・年会通知

	開催地	開催日	講演申込締切日
第86回例会	大阪市立大学 大阪市立自然科学博物館	1963年11月9・10日	1963年10月10日
1964年総会年会	九州大学	1964年1月18・19日	1963年12月1日

第86回例会（大阪市立大）：「古生物を中心として見た西日本の第四紀」についてのシンポジウム（日本第四紀学会と共催）（世話人，大阪市立大　池辺展生）

1964年総会年会（九州大学）：「進化と個体発生」（Ontogeny and Evolution）に関するシンポジウム（世話人，九州大学　松本達郎・首藤次男）

参加を希望する人は早目にそれぞれの世話人まで連絡されたい。

News

◎ 本年5月19日(日)に国立科学博物館にて日本貝類学会創立35周年記念総会が開催された。本会より小林貞一会長が出席祝辞を述べた。この総会で本会会員槇山次郎君は日本貝類学会の名誉会長に推戴された。

◎ 会員斉藤常正君は米国ニューヨーク州のコロンビア大学 Lamont Geological Observatory に留学のため本年5月下旬出発した。

◎ 本年6月2日(日)仙台東北大学において開催された日本古生物学会例会，討論会の終了後，日本学術会議古生物学研究連絡委員会主催の「古生物学の将来計画に関する討論会」が開催された。

購読御希望の方は本会宛御申込下さい

1963年9月5日　印刷
1963年9月10日　発行

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CONSTITUTION
of the
PALAEONTOLOGICAL SOCIETY OF JAPAN

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

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

Article 3. The Society, to execute Article 2, shall undertake the following business:
1. Issue the Society journal and other publications.
2. Hold or sponsor scientific le6tures and meetings.
3. Popularize the science by field trips, scientific lectures and other projects.
4. Aid and encourage research work; award outstanding contributions to the Society; carry out the objectives stated in Article 2.

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

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

Article 6. The members shol be known as Regular Members, Fellows, Patron and Honorary Members.

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

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

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

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

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

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

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

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

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

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

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

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