THE JURASSIC PLANTS FROM SHITAKA (THE MAIZURU COAL-FIELD), PROV. TANGO (KYÔTO PREFECTURE), JAPAN

By

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With 3 Plates and 1 Text-Figure.

The geology of the so-called Maizuru coal-field, about 8 km. SWW of Maizuru, and the surrounding area was first mentioned by D. YAMASHITA in 1895 in the Explanatory Text to the Geological Map in 1/200,000; Sheet Hieizan. But he did not announce the occurrence of any Mesozoic fossil plants there, and only correlated the coal seams to those of the Cretaceous age developed in the Islands of Amakusa. In 1897, Dr. T. OGAWA[1] also touched upon the geology of the Mesozoic area in his study on the basic eruptive rocks of northern Tamba and called the coal-bearing series, in which he found some fossil plants, the Shitaka Series. He enumerated the following fossil plants collected from Shitaka where the main anthracite seams are being worked now and mentioned that they indicate the Mesozoic age of the plant-beds; they are:

Zamiophyllum sp.
Podozamites lanceolatus
Asplenium roesserti
? *Taeniopteris*

Of these *Zamiophyllum* sp. may be a fragment of Cfr. *Zamites megaphyllus* (PHILLIPS) described in this memoir. In 1915, JIRÔ TAKAHASHI[2] wrote a brief note on the geology of the Maizuru coal-field

(1) T. OGAWA: Preliminary Notes on the Basic Eruptive of the Northern Tamba Highland. Journ. Geol. Soc., Tôkyô, Vol. IV, 1897.

(2) JIRÔ TAKAHASHI: On the Geology of the so-called Mesozoic formation of the Maizuru Coal-field. Ibid., Vol. XXII, 1915.

Jour. of Faculty of Science, Hokkaidô Imp. Univ., Ser. IV, Vol. II, No. 1, 1932.

and enumerated, besides the above four, the following additional species:

Cladophlebis nebbensis
C. nathorsti

Of these the last one may probably be *C. denticulata* (BRONGN.).

A description of fossil plants from Shitaka was first prepared by Prof. H. YABE[1], who figured a few specimens which he identified as follows:

Cladophlebis denticulata (BRONGN.)
C. haiburnensis (L. and H.)

In the summer of 1931, the present writer visited the district in order to make a collection of fossil plants, and brought back a number of specimens described in the following pages. The Mesozoic rocks developed at Shitaka and surrounding district occupy a narrow area along the River Yura (or R. Ōkumo) and are, as also described by the authors above mentioned, shales (including mudstones), sandstones and conglomerates. The last two occupy the lower part while the shales which contain three thin anthracite seams are found in the upper part. Plant fossils are contained in the black coloured shales close to the anthracite seams, and they are mostly fragmental. The present writer has discriminated the following species here described (* after H. YABE):

Neocalamites sp. cfr. *N. carrerei* ZEILLER
Cladophlebis nebbensis (BRONGN.)
C. argutula (HEER)
* *C. denticulata* (BRONGN.)
C. haiburnensis (L. and H.)
C. cfr. *raciborskii* ZEILLER
C. maizurensis sp. nov.
C. tenuissima sp. nov.
Cfr. *Zamites megaphyllus* (PHILLIPS)
Otozamites spp.
Taeniopteris stenophylla KRYSHT.
T. shitakensis sp. nov.
T. sp.
Czekanowskia ? sp.

(1) H. YABE: Notes on Some Mesozoic Plants from Japan, Korea and China. Sci. Rep., Tôhoku Imp. Univ., 2nd Ser., Vol. VII, No. 1, 1922.

Podozamites griesbachi SEWARD
P. lanceolatus (L. and H.)
Carpolithus sp.

GEOLOGICAL AGE OF THE PLANT-BEDS

A glance at the above list shows that the Shitaka plants, as a whole, are undoubtedly Jurassic or at least not younger than the Upper Jurassic. It is certain that the flora is not so young as the Tetori flora (Upper Jurassic) of central Japan, the former being entirely devoid of the characteristic or prevailing species of the latter such as *Cladophlebis browniana, Onychiopsis elongata, Coniopteris hymenophylloides, Nilssonia nipponensis, Nilssonia ozoana, Nilssonia kotoi, Dictyozamites indicus*, etc. Attention has also been paid to the identity of some of the Shitaka plants with the Rhaetic species of the Nariwa district, the species in common being *Cladophlebis nebbensis, C. denticulata, C. haiburnensis*, and *Podozamites lanceolatus*. But these species show a remarkable uniformity and a general persistence of type through the older Mesozoic rocks or from the Rhaetic even up the Upper Jurassic, so their presence does not argue in favor of assigning the plant-beds to the Rhaetic formation. The entire absence, though it may be accidental, of genera of Dipteridaceae which are represented by several species in the Rhaetic Nariwa flora is noteworthy. Only the presence of *Cladophlebis* cfr. *raciborskii* and fragments of *Neocalamites* which resembles *N. carrerei* points rather to Lower Jurassic or even Rhaetic horizon, but the material is too poor to admit of such an assignment. *Taeniopteris stenophylla* is originally of the Middle Jurassic and recorded also from the Liassic and Rhaetic horizons; cfr. *Zamites megaphyllus* is closely allied to *Zamites megaphyllus* from the Oolite of England, and *Podozamites griesbachi* is quite indistinguishable from *P. griesbachi* from the Middle Jurassic of Afghanistan.

