



Title	Notes on Some Jurassic Plants from Chalai-nor, Prov. North Hsingan, Manchoukuo
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Citation	Journal of the Faculty of Science, Hokkaido Imperial University. Ser. 4, Geology and mineralogy, 3(1), 61-77
Issue Date	1935-07
Doc URL	http://hdl.handle.net/2115/35764
Type	bulletin (article)
File Information	3(1)_61-78.pdf



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NOTES ON SOME JURASSIC PLANTS FROM
CHALAI-NOR⁽¹⁾, PROV. NORTH HSING-
AN⁽²⁾, MANCHOUKUO.

By

Shirô TOYAMA† and Saburô ÔISHI

With 3 Plates and 4 Text-Figures

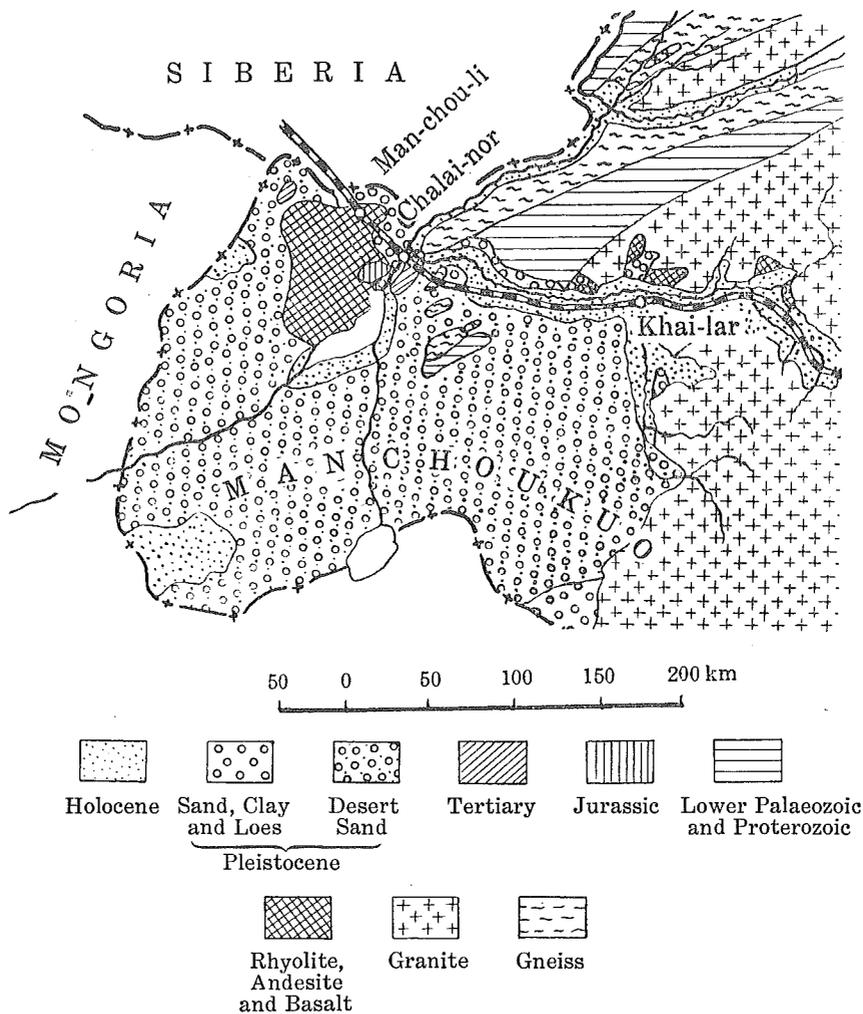
Contribution from the Department of Geology and Mineralogy, Faculty of
Science, Hokkaidô Imperial University, Sapporo; No. 110.

The specimens which form the subject of this note were collected by Prof. KUNIO UWATOKO, Dr. RIUJI ENDÔ and the senior author during their geological exploration of northern Manchoukuo in July, 1932. A part of the specimens then collected were sent by the senior author, who intended to study them himself under the guidance of Prof. H. YABE in Sendai, to the Institute of Geology and Palaeontology, Tôhoku Imperial University, while the remainder were brought back to Sapporo by Professor UWATOKO. Unfortunately, the senior author met his death in Manchoukuo by an accident on his way back to Sendai, and subsequently through the courtesy of Professor YABE his material was submitted to the junior author in Sapporo for investigation. Therefore, for the views expressed in this note, unless otherwise stated, the junior author alone is responsible.

The plant-bearing bed⁽³⁾ (text-fig. 1) occupies a small area of about 0.15 square kilometers at about 8 km. S. S. W. of Chalai-nor or nearly 50 km. S. E. of Man-chou-li, Prov. North Hsingan. It is composed of white siliceous sandstone forming a small isolated mountain 561 m. high, projecting above the so-called Mongolian steppe (text-fig. 2). This mountain has been called by the members of the explora-

(1) 扎賚諾爾 (2) 北興安省

(3) For the information on the geology of the plant-bed the present authors are indebted to the field observation of Prof. UWATOKO and to R. ENDÔ's Geology and Mineral Products of Manchoukuo. Tôkyô, 1934, p. 142.



Text-fig. 1. Geological map of the environment of Chalai-nor.
(After Dr. R. Endô).

tion Mt. "Toyama" in memory of the senior author, "yama" itself meaning "a mountain".

The fossils described in this note are as follows:

Filicales?

?*Chiropteris* sp. indet.

Cycadophyta:

Ctenis Uwatokoi sp. nov.

C. sp.

Taeniopteris vittata BRONGN.?

T. ? sp.

Ginkgoales:

Ginkgoites digitata (BRONGN.)

G. sibirica (HEER)

Baiera pulchella HEER

Coniferales incertae sedis:

Pityostrobus Endô-Riuji sp. nov.

Pityolepis ovatus sp. nov.

Pityospermum sp.

Pityophyllum Lindstroemi NATHORST

Coniferales?

Strobilites Yabei sp. nov.

Plantae incertae sedis

Czekanowskia rigida HEER

Phoenicopsis manchurensis YABE and ÔISHI sp. nov.



Text-fig. 2. A photograph of the Mt. "Toyama", looking west; the foreground is the steppe. (Photo. by Dr. R. Endô.)

Besides the species above enumerated, there are impressions of two types of branchlets or roots in the collection, but they have been only figured as they seemed not to deserve description.

As is clear from the above list, the florula of Chalai-nor comprises Filicales? 1, Cycadophyta 4, Ginkgoales 3, Coniferales incertae sedis

4, Coniferales 1, and Plantae incertae sedis 2, thus making the total number 15. Of these, 6 are referable to known species, 5 are specifically indeterminable, whereas 4 are new species. Taking a glance at the list, one may notice how remarkable it is that the florula consists mainly of arboreal plants, such as Cycadophyta, Ginkgoales and Coniferales, added to which are such genera as *Czekanowskia* and *Phoenicopsis* which may possibly represent the leaves borne on woody plant. Only ?*Chiropteris* seems to be herbaceous. Thus the former existence of a number of arboreal plants in N. W. Manchoukuo is interesting to note in contrast with the steppe or the desert condition barren of trees covering the wide area of this district at the present day.

