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Notes on Some Carboniferous Corals from Taishaku District, Hiroshima Prefecture, Japan

By

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with 3 Plates and 2 Text-figures

ABSTRACT. This paper gives the results of investigations on corals, obtained from the Carboniferous rocks of the Taishaku district, Hiroshima Prefecture, Japan, with special reference to their stratigraphic distribution and geological age.

Lithostrotionella taishakuensis, n. sp., *Stylidophyllum yokomizoi*, n. sp. and *Pseudoparona taisyakuana* are described and illustrated in the last chapter.

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I. INTRODUCTION AND ACKNOWLEDGEMENTS

The Taishaku district, Hiroshima Prefecture, Southwestern Japan, has been studied by many geologists because of its well developed fossiliferous Permo-Carboniferous limestone.

In the Carboniferous limestone there have been recognized two fossil zones, the upper or *Fusulinella* zone of Moscovian age (H. HANZAWA, 1941 and H. HUIJIMOTO, 1944) and the lower or *Staffella-Nagatophyllum* zone of Viséan age (H. HUIJIMOTO, 1944). With regard to the latter zone, M. MINATO (1949, 1952 and 1955) expressed the opinion that it should be referred to the Bashkilian in age, or to an age younger than that which H. HUIJIMOTO referred it to. This view was expressed very recently in his paleogeographic maps in details (M. MINATO, 1956).

In this paper the writer presents discussions on some Carboniferous corals with special reference to their stratigraphic occurrence and geological age. He also describes two massive species which evidently are new to science and an interesting hexacoral-like species. Details with regard to the geology of this district will be reported at another opportunity.

The writer extends his sincere thanks to Professor Motoki EGUCHI of the Tôhoku University for his kind suggestions and criticisms concerning the corals dealt with. He is deeply indebted to Professor Sotoji IMAMURA and Mr. Mitsuo NAKANO of the Hiroshima University for their continuous encouragement and criticisms with regard to the writer's study on the Paleozoic system of the Taishaku district. He also thanks the members of the Paleozoic research group of the same university for their helpful discussions, and to Mr. Masaharu YOKOMIZO, the principal of the Takamitsu Primary School, for his kind assistance during the writer's field work.

This study was favoured by a Grant in Aid for Scientific Research from the Ministry of Education.

II. STRATIGRAPHIC OCCURRENCE

The stratigraphic occurrence of the fossil corals from the Taishaku district listed in Table 1, may be summarized as follows.

TABLE 1. STRATIGRAPHIC OCCURRENCE OF THE FOSSIL-CORALS IN THE TAISHAKU-GAWA GROUP.

Carboniferous	Taishaku-gawa group	Eimyôji formation	Thick massive limestone (upper half oolitic)	h ₅ h ₄ h ₃ h ₂
		Dangyokei formation	Alternation of schalstein and limestone, limestone in the lower part crystalline and non-fossiliferous	h ₁

The Carboniferous deposits developed in this district has been named the **Taishaku-gawa group**, basing upon its type locality along the Taishaku-gorge, which dissects meridionally the limestone plateau. The limestone are also distributed to the western part of the plateau. The group can be subdivided into two conformable formations, the upper is named the **Eimyôji** and the lower is called the **Dangyokei**.

The Dangyokei formation consists of an alternation of limestone and schalstein intercalated with sandstone in its lower part. The limestone in the lower part is crystalline through the thermal effect of granite, and therefore it is non-fossiliferous. The Eimyôji formation is composed of non-stratified thick, massive limestone with characteristic and conspicuous oolitic structure in its upper half.

Five fossil zones can be recognized in the Taishaku-gawa group. The lowest or horizon **h₁** contains abundant corals and occupies the upper part of the Dangyokei formation. This horizon corresponds to HUIJIMOTO's loc. no. 53(1944), from where he mentioned the occurrence of *Lithostrotionella* sp., *Nagatophyllum* sp., *Thysanophyllum* sp.

and *Staffella* sp.* This horizon is also well developed at Dangyokei** and Tateishi, etc..