In short, the Shitaka flora is not so young as the Tetori flora and at the same time does not contain any Triassic species by which it should safely be assigned to the Rhaetic or even Liassic. For these reasons, it seems advisable at present to consider the fossiliferous beds together with the anthracite seams to represent, as a whole, the Middle Jurassic. Short descriptions of the Shitaka plants follow.

DESCRIPTION OF THE SPECIES

Neocalamites sp. cfr. N. *carrerei* (ZEILLER)

Pl. I, Figs. 1–3 A–C.

The material consists of impressions of stems characterised on their surfaces by the alternation of ridges and grooves in the longitudinal direction, sometimes connected with roots. Numerous detached linear leaves are found in close association with the stems, but in no cases are they found in organic connection.

Pl. I, fig. 1 is a piece of a stem 1.4 cm. broad, with an internode more than 3.5 cm. long. The number of ridges counts 19, so the whole number may be approximately 38. A node is seen at the lowest end of the stem: the ridges and gooves do not alternate at the node, and two ridges correspond to one leaf-base. Accordingly the number of leaves at this node may have been approximately 19. Numerous detached leaves occur in close association with the stems, but no organic connection of the leaves with the stems is seen. They are linear, 7 cm. long at least and 0.8–1 mm. broad. The nerves are obscure. A fascicle of leaves is shown in fig. 2 on the same plate.

In Pl. I, fig. 3 is shown roots connected with an Equisetaceous stem longitudinally ridged and grooved on its surface. A represents a side-view of the stem 3 cm. in diameter, the longitudinal axis of which is only a little oblique to the plane of stratification. The two ends of the stem represent the nodes, from the periphery of which rootlet-bearing roots are spread out radially and horizontally. Two views of the nodes, one node seen from above and the other from below, are shown in *B* and *C* respectively.

It is certain that the roots here shown belong to an Equisetaceous stem of unknown affinity, but there is no proof of the specific identity of the roots with the stems and leaves shown in figs. 1 and 2.

The measurement of the leaves somewhat resembles *N. carrerei* (ZEILLER)[1] from the Rhaetic of Tonkin, but the material is too poor to admit of their specific identity.

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(1) R. ZEILLER: Flore fossile des gîtes de charbon du Tonkin, 1903, p. 137, Pl. XXXVI, figs. 1–2; Pl. XXXVII, fig. 1; Pl. XXXVIII, figs. 1–8.

Cladophlebis nebbensis (BRONGNIART)

Pl. I, Fig. 4; Pl. II, Fig. 3.

Pl. II, fig. 3 shows an imperfect frond at least bipinnate, more than 8 cm. long, and with slender rachis. The ultimate pinnae are opposite or subopposite making an angle of approximately 45° with the rachis, slender, sometimes flexuous possibly due to the preservation, and closely set or touching each other laterally. The pinnules are alternate, oblong to deltoid, with an obtuse apex, and attached by the whole base at a wide angle. The midnerve distinct, sending off once forking secondary nerves at an angle of about 50°.

Cladophlebis nebbensis is a common Rhaetic and Liassic plant already known from several localities in Europe, South Africa, Arctic Region, Tonkin, China, Japan and Korea. It has also been reported from the Middle Jurassic of Turkestan and Siberia.

Cladophlebis argutula (HEER)

Pl. I, Fig. 5.

1889. *Asplenium argutulum* YOKOYAMA: Jurassic Plants from Kaga, Hida, and Echizen. Journ. Coll. Sci., Imp. Univ. Tôkyô, Vol. III, Art. 1, p. 32, Pl. III, fig. 1; Pl. XII, fig. 8; Pl. XIII, fig. 9; Pl. XIV, fig. 2.

1922. *Cladophlebis argutula* YABE: Notes on Some Mesozoic Plant from Japan, Korea and China. L. c., p. 15, Pl. I, fig. 5; Pl. II, figs. 4–8; Text-figs. 10–11.

For further references see YABE, 1922, l. c.

An imperfect fern frond shown in Pl. I, fig. 5 is at least bipinnate with slender axis, to which pinnae attached oppositely at a wide angle. The pinnules are closely set, linear-oblong, the length being as much as three times the breadth, with subacutely pointed apex. The nervation is of the usual *Cladophlebis*-type, the midnerve sending off secondary nerves only once forking.

Cladophlebis argutula resembles *C. pseudodelicatula* ŌISHI from the Rhaetic of Nariwa[1] and Kita-Otari, but in the latter species the pinnules are longer and narrower, straight, and perpendicular to

(1) S. ÔISHI: Rhaetic Plants from the Nariwa District, Prov. Bitchû, (Okayama Prefecture), Japan. This Journal, Vol. I, Nos. 3–4, 1932, p. 288, Pl. XXIX (XI), fig. 2.

the axis. The present specimen agrees closely with *C. argutula* from Korea figured by Prof. YABE[1].

