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The Upper Jurassic of Cape Shiriya, Aomori Prefecture, Japan

Masafumi Murata

(With 3 plates, 1 text-fignre)

INTRODUCTION AND ACKNOWLEDGEMENTS

In a small area of Cape Shiriya situated at the northeastern end of Honshu in Aomori Prefecture there are developed sandstones, slates, cherts and limestones all of which had long been supposed to be Paleozoic in age and a northern extension of the Paleozoic formations of the Kitakami massif situated in the south of the present area. These rocks so far as exposed form the basement of the area in question and had yielded no fossils until Y. Onuki (1959) discovered some Hexacoralla from a limestone conglomerate exposed in the northeast of Cape Shiriya in Higashitori-mura, Shimokita-gun, Aomori Prefecture.

From the find of Hexacoralla similar to those collected by K. Hase (1952) from the Mesozoic rocks in Iwaizumi-machi, Shimohei-gun, Iwate Prefecture, in the Shiriya area the long supposed Paleozoic age of those rocks should be discarded regardless of their adpparent similarity in lithology with the Paleozoic rocks of the Kitakami Massif.

Before proceeding the writer expresses his thanks to Professor Yoshio Onuki of the Department of Geology, Faculty of Education, and Professor Motoki Eguchi of the Department of Mining, Faculty of Technology, both of the Tohoku University, for their continuous guidance. Thanks are also due to Professors Enzo Kon'no, Kotora Hatai and Kiyoshi Asano of the Institute of Geology and Paleontology, Tohoku University, for their kind advice and encouragement.

REMARKS ON THE STRATIGRAPHY

The area of Cape Shiriya was studied by K. Sato (1961) who worked out the stratigraphical sequence of the disturbed rocks and established the following order, from the older to the younger, namely :

Shimokita group	Iwaya formation	450 m thick
	Kuwabatake-yama formation	1,500 m thick
	Tatemachi-jima formation	800 m thick

The Shimokita group which includes the three formations above cited is distributed in patches within the Tertiary and Quaternary deposits. The main areas of distribution of the Shimokita group are the vicinity of Kuwabatake-yama and the Katasaki-yama area. The above given classification of the rocks was made in the former area, whereas in the latter area there is developed the Katasaki-yama formation, a name applied to the rocks there distributed because of the lithology being different from the formations in the former area. The Katasaki-yama formation is included by Sato into the Shimokita group. These mentioned formations are described in the following lines.

1. Tatemachi-jima formation.

The type locality of this formation is the wave-cut benches and cliffs distributed around the northeastern end of Cape Shiriya, being best exposed along the northwestern

beach from the Shiriya Lighthouse to the southwest of Tatemachi-jima. It is also distributed intermittently along the eastern beach of the Cape to the west of Ataka-jima, being exposed as small patches under the marine terrace deposits of the area.

The lower part of this formation consists mainly of a thin alternation of shale and sandstone intercalated with lenses of limestone, conglomerate and fine to medium grained sandstone. The chief lithofacies of the upper part of the formation comprise thick chert associated with lenticular siliceous shale, sandstone, limestone and conglomerate, among which limestone and conglomerate predominate along the eastern beach.

The conglomerate of this formation contains angular to subrounded pebbles of chert, shale and limestone debris which measure less than seven centimeters in diameter. The matrix consists of shale or calcareous shale, and the facies changes gradually into shale or limestone both laterally and vertically. Rarely rounded grano-diorite pebbles are found in the conglomerate.

Limestone lenses are found at several places and some of them are of conglomeratic limestone. The limestone and the limestone pebbles in the conglomeratic limestone are mostly black or dark gray and oolitic or pisolitic. From the four limestone lenses along the eastern beach between Fujiishimisaki and Kishima and at Kishima the opposite shore of Kishima (Loc. 029, 030) and near Ataka-jima Hexacoralla and Stropatoporoid were found. These fossils were determined to comprise the following, namely:

Kobya shiriyaensis Murata, n. sp.

Stromatopora (*Parastromatopora*) *crassifibra* Yabe and Sugiyama

The base of the Tatemachi-jima formation remains unknown because of being intruded with igneous rocks, and the thickness of the formation was estimated to be about 800 meters, because of being thought to be homoclinal. However, folding and faulting aid in making the structure complicate and phyllitic structure is developed throughout. For such reasons it is thought that the true thickness may be less than the estimated one.