In the Eimyôji formation there can be recognized four horizons, namely $h_2 \sim h_5$, in

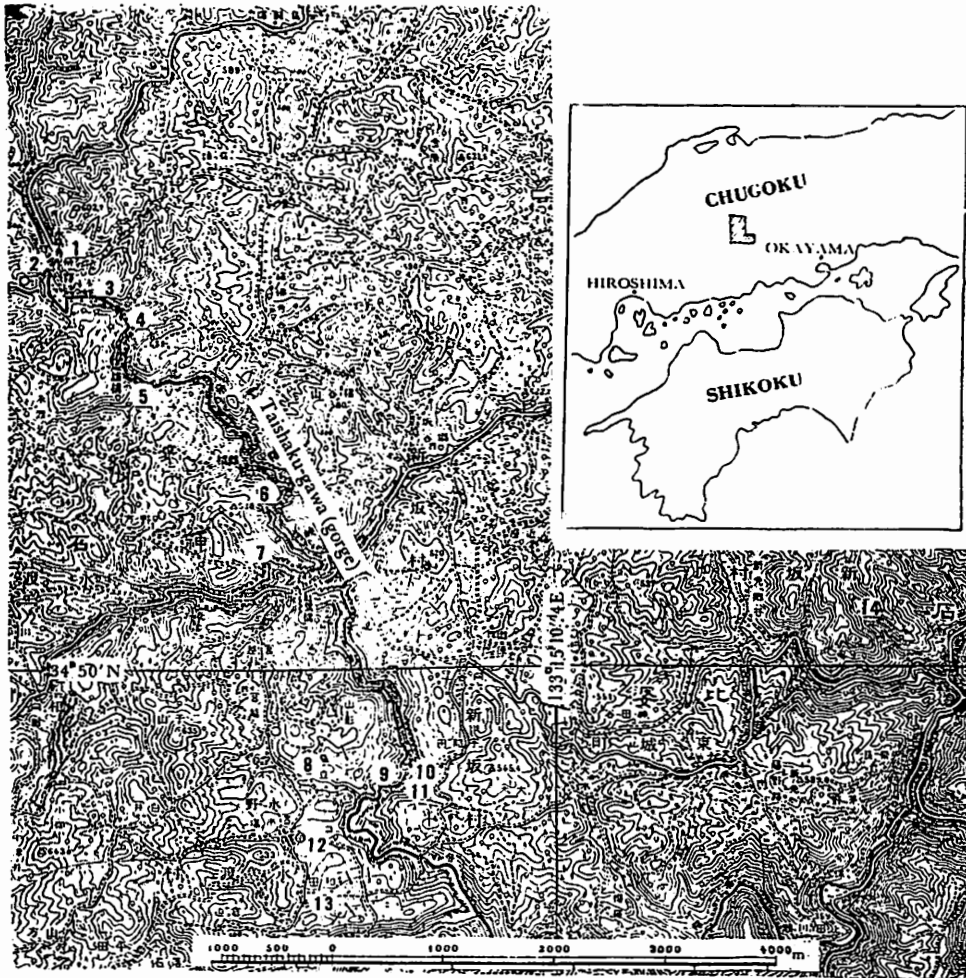


FIG. 1. Fossil locality map and Index map of the Taishaku district. (T. YOKOYAMA, 1957)

1. Eimyôji; 2. Taishaku; 3. Hakuundô; 4. Dantai-gan; 5. Dangyokei; 6. Maku-iwa;
7. Tarô-sako; 8. Tateishi; 9. Kabuto-iwa; 10. Dam; 11. Tarô-iwa; 12. Nagano;
13. Wada; 14. Shinmen.

* Restudying HUZIMOTO's thin sections of the limestone, MINATO (1949 and 1955) determined the following species; *Lithostrotionella* cfr. *tingi* CHI, *Taisyakuphyllum rostfer* MINATO, *Fistripora* sp.