The species indicative of the age of the plant-bearing bed are *Taeniopteris vittata?*, *Ginkgoites digitata*, *G. sibirica*, *Baiera pulchella* and *Czekanowskia rigida*, all of these being very common in the middle Jurassic strata of eastern Asia; *Phoenicopsis manchurenensis* is probably identical with a specimen described as *Phoenicopsis* sp. nov.¹⁾ from Huo-shih-ling. *Pityophyllum Lindstroemi* is also common in the Siberian middle Jurassic rocks, though it occurs in a somewhat higher horizon in the arctic region. Among the new species, *Pityostrobus Endô-Riuji* alone is comparable to a Jurassic form, *P. oblongus* (L. and H.), from Yorkshire, while the others have few allied forms. Though the material at hand is by no means sufficient for the determination of the age of the florula, yet the existence of some valid species mentioned above seems to indicate the middle Jurassic age of the plant-bed.

DESCRIPTION OF THE SPECIES

FILICALES?

GENUS *Chiropteris* KURR

?*Chiropteris* sp. indet.

Pl. III, Fig. 1 A.

Pl. III, fig. 1A shows a portion of outer margin of a lamina more than 4.5 cm. broad and 3 cm. high, and provided with anastomosed nervation with elongated fusiform to rhomboidal meshes about

(1) H. YABE and S. ÔISHI: Mesozoic Plants from Manchuria. Sci. Rep., Tôhoku Imp. Univ., 2nd Ser. (Geology), Vol. XII, No. 2B, 1933, p. 223 (29), Pl. XXXII (IV), figs. 12-13.

1–1.5 mm. broad and 5–10 mm. long. The longitudinal axis of each mesh is divergent and it is highly probable that the nerves arise from a common origin where the petiole, if any, might have been attached.

The affinity of *Chiropteris* is as yet uncertain, RUEHLE von LILIENSTERN¹⁾ has recently announced the presence of some sori-like circular objects on the lower surface of *Chiropteris lacerata* (QUENST.) from the Schilfsandstone of Eyershausen in Franconia and mentioned that *Chiropteris* may be an intermediate form between Matoniaceae and Dipteridaceae; no internal structure of the circular objects being known, this conclusion is based on very unsatisfactory ground. RUEHLE von LILIENSTERN himself says that the circular objects may be a kind of concretion or traces of fungus pathologically grown on the lamina.

CYCADOPHYTA

GENUS *Ctenis* LINDLEY and HUTTON

Ctenis Uwatokoi sp. nov.

Pl. III, Figs. 2-3.

The specimen in Pl. III, fig. 2, though it is rather imperfectly preserved, seems to be not identical with any species of this genus hitherto recorded. It is a portion of a linear, long and narrow *Ctenis*-frond more than 12 cm. long and about 5 cm. broad: it is traversed by a moderately strong rachis 2 mm. broad measured in the broken proximal end, narrowing and vanishing towards the apex

and with a marked longitudinal median groove on its upper surface (text-fig. 3). The pinnae are 1–1.5 cm. broad, the length being less than 2.5 times as long as the breadth; they become gradually smaller towards the proximal end of the frond; they are at a right angle to



Text-fig. 3. *Ctenis Uwatokoi* sp. nov. Transverse section of the frond showing the median groove on the rachis.

the rachis, slightly swollen at the distal portion, lightly expanded at the base, thus leaving a narrow space between any two adjacent pinnae and they are provided with broadly rounded apex. The nervation is of characteristic *Ctenis*-type, the nerves being anastomosed;

(1) RUEHLE von LILIENSTERN: Ueber *Chiropteris* KURR. Palaeont. Zeitsch., Bd. XIII, No. 4, 1931, p. 265.

they are crowded and divergent according to the distal expansion of the pinnae. The density of the nerves is generally 13 per 1 cm. at the middle portion of each pinna.

Pl. III, fig. 3 shows an apical portion of a frond 5.5 cm. in breadth. It is also characterised by the short pinnae with slight distal expansion and the corresponding divergence of the nerves. It agrees in all respects with the specimen in fig. 2. The anastomosed nerves and the median groove on the rachis are clearly seen in the figure.

In the form of the frond, *C. Uwatokoi* is closely allied to a Chinese species recently described by SZE from Szechuan under the name *C. Chaoi*⁽¹⁾, and the two seem to be almost specifically identical. But in our species there is a marked longitudinal median groove on the upper surface of the rachis, and the pinnae are slightly expanded distally with a corresponding divergence of the nerves.

Ctenis sp.

Pl. IV, Fig. 1.

Pl. IV, fig. 1 shows another specimen of a *Ctenis* which the authors believe to be specifically distinct from that described above as *C. Uwatokoi*. It is a portion of a frond, more than 10 cm. long, with slender rachis to which pinnae are attached at an angle of about 45°. The pinnae are 3–3.5 cm. broad at the base along the rachis, about 7 cm. long, and set closely. As the apical portion of each pinna is imperfect, the general shape of the pinnae is obscure, though it seems that they converge gradually towards the apex. As far as the imperfect specimen at hand is concerned, the anterior margin of the pinnae is concave, while the posterior one is convex with a broad gentle curve. The nervation is of *Ctenis*-type, the parallel nerves being frequently connected by cross-bars and thus anastomosed. Each mesh is about 1–1.2 mm. wide.

Unfortunately the specimen is too imperfectly preserved to admit of the specific determination. This form is easily distinguished from *C. Uwatokoi* above described by the slender rachis, larger pinnae and coarser meshes. The specimen is most closely allied to *Ctenis auriculata* FONT.? figured and described by FONTAINE⁽²⁾ from

(1) H. C. SZE: Fossile Pflanzen aus Shensi, Szechuan und Kueichow. Pal. Sinica, Ser. A, Vol. I, Fasc. 3, 1933, p. 18, Pl. II, figs. 1–8.

(2) W. M. FONTAINE: In WARD's Status of the Mesozoic Floras of the United States. Sec. Paper. U. S. G. S. Mon., Vol. XLVIII, 1905, p. 117, Pl. XXIX, fig. 1.

the Jurassic of Oregon which he thought to be distinct from his original specimen of *C. auriculata* in having no auriculate base in the pinnae. But as the apical nature of the Manchurian specimen, which in the Oregon specimen is bluntly pointed, is obscure, it is thought premature to hold them specifically identical.

Our specimen is not unlike *C. latiloba* KRYSH. and PRYNADA¹⁾ from Ussuriland, but in this the pinnae are fairly parallel-margined.

GENUS *Taeniopteris* BRONGNIART

Taeniopteris vittata BRONGN.?

Pl. IV, Fig. 4.

An imperfect specimen of Taeniopteroid-leaf in Pl. IV, fig. 4 seems most probably to be specifically identical with this well-known Jurassic species. It is a linear leaf more than 12 cm. long and 2.5 cm. broad in its distal broken end thence tapering towards the base. The midnerve is thick and broad, being 3 mm. broad even in the distal end of the specimen, and marked as a prominent groove on the impression. The lateral nerves are very imperfectly preserved so that the precise number of them per unit distance can hardly be made out. But by the aid of proper application of light one can see that they are apparently simple, nearly perpendicular to the midnerve, and that they number approximately 11 per 5 mm. The margin of the leaf is perfectly entire.

