日本古生物学會 報告·紀事

Transactions and Proceedings

of the

Palaeontological Society of Japan

New Series

No. 54



日本古生物学会

Palaeontological Society of Japan June 30th, 1964

CONTENTS

TRANSACTIONS

467.	Notes on the Foraminiferal Genus Pseudocibicidoides Naoaki AOKI	Page 195
468.	Microplankton from the Asagai Formation in the Jōban Coal-field	201
469.	Some Middle Permian Aviculopectinidae from the Kitakami Massif, North- east Japan	215
470.	On the Occurrence of <i>Gonialites</i> (s. s.) from the Hida Massif, Central Japan	234
PRO	CEEDINGS	239

President : Teiichi KOBAYASHI

Councillors: Kiyoshi Asano (Editor of "Fossils"), Riuji ENDO, Haruyoshi FUJIMOTO, Shoshiro Hanzawa, Tetsuro Hanai (Secretary), Wataru Hashimoto (Treasurer). Kotora Hatai, Ichiro Hayasaka, Hiroshi Ozaki (Planning), Teiichi Kobayashi, Tatsuro Matsumoto (Editor of Special Publications), Masao Minato, Tokio Shikama (Membership), Fuyuji Takai (Editor), Ryuzo Toriyama Assistant Secretary: Takeo Ichikawa

All Communications relating to this Journal should be addressed to the PALAEONTOLOGICAL SOCIETY OF JAPAN Geological Institute, Faculty of Science, University of Tokyo, Japan

467. NOTES ON THE FORAMINIFERAL GENUS PSEUDOCIBICIDOIDES*

NAOAKI AOKI

Institute of Geology and Mineralogy, Tokyo University of Education

Pseudocibicidoides 属(有孔虫) について: 伊豆下田・鍋田,潮岬沖,片瀬海岸などか ちえた材料によって、Pseudocibicidoides 属の模式種, P. katasensis の原記載はその幼形 の標本にもとづくものであることを指摘し、本種の個体発生的な形態発達についてのべ、これ によって Pseudocibicidoides 属を再定義した。本属は Planorbulina, Caribeanella など にもっとも近縁で、Planorbulinidae 科に入れられるものである。 背木 直 昭

Introduction

The genus Pseudocibicidoides of Foraminifera was established by UJIIÉ (1956) with the type species. *Pseudocibicidoides* katasensis UJHE, 1956, from the coast of Katase, Sagami Bay, Japan. This genus has been considered to have peculiar and interesting morphological characters in the immature stages. During my foraminiferal study of the Recent sediments. Pseudocibicidoides katasensis was found to show a wide variation in external morphology. About 250 specimens were obtained from several localities and Further examination showed studied. that the trochospiral coiling in the juvenile changes later to the radial attachment of chamber in this species. This morphological development of Pseudocibicidoides katasensis is herein noted, and the genus Pseudocibicidoides is emended.

Material

This species has not been previously recorded outside of the type locality.

The specimens examined in this study are came from the following samples:

- 5 samples, from Katase, Fujisawa (type locality); beach sands.
- (2) 7 samples, from Katase and Enoshima, Fujisawa; depth ca. 2-3 m.
- (3) 1 sample, from off Tsujido, west of Katase; depth ca. 3 m.
- (4) 1 sample, from off Shichiriga-hama, east of Katase; depth ca. 10-15 m.
- (5) 1 sample, from near Inamuraga-saki, Kamakura, east of Katase; depth ca. 3 m.
- (6) 7 samples, from Nabeta. Owura-wan, Shimoda. Idzu Peninsula; depth 1-4 m.
- (7) 1 sample, from off Kisami, Shimoda, Idzu Peninsula; depth ca. 25 m.
- (8) 3 samples, from Habu, Oshima, Idzu Islands; beach sands.
- (9) 2 samples. from off Shiwono-misaki, Kii Peninsula; depth ca. 40 m.

At present, this species is known from sandy or shelly sediments of littoral to inner shelf in the warm water region of the Pacific side of the Honshu Island. In every locality this species occurs in very low frequency (usually less than 0.5 percent) as well as in the type locality.

Topotype specimens are all smaller in

^{*} Received July 2, 1963; read at the Annual Meeting of the Society at Tokyo, Jan. 19, 1963.

size and only the juvenile individuals They have five to have been found. about eight chambers and the greatest diameter ranges from 0.35 to 0.50 mm. All specimens are ill preserved. As the bottom sediment of this area is composed extensively of well-sorted, fine- to medium-grained sands, it can be said that the specimens were more or less worn out by littoral wave action or local nearshore current. More grown specimens and fragments of mature stages are rarely found from the nearshore samples of Katase and its environs. The frequencies and preservations of specimens from Kisami and Oshima are almost similar to those of Katase.

In addition, a number of specimens could be obtained from Shimoda and Shiwono-misaki as the result of the treatment of a large quantity of sediments by Carbon-tetrachloride floatation. The two samples are shelly sands containing calcareous shell fragments of molluscs, corals, bryozoa, foraminifers, etc., in extreme abundance. Particularly from the Shimoda sample, this species occurs in nearly all growth stages from fivechambered individuals to more than 20-30 chambered ones of full mature, although mature specimens are hardly detected compared with the frequent occurrence of the invenile ones. All are well preserved and the majority has less than 7-8 chambers like as the topotypes do. These suits of specimens exbinit that the original description of Pseudocibicidoides katasensis was based on insufficient material of quite immature stage. The following is the brief description of the morphology of this species.

Pseudocibicidoides katasensis

The initial form of the immature stage of *Pseudocibicidoides katasensis*

comprises five chambers of globose shape. The test is coiled and planoconvex in shape, having the nearly flat dorsal and the moderately convexed ventral surfaces. The outline is roundly trigonal in side view and is lobulate in some degree. The margin is narrowly rounded in peripheral view.

The first chamber (=proloculus) is large. There are two modes of diameter of the first chamber in the present materials. It is about 0.10 mm. or more in the megalospheric specimens, and is about 0.060-0.075 mm. or less in the others. The latter seems to represent the another generation of the megalospheric in life cycle. The true microspheric specimen is unknown. The second chamber is smaller than the first and third chambers.

The surface of the first to third chambers is smooth without any perceptable perforation, or covered with reticulated ornamentation. The change of wall perforation abruptly occurs between the third and fourth chambers. The chambers in the later stages have coarse perforation and the wall is pitted by regularly spaced, very distinct pores (diameter: ca. 0.006-0.008 mm.). The wall is translucent and pale brown in color, but it changes to whitish and opaque in the corroded specimens. Ĩ٢ is rather thick and is lined with a thin chitinous inner layer of reddish brown in the earlier stages.

Increasing gradually in size, chambers are trochospirally coiled, however, the ventral side is also more or less evolute. The number of chambers is generally 7 to 9 in a whorl.

The primary aperture is peripheral, large, semicircular, bordered with a prominent lip, at the base of the apertural face.

The sutures are thick and flush with

surface in the earlier, becoming to be depressed later on the both sides.

Evolute-spiral coiling continues to about 8 to 13 chambered stages (about two whorls). The later chambers are inflated and sometimes tend to be larger and somewhat abnormal. At this stage, the test becomes to be provided with a supplementary aperture on the peripheral margin at the posterior side of the last chamber. Rarely, the penultimate chamber has also a peripheral supplementary aperture. It is a distinct, crescent-shaped opening with a distinct lip.

The chamber is added as if it covers the supplementary aperture of the preceeding one, then, the original trochoid coiling is abondoned and the chambers are irregularly attached around the peripheral margin of the cibicidian central body. The radial arrangement of chamber is thus developed and the test grows progressively to complete the *Planorbulina*-like final stages. Many of the supplementary apertures are opened at the both ends of periphery of each marginal chambers as in the genus *Planorbulina*.

At the central part of the dorsal side, the "umbilical hole" is opened in the subcircular or fissure-like depression, which is surrounded by slightly raised clear shell thickening of the umbonal region. It is connected with both the first and third chambers and is situated between these two chambers. The size is relatively large, ca. 0.020-0.075 mm. in diameter. The brown chitinous inner layer is visible through the "hole".

Genus Pseudocibicidoides

This genus is monotypic and was assigned into the family Anomalinidae. The important characters of the genus are originally given as follows: 1) planoconvex test, with globose shaped chambers in the juvenile stage. 2) more or less evolute coiling, 3) smooth surface of the early stage in reverse to the coarser perforation of the later one, and 4) the presence of an "umbilical hole" on the dorsal side, besides a cibicidian aperture. From the present new observation, it is known that these characters are most clearly shown in the immature specimens of the type species, especially in the fivechambered ones.

Concerning the ontogenetic developments of chamber arrangement, wall perforation and apertures, the full mature individual of the present species possesses the principal generic characters of the genus *Planorbulina*, therefore, Planorbulina mediterranensis (D'ORBIGNY, 1826), the type species of this genus, was examined. The specimens used for comparison are not topolypes but are from Gulf of Mexico. It has been identified as Planorbulina mediterranensis by American workers (PHLEGER and PARKER, 1951, and ANDERSEN, 1961). In this Mediterranean species, a very small, comma-shaped opening is present at both the second and third chambers respectively. It is somewhat larger than the original pores of the chamber wall and is easily found out at least in the megalospheric specimens.

Although the size is very minute, the same sort of opening is recognized in the megalospheric specimens of *Planorbulina acevalis* BRADY, 1884. from Shimoda and Shiwono-misaki. The details of the microspheric *Planorbulina* are not known.

The morphology of the five-chambered specimens of *Planorbulina mediterranensis* from Villefranch-sur-Mer. was described in detail by LE CALVEZ (1934, 1938) with special reference to trimorphism of this species. The text-figure in his paper shows that the "embryon" of Planorbulina mediterranensis is closely related to the five-chambered megalospheric specimen of Pseudocibicidoides katasensis in many respects, but the former species has a special kind of opening on the dorsal side which was called "fenêtre dorsale" by LE CALVEZ. The above mentioned pores observed on the dorsal umbilical portion of Planorbulina are regarded as "fenêtres dorsales". According to his observation, there are no foramen on the septal wall between the second and third chambers in the megalospheric form of Planorbulina mediterranensis. Instead, the "fenêtre dorsale" exists on each of these two chambers. It seems to be one of the passages between the chambers and to be correspond to the septal foramen.

On the contrary, *Pseudocibicidoides katasensis* has the foramen on each septum of the initial part of the test. The "umbilical hole" of this species differs from the "fenêtre dorsale" of *Planorbulina* both in number and in position. As the external morphology of *Pseudocibicidoides katasensis* falls well within the generic catergories of *Planorbulina*, the character of this opening is presumably the only, remarkable difference between the two genera. The detailed study on the "fenêtre dorsale" would be interesting for biology and taxonomy of this group. The comparison of this genus to *Cibicidella* CUSHMAN, 1927, has not been made in this study for the lack of apparent specimen of *Cibicidella variabilis* (D'ORBIGNY, 1826) and other *Cibicidella* species, but *Pseudocibicidoides* is distinguishable from the other genera of the family Anomalinidae. It is closest to *Planorbulina* D'ORBIGNY, 1826, and *Caribeanella* BERMÚDEZ, 1952. It is most suitable that the genus *Pseudocibicidoides* is placed in the family Planorbulinidae. The genus may be re-defined as follows.

Family Planorbulinidae

Genus *Pseudocibicidoides* UJIIÉ, 1956, emended

Pseudocibicidoides UME, 1956. Tokyo Kyoiku Daigaku. Sci. Rept., sec. C. vol. 4, no. 37, p. 268.

Type species :—Pseudocibicidoides katasensis UJIIÉ, 1956. Fixed by original designation and by monotypy.

Test in the early stages spirally coiled. later irregularly or radially spreading in a single plane, sometimes irregularly piled up into a mass; wall calcareous, very coarsely perforate, radial in structure, with a thin chitinous inner layer in the initial portion; aperture peripheral in the earlier, multiple, two to each peripheral chamber in the

Explanation of Plate 29

Figs. 1-15. Pseudocibicidoides katasensis UJHÉ, showing the morphological development of the test. 1-9, ×50; 10, 11, ×40; 12, 14, 15, ×30; 13, ×ca, 42, 2, 9, ventral view; 8, edge view; all others, dorsal view. 6, from beach of Katase; 15, from near-shore of Katase; all others, from Nabeta, Shimoda.

Figured hypotypes are deposited in the micropaleontological collections of the Tokyo University of Education. Reg. nos. 68021 to 68032.

Plate 29



adult; "umbilical hole" opened on the dorsal side, connecting both the first and third chambers with the exterior.

Remarks:—*Pseudocibicidoides* differs from *Planorbulina* in the communication system among the initial three chambers. The immature form of this genus superficially resembles some genera of the family Anomalinidae. but develops later into the *Cibicidella*- or *Planorbulina*-like stages.

Pseudocibicidoides katasensis UJIIÉ,

Pl 29, Figs. 1-15

Pseudocibicidoides katasensis UJIIÉ. 1956, Tokyo Kyoiku Daigaku, Sci. Rept., sec. C. vol. 4, no. 37, p. 268, pl. 13, figs. 1–3.

Figured hypotypes:—Reg. nos. 68021 to 68030, from Nabeta, Shimoda. Idzu Peninsula; Reg. no. 68031, from beach of Katase, Fujisawa; Reg. no. 68032, from nearshore of Katase, Fujisawa.

Length (max.) up to 2.30 mm.

Remarks :—Planorbulina medilerranensis (D'ORBIGNY, 1826) is somewhat similar to the present species, but has smaller sized and concentrically elongate chambers with finer perforation. Pseudocibicidoides katasensis is also similar to and found together with Caribeanella ogiensis (MATSUNAGA) (=Oinomikadoina ogiensis MATSUNAGA, 1954) in the samples from Shimoda and Shiwono-misaki. The latter species is different from the former in having acute periphery, multiple peripheral supplementary apertures and finer perforation of the wall. It does not develop into the Cibicidella-type stages of chamber arrangement.

Acknowledgements :- The author wishes to thank Dr. Takayasu UCHIO of the University of Tokyo. Dr. Yokichi TAKAYANAGI of the Tohoku University and Dr. Hisayoshi IGO of the Tokyo University of Education for many valuable suggestions and to Prof. Wataru HASHIMOTO of the Tokyo University of Education for supervision. Thanks are also due to Dr. Pedro J. BERMÜDEZ of the Creole Petroleum Corporation, Prof. Tetsuro HANAI of the University of Tokyo. Dr. Michihei Hoshino and Mr. Takahiro SATO of the Hydrographic Office of Japan, and Mr. Kazukiyo Oshima of the Nippon Mining Company for their kind offers of foraminiferal material.

References

- ANDERSEN, H. V., (1961): Foraminifera of the mudlumps, lower Mississippi River Delta, Louisiana Geol. Surv., Dept. Conserv., Geol.Bull. no. 35, pt. 2, vii+208 p., 29 pl.
- BERMÚDEZ, P. J., (1952) : Estudio sistematico de los Foraminiferos rotaliformes. Venezuela Minist. Minas Hidrocarb., Bol. Geol., v. 2, no. 4, p. 7-230, pl. 1-35.
- LE CALVEZ. J., (1934): Embryons á cinq loges de *Planorbulina mediterranensis* (D'ORBIGNY) et trimorphisme de cette espèce, Soc. Zool. France, Bull., tome 59, no. 4. p. 284-291.
- . (1938): Recherches sur les foraminifères: I. Développement et reproduction, Arch. Zool. Expér. et Gén., tome 80, p. 163-333, pl. 2-7.
- MATSUNAGA, T., (1954): Oinomikadoina ogiensis, n. gen., n. sp., from the Pliocene of Niigata, Japan. Pal. Soc. Japan, Trans. Proc., N. S., no. 15, p. 163-164.
- PHLEGER, F. B. and PARKER, F. L., (1951): Ecology of Foraminifera, Northwest Gulf of Mexico. Part 2, Foraminifera species, Geol. Soc. Amer., Mem. 46, iv+64 p., 20 pl.
- UJHÉ, H., (1956): Pseudocibicidoides, n. gen., from the sea coast of Katase, Kanagawa Prefecture, Japan. Tokyo Kyoiku Daigaku. Sci. Rept., sec. C, vol. 4, no. 37, p. 263-265, pl. 13.

