

471. NOTES ON PALMAEAN LEAF FROM THE ÔARAI FLORA
(UPPER CRETACEOUS),
ÔARAI MACHI, IBARAKI PREFECTURE, JAPAN*

TOSHIJI ÔYAMA

Ibaraki University

and

HIDEKUNI MATSUO

Kanazawa University

大洗植物群（上部白堊紀）に産出したヤン科の葉片について：このヤン科の葉片は、1963年4月、松尾が金沢大学学生をつれて、茨城大学齋藤登志雄助教授の案内で、大山が報告した大洗植物群の産出地を見学した際に、学生の一人である石田財司が現場の転石中に発見したものである。不完全な標本であるが、葉軸先端部のヤン科特有の三角状を残しているので、既産の化石種と比較検討した。

本邦既産の *Sabalites nipponicus*, *S. taishuensis* よりも大型で、北米始新世産 *S. powelli*、同じく漸新世産 *S. apalachicolensis* に似ている。この葉片の産出層準が上部白堊系であることも考慮に入れて、既産のものとは区別し、原産地名をとって *Sabalites ooaraiensis* と新称する。ヤン科葉片としては、我が国のみならず全東亜においても最古の種である。また、大洗植物群の古植物地理を考察するのに重要な構成員の一つでもある。 大山年次・松尾秀邦

I. Introduction

Two species of the palmaean leaves are hitherto known; one of them is *Sabalites nipponicus* (*Sabal nipponica* KRYSHTOFOVICH, 1918) emended by S. ENDÔ, 1934; the other is *Sabalites taishuensis* established by K. TAKAHASHI in 1958 as a new species.

The former species occurred in the Eocene coal-fields of Takashima, Nagasaki Prefecture, Kyûshû, of Bibai in Hokkaidô, and in the Oligocene coal-fields in Northern Kyûshû, and Ube City, Yamaguchi Prefecture. The latter

species was yielded in Tsushima Islands, Nagasaki Prefecture, but S. ENDÔ doubts its being different from *Sabalites nipponicus*.

In the continental Eastern Asia, *Sabalites chinensis* was described by S. ENDÔ from the Fu-shun coal-field in southern Manchuria (North-Eastern Province of China), where the Palaeogene strata occur. In the continent of America, however, this genus has been known by the upper Cretaceous forms. Thus, the genus *Sabalites* is known to occur since Cretaceous period in the Northern Hemisphere.

Ôarai flora is considered by T. ÔYAMA, that it grew in abundance in the late

* Received May 20, 1964; read Nov. 10, 1963.

Cretaceous age in Japan, though the occurrence of the genus *Nilssonia* of the primitive *Cycas* common in the Mesozoic flora is not recognized in this flora. Consequently, there are two interpretations on the age of the Ôarai flora: first, if *Sabalites* has been found only in the Palaeogene formation in Japan, the Ôarai flora may possibly have been considered Palaeogene in age; secondary, if the Ôarai flora is of the upper Cretaceous age, then, this *Sabalites* species must be the oldest in Eastern Asia.

Nevertheless, T. ÔYAMA recognized in the Ôarai flora the following Mesozoic species, suggesting that it is of the upper Cretaceous age. They are: *Thalites yabei* (KRYSHTOFOVICH) HARRIS, *Coniopteris burejensis* (ZALESSKY) SEWARD, *Zamites megaphyllus* (PHILLIPS) SEWARD, *Olozamites* sp., etc.

Here, the writers wish to express their sincere thanks to Dr. T. SAITÔ of the Ibaraki University, and also to Dr. I. HAYASAKA for his kind criticism and for reading of the manuscripts.

II. Geological Notes on the Ôarai Formation

This Ôarai formation was established by H. OZAKI and T. SAITÔ in 1955, and was believed to continuously lie under the Nakaminato formation, which yielded some ammonites. It is evident, therefore, that with various plant fossils must be of Mesozoic age. These Mesozoic plant fossils were described by T. ÔYAMA as the Ôarai flora of the upper Cretaceous age in the years 1956 to 1959. Of the animal fossils, especially turreted ammonites and an echinoid, T. SAITÔ published notes in 1958 and 1959, and concluded that they are of upper Senonian

age, as they very closely resemble those of the Minato shale of Awaji Island, Kinki District, Japan.

The Ôarai formation is 1,300 m in thickness, and consists of many conglomeratic layers intercalating three horizons of the plant beds.