Taeniopteris vittata is widely distributed in the Jurassic rocks of the world and has been recorded from Central Asia²⁾, India³⁾, Europe⁴⁾, North America⁵⁾, New Zealand⁶⁾ and some other parts of

(1) A. KRYSHTOFOVICH and V. PRYNADA: Contribution to the Mesozoic Flora of Ussuriland. Bull. U. Geol. Prosp. Serv. U. S. S. R., Vol. LI, Fasc. 22, 1932, p. 368, Pl. II, fig. 1.

(2) H. H. THOMAS: The Jurassic Flora of Kamenka. Mém. Com. Géol., N. S., Liv. 71, 1911, p. 71, Pl. IV, figs. 2, 3. A. C. SEWARD: Jurassic Plants from Chinese Dzungaria. Ibid., Liv. 75, 1911, p. 45, Pl. III, figs. 30, 31.

(3) O. FEISTMANTEL: Jurassic (Oolitic) Flora of Kach. Pal. Indica, Ser. XI, Vol. II, Pt. 1, 1876, p. 15, Pl. I, figs. 1-3; Pl. II, figs. 1-5;? Pl. XII, figs. 1, 1a.

(4) Cfr. A. C. SEWARD: Jurassic Flora, Pt. I, 1900, p. 157.

(5) W. M. FONTAINE: in WARD's Status of the Mesozoic Floras of the United States. Sec. Paper. U. S. Geol. Survey, Mon., Vol. XLVIII, 1905, p. 80, Pl. XIII, figs. 4-8.

(6) E. A. N. ARBER: The Earlier Mesozoic Floras of New Zealand. New Zeal. Geol. Surv., Pal. Bull. No. 6, 1917, p. 47, Pl. IV, fig. 4; Pl. VI, figs. 2, 3.

the world. An imperfect specimen of it was lately figured by GOTHAN and SZE¹⁾ from Chinese Turkestan.

Taeniopteris? sp.

Pl. IV, Fig. 5.

Pl. IV, fig. 5 shows a very imperfect *Taeniopteroid*-leaf which may have attained a considerable dimension in its complete state; its outer margin is so entirely imperfect all round, that it is impossible to get an idea of the shape of the leaf. It is more than 14 cm. long and at least 8 cm. broad in its broken proximal end. The midnerve with continuous longitudinal striations is very prominent and broad, the breadth being about 4 mm. in the proximal end. It sends off well-marked lateral nerves at a very acute angle which then curve outwards and are frequently dichotomized at variable distances from their origin. So far as one can see in the single specimen at hand, the lateral nerves seem never to be anastomosed.

This specimen is well characterised in the broad midnerve and the lateral nerves which first make a very acute angle to the midnerve and soon arch outwards bifurcating frequently. Unfortunately the outline of this leaf with its peculiar nervation is quite obscure, and it is only for convenience sake that the generic name *Taeniopteris* has been applied to the present specimen.

As far as the nervation only is concerned, the specimen resembles closely an interesting plant described by ARBER²⁾ from the Older Mesozoic rocks of New Zealand under the name *Linguifolium lilieanum* ARBER, but not knowing the outline of the leaf of the present specimen, the authors cannot of course appropriately apply ARBER's generic designation to it. The present plant is decidedly larger in size than the New Zealand one. *Linguifolium* is, in the shape of the leaf, certainly a type of *Taeniopteris*. But if we do not admit the inclusion of such a leaf with lateral nerves which make an acute angle to the midnerve in the genus *Taeniopteris*, in which the lateral nerves are far less oblique, then the Manchurian specimen also should be excluded from ARBER's genus. Another point of resemblance between the Manchurian and the New Zealand specimens is that the lateral nerves are very coarse in both examples; in *Taeniopteris* they are usually more crowded.

(1) W. GOTHAN and H. C. SZE: Pflanzenreste aus dem Jura von Chinesisch Turkestan. Academia Sinica, No. 1, 1931, p. 33.

(2) E. A. N. ARBER: Op. cit., p. 35.

GINKGOALES

GENUS *Ginkgoites* SEWARD

Ginkgoites digitata (BRONGN.)

Pl. III, Figs. 4-5.

1828. *Cyclopteris digitata* BRONGNIART: Histoire des Végétaux Fossiles, p. 219, Pl. LXI, bis, figs. 2, 3.
1884. *Salisburyia digitata* SAPORTA: Plantes jurassiques, Vol. III, p. 294, Pl. CLX, figs. 1, 2.
1889. *Ginkgo digitata* YOKOYAMA: Jurassic Plants from Kaga, Hida, and Echizen. Journ. Coll. Sci., Imp. Univ. Tôkyô, Vol. III, Pt. I, p. 59, Pl. XIII, fig. 2.
1894. *Ginkgo digitata* BARTHOLIN: Nogle i den bornholmske Juraformation forekommende Planteforsteninger. Bot. Tidskr., Bd. XIX, p. 96, Pl. IV, fig. 1.
1894. *Ginkgo Huttoni* BARTHOLIN: Ibid., p. 97, Pl. IV, figs. 2, 3.
1897. *Ginkgo digitata* NATHORST: Zur mesozoischen Flora Spitzbergens. Kgl. Svensk. Vet.-Akad. Handl., Vol. XXX, No. 1, p. 15.
1900. *Ginkgo digitata* SEWARD: Jurassic Flora, Pt. I, p. 258, Pl. IX, figs. 1, 9 (non 2, 10).
1900. *Ginkgo digitata* SEWARD: Notes on Some Jurassic Plants in the Manchester Museum. Mem. Proc. Manch. Lit. Phil. Soc., Vol. XLIV, Pt. III, p. 23, Pl. II, fig. 5.
1900. *Ginkgo digitata* SEWARD and GOWAN: The Maidenhair Tree (*Ginkgo biloba* L.). Ann. Bot., Vol. XIV, Pl. IX, fig. 46; Pl. X, fig. 54.
1905. *Ginkgo digitata* KRASSER: Fossile Pflanzen aus Transbaikalien, der Mongolei und Mandschurei. Denk. k. Akad. Wiss., Wien., Math.-Naturwiss. Kl., Vol. LXXVIII, p. 16, Pl. II, fig. 3.
1907. *Ginkgo digitata* SEWARD: Jurassic Plants from Caucasia and Turkestan. Mém. Com. Géol. St.-Pétersbourg, N. S., Liv. 38, p. 29, Pl. VII, figs. 53-55.
1907. *Ginkgo digitata* STOPES: The Flora of the Inferior Oolite of Brora (Sutherland). Quart. Journ. Geol. Soc., London, Vol. LXIII, p. 375, figs. A, B.
1910. *Ginkgo digitata* KRYSHTOFOVICH: Jurassic Plants from Ussuriland. Mém. Com. Géol. St.-Pétersbourg, N. S., Liv. 56, p. 13, Pl. III, fig. 1.
1911. *Ginkgo digitata* THOMAS: Op. cit., p. 73, Pl. IV, fig. 7; Pl. VIII, fig. 2.
1912. *Ginkgo digitata* SEWARD: Mesozoic Plants from Afghanistan and Afghan-Turkestan. Pal. Indica, N. S., Vol. IV, Mem. No. 4, p. 23, Pl. IV, fig. 51.
1914. *Ginkgo digitata* KNOWLTON: The Jurassic Flora of Cape Lisburn, Alaska. U. S. G. S. Prof. Paper 85, p. 55, Pl. VI, fig. 5; Pl. VII, figs. 3-5.
1917. *Ginkgo digitata* WALKOM: Mesozoic Flora of Queensland. Pt. I-concl. The Flora of the Ipswich and Walloon Series. Queensl. Geol. Surv. Publ. No. 259, p. 8, Pl. I, figs. 3-5.