** According to the personal information from M. EGUCHI, K. HARADA obtained *Caninia* sp. in this locality in association with *Lithostrotionella* sp., *Thysanophyllum* sp. in 1943.

ascending order, among which h_2 , near the base of the formation, is also characterized by the occurrence of a rich coral fauna and some forms of *Millerella*. The horizon h_2 coincides with HUIJIMOTO's loc. no. 19, and has yielded *Nagatophyllum* sp., *Lophocarino-phyllum* sp., *Chaetetes* sp. (1944). At Hakuundô,* Wada, Tateishi and some places in "Shimo-taishaku", horizon h_2 is found, and in the dark grey limestone near Tateishi horizon h_3 can be recognized above h_2 . Above these mentioned horizons there is developed the characteristic oolitic limestone in which two horizons, h_4 and h_5 are found. The horizon h_4 can be recognized in the algal part of the oolitic limestone at the Dam and in the same limestone near Eimyôji, the horizon is characterized by the occurrence of *Profusulinella*.

The part of the limestone hitherto considered as belong to the *Fusulinella* zone and known as yielding abundant *Fusulinella* corresponds to horizon h_5 where *Pseudopavona taisyakuana* YABE, SUGIYAMA et EGUCHI and *Stylidophyllum yokomizoi*, n. sp. have been found.**

All of the above stated fossil species are shown in Table 2.

M. MINATO (1955) reported on the occurrence of *Lonsdaleoides enormis* (OZAWA) from Taishaku based on the specimens collected by H. MOCHIZUKI, but unfortunately the exact locality is uncertain.

III. FOSSIL ZONES

So far as the occurrence of Fusulinids is concerned, the Carboniferous deposits of the Taishaku district can be subdivided into three Fusulinid zones; *Millerella*, *Profusulinella* and *Fusulinella*.

As shown in Table 2, the three horizons h_1 , h_2 and h_3 belong to the *Millerella* zone, h_4 to the *Profusulinella* zone and h_5 to the *Fusulinella* zone respectively. Consequently, in the writer's opinion, the *Staffella-Nagatophyllum* zone of HUIJIMOTO (1944) corresponds to the *Millerella* zone while the *Profusulinella* zone hitherto unknown from the present area must be inserted between the *Staffella-Nagatophyllum* zone and *Fusulinella* zone. Detail discussions with regard to this problem will be reported at another opportunity.

IV. CORRELATION AND GEOLOGICAL AGE

Here the writer intends to consider the *Millerella* zone i.e. HUIJIMOTO's *Staffella-Nagatophyllum* zone on which there still remains some problems to be discussed. As already stated, the coral fauna characterized by *Nagatophyllum* can be referred to the

* MINATO, M. (1955) reported *Clisaxophyllum awa* MINATO from this locality (HUIJIMOTO's loc. no. 30).

** According to EGUCHI, K. HARADA recorded *Amygdalophyllum* sp., *Cyathaxonia*? sp.

Consequently the writer is of the opinion that the *Millerella* zone of the Taishaku limestone is most probably a correlative to the upper subzone of the *Millerella* zone developed in the Fukuji district, Gifu Prefecture (*Millerella bigemmicula-Pseudostaffella kanumai* subzone as named by H. IGÔ in 1956).

Following OZAWA's opinion that the *Nagatophyllum satoi* subzone of the Akiyoshi limestone, Province Nagato may be Viséan in age, HUIJIMOTO (1944) asserted that his loc. no. 53 which contains *Nagatophyllum* sp. may be referred to the Viséan and that his loc. no. 19 with the same species to either the Viséan or to the lower part of the Middle Carboniferous.

On the other hand, MINATO considered the *Nagatophyllum* fauna to represent the Middle Carboniferous and to be one of its important elements and this view was developed further in his later reports.

Considering from the evidences stated above, the writer is lead to the opinion that the coral fauna contained in the *Millerella* zone in this district may be referred to the lowermost part of the Middle Carboniferous.

