Notes on Some Permian Fossils from the Toman Formation in Southeastern Manchoukuo

By

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With 2 Plates

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The Younger Palaeozoics in Northeastern Manchoukuo, namely, Provinces Kirin, Pinchiang, Chientao, etc. appear to be quite different in faunal aspect as well as in rock facies from those in Southwestern part of the country. The former includes such geological formations as hitherto known under the names Kirin* and Toman** Formations; the Hekijô*** Groups in Northern Tyôsen (Korea) belongs equally to the same category. Palaeontologically these formations have been scarsely studied and the occurrence of fossils has been rarely reported from either the Kirin Formation or the Hekijô Groups, while none has been known from the Toman Formation.

Three years ago, Mr. G. ASANO[1], a geologist of the Geological Institute of Manchoukuo, collected numerous fossils from the shaly slate of the Toman formation developed near Kai-shan-tun,**** Province Chientao, and reported the occurrence of the following fossils (determined by Mr. J. IWAI): *Spiriferina* ? sp., *Productus* sp., *Fenestella* spp., *Chonetes* sp., *Marginifera* sp., *Retzia* (*Hustidea*) sp., and *Camarophoria* sp.

In 1940, Prof. T. NAGAO, Institute of Geology and Palaeontology, Tôhoku Imperial University, Sendai, visited the same locality from where Mr. G. ASANO collected the fossils mentioned above, and kindly entrusted to me the study of the fossils.

1) G. ASANO: Report on the Chromite and Some Other Deposits near Kai-shan-tun, Ho-lung Prefecture (in Japanese). Bull. Geol. Inst. Manchoukuo, no. 97, p. 35, 1939.

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The materials are unfortunately of very unsatisfactory preservation, being represented by impressions of outer and inner surface, and moreover each fossil is considerably deformed subjected to the crushing of the formation in which they were contained, and only a preliminary study is now available. The following is a list of fossils collected by Prof. T. NAGAO from the Toman Formation at Kai-shan-tun:

Fenestella spp.
**Polypora manchoukuoensis* sp. nov.
Acanthocladia ? sp.
Batostomella ? sp.
**Waagenophyllum indicum* (WAAGEN and WENTZEL).
**Linoproductus lineatus* (WAAGEN).
**Echinochonchus* sp.
**Spiriferina cristata* SCHLOTHEIM
**Spiriferina* cfr. *nasuta* WAAGEN
Spirifer sp.
Chonetes sp.
Hustedia sp.
Marginifera sp.
Aviculopecten sp.

Besides these fossils listed above, there are a number of specimens of Bryozoa and Pelecypoda, but they are hardly generically determinable. Of these fossils, *Polypora manchoukuoensis* is allied to *P. koninckiana* WAAGEN and PICHL from the Salt Range, which is very common in the Middle *Productus* Limestone, though it occurs also rarely from the Upper *Productus* Limestone. *Waagenophyllum indicum* is also one of the characteristic species in the Middle *Productus* Limestone, and is an element of the *Yabeina* and *Pseudoschwagerina* fauna in the Kitakami Mountainland in Japan. *Linoproductus lineatus* is a form hardly distinguishable from the type specimen of this species from the Salt Range, where it is mostly concentrated in the Middle *Productus* Limestone, though not so much rare also in the Upper and Lower *Productus* Limestones. *Spiriferina cristata* is closely allied to *S. cristata* described by HAYASAKA from the Kitakami Mountainland, where it is associated with *Productus vishnu* WAAGEN, *Camarophoria humbletonensis* HOWSE, *Lyttonia*

* Species with illustrations and short descriptions in the present paper.

richthofeni KAYSER, all common in the Middle *Productus* Limestone. *Spiriferina* cfr. *nasuta* is allied to *S. nasuta* from the Middle Productus Limestone.

Although the material at hand is thus very meagle in number and very unsatisfactory in preservation, yet it is undeniable that the assemblage of the fauna is very similar to that of the Middle *Productus* Limestone of the Salt Range and also to the *Yabeina* Limestone of the Kitakami Mountainland. Thus it may be appropriate to consider that the Toman Formation, at least its fossil bearing part, is nearly equivalent to the Middle *Productus* Limestone and its equivalents.