2. **Kuwabatake-yama formation.**

Superposed upon the Tatemachi-jima formation with conformity and widely developed in the Kuwabatake area is the Kuwabatake-yama formation. This formation is distributed from the northeastern beach of Akasaka from where it extends southeastwards to the sea cliff of Shikkari via Shiriya and Kuwabatake-yama. Good exposures are found along the northwestern beach between the type locality of the Tatemachi-jima formation and Akasaka. The Kuwabatake-yama formation is also exposed in the vicinity of Iwaya because the group forms a syncline with axis trending NNW–SSE.

The main rock facies of the formation consist of sandy shale and limestone intercalated with schalstein, chert and sandstone lenses. In the type section the formation begins with a more than five meters thick coarse grained massive quartzose sandstone bearing angular fragments of shale. This quartzose sandstone is distributed southeastwards along the eastern beach where it attains more than 20 meters in thickness. This sandstone is superposed with a more than 50 meters thick sandy shale covered by a nearly 200 meters thick alternation of sandy shale and medium to fine grained sandstone, and chert layers are embedded in the sandy shale. The upper and middle parts of the Kuwabatake-yama formation consist of limestone and shale intercalated with schalstein and chert lesnes. The limestone is massive and without stratification, being of a light gray to white color. In the eastern part of its distribution the limestone becomes conglomeratic. However, at the western part of the beach the lower part of the limestone is argillaceous and yields some Hexacoralla. Schalstein occurs in the limestone or shale in the middle and uppermost parts of the formation. Chert lenses are well developed in the upper part of the limestone and shale.

The formation is estimated at 1,500 meters in thickness.

The Hexacoralla found from this formation are as follows, namely:

Calamophyllia ? sp.

Thecosmilia ? sp.

3. Iwaya formation.

The Iwaya formation is widely distributed in the southwestern part of the Kuwabatake area, being well exposed along the beach from Akasaka to Iwaya and in the entire valley of Kitazawa. It consists mainly of sandstone and sandy shale intercalated with chert, conglomerate or conglomeratic shale and small limestone lenses.

The Iwaya formation begins with conglomeratic shale comprising angular to subrounded pebbles of chert, siliceous shale and limestone, most of which are less than five centimeters in diameter. This is overlain with fine to medium grained sandstone which grades into chert at places. The middle part of the formation consists of chert, limestone and conglomerate which grade into one another, laterally as well as vertically. The upper part of the formation comprises an alternation of sandstone and sandy shale. The thickness of the formation is estimated to be about 450 meters.

4. Katasaki-yama formation.

This formation is developed in the south of Horobe, being distributed in Katasaki-yama and its vicinity, and is well exposed in the valley of Higurashizawa. This formation is separated from the others of the Shimokita group by Tertiary and Quaternary deposits.

The Katasaki-yama formation comprises sandstone and siliceous shale with subordinate amounts of chert, conglomerate and limestone. The sandstone may be fine grained and the siliceous shales of less than 100 meters in thickness may be black colored. The middle part of the formation consists of dark grayish medium to coarse grained sandstone, black sandy shale with chert fragments and pebbly conglomerate. The conglomerate comprises angular to subangular fragments of chert and sandstone most of which are less than three centimeters in diameter, and the sizes gradually decrease upwards. The upper part of the formation consists of coarse grained sandstone and siliceous shale, the latter becoming more dominant in the upper part where it is intercalated with beds of sandstone. The formation is estimated to exceed 600 meters in thickness.

5. Geological structure of the Shimokita group

In general in the Kuwabatake-yama area the Shimokita group forms a syncline with axis trending NNW-SSE and plunging towards the south. For this reason the strike of the group in the eastern wing is NW-SE in the northwestern part but N–S in the southeastern, whereas the western wing strikes N–S to NNE-SSW, and the dips are to the SW or W in the eastern wing and E in the western one, but the northern part of the western wing is overturned to W.

In the northern part of the Katasaki-yama area the Katasaki-yama formation forms a syncline with axis trending NNE-SSW, and the strikes are generally NNE-SSW to NNE-SSE, and the dip is towards the W in the eastern wing and to E in the western one.

Faults and folds of minor scale are observed commonly and the shale facies show phyllitic structure, and by these features the structure of the Shimokita group is more or less complicate.

