Jour. Fac. Sci., Hokkaido Univ., Ser. IV,
vol. 17, no. 4, Aug., 1977, pp.555-573.

A NEW TABULATE CORAL FROM THE LOWER DEVONIAN OF JAPAN

by

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(with 8 plates and 2 text-figures)

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Abstract

A new tabulate coral named as *Ohnopora hayasakai* is described. This is found at the lower part of the Ohno formation, typically developed at Ohno, Kitakami mountains. It somewhat resembles *Syringolites*, but may be generically distinct from the latter. Age may be the Lower Devonian.

Introduction

The tabulate coral to be described below was collected by the senior author in 1950 at Ohno, Iwate Prefecture, the type locality of the Ohno formation (Yabe and Sugiyama 1937), presumably Lower Devonian in age, when he was mapping there on this formation. The fossils were unexpectedly found as a few fragmental specimens in the tuffaceous sandstone in association with various sized crinoid stems.

The material was quite imperfect. The senior author has long been waiting to find more specimens of this coral but in vain. Thus the senior author decided to describe this older material in cooperation with the junior author. As a matter of fact, this coral was previously thought by the senior author to be somewhat resembling a tabulate coral belonging to the genus *Thecostegites* Edwards & Haime 1849 (Minato et al, 1959).

In a careful recent study, however the authros became aware of this tabulate coral to be more nearly related to the genus *Syringolites* Hinde 1879, than *Thecostegites* although our material may be generically distinct from both of them. The authors would like to name the Japanese coral as *Ohnopora hayasakai.* The generic name is derived from the name of the locality where the coral was found, while the specific name is dedicated to our teacher, Professor emeritus I. Hayasaka who is a pioneer of the study of the Palaeozoic corals of our country.

Acknowledgements

Before going into description the authors wish to thank Messers I. Niikawa, M. Kawamura and K. Kamada, graduate students of our department who kindly helped us in making many serial replicas of the polished surface of certain part of corallites. The senior author is specially grateful Dr. D. Hill, University of Queensland, St. Lucia for her kind suggestions given him on the Japanese coral now in concern, at the occasion of his short stay in Paris, Semptember 1975. He would like also to thank for Dr. A. Stasinska, Warsaw, for kind talking with him on the same coral, also in Paris, 1975.

Prof. P. Semenoff-Tian-Chansky, Institute de Paleontologie, Museum National d'Histoire Naturelle kindly placed many related tabulate corals for the senior author for study, when he visited Prof. Semenoff in Paris. Also Prof. Semenoff kindly sent him photographs of certain tabulata corals, which the senior author studied at his laboratory in Paris. We greatly acknowledge him for his many helps.

Professor Dr. M. Kato of our Department kindly helped us in various ways. Part of the photograph figured in plates was taken by Mr. S. Kumano.

Pl.1 *Ohnopora hayasakai* Minato and Minoura, gen. et sp. nov.
Specimen UHR 30189, fig.1. Ca x 1.6; fig.2. Ca x 5.5

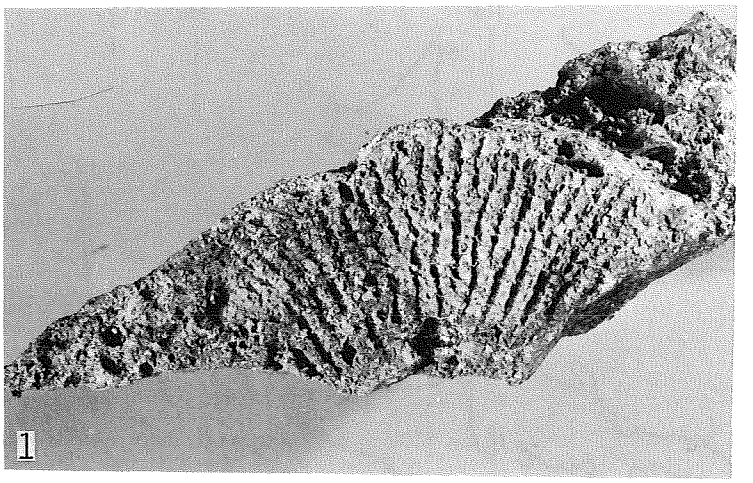
Horizontal view of the corallites

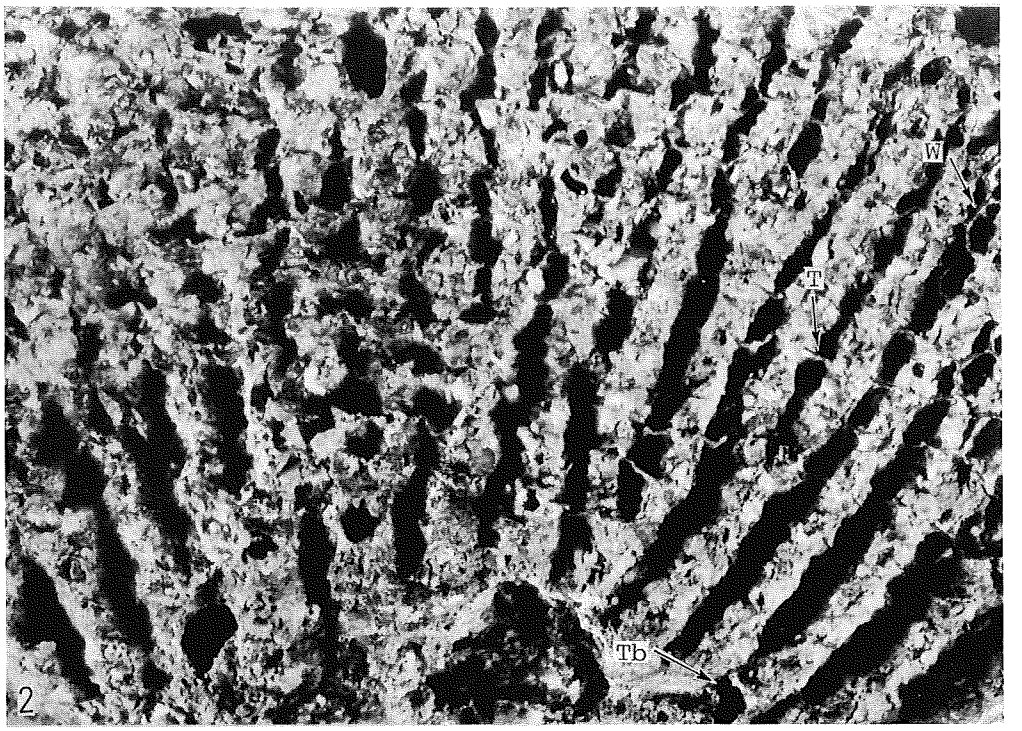
The material is mostly broken and missing, about 1/3 of the entire surface is preserved. There, a number of large tubes are exposed, as a result of exfoliation of the outer surface of corallites.