1918. *Ginkgo digitata* ZALESSKY: Flore paléozoïque de la rivière d'Angara. Mém. Com. Géol. St.-Petersbourg, N. S., Liv. 174, Pl. XXVII, fig. 2; Pl. XLII, figs. 4, 5; Pl. XLVIII, figs. 3, 4.
1919. *Ginkgo digitata* WALKOM: Mesozoic Flora of Queensland. Pts. III-IV. The Floras of the Burrum and Styx River Series. Queensl. Geol. Surv. Publ. No. 263, p. 38, Pl. I, figs. 3, 4.
1919. *Ginkgoites digitata* SEWARD: Fossil Plants, Vol. IV, p. 14, fig. 634.
1927. *Ginkgoites digitata* DU TOIT: The Fossil Flora of the Upper Karroo Beds. Ann. South Afr. Mus., Vol. XXII, Pt. II, 5, p. 370, Text-fig. 16, B.
- ?1927. *Ginkgoites digitata* CHAPMAN: Monograph on the Triassic Flora of Bald Hill, Bacchus Marsh, Victoria. Mem. Nat. Mus., Melbourne, No. 7, p. 138, Pl. XI, fig. 29.
1930. *Ginkgo digitata* HOLLICK: The Upper Cretaceous Floras of Alaska. U. S. G. S. Prof. Paper 159, p. 48, Pl. XI, figs. 2-7a, 8.

The type of leaves which the present authors have here called *Ginkgoites digitata* includes all the leaves of *Cyclopteris digitata*-type of Brongniart, the laminae of which are almost lobe-less or shallowly lobed and the apex of each segment is more or less truncated or broadly rounded instead of being rather obtusely rounded. For leaves with similar size and outline as *G. digitata* but with deeply-lobed laminae generally four in number, each bearing an obtusely rounded apex, has been proposed the name *G. digitata* var. *huttoni* SEWARD. To the former category belong the leaves shown in Pl. III, figs. 4-5.

The leaf in Pl. III, fig. 4 is long petiolate, the petiole being more than 3.5 cm. long and 1.3 mm. broad. The lamina is semi-orbicular, 3 cm. high, with a nearly straight base and first cleft to two halves and then each segment again once or twice very shallowly lobed. The nerves are numerous and frequently bifurcating.

Ginkgoites digitata is widely distributed in the world and has been reported from various horizons of the Mesozoic rocks, though mostly concentrated in the Middle Jurassic. The leaves with entire, unevenly lobed or very shallowly lobed laminae from the Tertiary rocks of various countries have been called under the name *G. adiantoides* (UNGER).

Ginkgoites sibirica (HEER)

Pl. III, Fig. 6; Pl. IV, Fig. 2.

We have a number of specimens of *Ginkgoites*-leaves which are identical in leaf-form and nervation with typical form of *Ginkgo sibirica* figured by HEER. The specimen shown in Pl. IV, fig. 2 is a lamina semi-circular in outline, with basal edges nearly straight,

about 2 cm. high, and dichotomously branched into six ultimate segments. The ultimate segments are obovate in outline, being provided with obtusely rounded apices. There are 9–11 parallel nerves in each ultimate segment, forking near the proximal portion. Another specimen in Pl. III, fig. 6 is a somewhat larger form, the lamina being about 4 cm. high. The mode of division of the lamina, the number of the ultimate segments and the nerves are the same as in the specimen in Pl. IV, fig. 2. The only difference is that in the latter specimen the ultimate segments are more linear, and somewhat allied to a type of *Ginkgo concinna* HEER. The present specimen may be a type of *Ginkgo sibirica* as figured by HEER in his "Beitraege zur Jura-Flora Ostsibiriens und des Amurlandes, Pl. IX, fig. 5c."

GENUS *Baiera* F. W. BRAUN

Baiera pulchella HEER

Pl. IV, Fig. 3.

1877. *Baiera pulchella* HEER: Beitrage zur Jura-Flora Ostsibiriens und des Amurlandes. Flora Fossilis Arctica, Vol. IV, p. 114, Pl. XX, fig. 3c; Pl. XXII, fig. 1a; Pl. XXVIII, fig. 3.
1878. *Baiera pulchella* HEER: Beitrage zur fossilen Flora Sibiriens und des Amurlandes. Ibid., Vol. V, p. 24, Pl. VII, fig. 1.
1880. *Baiera pulchella* HEER: Nachtraege zur Jura-Flora Sibiriens. Ibid., Vol. VI, p. 15, Pl. IV, figs. 3, 4.
1894. *Baiera pulchella* BARTHOLIN: Op. cit., p. 96, Pl. III, fig. 5.
1903. *Baiera pulchella* MOELLER: Bidrag till Bornholms Fossila Flora. Gymnospermer. Kgl. Svensk. Vet.-Akad. Handl., Vol. XXXVI, No. 6, p. 26, Pl. IV, fig. 19.

The specimen in Pl. IV, fig. 3 may, though it is imperfectly represented, very probably be specifically identical with the Jurassic species *Baiera pulchella* first described by HEER from eastern Siberia. The specimen is a posterior portion of a lamina more than 7 cm. long, obcuneate, narrowing with broad gentle curve to the base, and deeply divided into two symmetrical halves. Each half, as the figure shows, seems to cleft again, but this may possibly be accidental. The nerves numbering approximately 20 per 1 cm. are parallel to each other and to the margin of the lamina and appear to be not branched except near the base. The petiole is not known.

B. pulchella is rather easily distinguished from other species of this genus in the characteristic obcuneate and bi-lobed lamina with

reduced petiole. As SEWARD¹⁾ also mentioned, the typical examples of the lamina of this species are divided into two segments only, and the laminae with similar shape but twice or more divided are known from the Rhaetic rocks of northern Europe under the name *B. spectabilis* NATHORST.²⁾ As to an imperfect specimen from Bornholm figured by MOELLER³⁾ as *B. pulchella*, NATHORST⁴⁾ suggests that it may be a piece of a *B. spectabilis*-leaf. *B. ikorfatensis* SEWARD⁵⁾ from the Cretaceous of western Greenland is similar in leaf-form to the present species.

Pityostrobus Endô-Riuji sp. nov.

Pl. IV, Figs. 6-7.

