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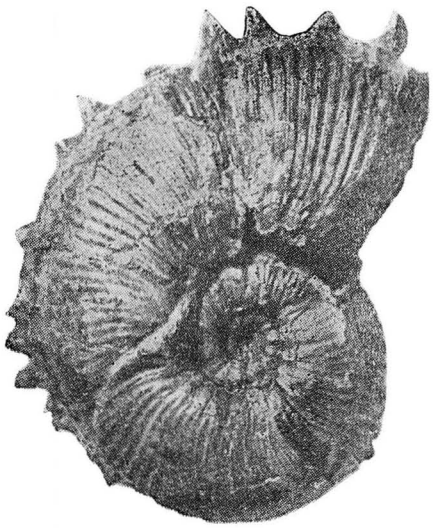

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Palaeontological Society of Japan

September 30, 1982

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The fossil on the cover is an adult example (T. TAKAHASHI coll.) of *Mikasaites orbicularis* MATSUMOTO (subfamily Marshallitinae, family Kossmaticeratidae) from the Lower Cenomanian (Cretaceous) of the Mikasa area, central Hokkaido. (photo by M. NODA, natural size)

All communications relating to this Journal should be addressed to the
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Yayoi 2-4-16, Bunkyo-ku, Tokyo 113, Japan.

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747. A NEW SPECIES *ACESTA (PLICACESTA) WATANABEI* FROM THE MIOCENE IN SOUTHWEST JAPAN*

MITSUO NAKANO**

Institute of Geology and Mineralogy, Faculty of Science, Hiroshima University, Higashi-senda-machi, Hiroshima 730

KAZUO OKAMOTO

Laboratory of Geology, Faculty of School Education, Hiroshima University, Shinonome 3 chôme, Hiroshima 734

Abstract. In this paper, the writers wish to add some notes on *Acesta* (*Plicacesta*) from the Tertiary formations in Southwest Japan and give a new name, *Acesta* (*Plicacesta*) *watanabei* sp. nov., to *Lima* (*Acesta*) aff. *amaxensis* Yokoyama of Okamoto and Nakano, 1967.

Introduction and Acknowledgments

Plicacesta Vokes, 1963 is a subgenus of the genus *Acesta* Adams and Adams, 1858, and is well characterized by its plicated radial sculpture on the surface. It is well represented by numerous species from the Eocene to the Recent in the North Pacific region. It was most prospered and widely spread from Burma to Chikotka peninsula of East Siberia through Japan in the Miocene, but it was declined in the Recent seas, where only two species are known from Japan and California as relics.

Recently, the writers had a good chance to study many Japanese fossils of *Acesta* (*Plicacesta*) from various localities. On this occasion, the writers wish to add some notes on *Acesta* (*Plicacesta*) and give a new specific name, *Acesta* (*Plicacesta*) *watanabei* sp. nov., to *Lima* (*Acesta*) aff. *amaxensis* Yokoyama of Okamoto and Nakano, 1967.

The writers wish to express their sincere thanks to the late Mr. Genji Watanabe of Oyabe City in Toyama Prefecture and gentlemen of the Wanibuchi Mine, Showa Mining Company and the Kagoshima Prefectural Culture Centre for supply of the materials. The writers acknowledge the kind helps given by Professor Harold E. Vokes of the Tulane University in Louisiana, Dr. Junji Itoigawa of the Nagoya University, Dr. Yoshiro Ueda of the Geological Survey of Japan at Tsukuba, Mr. Iwao Yamana of the Tottori Prefectural Museum, Professor Tadashige Habe of the Tokai University at Shimizu, Professor Shozo Hayasaka of the Kagoshima University and Professor Shoji Fujii of the Toyama University. This study was supported in part by

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** Deceased

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Notes on *Acesta* (*Plicacesta*)

Family Limidae Rafinesque, 1815

Genus *Acesta* Adams and Adams, 1858

Type species: *Ostrea excavata* Fabricius, 1779. Recent, North Atlantic Ocean.

Subgenus *Plicacesta* Vokes, 1963

Type species: *Lima smithi* Sowerby, 1888. Recent, Japan.

Remarks:—In Japan the Tertiary limid specimens under the name of *L. smithi* or *L.* cf. *smithi* were reported and collected from various localities by several authors, such as Yokoyama (1925), Kuroda (1932), Uozumi (1962) and others, but most of their specimens are not so well-preserved in condition. As suggested by Vokes (1963a, p. 91), therefore, their morphological characters are, as a rule, unable to be recognized from these specimens except Yamana's (Tottori Prefectural Government, 1966, pl. 3, fig. 5; Yamana, 1969, p. 6, fig. 1) and Okamoto and Nakano's specimens (1967, pp. 189-190, pl. 21, figs. 1a-b). *L.* cf. *smithi* of Yamana is closely similar to the middle stage of *L.* aff. *amaxensis* of Okamoto and Nakano (1967, pp. 188-189, pl. 20, figs. 1a-b) in shell form and surface costation, and they are conspecific with each other. In essential characters, *L.* aff. *amaxensis* is distinctive from the other members of *Plicacesta* and, therefore, this is possibly new to science. On this occason, the writers give a new specific name *Acesta* (*Plicacesta*) *watanabei* sp. nov., to this form. *L.* cf. *smithi* of Okamoto and Nakano has some resemblance to the Recent *L. smithi* in essential characters, but differs in having large shell and wide and depressed posterior auricle. In this respect, this form is also new to science. However, more sufficient materials are necessary to give a new specific name exactly. Therefore, whether *L. smithi* was inhabited in the Tertiary or not is a question.

The plicated radial costation on the surface is the most important character for the subgenus which comprises several forms as listed by Vokes (1963a, pp. 90-91; 1963b, p. 20). The following forms may be added to this subgenus.

Acesta (*Plicacesta*) *watanabei* sp. nov. Middle-Late Miocene; Shimane, Tottori and Toyama Prefectures, Japan.

Lima (*Acesta*) cf. *smithi* Sowerby of Okamoto and Nakano, 1967. Late Miocene; Hirata City, Shimane Prefecture, Japan.

Lima takeyamai Ozaki, 1956. Middle Miocene; Ibara City, Okayama Prefecture, Japan.

Acesta oyamai Kamada, 1973. Eocene; Iojima-machi, Nagasaki Prefecture, Japan.

This subgenus varies to a fairly wide extent in surface sculpture and shell form. The shell size is fairly large in ordinary species, but small in *A. oyamai* and *L. protosquamosa* (Noetling, p. 1901, 114, pl. 3, figs. 10, 10a) and large in *A. watanabei* sp. nov. The shell outline is triangularly ovate in many forms, but somewhat trapezoidal in *A. watanabei* sp. nov. and elongated ovate in *A. oyamai*.

The posterior auricle is broad but not so well-defined from the main part of the body in many cases. It is, however, fairly distinct and depressed in *L. amaxensis* and *L.* cf. *smithi*. The ribs on the surface are fairly thick in ordinary species, but broad and stout in *L. sameshimai* (Oyama and Mizuno, 1958, p. 10, pl. 1, figs. 11, 12) slender in *A. oyamai* and bi- or trifurcated in *L. takeyamai*. Their number is as a rule 40 to 50, but 16 to 21 in *L. sameshimai*

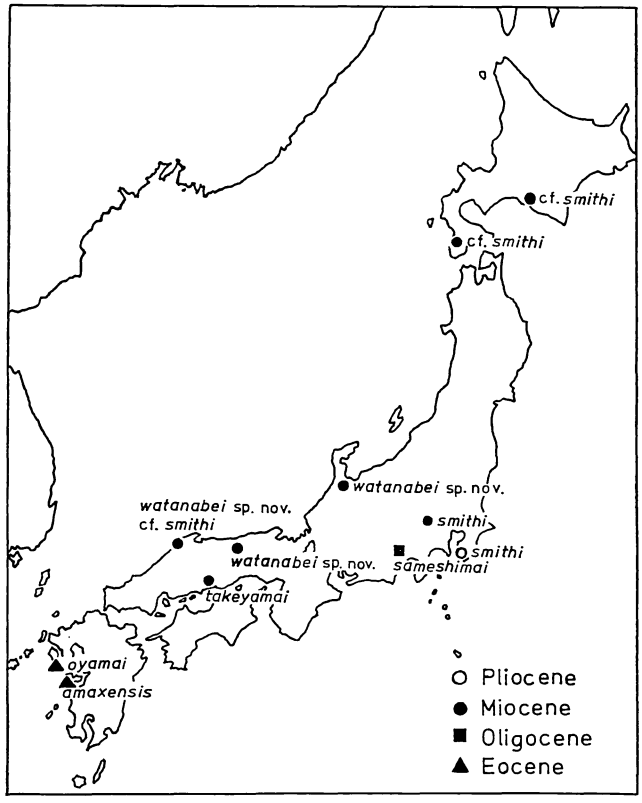

Fig. 1. Locality map of the fossil *Acesta* (*Plicacesta*) species in Japan.

and about 35 in *A. oyamai*.

It is noteworthy that *Lima* (*Acesta*) *amaxensis* Yokoyama of Monden (1960, p. 280, fig. 1) from the Tertiary or Quaternary tuffaceous sandstone layer at a cliff near Irino, Kaimon-cho, Kagoshima Prefecture, Japan, is represented by a single fragmental left valve specimen now stored in the Kagoshima Prefectural Culture Centre in Kagoshima City. This form appears to be somewhat similar to the typical form of *L. amaxensis* in essential characters, but is distinguishable from the latter in the nature of radial ribs which are flat-topped on the anterior fourth of the shell. In this respect, the writers are of the opinion that it may be better to be treated as *Acesta* sp. Therefore, it is obvious that the Eocene formation is not distributed in the Kaimon area mentioned above.

Lima takeyamai Ozaki (1956, p. 8, pl. 2, fig. 3) from a coarse-grained shell sandstone layer of the Middle Miocene Namigata Formation in Ibara City, Okayama Prefecture, Japan, is, though imperfect, quite similar to *Lima smithi* Sowerby in essential characters. The ribs on the surface of the topotype stored in the Nagoya University are plicated and about 40 in number. The shape of ribs is broadly round-topped in the latter, but it is fairly sharp and narrow in the former which has deeper grooves than those of the latter. However, the ribs of *L. takeyamai* soon become broad and round-

topped and bi- or trifurcated in the adult stage and grooves are broad. In this respect, *Lima takeyamai* Ozaki belongs to this subgenus and is separable from *Lima smithi* Sowerby.

Distribution:—This subgenus may have appeared in the Eocene of Japan, and widely distributed in the Miocene from Burma (*L. protosquamosa* Noetling, 1901) to East Siberia (*L.* aff. *goliath*: Merklin, 1954) through Japan. In the Recent, two species, i.e. *L. smithi* and *L. sphoni* (Hertlein, 1963), are known as the relics from Japan and California, respectively.

Description of *Acesta* (*Plicacesta*) Species

Acesta (*Plicacesta*) *watanabei* sp. nov.

Pl. 57, Figs. 1a-b; Pl. 58, Figs. 1a-b.

1962. *Lima* sp.: Yamana, *Bull. Tottori Pref. Mus.*, No. 1, pl. 2, fig. 1.
1966. *Lima* (*Acesta*) cf. *smithi*: Tottori Pref. Government, *Expl. Text Geol. Map. "Tottori Pref." (1/100,000)*, pl. 3, fig. 5.
1967. *Lima* (*Acesta*) aff. *amaxensis*: Okamoto and Nakano, *Trans. Proc. Palaeont. Soc. Japan., N. S.*, No. 68, pp. 188-189, pl. 20, figs. 1a-b.
1969. *Lima* (*Acesta*) cf. *smithi*: Yamana, *Native Places and Sciences* (*Kyodo to Kagaku*), Vol. 15, No. 1, p. 6, fig. 1.
1976. *Lima* (*Acesta*) cf. *smithi*: Tottori Pref. Mus., *Fossil Catalogue 2*, p. 15, pl. 3, fig. 1.
1977. *Lima* (*Acesta*) cf. *smithi*: Yamana, *Bull. Tottori Pref. Mus.*, No. 14, p. 14, pl. 3, fig. 1.

Material:—A fairly well-preserved left valve specimen, holotype (Reg. No. GSEH-OK-S001), derived from the early Middle Miocene Taisha Formation or Tadaura Formation in Yuya-dani, Yokan, Taisha-machi, Shimane Prefecture and a right valve impression cast, paratype (Reg. No. GSEH-OK-T003), from the Middle Miocene Yashiro Formation in Nukakojima (36°41′54″N, 136°51′17″E), Oyabe City, Toyama Prefecture. Besides them, the writers observed several specimens from the Middle Miocene Tochimoto Shale Member of the Tottori Group in the southeastern area to Tottori City, Tottori Prefecture.

Description:—Shell of large size, opisthocline, somewhat trapezoidal to triangularly ovate and inequilateral exclusive of auricles, a little higher than broad, gently convex from umbo to venter and from anterior to posterior; antero-dorsal margin slightly concave and about a half as long as the shell, sloped subvertically downward; antero-ventral rounded but somewhat subangulate at junction with antero-dorsal, passing gradually into broadly arcuated ventral as can be judged from the growth-lines; postero-dorsal gently arched and almost a half of the shell length, forming an angle of about 120 degrees with the hinge-line which is nearly straight or slightly arcuated and about a fourth of the shell length; umbo prominent and subcentral; anterior auricle, tiny, triangular, slightly produced

Explanation of Plate 57

Figs. 1a-b. *Acesta* (*Plicacesta*) *watanabei* Nakano et Okamoto sp. nov. ..... p. 360
Holotype, side (1a) and anterior (1b) views, ×1
Fig. 2. *Acesta* (*Plicacesta*) sp. cf. *A.* (*P.*) *watanabei* Nakano et Okamoto sp. nov. ..... p. 361
Side view, ×1

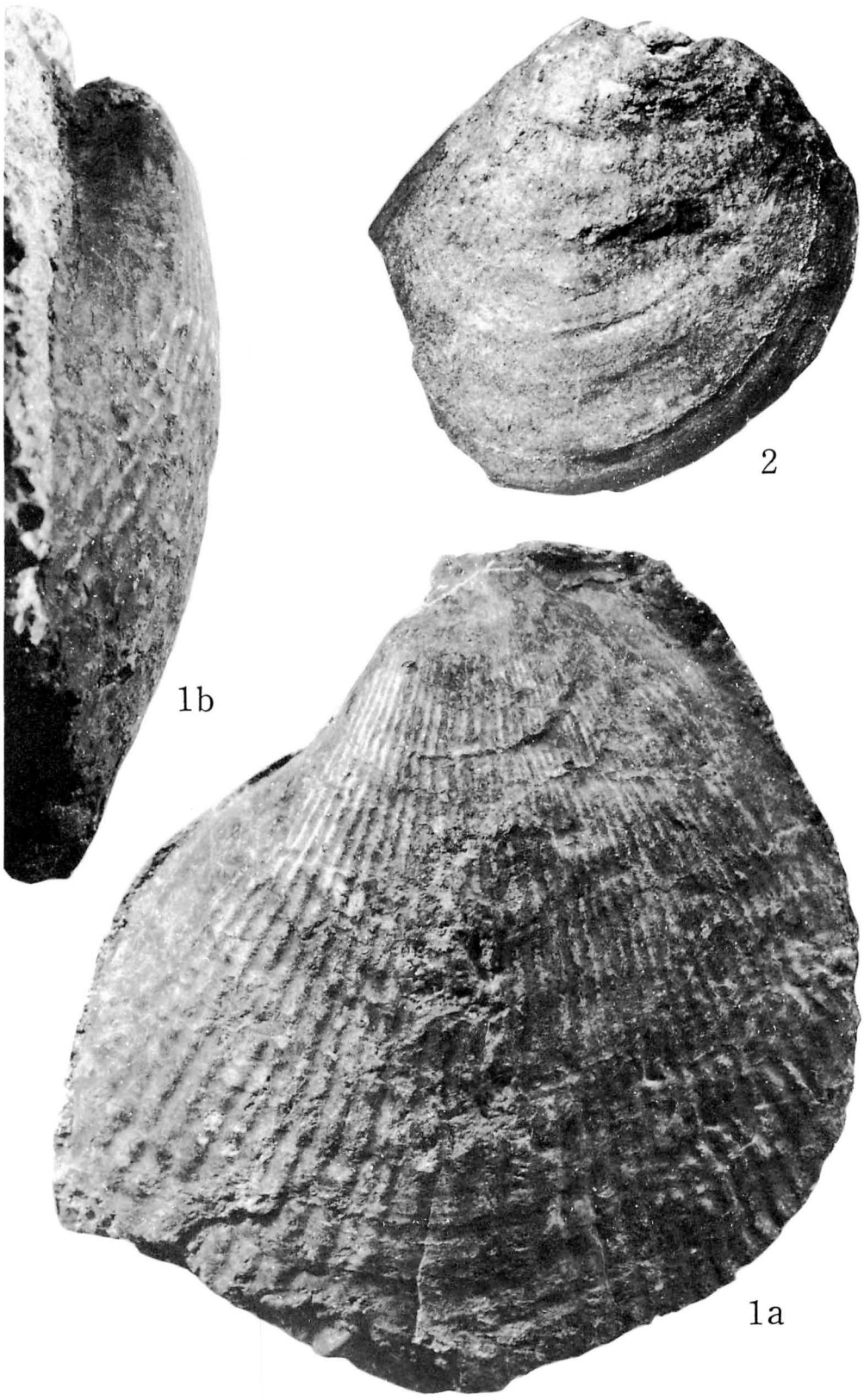
1b
2
1a

Table 1. Measurements (in mm), *Acesta (Plicacesta) watanabei* sp. nov. Employed Aoki's method (1956).

	Height	Width	Obliquity	1/2 thickness
Holotype (GSEH-OK-S001)	ca 132	126	135+	ca 24
Paratype (GSEH-OK-T003)	120+	130+		22

and depressed; posterior one trigonal, large but not so depressed and ill-differentiated from body of the shell; lunule fairly large, cordiform and well excavated.

Surface ornamented with numerous, fairly broad, round-topped plicated radial ribs with narrow and shallow grooves except for the posterior and anterior extremities where the grooves are broad and about twice of the width of ribs; 6 or more on the antero-dorsal part nearly straight or slightly curved anteriorly; about 30 on the medial part of the shell almost straight and somewhat flexiated and rarely bifurcated but gradually become thinner toward the posterior; some 5 on the rest of the shell almost straight and rather thin; auricle and lunule provided with several radial ribs.

Growth-lines well developed on the whole surface, especially on the ventral and posterior extremities. Internally, resilifer pit fairly large, triangular, and directs forward.

Remarks:—The shell outline in the early stage (less than about 30 mm near umbo) is ovate, but it gradually changes into trigonally ovate in the adult. The surface in the early stage is sculptured with flat-topped ribs with narrow grooves, but the ribs gradually change into roof-shaped through round-topped and the grooves become very broad.

This species shows a certain degree of the variation in its shell form. The shell of the holotype is taller and more triangular than that of paratype. Of the posterior auricle, it is straight and rather short in the holotype but gently arcuate and broad in the paratype. It is, however, fairly constant in number of ribs on the body of the shell, and it is 41 or so.

Comparison:—This is allied to *Lima amaxensis* Yokoyama, 1911 from the Eocene of Kumamoto Prefecture, but is distinct in having more inflated ovate and large shell on which the posterior auricle is not so well-defined as that of the latter. *Lima (Acesta)* cf. *smithi* Sowerby of Okamoto and Nakano (1967) from the Upper Miocene Wanibuchi Formation in Shimane Prefecture is very close to the present form, but differs in the tall and large shell. This is similar to *Lima smithi* Sowerby in the Recent from the sea around Japan in the character and number of ribs, but the latter is easily distinguishable from the former by more ovate and smaller shell.

Occurrence and Lithology:—The holotype was found in a moderately brown to dark greenish gray lapilli tuff or volcanic conglomerate layer of the Taisha or Tadaura Formation. The paratype, with *Doliocassis japonica* (Yokoyama) and "*Dentalium*" sp., was collected from a light brown tuff bed of the Miyajima Tuff Member of the Yashiro Formation. This form is fairly abundant in a tuff bed in the Tochimoto Shale Member of the Tottori Group.

Acesta (Plicacesta) sp. cf. *A. (P.) watanabei* sp. nov.

Pl. 57, Fig. 2.

Compare:—

1962. *Lima* sp.: Yamana, *Bull. Tottori Pref. Mus.*, No. 1, pl. 2, fig. 1.

1966. *Lima* (*Acesta*) cf. *smithi*: Tottori Pref. Government, *Expl. Text. Geol. Map. "Tottori Pref." (1/100,000)*, pl. 3, fig. 5.
1967. *Lima* (*Acesta*) aff. *amaxensis*: Okamoto and Nakano, *Trans. Proc. Palaeont. Soc. Japan, N. S.*, No. 68, pp. 188-189, pl. 20, figs. 1a-b.
1969. *Lima* (*Acesta*) cf. *smithi*: Yamana, *Native Places and Sciences* (*Kyodo to Kagaku*), Vol. 15, No. 1, p. 6, fig. 1.
1976. *Lima* (*Acesta*) cf. *smithi*: Tottori Pref. Mus., *Fossil Catalogue 2*, p. 15, pl. 3, fig. 1.
1977. *Lima* (*Acesta*) cf. *smithi*: Yamana, *Bull. Tottori Pref. Mus.*, No. 14, p. 14, pl. 3, fig. 1.
1982. *Acesta* (*Plicacesta*) *watanabei* sp. nov., *Trans. Proc. Palaeont. Soc. Japan, N. S.*, No. 127, pp. 360-361, pl. 57, figs. 1a-b; pl. 58, figs. 1a-b.

Material:—A single, imperfect internal mould specimen (Reg. No. GSEH-OK-S004) from the Late Miocene Wanibuchi Formation in the southern area of Uchida (35°25′53″N, 132°45′04″E), Kawashimo-machi, Hirata City, Shimane Prefecture.

Remarks:—This form is, though imperfect, fairly large in size and its outline is triangularly ovate to ovate as can be judged from the growth-lines. The surface is provided with 40 or so, radial ribs. In this respect, this form is quite similar to the middle stage of *Acesta* (*Plicacesta*) *watanabei* sp. nov. in essential characters, but its exact specific determination is difficult to the writers because of the ill-preservation.

Occurrence and Lithology: A volcanic sandstone layer of the Wanibuchi Formation.

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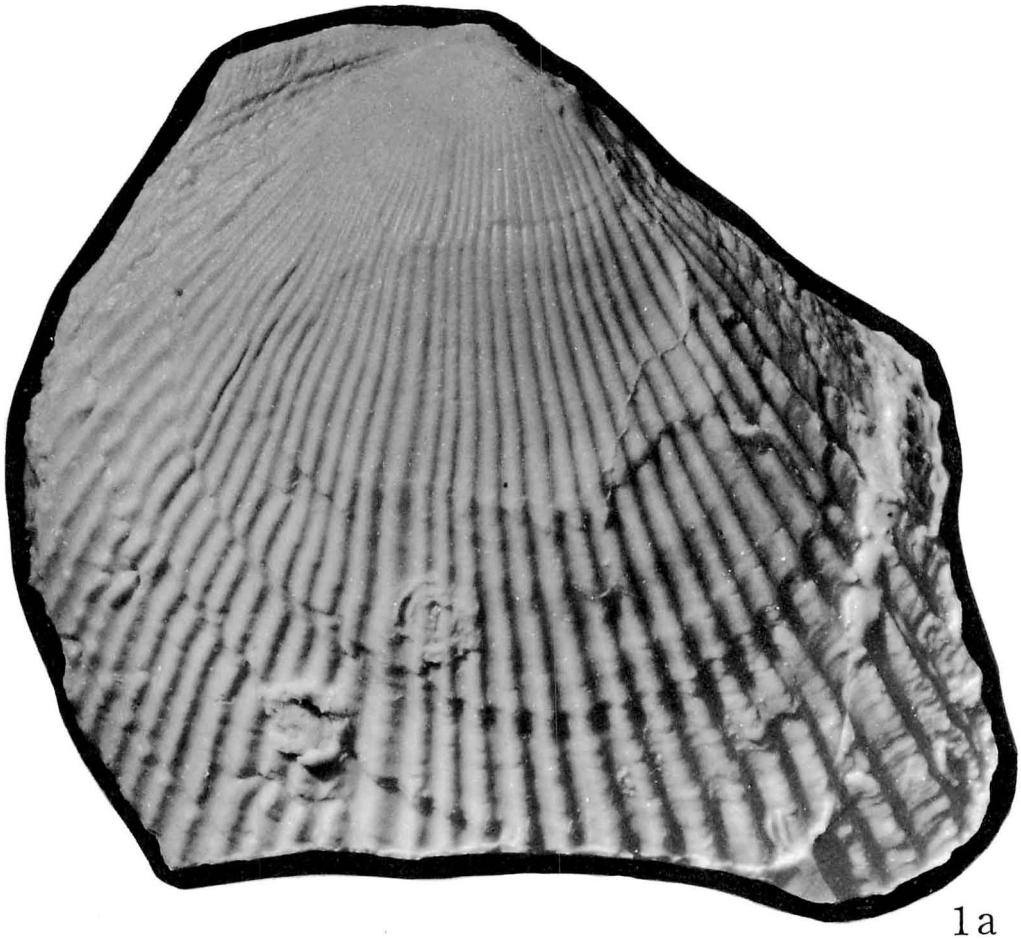
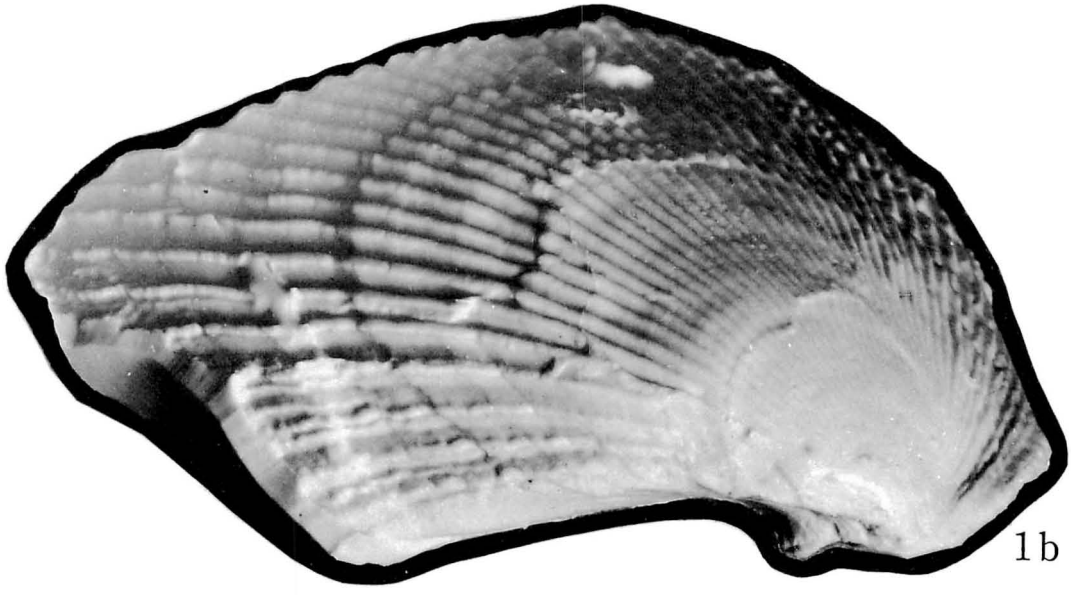
Explanation of Plate 58

Figs. 1a-b. *Acesta* (*Plicacesta*) *watanabei* Nakano et Okamoto sp. nov. ..... p. 360
Paratype (Silicon rubber cast from external mould), side (1a) and laterally antero-dorsal (1b) views, ×1.