V. DESCRIPTION OF CORAL SPECIES

ORDER TETRACORALLA HAECKEL

Family Lithostrotionidae GRABAU, 1927

Genus *Lithostrotionella* YABE and HAYASAKA, 1916

Lithostrotionella taishakuensis YOKOYAMA, n. sp.

Pl. 10, Figs. 1-4.

Corallum massive, cerioid, composed of polygonal corallites. Corallite prismatic, usually hexagonal in section and 3~4 mm in diameter. Outer wall composed of three distinct layers, appearing slightly curved and moniliform in cross-section. Septal ridges partly observed. In some well preserved corallites large lonsdaleoid dissepiments occupy the peripheral zone; vesicles unequal in size and arranged in one or two rows. Septa of two orders, major and minor; major septa usually 13~15 in number, thin unequal in length, and alternating with the minor ones, which have the same number, but only half as long as the major. Some of the major septa extending as far as the palicolumella. Concentric dissepiments few. Columella lamellar, thin, often uniting with major one.

In the longitudinal section tabulae are nearly horizontal but sometimes curved irregularly, numbering about 10 per 5 mm, often with unequal intervals. Peripheral dissepiments facing upwards and inwards, unequal in size and usually arranged in single or double rows.

In the well preserved section dimentions of corallites and tabularium as follow :

Corallites; $3.4 \times 2.4 : 4.2 \times 3.4 : 4.4 \times 3.4$ (mm)

Tabularium; $2.6 \times 1.6 : 2.6 \times 2.0 : 2.4 \times 2.2$ (mm)

Remarks :—The outer shape of the corallium is unknown being immersed in a hard limestone block. It may probably be identical or closely related to *Lithostrotionella* sp. of H. HAJIMOTO (1944), which was treated by M. MINATO (1949) as *L. cfr. tingi* CHI. However, the present specimens differ specifically from *Lithostrotionella tingi* CHI from the Middle Carboniferous of South-China in the following characteristics; the Japanese form has smaller corallites with fewer septa and more numerous tabulae and moreover it is characterized by having more regularly arranged peripheral dissepiments.

Lithostrotionella kiakamiensis MINATO from the *Fusulinella* zone of the Kitakami massif is another ally but the present species differs by having minute corallites and fewer septa and other characteristic as described above.

Occurrence :— *Millerella* zone from (1) Dangyokei, Taishaku-gorge, Tōjō-chō, Hiba-gun, Hiroshima Prefecture. (Holotype: IGSH* coll. cat. no. Y. T. 1.); (2) Tateishi, Nagano, Jinseki-chō, Jinseki-gun, Hiroshima Prefecture.

Family Clisiophyllidae NICHOLSON and THOMSON, 1886

Genus *Stylidophyllum* FROMENTAL, 1861.

Stylidophyllum yokomizoi YOKOYAMA, n. sp.

Pl. 11, Figs. 1-2.

Corallum compound, massive, cerioid, consisting of numerous polygonal minute corallites of unequal size. The irregularities of shape and size of the corallites are very conspicuous. Wall thickened by stereoplasmic deposits as well as septal ridges; theca distinct and nearly straight. Peripherally the septa extend to the outer wall, but sometimes are separated by the irregularly developed dissepiments. Septa thick but gradually tapering towards the inner end, and in two orders, major and minor. Major septa 15~17 in larger corallites, and some of them reach to the axial structure but never intersect it. Minor ones are less in number. Numerous septal crests occur on the interseptal tabulae of the one of greater corallite.

Axial structure is not so distinct as other features, but the shape of the columella is subspherical or polygonal. Definite median plate present.

In the longitudinal section, peripheral dissepiments are coarse, but numerous. Outer wall and septa are composed of minute fibrous tissues arranged at right angle to the septal lamella. Tabular not so distinct. Axial area composed of many axial tabulae of irregularly arranged shape. Even here, the median plate distinct, straight and thick.

Remarks :—This material (Coll. T. WATANABE) is strengthened by the stereoplasmic

* IGSH:— Abbreviation for Institute of Geology, Faculty of Science, Hiroshima University.

deposits, so the features of the corallites become indistinct.

