

## Mesozoic Plants from China.

By

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*With 12 plates.*

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### 1. GENERAL REMARKS.

The greater willingness, recently shown by the Chinese to have the mineral resources of their country investigated by the Japanese, naturally led several of our scientific men to avail themselves of the opportunity to explore the mines and coal-fields of the interior of that bulky empire.

Between the years 1899 and 1900, Mr. T. HIRABAYASHI, now Assistant Professor in the Engineering College of Tokyo, visited the province of Chiang-hsi,<sup>1)</sup> and during his six months stay there made many valuable geological observations.

In 1902, Messrs. T. WADA, T. Ogawa and N. KANEHARA, all geologists, examined the mines of Northern China, especially those of Shan-tung<sup>2)</sup> and Chih-li.<sup>3)</sup>

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1) 江西. Often written Kiangsi.

2) 山東.

3) 直隸.

In the following year, Prof. K. YAMADA of the Kyoto University, explored South-western China, penetrating into the provinces of Ssu-ch'uang<sup>1)</sup> and Yün-nan.<sup>2)</sup>

Also during and after the late Manchurian campaign, many of our geologists went to investigate the mineral wealth of Southern Manchuria then occupied by our army. They were Messrs. T. OGAWA, K. INOUE, N. KANEHARA, N. FUKUCHI and C. ŌINOUE, most of whom belong to the Imperial Geological Survey of Japan.

Among the many valuable scientific prizes brought back by these men, are the fossil plants collected in coal-mines, and therefore directly available for determining their geological age. The greater part of these plants belong to those of the Mesozoic era, while others are either those of the Carboniferous or of the Tertiary period. The task of examining these fossils, I took upon myself, and the following are results obtained from my study of the Mesozoic forms.

The Mesozoic flora of China is already known from the works of SCHENK, KRASSER, ZEILLER, NEWBERRY, and others; but as the plants described in this paper all come from new localities, I hope they will add not a little to the knowledge of the Chinese flora of this formation.

The plants belong to three distinct periods of the Mesozoic, so that they may be treated under three distinct headings.

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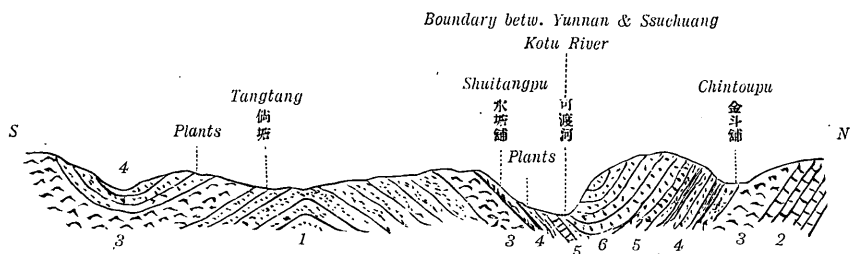
1) 四川. Also written Sechwan, Sz,tswan, etc.

2) 雲南.

It is here to be noted that the Chinese names of places are pronounced more or less differently in the different parts of the Empire. But for the sake of uniformity, they are all written herein as they are pronounced according to the official dialect of Pekin, and the mode of representing them in Roman letters followed in this paper is that proposed by THOMAS WADE.

## I. TRIASSIC PLANTS.

These were brought back by Prof. YAMADA from two places in Yün-nan, viz. T'ang-t'ang<sup>1)</sup> and Shui-t'ang-p'u,<sup>2)</sup> very near each other and quite near the boundary of Ssu-ch'uang. The distance between these two places may be from 15 to 16 kilom. The following is a rough geological profile constructed according to a sketch-map by Prof. YAMADA.



1. Sandstone probably of Palaeozoic age.
2. Limestone (Permo-Carboniferous?)
3. Diabase and its tuffs.
4. Red and green sandstones and shales, containing fossil plants; and near Shui-tang-pu a coal seam.
5. Limestone.
6. Red and yellow sandstones and shales probably belonging to a formation constituting the Mesozoic Basin of Ssu-ch'uang, the greater part of which seems to be Jurassic.

The number of species brought back from Yün-nan is small. From T'ang-t'ang we have

1. *Angiopteridium cf. infarctum* FEISTM.
2. *Cladophlebis* sp.
3. *Carpolithes Yamadai* N. sp.

Besides, there is an imperfect fragment of a fern which seems to be a species of *Glossopteris*. From Shui-t'ang-p'u, we have

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1) 倘塘

2) 水塘舖

1. *Angiopteridium cf. infarctum* FEISTM.
2. *Clathropteris* SP.
3. *Phœnicopsis? Yamadai* N. SP.

These plants are contained in a fine-grained greenish grey sandstone in which the venation of the leaves is for the most part imperfectly preserved, so as to make their determination extremely difficult. Notwithstanding this fact, the presence of *Angiopteridium cf. infarctum* FEISTM. in the florulas of the two places shows that in all probability they belong to the same geological horizon.

As to the age of the plant-bearing rocks, the only species available in determining it is the above mentioned *Angiopteridium*. *Angiopteridium infarctum* is a form described from the Upper Gondwana of India which belongs to the Triassic. Therefore it is most likely that the Yün-nan plants represent some part of the Triassic. Whether they are contemporaneous with the Rhætic forms described by Prof. ZEILLER from Tai-p'ing-ch'ang, a place more to the west in Yün-nan still remains to be confirmed.

## II. JURASSIC PLANTS.

By far the greater part of the fossils treated in this paper belong to the Jurassic. They are from five provinces, or Shêngs, as they are called by the Chinese.

### A. Ssu-ch'uang-Shêng.<sup>1)</sup>

The plants come from three places in this province, and all were collected by Prof. YAMADA.

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1) 四川省

a. Ch'ing-kang-lin, P'êng-Hsien.<sup>1)</sup>

The plant-bearing rock is a dark grey argillaceous sandstone, with fine glittering pieces of mica. The preservation is excellent. The species of plants found here are three, viz.:

1. *Todites Williamsoni* (BRONGN.).
2. *Podozamites lanceolatus* (LINDL. et HUTT.).
4. *Antholites chinensis* N. SP.

*Todites Williamsoni* is a widely distributed Middle Jurassic fern, and *Podozamites lanceolatus* is also a form, chiefly occurring in the same formation. Therefore there is hardly any doubt about the plant-bed being Jurassic. And so is the next locality.

b. Ta-shih-ku, Pa-Hsien, Chung-ching-Fu.<sup>2)</sup>

The plants are found in a dark shale having an imperfect platy structure. Their preservation is very good. We have only two forms.

1. *Todites Williamsoni* (BRONGN.).
2. *Carpolithes globularis* N. SP.

c. Lung-wang-tung, Chiang-pei-Ting.<sup>3)</sup>

From this place we have only two small fragments of Equisetaceæ in a dark micaceous shale. One specimen resembles *Schizoneura hoerensis* HISINGER. This species is a plant found in the Rhætic as well as in the Jurassic, and as it occurs also in the latter formation of Sai-ma-chi<sup>4)</sup> in Southern Manchuria, I consider it not improbable that the plant-bed of Lung-wang-tung belongs to the same formation as the above two places in Yün-nan.

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1) 彭縣青崗林.

2) 重慶府巴縣大石鼓.

3) 江北龍王洞.

4) 賽馬集

**B. Chiang-hsi-Shêng.<sup>1)</sup>**

The plants of this province were all collected by Mr. HIRABAYASHI who found them in shales in coal-mines. These shales are all of nearly similar character, being dark, more or less soft and imperfectly cleavable, except the one from Ch'ung-chia-fang, which is coaly and black, and harder than the others. The plant-species are very few, probably not because they are rare, but because the collector had not time to gather a large number of them. Of the six localities, those which show only a single species of *Podozamites lanceolatus* (LINDL. et HUTT.) are the following three.

- a. San-chia-chung, An-yüan, P'ing-hsiang-Hsien.<sup>2)</sup>
- b. Kao-kang, P'ing-hsian-Hsien.<sup>3)</sup>
- c. Ch'ung-chia-fang, I-ch'un-Hsien.<sup>4)</sup>

The place called

- d. Sha-shih-chieh, An-yüan, P'ing-hsiang-Hsien.<sup>5)</sup>

has given, besides *Podozamites lanceolatus*, a species of *Ginkgoaceæ* called *Phœnicopsis latior*, a plant widely distributed in the Jurassic of Siberia. At

- e. Ssu-lu-pu, Hsing-an-Hsien,<sup>6)</sup>

there are only two indeterminable *Cycads*, *Pterophyllum* and *Nilssonia* the former of which however shows some resemblance to that already found in the Jurassic of other parts of China. Also at

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1) 江西省.

2) 萍鄉縣安源三夾冲.

3) 萍鄉縣高坑.

4) 宜春縣鐘家坊.

5) 萍鄉縣安源沙市界.

6) 興安縣司路舖.

f. Liao-chia-shan, Fêng-ch'êng-Hsien<sup>1)</sup>

there is only a *Cladophlebis* which is not determinable, although it presents some resemblance to the Jurassic forms.

Of these six localities, the only one which is undoubtedly Jurassic is Sha-shih-chieh. Probably so are also the three places which have yielded *Podozamites*, while the last two, palæontologically speaking, can be described simply as Mesozoic. Mr. HIRABAYASHI, however, from the geological point of view, considers the six coal-mines above enumerated as belonging to one and the same formation.

C. Shan-tung-Shêng.<sup>2)</sup>

The plants from this province were collected in the coalmine of Fang-t'u in Wei-Hsien<sup>3)</sup> by Mr. WADA who visited the place in 1902 in company with Messrs. OGAWA and KANEHARA. A large slab of a grey argillaceous sandstone, together with some smaller ones sent to me by Mr. WADA, contain fossils in excellent preservation which belong to the following four species:

1. *Todites Williamsoni* (BRONGN.).
2. *Coniopteris hymenophylloides* (BRONGN.)
3. *Ctenis* SP.
4. *Podozamites lanceolatus* (LINDL. et HUTT.).

Of these four, the three which are specifically determined are well-known Jurassic forms, and *Ctenis* which I have left undetermined on account of its fragmentary character also presents some resemblance to one of the forms called *C. Zeuschneri* RACIB. occurring in the Jurassic of Poland. Therefore it is quite certain

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1) 豐城縣廖家山.

2) 山東省.

3) 濰縣坊士(或ハ房士トモ云フ).

that we have here a formation which represents the middle portion of the Mesozoic Group.

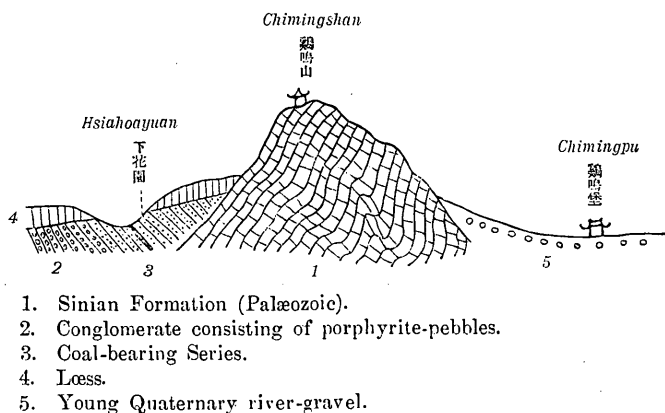
RICHTHOFEN in the second volume of his "China" refers to a coal-field situated south of Wei-hsien which certainly includes the mine of Fang-t'u. He took it for Carboniferous (China II, p. 227), an error which arose from his thinking that it belonged to the same geological formation as the Sinian which occurs very close to it.

#### D. Chih-li-Shêng.<sup>1)</sup>

Mesozoic plants were collected only in a single locality, viz. ;

#### Lao-tung-ts'ang, Hsuan-hua-Fu.<sup>2)</sup>

According to Mr. OGAWA who made this collection, the coal-bearing strata of this place are sandstones and shales, overlaid by a conglomerate composed of pebbles of porphyrite and presenting a tuffy character. Their strike is said to run parallel to the mountain-range of Chi-ming-shan which takes a east-north-east and west-south-west direction, and is made up of highly contorted layers of the platy sandstones, white limestones, etc. of the Sinian formation. The geological profile is as given below.