At this place the writer wishes to express his warmest thanks to Prof. T. NAGAO, who has kindly supplied the specimens for study and given him valuable advices throughout the course of the present study. The writer's cordial thanks are also due to Prof. S. ÔISHI of our Department for his criticism and kindly reading of the manuscript.

Polypora manchoukuoensis sp. nov.

Pl. I, Figs. 5, 6, 7; Pl. II, Fig. 1.

The specimens are rather fragmentary and pretty deformed, and none of the colonial body in a complete state are obtainable. The branches composing the colony bifurcate at distances from 12 mm. to 25 mm., whereby the whole network rapidly augments in lateral extension. The breadth of the branches is considerably variable, ranging from 2 mm. to less than 0.5 mm. In certain specimens, the dissepiments are quite thin, but in some zoaria they attain almost one-half of breadth of the branches. The round cell-apertures are visible on the surface of the branches, regularly arranged in oblique and 4 to 6 longitudinal rows. The breadth of dissepiments is quite narrow, but they are broadend at the base. No striations parallel to the length of dissepments as are commonly seen in the genus *Polypora* are observable, owing possibly to the unsatisfactory preservation of the specimens. The fenestrules are elongatedly oval in shape, but occasionally they are transversely oval. In the former case, there are generally 3 fenestrules in longitudinal, and 5 in transverse directions, within the space of 10 mm., while in the latter case where zoaria have transversely oval shaped fenestrules, there are 3

or 4 of them in transverse and 6 or 7 in longitudinal direction within the same space.

Remarks: On plate I, fig. 5 shows part of a colony attaining more than 10 cm. high and consisting of frequently bifurcating branches with longitudinally elongated fenestrules; fig. 6 shows also a fragment representing the similar habit in regard to the size, form and arrangement of fenestrules. While on the other hand, the specimen in pl. II, fig. 1 shows that the fenestrules are quite similar in all respects to the preceding specimens, especially being elongated longitudinally in the upper part (facing the figure) of the figure, while they become shorter and broader towards the other part. In this case one may consider that the polymorphism of fenestrules are subjected to the deformation of the specimens, but such a question may be erassed if we may see the specimen in pl. I, fig. 7 which, though imperfect, obviously shows that the fenestrules on the left hand side are short and broad while those in the lateral branches are considerably elongated in the longitudinal direction.

This Manchurian species is comparable to *P. koninckiana* WAAGEN and PICHL[1] from the Middle Productus Limestone of India, but may be different from this at least in having much broader fenestrules. In other minute characters, namely, the size, form and arrangement of cell-apertures, the present specimens are too unsatisfactorily preserved to admit of more precise comparison.

WAAGEN and PICHL described that the Salt Range fauna containing *Polypora koninckiana* is of Middle Productus Limestone. But as the fauna contains, besides *Polypora*, *Lonsdaleia* (= *Waagenophyllum*) *indica* WAAGEN and WENTZEL, *Lonsdaleia* (=*Wentzelella*) *salinalia* WAAGEN and WENTZEL, the age of the fauna should rather be regarded as Middle Permian.

Waagenophyllum indicum (WAAGEN and WENTZEL)

Pl. I, Figs. 1, 2, 3, 4.

1886. *Lonsdaleia indica*, WAAGEN and WENTZEL: Salt Range Fossils. Palaeontologia Indica, Ser. XIII, p. 987, pl. CI, figs. 1–3; pl. CXV, figs. 3, 4.

1) W. WAAGEN and P. PICHL: Salt Range fossils. Palaeontologia Indica, Ser. XIII, vol. I, p. 783, pl. XXXVII, fig. 5, pl. XXXVIII, fig. 4.; pl. XC, fig. 1. In Eastern Asia, GRABAU described *P. koninckiana* from the Kaiping coal basin in north China (cfr. A. W. GRABAU: A Lower Permian fauna from the Kaiping coal basin. Bull. Geol. Surv. China, no, 2, p. 69, 1920).

