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TRANSACTIONS

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Geological Institute, Faculty of Science, University of Tokyo, Japan

Trans. Proc. Palaeont. Soc. Japan, N.S. No. 8, pp. 223—230, Pl. 21, 3 text-figs.. Oct. 31, 1952.

222. A FOSSIL PALM IN KENROKU PARK AT KANAZAWA[1)]

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金沢兼六園に於けるヤシ化石： 金沢の兼六園内夕顔亭の庭先に「竹根石」として知られる化石があり，かつて海外から運ばれたものと伝えられているがその史実は詳かでない。幹の基部は根で蔽われ，上部には二次的に出来たと思われる大きな孔があつて竹に似た点があるが，節がなく，幹と根との組織が極めてよく保存せられ，その構造からヤシ類の1種たることが明かである。幹では維管束が散在し，それに大きな繊維鞘を伴い，その横断面は心臓形をなし，基本組織には著るしい細胞間隙を具え，細い繊維条を交える。根では皮層に放射状の間隙があり，中心柱は常型を示す。これを従来知られたヤシ類と比較して未知の種であるので *Palmoxylon Maedae* と名附ける。種名は藩主前田家に献じたものである。 小倉 謙

In Kenroku Park at Kanazawa, there is a large fossil sitting on the ground, as an ornament, in front of a tea house. It is called as "Take-ne-ishi", meaning bamboo-root-stone, as it looks like a bamboo culm, the basal part being covered with a mass of roots (Text-fig. 1). It received no scientific examination, until in summer of last year the writer had an opportunity to observe it, and he could understand, at a glance, that this fossil was not a bamboo but a palm.

Fig. 1. Fossil palm at Kenroku Park in situ.

Through the permission of the Ishikawa Prefecture Office he could obtain some fragments of this fossil, whose tissues were so fine preserved, that it was worth while to study its internal structure.

External Characters

This fossil is a basal part of the stem of a palm, whose lowest part is covered with a dense cluster of roots. Through the courtesy of the authorities of the

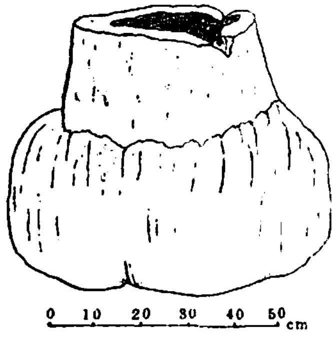

Fig. 2. The outline of the specimen dug out of the ground.

Prefecture Office, this fossil was dug out of the ground and its dimensions were measured (Text-fig. 2). It is onion-shaped. In its upper part the stem, 40 cm. in diameter and 20 cm. in height,

1) Contributions from the Division of Plant Morphology, Botanical Institute, Faculty of Science, University of Tokyo, N.S. No. 61. Read June 22, 1952; received May 1, 1952.

is exposed, while its lower part is covered completely by a thick mass of roots, whose diameter is 84.60 cm. in the thickest part. The total height is 65 cm. and the total weight is 241.25 kg. This is black in colour. In the upper face of the stem is a hollow cavity, about 26.60 cm. in diameter, which might be formed secondarily by the decay of tissue. On the upper face are seen numerous small dots scattered throughout the stem, and on the lateral surface, which was more or less eroded, numerous striations running longitudinally. They are the vascular bundles accompanying thick fibrous sheaths, and their arrangement shows the character of the typical monocotyledonous stem. There are no nodes such as in bamboos. In the external surface there are numerous small pores, due to the decay of the fibrous sheaths of vascular bundles.

The cluster of roots consists of thick roots, 4—8 mm. in diameter, running vertically. Though they are cemented by clay, they can be easily separated from each other.

From the characters above mentioned, this fossil should be recognized as a fossil palm. The fossils of palm stems have been found in various localities of the world since the Upper Cretaceous, and are called usually as *Palmoxylon*. The specific distinction of them is impossible by their external features and must be done by their internal structure. Through the critical study of STENZEL (1904), all species of *Palmoxylon* described in the 19th century have been investigated and summarized into 41 species of stems and 4 species of roots, of which 2 are known as roots only. In the 20th century some new species of *Palmoxylon* have been added by some authors, such as STEVENS (1912), JURASKY (1930), JONGMANS (1935), MÜLLER-STOLL (1935), etc. Most species of these fossils are either merely stems or roots, and there are only a few ones which are provided with both of the stem and roots, such as *P. astron* STENZEL *β radicatum* STENZEL (1904), *P. iriartum* STENZEL (1904), *P. anchorus* STEVENS (1912), *P. bacillare* JURASKY (1930). The present specimen is worth while in this respect, as it has both organs in organic connection. It is, however, very regret that the locality, where this was found, is unknown. It is said that this has been transported from a southern Asiatic country in the Tokugawa era, but the exact history is uncertain.

The anatomical studies on palms have been done by some authors since MOHL (1831, 1845) or KARSTEN (1847), whose results have been summarized by SOLEREDER and MEYER (1928).

INTERNAL STRUCTURE OF THE STEM

Cross and longitudinal sections in some parts of the stem have been made. The tissue is generally preserved in a very good condition. As the thick wall of the fibrous tissue is dark brown, the presence of this tissue is very remarkably visible, but in the external part of the stem this tissue is not preserved and becomes a small hollow pore.

The characteristics of this stem lie in the presence of 1) vascular bundles accompanying large fibrous sheaths, scattered throughout the stem, 2) collateral bundles whose phloem being situated within the indentation of the sheath, 3) large intercellular spaces in the fundamental tissue, and 4) small fibrous strands scattered in the fundamental tissue.

Vasular Bundles. In monocotyledonous stem, the vascular bundles, which are provided more or less by fibrous sheaths, run longitudinally, scattered throughout the stem, and those of the outer part are arranged more closely than those in the inner part. It is also true in palms, but in some species the distribution of the bundles in both parts is nearly equal—this is the case of "Cocos resembling stems" of STENZEL. In the present specimen, the distribution of the bundles in the outermost part, which are traced by the hollow pores, is somewhat closed with each other than that of those in the internal part (internal edge round the cavity), that is, the bundles are distributed within 10 mm^2 nearly 44 in the former part, while nearly 30 in the latter.

The form and size of the bundles and their accompanying fibrous sheaths are variable even in one cross section (Pl. 21, Fig. 1). Their cross section is generally egg-form in outline, and the vascular bundle is situated at its pointed side. The fibrous sheath itself is very large and is nearly oval with a slight indentation, where it joins the bundle. In general, the fibrous sheath is situated toward the external side of the stem, but there are few bundles whose sheaths are orientated in reverse or intermediate position.

The vascular bundle is collateral consisting of a large part of the xylem and a small part of the phloem, the latter being situated at the median indentation of the sheath (Pl. 21. Figs. 3–4.). The xylem consists of thick-walled parenchyma and intermingled vessels, which are distinguished into small-sized and large-sized ones, the latter being peripheral, that is nearest the phloem. The number and mutual arrangement of large, and small vessels are variable in each bundle. STENZEL distinguished 3 types in their arrangement in palms; 1) the typical or longitudinal bundle running vertically through the stem, and 4) the transitional and 3) oblique bundles running obliquely to the leaf. The case, in which 2 large vessels and 2 or 3 small ones are closely arranged, is most frequently found and corresponds to the typical or longitudinal bundle (Fig. 4). There is another case, in which 2 large vessels are separated and numerous small ones are scattered, corresponding to the transitional bundle (Fig. 3). In another case, more than 2 large vessels are arranged in two lateral groups or are arranged in a cross row, corresponding to the oblique bundle. There are also the bundles which are intermediate of these two. The diameter of large vessel is ca. 12 μ. The wall of vessels is thick and is sculptured in scalariform manner. The parenchyma among the vessels is small-sized but is thick-walled, and in longitudial section each cell shows long rectangular shape, so that, this is easily distinguished from the fundamental tissue.

The phloem is not very well preserved, but we can see thin-walled sieve tubes, polygonal in cross section and elongated in longitudinal section, though we cannot see the sieve plates. It is rather rare that the phloem is preserved in such a good condition as this.

The fibrous sheath consists of thick-walled fibers, whose thick walls are very distinct owing to their dark brown colour, which makes somewhat indistinct to observe fine structure. Each cell is polygonal in cross section, and is very thick, so as to leave only a small central space. In some cells concentric striations on the wall and fine pits between two fibers are visible.

Fundamental Tissue. The fundamental tissue is very well preserved, and is characterized by porous structure (Pl. 21, Figs. 3-4). It consists of cylindrical parenchyma, which lie horizontally (Text-fig. 3, *1-2*). In cross section, some of these cells are arranged to form a large intercellular space, while in longitudinal section, these cells are arranged contact with each other vertically, so as to make a vertical hollow cylinder. Each space is separated by one row of cells, just as seen in some water plants. Such a construction of parenchymatous cells was observed in the porous tissue of *Palmoxylon lacunosum* by STENZEL. The parenchymatous cells, which are in contact with the vascular bundles, are arranged more or less in radial direction, while those in contact with the fibrous sheath are arranged more or less in tangential direction. Even between these cells are found small space, and this is the important character of the present fossil, which is different from other similar *Palmoxylon* species, for, in the latter no spaces are found between the parenchyma round the vascular bundle and its accompanying fibrous sheath, even though large space are found in other parts. The wall of each cell is thin, and has no special structure. In some cells a dark mass is included, but its nature is uncertain.

In the fundamental tissue are found very small fibrous strands running longitudinally, which are distinct by their dark brown colour (Pl. 21, Figs. 1-2). They are oval in cross section, conisting of some thick-walled fibrous cells, similar to those of fibrous sheath of the vascular bundle. They accompany no vascular bundles. In the periphery of each strand is found a layer of special importance (Text-fig. 3, *3*). It consists of cells of special form, whose wall is somewhat thick and dark brown. They are the so-called stegmata, which are found in some living and fossil palms. In the present case, the stegmata are more or less imcomplete, arranged discontinuously, just as described by

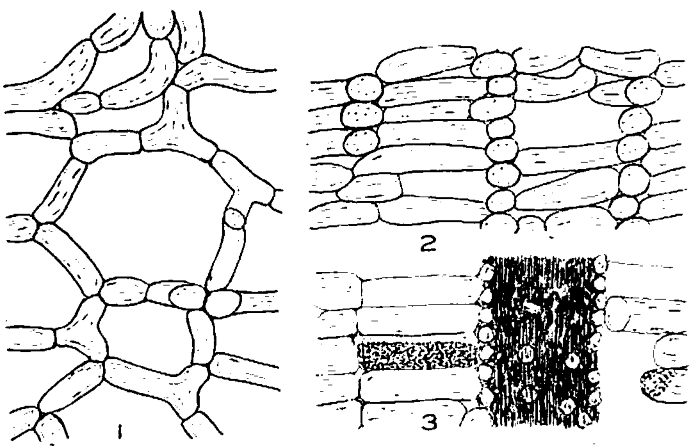

Fig. 3. *1*. A part of fundamental tissue in cross section, showing large intercellular spaces. *2*. The same in longitudinal section. *3*. Longitudinal section through a fibrous strand, showing its stegmata. ×80.

DRABBLE in the root of *Raphia Hookeri*.

Leaf Traces. In monocotyledonous stems in general, there are numerous leaf traces running obliquely, especially abundant in the periphery. In the present specimen also, they are found abundantly. In cross section the leaf trace is cut obliquely, while in tangential section its cross section is visible. (Pl. 21, Figs. 1-2). They accompany fibrous sheaths just as ordinary bundles. The type of the bundle is of a transitional one of STENZEL, and his conclusion, that the transition type is that going to the leaf, should be correct.