Cladophlebis denticulata (BRONGNIART)

Prof. YABE[2] figured a fragment of this species from Shitaka; it shows a portion of a pinna carrying falcate pinnules provided with an acutely pointed apex; the midnerve is distinct, and the secondary nerves are once forking. We have no additional material of this species.

Cladophlebis haiburnensis (L. and H.)

Pl. I, Figs. 6; Pl. II, Fig. 2.

The specimen shown in Pl. I, fig. 6 strongly reminds one of *Cladophlebis haiburnensis* (L. and H.), in respect to linear and nearly parallel-sided pinnae and the oblong pinnules with twice forking secondary nerves. In the usual type of this species the pinnules are oblong, parallel-sided and provided with rounded apex, but in the present specimen they are slightly falcate and taper to an obtusely rounded apex. The midnerve is distinct, and the secondary nerves are twice forking as is usually the case in this species. The margin of the pinnules is entire.

Prof. YABE[3] already figured this species from Shitaka; one of his specimens (YABE'S Pl. II, fig. 11), as the present writer[4] has already suggested, resembles *C. raciborskii* ZEILLER from Tonkin[5] differing only from it in having entire margin of the pinnules. *C. haiburnensis* figured by SEWARD[6] from the Middle Jurassic rocks of Afghanistan agrees essentially with the Japanese form.

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(1) H. YABE: Notes on Some Mesozoic Plants from Japan, Korea and China. L. c., p. 15, Pl. I, fig. 5; Pl. II, figs. 4–8; Text-figs. 10–11.

(2) H. YABE: Op. cit., p. 9, Pl. I, fig. 1; Text-fig. 7.

(3) H. YABE: Op. cit., p. 16, Pl. II, figs. 10 and 11.

(4) S. ÔISHI: Mesozoic Plants from Kita-Otari, Prov. Shinano, Japan. L. c., p. 236.

(5) R. ZEILLER: Op. cit., p. 49, Pl. V, fig. 1.

(6) A. C. SEWARD: Mesozoic Plants from Afghanistan and Afghan-Turkistan. Pal. Indica, N. S., Vol. IV, Mem. No. 4, 1912, p. 19, Pl. II, figs. 31–35.

Cladophlebis cfr. *raciborskii* ZEILLER

Pl. II, Fig. 1.

The specimen in Pl. II, fig. 1 does not agree with any species figured and described in this memoir. It is a portion of pinnae characterised by a slender pinna-rachis carrying large pinnules. The pinnules are 3.5 cm. long, 1 cm. broad at the base, slightly falcate, narrowing gradually towards an acutely pointed apex, set closely but not confluent laterally, and attached at an angle of about 45° by the whole base. The midnerve is distinct, straight and persits to the tip of the pinnules. The secondary nerves are crowded, being dichotomously twice branched.

Cladophlebis cfr. *raciborskii* here described resembles *C. raciborskii* ZEILLER[1] from Tonkin in respect to the long and narrow, slightly falcate pinnules with dichotomously twice branched secondary nerves and acute apex, but differs from the typical *C. raciborskii* in having entire margin of the pinnules. One of the specimens from Shitaka assigned by Prof. YABE[2] to *C. haiburnensis* (L. and H.) is practically identical with the present form.

Cladophlebis maizurensis sp. nov.

Pl. II, Figs. 4–5.

The size and shape of the frond is not known. The ultimate pinnae are at least 4.5 cm. long and taper gradually from the proximal end towards the narrow apex. The pinnules are 1 cm. long, 4–5 mm. broad at the base, closely set, nearly parallel-sided, with an obtuse apex, and attached at a wide angle by the whole base. The pinna-rachis is about 0.7 mm. thick at the proximal portion of the pinna. The nervation is very distinct. The midnerve running into the lamina of the pinnules from near their lower basal edge assumes a zigzag course and dissolves into the secondary nerves at the apex. The secondary nerves are of the same strength with, and acute to the midnerve, arching and once forking, the distal branch sometimes forking once more.

The characteristic features of this species are first, the midnerve which runs in the lamina of the pinnules from near the lower basal

(1) R. ZEILLER: Op. cit., p. 49, Pl. V, fig. 1.
(2) H. YABE: Op. cit., p. 16, Pl. II, fig. 11.

edge of the pinnules assuming a zigzag course towards the apex; secondly, the secondary nerves which are of the same strength with the midnerve, arching, and once or twice forking.

Cladophlebis maizurensis resembles *C. roesserti* as figured by ZEILLER[1] and ÔISHI[2], but in this Rhaetic species the midnerve is straight or simply curved and the secondary nerves are much crowded.

Cladophlebis tenuissima sp. nov.

Pl. III, Figs. 1–2.

The frond is at least bipinnate, more than 8 cm. long. The axis is 5 mm. across at the lower portion and narrows gradually towards the apex. The pinnae are subopposite, slender, sometimes curving or flexuous, overlapping each other laterally, nearly parallel-sided or tapering towards the blunt apex, and at a wide angle with the axis. The pinnules are closely set, and narrow, straight, or occasionally falcate, subacutely pointed at the apex, and attached at a wide angle to the pinna-rachis by the whole base. The midnerve is distinct, and sends off secondary nerves which are dichotomously twice forking. The margin of the pinnules is entire.