The columnar section along the coast of Nakaminato City by T. SAITÔ, 1958, is shown in Fig. 1.

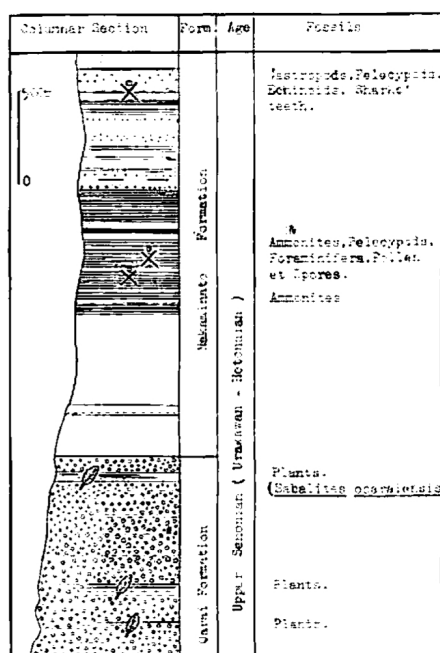


Fig. 1: The Columnar Section along the Coast of Naka-Gawa (T. SAITÔ, 1958).

III. Occurrence of the new species

This *Sabalites oaraiensis* was discovered by S. ISHIDA, a student of the Kanazawa University from the upper of these plant-bearing beds, when H. MATSUO and several students of Kanazawa University visited the locality of the Ôarai flora, guided by T. SAITÔ

in April, 1963. The materials collected were all incomplete fragments, except for this characteristic palmaean form which shows the deltoid-form at the base of the leaf. The slab of rock with the fossil leaf was found up-side down

on the fluvial deposits on the coast of the Naka-gawa. However, it is certain that the rock must have been derived from the black sandy layer and medium grey sandstone layer in alternation, representative of the Ôarai formation.

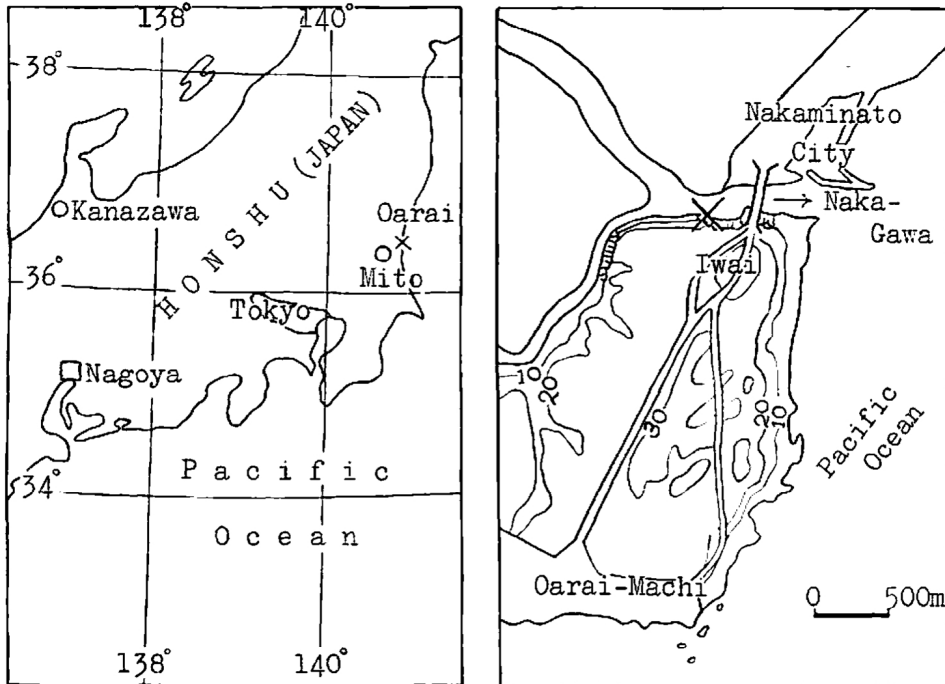


Fig. 2: Map showing principal locality of the Ôarai Flora.

IV. Description of the new species

Monocotyledoneae

Palmae

Sabalites SAPORTA, 1865

Sabalites oaraiensis new species

Fig. 4.