1a



1b

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Hirata 平田, Ibara 井原, Iojima 伊王島, Irino 入野, Kaimon 開門, Kawashimo 河下, Miyajima 宮島, Namigata 浪形, Nukakojima 糠子島, Oyabe 小矢部, Tadaura 唯浦, Taisha 大社, Tochimoto 栃本, Uchida 内田, Wanibuchi 鰐淵, Yashiro 八代, Yokan 遙堪, Yuyadani 湯屋谷

西南日本中新統からの新種 *Acesta* (*Plicacesta*) *watanabei* について：第三系からの *Acesta* 属 (*Plicacesta* 亜属) の貝化石の地史的分布を概観して気付いたことを述べ，山陰・北陸産の中新世 *Lima* (*Acesta*) aff. *amaxensis* Yokoyama of Okamoto and Nakano, 1967 に対し，新種名 *Acesta* (*Plicacesta*) *watanabei* を提唱した。

中野光雄・岡本和夫

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 127, pp. 364-367, September 30, 1982

748. SEXUAL DIMORPHISM OF THE PALEOCOPID OSTRACODE GENUS *MANAWA* FROM OKINAWA-JIMA*

TOMOHIDE NOHARA and NORIKO NAKASONE

Department of Earth Sciences, College of Education, University of the Ryukyus, Senbaru-1, Nishihara, Okinawa 903-01

Abstract. Three new localities of paleocopid ostracode genus *Manawa* are reported from Okinawa-jima. Examination of many individuals of *Manawa konishii* indicates that the species is sexually dimorphic. The orientation of the genus *Manawa* is discussed.

Introduction

The paleocopid ostracode genus *Manawa* is at present known only from New Zealand and Okinawa-jima of southern Japan. The genus is very significant because of its close resemblance to some of the Paleozoic Eurychilinas, as pointed out by Hornibrook (1949).

The studies of the genus were originally carried out by Hornibrook (1949, 1961). In Japan, the occurrence of the species of this genus was reported first by Ishizaki (1973). Since then the studies were carried out by Nohara (1976), and Nohara and Miura (1977). In addition to the previously known occurrences of the fossil of the genus, new occurrences from three other localities are reported in this paper. The dimorphic features and the carapace orienation of genus *Manawa* will be discussed later.

Sampling localities

Fossil ostracodes of genus *Manawa* are known at present from five localities of Pliocene Shinzato tuff and Pleistocene Chinen sand. The specimens discussed in this paper are mainly from Pleistocene Chinen sand 500 m north of Asato, Gushichan-son, Okinawa-jima (Loc. 1) and Pliocene Shinzato tuff of the southern cliffs of Miyagi-jima (Loc. 5).

The sampling localities are listed below, and classic localities are marked with an asterisk:

*Loc. 1.—Chinen sand, 2 m above the roadcut, 500 m north of Asato, Gushichan-son, Okinawa-jima, No. 1975122802-c (Lat. 26° 7′12″N, Long. 127°43′12″E), bluish gray fine silty sand, Pleistocene.

Loc. 2.—Chinen sand, the type locality, about 500 m east of Kudeken, Chinen-son, Okinawa-jima, No. 197571703 (Lat. 26°10′N, Long. 127°49′E), 3 m above National Highway No. 329, silty sand, Pleistocene.

*Loc. 3.—Shinzato tuff, the type locality, about 500m south-east of Shinzato, Sashiki-son, Okinawa-jima, No. 1976121501 (Lat. 26° 9′5″N, Long. 127°46′7″E), bluish gray silty sand, Pliocene.

Loc. 4.—Shinzato tuff, the top of Miyagi-jima, Yonagusuku-son, Okinawa-jima, No. 198031505 (Lat. 26°21′18″N, Long. 127° 58′48″E), Pliocene.

Loc. 5.—Shinzato tuff, south side cliff of

* Received November 5, 1981.

Miyagi-jima, Yonagusuku-son, Okinawa-jima, No. 198031506 (Lat. 26°21′12″N, Long. 127°58′34″E), bluish gray silty sand, Pliocene.

Discussion

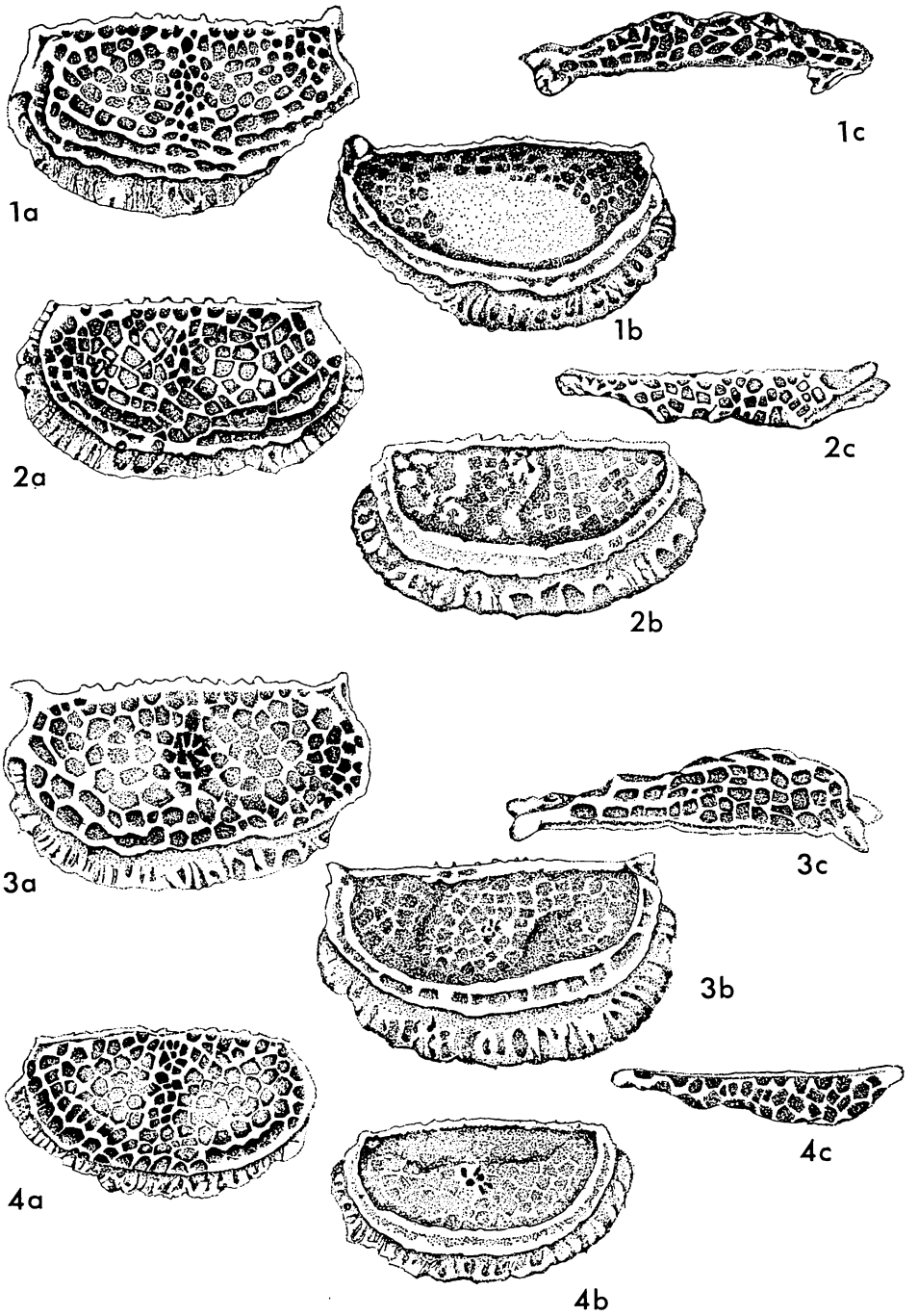
It is well known that some living and fossil ostracodes are sexually dimorphic (Scott, 1961, Morkhoven, 1962, and Sarv, 1971). One of the authors (Nohara, 1969) pointed out the possibility of sexual dimorphism of paleocopid ostracode genus *Perprimitia* (?) sp. Lately, the existence of two forms of carapaces in *Manawa konishii* was noted by Nohara and Miura (1977). The differences were noticeable in width in external view. The differences are also noticeable in the internal view of the carapace; one is smooth and the other is convex at the central muscle scar area. Such a difference is neither enough to establish a new species nor to treat as a continuous variation, because it is very minor in dimension but distinct enough to distinguish two types of carapaces. Other features, such as muscle scar patterns and surface ornamentations, are similar.

Figure 1 is a right valve of one form of *Manawa konishii*. In lateral view (Fig. 1a), the surface reticulates and two brackets are at the anterior and posterior cardinal angles. In internal view (Fig. 1b), a frill becomes slightly wider toward the posterior. In dorsal view (Fig. 1c), the carapace is rugged and flat in the central and the posterior areas. Figure 2 is a left valve of the same form. In lateral view (Fig. 2a), the dorsal margin is straight and brackets are not present. In internal view (Fig. 2b), sockets are observed at anterior and posterior cardinal angles and the frill becomes wider toward the posterior. In dorsal view (Fig. 2c), the width becomes slightly greater toward the posterior.

Figures 3 and 4 are right and left valves of the other form. The carapace appears to be the same as that of the former form in surface ornamentation, in the presence and absence of brackets at anterior and posterior cardinal angles in lateral view (Fig. 3a and 4a), and in the posteriorly wider frill in internal view (Fig. 3b and 4b). In dorsal view (Fig. 3c), however, the carapace is distinctly swollen toward the posterior.

In living ostracodes, the carapace of the female is quite often wider in the posterior part than that of the male (Bonnema, 1930, Scott, 1961, and Morkhoven, 1962). The valves of Figures 1 and 2 are, therefore, quite likely to be a male carapace, because there is no significant swelling of the posterior part. On the contrary, the valves of Figures 3 and 4 are probably a female carapace, since there is a significant swelling of the posterior part. The swollen part indicates the manifestation of a sexual dimorphism, as does the presence of the ovary and egg sacs in the posterior part of the female carapace.

The orientation of paleocopid ostracode genus *Manawa* has been a problem. Hornibrook (1949, figs. 1-8) oriented his specimens as we did in this paper. Scott (1961, figs. 2a-h), however, used the same figures as Hornibrook (1949), but gave his explanation of them in reverse orientation. Their reasons for thus orienting the specimens are not explained in their papers as regards genus *Manawa*. Our present study on sexual dimorphism of *Manawa konishii* suggests that a valve with brackets is a right valve, and so a valve with sockets is a left valve. So, we come to the conclusion that the orientation of genus *Manawa* by Hornibrook (1949) is tenable, while the orientation of genus *Manawa* by Scott (1961) is untenable.


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

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沖縄島産貝形虫 *Manawa* 属の性的2型：沖縄産の貝形虫 *Manawa* 属は，従来2カ所より知られていたが，今回新たに3カ所の新産地を加え合計5カ所の鮮新世新里凝灰岩及び更新世知念砂岩から産出することがわかった。*Manawa* 属は，雌雄の形態が異なることがわかった。従来此の属の背甲の定位については混乱が生じていたが，雌雄の形態の差異の面から定位を考えると Scott (1961) の定位は支持しがたい。

野原朝秀・仲宗根典子

Figs. 1a-c. Lateral, internal, and dorsal views of the male right valve of *Manawa konishii*. Sketched is Sample No. 1975122802-c, #14 from Loc. 1, ×100.

Figs. 2a-c. Lateral, internal, and dorsal views of the male left valve of *Manawa konishii*. Sketched is Sample No. 198031506, #1 from Loc. 5, ×100.

Figs. 3a-c. Lateral, internal, and dorsal views of the female right valve of *Manawa konishi*. Sketched is Sample No. 1975122802-c, #15 from Loc. 1, ×100.

Figs. 4a-c. Lateral, internal, and dorsal views of the female left valve of *Manawa konishii*. Sketched is Sample No. 1975122802-c, #13 from Loc. 1, ×100.

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749. *ATRYPA* (DEVONIAN BRACHIOPODA) FROM JAPAN*

PAUL COPPER

Department of Geology, Laurentian University, Sudbury, Canada

JUN-ICHI TAZAWA, KEI MORI

Institute of Geology and Paleontology, Tohoku University, Sendai 980

and

MAKOTO KATO

Department of Geology and Mineralogy, Hokkaido University, Sapporo 060

Abstract. The genus *Atrypa* is the only known atrypoid brachiopod represented in the Devonian strata of Japan, with *Atrypina* the sole atrypoid recorded from fossiliferous Silurian rocks. The Fukuji Formation in central Honshu Island, of probable Siegenian-Emsian age, contains *Atrypa* (*Atrypa*) cf. *A. lorana* Fuchs as well as a more finely ribbed species, *Atrypa* (*Atrypa*) sp. The N3 member of the Nakazato Formation in northeastern Honshu contains *Atrypa* (*Planatrypa*) *japonica* Sugiyama of middle to late Eifelian age. All the atrypoid taxa thus far known are of widespread distribution in the Devonian Old World province, particularly in siliciclastic-volcaniclastic Rhenish facies.

Introduction

In 1942 Sugiyama described the first discovery of *Atrypa* shells from the Japanese Islands, two somewhat poorly preserved external moulds which were cited as *Atrypa desquamata* mut. *japonica*. These specimens are in the collections of the Institute of Geology and Paleontology, Tohoku University and were re-examined for this study. They come from what is probably member N3 of the Nakazato Formation in the Kitakami mountains of northeastern Honshu Island. The species described by Sugiyama belongs neither to the classical species *Desatrypa desquamata* Sowerby 1840, known from the late Givetian of northwestern Europe (*see* Copper 1965), nor to the Lower-Upper Devonian genus *Desquamatia* Alekseeva 1960 to which many *desquamata*-like species have been attributed in the past. Sugiyama (1942) and others, have thus cited *japonica* as an indicator of Givetian age. This is shown here to be highly unlikely as *japonica* belongs to the subgenus *Atrypa* (*Planatrypa*) Struve 1966, which has never been recorded higher than the late Eifelian. It is thereby suggested that at least the *Atrypa* bed

* Received December 23, 1981.

of the N3 member of the Nakazato Formation is no younger than late Eifelian age.

In 1956 Okubo described another species, *Atrypa pauciplicata* from the Nakazato Formation, in a locality close to, and probably a horizon correlative with the sample of Sugiyama (1942). Okubo had a single brachial valve internal mould available for study. Further material available to us in the collections of Tohoku and Hokkaido universities, and comparison with Okubo's specimen suggest very strongly that *pauciplicata* is a junior synonym of *japonica*. Okubo (1956) also described an associated new species of anoplothecid brachiopod, *Anoplotheca dorsosulcata* which is referable to the Emsian-Eifelian genus *Coelospirina* Havlicek 1956 by its strong biconvexity and well-developed ribs on both valves. From "Group II" in the Kitakami region, Okubo (1950) had earlier cited the occurrence of "A*trypa* ? sp." in pale greenish vitric tuffs. This material has not been available for study, but the horizon referred to is probably the underlying Ohno Formation of early Devonian age. No other brachiopods from this formation are presently known.

From the Hida massif in central Honshu Island, Kamei (1952, 1955, 1961) and Hamada (1961) first listed the occurrence of other *Atrypa* from Japan. These were derived from various levels within the Fukuji Formation and referred to as *Atrypa reticularis*, *A. tennesseensis* or *Atrypa* sp. Hamada (1961, fig. 22) first figured a specimen of *Atrypa* from this area. In 1977 Ohno described the Fukuji fauna in some detail confirming the Siegenian-Emsian age assigned to it by Hamada (1961). Brachiopods of the Fukuji Formation are relatively well-preserved calcareous shells showing little deformation, like the shells from the Kitakami region. Ohno (1977) described and figured two atrypoid species, forma a and forma b, leaving them under open nomenclature without assigning a genus rank. Examination of topotypic material in the Hokkaido University collections of forma b indicates a dorsibiconvex, imbricately ribbed species with an adpressed ventral beak assignable to *Atrypa* (*Atrypa*). The stronger biconvexity and greatly overlapping short growth lamellae of *Atrypa* (*Kyrtatrypa*) Struve 1966 are absent, the latter subgenus ranging in known age from the Eifelian to Frasnian.

Kamei (1952, 1955, 1961), who first identified the Fukuji Formation, collected *Atrypa* from the massive lower limestone member (his unit 1), a crinoidal limestone (unit 7), a black, limy shale called the *Atrypa* bed (unit 8) and an upper sandy shale (unit 11). Ohno (1977), using a different subdivision of the formation, cited no other occurrence than "bed B2", also providing no other additional stratigraphic data for his *Atrypa* collections. A recent revision of the Fukuji stratigraphy by Niikawa (1980) combines the units employed by both Kamei and Ohno into a four-fold division, units D1 to D4. Unit D1 of Niikawa thus equates with bed B of Ohno, unit D2 with beds C and D (and D1-D2 with unit 1 of Kamei), unit D3 includes beds E to I of Ohno and units 2 to 6 of Kamei, and unit D4 includes beds J to N of Ohno and units 7 to 11 of Kamei.

The "forma a" atrypoid described by Ohno in 1977 apparently came from the same horizon as "forma b", *i.e.* unit D1. Tentatively, "forma a", which is rather coarsely ribbed and has a flattened pedicle valve can be referred to the Siegenian-Emsian species *Atrypa lorana* Fuchs 1915, known from the Bornicher Horizon of Oberstadtfeld, Germany (*compare with*

Mauz, 1935, pl. 3, fig. 23). The type material of *lorana* is somewhat poorly preserved, but somewhat coarser-ribbed *Atrypa* appear to be fairly common in the Emsian rocks of western Europe. Therefore, on the basis of atrypoids, the Fukuji Formation holds no forms diagnostic of Eifelian age, and could range in age from Siegenian through Emsian. A Gedinnian age cannot be excluded at the present time because of our poor knowledge of Gedinnian atrypoids in the classic Lower Devonian sections of Europe.

A third locality for Devonian *Atrypa* was listed by Hamada (1959, p. 210) from Fukui prefecture, south of the Hida massif (Oisedani, Kamiise, Izumi village). This outcrop of black limestones has a Fukuji fauna and probably comes from the equivalents of the upper D4 member. The specimens have not been examined.

Very recently Tachibana (1981) described the first Silurian atrypoids from Japan, *Atrypina kitakamiensis* n. sp. from the "*Encrinurus* bed" of the Kawauchi Series of probable Ludlovian age. This small fauna from the Kitakami mountains of northeastern Honshu appears to be dominated by *Salopina* and *Aegiria*. No other atrypoids are known in the Paleozoic succession of Japan.

The Nakazato Formation

This formation was first proposed in 1937 by Yabe and Sugiyama as the Nakazato Group, and subsequently given formational status by Onuki (1956). It consists of tuff and shale in the lower part, shale and sandstone in the upper part and totals some 530 m in thickness (Onuki, 1969).

The fauna of the Nakazato Formation is relatively sparse in comparison with the older Fukuji Formation in central Honshu. Trilobites tend to support a Middle Devonian, most probably an Eifelian age, *e.g.* by the presence of *Thysanopeltella* (*Septimopeltis*) *paucispinosa* (Okubo 1951) and *Phacops okanoi* Sugiyama 1944, as re-described by Kobayashi and Hamada (1977). Corals present include the ubiquitous *Calceola* sp., *Heliolites* ex. gr. *porosus* (Goldfuss), *Pachyfavosites* ex. gr. *polymorphus* (Goldfuss) as listed by Kato (1979, *in* Minato *et al.*).

Systematic descriptions

Order Atrypida Rzhonsnitskaya 1960

Family Atrypidae Gill 1871

Genus *Atrypa* Dalman 1828

Subgenus *Atrypa* (*Planatrypa*) Struve 1966

Type species:—*Atrypa* (*Planatrypa*) *collega* Struve 1966, p. 143-146, pl. 15, fig. 1, Giesdorf Horizon, Junkerberg Schichten, middle Eifelian, Eifel region, Germany.

Diagnosis:—Medium to large *Atrypa* shells with very flat, even partly concave pedicle valve, strongly convex brachial valve, large sinus, strongly incurved or adpressed beak, closely spaced imbricate growth lamellae, very short frills or no frills, moderately sized ribs.

Atrypa (*Planatrypa*) *japonica* Sugiyama 1942

Pl. 59, Figs. 1a-4b.

1942 *Atrypa desquamata* mut. *japonica* Sugiyama, p. 127-128, figs. 1, 1a, 1b.
1956 *Atrypa pauciplicata* Okubo, p. 39-40, pl. 3, fig. 5.

Type locality:—"Southwestern foot of Takainari-yama, Hikoroiti-mura, Kesen-gun, Iwate-ken" (Sugiyama, 1942), Kitakami mountains, northeastern Honshu

Island, Japan.

Type stratum:—Nakazato Formation, Member N3, in siliceous, tuffaceous mudstones and siltstones. No exact horizon was given by Sugiyama in 1942.

Diagnosis: — Medium-sized (22-28 mm wide), slightly longer than wide, shield-shaped, convexoplane *Atrypa* with 4-6 ribs per 5 mm at the commissure, growth lamellae fairly regularly close-spaced at 1.0 to 1.5 mm, lacking frills. Beak weakly protruding, adpressed, hinge line weakly concave, short, sinus moderate in height.

Materials:—All specimens are moulds or casts preserved in tuffaceous mudstones or siltstones. There are two syntypes in the Sugiyama collection, the lectotype being here chosen as the specimen IGPS 65468A figured by Sugiyama (1942, fig. 1), a partial external mould of conjoined pedicle and brachial valve. The second specimen, paralectotype IGPS 65468B (Sugiyama, 1942, figs. 1a, 1b), is a deformed partial mould of two conjoined valves showing the umbonal region. Additional material includes two external pedicle valve moulds, hypotypes IGPS 97685, 97686, which were collected by J. Tazawa and K. Mori from shale float of the upper Nakazato Formation, about 60 m below the top contact (=*Phacops* bed of Yabe and Sugiyama, 1937), midstream in the Kuronbora valley, tributary of the Omori valley (Fig. 1). Two hypotypes in the Hokkaido University collections include a mould, and facing cast, of a small pedicle valve and a doubtful part external mould of another specimen from the middle of the N3 member, Kuronbora tributary, Omori valley (for sketch of the section, *see* Minato *et al.*, 1979, fig. 2b-3 for the horizon sampled).

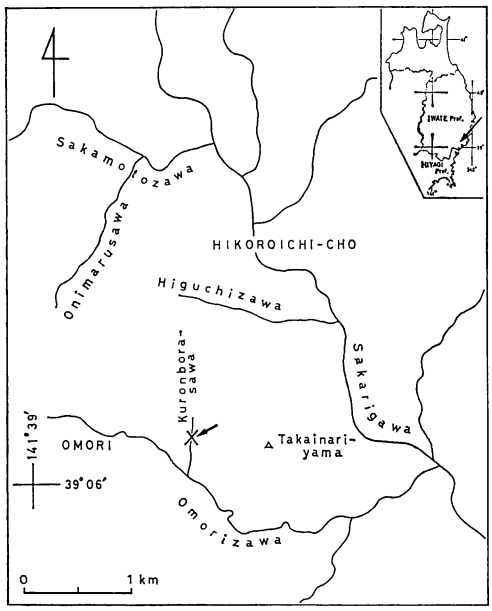

Fig. 1. Map showing the fossil locality in the Hikoroichi district, Kitakami mountains, where hypotypes of *Atrypa* (*Planatrypa*) *japonica* Sugiyama (IGPS 97685, 97686) were collected.

