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A Revision of the Miocene Fern of *Osmunda bromeliaefolioides* Matsuo from Noto Peninsula in the Innerside of Central Japan.*

by

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I. Introduction **)

In 1953, I published about three new Miocene ferns from the Hokuriku region in the Innerside of Central Japan. Among of these species, the most magnified species has been named by me "*Osmunda bromeliaefolioides*"[1] from the living species of *O. bromeliaefolia* Copland.[2] (This living species is synonymed of *Plenasium banksiaefolia* Presl.)

But I discovered some hitherto desciptive fossils had been published from the "Braunkohle bei Wissenfels"[3] as *Pecopteris leucopetrae* (S. 304, Taf. II, Fig. 1), *P. lignitum* (S. 305, Taf. II, Fig. 2a, 2b), *P. angusta* (S. 306, Taf. II, Fig. 3) and *P. crassinervis* (S. 307, Taf. II, Fig. 4). When Heer[4] reported the Miocene fern from the Bovey Tracey in Devonshire named *Pecopteris (Hemiteria) lignitum*, which he himself had named *Aspidium lignitum* in 1861, he adopted the second species of *Pecopteris lignitum*, instead of taking Giebel's first species. Many other authors used the species name "lignitum" without correcting Heer's description; among them, Kräusel and Weyland[5] reported the mistake that Giebel's first name "*P. leucopetrae*" had been written later than "*P. lignitum*"; that is the former is written in page 304, the latter in page 303. However, in page 303, I did not discover the "*P. lignitum*".

Above mentioned facts are nonsense manners that the priority name was less respected the other name. But I consider that Heer and other authors would have been regarded "lignitum" the meaning of the "Braunkohle or Lignite".

After in 1882, Gardner and Ettingshausen had done a detailed description of this species of *Osmunda lignitum* from the British Miocene flora, and they referred to that it was so closely resembled to some of the forms of a living species of *Osmunda javanica* Blume.[6] And more other researchers considered that their species of *Pecopteris*

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** I read this paper, at a regular meeting of the Palaeontology Society of Japan, at Kyoto in September 28, 1957.

1) Matsuo, H. (1953); p. 141, Text-fig. 1.
2) Ogata, M. (1933); pl. 237.
3) Giebel, C. (1857): p. 304–307, Taf. II, Fig. 1–4.
4) Heer, O. (1863); p. 1047, Pl. LV. figs. 5, 6 (not fig. 4): Pl. LVI, figs. 2–11 (not fig. 1).
5) Kräusel, R. and H. Weyland (1951): S. 28.
6) Gardner, J. S. & C. von. Ettingshausen (1879–1882): p. 66.

lignitum had been referred to the living species of *Plenasium banksiaefolia*, as Saporta reported comparing his species from the southern France with the living species of *Plenasium bromeliaefolium*[7] and as Stur[8] had been referred to the living species of *Osmunda* (*Plenasium*) *presliana* (as it is *Plenasium banksiaefolium*), when he described the new species of *Osmunda Gutschreiberin* from the Tertiary in Germany, which was closely resembled to *Pecopteris lignitum*.

More recently, Kräusel and Weyland reported the anatomical and morphological works of the *Osmunda lignitum*, using the genus *Osmunda*. According to their notes[9], Squinabol had been already published the name of *Plenasium lignitum* in 1889.

Because of above mentioned reasons, my magnified species of *Osmunda bromeliaefolioides* has to be revised to *Plenasium lignitum*.

II. On the two reasons of the revised name.

I try to report on the two reasons in detail, of which my *Osmunda bromeliaefolioides* is revised to *Pelnasium lignitum*.

The first reason: It may be unjust to adopt to the name of the living genus *Plenasium* for a fossil sterial pinna; nevertheless, a sterial pinna of *Plenasium banksiaefolium* shows a very characteristic shape of a bload leaf of *Banksia*. So that, if a fossil sterial pinna should suggest the above mentioned characteristic shape, it may be compared with the genus *Plenasium*. And more, I consider that the fossil genera of the Miocene age should have been referred to the living genera as possible. So the hitherto described fossil species of *Pecopteris lignitum* or *Osmunda lignitum* must be emended to a name of *Plenasium lignitum*.

The other reason: In spite of the poor references in my hand, I reported the new species of the name of *Osmunda bromeliaefolioides*; as it has a characteristic and magnified pinna, and has never been known the Miocene flora in Japan at least. I have never heard some hitherto described works at that time.

However, when I read a report of Florin, I saw he had been described the large pinna as name of *Osmunda lignitum*[10] noted as followed:

Eine unvollständige, sterile Fieder, ungefähr 1.5 cm breit, von lineallanzettlicher Form, in dicht gestellte, ganzrandige, kurze Segmente geteilt; diese nur wenig von einander frei, vorwärts-auswärts gerichtet mit nahezu stumpfer Spitze; ihre Mittelader deutlich hervotretend, in die Spitze auslaufend, mit under mässig spitzen Winkel ausgehenden und einmal sich gabelnden Seitenadern; die Anzahl der letzteren auf der nach der Spitze der Fieder gewandten Seite der Mittlader ungefähr 6, auf der entgegegesetzten Seite etwa 8 betragend.