The stratigraphical relation of the Katasaki-yama formation to the Shimokita group in the Kuwabatake-yama area remains unknown because the former is barren of fossils and differs from the latter in rock facies and geological structure. Thus, it may be considered that these two blocks are separated from one another by fault estimated to trend NWW-SEE.

Although the paleontological evidence for age determination of the Shiriya group is not abundant, it is important that a few species which may be regarded as good age-indicators occured from the fauna.

The genus *Kobya* occurs from the Upper Jurassic (Bajocian upper Putchum beds) in the northwest of Jumara, Cutch in India, and from the upper part of the lower Cretaceous (Miyakoan-Miyako group) in the Miyako District in Iwate Prefecture. Consequently the genus ranges from the Upper Jurassic to the lower Cretaceous. However, comparing *Kobya shiriyaensis* with the known Cretaceous species it is evident that the former is more primitive than those of the latter, and for this reason, it is probable that the former species may be older than those of the latter. Therefore, *Kobya shiriyaensis* may be regarded as a species better referable to the Upper Jurassic. Upholding the Jurassic age of the just mentioned coral is the associated occurrence of *Stromatopora* (*Parastromatopora*) *crassifibra* which was first described by Yabe and Sugiyama in 1935 from the Torinosu Limestone (Upper Jurassic) at Hukazawa near Itsukaichi-machi, Nishitama-gun, Tokyo-to, and from the type locality of the Torinosu Limestone at Kubokawa, Sagawa-machi, Takaoka-gun, Kochi Prefecture. This stromatoporoid is known only from the Upper Jurassic rocks of the Japanese Islands.

These two mentioned species were collected from the limestone lenses of the Tatemachi-jima formation. Although the geological age of the Kuwabatake-yama and Iwaya formations cannot be determined with certainty because or being barren of fossils, stratigraphically they are younger than the Tatemachi-jima formation, and being continuous with the last mentioned, those two are also thought to belong to the Upper Jurassic in age.

DESCRIPTION OF THE SPECIES

Class Anthozoa
Order Scleractinia Bourne, 1900
Suborder Fungiina Verrill, 1865
Superfamily Fungiicae Dana, 1846
Family Synastreidae Alloiteau, 1952
Genus ***Kobya*** Gregory, 1900
Kobyashiriyaensis Murata, n. sp.
Pl. 30, figs. 1–6.

Description : – Corallum massive, thamnasterioid intertentacular budding. (Holotype more or less worn, 45×20×14 mm in size.) Corallites oval or more or less polygonal in cross-section, and with irregular arrangement. Diameter of corallite uniform, no wall, completely blended by confluent septa. Columella parietal, formed by innerseptal denticulation, feebly developed, disposed at distances of mostly 2.6–3.0 mm, occasionally 3.5–4.0 mm. Septa directly confluent, thin, 15 to 24 in number, perforate, compound trabeculate in structure, and united by numerous synapticulae. 10 to 13 principal septa extend to columella. Septo-costae subparallel, as thin as septa, crowded, 12 per 3 mm. Endothecal dissepiments well developed.

Remarks : – Although the type specimen is unfavourably preserved for examination of the external features of the corallum, in cross and longitudinal sections of the corallites the structures described above could be observed well. The present species differs from the known ones of *Kobya* by the smaller corallite and fewer septa.

Thamnasteria hideshimaensis Eguchi from the Hiraga sandstone somewhat resembles the present one, but it belongs to the genus *Thamnasteria* Lesauvage and has simple trabeculae septa.

The type specimen was collected by Y. Onuki and recorded with a short communica-

tion but without description in 1959.
Occurrences : – Rare at IGPS Loc. cat no. Ao. 029; Tatemachi-jima formation.
Repository : – IGPS coll. cat. no. 76566 (Holotype), 78940, 78941, 78942 (Paratype).

Superfamily Agariciicae Gray, 1847
Family Calamophylliidae Vaughan and Wells, 1943
Genus ***Calamophyllia*** Blainville, 1830
Calamophyllia ? sp.
Pl. 31, figs. 2–5.

Remarks : – The material consists of many ill-preserved fragments of the corallite or parts of the branches in association with broken parts of *Thecosmilia* ? sp. The corallum is phaceloid, probably forming fasciculate lumps 0.5–2.0 cm in size. The normal corallites are cylindrical, compressed, elliptical or trilobate in section, if budding , externally finely costate, 4–8 mm in diameter. Well composed of a single ring of synapticulae. The septa are thin, but the microstructure is obliterated by crystalization. The number of septa vary according to the size of the corallites; 36–40 septa in 5 mm diameter corallites, about 60 septa when the diameter attains about 8 mm and half of them reach the columella.