Cladophlebis tenuissima resembles C. *pseudodelicatula* from the Rhaetic of Nariwa, but is distinguished from it in having dichotomously twice forking secondary nerves. This is not unlike *C. argutula* (HEER), but in HEER's species the secondary nerves fork once. In respect to the form of the pinnules and the nervation, the present species is closely akin to *C.* cfr. *raciborskii* described in this memoir, but in the latter the pinnules are always larger.

Cfr. *Zamites megaphyllus* (PHILLIPS)

Pl. III, Fig. 5.

Compare:

1904. *Zamites megaphyllus* SEWARD: Jurassic Flora. Pt. II, p. 110, Pl. X, figs. 4–5; Pl. XII, figs. 1, 3–5; Text-fig. 11.

A specimen shown in Pl. III, fig. 5 has provisionally been referred to this Jurassic Cycadophyta of uncertain affinity taking the general features of the pinnae into consideration, though the

(1) R. ZEILLER: Op. cit., p. 38, Pl. II, figs. 1–7; Pl. III, figs. 1–3.

(2) S. ÔISHI: The Rhaetic Plants from the Nariwa District, Prov. Bitchû. L. c., p. 274, Pl. XXII (IV), figs. 7–9; Pl. XXIII (V), figs. 1–3.

evidence of its being *Zamites* is very uncertain. It is 12 cm. long at least and 3.5 cm. broad at one broken end, narrowing gradually to another broken end which is 1.8 cm. broad. One margin of the pinna is straight as shown in the figure, while the other is gently curved. The surface of the lamina is not practically flat but slightly convex. The nerves are fine, numerous, parallel to each other and to the lateral margins of the pinna and number approximately 18–20 per cm. counted at the upper broken end.

Prof. YABE[1] reported the occurrence of *Zamites* cfr. *megaphyllus* (PHILLIPS) from the plant-bed (the Rhôseki Series; Wealden) of Ōshima, Prov. Rikuzen (Miyagi Prefecture), but without illustration.

Otozamites spp.

Pl. III, Figs. 3–4.

The genus *Otozamites* is represented in the collection by two imperfect specimens of detached pinnae which are hardly specifically determinable. In Pl. III, fig. 4 the pinnae are more than 3.5 cm. long, 1 cm. broad, nearly parallel-sided, and rounded off at the base, which is somewhat symmetrical. The auricular development at the base is not conspicuous. The nerves are diverging, forking and end at the lateral and apical margins of the pinnae.

Another fragmentary pinna shown in fig. 3 on the same plate differs somewhat from the preceding in the larger size and the strong, asymmetrical basal development of the lamina. It is more than 4.5 cm. long and 2 cm. broad, but as it is imperfect at the apex the size and form of the pinna are not clear. The nerves are diverging and forking occasionally as is usually the case in this genus.

Taeniopteris stenophylla KRYSHTOFOVICH

Pl. III, Figs. 6–7.

Pl. III, fig. 7 shows an apical portion of a *Taeniopteris*-leaf characterised by a linear lamina more than 3 cm. long and 1 cm. broad, narrowing gradually towards an obtusely pointed apex. The midnerve is distinct, and the lateral nerves which are branching at variable distances from their origin are given off at an angle of ap-

(1) H. YABE: Cretaceous Stratigraphy of the Japanese Islands. Sci. Rep., Tôhoku Imp. Univ., 2nd Ser., Vol. XI, No. 1, 1927, p. 51 (25).

proximately 60°; they are about 20–25 in number per cm. at the margin of the lamina. Another specimen shown in fig. 6 on the same plate is also an imperfect frond broken at apex and base; it agree well with the preceding specimen in the linear form of the lamina and the characteristic oblique lateral nerves.

Allied forms are *Taeniopteris ensis* OLDHAM and MORRIS[1] from the Upper Gondwanas of India and *T. tenison-woodsi* ETHERIDGE Jr.[2] from the Ipswich and Walloon Series of Queensland, but in them the lateral nerves are always less dense than in *T. stenophylla*.

T. stenophylla is originally from the Middle Jurassic of Siberia, but has been reported also from the Liassic of Korea[3] and the Rhaetic of Nariwa[4].

Taeniopteris shitakensis sp. nov.

Pl. III, Fig. 8.

A single specimen examined: Leaf probably simple, elongate, linear-ovate in outline, broadest a short distance below an obtusely pointed apex, narrowing gradually towards the base. Midnerve distinct, 1.3 mm. broad at the proximal end, narrowing gradually towards the apex. Lateral nerves, making an angle of approximately 60° with the midnerve, straight, simple or once forking close to the origin, and numbering 25–30 per cm. at the margin.

The specimen (Pl. III, fig. 8) upon which the above diagnosis is based is incomplete at the very proximal end; it measures 6 cm. in length and 1.4 cm. in breadth at the broadest portion. Margin is entire.

In the shape of the leaf, especially in the oblique lateral nerves, this species resembles closely *Stangerites* (*Taeniopteris*) *ensis* OLDH. and MORR.[5] from the Upper Gondwanas of India, but is distinguished from it in having denser lateral nerves. Another allied species is

(1) T. OLDHAM and J. MORRIS: Fossil Flora of the Rajmahal Series in the Rajmahal Hills. Pal. Indica, Ser. II, Vol. I, Pt. 1, 1863, p. 35, Pl. VI, figs. 8–10.