AFFINITY OF THE STEM

From the above mentioned characteristics, it is true that the present fossil would belong to a *Palmoxylon*. The classification of *Palmoxylon* has been done by STENZEL in an excellent way, and as his method is very useful for the determination of *Palmoxylon* species, the writer would like to follow his method in determining the present fossil.

According to him, 3 main types of *Palmoxylon* may be distinguished: 1) *Mauritia* resembling stems; outer bundles arranged closely with each other, and fibrous sheath larger than bundle; inner bundles separated, and fibrous sheath smaller than bundle; 2) *Corypha* resembling stems; outer bundles arranged closely with each other, and fibrous sheath larger than bundle; inner bundles separated, and fibrous sheath larger than bundle; 3) *Cocos* resembling stems: outer and inner bundles equally distributed and equally constructed. The present fossil should be placed in 2) type. STENZEL subdivided this into 3 types, according to the form of fibrous sheath:— its inner side is i) cordate (Group Cordata), ii) sagittate (Group Sagittata), or iii) straight (Group Complanata). The distinction of these three is not absolute, and two types may be found even in one cross section. In the present fossil the ii) type is predominate, though there is a few bundle of iii) type, and should belong to the Group Cordata. In these cases, we must consider further on the presence or absence of fibrous strands among the fundamental tissue, and also the presence or absence of stegmata round the strand. STENZEL observed the stegmata round the strand in 8 species of *Palmoxylon* among the Group Cordata, e. g. *P. iriartum*.

On the other hand the present fossil is characterized by the porous fundamental tissue. Such large intercellular spaces as this may be found in *Palmoxylon Boxbergae*, *P. lacunosa*, *P. texense*, *P. axonense*, *P. Blanfordi*, etc., among which *P. Blanfordi* has no fibrous strands, while *P. texense*, *P. lacunosa*, *P. axonense* have fibrous strands but no stegmata. In this respect, *P. Boxbergae*, which has stegmata round the fibrous strand, is mostly similar to the present fossil, but it belongs to the Group Complanata. There are also some other species which are provided with large intercellular spaces, but there are no spaces in the fundamental tissue in contact with the bundle or its sheath. The porous character of the present species is, therefore, more prominent than any others already known.

EXTERNAL FORM OF THE ROOTS

A cluster of roots surrounds the basal part of stem completely just as in the living forms. These roots are borne on the lower part of the stem, and they accumulate with each other in a large mass. Though they are connected into a cluster, each of them is easily separated from each other, as they are merely cemented by clay. Each of them is cylindrical, 4–7 mm. in diameter.

INTERNAL STRUCTURE OF THE ROOTS

Comparative study of the roots of palms has been done by DRABBLE (1905), which is the most important literature on the structure of the roots.

The root is characterized by possessing 1) a large cortex provided with large radial spaces, and 2) a central stele, whose external part being sclerenchymatous and internal part consisting of parenchymatous pith. In a large root with a diameter of 7 mm. and a small one of 4.5 mm. sectoined, there are no fundamental differences in structure, both showing a typical root construction. The root consists of a thick cortex and a small central stele (Pl. 21, Fig. 5).

On the surface there is a thin-layer consisting of 1–2 cells, sometimes of 3–4 cells. They consist of thin-walled parenchyma, and there are no appendages such as root hairs. Comparing with the roots of living palms and a fossil root of *Palmoxylon* described by STEVENS (1912), which are provided with a thick cortex, this layer would not be an epidermis and may be an innermost layer of the external cortex, external part of which being decayed off. The middle cortex is thick, 2.5 mm. in breadth in a large root, 1.7 mm. in a small one, and is characterized by the prominent radial structure. This structure is based on the radial arrangement of cortical cells and the large intercellular spaces between them. Each space is very large and is separated by radial layers consisting of some cells. Though these layers are sometimes irregularly arranged, they are nearly 46 in a large root and 35 in a small one. Each cell consists of thin walled parenchyma and includes sometime dark masses, but there are no thick-walled elements. Such a radial structure of the cortex is also found in some living palms and a fossil *Palmoxylon anchorus*. In the case of living roots, at the border of the space may be found fragments of cell walls, which are due to the destruction of cells, and the space should be formed lysigenously. It is noticeable that the similar structure is found in the present fossil.

The spaces become narrower toward the central part, and there is a thin tissue of the inner cortex with no spaces, and this tissue is limited internally by the endodermis (Pl. 21, Fig. 6).

The stele is circular in cross section, 2 mm. in diameter in a large root and 1.2 mm. in a small root. Two parts are distinctly distinguished as the peripheral part consists of thick-walled parenchyma and the central part of thin-walled parenchymatous pith, and the elements of the vascular bundle are embedded in the peripheral one (Pl. 21, Fig. 6). The vascular bundle is of a normal radial type, 39-arch in a large root and 27-arch in a small one. Though the phloem and protoxylem are situated very regularly in alternating position, some large vessels of the metaxylem are situated not in a radial position.

The phloem consists of a few small protophloem elements and some slightly large metaxylem ones. They are both thin-walled and longitudinally elongated. Though no sieve pits are to be seen, they should be sieve tubes. The xylem, consisting of 1–2 small vessels of protoxylem and 2–3 slightly large ones of metaxylem, shows a similar outline with the phloem. Besides, inside of these xylem elements, there are larger vessels, embedded in the fundamental tissue, but their position is more or less irregular. The sclerenchymatous tissue situated between these elements are small but thick-walled, and we see concentric striations in their walls. Outside of the protoxylem and phloem is a layer of somewhat large cells and a layer of small cells, the latter being the endodermis.

The central pith of the stele consists of large thin-walled parenchyma, and is clearly distinguished from the outer sclerenchyma. The distinction of two tissues in the root stele is generally met with in the roots of living palms and fossil *Palmoxylon anchorus*. In the pith, there are some intercellular spaces in a large root, but there are no vessels or other elements, which are sometimes visible in some palms.

Affinity of the Root

The structure of the present root is of a typical monocotyledonous. The structure of roots of living palms has been fully described by Drabble, and the structure of this fossil is similar to that of some palms. As for the structure of fossil roots of palms, Stenzel distinguished 4 species, and Stevens (1912) and Jurasky (1930) described a species respectively.

The presence of large radial spaces in the cortex, one of the characters of the present root, is sometimes observable in some living species, such as in *Trachycarpus excelsa*, *Licuala spinosa*, *L. graciolus*, etc., as well as in the large root of *Palmoxylon anchorus*. According to Drabble, the vascular bundle in most species of palms is rather irregularly constructed, as the large vessels are distributed within the central pith, and the bundle with a typical structure, another character of the present root, is rather rarely found, such as in *Kentia Forsteriana*, *Sable filamentosa*, etc. In *Palmoxylon anchorus* large vessels are found within the pith of the large roots, but they are wanting in the small ones. Concerning the root only, the present fossil resembles to the small root of this species.

Conclusion

The above mentioned characteristics of the present fossil palms differ from those of hitherto described species, and this should be an undescribed species. The most valuable point of this fossil is in its fine preservation of two organs, but it is very regret that its original locality is unknown, though it is said that this was brought from an uncertain southern country, so that the geological age is also obscure.

The oldest species of *Palmoxylon*, that is *P. Boxbergae* (Geinitz) Stenzel was known from the Turonian (Upper Cretaceous) of France, and since then the others were found from every ages and localities. The writer tried whether he could judge the locality or geological age of the present fossil anatomically from the fossils already described, but it was in vain. There are no distinctive characters according to different ages or localities.

Description of Species

Palmoxylon Maedae, Ogura sp. nov.

Palmoxylon consisting of a stem and cluster of roots associated.

Stem. Stem with diameter of 40 cm. Vascular bundle accompanying fibrous sheath scattered throughout, more closely in peripheral part than in internal part. Fibrous sheath, consisting of thick-walled fibers, much larger than vascular bundle, cordate; bundle situated at its indentation. Phloem consists of thin-walled sieve tubes; xylem consists of small and large vessels with thick walls. Fundamental tissue porous, consisting of parenchyma including large intercellular spaces, separated by a single row of parenchyma. Fibrous strands scattered in fundamental tissue; stegmata at periphery. Obliquely running leaf traces abundant.

Root. Roots, 4–7 mm. in diameter, consists of thick cortex and central stele. Epidermis and outer cortex unknown. Middle cortex with radial construction, traversed by very large radially extending intercellular spaces, separated by thin layers of 2–3 parenchyma. No special tissue in cortex. Stele oval in cross section, consists of external thick-walled sclerenchyma and central thin-walled pith. Typical polyarch vascular bundle embedded within sclerenchyma; without abnormal vessels.

Locality and *age* unknown. This is preserved now as a natural monument in Kenroku Park at Kanazawa. The park was originally the private garden of the Family of MAEDA, the lord of Kanazawa clan, whom the specific name is dedicated.

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A few literature appeared during and after the War cannot be cited.

Explanations of Plate 21

Fig. 1. Cross section of a part of the stem, showing the arrangement of vascular bundles accompanying fibrous sheaths and small fibrous strands; oblique section of a leaf trace is visible. ×8

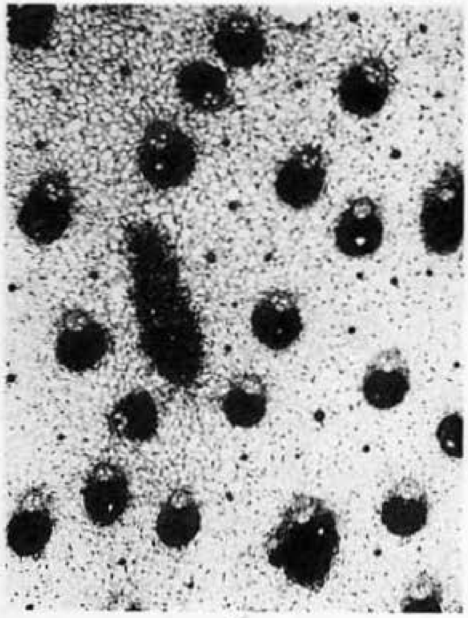
Fig. 2. Tangential section of a part of the stem, showing the vascular bundles accompanying fibrous sheaths (thick) and the fibrous strands (thin) running vertically, and some leaf traces in cross section. ×4

Fig. 3. Cross section of a vascular bundle of a transitional type accompanying fibrous sheath (black mass); fundamental tissue with large intercellular spaces is also visible. ×35.

