77. Discovery of Corals of Devonian Types from Tyôsen (Korea).*

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A few years ago, Mr. K. Ozaki of the Shanghai Science Institute sent to the senior writer two slabs of dark gray limestone with corals of two different kinds. These slabs were collected by him at Tenseiri, Zyunsegun, Heian-Nan-dô, in northern Tyôsen (Korea). The limestone, according to him, occurs there interbedded in a complex which is usually regarded to be equivalent to the Kôten series of the Heizyô coal-field, both agreeing with each other in lying beneath the coal-bearing Zidô series and upon the thick limestone formation of Ordovician age.1)

The details of the geological condition of the locality of the fossiliferous limestone are now unknown to the writers, but the locality is situated diametrically some 12 km south of Hôsô on the main road from Zyunse to Tokusen along the river Daidô-kô, and the senior writer's own observation along the route some twenty five years ago is briefly reported as follows5): "Following the route from Zyunse toward Hôsô, the Ordovician limestone which is quite similar to that of the Heizyô coal-field is succeeded in upward sequence by ottrelite slate, dark coloured and greenish clayslate and sandstone, metamorphosed limestone, and a series of dark gray slate and sandstone in alternation with interbedded limestone. This limestone did not yield any fossils, but a thick limestone exposed farther east between Hôsô and Syasô contains some foraminifera and may be correlated with the foraminiferous limestone lying near the top of the Kôten series in the Heizyô coal-field." The foraminiferous limestone of the Heizyô coal-field is the Fusulina-limestone of Moscovian age. He concluded the above paragraph with a word on the urgent need of re-study of this intermediate complex on the Zyunse-Hôsô route.

In a report on the geology of the Tokusen coal-field which includes this locality of fossiliferous limestone in its southwestern part, Mr. T. Shiraki3) mentioned the intermediate complex consisting of limestone, sandstone, reddish and greenish gray shale, all often containing ottrelite; the limestone occurs in six beds and the third limestone from below, the thickest of all, attains 40 m and has corals and brachiopods. It is not unlikely that the fossiliferous limestone blocks of Ozaki is derived from this limestone zone, though he did not find any trace of brachiopods.2)

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1) Communicated in a letter.


pods in the association of corals at the locality of his coralline limestone.

The field now in concern was also mapped by Mr. I. Tateiwa in the Geological Atlas of Tyōsen, No. 12, issued in the same year (1931) from the Geological Survey of Tyōsen Governorship; Tateiwa, who then likewise correlated the series of green ottrelite slate and limestone in alternation, with the Köten series, plotted several localities of fossils of the “Kötten series” in the Inzan Sheet and made mention of the occurrence of corals and crinoid stem-joints in several limestone beds, especially notifying his find of a tabulate coral in a limestone exposed at Zuido, Tenseiri; unfortunately no one has yet studied his corals in detail. A comparison of Tateiwa’s map and note and Ozaki’s communication makes it beyond doubt that the coral remains now at the writers’ disposal were derived from one of the limestone beds inter-bedded with ottrelite slate in the “Kötten series.”

The Kötten series which is the lowest of the three divisions of the Heian system in Tyōsen is marked by prevailing reddish and brownish shale and sandstone; it has often several lenses of limestone and chert. It is a wide-spread formation not only in Tyōsen, but also in southern Manchuria: everywhere it has along with it Lower Permian coal measure with Pseudoschwagerina ‘princeps’ zone at the very base on one side and Ordovician limestone on the other. The limestone and also chert lenses in the Kötten series are usually fossiliferous, sometimes being very rich in foraminifera such as Fusulinella bocki Möller, Fusulina konnot Ozawa and Staffella spheroida (Möller), as in the eastern part of the Heizyo coal-field and in the Nei-etu district in Kōgen-dō; in the Honkeiko coal-field, Manchuria, the same limestone is not only rich in the foraminifera cited above, but also in corals such as Arachnastraea and Cystophora. This part of the Köten series is Moscovian in age on the palaeontological evidence.

The Kötten series in its typical development in the Heizyo coalfield has a brachiopoda bed very near the base; this yielded to K. Ozaki a faunule consisting of

- Lingula sp.
- *Rhipidomella* cf. cora d’Orb.
- *Streptorhynchus* ? sp.
- *Schizophoria swallowi* (Hall)
- *Chonetes* cf. *carbonifera* Keyserling
- *Productus* sp.
- *Productus* sp.
- *Spirifer* (*Choristites*) *pavlovi* Stuckenberg
- *Spirifer* sp.
- *Spirifer* sp.

and is of Carboniferous age according to him. Mr. N. Ikebe who


2) N. Hatae: Stratigraphical Division of Heian System on Fossil Foraminifera (Japanese, with an English abstract). Jubilee Publ. in the Commemoration of Prof. H. Yabe’s 60th Birthday, pp. 551-562, 1939.

studied more recently the details of the complicate geological structure of the coalfield confirmed the stratigraphical position of the brachiopod bed near the very base of the series and followed Ozaki as to its geological age.1)