The exact locality of Okubo's *Atrypa pauciplicata* is unknown, except that it is roughly in the middle of the Higuchi valley, about 1.7 km north of the Sugiyama outcrop.

Remarks:—The material is sufficiently well preserved to identify generic and subgeneric affinities, which lie with *Planatrypa*. This is especially clear in the new materials. In terms of size and shape as specific characters, *Atrypa* (*Planatrypa*) *japonica* is close to *A.* (*P.*) *squamifera* Schnur 1853, as illustrated by Schnur on Pl. 24, figs. 4a-b. Struve (1966) has pointed out that the three syntypes in the Schnur collection are not directly referable to any Schnur figures, nor is the precise locality or horizon known since Schnur used the name *squamifera* rather broadly for Eifel atrypids of the "*reticularis*" type. As a result, the present status of *A. squamifera* is uncertain, only the Schnur illustration serving as lectotype in lieu of a neotype designation

or revision of the species. Material similar to the Schnur figure is most common in the late Eifelian beds of the Eifel region. It is quite possible that *A.* (*P.*) *japonica* is a junior synonym of *A.* (*P.*) *squamifera*, the name being here retained for convenience, and not as an indication of its clear identity or endemic nature.

Atrypa japonica has a larger size, narrower shape and flatter pedicle valve than *Atrypa* (*Planatrypa*) *tirocinia* Copper 1967 and is about two times wider than *Atrypa* (*Planatrypa*) *petasa* Copper 1967, with which it shares a common shape and outline. The Sugiyama species is clearly smaller than *Atrypa* (*Planatrypa*) *collega* Struve 1966, and, likes *A.* (*P.*) *squamifera*, spans the size gap between *A.* (*P.*) *collega* and *A.* (*P.*) *petasa*, being most like some of the specimens found in the Eilenberg Horizon of the Eifel region in Germany. It should here be noted that *Atrypa* (*Planatrypa*) *thola* Copper 1967 is a junior synonym of *A.* (*P.*) *collega* Struve 1966.

Atrypa pauciplicata Okubo 1956, represented by a single internal brachial mould, is a probable synonym of *A.* (*P.*) *japonica* because there are close similarities in size and spacing of the ribs and growth lamellae, particularly with Sugiyama's paralectotype IGPS 65468B. Okubo mentioned that "concentric lines and radial plications are more numerous in Sugiyama's specimen", but this is clearly not so. The Okubo specimen is definitely referable to *Atrypa*, and though the pedicle valve is not exposed; the brachial valves are so similar that they are most likely synonymous. We assume, therefore that the *Atrypa*-bearing bed of the Higuchi valley is correlatable to the bed in the Omori valley.

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Fukuji 福地, Hida massif 飛騨山地, Higuchizawa (Higuchi valley) 樋口沢, Hikoroichi (Hikoroiti) 日頃市, Izumi 和泉, Kamiise 上伊勢, Kawauchi 川内, Kesen-gun 気仙郡, Kitakami mountains 北上山地, Kuronborasawa (Kuronbora valley) クロンボラ沢, Nakazato 中里, Ohno 大野, Oisedani 大伊勢谷, Omorizawa (Omori velley) 大森沢, Takainari-yama 高稲荷山

日本産デボン紀腕足類 *Atrypa*：本邦のデボン系から従来報告された *Atrypa* のうち，飛騨山地 福地の 下部デボン系福地層産 のものについては *Atrypa* (*Atrypa*) cf. *A. lorana* Fuchs と *Atrypa* (*Atrypa*) sp. の 2 種に，また北上山地日頃市の中部デボン系中里層上部 N 3 部層産のものは *Atrypa* (*Planatrypa*) *japonica* Sugiyama 1 種にまとめられる。これらはいずれもドイツのライン相に多産する *Atrypa* に近縁な種であると考えられる。

本論文では中里層産のかつて杉山 (1942) により *Atrypa desquamata* mut. *japonica* と記載された種を，杉山の標本 (後模式標本) と新たに採集した標本をもとに *Atrypa* (*Planatrypa*) *japonica* として再記載した。本種はアイフェル地域のアイフェル統上部に産する *Atrypa* (*Planatrypa*) *squamifera* Schnur の新参シノニムである可能性が強い。*Atrypa* (*Planatrypa*) はジベーチアン以降には知られていないことから，中里層上部の年代はジベーチアンとはならず，アイフェリアン中期ないし後期であると考えられる。

P. コッパー・田沢純一・森　啓・加藤　誠

Explanation of Plate 59

Atrypa (*Planatrypa*) *japonica* Sugiyama 1942

Figs. 1a, 1b. Hypotype IGPS 97685, from shale float of the upper Nakazato Formation, about 60 m below the top contact, middle of Kuronborasawa stream, tributary of Omorizawa, Hikoroichi district, Kitakami mountains, NE Japan. Fig. 1a is the latex cast of a pedicle valve; Fig. 1b is the original external mould of the same valve.

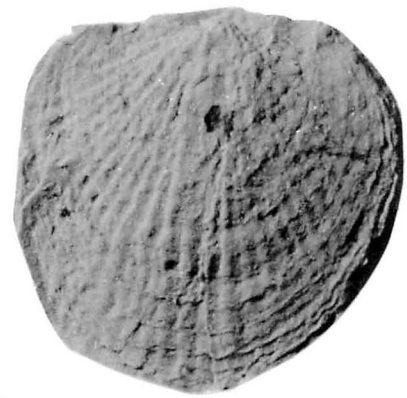
Figs. 2a, 2b. Hypotype IGPS 97686, from the same locality as Figs. 1a, 1b. Fig. 2a is the latex cast of a pedicle valve; Fig. 2b represents the external mould.

Fig. 3. Latex cast of a pedicle valve. Lectotype IGPS 65468A, figured by Sugiyama, 1942, fig. 1, one of two syntypes in the Sugiyama collection, Tohoku University.

Figs. 4a, 4b. Latex cast of paralectotype IGPS 65468B, figured by Sugiyama, 1942, figs. 1a, 1b. Fig. 4a is the ventral view; Fig. 4b is the posterior view.

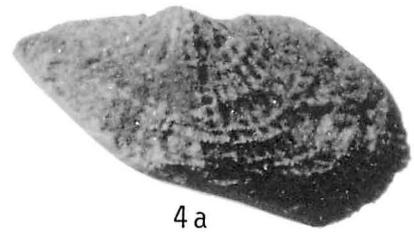
All figures are twice natural size.

1a

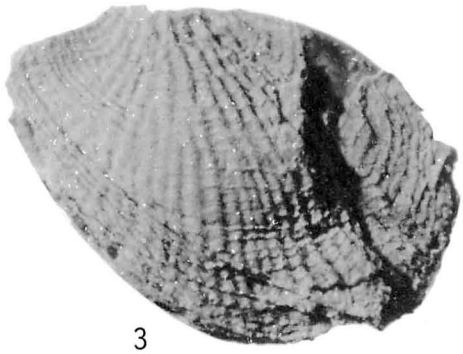


2a

4b



4a



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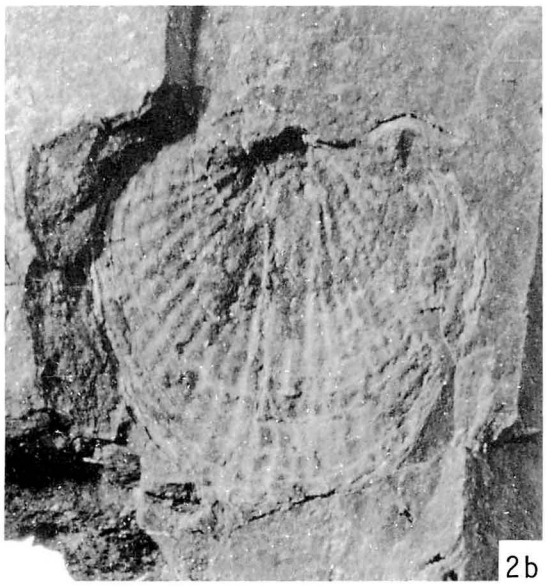
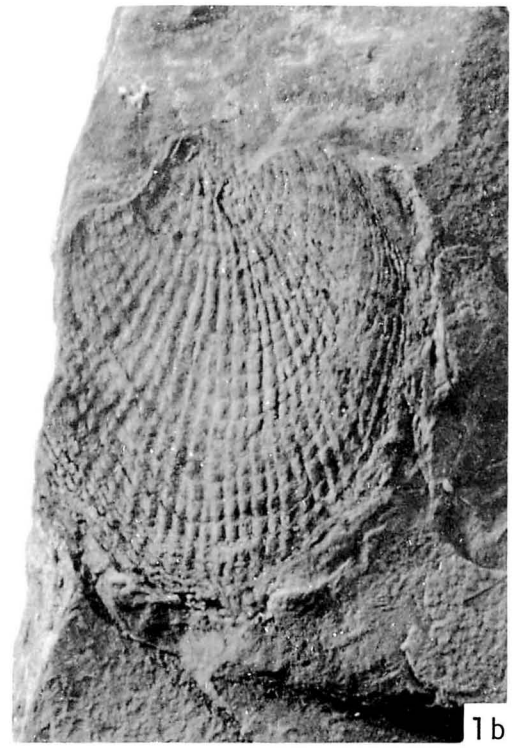


2b



1b

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 127, pp. 375-385, pl. 60, September 30, 1982

750. ON SOME LOWER TRIASSIC AMMONITES FROM THE OSAWA FORMATION AT ASADANUKI, TOWA-CHO, TOME-GUN, MIYAGI PREFECTURE, NORTHEAST JAPAN

YUJI BANDO

Department of Geology, Faculty of Education, Kagawa University, Takamatsu, 760

and

MASAYUKI EHIRO

Department of Earth Sciences, College of General Education, Tohoku University, Sendai, 980

Abstract. Two Lower Triassic ammonites, *Procarnites kokeni* (Arthaber) and *Eosturia towaensis* Bando and Ehiro gen. et sp. nov., from the Osawa Formation in the southern part of the Kitakami Massif are described. These ammonites indicate the Latest Scythian or Latest Spathian age and belong to the *Subcolumbites perrini-smithi* Zone biostratigraphically. Morphological and septal features suggest that the new genus *Eosturia* may be intermediate between the Lower Triassic *Procarnites* and the Middle Triassic *Sturia*.

Introduction

Two specimens of Lower Triassic ammonites, *Procarnites kokeni* (Arthaber) and *Eosturia towaensis* gen. et sp. nov. were discovered in the Osawa Formation at Asadanuki, Towa-cho, Tome-gun, Miyagi Prefecture, in the southern part of the Kitakami Massif. These ammonites occur in the uppermost part of the Osawa Formation and belong to the latest Scythian, which corresponds to the Prohungaritan ammonite stage (Spath, 1930, 1934) or latest Spathian age (Tozer, 1965). The ammonites are also very important in establishing international correlation between the Osawa Formation and Lower Triassic formations of the world.

Lower Triassic ammonites from the Osawa Formation of the Kitakami Massif were described by Bando (1964, 1966, 1970) and Bando and Shimoyama (1974) as the *Subcolumbites* faunas, but up to now *Procarnites* has not been discovered in the Kitakami Massif.

Historically, the Osawa Formation has been studied by many authors. For example, Mabuti (1932) discovered specimens of Lower Triassic pelecypods such as *"Pecten" (Eumorphotis) ussuricus* (Bittner), *"Pecten" sichoticus* (Bittner), *"Pecten"* cf. *discites* (Schlotheim), *Pecten alberti virgalensis* (Wittenburg) at Tate near Isatomae, but since then no other fossils have been discovered in the Lower Triassic. Subsequently, Shiida (1939)

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surveyed the area in which the present specimens occur and subdivided the Triassic beds into H_1 to H_4 members in ascending order and included them in the Hiraiso Formation. Later Inai (1939), Ichikawa (1948, 1951), Mito (1957), Onuki and Bando (1959a) and Bando (1958, MS) contributed to the stratigraphy and subdivision of the Osawa Formation. Ichikawa (1948, 1951) proposed the name Osawa Formation and referred it to his Tatean age of the Lower Triassic chronological subdivision of Japan.

In 1964, Bando described *Subcolumbites* cf. *perrinismithi* Arthaber based on the collection of Prof. Onuki from the Osawa Formation at Tate near Isatomae, and subsequently also described other Lower Triassic ammonoids, e. g. *Flemingites* sp., *Euflemingites* sp., *Meekoceras* spp., *Xenoceltites* ? sp. and *Danubites* sp., from the Osawa Formation on the coast at Hiraiso, Motoyoshi-cho, Motoyoshi-gun, Miyagi Prefecture. In addition, Bando (1970) described the *Leiophyllites* fauna, which consists of *L.* cf. *pitamaha* (Diener), *L.* aff. *pradiumna* (Diener), *L.* sp. and *Danubites* aff. *ambika* Diener, from the Osawa Formation at Konori near Onagawa-cho, Ojika-gun, Miyagi Prefecture, on the basis of the collection of Prof. Onuki. Bando and Shimoyama (1974) also described further members of the *Subcolumbites* fauna i. e. *Preflolianites* aff. *sulioticus* (Arthaber), *Columbites parisianus* Hyatt and Smith, *C.* sp., *Eophyllites* cf. *dieneri* (Arthaber), *Leiophyllites* sp., *Stacheites* sp., *Nordophiceras* sp., *Arnautoceltites* sp., *Prenkites* cf. *timorensis* Spath, *P.* sp., *Prohungarites* ? sp., *Dalmatites* sp., *Subcolumbites perrinismithi* (Arthaber), *S.* sp., *Isculites* aff. *originis* (Arthaber), from the Osawa Formation at the type locality, Hiraiso, Motoyoshi-cho, Motoyoshi-gun, Miyagi Prefecture. The *Subcolumbites* fauna is found about 30 m above the top of the subjacent Hiraiso Formation.

On March in 1980, the junior author (M. E.) collected an ammonite, *Procarnites*, from the uppermost part of the Osawa Formation at 2 km southest of Asadanuki, Towa-cho. In addition, we again visited the locality of Asadanuki on January in 1981 in association with Prof. M. Murata of Kumamoto University and at that time we collected an interesting ammonite, *Eosturia*, described in this paper.

The Osawa Formation, which has yielded the present specimen is thicker than the Hiraiso Formation, and the main part of the formation may comprise the Prohungaritan-Columbitan ammonite stages of Spath (1930, 1934), as already mentioned by Bando and Shimoyama (1974).

Stratigraphical Note on the Lower Triassic Formations in the Southern Kitakami Massif

The Lower Triassic of the southern part of the Kitakami Massif consists of the two formations, the Hiraiso Formation below and the Osawa Formation above. These formations are distributed along the eastern and western margins of the southern Kitakami Massif, and lie on the subjacent Upper Permian Toyoma Formation and its equivalents (Fig. 1). At the Hiraiso coast, the type area of the Lower Triassic formations, the Hiraiso Formation, about 160 m thick, is composed of basal conglomerate which unconformably overlies black shale of the Toyoma Formation, coarse sandstone in the lower part and a banded alternation of sandstone and shale in the upper part. The latter grades upwards into a laminated alternation of shale and sandstone of superjacent Osawa Formation. From the type locality of the Hiraiso Formation,

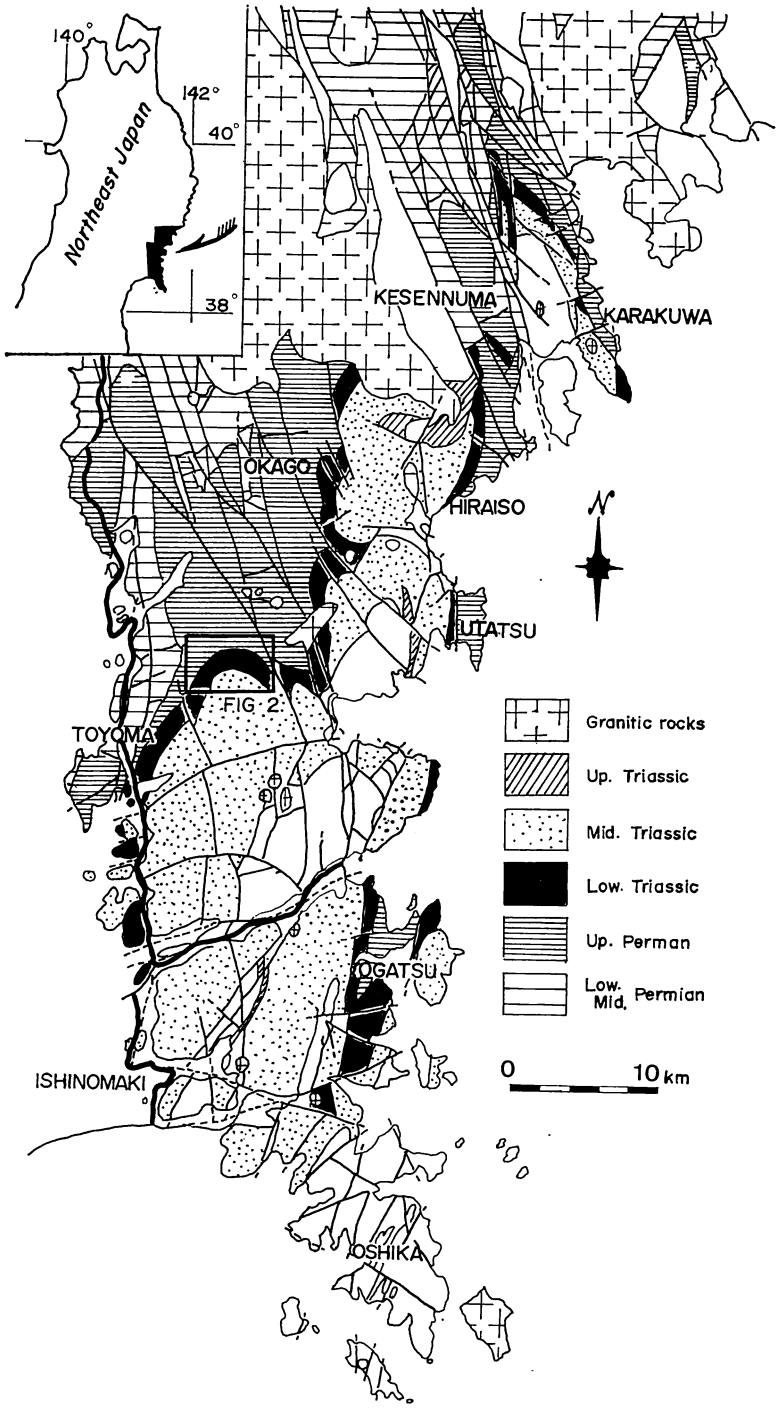

Fig. 1. Geologic map of the southern part of the Kitakami Massif. (Geologic data based on various sources and map compiled by M. Ehiro)

the Early Scythian ammonoid "*Glyptophiceras*" cf. *gracile* has been described by Bando (1970). The Osawa Formation consists of alternating laminated shale and sandstone in the lower part and dark gray shale in the upper part, and is estimated to be 300 m thick. The formation is covered by thick sandstone of the Middle Triassic Fukkoshi Formation.

The Osawa Formation yields abundant Scythian ammonoids as already mentioned. In the Mizusakai-toge area, including the present fossil locality, Lower Triassic formations are widely distributed in a synclinal structure, whose axis plunges gently to the south (Fig. 2). The lithologic features and thickness of the formations differ somewhat from those of the type locality on the Hiraiso coast. The Hiraiso Formation in the Mizusakai-toge area, 200-250 m in thickness, contains thin beds of reddish or greenish tuff in the lower part. The lithologic character of tuffs in the basal part of the Hiraiso

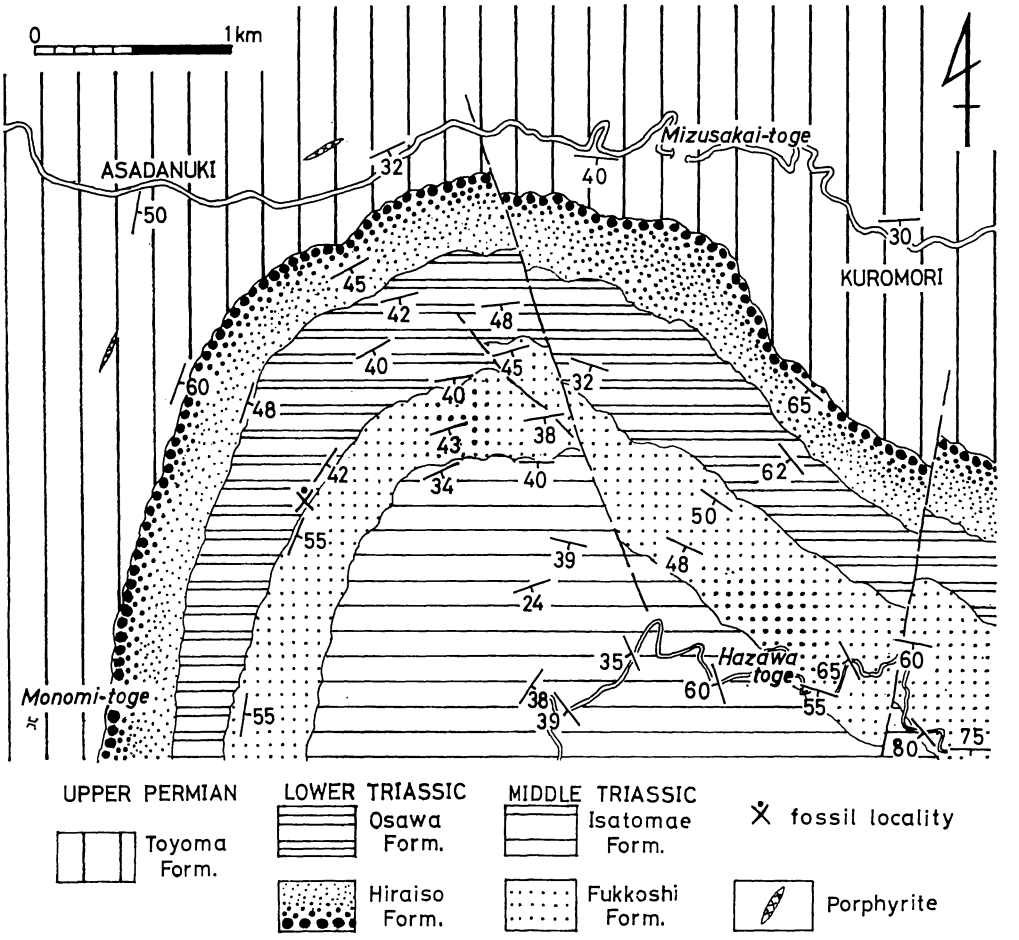

Fig. 2. Geologic map of the ammonite locality at Asadanuki near Towa-cho, Tome-gun, Miyagi Prefecture. Geologic survey carried out by M. Ehiro.

Formation was studied by Onuki and Bando (1958) and regarded as products of the basic volcanic activity in the earliest Lower Triassic. The Osawa Formation contains thick beds of sandstone in the middle part, and the total thickness attains 400 m. The present ammonites were collected from the shales in the uppermost part of the Osawa Formation, about 20 m below the base of the Fukkoshi Formation (Fig. 3) in the upper reaches of Nameshi-zawa, southeast of Asadanuki, Towa-cho, Miyagi Prefecture. From the stratigraphic evidence, although no additional ammonoids were found at the locality, the horizon of the present specimens especially corresponds to the *Arnautoceltites* zone of the type locality.

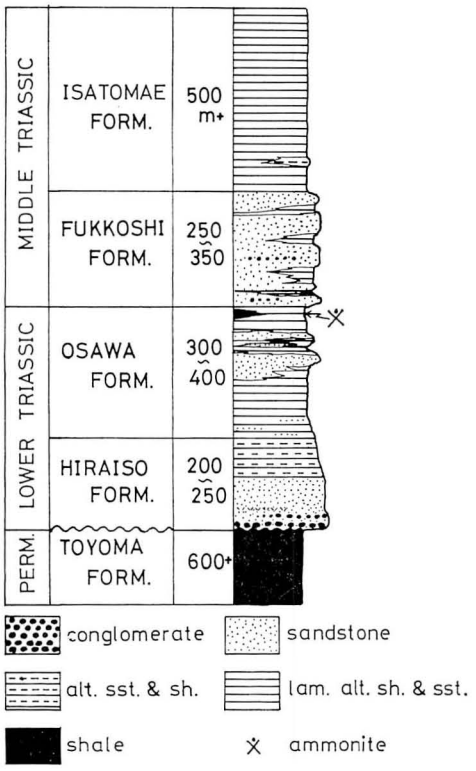

Fig. 3. Geological columnar section of the Lower and Middle Triassic at Asadanuki, showing the horizon of *Procarnites* and *Eosturia* at the top of the Osawa Formation.

