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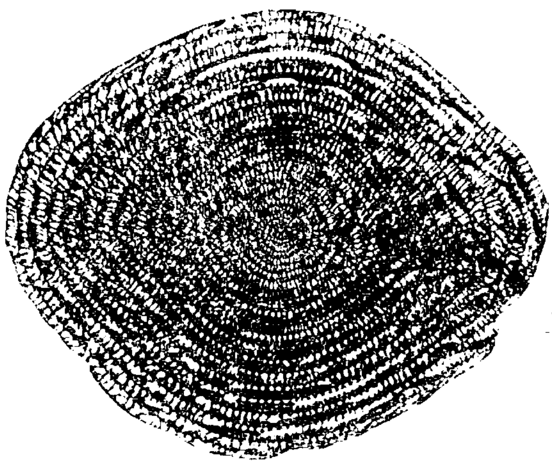

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298. ON THE MIOCENE PECTINIDAE FROM THE ENVIRONS OF SENDAI; PART 9, ON *PECTEN* (*CHLAMYS*) *MIYATOKOENSIS* NOMURA AND HATAI*

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仙台附近中新統産 Pectinidae；その 9. *Pecten* (*Chlamys*) *miyatokoensis* NOMURA and HATAI について：宮城県黒川郡大和町大堤の模式地から採集した多数の標本を検討して詳細な再記載を行い、他種との関係について論じた。 増田孝一郎

In this article is treated *Pecten* (*Chlamys*) *miyatokoensis* NOMURA and HATAI which was described from the Ôtsutsumi formation at Ôtsutsumi, Yamato-machi, Kurokawa-gun, and its subspecies *matumori* from the Nanakita formation at Matsumori, Izumi-mura, Miyagi-gun, both in Miyagi Prefecture, in the northern border of Sendai City.

Many specimens of the species were collected from the type locality and a few from the Utsuno formation (SHOJI, 1954) at Sabusawa, Miyazaki-machi, Kami-gun, Miyagi Prefecture, by the writer. Based upon these and other specimens, a redescription of the characters of this species and its relationship with certain others mentioned in this article are presented herein. The collections preserved in the Department of Geology, College of Education, in the Institute of Geology and Paleontology, Faculty of Science, both of the Tohoku University and of the Saito Ho-on Kai Museum, all in Sendai City, were studied in connection with this species.

Acknowledgements are due to Dr. Kotora HATAI of the Department of Geology, College of Education, Tohoku University, for kindly supervising the present work.

Family Pectinidae

Subfamily Pectininae

Genus *Chlamys* (BOLTEN) RÖDING, 1798

Chlamys miyatokoensis (NOMURA and HATAI)

Pl. 35, Figs. 1a-b, 2a-b, 3-8, 9a-b.

1936. *Pecten* (*Chlamys*) *miyatokoensis* NOMURA and HATAI, *Saito Ho-on Kai Mus., Res Bull., No. 13*, p. 127, pl. 19, figs. 2 4, pl. 20, fig. 1.

The specimens collected from the type locality may be redescribed as follows:

Shell rather small in size, rather thin, compressed, orbicular, equilateral except for auricles; left valve a little more convex than right; both valves radiately ribbed, and forming an angle of about 90° at apex.

Right valve with numerous (about 23 main ribs), finely scaled radial ribs and finely scaled intercalary threads; radial ribs on about central part of disc nearly equal to or a little wider than their

* Read at the 62 nd meeting of the Society at Tokyo, Oct. 29, 1955; received Oct. 29, 1955.

interspaces in breadth, and divided into three or rarely four parts by shallow longitudinal furrows at upper half of disc; divided threads subequal and finely scaled, sometimes radials bifurcate at upper half of disc, and remains usually divided into two parts by a furrow or rarely undivided; submargins sculptured with numerous, fine, finely scaled undivided radial ribs, in which radials on the posterior side continue to the posterior auricle; intercalary threads usually two or three, in which primary intercalary threads usually appear near the beak and nearly equal to or a little less than the divided radial threads of the main radial ribs in strength near the ventral margin, secondary riblets appear at about upper half of disc and tertiary ones near the ventral margin; anterior auricle much larger than the posterior and sculptured with several, imbricated, distinct radial threads and concentric lines, and furnished with deep byssal notch and more or less narrow byssal area; posterior auricle truncated behind with obtuse angle, and sculptured with more or less numerous, imbricated fine radial threads; hinge with distinct cardinal crura, more or less indistinct ctenolium, and shallow resilial pit with more or less distinct lateral ridges: hinge plate rather flat and wide with slight fold, and sculptured with fine striae parallel to the hinge in the full adult specimens, but in the younger shells with no hinge plate. Left valve almost similar to the right valve in sculpture, except for the obtuse network on the disc of left valve, but in younger shells the radial ribs near the beak a little elevated, and much narrower than their interspaces. Interior surface smooth, but with fine marginal serration.

Dimensions (in mm.):—

Valve	Right	Right	Right	Left	Left	Left
Height	62.9	47.7	48.6	61.2	44.8	ca. 48.0
Length	ca. 59.0	44.5	45.0	60.7	40.8	48.0
Hinge-length	27.4	19.0	18.4	27.4	17.0	ca. 19.0
Depth	12.3	8.6	11.3	14.4	9.6	10.8
Apical angle	90°	90°	85°	90°	90°	90°

Remarks:— This species is characterized by its rather small, orbicular and subequivalve shell, numerous, densely scaled, low radial ribs which are divided into three subequal parts by longitudinal furrows, two or three finely scaled intercalary threads, larger anterior auricle sculptured with imbricated and distinct radial threads and concentric lines; furnished with deep byssal notch and more or less narrow byssal area, much smaller posterior auricle sculptured with imbricated fine radial threads, indistinct ctenolium, fine marginal serration, rather wide hinge plate ornamented by fine striae parallel to the hinge in full adult specimens, and left valve with sculpture almost similar to the right valve.

The subspecies *matumori* described by S. NOMURA and K. HATAI (1936, p. 129, pl. 20, fig. 11) from the lowermost part of the Nanakita formation at Matsumori is said to differ from *miyatokoensis* by the fewer radial ribs (about ten) and slightly more distinct main ribs. According to the writer's examination of the type specimen, the following features must be added: the majority of the radial ribs consist of a set of two main radial ribs, and the interspace between the main radials of a pair is somewhat deep and narrow; interspaces between the pair are much narrower than the pair itself and more or less deep; the number of main radial ribs are almost similar to *miyatokoensis*, though S. NOMURA and K. HATAI pointed that the number of radial ribs are fewer than *miyatokoensis* by counting the paired radial ribs as one.

This species resembles *Chlamys kaneharai* (YOKOYAMA) (YOKOYAMA, 1926, p. 135, pl. 18, fig. 1, pl. 19, figs. 1, 2, 5–7) in general features. The characteristics of the hinge are other differences between *kaneharai* and the present one as already pointed by S. NOMURA and K. HATAI (1937, p. 128). This species is also related to *Chlamys hericius* (GOULD) (ARNOLD, 1906, p. 110, pl. 43, figs. 3, 3a) as also pointed by S. NOMURA and K. HATAI, which occurs as Recent in the Northern Pacific and as fossil in the upper Miocene, Pliocene and Pleistocene formations of California, but it differs therefrom in having a larger shell, divided radial ribs in which the middle part is most prominent, and several intercalary threads in the interspaces between the radial ribs.

At the type locality of Ôtsutsumi in the northern border of Sendai, many specimens of this species were collected from a granule conglomerate cemented by tuffaceous sand or conglomeratic tuffaceous very coarse-grained sandstone. Here, abundant and intact valves are most common, as already noticed by M. NAKAMURA (1940, pp. 6–7), but many of the specimens are slightly or severely deformed. The associated fauna of this species are not always deformed, therefore, the writer considers that the shells of the present species are probably easily deformed.

Miyatokoensis has been known to occur in the Ôtsutsumi and Utsuno formations in Miyagi Prefecture, and from the Ginzan formation at the Ginzan Hot Spring, Obanazawa-machi, Kita-Murayama-gun, Yamagata Prefecture. Though S. NOMURA and K. HATAI reported on occurrence of *miyatokoensis matumori* from the Nanakita formation at Matsumori, Izumi-mura, Miyagi-gun Miyagi Prefecture, the writer failed to collect it from the same locality. The geological age of these formations are all Miocene, and the range of this species is considered to be Early Miocene.

As noticed in early lines, the present species is closely related to *Chlamys hericius* (GOULD), and the former is restricted in the Early Miocene formation of the Northeastern Japan, the latter is known as fossil from the upper Miocene Santa Margarita formation, and Pliocene and Pleistocene formations of California and as Recent in the Northern Pacific. According to R. ARNOLD (1906, pp. 110–111,) the fossil shells of *hericius* are on the average smaller and appear to have slightly more scaly secondary riblets than the living species. *Miyatokoensis* is on the average small in size, and it may be the ancestral form of *Chlamys hericius* (GOULD), but further materials are necessary to settle this problem.

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Explanation of Plate 35

Chlamys miyatokoensis (NOMURA and HATAI)

(Natural size)

Figs. 1a-b. a, Right valve. b, Hinge area of 1a. DGS. Reg. No. 2122. Loc. Ôtsutsumi, Yamato-machi, Kurokawa-gun, Miyagi Prefecture.

Figs. 2a-b. a, Right valve. b, Left valve. DGS, Res. No. 2122. Loc. Same as above.

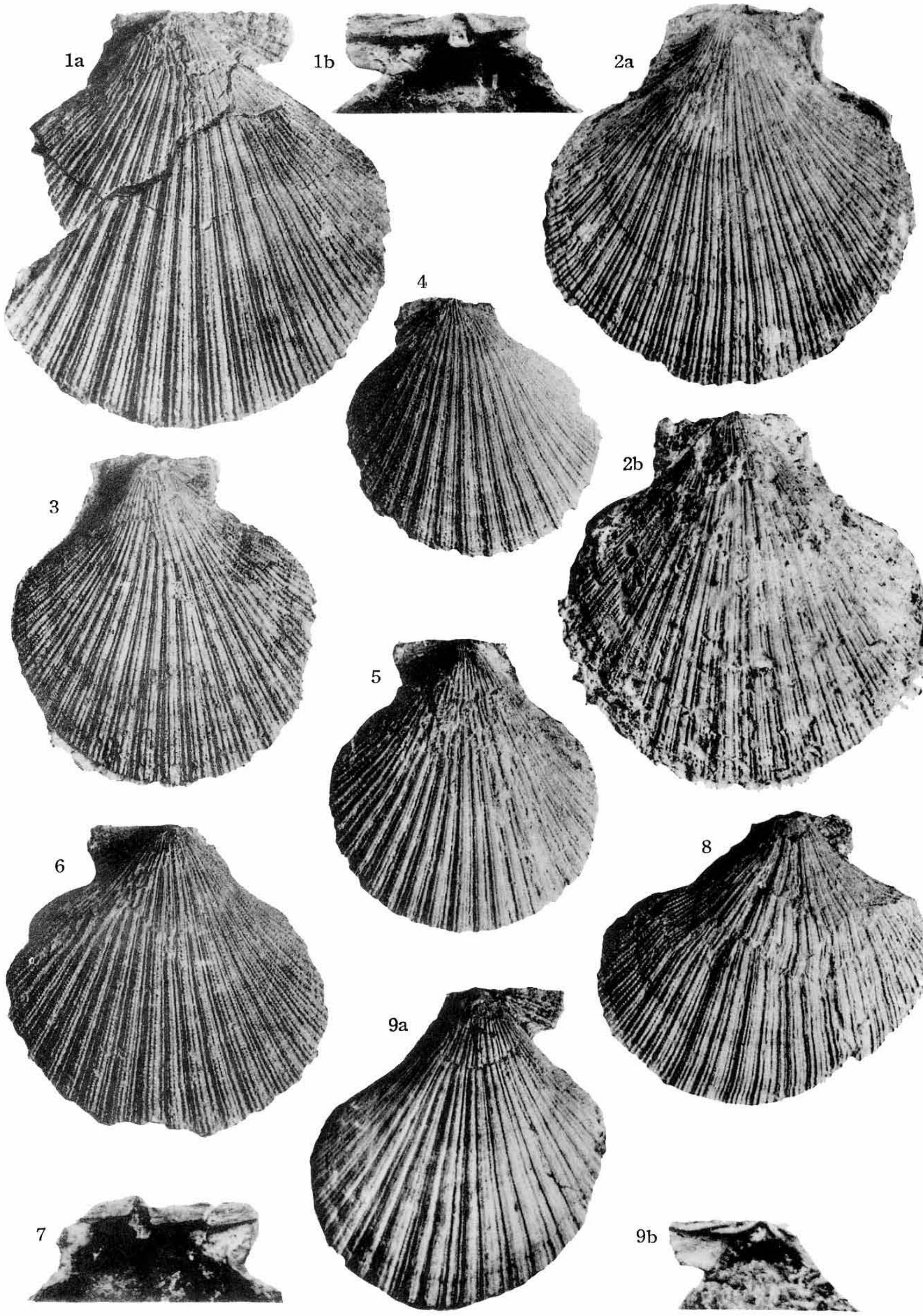
Fig. 3. Right valve. DGS. Reg. No. 2122. Loc. Same as above.

Figs. 4-6. Left valve. DGS. Reg. No. 2122. Loc. Same as above.

Fig. 7. Hinge area of left valve. DGS. Reg. No. 2122. Loc. Same as above.

Fig. 8. Deformed right valve. DGS. Reg. No. 2124. Loc. Same as above.

Figs. 9a-b. a, Right valve. b, Hinge area of 9a. DGS. Reg. No. 2124. Loc. Same as above.



K. KUMAGAI, Photo

Trans. Proc. Palaeont. Soc. Japan, N. S., No. 21, pp. 251—257, Pl. 36, Oct. 31, 1956

299. *TORIYAMAIA*, A NEW PERMIAN FUSULINID GENUS FROM THE KUMA MASSIF, KYUSHU, JAPAN*

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二畳紀紡錘虫新属 *Toriyamaia*：熊本県八代郡田ノ浦村海ノ浦の鹿児島本線々路切割に露出する小崎層（二畳系中部統下部階）礫岩中の石灰岩礫に小型の紡錘虫新属を見出した。それは幼殻に *Leëlla* DUNBAR & SKINNER のそれに似た構造をもち，成殻では *Rauserella* DUNBAR のそれに類似し，両属の中間型の特徴をもつている。ここに *Toriyamaia* と名づけ，*T. laxiseptata* sp. nov. を模式種として記載する。新属は前述の 2 属より早期に出現し，時代は二畳紀下部世と考えられる。

勘米良 亀齢

Introduction

There is a particular group in the subfamily Ozawainellinae THOMPSON & FOSTER, which comprises *Leëlla* DUNBAR & SKINNER and *Rauserella* DUNBAR, having a long axis of coiling and rather loosely coiled shell. In addition to the above two genera previously known, a similar small fusulinid probably belonging to this group is described here as a new genus *Toriyamaia*, with *T. laxiseptata*, sp. nov., as the type species.