1915. *Lonsdaleia* (*Waagenella*) *indica*, YABE and HAYASAKA: Palaeozoic Corals from Japan, Korea and China. Jour. Geol. Soc. Tokyo, Vol. 22, p. 96.

1935. *Waagenophyllum indicum*, SMITH (pars.): Anthracolithic corals from British Columbia and related Species from the Tethyls. Jour. Palaeontology, Vol. 9, p. 32.

Corallum composite, fasciculate, consisting of fairly long cylindrical corallites which are more or less irregularly arranged and separated from one another at variable distances, the greater one being more than the diameter of the corallites. The diameter of the corallites measures about 3–5 mm. There are a number of major septa alternating with the minor ones. The number of major septa varies, ranging from 20 to 22; of these 22 is the most common case. The major septa are much thickened at the proximal ends becoming thin at the distal ends, straight or more or less sinuous and mostly reaching the collumella. Minor septa are more or less variable in length but longer than 1/3 and less than 1/2 of the major ones. The minor septa have almost the same features as the major ones, being considerably thickend close to the wall and thin distally. Columella is very thick occupying less than 1/3 of the diameter of the corallites, composing of numerous concentric tabellae, and radiating lamellae which are somewhat indistincntly preserved. Between the septa, there exist a large number of dissepiments which are arranged generally quite irregularly, but in rare cases they are so crowded at the distal ends of the minor septa so as to unite to each other to give an appearance of existing there an accessory wall. This feature is often seen in the smaller corallites than in the larger ones. Therefore the features appear to occur rather in the younger stage of the corallites, even though they have almost the same number of major septa as in the larger corallites. The outer wall is indistinct owing possibly to the ill preservation of the material.

In longitudinal sections, no definite horizontal tabulae are seen. The columella is composed of steeply sloping tabellae which are set closely (pl. I, fig. 3). The outer zone is composed of several rows of vesicles which may be unequal in size.

Remarks: There is a large number of specimens which have been reported under the name *Lonsdaleia indica* (= *Waagenophyllum indicum*) or its varieties. S. SMITH[1] took the limit of specific variations of the species very widely, and included *L. virgalensis* WAAGEN

1) S. SMITH: Op. cit., p. 32.

and WENTZEL, *Lithostrotion jourdyi* MANSUY, *Waagenophyllum virgalensis* var. *mongoliensis* GRABAU, and *Lonsdaleia* (*Waagenophyllum*) *indica* var. *akagoensis* OZAWA into the synonym of typical *Lonsdaleia indica* from the Salt Range, while YABE, GRABAU, HAYASAKA, and OZAWA took it in a rather narrow sense, an opinion to which the writer follows.

Although the Manchurian specimens are not satisfactorily preserved, it may be almost doubtless that all the characters mentioned above show that they are identical with the type specimen of *L. indica* described by WAAGEN and WENTZFL from the Salt Range, except that the minor septa in ours are a little longer than those in the latter.

Linoproductus lineatus (WAAGEN)

Pl. II, Figs. 2, 3, 4, 5.

1884. *Productus lineatus*, WAAGEN: Salt Range fossils. Productus Limeston. Brachiopoda. Palaeontologia Indica, Ser. XIII, p. 673, pl. LXVI, figs. 1, 2.

1914. *Productus cora*, HAYASAKA: Palaeozoic Brachiopoda from Japan, Korea and China. Sci. Rep. Tôhoku Imp. Univ., Sec. Ser. (Geol.), Vol. VI, no. 1, p. 68, pl. V, figs. 3, 4.

1927. *Linoproductus lineatus*, CHAO: Productidae of China, Part I. Paleontologia Sinica, Ser. B, vol. 5, fasc. 2, p. 129, pl. XV, figs. 25–27.

The materials are represented by only a few ventral valves which are deformed and partly broken. They show, however, the characters agreeing with *Linoproductus lineatus* in the original sence described by WAAGEN from India: the specimens at hand show an elongated form with the sides sub-parallel, and with the early development of the sinus recognized only in the umbonal region. The width of the shell is about 35 mm. and the length about 65 mm. There are regular surface striae running straight towards the anterior border, numbering 7 or 8 within the space of 5 mm.