Fig. 4. The same of a typical type. ×35

Fig. 5. Cross section of a root, showing the thick radially constructed cortex and the central stele. ×8

Fig. 6. A part of the same enlarged. ×35



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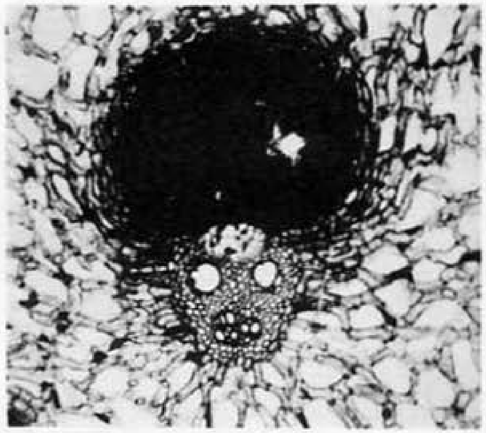

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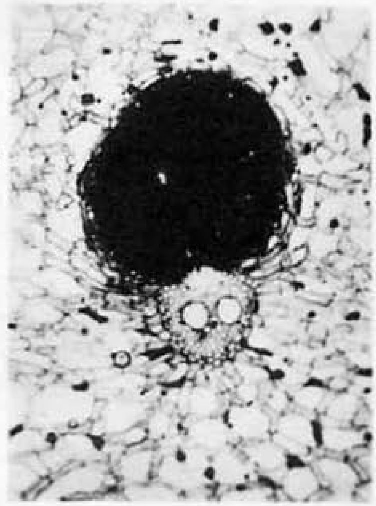

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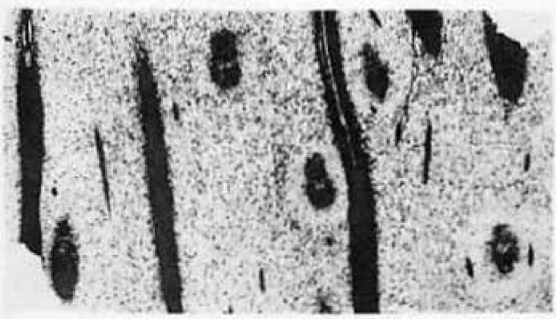

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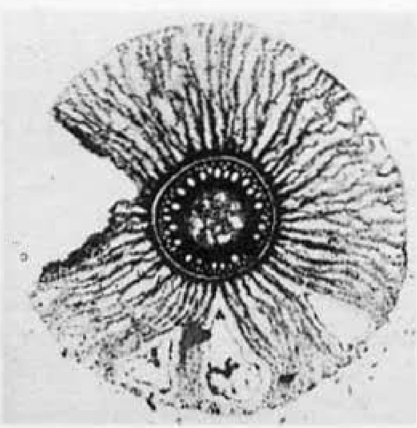

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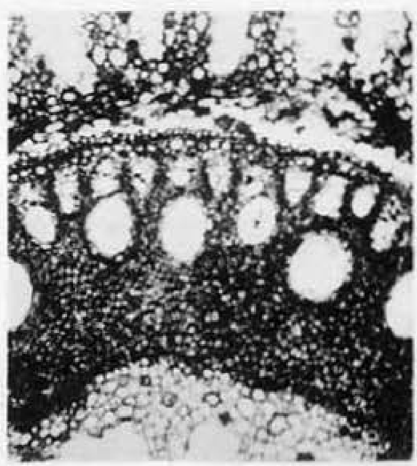

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223. NOTES A PROPOS DE QUELQUES PLANTES FOSSILES DANS LE GROUPE D'ENNICHI (YONGIL) DU CORÉE MÉRIDIONALE. I.[1)]

TOSHIMASA TANAI

Service géologique du Japon

朝鮮南部延日層群産植物化石—I: 朝鮮の延日層群から, 保存良好な植物化石が豊富に産出することは, 古くから知られている。この植物群は, 本邦の中新世前〜中期の植物群に近縁である。筆者は, 金原均二氏が採集した標本の中, カンバ科・クス科・マメ科・カヘデ科及びムクロジ科に属すると思われるものを再検討し, それらの主要な種を記載した。これらの大部分は, 台湾その他の暖帯に現在自生しているものに近縁であることは興味深い。 棚井敏雅

Les provenances des riches flores de la période tertiaire moyenne dans le Corée, ont été signalées; par exemple, S. ENDO, en 1940, a fait une étude sur la flore tertiaire du Corée, K. HUZIOKA, en 1943, a écrit une note sur quelques échantillons des plantes tertiaires du Corée. Ces flores fossiles offrent certaines ressemblances avec des flores miocènes du Japon, et leurs recherches renferment de quelques problèmes intéressants pour les questions de géographie végétale et pour d'autres questions paléobotaniques.

Dans la region du Geijitsu (Yongil), Keisho-hokudo (North Kyŏngsang-do) du Corée, le système tertiaire se developpe en étendue vaste: le district septentrional de cette région fut aussi fait des recherches par K. KANEHARA, qui y recueillit une quantité assez considerable de restes de végetaux fossiles. Comme il décrit en detail, géologiquement cette région représente une vaste formation mésozoïque, pénéplainise, puis profondément disséque, avant la fin du tertiaire. La formation tertiaire se présente sous divers aspects: dans les parties inférieurs, ils sont composés de conglomérat et de sable conglomératiques. Mais au-dessus de ces couches pierreuses se superposent de couches de sable et d'argiles; cependant ils renferment souvent des moules avec quelques mollusques, des genres *Lucina*, *Nuculana*, *Yoldia*, *Acila* etc., de plus, les argiles renfermaient de nombreuses empreintes de feuilles dont la conservation est bonne.

Les plantes fossiles étudiées dans le présent travail ont été recueillies par KANEHARA, dans les argiles tufacées du Groupe d'Ennichi. L'auteur a examine leurs échantillons, cependant les éspèces de Bétulacées, Laurinées, Léguminocées, Acéracées, Sapindacées determinés premièrement sont les suivantes:—

Carpinus protojaponica ENDO
C. protoerosa TANAI
Cryptocarya ennichiensis TANAI
Phoebe mioformosana TANAI
Entada formosana KANEHIRA
Dodonaea japonica (MORITA) TANAI
Acer ornatum CARR.
A. cfr. *palaeodiabolicum* ENDO
A. prototrifidium TANAI
A. subpictum SAPORTA

1) Read June 30, 1951; received May 23, 1952.

A. Ginnala MAXIM.
A. Mayrii SCHWERIN
Sapindus Kaneharai TANAI
S. linearifolius BERRY

Enfin, il nous faut remercier très vivement MM. F. MAEKAWA et H. HARA, de l'Institut botanique de l'Universite de Tokio pour les suggestions cordiales et amicales. Nous tenons a témoigner ici notre reconnaissance à M. K. KANEHARA du Service géologique du Japon et M. T. KOBAYASHI de l'Institut géologique de l'Université de Tokio, qui ont bien voulu me présenter leurs échantillons.

Famille Bétulacées

Carpinus protoerosa TANAI sp. nov.

pl. 22, fig. 2

1936. *Carpinus* sp. nov., KANEHARA: *Jour. Geol. Scc.*, vol. 43, p. 82.

Description:—Involucre ovate ou ovate-elliptique, large de 1.0 cm. sur 1.5 cm. de longueur, sommet obtusement aiguë, base largement arrondie, asymétrique; bords inférieurs entiers, supérieurs dentées. Stipe net, droit, 3 mm. de longueur: nervures principales au nombre de 4, presque droites, divergentes dans la base; nervures secondaires et tertiaires figurant des mailles grossièrement rectangulaires.

Remarques:—Cet échantillon, malgré légèrement incomplet, offre certaines ressemblances avec des involucres du *Carpinus erosa* vivant actuellement au Japon, duquel cependant notre éspèce fossile est parfaitement distincte par sa denture. Parmi les involucres fossiles du *Carpinus*, cette éspèce se rapproche légèrement du *C. miocordata* HU et CHANEY de la flore miocène dans Shantung de la Chine.

Lacalités de Provenance:[1]—730, 781

Famille Laurinées

Cryptocarya ennichiensis TANAI sp. nov.

pl. 22, figs. 3 et 4

1936. *Cinnamomum oguniense*, KANEHARA: loc. cit p. 83.

Description:—Feuille ovalée ou longuement elliptique, large de 3.5 cm. environ sur 6.5 cm. environ de longueur, bords entiers, largement arrondie à la base, sommet arrondie. Nervures principales au nombre de 3 à la base, nervure mediane faible; nervures latérales externes s'echappant (angles d'émergence 25°-30° environ) de la médiane 1.5 mm. au-dessus de la base, arquées, puis dressées, atteignant à deux tiers de feuille. Nervures de deuxième ordre peu discernables, subopposées, naissant de la médiane ou des basilaires; les supérieures paraissant camptodromes par bifurcation; la troisième nervures reliant les secondaires.

Fruit globulaire, ou plutôt ovoïde, avec les fines rides longitudinales; mesurant 1.2 mm. de largeur sur 1.0 mm. de longueur. Pédoncule curt, nette, 3 mm. de longueur.

Remarques:—Nous avons pensés à la rapprocher des feuilles de *Laurus* ou *Cinnamomum*, mais la nervation montre de grands rapports avec celle de certaines feuilles de *Cryptocarya*. La nervation de cette feuille se rapporte à celle de *Cinnamomum miocenum* MORITA, elles se distinguent des feuilles de *C. miocenum* à la base.

Actuellement, le genre *Cryptocarya*

1) Des nombres qui signalent chaques localités ont été decrits dans la carte géologique par M. K. KANEHARA.

comprend près de 7 éspèces habitantes à l'Asie tropicale et subtropicale. Parmi les éspèces actuelles, cette éspèce fossile se rapproche plus ou moins à *Cryptocarya chinensis* HEMSL. de l'île de Formose et de la Chine méridionale ; elles se distinguent cependant notablement à la formes de feuille. Cette feuilles fossiles se distinguent de celle de *C. praesamarensis* SANBORN dans la flore du Comstock, Oregon de l'Amérique du Nord.

Localités de provenance: 730, 781.

Phoebe mioformosana TANAI sp. nov.

pl. 22, fig. 5

1934. *Laurus umbellata*, KANEHARA : loc. cit. p. 83.

Description :—Feuilles lancéolées ou oblancéolées à sommet légèrement obtuse, à base cunéiformé, à bord entier, fermes et coriaces, large de 2.5–2.8 cm. sur 8.5–9.5 cm. de longueur. La nervure primaire évidente jusqu'au sommet, les nervures secondaires étroites mais évidentes, subalternes ou alternes, 6-7 paires, légèrement recourbées en arc, camptodromes. Les nervures tertiaires peu distinctes, percurrentes. Petiole allongée, mesurant 1.3 cm. de longueur.

Remarques :—Ces feuilles se rapprochent beaucoup de celles de *P. formosana* HAYATA, qui habite les forêts montagneuses de la Formose. Les dimensions de la feuille fossile sont cependant légèrement inférieures à celles des exemplaires de *P. formosana* vivant actuellement.

La feuille du *Phoebe* offre certaines ressemblances avec des feuilles de quelques genre de *Machilus*, *Persea* et *Lindera*. Cette feuille fossile se rapproche plus ou moins du *Laurophyllum merrilli* CHANEY et SANBORN dans la flore de Weaverville, California de l'Amérique du Nord.

Localités de provenance :—1, 83, 528, 730.

Famille Léguminosées

Entada formosana KANEHIRA

pl. 22, figs. 6 et 7

Description :—Folioles petites, longue-ovalées, large de 1.0–1.8 cm. sur 2.3–3.5 cm. de longueur, base arrondie, légèrement asymétrique, bords entiers, sommet arrondi ou petitement emarginate. Nervure médiane rectiligne, forte, proéminent sur la face inférieure de la feuille. Nervures secondaires, alternes ou subalternes, grêles, s'échappant irregulièrement de la médiane, sous des angles ouverts, arquées en avant, remontant le long de la marge, camptodromes par grêle bifurcation, et s'anastomosant en un réseau marginal. Nervures d'ordres plus éléves, de même force que les secondaires, formant un lacis compliqué ; les mailles ultimes étant polygonales.

Remarques :—Cette petite feuille, d'après ses caractères, aurait appartenu à la famille des Léguminosées. Nous avons pensé à la rapprocher des folioles de *Dalbergia*, *Gledtchia* ou *Lespedeza*, mais la nervation montre de grands rapports avec celle de certain folioles de *Entada*, notament identique totalement à la folioles d'*Entada formosana* KANEHIRA. Cette éspèce est actuellment vivante dans l'île de Formose. Cette feuille fossile se rapproche plus ou moins du *Cassia puryearensis* BERRY dans la flore éocène de l'Amerique de Nord.