1) 直隸省.

2) 宣化府老東蒼.

The plants occur in dark-grey, banded, sandy shales, and are tolerably well preserved. They belong to two species, viz.:

1. *Coniopteris hymenophylloides* (BRONGN.)
2. *Ginkgo flabellata* HEER.

The first occurring in the Middle Jurassic of Europe, Siberia, Japan etc. and the second also in that of Siberia, there is no doubt about the coal-field of Lao-tung-ts'ang belonging to the same formation.

RICHTHOFEN had already taken this coal-field for Jurassic, not from plants found at Lao-tung-ts'ang, but probably from those which he collected at Tshai-tang,<sup>1)</sup> lying to the south of the above place.

### E. Shêng-ching-Shêng.<sup>2)</sup>

Plants were collected at the following four places:

#### a. Nien-tzu-kou, Sai-ma-chi.<sup>3)</sup>

The collector, Mr. KANEHARA, went to Nien-tzu-kou to examine the coal-field. The plants are contained in a brittle shale, dark grey to blackish, sometimes slightly reddish. They are generally well preserved, although rarely they are quite carbonized. The following forms have been distinguished:

1. *Schizoneura hoerensis* HISINGER.
2. *Todites Williamsoni* (BRONGN.).
3. *Ctenis Kaneharai* N. SP.
4. *Ginkgo lepida* HEER.
5. *Baiera gracilis* BUNB.

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1) 齋堂 Chai-t'ang according to the Pekin official dialect.

2) 盛京省.

3) 賽馬集碾子溝.

6. *Czekanowskia Murrayana* (LINDL. et HUTT.).

7. *Palyssia manchurica* N. SP.

*Todites Williamsoni*, *Ginkgo lepida*, *Baiera gracilis*, and *Czekanowskia Murrayana* are true Middle Jurassic forms. *Schizoneura hoerensis* is a species occurring in both the Jurassic and the Rhætic of Europe, while *Palyssia manchurica* has its nearest allies in forms found in the Indian Jurassic and the European Rhætic. Therefore it is quite certain that the plant- and coal-bearing series of Nien-tzu-kou belongs to the Middle Jurassic.

b. Sha-ho-tzu, Ch'ang-tu.<sup>1)</sup>

From this locality, Mr. OGAWA brought several pieces of a fine-grained yellowish sandstone, containing several fragments of plants which belong to a single species of *Dioonites Brongniarti* (MANT.). This *Cycad* which was first found in the Wealden of Europe has also been found in the Jurassic of Japan. Therefore the coal-bearing layers of Sha-ho-tzu in which it was found probably belong to the same formation.

c. Ta-t'ai-shan, Ch'üan-yen-kou.<sup>2)</sup>

From the coal-mine of this place, Mr. OGAWA brought a thinly cleavable, brittle, grey shale containing several fragments of plants which belong to two species, viz.

1. *Podozamites lanceolatus* LINDL. et HUTT.

2. *Ginkgo* SP.

The first, as has already been stated several times, is a widely distributed Jurassic species, although it occurs also in the layers above as well as in those below this formation. Of the second species the specimens are all fragmentary and not determinable

1) 昌圖沙河子.

2) 泉眼溝大台山.

with any degree of certainty; still it seems to be a form undoubtedly belonging to those found in the Jurassic. Therefore we may fairly assert that we have here a formation which probably corresponds to the one above named.

d. Pao-êrh-shan.<sup>1)</sup>

A piece of light grey sandy shale, found by Mr. OGAWA in the coal-mine of the above place, contains numerous fragments of roots of an Equisetaceous plant which, however, resemble those of *Phyllothea sibirica* HEER of the Siberian Jurassic, and which I have therefore called *Phyllothea* sp. Also a small fragment of a pinna of a *Cladophlebis* was found with acute pinnules. But it is so imperfect that it can not be determined with any degree of accuracy. On this account, I leave the age of this coal-bearing formation undetermined, although presumably it is also Jurassic.

### III. Cretaceous Plants.

At two places in the Mesozoic Basin of Ssu-ch'uang, Prof. YAMADA collected plants which are decidedly younger than those found in other localities. These two places are called Shi-kuan-fzu and Sha-chi-miao.

a. Shi-kuan-tzu, Chao-hua-Hsien.<sup>2)</sup>

This place lies north-east of Ching-tu-Fu<sup>3)</sup> the capital of the province, and very near the northern boundary of the Mesozoic Basin. The plant-bearing rock which occurs together with coal-seams is a dark grey friable shale, in which the plants seem to

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1) 抱兒山.

2) 昭化縣石鑛子.

3) 成都府.

be tolerably numerous. The species, however, which I have been able to distinguish number only three, viz.:

1. *Coniopteris nitidula* N. SP.
2. *Glossozamites Hoheneggeri* (SCHENK).
3. *Podozamites lanceolatus* (LINDL. et HUTT.).

*Glossozamites Hoheneggeri* is a species hitherto found only in the Wernsdorf beds of the Northern Carpathians; while *Coniopteris nitidula*, although new, shows a great affinity to *C. Cordai* (SCHENK) of the German Wealden. *Podozamites lanceolatus* is a form ranging from Rhætic to Cenomanian. Therefore it is fairly certain, that we have here a formation which corresponds to the Neocomian of Europe.

b. Sha-chi-miao, Ho-Chou.<sup>1)</sup>

This place is situated to the east of Ching-tu-Fu, and in the midst of the Mesozoic Basin. The plants are imbedded in a light grey cleavable shale, associated with the coal-layers of the district. The specimens belong to the following three species:—

1. *Gladophlebis* SP.
2. *Glossozamites Hoheneggeri* (SCHENK).
3. *Glossozamites acuminatus* N. SP.

A glance at these forms immediately suggests the same formation as at Shi-kuan-tzu, especially as the genus *Glossozamites* occurs mostly in the Lower Cretaceous.

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1) 合州沙溪廟.

Tabular View of the Mesozoic Plants.

I. TRIASSIC PLANTS.		塘 倘 省 南 雲		舖 塘 水 省 南 雲		Occurrence of identical or allied species in other countries.	
Filices.		T'ang-t'ang in Yün-nan-Shêng.		Shui-t'ang-p'u in Yün-nan-Shêng.			
1. <i>Angiopteridium</i> cf. <i>infarctum</i> FEISTM. ...	+			+			
2. <i>Cladophlebis</i> SP.....	+			—			
3. <i>Clathropteris</i> SP.....	—			+			
4. <i>Glossopteris</i> ? SP. ....	+			—			
Ginkgoaceæ.							
5. <i>Phœnicopsis</i> ? <i>Yamadai</i> N. SP.....	—			+			
Incertæ Sedis.							
6. <i>Carpolithes Yamadai</i> N. SP. ....	+			—			

## DESCRIPTION OF THE SPECIES.

## I. TRIASSIC PLANTS.

A. T'ang-t'ang, Hsüan-wei-Chou.  
Yün-nan-Shêng.<sup>1)</sup>1. *ANGIOPTERIDIUM* *CFR. INFARCTUM* FEISTM.

Pl. I. Figs. 1-7.

*Angiopteridium infarctum* FEISTMANTEL, Flora of the Damuda and Panchet Divisions, p. 93, pl. XXXIVA, Figs. 4, 5, 5a.

We have several fragments of isolated pinnæ of a fern which evidently belongs to the family of *Tæniopteridæ*. They are oblong-linear in shape slightly tapering both above and below. The apex is quite rounded, while the base narrows abruptly. The midrib is moderately strong, straight and evanescent. The secondary veins are fine, numerous, dense and parallel. They rise from the midrib at an angle of  $40^{\circ}$ - $45^{\circ}$ , and then curving outward go obliquely to the margin of the pinna. Forking generally takes place close to the midrib, but further on, the veins remain mostly simple.

The greatest breadth attained by our specimens is 30 mm., but the length is not known. The density of the veins is about 4 to a millimeter.

The species, to which this Chinese form shows the greatest resemblance, is the one above named from the Triassic of

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1) 雲南省宣威州倘塘

India which, however, has been founded on only two fragmentary pinnæ.

But so far as I can judge from the figures and descriptions of the Indian form, it seems to agree perfectly with the Chinese, both in the shape and size of the pinnæ, and also in the closeness of the veins. Still the specimens in both forms being imperfect, I deem it advisable at present not to assert their perfect identity.

## 2. CLADOPHLEBIS SP.

Pl. I. Figs. 8, 9.

The specimen shown in fig. 8 represents a fragment of a pinna of a fern which probably belongs to the collective genus of *Cladophlebis*.

The pinnules are finger-shaped, blunt at apex, close together, attached to the rachis by the whole base, mostly straight and slightly inclined forward. The midrib is distinct and evanescent; the secondary veins are not well preserved, but on careful examination, they seem to be twice forked.

Another specimen shown in fig. 9 has similar but smaller pinnules. The secondary veins have been totally defaced.

From the impossibility of determining the species of *Cladophlebis* from such meagre fragments, I leave them without any specific name.

## 3. CARPOLITHES YAMADAI N. SP.

Pl. I. Figs. 10, 11?

We have two fruits of an oval outline, with their apices, which may have been more or less pointed, broken off. One of

them (represented on the right hand side of fig. 10) measures 52 mm. long, 32 mm. broad and 10 mm. thick. They appear to have been sessile, with the place of attachment about 8 mm. broad.

The surface is nearly smooth, showing only longitudinal striations in its lower part.

These fruits have been found attached to each other by their lateral faces as if they were twins, so that the place of contact has been quite flattened. Their cross-section, as they now are, is elliptical, but this may possibly be a distortion by pressure, from a shape originally round.

It is quite singular that there is another, though much smaller, specimen (fig. 11) pressed almost flat, but also consisting of two pieces. If this specimen belongs to the same plant as the first, it is not at all impossible that the fruits were borne on the stem quite close to each other.

#### 4. GLOSSOPTERIS? SP.

Pl. V. Fig. 2.

A fragment of the basal part of a frond. It shows a midrib, from which the lateral veins, though indistinct, are evidently divergent. It seems to belong to one of the species of *Glossopteris*, such as *G. indica* FEISTM. already described by ZEILLER (Flore Fossile des Gîtes de Charbon du Tonkin, pl. LVI, fig. 1) from Tai-p'in-ch'ang (太平場), a place also in Yün-nan. It is much to be regretted that the only specimen from T'ang-t'ang is so imperfect as not to allow any accurate determination.

**B. Shui-t'ang-p'u, Hsüan-wei-Chou,  
Yün-nan-Shêng.<sup>1)</sup>**

**1. ANGIOPTERIDIUM CFR. INFARCTUM FEISTM.**

Pl. II. Fig. 2.

Two fragments of oblong-linear entire leaves. The one which has been figured measures about 16 mm. in breadth, pierced by a moderately strong, straight midrib. Although the secondary veins are mostly defaced, yet by a proper illumination, we can observe that they are very fine and dense, similar in their course to those of the above named species.

**2. CLATHROPTERIS SP.**

Pl. II. Fig. 3.

On a piece of stone, we see fragments of two broad laminae of a fern apparently partly overlapping each other. One of these laminae shows a distinct, but weak straight midrib which gives off at regular intervals straight secondary veins at angles of from 45° to 50°. They are mostly opposite or subopposite, but sometimes alternate. We have probably here to do with a species of *Clathropteris*, a genus widely distributed in the Rhætic formation of several countries.

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1) 雲南省宣威州水塘舖

Shuitangpu is said to be an insignificant village, not quite 4 kilom. south of Ko-tu-ho (可渡河).

**3. PHÆNICOPSIS (?) YAMADAI** N. SP.

Pl. II. Fig. 1.

