A NEW LOCALITY OF GIGANTOPTERIS IN SOUTHERN CHINA

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(With 1 Plate.)

I. Introduction

Our knowledge concerning the geological and geographical ranges of the genus *Gigantopteris* was summarized by Prof. H. Yabe[1] in one of his papers published in the year 1917, in which Mr. K. Koiwai described three Asiatic species. At that time fourteen localities of the genus were known, of which five are the localities where *G. americana* White was recorded to occur in the United States, and the rest are in China and Korea. Of the nine localities in eastern Asia, Lui Pa Kou (prov. Hunan) and Yen Tai (southern Manchuria) yielded *G. nicotinaefolia*, and the material from the province of Fukien was described as an indeterminable, but a new species while *G. dentata* was mentioned to have occurred in all the other localities. Thus there are at present 3 species of the genus ever known from eastern Asia, of which *G. nicotinaefolia* is said to be Permian and the other two, lower Triassic

The new locality where I have collected several specimens of *Gigantopteris* is the mining district of Tao Chung, (桃 冲) Anhui in southern China. In the spring of the year 1922, I had an opportunity to visit this district with several of our students of geology, and on that occasion specimens of plant impressions were collected by us in a hard black shale exposed along the eastern side of the middle part of the great incline. On the eastern side of the top of this same incline N. Fukuchi, T. Ogawa and G. Kobayashi found in the similar, but more sandy shale some marine fossils, of which I have been able to find *Gastrioceras zittieli*[2] and an indeterminable fragment

1) H. Yabe:—Sci. Reports, Tôhoku Imp. Univ., II. ser., vol. IV., No. 2.
2) I. Hayasaka:—Jour. Geol. Soc. Tokyô, vol. XXVII., No. 326. 1920. In the paper of 1920 I described two forms without giving definite specific names; but I have subsequently, and

of a *Marginifera*. The vertical or stratigraphical distance between the Ammonite and the Plant horizons is assumed to be about 140 m., the dip of the stratum or strata being northward, and varying from 40° in the north to about 70° in the south. Further southward we find a bed of limestone of a certain thickness which is nearly vertical and grading into the ore body in its southern border, the iron being said to have originated in the contact of a porphyrite and the limestone. In the limestone itself Fukuchi collected specimens of a peculiar Tabulata, *Tetrapora elegantula* YABE and HAYASAKA.[1]

The plant impressions found in the mining district of Tao Chung are in rather a bad state of preservation, but the fragments of big leaves of *Gigantopteris* were very attractive in the field. Three of the specimens are illustrated on the plate annexed to this paper.

II. Specific Determination

Now, let us turn to the specific determination of our *Gigantopteris*. As was discussed by Yabe and Koiwai, the North American Permian species, *G. americana*[2] is very easily distinguishable from any of the Asiatic species, although the former has a little similarity with *G. dentata* in point of nervation. But the American species is characterized by the peculiar form of its frond, and consequently may be excluded from the consideration of the affinities. The first thing needed, it appears to me, is the comparison of characteristic points of the two species, *G. nicotinaefolia* and *G. dentata;* the fourth species, *G.* sp. from Fukien having very peculiar, linear laminæ that constitute fronds and consequently being very much different either from the former two or the one now under consideration, needs not be here taken into account

According to Schenk,[3] Zeiller,[4] White and Yabe, who have studied the genus, the points of distinction between *G. nicotinaefolia* and *G. dentata* may be summarized as follows.

especially after I examined the specimens collected by myself, found that the Ammonite is *G. zitteli*

1) YABE and HAYASAKA:—*ditto*, vols. XXIII.-XXIV. 1916-1917
2) D. WHITE:—Proc. U. S Nat. Mus., vol. 41. 1912.
3) SCHENK:—v. RICHTHOFEN's China, vol. IV., pp. 283. 1883.
4) ZEILLER:—Annales des Mines Livr. d'Avril, 1907.

			G. dentata	*G. nicotinaefolia*
I.	Margin		With acute dentition or undulation	entire or sometimes with undulation
II.	Angle between Primary and Secondary Nerves		50°±	60°±
III.		A. Development	distinct	less distinct
		B. Angle with Secondary Nerves	acute: 40°±	obtuse: 60°±
		C. Distance and Density	regularly distant and dense	irregular and less dense, partly anastomosing
IV.	Meshes of Nervules		elongate along Tertiary nerves	irregular
V.	Narrow bands between Secondary Nerves		present	absent

With those points of demarkation in mind, we are to examine the specimens from Tao Chung.