This new form of fusulinid was obtained from a limestone pebble in a conglomeratic bed with isolated pebbles of various rocks in sandy shale matrix that is exposed at a railroad cut in Umino-ura, Tanoura-mura, Yatsushiro-gun, Kumamoto Prefecture.

The conglomeratic bed is a member of the middle part of the lower Middle Permian Kozaki formation, the main part of which is correlated with the "Nn" zone—*Cancellina nipponica* zone of OZAWA in the Akasaka limestone of central Japan. Excepting for the material from that pebble, I have not been able to find the same species in any other pebbles of limestone at that locality or in any limestone beds and lenses of the Kozaki formation.

The specimens of *Toriyamaia* are scarce in an indurated white-grey limestone pebble, associated with *Misellina* aff. *M. claudiae* (DEPRAT), *Pseudofusulina parumvoluta* (DEPRAT), *P. vulgaris* (SCHELLWIEN), *P.* sp., *Nagatoella* aff. *N. kobayashii* THOMPSON, *Nankinella* sp., *Schubertella irumensis* (HUZIMOTO), and *Schubertella* sp. nov. Algal remains such as *Gymnocodium* sp., *Mizzia velebitana* SCHUBERT, and *Mizzia* sp. are abundant in the same pebble. The faunal assemblage of fusulinids indicates that the new genus probably is of Lower Permian age.

Description

Genus *Toriyamaia* KANMERA, nov.

* Read at the 61st meeting of the society at Kyoto, June 18, 1955; received Dec. 8, 1955.

Type species: *Toriyamaia laxiseptata* KANMERA, sp. nov.

Diagnosis.— The shell is small and elongate fusiform to subcylindrical in shape, with bluntly to broadly rounded polar ends. Mature specimens of five volutions measure about 2.5 mm. long and 1 mm. wide. The inner one to one and a half volutions are subdiscoidal in shape with bluntly to broadly rounded periphery, of which the first is slightly to distinctly evolute, possessing a short axis of coiling which is sometimes coiled askew at an angle of less than about 30 degrees to the axes of mature volutions. The second volution is involute, having a short axis of coiling and a very broadly swelled periphery. Beyond the second volution the axis of coiling is highly elongate and the shell becomes cylindrical in shape.

The proloculus is minute and spherical. The chambers rather rapidly increase in height, especially in outer volutions.

The spirotheca is thin, consisting of a tectum, which is exceedingly thin, and a less dense structureless lower layer which corresponds to diaphanotheca of other fusulinids. The upper and lower tectoria are not developed. The septa are loosely spaced and are the same in structure as the spirotheca. They are essentially unfluted throughout the shell. The tunnel is singular and broad, reaching a height of about 1/3 to 1/4 of that of the chambers in outer volutions. Chomata are almost absent throughout the shell.

Discussion.—Only the type species is known at present. It seems to be closely related to the genotype species of *Rauserella* DUNBAR on one hand and to *Leëlla* DUNBAR & SKINNER on the other. It is intermediate in shell structure between the two genera: It is provided with inner volutions similar to those of *Leëlla* and with outer volutions resembling those of *Rauserella*. However, it is readily distinguished from *Leëlla* in possessing a markedly elongated subcylindrical mature shell, more broadly swelled periphery in inner volutions, more loosely spaced and less numerous septa, and the absence of chomata and tectoria of spirotheca throughout the shell. It also differs from *Rauserella* in that the mature shape is uniform, the axes of coiling of inner discoidal volutions are inclined to those of outer volutions at distinctly smaller angle than in *Rauserella*, the axis rapidly extends in an earlier stage, the discoidal to subdiscoidal volutions are less numerous and their periphery is very broadly rounded, and the chomata are absent throughout the shell.

This new genus *Toriyamaia* is named in honor of Dr. Prof. TORIYAMA who had been guiding me in studies of fusulinid fossils.

Geologic age.— Probably the Lower Permian; the associated fusulinids and calcareous algae are mentioned in the foregoing chapter.

Toriyamaia laxiseptata, sp. nov.

Plate 36, figures 1–14

Description. — The shell is small, elongate fusiform to subcylindrical, with bluntly to broadly rounded polar ends. Mature specimens consist of five volutions and attain a length of 2.0 to 2.6 mm. and a width of 0.8 to 1.1 mm, giving form ratios of 2.0 to 2.6. The first volution is discoidal in shape with broadly rounded periphery. It appears to be slightly to distinctly evolute. Although the second volutions also has a short axis of coiling, it is perfectly involute and has a more broadly swelled periphery. About a half of the specimens at my disposal have a straight axis of coiling throughout growth of shell. However, in the rest of them the axes of coiling of inner one to one and a half volutions are inclined at angles less than 30 degrees to those of outer volutions. Beyond the second volution the axis becomes rapidly extended. Average form ratios of the first to the fifth volutions of five specimens are 0.65, 0.88, 1.8, 2.2, and 2.3, respectively.

The proloculus is minute, and its outside diameter ranges from 72 to 114 microns, averaging 86 microns for seven specimens. The shell rather rapidly expands, especially in the third and fourth volutions. Average heights of volutions of the first to fifth volutions in nine specimens are 42, 58, 95, 154, and 165 microns, respectively. The chambers are lowest in the center of the shell and are highest in the end zones of the shell, especially in outer volutions.

The spirotheca is thin and is composed of a very thin tectum and a less dense, but not clear, structureless lower layer which corresponds to the diaphanotheca of other fusulinids. The lower and upper surfaces of the spirotheca are not covered by a tectorium. The thicknesses of the spirotheca of the first to fifth volutions are 6-9, 9-14, 14-18, 23-28, and 28-32 microns, respectively. It is almost equal in thickness throughout the length of the shell.

The septa are the same in structure as the spirotheca and the lower layer extends down to the lower margins of the septa. They are essentially unfluted throughout the length of the shell. However, they are not straight and plane but are gently curved or undulated, especially in polar regions. They are very loosely spaced and extend anteriorly at a rather large angle from normal to spirotheca and number 6-7 in the first volution, 6-8 in the second, 7-8 in the third and fourth, and 8 in the fifth. Although the tunnel had been observed in only two specimens (pl. 36, figs. 4 and 5), it is broad and low, attaining about 1/3 to 1/4 the height of the chambers. In those specimens the tunnel angle is 30-34 degrees in the third volution and 43-54 degrees in the fourth. Its path seems to be slightly sinuous. The chomata are almost absent throughout the shell, as the accompanying illustrations demonstrate. However, so far as seen in the section cutting along the septa, they seem to be developed weakly at only the edges of the tunnel.

Discussion. — *Toriyamaia laxiseptata*, sp. nov., is the only representative of this genus known at present. The other described forms which it resembles are *Leëlla fragilis* DUNBAR & SKINNER, *L. bellula* DUNBAR & SKINNER, and *Rauserella erratica* DUNBAR. However, it clearly differs from the former two in having more elongate cylindrical shell, more broadly rounded periphery in inner volutions, more rapid extension of axis of coiling in earlier volution, less numerous septa, and the absence of chomata. It also is readily distinguished from *R. erratica* in some respects. Its inner volutions are of staffelloid form, having very broadly swelled periphery, while those of *R. erratica* are ozawainellid, having rather angular periphery. Its shell attains greater length in earlier volutions. The axes of inner volutions are sometimes coiled at angles up to

Measurement of *Toriyamaia laxiseptata*, gen. et sp. nov., in millimeters

Specimen	Num. of Vol.	Length	Width	Form ratio	Diam. Prol.	Height of volutions					Form ratio of volutions				
						1	2	3	4	5	1	2	3	4	5
1 (Kz. 209-38)	5	—	1.08	—	.086	.043	.061	.107	.164	.174	—	—	—	—	—
2 (〃 40, b)	4	—	.85	—	.075	.043	.057	.100	.150	—	—	—	—	—	—
3 (〃 89)	$4\frac{1}{2}$	—	.90	—	—	.043	.057	.100	.136	—	—	—	—	—	—
4 (〃 88)	5	2.30	.92	2.5	.072	.033*	.043*	.072*	.114*	.155*	.70	.90	1.7	2.0	2.3
5 (〃 81)	4	1.54	.69	2.2	.086	.041*	.057*	.079*	.143*	—	.61	.75	1.9	2.2	—
6 (〃 40, a)	$3\frac{3}{4}$	1.31	.54	2.4	.072	.041*	.055*	.070*	.116*	—	.60	.75	1.6	2.3	—
7 (〃 90)	4	—	.79	—	.100	.043	.072	.100	.172	—	.70	.90	—	—	—
8 (〃 87)	$3\frac{1}{4}$	1.38	.65	2.1	.114	.043*	.050*	.093*	—	—	.66	1.1	2.0	—	—

Specimen	Thickness of spirotheca					Septal count				
	1	2	3	4	5	1	2	3	4	5
1 (Kz. 209-38)	.007	.009	.018	.025	.028	7	7	7	8	8
2 (〃 40, b)	.007	.009	.018	.028	—	6	6	7	7(?)	—
3 (〃 89)	—	.011	.018	.023	.032	6	8	8	8	—
4 (〃 88)	.007	.009	.014	.028	.032	—	—	—	—	—
5 (〃 81)	.007	.009	.014	.025	—	-	—	—	—	—
6 (〃 40, a)	.005	.011	.016	.028	—	—	—	—	—	—
7 (〃 90)	.007	.014	.018	.023	—	—	—	—	—	—
8 (〃 87)	.009	.014	.018	—	—	—	—	—	—	—

* Heights of volutions are measured at $\frac{3}{4}$, $1\frac{3}{4}$, $2\frac{3}{4}$, $3\frac{3}{4}$, and $4\frac{3}{4}$ volutions, respectively.

Specimens 1-6 and 8 are illustrated on Plate 36 as figures, 11, 12, 13, 2, 1, 4, and 5, respectively.

about 30 degrees to those of mature volutions, but the change of axis of coiling is not so large as in *Rauserella*. It retains regular and uniform shape in mature stage, but *Rauserella* has an aberrant nature of irregular coiling in mature shell.

Chomata are almost absent throughout the shell in this species but are well developed in inner discoidal volutions in *Rauserella*.

Paleontological Considerations

Among the genera which were referred to the subfamily Ozawainellinae THOMPSON & FOSTER, *Rauserella* and *Leëlla*, and *Toriyamaia* described above constitute themselves one particular group having long axes of coiling and rather large and loosely coiled shell. Species belonging to those genera have minute proloculi and discoidal to subdiscoidal juvenile shells with rounded periphery. They seem to show little by little a variation in the pattern of coiling within the group. Namely, in the species of *Leëlla* the axis of coiling is straight throughout the shell, although it is the shortest diameter in inner two to three volutions, and the change from a discoidal first volution to a fusiform mature shape is uniform. Whereas in *Rauserella* the inner three to four discoidal volutions are coiled at a large angle to the axis of coiling of the outer volutions which form irregular fusiform shape. However, an intermediate pattern of coiling between the two genera just mentioned is observed in *Toriyamaia*. Namely, in that genus the inner one to one and a half discoidal volutions are frequently coiled at angles up to about 30 degrees to the axes of mature volutions, which assume uniform shape.

Furthermore, the spirotheca of those genera seems to be principally identical in structure. Namely, it is composed of a tectum and a rather thick less dense lower layer or a diaphanotheca. Seemingly tectoria only cover it upper and lower surfaces in chambers where chomata are well developed. In *Toriyamaia* chomata are absent, and the spirotheca is not covered by tectoria. However, chomata are well developed in inner volutions of *Rauserella* and in *Leëlla*, and the spirotheca of the latter genus is composed of a tectum, diaphanotheca, and upper and lower tectoria, and that of *Rauserella* is, according to the original description by DUNBAR, composed of a tectum and a diaphanotheca in outer volutions, but of a thin median layer and epitheca above and below in inner volutions. In short, it is obvious that the three genera are biologically closely related and should be included in a group of the same phylogenetical stock. Therefore, it is considered that it had better to discriminate the group having long axis of coiling from other genera of Ozawainellinae. However, the species referred to those genera are scarce and their phylogenetical positions and their ancestoral form are not yet certain, so it is not entirely feasible at this time to establish a new subfamily.

Whereas, as stated by DUNBAR and SKINNER, the shell of *Leëlla* shows a close parallel with *Sphaerulina* in the pattern of coiling, especially in inner volutions. However, they probably differ entirely from each other in the structure of their spirotheca. Namely, the spirotheca of *Sphaerulina* is always replaced by secondary mineralization, so far as has been known. The same replacement in spirotheca is seen in the genera of *Nankinella*, *Pisolina*, and *Staffella*, the spirotheca of which also resemble that

Explanation of Plate 36

Figure 1-14. *Toriyamaia laxiseptata*, gen. et sp. nov.
1, Axial section of the holotype (immature); 2, diagonal section of a paratype; 3, tangential section of a paratype; 4, 5, axial sections of paratypes (immature); 6-9, tangential sections of paratypes (8, slightly oblique); 10, diagonal section of paratype; 11-13, sagittal sections of paratypes (13, not well-centered); 14, parallel section of a paratype; parachomata-like pattern in outer volution is formed by secondary replacement of dolomite crystals. All figures ×25
All are from an isolated pebble in a conglomeratic sandy shale exposed at a railroad cut (Loc. Kz. 209) in Uminoura, Tanoura-mura, Yatsushiro-gun, Kumamoto Prefecture. Reg. no. GK-D 10201-10214.

15-17. Associated species with *Toriyamaia laxiseptata*.
15, ***Misellina* aff. *M. claudiae*** (DEPRAT), axial section. ×10
16, ***Nagatoella* aff. *N. kobayashii*** THOMPSON, axial section. ×10
17, ***Pseudofusulina parumvoluta*** (DEPRAT), axial section. ×10

18. Enlarged part of sagittal section of a paratype illustrated as fig. 14 showing the structure of spirotheca and septa, ×100

19. Enlarged part of axial section of a paratype illustrated as fig. 10 showing the structure of spirotheca, ×100

Photos by KANMERA

All specimens used in this study are kept in Department of Geology, Faculty of Science, Kyushu University.

of *Sphaerulina*. These latter four genera resemble one another in many other respects, and they should be included in another group classified by MIKLUCHO-MAKLAI (1949) as the Staffellininae.