Enoshima	江ノ島
Fujisawa	藤 沢
Habu	波 浮
Idzu	伊 豆
Inamuraga-saki	稲村ケ崎
Kamakura	鎌倉
Katase	片 瀬
Kii	紀伊
Kisami	吉 佐 美

Nabeta	鍋	田
Oshima	大	島
Owura-wan	大 浦	湾
Sagami	相	模
Shichiriga-hama	七里夕	r浜
Shimoda	ኾ	Ħ
Shiwono-misaki	潮ノ	岬
Tsujido	辻	堂

٠

 $\mathbf{200}$

468. MICROPLANKTON FROM THE ASAGAI FORMATION IN THE JÖBAN COAL-FIELD*

KIYOSHI TAKAHASHI

Department of Geology, Faculty of Science, Kyushu University

常磐炭田浅貝層産マイクロプランクトン: 平市北方約 4km の平窪のボーリングコアから 多くのマイクロプランクトン. Micrhystridium (8 種). Baltisphaeridium (4 種). Hystrichosphaeridium (1 種). Leiofusa (1 種). Cymatiosphaera (2 種). Leiosphaeridia (3 種). Apteodinium (1 種) を発見し、記載した。 高 橋 清

Introduction

In 1963 the author engaged in the study of spores and pollen from the marine sediments in the Jöban coal-field. At that time, he found many microplankton coexisting with spores and pollen. In Japan, hitherto, there has been no report on the fossil microplankton. This study supplements the knowledge of Tertiary microplankton and is a groundwork of future research in Japan.

The present paper is concerned mainly with the classification and description of some new species of microplankton from the Oligocene Asagai formation in the Jōban coal-field. Suitable samples for the study were provided by the Yoshima colliery, Furukawa Mining Company from the new no. 1 bore at Hirakubo, ca. 4 km north of Taira.

Recently, C. DOWNIE, W. R. EVITT and W. A. S. SARJEANT (1963) have proposed that the classification of the organic

palaeomicroplankton should accord with the International Code of Botanical Nomenclature. However, as their proposal should yet thoroughly be discussed and then the author hesitates to assent to their proposal, he has described all the species under the traditional classification.

Acknowledgements

The author would like to express his cordial thanks to Professors Ryuzo TORI-YAMA (Kyushu University) and Alfred EISENACK (Tübingen University, Germany) for their valuable advices and reading the typescript.

Grateful acknowledgement is also due to Mr. Hiroaki ŌNUMA of the Yoshima colliery, Furukawa Mining Company for his kind offering of the boring cores.

Location and microplankton

The Palaeogene sediments in the Joban coal-field are divided into three formations, the Iwaki, Asagai and Shirasaka, which are conformable with each other.

^{*} Received March 28. 1964; read at the annual meeting of the Palaeontological Society at Fukuoka, January 18, 1964.

The lowest formation, the Iwaki. is composed mainly of the non-marine sediments and intercalates some important coal seams.

The middle formation, the Asagai, represents the Palacogene marine sediments in the Jōban coal-field. Muddy fine sandstone which contains many molluscan fossils and belongs to the Asagai formation, was obtained from the new no. 1 bore of the Yoshima colliery. Furukawa Mining Company at Hirakubo, ca. 4 km north of Taira, Fukushima Prefecture.

In 1963 the author made a study of the pollen analysis of some coal seams in the Jōban coal-field, resulting that he has established the "Iwaki pollen group" from the Iwaki formation (Oligocene) and the "Goyasu pollen group" from the Goyasu formation (Miocene). This Iwaki pollen group can be correlated with the Onga pollen group of north Kyushu and the Goyasu pollen group with the Sasebo pollen group of northwest Kyushu.

The Asagai formation has been dated and correlated by means of foraminifera (K. ASANO, 1949, 1962) and mollusca (K. HATAI & Y. KAMADA, 1950; Y. KAMA-DA, 1960; A. MIZUNO, 1962), but these opinions on the geologic age and stratigraphic correlation do not always come to an agreement.

Recently the author (1963) made a palynological and stratigraphical study of the spores and pollen obtained from the Asagai sandstone. This pollen assemblage belongs to the Goyasu pollen group and can be correlated with the Sasebo pollen group of northwest Kyushu.

The hystrichospheres and dinoflagellate are classified as follows:

Micrhystridium minus sp. nov. ...few M. asagaiense sp. nov.few

M. miserum sp. nov
M. (?) spinuliferum sp. nov abundant
M. fragile DEFLANDRE
M. sp. arare
.M. sp. brare
M. sp. crare
Baltisphaeridium (?) polyceratum
sp. novcommon
B. sp. acommon
<i>B</i> . sp. bfew
<i>B.</i> sp. cfew
Hystrichosphaeridium sprare
Leiofusa spfew
Cymatiosphaera globulosa sp. nov. few
C. reticulosa sp. nov
Leiosphaeridia laevigata sp. nov. few
L. rugulata sp. nov
L. sprare
Apteodinium sprare

The hystrichospheres in this study are very primitive in form and closely similar to the Palaeozoic and Mesozoic forms.

C. DOWNIE and W. A. S. SARJEANT (1963) emended some hystrichosphere genera. Baltisphaeridium and Micrhystridium were divided mainly by a shell diameter. They described: "The size ranges of individual species reveal two major groupings. The boundary between these two major groupings has been accepted by most workers as being sensibly drawn at 20 µ." This boundary is completely artificial. Of the hitherto described species, there are some species of Micrhystridium which overlap this boundary : Micrhystridium eatonensis DOWNIE (12-22 μ), Micrhystridium ambiguum DEFLANDRE (14-22 µ), Micrhystridium bigoti DEFLANDRE (13-25 \times 12-22 μ). Micrhystridium piliferum DEFLANDRE (20-22 μ). Micrhystridium recurvatum VALENSI (10-21 µ), Micrhystridium leptothrix VALENSI (17-22 µ), ? Micrhystridium stellatum DEFLANDRE (SARJEANT ca. 25µ).

The present species, Micrhystridium (?) spinuliferum and Blatisphaeridium (?) polyceratum, overlap this boundary in their shell diameter. The former ranges in size from 14μ to 22.5μ , but the individual specimens are almost under 20μ . On the contrary, the latter varies in size from 16.3μ to 27μ , but its major specimens are over 20μ . Accordingly, the author would like to give the former the name Micrhystridium (?) and the latter Baltisphaeridium (?).

C. DOWNIE, W. R. EVITT and W. A. S. SARJEANT (1963) proposed that the nomenclatorial treatment of the organic palaeomicroplankton should accord with the International Code of Botanical Nomenclature and they re-divided the individual genera into a new group and twelve new subgroup. As the author can not yet determine approval or disapproval of this proposal, he describes the present specimens according to the classification used so far ordinarily.

Systematic description

Hystrichosphaeridea

Family Hystrichosphaeridae O. WETZEL, 1933

Genus Micrhystridium (DEFLANDRE, 1937) DOWNIE and SARJEANT, 1963

Micrhystridium minus sp. nov.

Pl. 30, figs. 2-4; Pl. 33, fig. 2,

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3089; Pl. 30, figs. 2a-c.

Diagnosis:—Test spherical, smooth, thin-walled: spines very fine and small, straight, with a little conical bases less than 0.5μ in diameter: number of spines countless, length of spines less than 10 per cent of the test diameter. Dimensions:—Test diameter 10.8 to 11.3μ ; test wall less than 0.5μ thick; length of spines 0.8 to 0.9μ ; holotype: Test diameter 11.3μ .

Description:—A species of Micrhystridium having a spherical shell from which numerous simple spines of very small size arise. The number of spines is countless. The spines are very fine and somewhat bronden at their point of insertion and their spacing is relatively regular. The spine bases are circular. less than 0.5μ wide. The length of spines is nearly constant, less than 10 per cent of the shell diameter. The surface of the shell between fine spines is smooth. The shell often folds.

Remarks:—The species Micrhystridium deflandrei was described by L. VALENSI (1948, 1953) from the Bathonian formation of Airvault. Micrhystridium minus is very closely similar to this species (11 to 13 μ ; spine 1 μ long), but differs from Micrhystridium deflandrei in that the latter possesses more numerous and a little longer spines.

L. VALENSI (1953) described also the similar species *Micrhystridium densispinum* from the Bajocian formation of Bois-Halbout and Croisilles and the Bathonian formation of Tour-aux-Coguons and Bretteville-sur-Odon. The test diameter of this species is 5 to $11 \,\mu$, smaller than that of *Micrhystridium minus* and the latter possesses more numerous and weaker spines.

Age and occurrence :—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation; Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium asagaiense sp. nov.

Pl. 30, figs. 1a, b; Pl. 33, fig. 1.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3089; Pl. 30. figs. 1a, b.

Diagnosis:—Shell spherical, smooth, thin-walled, reddish in color; spines very fine and small, straight, with no conical bases; number of spines countless, length about 5.5 to 6 per cent of the shell diameter.

Dimensions:—Shell diameter 16.2 to 17.7 μ ; shell wall $\pm 1 \mu$ thick; length of spines 1μ ; holotype: Shell diameter 16.2 μ .

Description:—The shell is reddish in color and circular in outline with many slender appendages of uniform width. The spine spacing is relatively regular. The spine bases are circular to subcircular. The length of spines is constant, ± 6 per cent of the shell diameter. The shell wall is 1 μ thick. The shell often folds.

Remarks:—The specimens found were only a few in number. *Micrhystridium minus* is very similar to this species *M. asagaiense*, but the latter is reddish in color and possesses larger shell and a little longer spines than the former.

The present species is also similar to the European species *Micrhystridium deflandrei* VALENSI, but differs from the latter on account of the different shell dimensions.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium miserum sp. nov.

Pl. 30, figs. 11, 12.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3088; Pl. 30, fig. 11.

Diagnosis:—Test spherical to oval, smooth, thin-walled; spines slender, straight or curved, with no conical bases; number of spines about fifty. length 16 to 20 per cent of the test diameter.

Dimensions:—Test diameter 15.7 to 16.8 μ ; length of spines 2.7 to 3.2 μ ; holotype: Test diameter 15.7 μ .

Description:—The shell is circular to subcircular in outline with about fifty slender appendages of approximately uniform width. The spine spacing is relatively irregular. The spine bases are circular and the length of spines is 16 to 20 per cent of the shell diameter. The surface of the shell between slender spines is smooth. The shell often folds.

Remarks:—Micrhystridium miserum is distinguishable from the Oligocene species M. minus by the type of spine and the size of shell.

W. A. S. SARJEANT (1962) figured the similar species *Baltisphaeridium pilosum* (EHRENBERG) from the Upper Jurassic sediments of Dorset, England. This species is greater than *Micrhystridium miserum* and possesses more numerous and smaller spines.

Hystrichosphaeridium centrocarpum DEFLANDRE and COOKSON was reported by D. MAIER (1959) from the Upper Miocene to Middle Oligocene marine sediments of NW-Germany. This species is apparently similar to Micrhystridium miserum, but the former is several times as great as the latter in size.

Age and occurrence :--Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium (?) spinuliferum sp. nov.

Pl. 32, figs. 1-9; Pl. 33, figs. 4-6.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3086; Pl. 32, fig. 5.

Diagnosis:—Test spherical, smooth, thin-walled, 14 to 22.5μ without the spines; spines strong, straight or curved, with more or less conical bases; number of spines twenty to thirty five; length of spines ca. 6 to 10.5μ .

Dimensions:—Test diameter 14 to 22.5 μ : test wall less than 1 μ thick; length of spines ca. 6 to 10.5 μ ; holotype: Test diameter 15.6 μ ; number of spines twenty-seven; length of spines 10 μ .

Description:—The shell is spherical in outline. The thickness of the test wall is less than 5 per cent of the diameter. The spines are strong, straight or somewhat curved, and sometimes broaden at their point of insertion: their length ranges from about 1/3 to about 3/4 the shell diameter. The number of spines varies between twenty and thirtyfive. The spine bases are circular. The surface of the shell between spines is smooth. The shell often folds.

The specimen (Pl. 32, fig. 1) is smaller in size (14μ) . The test wall is thin, less than 1μ thick. The number of spines is twenty: their length is approximately three-fourths the shell diameter.

The specimens (Pl. 32, figs. 2-8) vary in size from about 15 to 20μ and in spine number from twenty-seven to thirty-five. The spine length is about 8 to 10μ . The spine bases are circular and somewhat enlarged. The test wall is thin, less than 1μ thick.

The largest specimen (Pl. 32, fig. 9) of this species: The shell may be originally spherical in outline and 22.5μ without the spines. The spines are straight or curved and broaden slightly at their point of insertion. The number of spines is thirty-one and their length varies from 8.4 to 10 μ . The three specimens (Pl. 33, figs. 4-6) are medium in size, 14.6 to 21.2μ . The spines are straight or curved and relatively short, 6.2 to 7μ . Their bases are circular and somewhat widen. The number of spines is twenty-one to thirty-one.

Remarks:--W. A. S. SARJEANT (1962) described the very similar specimens (*Baltisphaeridium* cf. stinuliferum (DE-FLANDRE); Pl. 2. fig. 10; text-fig. 8a) from the Upper Jurassic sediments of Dorset. England. The present specimens differ in the smaller diameter of shell. the enlargement of spines at junction with the shell, and their smaller length.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira). Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium fragile DEFLANDRE

Pl. 31, figs. 8-10.

- Micrhystridium fragile. VALENSI. 1953. Mem. Soc. Géol. Frace. N. S., Tome 32, Fasc. 4, pp. 41-43, pl. 5, figs. 1-14, 17-19; pl. 14, figs. 1, 2.
- Micrhystridium fragile, SARJEANT, 1962, Micropaleontology, vol. 8, no. 2, p. 264, text-fig. 8d.
- Micrhystridium fragile, WALL and DOWNIE, 1963. Palaeontology, vol. 5, part 4, p. 774 (in discussion).

Description :— The test is smooth, thinwalled, and globose to subglobose. The test diameter is about 16 to 18.6μ . The spines are relatively strong, straight or curved, and broaden at their point of insertion. The number of spines varies between eleven and sixteen; their length ranges from 5 to 16.6μ (from about 30 to about 90 per cent of the test diameter).

Remarks:—The present specimens correspond exactly to *Micrhystridium fragile* described and figured by G. DE-FLANDRE (1947) and L. VALENSI (1953) in the shell form, the shell dimension, and the number of spines.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira). Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium sp. a

Pl. 30, figs. 5a, b.

Description:—The shell is spherical and thin-walled, ca. 0.7μ thick. The diameter of shell without the spine is 13μ . The spines are numerous, simple, and very small, ca. 0.9μ long. Some stronger and larger spines are found in the irregular disposition between the numerous small spines. The spine bases are circular. The specimen folds slightly.

Remarks:—This specimen is similar to *Micrhystridium minus* (Pl. 30, figs. 2-4: Pl. 33, fig. 2) in the shell and spine size, but the former possesses some stronger spines which arrange irregularly.

Age and occurrence :--Oligocene : muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira). Fukushima Prefecture ; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium sp. b

Description:—The shell is spherical (?). The diameter of shell is 12.5μ . The spines are numerous, simple, and relatively small. Their length is approximately one-fifth the shell diameter.

Remarks:—This specimen resembles *Micrhystridium minus* (pl. 30, figs. 2-4; pl. 33, fig. 2) in the possession of the numerous simple processes, but differs in the stronger and larger spines.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Micrhystridium sp. c

Pl. 33, fig. 3.

Description:—The shell is spherical, 10 μ , with simple spines of small size. The spines are relatively slender, straight, with no conical bases. The number of spines is about twenty. Their length is about 1.7 μ . The surface of the shell between spines is smooth.

Remarks:—This form was very rarely found in the Oligocene sandstone of the Asagai formation examined.

Genus Baltisphaeridium (EISENACK, 1958) Downie and Sarjeant, 1963

Baltisphaeridium (?) polyceratum

sp. nov.

Pl. 31, figs. 11, 12a c; Pl. 33, figs. 7-9.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3087; Pl. 31, figs. 12a-c.

Diagnosis: — Test polygonal to subpolygonal in outline, with straight and somewhat rounded sides. Spines strong, straight or curved. Spine bases generally broad. Number of spines nine to fourteen.

Dimensions:—Test diameter 16.3 to 27 μ ; test wall very thin; length of spines ca. 3 to 20 μ ; number of spines nine to fourteen; holotype: Test diameter 21.4 μ .