This species somewhat resembles *Stylidophyllum sikokuensis* MINATO, which is described and illustrated by M. MINATO (1955) from the Middle Permian of Kochi Prefecture, but it is characterized by the wall structure, septal crests and the construction of septa in longitudinal section.

This species is associated with *Fusulinella* sp. and other Foraminifera. The specific name is given in the honor of Mr. Masaharu YOKOMIZO, the principal of the Takamitsu Primary School, who is an earnest geologist in this district.

Occurrence :— *Fusulinella* zone from Shinmen, Yuki-chô, Jinseki-gun, Hiroshima Prefecture. (Holotype: IGSB coll. cat. no. Y. T. 2)

ORDER HEXACORALLA HAECKEL

Family Pseudopavoniidae YABE, SUGIYAMA and EGUCHI, 1943

Genus *Pseudopavona* YABE, SUGIYAMA and EGUCHI, 1943

Pseudopavona taisyakuana YABE, SUGIYAMA and EGUCHI

Pl. 12, Figs. 1-2, Text-fig. 2

1943 *Pseudopavona taisyakuana*, YABE, SUGIYAMA and EGUCHI: A New Hexacoral-like Carboniferous Coral (Preliminary note). *Jour. Geol. Soc. Japan*, Vol. 50, No. 600, pp. 242-245, figs. 1, 2.

1955. *Pseudopavona taisyakuana*, MINATO: Japanese Carboniferous and Permian Corals. *Jour. Fac. Sci. Hokkaido Univ.*, Ser. IV, No. 2, pp. 180-181, Pl. 41, figs. 1a, 1b.

Corallum massive, maeandroid. In the transverse section, corallites lack the proper walls, connected with confluent septa in each other; calices arranged sporadically,



FIG. 2, Transverse section of *Pseudopavona taisyakuana*, showing the trabecular structure and conjunction of septa. (ca. $\times 25$)

disposed of 5~7 mm in their center's distance. In the calicular area, septa radial and almost straight, counting about 21 in number, and some of them are in contact with the columella; tabulae also partly present. Columella obscure in its structures. Septa confluent except near the calicular area, and composed of numerous trabeculae. Trabeculae consisted of radial fibrous tissues, sit in two rows, and show the saw-teethed figures having the distinct Y-shaped boundaries by the fusion of the central portions on the both side of septa. Stereoplastic deposits exist in the interspaces of septa, and its strongly fillings recognized in some places.

In the longitudinal section, septa composed of numerous trabeculae which are made up of radiating fibers. Trabeculae nearly straight, subparallel, sometimes radial and slightly curved. Tabulae and dissepiments present in the axial and interseptal parts, respectively, with their convex side facing upwards.

Remarks :- The present material at hand was obtained from another locality about 5 km NNW of the original one. It is quite identical with *Pseudopavona taisyakuana* described by YABE, SUGIYAMA and EGUCHI in 1943. They considered that this form may be a hexacoral and its geological age is the Lower or Middle Carboniferous on account of the association with *Stylidophyllum* sp., several other rugose corals and chaetetoid. On the other hand, M. MINATO (1955) showed its age to be *Fusulinella* zone.

There is no doubt in believing that this species is Moscovian in age or belong to the *Fusulinella* zone, because it associates with *Fusulinella biconica*, *F.* sp. and *Staffella* sp..

Occurrence :- *Fusulinella* zone of Moscovian age from Dantai-gan, Taishaku-gorge, Tōjō-chō, Hiba-gun, Hiroshima Prefecture.