Rauserella was first described from rocks of upper Guadalupian age in northern Mexico and Texas. In Japan it has been known in association with moderately advanced species of *Neoschwagerina* and *Verbeekina*, such as *N. craticulifera* (SCHWAGER), *N. margaritae* DEPRAT and *V. verbeeki* (GEINITZ), and with highly advanced forms of *Yabeina* and *Lepidolina*, such as *Y. yasubaensis* TORIYAMA and *L. toriyamai* KANMERA. *Leëlla* was originally described from the upper Guadalupian series of Texas where it is associated with *Codonofusiella paradoxica* DUNBAR & SKINNER and *Polydiexodina shumardi* DUNBAR & SKINNER, but it has not yet been found in Japan. *Toriyamaia*, as described in the foregoing chapter, occurs together with the most primitive verbeekinid, *Misellina* aff. *M. claudiae* (DEPRAT) and with more or less advanced forms of schwagerinid, such as *Nagatoella* aff. *N. kobayashii* THOMPSON, *Pseudofusulina parumvoluta* (DEPRAT), *P. vulgaris* (SCHELLWIEN), and *P.* cf. *P. ambigua* (DEPRAT). Moreover, the limestone containing those species is a pebble of the conglomerate of the Kozaki formation which is characterized by the fauna comprising the most primitive neoschwagerinid, *N. simplex* OZAWA, and *Misellina claudiae* (DEPRAT), *Cancellina* sp., "*Verbeekina sphaera* OZAWA", *Parafusulina lutugini* (SCHELLWIEN), *Schwagerina japonica* (GÜMBEL), *Yangchienia iniqua* LEE, *Sphaerulina crassispira* LEE and *Schubertella giraudi* (DEPRAT), etc., and, is compared with the "Nn" zone—*Cancellina nipponica* zone of OZAWA in the Akasaka limestone in central Japan and with Chihsia limestone of China. From these facts, *Toriyamaia* probably occurs earlier in Permian time than the other two genera in consideration.

Aknowledgements

I wish to express my hearty thanks to Dr. M. L. THOMPSON of Kansas University who has read through the typescript and given me valuable criticisms. I acknowledge my sincere thanks to Prof. R. TORIYAMA of Kyushu University for his kindness in permitting free use of his library and in reading through the typescript and to Prof. T. MATSUMOTO of the same university for his continuous guidance and encouragement.

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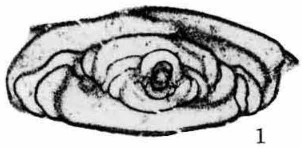
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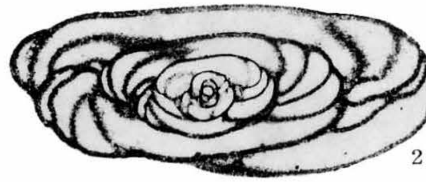
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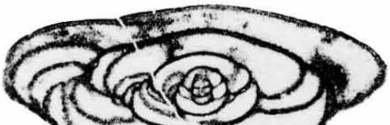
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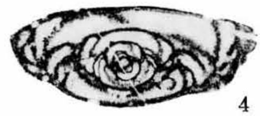
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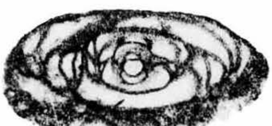
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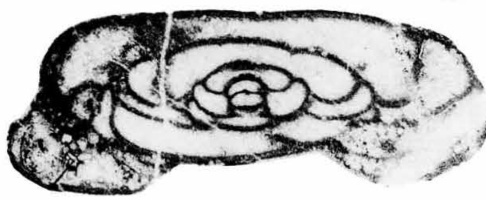
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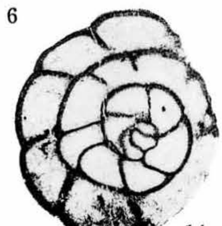
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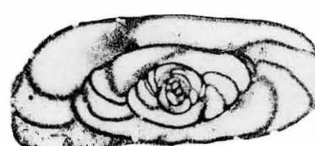
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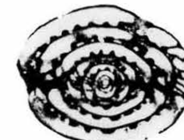
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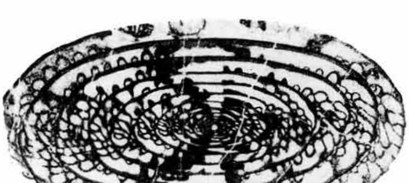
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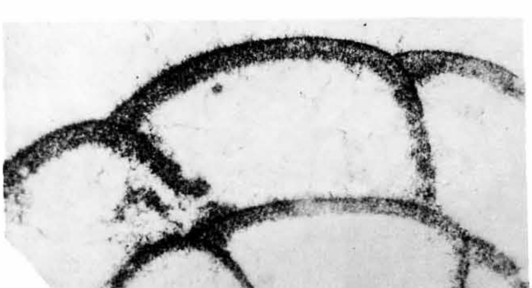
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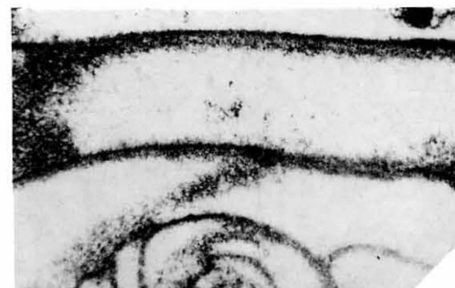
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300. FUSULINIDS FROM THE LIMESTONE CONGLOMERATE IN THE YAGOOKI VALLEY, TAMANOUCHI, HINODE-MURA, NISHITAMA-GUN, TOKYO-TO, JAPAN*

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東京都西多摩郡日の出村（旧大久野村）玉の内ヤゴオキ谷における石灰岩礫岩中の紡錘虫化石：関東山地で新たに発見した石灰岩礫岩――玉の内石灰岩礫岩の層位学的な考察とそれに含まれている化石中，紡錘虫化石の新種 *Pseudostaffella? tamanouchiensis* SAKAGAMI 及び新変種 *Schwagerina furoni* var. *tamanouchiensis* SAKAGAMI を記載した。とくに前者については興味がある。

坂 上 澄 夫

Introduction and Acknowledgements

Since 1954, I have been engaged in a stratigraphical and paleontological study of the Itsukaichi and Ôme districts in the southern part of the Kwanto-massif, Japan. During my field survey in the Yagooki Valley, Tamanouchi, Hinode-mura, northeastern part of Itsukaichi town, I have found interesting stratigraphical and paleontological data, of which the latter is dealt with here. In the present paper is described some fusulinids which were found in a limestone conglomerate, for which I propose the name of Tamanouchi limestone conglomerate. This facies may be correlated to the upper type of the Yasuba conglomerate. The fusulinids from the Yasuba type conglomerate were studied by R. TORIYAMA in 1942 to 1947. In his paper he has pointed out that there are at least two kinds of fauna in the Yasuba type of limestone conglomerate. The present fusulinid fauna is intimately related with the one described by R. TORIYAMA from his Yasuba type conglomerate.

I am greatly indebted to Prof. Haruyoshi FUJIMOTO of Geological and Mineralogical Institute, Tokyo University of Education for his valuable assistance and kind guidance during the course of my study. I also express my gratitude to Dr. Ryuzo TORIYAMA, Professor of the Kyushu University for sending me his papers on fusulinids from the Yasuba type conglomerate. My thanks also due to Mr. Yataro YAMADA, teacher of the Sakari High School, Iwate prefecture whose manuscript paper has stimulated my study. I also wish to thank Prof. Kotora HATAI of the Department of Geology, College of Education, Tohoku University for his encouragement and reading of this manuscript. Acknowlegements are also due to Assistant Prof. Kei OSHITE of our Institute and Mr. Hisayoshi IGO of the Tokyo University of Education for their kind advice and encouragement.

Stratigraphical consideration

The Yagooki Valley consists of rocks which have been included into the

* Read Jan. 21, 1956; received Feb. 8, 1956.

formations referred to the Tamanouchi Paleozoic Zone by H. FUJIMOTO. This zone consists of sandstone, shale, schalstein, chert and conglomerate. The different rocks have a general strike of N 30°–60° W and with varied dips.

According to Y. YAMADA's investigation, the following species are discriminated from two limestone lenses in the Tamanouchi conglomerate in the Yagooki Valley (his "Tamanouchi Valley").

Glomospira cfr. *pussilla* GEINITZ
Endothyra sp.
Tetrataxis cfr. *conica* EHRENB.
Tetrataxis platycephala YAMADA, MS.
Tetrataxis triangulata YAMADA, MS.
Ozawainella waageni SCHWAGER
Staffella yobarensis OZAWA
Staffella minima YAMADA, MS.
Schubertella melonica DUNBAR and SKINNER
Fujimotoinella tamanouchiensis YAMADA, MS.
Triticites minimus SCHELLWIEN
Schwagerina krotowi (SCHELLWIEN)
Schwagerina japonica (GÜMBEL)
Schwagerina cfr. *japonica* var. *hayasakai* (LEE)
Misellina claudiae (DEPRAT)
Misellina claudiae var. *ogunoi* Yamada, MS.
Pseudodoliolina ozawai YABE and HANZAWA
Neoschwagerina margaritae DEPRAT
Mizzia verebitana SCHUBERT
Tetracoral gen. and sp. indet.

He had pointed out that the faunal assemblage constitutes a unique and interesting one.

The Tamanouchi conglomerate which is best distributed in the Yagooki Valley can be observed at only one exposure in the Minokuchi Valley situated to the west, and it seems to be missing in other nearby valleys. From such facts, it is considered that the structure is complicated.

The succession of the rocks in the Yagooki Valley refer to route map of text figure. It consists of sandstone, shale, limestone and conglomerate which intercalates schalstein and small limestone lenses. The Tamanouchi limestone and other small limestone lenses are generally non-fossiliferous, but a small limestone block measuring about 2.5 m thick and about 3 m long, and intercalated in limestone conglomerate shown in the route map yielded the following fusulinid species.

Schwagerina furoni var. *tamanouchiensis* SAKAGAMI, n. var.
Schwagerina cfr. *japonica* (GÜMBEL)
Schwagerina sp. A
Neoschwagerina margaritae DEPRAT

There are at least four horizons of the Tamanouchi limestone conglomerate in the Yagooki Valley. Its true thickness is unknown due to the complicate geologic structure already mentioned. The conglomerate is composed of pebbles of sandstone, schalstein, limestone and rarely chert cemented by limy sandstone. The pebbles vary in size, but are mostly 1 to 2 cms in diameter, and subangular or round in shape. The limestone pebbles comprise two kinds in color, namely one kind are brownish grey and the other whitish colored. The limestone pebbles and the matrix contain different species of fusulinids and some corals.

The pebbles yielded the following species.

Ozawainella sp.
Staffella moelleri OZAWA
Nankinella sp.
Schubertella? *thompsoni* SAKAGAMI MS.
Pseudostaffella? *tamanouchiensis* SAKAGAMI, n. sp.
Triticites kawanoboriensis FUJIMOTO
Triticites sp.
Pseudoschwagerina sp.

Pseudofusulina vulgaris (SCHELLWIEN)
Pseudofusulina vulgaris var. *globosa* (SCHELLWIEN)
Pseudofusulina sp.

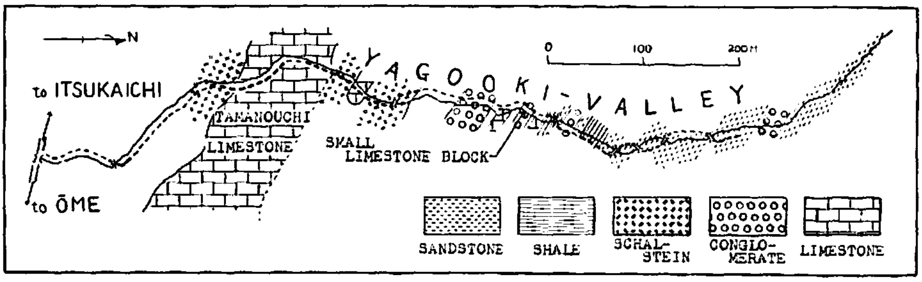
The faunal assemblage of the limestone pebbles abridged above indicates the Wolfcampian in age.

The matrix of the pebbles yields the following fossils.

Pseudofusulina spp.
Verbeekina sp.
Misellina claudiae (DEPRAT)
Pseudodoliolina ozawai YABE and HANZAWA
Neoschwagerina craticulifera (SCHWAGER)
Neoschwagerina douvillei OZAWA
Yabeina cascadensis (ANDERSON)
Chaetetes sp. indet.
Waagenophyllum sp. indet.

From this fauna, it is inferred that the assemblage corresponds to the Guadalupian in age. Most of the fusulinids that occur in the matrix may have been, in part, derived from their heimatland.

Pseudostaffella has been known to range from the *Profusulinella* zone to the *Fusulina* zone in the middle Pennsylvanian, thus it is older than the Wolfcampian that yields *Pseudofusulina vulgaris*. However, at the present locality, *Pseudostaffella ? tamanouchiensis* n. sp. was found in a limestone pebble containing *Pseudofusulina vulgaris*. From the lithologic character and the mode of occurrence of *Pseudostaffella ? tamanouchiensis* n. sp. and *Pseudofusulina vulgaris* (Plate 37, figure 3), it is difficult to consider that the shell of the former was embedded in the limestone that contains the latter species, before the limestone was sedimented as a pebbles. *Pseudostaffella ? tamanouchiensis* n. sp. is questionably referred to the named genus.



Text figure; Route map of the Yagooki Valley.

The geological age of the Tamanouchi limestone conglomerate from its fauna may be referred to the late Guadalupian if not later, and it is regarded that this conglomerate can be correlated with the upper type of the Yasuba conglomerate, even though the lithologic character of the former may be slightly different from that of the latter. Unfortunately, I have had no opportunity to visit the type locality of the Yasuba conglomerate in Shikoku.

In the Kwanto-massif, the Yasuba type conglomerate had been known from only one locality in the northwestern part of Ome, and it is to be stated that it is of the lower type. Hence the present paper is the first description of a conglomerate facies that should be correlated with the upper type of Yasuba conglomerate in the Kwanto-massif.

I am of the opinion that the conglomerate in question may prove to be a key important for solving many problems with regard to the geology and paleontology of the upper Permian in the Japanese Islands.

Description of new species and new variety

Pseudostaffella ? tamanouchiensis SAKAGAMI, n. sp.

Pl. 37, Figs. 1-3

A single but typical axial section and one tangential section. Shell minute and spherical. The periphery of all volutions are rounded and the axial regions are slightly depressed in outer volutions. The first two to three volutions are coiled at a large angle to the axis of the outer volutions. Axial length and width are 0.67 mm and 1.11 mm respectively in the sixth volution.

Form ratio of the first to the sixth volutions of axial section is 0.80, 1.0, 1.0, 1.11, 0.94, 0.77 and 0.60, respectively.

The proloculus is minute. Its outer diameter is 0.03 mm. The rate of growth of the first to the sixth volutions of the axial section is 0.10, 0.18, 0.27, 0.34, 0.57 and 0.86 mm, respectively.

Spirotheca thin. Its thickness of the first to the sixth volutions of the axial section is 0.013, 0.017, 0.016, 0.017, 0.021 and 0.021mm, respectively. The spirotheca seems to be composed of a tectum, a diaphanotheca and a thin lower tectorium.