Calamophyllia sandbergeri Felix is somewhat similar to the present specimens in size and shape of the corallites but the septal structure of the former are not well preserved.
Occurrence : – Abundant at the sea cliff of about 500 m NE of Akasaka, Higashidori-mura, Shimokita-gun, Aomori Prefecture. IGPS loc. cat. no. Ao 031; Kuwabatake-yama formation.
Repository : – IGPS coll. cat. no. 78943.

Suborder Faviina Vaughan and Wells, 1943
Superfamily Faviicae Gregory, 1900
Family Montlivaltidae Dietrich, 1926
Subfamily Montlivaltinae Dietrich, 1926
Genus ***Thecosmilia*** M. Edward and Haime, 1848
Thecosmilia ? sp.
Pl. 31, fig. 1.

Remarks : – The weathered cyclindrical corallite fragment at hand measures 12 mm in length. The corallite is circular in cross-section, and 15 mm in diameter. The septa are thin, laminar, dentate marginally, non-porous, of four more or less complete cycles, alternating in size, and diminishing in breadth with growth. The costae are distinct and subequal to one another. The columella is rudimentary.

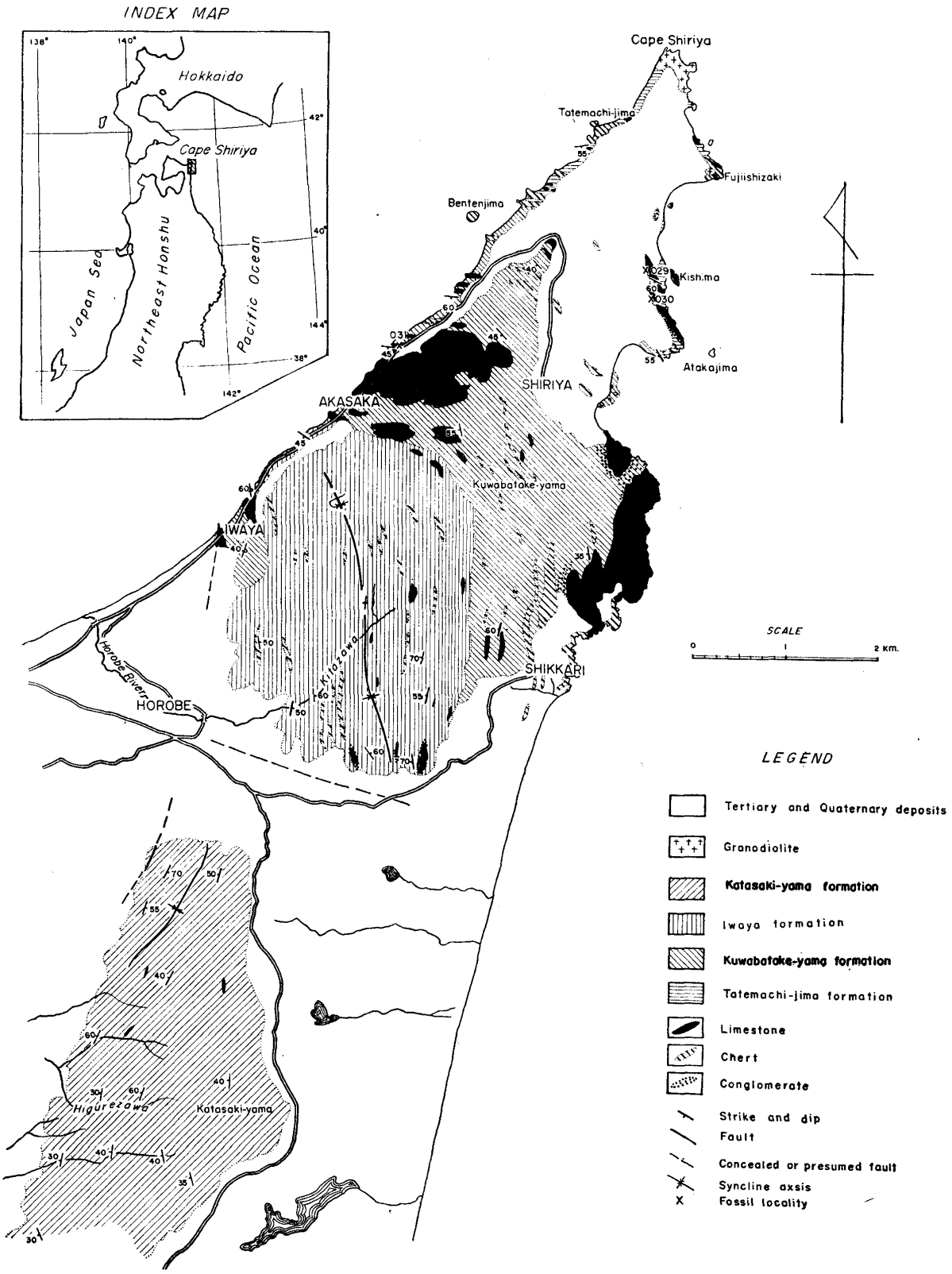
This species could not be determined because the entire shape of the corallum and nature of branching remains unknown.
Occurrence : – Rare at IGPS Loc. cat. no. Ao. 031; Kuwabatake-yama formation.
Repository : – IGPS coll. cat. no. 78944.

