PERMIAN CORALS OF MIHARANORO (AN UPPER PALAEOZOIC FAUNA FROM MIHARANORO, HIROSHIMA PREFECTURE, JAPAN. 4TH NOTE)

by

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(with 2 plates)

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Corals are not seldom found amongst fossils at Miharanoro. But they appear to be not rich in the number of species. So far only one species, *Lonsdaleoides nishikawai* HAYASAKA & MINATO has been described from Miharanoro (HAYASAKA & MINATO, 1966; MINATO & ROWETT, 1968).

Solitary corals are in general not abundant there, but colonial forms have been rather commonly met with. Mr. I. NISHIKAWA collected a number of corals from white gray, massive limestone of Miharanoro and trusted them to the author for study. The following two species are discriminated and treated in the present article.

Amandophyllum sp. Loc. 2072

Yokoyamaella (Yokoyamaella) yokoyamai (OZAWA)
Locs. 2031, 2032, 2024.

Both corals are denoting the Lower Permian age. And forms comparable or identical with these species have been reported from Lower Permian limestones in southwest Japan. Thus they prove to be useful in stratigraphical correlation.

The author wishes to thank Mr. I. NISHIKAWA for kindly donating his collection for study. Thanks are due to Professor M. MINATO for his guidance and instruction. Mr. S. KUMANO took the photographs herein illustrated and Mr. I. KAWASAKI prepared thin sections of corals.

All the specimens described are now stored at the Departent of Geology and Mineralogy, Faculty of Science, Hokkaido University. Registration numbers are indicated with the prefix UHR.

Description of Species

Family Durhaminidae MINATO & KATO, 1965

Genus *Amandophyllum* HERITSCH, 1936

Amandophyllum sp.

plate 1, fig. 1

Compare with *Huangia* sp. A of YOKOYAMA, 1960, p. 244, pl. 27, figs. 2a-b.

Description: A slightly oblique, transverse section is at hand. (UHR 19679)

Corallum simple, and is giving somewhat quadrate outline, as a part of the peripheral portion is considerably eroded away. Corallite measures 16 mm in short diameter.

Axial structure is situated excentrically, and one side of the corallite is reduced in the width of both tabularium and dissepimentarium. To this side a median septum which nearly bisects the axial structure is extended. And the side is presumably cardinal side and the concave side of the corallum is also to be located on this side.

Wall is thin, smooth, and fibrous as far as it is preserved. A part of the wall is encrusted by bryozoan fossils.

Dissepimentarium is narrow, occupies only one to two mm. in the width in presumable cardinal quadrants. Dissepiments are rather irregular in shape, and are arranged in herringbone and psendoherringbone pattern between septa. No lonsdaleoid dissepiments are observed. Differentiation of dissepimentarium from tabularium is not clear, but a little thickening is observed on the inner side of dissepimentarium in the "Cardinal" quadrants.

Tabularium is wide, almost 13 mm in diameter, consists of uparched tabellae towards the axial structure.

Septa are in two orders. They are diffuso-trabecular in their fine structure, thin, only slightly thickened in the median portion of septa. Major septa are 32 in number, extending towards the axial structure, and some of which are intruded in the latter structure. Minor septa alternate with the major, but are a little obscure in the area where dissepiments are well developed. These minor septa are confined in the dissepimentarium. While minors are a little protruded into the tabularium in the quadrants where dissepiments are narrowly represented.

Axial structure is wide, 5 mm in diameter, but is not well differentiated from tabularium. The axial structure is composed by a median septum, as already stated, and a few septal lamellae, some axial ends of septa and axial tabellae which are convex outward. Axial tabellae are small and numerous on one side of the axial structure, while they are irregular, large and sparse on the other side.

No distinct fossula is observed. But the length of major septa is gradually shortened in the "Cardinal" quadrants. One of major septa, which is presumably the cardinal septum, is connected with the median septum of axial structure.

Remarks: Huangia sp. A of YOKOYAMA (1960) from the Taishaku limestone is probably identical with the present form. But the ill preservation of his

material prevents to make a more detailed comparison between the two.

No other previously recorded species of *Amandophyllum* is readily comparable with the present form.

The form now under consideration is provided with a relatively large corallum with somewhat clearly represented median septum. This character is lacking in the typical forms of *Amandophyllum*. But from the nature of dissepimentarium the present form is better retained in the genus *Amandophyllum*, and not to place under the genus *Dibunophyllum*.

All the hitherto reported species of *Amandophyllum* occur from the *Pseudoschwagerina* zone of Lower Permian, and so is the case in the present form.