Impressions of two specimens of coniferous cones are dealt with; the diagnosis runs as follows:

Cone elongated, cylindrical, being more than 7.5 cm. long and approximately 2.5 cm. in diameter, tapering at the top into somewhat rounded end; basal part unknown; cone-scales densely imbricated, numbering more than 100, about 1.5 cm. broad and high, and thin without apophyses; seeds two in number on each scale, obovate cuneate in shape and about 5 mm. long and 3 mm. broad at the broadest portion.

The cones here called under the new designation, *Pityostrobus Endô-Riuji* are characterised by the oblong and cylindrical form bearing densely imbricated scales without apophyses. The general external form of the cones and the presence of two seeds on each scale suggest that the cones now under consideration possibly belong to Abietineae. The apparent absence of seed wings may be due to the unsatisfactory preservation of the specimens, unless they were already fallen apart from the seeds as is usually the case in the seeds of *Picea*.

It is very difficult to settle the position of the present cones in Abietineae; however, the absence of apophyses in the cone-scales of our specimens shows that they belong to other genera than *Pinus*

(1) A. C. SEWARD: Fossil Plants, Vol. IV, 1919, p. 42.

(2) A. G. NATHORST: Om Nagra Ginkgoväxter från Kolgrufvorna vid Stabbarp i Skåne. Lunds Univ. Årsskr. N. F. Afd. 2, Bd. 2, No. 8, 1906, p. 4, Pl. I, figs. 1-8; Pl. II, fig. 1.

(3) H. MOELLER: Op. cit., 1903, p. 26, Pl. IV, fig. 19.

(4) A. G. NATHORST: Op. cit., 1906, p. 10.

(5) A. C. SEWARD: The Cretaceous Plant-bearing Rocks of Western Greenland. Phil. Trans. Roy. Soc. London, Ser. B, Vol. 215, 1926, p. 96, Pl. IX, fig. 81.

in Abietineae; in the existing species of *Pinus* the cone-scales have usually apophyses.

Pityostrobus Endô-Riuji occurs in association with coniferous needle-like leaves which are described in this note under the name *Pityophyllum Lindstroemi* NATHORST, but as there is no organic connection between them, it is not clear what kind of leaves have been borne on the tree, to which the present cones were attached.

Among the known fossil cones with similar form, *Pityostrobus oblongus*¹⁾ originally figured and described by LINDLEY and HUTTON from the Lower Greensand as *Abies oblonga*²⁾ comes near the present specimens; in the British specimen, however, the cone is oblong and not so elongated and cylindrical as in the present ones. Another comparable species is an Arctic species figured by NATHORST³⁾ as *Pinites (Pityostrobus) Conwentzi* NATHORST from the Upper Jurassic bed of Advent Bay, where *Pityophyllum Lindstroemi* has also been reported.

***Pityolepis ovatus* sp. nov.**

Pl. IV, Figs. 9-10.

In NATHORST's provisional genus *Pityolepis* the present authors wish to include some coniferous cone-scale-like impressions which seem to represent a new form among the fossils of this type.

Coniferous cone-scales(?), thick in texture or probably woody, elongated ovate in shape, 1.3 cm. long and about 0.6-0.7 cm. broad at the broadest portion; on one surface with prominent broad ridges about 5 in number springing up radially from the narrow base and reaching near the broader apex.

Each of the specimens shown in Pl. IV, figs. 9-10 bears in the narrow basal end a minute oval object probably a seed about 1 mm. in length; at first the present authors thought it to be an actual seed attached to the scale, thus representing a very peculiar form of fruiting body living and fossil. But as the body in question, as seen in the figures, is much too small compared with the dimension of the scale itself to which it has been attached, and moreover as there are no data on the anatomical character of the object, it seems that it may be more appropriate to consider the object to be a portion of

(1) A. C. SEWARD: Fossil Plants, Vol. IV, 1919, p. 387.

(2) J. LINDLEY and W. HUTTON: Fossil Flora of Great Britain, Vol. II, 1833-35, p. 155, Pl. 137.

(3) A. G. NATHORST: Zur mesozoischen Flora Spitzbergens. Kgl. Svensk. Vet.-Akad. Handl., Bd. XXX, No. 1, 1897, p. 63, Pl. V, fig. 37.

the proximal prolongation of the scale with which each scale might have been attached to the cone-axis.

The type of scale here described exhibits a certain resemblance in shape to the scales of *Drepanolepis*, *D. rotundifolia* (HR.) figured by HEER¹⁾ from the Jurassic of Spitzbergen under the name *Phyllocladites rotundifolia*; but in *Drepanolepis* each scale bears a single seed-like body enclosed entirely in the basal part of the scale. In size and form the greatest resemblance is no doubt to some two-seeded cone-scales figured by NATHORST²⁾ from the Upper Jurassic bed of Advent Bay under the name *Pinites (Pityolepis) tsugaeformis* NATH., but as there is no trace of the former existence of the seeds on scales, the present Manchurian specimens have provisionally been kept separate from NATHORST's species.

Pityospermum sp.

Pl. IV, Fig. 8.

Pl. IV, fig. 8 shows an imperfect winged seed 1.3 cm. long and 6 mm. broad near the distal end of the wing bearing at the other end a small oval depressed area which marks the position of a seed. This specimen resembles the winged seed of several members of Abietineae, and similar examples have been known as early as the upper Triassic.

Pityophyllum Lindstroemi NATHORST

Pl. III, Fig. 1 B.

For references see YABE and ÔISHI: Mesozoic Plants from Manchuria, 1933, p. 231 (37).

The specific distinction of most of the detached coniferous leaves grouped under the conventional generic name *Pityophyllum* proposed by NATHORST³⁾ are very difficult or rather valueless, but the artificial classification by form and size of such leaves is sometimes used only for convenience sake as the occurrence of each distinct form is in some cases roughly limited to certain geological formations.

The leaves which are grouped under the name *P. Lindstroemi* are detached needle-like leaves sometimes sickle-shaped; according to

(1) O. HEER: Die Kreide-Flora der arctischen Zone. Kgl. Svensk. Vet.-Akad. Handl., Vol. XII, No. 6, 1874, p. 124, Pl. XXXV, figs. 17-18.

(2) A. G. NATHORST: Op. cit., 1897, p. 64, Pl. V, figs. 42-45.

(3) A. G. NATHORST: Op. cit., 1897, p. 62.

NATHORST¹⁾, they are at least 86 mm. long and 1-1.5 mm. or rarely 2 mm. broad at most near the distal end, and thence they taper gradually towards the base and abruptly narrow to the blunt apex; on one side of the leaves is a strong midnerve and, in some cases, there is an indication of an elevated marginal nerve.

Pl. III, fig. 1B shows a slab of rock, the surface of which is covered by numerous detached needle-like leaves 1.5 mm. broad and more than 6 cm. long with a well-defined midnerve. Sometimes there is a longitudinal ridge or there are fine striations on either side of the midnerve.

Strobilites Yabei sp. nov.

Pl. V, Figs. 1-1 a; Text-fig. 3.