Class Hydrozoa
Order Stromatoporoidea Nicholson and Murie, 1878
Family Stromatoporidae Nicholson, 1886
Genus ***Stromatopora*** Goldfuss, 1826; emend. Yabe and Sugiyama, 1935
Subgenus ***Parastromatopora*** Yabe and Sugiyama, 1935
Stromatopora (Parastromatopora) crassifibra Yabe and Sugiyama, 1935

Stromatopora (*Parastromatopora*) *crassifibra* Yabe and Sugiyama, 1935, p. 179, pl. 41, figs. 8; pl. 43, fig. 8 ; pl. 45, fig. 3; pl. 51, fig. 9 ; pl. 57, figs. 6, 7; pl. 61, fig. 1.

Fig. 1, Geological Map of Cape Shiriya

(modified from Sato, 1961)



Description : – Colonial, laminar, more or less hemispherical in extension. Mammelons and astrohizae unknown. Coenosteum composed of continuous subparallel pillars, straight or slightly bent at margin, mostly lamellate and showing strong tendency to produce adjoined tubes, and thin regular tabulae. Pillars 0.21–0.37 mm broad, 4 per 2 mm; lamellae somewhat thinner in breadth. Numerous horizontal tabulae in interspaces between pillars 5–6 per 2 mm. Trabeculae fibrous in microstructure, with fine poorly defined bundles.
Remarks : – The new material of this species consists of small fragments of colonies, 3×4 ×0.5 cm in size.

The coarse texture of the coenostum and distinct features of the skeletal elements agree well with Yabe and Sugiyama's description, especially their pl. 45, fig. 3 and pl. 43,
Occurrence : – Abundant at IGPS loc. cat. no. Ao 030; Tatemachi-jima formation.
Repository : – IGPS coll. cat. no. 78945.