(2) A. B. WALKOM: Mesozoic Floras of Queensland. Pt. I.—cont. The Flora of the Ipswich and Walloon Series. Queensland Geol. Surv. Publ. No. 257, 1917, p. 32, Text-fig. 9.

(3) S. KAWASAKI: Some Older Mesozoic Plants in Korea. Bull. Geol. Surv. Korea, Vol. IV, Pt. I, 1925, p. 31, Pl. XXI, fig. 65.

(4) S. ÔISHI: Rhaetic Plants from the Nariwa District, Prov. Bitchû. L. c., p. 329, Pl. XLIII (XXV), fig. 10.

(5) T. OLDHAM and J. MORRIS: L. c., p. 35.

T. tenison-woodsi ETHERIDGE Jr.[1] from the Ipswich and Walloon Series of Queensland, but in the Queensland species also the lateral nerves are coarser than in ours. *T. howaradensis* WALKOM[2] from the Styx Series (Jurassic) of Queensland is not unlike ours, but in that the lateral nerves are far denser than in *T. shitakensis*, counting 21 in a space of 4 mm. From *T. stenophylla* ours is distinguished in the linear-ovate form of the leaf, instead of being linear as in the former.

Taeniopteris sp.

Pl. III, Figs. 9–10.

Besides two species of *Taeniopteris* above described, we have a number of very fragmentary specimens undoubtedly of *Taeniopteris* but hardly specifically determinable. Pl. III, fig. 10 represents a proximal portion of a leaf characterised by the gradual contraction of the lamina towards the base, with prominent midnerve 1.4 mm. broad and ornamented by longitudinal striations. The lateral nerves are at a right angle to the midnerve simple or branching close to their origin and approximately 20 in number per cm. The margin is entire.

Czekanowskia? sp.

Pl. III, Fig. 11.

Some imperfect needle-like leaves shown in Pl. III, fig. 11 are, with some doubts, assigned to the genus *Czekanowskia*. They are more than 3.5 cm. long and nearly 1 mm. broad, straight and so far as can be seen they do not show any branching. There are two distinct parallel nerves indicated as ridges on one surface of the lamina and as grooves on the other.

They may represent detached coniferous leaves. The assignment of the specimens to *Czekanowskia* is thus only provisional.

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(1) A. B. WALKOM: L. c.

(2) A. B. WALKOM: Mesozoic Floras of Queensland. Pts. III and IV. The Floras of the Burrum and Styx Series. Queensland Geol. Surv., Publ. No. 263, 1919, p. 36, Pl. I, fig. 1.

Podozamites griesbachi SEWARD

Pl. III. Fig. 12.

1912. *Podozamites griesbachi* SEWARD: Mesozoic Plants from Afghanistan and Afghan-Turkistan. L. c., p. 36, Pl. IV, fig. 58; Pl. VI. fig. 79.

After a considerable hesitation the specific name *griesbachi*[1] has been applied to an incomplete shoot of *Podozamites* shown in Pl. III, fig. 12 characterised by a slender axis to which are attached shortly petiolate, elongate-ovate leaves about 4 cm. long and 1.7 cm. broad at the broadest portion. The leaves are sometimes much elongated possibly due to the preservation. The nerves are distinct, parallel to each other and to the lateral margins of the lamina and approximately 20–23 in number at the broadest portion. No interstitial nerves are observable.

In the shoot in fig. 12 the leaves on the left side are ovate in shape, while those on the opposite side are much elongated actually having been effected by the lateral compression of the matrix in that portion.

The *Podozamites*-leaves display a considerable variation in their size, form and number of nerves, so it is very difficult to settle the limit of variation of each in one species. *P. griesbachi* also may be a variety of *P. lanceolatus* (L. and H.), but the former designation has been here adopted provisionally, as the leaves are indistinguishable from *P. griesbachi* figured by Seward in shape which appears to be constant in a number of specimens available to us.

An allied species is *P. reinii* GEYLER[2] from the Tetori Series of Central Japan, but in Geyler's species the nerves are much crowded, numbering 34–50 in general. A certain specimen figured by YOKOYAMA[3] from the Tetori Series at Shimamura as *P. lanceolatus* var. *latifolia* HEER is almost indistinguishable from *P. griesbachi*, though in the former the apex of the leaves is less acuminated than in the latter.

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(1) A. C. SEWARD: Mesozoic Plants from Afghanistan and Afghan-Turkistan. L. c., p. 36, Pl. IV, fig. 58; Pl. VI, fig. 79.

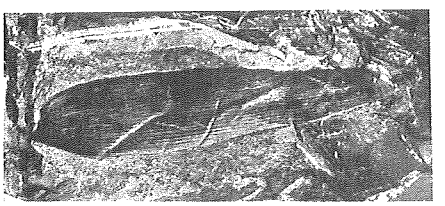
(2) M. YOKOYAMA: Jurassic Plants from Kaga, Hida, and Echizen. Journ. Coll. Sci., Imp. Univ. Tôkyô, Vol. III, Art. 1, 1889, p. 50, Pl. III, fig. 6a–c; Pl. IV, figs. 1b, 3b; Pl. VI, figs. 2, 3b–d, 4–7; 8a–c, e; Pl. IX, fig. 12a; Pl. XII, fig. 4.