Description :- The test is smooth, thinwalled, polygonal to subpolygonal, with straight and somewhat rounded sides. The spines are strong, straight or curved, and broaden at their point of insertion. The number of spines is nine to fourteen. The length of spines ranges from about 11 to 90 per cent of the test diameter.

The figure 7 of Plate 33 is polygonal with both straight and rounded sides and 16.3 μ in size. The spines are strong and straight : their length varies between 7.9 μ and 14.8 μ . The number of spines is ten.

The figure 8 of Plate 33 is polygonal with both straight and rounded sides and 27.1 μ in size. Some spines are broken, but the measurable spines range from 3 to 16 μ in their length. The number of spines is nine.

Remarks:—The present specimens are Micrhystridium similar to stellatum DEFLANDRE (L. VALENSI, 1953, p. 59, pl. 9, fig. 27, cf. pl. 9, figs. 30-32, Jurassic: Bajocian and Bathonian : D. WALL and C. DOWNIE, 1963, pp. 772-776 (in discussion); pp. 780-781, pl. 113, figs. 1-5, Permian) in the shell form and the number of spines, but differ in the test dimension and the spine form. The spines of the present species taper abruptly to form more slender processes from the broad bases, but by the latter the spines become slender gradually.

Age and occurrence:--Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km nerth of Taira). Fukushima Prefecture; new no. 1 bore at $\pm 204.30 \text{ m}$ of the Furukawa-Yoshima colliery.

Baltisphaeridium sp. a

Pl. 31. figs. 3, 4, 7 (?).

Description :- The two specimens (figs. 3. 4) are broken, but the original form of this species is spherical. The shell diameter is 24.4 to 27.2μ . The shell wall is thin. The spines are relatively slender, almost curved, with more or less conical bases. The number of spines varies between thirty and forty. Their length is about 5 to $10 \,\mu$. The spine bases are circular, but taper abruptly to form slender spines which do not appear to communicate with the shell lumen. The figure 7 belongs doubtfully to this species.

Remarks:—This species is apparently similar to *Baltisphaeridium debilispinum* WALL and DOWNIE (1963, pp. 777-778, pl. 112, figs. 1, 2; text-figs. 3a, b), but differs in the thickness of test wall and the number of spines.

Micrhystridium inconspicuum DE-FLANDRE forma bullosa VALENSI (L. VALENSI, 1953, p. 55, pl. 7, figs. 14, 15; pl. 14, fig. 10) described and figured by L. VALENSI differs from this species in the size of shell, the number of spines, and their length.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Baltisphaeridium sp. b

Pl. 31, figs. 5, 6.

Description:—The shell is elongateoval and possesses simple spines of moderate size. The long diameter of shell is about 20 to $21 \,\mu$. The spines are relatively slender, straight or curved, with somewhat conical bases. The number of spines varies from twentynine to thirty-one. Their length measures $\pm 7 \,\mu$. The surface of the shell between spines is smooth.

Remarks:—The species Hystrichosphaeridium xanthiopyxides (O. WE.) DE-FLANDRE var. granulosum DEFLANDRE and Hystrichosphaeridium xanthiopyxides (O. WE.) DEFLANDRE var. parvispinum DEFLANDRE which resemble the present species in the form of the shell and spine were described by G. DEFLANDRE (1927) from the Cretaceous flints, Paris. W. A. S. SARJEANT (1962) revised Hystrichosphaeridium xanthiopyxides (O. WE.) DEFLANDRE var. granulosum DEFLANDRE to Baltisphaeridium granulosum (DE- FLANDRE). Hystrichosphaeridium xanthiopyxides (O. WE.) DEFLANDRE var. parvispinum DEFLANDRE possesses stronger and larger spines than those of Baltisphaeridium granulosum (DEFL-ANDRE). The former is sculptured by a small spot on the surface of the shell between spines and the latter possesses a granulated sculpture on the surface.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Baltisphaeridium sp. c

Pl. 32, fig. 10.

Description :— The test is smooth, thinwalled, and spherical. The test diameter is about 29 μ . The spines are relatively strong, straight or curved, and broaden

Explanation of Plate 30

(x ca. 1000)

Figs. 1a, b.	Micrhystridium asagaiense sp. nov.
	holotype, slide GK-V 3089.
Figs. 2-4.	Micrhystridium minus sp. nov.
	2a-c: holotye, slide GK-V 3089; 3: slide GK-V 3096; 4a, b: slide GK-V 3093.
Figs. 5a, b.	Micrhystridium sp. a
	slide GK-V 3092.
Figs. 6a. b.	7a, b. Cymatiosphaera globulosa sp. nov.
	6a, b: holotype, slide GK-V 3088; 7a, b: slide GK-V 3088.
Figs. 8a, b, 9	9a-c. Cymatiosphaera reticulosa sp. nov.
-	8a. b: slide GK-V 3088; 9a-c: holotype, slide GK-V 3088.
Fig. 10.	Micrhystridium sp. b
	slide GK-V 3088.
Figs. 11, 12.	Micrhystridium miserum sp. nov.
-	11: holotype, slide GK-V 3088: 12: slide GK-V 3088.
Figs. 13, 14.	Leiosphaeridia laevigata sp. nov.
-	13: holotype, slide GK-V 3087: 14: slide GK-V 3093.



somewhat at their point of insertion. The number of spines is twelve and their length is about 20 μ or less.

ì

Remarks:—The similar species, *Micrhystridium filigerum* VALENSI (L. VALENSI, 1953, pp. 45-46, pl. 6, figs. 13-15), has been recorded by L. VALENSI from the Bathonian and Bajocian of France, but differs from the present species in the shell dimension and the spine form.

L. VALENSI (1953) described the similar species. *Micrhystridium arachnoides* VALENSI (p. 45. pl. 5. figs. 16, 20; pl. 6, fig. 16; (cf.) pl. 6, fig. 22), from the Bathonian of France. This species is smaller than the present species.

Age and occurrence:—Oligocene: muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira). Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Genus Hystrichosphaeridium DEFLANDRE, 1937

Hystrichosphaeridium sp.

Pl. 31, figs. 13a, b.

Description:—The shell is smooth and elliptical in outline with twenty or more slender appendages. The appendages taper gradually towards the tip and broaden more or less at the base; the tips of the appendages are fringed with short processes, which divide once or twice into short, hair-like branches.

Dimensions:—Shell diameter 36.5μ ; length of spines about 10μ ; number of spines twenty or more.

Remarks:—The present species is very rare in the Oligocene Asagai sandstone examined. The specimen is broken.

Age and occurrence:—Oligocene; muddy fine sandstone containing many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204.30 m of the Furukawa-Yoshima colliery.

Family Leiofusidae EISENACK, 1954.

Genus Leiofusa EISENACK, 1938. Leiofusa sp.

Pl. 31, figs. 1, 2.

Description:—The test is smooth and fusiform. The whole body with the spines is probably about 27 to 31 μ and the central body is about 14 to 17 μ . Its breadth is 6.5 to 9.4 μ . The spine is relatively strong, straight or curved, and gradually narrowing from the spine base towards the apex. The length of spines is less than half of the central body.

Remarks:—The present specimens are broken. This hystrichosphere is rare in the Oligocene Asagai sandstone examined. It is similar to Leiofusa jurassica COOKSON and EISENACK from the Upper Jurassic of Western Australia and the Permian of Britain. This Japanese form is approximately half in size of L. jurassica.

Age and occurrence: — Oligocene; muddy fine sandstone conatining many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore at ± 204 . 30 m of the Furukawa-Yoshima colliery.

Family Dictyosphaeridae KLEMENT, 1960.

Genus Cymatiosphaera (O. WETZEL, 1933) DEFLANDRE, 1954.

Cymatiosphaera globulosa sp. nov.

Pl. 30, figs. 6a, b. 7a, b.

Holotype:—Dept. Geol. Kyushu Univ., slide GK-V 3088; pl. 30, figs. 6a, b.

Diagnosis:—Shell globular, the external surface divided into polygonal fields by the net.

Dimensions: — Shell diameter 10 to 13.7 μ ; maximum width of networks 4 to 5 μ : length of spines 1.9 to 2.3 μ : number of polygonal fields thirteen to fifteen; holotype: Shell diameter 10 μ .

Description:—The shell is spherical. thin-walled, and yellowish in color. with thirteen—fifteen polygonal fields. The spines are relatively slender and short; their length ranges from 13 to 23 per cent of the shell diameter. The networks connect with the straight line.

Remarks:—The present specimens are similar to *Cymatiosphaera parva* SAR-JEANT (1959, pp. 342-343, pl. 13, fig. 6; text-fig. 8) from the Upper Cornbrash sandy limestone of Yorkshire. England, but the former differs from the latter in its smaller size and the low number of polygonal fields present (13-15 as against 15-25). This new species is different from *C. reticulosa* (in this report, pl. 30, figs. 8-9) in the shell dimension and the form of network.

Age and occurrence: — Oligocene; muddy fine sandstone which contains the marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore of the Yoshima colliery, Furukawa Mining Company.

Cymatiosphaera reticulosa sp. nov.

Pl. 30, figs. 8a-b. 9a-c.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3088; pl. 30, figs. 9a-c.

Diagnosis:—Shell spherical, the external surface divided into polygonal fields of the networks composed of the undulate line.

Dimensions:—Shell diameter 18.6 to 21.4 μ ; length of spines 2.3 to 3.7 μ ; number of networks eleven (?) to twentyone; holotype: Shell diameter 18.6 μ ; maximum width of networks 6.5 to 7.5 μ .

Description:—The shell is spherical, thin-walled, and yellowish in color, with

GK-V 3096.

Explanation of Plate 31

 $(\times ca. 1000)$

Figs. 1	, 2 .	Leiofusa sp.
		1: slide GK-V 3087; 2: slide GK-V 3094.
Figs. 3	3. 4, 7 (?). Baltisphaeridium sp. a
		3, 4: slide GK-V 3086; 7: slide GK-V 3088.
Figs. 5	i, 6.	Baltisphaeridium sp. b
		5: slide GK-V 3087: 6: slide GK-V 3086.
Figs. 8	-10.	Micrhystridium fragile DEFLANDLE
		8: slide GK-V 3087; 9: slide GK-V 3088: 10: slide G
Figs. 1	1, 12a-	c. Baltisphaeridium (?) polyceratum sp. nov.
		11: slide GK-V $3090:$ $12:$ holotype, slide GK-V $3087.$
Figs. 1	3a. b.	Hystrichosphaeridium sp.
		slide GK-V 3087

eleven (?) to twenty-one polygonal fields divided by the undulate line. The relatively short and stout spines arise at the junctions of ridges; their length varies between about 12 and 17 per cent of the shell diameter.

Remarks:—The present specimens are found rarely in the Oligocene Asagai sandstone examined. They are similar to *Cymatiosphaera parva* SARJEANT (1959, pp. 342-343, pl. 13, fig. 6; text-fig. 8) from the Upper Cornbrash sandy limestone of Yorkshire. England, but the Japanese species differs from *C. parva* in the form of polygonal fields. This species differs also from another Japanese species *C. globulosa* (in this report, pl. 30, figs. 6-7) in the shell dimension and the form of polygonal fields.

Age and occurrence: — Oligocene: muddy fine sandstone which contains many mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira). Fukushima Prefecture; new no. 1 bore of the Yoshima colliery. Furukawa Mining Company.

Family Leiosphaeridae EISENACK, 1954.

Genus Leiosphaeridia (EISENACK, 1958) Downie & Sarjeant, 1963.

Leiosphaeridia laevigata sp. nov.

Pl. 30. figs. 13. 14: Pl. 33, fig. 12 (cf.).

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3087; pl. 30, fig. 13.

Diagnosis:—Shell spherical to ellipsoidal. smooth, thin-walled. Without processes. Without divisions into fields and without furrows or girdles. Without pylome (?).

Dimensions:—Shell diameter 42-73.6 μ ; shell wall very thin; holotype: Shell diameter 56.5 μ . Description:—The shell is smooth, relatively large, with a thin and folded membrane. The length of the shell is somewhat greater than breadth. It is unknown whether an opening exist or not. The specimens (Pl. 30, fig. 14; Pl. 33, fig. 12) are broken.

Remarks: — Palaeostomocystis fragilis COOKSON & EISENACK was described by I. C. COOKSON and A. EISENACK (1962, pp. 496-497, pl. 7, figs. 10-11) from the Cretaceous of Western Australia. This Australian specimens possess large shell and finely granulated surface of wall, but the Japanese specimens are formed by a smooth membrane.

The present species is similar to *Leio-sphaeridia baltica* EISENACK (1958, p. 3, pl. 2, fig. 5) described and figured by A. EISENACK from Ordovician. The former differs from *L. baltica* in that the latter possesses larger size and thicker wall.

Age and occurrence: — Oligocene; muddy fine sandstone which contains many marine mollusca of the Asagai formation, Hirakubo. ca. 4 km north of Taira, Fukushima Prefecture: new no. 1 bore of the Yoshima colliery. Furukawa Mining Company.

Leiosphaeridia rugulata sp. nov.

Pl. 32, figs. 11-15.

Holotype:-Dept. Geol. Kyushu Univ., slide GK-V 3087; pl. 32, fig. 15.

Diagnosis:—Shell spherical to ellipsoidal, finely granulate or rugulate, thin-walled. Without processes. Some specimens with pylome.

Dimensions:—Shell diameter ca. 32 to 47 μ : shell wall 0.5 μ or less; diameter of opening 2.7 to 3.5 μ ; holotype: Shell diameter ca. 47 μ ; shell wall 0.5 μ thick.

Description :- The shell is circular to

broad-elliptical in outline, with a thin and folded membrane and a relatively wide pylome (seen only in figs. 11 and 15). The surface of wall is sculptured with a finely granulated and rugulated pattern.

Remarks:-Leiosphaeridia granulata (EISENACK) was emended and described by A. EISENACK (1958). This species is a form with very large opening (pylome; ca. 40 per cent of shell diameter), but Leiosphaeridia rugulata possesses a small opening (under 1/10 of shell diameter).

Age and occurrence:—Oligocene; muddy fine sandstone which contains many marine mollusca of the Asagai formation, Hirakubo (ca. 4 km north of Taira), Fukushima Prefecture; new no. 1 bore of the Yoshima colliery, Furukawa Mining Company.

Leiosphaeridia sp.

Pl. 33. fig. 11.

Description:—The shell is circular in outline, with a thin and folded membrane. No pylome is seen. The surface of wall is sculptured with a finely granulated pattern.

Dimensions:—Shell diameter 42.7μ ; shell wall very thin. Remarks:—The present specimen is similar to the Ordovician species Leiosphaeridia tenuissima EISENACK (1958, p. 8, pl. 2, figs. 1-2) which possesses many small and round spots. It is not determined whether the present specimen belongs to the tenuissima form or not.

Age and occurrence:-Oligocene; fine sandstone of the Asagai formation, Hirakubo, ca. 4 km north of Taira, Fukushima Prefecture; new no. 1 bore of the Yoshima colliery, Furukawa Mining Company.

Dinoflagellata

Incertae sedis

Genus Apteodinium EISENACK, 1958 Apteodinium sp.

Pl. 33, figs. 10a. b.

Description:—The shell is globular form, prolonged at the apex into a short horn. The shell wall is thin, yellowish brown in color, and with a fine granulation. A median transverse girdle is uncertain. The horn is yellowish in color and somewhat curved falcate form.

Dimensions:—Shell diameter without horn 24.7 μ ; length of horn 2.3 μ ; width

Explanation of Plate 32

(× ca. 1000)

Figs. 1-9.	Micrhystridium (?) spinuliferum sp. nov. 1. 3. 5, 6: slide GK-V 3086: 5: holotype: 2, 4, 7: slide GK-V 3088; 8a, b, 9: slide GK-V 3087.
Fig. 10.	Baltisphaeridium sp. c slide GK-V 3086.
Figs. 11-15.	Leiosphaeridia rugulata sp. nov. 11, 12, 14: slide GK-V 3088; 13: slide GK-V 3093; 15: holotype, slide GK-V 3087.



10

at horn base 3.2μ .

Remarks:—Only one specimen was found in the Oligocene Asagai sandstone examined.

The similar species, *Apteodinium* granulatum EISENACK (1958, pp. 386-387, pl. 23, figs. 8-14. text-fig. 1), was described by A. EISENACK from the Upper Aptian of North Germany. This species is more than two to three times as large as the Japanese species.