Description of Ammonites

Class Cephalopoda Cuvier, 1797

Subclass Ammonoidea Zittel, 1884

Order Ceratitida Hyatt, 1884

Superfamily Noritaceae Karpinsky, 1889

Family Proptychitidae Waagen, 1895

Genus *Procranites* Arthaber, 1911

Type species: *Parapopanoceras kokeni* Arthaber, 1908

Remarks: *Procarnites* predominates in the uppermost Scythian, i. e. the Prohungaritan (Spath, 1930, 1934) or the latest Spathian (Tozer, 1965), and is generally associates with the *Subcolumbites* fauna which consists of *Subcolumbites, Columbites, Prohungarites, Nordophiceras, Isculites, Prenkites, Leiophyllites*, etc.

From the phylogenetic point of view, the present genus may be ancestral to *Sturia* (Ptychitidae) and an intermediate form may be represented by *Eosturia* gen. nov. described below. *Procarnites* and *Eosturia* are both associated in the same horizon of the Osawa Formation in the Kitakami Massif.

Occurrence and geological horizon: Prohungaritan or Latest Spathian of the Lower Triassic. Timor, Salt Range (Pakistan), Afghanistan, Chios (Greece), Albania, South China, Japan, Siberia and British Columbia.

Table 1. Measurement in mm [*Procarnites kokeni*].

	D	H	W	U	H/D	W/H	U/D
GLKU-Os -80004	57.0	32.9	11.0?	6.0	0.57	0.33?	0.1

D: Diameter of shell, H: Height of whorl, W: Width of whorl, U: Diameter of umbilicus.

Procarnites kokeni (Arthaber, 1908)

Pl. 60, Figs. 1a-b; Text-fig. 4A

1908. *Parapopanoceras kokeni* Arthaber, p. 259, pl. 11(1), figs. 1a-c, 2a-b.
1911. *Procarnites kokeni*, Arthaber, p. 215, pl. 17(1), figs. 16, 17, pl. 18(2), figs. 1-5.
1915. *Procarnites kokeni*, Diener, p. 228.
1917. *Procarnites kokeni*, Diener, p. 167.
1928. *Procarnites kokeni*, C. Renz, p. 155.
1947. *Procarnites kokeni*, C. Renz and O. Renz, p. 61.
1948. *Procarnites kokeni*, C. Renz and O. Renz, p. 81, pl. 8, figs. 5, 6-6a, 8-8a; pl. 9, figs. 2-2a.
1966. *Procarnites kokeni*, Kummel, p. 390, pl. 2, figs. 10-13.
1968. *Procarnites kokeni*, Kummel, p. 391, pl. 11, figs. 1-4; pl. 12, figs. 1-2; pl. 13, figs. 1-8.
1978. *Procarnites kokeni*, Wang, p. 167, pl. 11, figs. 15-19.
1968. *Procarnites* aff. *kokeni*, Bando, p. 101, pl. 6, figs. 3a-b.
1934. *Procarnites acutus* Spath, p. 183, pl. 5, figs. 4a-b.

Material: A single specimen was examined.

Description: Shell involute, discoidal, laterally compressed, with smooth shell surface, narrowly rounded venter and small funnel-shaped umbilicus as in ptychitids. Outer whorl completely embraces inner whorls. Suture consists of entirely rounded saddles and denticulated lobes, but median siphonal saddle not observed; first lateral saddle largest and others gradually becomes smaller toward umbilical margin; first lateral lobe highly denticulated and deeper than other lateral lobes.

Remarks: This specimen is not well preserved, but preservation of the shell surface, umbilicus and sutures is good and quite adequate for specific identification. The suture especially is well able to be identified with that of *Procarnites kokeni* (Arthaber), as illustrated in Fig. 4. Unfortunately, the type specimen described by Arthaber (1908) is a rather small and immature one with more simple sutures than those of specimens described by Renz and Renz (1948) from Chios Island in Greece. As already discussed by Kummel (1969, p. 391-396) the large number of *P. kokeni* from Chios, which have been described by Renz and Renz, show much variability in the whorl section, from a broadly rounded venter to a rather acute venter like that of Spath's holotype of *P. acutus* (Spath, 1934, p. 183, pl. 5, figs. 4a-b) from Kcira in Albania. Thus, Kummel (1969) included *P. acutus* in *P. kokeni* on the basis of the above mentioned variability of the venter of that species. The present writers agree with the opinion of Kummel in this point.

P. kokeni is a member of the Tethyan ammonite fauna and has been recorded from Albania (Arthaber, 1911), Chios (Renz and Renz, 1948), Mangyshlak Peninsula of the Caspian region (Kiparisova, 1947, as *P. andrusovi* Bakarunas, 1936), Afghanistan (Kummel, 1968), Salt Range in Pakistan (Kummel, 1966), Timor (Spath, 1934; Bando, 1968, in Nakazawa and Bando) and recently from the Mount Jolmo Lungma region in Tibetan Hima-

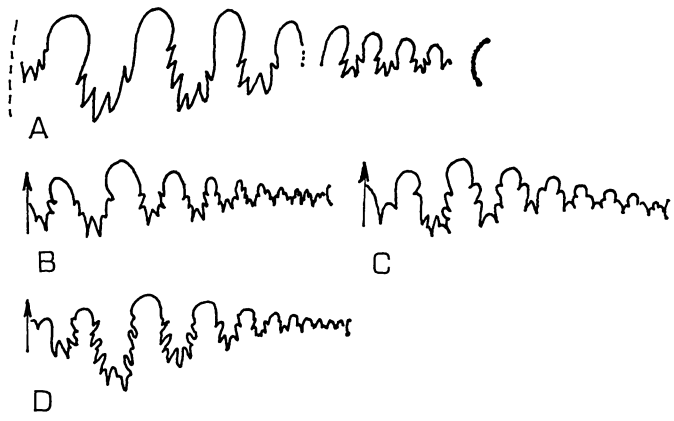

Fig. 4. Suture lines of *Procarnites kokeni* (Arthaber). A: present specimen, at a diameter of 34 mm, Osawa Formation; B: lectotype by Arthaber (1908, pl. 11(1), fig. 1c) at a diameter of 33 mm (see also Kummel, 1969, p. 392, fig. 12(A)). Albania. C: plesiotype by Arthaber (1911, pl. 18(2), fig. 2c) (see also Kummel, 1969, p. 392, fig. 12(C) at a diameter of about 80 mm. Albania. D: lectotype of *Procarnites skanderbegis* Arthaber (1911, pl. 18(2), fig. 7c) at a diameter of 55 mm; see also Spath (1934, p. 180, fig. d and Kummel (1969, p. 392, fig. 12(F)). Columbitan. Albania.

layas (Wang and He, 1976, as *P.* cf. *kokeni*). In south China, Zhao (1959) described *P. oxynostus* Chao from the Lower Triassic of Kwangsi, but Kummel (1969, p. 391) included the Chinese species in *P. kokeni* (Arthaber) because of their close similarity in shell form.

Biostratigraphically the present species occurs in the latest Scythian age, coexisting with *Subcolumbites, Nordophiceras, Arctomeekoceras, Preflorianites, Prohungarites, Proptychites* and *Isculites*. In the Salt Range, the horizon of *P. kokeni* is about 30 m below the base of the Middle Triassic Tredian Formation at Nammal Gorge (Pakistan-Japanese Research Group, 1981).

In the Kitakami Massif, northeast Japan, the *Subcolumbites* fauna including *Procarnites* occurs probably in the same beds as *Utatsusaurus hataii* Shikama, Kamei and Murata, a kind of Ichthyosaurid, and a little below the bed with *Leiophyllites*. In Eastern Timor, *Procarnites kokeni* was described by Bando (Nakazawa and Bando 1968, p. 101) from the Uppermost Scythian beds 7 km west of Manatuto based on the collection of Professor K. Nakazawa in 1961. *Procarnites* from Eastern Timor is associated with *Leiophyllites timorensis* Bando, *Pseudosageceras* cf. *multilobatum* Noetling, *Tropigastrites* aff. *lahontanus* Smith, *Meekoceras nakazawai* Bando etc. (Nakazawa and Bando, 1968, p. 91).

Occurrence and geological horizon: Dark gray shale of the uppermost part of the Osawa Formation 2 km southeast of Asadanuki, near Mizusakai-toge, Towa-cho, Tome-gun, Miyagi Prefecture, southern part of the Kitakami Massif. *Subcolumbites perrinismithi* Zone of the latest Scythian. Reg. No. GLKU-Os-80004. Coll. M. Ehiro, 1980.

Superfamily Ptychitaceae
Mojsisovics, 1882

Family Ptychitidae Mojsisovics, 1882

Genus *Eosturia* Bando and Ehiro, gen. nov.

Type species: *Eosturia towaensis* Bando and Ehiro, 1982.

Diagnosis: Shell involute, discoidal, highly laterally compressed, with closed umbilicus, narrowly rounded venter, and slightly convex sides. Surface ornamented with spiral striae on flanks and by weak radial folds ventrally. Suture ammonitic, saddles with simple phylloid terminations and lobes ammonitic.

Remarks: The present new genus is ancestral to *Sturia* Mojsisovics (1882) which is a characteristic of the Middle Triassic, especially Anisian age, because the shell ornamentation of spiral striae in the present genus shows the features of *Sturia*, but there are radial folds on the ventral margin of the shell and moreover the suture is simpler than that of *Psilosturia* Diener (1916) or *Sturia* in the form of the lateral saddles. *Psilosturia* has a wider umbilicus and more complicated sutures than either *Eosturia* or *Sturia*. The diameter of the umbilicus of *Psilosturia* is about 1/7 of the total shell diameter.

The genus *Eosturia* is considered to be an intermediate group between the *Procarnites* and *Sturia* because of the features of shell ornamentation and the suture. Biostratigraphically, the present genus occurs in the *Subcolumbites* Zone in association with *Procarnites kokeni* described above. In the Kitakami Massif species of *Sturia*, e. g. *S. japonica* Diener and *S.* cf. *sansovinii* Mojsisovics, were described from the Isatomae Formation of the Middle Triassic (Diener, 1915; Onuki and Bando, 1959b), but no species of *Struia* have yet been found in the Lower Triassic Osawa Formation. Previously, species of *Sturia* were thought to have been restricted to Middle Triassic strata of the Tethys region of the Alps and Himalayas, but no species of *Sturia* not even an ancestral form has yet been discovered in the Lower Triassic of that region.

Jacobshagen and Tietze (1974) described an interesting species, "*Sturia*" n. sp., from the *Subcolumbites* beds of the Greek Island of Chios and they suggested that some species of *Columbites*, *Subcolumbites*, and other Spathian ammonites are associated there with "Anisian" elements. That species of "*Sturia*" might fall in the scope of variation of *Eosturia* in shell form, sculpture and sutural pattern, but it is difficult to compare whorl sections because no illustration was provided by the authors.

Occurrence and geological horizon: Prohungaritan or late Spathian of the Lower Triassic. *Subcolumbites perrinismithi* Zone.

Eosturia towaensis Bando and Ehiro, n. sp.

Pl. 60, Figs. 2a-b; Text-fig. 5

Material: A single specimen was examined.

Diagnosis: Shell involute, discoidal highly laterally compressed, with closed umbilicus, narrowly rounded venter, and slightly convex sides. Shell surface ornamented with numerous spiral striae and indistinct ventral radial folds. Suture ammonitic, consisting of simple phylloid lateral saddles and denticulated ammonitic lateral lobes.

Description: Shell completely involute, discoidal, laterally compressed, with closed umbilicus, narrowly rounded venter and slightly convex sides. Inner whorl about half height of outer whorl.

Fig. 5. Suture line of *Eosturia towaensis* Bando and Ehiro, gen. et sp. nov. GLKU-OS-81001, H=28.4 mm Osawa Formation at Nameshi-zawa, Asadanuki, Towa-cho, Tome-gun, Miyagi Prefecture.

Maximum width at half height of the whorl. Venter very narrow and rounded. Shell surface ornamented with numerous spiral striae as in *Sturia* and by indistinct fine radial folds which are observed on the ventral sides of shell, extending from 2/3 height to the venter. Suture ammonitic, consisting of phylloid and terminated lateral saddles and of denticulated ptychitid lateral lobes, but the ventral lobe is unfortunately unknown (See Fig. 5).

Remarks: The general characters of the shell of the present species resemble those of the species of *Sturia*, especially *S. japonica* and *S. sansovinii*, but the simple suture of the new species differs from that of *Sturia*. Moreover, the faint radial folds, which are projected forwards near the venter, on the ventral sides of the shell are not known in any species of *Sturia*. Judging from its suture the present species may be intermediate between *Procarnites* and *Sturia*. In general, the suture of *Sturia* is more complicated than that of *Procarnites* and about as complex as those of *Ptychites* and *Gymnites* of the Middle Triassic.

The present new species is associated with *Procarnites kokeni* (Arthaber) in the Osawa Formation and the writers cannot find any comparable Lower Triassic species.

Occurrence and geological horizon: Dark gray shale of the uppermost part of the Osawa Formation 2 km southeast of Asadanuki, near Mizusakai-Toge, Towa-cho, Tome-gun, Miyagi Prefecture, southern part of the Kitakami Massif. *Subcolumbites Perrinismithi* Zone of the Lower Triassic. Reg. no. GLKU-Os-81001. Coll. Y. Bando and M. Ehiro, 1981.

Acknowledgem nts

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Table 2. Measurements in mm [*Eosturia towaensis* n. sp.]

	D	H	W	U	H/D	W/H	U/D
GLKU-Os -81001	82.0(56.7)	49.4(34.2)	8.0?	0.5	0.60	0.16	0.01

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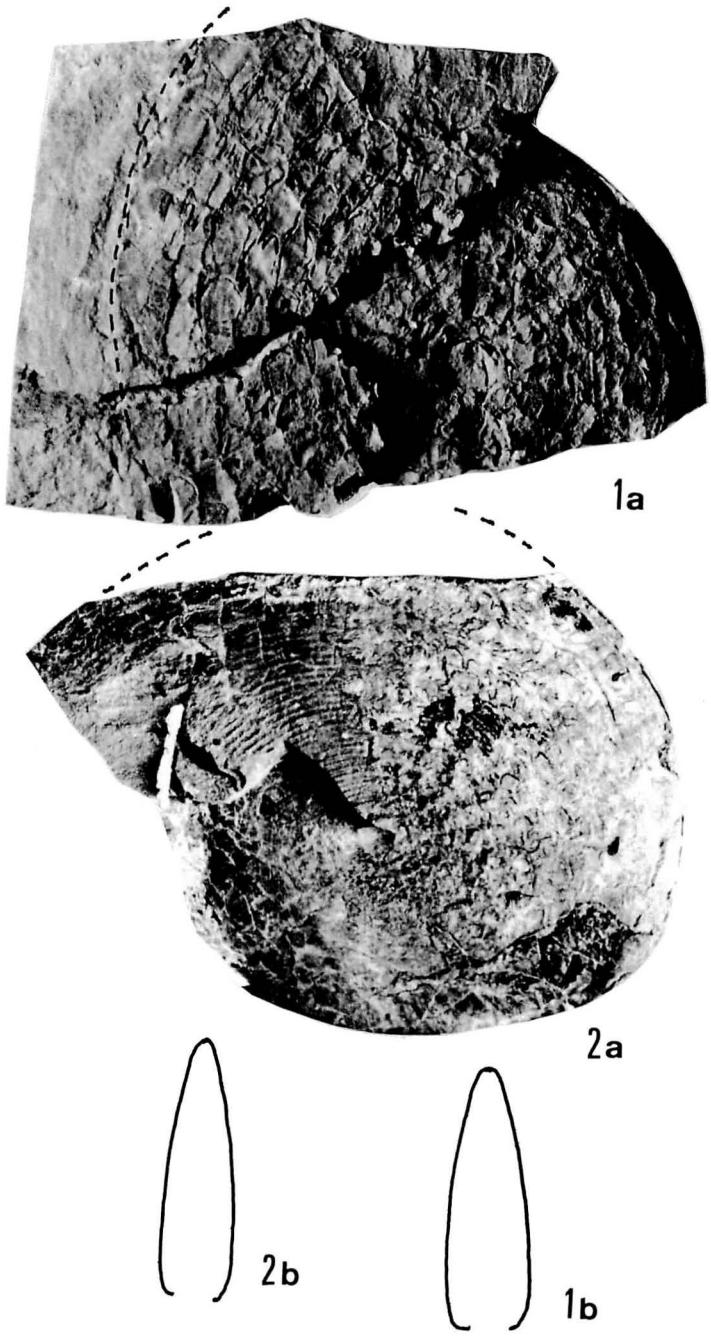
Explanation of Plate 60

Figs. 1a-b. *Procarnites kokeni* (Arthaber) ..... Page 380
GLKU-Os-80004, 1a: lateral view, ×1.4; 1b: cross section of last whorl, ×1.

Figs. 2a-b. *Eosturia towaensis* Bando and Ehiro ..... Page 382
GLKU-Os-81001, 2a: lateral view, ×1.1; 2b: cross section of last whorl, ×1.

Both specimens illustrated here were collected from the uppermost part of the Osawa Formation at 2 km southeast of Asadanuki, near Mizusakai-toge, Towa-cho, Miyagi Prefecture, southern part of the Kitakami Massif. Lower Triassic.


1a
2a
2b
1b

Pass area, Miyagi Prefecture, in the southern Kitakami Massif (Graduation thesis, Tohoku Univ., MS, in Japanese).

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三畳紀前期のアンモナイト2種，*Procarnites kokeni* (Arthaber)，*Eosturia towaensis* gen. et sp. nov. を南部北上山地大沢層より記載する。これらのアンモナイトは Scythian 末期あるいは Spathian 末期を指示し，生層序学的には *Subcolumbites perrinismithi* 帯に含まれる。形態的特徴，特に隔壁の特徴は新属 *Eosturia* が三畳紀前期の *Procarnites* と三畳紀中期の *Sturia* の中間形態である可能性を示唆する。

坂東祐司・永広昌之

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 127, pp. 386-392, pl. 61, September 30, 1982

751. *MAZAPHYLLUM* (RUGOSA) FROM THE SILURIAN OF JAPAN*

MAKOTO KATO

Department of Geology and Mineralogy, Faculty of Science,
Hokkaido University, Sapporo 060

Abstract. *Mazaphyllum* is a thamnasterioid, cystiphyllid rugose coral recorded first from Australia. It is now known also from Kazachstan, Arctic Canada and Japan, and ranges from ?Wenlockian to Lower Devonian. A new species, *M. mirum* is described from the Silurian Kawauchi Formation in the Kitakami mountains, N.E. Japan.

Introduction

A small fossil collected by Mr. F. Murakami of Ohfunato several years ago in the Higuchizawa valley, Ohfunato city, Iwate Prefecture was later presented to Dr. H. Kimura of Ohfunato, who considered the specimen a Silurian stromatoporoid. In looking through Kimura's collection of stromatoporoids Dr. K. Mori of Tohoku University found that the specimen was not a stromatoporoid but might be a rugose coral. I was then asked to identify it, and the specimen turned out to be a new species of *Mazaphyllum*. This genus was originally established from Australia, but has not been commonly known from elsewhere. The occurrence of *Mazaphyllum* in Japan is therefore interesting. The systematic position of *Mazaphyllum* is discussed below.

Acknowledgements

I acknowledge my thanks to Dr. Hozue Kimura of Ohfunato Hospital for donating this interesting coral for study, and to Professor Paul Copper of Laurentian University, Canada, for critically reading the paper in manuscript. Photographs are the work of Mr. Sumio Kumano of Hokkaido University.

* Received February 17, 1982; read June 26, 1982, in Sapporo.

Systematic description

Phylum Coelenterata Frey & Leuckart, 1847

Subphylum Cnidaria Hatschek, 1888

Class Anthozoa Ehrenberg, 1834

Order Rugosa Milne-Edwards & Haime, 1850

Suborder Cystiphyllina Nicholson, 1889

I recognize eight families within the suborder Cystiphyllina. They are listed in the following tabular key:

Rugose corals with acanthine septa .... Cystiphyllina
Without tabulae, without dissepiments.

Septal spines sparse and irregular. Corallum small, ceratoid..... ..... Family Primitophyllidae
Septal spines regular. Corallum small, discoid or patellate. .... Family Palaeocyclidae
With tabulae, without dissepiments.
Tabulae may be complete or incomplete. ..... Family Tryplasmatidae
With cystosepiments.
Operculate.
Corallum calceoloid. .... Family Calceolidae
Corallum pyramidal. .... Family Goniophyllidae
Non-operculate.
Septal spines short. Tabularium and dissepimentarium may be differentiated .....Family Cystiphyllidae
Septal spines fused to form partly platy septa..Family Digonophyllidae
With tabularium and dissepimentarium differentiated.
With long septal spines. Differentiation between tabularium and dissepimentarium may be not clear. .... Family Holmophyllidae

Family Holmophyllidae Wang, 1947

(nom. transl. Ivanovsky, 1968: *pro* Holmophyllinae Wang, 1947)

Diagnosis: Cystiphyllid rugose corals typically with tabularium clearly differentiated from dissepimentarium. Septal spines are relatively long and pierce dissepiments.

Genera: Within the limit of the above definition, the following genera appear to be referable to the Holmophyllidae. The possibility that several of these genera may be synonymous is noted.

Solitary .....*Holomophyllum* Wedekind, 1927
?*Hedstroemophyllum* Wedekind, 1927
?*Gyalophyllum* Wedekind, 1927
Spinolasma Ivanovsky, 1965
Gukoviphyllum Sytova, 1968
Holmophyllia Sytova, 1968
Mesouralinia Shurygina, 1971
Fasciculate....*Nipponophyllum* Sugiyama, 1940
Baeophyllum Hill, 1940
Dendroholmia Spassky & Kravtsov, 1974
Cerioid.....?*Storthygophyllum* Weissermel, 1894
Xiphelasma Smith & Lang, 1931
Plocoid.....?*Cystiphorolites* Miller, 1889
Mazaphyllum Crook, 1955
Aksarlinia Kaplan, 1975

Genus *Mazaphyllum* Crook, 1955

1955 *Mazaphyllum* Crook, p. 1052
1973 *Mazaphyllum*, Cotton, p. 125
1975 *Aksarlinia* Kaplan, p. 67
1976 *Mazaphyllum*, McLean, p. 298
1977 *Mazaphyllum*, Spassky, p. 70
1981 *Mazaphyllum*, Hill, F. 107

Type species (by original designation): *Mazaphyllum cortisjonesi* Crook, 1955

Generic diagnosis: Thamnasterioid Holmophyllidae.

Included species:

Mazaphyllum cortisjonesi Crook ?Wenlockian to ?Ludlovian of New South Wales, Australia (Crook, 1955; McLean, 1974, 1976)

Aksarlinia concavotabulata Kaplan ?Gedinnian of Central Kazachstan (Kaplan in Menner (ed.), 1975)

Mazaphyllum mirum Kato, n. sp. Silurian, Kawauchi Formation, Kitakami mountains, N.E. Japan (this paper).

Distribution: ? Wenlockian to Lower Devonian. East Australia, Kazachstan, Japan and Arctic Canada (Pridolian according to McLean, 1976).

Discussion: Crook (1955) clearly indicates that *Mazaphyllum* is a member of cystiphyllid corals. It is characterized by

thamnasterioid corallum, dimorphacanthine septa and sagging tabulae. Although Crook does not assign the genus to any family, he suggests some relationship exists between *Mazaphyllum*, *Holmophyllum* and *Hedstroemophyllum*.

Ivanovsky (1965) merged *Mazaphyllum* with query to *Palaearaea* of the Calostylidae, having perforate septa. Since *Mazaphyllum* has distinctly acanthine septa, Ivanovsky (1973, 1975) later placed *Mazaphyllum* within the Holmophyllidae (nom. transl. Ivanovsky, 1968, 1972), which procedure I will follow.

McLean (1974) put *Mazaphyllum* in the Cystiphyllidae. Later, he (1976) recognized two subfamilies of the Cystiphyllidae, namely the Cystiphyllinae and Digonophyllinae, and placed *Mazaphyllum* in the former subfamily, which Hill (1981) and I would divide into two families, the Cystiphyllidae and Holmophyllidae.

Spassky saw the importance of coloniality in rugosan classification and in 1977 relegated the position of *Mazaphyllum* to his Superorder Associata, Order Zonastraeida, Suborder Zonastraeina, Family Microplasmatidae, Subfamily Microplasmatinae. But, this procedure results in a seemingly unnatural grouping. My classification of cystiphyllids is tabulated above.

Crook (1955) compared his *Mazaphyllum* with other plocoid rugosa of the Silurian such as *Arachnophyllum* and *Zenophylla*. The completely thamnasterioid corallum and sagging tabulae of *Zenophylla* are similar to those of *Mazaphyllum*, but the former has platy septa. *Arachnophyllum* also typically has platy septa and uparched tabulae, so it is distinguishable from *Mazaphyllum*. The problem is that in some forms of *Arachnophyllum* the peripheral part of the septa may be split into series of discrete trabeculae (see for example McLean, 1975). Whether acanthine septa are stable and reliable morphological features or not should be tested further. We can name another example in the Cystiphyllidae and Digonophyllidae.

McLean (1974, 1976) compared his *Angullophyllum* with *Mazaphyllum*, but the former has a cerioid corallum, short acanthine septa and uparched tabulae. *Angullophyllum* is thus closer to *Arachnophyllum* than to *Mazaphyllum*.