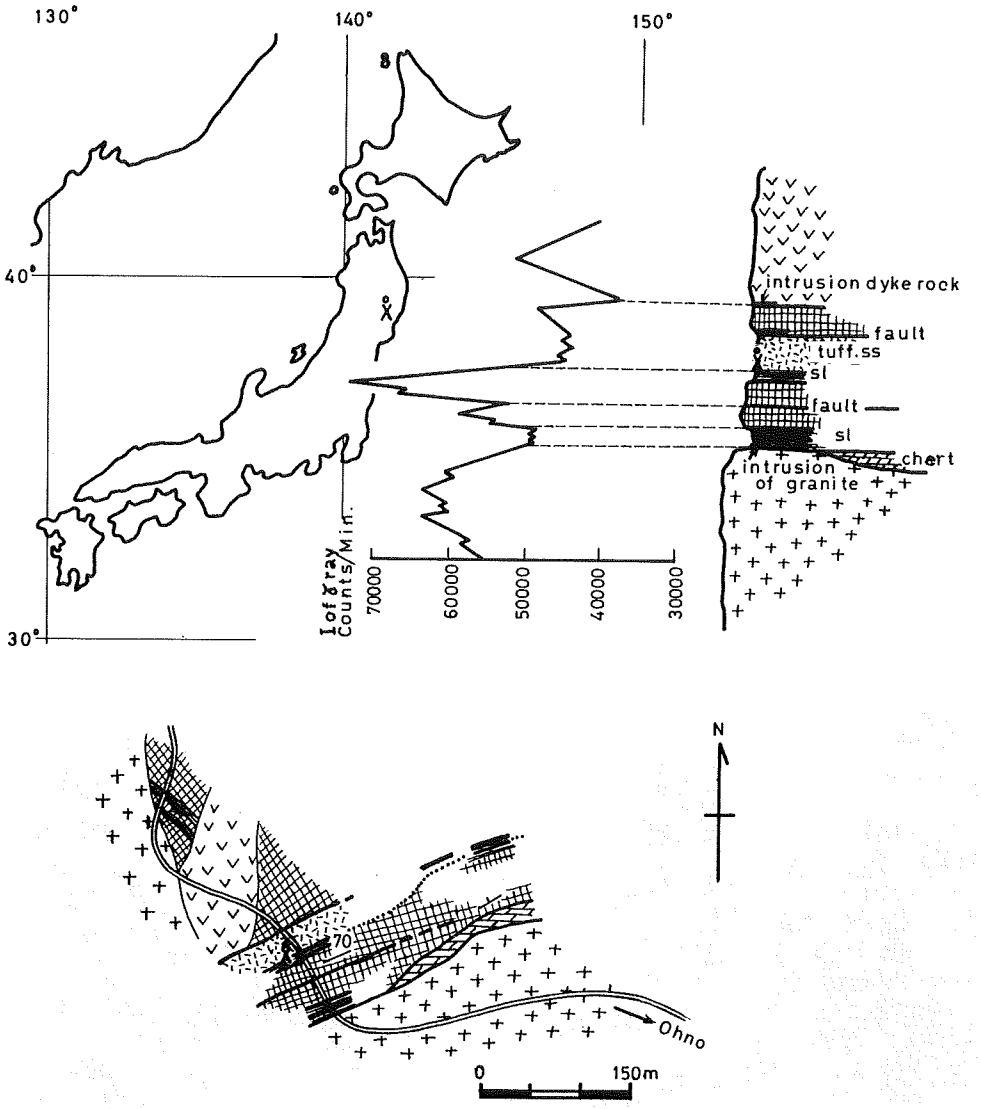
In this photograph tubes are remarkably well reproduced, while the tabulae and the corallite walls (between the tubes), being parallel to the elongation of the corallites are obscurely shown, although they are locally observable as arrow indicated. Nonetheless, the well developed tabulae (T) and walls (W) dividing each corallite are well visible by the naked eyes.

Tubes and/or corallites are radially arranged in the surface plane, which are repeatedly branched outwards. The surface of tubes apparently as granular and/or locally porous, but this might be resulted from the nature of the matrix of this fossil, which is tuffaceous sandstone. Actually, in another specimen to be shown in pls.3,4 and 5, tubes have rather smooth surface, and not perforated. However, if tubes are broken, large round cross section of tubes (Tb) are observed as indicated by arrows; this means, tubes are hollow.

Plate 1







Text-fig.1 Locality of fossils and their stratigraphical position.

The fossils were found at the road side near Ohno village, Kesen-gun, Iwate Prefecture, in the tuffaceous sandstone belonging to the Ohno formation. The locality is positioned at 39°5′16″N and 141°41′7″E.

The lithologic sequence of the lower part of the Ohno formation is shown on the sketch map and stratigraphic column, in which the stratigraphic position of the fossils is indicated.

The litholigic boundary of this sequence and faults were well detected by the measurement of the intensity of γ rays (Minato et al, 1974). The cross hatched part in this figure is acidic tuff which is very common in the lower part of the Ohno formation elsewhere. Further, the chert is observed to be underlain by the fossiliferous Upper Silurian limestone in another locality. Thus, the Lower Devonian age of the fossils to be described is almost doubtless.

Description of species

Order Tabulata Milne-Edwards and Haime, 1856

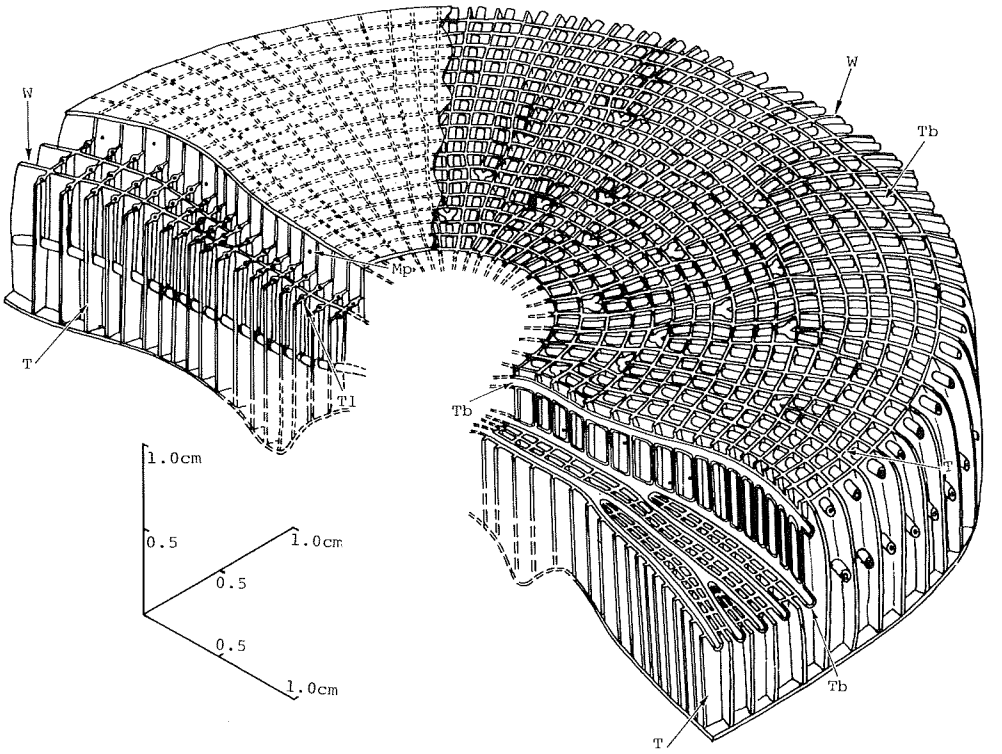
Superfamily Favositoidea Dana 1846

Family Syringolitidae Waagen & Wenzel 1886

Genus *Ohnopora* Minato and Minoura, nov.