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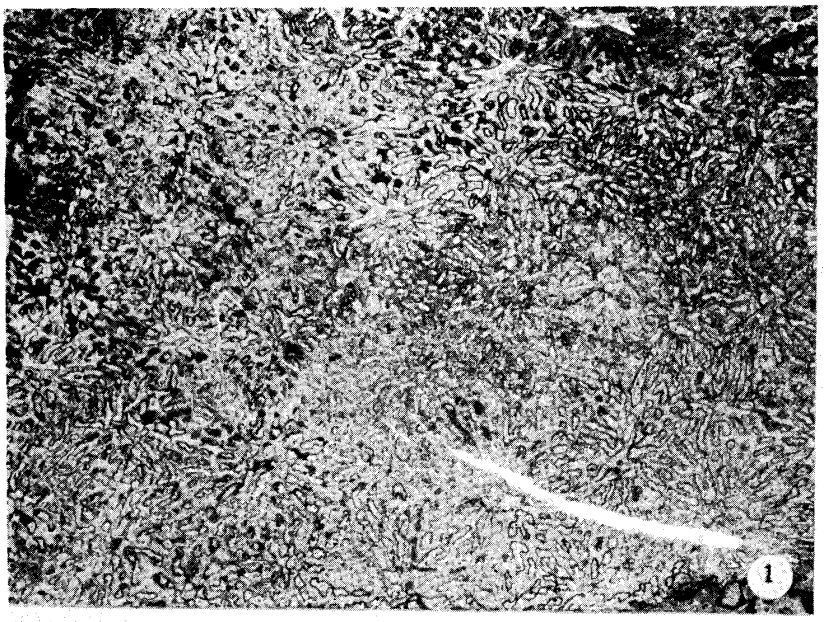
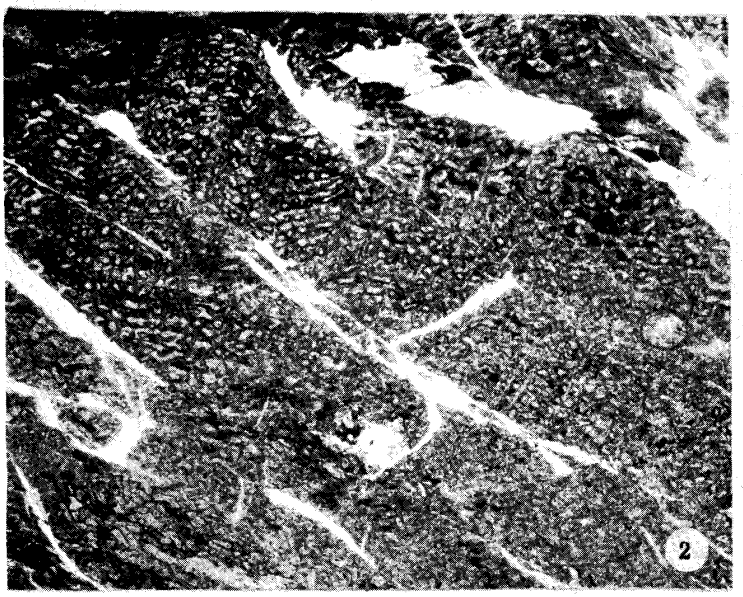
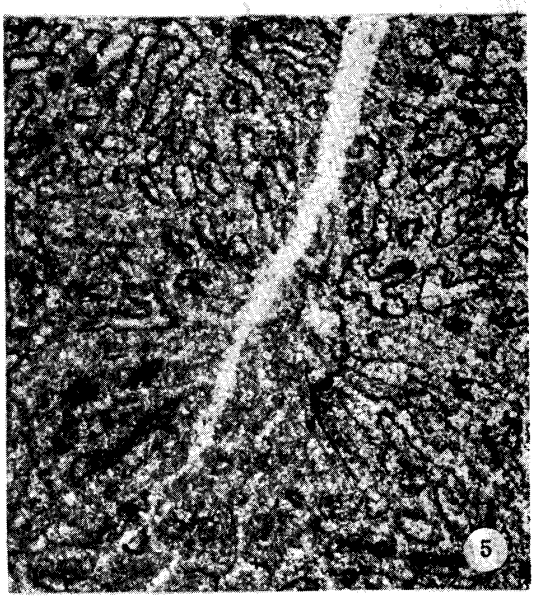
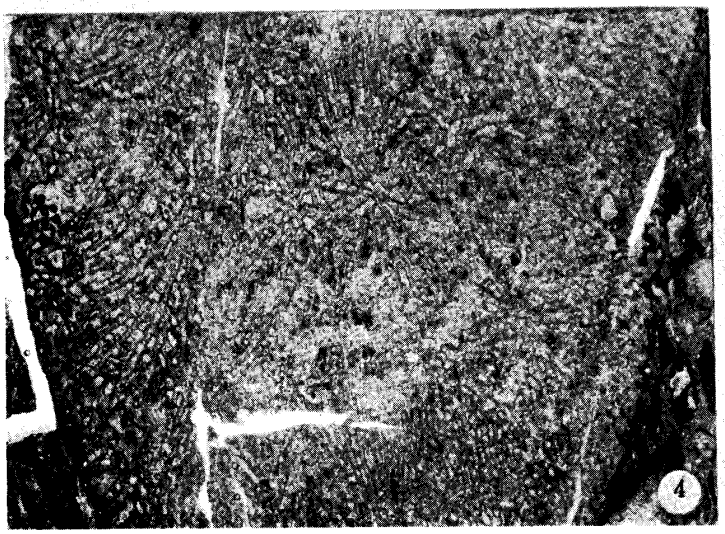
PLATE 30

Figs. 1–6. *Kobya shiriyaensis* Murata, n. sp. (p. 122) 1–Transverse section, ×4. 2–Longitudinal section, ×4. IGPS coll. cat. no. 76566 (Holotype). 3, 4–Transverse and slightly oblique transverse sections, ×4. IGPS coll. cat. nos. 78940, 78941 (Paratype). 5– A part of Fig. 1, enlarged, ×10. 6–A part of Fig. 2, enlarged, ×10. loc. no. Ao 029. Jurassic Tatemachi-jima formation. Coll. Y. Onuki.