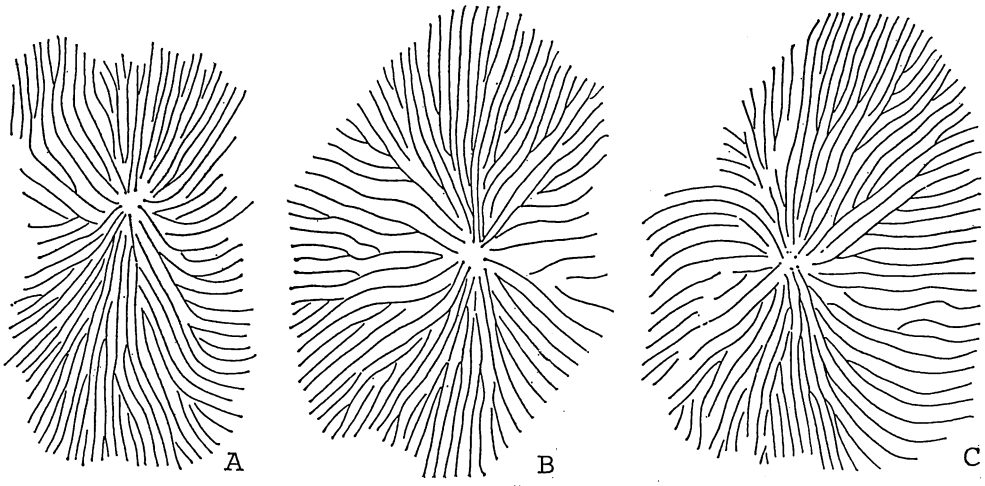
Kaplan (1975) recognized *Aksarlinia* to be rather closely related, and distinguished *Aksarlinia* on the basis of the posession of holacanthine septa, as compared to the dimorphacanthine septa of *Mazaphyllum*. In my opinion, fine structural pattern of acanthine septa cannot be taken alone as a reliable character to classify Rugosa in genus ranks. *Aksarlinia* has a plocoid corallum, acanthine septa, sagging tabulae and is best considered as a synonym of *Mazaphyllum*.

Cystiphorolites Miller (=*Vesicularia* Rominger) has thamnasterioid, partly aphroid corallum and is included in the Holmophyllidae by Hill (1981). The genus appears to be more similar to *Arachnophyllum*. Further examination of the form in thin section is neccesary to clarify its true systematic position (McLean, 1974). If it has genuine acanthine septa, it could possibly be a synonym of *Mazaphyllum*.

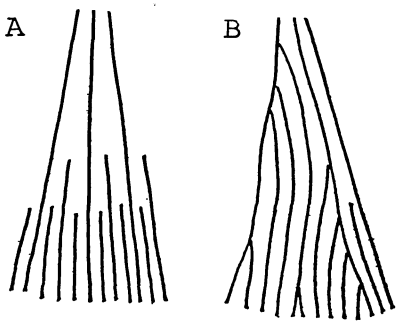
As mentioned above, Crook (1955) stated that *Mazaphyllum* has both holacanthine and rhabdacanthine septa. This dimorphacanthine nature of *Mazaphyllum* is confirmed also by McLean (1974). The Japanese form of *Mazaphyllum* cannot be described with certainty as to its fine acanthine septal structure because of poor preservation. It may be completely holacanthine, but the possibility of the initial presence of rhabdacanths cannot be excluded, since the external configu-

ration of each septal spine is sometimes irregular and crenulated. At any rate, it is difficult to distinguish genera and species of Rugosa by the nature of the fine structure of septa alone. Besides, I believe that monacanthine to rhabdacanthine septal trends operated in a number of lineages of cystiphyllids.

More interesting is the pattern of septal insertion in *Mazaphyllum*. Septa are arranged more or less radially in the type species of both *Mazaphyllum* and *Aksarlinia*. But in the new Japanese form septa are often bundled (Text-figure 1, A-C). The distinction between major and minor septa is not clear. A long septum appears to bifurcate repeatedly, or, short septa were inserted by intercalation, leaning upon long septa. Thus septal arrangement as a whole is not cyclical, yet it is not clearly bilateral or tetrameral. I am unable to decipher any regularity in septal insertion. However the overall pattern is rather similar to that described by Erina and Kim (1980) for some corals from the Ordovician of Tienshan. They say that for *Tjanshanophyllum* and *Sumsarophyllum* epitheca is lacking and septa are porous, showing peculiar arrangement what they call "fan-like coalescence". They assign these corals to the Fungiida of the Scleractinia; the lack of epitheca might be the result of peripheral erosion, and "porous septa" may be a kind of acanthine septa. I have seen a very similar mode of septal arrangement on the weathered calicular surface of a specimen of *Arachnophyllum typus* collected from Wenlock Edge. I would therefore hesitate to call these Ordovician corals from Tienshan genuine members of the Scleractinia. Lavrusewitsch (1971) originally placed his genus *Sumsarophyllum* in the family Paliphyllidae. In this connection, the septal arrangement in the genus *Idiophyllum* Cao (Lee et al., 1975) is very interesting. In this Chinese Silurian coral the presence of tertiary septa is recorded. But, in fact an overall pattern of septal arrangement in *Idiophyllum* is quite similar to that of *Sumsarophyllum*. Real tertiary septa should be distinguished from the septal pattern now in discussion (Text-figure 2).



Text-fig. 1, A-C. *Mazaphyllum mirum* Kato. Diagrams showing the pattern of septal arrangement as it appears in transverse section.



Text-fig. 2. Diagrams showing the difference between the genuine tertiary septa (A) and bundled septa (B).

What appears to be a peculiar mode of septal insertion in *Mazaphyllum* is now known to occur at least in some other ancient corals, and the mode may have originated in corals as old as Ordovician. Septal arrangement should be traced ontogenetically in each coral in order to clearly understand the true mode of septal insertion.

Crook (1955) commented originally that the range of the genus *Mazaphyllum* is from the Lower to Middle Silurian. But McLean (1974) later stated that the genus is common in East Australia from ? Wenlockian through ? Ludlovian strata. Further he mentioned (1976) on the occurrence of the genus from Arctic Canada in rocks of ? Pridolian age. This latter occurrence is not described or illustrated as yet. Taking *Aksarlinia* and the present Japanese form, the genus is now known from Australia, Kazachstan, Arctic Canada and Japan, in rocks from ? Wenlockian to Lower Devonian age.

The phylogeny of *Mazaphyllum* is not known. Holmophyllids in general may have been derived from some type of tryplasmatid. This course is suggested by observing ontogenetical changes in *Nipponophyllum* (Kato, in press). As stratigraphical range of holmophyllid genera compiled by McLean (1976) would indicate, solitary, cerioid and plocoid holmophyllids may have branched from tryplasmatid ancestor(s) at or nearly the same time in the Early Silurian.

Mazaphyllum mirum Kato, sp. nov.

Plate 61, Figs. 1-2; Text-fig. 1A-C.

Material: A small, peripherally weathered fragment of a colony, UHR 30519 (Holotype), with black limestone matrix. Preserved portion of the colony measures 8×4×2 cm. Collected by F. Murakami, as a float derived from the Silurian Kawauchi Formation, at Sugiyama Oné, Higuchizawa, Ohfunato city, Iwate Prefecture, Japan.

Derivation of the specific name: *mira* (Latin)—wonderful.

Specific diagnosis: *Mazaphyllum* with small tabularia (ϕ=1—1.5 mm).

Description: Corallum small, compound, massive and thamnasterioid. External shape and surface character of the complete corallum unknown. Holotheca not preserved.

In transverse section, series of acanthine septa are confluent from one corallite to the other to reveal the completely thamnasterioid nature of the corallum. The polygonal configuration of a corallite may only be realized by tracing the middle or junction parts of these series of confluent acanthine septa. The size of each corallite thus outlined may reach as long as 14 mm in minimum diameter. Tabularia appear as calicular pits on the surface of the corallum: eight such pits are counted in a space of 8×3 cm. Diameter of the tabularium is 1 to 1.5 mm, but it is generally not very well differentiated from the dissepimentarium. Septa are acanthine. As many as 93 series of acanthine septa are counted in a

corallite. They are protruded into the tabularium. Their septal arrangement is difficult to decipher, but it is not typically rugosan, in which four places of new septal insertion are usually clearly indicated. Instead, septal series are apparently bifurcated peripherally or with one series often leaning on another, thus multiplying the total number of the series of acanthine septa. Fine structure of septa is not clear, but it appears to be holacanthine. In places each spiny rod has a slightly indented surface suggesting that they may have originally been rhabdacanthine. No axial structure is present.

In longitudinal section, the dissepimentarium is wide, consisting of globose or slightly flattened, small dissepiments which are pierced by vertically straight, long septal spines. Spines are sometimes a little divergent in their arrangement especially near the boundary between the tabularium and dissepimentarium, where dissepiments are somewhat arched upwards. Dissepiments become smaller near the septal spines, so that they are inosculating between septal spines. Spines are occasionally seen bifurcating. Axial portion of septal spines protrudes for a relatively long distance into the tabularium, and steeply dipping outwards. Tabularium is not well differentiated from the dissepimentarium, and is composed of incomplete, sagging tabulae. No trace of corallite wall is observed.

Comparison: Assignment of the Japanese species to the genus *Mazaphyllum* is clear. The new species is readily distinguishable from other species of the genus, namely *M. cortisjonesi* and *Aksarlinia concavotabulata*, in having much smaller tabularia, which are only 1-1.5 mm in diameter, compared to 4-4.5 mm in the type species and 3-3.5 mm in *Aksarlinia*. Also septal spines fall short of the centre of corallite, thus leaving a wide open space in the tabularia in the other two species; in the new species septal spines protrude distantly into the tabularium. Peculiar septal arrangement is not so conspicuous in the other two species, in which it is more radial in nature.

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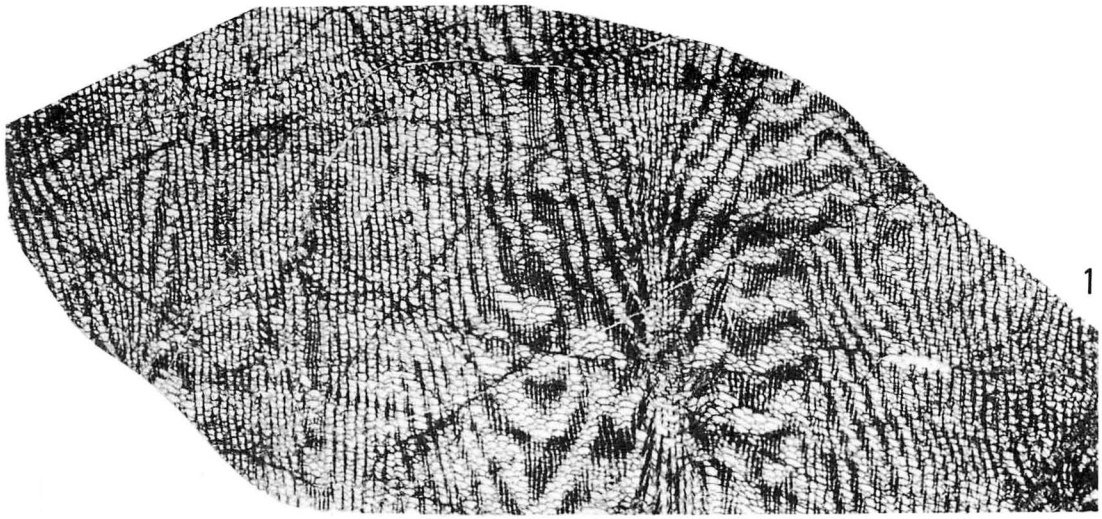
岩手県大船渡市樋口沢のシルル系川内層より，四射サンゴの1新種，*Mazaphyllum mirum* Kato を記載。*Mazaphyllum* 属が Cystiphyllid であることを論じ，Cystiphyllina 亜目の分類についてもふれた。新種にみられる隔壁挿入法は特異なものである。*Mazaphyllum* 属は，日本，カナダ，オーストラリヤ，ソ連の中部シルル系 (?)～下部デボン系より知られる。

Explanation of Plate 61

Figs. 1-2. *Mazaphyllum mirum* Kato, sp. nov.; all figures ×4. 1: Longitudinal section. 2: Transverse section showing completely thamnasterioid corallum. Note the type of septal insertion. UHR 30519 (Holotype), Silurian, Kawauchi Formation.



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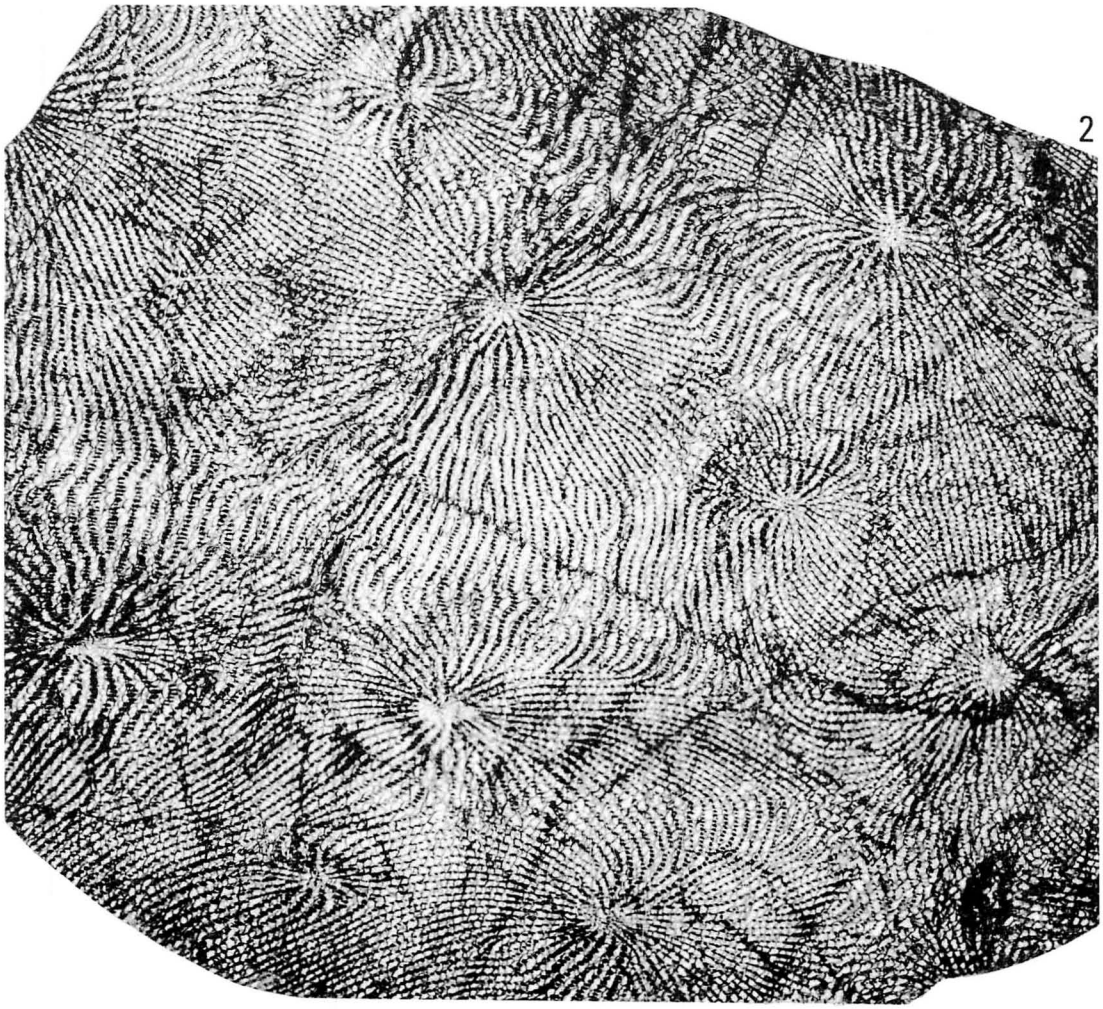

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Trans. Proc. Palaeont. Soc. Japan, N.S., No. 127, pp. 393-418, pls. 62-65, September 30, 1982

752. THE BIVALVE FOSSILS FROM THE CRETACEOUS FUKIGOSHI FORMATION OF THE MONOBE AREA, SHIKOKU

MASAYUKI TASHIRO and TOMOKO MATSUDA

Department of Geology, Faculty of Science, Kochi University, Kochi 780

Abstract. This paper deals mainly with the description of the bivalve fossils from the Fukigoshi Formation, which is composed of muddy sediments in the lower part and of sandy ones in the upper part and distributed at and near the Nagase Dam, Monobe area, Shikoku. 22 genera and 24 species including 4 new species, i.e., *Nucula* (*Pectinucula*) *kochiensis* sp. nov., *Acila* (*Truncacila*) *monobensis* sp. nov., *Portlandia* (s.l.) *nagaseana* sp. nov. and *Nanonavis pseudocarinata* sp. nov., are described from the upper part of the formation. The species composition of bivalve fauna suggests shallow marine or pure marine conditions in the Lower Cenomanian. This fauna resembles closely that of the Mifune Group in Central Kyushu, in the occurrence of many common species between them. Presumable geological age of the Fukigoshi Formation is with the range from the Upper Albian to the Lower Cenomanian. On the other hand the Horonbetsu Formation in northern Hokkaido is probably correlated with the upper part of the Fukigoshi Formation, because of the occurrence of *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano).

Introduction

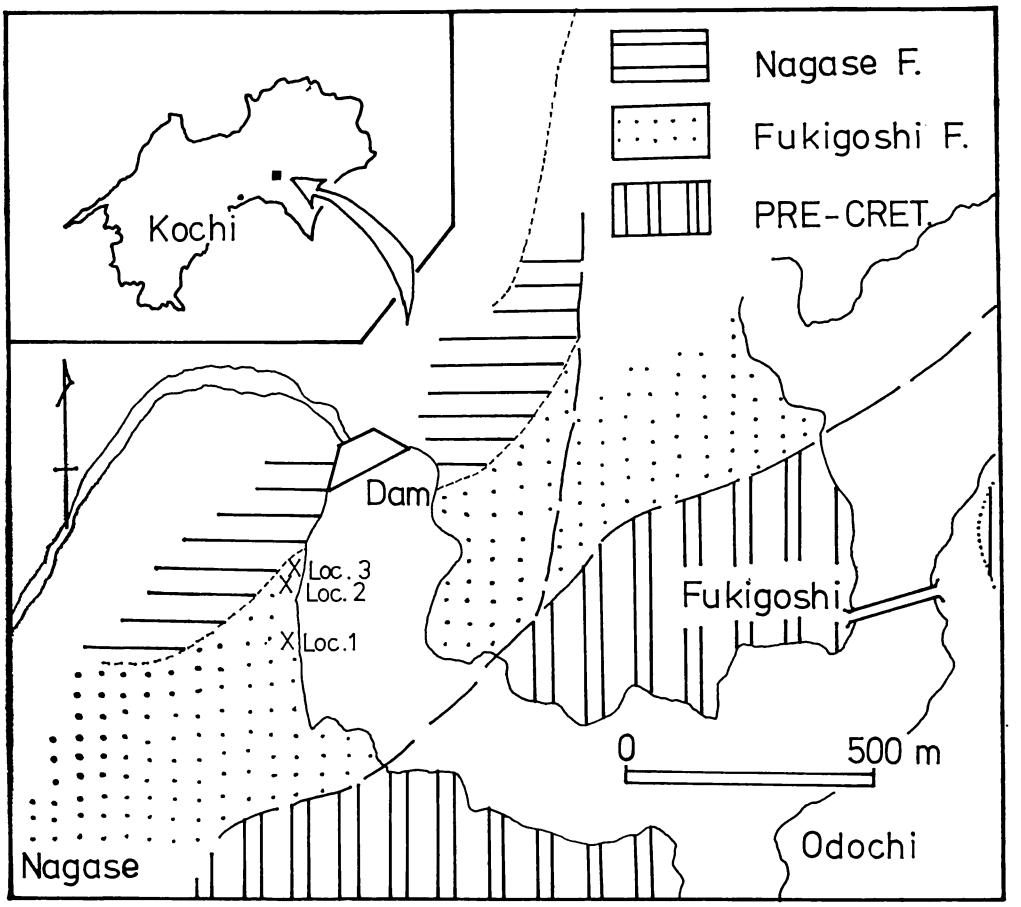
Recently the Fukigoshi Formation has been discriminated by Tashiro et al. (1981) from the Lower Cretaceous Hagino Formation, which is exposed at Hagino of the Monobe area, because of the distinction of the molluscan faunas and the difference in geological age between the Fukigoshi and Hagino Formation.

The Fukigoshi Formation is distributed narrowly at and near the Nagase Dam of Odochi in the Monobe area, Shikoku (see Text-fig. 1). Three molluscan fossil localities are recognized in the dark-gray shale of the Upper Member of the formation in addition to several localities of trace-fossils and "oyster" beds. On the material of our collection from these localities, the bivalves consisting of 22 genera and 24 species including 4 new species, are described in this paper, with their biostratigraphical implications.

The specimens (KSG) described in this paper are preserved in the Faculty of Science, Kochi University (Kochi 780).

Before going further, we wish to express our hearty thanks to Professor Emeritus Tatsuro Matsumoto of Kyushu University for his continuous guidance and reading the first draft. We also wish to express our sincere thanks to Professor Minoru Tamura of Kumamoto University for his valuable suggestion. Thanks are extended to Mr. Takeshi Kozai of Odochi Elementary school who kindly supplied us several

* Received February 19, 1982; read October 4, 1981 in Hiroshima.



Text-fig. 1. Geological map and fossil localities of the Fukigoshi Formation in the Monobe Area.

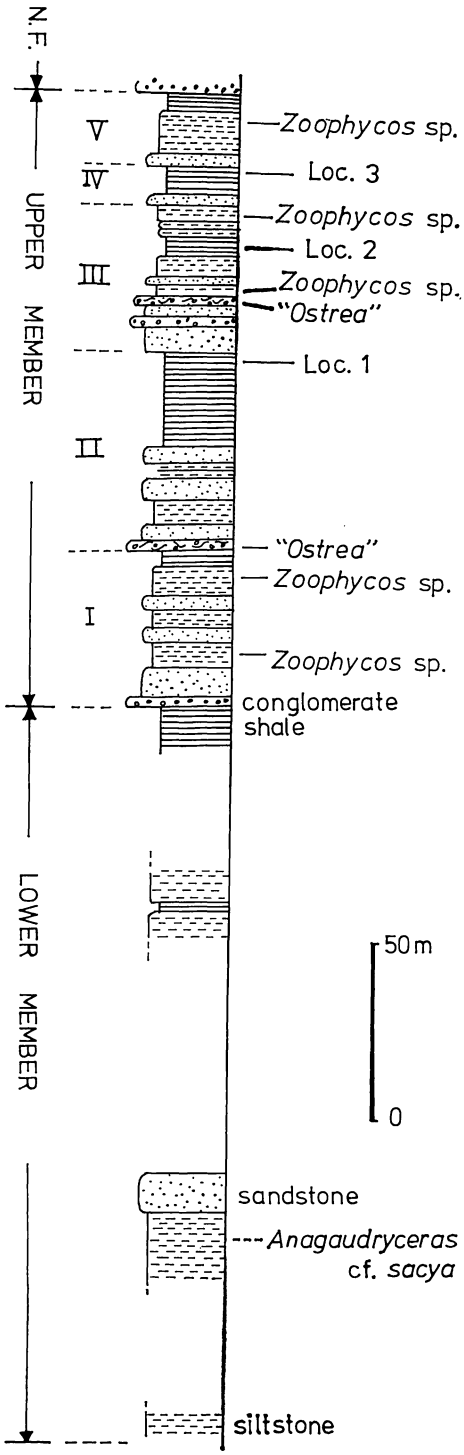
specimens from loc. 3.

Geological setting

The Fukigoshi Formation typically crops out on the southern bank of the Monobe River at and near the Nagase Dam, about 1500 m northwest of Odochi, Monobe area, Kochi Prefecture. The columnar section measured along the river Monobe is shown in Text-fig. 2.

The Fukigoshi Formation, about 380 m in total thickness, is divided into the Lower and Upper Members. The strata take the general attitude of N70°E in strike and about 80° to the north in dip.

The Lower Member, about 210 m in thickness, is mainly composed of dark-gray shale or siltstone, but several beds of fine grained sandstone, about a few meters in each thickness, are intercalated at the middle part. On its southern (i. e., lower) side this member is in contact with another unit of dark-gray shale of the Jurassic Torinosu Group. The contact is a strike fault. An ammonite, *Anagaudryceras* cf. *sacya* (Forbes), was once



collected from the probable lower part of this member (Matsumoto, 1982).

The Upper Member, about 170 m in thickness, is composed of five sedimentary cycles, each of which is composed of the conglomelate and light gray sandstone in the lower subdivision, the alternations of dark-gray siltstone and fine grained sandstone in the middle subdivision and dark-gray shale in the upper subdivision. Thin "oyster" beds are often found in the conglomelate of the lower subdivision of each cycle. The siltstone of the middle subdivision in each cycle except for the second one (see Text-fig. 2) (cycle II), is characterized by the occurrence of trace fossils, *Zoophycos* sp. Three fossiliferous beds are recognized in the Upper Member of the Fukigoshi Formation in addition to the "oyster" beds.

The lower fossiliferous bed (loc. 1) appears in the shale of the upper subdivision in the second cycle (cycle II). *Parvamussium cowperi yubarense* (Yabe et Nagao) is known from the bed.