Leaves sessile, elongate wedge-shaped, always split into two more or less unequal lobes near the base. Lobes straight with sides subparallel, pierced with fine straight, dense, parallel veins.

Heer established the genus *Phœnicopsis* (Beitr. zur Juraflora Ostsib. u. d. Amurl., p. 49) for long, linear, simple and undivided leaves attached to the stem in a bundle, and provided with dense parallel veins, while he brought similar leaves which repeatedly fork and possess rarer veins under the genus *Baiera* (l. c., p. 51). A fine specimen above figured from Yünnan has the general appearance of *Phœnicopsis* on the one hand and the forked nature of the leaves of *Baiera* on the other. Should the apices of the leaves, which are all broken off in our specimens, prove to be broad, the plant would assume an appearance somewhat like *Rhipidopsis* SCHMALHAUSEN (Beitr. zur Juraflora Russlands, pl. VI and VIII) and need be treated as a new genus.

The breadth of the lobes measures over a centimeter at a place 6 centimeters from the base. But I presume they become still broader above. The veins are mostly simple, but near the base they seem to fork several times. Their number ranges between 20 and 30 in the broadest part of the lobes.

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## II. JURASSIC PLANTS.

A. Ch'ing-kang-lin, P'êng-Hsien,  
Ssu-ch'uang-Shêng.<sup>1)</sup>

## 1. TODITES WILLIAMSONI (BRONGN.).

## Pl. III.

*Todites Williamsoni* SEWARD, The Jurassic Flora-Yorkshire coast, part, I, p. 87, pl. XIV, figs. 2, 5, 7, XV, 1-3, XXI, 6.

*Asplenium whitbyense* SCHENK, Richthofen's China, vol. IV, p. 246, pl. XLVI, figs. 5-7, XLVII, 3-5, XLVIII, 1-4, p. 253, pl. LII, figs. 1-3. Fossile Pflanzen in Wissensch. Ergebn. d. Reise d. Grafen Bela Szécheny in Ostasien, p. 310, pl. I, figs. 1-2, III, 1-2. YOKOYAMA, Jurassic Plants from Kaga, Hida and Echizen, p. 31, pl. III, fig. 3, X, 1, 2.

This fern which had borne the names of *Cladophlebis whitbyensis*, *Asplenium whitbyense*, *Alethopteris whitbyensis* etc. was some years ago pointed out by SEWARD, as being closely related to the recent genus *Todea* in the nature of its fructification.

Our specimens are tolerably well preserved in two good-sized slabs of stone, the whole surface of which is covered with the pinnæ of this fern which, however, are all sterile. The pinnules agree with those of the English specimens as described by SEWARD which, in spite of great variations in shape in different parts of a frond invariably have the acute apex and twice forked lateral veins.

This species occurs in several places in China, as will be seen further on.

## 2. PODOZAMITES LANCEOLATUS (LIND. ET HUTT.).

## Pl. II. Figs. 5, 6.

*Podozamites lanceolatus* SCHENK, Jurassische Pflanzen in Richthofen's China, vol. IV, p. 248, pl. XLIX, figs. 4, 5, p. 251, L, 1-6, p. 255, LI, 3, LII, 8,

1) 四川省彭縣青崗林

p. 258 LI, 7, p. 261, LIV, 2c. Fossile Pflanzen in Wissens. Ergebn. d. Reise d. Grafen Bela Szécheny in Ostasien, p. 317, pl. II. figs. 8b, 9b, III, 9, p. 320, II, 5. KRASSER, Die von W. A. Obrutschew in China u. Centralasien 1893-1894 gesam. fossilen Pflanzen, p. 146 pl. IV, fig. 1. YABE, Mesozoic Plants from Korea, p. IV, figs. 1-5. YOKOYAMA, Jurassic Plants from Kaga, Hida and Echizen, pl. 45, pl. IV, figs. 1a, 1c, 2, 3a, 4ab, V, VI, 1, VII. 8b, XII, 18. FEISTMANTEL, Fossil Flora of the Jabalpur Group, p. 11, pl. III, figs. 4-7, IV, 1-10.

The specimen represented in fig. 6 shows leaflets as they were attached to the rachis. Most of these leaflets have about 15 veins, and in shape correspond to what Heer distinguished as variety *minor*, although some are a little too broad for that. The one on the left side and in the lower corner is a long oval in shape. These facts show how variable the leaflets of this plant are, even on the same rachis.

The specimens shown in fig. 5 are isolated leaflets. The one in the right lower corner is the smallest of all the leaflets found at Ch'ing-kang-lin. It has an acute apex with about 15 veins, and resembles the oval one above alluded to.

The subdivision of this species into many varieties according to the form of the leaflets, as has been done by HEER, is, I believe, not tenable, as already pointed out by SEWARD.

### 3. ANTHOLITES CHINENSIS N. SP.

#### Pl. II. Fig. 4.

The only specimen we possess consists of a fragments of a stem, 2 mm. in breadth, and almost entirely changed into coal, on both sides of which are attached somewhat oval or sometimes, slightly quadrate bodies about 5 mm. long and 3 mm. broad, forming quite a close row. It probably represents an inflorescence of some coniferous or *Ginkgo*-like tree or, indeed, of a male catkin, the oval bodies being pollen-sacs.

**B. Ta-shih-ku, Chung-ching-Fu (Pa-Hsien),  
Ssu-ch'uang-Shêng.<sup>1)</sup>**

**1. TODITES WILLIAMSONI (BRONGN.).**

Pl. V, Fig. 1a.

We have several pinnæ of a fern well preserved and undoubtedly belonging to the species above named. The pinnules are often 20 mm. long, acute and furnished with twice forking secondary veins.

**2. CARPOLITHES GLOBULARIS N. SP.**

Pl. V. Fig. 1b.

On a stone with *Todites Williamsoni* are scattered many small spherical bodies mostly about 5 mm. in diameter, but sometimes a little larger. One of them is provided with a petiole 3 mm. long. They are probably seeds belonging to a plant of the family *Ginkgoaceæ*.

The seeds taken by SAPORTA as belonging to *Baiera Muensteriana Presl* (Paléontologie Française, Plantes Jurassiques, vol. III, pl. XXIX, fig. 3) show some resemblance to the present species, but they are more oblong in shape.

What has been figured by HEER (Beitr. z. Juraflora, pl. VIII, fig. 12) as belonging to *Baiera longifolia* HEER are a little larger than ours.

**C. Lung-wang-tung, Chiang-pei-Ting,  
Ssu-ch'uang-Shêng.<sup>2)</sup>**

From this locality we possess two indeterminable fragments of Equisetum-like stems which, however, apparently belong to

1) 四川省重慶府(巴縣)大石鼓

2) 四川省江北縣龍王洞

two different forms. The one (fig. 3, Pl. X) has the longitudinal grooves nearly 2 mm. apart, while the other (fig. 2. pl. X), has them much closer together, so that it looks somewhat like *Schizoneura hærens* HISINGER hereafter to be described from Nien-tzu-kou near Sai-ma-chi in Shêng-ching.

**D. Sha-shih-chieh, An-yüan, P'ing-hsiang-Hsien,  
Chiang-hsi-Shêng.<sup>1)</sup>**

**1. PODOZAMITES LANCEOLATUS (LINDL. ET HUTT.).**

Pl. IV. Fig. 3.

Two fragments of leaflets giving their basal portion. Their shape and venation undoubtedly point to the well known species above named.

**2. PHÆNICOPSIS LATIOR HEER.**

Pl. IV. Fig. 4.

*Phœnicopsis latior* HEER, Beitr. zur Juraflora Ostsib. u. d. Amurl., p. 113, pl. XXXI, figs. 1-6, XXIV, 1c. Ueber die Pflanzenversteinerungen von Andø in Norwegen, p. 13, pl. L, figs. 5-10.

Fragments of isolated leaves which measure up to 10 mm. in breadth, with 23 or 24 close veins. An interstitial vein is sometimes observable. The way in which the leaves narrow toward their base admits no doubt about their being *Phœnicopsis*, and indeed, *P. latior* HEER. That they do not belong to *P. speciosa* HEER is shown by their having more numerous veins and a more abruptly narrowed base. Small fragments only 6 or 7 mm. broad still possess 23 veins.

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1) 江西省萍鄉縣安源沙市界

**E. San-chia-chung, An-yüan, P'ing-hsiang-Hsien,  
Chiang-hsi-Shêng.<sup>1)</sup>**

**1. PODOZAMITES LANCEOLATUS (LINDL. ET HUTT.).**

Pl. IV. Fig. 2.

We have only a single fragment of the basal portion of a leaflet, but it undoubtedly belongs to the above named species.

**F. Kao-kang, P'ing-hsiang-Hsien,  
Chiang-hsi-Shêng.<sup>2)</sup>**

**1. PODOZAMITES LANCEOLATUS (LINDL. ET HUTT.).**

Pl. IV. Fig. 1.

On a slab of a dark coloured shale, there are several isolated, more or less fragmentary leaflets which also belong to the same species as that of San-chia-chung.

**G. Ch'ung-chia-fang, I-ch'un-Hsien,  
Chiang-hsi-Shêng.<sup>3)</sup>**

**1. PODOZAMITES LANCEOLATUS (LINDL. ET HUTT.).**

Pl. IV. Figs. 5, 6.

From this place came three fragments which we have identified with the species found in the above two places.

**H. Ssu-lu-p'u, Hsing-an Hsien,  
Chiang-hsi-shêng.<sup>4)</sup>**

**1. PTEROPHYLLUM? SP.**

Pl. IV. Fig. 9.

A fragment of a leaf with close segments, whose apices are all broken off. They are slightly inclined forward, about 3 mm.

1) 江西省萍鄉縣安源三夾冲  
3) 江西省宜春縣鐘家坊

2) 江西省萍鄉縣高坑  
4) 江西省興安縣司路舖

broad, and furnished with many parallel veins which are, however, very indistinct. In appearance, the specimen is not unlike that of *Pterophyllum Nathorsti* SCHENK (RICHHOFEN's China, pl. XIII, figs. 5, 7), but it might belong equally as well to the genus *Nilssonia*.

## 2. NILSSONIA? SP.

Pl. IV. Figs. 10, 11.

We possess two fragments, both of which have been figured. The one (fig. 10) represents an apical portion and seems not to be segmented. The other (fig. 11) shows two segments 6 to 7 mm. long and about 6 mm. broad, pierced with fine parallel veins numbering about 10.

### I. Liao-chia-shan, Fêng-ch'êng-Hsien.

Chiang-hsi-Shêng.<sup>1)</sup>

## 1. CLADOPHLEBIS SP.

Pl. IV. Figs. 7, 8.

Two fragmentary pinnæ of a *Cladophlebis* with closely set finger-like pinnules slightly inclined forward and furnished with furcate lateral veins. The forking is commonly single but in some cases double, especially in veins on the anterior side of the midrib.

The specimens look like some of the figures given by SCHENK as *Asplenium argutulum* HEER (e. g. figs. 2 and 3, pl. XLVI,

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1) 江西省豐城縣廖家山

RICHTHOFEN'S China l. c.), or by HEER as *A. whitbyense* (fig. 3, pl. LIII, Beiträge l. c.). But it is not possible now to determine them with any degree of accuracy.

J. Fang-t'u, Wei-Hsien,  
Shan-tung-Shêng.<sup>1)</sup>

# 1. CONIOPTERIS HYMENOPHYLLOIDES (BRONGN.).

Pl. VI. Fig. 3.

*Coniopteris hymenophylloides* SEWARD. The Jurassic Flora—The Yorkshire Coast, p. 99, pl. XVI, fig. 4-6, XVII, 3, 6-8, XX, 1, 2, XXI, 1-4.

*Sphenopteris hymenophylloides* BRONGNIART. Histoire Végétaux Fossiles, p. 189, pl. LVI, fig. 4.