Type species (by monotypy): *Ohnopora hayasakai* Minato and Minoura, sp. nov.

Generic diagnosis: Corallum is tabular and discoid in outer form. Corallites are tightly contiguous with common walls which may be locally wavy in vertical plane and possibly perforate. Each corallite is long and polygonal, commonly four sided, rectangular in cross section. There are two straight hollow tubes in each corallite, which are widely apart with each other.



Text-fig.2 Simplified restoration of the corallum of *Ohnopora hayasakai,* based on relatively well observable part of various skeletal elements.

W:	Wall	Tl:	Tuble
T:	Tabulae	Mp:	Mural pore
Tb:	Tube		

Tubes are almost straight, being perpendicular to the tabulae-plane, and parallel to the corallite walls. They locally appear somewhat thicker by the result of stereoplasmic coating. Neither septal partition nor tabulae-like plate are present in the interior of the tubes, although an irregularly formed deposits probably secondary in origin are sometimes present in the inner side of tubes. Tabulae are rather regularly spaced with subequal distance, almost flat or somewhat wavy in horizontal plane, and a little thickened in the central portion, where a slender tubule is present and connects the two large axial tubes above described.

Corallum grows by repeated radial branching, although this increasing occurs only in the horizontal plane, and neighbouring corallites are never separated by any interspace other than common walls.

Remarks: The present genus differs from the genus *Syringolites* Hinde 1879 in having two hollow axial tubes united with a slender tubule in each corallite. Corallum is discoidal in outer form, which is composed of long polygonal corallites, horizontally and radially arranged.

Ohnopora hayasakai Minato and Minoura, sp. nov.

pls.1-8; Text-fig.2.

1959 *Thecostegites* sp. Minato et al, listed only.

Material: From a single block of tuffaceous sandstone, about 15 x 10 x 10 cm in size, the present coral was found as several fragmental specimens. One of them is preserved as mold (UHR no.30189). The skeletons of this specimen are completely replaced by tuffaceous material. Other four specimens possibly belonging to the same species are also fragmental, but replaced by silica. Accordingly the state of preservation of them is rather good. They are numbered as UHR nos.30189-7, 30190-3, 30190-4 and 30190-6 respectively. Of them, specimen UHR no.30190-3 is purposely chosen as the holotype. A part of the specimen was cut to make thin section and replicas of serial polished surface. This is registered as UHR no.30190a. Altogether 34 serial

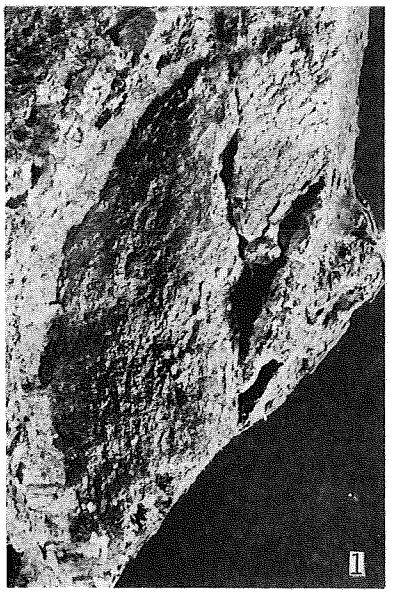
Pl.2 *Ohnopora hayasakai* Minato and Minoura gen. et sp. nov.
fig.1. Ca x 2.1; fig.2. Ca x 6.0; UHR 30189

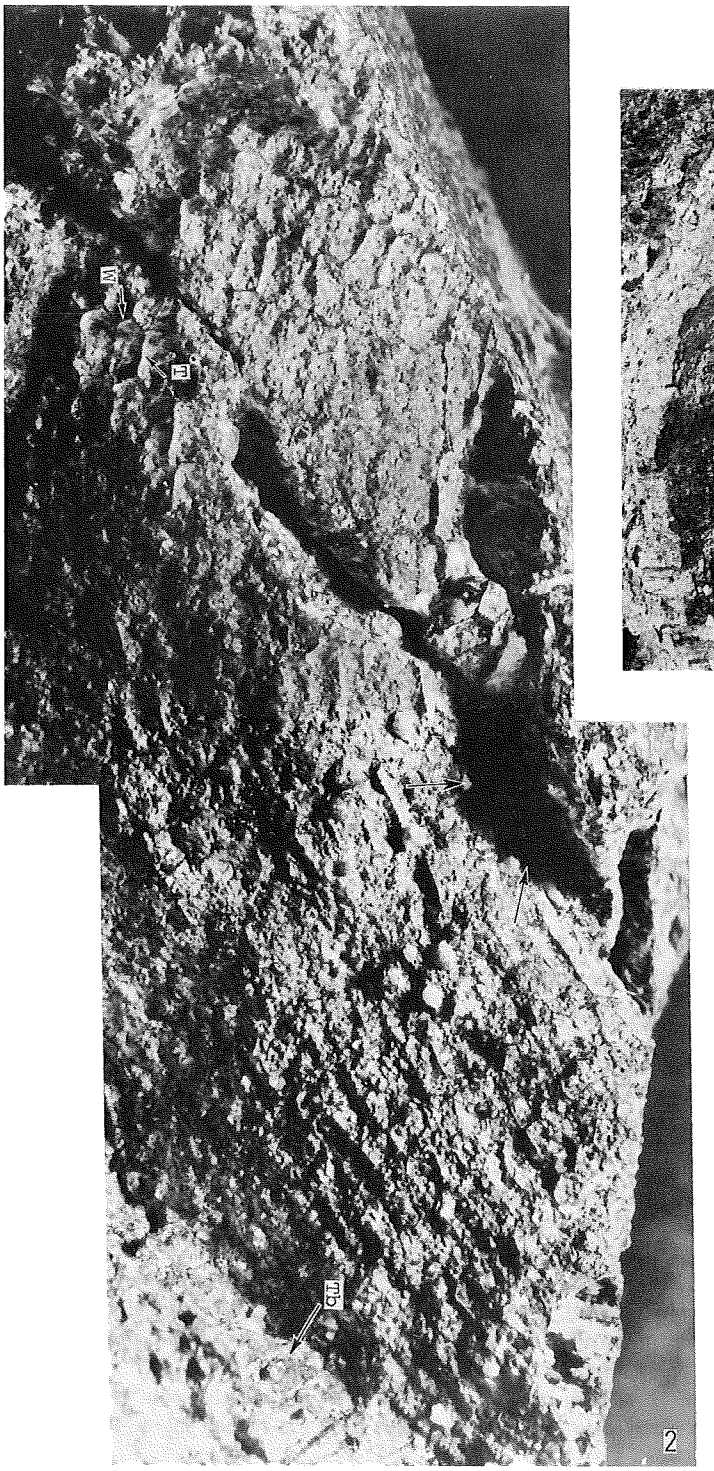
Horizontal view of the lower surface of the corallites. The surface is gently lowering toward central portion, where strong depression encircling the center present (arrows).

Cut edges of radial corallite wall (W) and concentric tabulae (T) form rectangular shape and sometimes flattened hexagonal forms on the surface, though hardly visible on the photograph.

Vertical part of the coral between the upper and lower surfaces is poorly seen at the perrifery of the corallum. Opening of tubes (Tb) are barely observable on this part.