Septa are unfluted, however, they are slightly fluted in the extreme axial regions. The chomata are developed. The tunnel angle measures 19° and 21° in the fourth and the fifth volutions, respectively.

Remarks:— The genus *Pseudostaffella* has been known only from the middle Pennsylvanian age throughout the world.

The present specimen from the following points is considered to be within the limits of the genus *Pseudostaffella*. The shell is minute and spherical, and the axial regions are slightly depressed. The inner volutions are coiled in a large angle to the axis of the outer ones. However, in the spirothecal structure, the present specimen seems to diverge from the true characters of *Pseudostaffella*. The spirotheca of the previously recorded species of the genus *Pseudostaffella* is composed of a tectum and lower and upper tectoria, while that of the present one consists of a tectum, a diaphanotheca and a lower tectorium, and furthermore, the chomata are less developed.

From the above mentioned criteria, it may be necessary to establish a new genus or a new subgenus for the present species. However, until a larger number of specimens accumulate, the present species is referred to the genus *Pseudostaffella* with question.

Geological age and Occurrence:— This species occurs in association with *Nankinella* sp., *Staffella moellrei* OZAWA, *Schubertella ? thompsoni* SAKAGAMI, MS., *Pseudofusulina vulgaris* (SCHELLWIEN), *Pseudofusulina vulgaris* var. *globosa* (SCHELLWIEN) and *Pseudofusulina* sp. in a limestone pebble of the Tamanouchi limestone conglomerate in the Yagooki Valley, Tamanouchi, Hinode-mura, Nishitama-gun, Tokyo-to, Japan. Its geological age may correspond to the upper Wolfcampian age of North America.

Schwagerina furoni var. *tamanouchiensis* SAKAGAMI n. var.

Pl. 37, Figs. 4-12

Shell moderate to large in size and

Measurements of *Schwagerina furoni* var. *tamanouchiensis* SAKAGAMI, n. var. (in millimeters).

Specimen	L.	W.	R.	P.	Rate of Growth							
					1	2	3	4	5	6	7	7 1/2
1. 2544-A	6.66	3.66	1.8	0.56	0.81	1.22	1.78	2.37	3.03	3.66	—	—
2. 2544-B	4.48	2.78	1.6	0.56	0.78	1.18	1.67	2.18	2.78	—	—	—
3. 2545-A	6.59	4.07	1.6	0.48	0.74	1.26	1.48	2.00	2.48	3.11	3.74	4.07
4. 2543-A	—	3.66	—	0.50	0.78	1.00	1.41	1.78	2.26	2.78	3.44	3.66
5. 2546-B	5.92	3.44	1.7	0.41	0.70	1.18	1.63	2.26	2.85	3.44	—	—
6. 2547-A	6.22	3.59	1.7	0.48	0.85	1.26	1.74	2.29	2.92	3.59	—	—
7. 2548-A	—	4.18	—	0.59	0.81	1.18	1.70	2.22	2.85	3.55	4.18	—
8. 2548-B	—	4.26	—	0.56	0.81	1.18	1.70	2.26	2.85	3.55	4.26	—
9. 2549-A	—	3.25	—	0.56	0.73	1.10	1.46	2.02	2.57	3.25	—	—
10. 2551-A	—	3.78	—	0.44	0.85	1.26	1.78	2.48	3.15	3.78	—	—

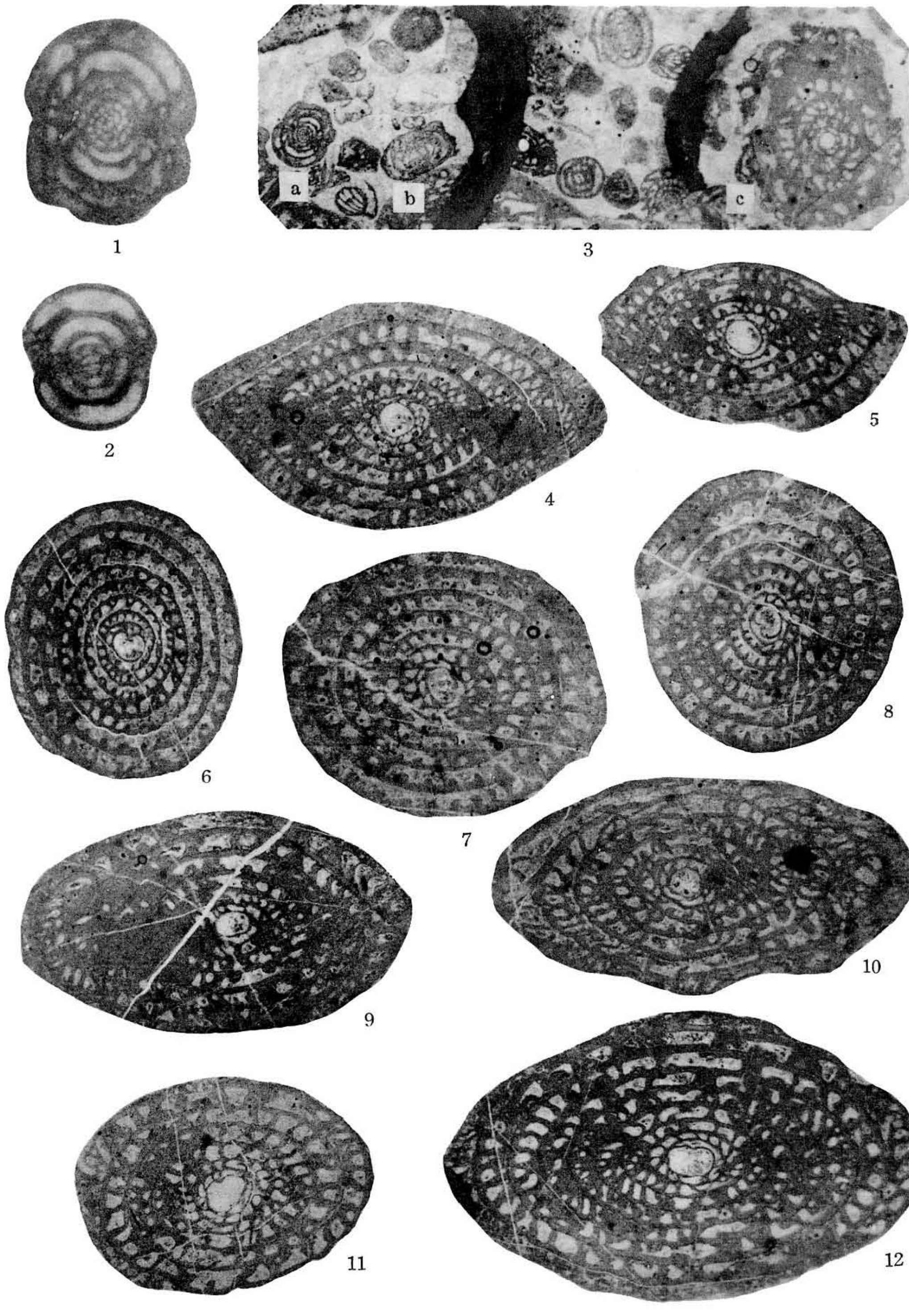
Specimen	Thickness of Spirotheca								Septal count							
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8
1. 2544-A	.042	.079	.087	.103	.126	.142	—	—	—	—	—	—	—	—	—	—
1. 2544-B	.048	.048	.095	.126	.111	—	—		—	—	—	—	—	—	—	—
3. 2545-A	.040	.048	.064	.087	.087	.126	.134	.111	—	—	—	—	—	—	—	—
4. 2543-A	.032	.048	.032	.048	.079	.111	.126	—	11	22	28	30	31	31	29	—
5. 2546-B	.048	.064	.064	.087	.079	.095	—	—	—	—	—	—	—	—	—	—
6. 2547-A	.048	.056	.079	.079	.111	.142	—	—	—	—	—	—	—	—	—	—
7. 2548-A	.048	.064	.079	.095	.095	.142	.142	—	5	19	25	31	35	36	—	—
8. 2548-B	.056	.079	.071	.111	.079	.111	.111	—	6	20	26	26	37	38	—	—
9. 2549-A	.035	.052	.052	.069	.087	.087	—	—	9	18	19	22	27	30	—	—
10. 2551-A	.064	.079	.079	.079	.111	?	—	—	7	23	26	28	32	38	—	—

Explanation of Plate 37

Figs. 1-3. *Pseudostaffella ? tamanouchiensis* SAKAGAMI, n. sp.
1. Axial section, holotype; 2. Tangential section, paratype; Reg. Nos. 2526-E and 2525-F, respectively. ×30; 3. Showing the mode of occurrence of *Pseudostaffella? tamanouchiensis*; 3a, *Pseudostaffella? tamanouchiensis*; 3b, *Nankinella* sp.; 3c, *Pseudofusulina vulgaris*. ×10.

Figs. 4-12. *Schwagerina furoni* var. *tamanouchiensis* SAKAGAMI n. var.
4. Holotype; 5-12. Paratypes; ×10. Reg. Nos. 2544-A. 2544-B, 2543-A, 2548-A, 2548-B, 2546-A 2547-A, 2549-A and 2545-A, respectively.

All are preserved in the collection of the Department of Geology, Hakodate Branch, Hokkaido Gakugei University.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fusiform with straight axis of coiling. The lateral slopes are convex.

The length and width in the sixth volution measure 5.9 to 6.7 mm and 2.8 to 3.7 mm respectively, with a form ratio of 1:1.6 to 1: 1.8.

Proloculus spherical and large. Its average outer diameter is about 0.51 mm for ten specimens.

Septa are rather thick and regularly fluted throughout the length of the shell.

Spirotheca is composed of a tectum and a keriotheca. The average thickness of spirotheca in the first to the sixth volutions of ten specimens measure 0.047, 0.062, 0.072, 0.090, 0.098 and 0.109 mm, respectively.

Axial filling is poorly developed in the axial regions. Chomata indistinct.

Remarks: — The present form resembles *Schwagerina furoni* THOMPSON, which M. L. THOMPSON reported from the Bamian limestone of Afghanistan, in its shape, large proloculus and the mode of axial filling. However, the present form differs from THOMPSON's species by the thinner wall, more regular septal fluting and finer alveolar structure of the keriotheca.

Geological age and Occurrence:— The present form occurs in association with *Schwagerina* cfr. *japonica* (GÜMBEL), *Schwagerina* sp. and *Neoschwagerina margaritae* DEPRAT. Its geological age may correspond to the upper Guadalupian of North America. This new variety was collected from a small limestone block in the Yagooki Valley, Tamanouchi, Hinode-mura, Nishitama-gun, Tokyo-to, Japan.

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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

「日本古生物学会第64会例会」1956年10月6日京都大学理学部地質学鉱物学教室において開催した（参会者15名）。講演者並びに講演題目は次の通りである。

富山県南部の手取層群の植物化石（代読）……………………………………… 前田四郎・武南　馨

志摩で新たに発見した Neoschwagerininae について ……………………………山際延夫

京都西山産紡錘虫の1新種とその microspheric form? について ……………………………坂口重雄

On the Septal Projection of the Halysitidae ……………………………… Takashi HAMADA

On Some Fossil Echinoids from Kyushu, Japan …………………………………………… ...Akira MORISHITA & Kiyoshi TAKAHASHI

北アルプス西麓の手取層群に *Trigonia* の発見（代読）…………………………前田四郎・武南　馨

On the Occurrence of Liassic *Cardinioides* from the Kuruma Group in Nagano and Niigata Prefectures, Japan（代読）……………………………………………… Itaru HAYAMI

On Some Lower Triassic Pelecypod-Fossils from Maizuru Zone………Keiji NAKAZAWA

An *Aturia* from the Poronai Shale in Hokkaido ………………………Teiichi KOBAYASHI

An *Aturia* from (?) Kusu County, Oita Prefecture, Kyushu ……………Teiichi KOBAYASHI

Supplementary Notes on the Cambrian from Southeastern Asia………Teiichi KOBAYASHI

On the Occurrence of *Crotalocephalus*, Devonian Trilobites, in Hida, West Japan ... . Teiichi KOBAYASHI and Hisayoshi IGO

On the top-horizon of *Desmostylus* in Japan ……………………………………… Nobuo IKEBE

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 24, pp. 267-272, Pl. 38, Oct. 31, 1956

301. ON SOME NEW GLYCYMERID MOLLUSCS FROM JAPAN*

SABURO KANNO

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日本産 *Glycymeris* 属の新種について：化石 *Glycymeris* 属を検討中たまたま四種の新型を発見したのでこれを記載した。 菅野三郎

Introduction

From the stratigraphical and ecological point of view, the genus *Glycymeris* is considered to be an important member in the rich Tertiary pelecypod fauna of Japan, especially, in the Neogene from where about 20 species have been reported. The Glycymeridae, according to D. NICOL (1950) seems to have been derived from the cuculleid stock probably during the late Jurassic. However, in Japan, *Glycymeris densilineata* NAGAO (NAGAO, 1934), the oldest known species, *G. hokkaidoensis* YABE and NAGAO, and *G. amakusaensis* NAGAO appeared during the Cretaceous age. With the opening of the Neogene there was a remarkable increase both in species and individuals. The relationship among these numerous species of Neogene *Glycymeris* is an important and interesting problem, but at this place further remarks are reserved.

The purpose of this paper is to describe four new forms of *Glycymeris* from the Tertiary deposits of Miyagi, Fukushima, Saitama and Yamanashi Prefectures.

* Read at Sendai Jan. 21, 1956; received Jan. 27, 1956.

The writer whishes to express his gratitude to Profs. Haruyoshi FUJIMOTO and Kotora HATAI of the Geological and Mineralogical Institute, Tokyo University of Education for their advice and encouragement. Thanks are also due to Mr. Tsuyoshi KOMURA for kindly offering his collection to the writer for study.

Systematic Description

Family Glycymeridae

Genus *Glycymeris* DACOSTA, 1778

Glycymeris idensis KANNO, n. sp.

Pl. 38, figs. 1-5

Shell small in size, moderately thick and convex, subcircular in outline, slightly longer than high; equivalve, equilateral. Beak central in position, pointed, rather prominent, opisthogyrate.

Surface with more than 27 rather obscure radiating striae, obsolete at ends, crossed by wrinkled and fine concentric growth lines. Interior smooth, ventral margin crenulated; adductor scars distinct, isomyarian. Area broad, vertically incised with about 5 inverted broad V-shaped lines. Teeth 7-11 on anterior and posterior sides, radially arranged, strong, becoming smaller towards middle; about 10 small vertically arranged teeth in middle.