*Thyrsopteris Murrayana* Heer. Beitr. zur Juraflora Ostsib., 1876, p. 30, pl. II, fig. 4, II, 1-4, VIII, 11 b. Yokoyama Jurassic Plants from Kaga, Hida and Echizen, p. 22, pl. XII, fig. 5.

*Thyrsopteris Maakiana* HEER, Beitr. z. Juraflora, 1876, p. 31, pl. I, fig. 1-3, II, 5, 6.

*Dicksonia nephrocarpa* YOKOYAMA, loc. cit., p. 25, pl. I, fig. 1.

For further synonyms see SEWARD already cited.

SEWARD in the work before cited united many ferns theretofore known under different names with the British species which was first described by BRONGNIART under the name of *Sphenopteris hymenophylloides*. The reason why this plant received so many different denominations is undoubtedly due to the great variability in form of the pinnules, as has been proved by Seward and also to the fact that the fertile pinnules had been treated as belonging to a different fern.

Some fragments of pinnæ of a fern brought from the coal-mine of Fang-t'u, in spite of their rather imperfect preservation,

1) 山東省濰縣坊子炭坑

I consider to belong to the British species above referred to. Our figured specimen shows a very great resemblance to fig. 2. pl. XX of SEWARD. Better specimens of this species were found at Lao-tung-ts'ang in Chih-li as will be seen further on.

MR. YABE is probably right in referring specimens found by him in Korea to this species, (Mesozoic Plants from Korea, pl. II, fig. 8, III, 8) imperfect as they are.

## 2. **TODITES WILLIAMSONI** (BRONGN.).

Pl. VI. Fig. 4.

*Todites Williamsoni* SEWARD, The Jurassic Flora, p. 87, pl. XIV fig. 2, 5, 7, XV, 1-3, XXI, 6.

On a large slab of stone is a splendid frond of a fern which by the characteristic shape and venation of its pinnules, indubitably belongs to the well known form above cited, and which, not only has been already described from Ch'ing-kang-lin in Ssu-ch'uang, but also occurs near Sai-ma-chi in Shêng-ching, as will be seen later on. Our figure represents only a portion of the frond found.

## 3. **CTENIS** SP.

Pl. VI. Fig. 1 a

We possess only a portion of a pinna which shows alternate, elongated pinnules which are dilated at base and decurrent on the rachis. The entire length of the pinnules is not known, as we have only a small part of them preserved. Their breadth

near the base measures 25 to 28 millimeters. The veins, which are slightly divergent and therefore run more or less to the margin, dichotomize here and there and again anastomose, thus forming a network of meshes much elongated transversely. The number of veins is about 12 in the space of a centimeter.

In general aspect, this fern resembles *Ctenis Zeuschneri* RACIBORSKI (Flora Kopalna, p. 61, pl. XVI) from the Jurassic of Poland, but the latter possesses much closer veins, there being 16 to 24 in the space of a centimeter. *Ctenis remotinervis* RACIBORSKI (ibid., p. 59, pl. XVIII, fig. 2), also from the same place, resembles the Chinese form in the number of the veins (8 to 12 in the space of a centimeter), but the nets seem to be much shorter.

#### 4. **PODOZAMITES LANCEOLATUS** (LINDL.).

Pl. VI. Fig. 1 b, 2.

There are several isolated leaflets of this plant, some of which are very long and narrow. The one shown in the figure (1 b) has about 15 veins.

K. Lao-tung-ts'ang, Hsüan-hua-Fu,  
Chih-li-Shêng.<sup>1)</sup>

#### 1. **CONIOPTERIS HYMENOPHYLLOIDES** (BRONGN.).

Pl. VII. Figs. 1-5.

*Coniopteris hymenophylloides* SEWARD, The Jurassic Flora, p. 99, pl. XVI, figs. 4-6, XVII, 3, 6-8, XX, 1, 2, XXI, 1-4.

The species which has been already described from Fang-t'u

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1) 直隸省宣化府老東蒼 (鷄鳴山の北)

in the province of Shan-tung is here represented by several well preserved specimens which however belong to sterile pinnæ.

An example represented in fig. 2 belongs to the apical portion of a primary pinna. The secondary pinnæ are alternate, elongated, springing from the rachis at a wide angle, and separated from one another by an interspace which is generally narrower than the breadth of the pinnæ. The pinnules are more or less rhomboidal in general outline and possess a few rounded lobes, while the lowest of them, especially the one on the posterior side, show lobes which are spreading and irregular, a character already noticed by SEWARD in his British specimens.

Fig. 5 represents a pinna with more lacinated pinnules, while in the specimen shown in fig. 4, the pinnules are small and entire, showing only here and there slight traces of lobation.

As already stated, the variability in the form of the pinnules of this species has been amply proved by SEWARD in the work above cited.

## 2. GINKGO FLABELLATA HEER.

Pl. VII. Figs. 6-9.

*Ginkgo flabellata* HEER. Beitr. z. Juraflora Ostsib. u. d. Amurl., 1876, p. 60, pl. VII, fig. 10, XIII, 3, 4. Nachtrag, p. 16, pl. IV, fig. 7a.

HEER's description of this species is as follows ;

"Leaves small, kidney-shaped, deeply lobed, lobes 8 to 14, oblong, obtuse at apex ; veins longitudinal, 3 to 5 in number ; petiole slender, elongated."

We have several fragments of leaves of a *Ginkgo* which we identify with the above named species of HEER, although some look much like those also described by HEER as *Ginkgo pusilla*.

At all events, even granting that these two species are distinct, it would be impossible to distinguish them, if the specimens existed only in imperfect fragments, so alike are they in appearance.

An example represented in fig. 8 shows four lobes, one of which is again split into two, each of which measures about 3 mm. in breadth. The three others are all simple and possess about the same breadth as the other two. The length in the one at the extreme right, in which the apex is well preserved, is about 15 mm. The others which all lack the apex seem to be a little longer. The veins are indistinct, but appear to number 4 or 5.

A fragment represented in fig. 7 shows only two lobes, one of which is again split into two by a shallow incision. The lobes are all apically rounded, and measure not quite 3 mm. in breadth. Their length is not known as their basal portion is broken off. The veins are again indistinct.

Fig. 6 represents another isolated lobe partly split into two blunt loblets which are about 3 mm. in breadth. Its shape is slender in comparison with those of the typical form.

**L. Nien-tsu-kou, Sai-ma-chi,  
Shêng-ching-Shêng.<sup>1)</sup>**

**1. TODITES WILLIAMSONI (BRONGN).**

Pl. VIII. Fig. 1.

There are several splendid specimens of this world-wide fern which I have already described from Ssu-ch'uang. They all belong to the sterile pinnæ which, however, show all the characteristics of the species.

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1) 盛京省賽馬集礪子溝

**2. CTENIS KANEHARAI** N. SP.

Pl. IX. Figs. 1, 1a.

The frond is pinnate. The pinnules or segments are alternate, elongated, somewhat inclined forward, slightly overlapping, mostly parallel-sided, but slightly narrowed at base, and attached laterally to a straight rachis which is longitudinally striated. The length of the pinnules is not known, as they are not wholly preserved, but the breadth in one of them is 35 mm. which diminishes to 20 mm. at base. The stem or rachis is straight and measures 10 mm. in breadth. The veins are numerous, parallel, about 10-12 in the space of a centimeter measured across the segment, often dichotomizing and also uniting so as to form an elongated mesh.

The only specimen which we possess is incomplete as may be seen from the figure, but the above given characters sufficiently show that the plants belong to a form hitherto undescribed. In the size of the segments and the fineness of the venation, it resembles *Ctenis Zeuschneri* RACIBORSKI (Flora kopalna ogniotrwalyk gliniek krakowskich, czesc 1, Archegoniataë, p. 60, pl. XVI) from the Polish Jurassic, but in the former the basal portion of the segments is much more abruptly narrowed than in the latter.

**3. SCHIZONEURA HÆRENSIS** (HISINGER).

Pl. VII. Fig. 10.

*Schizoneura hærens* RACIBORSKI, Flora kopalna ogniotrwalyk gliniek krakowskich, czesc 1. *Archegoniataë*, p. 95, pl. XXVI, fig. 7, XXVII 28-31, 37-43. NATHORST, Floran vid Höganäs och Helsingborg, p. 9, 40, Höganäs äldre, pl. I, figs. 1-4, Helsingborg, pl. I. fig. 5. MÖLLER, Bidrag till Bornholm's fossila flora, *Pteridophyta*, p. 60, pl. VI, fig. 19.

*Calamites Guembeli* SCHENK, Die fossile Flora der Grenzsichten d. Keupers u. Lias Frankens, p. 10, pl. I, figs. 8-10.

A single specimen of a fragment of an equisetoid stem 25 mm. broad, and 170 mm. long, of which the lower 90 mm. is a cast. There are two nodes, one near the upper end of the fragment, and the other about 70 mm. from its lower end, the internode between being nearly 90 mm. in length. The surface of the stem shows longitudinal ridges and grooves, the former about half a millimeter broad and the latter much narrowed. The surface of the ridges is finely striated in the longitudinal direction.

I believe this plant is to be identified with the well known species widely distributed in the Rhætic of Europe, and according to RACIBORSKI, also occurring in the Jurassic of Poland.

#### 4. **BAIERA GRACILIS** BUNBURY.

Pl. IX. Fig. 2a.

*Baiera gracilis* SEWARD, The Jurassic Flora-Yorkshire Coast, part I, p. 263, pl. IX, figs. 3, 5.

*Baiera? gracilis* BUNBURY, Quart. Journ. Geol. Soc., vol. VII, p. 182, pl. XII, fig. 3.

The specimen which I designate by the above name is a leaf consisting of several lobes which again divide into two long narrow ones. These are more or less parallel-sided, bluntly pointed, 3-5 mm. broad, pierced with 3 or 4 longitudinal veins, between which several interstitial ones are also observable. The lower part of the leaf is not preserved, but that it is a fan-shaped one is quite evident. I believe it is to be identified with the species above named, described long ago from Scarborough in England.

**5. GINKGO LEPIDA HEER.**

Pl. IX. Fig. 2b.

*Ginkgo lepida* HEER, Beitr. z. Juraflora Ostsib. u. d. Amurl., p. 62, pl. VII, fig. 7, pl. XII. Nachtrag, p. 17, pl. IV, figs. 7b, 9-12, pl. V, figs. 1a, 2, 3a, 4.

*Ginkgo cf. lepida* YOKOYAMA, Jurassic Plants from Kaga, Hida and Echizen, p. 60, pl. XIV, fig. 10.

On the same piece of stone as the above species, there is another fan-shaped leaf which has a petiole 2 mm. broad and 20 mm. long. This petiole above splits twice into two, each branch bearing three to five narrow lobes which are shorter in comparison with the breadth than in the preceding species. The length of the lobes varies, but the breadth is commonly about 3 to 5 mm. Their apices are bluntly pointed. Veins are few, about five in number in the broadest part of the lobes.

According to HEER, this species is distinguished from *Ginkgo sibirica* HR., an allied one, by the leaf splitting into more numerous lobes which are narrower and pointed.

**6. CZEKANOWSKIA MURRAYANA (LINDL. ET HUTT.).**

Pl. X. Fig. 1.

*Czekanowskia Murrayana* SEWARD, The Jurassic Flora I, p. 279, text-figs. 48-50.

*Solenites Murrayana* LINDLEY AND HUTTON, Fossil Flora of Great Britain, vol. III, pl. 121.

*Czekanowskia rigida* HEER, Beitr. zur Juraflora l. c., pl. V and VI. (pars). SCHENK in Richthofen's China, vol. IV, p. 251 pl. L, fig. 7.

A piece of stone from Sai-ma-chi is covered with several tufts of long narrow leaves, one to two millimeters in breadth,

and occasionally dichotomizing. The veins are entirely obliterated. The length of the leaves must have been more than 10 cm., but there is none that is preserved up to the apex. Looking at the figure, some of the leaves seem to be tolerably broad; but this is only an appearance due to their partial overlapping.