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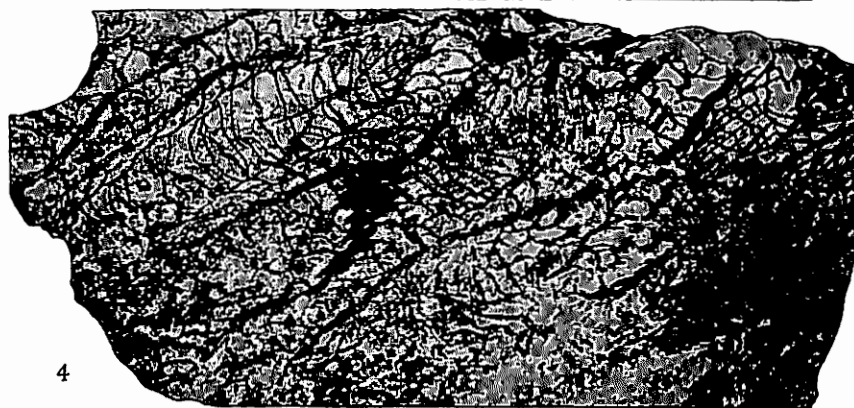
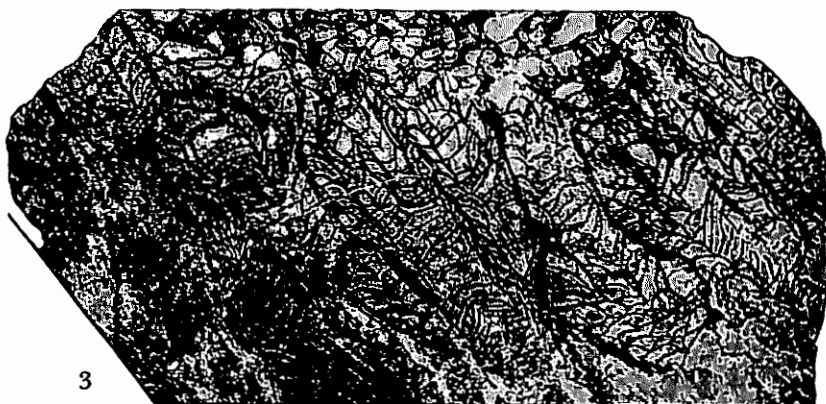
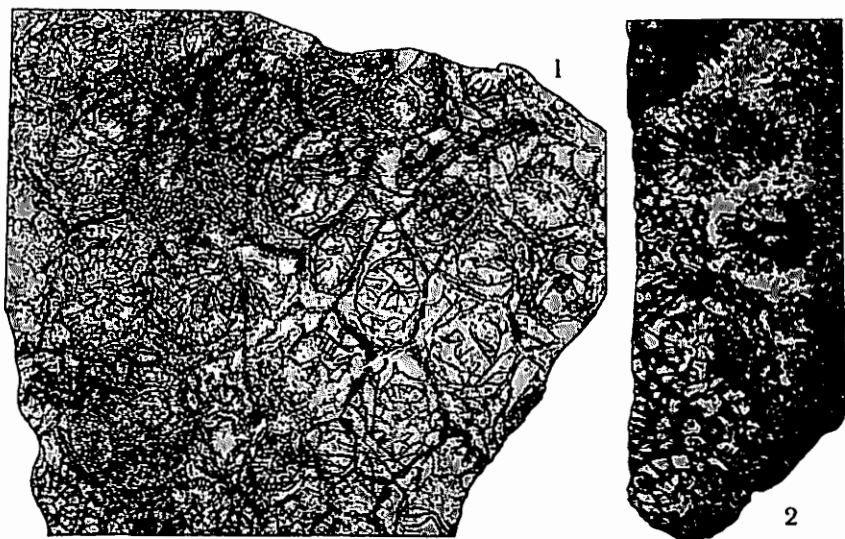
EXPLANATION OF PLATE

PLATE 10

Lithostrotionella taishakuensis YOKOYAMA, n. sp.