Localités de provenance :—210, 310, 520, 731.

Dodonaea japonica (MORITA) n. em.

pl. 22, fig. 8

1933. *Terminalia japonica*, MORITA: *Jour. Geol. Soc. Japan*, vol. 40, p. 355.
1936. *T. japonica*, KANEHARA: loc. cit. p. 83.

Description:—Fruit probablement deux-cellulaire, deux-ailé, pédonculé; capsule relativement petite, reticulée, orbiculaire, 8-9 mm. environ au diamètre. Aile légère, comparativement large, largement emarginée au sommet; veinules s'echappant regulièrement des bords de la capsule. Pédoncule relativement longue, faible, 8-9 mm. de longueur.

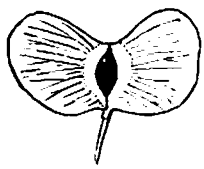

Fig. 1 *Dodonaea japonica* (MORITA)
(reconstitution probable, mais non certaine)

Remarques:—Nos échantillons correspondent totalement aux fruits de *Terminalia japonica* figurés par H. MORITA dans la flore miocène d'Oguni, préfecture de Yamagata, cependant ces fruits ne montrant pas les caractères de ceux de *Terminalia*. Les genres avec les fruits ressemblants de notre échantillon sont les suivantes: *Pterocellis, Ptelea, Dioscorea, Tripterygium, Dodonaea*. C'est de cette dernière genre que notre fruit se rapproche le plus.

La découverte de *Dodonaea* fossile est très intéressante; cette plante est actuellement vivante dans l'île d'Ogasawara et de Formosa, *Dodonaea viscosa* (LINNÉ). Parmi les éspèces fossiles, ce fruit se rapporte plus ou moins au *D. Knowltoni* BERRY dans la flore éocène de l'Amérique du Nord; elle se distingue cependant à la forme de l'aile et de la capsule.

Lacalités de provenance:—4, 29, 227.

Famille Acéracées

Acer prototrifidium TANAI sp. nov.

pl. 22, fig. 13

1936. *Acer trifidium*, KANEHARA: loc. cit. p. 83.

Description:—Feuille petites, trilobée, légèrement asymétrique, base arrondie, chaque lobe se terminant en une pointe longuement effilée, leurs bords latéraux entiers. Nervures principales au nombre de trois (fortes) à la base; nervures secondaires indistinctes, opposées ou subopposées, s'échappant normalement de la médiane et s'anastomosant avec les nervures secondaires internes issues des basilaires externes.

Remarques:—Les feuilles de l'érable trilobée abondent dans les giesements de plantes fossiles et dans la nature actuelle. Notre échantillon montre certains caractères communs à *Acer trifidium* vivement actuelle de la Chine centrale; elle en diffère cependant par la forme de ses lobes, qui, dans l'ensemble, sont plus allongées proportionnellenment à leur largeur et se terminant en pointe plus acuminée. Cette éspèce se rapporte plutôt à *A. oblongum* var. *biauritum* SMITH. par la forme des lobes. Parmi les feuilles fossiles, cette échantillon se rapporte à *A. trilobatum* (STERNBERG) ou *A. florinii* HU et CHANEY.

Localité de provenance:—528.

Acer ornatum CARR.

pl. 22, figs. 10 et 11

1936. *Acer eupalmatum*, KANEHARA: loc. cit. p. 83.
1943. *Acer ornatum*, HUZIOKA; *Jour. Fac. Sci. Hokkaido Imp. Univ.*, Ser. IV vol. VII, No. 1, p. 133.

Feuille petiolée, largement cordiforme à la base, palmatifide, à 7 lobes, irregulièrement dentée sur tout la circonférence; dents aigües, tournées en avant; chaque lobe acuminé, terminé en longue pointe; les sinus entre les lobes forment des angles très aigus.

Samare petite, 1.0–1.3 cm. environ de longueur; aile rectiligne au côte extérieur, arrondie au côte interieur; fruit petit, semiellipsoid, 3 mm. environ de longueur.

Remarques:—Les feuilles d'*Acer palmatum* vivant actuellement varient beaucoup par rapport à la forme et à la denture. Parmi beaucoup de variation-éspèce, ces échantillons paraissent se rapprocher le plus d'*Acer palmatum* var. *eupalmatum* vivant actuellement.

Localités de provenance:—211, 817.

Famille Sapindacées

Sapindus Kaneharai TANAI sp. nov.

pl. 22. figs. 14 et 15

Description;—Feuilles (folioles) petiolées, très variables, ovales-lanceolées ou ovales, large de 3.5–2.1 cm. sur 6.5–4.2 cm. de longueur, sommet longuement acuminé; base arrondie ou largement attenuée, asymétrique, bords entiers. Nervure médiane rectiligne, nette, forte; nervures secondaires opposées ou subalternes, faibles, dressées (angles d'émergence 35°–60° environ), arquées en avant, se terminant en camptodromie ou par bifurcation. Nervures du troisième reticulaires, formant des mailles grossièrement rectangulaires.

Remarques:—Les folioles rappellent bien par leur forme celle des *Sapindus*, toutefois la nervation n'est pas assez bien concervée pour qu'on puisse regarder cette détermination comme parfaitement assurée.

Ces feuilles fossiles se rapprochent principalement de celles de *S. oregonianus* KNOWLTON dans la flore miocène de l'Amérique du Nord. Ces feuille correspondent avec celles de *S. Mukurossi* GAERTN. vivant actuellement, dans l'Asie orientale. Cette éspèce se rapporte plutôt à *Rhus succedanea* LINNAEUS vivant actuellement.

Localités de provenance:—362, 950.

Sapindus linearifolius BERRY

pl. 22, fig. 16

1916. *Sapindus linearifolius*, BERRY, *U. S. Geol. Surv., Prof. Paper. 91*, p. 275.
1936. *Rhus* sp., KANEHARA: loc. cit. 83.

Fragments de feuilles (folioles) ne montrant le sommet, le plus longs 5.0 cm. 1.2–1.5 cm. de largeur; base cunéiforme, légèrement asymétrique, limbe étroit, linéaire, lancéolé, légèrement falciforme, bords entiers, subparallèles sur une grande longueur. Nervure médiane forte; nervures secondaires grêles, opposées, arquées en avant, comptodromes, au nombre de plus 15 paires.

Remarques:—Au premier abord, cette feuille se rapporte semblablement aux feuilles de quelques genres de *Salix*, *Litsea* ou *Pistacia*, cependant elle se distingue des feuilles de leurs genres à la nervation et les bords. Malgré les échantillons incomplets, ces feuilles fossiles présentent des rapports incontestables avec une Sapindacées fossile de l'Amérique du Nord, le *Sapindus linearifolius* BERRY. Cette éspèce se rapproche plus ou moins de *S. falcifolius* A. BROWN dans les flores oligo-miocènes de l'Europe.

Localités de provenance:—269, 953.

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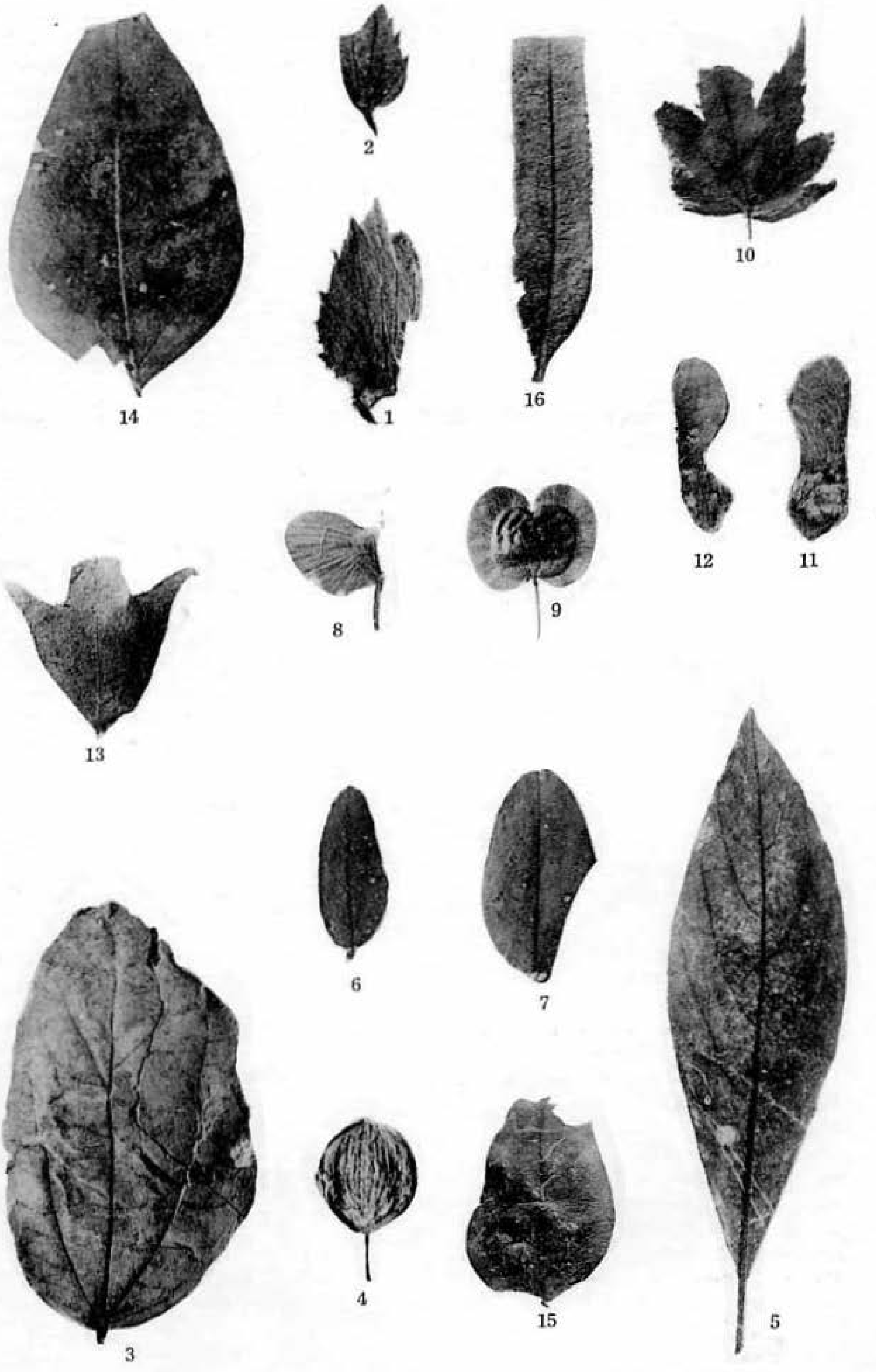
Explication de Planche 22

Fig. 1. *Carpinus protojaponica* ENDO ×2
Fig. 2. *Carpinus protoerosa* TANAI ×1
Fig. 3. *Cryptocarya ennichiensis* TANAI ×1
Fig. 4. *Cryptocarya ennichiensis* TANAI (fruit) ×1
Fig. 5. *Phoebe mioformosana* TANAI ×1
Figs. 6 et 7. *Entada formosana* KANEHIRA ×1
Fig. 8. *Dodonaea japonica* (MORITA) (fruit) ×1
Fig. 9. *Dodonaea viscosa* (LINNE) ×1
Fig. 10. *Acer ornatum* CARR. ×1
Fig. 11. *Acer ornatum* CARR. (fruit) ×2
Fig. 12. *Acer palaeodiabolicum* ENDO ×1
Fig. 13. *Acer prototrifidium* TANAI ×1
Figs. 14 et 15. *Sapindus Kaneharai* TANAI ×1
Fig. 16. *Sapindus linearifolius* BERRY ×1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by NEWTON (1925).