Although the breadth of the leaves is a little greater than in most of the specimens hitherto found in other countries, I believe, the plant belongs to the same species.

#### 7. **PALYSSIA MANCHURICA** N. SP.

Pl. VIII. Fig. 2, 2a.

A single specimen of a branch of a *Palyssia* shows subopposite branchlets, with leaves linear, broadest at a point about one-third of the distance from the base, expanding, acuminate, recurved, spirally disposed, on a cushion decurrent and sessile. The midrib is strong, elevated as a ridge on the back side of the leaf.

The species already described which can be compared with this one are three, viz. *Palyssia Brauni* ENDL., *P. indica* FEISTM. and *P. conferta* FEISTM. The first occurs in the Rhætic of Europe and has been figured by SCHENK, SCHIMPER and others, and when compared with the Chinese form, shows leaves which are decidedly longer. The second which occurs in the Rajmahal (Liassic) and Cutch (Lower Oolite) Series of India has leaves which besides being larger, are obtuse at apex. The third, also found in the Cutch Series, shows leaves which, though more or less acute, are more parallel-sided and not so recurved as in those of the Chinese form.

**M. Sha-ho-tzu, Ch'ang-tu,  
Shêng-ching-Shêng.<sup>1)</sup>**

**1. DIOONITES BRONGNIARTI (MANT.).**

Pl. XI. Figs. 1, 2.

*Dioonites Brongniarti* SEWARD, The Wealden Flora, p. 47.

*Dioonites Kotai* YOKOYAMA, Jurassic Plants, p. 44, pl. VII, fig. 1abc, XIV, 14.

This is the only fossil brought from the Sha-ho-tzu coal-mine. It consists of several fragments, some belonging to the apical portion (fig. 2) of a leaf, and some to the middle portion (fig. 1) of the same. The segments are close together, long, narrow, parallel-sided, either straight or very slightly curved forward, attached to the upper surface of the rachis by the whole base and more or less inclined forward, especially near the apex of the leaf. The apices of the segments are mostly broken off, but judging from their form, they seem to have been bluntly pointed. The most of the segments are about 3 mm. broad, pierced by 6-7 fine, equal, parallel veins.

I formerly described a species of *Dioonites* found in the Jurassic of Kaga and Echizen under the name of *D. Kotai* which SEWARD considers as probably identical with *D. Brongniarti*, an opinion to which I now quite agree.

**N. Ta-t'ai-shan, Ch'üan-yen-kou,  
Shêng-ching-Shêng.<sup>2)</sup>**

**1. PODOZAMITES LANCEOLATUS (LINDL. ET HUTT.).**

Pl. XI. Fig. 3.

Seven fragments of leaflets of *Podozamites lanceolatus* which

1) 盛京省昌圖沙河子

2) 盛京省泉眼溝大台山 (12 kilom. south-west of T'ieh-ling).

are blunt at apex are contained in one piece of stone. The veins are numerous, being up to 20 in number and mostly provided with a finer interstitial vein. In shape they correspond to what HEER once called the variety *Eichwaldi*.

## 2. GINKGO SP.

Pl. XI. Figs. 4-7.

We have several specimens of leaves of a *Ginkgo* all of which lack their apical portions. Their general shape however reminds us of those of *Ginkgo lepida* (HEER Beitr. z. Juraflora Ost-sib. 1876, pl. XII) and *Ginkgo sibirica* (ibid. pl. XI), although fig. 7 is also not unlike that of *Ginkgo concinna* HEER (ibid. pl. XIII, fig. 7).

## O. Pao-êrh-shan, Shêng-ching-Shêng.<sup>1)</sup>

### 1. PHYLLOTHECA SP.

Pl. XI. Fig. 8.

Numerous fragments of roots of an equisetaceous plant, 1-3 mm. in breadth and with slender fibres rising from them, look very much like those figured by HEER from Siberia, as probably belonging to his *Phyllothea sibirica* (Beitr. z. Juraflora Ost-sib. u. d. Amurl., 1876, p. 43, pl. IV, fig. 7).

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1) 盛京省抱兒山 (30 kilom. south-east of T'iehling.

## III. CRETACEOUS PLANTS.

A. Shi-huan-tzu, Chao-hua-Hsien,  
Su-ch'uang-Shêng.<sup>1)</sup>

## 1. CONIOPTERIS NITIDULA N. SP.

Pl. XII. Fig. 4, 4a.

Fronde tripinnate. Primary pinnæ elongated. Secondary pinnæ also elongated, bluntly pointed, attached to the rachis at a very wide angle, close together and often touching. Pinnules short, blunt, inclined forward, very close together, united at base so as to appear like mere lobes, indistinctly and coarsely crenate. Veins few, the midvein which is fine and goes off at an acute angle from the rachis usually forks twice, so that the pinnules become three-veined.

Our only specimen, shown in the figure, represents two primary pinnæ side by side, but separated from each other by a short interspace. The secondary pinnæ which measure about 10 mm. in length and about 2 mm. in breadth are generally given off at right angles to the rachis and possess 6 or 7 pinnules besides the terminal one.

This plant shows a distant resemblance to *Coniopteris hymenophylloides* BRONG. already described from Lao-tung-ts'ang in the province of Chih-li, but the shape of the pinnules in the two is quite different.

A closer relationship is shown by *Sphenopteris Cordai* SCHENK (Foss. Flora d. norddeutsch. Wealdenform., pl. VI, fig. 1.) which, however, seems to have pinnules a little larger

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1) 四川省昭化縣石蹟子

and more distinctly crenate. Of the generic denomination, I am not quite certain.

## 2. GLOSSOZAMITES HOHENEGGERI (SCHENK.).

Pl. XII. Fig. 1, 1a.

*Podozamites Hoheneggeri* SCHENK, Die fossilen Pflanzen der Wernsdorfer Schichten in den Nordkarpathen, p. 9, pl. II, figs. 3-6.

A cycad, hitherto known only from the Urgonian beds of Wernsdorf in the Northern Carpathians, is represented in China by the fine specimen here figured and one other less perfect. The figured specimen represents a part of a leaf probably belonging to its lower portion. The leaf is pinnate with segments inserted upon the rachis, but as the specimen shows the back side of the leaf, they appear as if attached to the lateral sides of the rachis. Segments are linear, obtuse, rather abruptly narrowed at base, sessile, straight, varying in length, being longest in the middle portion of the leaf, sub-opposite or alternate, mostly set at right angles to the rachis, only slightly inclined forward in the anterior portion, separated from one another by an interval which varies but is generally less than the breadth of the segments; but in the anterior part they are closer and almost touch. The rachis is slender, straight and longitudinally grooved. The veins in our specimens are not well preserved, but on careful examination they are seen to be fine, divergent and dichotomous, just as represented in SCHENK's figure.

The length attained by the longest segments is not exactly known, for all of them have their apices broken off. But this much is certain that they are more than 30 mm. long, with a breadth of about 5 mm.

**3. PODOZAMITES LANCEOLATUS** (LIND. ET HUTT.).

Pl. XII. Fig. 3.

A part of a stem with leaves attached to it which possess about 16 veins and corresponding in shape to the variety *genuina* of HEER.

B. Sha-chi-miao, Ho-Chou,  
Ssu-ch'uang-Shêng.<sup>1)</sup>

**1. CLADOPHLEBIS** SP.

Pl. XII. Fig. 2.

A faint impression of a fragment of a pinna of a fern probably belonging to the genus *Cladophlebis*. The pinnules are close together, falcate, pointed, with secondary veins once forked. It is not unlike a specimen figured by SCHENK as *Alethopteris Albertsii* SCHIMP. from the Wealden of Germany (Foss. Flora d. nordwestdeutschen Wealdenform., pl. VI. fig. 4.)

**2. GLOSSOZAMITES HOHENEGGERI** (SCHENK.).

Pl. XII. Figs. 5a, 6?

Fig. 5a is an isolated segment lacking the apex. It is 20 mm. long with the broadest part about 5 mm., and lying a little anterior to its middle portion. From this broadest part, it gradually narrows to the base where the breadth is only 2 mm. The veins are fine, but distinct, divergent and dichoto-

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1) 四川省合州沙溪廟

mous, numbering about 15 in the broadest part. Between these veins, there are longitudinal striations.

Another segment represented in fig. 6 is comparatively a broad one, attaining a breadth of 6.5 mm., while its length is 35 mm. The veins are quite of the *Glossozamites* type, so that it probably belongs to the same species as the other specimen.

### 3. GLOSSOZAMITES ACUMINATUS N. SP.

Pl. XII. Figs. 5b, 7.

What I call by the above name are long, lanceolate segments, broadest near the base and gradually tapering above to an acuminate apex. A specimen shown in fig. 5b attains the breadth of 10 mm., while its length, if it had the apex preserved, would measure more than 70 mm. The base measures about 7 mm. in breadth and has no stalk. The veins are distinct, divergent and dichotomous, quite in the *Glossozamites* style. They number about 20 in the broadest part. The interspaces are longitudinally striated as in the preceding species. Fig. 7 represents the apical portion of a segment, though the extreme apex is broken off.

In shape these segments are considerably different from those of *Glossozamites Hoheneggeri*. Therefore at present I prefer to treat them as belonging to a new species.

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**M. YOKOYAMA.**  
**MESOZOIC PLANTS FROM CHINA.**

**PLATE I.**

## Plate I.

Triassic Plants.

### T'ang-t'ang (Yün-nan).

Figs. 1-7. *Angiopteridium* cf. *infarctum* FEISM.

Fig. 1a. A part of the same enlarged to show the venation.

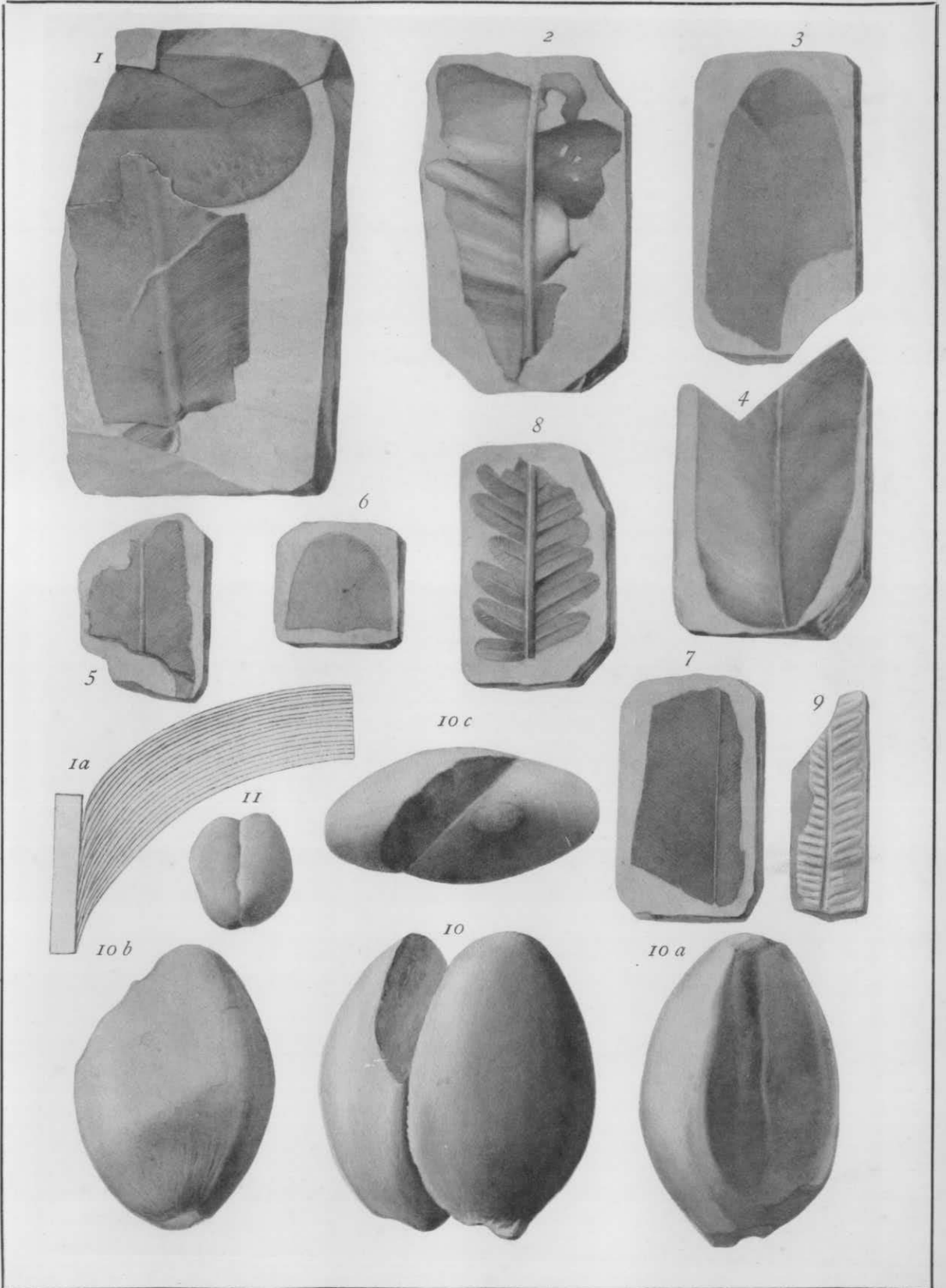
Figs. 8, 9. *Cladophlebis* sp.