Description:—Incompletely preserved small palmaean leaf; fiabellate. Rachis 42 mm in *width*, and up to 86 mm in *length* on the surface; ligule large,

triangular, adherent to the upper side of the rachis. Rayss lightly carinate, 44 in numbers; midrib of rays slender; lateral veins parallel to midrib, indistinctly.

Discussion:—Only a specimen is at disposal, but it shows the characteristic deltoid rachis which closely resembles previously known forms of *Sabalites*. The writers have measured dimensions of other known species from Japan, Manchuria and elsewhere: the result is given in the following table.

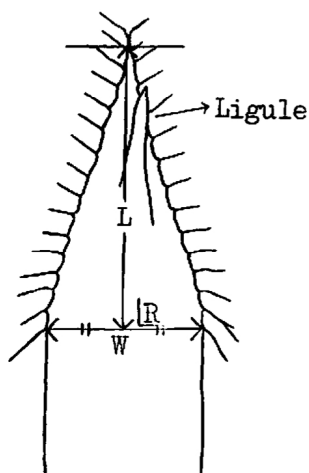


Fig. 3: Relation between Length and Width in the Rachis.
L: Length; W: Width

The taxonomic relations of all these species are not clear from what are given in the table below. But this new species differs from the other in its wider rachis, longer ligule, and thinner

texture. The new species appears, however, to have a very close resemblance to *Sabal major* HEER (1855) in the Tertiary of Switzerland, which was established by F. UNGER in 1841 as *Flabellaris major* (UNGER, F., 1841: 42. XIV, fig. 2); nevertheless, it differs from these specimens (HEER, O. 1855: XXXV; XXXVI, fig. 2) in its more numerous rays: it differs from the Kuma-form of the upper Eocene of Shikoku, *Sabalites nipponicus* (NAGAI, K., 1957: II, fig. 2) in its fewer rays and larger size: it differs from Bibai-form of the Oligocene of Hokkaidô, *S. nipponicus* FURÛ (KRYSHTOFOVICH, A., 1918: XLI, fig. 1) in its wider rachis and more numerous rays: it differs from *Sabalites taishuensis* TAKAHASHI (1958: XXVIIa) in its larger size.

Further, the present species is closely allied to *Sabalites powelli*, described by E. W. BERRY (1930: X, fig. 6 resembles especially very closely the new species) from the Wind River Basin of Green

Table 1: The measurement of rachis and rays in numbers of the palmaean leaf.

Species Name	Age	Width	Length	L/W	Numbers of Ray	Rays in Complete leaf (Estimation)
<i>Sabalites chinensis</i> , ENDO	Oligocene	22 mm	75 mm	3.4	27+	35-45
<i>S. nipponicus</i> , ENDO	Oligocene	22	58	2.6	33+	35-40
<i>S. taishuensis</i> , TAKAHASHI	Oligocene	26	54+	2.1+	45+	45-50
<i>S. nipponicus</i> , NAGAI	Up. Eocene	22	62	2.8	55+	55-60
<i>Sabal major</i> , HEER	Tertiary	27	60	2.2	30+	30-40
<i>Sabal major</i> , REID & CHANDLER	Oligocene	30	?		14+	Numerous
<i>Sabalites apalachicolensis</i> , BERRY	Oligocene	20-40	?			40-60
<i>S. powelli</i> , BERRY	Eocene	?	?			Numerous
<i>Sabalites ooaraiensis</i> n. sp.	Up. Cretaceous	12	86+	2.0	44+	45-50

River Age, but differs from the latter in being smaller in size, and from the Bembridge-form, *Sabal major* (UNGER) (REID & CHANDLER, 1926: IV, fig. 26) in being larger in size and the rays being numerous.

This new species represents the oldest known occurrence of the genus *Sabalites*, being the upper Cretaceous of Japan and

the Eastern Asia in general.

Occurrence:—Ôarai flora (Upper Cretaceous).

Locality:—At the right bank of the Naka-gawa 350 m up from the Kaimon-kyô (bridge), Iwai-machi, Ôarai Machi, Higashi-ibaraki Gun, Ibaraki Prefecture, Kantô District, Japan. (Lat. $36^{\circ}19'28''$ N. and Long. $140^{\circ}35'27''$ E.)



Fig. 4: *Sabalites oaraiensis* n. sp. Holotype; Reg. no. 14012.

Collection:—Holotype; Reg. No. 14012.

Repository:—Department of Geology, College of Liberal Arts, Kanazawa University.