Dimensions (in mm.):—

Specimens	Height	Length	Thickness	$\frac{H}{L}\times 100$	$\frac{T}{L}\times 100$	Valve	Type
1.	34.8	35.4	21.1	98.3	29.8	Intact	Holotype
2.	34.2	34.1	18.4	100.0	27.0	〃	Paratype
3.	30.3	28.8	10.0	100.5	34.8	Right valve	〃 rather deformed
4.	28.0	29.9	10.3	94.0	34.5	〃	〃 〃
5.	32.5	35.1	9.8	92.5	27.9	〃	〃
6.	33.6	35.0	11.0	96.0	31.4	〃	〃
7.	31.3	10.5	9.3	100.6	30.5	Left valve	〃

Remarks:—About one hundred intact and isolated valves were examined. This new species resembles *Glycymeris yessoensis* (SOWERBY), a fossil and Recent species from Japan, but the former can be distinguished from the latter by having a less number of radial striae, heavier test, and the more inflated shell. *Glycymeris matsumoriensis* NOMURA and HATAI (1937, p. 123, pl. 17, figs. 1-6) from the Miocene of Nanakita, Miyagi Prefecture is another related species, but the heavy and large shell, the great convexity, and large number of radial striae serve to distinguish it therefrom.

Type specimens:—Holotype Reg. No. 5536, and paratype Reg. No. 5537, Geological and Mineralogical Institute, Tokyo University of Education.

Locality and geological horizon:—A valley cliff about 150 meters in the upper stream of the Tamagawa reservior, Minami-ide, Ôuchi-mura, Igu-gun, Miyagi Prefecture. Middle fossil zone of the Yoshigasawa formation of the Kaneyama group, Miocene.

Associated fauna:—*Laevicardium shiobarense* (YOKOYAMA), *Chione y-iizukai* (KANEHARA), *C. osyuensis* NOMURA, *Dosinia (Kaneharaia) kaneharai ouchiensis* KANNO.

Glycymeris flabellata KANNO, n. sp.

Pl. 38, figs. 9-13

Shell small in size, strongly convex, transversely elongated, inverted fan-shaped, subequilateral; anterior and posterior ends both narrowly rounded, ventral margin regularly arcuate, dorsal margin sloping, posteriorly and anteriorly straight. Beak central in position, not prominent, but slightly pointed. Surface provided with more than 20 narrow and shallow impressed radial grooves marked on central part and obsolete on either side of disc; growth lines rather indistinct. Teeth about six on the posterior side, radially arranged. Muscle scars inaccessible in all specimens at hand, inner margin crenulated.

Remarks:—This new species show some variations in shell outline, however, the inverted fan-shaped form is its characteristic feature. *Glycymeris k-suzukii* OINOMIKADO (1938, pl. 20, figs. 1-3) from the Itahana formation (Miocene) is the most related species, but it can be distinguished from the present one by having a large shell, heavier test, and higher shell. *Glycymeris* sp. (M. YOKOYAMA, 1926, p. 123, pl. 16, fig. 5) from the Miocene of Shiobara, Tochigi Pre-

Dimensions (in mm.) :—

Specimens	Height	Length	Thickness	$\frac{H}{L}\times 100$	Angle between posterior and anterior margin	Type
1.	25.0	ca. 35.0	ca. 7.5	ca. 71.5	113°	Syntype
2.	24.0	ca. 32.0	ca. 7.2	ca. 75.0	119°	〃
3.	23.0	ca. 31.0	ca. 8.5	ca. 74.3	121°	〃
4.	17.5	24.3	——	72.0	129°	〃
5.	12.4	17.8	ca. 4.5	70.0	123°	〃
6.	14.2	18.7	ca. 4.0	76.0	123°	〃
7.	14.0	22.0	——	63.6	126°	〃
8.	11.9	16.7	——	71.2	121°	〃
9.	25.0	35.2	——	71.0	112°	Collected from the Chichibu Basin
10.	14.0	20.0	——	70.0	114°	〃
11.	15.5	21.0	——	73.6	125°	Collected from Osozawa

fecture is the another allied species, but its poor preservation makes precise comparison with the present difficult.

Type specimens:-Syntype Reg. No. 5538, Geological and Mineralogical Institute, Tokyo University of Education.

Locality and geological herizon : — A valley cliff about 200 meters upstream of the Tamagawa reservior, Minami-ide, Ôuchi-mura, Igu-gun, Miyagi Prefecture. Middle fossil zone of the Yoshigasawa formation of Kaneyama group, Miocene. About 300 meters on the western road side of the Chigaya mineral spring, Chigaya, Kamiyoshida-mura, Chichibu-gun, Saitama Prefecture. Upper fossil zone of the Akahira formation, upper Oligocene.

Type specimens:—Syntype Reg. No. 5540, Tokyo University of Education.

Associated fauna at the type locality : — *Laevicardium shiobarense* (YOKOYAMA), *Lima yagenensis* OTUKA, *Panope japonica* (A. ADAMS), *Peronidia lutes venulosa* SCHRENCK, *P. protovenulosa* NOMURA, *Nassarius iwakianus* YOKOYAMA.

Glycymeris compressa KANNO, n. sp.

Pl. 38, figs. 6-8

Shell small in size, subcircular in outline, nearly equilateral, strongly compressed; test thin; anterior and posterior extremities almost equally rounded; base regularly semi-circular, dorsal margin subequal, straight or a trifle convex, forming at the beak an angle of about 115°-120°. Beak almost central in position, pointed, small but prominent, orthogyrate. Surface provided with more than 25 narrow and shallow impressed radial grooves which are marked at central part, becoming obsolete towards either sides of disc; interspaces between grooves flattened, much wider than groove, probably not ornamented by fine radial striae on their disc; growth lines rather indistinct. Area rather low and narrow, vertically incised with inverted broad V-shaped lines. Teeth 12 on either side, radially arranged, not strong, becoming smaller towards middle; more than eight small, vertically arranged teeth in middle; inner margin crenulated.

Remarks:—The equilateral, compressed and subcircular shell of the present new species resembles *Glycymeris yessoensis* (SOWERBY), but the more pointed beak, *Dimensions* (in mm.) :—

Specimens	Height	Length	Thickness	$\frac{H}{L} \times 100$	$\frac{T}{L} \times 100$	Valve	Type
1.	32.8	31.8	14.2	100.3	44.7	Intact v.	Holotype
2.	27.3	28.7	7.0	95.0	48.8	Left v.	Paratype
3.	32.2	33.0	15.1	97.5	45.6	Intact. v.	〃
4.	25.5	ca. 26.5	——	——	——	Right v.	〃

more distinct radial grooves and thinner test serve to distinguish it therefrom. *G. yamasakii* (YOKOYAMA) (1925, p. 20, pl. 5, fig. 6) from the Pliocene of Shigarami formation in Shinano province is another related species, but it can be distinguished from the present one by having a lower shell and more finer radial grooves. *G. nozokiensis* HATAI and NISIYAMA (1951, p. 1, text-figs. 1-2) from the Miocene of Nozoki mura, in Yamagata Prefecture has more predominate radial ribs and a more circular shell than the present new species.

Type specimens:— Holotype Reg. No. 5541, and paratype Reg. No. 5542. Geological and Mineralogical Institute, Tokyo University of Education.

Locality and horizon :—A road side cliff, about 600 meters west of Akashiba, Shinchi-mura, Fukushima Prefecture. Upper part of the Akashiba formation.

Associated fauna :—*Acila* sp., *Macoma incongrua* (v. MARTENS), *Dentalium* sp.

Glycymeris osozawensis KANNO, n. sp.

Pl. 38, figs. 14 a-c

Shell medium in size, subovate in outline, nearly equilateral, moderately convex; test thick; anterior and posterior extremities widely rounded like ventral margin, which forms with them a subquadrate angle. Beak central in position, small, not so prominent, orthogyrate. Surface provided with more than 25 narrow, shallow and obscure radial striae, crossed by obscure incremental concentric lines. Inner ventral margin crenulated. Area rather high and wide, vertically incised with 5-6 chevrons. Teeth 7-8 on either side, radially arranged, rather strong, becoming smaller towards middle; more than 8 small, vertically arranged teeth in middle.

Dimensions (in mm.) :—39.0 in length, 42.3 in height and 13.7 in thickness of the right valve (holotype), 41.3 in length and 43.6 in height of the another right valve (paratype).

Remarks :—This new species more or less resembles *Glycymeris crassitesta* OZAKI (1954, p. 15, pl. 8, figs. 1-2) from the Pliocene of Chôshi, Chiba Prefecture, but it can be distinguished therefrom by having a higher form, narrow cardinal area and less number of chevrons. The present specimens were collected by T. KOMURA.

Type specimens :—Holotype Reg. No. 5543, and paratype Reg. No. 5544, Geological and Mineralogical Institute, Tokyo University of Education.

Locality and geological horizon :—Osozawa, Akebono mura, Minami-koma gun, Yamanashi Prefecture. Shizukawa sandstone, upper part of the Shizukawa group, Pliocene.

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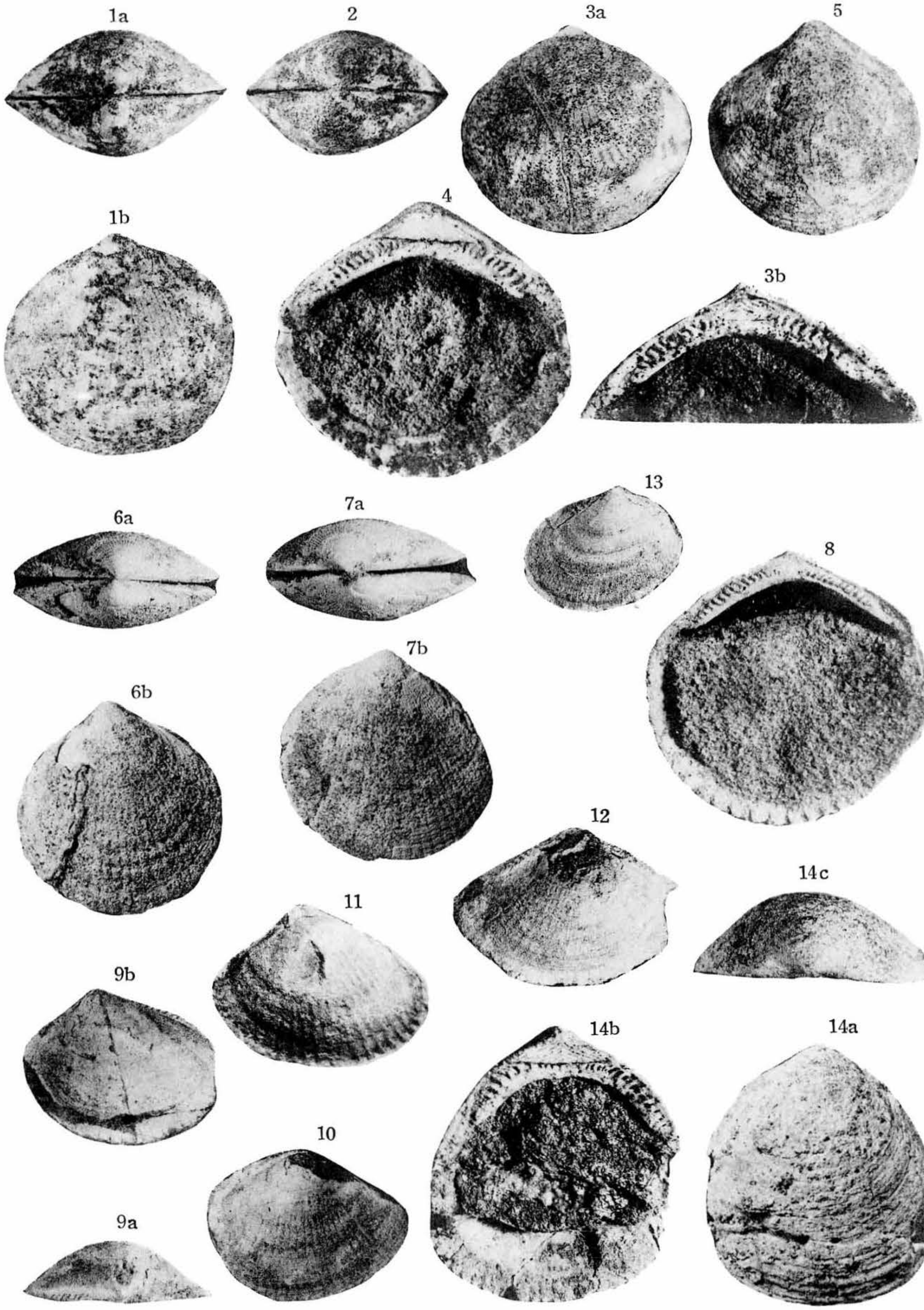
Explanation of Plate 38

(All figures in natural size unless otherwise stated.)

Figs. 1a-b. *Glycymeris idensis* KANNO, n. sp., (Holotype)
a. Apical view, b. Right view.
Figs. 2. *Glycymeris idensis* KANNO n. sp. (Paratype), apical view.
Figs. 3 a-b. *Glycymeris idensis* KANNO, n. sp., (Paratype)
a. Left valve, b. Hinge plate and teeth of the same. ×1.5
Fig. 4. *Glycymeris idensis* KANNO n. sp., (Paratype), inner surface of the left valve. ×1.5
Fig. 5. *Glycymeris idensis* KANNO n. sp., (Paratype), right valve.
Figs. 5a-b. *Glycymeris compressa* KANNO n. sp., (Holotype)
a. Apical view, b, Right valve of the same.
Figs. 7a-b. *Glycymeris compressa*. KANNO, n. sp., (Paratype)
a. Apical view, b. Left valve of the same.
Fig. 8. *Glycymeris compressa* KANNO, n. sp., (Paratype), inner surface of the left valve. ×1.5.
Figs. 9a-b. *Glycymeris flabellata* KANNO, n. sp. (Syntype)
a. Apical view of the left valve. b. outer surface of the same.
Figs. 10, 12, 13. *Glycymeris flabellata* KANNO, n. sp. (Syntype)
Fig. 11. *Glycymeris flabellata* KANNO. sp., from the Chichibu Basin.
Figs. 14a-c. *Glycymeris osozawensis* KANNO, n. sp., (Holotype)
a. Outer surface of the right valve, b. Inner surface of the same, c. Apical view of the same.



S. AOKI photo.

Trans. Proc. Palaeont. Soc. Japan. N. S., No. 24, pp. 273—276, Pl. 39, Oct. 31, 1956.

302. ON FOSSIL DIATOMS FROM THE OIL-SHALE OF YOSHIOKA FORMATION IN THE SOUTHWESTERN PART OF HOKKAIDO, JAPAN*

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北海道南西部吉岡層の油母頁岩中の化石珪藻について： 油母頁岩中から多数の珪藻を見出し記載した. 大部分は淡水性のものであるが, 海水及び汽水性のものもあり又海産の珪鞭藻類も共存する. 従つてこれ等の堆積環境は浅海の汽水水域であると考えられる. 押 手 敬

The material dealt herewith was procured in October 1955, from the Miocene Yoshioka formation at Yoshioka in Southwestern Hokkaidô. In its lower part there are oil shale beds which are well exposed on the floor of the Yoshioka river, 3 km. above the embouchure. They comprise alternations of numerous black muddy layers, 0.5-2 mm. thick, rich in plant remains and thin tuffaceous ones, 0.02-0.05 mm. thick, containing diatoms, pollens, and silicoflagellates (*Dictyocha*) in profusion.