Plate 2





replicas of cross section of corallites were made from the specimen on each polished surface, usually less than 0.2 mm interval. And 26 serial replicas of longitudinal section, also less than 0.2 mm interval were made from the same specimen, besides a single thin section.

Locality and age: The exact locality where the fossils were found is shown in text-fig.1 (Lat.39°5′16″N, Longt.141°41′7″E). The stratigraphical level of the present fossil in the lithologic sequence of the Ohno formation is also denoted in the same fig.1. There is a fossiliferous limestone in the lower part of the Ohno formation, exposed in another localities near by. This limestone is badly recrystalized owing to an intrusion of the younger granite than the Carboniferous (the Higami granite). From this limestone, the Late Doctors H. Yabe and T. Sugiyama found *Thamnopora cristata* and Dr. M. Kato collected corals such as *Xystriphyllum, Thamnopora* and so forth (M. Kato, personal communication to the senior author in 1976). Unfortunately all the corals above listed have not been described yet. Nevertheless, it may be almost sure that the Ohno formation is lower Devonian in age. As a matter of fact, the Ohno formation is conformably underlain by the radiolarian chert, less than 50 m in thickness, which rests on the fossiliferous Silurian limestones (probably Ludlovian in age), without stratigraphical break (H. Yabe and T. Sugiyama, 1937).

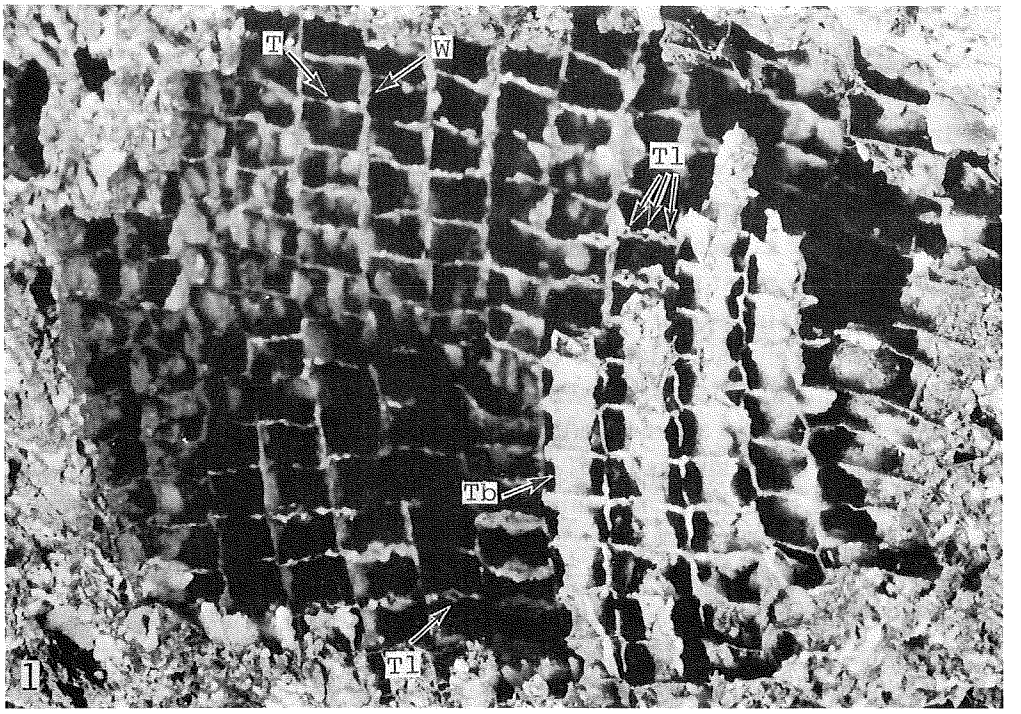
Description: The outer form of the corallum may be restored as being discoid from the specimen UHR no.30189, which is although slightly deformed and lacking the central part (Text-fig.2). The upper side of the discoidal corallum may be almost flat or only gently inclined towards the central part, and sub-elliptical in outer configuration although more than half of the specimen is missing. The longer diameter of it is estimated to be a little longer than 60 mm, while the shorter, about 54–56 mm. The lower side seems to be inclined downwards especially near the central part. The encircling surface of the side of corallum is almost vertical towards both upper and lower surfaces; its height is about 9–10 mm. Epitheca is nowhere preserved.

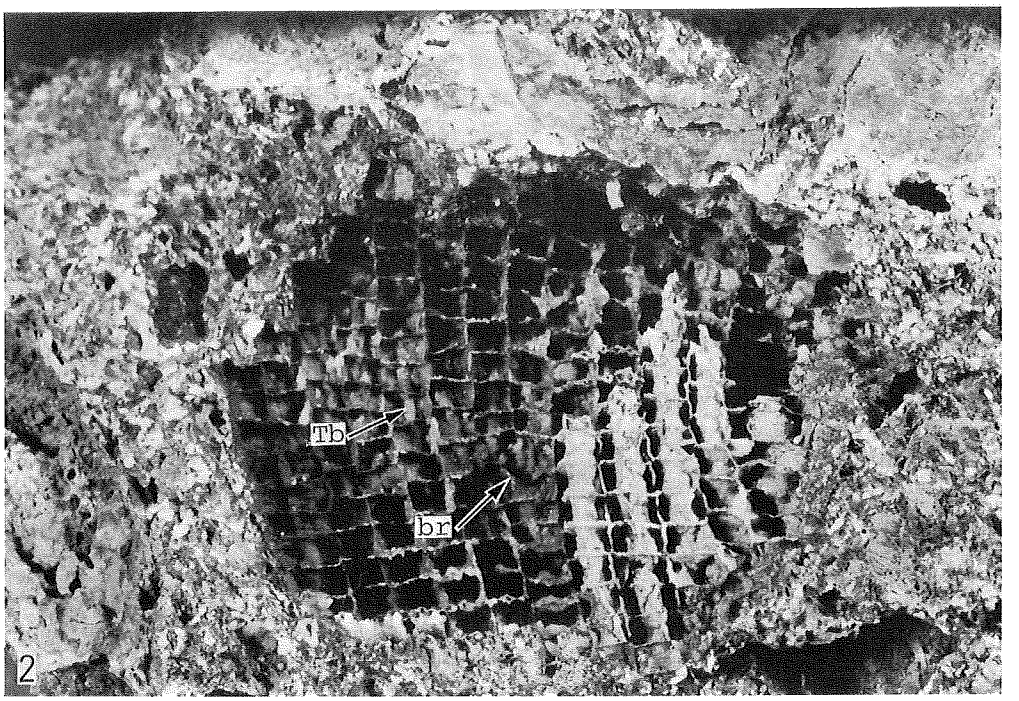
The distal surface of each corallite is exposed at the side of discoidal corallum. Cross section of the corallite is rectangular where two large tubes are

Pl.3 *Ohnopora hayasakai* Minato and Minoura, gen. et sp. nov.
Specimen UHR 30190-3, fig.1. Ca x 5.4; fig.2. Ca x 3.6

Although original chemical composition is unknown, fairly well preserved highly silicified fragmental corallite is found embeded in the matrix. Carallite walls (W) and regularly spaced tabulae (T) are forming four sided corallites which are elongating radially. Locally tubes (Tb) and their branching (br) are well observable.