Estheriella s. str. is different from the preceding in the smaller number of radial costae, although they attain some 20. They are stronger on the ventral side, but frequently become obsolete toward the umbo. Because the radial costation is a remarkable characteristic *Estheriella* is better to be distinguished from the rest of Estherians as the Estheriellidae, if not as the Estheriellinae.

The difference between the Estherians and Leaians is greater. In the latter prominent carinae, 5 or less in number, radiate from the umbo. Therefore I agree with RAYMOND to distinguish them in the family rank.

Praeleaia triasiana CHERNYSHEV, 1934, is the latest member of the family and represents an explicit genus by itself. Therefore *Metaleaia* is proposed for it.

Finally *Leperitta alta*, *L. curta*, *Fordilla troyensis* and *Modiolloides prisca* are, insofar as can be judged from their descriptions and illustrations, certainly similar to Estherians. They are distinct from either one of the Bradoriidae, Beyrichonidae and Indianidae which ULRICH and BASSLER (1931) referred to the Conchostraca but RAYMOND (1935) proposed a new order, Bradorina, with the contention that they are ancestral to the Ostracoda.

ULRICH and BASSLER referred the afore mentioned species to the Limnadiiae and RAYMOND suggested their being ancester of the Conchostraca. They are all marine fossils and no Estherian ornament is found on their carapace. Furthermore no linking form is known in the prolonged time from late Cambrian to Gotlandian. Therefore it may appropriate to distinguish them as a family in Conchostraca, separated from the Lioestheriidae.

Family Lepidittidae KOBAYASHI, new family

Carapace calcaro-phosphatic, similar to Estherian, but has no Estherian type of ornamentation.

This comprises Lower (?) and Middle Cambrian *Lepiditta*, Lower Cambrian *Fordilla* and Lower Cambrian *Modioloides*, all Atlantic and marine.

Family Lioestheriidae RAYMOND

This includes all of the fossil Estherian genera without any distinct radial ribs or carinae.

Distribution:—Lower Devonian to Cretaceous.

Figure 1
Pseudoleaia rectangula (YOKOYAMA)

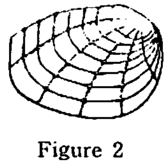
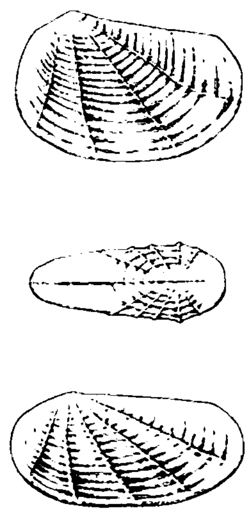


Figure 2
Metaleaia triasiana (CHERNYSHEV)



3a
3b
3c

Figures 3a-c
Praeleaia quadricarinata LUTKEVICH

Genus *Pseudoleaia* KOBAYASHI, new genus

Estherians similar to Leaians in subquadrate outline and presence of diagonal carinae which are, however, incomparably weak, one extending from the umbo to the postero-ventral angle and the other from the umbo to the middle of the ventral margin and especially weak.

The monotype is *Estheria rectangula* YOKOYAMA, 1894 (Fig. 1), from the Neocomian of the Yuasa basin, Prov. Kii, (Wakayama Pref.), Japan.

Family Estheriellidae KOBAYASHI, new family

Similar to the Estherians but having radial ribs which become generally obsolete toward the umbo.

Family Leaiadidae RAYMOND

Similar to Estherians but have one or several prominent radial carinae.

Distribution: — Middle Devonian to Lower Triassic.

Genus *Metaleaia* KOBAYASHI, new genus

Leaian with 5 nodose radials carinae beside one on the dorsal margin. *Praeleaia* (Figs. 3a–c) has four or five carinae which are not nodose; dorsal margin not carinated.

Monotype is *Praeleaia triassiana* CHERNSHEV, 1934 (Fig. 2), from the Lower Triassic Maltsevo series in the Kuznetsk basin, Siberia.

Alphabetical List of Fossil Estherian Genera and Related Genera

Anomalonema RAYMOND, 1946. (*Estheriella reumauxi* PRUVOST, 1911)	Westphalian
Asmussia PACHT, 1849. (*Amussia membranacea* PACHT, 1849)	Devonian
Cornia LUTKEVICH, 1938. (*Cornia papillaria* LUTKEVICH, 1937)	Upper Permian
Cyclestherioides RAYMOND, 1946. (*Estheria lenticularis* MITCHELL, 1927)	Triassic
Dadaydedeesia RAYMOND, 1946. (*Estheriella radiata* (SALINA) var. *multiradiata* JONES)	Westphalian to Triassic
Diaplex NOVOZHILOV, 1946. (*Diaplex tigjanensis* NOVOZHILOV, 1946)	Triassic
Diaphora NOVOZHILOV, 1946. (*Diaphora tuberculata* NOVOZHILOV, 1946)	Triassic
Eriopsis RAYMOND, 1946. (*Eriopsis belli* RAYMOND, 1946)	Carboniferous
Estheriella WEISS, 1875. (*Posidonomya nodosocostata*, GIEBEL)	Triassic
Estheriina JONES, 1891. (*Estheriina bresiliensis* JONES, 1897)	Carboniferous (?), Cretaceous
Estherites KOBAYASHI and HUZITA, 1943. (*Estheria mitsuishii* KOBAYASHI and HUZITA, 1942)	Mesozoic and older
Euestheria DEPERAT and MAZERAN, 1912. (*Posidonia minuta* von ZIETEN, 1833)	Devonian (?) to Triassic
Fordilla BARRANDE, 1881. (*Fordilla troyensis* BARRANDE, 1881)	Lower Cambrian
Hemicycloleaia RAYMOND, 1946. (*Hemicycloleaia laevis* RAYMOND, 1946)	Dinantian to Westphalian
Leaia JONES, 1862. (*Cypricardinia leidyi* LEA, 1855)	Dinantian to Permian
Leperditta MATTHEW, 1886. (*Leperditta alta* MATTHEW, 1886)	Lower (?) and Middle Cambrian
Limnestheria WRIGHT, 1928. (*Limnestheria ardra* WRIGHT, 1928)	Westphalian
Lioestheria DEPERAT and MAZERAN, 1912. (*Lioestheria lallyensis* DEPERAT and MAZERAN, 1912)	Devonian to Triassic
Metaleaia KOBAYESHI, 1952. (*Praeleaia triassiana* CHERNYSHEV, 1934)	Lower Triassic
Modioloides WALCOTT, 1889. (*Modoioloides prisca* WALCOTT, 1887)	Lower Cambrian
Monoleiolophus RAYMOND, 1946. (*Monoleiolophus unicostatus* RAYMOND, 1946)	
Orthothemos RAYMOND, 1946. (*Estheria draperi* JONES and WOODWARD, 1894)	Permian (?) to Cretaceous

Palaeolimnadia RAYMOND, 1946. (*Estheria wianamattensis* MITCHELL, 1927) Permian to Triassic
Palaeolimnadiopsis RAYMOND, 1946. (*Palaeolimnadiopsis carpenteri* RAYMOND, 1946) Devonian (?) to Permian
Palaestheria BERNARD, 1929. (*Estheria anomala* JONES, 1901) Westphalian to Lower Cretaceous
Paraleaia RAYMOND, 1946. (*Leaia klieveri* GOLDENBERG, 1873) Stephanian
Pemphicyclus RAYMOND, 1946. (*Pemphicyclus laminatus* RAYMOND, 1946) Westphalian to Permian
Polygrapta NOVOZHILOV, 1946. (*Polygrapta chatangensis* NOVOZHILOV, 1946) Permian
Praeleaia LUTKEVICH, 1929. (*Prealeaia quadricarinata* LUTKEVICH, 1929) Middle Devonian
Pseudoleaia KOBAYASHI, 1952. (*Estheria rectangula* YOKOYAMA, 1894) Neocomian
Pseudostheria RAYMOND, 1946. (*Pseudestheria brevis* RAYMOND, 1946) Devonian to Triassic
Rhabdostichus RAYMOND, 1946. (*Estheria pulex* CLARKE, 1882) Cambrian (?), Gotlandian (?), Devonian

NB. Beside them there are some Jurassic and Cretaceous species referred to *Bairdestheria* RAYMOND, *Lynceus* MÜLLER and *Limnodiopsis* SPENCER and HALL.

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* I thank Prof. J. M. WELLER for having access of a photograghed copy of NOVOZHILOV's paper.

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Postscript

In hunting through literatures, two genera and a subgenus were found as follows:
Vertexia LUTKEVICH, 1941 (*Vertexia tauricornis* LUTKEVICH, 1941)
Estheriopsis RUSCONI, 1948 (*Estheriopsis bayensis* RUSCONI, 1948)
Echinestheria MARLIÈRE, 1950 (*Estheria* (*Echinestheria*) *marimbensis* MARLIÈRE, 1950)

The second genus is quite different from all others in the *Lingula*-like aspect.

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 8, pp. 241—248, Pl. 23, Oct. 31, 1952

225. STRATIGRAPHICAL AND PALEONTOLOGICAL STUDIES OF THE LATER PALEOZOIC CALCAREOUS ALGAE IN JAPAN, IV.

— Notes on the calcareous algae of the Omi limestone[1] —

RIUJI ENDO

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青海石灰岩產石灰藻: 河田茂磨は過去数年に亘つて新潟県西頸城郡歌外波・田海川・清水倉・黒姫山・小滝川附近に分布している所謂青海石灰岩を有孔虫方面から研究し野外作業と相俟つて各露出地の二畳紀乃至石炭紀の層位を決定した。同氏の有孔虫薄片中には多数の石灰藻化石が含まれているので，その提供をうけ，筆者は石灰藻方面から，河田の結論とは全然，独自の立場で該石灰岩層の層位を研究した処，非常によく河田の結論と一致したので玆にそれを報告する。同時に2つの *Oligoporella* の新種を創定し，尚ほ *Anthracoporella*, *Mizzia* 及び *Anchicodium* 各属中の既発表種各一種づゝを記載報告した。遠藤隆次

INTRODUCTION AND ACKNOWLEDGEMENTS

For several years Shigema KAWADA has studied in detail fusulinid specimens, collected in the Ōmi limestone which occurs in the vicinity of Utatonami and along the upper course of the Tamigawa River, and he found several species of *Triticites*. He and his leader (in FUJIMOTO & KAWADA, 1951) thereby succeeded in establishing with certainty the presence of the Uralian age in Japan. During his study of Fusulinidae he used more than 200 thin sections. Since some of them include rather well preserved calcareous algae which KAWADA kindly forwarded to me for study.

From his studies of calcareous algae found in Sakamotozawa, Iwate Prefecture, in 1951 the writer (ENDO, 1951, '52) concluded that *Anthracoporella spectabilis* PIA, *Anchicodium magnum* ENDO and *Mizzia velebitana* SCHUBERT indicate respectively the Visean, Lower Permian, and Middle to Upper Permian ages.