The diatom cells are usually brown coloured, not well preserved but 15 species, 1 variety and 2 forms in 12 genera were distinguished. They are all freshwater forms but one true marine and brackish form. From the fossil assemblage the oil shale beds are considered to have been deposited in an environment where fresh and salt water are mixed, or perhaps in shallow brackish water with forests in the hinterland.

The material is kept in the department of geology, Hokkaidô Gakugei University at Hakodate.

The writer tenders his cordinal thanks to Prof. Y. SASA, Prof. K. HUZIOKA, Prof. T. ISHIKAWA and Mr. S. UOZUMI for their advices from various angles.

Description of species

Melosira granulata RALFS

HEURCK (1884): Synopsis, pl. 87. fig. 17.

Cell cylindrical, 6-8 μ in diameter, puncta 11-13 in 10 μ on girdle.

This is a very common species in fresh water, most abundant in the present sample.

Melosira granulata fo. *curvata* GRUNOW

HUSTEDT (1927): Kieselalgen, fig. 80.

Cell cylindrical, slightly curved, ca. 6 μ in diameter, puncta 9-10 in 10 μ.

This is a very common species in fresh water, very abundant in the present sample.

Cyclotella striata (KÜTZ.) GRUNOW

Pl. 39, fig. 2.

HUSTEDT (1930): Kieselalgen, p. 344, fig. 176.

* Read Jan. 21, 1956; received Feb. 9, 1956

Cell disk-shape, 20–25 μ in diameter, radial striae ca. 12 in 10 μ.

This is a common species in brackish and marine water, not rare in the present sample though often fragmental.

Fragilaria construens GRUNOW

HUSTEDT (1930): Diatomeae, p. 156, fig. 670.

Cell long panduliform, 20 μ in length and 5–6 μ in width, striae parallel, 12 in 10 μ.

This is a fresh water species, rarely found in the sample.

Synedra Goulardi (BRÉBISSON) GRUNOW

OKUNO (1952): Atlas, pl. 10, fig. 5.

Cell long lanceolate, length 60–75 μ, width 6–8 μ striae 10–11 in 10 μ.

This is a fresh water species, common in the present sample.

Synedra ulna EHR.

Pl. 39, fig. 8

HEURCK (1884): Synopsis, pl. 38, fig. 7.

Length of cell 160–200 μ, width about 3 μ, striae parallel, 14–16 in 10 μ.

This is a common species in fresh water, in the present sample common and often fragmental.

Synedra Vaucheriae KÜTZING

HEURCK (1884): Synopsis, pl. 40, fig. 19.

Length of cell about 20 μ, width 4 μ, striae 13 in 10 μ.

This is a common fresh water species, common in the present sample.

Achnanthes lanceolata (BRÉBISSON) GRUNOW

HEURCK (1884): Synopsis, pl. 27, fig. 8.

Length of cell about 16 μ, width 8 μ, striae 8–9 in 10 μ.

This is a common fresh water species, rather common in the sample.

Rhoicosphenia curvata GRUNOW

Pl. 39, fig. 6, 7.

HEURCK (1884): Synopsis, pl. 26, fig. 1–3.

Cell curved edge-shape, length 30–50 μ, width 10–12 μ, striae 12–13 in 10 μ.

This is a fresh water form though sometimes found in brackish water, rather common in the present sample.

Cocconeis placentula var. *lineata* (EHR.) CLEVE

Pl. 39, fig. 1

HUSTEDT (1930). Diatomeae, p. 348, fig. 803.

Cell elliptical, length 30–35 μ, striae 15–20 (transverse) and 13–16 (longitudinal) in 10 μ.

This is a common and widely distributed species in fresh water, rather common in the present sample.

Navicula anglica RALFS

HEURCK (1884): Synopsis, pl. 4, fig. 6.

Cell elliptical, end subapiculated, length 46 μ, width 13 μ, striae 11–12 in 10 μ.

This is a fresh water species, rare in the sample.

Navicula lanceolata KÜTZING

HEURCK (1884): Synopsis, pl. 8, fig. 16.

Cell lanceolate, length about 40 μ, width 10 μ, striae 14 in 10 μ.

This is a fresh water species, rather

common in the present sample.

Pinnularia esox fo. *major* HUSTEDT

OKUNO (1952): Atlas, pl. 26. fig. 14.

Cell long elliptical with round end, length 120μ, width 25μ, costae 7–9 in 10μ.

This is a typical fresh water species, rarely found in the sample.

Amphora ovalis KÜTZING

HEURCK (1884): Synopsis, pl. 1, fig. 1.

Cell elliptical, length 35 μ, width 17 μ, striae 14 in 10 μ.

This is a common fresh water species, rare in the sample.

Cymbella cistula HEMPRICH

Pl. 39, fig. 3

HUSTEDT (1930): Diatomeae, p. 363, fig. 626.

Length of cell 80–100 μ, width 20–30μ, striae 8–10 and puncta 15–20 in 10 μ.

This is a very common and widely distributed species in fresh water, rather common in the sample.

Cymbella parva (W. SM.) CLEVE

HUSTEDT (1930): Diatomeae, p. 363, fig. 675.

Length of cell 60–70 μ, width about 15 μ, striae 9 in 10 μ.

This is common fresh water species, abundant in the present sample.

Epithemia sorex KÜTZING

Pl. 39, fig. 5

HEURCK (1884): Synopsis, pl. 32, fig. 6–8.

Cell slightly arched, end attenuate and recurved, length 40–60 μ, width 10–15 μ, costae 6 and areolae 10–12 in 10 μ.

This is a fresh and brackish water species, common in the sample.

Epithemia zebra (EHR.) KÜTZING

Pl. 39, fig. 4

HUSTEDT (1930): Diatomeae, p. 384, fig. 729.

Cell slightly curved with round end, length 60–70 μ, width 15 μ, costae 3–4, areolae 10 in 10 μ.

This is a very common in fresh water, not rare in the present sample.

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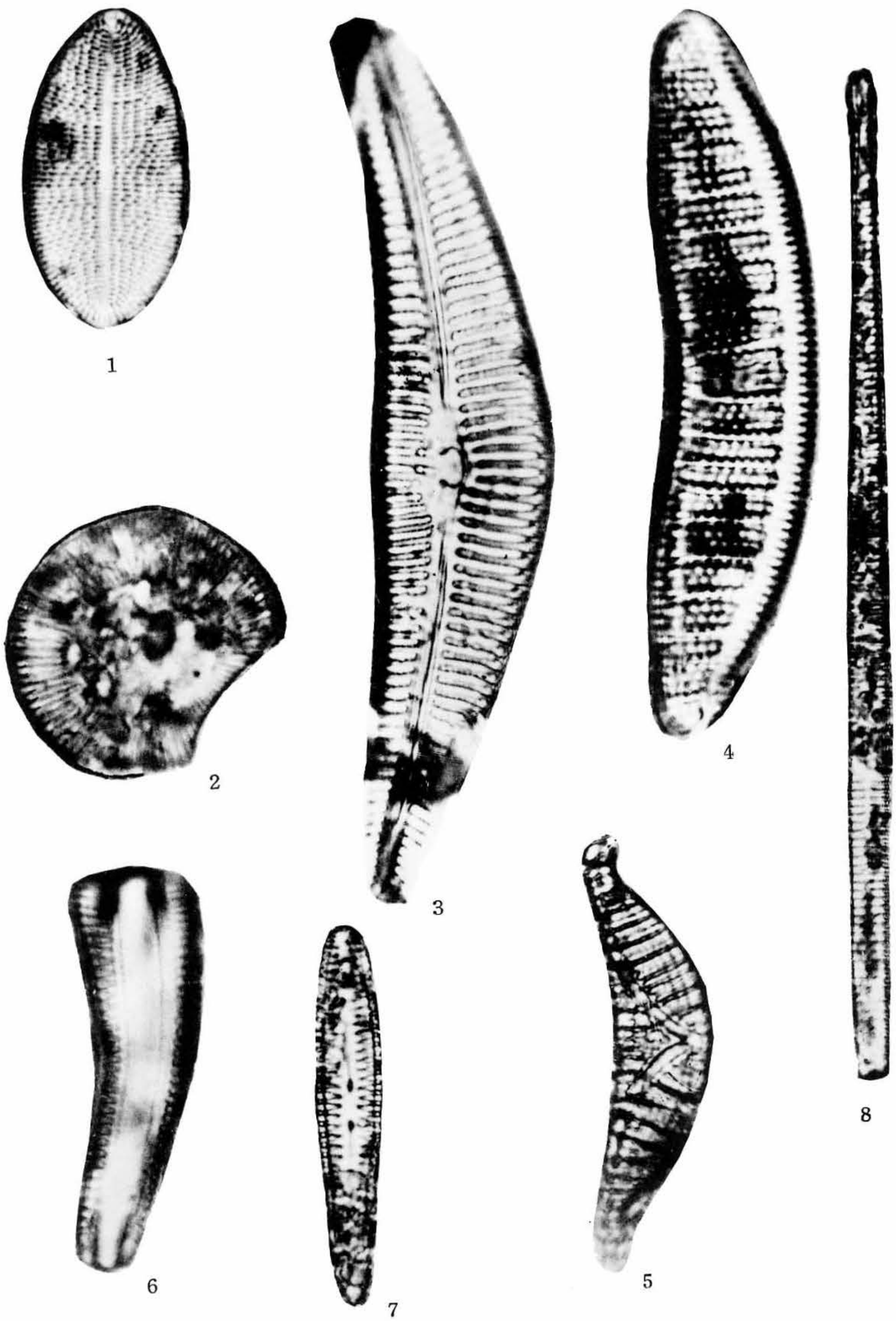
Explanation of Plate 39

Fig. 1. *Cocconeis placentula* var. *lineata* (EHR.) CLEVE × 1500.
Fig. 2. *Cyclotella striata* (KÜTZ.) GRUNOW × 1500.
Fig. 3. *Cymbella cistula* HEMPRICH × 1500.
Fig. 4. *Epithemia zebra* (EHR.) KÜTZING × 1500.
Fig. 5. *E. sorex* KÜTZING × 1500.
Fig. 6, 7. *Rhoicosphenia curvata* GRUNOW × 1500.
Fig. 8. *Synedra ulna* EHR. × 1500.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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 24, pp. 277—284, pl. 40, 1 text-fig., Oct. 31, 1956.

303. MISCELLANEOUS NOTES ON THE CAMBRO-ORDOVICIAN GEOLOGY AND PALAEONTOLOGY, XXVI

SUPPLEMENTARY NOTES ON THE CAMBRIAN TRILOBITES FROM SOUTHEASTERN ASIA*

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東南アジア産寒武紀三葉虫追記： アジア最南端の寒武系は多分カンボジャ北部の三葉虫の産地であろう。DEPRAT がトンキン雲南境の長蓬系から採集した三葉虫のうちに，*Plethopeltis saurini* 外1新種2新亜種を含む10種が識別された。また *Annamitia spirifera* では胸部軸環節の棘が生長の或時期に第7節から第9節へと処を代へることも判つた。 小 林 貞 一

On the occasion of describing some Lower Cambrian trilobites from Yunnan, I have discussed the Cambrian faunas of Haut-Tonkin in some length (1934, 44). Lately Dr. E. SAURIN, Director of the Service géologique et Laboratoire, Centre National de Recherches Scientifiques et Techniques at Hanoi, Viet-Nam, kindly sent me some trilobites collected from the Changoung series on the Tonkin-Yunnan border by DEPRAT and two photographs of FROMAGET's *Asaphiscus* aff. *gregarius* from the vicinity of Mélpourey, Cambodga. Before describing the results of my study on them, I record here my gratitude to Dr. SAURIN for his courtesy.

I. *Asaphiscus* aff. *gregarius* by FROMAGET from Cambodga.

Insofar as I am aware, the southernmost locality of Cambrian trilobites in Asia may be Mélpourey in northern Cambodga whence FROMAGET and BONELLI (1932) (see also FROMAGET, 1941) has reported the occurrence of *Asaphiscus* aff. *gregarius* in a horizontal quartzose shale bed on the Indosinian massif.[1] There are two photographs of this trilobite at hand, one in natural size and the other about two and a half times magnified (Fig. 16). It is a nearly complete shield, but unfortunately its cephalon not well preserved.

Dorsal shield subelliptical in outline, but perhaps twice as long as broad and somewhat broader on the anterior than on the other side. Dorsal furrows on the cephalon deep and seemingly subparallel to each other at least on the posterior part; glabella distinctly elevated above cheeks and unfurrowed except for a faintly impressed occipital furrow; right eye apparently located at the midlength of the cephalon. Thorax composed probably of nine (?) segments; axial ring convex, almost as wide as the pleura. Pygidium two-thirds as long as broad, trilobed by a pair of profund furrows and surrounded by a narrow depressed border; only the first

* Received Feb. 27, 1956; read Oct. 6, 1956.

1) According to Dr. SAURIN the trilobite was collected from the vicinity of Thalabrioat near Stung Treng, which is located about 80 km ESE of Mélouprey.

furrow discernible on the pleural lobe.

The thorax and pygidium measure about 12.5 mm. in total length and about 8.5 mm. in breadth.

Such a cylindrical glabella is found in *Psilaspis* (*Entorachis*) *shantungensis* KOBAYASHI (1955), but the associated pygidium is much broader and the axial lobe narrower, if compared with the Mélpourey form. In the outline of the pygidium this resembles "*Anomocarella*" *tatian* WALCOTT, but again they are different in the breadth of the axial lobe. In the general aspect this shield looks very similar to *Blainia gregarius* WALCOTT which is a common member of the Maryville limestone at the top of the Middle Cambrian in the Appalachian mountains. In that species, however, the glabella somewhat tapers forward, the thorax has a little narrower axis, and the posterior margin of the pygidium is transversal or even sinuated. Nevertheless I agree with FROMAGET to contend that it bears close affinity with *Blainia*.

In the above description I suggested nine for the number of thoracic segments, because the terminal band of the thorax appears broader than the seventh segment, but the photographs are not clear enough to warrant the existence of the eighth and ninth segments in this space. Assuming it to be an octasegmented trilobite, its alliance to certain asaphids, such as *Charchaqia* TROEDSSON, 1937, *Eoasaphus* KOBAYASHI, 1936 (i.e. *Anorina* WHITEHOUSE, 1936) and *Isoteloides* RAYMOND, 1910, is undeniable. In *Charchaqia* the glabella is cylindrical, but its thorax is much shorter in proportion to the pygidium and the axial lobe narrower. In *Liostracus* (?) *superstes* LINNARSSON, the type of *Eoasaphus*, the glabella is tapering forward, the axis of the thorax narrower and the pygidium broader than in the Mélpourey form. In *Isoteloides whitfieldi* RAYMOND, the type species of *Isoteloides*, the axis of the thorax is nearly as broad as that of the Mélpourey form, but the pygidium is relatively long and the glabella teretely conical.