Family Waagenophyllidae WANG, 1950

Genus *Yokoyamaella* MINATO & KATO, 1965

1965: *Yokoyamaella* MINATO & KATO, p. 135

Type species: *Lonsdaleia (? Waagenophyllum) yokoyamai* OZAWA, *1925*

Subgenus *Yokoyamaella* MINATO & KATO, 1965

MINATO & KATO (1965) proposed a new genus *Yokoyamaella* for massive waagenonphyllids provided with exceptionally thick wall of mural septa and only two orders of septa. Lonsdaleoid dissepiments may develop in the genus. Only cerioid forms are grouped together under the subgenus *Yokoyamaella*.

Several species herein included in *Yokoyamaella (Yokoyamaella)* have been hitherto classified as *Stylidophyllum*, *Wentzelella* or *Ipciphyllum*. *Stylidophyllum* is a synoym of *Actinocyathus*, which is cerioid *"Lonsdaleia"*, and Lower Carboniferous in age (KATO, 1966). These older Lonsdaleiids have been conjectured to have Thysanophylloid ancestry. While *Wentzelella* and *Ipciphyllum* are both genuine Waagenophyllids, yet the former possesses tertiary or more order of septa, whereas the latter shows thin wall. Thus these generic names are clearly unavailable to the forms for which *Yokoyamaella (Yokoyamaella)* is applied. Some forms of *Wentzelophyllum* have thick wall and look similar to cerioid *Yokoyamaella*. But these forms show large lonsdaleoid dissepiments and numerous denticulation on the wall, which may be indicative of the presence of the third order of septa.

In Japan *Yokoyamaella (Yokoyamaella)* is found in association with such fusulinid foraminifers as *"Pseudofusulina"* and *Triticites*. It is considered to range from *Pseudoschwagerina* to *"Pseudofusulina"* zones of Lower Permian in fusulinid zonation.

The following nominal species have been reported and are treated here as

members of *Yokoyamaella (Yokoyamaella)* in Japan.

yokoyamai = *Lonsdaleia* (? *Waagenophyllum*) *yokoyamai* OZAWA, 1925
japonica = *Polythecalis japonica* YABE & MINATO, 1945
= *Stylidophyllum sikokuense* MINATO, 1955
tertioseptata = *Stylidophyllum yokoyamai tertioseptatum* YOKOYAMA, 1960
matsunagiensis = *Stylidophyllum matsunagiense* YAMAGIWA, 1962
shimoyukawensis = *Wentzelella shimoyukawensis* YAMAGIWA, 1962
kurohime = *Yokoyamaella (Yokoyamaella) kurohime* MINATO & KATO, 1965

Yokoyamaella (Yokoyamaella) yokoyamai (OZAWA)
pl. 1, figs. 2a-c; pl. 2, figs. 1, 2a-e.

1925: *Lonsdaleia* (? *Waagenophyllum*) *yokoyamai* OZAWA, p. 72, pl. XIII, figs. 5-6.

For further synonymy see MINATO & KATO, 1965a, p. 136

Materials: Each one colony from Localities 2024, (UHR 19682), 2031 (UHR 19680) and 2032 (UHR 19681) respectively.

Description: Corallum compound, cerioid and massive, attains 4.5 cm in long diameter in the largest corallite at hand, as far as it is preserved.

In transverse section, corallites are polygonal, mostly 5 to 6 sided. Each corallite is consisting of thick wall, comparatively narrow dissepimentarium, wide tabularium and axial column.

Axial structure is round to oval in outline, measures 1.5 to 1.7 mm in short diameter, which may reach up to 2 mm. It is composed of a short median septum if present, several short septal lamellae and 5 to 6 rows of axial tabellae which are convex outward. The size of tabellae is variable. They may be small, but often quite large. Axial column is differentiated well from tabularium. It is quite free from the axial ends of major septa except for the axial elongation of cardinal septum which sometimes touches and is connected with the median septum in the axial column.

Septa are in two orders. In fine structure they are diffuso-trabecular. The axial ends of them are often a little swollen and rhopaloid. Major septa number 18 to 22, and commonly 20. And majors extend near to the axial column with which only the cardinal septum is occasionally connected, as above stated. New insertion of septa occurs at the counter side of each alar septum and in the both sides of the cardinal septum. Septa are in general radially arranged, but show somewhat pinnate arrangement when some short major septa are newly

inserted. Minor septa alternate with the major, and intruded into the tabularium. They attain 2/3 to even 4/5 the length of the major. Septa are straight in the tabularium, and are often greatly thickened by intrathecal dilation. They are however sinuous or zigzag and sometimes discontinuous in the dissepimentarium. Zigzag or sinuous septa give an appearance of carinae like projections to the septa. Septa are connected to the wall unless lonsdaleoid dissepiments develop in various degree and septa become crestal.