Age and occurrence:-Oligocene: fine sandstone of the Asagai formation, Hirakubo, ca. 4 km north of Taira, Fukushima Prefecture: new no. 1 bore of the Yoshima colliery, Furukawa Mining Company.

References

- ALBERTI, G. (1959): Zur Kenntnis der Gattung Deflandrea EISENACK (Dinoflag.) in der Kreide und im Alttertiär Nord-und Mitteldeutschlands. Mitt. Geol. Staatsinst. Hamburg. 28, 93-105, Taf. 8-9.
- (1961): Zur Kenntnis mesozoischer und alttertiärer Dinoflagellaten und Hystrichosphaerideen von Nord- und Mitteldeutschland. Palaeontographica. A. 116, 1-58, Taf. 1-12.
- COOKSON, I.C. and EISENACK. A. (1960): Microplankton from Australian Cretaceous sediments. *Micropaleontology*, 6, (1), 1-18, pls. 1-3.
- and (1962): Additional microplankton from Australian Cretaceous sediments. *Micropaleontology*. 8, (4), 485-507, pls. 1-7.
- DEFLANDRE, G. (1936): Microfossiles des silex crétacés. Première partie. Ann. Paléont., 25, 151-191.
- (1937): Microfossiles des silex crétacés. Deuxieme partie. Ann. Paléont., 26, 51-103.
- (1945): Microfossiles des calcaires siluriens de la Montogne Noire. Ann. Paléont., 31. 41-75. pl. 1-2.
- ---- (1954) : Systematique des hystricho-

sphaeridés: sur lácception du genre Cymatiosphaera WETZEL. C. R. Somm. Soc. Geol. France, 257-259.

- DEUNFF, J. (1954): Verhachium, genre nouveau d'Hystrichosphéres du Primaire. S. R. Soc. Géol. France, 305-306.
- DOWNIE, C., EVITT, W.R. and SARJEANT, W.A.S. (1963): Dinoflagellates, Hystrichospheres and the classification of the Acritarchs. Stanford Univ. publications, Geol. Sci., 7, (3), 1-16.
- DOWNIE, C. and SARJEANT, W. A. S. (1963): On the interpretation and status of some hystrichosphere genera. *Palaeontology*, 6, (1), 83-96.
- EISENACK. A. (1954): Microfossilien aus Phosphoriten des samländischen Unteroligozäns und über die Einheitlichkeit der Hystrichosphaerideen. Palaeontographica, A. 105, 49-95.
- (1957): Mikrofossilien in organischer Substanz aus dem Lias Schwabens (Süddeutschland). N. Ib. Geol. Palaeont., Abh. 105, 239-249.
- (1958): Tasmanites NEWTON 1875 and Leiosphaeridia n. g. als Gattung der Hystrichosphaeridea. Palaeontographica. A. 110, 1-19.
- (1958): Mikroplankton aus dem norddeutschen Apt. N. Jb. Geol. Palaeont., Abh. 106, 383-422.
- (1963): Hystrichosphären. Biol. Reviews, 38. (1), 107-139. pls. 2.
- EVITT. W. R. (1961) : Observations on the morphology of fossil dinoflagellates. *Micropaleontology*, 7, (4), 385-420, pls. 1-9.
- GOCHT. II. (1957): Mikroplankton aus dem nordwestdeutschen Neokom (Teil I). Patäont. Z., 31, 163-185.
- (1959): Mikroplankton aus dem nordwestdeutschen Neokom (Teil II). Paläont.
 Z., 33, (1/2), 50-87.
- (1960): Die Gattung Chiropteridium n. gen. (Hystrichosphaeridea) im deutschen Oligozän. Paläont. Z., 34, (3/4), 221-232.
- JEKHOWSKY. B. DE (1961): Sur quelques Hystrichospháres Permo-Triassiques d'Europe et d'Afrique. Revue de Micropaléontologie, 3, 207-212, pl. 1-2.
- KLEMENT, K. W. (1960) : Dinoflagellaten und

Hystrichosphaerideen aus dem unteren und mittleren Malm Südwestdeutschlands. *Palaeontographica*, A. 114, 1-111, Taf. 1-10, tfs. 1-37, Tab. 1.

- KLUMPP, B. (1953): Beitrag zur Kenntnis der Mikrofossilien des mittleren und oberen Eozäns. Palaeontographica. A, 103, 377-406.
- MAIER, D. (1959): Planktonuntersuchungen in tertiären und quartären marinen Sedimenten. N. Jb. Geol. Paläont., Abh. 107, 278-340.
- SARJEANT, W. A, S. (1959) : Microplankton from the Combrash of Yorkshire. Geol. Mag., 96, 329-346, pl. 1.
- (1962): Upper Jurassic microplankton from Dorset, England. Micropaleontology.
 8, (2). 255-268, pls. 1-2.
- STOCKMANS, F. et WILLIÈRE, Y. (1960): Hystrichosphéres du Devonien belge. Senck. leth., 41, 1-11.

TAKAHASHI, Kiyoshi (1963) : Palynologisch-

stratigraphische Untersuchung im Jooban-Kohlenfeld. (Japanisch mit deutschen Zusammenfassung). Sci. Rep. Fac. Sci.. Kyushu Univ., Geol., 6. (2). 77-94. textfigs. 8, tabs. 6. pls. 9-12.

- (1963): Pollen analysis of the marine sandstone of the Asagai formation in the Joban coal-field—with special reference to the stratigraphic correlation—(in Japanese with English abstract). Jour. Mining Inst. Kyushu. 31, (11), 447-455, pl. 1.
- VALENSI, L. (1953) : Microfossiles des silex du Jurassique moyen. Mem. Soc. Géol. France. Nourelle sèrie, 32, (4), 68, 1-100.
- WALL, David and DOWNIE, Charles (1963): Permian hystrichospheres from Britain. Palaeontology, 5. (4), 770-784, pls. 112-114.
- WEILER. H. (1956): Über eine Fund von Dinoflagellaten. Coccolithophoriden und Hystrichosphaeriden im Tertiär des Rheintales. N. Jb. Geol. Paläont., Abh. 104, 129-147.

Hirakubo 平窪

Explanation of Plate 33

(× ca. 1000)

Fig. 1.	Micrhystridium asagaiense sp. nov.
	slide GK-V 3086.
Fig. 2.	Micrhystridium minus sp. nov.
	slide GK-V 3088.
Fig. 3.	Micrhystridium sp. c
	slide GK-V 3086.
Figs 4-6	Micrhystridium (?) spinuliferum sp. nov.
	4, 6: slide GK-V 3086; 5: slide GK-V 3087.
Figs. 7-9.	Baltisphaeridium (?) polyceratum sp. nov.
	7: slide GK-V 3087; 8, 9: slide GK-V 3086.
Figs. 10a, b.	Apteodinium sp.
	slide GK-V 3087.
Fig. 11.	Leiosphaeridia sp.
	slide GK-V 3087.
Fig. 12.	Leiosphaeridia cf. laerigata sp. nov.
	slide GK-V 3087.
Fig. 13:	Indeterminable remain.
	slide GK-V 3088.

Plate 33











8



















10ь

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 54, pp. 215-233, pls. 34, 35, June 30, 1964

469. SOME MIDDLE PERMIAN AVICULOPECTINIDAE FROM THE KITAKAMI MASSIF, NORTHEAST JAPAN*

MASAFUMI MURATA

Institute of Geology and Paleontology. Tohoku University

北上山地中部ペルム系の Aviculopectinidae: 北上山地南部に発達する中部ペルム系叶倉 層及び同層に対比される飛竜山層より産出した Aviculopectinidae について、早坂 (1925) の記載種も含めて検討した結果4属8種が識別された。6種は新種であるが、その中には欧亜 地域の上部石炭系一下部ペルム系より報告された種に近縁のものが含まれる。叶倉層の時代に ついては、他の産出化石をも検討し北米の Word formation に対比されるものである事を 指摘した。 村田正文

Introduction and Acknowledgements

It has been known for a long time that pelecypods, brachiopods, corals, fusulinids and other fossils occur in abundance from the Permian Kanokura formation which is distributed typically in the southern part of the Kitakami Massif in lwate and Miyagi Prefectures, Northeast Japan. Among these fossils the brachiopods from the associated occurrence of *Lyttonia* had been studied in more or less detail since many years ago. However, there are only a few publications (HAYASAKA, 1925) concerning the systematics of the pelecypod fauna of the formation.

During the 40 years since HAYASAKA's publication on the Permian pelecypods of the Kanokura formation, our knowledge on the geology of the Paleozoic sediments distributed in the southern part of the Kitakami Massif has increased remarkably. It is during this period that the collection of pelecypods and other fossils has accumulated in our Institute of Geology and Palcontology. Tohoku University. Among these newly added specimens, there are many aviculopectinids which are additional to the ones previously described by HAYASAKA (1925) and important in a reinstatement of that fauna.

In the present article the writer describes the result of a restudy HAYASAKA's original materials together with aviculopectinids accumulated since 1925. As the result the writer distinguished eight species distributed among four general of Aviculopectinidae from the Permian Kanokura formation and its equivalent Hiryuyama formation. Among these eight species, six are described as new to science and the fauna in general is characterized by some of its species being related with peculiar species of Eurasia and others showing intimate relation with certain North American forms.

^{*} Received April 27, 1964; read at the annual meeting of the society, Jan. 19, 1964.

Before proceeding, the writer thanks Professor Ichiro HAYASAKA of the Tamagawa University, Tokyo, for his kind guidance and valuable suggestions during the course of the present work. He is indebted to Professor Kotora HATAI, Institute of Geology and Paleontology, Tohoku University, for his kind supervision during this work in the laboratory. Acknowledgements are dur to Drs. Hisakatsu YABE and Shoshiro HANZAWA. Professors Emeritus of the Tohoku University, and to Professor Yoshio ONUKI, Department of Geology, Faculty of Education, Tohoku University for their encouragements and suggestions. Thanks are also due to Dr. Shozo HAYASAKA of the Tohoku University for his valuable suggestions and discussions and to Mr. lkuro SASAKI of the Kurokawa High School, Mivagi Prefecture, for his specimens.

Stratigraphical Position and Geological Age of the Aviculopectinids

The aviculopectinids described in the present article are from three localities, two of the Kanokura formation and one of the Hiryuyama formation. Of these localities, one includes the type locality of the Kanokura formation, where the stratigraphical sequence and lithological facies are shown in the first column of Table 1. The lithofacies of the fossil localities are different from one another though in the same stratigraphical position, and for this reason this relation is shown in the three columns of Table 1.

From Table 1, it is evident that the lithofacies of the aviculopectinids from the three localities are different, consisting of thick sandstone at the type locality, of calcareous sandstone at the locality of Kamiyasse and of tuffaceous sandstone at Hiryu-yama. But, it should be noticed that each of the localities consists of coarse grained sediments, thus indicating a clean sea bottom. However, it may be added that the aviculopectinids occur from both the coarse and argillaceous sediments, which points to that the former may have been that of the life environment whereas that of the latter the one of death environment, because it is considered that these aviculopectinids are swimming forms which would not prefer to settle on soft muddy bottoms.

The geological age of the Kanokura formation and its equivalents can be determined also from that Yabeina multiseptata (DEPRAT) and Verbeekina verbeeki (GEINITZ) occur from the limestone intercalated in the middle and upper parts of the formation. Parafusulina matsubaishi FUJIMOTO occurs throughout the formation. These fusulinids are typical Middle Permian protistids with extensive distribution and short geological range. The aviculopectinids occur in a position below the first two fusulinids yet above the basal conglomerate of the formation, which shows that they are of the same geological age. Besides the fusulinids just mentioned. Paraceltites aff. elegans GIRTY (HAYASAKA, 1940), Propinacoceras aff. galilaei GEMMELLARO, (HAYASAKA, 1955, 1963), Agathiceras aff. suessi GEM-MELLARO. Cibolites cf. uddeni PLUMMER. Tainoceras kitakamiensis HAYASAKA and Foodiceras? sp. (HAYASAKA, 1962, 1963) have been reported from the Kamiyasse and its neighboring localities. The third listed one of these cephalopods occurs from the upper part of the Kanokura formation, and the others are said to have been collected from the lower part of same formation from where the aviculopectinids were collected. The pre-

Table 1. Stratigraphical Sequence of the Fossil Localities.* fossil horizon

Type section of the Kanokura formation (Kanokura-zawa, Sumita- chô, Kesen-gun, Iwate Prefecture)		Kamiya Miyagi	asse, Kesennuma City, Prefecture	South slope of Hiryuyama Miyamori-mura. Kamihei-gun, Iwate Prefecture			
Toyoma Slate	Toyoma Slate Dark to black slate with intercalated conglomerate and limestone.		Toyoma Dark to black slate with intercalated conglomerate and limestone.		Missing		
Kanokura formation	Sandy slate intercalated with 300 m thick limestone. 180 m thick sandstone with thin sandy slate layers.* 35 m thick conglomerate of granule to pubble gravels.	Kanokura formation	4 m thick limestone. Alt. of sandstone and black slate, 130 m thick. 7 m thick limestone. 80 m thick alt. of calca- reous sandstone and gray sandy slate.* 8 m thick conglomerate of pebble to cobble gravels.	Hiryuyama formation	Thick conglomerate of pebble to cobble gravels. Massive tuffaccous sand- stone* intercalated with about 3 sandy slate layers.		
Sakamoto- zawa formation	fault contact Sandy slate. Thick limestone. Calcareous slate interca- lated with acidic tuff. Thick conglomerate of pebble to cobble gravels.	Sakamoto- zawa formation	Alt. of sandstone and sandy slate. Thick limestone. Sandy slate. Conglomerate. thick, pebble to cobble gravels.	Tassobe formation	fault contact		
Pre-Permian formations (Carboni- ferous and older)		Older formation not exposed		Pre-Permian Carbonifero	formation (Middle us)		

••

... _ _ _

viously recorded cephalopods other than those above mentioned and their localities in the Kanokura formation and its equivalents in the Kitakami Massif are as follows:

- Medlicottia? sp.; the Haritsuke Pass. Miyamori-mura, Kamihei-gun, Iwate Prefecture; the Kumonoueyama formation (ΠΑΥΑSΑΚΑ, 1953).
- Hanieloceras intermedium (WANNER); Budô-zawa, Sumita-cnô, Kesen-gun, Iwate Prefecture: lower part of the Kanokura formation (HAYASAKA, 1953).
- Foodiceras akiyamai HAYASAKA; Tagara, Kesennuma City, Miyagi Prefecture: lower part of the Kanokura formation (HAYASAKA, 1960).
- Stacheoceras iwaizakiense MABUTI; Iwaizaki, Kesennuma City, Miyagi Prefecture; lower part of the Iwaizaki limestone (MABUTI, 1935).
- Propinacoceras aff. galilaei GEMMELLARO. Foodiceras akiyamai HAYASAKA and Tainoceras abukumense HAYASAKA: Iwaizaki, Kesennuma City, Miyagi Prefecture; upper most of the Iwaizaki limestone where just above Yabeina limestone (HAYASAKA 1962, 1963).
- Paracellites sp. and Stenopoceras japonicum NAKAZAWA; Tenjinnoki, Towa-chô. Tome-gun, Miyagi Prefecture; Tenjinnoki formation (ΝΑΚΑΖΑWΑ, 1960; UE-DA, 1963).
- Stacheoceras sp.; Obama, Ogachi-chô, Monogun, Miyagi Prefecture: Obama limestone (HAYASAKA, 1940).

On the strength of those cephalopods HAYASAKA (1963) concluded that the age of the Kanokura formation is equivalent to GERTH's (1950) Basleo Stage (*Timorites* Zone). In the Takakura-yama district of the Abukuma Massif, Agathiceras spp., Stacheoceras sp., Medlicottia? sp., Propinacoceras sp., Paraceltites sp., Pseudogastrioccras sp., Waagenoceras sp., Tainoceras abukumense HAYASAKA and Tylonautilus permicus HAYASAKA have been recorded by HAYASAKA (1957) from

the upper part of the Kashiwadaira formation, from which Yabeing sp. and Yabeina multiseptata (DEPRAT) also occurred (HAYASHI, 1937; HANZAWA and MURATA, 1963). According to HAYA-SAKA (1963) the age of this formation is equivalent to the Socio Stage (Waagenoceras Zone). However, according to the range chart of DUNBAR et al. (1960) the cephalopod fauna of the Kanokura formation as well as of the Kashiwadaira formation corresponds to that of the Word formation in North America. Therefore, from the fusulinids and cephalopods the writer thinks that it is quite reasonable to consider that the age of the Kanokura formation and the Hirvuyama formation is middle Permian. and that these formations should be correlated with the Word formation in North America.

