

KLUKIA REMAINS NEWLY FOUND IN JAPAN

SEIDO ENDÔ

Institute of Geology & Palaeontology, Tohoku University, Sendai, Japan

THE genus *Klukia* is one of the most interesting and characteristic ferns of the Jurassic; its genotype is *Pecopteris exilis* Phillips from the English Jurassic, and the well-known *Pecopteris browniana* Dunker from the German Wealden is its close ally.

There are many occurrences of sterile fronds of ferns indistinguishable from *Klukia exilis* in the Jurassic and Wealden plant beds of Japan and, according to M. Yokoyama, some of the pinnules of *Cladophlebis browniana* from the Ryôseki (Japanese Wealden) plant bed of Kaiseki-yama, Shikoku, have 2-4 black round dots, like sori on each side of the midvein, but their structure is not preserved. However, we are fortunate in obtaining specimens indisputably referable to the genus *Klukia* on the characteristic feature exhibited by the sporangia which bear apical annulus on the pinnules.

Klukia exilis (Phillips) Raciborski; Plate 1; Text-fig. 1

1837. *Pecopteris obtusifolia* Lindley & Hutton, Pl. 158, Figs. 1, 1a, 1b (fertile leaf).
1851. *Pecopteris exilis* Phillips, Bunbury, p. 188, Pl. 13, Fig. 5 (fertile fragment, sporangia).
1891. *Klukia exilis* (Phillips) Raciborski, p. 1.
1894. *Klukia acutifolia* (non L. & H.) Raciborski, p. 168, Pl. 7, Figs. 10-12, 18 (sterile and fertile fragments).
1894. *Klukia exilis* (Phillips) Seward, p. 197, Figs. 1-5 (fertile fragments, sporangia).
1900. *Klukia exilis* (Phillips) Seward, p. 130, Pl. 16, Fig. 7 (fertile fragments).
1907. *Klukia exilis* (Phillips) Seward, p. 4, Pl. 1, Figs. 4-7; Pl. 3, Fig. A (fertile fragment).
1912. *Klukia exilis* (Phillips) Seward, p. 11, Pl. 2, Figs. 20, 21; Pl. 6, Fig. 81; Pl. 7, Fig. 88 (fertile fragment, sporangia).
1933. *Klukia marginata* Prinada, p. 6, Pl. 1, Figs. 1-6 (good sterile and fertile leaf fragments).
1945. *Klukia exilis* (Phillips) Harris, p. 358, Figs. 1-3 (fertile and sterile leaf fragments, sporangia and spores).

Frond of Cladophlebis type, tripinnate, sterile and fertile leaves similar or partly sterile, partly fertile; pinnae linear, attached to rachis at a wide angle; pinnules oblong, usually 2.5-4 mm. long and 0.5-1.5 mm. broad in the middle, united by a web of lamina. Surfaces of pinnules convex above, with an

obscure furrow along the midrib; substance of lamina thick, lateral veins obscure, once forked or simple. Margin of pinnules apparently entire; apex obtuse. Fertile pinnules small, 2.5 mm. long and 0.5-1.0 mm. broad; sporangia usually 4-5 in number on one pinnule, 0.42-0.5 mm. in diameter, arranged in 2 linear rows, annulus composed of 14 cells. Spores not preserved.

The present material is quite indistinguishable from the specimen figured by Professor Harris as *Klukia exilis* from Yorkshire, England. Both the text and excellent illustrations of Harris are a great contribution to our knowledge of the species; his Figs. 3 A and B show sterile pinnules and sporangium, which are quite identical with the present Japanese material.



TEXT-FIG. 1 — *Klukia exilis* (Phillips) sporangium from Shidazawa, Ishigami-Mura, Sôma-Gun, Fukushima Prefecture. $\times 20$.