Fig. 10, 11? *Carpolithes Yamadai* n. sp.

Fig. 10a. Do. showing the face of contact of one of the twin-fruits represented on the right hand side of fig. 10.

Fig. 10b. Do. showing the back-surface of one of the twin-fruits represented on the left-hand side of fig. 10.

Fig. 10c. Twin-fruits seen from below.



**M. YOKOYAMA.**  
**MESOZOIC PLANTS FROM CHINA.**

**PLATE II.**

**Plate II.**

Triassic Plants.

**Shui-t'ang-p'u (Yün-nan).**

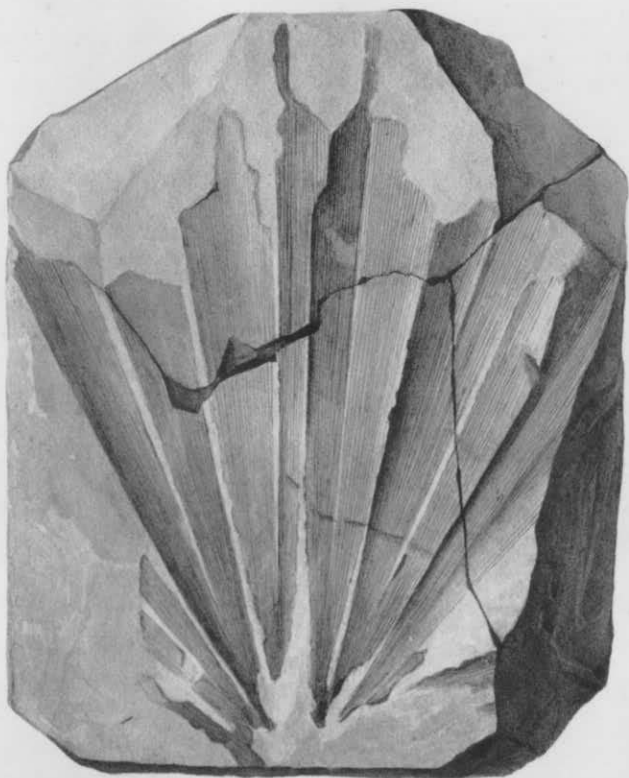
- Fig. 1. *Phœnicopsis* (?) *Yamadai* n. sp.  
Fig. 2. *Angiopteridium* cf. *infarctum* FEISTM.  
Fig. 3. *Clathropteris* sp.

Jurassic Plants.

**Ch'ing-kang-lin (Ssu-ch'uang).**

- Fig. 4. *Antholites chinensis* n. sp.  
Figs. 5, 6. *Podozamites lanceolatus* (LINDL. ET HUTT.).

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2.



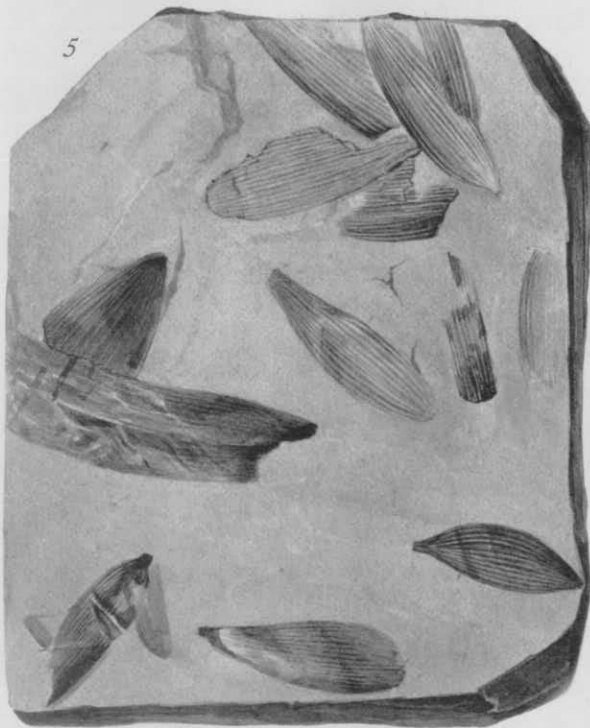
4.



3.



5.



6.



**M. YOKOYAMA.**

MESOZOIC PLANTS FROM CHINA.

PLATE III.

**Plate III.**

Jurassic Plants.

**Ch'ing-kang-lin (Ssu-ch'uang).**

Fig. 1. *Todites Williamsoni* (BRONGN.), with two magnified pinnules on the left.



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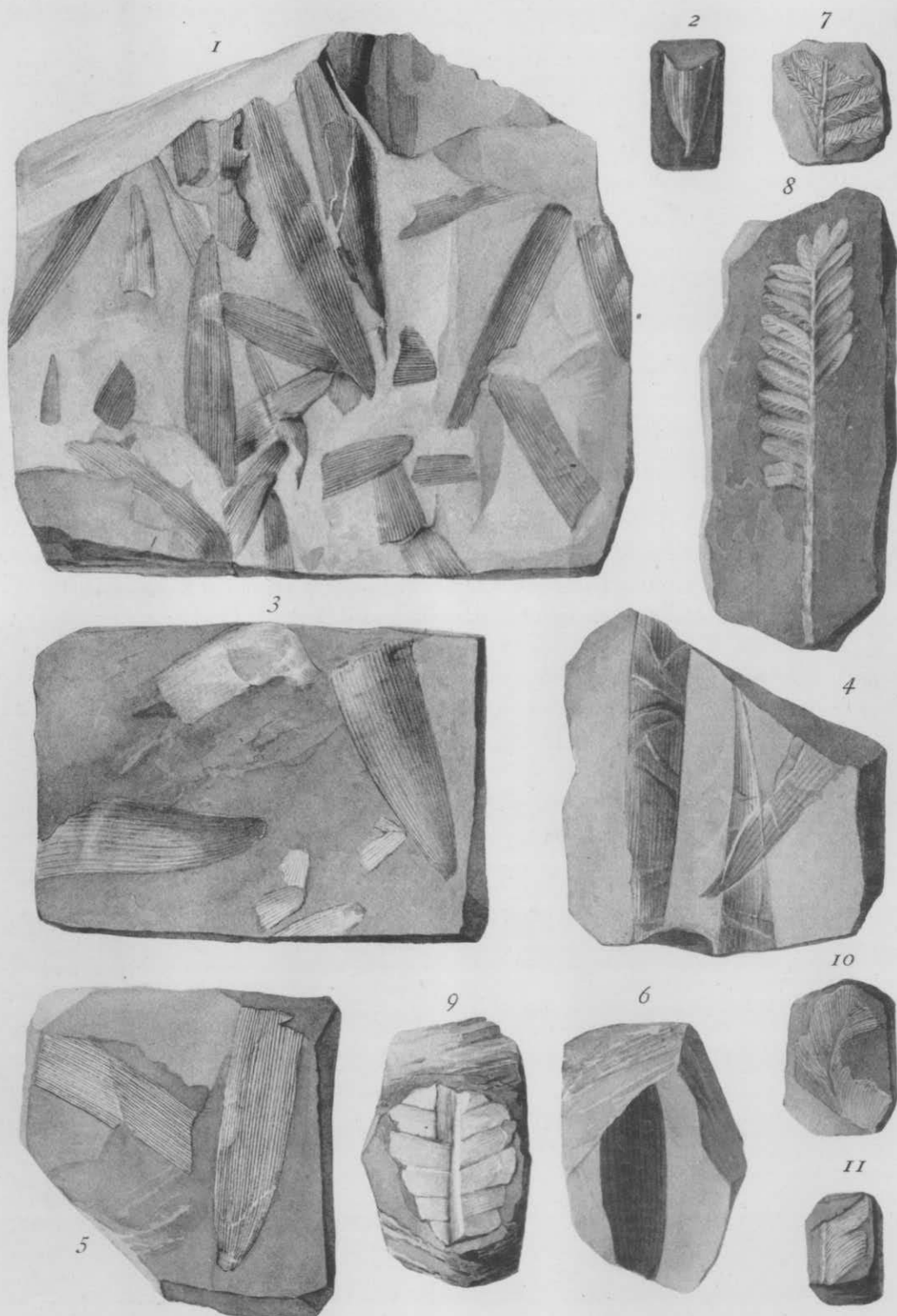
**PLATE IV.**

## Plate IV.

Jurassic Plants.

### Chiang-hsi.

- Fig. 1. *Podozamites lanceolatus* (LINDL. ET HUTT.). Kao-kang.  
Fig. 2. *Podozamites lanceolatus* (LINDL. ET HUTT.). San-chia-chung.  
Fig. 3. *Podozamites lanceolatus* (LINDL. ET HUTT.). Sha-shih-chieh.  
Fig. 4. *Phænicopsis latior* HEER. Sha-shih-chieh.  
Figs. 5, 6. *Podozamites lanceolatus* (LINDL. ET HUTT.). Ch'ung-chia-fang.  
Figs. 7, 8. *Cladophlebis* sp. Liao-chia-shan.  
Fig. 9. *Pterophyllum*? sp. Ssu-lu-p'u.  
Fig. 10, 11. *Nilssonina*? sp. Ssu-lu-p'u.



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**MESOZOIC PLANTS FROM CHINA.**

**PLATE V.**

**Plate V.**

Jurassic Plants.

**Ta-shih-ku (Ssu-ch'uang).**

Fig. 1a. *Todites Williamsoni* (BRONGN.).

Fig. 1b. *Carpolithes globularis* n. sp.

Triassic Plants.

**T'ang-t'ang (Yün-nan).**

Fig. 2. *Glossopteris* (?) sp.



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MESOZOIC PLANTS FROM CHINA.

PLATE VI.

**Plate VI.**

Jurassic Plants.