The middle bed (loc. 2), which is characterized by many species of bivalves and gastropods, appears in the shale of the upper subdivision in the third cycle (cycle III). The bivalve fossils are as follows: *Nucula* (*Pectinucula*) *kochiensis* sp. nov., *Acila* (*Truncacila*) *monobensis* sp. nov., *Mesosaccella mifunensis* Tamura, *Portlandia* (s. l.) *nagaseana* sp. nov., *Matsumotoa unisulcata* (Amano), *Nanonavis pseudocarinata* sp. nov., *Arca* (*Eonavicula*) sp., *Glycymeris* (*Pseudoveletuceta*) cf. *mifunensis* Tashiro, *Septifer* cf. *mifunensis* Tamura, *Entolium* sp. cf. *E. obovatum* (Stoliczka), *Nippononectes kozaii* Tashiro, *Anomia* sp. aff. *A. foldia* Tamura,

Text-fig. 2. The columnar section of the Fukigoshi Formation. I-V: Sedimentary cycles in the Upper Member.

Crassostrea kawauchidensis Tamura, *Pterotrigonia* (? *Scabrotrigonia*) *monobeana* Tashiro et Kozai, *P.* (? *Acanthotrigonia*) *mashikensis* (Tamura et Tashiro), *Myrtea* (s. l.) sp., *Thetis* sp. aff. *T. japonica* (Yabe et Nagao), *Anthonya* sp. cf. *A. mifunensis* Tamura, ? *Cymbophora* sp., *Eomiodon matsubasensis* Tamura, *Goshoraia crenulata* (Matsumoto) and *Legumen* sp..

The upper fossiliferours bed (loc. 3) is inserted in the shale of the upper subdivision in the fourth cycle (cycle IV). Several bivalve species, i. e., *Acila* (*Truncacila*) *monobensis* sp. nov., *Mesosaccella mifunensis* Tamura, *Nanonavis pseudocarinata* sp. nov., *Nippononectes kozaii* Tashiro, *Parvamussium cowperi yubarense* (Yabe et Nagao) and *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano), commonly occur in this bed.

On the north side the Upper Member is conformably overlain by the basal conglomelate of the Nagase Formation (Katto and Suyari, 1956; Tashiro et al., 1982), which ranges from the (upper) Lower Cenomanian to the Upper Cenomanian (Matsumoto and Tashiro, 1982).

Systematic description

Class Bivalvia

Subclass Palaeotaxodonta

Order Nuculoida

Family Nuculacea Gray

Genus *Nucula* Lamarck, 1799

Subgenus *Pectinucula* Quenstedt, 1930

Nucula (*Pectinucula*) *kochiensis*, sp. nov.

Plate 62, Figs. 7, 11-15, Text-fig. 3

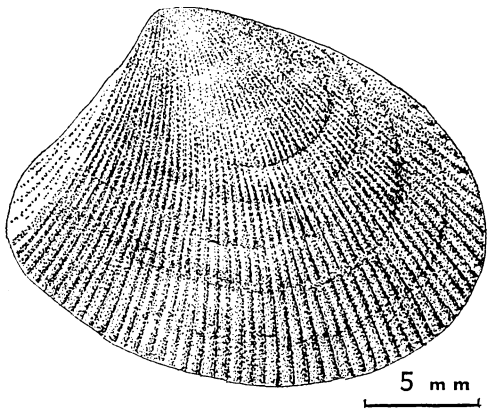
Material:—Holotype, KSG 3111, right external mould, from loc. 2; paratypes, KSG 3112-KSG 3114, from the same type locality.

Description:—Shell small, trigonal ovate, longer than high, moderately inflated; umbo small, opisthogyrous, not prominent, located at two thirds from front of the valve; anterior dorsal margin weakly arched; anterior margin well rounded; ventral margin broadly arched; posterior margin not discriminated clearly from posterior dorsal margin, very short, forming nearly right angle with the ventral margin; posterior dorsal margin nearly straight, but weakly concave near the umbo; umbonal angle about 100°; pseudolunule narrow, strongly depressed; posterior carinal ridge well elevated, weakly concave, extending from the umbo to the postero-ventral corner; disk ornamented with about 50 radial ribs which are round-topped, broader than their interspaces; hinge line about two thirds of the valve length; anterior part of the hinge about twice as long as posterior part, weakly arched, with 10 or more small hooked teeth; posterior part of the hinge nearly straight, with about 6 or more hooked teeth; resilifer small, with an opisthocline axis; posterior adductor scar stronger than anterior one; inner margin provided with about 45 dense crenulations; pallial line weakly impressed; growth lines on the disk very weak.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3111, R. ex. mould	16.8	13.8	4.1
KSG 3112, L. ex. mould	9.3	7.0	3.1
KSG 3113, R. in. mould	12.4	10.2	—
KSG 3114, R. ex. mould	ca 6.6	7.5	1.7

Observation:—The radial ribs on the disk are strongly impressed. The hinge



Text-fig. 3. *Nucula (Pectinucula) kochiensis*, sp. nov.

teeth are less numerous for the genus. This species is undoubtedly referable to the subgenus *Pectinucula* Quenstedt (1930), judging from the distinct round-topped radial ribs on the disk.

Comparison:—This species resembles *Nucula (Pectinucula) pectinata* Sowerby (Woods, 1899; Quenstedt, 1930), type species of *Pectinucula*, from the Upper Greensand of England, in its distinct radial ribs, but differs in having a more clearly triangular outline, more numerous radial ribs and less numerous hinge teeth. This is discriminated from *Nucula (Nucula) amanoi* Tashiro (1976), from the Himenoura Group of Kyushu, by its less rostrated posterior ventral part and the round-topped radial ribs. *Nucula (Pectinucula) radiatocostata* Nagao (1932), from the Upper Ammonite Beds of South Saghalien, is distinguishable from this species in its large valve and variable features of the radial ribs on the disk.

Occurrence:—Common at loc. 2 and loc. 3.

Genus *Acila* Adams et Adams, 1858

Subgenus *Truncacila* Grant et Gale, 1931

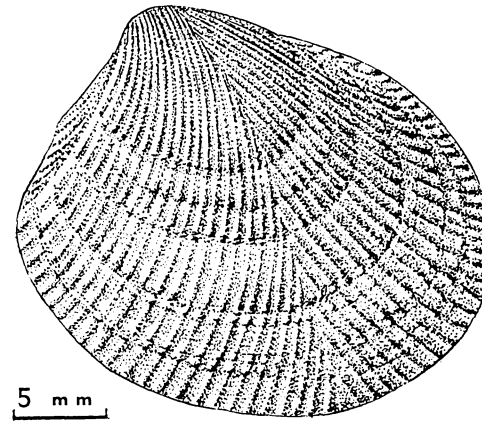
Acila (Truncacila) monobensis, sp. nov.

Plate 62, Figs. 1-6, 8-10, Text-fig. 4

1976. *Acila (Truncacila)* sp. aff. *A. demessa* Finley; Tashiro, *Palaeont. Soc. Japan. Sp. Pap.*, no. 19, pl. 1, figs. 16-18. (no description)

Material:—Holotype, KSG 3101, right valve, from loc. 2; paratypes, KSG 3102-KSG 3109, from the same type locality.

Description:—Shell medium to small, trigonal ovate in outline, a little longer than high, moderately inflated; umbo opisthogyrous, slightly elevated from dorsal margin, located at about three fifths from front of the valve; apical angle about 90°; anterior dorsal margin very weakly arched, about a half length of the valve; anterior margin well rounded; ventral margin moderately arched; posterior margin very narrow, discernible clearly from posterior dorsal margin; posterior dorsal margin nearly straight or slightly concave; pseudolunule indistinct; escutcheon narrow; strongly depressed; disk ornamented with numerous diverging ribs which are plain and wider than interspaces; a line bisecting chevron



Text-fig. 4. *Acila (Truncacila) monobensis*, sp. nov.

generally located on the central line or slightly anterior to that line; hinge line about two thirds of valve length; anterior segment of hinge long, about twice of the posterior one, weakly arched, with about 10 or more strong and hooked teeth; posterior segment nearly straight or slightly concave, with about 6 hooked teeth; resilifer opisthocline, small; anterior and posterior adductor scars strongly impressed; pallial line simple; inner margin finely crenulated; growth lines nearly indistinct.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3101, R. valve	19.9	14.4	4.8
KSG 3102, R. ex. mould	12.3	8.2	2.8
KSG 3104, R. valve	25.3	14.4	—
KSG 3106, R. valve	16.2	13.2	4.9
KSG 3107, R. valve	12.8	11.5	2.9
KSG 3108, L. valve	—	11.5	3.5
KSG 3109, R. in. mould	19.4	13.1	—

Observation:—The ribs posterior to the bisecting line of chevron number about 25, are set in nearly parallel with the posterior carina, which extends from umbo to postero-ventral corner and is weakly concave. The ribs anterior to the line are subradial, countable about 20 in number, and sometimes bifurcate near anterior ventral part on the mature specimens. The apical angles of the chevrons are about 50° or more on the mature stage.

Comparison:—The specimens (KE 2029, GK 6989a and GK 6989b in Tashiro, 1976) from the Cenomanian Mikasa Formation of Hokkaido, are undoubtedly conspecific with the present specimens from the Fukigoshi Formation in having the same characters. This species is very similar to *Acila* (*Truncacila*) *demessa* Finley from the Upper Cretaceous of California (Schenck, 1936), in its subtrigonal outline and the location of the bisecting line. *A.* (*T.*) *demessa* is, however, characterized by weaker chevron-shaped ribs and more posterior location of the umbo than those of this species. It is akin to *Acila* (*Truncacila*) *schencki* Stoyanow (1949) from the Lowell Formation of Arizona, in its triangular outline, but differs in its numerous ribs. *Acila* (*Truncacila*) *bivirgata* (Sowerby) from the Lower Greensand of England (Woods, 1899; Schenck, 1936), is characterized by more numerous ribs on the disk than those of this species. This species is discriminated easily from *Acila* (*Truncacila*) *hokkaidoensis* (Nagao), from the Upper Cretaceous of Japan (see, Tashiro, 1976), which is characterized by the protruded posterior margin.

Occurrence:—Abundant at loc. 2 and loc. 3

Superfamily Nuculanacea Adams et Adams

Family Malletiidae Adams et Adams

Genus *Mesosaccella* Chavan, 1946

Mesosaccella mifunensis Tamura

Plate 62, Figs. 19-22

1976. *Mesosaccella mifunensis* Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 25, nat. sci., p. 49, pl. 1, figs. 25-30.

Material:—KSG 3127-KSG 3130, internal moulds of right valves; KSG 3125-KSG 3126, internal moulds of left valves; KSG 3122-KSG 3123, right valves; all from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3122, R. valve	8.4	6.1	2.4

KSG 3123, R. valve	7.6	4.9	1.2
KSG 3125, L. in. mould	8.4	5.0	—
KSG 3126, L. in. mould	6.6	4.9	—
KSG 3127, R. in. mould	8.8	5.6	—
KSG 3130, R. in. mould	9.0	4.9	—

Remarks:—Numerous specimens of this species are before us. This species is conspecific with *Mesosaccella mifunensis* Tamura (1976), from the Mifune Group of Central Kyushu, which was well defined by Tamura.

Occurrence:—Abundant at loc. 2; common at loc. 3.

Family Nuculanidae Adams et Adams

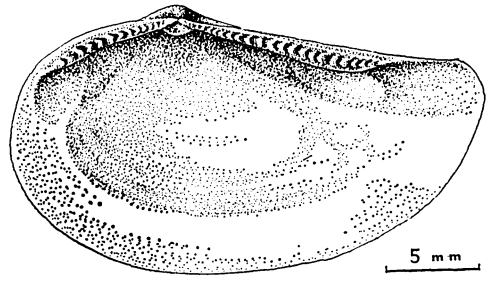
Genus *Portlandia* Morch, 1857

Portlandia (s. l.) *nagaseana*, sp. nov.

Plate 62, Figs. 23-25, Text-fig. 5

Material:—Holotype, KSG 3132, internal mould of right valve; paratypes, KSG 3133-KSG 3135, internal moulds of right valves; all the specimens are collected from loc. 2.

Description: — Shell small, elongately ovate, somewhat rostrated to posterior, weakly inflated; umbo small, nearly orthogyrous, not prominent, pointed at about two fifths from front of the valve; anterior dorsal margin short, slightly convex; anterior margin semi-circular; ventral margin broadly arched; posterior margin narrowly rounded; posterior dorsal margin elongated, weakly concave; pseudolunule very narrow, strongly depressed from an angulated marginal carina; posterior carina not angulated but weakly swollen; external surface nearly smooth except for fine growth lines; hinge plate long with about two thirds of the valve length but very narrow in breadth with abundant hooked teeth; anterior segment of the hinge plate shorter than posterior one with about three fifths in length; resilifer small, situated under the umbo; both lateral adductor scars weakly impressed; pallial line indistinct; inner margin smooth.



Text-fig. 5. *Portlandia* (s. l.) *nagaseana*, sp. nov.

Measurements (in mm.):

Specimen	Length	Height
KSG 3132, R. in. mould	21.1	14.0
KSG 3133, R. in. mould	16.3	13.3
KSG 3134, R. in. mould	9.2	5.5
KSG 3135, R. in. mould	8.8	5.4

Observation:—The outline of this species is somewhat variable. The resilifer is shallow and small for *Portlandia*.

Comparison:—This species resembles *Portlandia sanchuensis* (Yabe et Nagao) from the Ishido Formation of Sanchu Area (Yabe, Nagao and Simizu, 1926; Hayami and Oji, 1980), in its features of the hinge structure and elongated outline, but differs in its location of the umbo, which is situated more anterior than of *P. sanchuensis*. *Portlandia izumensis* Ichikawa et Maeda (1958), from the Izumi Group of Awaji island, resembles this species in its elongated outline, but differs clearly in its fine oblique striae on the surface. *Portlandia* (*Cnestriella*) *cuneistriata* Ichikawa et Maeda, from the Izumi Group and the Himenoura Group, (see, Tashiro and Otsuka, 1980) is distinguishable from this species in its fairly

inflated valve and distinct oblique striae on the disk.

Occurrence:—Common at loc. 2.

Family Noetiidae Stewart

Subfamily Noetiinae Stewart

Genus *Matsumotoa* Okada, 1958

Matsumotoa unisulcata (Amano)

Plate 62, Figs. 30-32, Plate 65, Fig. 11

1938. *Navicula* sp., Matsumoto, *Jour. Geol. Soc. Japan*, vol. 45, p. 14, pl. 1, figs. 2, 3.
1956. *Breviarca unisulcata* Amano, *Kumamoto Jour. Sci.*, ser. B, sec. 1, p. 66, pl. 1, figs. 2, 3.
1968. *Matsumotoa unisulcata* (Amano); Tamura, Tashiro and Motojima, *Mem. Fac. Educ. Kumamoto Univ.*, no. 16, nat. sci., p. 36, text-fig. 1, pl. 1, figs. 1-5.
1968. *Matsumotoa unisulcata densestriata* Tamura et Tashiro, *in* Tamura, Tashiro and Motojima, *Ibid.*, p. 36, text-fig. 1, pl. 1, figs. 6-9.
1976. *Matsumotoa unisulcata* (Amano); Tamura, *Ibid*, no. 25, nat. sci., pp. 50-52, pl. 1, figs. 7-16.

Material:—KSG 3148, internal mould of left valve, from loc. 2; KSG 3149, external mould of left valve, from loc. 2.

Remarks:—KSG 3148 is measurred 8.1 mm in length, 4.6 mm in height and 6.5 mm in inner thickness. Another specimen, KSG 3149, is 8.4 mm in length and 5.0 mm in height. These specimens are undoubtedly identified with *Matsumotoa unisulcata* (Amano), from the Mifune Group of Central Kyushu (Tamura, 1976). They are more closely related in shell-form to *Matsumotoa unisulcata densestriata* Tamura et Tashiro (1967), which was revised as a synonym of *Matsumotoa unisulcata* by Tamura (1976), from the Mifune Group, than *Matsumotoa unisulcata* s. s. (Amano, 1956) from the Goshonoura Group, in their oblique outline and finer, more crowded hinge teeth on both lateral segments of the hinge plate. The radial ribs on the surface are irregularly spaced and variable in strength.

Occurrence:—Common at loc. 2; dark-gray siltstone of the upper part of IIe Member (by Yamamoto and Hayami, 1971) of the Goshonoura Group at about 300 m west of Hegushi, Shishijima island, Kagoshima Prefecture.

Subclass Pteriomorphia

Order Arcoida

Superfamily Arcacea Lamarck

Family Parallelodontidae Dall

Subfamily Parallelodontinae Dall

Genus *Nanonavis* Stewart, 1930

Nanonavis pseudocarinata, sp. nov.

Plate 62, Figs. 16-18, Plate 63, Fig. 10, Plate 64, Figs. 15-17, 23, Text-fig. 6

Material:—Holotype, KSG 3217, external mould of left valve, from Sannosawa, Ikushunbetsu, Hokkaido; a paratype, KSG 3216, left external mould, from Hegushi of Shishijima, Kagoshima Prefecture; the other paratypes, KSG 3142-KSG 3147, internal and external moulds, from loc. 2.

Description:—Shell medium to small, subquadrate in outline, longer than high, moderately inflated; umbo prominent, slightly prosogyrous, located at about a third from front of the valve; hinge margin elongated, straight; anterior margin obliquely truncated at an angle 70° to hinge margin, gradually changing into broadly arched ventral margin but nearly straight on its posterior half;

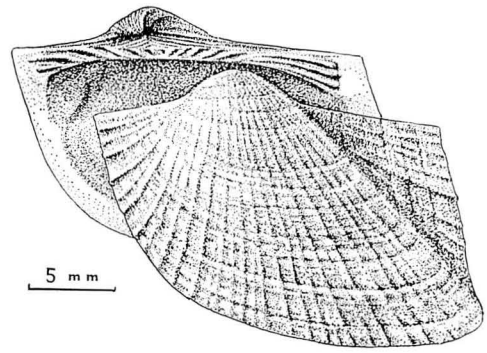
posterior margin nearly straight, obliquely truncated, forming an angle of about 120° with hinge margin; postero-ventral corner generally angulated; ligament area narrow but elongated with several chevron-shaped grooves; hinge area long with each three anterior and posterior teeth, and small and short median teeth; the anterior teeth elongated, subparallel with one another, a little oblique to the horizontal hinge line, inclining towards venter; the posterior teeth elongated, nearly horizontal, fairly longer than the anterior ones, parallel with one another; median teeth about 6 or more in number, converging toward venter; hinge teeth with fine crenulation; surface ornamented with primary and secondary radial ribs; the ribs narrower than their interspaces, stronger and less numerous in left valve than in right valve; posterior carina angulated; posterior area to the carina strongly depressed; inner margin smooth; both lateral adductor scars weakly impressed.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3217, L. ex. mould	26.1	18.0	7.0
KSG 3142, L. ex. mould	13.4	8.4	3.6
KSG 3143, L. in. mould	20.7	12.3	—
KSG 3144, R. in. mould	20.4	10.0	—
KSG 3145, L. in. mould	23.5	10.0	—
KSG 3146, L. ex. mould	14.3	7.9	4.0

Observation:—The radial ribs number about 70 in right valve and about 40 in left valve. The posterior carina is angulated, extends from umbo to postero-ventral corner, demarcating the boundary between the inflated disk and the depressed and flattened posterior area.

Comparison:—This species was listed



Text-fig. 6. *Nanonavis pseudocarinata*, sp. nov.

at first as "*Nanonavis* aff. *sachalinensis* (Schmidt)" by Tashiro and Yamamoto (1980) based on the specimens from the Cenomanian formations i. e., the Mikasa Formation of Hokkaido and the Goshonoura Group of Shishijima, Kyushu. The specimens from the Fukigoshi Formation are undoubtedly identified with the so-called "*Nanonavis* aff. *sachalinensis* (Schmidt)" by the same features. This species is, however, discriminated from *Nanonavis sachalinensis* (Schmidt), from the Urakawan (Coniacian and Santonian) of Japan and Sachalin, by its angulated posterior carina, sharply expanded antero-dorsal corner and somewhat oblique anterior teeth.

Nanonavis carinata (Sowerby), from the Lower Greensand of England (Woods, 1899), is similar to this species in its angulated posterior carina, but differs in its flat-topped and widely spaced radial ribs on the disk. It is closely akin to *Nanonavis yokoyamai* (Yabe et Nagao) from the Lower Cretaceous of Japan (Yabe, Nagao and Shimizu, 1926; Hayami, 1965; Hayami and Oji, 1980), in its features of hinge structure and angulated posterior carina, but differs in its less numerous radial ribs of the right valve, more numerous secondary ribs of the left

valve and narrower ligament area with less numerous ligament grooves. This species seems to show intermediate characters betweed *Nanonavis yokoyamai* and *Nanonavis sachalinensis*.

Occurrence:—Gray siltstone of the lower-most part of the Mikasa Formation at Sannosawa, Ikushunbetsu, Mikasa City, Hokkaido; Lower Cenomanian. Dark-gray siltstone of the upper part of the Member IIe (by Yamamoto and Hayami, 1971) of the Goshonoura Group at about 400 m west of Hegushi, Shishijima, Kagoshima Prefecture, Kyushu; Lower Cenomanian. Common at loc. 2 and loc. 3 of the Fukigoshi Formation.

Family Arcidae Lamarck

Genus *Arca* Linné, 1758

Subgenus *Eonavicula* Arkell, 1929

Arca (*Eonavicula*) sp.

Plate 64, Fig. 22

Material:—KSG 3161, external mould of left valve, from loc. 2.

Description:—Shell small, elongately subquadrate, weakly inflated; umbo prominent, orthogyrous, located at nearly central point of horizontal dorsal margin; anterior and posterior margins weakly convex, subvertical to the dorsal margin on each side; ventral margin long, horizontal, nearly straight but slightly concave at the middle part; a shallow radial sulcus extends from umbo to the center of the ventral margin; posterior carinal ridge not angulated but well elevated; surface with numerous laminated concentric ribs and abundant fine radial ribs; median part of the disk near the radial sulcus somewhat reticulated.

Remarks:—The specimen is 25.7 mm long, 13.4 mm high and 4.4 mm thick. Its internal features are not clear because the available internal mould is fragmentary. The inner ventral margin is smooth. This specimen is discriminated from *Arca* (*Eonavicula*) *shinanoensis* Yabe et Nagao *in* Yabe, Nagao and Shimizu (1926), from the Shiroi Formation of the Sanchu Area, and *Arca* (*Eonavicula*) *prolata* Amano (1957), from the Hagino Formation of the Monobe Area, by its strongly laminated concentric ribs.

Occurrence:—Rare at loc. 2.

Family Glycymerididae Newton

Genus *Glycymeris* da Costa, 1778

Subgenus *Pseudoveletuceta* Tashiro, 1971

Glycymeris (*Pseudoveletuceta*) cf. *mifunensis* Tashiro

Plate 62, Figs. 26-29

Compare.—

1971. *Glycymeris* (*Pseudoveletuceta*) *mifunensis* Tashiro. *Trans. Proc. Palaeont. Soc. Japan*, n. s., no. 84. p. 236, text-fig. 6, pl. 28, figs. 24-30.
1975. *Glycymeris* (*Pseudoveletuceta*) *mifunensis* Tashiro; Hayami, *Univ. Mus. Univ. Tokyo, Bull.* no. 10, p. 35, pl. 1, fig. 8.
1976. *Glycymeris* (*Pseudoveletuceta*) *mifunensis* Tashiro, Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 25, nat. sci., p. 58, pl. 1, figs. 23, 24.
1979. *Glycymeris mifunensis* Tashiro; Matsukuma, *Venus* (Japan. Jour. Malac.), vol. 38, no. 2, p. 111.
1982. *Glycymeris* (*Pseudoveletuceta*) *mifunensis* Tashiro; Tashiro and Kozai, *Palaeont. Soc. Japan, Sp. Pap.*, no. 25 (in press).

Material:—KSG 3116, KSG 3117 and

KSG 3121, internal moulds; KSG 3115 and KSG 3118, left valves; all the specimens are collected from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3115, L. valve	8.0	7.2	3.0
KSG 3116, R. in. mould	19.4	15.8	—
KSG 3117, L. in. mould	11.8	12.8	—
KSG 3121, L. in. mould	—	12.5	—
KSG 3118, L. valve	16.0	13.5	4.1

Remarks:—This species is characterized by its narrow hinge plate with small taxodont teeth and somewhat prosogyrate umbo. Generally it is rounded in the immature stage, but is somewhat expanded to posterior in outline and the nearly smooth surface except for very fine radial threads on the disk in the mature stage. The outline is, however, variable for glycymerids.

Occurrence:—Common at loc. 2.

Order Mytiloida

Superfamily Mytilacea Rafinesque

Family Mytilidae Rafinesque

Subfamily Mytilinae Rafinesque

Genus *Septifer* Recluz, 1848

Septifer cf. *mifunensis* Tamura

Plate 63, Fig. 7

Compare.—

1976. *Septifer mifunensis* Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 25, nat. sci., pp. 54, 55, pl. 2, figs. 1-18.

1982. *Septifer* cf. *mifunensis* Tamura; Tashiro and Kozai, *Palaeont. Soc. Japan, Sp. Pap.*, no. 25 (in press).