Remarks: WAAGEN wrote in the original paper that the distinction between *Linoproductus cora* and *L. lineatus* exists in the presence (*lineatus*) or the absence (*cora*) of the median sinus in the ventral valve. But later it has become clear that even in *cora* the sinus sometimes occurs without changing the shell form. The presence or absence of the spines was also taken by WAAGEN as a criterion with which species of *cora* group may be distinguished from *lineatus*. However, it has become clear that this is also not tenable. Thus the

shell form is left as only feature distinguishing these two types. As to the specific distinctions between *cora* and *lineatus*, CHAO wrote as follows: "One thing seem certain, the sinus of the pedicle valve is subject to acceleration in developing in the different forms. Thus in the typical *Linoproductus cora* from Bolivia, it is the merest depression at the front; other specimens, however, show this condition when the shell is still quite young and this median depression increases as the shell grows in size. Thus in the adult the sinus is well developed. But the form of the shell is still the same as in the non-sinuate type which is essentially triangular, the sides of the umbonal region diverging rather strongly. In *Linoproductus lineatus* of the Permian Productus Limestone, on the other hand, the form is more nearly rectangular, with the sides nearly parallel."

Thus CHAO obviously tends to distinguish these types only in regard to the shape of shell, that in *cora* being triangular while that in *lineatus* parallel.

The Manchurian specimens now at hand are unfortunately too imperfect to make out any statement concerning the more detailed character with which to separate the two species in question specifically. But the presence of rather defined sinus, and the shell form which is sub-parallel on both sides appear to bring the Manchurian specimens nearer to *L. lineatus* in the sense of CHAO rather than to *L. cora*. HAYASAKA once treated the *cora* group in a wide sence, and figured some specimens with sinus and parallel sides from South China under the name *P. cora*.

Echinochonchus sp.

Pl. II, Fig. 6.

The specimen is represented by a single ventral valve with a greater part of the posterior portion broken off; it is ca 65 mm. long and 35 mm wide. Being the shell is much deformed and compressed, the true outline and convexity are hardly recognizable. The trace of spinose bands are clearly seen on the anterior border of the shell, spines being arranged in two indefinite rows; the larger ones are in the posterior side. In the remaining area of the shell the spinose bands are hardly observable, possibly having been obliterated after fossilisation. In the middle portion of the anterior border of the shell, there are two bands in a space of 10 mm. The median sinus appears to be not existed.

Remarks: Although the specimen is imperfect, there may be little doubt that it represents a species of the genus *Echinochonchus*. It may be distinguished from the genus *Pustula* in that the spines of the latter are arranged in a single row. *Echinochonchus* ranges from Viséan to Artinskian in age. A number of species have already been described by several authors. The present specimens may probably represent a new species, but it is too imperfect to give a new specific name for it.

Spiriferina cristata SCHLOTHEIM

Pl. II, Figs. 7, 8, 9.

1857. *Spiriferina cristata*, DAVIDSON: A monograph of the British Permian Brachiopoda. Palaeontographical Society, Vol. X, p. 17, pl. 1, figs. 30–40, 46.

1862. *Spiriferina cristata*, DAVIDSON: On some Carboniferous Brachiopoda collected in India by A. Fleming and W. Purdon. Q.J.G.S. London, Vol. 29, pl. 1, figs. 12, 13.

1863. *Spiriferina cristata*, DAVIDSON: A monograph of the British Carboniferous Brachiopoda. Appendix to the Carboniferous and Permian Monographs. Palaeontographical Society, Vol. XIII, p. 267, pl. LIV, figs. 11, 13.

1887. *Spiriferina cristata*, WAAGEN: Productus Limestone Fossils, IV, Fasc. I. Brachiopoda. Palaeontologia Indica, Ser. XIII, p. 499, pl. XLIX, figs. 3–7.

1892. *Spiriferina cristata*, ROTHPLETZ: Die Perm-, Trias-, und Jura-Formation auf Timor und Rotti im indischen Archipel. Palaeontographica, Bd. 39, p. 81.