Pl. V, fig. 1 shows an impression of strobili of uncertain affinity attached to a branched axis. The axis to which the strobili are attached is comparatively stout, being 5 mm. broad measured on the



Text-fig. 4. *Strobilites Yabei* sp. nov. A part of a strobilus in Pl. V, fig. 1, somewhat diagrammatically enlarged.

compressed surface; it is also characterised by transverse wrinkles irregularly disposed on the surface. The strobili are apparently opposite, being arranged on each side of the axis with an angle of approximately 60° and at the distance of about 1.5 cm.; they are elongated in form, about 3 cm. long, ±6 mm. broad at the base, slightly widening towards the rounded apex and they are attached to the axis by the whole base. On the surface of each strobilus there are many longitudinally elongated minute tubercles arranged in about 20 transverse rows, each row being formed

by 7-9 of them. A careful examination of the tubercles shows that, at the top of each, they bear terminal appendages slightly curved outwards (text-fig. 4).

Our specimen seems to be included in the category of *Masculostrobilus* SEWARD²⁾, but as SEWARD says this generic designation is given to a specimen which affords evidence "either by the presence of microsporangia or by their habit, of a microsporangial nature"; but as there is no indication of either microsporangial or macrosporangial nature in our specimen, it may be more appropriate to

(1) A. G. NATHORST: Ibid., p. 67.

(2) A. C. SEWARD: The Jurassic Flora of Sutherland. Trans. Roy. Soc. Edinburgh, Vol. XLVII, Pt. IV, No. 23, 1911, p. 686.

adopt the comprehensive genus *Strobilites* for the Manchurian specimen.

Superficially the specimen is not unlike a shoot of Lycopodiales with strobili, but the shoots in Lycopodiales show the characteristic dichotomy, and at the top of each branch there is a terminal strobilus. It resembles also cone-bearing shoots of the well-known Palaeozoic conifer, *Walchia*, especially *W. ficiformis* figured by ZEILLER¹⁾; but there is no sufficient ground for regarding the present specimen as a conifer. Among the living plants, *S. Yabei* externally similar to the staminate strobili of *Araucaria*, for instance *A. angustifolia* (BERTOL), but there is no indication of a microsporophyllous organ in our specimen.

Though nothing is known of any internal structure of the strobili, such features as can be observed in regard to the mode of attachment of the strobili to the central axis and the surface features of the strobili themselves would seem to argue in favour of including the specimen among the Coniferales. But the data are too insufficient to form the basis of any definite statement as to the position of this species among the conifers.

Phoenicopsis manchurensis YABE and ÔISHI sp. nov.

Pl. V, Fig. 2.

- ?1905. *Phoenicopsis angustifolia* KRASSER (non HEER): Op. cit., p. 23, Pl. III, figs 3, 4.
 1933. *Phoenicopsis* n. sp. YABE and ÔISHI: Mesozoic Plants from Manchuria, p. 223 (26), Pl. XXXIII (IV), figs. 12, 13.

Quite recently Professor YABE and the junior author²⁾ described *Phoenicopsis*-leaves from Manchuria as *Phoenicopsis* n. sp. without giving any specific name for them, for there were then available only two imperfect leaves, of which one was very imperfectly preserved. Now having in hand a good number of specimens of similar leaves belonging certainly to the genus *Phoenicopsis*, the writers are now quite certain that *P.* n. sp. from Manchuria justifiably belongs to a new species, which is here called *P. manchurensis*.

In Pl. V, fig. 2, four linear leaves are arranged in parallel, of which two distinctly arisen from a common origin inclosed by an object like a cluster of scale-leaves. The leaves are about 4-5 mm.

(1) R. ZEILLER: Bassin Houiller et Permien de Banzy et du Creusot. Fasc. II, Flore Fossile, 1906, p. 211, Pl. XLIX, figs. 1-2.

(2) H. YABE and S. ÔISHI: Mesozoic Plants from Manchuria.

broad at the broken distal end, and there are approximately 7-12 parallel nerves in each, bearing 1-2 interstitials.

An allied species is *P. angustifolia* HEER¹⁾, but it has no interstitials.

Czekanowskia rigida HEER

Pl. V, Fig. 3.

(An addition to the synonym table given in ÔISHI: Mesozoic Plants from Kita-Otari, Prov. Shinano. Journ. Fac. Sci., Hokkaidô Imp. Univ., Ser. IV, Vol. I, No. 2, 1931, p. 249; ÔISHI: The Rhaetic Plants from the Nariwa District. Ibid., Vol. I, Nos. 3-4, 1932, p. 355).

1879. *Czekanowskia rigida* SCHMALHAUSEN: Beitrage zur Jura-Flora Russlands. Mém. l'Acad. Imp. Sci. St.-Pétersbourg, Sér. VII, Tom. XXVII, No. 4, p. 86, Pl. XVI, figs. 16, 17; Pl. XV, fig. 13a.

?1883. *Czekanowskia rigida* SCHMALHAUSEN: Pflanzenpalaeontologische Beitrage. Bull. l'Acad. Imp. Sci. St.-Pétersbourg, Tom. XXVIII, No. 4, p. 436, Pl. I, fig. 10; p. 437, Pl. I, figs. 11, 12.

1922. *Czekanowskia rigida* JOHANSSON: Die rhaetische Flora der Kohlengruben bei Stabbarp und Skromberga in Schonen. Kgl. Svensk. Vet.-Akad. Handl., Bd. LXIII, No. 5, p. 49, Pl. VIII, fig. 6; Text-fig. 5.

Pl. V, fig. 3 shows a needle-like leaf which is more than 5.5 cm. long and 1 mm. broad, single-nerved and once branching in a acute angle. The breadth and the branching habit of the leaves in the present specimen agree closely with the characteristic features of *C. rigida*. This species is very common in the collection, and a slab of rock is sometimes covered by numerous detached leaves of this species almost exclusive of other fossil plants.

Some needle-like leaves resembling *C. rigida* have been also recorded from Franz Josef Land²⁾ under several names, such as *Czekanowskia* cfr. *rigida*, *C. ?*, or *Phoenicopsis* cfr. *angustifolia*.

In the end, the present authors take opportunity to thanks to Prof. H. YABE for reading of the whole manuscript and for the helpful suggestions. Thanks are also due to Prof. K. UWATOKO for the loan of the material and for reading parts of the manuscript.

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April, 1935.

(1) O. HEER: Beitrage zur Jura-Flora Ostsibiriens und des Amurlandes, p. 51, Pl. I, fig. 1d; Pl. II, fig. 3b; p. 113, Pl. XXXI, figs. 7, 8.