The writer studied KAWADA's thin sections in reference to the above conclusion and determined the stratigraphical relations and geological ages in each locality of the Ōmi limestone. Then the writer compared the results of his laboratory work with KAWADA's opinions which were attained by his field as well as his laboratory work. The stratigraphical conclusions gained by the study of calcareous algae were found to be nearly identical with KAWADA's opinions. There were a few minor disagreements between the writer's and KAWADA's opinions. At any rate, it seems appropriate to report these facts in the following in association with the paleontological descriptions of the several species of calcareous algae found in KAWADA's thin sections.

In this opportunity, the writer wishes to express his sincere thanks to Shigema KAWADA, Tokyo Educational University,

1) Read April 5, 1952; received June 21, 1952.

2) Contribution from the Laboratory of Earth Sciences, Saitama University, Urawa.

for his grateful friendship. The writer express also his gratitude for the financial help provided by the Educational Department. The author is also indebted to Mr. Arnold MASON, of the Tokyo branch office, U. S. G. S., for his aid in editing the English typescript.

STRATIGRAPHY

Since the writer had never previously visited the Ōmi district, the following listed stratigraphical relations and geological ages of each fossil locality were obtained by the laboratory examination of the thin sections containing calcareous algae. KAWADA's conclusions from his studies of Fusulinidae and his field work are compared as follows.

Algae (ENDO)	Permian	Upper	*Gymnocodium japonicum* KONISHI	KH23, KH24[3]
		Middle	*Mizzia yabei* (KARPINSKY)	KH1, KH8, KH9, S13, S24
			Oligoporella s-kawadai, new species	KH8
		Lower	*Anchicodium magnum* ENDO	S11, S32, S34, S36, S40
			Oligoporella omiensis, new species	K134 K137, K142, UT77
				UT100a, T40
				UT77
	Carboniferous		*Anthracoporella spectabilis* PIA	UT13
Foraminifera (KAWADA)	Permian	Upper	lacking	
		Middle	*Ozawainella* sp.	S13, S24
			Neoschwagerina margaritae DEPRAT	S13, S24
			Sumatrina sp.	S24
			Pseudofusulina cfr. *regularis* (SCHELLW.)	S13
		Lower	*Schubertella* sp.	S11, S34, S36, S40, KH2, KH24
			Ozawainella sp.	KH1-9
			Pseudofusulina cfr. *vulgaris* (SCHELLW.)	KH1-9
			P. tschernychewi (SCHELLW.)	KH1-9
			P. krotowi (SCHELLW.)	KH23, KH24
			According of oral statements by KAWADA, KH23 and KH24 are higher horizons than that of KH1-9.	
			Fusulinella sp.	UT100a
			Pseudofusulina cfr. *alpina* var. *communis* (SCHELLW.)	K134, K137, K140, K142
			Pseudofusulina rouxi (DEPRAT)	K134, K137, K140, K142
			Triticites cfr. *simplex* (SCHELLW.)	T40
	Carboniferous		*Quasifusulina* sp.	UT13
			Triticites minimus THOMPSON	UT13
			T. milleri THOMPSON	UT13

3) KAWADA's locality number.

Among the above listed symbols T, S, KH, UT and K indicate respectively the Tamigawa River (田海川), Shimizukura (清水倉), Mt. Kurohime (黒姫山), Utatonami (歌外波) and the Kotaki River (小滝川).

According to KAWADA's report, the Ōmi limestone consists of two separate limestone blocks, the Kurohime limestone and the Myôjô limestone. The former occurs at the Tamigawa River, Shimizukura, Utatonami, and Mt. Kurohime, and the latter along the Kotakigawa River.

As will be seen from the above tables, one may note that KAWADA and the writer's opinions are nearly indentical on the stratigraphical and paleontological standpoints. However, a few disagreements exist as indicated in the following.

	ENDO		KAWADA	
KH23 KH24	Upper Permian	*Gymnocodium japonicum*	Lower Permian	*Schubertella* sp. *Pseudofusulina krotowi*
KH 1 KH 8 KH 9	Middle Permian	*Mizzia yabei* *Oligoporella s-kawadai*	Lower Permian	*Schubertella* sp. *Ozawainella* sp. *Pseudofusulina* cfr. *vulgaris* *P. tschernychewi*

According to Carl C. BRANSON's (1948) " Bibliographic Index of Permian Invertebrates" and M. L. THOMPSON's (1948) " Protozoa ", genus *Schubertella* is reported in the strata ranging from the basal Permian to the Middle Permian while *Pseudofusulina krotowi* is found in the *Schwagerina* bed alone. On the other hand, *Gymnocodium bellerophontis* (ROTHPLEZ) is reported in the Bellerophonkalk in Alpen, Europe, and its allied species *G. japonicum* (KONISHI, 1952) is found also in the Iwaisaki limestone (ENDO, MS) associated with *Yabeina*. However, since the specimens of *G. japonicum* from localities KH23 and KH24 are very poor, there is need to reexamine the specimens as well as that of *P. krotowi*. Therefore, the geological age of KH23 and KH24 need to be restudied.

The geological age of KH1, KH8 and KH9 was identified as the Middle Permian by the writer it was reported as the Lower Permian by KAWADA. Among the fossils from these localities, *Schubertella* and *Ozawainella* are found also in the Middle Permian strata and the vertical range of *Pseudofusulina tschernychewi* is great, extending from the *Schwagerina* bed to the Upper Permian. However, there might remain some problem as to the specimens of *Pseudofusulina* cfr. *vulgaris*. It is immaterial whether the specimen of *Fusulinella* sp. from UT100a is regarded as Lower Permian or Middle Permian species. The exact stratigraphical position of UT100a may be decided directly upon the basis of the field work.

In short, the stratigraphical deteminations based upon the calcareous algae may be correct in a broad sense.

Even though this species is representsented by each one of longitudinal and cross sections, they show sufficient characteristic features to identify it and determine its major characters.

Descriptions : – Thallus 6 mm. long, cylindrical; nealy circular in cross-section. Pores given off from the central stem as ball-like expansions which gradually diminish into very slender passages toward exterior. Pores are arranged perpendicularly to both inner and outer surfaces of the calcareous wall; however, they are sometimes slightly ascending towards exterior. Pores are arranged as definite whorls. The basal, spherical part of pores seem to be sporangia.

Comparisons :—This species may be compared with *Oligoporella duplicata* PIA in Europe, but the ball-like expansions at the basal part of the pores serve readily in distinguishing it from the latter species.

Remarks :—The specific name is given in honor of Shigema KAWADA, who kindly forwarded all materials of the present work to me for study.

This alga is associated with *Mizzia yabei* (KARPINSKY).

All described species of *Oligoporella* were reported only from rocks of Triassic age. Thus the present species and the following described *O. ômiensis* are believed to be the first reported occurrence of this genus in the Permian strata and the first record of it in Japan.

Occurrence :—Middle Permian: (KH8) in the limestone bed on Mt. Kurohime, Nishikubiki-gun, Niigata-Ken, Japan.

Holotype :—D. E. S., Saitama Univ., Slides Nos. 117, 124.

Oligoporella ômiensis, new species

Pl. 23, fig. 8

Measurements	*Oligoporella ômiensis* ENDO					
	D.	d.	h.	w.	p.	s.
No. 121	1.042 mm.	0.521 mm.	0.2824 mm.	7±	0.2605 mm.	0.2605 mm

This species is based on relatively well preserved longitudinal-sections and associated fragment of cross-section.

Less number of pores in a whorl, its ball-like expansion at the basal ends along the central stem and the presence of remarkable distance between two whorls suggest that the present species belongs to genus *Oligoporella*.

Descriptions :—Thallus long, cylindrical and slightly undulating; almost circular in cross-section. Pores start from the central stem as ball-like expansions which may gradually diminish into slender passages toward exterior. Pores may be slightly ascending. No sporangia observed, however the basal spherical part of pores might be furnished as sporangia.

Comparisons :—This species differs from all described species of *Oligoporella* in having a remarkable distance between two whorls, namely high numerical value of h and a small number of pores in a whorl.

Remarks : – Observed specimens are associated with *Anchicodium magnum* ENDO and *Pseudofusulina* cfr. *japonica* (GÜMB.)

Occurrence :—Lower Permian: (UT77)

in the limestione at Utatonami, Nishi-kubiki-gun, Niigata-Ken, Japan.

Syntypes:—D.E.S., Saitama Univ., Slide No. 121.

Family Codiaceae

Genus *Anchicodium* JOHNSON, 1946

Anchicodium magnum ENDO

Pl. 23, figs. 6 and 7

Anchicodium magnum ENDO, 1952, *Trans. Proc. Palaeont. Soc. Japan, N. S, No 4*, pp. 125, 126, Pl. 11, figs. 3-5.

Measurements	*Anchicodium magnum* ENDO			
	D.	p.	Diameter of fine terminal branch	d.
No. 120	0.4689 mm.	0.0771 mm.	0.0260 mm.	0.2084 mm.
No. 118	0.6252	0.1042	0.0260	0.2605
No. 113	0.7815	0.0771	0.0365	0.3647
No. 112	0.4689	0.0771	0.0260	0.1563

This species is rather abundantly and extensively distributed in the Ōmi limestone and show distinct specific charaters.

Descriptions:—The measurements, characters of pores with fine terminal branches, somewhat undulating cylindrical thalli with pith-like central mass of the present specimens indicate that they are identical with *Anchicodium magnum* ENDO from the Kitakami Mountainous Land in Japan.

Remarks:—Though almost all specimens of this species from the Kitakami Mountainous Land are coated with dark, concentric layers of some kind of sponge or Porostromata at their outside of the calcareous bodies, while the specimens from Ōmi limestone did not show any such coatings except very few cases.

Observed specimens are found in associated with *Oligoporella ômiensis*, new species, *Pseudofusulina* cfr. *alpina* var. *communis* (SCHELLW.), *P. rouxi* (DEPRAT), and *Triticites* cfr. *simplex* (SCHELLW.)

Occurrence:—Lower Permian: (S11, S32, S36, S40) in the limestone at Shimizukura; (KI34, KI37, KI40, KI42) along the Kotaki River; (UT77, UT100a) at Utatonami; and (T40) along the Tamigawa River. All these localities are situated in the Ōmi district, Nishi-kubiki-gun, Niigata-Ken, Japan.

Plesiotypes:—D.E.S., Saitama Univ., Slide Nos. 118, 120.

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Explanation of Plate 23

The symbols used for the explanation of the plate are as follows.

UT, KH, T. = Fossil localities

S. no = Slide number

Fig. 1. *Anthracoporella spectabilis* PIA (×15)
A fragment of tangential section.
Upper Carboniferous: UT 13, S. no. 114.

Figs. 2-5. *Mizzia yabei* (KARPINSKY) (×15)

2. Slightly oblique, longitudinal section and an associated, oblique cross section.
Middle Pnrmian: KH 7, S. no. 109.

3. and 4. Two cross sections showing central stems and character of pores. KH 8, S. nos. 123 and 117.