The present material was collected by Mr. J. Iwai, of our Institute, from Shidazawa, Ishigami-Mura, and from Zisahara, Kami-mano-Mura, both in Sôma-Gun, Fukushima Prefecture, Northern Hondô (Reg. No. 51793), together with, among others:

Nilssonsonia orientalis Heer
Nilssonsonia schauburgensis (Dunker)
Ptilophyllum pecten (Phillips)
Cladophlebis lobifolia (Phillips)
Cladophlebis browniana (Dunker)

The plant bed is generally regarded as Upper Jurassic in age. There are many localities of the plant fossils of the same or nearly the same horizon in the neighbourhood of Shidazawa, and the total number of species known at present from this district is given in the annexed table.

The writer wishes to thank Mr. R. Imaizumi for his assistance with the illustrations.

LIST OF THE FLORA FOUND IN SOMA DISTRICT, FUKUSHIMA PREFECTURE

LOCALITY	HACHIMAN-MURA			ISHIGAMI-MURA			KAMIMANO-MURA				
	Ikegami	Horisaka Bashi	Tamizawa	Kayaki Bashi	Shida-zawa	Takakura	Hayama	Minahara	Oyatnada	Zisahara	Tochikubo
Fossil Species											
<i>Carpolithus</i> sp.	X	...	...	...	...	...	...	X	...
<i>Cladophlebis browniana</i> (Dunker)	...	X	X	...	X	...	X	...	X	X	X
<i>C. browniana</i> (Dunker) ?	X	...	...	...	...	...	...	...	...	...	...
<i>C. geyleiriana</i> (Nath.)	X	...	...	...	...	...	...	...
<i>C. cf. lobifolia</i> (Phillips)	X	...	X	...	...	X	...
<i>C. sp. aff. C. browniana</i> (Dunker)	X	...	...	...	...	...	X
<i>C. sp.</i>	X	...	...	...	X	...
<i>C. denticulata</i> (Brongniart)	X	...
<i>Equisetites</i> sp.	X	...	...	...	...	...
<i>E. ?</i>	X	...	...	...	...	...	...	...	...
<i>Klukia exilis</i> (Phillips)	X	...	...	...	...	X	...
<i>Nageiopsis zamiioides</i> Fontaine	X	...
<i>Nilssonia schauburgensis</i> (Dunker)	...	X	X	...	X	...	...	...	...	X	...
<i>N. schauburgensis</i> (Dunker) var. <i>parvula</i> Yabe ?	X	...	...	...	...	X	...
<i>N. cf. compta</i> (Phillips)	X	...	...	...	...	...	...	...
<i>Cf. N. nipponensis</i> Yokoyama	X	...	...	...	...	...	...	...
<i>N. orientalis</i> Heer	X	X	...	...	...	X	X
<i>N. orientalis</i> ?	...	X	...	...	...	...	...	...	...	X	...
<i>N. "pterophylloides"</i> Yokoyama	X	...
<i>Onychiopsis elongata</i> Geyl.	X	...	X	X	...	...	...	...	...
<i>Otozamites</i> sp. cf. <i>O. Klipsteini</i>	X	...
<i>O. ? sp.</i>	X	...	...	...	...	...	...	...	...
<i>Podozamites lanceolatus</i> (Lindley & Hutton)	X	...	...	...	...	...	...	X	...
<i>P. sp.</i>	X	...	...	...	...	...	...	...	...
<i>Pseudoctenis crassinervis</i> Seward	X	...
<i>Pterophyllum</i> ? sp.	X	...	...	...	...	...
<i>Ptilophyllum pecten</i> (Phillips)	X	X	...	X	...	X	...
<i>P. Nordenskiöldi</i> (Heer)	...	X	...	...	...	...	...	...	...	...	...
<i>P. ? sp.</i>	X	...	...	...	...	...
<i>Sagenopteris Phillipsi</i> (Brongniart)	X	...	...	...	...	...
<i>Sphenopteris Goepfertii</i> Dkr.	...	X	...	...	...	...	...	...	...	X	...
<i>S. Goepfertii</i> Dkr. ?	X	...
<i>S. pinnatifida</i> (Fontaine) n. comb.	X	...
<i>Taxites</i> sp.	X	...	...	...	...	...
<i>Zamiophyllum Naumannii</i> Nathorst	X	...	...	...	...	...