Tabularium is wide, 4 to 6 mm in short diameter. Cut edges of tabulae are seen between septa. But the intrathecal dilation may completely mask the structure of tabularium, because it leaves no space for other skeletal elements to be observed.

Dissepimentarium is relatively narrow, where concentric dissepiments are arranged in 2 to 3 rows. Lonsdaleoid dissepiments are developed especially at the corner of each corallite where dissepimental vesicle is not large as in the case of *Wentzelophyllum* or in *Lonsdaleia.*

Wall is very thick, and is the type of mural septa which is the lateral coalition of the peripheral part of septa. Septa became multitrabecular at their periphery finally to form mural septa. Internal margin of the wall may be bead shaped or may be denticulated where lonsdaleoid dissepiments develop.

Increase is peripheral. A new bud is occurring in the dissepimentarium of a parental corallite. In the course of corallum growth, young corallites tend to arrange in the periphery of the corallum, so that they may give an appearance as if the corallum is composed of small corallites (pl. 2, fig. 1).

In one corallum (UHR 19680), ontogenetical change can be seen through a series of transverse sections.

Compound corallum definitely originates from a single corallite which is morphologically identical with genuinely solitary *Pavastehphyllum.* In this initial corallite intrathecal dilation is so strong that major septa are in contact laterally. Strong dilation is also indicated by fibres perpendicular to the outer configuration of the axial column. In dissepimentarium and in the axial column dilation is not observed.

A new bud is then sprung out in the periphery of the initial parental corallite. and the corallite of this new bud is composed of radially disposed and laterally coalesced thick septa, avoiding the trace of axial structure. Wall dividing the new bud from the parental corallite already exists (pl. 2, fig. 2a).

In the next stage, the new corallite is to develop axial column which is only composed of a few rings of concentrically arranged tabellae. Two neighbouring septa, one of which is presumably the cardinal, extend to the centre of corallite as if they partly surround the said axial structure. Dissepimentarium is apparently not differentiated yet (pl. 2, fig. 2b).

In the next an axial column with a median septum and several lamellae and tabellae is formed, and it is well differentiated from the axial ends of major septa which continue to be thickened. Minor septa and dissepiments are newly introduced, and the latter of which partly show lonsdaleoid nature. Meanwhile the intrathecal dilation in a parental corallite is reduced and lonsdaleoid dissepiments are a little developed.

In a mature stage, the axial column is large and is provided with numerous axial tabellae which are convex outward, and a number of septal lamellae. Median septum is not conspicuous in mature corallite. In some corallites thickening is great in the axial structure, but not in the tabularium.

Fine structure of septa is diffuso-trabecular throughout the ontogeny and no dark lines are observed between adjacent corallites.

In longitudinal section, thick wall, dissepimentarium, tabularium and axial column are clearly discernible. The axial column is composed of dome shaped axial tabellae, discontinuous septal lamellae and sometimes a sinuous median septum. As a whole the axial structure is dilated on its external surface, and is differentiated from tabularium.

Wall is very thick, and consists of divergent fibre fascicles of trabeculae in the mode of "convex upward" (KATO, 1963). Yet true dividing wall of dark, thin layer is not at all detected. Therefore wall between the neighbouring corallites gives an appearance of composite trabeculae.

Tabularium is wide, consists of rather sparsely arranged clinotabulae and tabellae, and less inclined transverse tabulae. Sometimes the tabularium is completely filled by sclerenchymal deposits which are constructed by fibres perpendicular to the surface of such skeletal elements as clinotabulae.

Septa are judged to be concave upward in the vertical arrangement of fibres and henceforth in the peripheral portion of each septum.

Remarks: The species shows considerable variation in some of its skeletal elements. Especially the difference in the degree of dilation may give totally different appearance to each corallum. Thus three specimens illustrated in the present article may be apt to be treated as representing three different species. Yet statistical treatment reveals that they are quite identical in the range of the diameters of corallite, tabularium, axial column and dissepimentarium, and in the number of major septa. As a whole they are conspecific with the type specimen of *Yokoyamaella (Y.) yokoyamai.*