Without seeing the specimen, it is difficult for me to say whether it is more allied to the Asaphidae or the Asaphiscidae, but I think it quite probable that it is an ally to *Blainia*, if not a primitive member of the Asaphidae. The age of the trilobite suggested from its general aspects is in a range from late Middle Cambrian to early Ordovician.

Incidentally, "fucoidal" impression is reported to occur in a dark gray shale or slate on Phuket island on the west coast of Peninsular Thailand. DUNCAN suggested *Eophyton* for it and noted the belonging of MANSUY's *Planolites* (?) from the Lower Cambrian of Yunnan to the same kind. Neither a description nor an illustration of the Siamese specimen appears as yet published. The occurrence of *Planolites* is reported also by PATTE (1927) from southwestern Tonkin. *Planolites* is, however, widely ranged as a genus. *P. vulgaris* is its type species which was described by NICHOLSON (1873) from the Clinton group. *Planolites corrugatus* is an enigma discovered in the Beltian of Montana.

Phuket Island is located more southerly than Mélpourey and the Phuket series which yielded the fucoidal impression is tentatively referred to the Cambrian system by BROWN and others (1953). It is, however, desirable that the chronology is confirmed by any fossil other than such a problematicum.

II. Some Trilobites from the Changpoung Series on the Yunnan-Tonkin Border.

In a small lot of specimens from four localites are distinguished 10 species of trilobites as tabulated below.

The specimens before hand are mostly not so well preserved, as may be understood from SAURIN's statement (in his letter, Dec. 16, 1953) that "Ce sont les reliquats de la faune étudiée par MANSUY." Supplementary notes are, however, given here to his monumental works in 1915 and 1916.

Annamitia spinifera MANSUY

Plate 40, Figures 13-15

1916. *Ptychoparia* (*Annamitia*) *spinifera* MANSUY, *Mém. du Serv. géol. de l' Indochine, Vol. 5, Fasc. 1*, p. 25, pl. 3, figs. 4a-q.

1944. *Annamitia spinifera* KOBAYASHI, *Japan. Jour. Geol. Geogr. Vol. 19*, p. 133, text-fig. 2.

Four slabs from Penkai contain five shields in two of which, however, tubercles and spines are not well preserved. As MANSUY mentions, the thorax is composed of 11 segments, but the last one is not spiniferous as in his diagnosis. The spine issues from the 7th segment in a small shield (fig. 13) and from the ninth in a medium and large ones (figs. 14 and 15). The medium sized one of the three shields is just about the size of MANSUY's in figs. 4d and 4e having the spine on the 7th segment. The large shield is not much different in size from MANSUY's in fig. 4c with a spine on the ninth segment. It is certainly an interesting fact that the axial spine changes its position from the 7th to the 9th segment of the thorax in the growth stage in which the cranidium measures 6 to 7 mm. in length.

On the pygidium of the large shield (fig. 15) tubercles are seen to be paired

Changpoung Series on Yunnan-Tonkin Borderland	Locality				Cambrian
	Penkai	Kiaotieou	Changpoung	Dongquan	
1. *Annamitia spinifera* MANSUY	×				Late Middle
2. *Damesella brevicaudata* WALCOTT, var.		×			
3. *Drepanura kettereli* MONKE, var.		×			
4. *Dorypygella* sp. nov.			×		
5. *Haniwa conica* KOBAYASHI				×	Upper
6. *Prosaukia angulata* (MANSUY)			?	×	
7. *Eosaukia* (?) *walcotti* (MANSUY)	?		×	×	
8. *Plethopletis saurini* KOBAYASHI, nov.			×		
9. *Shirakiella* sp.	×				
10. *Koldinioidea* sp.				×	

on the third ring and the terminal lobe of the axis as indicated in my restoration (1944).

Damesella brevicaudata WALCOTT, var.

Plate 40, Figures 9a-b.

This pygidium fits in *Damesella brevicaudata* (KOBAYASHI, 1941-42) in most features except for the position of long spines. Among 7 pairs of marginal spines the first and fourth are longer than the others in this variety whereas the first and fifth spines are elongated in the typical form.

Drepanura ketteleri MONKE, var.

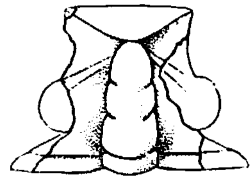
Plate 40, Figure 10

1916. *Stephanocare* (?) *monkei* MANSUY, non WALCOTT, *Mém. Serv. géol. l'Indochine Vol. 5, Fasc. 1*, p. 19, pl. 1, fig. 30.
1931. *Teinistion typicalis* KOBAYASHI, non MONKE, *Japan. Jour. Geol. Geogr. Vol. 8*, p. 176, pl. 20, fig. 17, non. fig. 20b.

A pygidium from Kiaotieou belongs to an identical species with MANSUY's from Changpoung and probably my pygidium of *Teinistion typicalis* (?) from Hualienchai. They are similar to MONKE's *Teinistion lansi* in the broad outline and wide divergence of long spines in the first pair. There are 5 or 6 more pairs of flat spines or serrations which are different from MONKE's as well as *Drepanura premesnili*'s, but agree with *D. ketteleri*'s in the diminishing size from anterior to posterior. In the relatively broad axial lobe this agrees better with *D. ketteleri* than with the other allies.

Dorypygella sp. nov.

Plate 40, Figure 11, Text-figure



Text-Fig. *Dorypygella* sp. nov.

A tiny cranidium has the frontal rim strongly bent as in *Teinistion lansi* MONKE (1903) and *T. monkei* KOBAYASHI (1955), but it is typical of *Dorypygella* in its long conical glabella, two pairs of oblique lateral furrows in addition to a transverse occipital one, medium sized eyes at the mid-length and highly oblique eye-ridges running across the fixed cheeks of moderate breadth.

Haniwa conica KOBAYASHI

Plate 40, Figure 8

1935. *Haniwa conica* KOBAYASHI, *Jour. Fac. Sci., Imp. Univ. Tokyo, Sect. 2, Vol. 4, Pt. 2*, p. 245, pl. 7, fig. 4.

This is a *Haniwa* having a truncato-conical glabella which is a little broader than in the type of *H. conica* but on which lateral furrows are well impressed as in the type. In the outline of the glabella it resembles *H. sosanensis*, but the preglabellar area is evidently more expanded and divided into a narrow rim and long limb, instead of two parts of equi-length in *H. sosanensis*. The narrowness of the glabella and the shallow concavity of the preglabellar area in the type specimen of *H. conica* depend possibly upon lateral compression. I have previousely suggested *Haniwa* for MANSUY's *Ptychaspis* sp. from Dongvan with query, but the occurrence of the genus in the Changpoung series is now warranted.

Prosaukia angulata (MANSUY)

Plate 40, Figure 12.

1915. *Ptychaspis angulata* MANSUY, *Mém. Serv. géol. l'Indochine, Vol. 4, Fasc. 2*, p. 21, pl. 3, figs. 2a-v.
1916. *Ptychaspis angulata* MANSUY, *Ibid. Vol. 5, Fasc. 1*, p. 34, pl. 5, figs. 12a-e, pl. 6, figs. 1a-d.
1931. *Ptychaspis angulata* KOBAYASHI, *Japan. Jour. Geol. Geogr. Vol. 8*, p. 182, pl. 21, fig. 13.
1933. *Prosaukia angulata* KOBAYASHI, *Japan. Jour. Geol. Geogr. Vol. 11*, p. 125.

The cephalon and especially the preglabellar area reveal the typical aspects of the genus. The associate pygidium is also diagnostic in the presence of the pleural and interpleural furrows, but the anterior outline is more transversal than any of the genus in North America.

Eosaukia (?) *walcotti* (MANSUY)

Plate 40, Figures 1-4

1915. *Ptychaspis walcotti* MANSUY, *Mém. Serv. géol. l'Indochine, Vol. 4, Fasc. 2*, p. 22, pl. 2, figs. 16a-b, pl. 3, figs. 1a-z.
1916. *Ptychaspis walcotti* MANSUY, *Ibid. Vol. 5, Fasc. 1*, p. 33, pl. 5, figs. 10a-j, 11a-b.
1924. *Ptychaspis walcotti*, SUN, *Palaeontol. Sinica., Ser. B, Vol. 1, Fasc. 4*, p. 68, pl. 5, fig. 2.
1931. *Ptychaspis walcotti* KOBAYASHI, *Japan. Jour. Geol. Geogr. Vol. 8*, p. 183, pl. 22, figs. 18-19.
1933. *Calvinella walcotti* KOBAYASHI, *Ibid. Vol. 11*, p. 129.

There are several specimens from Penkai, Changpoung and Dongquan among which a cranidium from Changpoung (fig. 4) is as long as 20 mm. A cranidium and free cheek are found together in a specimen from Dongquan (fig. 1). A pygidium from Dongquan (fig. 2) has the triangular broad outline as that in fig. 1w, pl. 2, in MANSUY, 1915. Because it is so different from *Calvinella* or any other genus of the Saukinae in North America, the reference of this species to that genus is a question.

This pygidium is more allied to that of *Quadraticephalus* as well as *Eosaukia*. *E. latilimbata* is the monotypic species of the latter genus and its pygidium is said by LU (1954) to be *broadly transverse, semicircular*, instead of triangular. His species is represented by an internal and external mould of a shield which is depressed from anterior to posterior. It is probable that such a form as *walcotti* was derived from the early Upper Cambrian stock including *Eosaukia*.

Plethopeltis saurini KOBAYASHI, new species.

Plate 40, Figures 5-7.

Description:—Cephalon gently convex; glabella only slightly elevated above the general curvature of the cephalon, fairly large, subquadrate, outlined by dorsal furrows; lateral furrows, if present, very faintly impressed; posterior pair of the furrows confluent on the axis; occipital furrow not strong, but always present; occipital ring somewhat thickened in the middle; eyes relatively small, located at the mid-length of the cephalon and close to the glabella; frontal limb and rim undivided, or if divided, the frontal furrow is very weak. Free cheek relatively broad, gently convex and inclined laterally without any interruption of a marginal furrow; genal spine present. Facial sutures divergent for- and back-ward from the eyes; their anterior branches swinging inward near the anterior margin; posterior branches nearly straight, diagonal, outlining a large posterior limb of the fixed cheek.

Pygidium semicircular, but the anterior margin is gently arcuate; axial lobe composed of 3 or 4 rings and a terminal lobe, conical, elevated above the slightly convex pleural lobes; three pleural furrows distinctly seen on each side of the axis; interpleural furrows faintly impressed on the two flat anterior pleurae.

Test smooth.

Comparison:—As discussed elsewhere (KOBAYASHI, 1943), there are some 7 or 8 species of *Plethopeltis*. A solitary representative of the genus in Asia has been *P. stenorhachis* from Siberia having an unusually small glabella. The present species is very similar to *P. buehleri* ULRICH (1930), but the occipital ring narrows more distinctly and fixed cheeks are less developed in that species.

Shirakiella sp.

from Penkai is almost identical with *Anomocarella* sp. (?) by MANSUY, 1916.

Koldinioidia sp.

is represented by a cephalon and pygidia from Dongquan, but they are poorly preserved.

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Explanation of Plate 40

Figure 1. Cephalon, ×2, Loc. Dongquan.
Figure 2. Pygidium, ×2, Ditto.
Figure 3. Cranidium, ×2, Changpoung.
Figure 4. Ditto. ×1, Ditto.

Figure 5. Holotype cranidium, ×2, Loc. Changpoung.
Figure 6. Paratype free cheek, ×1.5, Ditto.
Figure 7. Paratype pygidium, ×1.5, Ditto.

Figure 8. Cranidium, ×3, Loc. Dongquan.

Figures 9a–b. Internal and external moulds of a pygidium, ×2, Kiao-Tieou.

Figure 10. Pygidium, ×2, Kiao-Tieou.

Figure 11. Cranidium, ×5, Changpoung.

Figure 12. Pygidium, ×1.5, Dongquan.

Figure 13. Clay-cast of a cephalon and thorax with an axial spine on the 7th segment, ×4, Penkai.
Figure 14. Clay-cast of a cephalon and thorax with an axial spine on the 9th segment, ×3, Ditto.
Figure 15. A thorax with an axial spine on the 9th segment and a pygidium with paired tubercles on the axial lobe. ×3, Ditto.

Figure 16. Dorsal shieid, ×2.5, Loc. Mélpourey.

All of the specimens illustrated in figures 1–15 were returned to Prof. E. SAURIN of the Faculté des Sciences at Saigon, in Viet-Nam.


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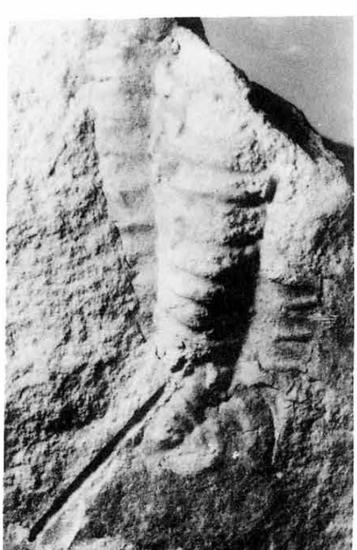
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Trans. Proc. Palaeont. Soc. Japan. N. S., No. 24, pp. 285-289, Pl. 41, 1 text-fig., Oct. 31, 1956

304. A MIOCENE *STEGOLOPHODON* FROM YATUO GROUP IN TOYAMA PREFECTURE*

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and

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富山県八尾層群産の中新世 *Stegolophodon*：富山県婦負郡黒瀬谷村須原と神通川対岸の上新川郡大沢野町春日より発見された象歯化石は，日本中新世第 3 の Mastodont で，*latidens* と *pseudolatidens* の中間に位する新種で *Stegolophodon tsudai* とした。須原のは村上勲により，春日のは前田建設会社の羽下憲蔵により発見された。地層は津田禾粒の八尾層群上部黒瀬谷累層の基底部の上黒瀬谷砂岩泥岩互層である。

鹿間時夫・桐井義博

Of the Japanese Miocene proboscidea, *Serridentinus annectens* (MATSUMOTO) and *Stegolophodon pseudolatidens* (YABE) are the best known and the most fully described species, of which the former is firstly described by MATSUMOTO under the generic name of *Hemimastodon* for a type specimen from the Hiramaki formation of Banzyo-bora, Kaminogô-mura, Gihu Prefecture, and the latter is also described by him under the name of *Prostegodon latidens* (CLIFT) for a specimen from the Tiganoura formation of Siogama, Miyagi Prefecture. MAKIYAMA described a fine lower jaw of *annectens* from the Hiramaki formation of Banzyo-bora. The elephant known as *latidens* was added by YABE with new materials from Siogama and Hunaoka-mati, Sibata-gun, Miyagi Prefecture (Tukinoki plant bed); he proposed new generic and specific name, *Eostegodon pseudolatidens*, for this archetypal stegodont. Besides these, the senior author once described a fragmental cheek tooth under the name of *Pentalophodon* (?) sp. from the Dômi formation of Hosoya, Mii-mura, Hôdi-gun, Isikawa Prefecture.