1897. *Spiriferna cristata* var. *octoplicata*, DIENER: Permocarboniferous fauna of Chitichun, No. 1, Himalayan Fossils. Palaeontologia Indica, Ser. XV, vol. 1, p. 39, pl. VII, figs. 5–7.

1911. *Spiriferina cristata*, DIENER: Anthracolithic Fossils of the Shan States. Palaeontologia Indica, New Ser., Vol. III, Memoir no. 4, p. 8, 2, figs. 2, 3, 4.

1922. *Spiriferina cristata*, HAYASAKA: Some Permian Brachiopoda from the Kitakami Mountains. Jap. Jour. Geol. Geogr., Vol. 1, p. 66, pl. IX, figs. 5–9.

1933. *Spiriferina cristata* var. *octoplicata*, HUANG: Late Permian Brachiopoda of S. W. China, Part II, Palaeontologia Sinica, Ser. B, vol. 9, fasc. 2, p. 55, pl. VIII, figs. 5–7.

There is considerably a large number of specimens which have hitehrto been described under the name *Spiriferina cristata* SCHLOTHEIM, some of them occurring from the Lowest Carboniferous or

from the Younger Carboniferous or the Permian. But there is some doubt whether this species has really such a long geological range or not. It may be said with possibility that some of them are confused with *Spiriferina octoplicata,* as various authors mentioned. But it is also quite doubtful, whether these two types are able to be definitely distinguished to each other. The writer cannot refer the original literature of SCHLOTHEIM, and the specimens at hand are somewhat imperfect and scarse in number, so that it is somewhat difficult to make a statement regarding the specific relation between these types in question. According to Prof. HAYASAKA,[1] *cristata* is smaller, has less number of ribs than *octoplicata* and bears no triplications in the median sinus as it is usually the case in *octoplicata.* Thus in this sense he identified the specimens from the Kitakami Mountainland to *cristata.*

HUANG[2] who described some specimens from the Permian from S. W. China applied the name *cristata* var. *octoplicata* following DIENER and brought HAYASAKA's *cristata* from the Kitakami Mountainland into its synonym. However HAYASAKA describes that DIENER's *cristata* var. *octoplicata* appears to have no secondary ribs or plications in the median sinus, and states also DIENER's examples are nothing but *cristata* itself.

Now in the Manchurian specimens under consideration, there is no triplications or secondary ribs in the median fold and moreover the shell is quite small in size. In these points the present specimens are identical with HAYASAKA's ones. Thus being the case, it may be at present the best way to give the name *cristata* for such specimens as ours, which have no secondary ribs in the median fold, awaiting further material which may add further knowledge regarding the morphological relation between *cristata* and *octoplicata* types.

Spiriferina cfr. *nasuta* WAAGEN

Pl. II, Fig. 10.

Compare with:

1887. *Spiriferina nasuta,* WAAGEN: Op. cit., p. 504, pl. XLIX, figs. 1, 2.

Only one dorsal valve is examined. The general outline of the shell is not clear but the length of the shell may have attained more

1) I. HAYASAKA: Op. cit., p. 69.
2) T. K. HUANG: Op. cit., p. 56.

than 20 mm. A large prominent median fold is the most striking feature of the shell. Hinge line is straight. On the surface of the shell there are many minute rounded warts. There are four folds, rounded on top and separated from each other by rounded valleys alternately.

Remarks: The present specimens has provisionally identified to the Salt Range species which WAAGEN called *Spiriferina nasuta*. It is somewhat doubtful whether the species is truely represented in the present collection, but the comparatively large size of the shell and the broad prominent median fold suggest that the specimen is rather referable to *nasuta* than the allied form *cristata*.

EXPLANATION OF THE PLATES

Plate V(I).

Figs. 1, 2, 3, 4. *Waagenophyllum indicum* (WAAGEN and WENTZEL). Figs. 1 and 2, transverse section, ×10; fig. 3, longitudinal section, ×10; fig. 4, polished transverse section, ×2.

Figs. 5, 6, 7. *Polypora manchoukuoensis* sp. nov. ×1.

Plate VI(II).