(3) M. YOKOYAMA: Ibid., p. 48, Pl. V, fig. 1.

Podozamites lanceolatus (L. and H.)

Pl. III, Fig. 13; Text-fig. 1.

Pl. III, fig. 13 shows a portion of a shoot of *Podozamites* characterised by a slender axis to which are attached elongate-oval leaves 2.5 cm. long and 0.7 cm. broad, provided with an obtuse apex. The nerves are simple except at the base and number about 17 at the middle portion of the leaf. In another specimen shown in the text-figure a slender axis bears an elongate-ovate leaf broadest a little above the base, thence contracting rapidly toward the base and tapering gradually towards the apex. The very tip is imperfect. There are 22 nerves at the broadest portion, forking close to the base.



Text-fig. 1. *Podozamites lanceolatus*. 1×.

In two specimens illustrated here, the one in fig. 13 is a type of *P. distans* (PRESL) in the meaning of HARRIS[1], the leaves being broadest at the middle portion, while the one in the text-figure resembles *P. tenuistriatus* GEYLER figured by GEYLER[2] as to leaf-form.

Carpolithus sp.

Pl. III, Fig. 14.

Pl. III, fig. 14 shows a small oval seed 8 mm. long and 6 mm. broad, terminating in rounded ends. The surface is ornamented with fine transverse striations, but these are regarded as an accident of preservation and not an important feature.

In the end, I tender my grateful acknowledgement to Professors H. YABE and T. NAGAO for their offering several valuable suggestions.

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April, 1932.

(1) T. M. HARRIS: The Rhaetic Flora of Scoresby Sound, East Greenland. Med. om Grønland, Bd. LXVIII, 1926, p. 118.

(2) H. T. GEYLER: Ueber fossile Pflanzen aus der Juraformation Japans. Palaeontogr., Vol. XXIV, 1877, p. 228, Pl. XXIV, fig. 2b.

Plate I

PLATE I

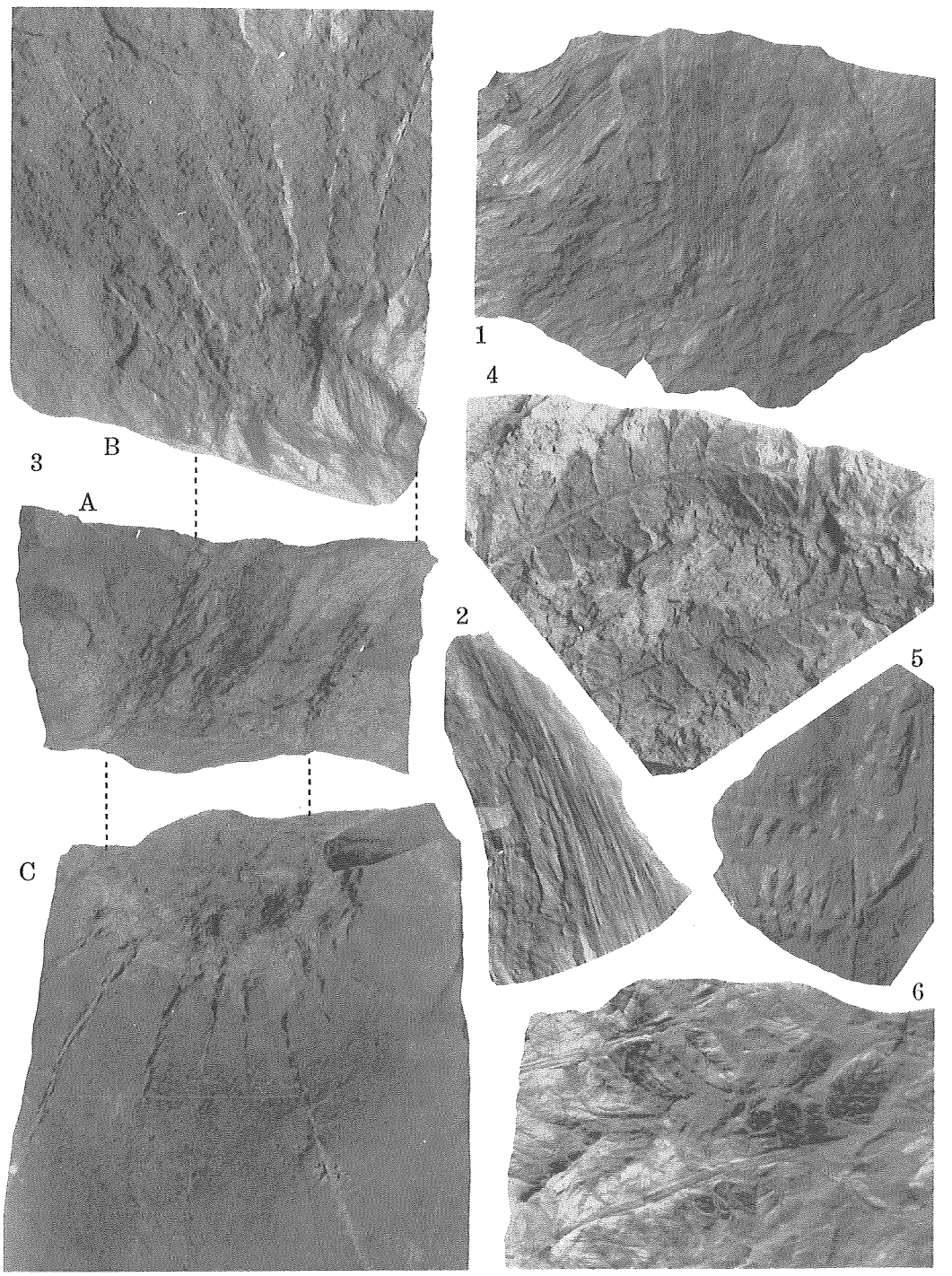
(The figures are natural size).