Tubule (Tl) or a few tubules which intrude into a tabulae are clearly seen. It is noticed that very minor mural pores present in the walls, though they are rather scarce in number, and irregular in arrangement.


T
W
Tl
Tb
Tl
1


Tb
br
2

present (Pl.2, figs.1,2; Pl.5, text-fig.2). Longitudinal nature of the corallites is well observable on the upper and lower side of corallum (Pl.1 and 2). Each corallite is also very long in this direction and tabulae are rather regularly developed.

Increasing of corallites is well observable at the upper side of corallum, where the epitheca is completely exfoliated. Corallites are branching outwards from inwards (the central part), although the increasing occurs only on the horizontal plane, as mentioned in generic diagnosis. Long walls of corallites are fairly thick and almost straight, wavy or zig zag in vertical section. Tabulae are nearly horizontal in general but more or less curved at places, locally varied in thickness, although the middle portion of it is thickest in general. Both in walls and tabulae, median dark line is visible in thin section and polished surface, presence of which is also indicated in the photograph of certain corallites shown in pl.7. Normally one, but rarely two or three slender, hollow tubules are penetrating the tabulae and unite the large two axial tubes of each corallite.

Two axial tubes have rather thick wall although vary more or less in thickness at places. Tubes are rather widely apart with each other, usually about 2.0 mm in distance. Cross section of each tube is elliptical with longer axis parallel to the connecting tubules. Interior of the axial tubes seems to be entirely hollow, with neither septal nor tabulae-like structure, as clearly shown in the serial replicas (Pl.6). Only the presence of some filling matter is indicated near the wall, especially at the corners of the longer diameter, but it is uncertain whether this may be a true skeletal element or not.

All the tabulae, regularly spaced and being complete are observed to be opened by the two tubes. In other words, each tabula is developed, encircling

Pl.4 *Ohnopora hayasakai* Minato and Minoura, gen. et sp. nov.
Specimen UHR 30190a, fig.1. Ca x 11.2; fig.2. Ca x 11.2; fig.3. Ca x 11.2

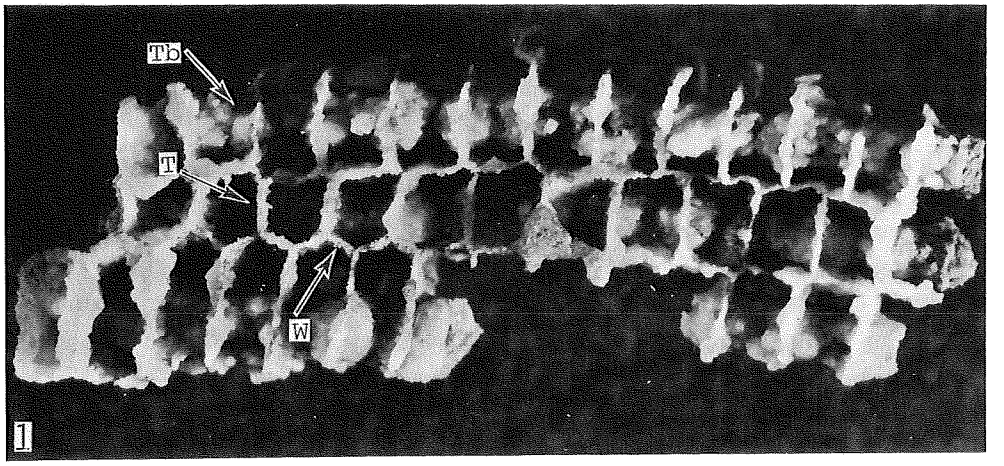
During the specimen UHR 30190-3 (shown in pl.3) was washed by ultrasonic cleaner, an well preserved part of corallites was separated from the original material. It is shown in this plate viewed from the different directions.

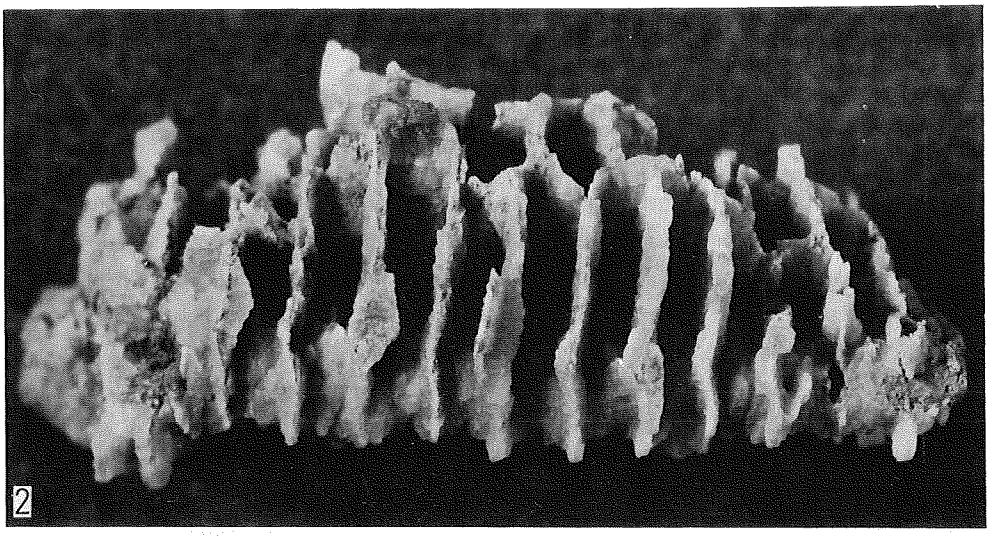
Fig. 1. Horizontal view in which the tubes are obscurely observed. Walls (W) are not always straight but locally zig-zag in section, and different in thickness. Tabulae (T) are nearly horizontal, usually thick at the center and irregularly change their thickness. Rectangular or flattened hexagonal shape observed on the surface of coral in pl.2 should be formed by the combination of the cut edges of walls and tabulae in this figure.

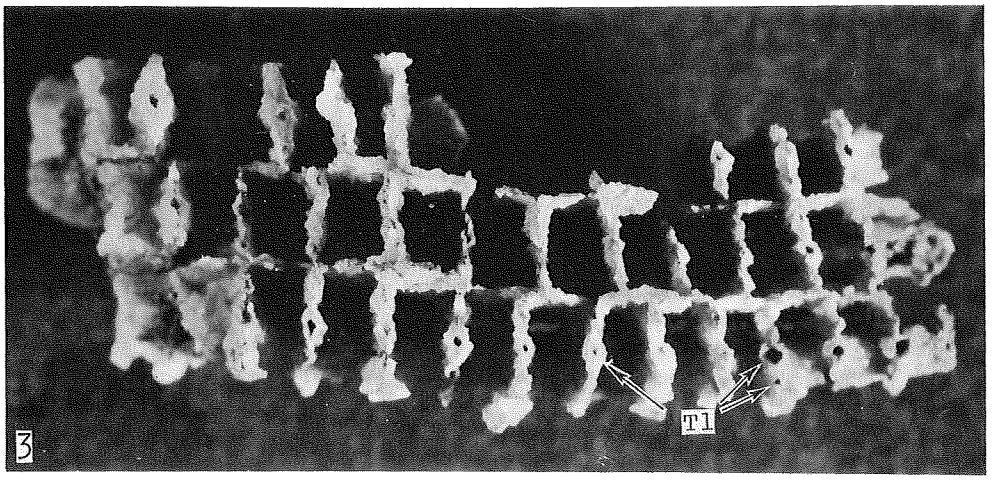
Fig. 2. Side view, in which the tabulae are much longer than those seen in figures 1 and 3. The tabulae are generally flat but slightly wavy locally. Their thickness is also changeable. It may be important, that there are two tubes in each corallite, although right side one in this figure is mostly missing.