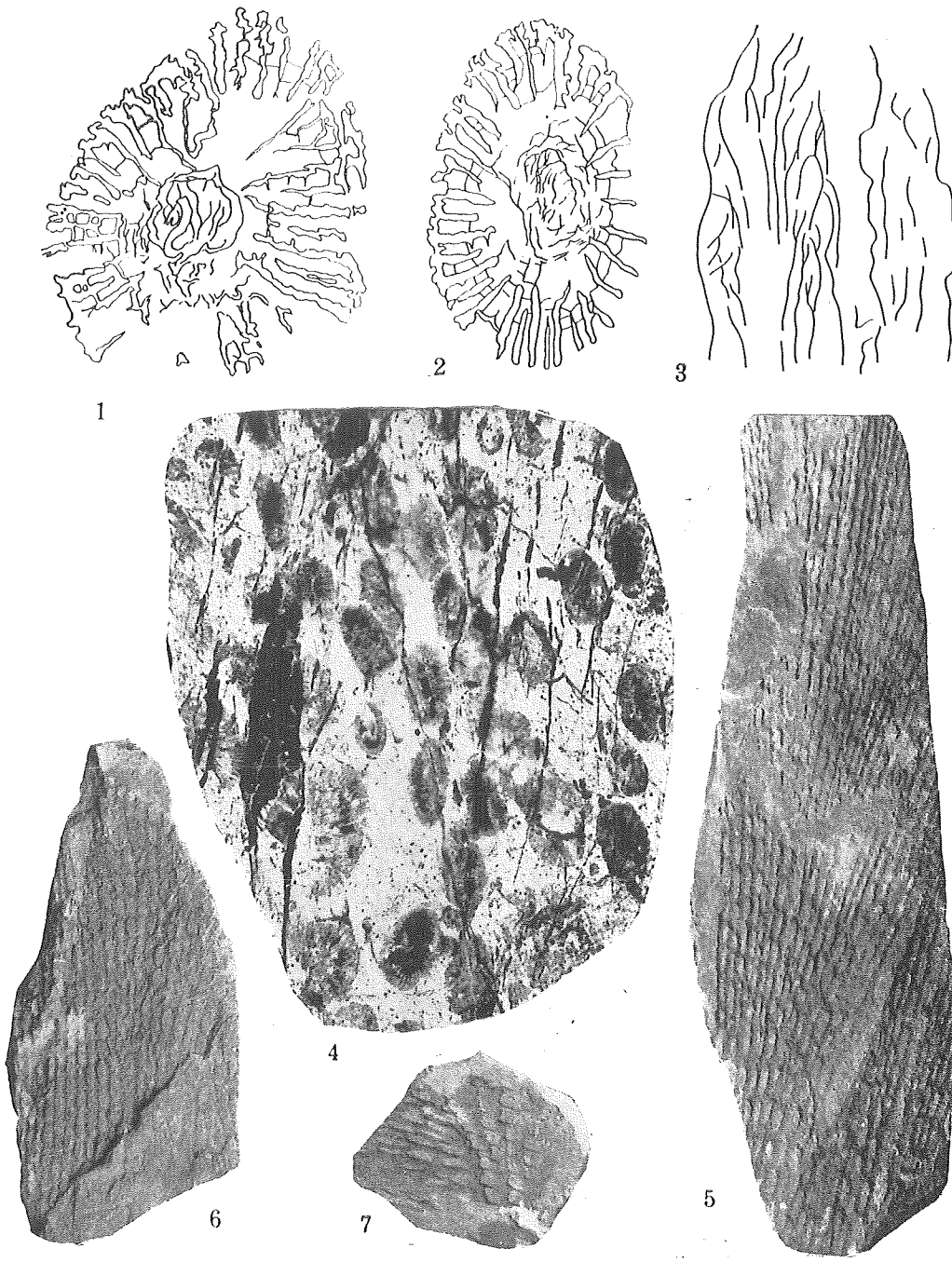
Fig. 1. *Polypora manchoukuoensisis* sp. nov. ×1.

Figs. 2, 3, 4, 5. *Linoproductus lineatus* (WAAGEN). ×1.

Fig. 6. *Echinochonchus* sp. ×1.