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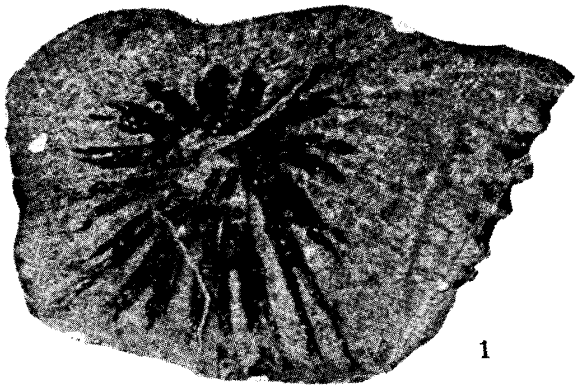

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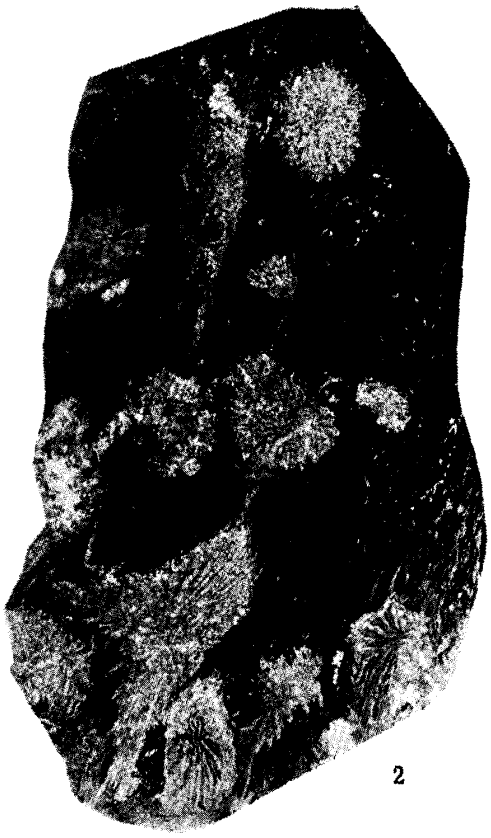

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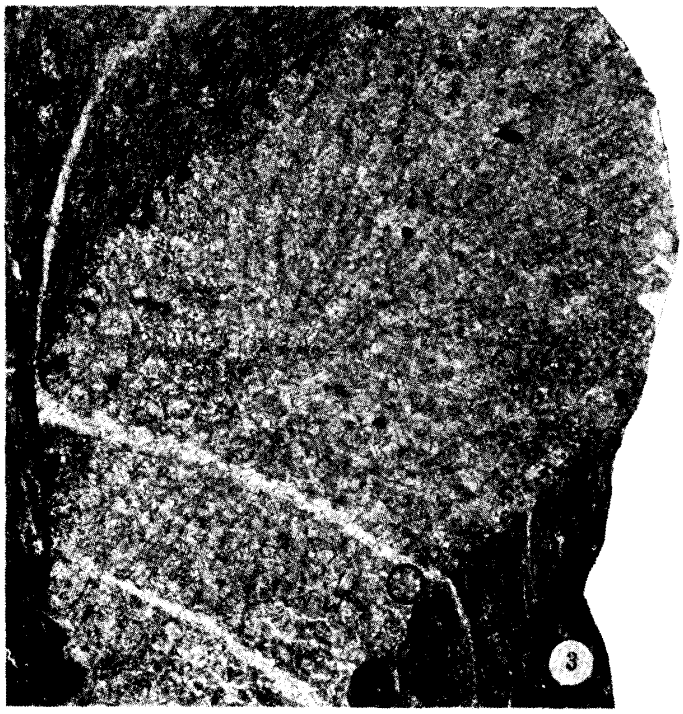