Remarks:—Only one specimen, KSG 3155, ca. 6.3 mm long, ca. 5.8 mm high and 1.7 mm thick, was collected from loc. 2. This is probably conspecific with *Septifer mifunensis* Tamura (1976), from the Mifune Group of Central Kyushu, judging from its nearly the same features. It has, however, somewhat less numerous radial ribs on the surface than the holotype from the Mifune Group.

Occurrence:—Very rare at loc. 2.

Order Pterioida

Suborder Pteriina

Superfamily Pectinacea Rafinesque

Family Entoliidae Korobkov

Genus *Entolium* Meek, 1865

Entolium sp. cf. *Entolium obovatum* (Stoliczka)

Plate 65, Figs. 6 and 7

1928. *Pecten* (*Syncyclonema*) cf. *obovatus* Stoliczka; Yabe and Nagao, *Sci. Rep. Tohoku Imp. Univ.*, ser. 2, vol. 9, no. 3, p. 87, pl. 17, figs. 3-6.

1938. *Pecten* (*Syncyclonema*) aff. *obovatus* Stoliczka; Nagao, *Jour. Fac. Sci., Hokkaido Imp. Univ.*, ser. 4, vol. 4, nos. 1-2, p. 128, pl. 16, figs. 1, 2.

1975. *Entolium* sp. cf. *E. obovatum* (Stoliczka); Hayami, *Univ. Mus. Univ. Tokyo, Bull.* no. 10, p. 73.

1975. *Entolium* sp. cf. *E. obovatum* (Stoliczka); Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 24, nat. sci., pl. 3, fig. 9.

1981. *Entolium* sp. cf. *E. obovatum* (Stoliczka); Hayami and Kase, *Trans. Proc. Palaeont. Soc. Japan*, n.s., no. 121, p. 34, pl. 4, fig. 7.

Material:—KSG 3156, internal mould of right valve, from loc. 2; KSG 3157, external mould of left valve, from loc. 2.

Measurements (in mm.):

Specimen	Length	Height
KSG 3156, R. in. mould	16.0	—
KSG 3157, L. ex. mould	9.7	12.4

Remarks:—The hinge structure is well preserved in KSG 3156. A pair of cardinal crulae is horizontal, situated under the beak, elongated with about a third of the valve length. A trigonal resilifer is large for the genus. The specimens from the Fukigoshi Formation somewhat differ from *Pecten* (*Syncyclonema*) *obovatus* Stoliczka (1871, pl. 32, figs. 6-9) from India, in its large ears and long hinge line.

Occurrence:—Common at loc. 2 and loc. 3.

Family Pectinidae Rafinesque

Subfamily Chlamydinae Korobkov

Genus *Nippononectes* Tashiro, 1982

Nippononectes kozaii Tashiro

Plate 63, Figs. 1-6

1982. *Nippononectes kozaii* Tashiro, *Mem. Fac. Sci. Kochi Univ.*, ser. E, vol. 3, (in press).

Material:—(see, Tashiro, 1982).

Remarks:—This species is characterized by the strong radial ribs on the surface and large ears for *Nippononectes*.

Occurrence:—Common at loc. 2 and loc. 3.

Family Propeamussiidae Abbot

Genus *Parvamussium* Sacco, 1897

Parvamussium cowperi yubarense (Yabe et Nagao)

1928. *Pecten* (*Propeamussium*) *cowperi* var. *yubarensis* Yabe et Nagao, *Sci. Rep. Tohoku Imp. Univ.*, ser. 2, vol. 9, no. 3, p. 88, pl. 16, figs. 17-19.

1932. *Pecten* (*Propeamussium*) *cowperi* var. *yubarensis* Yabe et Nagao; Nagao, *Jour. Fac. Sci. Hokkaido Imp. Univ.*, ser. 4, vol. 1, no. 1, p. 38, pl. 6, figs. 7, 8, 12, 13.

1956. *Pecten* (*Propeamussium*) *cowperi* var. *yubarensis* Yabe et Nagao; Amano, *Kumamoto Jour. Sci.*, ser. B, sec. 1, vol. 2, no. 1, p. 73, pl. 1, fig. 12.

1975. *Propeamussium cowperi yubarense* (Yabe et Nagao); Hayami, *Univ. Mus. Univ. Tokyo, Bull.* no. 10, pp. 82, 83.

1976. *Parvamussium cowperi yubarensis* (Yabe et Nagao); Tashiro, *Palaeont. Soc. Japan, Sp. Pap.* no. 19, p. 52, pl. 4, figs. 20-24.

1982. *Parvamussium cowperi yubarense* (Yabe et Nagao); Tashiro and Kozai, *Ibid.* no. 25 (in press).

Material:—KSG 3220, internal mould of left valve, from loc. 3; KSG 3221, external mould of imperfect right valve, from loc. 1.

Remarks:—A specimen, KSG 3220, 9.0 mm long and 8.9 mm high, is characterized by 8 inner radial ribs. The secondary inner ribs are not observable in it. Another specimen from loc. 1 is an external mould of imperfect right valve, which is characterized by numerous weak radial ribs. The ribs are composed of primary and secondary elements. This species undoubtedly conspecific with *Pervamussium cowperi yubarense* (Yabe et Nagao), from the Upper Cretaceous of Japan (see, Tashiro, 1976), because of its inner and outer ornamentations and its rounded outline. This species is discriminated from *Parvamussium kimurai* (Hayami), from the Lower Cretaceous of Aridagawa and Monobe areas (Hayami, 1965; Tashiro et al, 1980), and *Parvamussium hinagense* Tamura (1973), from

the Lower Cretaceous of Hinagu, by having less develop secondary inner ribs and weaker radial ribs on the disk. This species is discriminated from *Parvamussium* sp. from the Maastrichtian formation of the Himenoura Group of Amakusa-Shimojima, Kyushu (Tashiro and Otsuka, 1980), by its distinct radial ribs on the surface.

Occurrence:—Rare at loc. 1; common at loc. 3.

Superfamily Anomiacea Rafinesque

Family Anomiidae Rafinesque

Genus *Anomia* Linné, 1758

Anomia sp. aff. *Anomia foldia* Tamura

Plate 65, Figs. 1-5

Compare.—

1977. *Anomia foldia* Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 26, nat. sci., pp. 110-111, pl. 1, figs. 8-22.

Material:—KSG 3158 and KSG 3159, left valves and KSG 3222, right internal mould, from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3158, L. valve	29.8	28.1	10.3
KSG 3159, L. valve	25.4	21.8	10.3

Remarks:—The shell is very inflated in left valve but nearly flat in right valve, roundly ovate in outline. The test is rather thick. Regarding those characters, the specimens from the Fukigoshi Formation are very close to *Anomia foldia* Tamura (1977), from the Mifune Group of Central Kyushu. They are, however, somewhat smaller than *Anomia foldia*.

Occurrence:—Common at loc. 2.

Suborder Ostreina

Superfamily Ostracea Rafinesque

Family Ostreidae Rafinesque

Subfamily Ostreinae Rafinesque

Genus *Crassostrea* Sacco, 1897

Crassostrea kawauchidensis Tamura

Plate 63, Figs. 8, 9, 11

1938. *Ostrea* sp. (sp. nov.), Matsumoto, *Jour. Geol. Soc. Japan*, vol. 45, no. 532, p. 13, text-figs. 1, 2.

1977. *Crassostrea kawauchidensis* Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 26, nat. sci., p. 114, pl. 2, figs. 1-5.

1982. *Crassostrea* cf. *kawauchidensis* Tamura; Tashiro and Kozai, *Palaeont. Soc. Japan, Sp. Pap.* no. 25 (in press).

Material:—KSG 3166, internal mould of left valve from loc. 2.

Remarks:—Though many specimens occur from this locality (loc. 2), they are imperfect or fragmentary except for a specimen, KSG 3166. The KSG 3166 is measuerd 46.8 mm in length, 118.7 mm in height and 33.5 mm in thickness. The test is very thick. This specimen is certainly identified with *Crassostrea kawauchidensis* Tamura (1977), from the Mifune Group of Central Kyushu, because it shows the same specific diagnosis.

Occurrence:—Abundant at loc. 2.

Order Trigonioida

Superfamily Trigoniacea Lamarck

Family Trigoniidae Lamarck

Subfamily Pterotrigoniinae van Hoepen

Genus *Pterotrigonia* van Hoepen, 1929

Subgenus *Scabrotrigonia* Dietrich, 1933

Pterotrigonia (? *Scabrotrigonia*) *imanishii* (Nakano)

Plate 64, Figs. 1-6, 8, Text-fig. 7

1956. *Trigonia pocilliformis* Yokoyama; Imanishi, *Kumamoto Jour. Sci., ser. B*, vol. 2, no. 1, p. 53, figs. 1-3.
1958. *Scabrotrigonia imanishii* Nakano, *Jour. Sci. Hiroshima Univ., ser. C.*, vol. 2, no. 2, p. 230, pl. 29, figs. 1-4.
1975. *Pterotrigonia* (*Scabrotrigonia*) *imanishii* (Nakano); Hayami, *Univ. Mus. Univ. Tokyo Bull.*, no. 10, p. 120.

Material:—KSG 3214, external mould of right valve; KSG 3181-KSG 3212, external moulds of left valves; KSG 3211, right valve; all the specimens are collected from loc. 3.

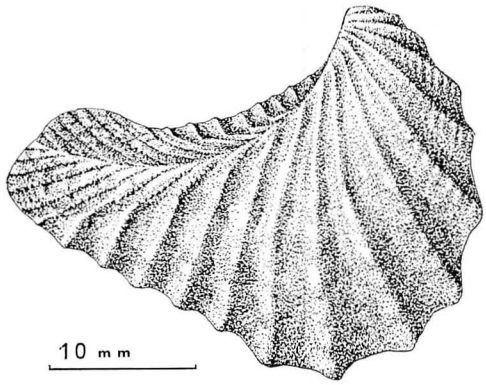
Description:—Shell medium to small in size, crescentric in outline, longer than high, moderately inflated; umbo prominent but not so large, strongly opisthogyrous, located at about a fourth or fifth from front of the valve; anterior margin convex, gradually changing into broadly arched ventral margin; ventral margin elongated, nearly straight or slightly sinuated on the posterior half; siphonal margin well rounded, strongly expanded to posterior; posterior dorsal margin long, concave; disk ornamented with roof-shaped and finely tuberculated costae; 6 or more costae near umbo subconcentric, finely crenulated; next 7 or so costae strong, situated diagonally on the main part of the disk; later 5 or more costae short, subradial on the posterior part of the disk; area broad with a distinct median groove, ornamented with 6 or more divaricated costellae each of which consists of a subhorizontal costella on the dorsal side of the median groove and an oblique costella on the posterior carinal side of the groove; the divaricated costellae finely tuberculated narrower than their interspaces but strongly impressed; escutcheon rather broad with 10 or more transverse tuberculated costellae, strongly depressed; posterior carina not angulated except for near umbo; dorsal carina rather indistinct.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3181, L. ex. mould	28.2	21.7	9.4
KSG 3211, R. valve	25.9	25.9	—
KSG 3212, L. ex. mould	21.9	ca 13.4	—
KSG 3214, R. ex. mould	16.0	13.0	—

Observation:—This species is characterized by the divaricated costellae on the area and finely crenulated costae on the umbonal part of the disk. The area is very narrow in young stage (about 25 mm in length), but soon rapidly broadened with growth in later stages. The growth lines on the area are very weak. Several subconcentric costellae are indistinctly discernible on the area near the umbo. The apical angle is about 60° or less.

Comparison:—This species is undoubtedly conspecific with *Scabrotrigonia imanishii* Nakano (1958), from the Horombetsu Formation (Imanishi, 1956) of northern Hokkaido, judging from the same specific diagnosis which is well defined by Nakano (1958). *Scabrotrigonia* was established by Dietrich (1933) as a distinct genus of Trigoniidae, based on *Trigonia scabra* Lamarck, from the Upper Cretaceous of Europe. Cox (1969) ranked *Scabrotrigonia* down to a subgenus of *Pterotrigonia* van Hoepen (1929). This species is clearly distinguishable from the type species of *Scabrotrigonia* (op. cit.) in its transverse costellae on the escutcheon and the distinctly angulated posterior carina which is gradually changing into well elevated rounded ridge in the later stage. So far as we can see, it is questionable whether this species belongs to *Scabrotrigonia* or



Text-fig. 7. *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano)

to a new subgenus of *Pterotrigonia*.

This species differs clearly from *Pterotrigonia* (*Scabrotrigonia*) *obsoleta* (Nakano), from the Goshonoura Group (Nakano, 1958; Tamura, 1978), in its distinct divaricated costellae which are developed on the entire surface of the area and weak growth lines of the area. This is discriminated from *Pterotrigonia* (*Scabrotrigonia*) *kobayashii* (Nakano), from the Mikasa Formation of Hokkaido (Nakano, 1958; Tamura, 1978), by having its strong divaricated costellae on the area and distinctly crenulated costae on the umbonal part of the disk.

This species is similar to *Pterotrigonia* (*Acanthotrigonia*) *pustulosa* (Nakano), from the Goshonoura Group of Central Kyushu (Nagao, 1930; Tamura, 1978), in the features of costae and costellae on the disk and escutcheon, but differs in its distinct divaricated costellae on the area. *Pterotrigonia* (*Acanthotrigonia*) *moriana* (Yehara), from the Hagino Formation of Kochi Prefecture (Yehara, 1927; Kobayashi and Nakano, 1957), also resembles this species, but is discriminated by its numerous oblique costellae on the area.

Occurrence:—Abundant at loc. 3.

Pterotrigonia (? *Scabrotrigonia*) *monobeana* Tashiro et Kozai

Plate 64, Figs. 7, 11-14, 18-21; Plate 65, Figs. 18-19

1982. *Pterotrigonia* (*Scabrotrigonia*) *monobeana* Tashiro et Kozai, *Palaeont. Soc. Japan Sp. Pap.*, no. 25 (in press).

Material:—KSG 3185-KSG 3189, imperfect external moulds of right valves; KSG 3180-KSG 3183, external moulds of left valves; all the specimens collected from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3180, L. ex. mould	44.8	22.1	—
KSG 3183, L. ex. mould	21.9	14.3	5.5
KSG 3189, R. ex. mould	15.0	12.0	3.0

Remarks:—Many specimens were obtained from the Fukigoshi Formation. This species is characterized by the narrow but long area which is strongly expanded to the posterior, the *Haidaia*-like finely crenulated costae on the disk near the umbo, and 5 or more distinct oblique costellae on the area near the umbo. The ornamentation of the area in this species are quite variable. On some specimens the costellae on the area are characterized by finely pustulated and chevron-shaped costellae as in *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano). The chevron-shaped costellae are, however, very low and weaker than those of *P.* (? *S.*) *imanishii*. In several specimens, the area is nearly smooth except for indistinctly discernible chevron-shaped costellae in the early stage. This species is akin to *Pterotrigonia* (*Acanthotrigonia*) *yeharai* (Nakano et Numano), from the

Goshonoura Group in Kyushu (Nakano and Numano, 1961; Tamura et al., 1968), in its smooth area and finely crenulated umbonal costae, but is discriminated by its small shell and numerous costae on the disk.

Occurrence:—Abundant at loc. 2.

Subgenus *Acanthotrigonia* van Hoepen, 1929

Pterotrigonia (? *Acanthotrigonia*) *mashikensis* (Tamura et Tashiro)

Plate 64, Figs. 9, 10

1967. *Acanthotrigonia mashikensis* Tamura et Tashiro, *Mem. Fac. Educ. Kumamoto Univ.*, no. 15, nat. sci., p. 19, text-fig. 2, pl. 1, figs. 1-7.
1975. *Pterotrigonia* (*Acanthotrigonia*) *mashikensis* (Tamura et Tashiro); Hayami, *Univ. Mus., Univ. Tokyo, Bull.* no. 10, p. 120.
1977. *Pterotrigonia* (*Acanthotrigonia*) *mashikensis* (Tamura et Tashiro); Tamura *Mem. Fac. Educ. Kumamoto Univ.*, no. 26, nat. sci., p. 116, pl. 4, figs. 1-8.
1982. *Pterotrigonia* (*Acanthotrigonia*) *mashikensis* (Tamura et Tashiro); Tashiro and Kozai, *Palaeont. Soc. Japan, Sp. Pap.* no. 25 (in press).

Material:—KSG 3182, external mould of left valve, from loc. 2.

Remarks:—KSG 3182 is measured 30.9 mm in length, 18.1 mm in height and 10.4 mm in thickness. The specimen is somewhat deformed, but the features of the external surface are well preserved. This species is characterized by the fine crenulations of the anterior margin near umbo, striated costellae on the escutcheon, nearly smooth area except for several loosely spaced oblique costellae near umbo, less numerous smooth and low costae on the disk and the semicircular outline of the valve.

Occurrence:—Rare at loc. 2.

Subclass Heterodonta

Order Veneroida

Superfamily Lucinacea Fleming

Family Lucinidae Fleming

Subfamily Myrteinae Chavan

Genus *Myrtea* Turton, 1822

Myrtea (s. l.) sp.

Plate 65, Fig. 23

Material:—KSG 3165, internal mould of right valve, from loc. 2.

Description:—Shell very small, subquadrangular in outline, longer than high, weakly inflated; umbo not prominent, small, pointed at nearly mid-length of the valve; anterior margin nearly straight but weakly concave near umbo; posterior dorsal margin weakly convex; anterior margin very weakly arched, truncated vertically from the dorsal margin; ventral margin broadly arched; posterior margin a little convex, truncated subvertically from the dorsal margin; apical angle about 120°; hinge plate long with two small cardinals and both lateral teeth; lateral teeth elongated; anterior adductor scar oblong, weakly impressed; posterior adductor scar small; fine and numerous radial striae appear on the internal surface, extending from the umbonal axis to distinct pallial line; inner margin smooth.

Remarks:—Only one specimen, KSG 3165, 10.4 mm long and 8.7 mm high, is obtained. The external features of this specimen is unknown.

Occurrence:—Rare at loc. 2.

Family Mactromyidae Cox

Genus *Thetis* Sowerby, 1826

Thetis sp. aff. *Thetis japonica* (Yabe et Nagao)

Plate 65, Figs. 20-22

Compare.—
1928. *Thetironia affinis* (Whiteaves) var. *japonica* Yabe et Nagao, *Sci. Rep. Tohoku Imp. Univ., ser. 2*, vol. 9, no. 3, p. 89, pl. 17, figs. 14a, 14b and 15a.
1975. *Thetis japonica* (Yabe et Nagao); Hayami, *Univ. Mus. Tokyo, Bull.* no. 10, p. 122.
1976. *Thetis japonica* (Yabe et Nagao); Tamura and Tashiro, *Atlas of Japanese Fossils*, no. 43-258, pl. Cr.-24, figs. 17, 18.
1981. *Thetis japonica* (Yabe et Nagao); Hayami and Kase, *Trans. Proc. Palaeont. Soc. Japan, n.s.*, no. 121, pp. 37, 38, pl. 5, figs. 2-4.

Material:—KSG 3173 - KSG 3174, left valves from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3173, L. valve	10.2	8.4	3.0
KSG 3174, L. valve	10.5	8.3	4.4

Remarks:—The specimens from the Fukigoshi Formation are somewhat deformed. Although their hinge structures are unknown, they are probably referable to *Thetis japonica* (Yabe et Nagao), from the Cenomanian of Japan (Tamura and Tashiro, 1976; Hayami and Kase, 1981), because of the well inflated valve and rounded outline.

Occurrence:—Common at loc. 2.

Superfamily Crassatellacea

Family Crassatellidae Ferussac

Genus *Anthonya* Gabb, 1864

Anthonya sp., cf. *Anthonya mifunensis* Tamura

Plate 65, Figs. 16, 17

Compare.—
1977. *Anthonya mifunensis* Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 26, nat. sci., pp. 116, 117, pl. 4, figs. 13-19.
?1981. *Anthonya* sp. cf. *A. apicalis* Nagao; Hayami and Kase, *Trans. Proc. Palaeont. Soc. Japan, n.s.*, no. 121, pp. 38-39, pl. 4, fig. 17.

Material:—KSG 3167b, internal mould of left valve, from loc. 2; KSG 3167a, external mould of the same specimen as KSG 3167b.

Remarks:—The specimen is measured about 33.5 mm in length and 10.2 mm in height. The external surface of the specimen is ornamented by numerous concentric striae on the anterior half. The posterior carinal ridge is moderatelly inflated. The umbo is located subterminal, less prominent. The anterior margin of the valve is more or less protruded to anterior. The apical angle is about 90°. The hinge formula is as follows:—

AIII 3a 3b 5b PIII/AII 2 4b PII PIV

Inner buttress is long and nearly vertical.

This species is possibly conspecific with *Anthonya mifunensis* Tamura (1977), from the Mifune Group of Central Kyushu, judging from the features mentioned above.

Occurrence:—Rare at loc. 2.

Family Mactridae Lamarck

Subfamily Mactrinae Lamarck

Genus *Cymbophora* Gabb, 1869

? *Cymbophora* sp.

Plate 65, Figs. 24-26

Material:—KSG 3175 and KSG 3197, left valves, from loc. 2.

Description:—Shell small, rounded subtriangular, well inflated; umbo orthogyrous, slightly prominent, located at a half distance from anterior margin; anterior and posterior margins rounded; ventral margin broadly arched; anterior and posterior dorsal margins nearly straight; apical angle about 100°; inner margin smooth; external surface nearly smooth; lunular area well depressed.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3175, L. valve	19.0	14.8	3.2
KSG 3179, L. valve	11.8	8.5	2.8

Remarks:—The hinge structures of this specimens are not clear. Imperfect cardinal teeth and a small resilifer are slightly observable under the beak.

Occurrence:—Rare at loc. 2.

Family Neomiodontidae Casey

Subfamily Eomiodontinae Hayami

Genus *Eomiodon* Cox, 1935

Eomiodon matsubasensis Tamura

Plate 65, Figs. 14, 15

1938. *Astarte* sp., Matsumoto, *Jour. Geol. Soc. Japan*, vol. 45, no. 532, p. 16, text-fig. 4.

1977. *Eomiodon matsubasensis* Tamura, *Mem. Fac. Educ. Kumamoto Uuiv.*, no. 26, nat. sci., pp. 127-128, text-figs. 6, 7, pl. 6, figs. 9-19, pl. 7, figs. 10, 11.

Material:—KSG 3171, right valve, from loc. 2; KSG 3172, internal mould of left valve, from loc. 2.

Measurements (in mm.):

Specimen	Length	Height	Thickness
KSG 3171, R. valve	18.2	12.4	5.7
KSG 3172, L. in. mould	13.8	11.8	—

Remarks:—These two specimens are referable to *Eomiodon matsubasensis* Tamura (1977), from the Mifune Group in Kyushu, as they show the same diagnosis as defined by Tamura.

The specimen, KSG 3171, is characterized by 10 concentric ribs, which are regularly spaced, narrow but distinctly raised and sometimes finely laminated on the top. The escutcheon and lunule are distinct, smooth and well demarcated from the disk. The hinge structures are well preserved on the specimen, KSG 3172. PII and AII are very long on both sides of the hinge plate. The cardinal 2 is subvertical; 4b is longer than 2 and obliquely situated.

Occurrence:—Rare at loc. 2.

Superfamily Veneracea Rafinesque

Family Veneridae Rafinesque

Subfamily Pitarinae Stewart

Genus *Goshoraia* Tamura, 1977

Goshoraia crenulata (Matsumoto)

Plate 65, Figs. 12, 13

1938. *"Callista" (Pseudamiantis) crenulatus* Matsumoto, *Jour. Geol. Soc. Japan*, vol. 45, no. 532, p. 19, text-figs. 12, 13, pl. 1, fig. 5.

1956. *Pseudamiantis crenulatus* (Matsumoto); Amano, *Kumamoto Jour. Sci., ser. B, sec. 1*, vol. 2, no. 1, p. 78, pl. 1, fig. 26, pl. 2, figs. 13-19.

1963. *"Callista" (Pseudamiantis) crenulatus* Matsumoto; Iwasaki, *Trans. Proc. Palaeont. Soc. Japan, n.s.*, no. 51, p.

94, pl. 15, figs. 4-7.
1975. *Pseudamiantis*? *crenulata* (Matsumoto); Hayami, *Univ. Mus. Univ. Tokyo, Bull.*, no. 10, p. 144.
1977. *Goshoraia crenulata* (Matsumoto); Tamura, *Mem. Fac. Educ. Kumamoto Univ.*, no. 26, pp. 139-140, text-fig. 14, pl. 9, figs. 9-16.
1981. *Goshoraia crenulata* (Matsumoto); Hayami and Kase, *Trans. Proc. Palaeont. Soc. Japan, n. s.*, no. 121, pp. 39-40, pl. 5, figs. 5-8.

Material:—KSG 3169, right valve, from loc. 2.

Remarks:—A sole specimen, KSG 3169, is in our hand, measured 29.0 mm in length, 28.0 mm in height and 9.9 mm in thickness. It is undoubtedly conspecific with *Goshoraia crenulata* (Matsumoto), from the Goshonoura Group in Kyushu (Matsumoto, 1938; Tamura, 1977), because of its subinternal radial ribs and numerous irregularly concentric striae both on the disk, prominent and prosogyrate umbo, subovate outline and finely crenulated inner margin.

Occurrence:—Rarely found at loc. 2.