Systematic Description

Family Aviculopectinidae ETHERIDGE. Jr., 1906 Subfamily Aviculopectininae MEEK

and HAYDEN, 1864

Genus Aviculopecten McCoy, 1851

Aviculopecten sasakii MURATA, n. sp.

Pl. 34, figs. 1. 2

Description :--Shell small, subrectanglar in outline, somewhat wider than high, with an acute posterior auricle and rather deeply incised sinuses at margin of each auricle; hinge-line slightly longer than the greatest transverse diameter; obliquity, acline or slightly prosocline; axis of posterior sulcus nearly bisecting auricles; umbonal angle about 90 degrees; convexity ratio in left valves 0.28, 0.30, in right valve 0.22.

Surface of shell including transition



Fig. 1. Antero-posterior profile across the ventral margin of the left valve of *Aviculopecten sasakii*, MURATA, n. sp.

zone with 21 to 23 thin, high and subequal costae, separated by relatively broad and round valleys. Left valve with numerous tangential spines arranged on costae in irregular concentric rows, indistinct except for anterior transitional costae in right valve. Auricles ornamented with closely spaced spinose costae, 5 to 8 in number, but increase in number in later stages by intercalation, on the right posterior.

The measurements of the specimens of *Aviculopecten sasakii* are given in Table 2.

Comparison and Affinity:—This species closely resembles in shape and number of costae A. phosphaticus GIRTY (1910, p. 43, pl. 4, fig. 11), but differs therefrom by having numerous spines on costae, no concentric ornamentation on the shell surface and larger size.

A. manchuricus CHAO (1927, p. 31, pl. 2, figs. 23, 24) is an another species related to the present one, but can be distinguished by its intercalation of the costae on the shell surface and by the other characters mentioned above.

Remarks:—This species is named after Mr. Ikuo SASAKI of the Kurokawa High School, Miyagi Prefecture, who offered the specimens to the writer for study.

Material:—The new species is based on several specimens, among which two of them consist of nearly complete valves, the others include fragmental materials, all from a single locality. The preservation of these specimens is not good, and consist only of external and internal molds: the external ornamentation is retained and can be observed in detail.

Holotype:--IGPS. coll. cat. no. 85730.

Paratype :—IGPS, coll. cat. nos. 85731, 85746.

Occurrence:—Rare in the calcareous sandy slate of the Kanokura formation, at the upper course of the Shigeji-zawa, Kami-yasse, Kesennuma City, Miyagi Prefecture (IGPS, loc. no. Mi 117). Kanokura formation, Middle Permian.

Aviculopecten hayasakai MURATA, n. sp.

Pl. 34, figs. 3-9

1925, Aviculopecten interstitialis (PHILLIPS), HAYASAKA (non PHILLIPS, 1936), p. 7, pl. 8, figs. 3-5.

Description : - Suborbicular mediumsized shells ranging in height up to 30 mm. in adults, with deeply depressed auricles, separated from shell body by rather deep auricular sulci and well defined, outwardly curved, subangular umbonal folds; acline or slightly prosocline, but majority of present specimens obliquely deformed by pressure; umbonal angle in undistorted specimens about 90 degrees; both valves moderately convex, right one a little less than left. convexity ratio in left valves 0.20 to 0.21, in right valves 0.13 to 0.17. Margin of left anterior auricle subrounded, indented at extremity of sulcus by a shallow sinus, margin of posterior auricles indented by a broad and deep sinus, making auricles acute.

Shell of left valve with two distinct sets of costae. 7 prominent rounded ones of first set of costae with numerous coarse tangential spines arranged in irregular concentric rows. and several finer costae intercalated in broad rather



Fig. 2. Antero-posterior profiles across the ventral margin of *Aviculopecten hayasakai* MURATA, n. sp.

A, left valve: B, Right valve.

deep concave interspaces: these finer costae not uniform in strength, rather variable according to stage of development, three of them start from umbo and others intercalated alternately; each finer costae marked by small spinelike imbricating scales. Left anterior auricle with 9 to 14 fine costae grading into 3 to 5 crowded transitional costae; 7 or 8 fine rather uniform costae on left posterior auricle; small spines and projecting imbricate lamellae on auricular costae; coarse rugose cardinal costae present. Surface of right valve gently undulated, with numerous fine costae, several fine costae intercalated in broad shallow depressed interspaces: and costae crossed by fine imbricating lamellae with spine-like projections, although they are obscure than left valve.

The measurements of Aviculopecten hayasakai are given in Table 2.

Comparison and Affinity:—This form is quite identical with the specimen which HAYASAKA (1925) figured and described as A. interstitialis (PHILLIPS). PHILLIPS (1836) originally described only the left valve, as follows:—"What about sixteen narrow, sharp, rough, radiating ribs, the intervening spaces with three striae or fine ribs. A specimen in Mr. GILBERTSON'S collection has stronger ribs. Near the beak the ribs are alternately larger and smaller, ears acute."

M'Coy (1844) retained PHILLIPS' species name, and though he gave no illustrations, he stated that his specimens have about 18 spinose costae of the first order and three smaller ribs or striac intercalated in the interspaces. Nevertheless. he (1855) described that, this form possesses 9 to 18 narrow, sharp, radiating ribs, between which are 3 to 9 smaller ones, and that the ribs have hooked spines at close regular intervals. He placed Pecten intercostata M'COY into the synonymy of A. interstitialis. On the other hand, the specimens described and illustrated by HIND (1903) as A. interstitialis have about six costae of the first order, three or more finer lines in the interspaces, and obscure concentric folds, but no spines on the left valve. The writer considers that neither HIND'S A. interstitialis nor M'COY'S P. intercostata are valid species and they may be individual variants which should be included into the synonymy of A. interstitialis of PHILLIPS. The present new species is distinguished from PHILLIPS' type specimen and M'COY's (1814) A. interstitialis in having 7 costae of the first order. The ornamentation of the left valve in this form is more similar to HIND'S A. interstitialis than PHILLIPS' holotype, and distinct protuberances of the costae are observed. Furthermore, the writer has been fortunate to obtain a single specimen (pl. 34, figs. 4a, b) of which both valves make a pair, the right valve of this from has a quite different ornamentation from that of HIND's specimen. P. intercostata M'Coy is also distinguished from the present one by the shape of the spines and in the smaller costae, the middle one of which is usually larger than the

others. This species is very much like A. segregatus M'COY which HIND and HAYASAKA considered to be identical with their A. interstitialis, but differs in the spinosity on the costae, and broad and flat interspaces. The writer agrees with EICHWALD (1860) in that, DE VER-NEUIL'S Pecten kokcharofi and P. bouei are synonyms of the present species, but has some doubt about HIND's opinion that these species are identical with A. segregatus M'COY, because DE VERNEUIL'S species are based upon only left valves whereas that of the latter is a right valve. In any case, these specimens have no spines. A. hiemalis SALTER which HAYASAKA (1925) considered to be synonymous with his A. interstitialis, is closely related to the present new form, but differs in outline of the shell which is longer than high and by the second order costae attaining the size of that of the first order.

Remarks: — As stated already, this form could not be identified with any known species except HAYASAKA'S *A*. *interstitialis*, which seems to be different from PHILLIPS' type for such reason the writer proposes the new name of *hayasakai*.

Material:—The species is based on a dozen specimens, almost all external and internal molds, and more or less deformed. The external ornamentation is well preserved. In a single internal mold both valves were found in apposition.

Holotype:--IGPS, coll. cat. no. 85737. Paratype:--IGPS, coll. cat. nos. 85738,

85739, 85741.

Occurrence:-Rather common in the lower part of the Kanokura formation, at some lacalities all of which belong to about the same stratigraphic horizon. The holotype and one paratype were found in a gray sandy slate of the Shigeji-zawa member of the Kanokura formation, at the upper course of the Toya-zawa, Kamishishiori, Kesennuma City, Miyagi Prefecture (IGPS, loc. no. Mi 116). One paratype and five other specimens were collected from a calcareous sandstone and gray calcareous slate at the upper course of Shigeji-zawa, Kamiyasse, Kesennuma City, Miyagi Prefecture (IGPS, loc. no. Mi 117). HAYA-SAKA's specimens are internal molds of two left and one right valves, and were collected from a dark gray sandy shale at Imô. Yahagi-machi, Rikuzen-takada City, Iwate Prefecture (IGPS, loc. no. It 011) These localities are adjacent to each other, and the respective beds can be trace to one another. Another locality is Kanokura-zawa, Sumita-chô, Kesengun, Iwate Prefecture (IGPS, loc. no. It 042), which is the type locality of the Kanokura formation. Kanokura formation. Middle Permian.

Aviculopecten hataii MURATA, n. sp.

Pl. 34, figs. 10a-d

Description:—Shell below medium size, suborbicular, with moderately incised sinuses at margin of each auricle; anterior umbonal fold moderately curved outward, posterior one nearly straight, curved very slightly outward; margin of anterior auricle subrounded, sigmoidally recurved at hinge: posterior auricle acute; acline or slightly opisthocline (this specimen is obliquely deformed by pressure); umbonal angle about 80 degrees; convexity ratio in left valve 0.10, right valve unknown.

Surface of left valve with numerous radial costae of different strengths, which may be classified into four orders. First order costae rounded and 7 or 8 in number. Between two of them a are external and internal molds of left valves. Their preservations are not so good, but their surface ornamentations are well observed in some external molds.

Holotype :-- IGPS, coll. cat. no. 85745.

Paratype :---IGPS, coll. cat. nos. 85749, 85756, 85761.

Occurrence:—Rather common in the lower part of the Kanokura formation, in some localities of the same horizon. The holotype occurred from a gray calcareous fine grained sandstone with fragments of brachiopods and fusulinids, at Shigeji-zawa, Kamiyasse, Kesennuma City, Miyagi Prefecture (IGPS, loc. no. Mi 117). The other localities of this species are Hosoo-zawa, Kamiyasse, Kesennuma City, Miyagi Prefecture and Imô, Yahagi-machi, Rikuzen-takada City, Iwate Prefecture. Kanokura formation, Middle Permian.

Acanthopecten spinosus HAYASAKA

Pl. 35, figs. 10a, b

1925. Acanthopecten spinosus HAYASAFA, p. 10, pl. 8, fig. 6 (non fig. 7=A, cf. coloradoensis (NEWBERRY))

This species was first described and illustrated by HAYASAKA (1925) from the Kanokura formation, based on two external molds, however, their surface ornamentations are quite different from one another. From such reason the writer considers that the two specimens should be separated into different species.

With regard to the surface ornamentation of this species the writer offers the following description.

Description:-Shell left valve with 16 broad flattened costae separated by narrow angular interspaces. Crest of each costa with by a narrow costellalike keel. Auricular costae absent. Only one order of fila observed at more or less regular intervals, extending straight across costae and interspaces. At early stage, fila delicate, but subsequent fila become extended ventrally into sharp points between costae and appear as thickened edges of imbricating lamellae.



Fig. 5. Antero-posterior profile of the shell surface near the ventral margin of *Acanthopecten spinosus* HAYASAKA.

Remarks: — This species resembles *Acanthopecten carboniferous* (STEVENS) described and figured by NEWELL (1937) from the Upper Carboniferous Centralia formation, Missourian stage, at Crooked Creek, Illinois. However, this species differs from the one described by NEWELL, by the larger size, more numerous fila, development of edges of imbricating lamellae and the form of the auricles.

Holotype:—IGPS, coll. cat. no. 22388 (HAYASAKA's fig. 6).

Locality and Horizon:-Imô, Yahagimachi. Rikuzen-takada City, Iwate Prefecture. Kanokura formation, Middle Permian.

Acanthopecten cf. coloradoensis (NEWBERRY)

Pl. 35, figs. 11-13

1925 Acanthopecten spinosus HAYASAKA, p. 10. pl. 8. fig. 7 (non fig. 6=A. spinosus HAYASAKA, Holotype).

Compare with :

1937 Acanthopecten coloradoensis. (NEWBER-



Fig. 3. Antero-posterior profile across the ventral margin of the left valve of *Aviculopecten hataii* MURATA, n. sp.

costa of second order is intercalated regularly, often attains to size of first ones on ventral margin of shell, but either not reach umbo or its vicinity. Third order costae more delicate, although rather unequal in strength and size, and placed irregularly between costae of former orders. Near ventral margin still younger delicate costae interpolated regularly between older During development of shell. ones costae bear numerous coarse tangential spines arranged in irregular concentric rows. On costae of first order, spines appear from umbonal region and developed progressively to ventral, but they appear from mid-length of shell on second order. Fine spines recognized only on some developed costae of third order. Concentric lines of growth fine, some of which are sublamellose, and much more crowded than others. Both auricles of left valve covered by spinose costae and fine lines of growth. Costae of auricles classified to four orders but not so distinct as on shell body. Single costa of first order approximately bisecting auricle. Cardinal costae as strong as first order costa of auricle.

The measurements of the holotype of *Aviculopecten hataii* is given in Table 2.

Comparison and Affinity:—Of the described Eurasian species of Aviculopecten, A. hiemalis SALTER, 1865 is most nearly like A. hataii. However, the present new species differs from the one described by DIENER (1897) in the development of the costae of four orders and by the more numerous spines on the costae. A. mutabilis LICHAREW, 1927, also resembles the present species, but LICHAREW's species is distinguishable by having no distinct spinosity on the costae. A. subcalthratus (KEYSERLING) 1846, is more or less related to this form, however, according to KEYSERLING, the auricular costae of his species consist of two principal costae and three bundless of finer ones.

The species is named after Dr. Kotora HATAI. Professor of Historical Geology, Institute of Geology and Paleontology, Tohoku University, who has given to the writer valuable suggestions during the course of this study.

Remarks and Material:—Only external molds of a single left valve of this species are known. The external ornamentation of this species is so distinctive that there should be no difficulty in recognizing it.

Holotype:-IGPS, coll. cat. no. 85732.

Occurrence:-Rare in the calcareous sandy slate of the Snigeji-zawa member of the Kanokura formation, at Toyazawa, Kamishishiori, Kesennuma City, Miyagi Prefecture (IGPS. loc. no. Mi 116). Kanokura formation, Middle Permian.

Genus Acanthopecten GIRTY, 1903 Acanthopecten onukii MURATA, n. sp.

Pl. 35. figs. 1-9

Description:—Shell rather small, acline, orbicular, slightly higher than long, with straight hinge-line which is a little less than length of shell; beak pointed and situtated at anterior third of hinge-line; triangular anterior auricle rather rounded at extremity and sharply marked off from shell body by angular umbonal fold and deep sulcus which overhang at base;

	Specimen	Length	Height	Height	Hinge length	Hinge	Con-	Con-	Umbonal angle degrees	Auricula	Body	
Species		cimen	num.	Length		Length	mm.	Height		Anterior	Posterior	costae
	85730 R E*	16.3	13±	0.80	16.5	1.01	2.9	0.22	93	7	10	22
sasakii	85731 L E	14.5	12. 2	0. 84	15.3	1.06	3.4	0. 28	90	5+	8	21
	85746 L I	11.6	10.2±	0. 88	_	_	3, 1	0.30	90	8	_	23
	61423 R 1	23.1	30.6	1.32	22.6	0. 98		-	81			
	85736 R I	27.1	30.4	1.12			5.3	0.17	82		—	37+
	85737 R I*	28.5	31.8+	1.47±	21+	0, 7:1+	5.3	0, 17	78			354
	85743 R E		29. 1		_		3. 8	0. 13	_	6	9	42+
havasakai	85738 R E	25.1		_	23.4	0. 93	4. 7		81	11	8	48
Aujuoukui	85742 R E	_	22.4			_	3.8	0.17	-	7	—	47
	85737 L 1•	30±	37.2	1.24	22.1+	0. 77	7.6	0, 20	78			32+
	22421 L 1	_	37.4		23.4		7.4	0.20	77-+		-	37
	85741 L E	14.2	15.6	1.10	12.4	0. 87	3. 2	0, 20	79	14	8	
	85739 L I	23.7	24.5	1.03	20.4	0.86	5. 2	0. 21	83	9	—	
hataii	85732 L E*	28.0	29.4	1.05	24.2	0.86	3.0	0,10	80	12	15	54

Table 2. Measurements of Japanese Aviculopecten Species

- -

469.

posterior auricle larger than anterior one, extends at extremity into an acute projection and separated from main shell below by low umbonal fold and below by an almost indistinguishable low umbonal fold and weak sulcus; umbonal angle in undistorted specimens about 110 degrees; left valve moderately convex, convexity ratio 0.11 to 0.25.