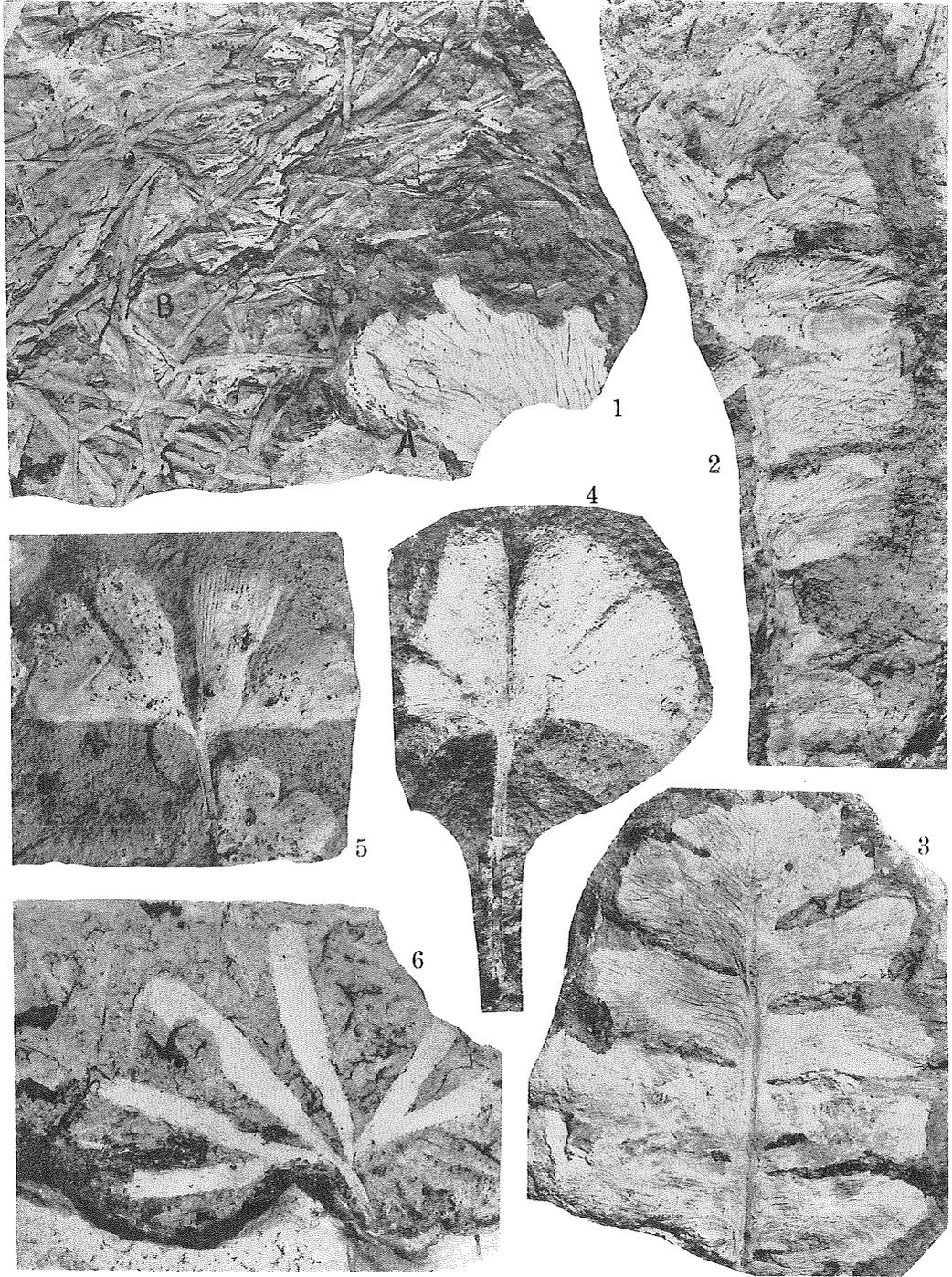
(2) A. G. NATHORST: Fossil Plants from Franz Josef Land. The Norweg. North Polar Expedition, 1893-1896, Scientific Result, III.

PLATE III

PLATE III

(The figures are natural size)

- Fig. 1A. ?*Chiropteris* sp. indet. (Sendai: Reg. No. 50299). P. 64.
Fig. 1B. *Pityophyllum Lindstroemi* NATHORST. (Sendai: Reg. No. 50299). P. 74.
Fig. 2. *Ctenis Uwatokoi* sp. nov. (Sendai: Reg. No. 50286). P. 65.
Fig. 3. *Ctenis Uwatokoi* sp. nov. (Sendai: Reg. No. 50296). P. 65.
Fig. 4. *Ginkgoites digitata* (BRONGNIART). (Sapporo: Reg. No. 6297). P. 69.
Fig. 5. *Ginkgoites digitata* (BRONGNIART). (Sapporo: Reg. No. 6298). P. 69.
Fig. 6. *Ginkgoites sibirica* (HEER). (Sendai: Reg. No. 50289). P. 70.



Takeda photo.

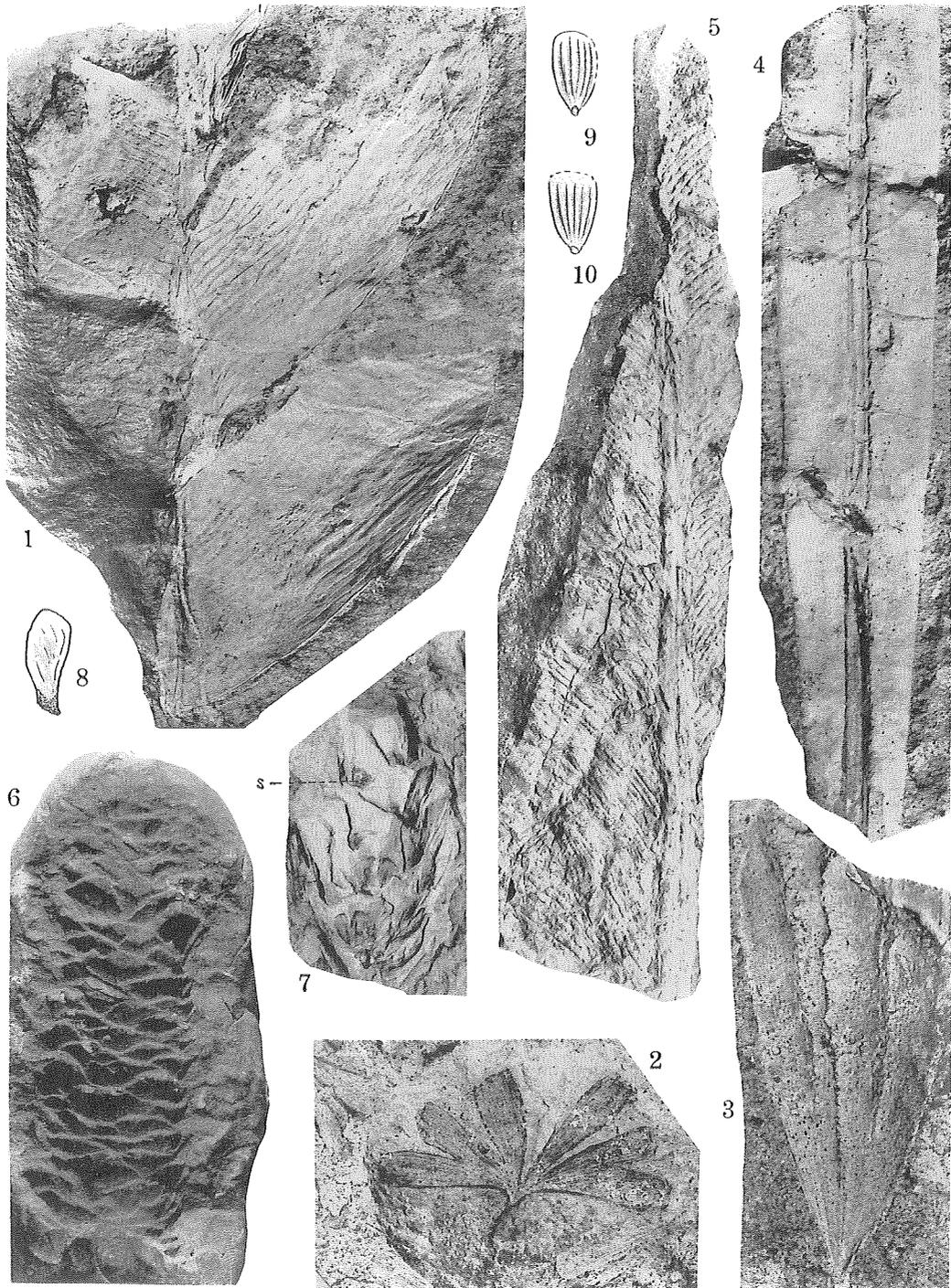
Toyama and Ôishi : Jurassic Plants from Chalai-nor.