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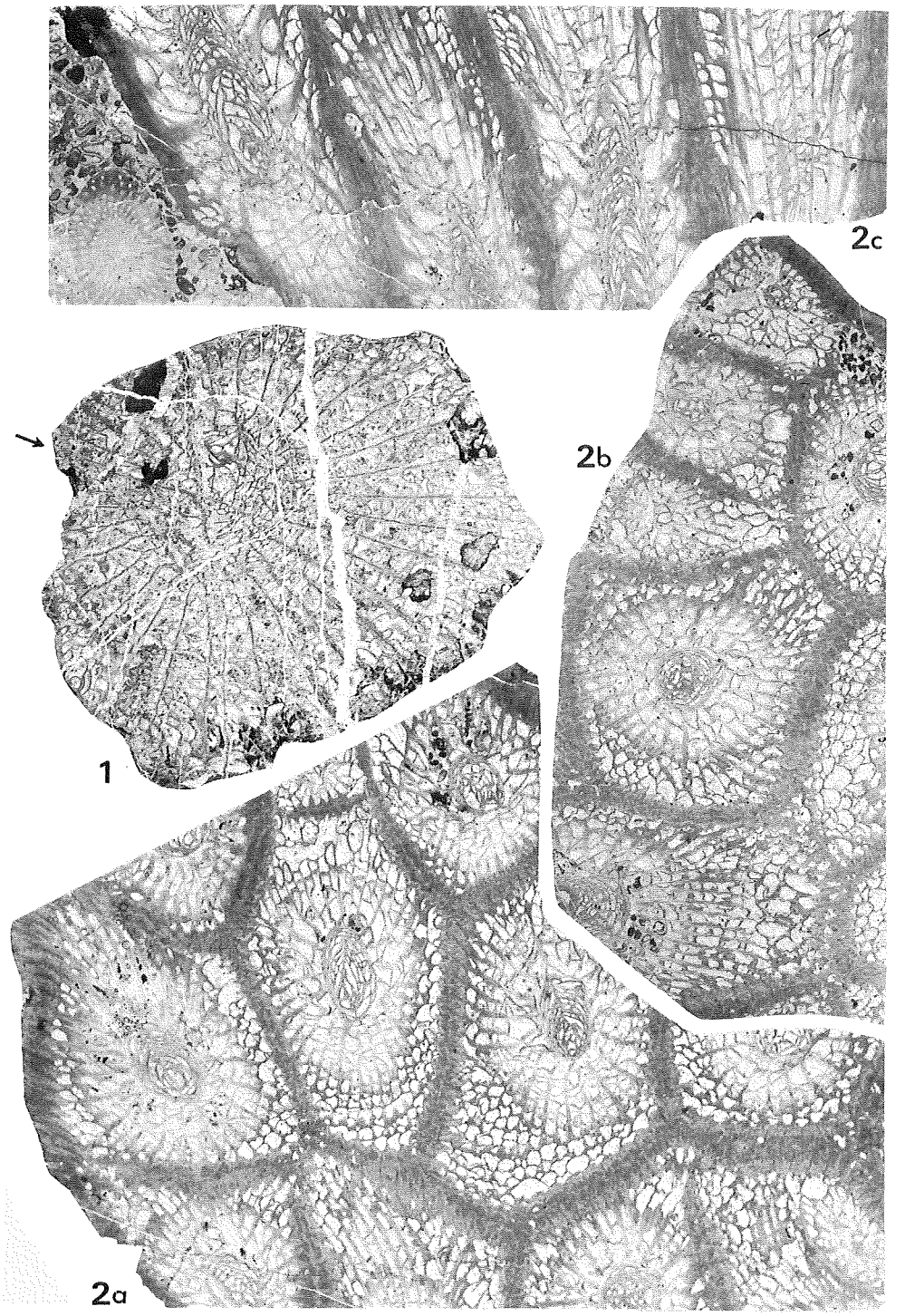
Explanation of Plate I.
(All figures 4 times natural size)

Fig. 1: *Amandophyllum* sp.
Transverse section, slightly oblique.
An arrow indicates the site of the cardinal septum which unites with a median septum of axial column. UHR. 19679, Loc. 2072, Miharanoro.

Figs. 2a-c: *Yokoyamaella (Yokoyamaella) yokoyamai* (OZAWA)
2a – Transverse section showing a new bud in the perphery of a corallite at the right corner. UHR 19681-a.
2b – Transverse section showing that the thick wall partly becomes obsolete in some corallites. Also carinae like projections are to be seen in the periphery of some corallites. UHR 19681-b.
2c – Longitudinal section. UHR 19681-c.
All from Loc. 2032, Miharanoro.



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Explanation of Plate II.

(All figures 4 times natural size)

Fig. 1: *Yokoyamaella (Yokoyamaella) yokoyamai* (OZAWA)
Transverse section showing the margin of a corallum where small corallites are assembled. UHR 19682. Loc. 2024.