Diese *Osmunda* erinnert so affallend an die aus der europäischen Tertiärformen

7) Saporta, G. (1867). p. 44.
8) Stur, D. (1870): S. 5–6.
9) Kräusel, R. & H. Weyland (1951), S. 28.
10) Florin, R. (1922): S. 7–8, Taf. I, Fig. 1, 2.

mehrmals beschriebene und abgebildete *Osmunda lignitum* (Giebel) Stur, dass ich sie als mit dieser Art identisch ansehen muss.·····

Osmunda lignitum (Giebel) Stur, ist für Ostasien neu. Sie ist früher aus dem Eozän und Oligozän Europas bekannt geworden.

But I regarded that my species was the different type of nervation from the species of *Osmunda lignitum* of Go-chen-Tzu in the Fu-shun Coal Field. And then I established the new species referenced with the living species of *Osmunda bromeliaefolia.*

In the truth, Florin's specimens is very closely resembled to the Tertiary fern of Swiss, as Heer described as *Lastraea (Goniopteris) stiriaca* Unger[11] from the Miocene flora of Bovey Tracy[12] and from Greenland[13]; and also resembled to the Tertiary flora of the Yellowstone National Park in U. S. America, as Knowlton described as *Asplenium magnum.*[14]

Although Kräusel and Weyland[15] considered that *Lastraea stiriaca* was the synonym of *Osmunda lignitum.* I don't complied with their opinions.

Because of the two above mentioned reasons, I consider to revise to *Plenasium lignitum* from the *Osmunda lignitum* which had been distributed in the Northern Hemisphere at the age of Miocene.

III. Discussion of Species

Family Osmundaceae

Genus *Plenasium* Presl.

Plenasium lignitum (Giebel) Squinabol 1889.

1857. *Pecopteris Leucopetrae* Giebel; S. 304, Taf. II, Fig. 1.
1857. *P. lignitum* Giebel; S. 305. Taf. II, Fig. 2.
1857. *P. angusta* Giebel; S. 306, Taf. II, Fig. 3.
1857. *P. Crassinervis* Giebel; S. 307, Taf. II, Fig. 4.
1860. *Asplenium meyeri* Ludwig; S. 63, Taf. XII, Fig. 3.
1863. *Pecopteris (Hemitelia) lignitum* Heer; pp. 1047–51, pl. LVI, figs. 2–11 (non fig. 1); pl. LVII, figs. 1–7.
1867. *Pecopteris lignitum* Saporta; p. 42–44. pl. 3, figs. 4, 5.
1868. *P. Torelli* Heer; Taf. I, Fig. 15.
1870. *Osmunda lignitum* Stur; S. 5.
1870. *Osumunda Gutschreiberin* Stur; S. 9, Taf. II, Fig. 1–8.
1879. *O. lignitum* Gardner & Ettingshausen ; p. 49, pl. IV, figs. 1~3, pl.XIII, figs. 1~4.

11) Heer, O. (1855): S. 31, Taf. 7, 8.
12) Heer, O. (1863): p. 1046, pl. LVI, figs. 12–15, as synonymy as *Lastraea Bumburii* Heer (p. 1046–47, pl. LXIII, fig. lb, magnified c, d.).
13) Heer, O. (1868): Taf. XLV, Fig. 7.
14) Knowlton, F. H. (1899): p. 667, pl. LXXIX, figs. 5–8.
15) Kräusel, R. & H. Weyland, (1951): S. 26, S. 28.

1889. *Plenasium lignitum* Squinabol; after Kräusel & Weyland (1951), S. 28.
1916. *Osmunda delawarensis* Berry; pp. 763–64, pl. L, figs. 2–4.
1920. *Pecopteris To-tangensis* Colani; pp. 116–17, pl. IV, fig. 4.
1925. *Raphaelia neuropteroides* Berry; p. 26, pl. I, fig. 8.
1951. *Osmunda lignitum* Kräusel & Weyland; S. 25–28, Fig. 1–4. Textabb. 3.
1953. *O. bromeliaefolioides* Matsuo; pp. 141–42, Text-fig. 1.
1956. *O. bromeliaefolioides* Matsuo; pp. 718~19, Text-fig. 1.

The pinnules are found in layers of the diatomaceous white mudy clay beds in neighbourhood at Kanmachi, and Tsuchikawa etc. Nakajima-Machi, Kashima-Gun, Ishikawa Prefecture* in the middle part of Noto Peninsula.[16]

The first description of the *Plenasium lignitum* had been written by Giebel in 1857 as name of *Pecopteris leucopetrae*, *P. lignitum*, *P. angusta* and *P. crassinervis* from the "Braunkohle" of Wissenfels in Germany. When I read these descriptions, I find that though they are closely resembled each others, there are some differences among their angles between midribs and secondary nerves. They are 30° in *P. leucopetrae*, 48° in *P. lignitum*, 30° in *P. angusta* and 40° in *P. crassinervis*. And so Giebel pointed out the resemblance of the *P. lignitum* with *P. crassinervis*, and said on *P. lignitum* as "—mit ähnlich wie bei *Goniopteris oeningensis* gekerbten Rande—" in page 305.