Subfamily Tapetinae Adams et Adams

Genus *Legumen* Conrad, 1858

? *Legumen* sp.

Plate 65, Figs. 8-10

Material:—KSG 3163, left internal and external moulds, from loc. 2.

Description:—Shell small, elongately ovate, weakly inflated; umbo small, not prominent, nearly orthogyrous, pointed a little anterior than the mid-length of the valve; anterior and posterior margins well rounded; ventral margin very broadly arched; anterior dorsal margin slightly concave; posterior dorsal margin nearly straight; surface smooth; posterior carinal ridge weakly elevated but not angulated; lunule indistinct; escutcheon narrow but elongated, distinctly separated from the disk by an angulated posterior dorsal carina; hinge plate very narrow with two small cardinal teeth; inner margin smooth.

Remarks:—A specimen, KSG 3163, is measured 14.6 mm in length, 6.9 mm in height and 2.5 mm in thickness. It is probably referable to the genus *Legumen* Conrad (Myra Keen, 1969) in its two small cardinal teeth without lateral teeth on the narrow hinge plate, less inflated valves and elongated outline.

Occurrence:—Rare at loc. 2.

Concluding remarks

The bivalve fauna of the Fukigoshi Formation which is mainly represented by the fossils from loc. 2, closely resembles that of the Lower Formation of the Mifune Group in Central Kyushu, which has been well defined by Tamura (1976-1979). There are many common species between them, i. e., *Mesosaccella mifunensis*, *Matsumotoa unisulcata*, *Glycymeris* (*Pseudoveletuceta*) cf. *mifunensis*, *Septifer* cf. *mifunensis*, *Anomia* aff. *foldia*, *Crassostrea kawauchidensis*, *Pterotrigonia* (? *Acanthotrigonia*) *mashikensis*, *Eomiodon matsubasensis* and *Goshoraia crenulata*.

As is concluded by Tamura (1979) on ample evidence, the fauna of the Lower Formation of the Mifune Group consists of the shallow-marine and brackish-water elements. Its brackish-water elements are represented by the species belonging to *Eomiodon*, *Pseudasaphis*, *Matsumotoa* and *Nipponicorbula*. The Fukigoshi fauna also contains *Eomiodon matsubasensis* and *Matsumotoa unisulcata*, though rather rarely. It is, however, of mixed nature in that some offshore elements such as the species belonging to *Acila* (*Truncacila*),

Nucula (*Pectinucula*), *Portlandia* (s. l.), *Nippononectes* and *Parvamussium*, are assembled with the near shore shallow-marine elements, e. g., the species of *Anthonya, Anomia, Crassostrea, Glycymeris, Nanonavis, Septifer, Goshoraia* and *Pterotrigonia*.

The fauna of the Fukigoshi Formation is distinguished from the fauna of the Middle Formation of the Goshonoura

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Explanation of Plate 62

Acila (*Truncacila*) *monobensis*, sp. nov.

Fig. 1: lateral view of right valve (KSG 3101), ×1.5, loc. 2.
Fig. 2: lateral view of right valve, gum cast of external mould (KSG 3102), ×1.5, loc. 2.
Fig. 3: lateral view of imperfect right valve, gum cast of external mould (KSG 3103), ×1.5, loc. 2.
Fig. 4: lateral view of left valve, gum cast of external mould (KSG 3114b), ×2, loc. 2.
Fig. 5: anterior view of imperfect right valve, gum cast of external mould, ×2, loc. 2.
Fig. 6: posterior view of imperfect right valve, gum cast of external mould, ×1.5, loc. 2.
Fig. 8: lateral view of right internal mould (KSG 3109), ×1.5, loc. 2.
Fig. 9: lateral view of right valve, gum cast of external mould (KSG 3107), ×1.5, loc. 2.
Fig. 10: lateral view of right internal mould (KSG 3110), ×1.5, loc. 2.

Nucula (*Pectinucula*) *kochiensis*, sp. nov.

Fig. 7: lateral view of right internal mould (KSG 3113), ×1.5, loc. 2.
Fig. 11: lateral view of right valve, gum cast of external mould (KSG 3111), ×1.5, loc. 2.
Fig. 12: lateral view of left internal mould, ×1.5, loc. 2.
Fig. 13: lateral view of right valve, gum cast of external mould (KSG 3114), ×2.5, loc. 2.
Fig. 14: lateral view of right valve, gum cast of external mould (KSG 3112), ×2, loc. 2.
Fig. 15: lateral view of right internal mould (same specimen with KSG 3112), ×2.

Nanonavis pseudocarinata, n. sp.

Fig. 16: inner lateral view of right valve, gum cast of internal mould (KSG 3162), ×2, loc. 2.
Fig. 17: lateral view of right internal mould (same specimen with KSG 3162), ×1.5.
Fig. 18: lateral view of right valve (same specimen with KSG 3162), ×1.5.

Mesosaccella mifunensis Tamura

Fig. 19: lateral view of right valve (KSG 3122), ×2, loc. 2.
Fig. 20: lateral view of right valve (KSG 3123), ×2, loc. 2.
Fig. 21: lateral view of right internal mould (KSG 3127), ×2, loc. 2.
Fig. 22: lateral view of left internal mould (KSG 3125), ×2, loc. 2.

Portlandia (s. l.) *nagaseana*, sp. nov.

Fig. 23: lateral view of right internal mould (KSG 3132), ×1.5, loc. 2.
Fig. 24: lateral view of right internal mould (KSG 3133), ×2, loc. 2.
Fig. 25: lateral view of imperfect right valve (KSG 3132), ×1.5, loc. 2.

Glycymeris (*Pseudoveletuceta*) cf. *mifunensis* Tashiro

Fig. 26: lateral view of right internal mould (KSG 3116), ×1.5, loc. 2.
Fig. 27: lateral view of left valve, ×1.5, loc. 2.
Fig. 28: lateral view of left internal mould (KSG 3121), ×1.5, loc. 2.
Fig. 29: lateral view of left valve, gum cast of external mould ×2, loc. 2.

Matsumotoa unisulcata (Amano)

Fig. 30: lateral view of right valve, ×2, loc. 2.
Fig. 31: lateral view of left valve, gum cast of external mould (KSG 3149), ×2, loc. 2.
Fig. 32: lateral view of left internal mould (KSG 3148), ×2, loc. 2.


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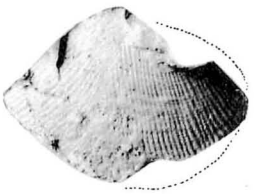
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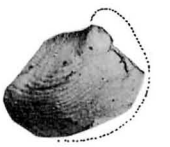
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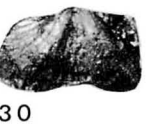
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Group in Kyushu (Matsumoto, 1938; Matsumoto and Tashiro, 1975), in the absence of such species as *Pterotrigonia* (? *Acanthotrigonia*) *ogawai* (Yehara), *P.* (? *A.*) *dilapsa* (Yehara), *P.* (? *A.*) *pustulosa*, *P.* (? *Scabrotrigonia*) *obsoleta*, *Nipponitrigonia* aff. *kikuchiana* (Yehara), *Anthonya japonica* Matsumoto, *Crassatella nagaoi* Matsumoto and *Glycymaris* (*Hanaia*) *solida* Nagao, which are very common in the Goshonoura fauna. It shows, however, some similarity to the fauna of the upper part of the Middle Formation of the Goshonoura Group of the Shishijima Island (upper part of IIe Member by Yamamoto and Hayami, 1971), by the occurrence of *Nanonavis pseudocarinata*, *Eonavicula* sp., *Matsumotoa unisulcata*, *Nucula* (*Pectinucula*) *kochiensis* and *Parvamussium cowperi yubarense*. This is probably due to the situation that the Goshonoura Group itself has facies-changes even at the same stratigraphic level.

The geological age of the fossiliferous bed (locs. 1-3) of the Upper Member of the Fukigoshi Formation is not determined precisely, because no leading fossil has been obtained. It is probably referable to the lower Lower Cenomanian, judging from the following lines of evidence:—

1: Most of the bivalve species from the Fukigoshi Formation are hitheto well known in the Cenomanian strata in Japan.

2: The Nagase Formation, which is characterized by the occurrence of Lower Cenomanian ammonites, e. g., *Mantelliceras japonica* Matsumoto (1982), covers conformably the top of the Fukigoshi Formation.

Anagaudryceras sacya (Forbes), which ranges from the Albian to Cenomanian, occurs in the Lower Member of the Fukigoshi Formation (Matsumoto, 1982), but any species of *Graysonites* which indicates the lowest Cenomanian, has not yet been found from this formation. Although where abouts of the boundary between Albian and Cenomanian is still uncertain, it is probably allocated in the lower part than the fossiliferous bed of the Upper Member.

In connection with the age of the Fukigoshi Formation, the Horonbetsu Formation of northern Hokkaido (Imanishi, 1956) is also determinable tentatively to the Lower Cenomanian or neaby age on the evidence of a common species, *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano) which occurs characteristically not only in the Fukigoshi Formation but also in the Horonbetsu Formation.

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Explanation of Plate 63

Nippononectes kozaii, Tashiro

Fig. 1: lateral view of left internal mould (KSG 3150), ×1, loc. 2.

Fig. 2: lateral view of left valve, gum cast of external mould of the same specimen (KSG 3150).

Fig. 3: gum cast of imperfect internal mould, showing hinge structure and byssal ctenolia, ×1.2, loc. 2.

Fig. 4: gum cast of imperfect external mould, showing ornamentation on the anterior ear, ×1.2, loc. 2.

Fig. 5: lateral view of left valve, gum cast of external mould (KSG 2993), ×1.5, loc. 3.

Fig. 6: gum cast of imperfect external mould (left valve), ×2, loc. 2.

Septifer cf. *mifunensis* Tamura

Fig. 7: lateral view of imperfect right valve (KSG 3155), ×4, loc. 2.

Crassostrea kawauchidensis Tamura

Fig. 8: lateral view of right valves, ×1, loc. M-22 (by Tashiro and Kozai, 1982).

Fig. 9: lateral view of left internal mould (KSG 3166), ×1, loc. 2.

Fig. 11: immature stage of right valve, ×1, loc. 2.

Nanonavis pseudocarinata, sp. nov.

Fig. 10: lateral view of left valve, gum cast of external mould (KSG 3217), ×1, loc. Sannosawa, Ikushunbetsu, Mikasa City, Hokkaido.

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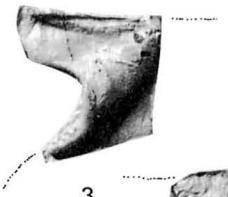

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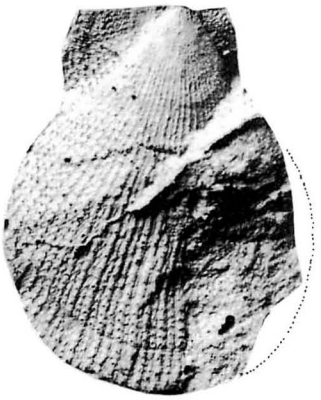

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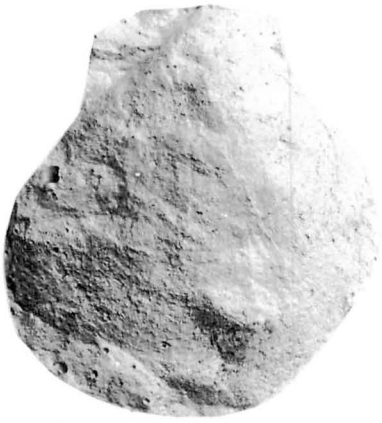

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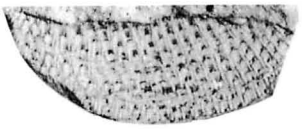

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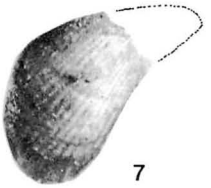

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Explanation of Plate 64

Pterotrigonia (? *Scabrotrigonia*) *imanishii* (Nakano)

Fig. 1: lateral view of imperfect right valve, gum cast of external mould (KSG 3211), ×1.5, loc. 3.

Fig. 2: lateral view of right valve (KSG 3211), ×1, loc. 3.

Fig. 3: lateral view of left valve, ×1.5, loc. 3.

Fig. 4: lateral view of left valve, gum cast of external mould (KSG 3212), ×1.2, loc. 3.

Fig. 5: lateral view of left valve, gum cast of external mould (KSG 3181), ×1.2, loc. 3.

Fig. 6: gum cast of imperfect left external mould, showing ornamentation of the area, ×1, loc. 3.

Fig. 7: dorsal view of the immature stage of left valve, gum cast of external mould, ×2, loc. 3.

Fig. 8: lateral view of right valve, gum cast of external mould (KSG 3214), ×2, loc. 3.

Pterotrigonia (? *Acanthotrigonia*) *mashikensis* (Tamura et Tashiro)

Fig. 9: lateral view of left valve, gum cast of external mould (KSG 3182), ×1.5, loc. 2.

Fig. 10: dorsal view of the same specimen, gum cast of external mould, ×1.5.

Pterotrigonia (? *Scabrotrigonia*) *monobeana* Tashiro et Kozai

Fig. 11: posterior dorsal view of imperfect left valve, gum cast of external mould, showing the ornamentation of the area, ×2, loc. 2.

Fig. 12: posterior dorsal view of left valve, gum cast of external mould (KSG 3183), ×1, loc. 2.

Fig. 13: posterior dorsal view of right valve, gum cast of external mould (KSG 3185), ×1.2, loc. 2.

Fig. 14: lateral view of immature right valve, gum cast of external mould (KSG 3189), ×2, loc. 2.

Fig. 18: lateral view of left valve, gum cast of external mould (KSG 3180), ×1.5, loc. 2.

Fig. 19: lateral view of left internal mould of the same specimen, ×1.5.

Fig. 20: posterior dorsal view of the same specimen, gum cast of external mould, ×1.5.

Fig. 21: lateral view of left internal mould (KSG 3184), ×2, loc. 2.

Nanonavis pseudocarinata, sp. nov.

Fig. 15: lateral view of left valve, gum cast of external mould (KSG 3202), ×1.2, loc. 3.

Fig. 16: lateral view of left internal mould (KSG 3143), ×1, loc. 2.

Fig. 17: lateral view of left internal mould (KSG 3145), ×1.2, loc. 2.

Fig. 23: lateral view of imperfect left valve, gum cast of external mould, ×2, loc. 2.

Arca (*Eonavicula*) sp.

Fig. 22: lateral view of left valve, gum cast of external mould (KSG 3161), ×1.5, loc. 2.


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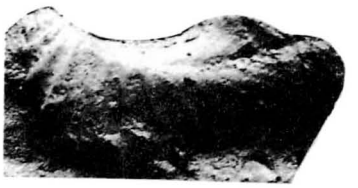
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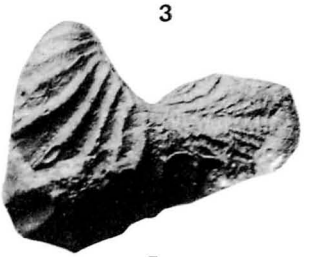
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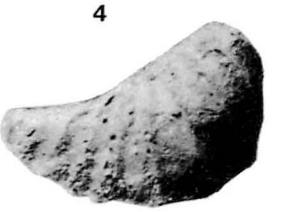
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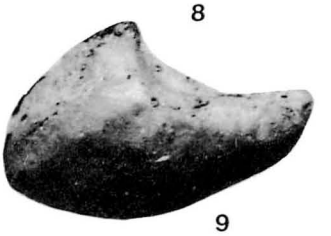
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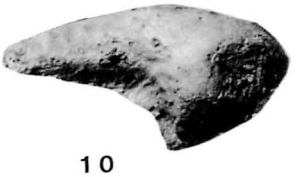
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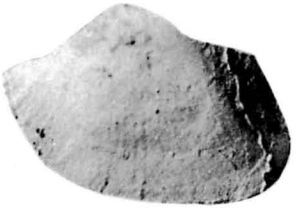
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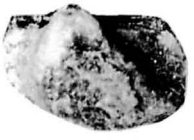
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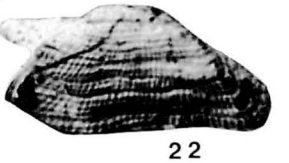
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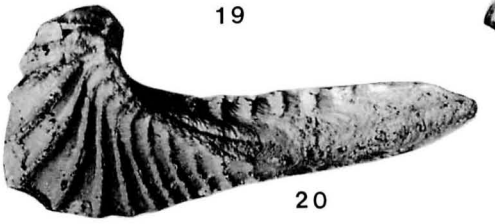
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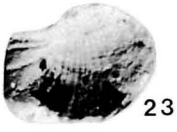
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Awaji 淡路, Fukigoshi 吹越, Goshonoura 御所浦, Hagino 萩野, Hegushi 幣串, Himenoura 姫ノ浦, Horonbetsu 保留運別, Ikushunbetsu 幾春別, Ishido 石堂, Izumi 和泉, Mifune 御船, Mikasa 三笠, Monobe 物部, Nagase 永瀬, Odochi 大栃, Sanchu 山中, Sannosawa 三沢, Shiroi 白井, Shishijima 獅子島, Torinosu 鳥ノ巣

四国高知県・物部地域の永瀬ダム付近に分布する吹越層は，下半部が泥岩勝ちで上半部が砂岩勝ちの地層である。この上半部より，今回多くの二枚貝化石を得たので記載する。それらは，*Nucula* (*Pectinucula*) *kochiensis* sp. nov., *Acila* (*Truncacila*) *monobensis* sp. nov., *Portlandia* (s.l.) *nagaseana* sp. nov., *Nanonavis pseudocarinata* sp. nov. の4新種をふくむ22属24種である。この二枚貝のファウナは，種の構成により Cenomanian の浅海性あるいは純海性を示している。またこのファウナは，九州の御船層群のファウナと多くの共通種を持ち，非常に似ている。吹越層の地質時代は Upper Albian から lower Lower Cenomanian と指定されるが，Albian と Cenomanian の境界についてはさらに検討を要する。また本層の上部からの *Pterotrigonia* (? *Scabrotrigonia*) *imanishii* (Nakano) の産出は，同種を産する北海道北部のホロンベツ層の地質時代を推定するのに重要である。

田代正之・松田智子

Explanation of Plate 65

Anomia sp. aff. *Anomia foldia* Tamura

Fig. 1: lateral view of left valve (KSG 3158), ×1.2, loc. 2.
Fig. 2: dorsal view of the same specimen, ×1.2.
Fig. 3: lateral view of left valve (KSG 3159), ×1.5, loc. 2.
Fig. 4: dorsal view of the same specimen, ×1.
Fig. 5: lateral view of left valve, ×1, loc. 2.

Entolium sp. cf. *Entolium obovatum* (Stoliczka)

Fig. 6: internal view of right valve, gum cast of internal mould (KSG 3156), ×2, loc. 2.
Fig. 7: lateral view of left valve, gum cast of external mould (KSG 3157), ×2, loc. 2.

? *Legumen* sp.

Fig. 8: lateral view of left valve, gum cast of external mould (KSG 3163), ×2, loc. 2.
Fig. 9: dorsal view of the same specimen, gum cast of external mould, ×2.
Fig. 10: lateral view of left internal mould, (same specimen with KSG 3163), ×2.

Matsumotoa unisulcata (Amano)

Fig. 11: lateral view of right valve, gum cast of external mould (KSG 3149), ×2, loc. 2.

Goshoraia crenulata (Matsumoto)

Fig. 12: lateral view of right valve (KSG 3169), ×1, loc. 2.
Fig. 13: dorsal view of the same specimen, ×1.

Eomiodon matsubasensis Tamura

Fig. 14: lateral view of right valve (KSG 3171), ×1.5, loc. 2.
Fig. 15: internal view of left valve, gum cast of internal mould (KSG 3172), ×1.5, loc. 2.

Anthonya sp. cf. *Anthonya mifunensis* Tamura

Fig. 16: lateral view of left internal mould (KSG 3167), ×1.2, loc. 2.
Fig. 17: external view of the same specimen, gum cast of external mould, ×1.

Pterotrigonia (? *Scabrotrigonia*) *monobeana* Tashiro et Kozai

Fig. 18: lateral view of left valve, gum cast of external mould (KSG 3183), ×2, loc. 2.
Fig. 19: dorsal view of the same gum cast, ×2.

Thetis sp., aff. *Thetis japonica* (Yabe et Nagao)

Fig. 20: lateral view of left valve (KSG 3173), ×1.5, loc. 2.
Fig. 21: dorsal view of the same specimen, ×1.5.
Fig. 22: lateral view of left valve (KSG 3174), ×1, loc. 2.

Myrtea (s.l.) sp.

Fig. 23: internal view of right valve, gum cast of internal mould (KSG 3165), ×2, loc. 2.

? *Cymbophora* sp.

Fig. 24: dorsal view of left valve (KSG 3175), ×1.5, loc. 2.
Fig. 25: lateral view of the same specimen, ×1.5.
Fig. 26: lateral view of left valve (KSG 3178), ×1.5, loc. 2.


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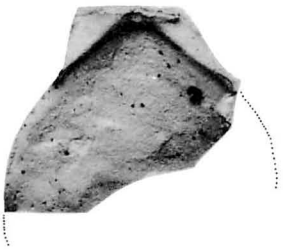
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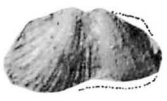
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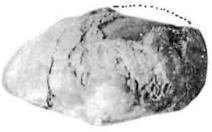
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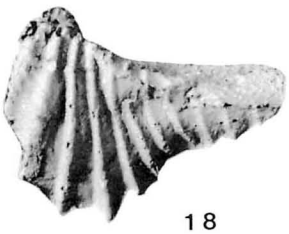
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PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

学 会 記 事

○1982年6月24日に行われた評議員会で次の諸君の入会を承認した。
[入会者] 籔本美孝，九島康夫，川上雄司，大石雅之，石井諦像，松岡敬二，松田智子，須山俊明，田中 均，牧島邦夫，後藤道治，岸良平，中里 薫，平山 廉，石垣武久，原 学，仲谷英夫，吉田光広，朴 淳亨

日本古生物学会第129回例会

頭書例会が1982年6月26日に，北海道大学理学部を会場として開催された（参会者68名）。

個 人 講 演

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北上山地ペルム系叶倉層産腕足類'*Permianella*' n. sp. .....田沢純一
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Crassostrea gigas（二枚貝）の体サイズ・形態と生息密度との関係 .....鎮西清高
チモール島産三畳紀頭足類 .....石橋 毅
中央ネパール，ムクチナート付近のジュラ系産アンモナイト .....鎌田耕太郎
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下部白亜系銚子層群産のアンモナイト *Olcostephanus* について .....松川正樹・小畠郁生
山口県産の三畳紀板鰓類ならびに條鰭類の化石 ..... 上野輝弥・長谷川善和・内藤源太朗
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カバノキ科植物葉の形態と脈系，その1，現生種の脈端型について .....植村和彦

行事予定

	開催地	開催日	講演申込締切
第130回 例会	三重大学	1982年10月17日	1982年8月17日
1983年年会・総会	東京大学	1983年1月22・23日	1982年11月22日

講演申込先：〒113 東京都文京区弥生 2-4-16 日本学会事務センター 日本古生物学会行事係
1982年年会・総会ではシンポジウム「進化古生物学の諸問題」が予定されている（世話人：速水 格・鎮西清高）。

お知らせ

○日本古生物学会では過去5年間経費の節減をはかりながら皆様の会費を据置いてきましたが，昨今の諸物価の高騰により次第に財政が苦しくなって参りました。現在の規模の活動を続けていくには来年度は会費の値上げをお願いしなければならなくなる見通しですので，お含みいただくと共に会費の完納に御協力下さるようお願いいたします。

○日本古生物学会では年会・例会をより魅力あるものにするため，シンポジウムをはじめ各種の新しい形の会合（例えば，テクニックの会合，ポスターセッション，ワークショップ，夜間小集会など）の提案を歓迎します。よい企画がありましたら早目に常務委員会あてお申出下さるようお願いします。

○日本古生物学会刊行の和文誌「化石」を次のように充実させる方向で検討しています。1）B5版の定期的（年2回発行）の刊行物とする［昭和57年度より実施］。2）現在の予約購読制を改め，誌代を会費に含め全会員に配布する。3）原著論文を掲載し，内容を一層充実させる。これらの実施につきましては，印刷実費に相当する会費の値上げが伴ないますので，御意見などがありましたら，化石編集部または常務委員会まで早目にお申出下さい。 常務委員会

○**化石31号**（B5版52ページ，1982年6月21日発行，1,500円）が刊行されました。「化石」は今回から本誌と同じB5版となり内容の刷新がはかられています。主な内容は次の通りです。

論説（本邦白亜系における海成・非海成層の対比，カキの古生態学），評論（寒武系の基底について），学会通信（進化古生物学研究所設立趣旨ならびに構想），化石通信（斎藤報恩会自然史博物館），ニュース，新刊紹介など。

「化石」は本学会の和文定期刊行物として1983年度から会費に含めて全会員に配布する方向で検討しておりますが，本号および今年度内に出版予定の32号は従来通りの方法（予約購読およびバラ売）で販売いたします。お申込は東北大学理学部地質学古生物学教室内化石編集部（送金先：振替 仙台17141）にお願いします。

○ 文部省科学研究費補助金（研究成果刊行費）による。

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編集者 速水 格・小畠郁生

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