Fig. 4. Antero-posterior profile of the shell surface near the ventral margin of *Acanthopecten onukii* MURATA, n. sp.

Surface of shell with 23 to 25 acutely rounded costae, two or three of which become crowded and weak over posterior umbonal fold, forming a transition, separated by narrow angular furrows; both sides of each costa with narrow costella; auricular costae not observed on auricles even in a well preserved specimen. Surface covered with two sets of fila, coarse, widely spaced of first order separated by numerous fine ones of second order ; in most specimens at hand, second order of fila obscure. At early stage, first order of fila crowded and weakly developed. First coarse filum originated at shell height of 9 to 13 mm, and thereafter distinct fila appear at rather variable intervals. First order fila extend ventrally into sharp points between costae and appear as thickened inbricating lamellae; fila not vaulted into projections over costae. Large fila extend to noncostate auricles across sulcus.

The measurements of Acanthopecten onukii are given in Table 3.

Comparison and Affinity — The present species closely resembles A elegantulus

(STUCKENBERG). 1898. from the "Schwagerina horizone" of the Urals, but is distinguished therefrom by the somewhat larger number of costae and noncostate auricles. The present species also bears some resemblance with A. carboniferous (STEVENS) from the Centralia formation (Missourian stage) of North America, but the American form differs in more smaller number of costae and in the costate or costellate auricles.

Remarks: — Acanthopecten carboniferous (STEVENS) 1858, and A. elegantulus have wide geographical distributions, the former one is distributed from the Mid-Continent region of North America to North China, and the latter is known from the Ural region, the Donetz basin (JAKOWLEW'S A. carboniferous) of Russia. Carnic Alps of Italy and the Yentai coal field of Manchuria. However, their geological ranges are restricted, that of the former is known from the Des Moinensian to Virgilian in the Mid-Continent region of North America and from the Upper Carboniferous of North China, and the latter is recorded from the Sakmarian of the Urals, Donetz basin (JAKOWLEW'S A. carboniferous in 1903) of Russia, Carnic Alps of Italy and Yentai coal field of Manchuria. Compared with these species, Acanthopecten onukii occurs in a higher horizon in the geological column. Therefore, the writer considers that the increase of body costae and extinction of auricular costae are related with the evolution of these species.

The species is named after Dr. Yoshio ONUKI, Professor of Geology, Faculty of Education, Tohoku University, who has been engaged in a study of the Paleozoic System of the Kitakami Massif of Miyagi and Iwate Prefectures.

Material:—The new species is based on about a dozen specimens, all of which RY), NEWELL, p. 75, pl. 12, figs. 7a, b, 13-15b.

Cuarse fila 9 â 91 oC ŝ 2 Body custae 7 35 30 ន 33 2 5 21 1 2 Posterior Auricular costae I Anterior + Umbonal legrees 75angle 110 115 102 105 110 130 107 1.7+ vexity Conmm. Ľ٦ 4. O ŝ 90 ŝ 2 5 ŝ eri. eri: ÷ Hinge length 9 9 ш Ш Ш 00 6 294 1 33 33 26. ន់ 21 2 Height 8 # 2 mm. œ x 00 _ 0 26. 46. 36. 24 5 20. ន្ល 2 2 25.4+ Length +1 24.0± 30 0 9 ~ mm. 29 3 ሷ 2 ន់ 83 ម្ល ۵ å έĽ ŝ £ (۲) Specimen Ľ 1 1 Ч Ļ Ч Ч 1 د. 22388 85745 85749 22408 85747 85748 85756 85761 85757 coloradoensis spinosus Species onnkii сŀ

Remarks:— In the collection of the aviculopectinids from the Kanokura for-

mation. there are two fragmental specimens which are refered to this species with doubt. One of the specimens is identified with one of the two of *Acanthopecten spinosus* described and figured by HAYASAKA (1925). However, as already stated, the external ornamentation serves to distinguish it from the type of *A. spinosus*.



Fig. 6. Antero-posterior profile of the shell surface near the ventral margin of *Acanthopecten* cf. coloradoensis (NEWBERRY).

Locality and Horizon:--Imô, Yahagi-machi, Rikuzen-takada City, Iwate Prefecture. (IGPS, loc. nos. It 043, 044) Kanokura formation. Middle Permian.

Repository:—IGPS, coll. cat. nos. 22408 and 85734.

Genus Annuliconcha NEWELL, 1937

Some of the aviculopectinids collected from the Kanokura formation are identical with what HAYASAKA (1925) figured and described as *Pleuronectites interlineatus* (MEEK and WORTHEN) from Imô. Yahagimachi, Rikuzen-takada City, lwate Prefecture. However, a review of the generic name as well as the species shows that it represents an undescribed species of *Annuliconcha* and the details are given below.

Aviculopecten interlineatus of

Table 3. Measurements of Japanese Acanthopecten Species

MEEK and WORTHEN, which HAYASAKA (1925) referred to *Pleuronectites*, is the genotype species of *Annuliconcha* which was by NEWELL (1937). However, neither HAYASAKA's *Pleuronectites interlineatus* nor MANSUY'S *Streblopteria magnini* which HAYASAKA considered to be synonymous with his *P. interlineatus* from the Kitakami Massif, are included into the synonymy of *Annuliconcha interlineatus* by NEWELL. This procedure of NEWELL (1937) shows that he considered those two species to be distinct from MEEK and WORTHEN's *interlineatus*.

The recently obtained aviculopectinids are quite identical with Pleuronectites interlineatus of HAYASAKA but not with that of MEEK and WORTHEN, and they could not be identified with any known species. They are also different from what MANSUY (1913) reported as Streblopteria magnini. For this reason the writer proposes the new name of kitakamiensis for what HAYASAKA figured and described as P. interlineatus from the Kitakami Massif. The holotype is designated as the original specimen used by HAYASAKA and now preserved in the collection of the Institute of Geology and Paleontology. Tohoku University (IGPS, coll. cat. no. 22389).

Annuliconcha kitakamiensis MURATA.

n. sp.

Pl. 34, figs. 11. 12

1925. Pleuronectites interlineatus (MEEK and WORTHEN), HAYASAKA (non MEEK and WORTHEN, 1860). p. 12, pl. 8, figs. 9, 9a.

Description: -- Orbicular, small-sized shells. obliquity of present specimens opisthocline, more or less deformed by compression, with nearly equal auricles;

in left valve, anterior umbonal fold narrow and angular, posterior one obscure; anterior sulcus deep, narrow and overhanging at inner boundary, posterior sulcus broad and shallow: an imperfect valve, which is presumed to right valve by obliquity, has rather deep angular but not overhanging posterior sulcus. Shell surface of both valves with two ranks of fila, coarse, widely spaced of first order, separated by many fine closely spaced ones of second order. First coarse filum appears at shell height of about 1 mm., and thereafter first order fila join periodically at increasing intervals. In holotype specimen (15mm, high), are 8 large fila, and 9 in paratype (18 mm. high). Table 4 shows shell height where first order fila become introduced and a number of those of second order in between.

Fila of first order elevated sharply with rounded summits, about 17 protuberances along outer surface are arranged regularly and extended ventrally into sharp points where second order fila are cut off, and inner surface waved corresponding to protuberances of outer surface. Coarse fila very pronounced on auricles without protuberances, but on a fragmental anterior auricle of presumed right valve strong radial costa extended along sulcus.

The measurements of Annuliconcha kitakamiensis are given in Table 5.

Comparison and Affinity:—Annuliconcha kitakamiensis MURATA, n. sp., resembles A. interlineatus (MEEK and WORTHEN) described and figured by NEWELL (1937) from the Upper Carboniferous Lasalle limestone, Missouri subseries, Lasalle. Illinois. However, the present new species can be distinguished from the one described by NEWELL, by the regular development of strong and very characteristic elevated protuberances along the outer surface of the coarse fila on the shell of the right and left valves. The other features, such as size of shell and shape of the auricles are more or less the same as in An. Annuliconcha magnini interlineatus. described and figured by MANSUY (1913) as Streblopteria magnini from Ban Bo. Indo-china is more or less related to the present new species in having protuberances developed on the first order fila only near the ventral margin. However. MANSUY's species is distinguishable from An. kitakamiensis by having protuberances of the coarse fila only near the ventral margin whereas in the present species they are developed even near the umbonal area.

Remarks: — Annuliconcha kitakamiensis is known only from the Kanokura formation of Middle Permian in age in Japan, whereas An. interlineatus is known only from the Upper Carboniferous (Pennsylvanian) of many localities in North America. The geological range of the genus Annuliconcha according to NEWELL (1937) extends from about the middle part of the Mississippian up to the middle part of the Permian, which shows that the Japanese species is situated in a position near to the time of extinction of the genus. It seems evident that the protuberances on the fila are related with the evolution of the species, and may be an indicator of the approximate age of the species. MANSUY's species is said to be early Permian in age, and was reported from the Lower Permian (Zone of Pseudoschwagerina) Mapping limestone in China by GRABAU (1936) and from the Artinskian in the Caracorum Range by RENZ (BRANSON, 1948), Judging from the descriptions, remarks and illustrations of the species recorded by those authors, it seems evident in these cases also that the development of the

<u>ر</u> ۱

Specimen		lst	2nd	3rd	4th	ōth	6th	7th	8th	
	Height of coarse fila mm.	2.0	3.1	3.8	5. 2	6.4	7.5	9. 2	12.2	14.8
22389 L E*	Number of fine fila	_		_	-	4	6	7	7	7
85735 R E	Height of coarse fila mm.	2.4	3.2	4.1	5.7	7.4	9, 4	12.0	15.6	18.0
	Number of fine fila	-	5	6	6	8	7	7	9	10

 Table 4. Height of coarse Fila from Dorsal Margin and Number of Intercalated

 Fine Fila of Annuliconcha kitakamiensis MURATA, n. sp.

Table 5. Measurements of Annuliconcha kitakamiensis MURATA, n. sp.

Specimen	Lngth mm.	Heightnm.	Hinge length mm.	Convexity mm.	Umbonal angle degrees	Coarse fila
22389 L E-	14.8	15.2	14.6	1.8	93	9
85735 R E	18.0	19.2		2.4	90	9

protuberances on the fila corresponds with the position in the geological column.

Holotype :-- IGPS, coll. cat. no. 22389

Paratype :-- IGPS, coll. cat. no. 85735

Locality and Horizon:—The holotype collected by HAYASAKA is from the Kanokura formation, Imô, Yahagi-machi, Rikuzen-takada City, Iwate Prefecture (IGPS, loc. no. It 044). The paratype was also collected from same horizon at Toya-zawa, Kami-shishiori, Kesennuma City, Miyagi Prefecture (IGPS, loc. no. Mi 116). Kanokura formation, Middle Permian.

Subfamily Streblochondriinae NEWELL, 1937

Genus Streblochondria NEWELL, 1937 Streblochondria miyamoriensis

MURATA, n. sp.

Pl. 35. figs. 14a, b

Description :- Medium-sized oval shell. slightly opisthocline. with broad anterior auricle about twice as long as posterior one, separated from shell body by narrow rounded auricular sulci: anterior umbonal fold slightly curved outward, posterior one nearly straight and well defined : umbonal angle about 90 degrees : convexity ratio in left valve 0.17. Right valve unknown.

Surface of left valve with numerous radial costae of different strengths. which may be classified into two or three ranks. First order costae rounded and about 20 in number. Between each two costae of first rank is intercalated regularly a finer costa, which generally assumes strength equal to that of first one on approaching ventral margin of shell. However, on anterior one third of shell finer costae still delicate even on ventral margin. because they appear later. Costae of left anterior auricle rounded and fine, 9 or 10 in number. A few faint costae occur across posterior auricle. Surface inclusive of auricles covered with numerous concentric lines of growth, which become irregularly spaced imbricating lamellae toward the ventral and front margins. Imbricating lamellae more pronounced on the auricles. Small erect projections occur at intersections of costae and imbricating lamellae.

The measurements of the holotype of *Streblochondria miyamoriensis* are given in Table 6.

Comparison and Affinity:—Of the described species of Streblochondria, S. stantonensis and S. condrai, which were described by NEWELL (1937) from the Upper Carboniferous of North America, are similar to S. miyamoriensis. However, the present new species differs from both of NEWELL's species in intercalating delicate finer costae on the anterior one third of the shell, and by the larger size of anterior auricle.

Remarks and Material:-Only external and one fragmental internal molds of a single left valve of this species were collected. The external ornamentation

Table 6. Measurements of Streblochondria miyamoriensis MURATA. n. sp.

Length mm.	Height mm.	Hinge length mm.	Con- vexity mm.	Maximum umbonal argle	Umbonal angle at beak	Auricula	ir costae Posterior	Body costae
33. 7	41.2	21.0	7.1	95	87	10	3	47

Explanation of Plate 34

Figs. 1, 2. Aviculopecten sasakii MURATA. n. sp.

- 1a, b. External and internal molds of right valve. holotype. IGPS, coll. cat. no. 85730, x2.
- 2a. b. External mold and gumtype of left valve, paratype. IGPS, coll. cat. no. 85731, ×2. Loc. Shigeji-zawa, Kamiyasse, Kesennuma City, Miyagi Prefecture. Kanokura formation, Middle Permian.
- Figs. 3-9. Aviculopecten hayasakai MURATA. n. sp.
 - Internal molds of left and right valves, somewhat obliquely compressed, HAYA-SAKA'S original specimens (HAYASAKA 1925, pl. 1, figs. 5, 6). IGPS, coll. cat. nos. 22421, 85736, ×1.
 - Loc. Imô. Yahagi-machi, Rikuzen-takada City. Iwate Prefecture.
 - 4a. b. Internal molds of left and right valves of same individual, holotype. IGPS, coll. cat. no. 85737. ×1.
 - Loc. Toya-zawa, Kamishishiori, Kesennuma City, Miyagi Prefecture.
 - 6a, b. External mold and gumtype of a typical left valve, paratype. IGPS, coll. cat. no. 85741, ×2.

Loc. Same as fig. 4.

- Enlarged external mold of left valve, showing characteristic sculpture of main ribs, paratype. IGPS, coll. cat. no. 85739, ×3. Loc. Same as fig. 1.
- 8a, b. External mold and gumtype of a typical right valve, paratype. IGPS, coll. cat. no. 85738. × 1.5.
 - Loc. Same as fig. 1.
 - Internal mold of right valve. IGPS, coll. cat. no. 61423, ×1.
 Loc. Kanokura-zawa. Sumita-chô, Kesen-gun, Iwate Prefecture. Kanokura formation, Middle Permian.
- Figs. 10a-d. Aviculopecten hataii MURATA, n. sp.
 - 10a, b. External mold and gumtype of left valve, holotype. IGPS, coll. cat. no. 85732, ×1.
 - 10c. Internal mold of holotype, $\times 1$.
 - 10d. Enlarged view of holotype to show details of radial ribs. ×5. Loc. Same locality as fig. 4. Kanokura formation, Middle Permian.
- Figs. 11-12. Annuliconcha kitakamiensis MURATA, n. sp.
 - 11a. External mold of a slightly imperfect right value, paratype. IGPS, coll. cat. no. 85735, $\times 1$.
 - Loc. Same as fig. 4.
 - 11b. Enlarged view of fig. 11a. $\times 2.5$.
 - 11c. Gumtype of fig. 11a, $\times 2.5$.
 - 12a. A well preserved external mold of left valve. HAYASAKA's original specimen (HAYASAKA 1925, pl. 1, figs. 9, 9a), holotype. IGPS, coll. cat. no. 22389, ×1. Loc. Same as fig. 3.
 - 12b. Enlarged view of fig. 12a to show detail of fila, ×3. Kanokura formation. Middle Permian.



of this species is so distinct that there should be no difficulty in recognizing it.