In November, 1953, I. MURAKAMI, then a mere boy student of the Ôsawano Middle School, found a proboscidean tooth at floor of a tributary of the Zinzu River, in Suwara, Kurosedani-mura, Nei-gun, Toyama prefecture, and the junior author, moreover, found a fragment of a limb bone at the same site. In June, 1954 the second specimen of a cheek tooth was found by K. HASHITA, a worker of Maeda Kensetu Company, at an excavating place of a culvert on the right bank of Zinzu River, at Kasuga, Ôsawano-mati, Kamisinkawa-gun, Toyama Prefecture. This locality is 500 m northeast to the first locality above mentioned. Furthermore, a fragment of a tusk was found by a dam construction worker from a bottom of Zinzu River at Suwara. These specimens were submitted for study to the senior author, who in August, 1954 visited the localities

* Read Jan. 21, 1956; received March 2, 1956.

and made some field observations with K. TSUDA of Niigata University and the junior author. The specimens now at hand, the third distinct representative of the Japanese Miocene proboscidean belonging to *Stegolophodon*, are comprised this short article.

According to TSUDA, the formation from which the specimens were obtained is the lower part of the Kamikurosedani alternation member of the Kurosedani formation which constitutes the upper part of the Yatuo group. The Kamikurosedani alternation member is 90–210 m thick, largely consists of alternation of sandstone and silt, constitutes the basal part of the Kurosedani formation, overlies the Iwaine formation of pyroclastic and green tuff members, and underlies the Kakehata alternation member; this member in question carries in its basal part many cobbles and boulders of andesite, and bears some marine fossils such as *Protorotella yuantaniensis* MAK., *Vicaryella* sp. and *Astriclypeus manni* VERRIL. etc. At Suwara, the site which bore the proboscidean specimens is about 2 m above the upper surface of the Iwaine formation. At Kasuga the fossil bearing site is composed of grey silty sandstone bearing many silicified woods and stamps. which are sometimes filled with pyrite, calcite and sulphur. TSUDA regarded the Kurosedani formation to be middle Miocene in age.

Stegolophodon tsudai n. sp.

Pl. 41, figs. 1-6

Cotype:—Upper left M3 from Suwara, stored in Geological Institute, Yokohama National University; plastotype of which, in Natural Science Museum, Tokyo and in Ôsawano Middle School. Upper right M1 from Kasuga belonged to HASHITA, plastotype of which, in Geological Institute, Yokohama National University. A fragment of upper incisive tusk, stored in the same institute.

Localities:—Suwara, Kurosedani-mura, Nei-gun, Toyama Prefecture and Kasuga Ôsawano-mati, Kamisinkawa-gun, Toyama Prefecture.

Horizon:—Kamikurosedani alternation member, Kurosedani formation of Yatuo group; Middle Miocene.

Diagnosis:—Upper incisive tusk laterally compressed with both of the lateral band of thin enamel layer. Cheek teeth intermediate in size between those of *latidens* and *pseudolatidens*. Ridge formula of upper M1 $^{1}/_{2}$—4—$^{1}/_{4}$(?); that of upper M3?—5—$^{1}/_{2}$. Basal cingula well developed; buccal cingulaum laminated and lingual one tuberculated. Distinct conulet present between first and second ridge of upper M 1. Median longitudinal cleft of crown rather weak in development. Anterior ridge of upper M 3 parallel to one another but posterior ones twisted. More developed than *pseudolatidens* but more archetypal than *latidens*.

Descriptions:—Upper left M 3. Provided with five ridges, hind talon and basal cingula. Anterior part well worn off and fore three ridges exposing dentine islets. Ridge formula ?—5—$^{1}/_{2}$; about 142 mm in median longitudinal length and 75 mm broad at second ridge where tooth is at its broadest. In upper view, tooth tapers backward; buccal margin more strongly curved than lingual margin; posterior margin obtusely pointed backward. At basal cingula on lingual side, conulets blocking valleys between second- and third ridges or between third- and fourth ridges, while there are no such conulets on buccal side. First two ridges parallel to one another and posterior ridges twisted or curved backward. First ridge tolerably damaged and enamel wall preserved only at posterior- and buccal sides, the former of which closely in contact with anterior wall of second ridge; dentine islet seems to be quadrate and broader in fore-&-aft direction than that of second ridge. Buccal part of second ridge partly damaged; posterior enamel wall nearly in contact at median portion with anterior wall of third ridge, which a little below grinding surface; dentine islet subquadrate, slightly expanded on both buccal and lingual; enamel wall thick, rugose and with no distinct crenulation. From third- to fifth ridges there is seen a feeble median longitudinal cleft, which situated a little outward turn and divides dentine islet of third ridge into two discs. Its posterior wall a little larger and more strongly crenulated than anterior; dentine islet elongate oval, moderately pointed toward both buccal and lingualsides; enamel wall thicker and more rugose than that of second ridge. Fourth ridge strongly curved backward, consists of mammillae which worn and show four dentine islets; median mammilla the largest; anterior enamel wall bending gently backward, posterior running in vertical direction; both buccal and lingual ends of ridge obtusely pointed. Fifth ridge running straight, consists of unworn four mammillae; innermost one the largest; longitudinal cleft runs between outermost mammilla and its neighbouring one; surface of unworn enamel wall very rugose. Hind talon, situated just behind longitudinal cleft through fifth ridge, consists of small sized and feeble mammillae.

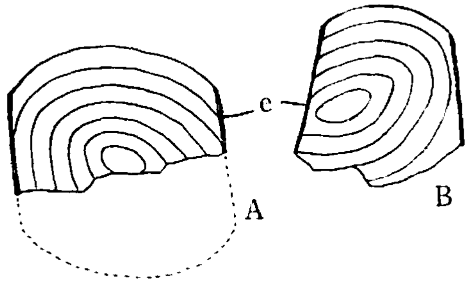
Enamel rugose, black, grey or greenish brown in colour on surface; enamel wall thick, consisting of two layers, outer layer nearly equal to inner in thickness, measuring 6 mm in thickness at posterior outer wall of second ridge. Ridge frequency in 100 mm 3.5-4 both at base and on grinding surface. Basal cingula rather thick, more developed on lingual than on buccal side, and bearing many laminae on both sides; cingulum on lingual side of third ridge, the best developed of all, bears many small tubercles. Dimensions of ridges as follows in mm:

	1	2	3	4	5
Greatest length of ridge at base	—	70.7	70.4	54.7	43.8
Ditto at grinding surface	69.0±	70.6	65.6	51.8	39.2±
Inner breadth of ridge at base	—	29.2	33.5	31.0	29.0
Outer breadth of ridge at base	—	24.5	31.2	29.8	15.4
Inner breadth at grinding surface	—	30.8	20.0	16.0	7.0
Maximum height at inner side	—	24.2	31.3	31.3	34.7
Ditto at outer side	—	21.5	31.2	37.6	34.0

Upper right M 1 Small sized, four ridged, well worn and quadrate in general outlines of crown view. Distinct accessory conulet present between first- and second ridges. All ridges expose dentine islets, bend forward, parallel to one another and running oblique to lingual margin. Enamel wall very smooth except basal cingula on lingual side, indicating water worning of this tooth. Ridge formula $^1/_2$–4–$^1/_2$(?); about 79 mm in median longitudinal length and 46.7 mm broad at fourth ridge where tooth at its broadest. In upper view, anterior-, buccal and posterior margins running almost straight, while lingual margin undulated. Median longitudinal cleft seems to be running with a little outward turn.

First ridge divided by longitudinal cleft into two dentine islets, of which outer being larger than inner; the former subtriangular in outline with pointed inner corner; the latter irregularly quadrate with opened anterio-outer corner; the ridge higher lingually than buccally. Anterior accessory conulet just before inner islet much worn and its dentine islet closely united with that of first ridge. Accessory conulet lies just posterior to constriction of dentine islets of first ridge, moderately worn with dentine disc of subquadrate dentine islet; fore-&-aft enamel wall expanded mesially; lingual margin more straight than buccal. Third ridge also higher buccally than lingually, broader lingually than buccally in fore-&-aft direction: posterior enamel wall rather straight while anterior a little crenulated; dentine islet elongate quadrate. Fourth ridge with three dentine islets of which inner one the largest and suboval; longitudinal cleft running outer side of it: the ridge higher buccally than lingually to grinding surface. Enamel wall thick, consisting of two layers: outer layer thicker than inner, the former white to grey coloured while the latter brown to black: distal margin of inner layer finely crenulated. Enamel surface very smooth, brownish black to greenish grey in colouration. Basal cingula relatively weaker than the one mentioned above in M 3. Dimensions of ridges are as follows in mm:

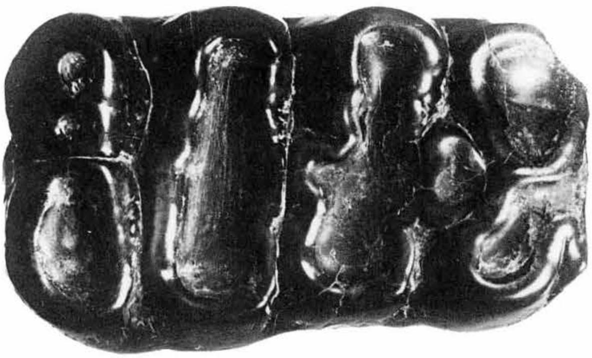
	1	2	3	4
Greatest length of ridge at base	35.0	40.6	45.0	43.0
Ditto at grinding surface	38.0	41.0	42.3	41.4
Inner breadth of ridge at base	19.0	19.0	18.8	18.5
Outer breadth of ridge at base	21.0	20.5	19.0	15.0±
Inner breadth of ridge at grinding surface	15.0	17.0	18.0	17.8
Maximum height at inner side	17.5	14.5	14.6	18.9
Ditto at outer side	14.5	17.0	17.6	20.2



Text-fig. 1. Transverse section of upper incisive tusk. A; proximal side. B; distal side. e; enamel layer.

A fragment of upper incisive tusk black to brownish black in colouration, composed of dentine, with a gently curved surface and two flat surfaces, the last of which covered by thin enamel layers, just as in that of *Stegodon cautleyi progressus* OSBORN, in which enamel bands are present at both lateral sides. Dentine tusk composed of seven concentric layers, outermost one of which concordant with curved surface and discordant with flat surfaces. The specimen about 67 mm long along curved surface, 41 mm wide at proximal side and 28 mm wide at distal, both in lateral directions.

Relationship:—By six ridges of upper M 3, *Stegolophodon lydekkeri* OSBORN, *S. sublatidens* SCHLESINGER and *S. stegodontoides* PILGRIM are distinct from this species. *S. nathotensis* OSBORN is distinguished from this species by four ridges of upper M 3. In the presence of five ridges of upper M 3, *S. cautleyi*



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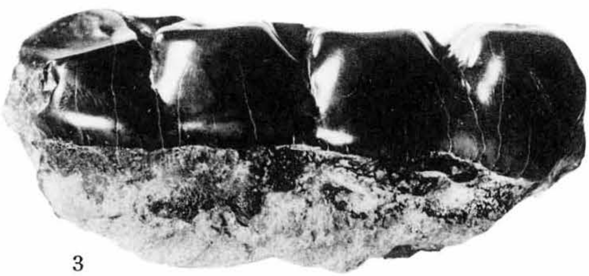

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IKEUTI, photo

LYDEKKER, *S. cautleyi progressus* OSBORN, *S. latidens* CLIFT and *S. pseudolatidens* YABE may come near this species. In general aspect, *cautleyi* much resembles this species, but its upper M 3 is much larger; it has more mammillae than this species. *Cautleyi progressus* is allied in the laterally compressed superior tusk with enamel band and in ridge numbers of upper M 1, but it has much larger teeth than this species. *Latidens* may be nearest to this species in size, ridge numbers and in general aspect of upper teeth etc., but may be distinguished from this species by the absence of distinct basal cingulum on lingual side of upper molars. Median longitudinal cleft is rather eminent in *latidens* and *pseudolatidens*, while it is not so well developed in this species. *Pseudolatidens* is allied to this species in the tuberculated lingual- and laminated buccal basal cingula, also in general aspect and ridge numbers of upper M 3, but it is clearly distinct by its smaller teeth. So that this species occupies an intermediate taxonomic position between *latidens* and *pseudolatidens*. The present writers regard it as a new species. The fragment of molar from Isikawa Prefecture described by the senior author under the name of *Pentalophodon* (?) sp. may be included in this new species. *Latidens* is known in the lowest horizon of the Irrawaddy series in Burma and in the Dhok Pathan zone of Middle Siwalik series in India. From the view point of proboscidean evolution, it may be significant that in the same horizon of Middle Miocene, both archetypal species of *pseudolatidens* and its closely allied but more advanced species of *tsudai* are included altogether.

Finally the writers wish to extend their sincere thanks to Messrs K. TSUDA, K. HASHITA and I. MURAKAMI for their kind help accorded to them in executing this research.

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Explanation of Plate 41

Stegolophodon tsudai n. sp.

Figs. 1-3. Upper right M 1. 1, upper view; 2, lingual view; 3, buccal view. All nat. size

Figs. 4, 5. Upper left M 3. 4, upper view; 5, lingual view. All 0.7 x nat. size.

Fig. 6. A fragment of upper incisive tusk; dorso-ventral view, nat. size.

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(Note: Every reference is to the number of article)

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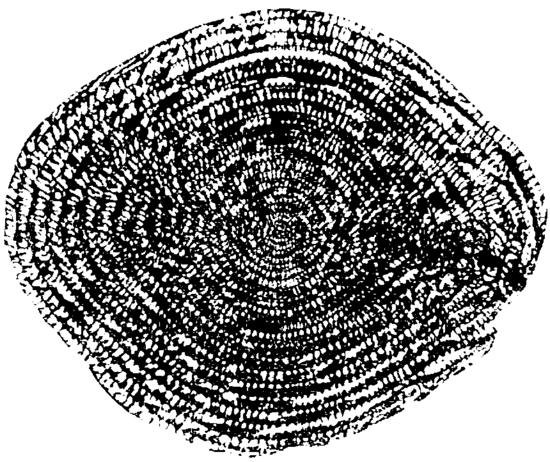

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(The heading in Japanese commemorates the handwriting of Prof. M. YOKOYAMA, father of Japanese Palaeontology, who was Professor of Stratigraphy and Palaeontology at the Geological Institute, Imperial University of Tokyo.)

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第2条　本会は古生物学およびこれに関係ある諸学科の進歩および普及を計るのを目的とする。

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第3条　本会は第2条の目的を達するため下記事業を行う。
- 第1項　会誌その他出版物の発行。
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