I. One of the specimens (fig. 1) shows very distinctly the acute dentition of the leaf margin. This specimen represents the most important characteristic of the species *G. dentata*, in a far better degree than the originals of Yabe and Koiwai.

II. The angle between the primary and the secondary or lateral nerves varies between 50° and 60° in all the figured specimens, except on the right half of fig. 1, where the angle is measured to be about 35°–40°. However, on this part of the specimen the leaf is rather strongly wrinkled. This leaf must have suffered deformation from some cause. As far as the angle under consideration is concerned, the present specimens can not be identified with either of the two species. Moreover, it is not always very easy to decide

whether or not certain leaves are deformed, as has been suggested by the specimen, fig. 1. In the former records of the genus also, the variability of such an angle is represented either in the text and especially in the figures.

III. The development of tertiary nerves is very distinctly shown by the figs. 1 and 2; in fig. 3 it is obliterated, or, this may represent an opposite surface of the similar leaf (A). In figs. 1 and 2 we observe that the angle between the secondary and tertiary nerves is very obtuse, usually being about 80°, and sometimes even perpendicular to each other. Thus the angle is much larger than that characteristic of *G. nicotinaefolia* (B). On the contrary, in point of the distance and density of the tertiary nerves, the specimens at hand are the comparatives of *G. dentata*, as is particularly well exhibited by fig. 1 (C).

IV. The meshes of nervules are not very well preserved, but it is so far certain that they are not irregular, as may be inferred from figs. 1 and 2. It is also suggested to be so by the following aspect.

V. The existence of narrow bands between secondary nerves is well exhibited also by figs. 1 and 2.

Thus, except such rather variable points, the specimens from Tao Chung have very much in common with *G. dentata*. The angles between the primary and secondary nerves on the one hand, and the secondary and tertiary on the other, may vary in a wide range, and the undulation of the leaf margin alone may not be quite enough to distinguish the two species. But the very distinct dentition as well as III. C, IV. and V. bring the Tao Chung species very close to *G. dentata*.

That the leaves of *Gigantopteris* grow very large is suggested by fig. 3 which, like others, is pictured in natural size. Judging from the picture one of the lower secondary nerve measures about 160 mm. and yet not reaching the margin.

III. Conclusion

From what have been written above, it must be understood that the specimens collected by us in the mining district of Tao Chung belong to *Gigantopteris dentata* Yabe. Concerning the geological age of this species

Yabe believes to be of lower Triassic. The ammonite discovered in a horizon some 140 m. below is, as has been remarked above, identical with a species described by Gemmellaro from the younger Paleo-Dyassic limestone of Sosio. *Gastrioceras* cf. *zitteli* described by Frech from Szechuan province,[1] I am sure, is identical either with the original of Gemmellaro or those in my collection. Frech considers his material as representing lower Neo-Dyassic.

As far as my hasty observations in the field are concerned, there is no stratigraphical break between the ammonite horizon and the plant bed, although the shale becomes sometimes sandy and other times calcareous, with a thin limestone bed or two. Further stratigraphical research and some associate fossils, to be found in future, especially of *Gigantopteris*, in this locality, may happen to lead us to a conclusion more or less different from what is prevailing with respect to the geological antiquity of the plant. On the other hand, the rock formation as a whole suggests rather a shallow water as the place of its deposition, and it appears that there was an interval of time ranging from the Permian to the earlier Triassic, during which an oscillation, or rather a regression of sea, took place; and finally the bottom might have been left dry on entering the Mesozoic period.

Elsewhere I have mentioned *Tetrapora elegantula* which was found in this district. The same species was obtained in the province of Szechuan by K. Yamada and in the province of Fukien by Y. Ishii. The occurrence of *Gigantopteris dentata* in the latter province was made known by Yabe. Unfortunately, however, the exact locality of the Tabulata in Fukien is not known, and consequently we can not say anything about the geological relations between it and the plant fossil in this province. In the district of Tao Chung, however, *Tetrapora* can not be much older than *Gastrioceras zitteli*.

1) Frech:—v. Richthofen's China, vol. V., p. 140. 1911.

Plate I.

Gigantopteris dentata YABE.

(All figures, natural size.)

Fig. 1 shows a well developed dentition of the leaf margin, as well as the nervation.

Fig. 2 shows, though faintly, the nervation.

Fig. 3 represents a fragment of a very large leaf. The specimen probably shows a surface of a leaf opposite to that represented by figs. 2 and 3.