Figs. 1-3 A-C. *Neocalamites* sp. cfr. *N. carrerei* (ZEILLER).

Fig. 4. *Cladophlebis nebbensis* (BRONGN.).

Fig. 5. *Cladophlebis argutula* (HEER).

Fig. 6. *Cladophlebis haiburnensis* (L. and H.).



Takeda photo.

S. Ôishi: Jurassic Plants from Shitaka.

Plate II

PLATE II

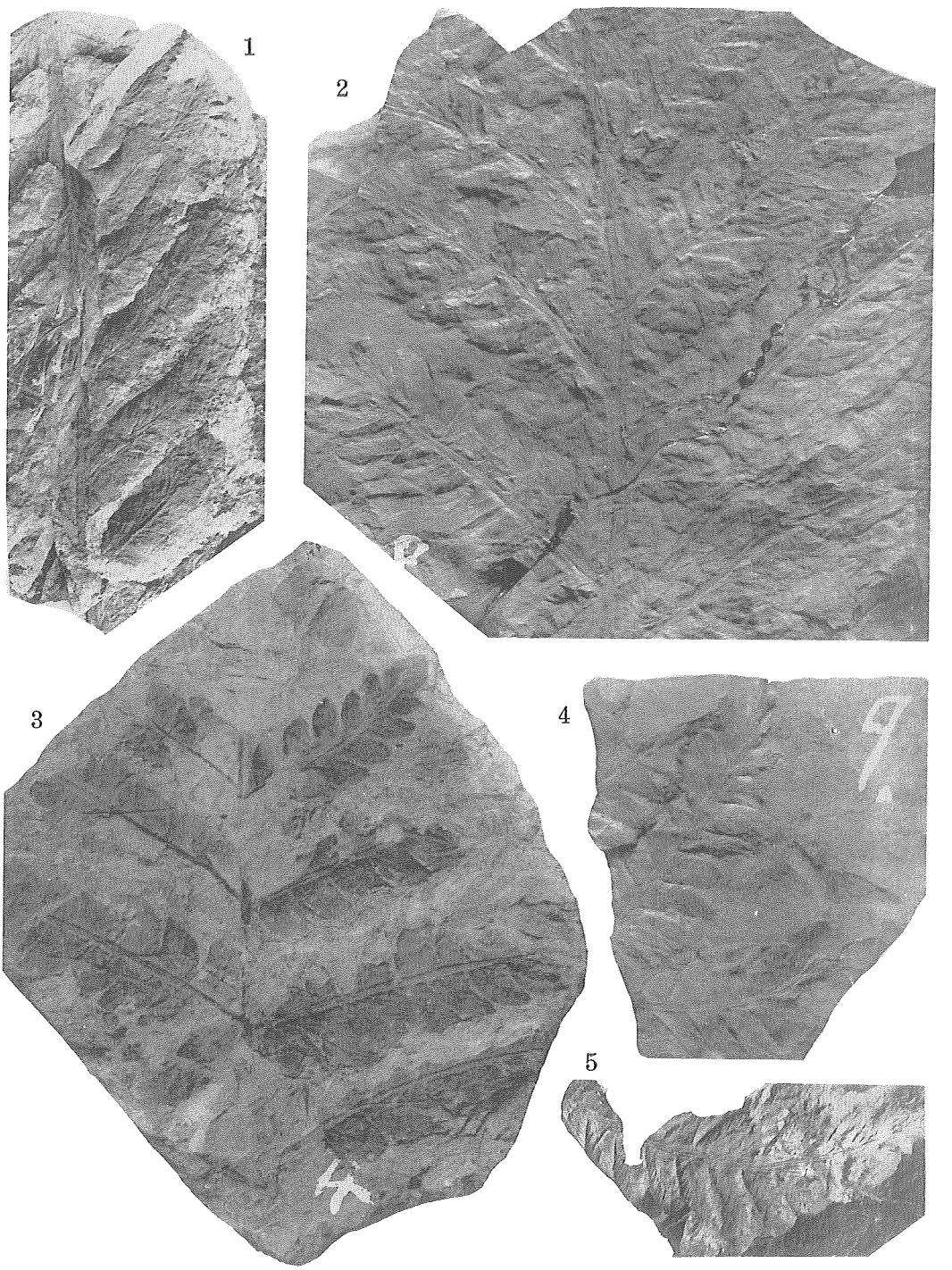
(The figures are natural size).