PLATE IV

PLATE IV

(The figures are natural size, unless otherwise stated)

- Fig. 1. *Ctenis* sp. (Sendai: Reg. No. 50295). P. 66.
- Fig. 2. *Ginkgoites sibirica* (HEER). (Sendai: Reg. No. 50289). P. 70.
- Fig. 3. *Baiera pulchella* HEER. (Sendai: Reg. No. 50291). P. 71.
- Fig. 4. *Taeniopteris vittata* BRONGNIART? (Sapporo: Reg. No. 6297). P. 67.
- Fig. 5. *Taeniopteris?* sp. (Sendai: Reg. No. 50293). P. 68.
- Fig. 6. *Pityostrobus Endô-Riuji* sp. nov. (Sapporo: Reg. No. 6300). P. 72.
- Fig. 7. *Pityostrobus Endô-Riuji* sp. nov.; s: seed. (Sendai: Reg. No. 50297). P. 72.
- Fig. 8. *Pityospermum* sp.; slightly magnified. (Sapporo: Reg. No. 6301). P. 74.
- Figs. 9-10. *Pityolepis ovatus* sp. nov. (Sapporo: Reg. No. 6301). P. 73.



Takeda photo, and Ôishi del.

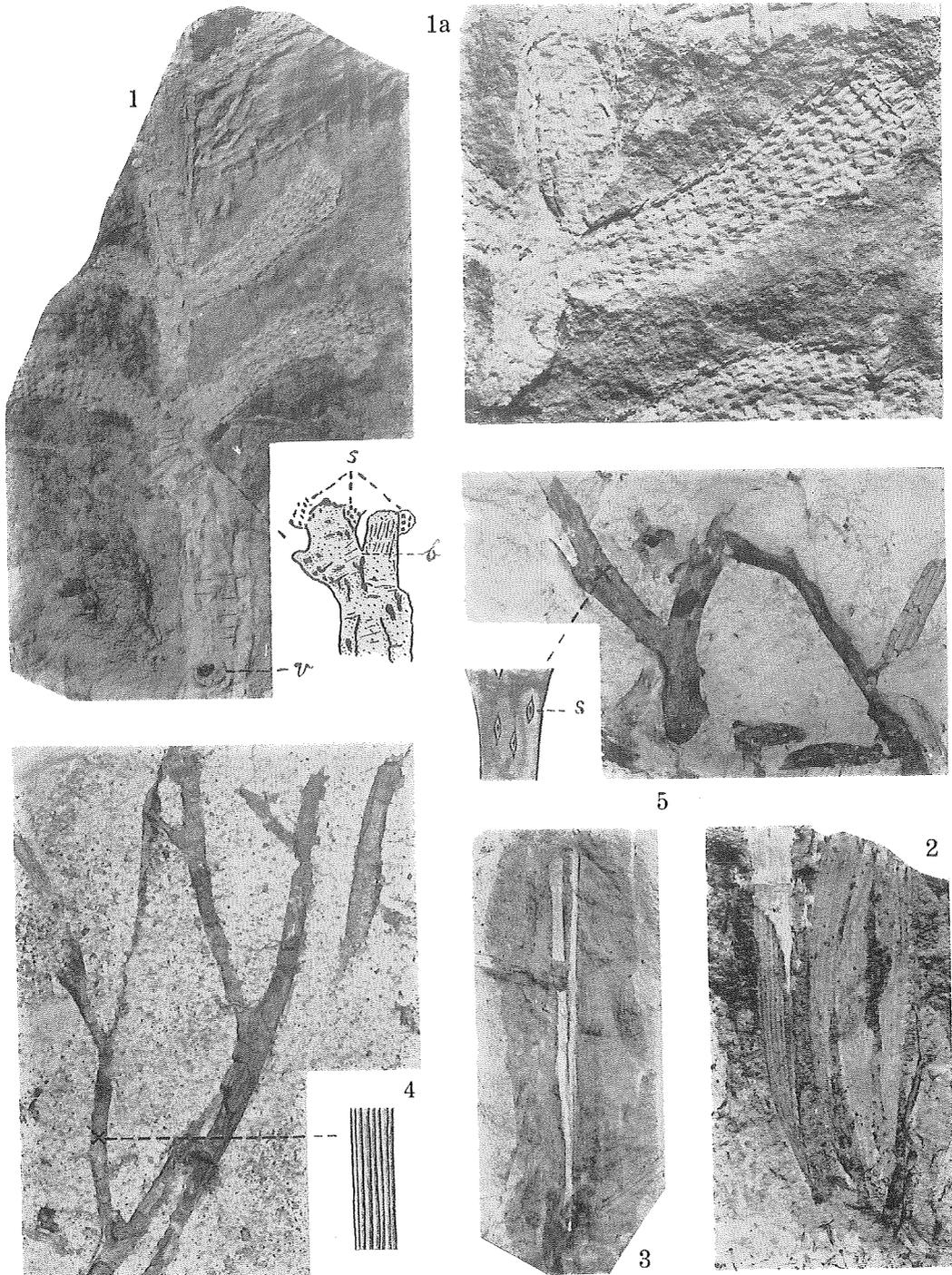
Toyama and Ôishi: Jurassic Plants from Chalai-nor.

PLATE V

PLATE V

(The figures are natural size, unless otherwise stated)

- Figs. 1, 1a. *Strobilites Yabei* sp. nov.; 1a $\times 2$; s: strobili; b: branching of the axis; v: trace of vascular bundle of a branchlet. (Sendai: Reg. No. 50294). P. 75.
- Fig. 2. *Phoenicopsis manchurensis* YABE and ÔISHI. (Sendai: Reg. No. 50286). P. 76.
- Fig. 3. *Czekanowskia rigida* HEER. (Sapporo: Reg. No. 6329). P. 77.
- Fig. 4. Branchlets, the surface of which bears longitudinal narrow furrows. (Sapporo: Reg. No. 6302).
- Fig. 5. Roots?; s: scars of appendages (probably rootlets). (Sendai: Reg. No. 50401).



Takeda photo. and Ôishi del.