Fig. 3. Opposite side of fig.1 is shown in this figure. Presence of tubule (Tl) or a few tubules opened in the central part of tabulae muts be noticed.

Plate 4







the tube, and is not stretching to the entire floor of each corallite. This is proved by the serial replicas of the longitudinal polished surface.

The original microstructure of the skeletons of the corals cannot be stated since all the specimens are either replaced by sandstone or strongly altered by silicification. The surface of tabulae is observed to be tubercular, and the outer surface of tubes appears also to be granular at places. However all such granular impressions are only observed on the skeletons replaced by sandstone. Consequently these tubercular or granular impressions may not be original structure. On the contrary, walls are observed to be locally rather smooth in their inner surface, and rarely perforated by small mural pores. The present coral may be thus concluded to have mural pores.

Specific diagnosis: As for genus.

Discussion: Although the entire outer form of the present species is unknown, at least its major part is discoidal and is composed of tightly contiguous corallites with mural pores. It may be accordingly placed in Favositoidea, Dana 1846. Tabulae of the present form are complete, and nearly horizontal, although they are pierced by large axial tubes.

In this concern, the present form seems quite distinct from the genus *Syringolites,* in which tabulae are infundibuli in form. However in *Syringolites* there is a large tube, like the present form in the central part of a corallite. In other words, structure of tabulae and tubes in *Syringolites* does not show any fundamental difference from the present form.

Therefore, the authors think that this species now in concern would be better placed in Syringolitidae Waagen and Wentzel 1886 among Superfamily Favositoidea Dana 1846.

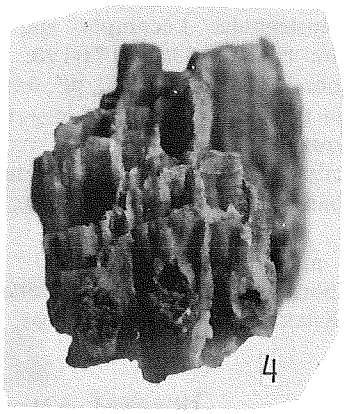
Now, the generic distinction between *Syringolites* Hinde 1879 and the present *Ohnopora* is obvious as is described in the foregoing pages.

Pl.5 *Ohnopora hayasakai* Minato and Minoura, gen. et sp. nov.
Specimen UHR 30190-3, fig.1. Ca x 8.2; fig.2. Ca x 8.2; fig.3. Ca x 8.2; fig.4. Ca x 8.2; fig.5. Ca x 8.2.

Figs.1, 2 and 3 show the same specimen shown in pl.4. Among them, fig.1 shows side view of corallite wall and tabulae, nearly horizontal. In figs.2 and 3, tubes are well reproduced in contrast with the figs.1 and 3 of pl.4.

Fig. 4. Lower view of the specimen shown in fig.1. Opening of tubes is somewhat irregular in shape.

Fig. 5. Upper view of the specimen shown in fig.1.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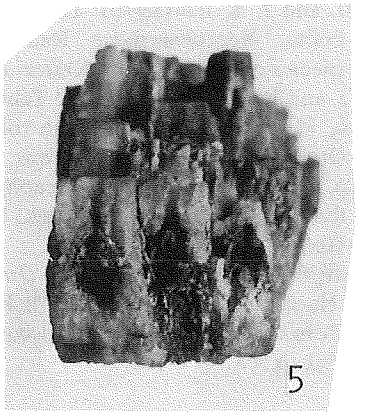
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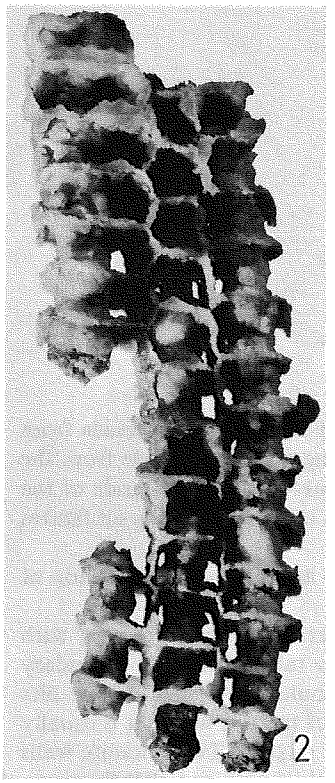
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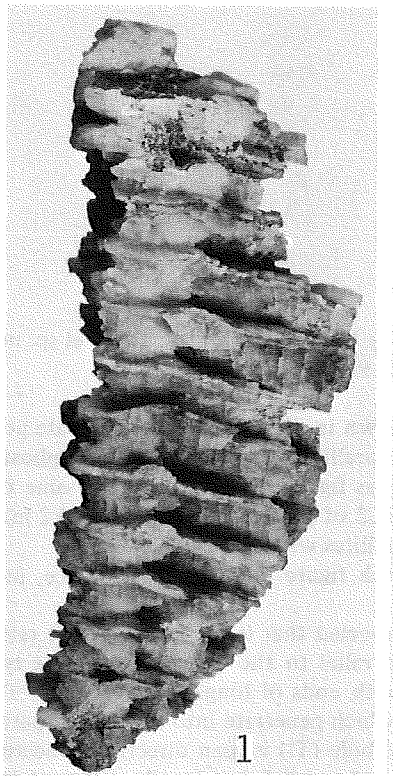
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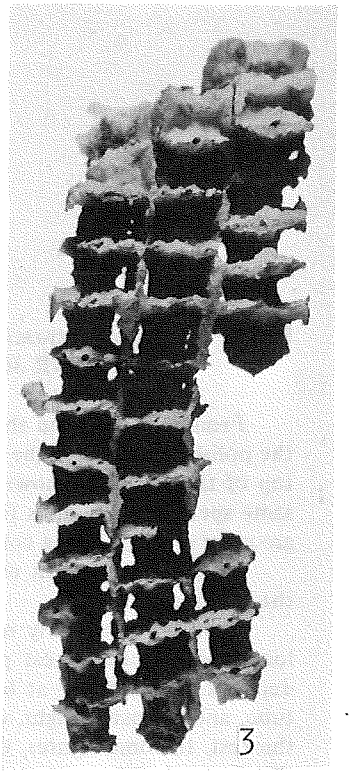
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References

Hill, D. and J. S. Jell (1970): The Tabulate coral families Syringolitidae Hinde, Roemeriidae Počta, Neoroemeriidae Radugin and Chonostegitidae Lecompte, and Australian species of Roemeripora Kraicz. *Proc. Royal Soc. Victoria,* 83(2): 171-190.

Hill, D. and E. C. Stumm (1956): Tabulata in R. Moore's Treatise, part F., pF. 444-477.

Minato, M. et al. (1959): On the volcanic rocks in the Japanese Palaeozoic – 1st Report: Gotlandian and Devonian. *Jour. Geol. Soc. Japan,* 65(761): 71-79.