5. Two well-preserved longitudinal sections. KH 8, S. no. 117.

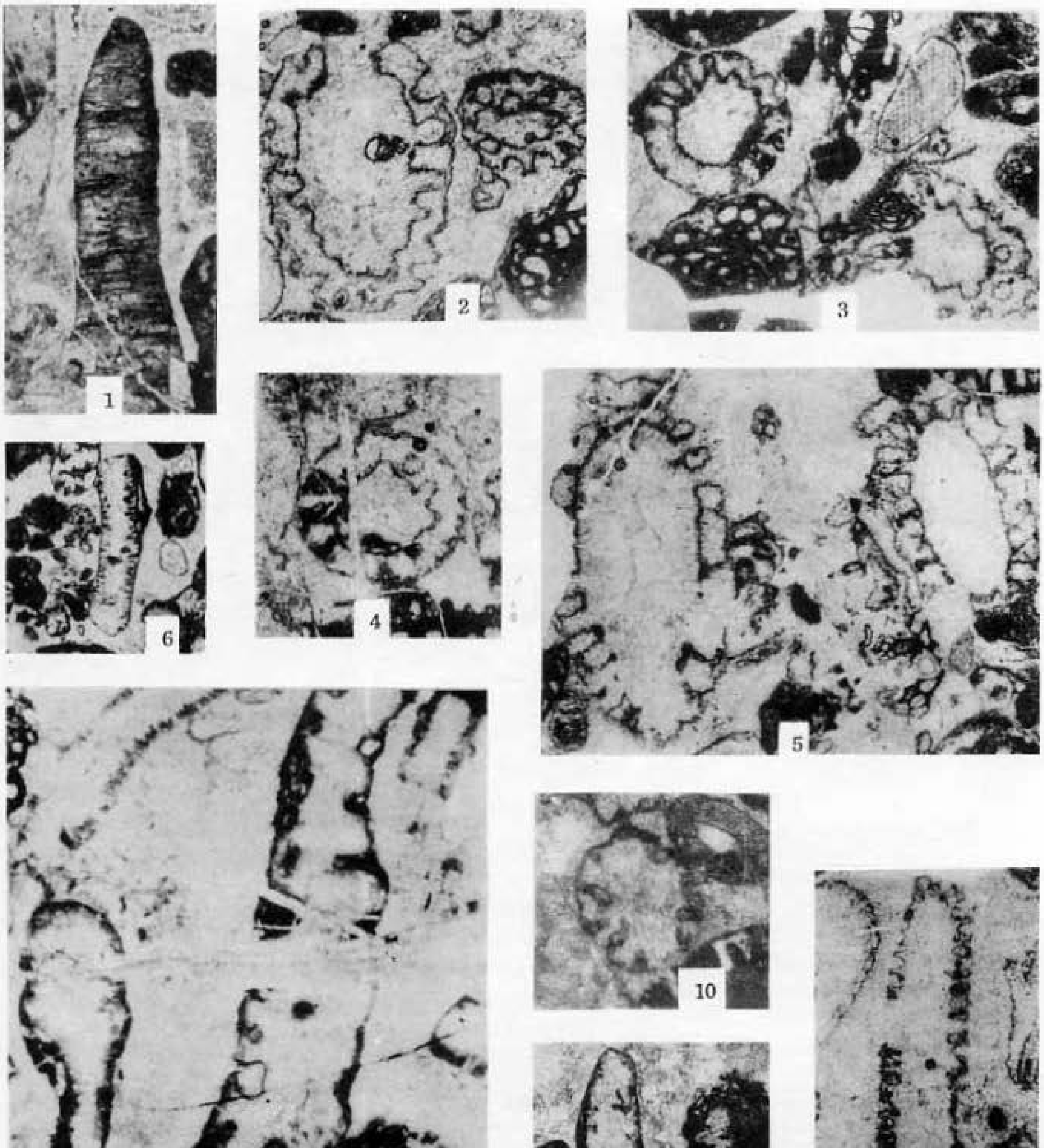
Figs. 6 and 7. *Anchicodium magnum* ENDO (×15).
Three, rather fragmental, longitudinal sections, showing branches and their tufts.
Lower Permian: T. 40, S. nos. 118, 120.

Fig. 8. *Oligoporella omiensis*, new species. (×15).
A longitudinal section and an associated fragment of cross section in the right lower corner.
Lower Permian: UT 77, S. no. 121.

Figs. 9 and 10. *Oligoporella s-kawadai*, new species. (×15)

9. Relatively well-preserved, longitudinal section showing central stem and character of pores.

10. A cross section.
Middle Permian: KH 8, S. nos. 117 and 124.



HORIGUCHI, Photo.

Trans. Proc. Palaeont. Soc. Japan, N.S., No. 8, pp. 249—254, pl. 24, Oct. 31, 1952

226. ON SOME MIOCENE PECTINIDAE FROM THE ENVIRONS OF SENDAI

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仙台附近中新統産 Pectinidae の二三に就いて：仙台附近の中新統産の Pectinidae の中，*Pecten* (*Pseudamusium*) *akihoensis* MATSUMOTO 及び，*Miyagipecten matsumoriensis* MASUDA n. sp. を記載し，新に *Miyagipecten* なる新属を提唱した。従来 *Pecten* (*Pseudamusium*) *akihoensis* MATSUMOTO は，筆者により記載された *Miyagipecten matsumoriensis* MASUDA と，屢々混同され居たもので，*Pecten* (*Pseudamusium*) *akihoensis* MATSUMOTO は *Placopecten* 属に属することが判った。又産出する Horizon は，*Placopecten akihoensis* (MATSUMOTO) は Lower Miocene であり，*Miyagipecten matsumoriensis* MASUDA は Middle Miocene で，仙台附近の層序研究の良い示準化石となる。　増田孝一郎

Introduction and Acknowledgements

Among the Pectinidae fossils hitherto recorded from the Miocene formations developed in the environs of Sendai, Miyagi Prefecture, *Pecten* (*Pseudamusium*) *akihoensis* described by H. MATSUMOTO is of particular interest, because of its limited geological range, rather wide geographical distribution and confusing characters.

The type of H. MATSUMOTO's species seems to have been lost, at least it has not been found in the collections of the Institute of Geology and Paleontology, Tohoku University or the Saito Ho-on Kai Museum, both in Sendai. His type was collected from "Kumanodô" in Takadate-mura, Natori-gun, Miyagi Prefecture, but the description given to his type is copied from I. SAGA's manuscript. However, the specimen which I. SAGA originally described and illustrated seems to have been either misplaced or lost. The manuscript name is applied to a specimen whose type locality is designated as "Akio, Natori District, Province of Rikuzen". However, Miocene marine deposits do not occur at that locality. Further, no subsequent reference has been given to the precise geographical position or geological horizon of tne type specimen.

S. NOMURA and K. HATAI reported *Pecten* (*Pseudamusium*) *akihoensis* MATSUMOTO from the Nanakita formation at Matsumori in Nanakita-mura, Miyagi-gun, Miyagi Prefecture. However, subsequent study shows that their specimen differs specifically from MATSUMOTO's, and for it a new name is proposed as shown in later pages of this article.

Under the circumstances, the writer finds it worthy to describe the characters of the so-called *akihoensis*, based upon a neotype which was collected from the Lower Miocene Moniwa formation at Kumanodo, which is the type locality of H. MATSUMOTO's specimen. He also finds it necessary to describe a new species of pectinid fossil from the Middle Miocene Nanakita formation at Matsumori, Nanakita-mura, Miyagi-gun, Miyagi Prefecture, particularly because it

1) Read June 22, 1952; received June 22, 1952

has been confused with H. MATSUMOTO's species.

Acknowledgements are due to Dr. Kotora HATAI of the Department of Geology, Junior College of Education, Tohoku University, Sendai, for kindly supervising the present work.

Description

Family Pectinidae

Subfamily Pectininae

Genus *Placopecten* VERILL, 1897

Placopecten akihoensis (MATSUMOTO), 1930

Pl. 24, Figs. 1 a-b, 2, 3.

MATSUMOTO (1930): *Pecten (Pseudamusium) akihoensis Sci. Rep. Tohoku Imp. Univ., Ser. 2, Vol. 13, No. 3*, p. 106, pl. 40, figs. 7, 8.

NOMURA and HATAI, (1936): *Saito Ho-on Kai Mus., Res. Bull., No. 10*, p. 121, pl. 16, fig. 12.

NOMURA, (1940): *Sci. Rep. Tohoku Imp. Univ., Ser. 2, Vol. 21, No. 1*, p. 20, pl. 1, figs. 2, 3, pl. 2, fig. 4.

Shell of moderate size, thin, suborbicular, subequivalve, equilateral, much compressed; right valve with numerous faint, very fine, close-set radial threads, and fine concentric growth lines; *Comptonectes* striation present near margin; radial threads usually narrower than the interspaces; auricles subequal in size, the anterior one with wide and shallow byssal notch and sculptured with only fine concentric growth lines. Left valve with about 37-40 fine, close-set, distinct, somewhat slightly imbricated primary radial threads with regular intervals and ocassionally with an intercalary riblet between the radials on lower half of disc; interspaces between radials usually wider than the radials themselves; concentric growth lines poorly developed; auricles with radial riblets and concentric lines, anterior auricle slightly larger than the posterior. Internal surface of both valves smooth.

Type locality and horizon (of Neotype and topotype specimens):—Hill side about 500 meters west of the Kumano Shrine, Kumanodô, Takadate-mura, Natori-gun, Miyagi Prefecture. (lat. 38° 11′5″ N., long. 140°50′40″ E.). Moniwa formation.

Depository:—Department of Geology, Junior College of Education, Tohoku University.

Geological horizon:—Lower Miocene.

Remarks:—Since the holotype of this

Dimensions (in mm.):—

	Right* valve	Right* valve	Right* valve	Left valve	Left valve	Left valve
Height	100 (mm.)	100	95	105	68	75
Length	96	97	90	110	68	73
Hinge length	46	45	36	50	25	31
Depth	11	ca. 11	ca. 10	10	7	8
Apical angle	105	110	100	110	105	105

.................................* Neotype specimen.

species cannot be found, the description given above was based upon a neotype specimen. Besides the neotype there are several topotype specimens which enabled the writer to study the variation in rib formation and also the relation between this species to related forms by direct comparison with the respective type materials.

In the left valve the primary riblets show no bi- or trifurcation, but remain roundly elevated and about equal to or slightly narrower than the broadly round-bottom interspaces. The primaries vary in number from 35 to 40 and may or may not have intercalary threads, but when present between the primaries, they may become nearly as strong at the margin, but are usually much weaker and occur only ocassionally. Slight imbrication of the primaries is seen only in specimens which have their surface well preserved. The other features such as convexity of the valves, presence of fine concentric growth lines, shallow byssal notch and subequal auricles remain invariable.

Although H. MATSUMOTO (1930, p. 106) described the right valve to possess fine concentric striae, the specimens of the right valve at hand are usually sculptured with numerous, very fine, faint radial threads which are additional to the fine concentric growth lines. The radial threads on the right valve are generally much weaker than those of the left. The radial threads seem to be totally lacking in several young specimens.

The left valve of this species resembles *Pecten protomollitus* and *P. arakawai*, both described by S. NOMURA (1935, p. 40, pl. 4, figs. 1, 2; p. 41, pl. 6, fig. 3) from the Miocene Tanosawa formation of the Nishi-Tsugaru District in Aomori Prefecture. In the former species there are generally three smaller threads in the interspaces between the larger ones and in the latter the primary riblets are squarish in profile and bifurcated, thus in the type of radial sculpture, those two species can be distinguished from the present one.

Placopecten akihoensis resembles *Placopecten setanaensis* KUBOTA (1950, pp. 183–184, pl. 7, figs. 1–4) from his Upper Miocene Setana formation in southwestern Hokkaido in having suborbicular, compressed, thin shell provided with numerous fine radial threads, but is distinguished therefrom by the larger auricles compared with the height of the shell, lack of internal sculpture, smaller apical angle (110°) and slightly imbricated radials, broader interspaces between the radials in the left valve, and by the left valve having much stronger sculpture than the right valve.