The coral remains in the limestone slabs collected by Ozaki represent two very characteristic forms, one of *Phillipsastraea* and the other of *Disphyllum* (*Phacellophyllum*) as illustrated below; though the materials are not sufficient for the specific determination, the generic reference of these corals to *Phillipsastraea* and *Disphyllum*, the writers believe, leaves no question. The two genera being confined in their geological range to the Devonian, the Devonian age of the limestone slabs and hence the formation interbedding the coralline limestone seems highly probable, and it is a question left unsettled for later researches, whether the limestone is a member of the deposits which certainly constitute a part of the Köten series in the original sense or of another independent series distinct from the Köten series. At any rate it is almost certain that there exists a formation lying on the great Ordovician limestone formation and probably of the Devonian age exposed in the Tenseiri field.2)

For a long time, it was generally accepted as an established fact that Devonian and Gotlandian deposits are thoroughly lacking over an extensive area of North China, Manchuria and Tyósen, owing either to

1. That the Ordovician floor now directly covered by the Köten series was originally overlain by Gotlandian and Devonian sediments which have since been totally eroded before the deposition of the Köten series,

or to

2. That the Ordovician floor was never covered by any Gotlandian or Devonian sediments.

and apparently the latter view has hitherto found general acceptance among a great many geologists. But the following two accounts now becoming known seem to be favourable for the former hypothesis.

1. The Kenniho limestone conglomerate with limestone boulders bearing many Gotlandian fossils discovered by K. Ozaki near Kenniho, Kókai-do, Tyósen.3)

2. The limestone of Tenseiri with Devonian corals dealt with in the present paper.

At least the land of northern Tyósen was probably transgressed by Gotlandian and Devonian seas, and the sub-Köten surface is not only pre-Köten, but also at the same time either post-Gotlandian or post-Devonian according to the limestone of Tenseiri with the Devonian

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2) After the present article was sent to the press, the writers have been fortunate, through the courtesy of Mr. I. Kató, general manager of the Tyósen anthracite company, to make a stratigraphical study at the locality from where fossils were procured. Field observations will be given in another article.

corals does or does not belong to the lower part of the Köten series. The time gap indicated by the stratigraphical hiatus becomes considerably narrower.

Description of Corals

**Phillipsastraea** sp.

Figs. 1, 2.

Corallum lamellar, moderately large, the fragmental sample at hand measuring over 300 mm in lateral extension and 30 mm in thickness. Surface feature unknown. Corallites columnar, 7–10 mm broad, irregularly pentagonal in cross-section, separated by wall or lacking it and then adjacent corallites connected by confluent septa and dissepimental tissue; wall if present thin, not much stronger than septa and appearing in cross section of corallites as zigzag lines by which alternate proximal end of septa of adjacent corallites are linked. Tabularia 2–3 mm broad, adjacent ones 4–7 mm apart. Septa numbering up to 20, alternately long and short, slightly dilated on the border of tabularia, strongly carinate; major septa extending to the centre of corallites where most of them touch one another; minor septa slightly extending into tabularia. Tabulae and dissepiments hardly distinguishable in vertical section of corallites, both being almost horizontal or rather slightly convex upwards, usually complete, but rarely forming vesicular tissue. No distinct columella.

The general features of the fossil outlined above will suffice to show its belonging to the genus **Phillipsastraea**, which is one of the long puzzled coral genera and whose distinctive features were first brought to light by later revision of its typical forms by W. D. Lang and S. Smith, and also mentioned by D. Hill in a recent paper. Though its specific identification is impossible owing to its scanty material, yet it is so far certain that it is a species with septa not so much dilated on the border of tabularia as the genotype *P. hennahi* (Lonsdale) from the Upper Devonian of Europe. In this respect, it more closely resembles some geologically older types, as, for instance, *P. speciosa* Chapman from the Middle Devonian of Victoria, Australia, fully described by Hill in her paper referred to above.

**Disphyllum** (*Phacellophyllum*) sp.

Figs. 3–5.

Corallum dendroid, more than 70 mm long, branches or corallites issuing from axis in rather broad angles.

Corallites up to 35 mm long, almost cylindrical, slightly expanded from proximal end to distal, where it is about 10 mm broad. Septa

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counted 22 in one of corallites examined, alternately long and short, longer ones extending from wall to one-half radius of corallites and shorter ones being as long as about one-third of former. Tabulae of two kinds, those occupying broad central area slightly convex upwards, some more or less wavy, 5 or 6 counted in 5 mm; peripheral tabulae small, forming vesicules, being convex inwards and upwards, very irregular in development, quite or almost lacking in some parts of corallite. Dissepiments also of two kinds, those of dissepimentarium or inner zone horse-shoe shaped and arranged in a single row, rather uniform in size and shape; those of outer zone likewise small, sometimes disappearing, tabula-like in aspect. Columella absent.

Growth habit is characteristic to this coral; by this and internal structure, it can safely be brought under the genus *Disphyllum* (*Phacellophyllum*), which according to Hill,¹ is strictly confined to the Devonian in the geological range and has a world-wide distribution. She distinguished four types of species of the genus on the different nature of dissepimentarium, and the Työsen fossil in concern no doubt belongs to her fourth type, which is said to have flourished in the Givetian and Frasnian of Europe.