Nevertheless, I consider that they were the same figures between *P. leucopetrae* (Taf. II, Fig. 1) with *P. angusta* (Taf. II, Fig. 3), as in the case of between *P. lignitum* (Taf. II, Fig, 2) with *P. crassinervis* (Taf. II, Fig. 4), and also I don't regard any difference of figures between *P. leucopetrae* with *P. lignitum*.

When Gardner and Ettingshausen[17] revised to *Osmunda lignitum* for *Pecopteris lignitum* from Bournemouth and Bovey Tracey in England, they described this species as followed;

Osmunda fronde pinnata, pinnis elongato-linearibus, subcoriaceis, apice valde attenuatis et acuminatis, basi breviter petiolatis, margnie profunde inciso-serratis rarius remote denticulatis vel basi undulatis; nervatione Pecopteridis verae, nervo promario basi valido prominente, subrecto, apicem versus attenuato, indiviso; nervis secundaris numerosis, angulis acutis egredientibus, plus minusve flexuosis sub apicibus loborum plerumque furcatis; nervis tertiariis inferioribus furcatis sub angulis minus actis orientibus, rarius elongatis convergenti-arcuatis, sinum attingentibus; nervis tertiariis superioribus sub angulis acutissimis orientibus, sceepe simplicibus subcurvatis flexuosisve.

And they defined this *Osmunda lignitum* as "this is a species of somewhat limited vertical range common in the Middle Eocene of Central Europe, France, and England where specimens have been found in profussion. It is indistinguished by any specific character from the existing *O. javanica* and the expediency of giving it a separate name is very doubtful" in page 66.

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16) Matsuo, H. (1956); p. 718—719.
17) Gardner, J. S. & C. B. Ettingshausen (1879–82); p. 50.

There are a few authors compared the fossil species with the living species of *Plenasium banksiaefolia*, except above-mentioned opinions by Gardner and Ettingshausen.

Saporta[18] mentioned on the Heer's *Pecopteris lignitum* as "La plus naturelle nous paraît encore celle que mentione M. Unger dans sa notice et qui repprocherait le *Pecopteris lignitum* du genere *Plenasium* et surtout du *Plenasium bromeliaefolium* Presl.,—"

And very most recently, Kräusel and Weyland[19] described the studies in detail on this species as followed;

"*Osmunda lignitum* ist mit verschiedenen Farnen der gegenwart vergleichen worden. So weist Stur auf *O. presliana* J. Smith, besonders ihre var. *banksiaefolia* Presl. hin, andere Autoren nennen *Plenazium bromeliaefolium* Presl. In beiden Fällen herrscht gute morphologische Uebereinstimmung. Aber es ist nicht zu bestreiten, dass es auch ausserhalb der Osmundaceen Farne mit ähnlich gestalteten Laube gibt.—"

I agree with above mentioned opinions that the *Plenasium lignitum* is resembled to the living species of *Plenasium banksiaefolium*; and in spite of having been unknown a fertile pinnule, I am sure its characteristic shape of sterial pinnule belongs to the genus *Plenasium*.

They mention that *Plenasium lignitum* had been distributed from Europe to Asia in the Paleogene and Neogene age. But about the North America no one ever been described in spite of the same distributed area in the Northern Hemisphere. But I consider that there are some species belonged to *P. lignitum* in North America. They are *Osmunda delawarensis* Berry[20] from the Magothy Formation (upper Cretaceous) in Maryland and *Raphaelia neuropteroides* Debey & Ettingshausen[21] from the Ripley Formation (upper Cretaceous) in Tennessee by Berry.

On the former species of *O. delawarensis*, Berry described as followed;

"Fronds pinnate. Pinnae simple, alternate, elongate, linearlanceolate, inequilateral at the base. Borders undulate, very slightly crenulate; frond substance thick. Pinnae 7.5 cm long, 5–20 mm wide near the base, tapering to a long narrow point, closely resembling the sterial pinnae of *Osmunda presliana* J. Smith of the east and south Asiatic region, except that the latter has a narrowed base, while the present species has a large base, more like that in *Osmunda regalis* Linne."

I agree with his description for these figures in plate L, and so I think this species is the oldest specimens in the Northern Hemisphere.

In conclusion, *Plenasium lignitum* had occurred from the North America at the Upper Cretaceous age and distributed from Europe to Asia in the Palaeogene age, and in the Neogene age its distributed area ocuppied in whole Northern Hemisphere. And recently, its offspring grows thick in the sub-tropical area of the Asiatic Continents.

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18) Saporta, G. (1867); p. 44.
19) Kräusel, R. & H. Weyland (1951); p. 27.
20) Berry, E. W. (1916); pp. 763–64, pl. L, figs. 2–4.
21) Berry, E. W. (1925); p. 26, pl. I, fig. 8. (not Debey & Ettingshausen, in 1859)

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