Placopecten clintonia rappanhannockensis MANSFIELD (1936, p. 186, pl. 23, figs. 1, 2, 3) can be distinguished from the present species by the surface of the valves being similarly sculptured with many nearly flat radials, dichotomous striation, much closer arranged radials and the right anterior with a very shallow byssal notch.

Genus *Miyagipecten* MASUDA, n. gen.

Genotype :—*Miyagipecten matsumorieis* MASUDA, n. sp.

Type locality :—Foot of the dam at Dôgasawa, about 700 meters north of Matsumori, Nanakita-mura, Miyagi-gun, Miyagi Prefecture.

Geological range :—Middle Miocene.

Diagnosis :—Shell of moderate size and thickness, subequivalve, equilateral, much compressed, suborbicular, exterior of right valve with only fine concentric growth lines, left with numerous weak, flatly raised, radial threads and fine concentric growth lines; radials becoming obsolete on lower half of disc, rarely associated with intercalary striae; interior surface smooth; hinge with strong cardinal crura and with small boss at each extremity: auricles of right valve subequal in size, anterior auricle with wide and shallow byssal notch.

Remarks.—*Miyagipecten* resembles the genus *Placopecten* VERRILL, but the latter can be distinguished from the former by possessing similar sculpture on the surface of both right and left valves, though the right is smoother than the left, and by having a ctenolium in the young stage.

Pseudamusium H. and A. ADAMS (1858, p. 553) also resembles the present genus, but can be distinguished therefrom by its smaller size, thinner test and weaker cardinal crura, possession of a ctenolium, well developed byssal notch and by exhibiting *Camptonectes* striation.

Miyagipecten matsumoriensis MASUDA, n. sp.

Pl. 24, Figs. 4a, b, 5, 6, 7a, b.

NOMURA and HATAI, (1937): *Pecten* (*Pseudamusium*) *akihoensis Saito Ho-on Kai Mus., Res. Bull., No. 13*, p. 131, pl. 20, figs. 2, 3. (not of H. MATSUMOTO, 1930).

Shell moderate in size, thin, subequivalve, equilateral, much compressed, orbicular. Right valve smooth, provided with only fine concentric growth lines; auricles subequal in size, the anterior with concentric lines and wide and shallow byssal notch; internal surface smooth. Left valve with anterior auricle slightly larger than the posterior, marked with radial threads and fine concentric growth lines; surface with 38–42 weak, flatly raised, closely arranged radial threads, which are much broader than their interspaces; radials tend to become obsolete on lower half of disc, and rarely associated with an intercalarly between them; radial threads on younger part of shell usually narrower than their interspaces, but rapidly broaden and flatten towards middle and tend to become obsolete thereon marginally. Internal surface smooth.

Type locality and horizon (*of syntype specimens*):—The foot of the dam of the water reservoir at Dôgasawa, about 700 meters north of Matsumori, Nanakita-mura, Miyagi-gun, Miyagi Prefecture. (lat. 38°19′8″ N., long. 140°55′44″ E.). Nanakita formation.

Depository:—Department of Geology,

Dimensions (in mm.) *of syntype*:—

	Right valve	Right valve	Right valve	Left valve	Left valve	Left valve
Height	76 (mm.)	87	90	69	83	62+
Length	75	88	90	ca. 67	ca. 80	67
Hinge-length	30	35	35	26	35	24
Depth	7	9	8	6	8	7
Apical angle	110°	110	105	110	105	105

Junior College of Education, Tohoku University.

Geological horizon:—Middle Miocene.

Remarks:—The radial threads of the left valve usually occupy the upper half of the shell, but in some specimens only one third to one-fourth of the disc is sculptured; rarely they extend to the margin of the shell and in such cases they are very faint and only recognizable by reflected light. In general, small specimens have the radials extending throughout their length, but with continued growth they tend to become obsolete.

Placopecten akihoensis (MATSUMOTO) resembles the present species and has been confounded with it, but MATSUMOTO's species can be distinguished from *Miyagipecten* by the faint radial threads on the surface of the right valve and by them being slightly imbricated, unequal and extending to the shell margin. Further, the interspaces between the radial threads in *Miyagipecten* are narrower than in *Placopecten akihoensis*.

Placopecten akihoensis, at least in the environs of Sendai, is limited to the Lower Miocene Moniwa formation in geological range, while *Miyagipecten matsumoriensis* is found only in the Middle Miocene Tsunaki formation (a correlative of the Nanakita formation of the Tomiya District). Thus from their respective geological ranges, it appears that these two species are good guide fossils for the Miocene stratigraphy, at least in the environs of Sendai.

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Explanation of Plate 24

Figs. 1a-b. *Placopecten akihoensis* (MATSUMOTO).
Neotype, a. right valve, × 1/2
b. hinge area of 1a, × 1

Fig. 2. *Placopecten akihoensis* (MATSUMOTO).
Topotype, right valve, × 1/2

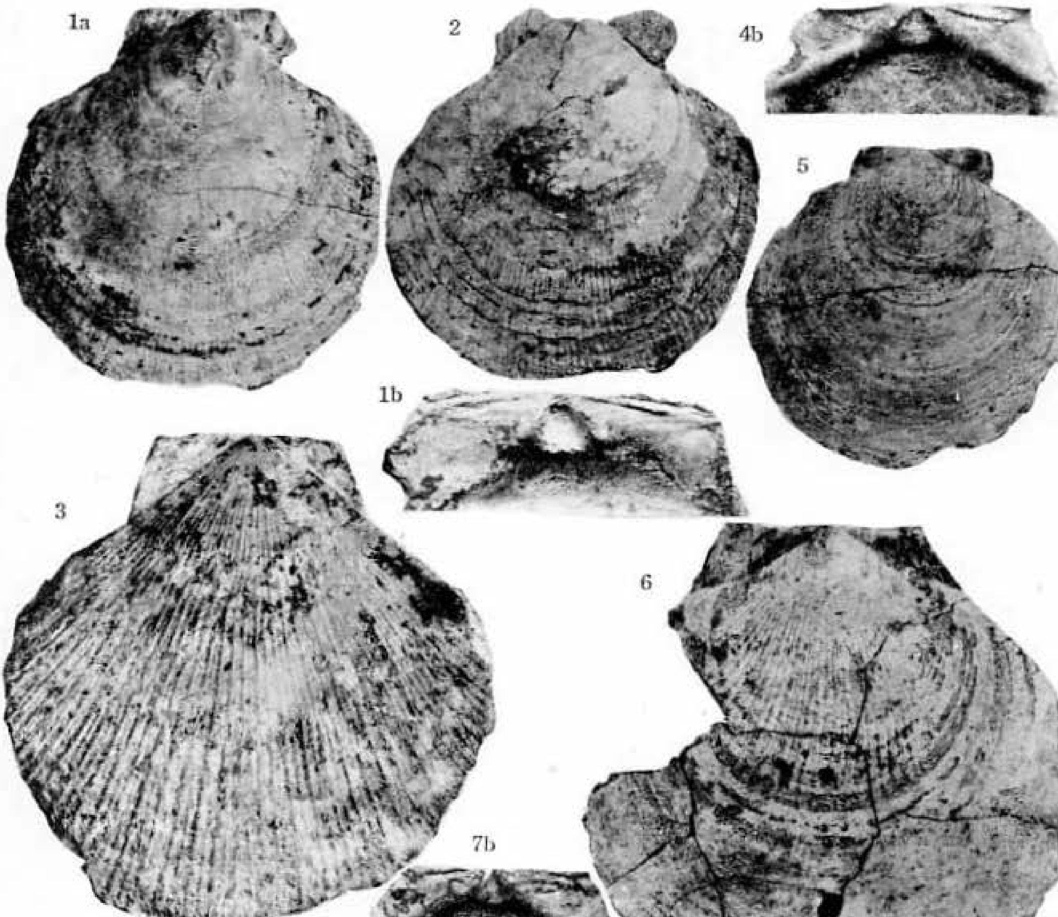
Fig. 3. *Placopecten akihoensis* (MATSUMOTO).
Topotype, left valve, × 1

Figs. 4a-b. *Miyagipecten matsumoriensis* MASUDA, n. sp.
Syntype, a, right valve, × 1
b, hinge area of 4a, × 1

Fig. 5. *Miyagipecten matsumoriensis* MASUDA, n. sp.
Syntype, right valve, × 1/2

Fig. 6. *Miyagipecten matsumoriensis* MASUDA, n. sp.
Syntype, left valve, × 1

Figs. 7a-b. *Miyagipecten matsumoriensis* MASUDA, n. sp.
Syntype, a, left valve, × 1
b, hinge area of 7a, × 1.



K. KUMAGAI, Photo.

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Palaeontological Society of Japan

(The heading in Japanese commemorates the handwriting of Prof. M. YOKOYAMA, father of Japanese Palaeontology, who was Professor of Stratigraphy and Palaeontology at the Geological Institute, Imperial University of Tokyo.)

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CONSTITUTION
of the
PALAEONTOLOGICAL SOCIETY OF JAPAN

ARTICLE 1. Name

The Society shall be known as the Palaeontological Society of Japan. The Society is a section of the Geological Society of Japan.

ARTICLE 2. Object

The object of the Society shall be to promote the study of palaeontology and related sciences.

ARTICLE 3. Achievement

The Society in order to execute Article 2 shall (a) issue the Society journal and other publications, (b) hold or sponsor scientific lectures and meetings, and (c) sponsor collecting or field trips, and lectures.

ARTICLE 4. Membership

The Society shall be composed of persons who are active of interested in palaeontology or related sciences, and shall be known as regular members, honorary members, and patrons.

ARTICLE 5. The members of the Society shall be obliged to pay annual dues to the Society, for which they shall enjoy the privilege of receiving the Society's journal and of submitting papers which have been read and discussed at the meetings for publication in the Society's journal.

ARTICLE 6. Administration

The Society shall have the following organizations for its administration.

(a) General meeting. The general meeting shall be composed of the Society members. More than one tenth of regular members shall be present to hold general meetings. Administrative affairs shall be decided during the general meeting.

(b) President. The president shall be elected from among the regular members. The president shall represent the Society and supervise its business matters.

(c) Council. The council shall be composed of councillors who are elected from among the regular members. The council shall discuss administrative affairs.

(d) Business council. The business councillors shall be elected from among the council members, and shall administer business affairs.

(e) Officers shall be elected by vote of returned mail ballots, as a general rule.

ARTICLE 7. Amendments to the constitution shall be by decision of the general meeting.

By-Laws and Administration

ARTICLE 8. The Society's journal shall be issued three times a year.

ARTICLE 9. Regular members shall be persons who have knowledge, experience, or interest in palaeontology or related sciences.

ARTICLE 10. Patrons shall be selected individuals or organizations who give special support to the objectives of the Society.

ARTICLE 11. Honorary members shall be persons of distinguished achievement in palaeontology. The council shall nominate honorary members for decision by the general meeting.

ARTICLE 12. Applicants for membership to the Society shall submit their full name, mailing address, date of birth, occupation, and name of school from which they graduated.

Dues

ARTICLE 13. Rates for annual dues of the Society shall be decided during the general meeting. Annual dues for regular members is Yen 400.00 (domestic members) and U.S. $ 2.00 (foreign members). Patrons are individuals or organizations donating more than Yen 10,000.00 annually. Honorary members are free from obligations.

ARTICLE 14. The Society income shall be from membership dues and bestowals.

ARTICLE 15. The Society shall have one chairman, fifteen councillors, and several business councillors, whose term of office shall be two years. They may be re-elected.

Addendum

ARTICLE 1. There shall be four business councillors for the present.

ARTICLE 2. The Society journal shall be issued three times a year for the present.