Fig. 1. *Cladophlebis* cfr. *raciborskii* ZEILLER.

Fig. 2. *Cladophlebis haiburnensis* (L. and H.).

Fig. 3. *Cladophlebis nebbensis* (BRONGN.).

Figs. 4–5. *Cladophlebis maizurensis* sp. nov.



Takeda photo.

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Plate III

PLATE III

(The figures are natural size).

Figs. 1–2. *Cladophlebis tenuissima* sp. nov.

Figs. 3–4. *Otozamites* spp.

Fig. 5. Cfr. *Zamites megaphyllus* (PHILLIPS).

Figs. 6–7. *Taeniopteris stenophylla* KRYSHT.

Fig. 8. *Taeniopteris shitäkensis* sp. nov.

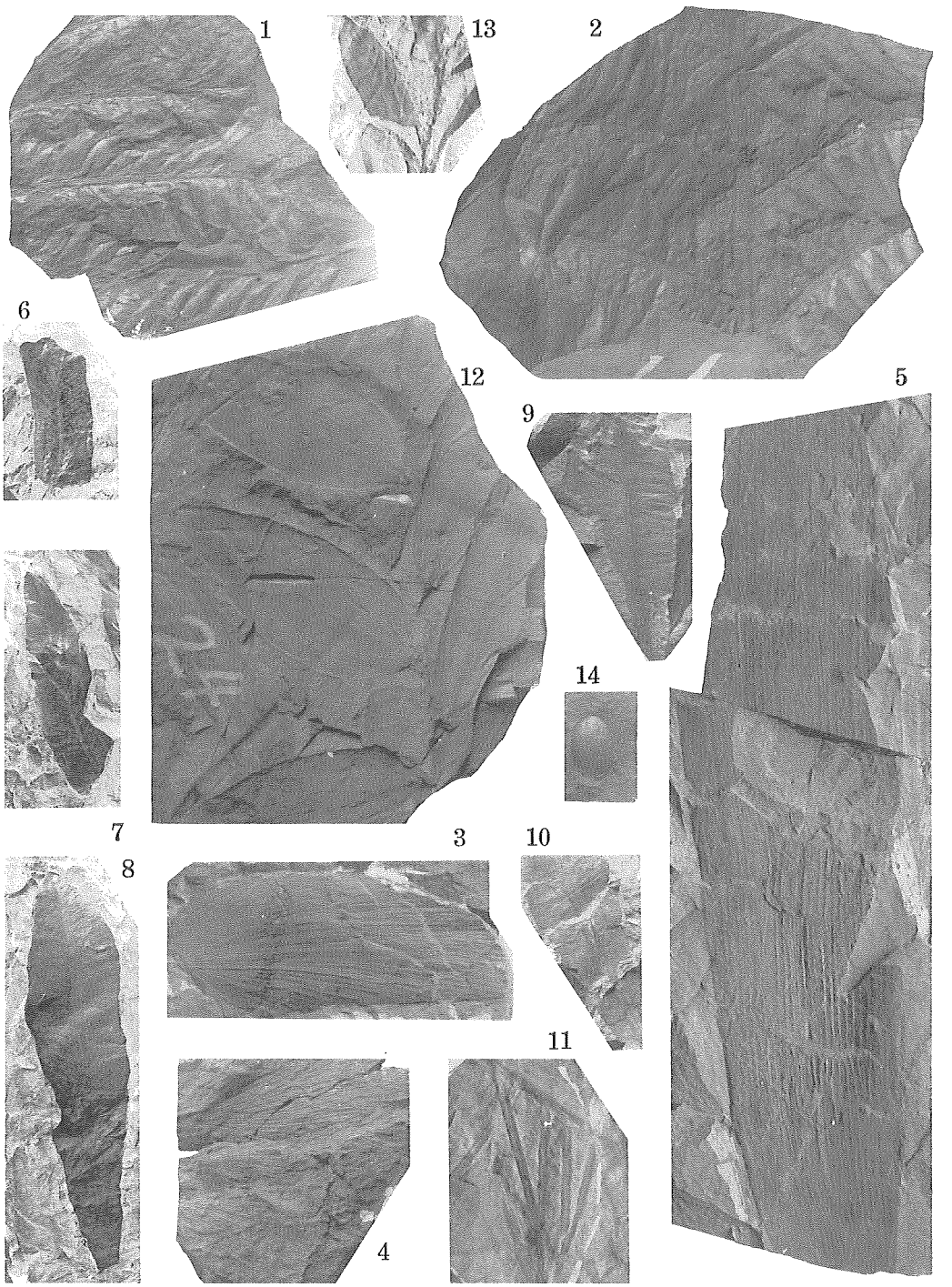
Figs. 9–10. *Taeniopteris* sp.

Fig. 11. *Czekanowskia* ? sp.

Fig. 12. *Podozamites griesbachi* SEWARD.

Fig. 13. *Podozamites lanceolatus* (L. and H.).

Fig. 14. *Carpolithus* sp.



Takeda photo.

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