FIGS. 1, 2. Transverse section. ($\times 3.0$)

FIGS. 3, 4. Longitudinal section. ($\times 3.0$)



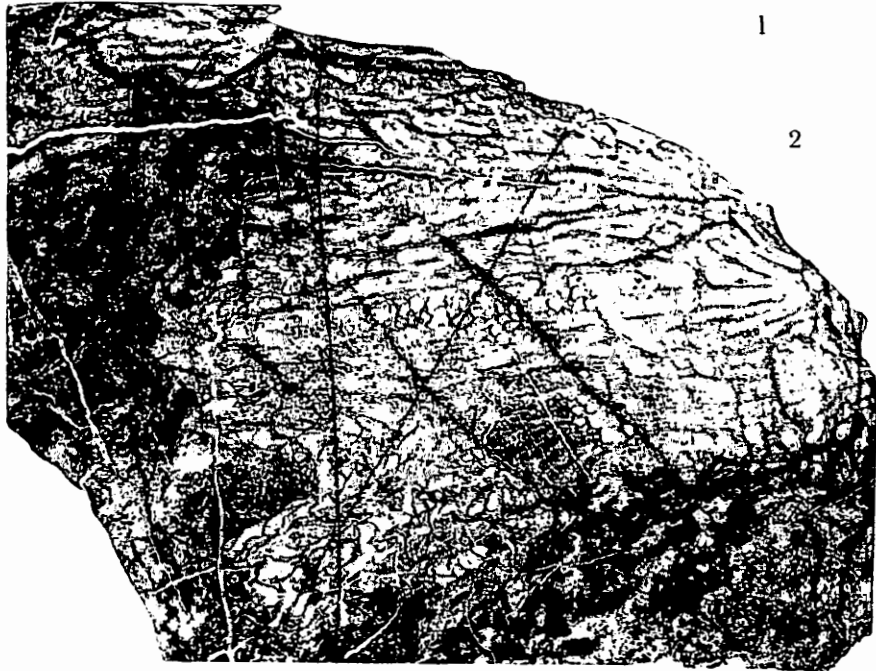
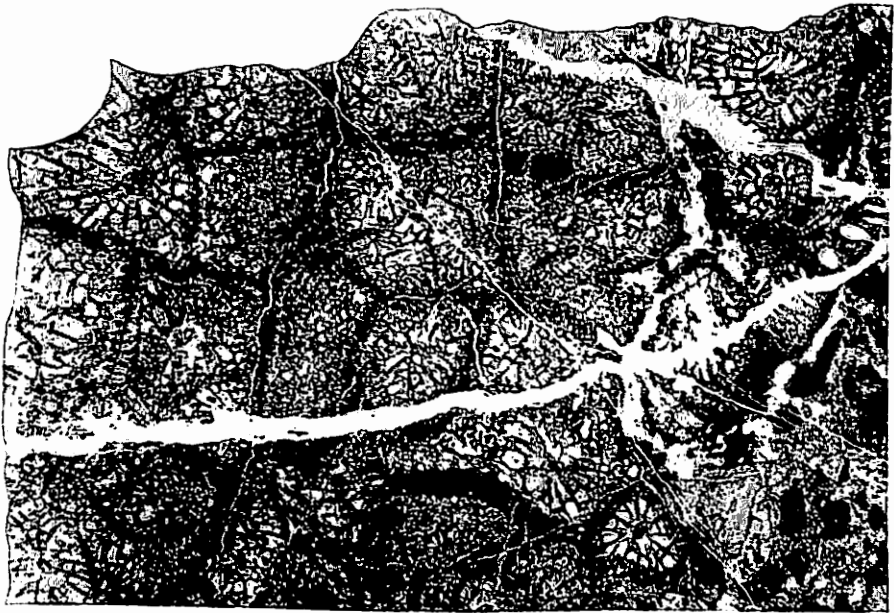
EXPLANATION OF PLATE

PLATE 11

Stylidophyllum yokomizo YOKOYAMA, n. sp.

FIG. 1. Transverse section. (× 3.0)

FIG. 2. Longitudinal section. (× 3.0)



1

2

EXPLANATION OF PLATE

PLATE 12

Pseudopavona taisyakuana YABE, SUGIYAMA and EGUCHI

FIG. 1. Transverse section. ($\times 3.5$)

FIG. 2. Longitudinal section, showing the association with *Fusulinella biconica*, F. sp., etc. ($\times 4.0$)



2