**Fang-t'u (Shan-tung).**

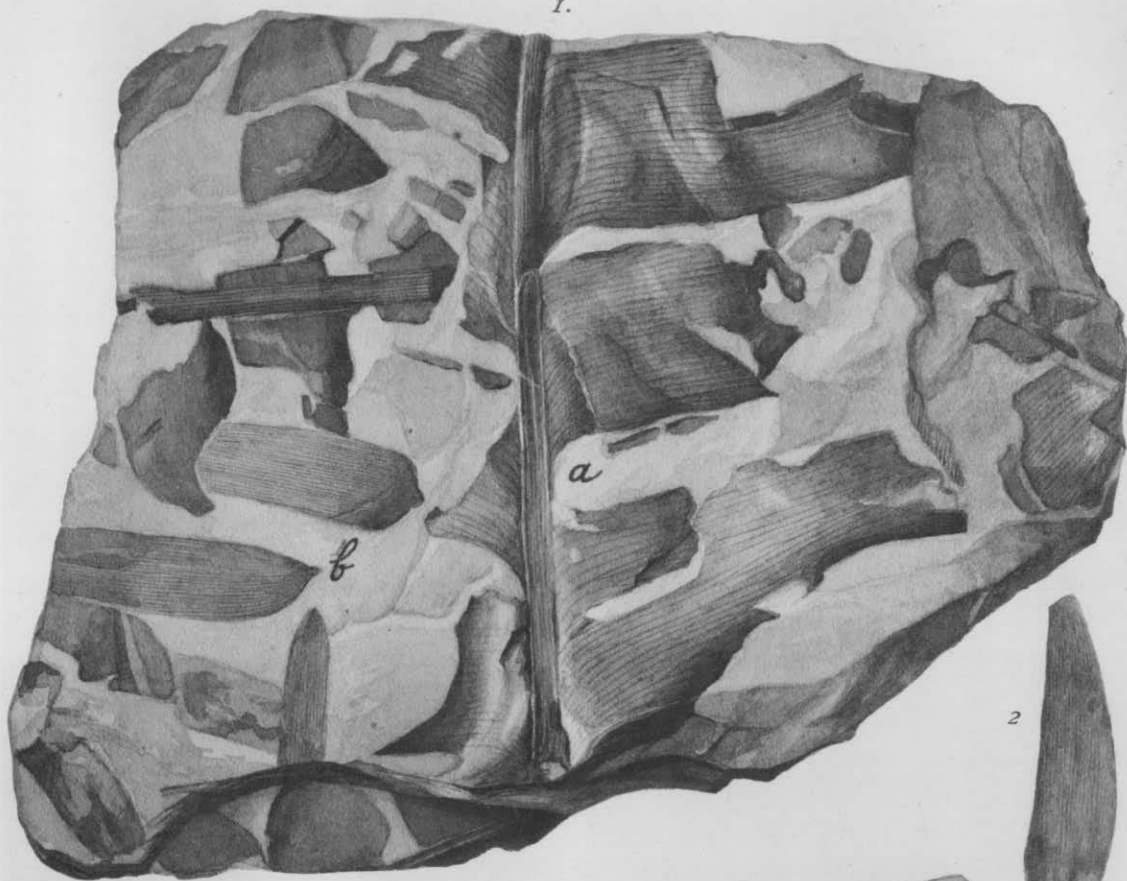
Fig. 1a. *Ctenis* sp.

Figs. 1b, 2. *Podozamites lanceolatus* (LINDL. ET HUTT.).

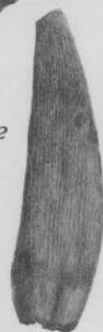
Fig. 3. *Coniopteris hymenophylloides* (BRONGN.).

Fig. 4. *Todites Williamsoni* (BRONGN.).

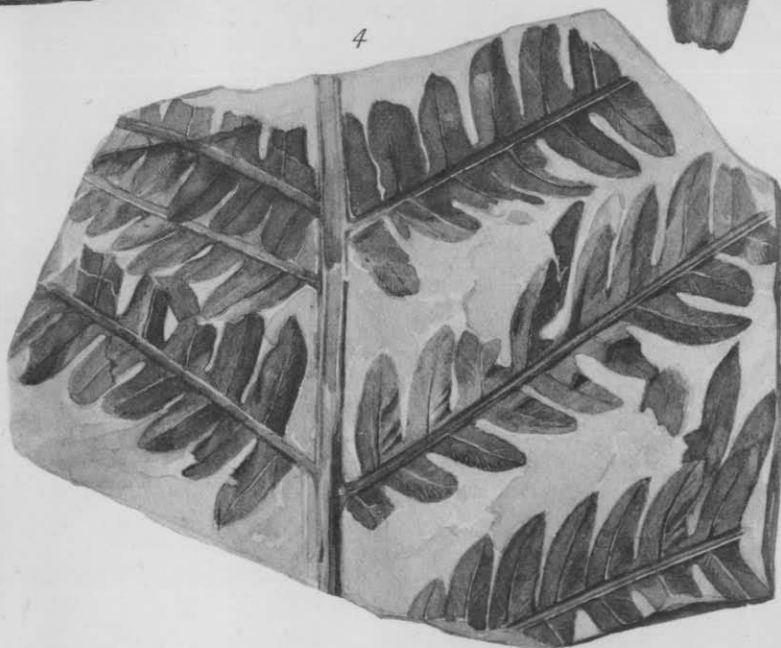
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3



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MESOZOIC PLANTS FROM CHINA.

PLATE VII.

**Plate VII.**

Jurassic Plants.

**Lao-tung-ts'ang (Chih-li).**

Figs. 1, 1a, 2-5. *Coniopteris hymenophylloides* (BRONGN.).

Figs. 6-9. *Ginkgo flabellata* HEER.

**Nien-tzu-Kou (Shêng-ching).**

Fig. 10. *Schizoneura hærens* (HISINGER.)



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**MESOZOIC PLANTS FROM CHINA.**

**PLATE VIII.**

**Plate VIII.**

Jurassic Plants.

**Nien-tzu-kou (Shêng-ching).**

Fig. 1. *Todites Williamsoni* (BRONGN.).

Fig. 2, 2a. *Palyssia manchurica* n. sp. 2a showing the enlarged leaves.



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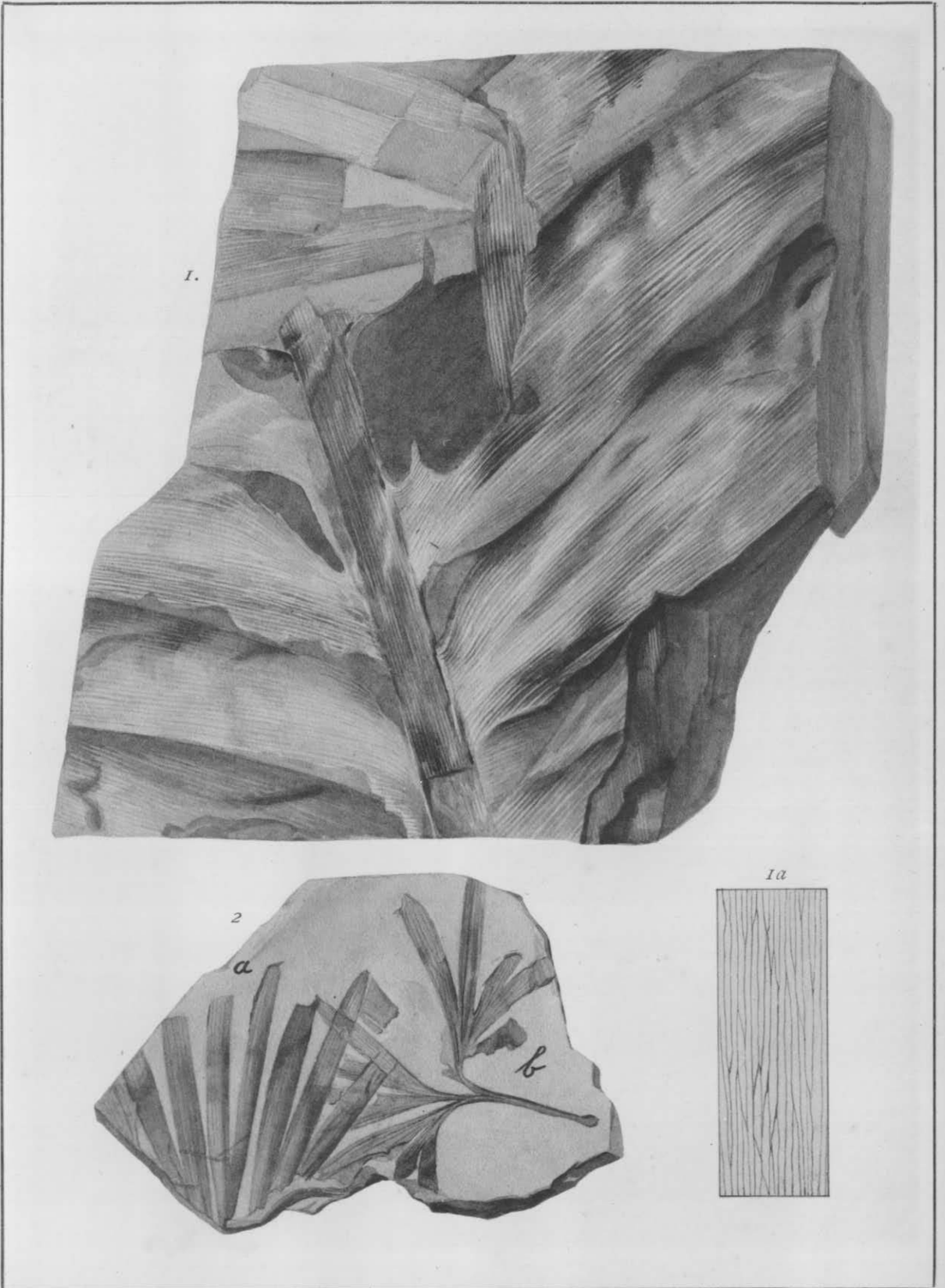
**PLATE IX.**

**Plate IX.**

Jurassic Plants.

**Nien-tzu-kou (Shêng-ching).**

- Fig. 1. 1a. *Ctenis Kaneharai* n. sp. 1a showing the venation.  
Fig. 2a. *Baiera gracilis* BUNB.  
Fig. 2b. *Ginkgo lepida* HEER.



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**MESOZOIC PLANTS FROM CHINA.**

**PLATE X.**

**Plate X.**

Jurassic Plants.

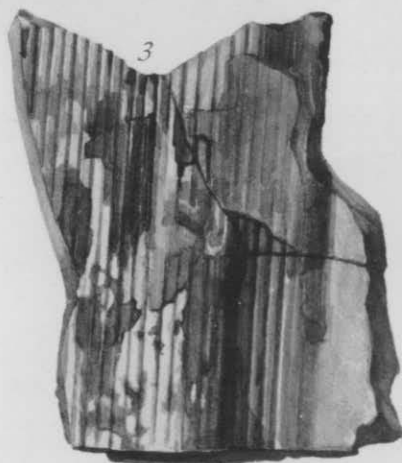
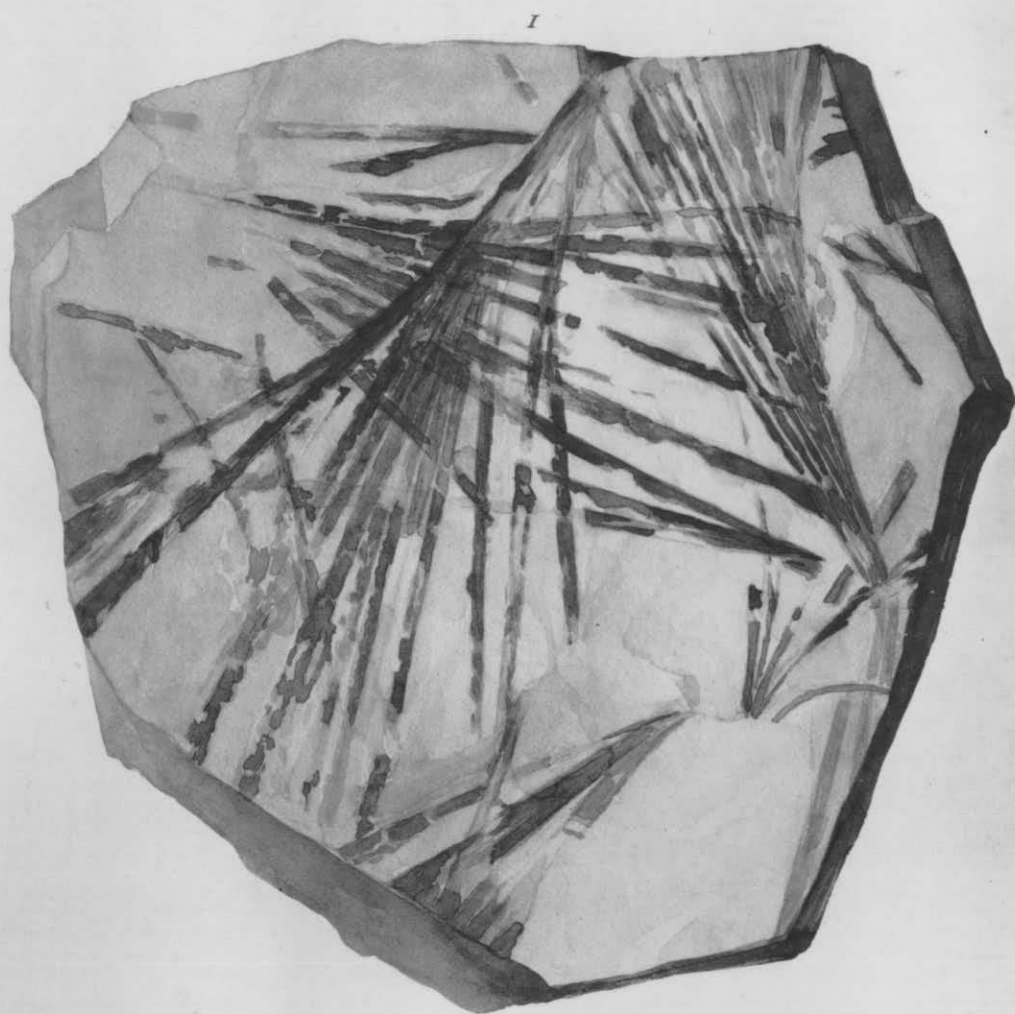
**Nien-tzu-kou (Shêng-ching).**