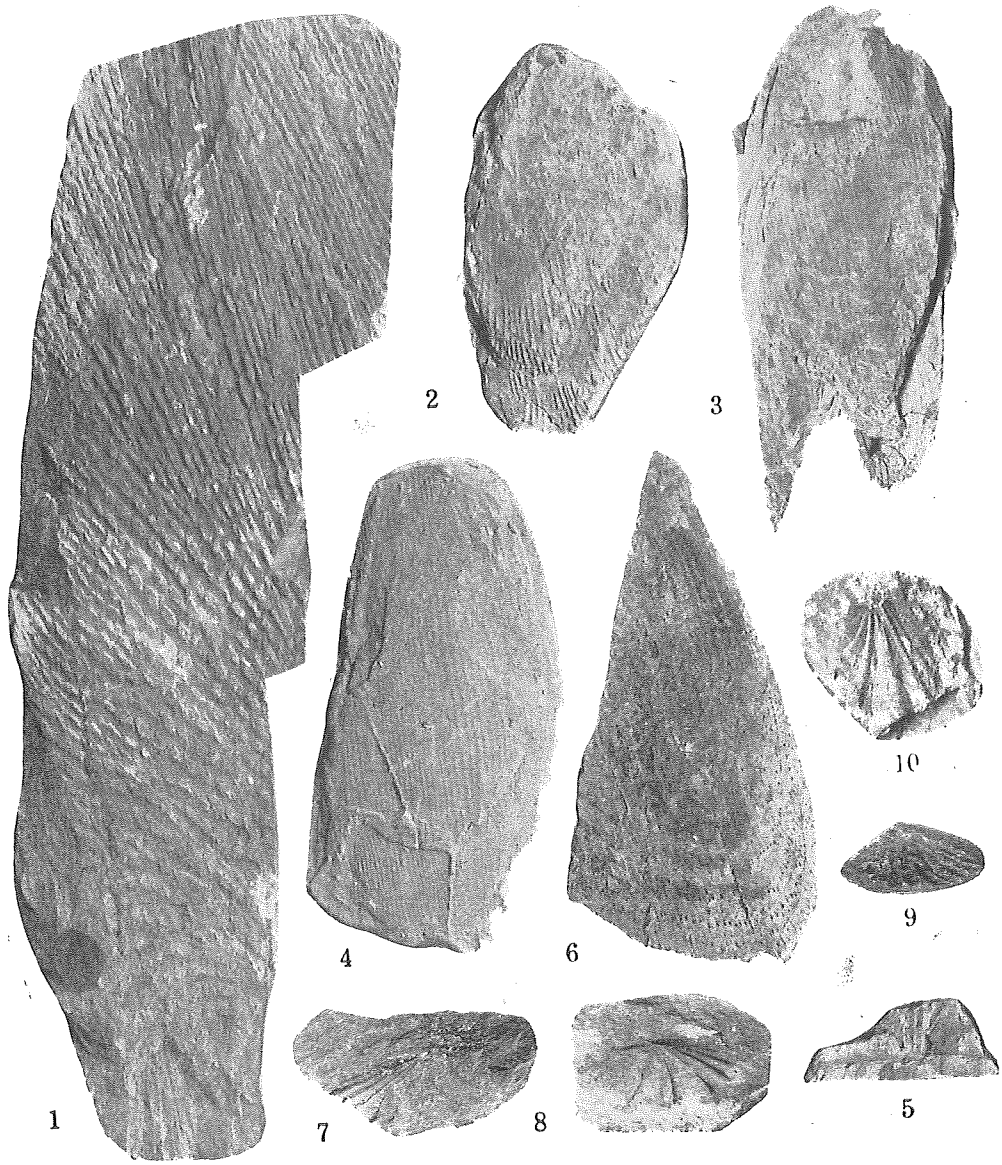
Figs. 7, 8, 9. *Spiriferina cristata* SCHLOTHEIM. ×1.

Fig. 10. *Spiriferina* cfr. *nasuta* WAAGEN. ×1.



Kumano photo. and Minato del.

M. Minato: Permian Fossils from the Toman Formation.



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M. Minato : Permian Fossils from the Toman Formation.