Holotype :--IGPS, coll. cat. no. 85733 Occurrence:--The tuffaceous fine sandstone of the Hiryuyama formation, at the southeastern slope of Hiryuyama

the southeastern slope of Hiryu-yama, Miyamori-mura, Kamihei-gun, Iwate Prefecture (IGPS, loc. no. It 041).

Hiryuyama formation, Middle Permian.

References

- BRANSON, C.C. (1948) : Bibliographic Index of Permian Invertebrates. Geol. Soc. Am., Mem. 26, pp. 1-1047.
- CHAO, Y. T. (1927): Fauna of the Taiyuan Formation of North China. Palaeontologia Sinica, Ser. B, vol. 9, fascicle 3, pp. 1-50, pls. 1-4.
- DIENER, C. (1897): The Permian Fossils of the Productus Shales of Kumaon and Garhwal. Palaeontologia Indica, Ser. 15. vol. 1, part 4, pp. 1-54, pls. 1-4.
- DUNBAR, C. O., et al. (1960): Correlation of the Permian Formations of North America. Bull. Geol. Soc. America, vol. 71, no. 12, pp. 1763-1806.
- EICHWARD, E. von (1860): Lethaea Rossica, ou Paléontologie de la Russie. Stuttgart. vol. 1, pp. 1-1657.
- ETHERIDGE, R. Jr. and DUN, W.S. (1906): A Monograph of the Carboniferous and Permo-Carboniferous Invertebrates of New South Wales, vol. 2. part 1, the Palaeopectens. New South Wales Geol. Survey, Mem., no. 5, pp. 1-39, pls. 1-16.
- GERTH, H. (1950): Die Ammonoiden des Perms von Timor und ihre Bedeutung für die stratigraphische Gliederung der Perm-formation. Neues Jahrb., Abh., 91, Abt. B, pp. 233-320.
- GIRTY, G.H. (1910): The Fauna of the Phosphate Beds of the Park City Formation in Idaho. Wyoming, and Utah. U.S.G.S., Bull., 436, pp. 1-61, pls. 1-7.
- GRABAU, A. W. (1936): Early Permian Fossils of China II: Fauna of the Maping Limestone of Kwangsi and Kweichow. Palaeontologia Sinica, Ser. B. vol. 8,

fascicle 4. pp. 1-320, pls. 1-31.

- HANZAWA, S. and MURATA, M. (1963): The Paleontologic and Stratigraphic Considerations on the Neoschwagerininae and Verbeekininae, with the Descriptions of Some Fusulinid Foraminifera from the Kitakami Massif, Japan. Sci. Rep., Tohoku Univ., 2nd Ser. (Geol.), vol. 35, no. 1, pp. 1-31, pls. 1-20.
- HAYASAKA, I. (1925): On Some Paleozoic Molluscs of Japan. I. Lamellibranchiata and Scaphopoda. *Ibid.*, vol. 8, no. 2, pp. 1-26, pls. 1, 2.
- (1940): On Two Permian Ammonoids from the Kitakami Mountains. North Japan. Jour. Geol. Soc. Japan, vol. 47, no. 565, pp. 422-427.
- (1953): Younger Paleozoic Cephalopods from the Kitakami Mountains, Japan. Jour. Fac. Sci., Hokkaido Univ., Ser. 4, vol. 8. no. 4, pp. 361–374, pls. 22, 23.
- (1955): On the Permian Cephalopods from Japan (in Japanese). "Chigaku Kenkyu", vol. 8, no. 3, pp. 71-76.
- (1957): Two Permian Nautiloids from Takakura-yama near Yotsukura-machi, Fukushima Prefecture (Abukuma Plateau Region), Japan. Sci. Rep., Yokohama National Univ., Sec. 11, no. 6, pp. 21-30, pls. 8, 9.
- (1960): A New Permian Species of Foordiceras from the Kitakami Mountains. National Science Museum (Tokyo), Bull., vol. 5, no. 2, no. 47, pp. 87-94, pls. 11, 12.
- (1962): Two Species of Tainoceras from the Permian of the Kitakami Mountains. Ibid., vol. 6. no. 2, pp. 137– 143. pls. 11, 12.
- (1963): Some Permian Fossils from Southern Kitakami, III Ammonoidea. Proc. Japan Academy, vol. 39, no. 8, pp. 594-599.
- HAYASHI, J. (1937): Geology of the Environs of Yotsukura-machi and Hisanohama-machi and of the Aria in their West (in Japanese). (MS.) Graduation thesis, Inst. Geol. Pal., Tohoku Unir., Sendai.
- HIND, W. (1901-1905): Monograph of the British Carboniferous Lamellibranchiata,

Explanation of Plate 35

- Figs. 1-7. Acanthopecten onukii MURATA, n. sp.
 - External mold and gumtype of typical left valve, holotype. IGPS, coll. cat. no. 85745, ×1.5.
 - Loc. Shigeji-zawa, Kamiyasse. Kesennuma City. Miyagi Prefecture.
 - 2a, b. External mold and gumtype of a fragmental specimen of left valve, paratype. IGPS, coll. cat. no. 85756, $\times1$
 - Loc. Imô. Yahagi-machi, Rikuzen-takada City, Iwate Prefecture.
 - 5a. b. Internal and external molds of left valve, somewhat obliquely compressed. IGPS, coll. cat. no. 85749. ×1.

Loc. Hosoo-zawa, Kamiyasse, Kesennuma City, Miyagi Prefecture.

- 3a. 4a, b. 7a, 9a, b. External molds and gumtypes of fragmentary left valves, showing angular interspaces between the main ribs.
- 3. IGPS, coll. cat. no. 85761, x1.
- Loc. Same as fig. 1.
- IGPS, coll. cat. no. 85759, ×1.5.
 Loc. Same as fig. 5.
- IGPS. coll. cat. nos. 85760. 85758, ×1.5.
 Loc. Same as fig. 1.
- 3b, 7b. Enlarged view of figs. 3a and 7a to show details of angular interspaces between the main ribs. $\times 5$.
- 6, 8. Internal molds of strongly deformed left valves. IGPS. coll. cat. nos. 85747, 85754, ×1.

Loc. Kanayama-zawa, Imô, Yahagi-machi, Rikuzen-takada City, lwate Prefecture.

- Figs. 10a, b. Acanthopecten spinosus HAYASAKA
 - 10a, External mold of left valve. HAYASAKA's original specimen (HAYASAKA 1925, pl. 1, fig. 6), holotype IGPS, coll. cat. no. 22388. ×1.
 - 10b. Gumtype of holotype, ×1. Loc. Same as fig. 2. Kanokura formation. Middle Permian.
- Figs. 11-13. Acanthopecten cf. coloradoensis (NEWBERRY)
 - 11a, b. External mold and gumtype of an imperfect left valve. Науазака's original specimen (Науазака 1925, pl. 1, fig. 7). IGPS. coll. cat. no. 22408, ×1. Loc. Same as fig. 2.
 - 12. Internal mold of fig. 11.
 - 13a, b. External mold and gumtype of a fragmentary left valve. IGPS. coll. cat. no. 85734. ×1.5.
 Loc. Same as fig. 6.
 - Kanokura formation, Middle Permian.

Figs. 14a, b. Streblochondria miyamoriensis MURATA, n. sp.

- 14a. External mold of left valve, holotype. IGPS, coll. cat. no. 85733, ×1. Loc. Hiryu-yama, Miyamori-mura, Kamihei-gun, Iwate Prefecture.
 - 14b. Gumtype of holotype. Hiryuyama formation, Middle Permian.





Some Middle Permian Aviculopectinidae from the Kitakami Massif 469_{-} 233

vol. 2. Monographs of the Paleontographical Soc. London, 222 pp.

- JAKOWLEW, N. (1903) : Die Fauna der Oberen Abtheilung der Palaeozoischen Ablagerungen im Donez-Bassin. Mém. du Com. Géol., new ser., liv. 4, pp. 1-44, pls. 1, 2.
- KEYSERLING, A. von (1846) : Geognostische Beobachtungen, Wissenschaftliche Beobachtungen auf einer Reise in das Petschora-Land. St. Petersburg.
- LICHAREW, B. K. (1927) : The Upper Carboniferous Pelecypoda of Ural and Timan. Mém. du Com. Géol., new ser., liv. 164, pp. 1-126, pls. 1-6.
- MABUTE S. (1935): On the Occurrence of Stacheoceras in the Kitakami Mountainland. Northeast Honshu, Japan. Saito Ho-on Kai, Sendai. Museum, Research Bull., Geol., vol. 6, pp. 143-149.
- MANSUY, II. (1913) : Faunes des Calcaires à Productus de l'Indochines. Mém. Serv. Géol. Indochine, vol. 2, fascicule 4, pp. 1-133, pls. 1-13.
- M'COY, F. (1844) : A Synopsis of the Characters of the Carboniferous Limestone Fossils of Ireland. Dublin.

峠

森

- (1851) : Annals and Mag. Nat. History, 2nd ser., vol. 7, p. 171.

- (1855) : British Paleozoic Fossils.

- NAKAZAWA, K. (1960) : Two Permian Nautiloids from Japan. Jap. Jour. Geol. Geogr., vol. 31, nos. 2-4, pp. 121-127, pl. 10,
- NEWELL, N. D. (1937) : Late Paleozoic Pelecypods: Pectinacea. Kansas. State Geol. Surv., vol. 10. pp. 10-123, pls. 1-20.
- OZAWA, Y. (1927) : Some Carboniferous Fossils Collected in Manchuria and Korea. Jap. Jour. Geol. Geogr., vol. 5, pp. 77-93, pl. 7.
- PHILLIPS, J. (1836): Illustrations of the Geology of Yorkshire; Part II the Mountain Limestone District. London.
- STUCKENBERG, A. (1898) : Allgemeine geologische Karte von Russland. Blatt 127. Mém. du Com. Géol., vol. 16, no. 1, pp. 1-362. pls. 1, 2.
- UEDA. F. (1963) : The Geological Structure of the Permian and Triassic System in the Toyoma and Maiya Districts, Southern Kitakami Massif, Northeast Japan (in Toyo Univ., Jour., General Japanese). Education, no. 4, pp. 1-78.

Budô-zawa ブドー沢 Haritsuke Pass 蹳 Hiryu-yama 飛龍山 Hosoo-zawa 細尾沢 Imô 飯 Iwaizaki 岩 井 崎 Kamihei-gun 上閉伊郡 Kamishishiori 上鹿折 Kamiyasse 上八瀬 Kanokura-zawa 叶倉沢 Kesen-gun 気仙郡 Miyamori-mura 宮守村

Mono-gun	桃生郡
Obama	小浜
Ogachi-chô	雄勝町
Shigeji-zawa	茂路 沢
Sumita-chô	住田町
Tagara	田柄
Takakura yama	高倉山
Tenjinnoki	天神ノ木
Tome-gun	登米郡
Toya-zawa	戶屋沢
Towa-cho	東和町
Yahagi-machi	矢 作 町

470. ON THE OCCURRENCE OF *GONIATITES* (S.S.) FROM THE HIDA MASSIF. CENTRAL JAPAN*

HISAYOSHI IGO

Institute of Geology and Mineralogy. Tokyo University of Education and the Mejiro Gakuen Women's Junior College

岐阜県本郷産アンモナイト Gonialiles (s.s.): 岐阜県吉城郡本郷付近に発達する荒城川 剤群上部の本郷層より Gonialiles sp. を見出した。この未定種は G. striatus に近縁で、本 郷層の一部は Viséan に相当する可能性を論じた。 猪 郷 久 義

Introduction

As already summarized by KOBAYASHI (1958) and NAKAZAWA (1960), Paleozoic cephalopods are exceedingly rare in Japan and about 20 species have been described. During my field survey of the Hongo area, Kamitakara Village. Yoshiki County, Gifu Prefecture, a poorly preserved ammonoid was found from the Arakigawa Group (text-fig. 1). It is a fragmentary conch which was more or less deformed during fossilization. Fortunately, its suture line, both external and internal, and surface ornamentation are preserved enough to discriminate its generic position. Although it is not an excellently preserved specimen, it is worthwhile to record its occurrence, because it is the only reliable fossil to indicate the geologic age of the Arakigawa Group and moreover, is the first record of the occurrence of Goniatites (s. s.) in Japan.

Acknowledgements :-- I thank Drs. Haruyoshi FUJIMOTO and Wataru HASHI-



Text-fig. 1. Map showing fossil locality.

MOTO of the Tokyo University of Education and Kotora HATAI of the Tohoku University for their suggestions and reading of the manuscript. I am also indebted to Dr. Tadao KAMEI of the Shinshu University for his collaboration in the field. Part of the expenses of this study was defrayed from the Post Doctoral Fellowship of the Japan Society for the Promotion of Sciences.

^{*} Received July 29, 1963: read at the Meeting of the Palaeontological Society of Japan held at Fukuoka, May 23, 1959.

Stratigraphic Summary

The stratigraphy of this area has been worked out by KAMEI (1954). ISOMI and NOZAWA (1957) and IGO (1957). I subdivided the Paleozoic rocks distributed in this area into the following lithologic units in descending order.

Permian

Moribu Group Kurabashira Formation Sannose Formation Carboniferous Arakigawa Group Hongo Formation Kunimiyama Formation

The Arakigawa Group is typically distributed along the Arakigawa River and can be subdivided into the lower or Kunimiyama and the upper or Hongo The lower limit of the Formations. Kunimiyama Formation is uncertain and it is rather narrowly distributed and in fault contact with the Tertiary volcanic rocks. It consists of clayslate, purplish and pale green tuff intercalated with crystalline limestone lenses. Its thickness attains approximately 800 meters. Fossils are very rare, but crinoid stems and poorly preserved Fenestella-like bryozoans are found.

The next younger Hongo Formation consists chiefly of dark green pyroclastic rocks comprising diabasic tuff, agglomerate and lava. Recrystallized limestone lenses are frequently intercalated in several horizons. This formation attains more than 1,000 meters in thickness. Owing to the complicated geologic structure and lack of any reliable key bed, the stratigraphy of this formation is still obscure, however, there can be recognized three fossil horizons. The lowest fossil horizon is found in the south of Hongo and is the most fossiliferous one. The fossils are embedded in both dark green diabasic tuff including granule-size pebbles of volcanic rocks and dark gray crystalline limestone lens. The limestone lens has yielded huge-size solitary corals of which internal characters are almost destroyed by recrystallization. The general feature, size and arrangement of the septa of this coral shows resemblance with Kueichouphyllum or *Heterocaninia*. I discriminated the following fossils from a dark green tuff situated immediately below the mentioned coral limestone, namely:-Linoproductus? sp., Spirifer? sp., Schizophoria ? sp., Loxonema? sp., Fenestella? sp., Goniatites (s. s.) sp., "Phillipsia" sp. and Echinoidea and Blastoidea gen. et sp. indet. They are much deformed and their generic discrimination rendered impossible except for the specimen of Goniatites.

The crystalline limestone lenses occupying approximately the middle part of the Hongo Formation crop out in both the Hongo and Sannose areas and have yielded *Koninckophyllum*? sp., *Lithostrotion* (*Siphonodendron*) sp., and *Diphyphyllum* sp. These corals are considerably deformed by thermal as well as dynamic metamorphism and their detail internal structures are obscure.

The highest limestone crops out at the quarry of Matumoto north of Takayama City. According to SHIBATA (personal communication) *Fusulinella* sp. was once collected from this limestone. This limestone is also recrystallized and I could not find any fossil reliable for age determination or systematic taxonomy.

As mentioned above, owing to the poor fossil record the geologic age of the Arakigawa Group has not been settled, however, the lower part of the Hongo Formation is apparently equivalent to the Upper Viséan of Europe and its upper part ranges up to the Middle Carboniferous *Fusulinella* Zone with some reservation.

Palaeontological Note

It is well known that ammonoids are most useful fossils for stratigraphic zonation and for correlation interregional as well as intercontinental. The Upper Dinantian distributed in Germany, Belgium and northern England consists mainly of dark shale and siliceous limestone and has been called "Culm facies" or Kohlenkalk. The deposits of this facies have yielded abundant ammonoids and pelecypods, particularly "Posidonia", but are almost barren in corals and brachiopods such as used to zone the Avonian succession in southwestern England. Successful ammonoid zonation and correlation in the so-called Culm facies were demonstrated by BISAT (1924 etc) in England SCHMIDT (1925, 1928) in Germany and DELÉPINE (1928 etc) in Belgium.