Minato, M. et al. (1974): Stratigraphy and radioactivity of the rocks in the Setamai-Sakari district, Kitakami Mountains, Northeast Honshu, Japan. *Jour. Fac. Sci., Hokkaido Univ.,* ser.4 14(1-2): 1-40.

Sokolov, S. B. (1962): *Tabulata in Osnobi Palaeont.* pp. 192-265.

Yabe, H. and Sugiyama, T. (1937): Preliminary report on the fossliferous Gotlandian and Devonian deposits newly discovered in the Kitakami Mountainland. *Proc. Imp. Acd. Tokyo,* 13: 417-420.

(Received on May 11, 1977)

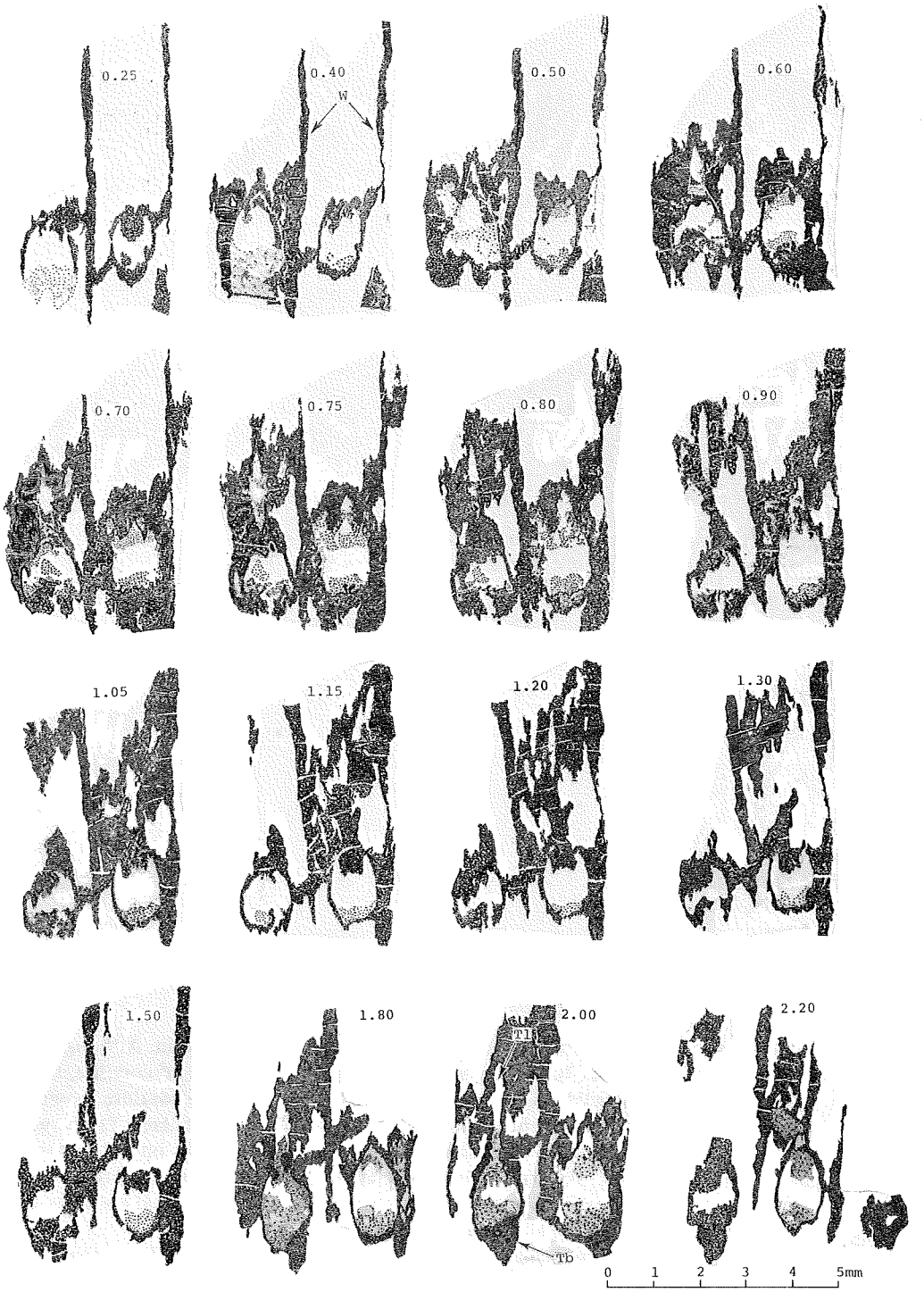
Pl.6 *Ohnopora hayasakai* Minato and Minoura gen. et sp. nov.
Specimen UHR 30190a.

From the specimen shown in pls.4 and 5, serial acetate peals, 34 in all, were made from the polished surface of the corallites. Actually, all these replicating films were made from the top of the corallite (shown as fig.1 of pl.5) and at the same time; from the left side of the same specimen shown as fig.2 of pl.4 with 0.05, 0.1 or 0.2 mm intervals. Namely all figures are cross sections of the corallites with vertical tube.

Numerals given on each figure indicate the distance, in mm, from the left or top of the specimen.

Tube (Tb) is clearly revealed that it is not round but rather oval in cross section with longer axis to be almost parallel to the tubule connecting two tubes. Probable secondary deposits are observed at both ends of longer axis of tubes. Tubule (Tl) is also hollow like tube, and almost straight, which penetrate into the central part of tabulae where it is usually thickest. In some figures, tubule (Tl) is seen directly connected to tube. Two corallite walls (W) for each figure are almost parallel, but locally different in thickness and slightly wavy. Tabulae are not always flat but irregularly and minutely folded, and probably changing its thickness at places.

Plate 6


0.25
0.40
W
0.50
0.60
0.70
0.75
0.80
0.90
1.05
1.15
1.20
1.30
1.50
1.80
2.00
T1
Tb
2.20
0 1 2 3 4 5mm

Pl.7 *Ohnopora hayasakai* Minato and Minoura gen, et sp. nov.
Specimen UHR 30190a, fig.1. Ca x 14.5; fig.2. Ca x 14.5.

Fig. 1: Polished surface of the corallite embeded in transparent epoxy resin. Although this photograph corresponds to the acetate peel in fig.2, deeper part of corallite, tubes (Tb) for example, is visible. This specimen is the right half of the corallite shown as fig.2 of pl.4. To some extent structure of walls (W) and tabulae (T) are well elucidated, viz dark coloured line in the middle, and brighter layers on both sides of the former. All these skeletal structures may be more or less strengthened by organic deposits. Nonetheless sometimes, marginal part of true skeletal elements are hardly distinguishable from either organic or inorganic matrix.

Fig. 2: An acetate peel of the polished surface, corresponding to the fig.1. In most part of this figure, walls and tabulae may show real thickness.