References

- BERRY, E. W. (1914): The upper Cretaceous and Eocene Floras of South Carolina and Georgia. *U. S. Geol. Surv., Prof. Paper. 84.* pp. 5-72, pls. 2-14, pp. 99-163, pls. 15-29.
- (1916): The Physical Conditions and Age indicated by the Flora of the Alum Bluff Formation. *Ibid., 98-E.* pp. 41-53, pls. 7-10.
- (1930): A Flora of Green River Age in the Wind River Basin of Wyoming. *Ibid., 156-B.* pp. 55-79, pls. 6-15.
- ENDŌ, S. (1934): The geological age of the Fu-shun Group, South Manchuria. *Proc. Imp. Acad., Vol. 10, No. 8.* pp. 486-489.
- (1953): Notes on the Cainozoic Plants of East Asia (1, 2). *Kumamoto Jour. Sci., Ser. B, No. 2.* pp. 13-17, pls. 3-6.
- (1955): Icones of Fossil Plants from Japanese Island. (in Japanese). *Sangyotosho Co.* pls. 1-51.
- HEER, O. (1855): Flora Tertiaria Helvetiae. Die Tertiäre Flora der Schweiz. *Bd. I.* pp. 1-117, pls. 1-50.
- KRYSHTOFOVICH, A. (1918): Occurrence of the Plant, *Sabal nipponica* n. sp. in the Tertiary Rocks of Hokkaido and Kyushu. *Jour. Geol. Soc. Tokyo, Vol. 25, No. 303.* pp. 59-66, pl. 41.
- NAGAI, K. (1957): The Upper Eocene Flora of the Kuma Group, in the Ishizuchi Range, Shikoku, Japan. *Mem. Ehime Univ., Sec. II (Sci.), Vol. 2, No. 4.* pp. 73-82, pls. 1-2.
- ŌYAMA, T. (1956): An Inspection of the Oarai Flora of Upper Cretaceous Oarai Formation in Ibaraki Prefecture, Japan. *Bull. Fac. Lib. Arts, Ibaraki Univ., Nat. Sci., No. 6.* pp. 53-73, pls. 1-9.
- (1961): On the Conclusion of the Oarai Flora from the Oarai Formation in Oarai, Ibaraki Prefecture, Japan. *Ibid., No. 12.* pp. 61-101, pls. 1-9.
- OZAKI, H. & T. SAITŌ. (1955): The Cretaceous System along the Coast of Nakaminato City, Ibaraki Prefecture. (Geology of Ibaraki Pref. pt. 3). *Ibid., No. 5.* pp. 37-49, with 1 plate.
- REID, E. M. & M. E. J. CHANDLER. (1962): Catalogue of Cainozoic Plants in the Department of Geology, Vol. I. The Bembridge Flora. *British Museum (Nat. Hist.),* pp. 1-206, pls. 1-12.
- SAITŌ, T. (1958): Notes on some Cretaceous Fossils from the Nakaminato Formation, Nakaminato City, Ibaraki Prefecture, Japan. Part I. *Bull. Fac. Lib. Arts, Ibaraki Univ., Nat. Sci., No. 8.* pp. 83-94, pls. 1-5.
- (1959): *Op. cit.* Part II. *Ibid., No. 9.* pp. 79-85, pls. 1, 2.
- TAKAHASHI, K. (1958): *Sabalites* aus den Wakata Schichten von Tsushima. Nordkyushu. *Trans. Proc. Palaeont. Soc. Japan, N. S., No. 30.* pp. 185-188, pl. 27a.
- UNGER, F. (1841): Chloris protogea: Beiträge zur Flora der Vorwelt. *Hft. 1.* (Repository in Kyoto University).
- YABE, H. (1944): Palaeogene Age of the Ube Coal-Field Yamaguchi-Pref. *Proc. Imp. Acad. Tokyo, Vol. 20.* pp. 725-731.
- YAMASAKI, T. (1952): Discovery of *Sabalites nipponicus* from the Karatsu Coal-field, Kyushu, Japan. *Mem. Fac. Engin., Kyushu Univ., Vol. 13, No. 1.* pp. 65-70, fig. 1.

Awaji Island
Bibai
Fu-shun
Iwai-machi
Kaimon-kyô

淡路島
美 唄
撫 順
祝 町
海 門 橋

Kuma
Naka-gawa
Takashima
Tsushima Island
久 万
那 珂 川
高 島
対 馬