According to them Goniatites (s. s.) is one of the most widespread and abundant fossils of the Carboniferous ammonoid genera, but it is restricted stratigraphically and is characteristic in the Beyrichoceras Zone and the Posidonia Zone. SCHMIDT's III Zone or Goniatites Zone is equivalent to both the Bevrichoceras and Posidonia Zones. Goniatites antiquatus, G. hudsoni, G. involutus, G. wedberensis, and G. maximus are important representatives in the Gonialites Zone (III α) or the Beyrichoceras Zone. The next younger III β or lower Posidonia Zone is characterized by the frequent yield of Goniatites crenistria, G. striatus and G. falcatus. Goniatites coronula, G. subcircularis and G. cresistriatus are from the $III\gamma$ or Upper Posidonia Zone.

As will be described below Goniatitessp. from the Hongo Formation is more closely related with Goniatites striatus and G, sphaericus than to any other described species. Therefore, Goniatitesbearing fossil bed in the lower part of the Hongo Formation apparently corresponds with the Upper Viséan Posidonia Zone or SCHMIDT'S III β Zone in western Europe.

Description of Fossil

Genus Goniatites DE HANN, 1826 Goniatites sp. indet.

Text-figs. 2-4.

Surface covered with fine continuous longitudinal lirae, numbering about seven within three millimeters space. Prominent constrictions present, slightly sinus, shallow and about one millimeter wide.

External suture line forms rather broad ventral lobe indented to about one-half its length by a narrow trapezoidal dentated ventral saddle; extension of ventral lobe sharply pointed; first lateral saddle not as wide as ventral lobe and with subangular crest; first lateral lobe narrow, V-shaped with convex sides and pointed; second lateral saddle an asymmetrically rounded and dorso-lateral lobe sharply pointed Vshape with slightly concave sides and continue to umbilical seam.

Remarks:—Specific subdivision of Goniatites (s. s.) are for the most part based on the differences in surface ornamentation. The present material stands very close to Goniatites striatus (SOWER-BY) in surface ornamentation and suture line, and it is thought to be quite conspecific, however, owing to the poor preservation its naming is reserved until better materials are found. The present Goniatites sp. differs from G. striatus described from Europe in the narrow ventral saddle, narrow and sharply



Text-figs. 2. 3. Goniatites sp. indet. 2. Internal mold of conch, $\times 2$: 3, external mold of conch showing striatus-type surface ornamentation, $\times 3$.



Text-fig. 4. Suture line of Goniatites sp. indet., ×2.5.

pointed first lateral saddle and broad first lateral lobe of the former species. The present specimen is also related to G. sphaericus (MARTIN) in surface ornamentation and suture line, but G. sphaericus has the ventral lobe slightly lower than G. sp. There is a high possibility of the secondary lateral compression of the suture line in this specimen, thus the direct comparison of the suture lines of them is difficult. The American species G. kentukiensis MILLER and G. choctauensis SHUMARD are also similar to the present material.

Occurrence:—Along the small creek south of Hongo Temple, Hongo, Kamitakara Village, Yoshiki County, Gifu Prefecture (approximately 36°16′40″ N. Lat., 137°21′40″ E. Long.).

Repository:—Collection of the Institute of Geology and Mineralogy, Tokyo University of Education. Reg. no. 21730.

References

- BISAT, W.S., (1924): The Carboniferous goniatites of the north of England and their zones: Yorkshire Geol. Soc. Proc., N.S., v. 20, p. 40-124, pls. 1-10.
- .-..., (1928): The Carboniferous goniatites zones of England and their continental equivalent: Cong. strat. carbonifere. Heerlen, 1927. Compte rendu. p. 117-133. pls. 6, 6a.
- —, (1934): The goniatites of the Beyrichoceras Zone in the north of England: Yorkshire Geol. Soc. Proc., N.S., v. 22, p. 280-309, pls. 24-27.
- —. (1952): The goniatite succession at Cowdale Clouth. Barnoldswick. Yorkshire: Leeds Geol. Assoc., Trans., v. 6, p. 155-181, pls. 1-3.
- CURRIE, E., (1954) : Scottish Carboniferous goniatites : Roy. Soc. Edinburgh, Trans., v. 62, p. 527-602, pls. 1-4.
- DELÉPINE, G., (1928) : Les faunes du Dinantien de l'Europe occsidentale : Cong. strat.

carbonifere, Heerlen, 1927, Compte rendu, p. 223-233.

- —. (1930): Les zones a goniatites du Carbonifere: Soc. Geol. France, Livre Jubilaire (1830-1930), tome 1. p. 213-233.
- —. (1940): Les goniatites du Dinantien de les Belgique: Mus. Roy. Hist. Nat. Belg., Mém., 91, p. 1-91, pls 1-5.
- FOORD, A. H., (1897-1903): Monograph of the Carboniferous Cephalopoda of Ireland: *Pal. Soc.*, p. 1-234, pls. 1-29.
- —. and CRICK, G. C., (1897): Catalogue of the fossil Cephalopoda in the British Museum (Nat. Hist.): pt. 3, p. 13-303. (Ammonoidea), text-figs. 1-145. London.
- 160, H., (1957): Geology of the castern Hida Massif: Unpublished Master of Science Thesis of Tokyo University of Education.
- ISOMI, H. and NOZAWA, T., (1957): Explanatory text of the geological map of Japan, scale 1:50.000 "Funatzu": Geol. Surv. Japan, p. 1-43.
- KOBAYASHI, T., (1958) : A Gotlandian nautiloid from Hida plateau in Japan : Pal. Soc. Japan. Trans. Proc., N. S., no. 31, p. 248-252, pl. 37.
- MILLER, A. K. and FURNISH, W. H., (1940): Studies of Carboniferous ammonoids. pts. 1-4: Jour. Paleont. v. 14, p. 356-377, pls. 45-49.
- —, —, and SCHINDEWOLF, O. H., (195-): Paleozoic Ammonoidea: in MOORE's Treatise on Invertebrate Paleontology, Pt. L, Mollusca 4, Cephalopoda, Ammonoidea: Geol. Soc. America and Univ. Kansas Press.

p. L11-L79.

- NAKAZAWA, K., (1960) : Two Permian nautiloids from Japan : Jap. Jour. Geol. Geogr., v. 31, p. 121-127, pl. 10.
- PHILLIPS, J., (1836): Illustrations of the geology of Yorkshire, or a description of the strata and organic remains: Pt. 2, The Mountain Limestone District: p. 1-253, pls. 1-25, London.
- PLUMMER, F. B. and SCOTT, G. (1937): Upper Paleozoic ammonoides in Texas: The geology of Texas, v. III. pt. 1. Texas Univ. Bull., 3701, p. 1-516, pls. 1-41.
- SCHMIDT, H., (1925): Die carbonischen Goniatiten Deutschlands: Jahrbuch. preuss. Geol. Landesant, v. 45, p. 489-609, pls. 19-26.
- (1928): Biostratigraphie des Karbon in Deutschland: Congr. strat. carbonifere. Heerlen, 1927. Compte rendu, p. 663-672, pl. 16.
- SELLER, D. H. A. and FURNISH, W. H., (1960): Mississippian ammonoids from northwestern Canada: *Jour. Paleont. v. 3.4*, p. 1124-1128, pl. 141.
- SMITH, J. P., (1903): The Carboniferous ammonoid of America: U. S. Geol. Surv. Mon., 42, p. 1-211, pls. 1-29.
- WEDEKIND, R., (1918): Die Genera der Palaeoammonoidea (Goniatiten): Palaeontogr., Bd. 62, p. 85-184, pls. 14-22.
- YIN, T. H., (1935): Upper Palaeozoic ammonoids of China: Pal. Sinica, ser. B, v. 11, fasc. 4, p. 1-52, pls. 1-5.

Arakigawa	荒城川	Matumoto	松本
Kamitakara	上 '我	Moribu	森部
Kunimiyama	国見山	Takayama	离山
Kurabashira	藏柱	Yoshiki County	吉城郡
Hongo	本郷		

PROCEEDINGS OF THE PALAEONTOLOGICAL SOCIETY OF JAPAN

日本古生物学会第 87 回例会および「新生代後半 の植物地理」についてのシンポジウムは 1964 年 6 月 7 日(日)京都大学理学部地質学教室において開 催された(参加者 30 名)。

個 人 講 演

Muro Group in the Kii Peninsula, Japan

(代読)Hiroo NATORI
A Cretaceous Trigonid from the Miocene
Misaki Formation in the Miura Penin-
sula, Kanagawa Prefecture (代読)
Yasumochi Матова
A Rudistid from the Cretaceous Deposits
of Ryoseki. Kochi Prefecture. Shikoku
(代読)Seiji SAITO
Palynological Study on the Alluvial Depo-
sits from Imizu Plain, Toyama Pre-
fectureNorio Fuji
The Miocene Noroshi Flora of Noto, Japan
Shiro Ishida

シンポジウム「新生代後半の植物地理」

新第三新	<u></u>	石田志朗
第四紀	とくにその前半	粉川昭平
第四紀。	とくにその後半	藤 則雄
現 世		北村四郎

PALAEONTOLOGICAL SOCIETY OF JAPAN SPECIAL PAPERS (NUMBER 11) を 1965年 度に刊行したく、その原稿を公募します。適当な原稿をお持ちの方は、次の事項に合わせて申込書を作成し、 東京大学理学部地質学教室気付、日本古生物学会宛に申し込んで下さい。

- (1) 古生物学に関する論文で、欧文の特別出版にふさわしい内容のもの。分量は従来発行の特別号に経費 上ほぼ匹敵すること。学会から支出できる経費は、毎年の予算により若干ちがいますが、従来の例に よると、多くても 20~30 万円程度です。学会以外からも経費が支出される見込のある場合には、そ の金額に応じて上記よりも分量が多くてもよい。
- (2) 内容、文章ともに十分検討済の完成した原稿(または完成間近い原稿)で、印刷社に依頼して正確な 見積りを算出できる状態にあること。なるべく原稿の写しを申込書に添えて提出して下さい。(用済の上は返却します。)
- (3) 申込用紙は自由ですが、次の事項を記入し、〔 〕内の注意を守って下さい。
 - (a) 申込者氏名: 所属機関または連絡住所。〔会費完納の本会会員であること。〕
 - (b) 著者名と論文題目 〔和訳を付記すること。〕
 - (c) 研究内容の要旨 [600~1200 字程度。]
 - (d) 内容ならびに欧文が十分検討済であることの証明。〔校閲者の手紙でもよい。〕
 - (e) 本文の頁数(刷上り見込頁数または原稿で欧女タイプパイカ字体 25 行詰の場合の枚数), 挿図・表の各々の数と刷上り所要頁数,写真図版の枚数。
 - (f) 上記に対する印刷社の見積書。〔欧文学術出版の経験を十分持つ信頼できる印刷社に依頼すること。適当な印刷社の心当りのない場合には、原稿またはその写しを提出して下されば、 学会から印刷社に依頼して見積書を作成させます。〕
 - (g) 他からの経費支出の見込の有無、その予算額、支出源。[その見込の証明となる書類または その写しを添えて下さい。] [1965 年度の文部省の刊行助成金を申請希望の場合も、その旨 を上記に準じて添記して下さい。]
 - (h) その他参考事項。 原稿が未完成の場合には、申込時における進行状況ならびに完成確約年 月日を必ず記して下さい。
- (4) 申込締切 1964年11月15日(沿印有効)。採否は1965年1月の評議員会で審議決定の上申込者に 回答の予定です。ただしその前または後に、申込者との細部の交渉を、編集委員から求めることがあ るかもしれません。
- (5) 印刷予定 論文が完全な場合には、決定後できるだけ早く印刷にとりかかる予定です。文部省の刊行 助成金(「研究成果刊行費補助金」)を申請希望の場合には、学会から申請(例年は2月上旬中に申請 締切)し、その採否、金額など決定後印刷にとりかかります。その場合は会計事務上の必要から、10 月中に初校を出すことになっています。

[註] 1964 年度の特別号(No. 10)の公募に対しては、5 件の申込がありました。いずれもすぐれた内容 で、申込者各位にお礼申し上げます。原稿の完成度が高く、かつ諸条件、とくに予算的に見合うものを選定 した結果、T. TANAI and N. SUZUKI: Late Tertiary Floras from Northeastern Hokkaido, Japan を出版することになりました。選外となられた方でも、上記諸項目に合わせて、1965 年度の公募に対し再度 申込むことは可能です。

240

例 会 • 年 会 通 知

		開催地	開催日	講演申込締切日
:	第88回例会	広島大学	1964年9月20日	1964 年 8 月 20 日
	第89回例会	北海道大学	1964年11月上旬	1964年10月1日

第88回例会(広島大学):「ジュラ・白亜紀の動物化石群の変遷」についてのシンポジウム。

(世話人 今村外治) (世話人 未定)

第89回例会(北海道大学): 題未定

١

2011 **.**

-

会員消息

· · ·

○ 会員高井冬二・鎮西清高の両君は東京大学西アジア洪積世人類遺跡調査団に参加し、鎮西団員は6月中 旬イタリプ経由で、高井副団長は7月下旬ソ連経由で目的地イスラエルに出発する。

News

● 会員張麗旭君の研究に中華民国教育部(女部省)民国 52 年(1963 年) 度会学術文芸奨金が授与された。

· .

1964年6月25日 印 剧	東京大学理学部地質学教室内
1964年6月30日 発 行	日本古生物学会
日本古生物学会報告・紀事	編集者 高 井 冬 二 発行者 市 川 健 雄 (短秋山座東京84780 愛)
新篇第54号	印刷着東京都港区芝片門前2/13
400円	学術図書印刷株式会社富田 元

購読御希望の方は本会宛御申込下さい

日本古生物学会報告紀事出版規定

(1964年1月18日改正)

1. 投稿規定

- 1. 原稿は日本古生物学会の年会または例会において講演(代読を認める)したものに限る。
- 原稿は欧文に限り、タイプライター用紙 (22.5×27.5 cm) にパイカ字体で1 行おきに明瞭にタ イプライトし、学名はイタリックに著者自身指定する。
- 3. 原稿(挿図・地図・付表を含む)は24印刷頁(タイプライター用紙約60枚)を限度とする。
- 4. 図版 (14.2×20.0 cm) は2枚を限度とする。
- 5. 挿図は10 偶合計60 坪(1 坪は1平方寸)を限度とし、白紙に墨または製図用黒インクにて明瞭 に書き、図中の字はなるべく活字又はタイプライター字をはりつける。印刷に際して縮図するこ とがあるから、線の太さ、字の大きさなどはこの点を充分に考えに入れて書く必要がある。
- 6. 地図には必ず縮尺をつける。縮尺何分の1としたものはいけない。
- 以上の限度を超える場合は著者がその費用を負担する。また原稿が4印刷員までの場合には挿図 2個合計18坪をこえる挿図および図版の費用を著者が負担する。
- 8. 原稿には邦文表題と簡単な邦文要約を付記する。
- 9. 引用文献はすべての文の最後に文献の項を設けてそこに一括する。文献は著者名のアルファベット順に配列し、同一著者の論文は発表年代順とする。著者名・発表年・論文表題・雑誌名・巻・ 頁・図版・挿図・地図・付表等を正確に記入する。
- 10. 原稿には著者名の次に現在の所属機関名を付記する。
- 11. 1印刷頁以内の短報(挿図・地図・付表を含む)は余白あり次第、受理日付の順に掲載する。
- 12. 別刷の必要部数を原稿に付記する。但し無表紙 100 部までは無償で、それ以上は 著者がその費用 を負担する。
- 13. 原稿は著者の責任において外人または適当と認められる人に見て貰う。
- 11. 扁巢規定
 - 1. 編集委員は原稿の受理・保管・編集を行う。
 - 編集委員は原稿を受理した場合、その原稿が鮮明であり且つ其の他形式上の不備の無いことを確認した上で直ちに受理日付を記入し、著者には保管証を送る。
 - 3. 原稿の採用不採用は会長と常務委員との合議により決定する。
 - 4 編集委員は不採用原稿を不採用の理由を付記して著者に返却する。
 - 5. 編集委員は採用原稿を出版費に応じて、受理日付の順に掲載する。
 - 6. 著者が編集前に論文内容を訂正した場合には受理日付を変更する。
 - 7. 校正は出版委員の責任においてこれを行う。