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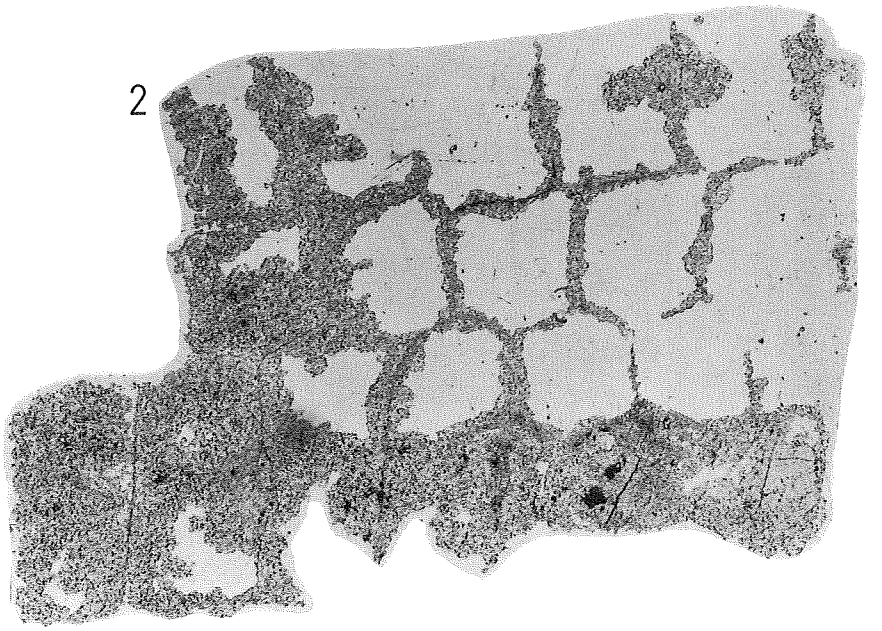

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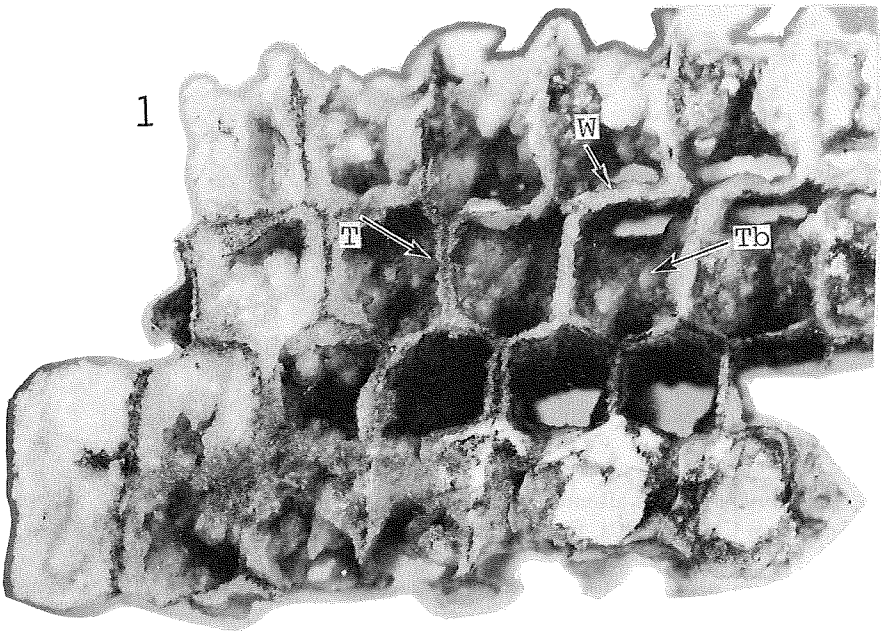
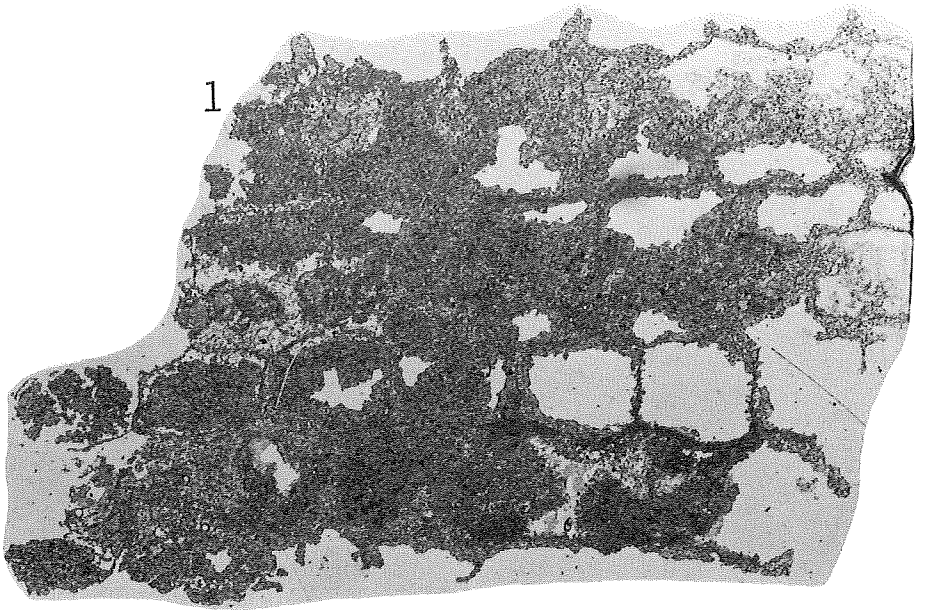


Pl.8 *Ohnopora hayasakai* Minato and Minoura gen et sp. nov.
Specimen UHR 30190a, fig.1. Ca x 14.5; fig.2. Ca x 14.5.

Fig. 1: An acetate peel corresponds to fig.2. Because of the secondary silica deposits in most spaces, distinction between walls, tubes and tabulae is hardly made.

Fig. 2: Polished surface of the corallite same as Plate 7. In this section nearly central portion of the tube is longitudinally cut. Inside the tube is partly filled with probable secondary silica deposits. Spaces surrounded by tubes, tabulae (T) and Walls (W) also are mostly silica filled, and appear as brighter tone.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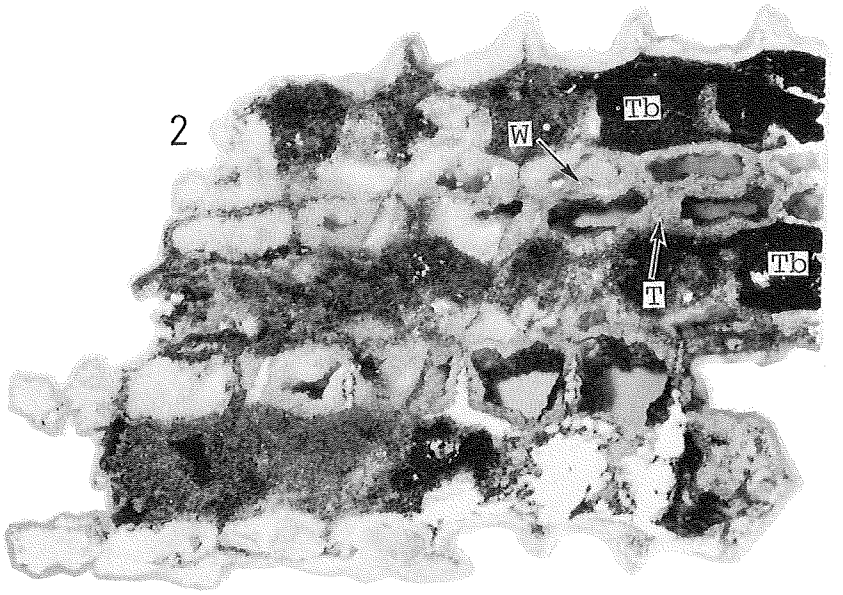
2
W
Tb
T
Tb