REFERENCES

- BERRY, E. W. (1922). The Mesozoic Flora of Peru. *Johns Hopkins Studies in Geol.* 4 : 55.
- BOWER, F. O. (1908). The Origin of a Land Flora : 546. London.
- BUNBURY, C. J. F. (1851). On Some Fossil Plants from the Jurassic Strata of the Yorkshire Coast. *Q. J. Geol. Soc.* 7 : 179.
- HALLE, T. G. (1913). The Mesozoic Flora of Graham Land. *Wiss. Ergebn. schwed. Südpol. Exped.* 1901-3. 3. Lief 14.
- HARRIS, T. M. (1945). Notes on the Jurassic Flora of Yorkshire, 19-21. *Ann. Mag. Nat. Hist.* (Ser. 11) 12 : 357.
- HIRMER, M. (1927). Handbuch der Paläobotanik, Bd. I Johansson, V. 1922. "Die rätische Flora der Kohlengruben bei Stabbarp und skromberga in Schonen." *K. Sv. vet.-akad.* 63 (5).
- KRYSHTOFOVICH, A. (1916). Contributions to the Fossil Flora of Ussuriland (title in Russian)

- Trav. Mus. Geol. Min. Acad. Imp. Sci. Petrograd.* **2** : 81-140.
- LINDLEY, J. & HUTTON, W. (1831-1837). The Fossil Flora of Great Britain. **3**. 1837. London.
- OISHI, S. (1939). On *Dicksoniopteris Naumanni* Nathorst. *Jour. Fac. Sci., Hokkaido Imp. Univ.* (Ser. iv) **4** (3-4) : 301.
- Idem (1940). The Mesozoic Flora of Japan. *Ibid.* **5** (2-4) : 123.
- PRINADA, V. (1933). Jurassic Plants from the Tkvarcheli Carboniferous Basin in Transcaucasia. *Trans. United Geol. Prospecting Service, U.S.S.R.* fasc. 261.
- RACIBORSKI, M. (1891). Ueber die Osmundaceen und Schizaeaceen der Juraformation. *Engler's Bot. Jahrb.* **13** : 1-9.
- SEWARD, A. C. (1894). Notes on the Bunbury Collection of Fossil Plants, with a List of Type-specimens in the Cambridge Botanical Museum. *Proc. Phil. Soc. Cambridge.* **8** (3) : 187.
- Idem (1900). Catalogue of the Mesozoic Plants. The Jurassic Flora.—1. Yorkshire.
- Idem (1907). Jurassic Plants from Caucasia and Turkestan. *Mém. comm. Géol. St. Petersbourg.* (N.S.) **38**.
- Idem (1910). Fossil Plants. **2** : 348. Cambridge.
- Idem (1912). Mesozoic Plants from Afghanistan and Afghani-Turkestan. *Mem. Geol. Surv. India (Pal. Indica).* (N.S.) **4** (4).
- YABE, H. (1905). Mesozoic Plants from Korea. *Jour. Coll. Sci. Imp. Univ. Tokyo.* **20** (Art. 8) : 32.
- YOKOYAMA, M. (1889). Jurassic Plants from Kaga, Hida, and Echizen. *Jour. Coll. Sci. Imp. Univ. Tokyo.* **3** (1) : 35.
- Idem (1894). Mesozoic Plants from Kozuke, Kii, Awa, and Tosa. *Ibid.* **7** (3) : 219.
- ZEILLER, M. R. (1914). Sur Quelques plantes Wealdiennes Recueillies au Péru. *Revue Gén. Bot.* **25** : 7-10.

EXPLANATION OF PLATE 1

1. *Klukia exilis*, enlarged from Fig. 2.
2. *Klukia exilis*, natural size.
3. Annulus of *Klukia exilis*. $\times 50$.
4. Fertile pinnule of *Klukia exilis*. $\times 7$.
All from Shidazawa, Ishigami-Mura, Sôma-Gun, Fukushima Prefecture.