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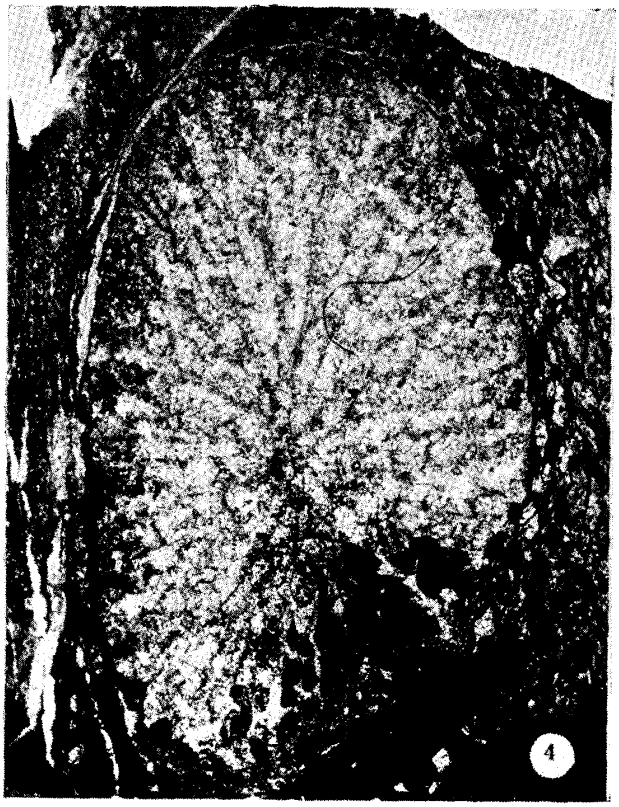

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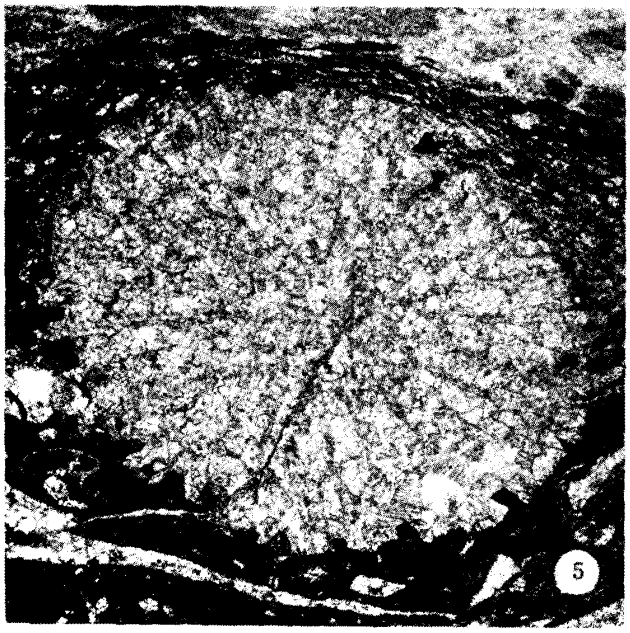

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K. Kumagai Photo.

PLATE 31

Fig. 1. *Thecosmilia* ? sp. (p. 123)
Transverse section, ×4, IGPS coll. cat. no. 78944. loc. no. Ao 031. Jurassic Kuwabatake-yama formation. Coll. M. Murata.

Figs. 2–5. *Calamophyllia* ? sp. (p. 123)
2–Transverse section, ×2. Corallites are more or less crushed. 3,4–Slightly oblique transverse sections, ×10. 5–Transverse section, ×10. IGPS coll. cat. no. 78943. loc. no. Ao 031. Jurassic Kuwabatake-yama formation Coll. M. Murata.

PLATE 32

Figs. 1–5. *Stromatopora* (*Parastromatopora*) *crassifibra* Yabe and Sugiyama (p. 123)
1–Transverse section, ×8. 2– A part of Fig. 1, enlarged, ×60. 3–A part of Figs. 1, 2, enlarged, highly magnified to show the microstructure of the trabeculae, ×180. 4–Longitudinal section, ×10. 5–A part of Fig. 4, enlarged, ×60. IGPS coll. cat. no. 78945. loc. no. Ao 030. Jurassic Tatemachi-jima formation. Coll. K. Sato.


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K. Kumagai Photo.