Fig. 1. *Czekanowskia Murrayana* (LINDL. ET HUTT.).

**Lung-wang-tung (Ssu-ch'uang).**

Fig. 2. *Schizoneura hærens* (HISINGER)?

Fig. 3. *Equisetaceæ*.



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MESOZOIC PLANTS FROM CHINA.

PLATE XI.

**Plate XI.**

Jurassic Plants.

**Sha-ho-tzu (Shêng-ching).**

Fig. 1, 2. *Dioonites Brongniarti* (MANT.).

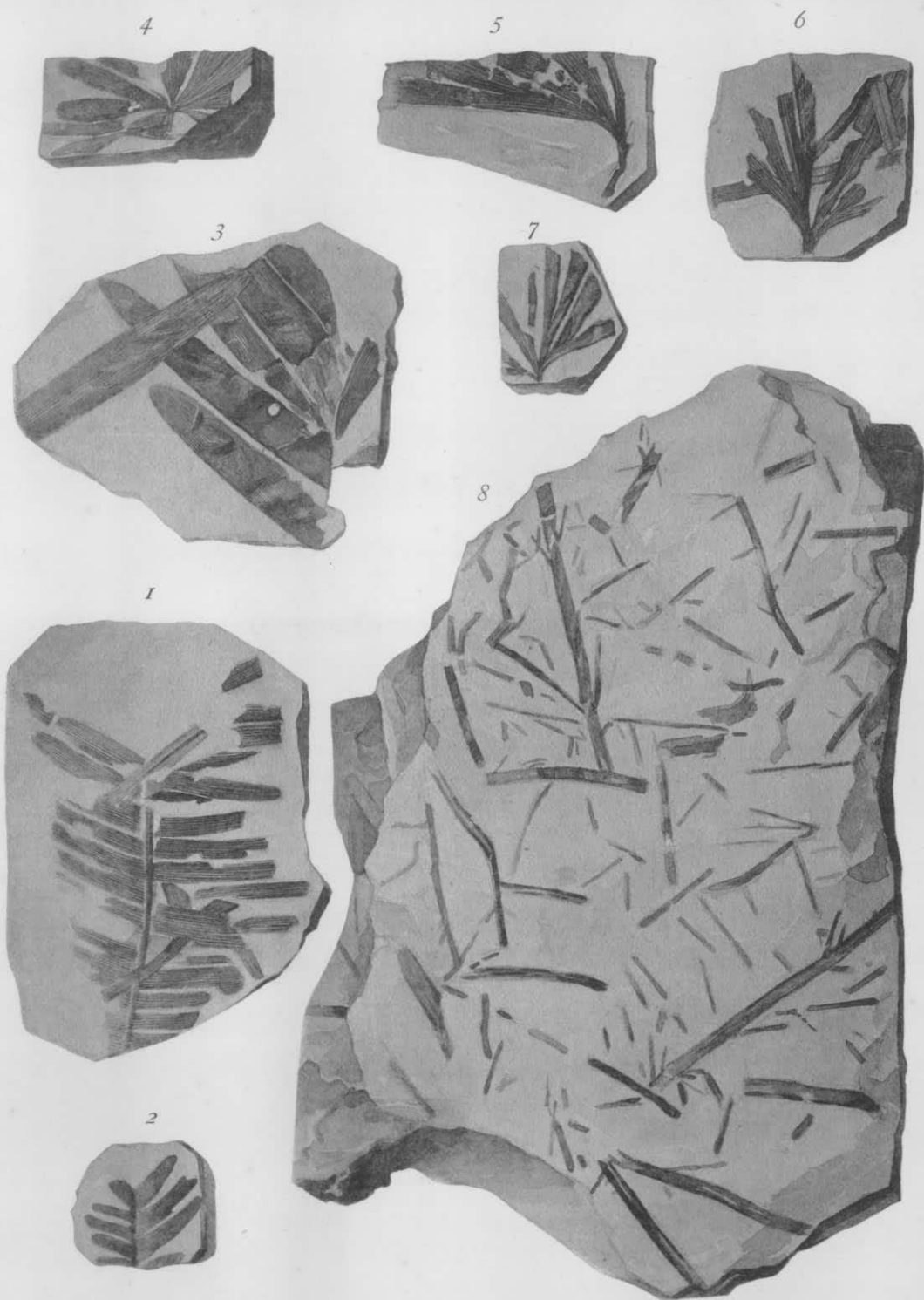
**Ta-t'ai-shan (Shêng-ching).**

Fig. 3. *Podozamites lanceolatus* (LINDL. ET HUTT.).

Fig. 4-7. *Ginkgo* sp.

**Pao-êrh-shan (Shêng-ching).**

Fig. 8. *Phyllothea* sp. Roots.



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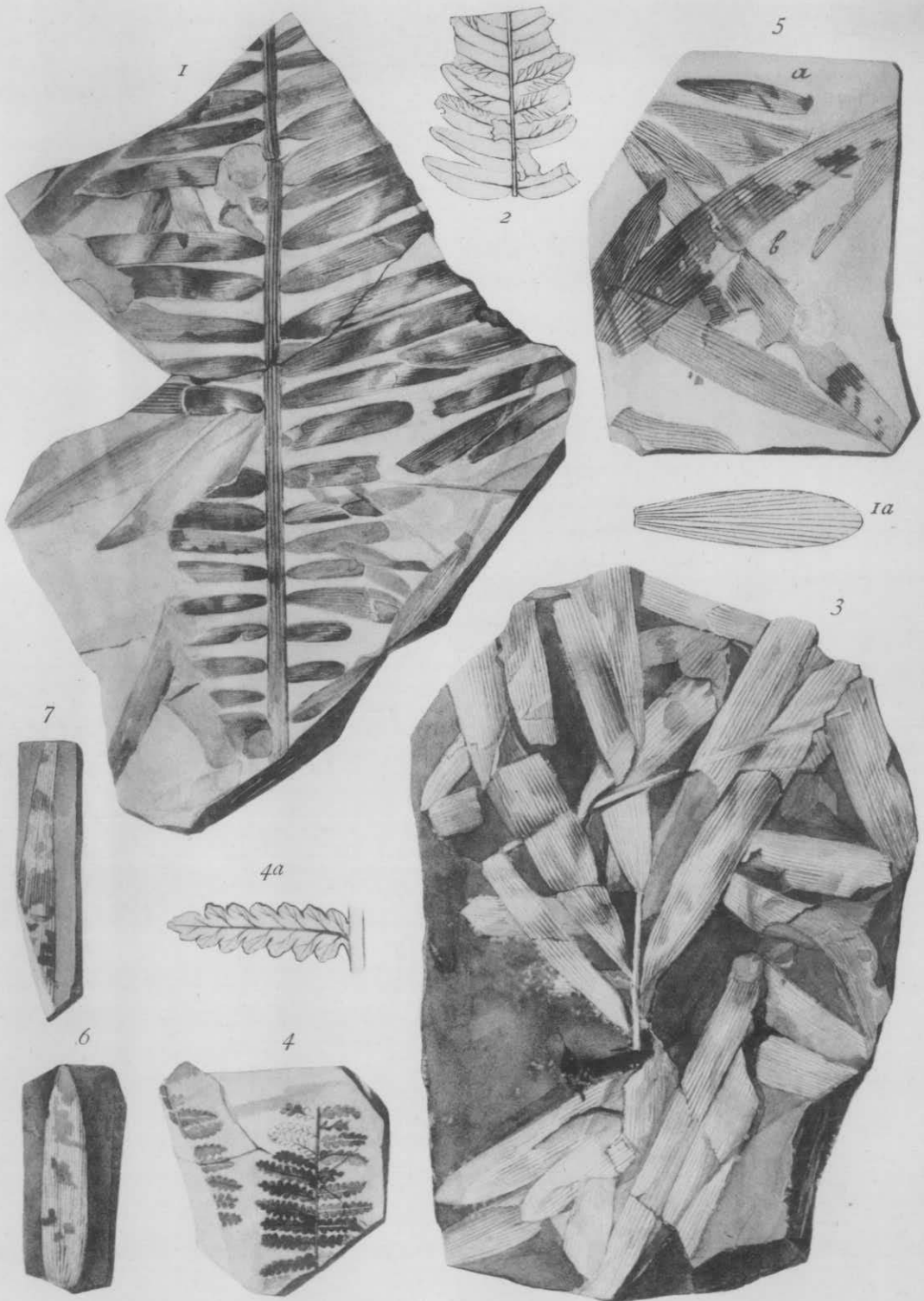
**PLATE XII.**

## Plate XII.

Cretaceous Plants.

### Ssu-ch'uang.

- Figs. 1, 1a. *Glossozamites Hoheneggeri* (SCHENK). Shi-huan-tzu.  
Fig. 2. *Cladophlebis* sp. Sha-chi-miao.  
Fig. 3. *Podozamites lanceolatus* (LINDL. ET HUTT.). Shi-huan-tzu.  
Fig. 4, 4a. *Coniopteris nitidula* n. sp. Shi-huan-tzu.  
Figs. 5a, 6? *Glossozamites Hoheneggeri* (SCHENK). Sha-chi-miao.  
Figs. 5b, 7. *Glossozamites acuminatus* n. sp. Sha-chi-miao.



## ERRATA FOR ART. 9, VOL. XXI.

(YOKOYAMA, MESOZOIC PLANTS FROM CHINA).

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On pp. 2-4, 11, 18, 20, 35, 37, in the table and in the explanations for plates, Ssu-ch'uang is to be read *Ssu-ch'uan*.

P. 5, l. 7. Read 3. instead of 4.

P. 6, l. 13. Read *P'ing-hsiang-Hsien* instead of P'ing-hsian-Hsien.

P. 8, l. 11. Read *Hsüan-hua-Fu* instead of Hsuan-hua-Fu.

P. 35, l. 2, in the table and in the explanations for plates, read *Shi-kuan-tzu* instead of Shi-huan-tzu.