Figs. 2a-e: *Yokoyamaella (Yokoyamaella) yokoyamai* (OZAWA)
Serial sections from a small corallum (UHR 19680) from Loc. 2031.

2a – Transverse section. A new bud is beginning to develop in the periphery. Dilation is strong in the tabularium.

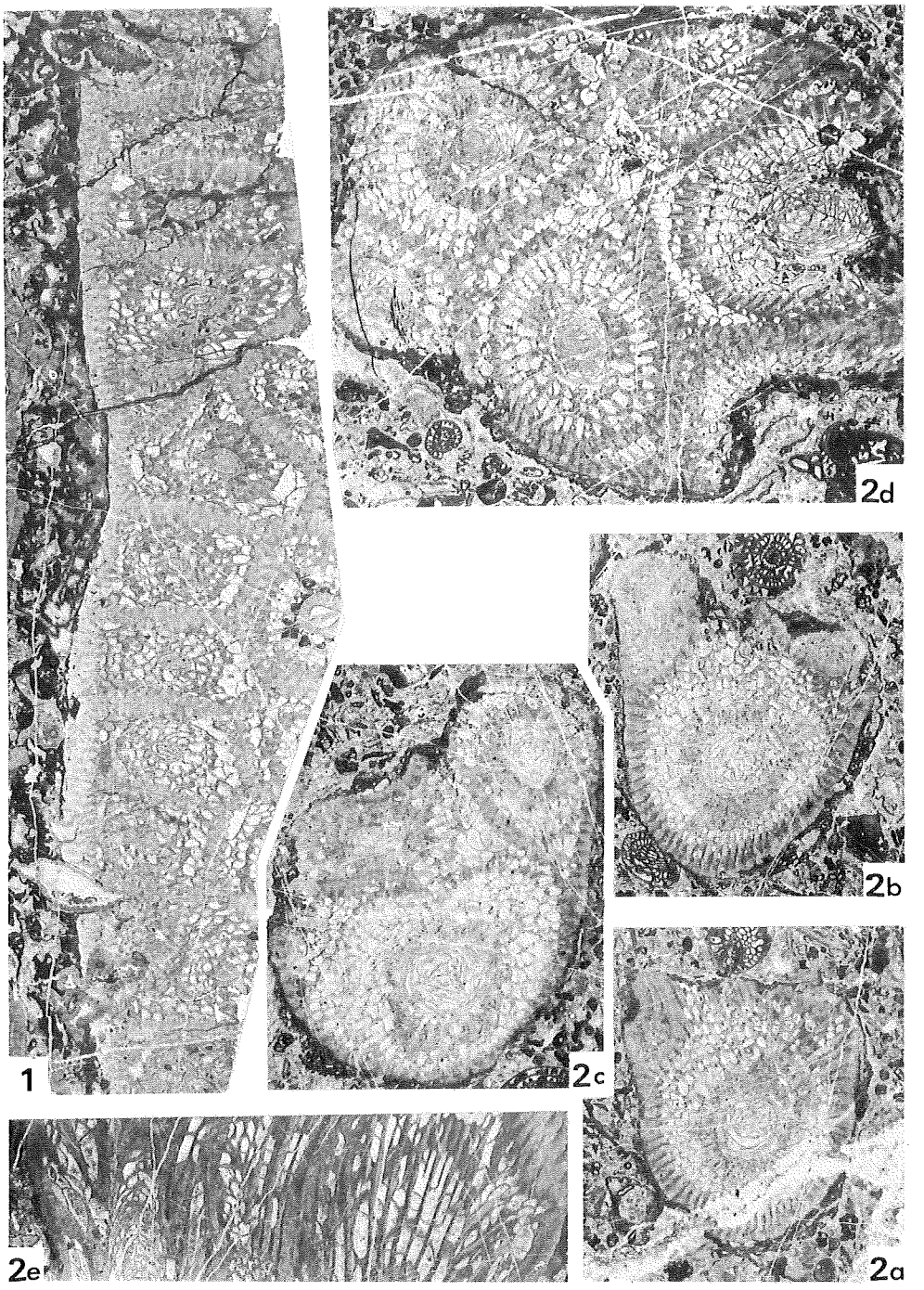
2b – In transverse section two buds are to be seen much dilated.

2c – Transverse section. Dilation in the tabularium of the parental corallite is reduced. Dissepimentarium and minor septa begin to develop in one of new buds.

2d – Transverse section. Mature corallites show little dilation in the tabularium but considerable thickening in the axial column.

2e – Longitudinal section showing the vertical arrangement of fibres in a septum.

plate 2



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