

Makoto NISHIDA\* & Tōru ŌISHI\*\* : **Some petrified plants from the Cretaceous of Kwanto Mountains, central Japan (2)\*\*\***

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(Plates XVII-XVIII)

The so-called Sanchu-Graben in the Kwanto Mountains of central Honshu, Japan, is famous to bear abundant plant fossils in its lower Cretaceous strata which are called the Sebayashi formation. The fossil-bearing beds are dated from Barremian to Aptian (Matsukawa 1977). Kimura & Matsukawa (1979) described many species of plant impressions from there. Nishida & Tanaka (1982) described a tree-fern stem, *Cyathocaulis naktongensis* Ogura, which is the first petrified plant described there. Subsequently Nishida & Nishida (in press) described three species of coniferous wood including a new species of *Mesembrioxylon*. In this paper, we will describe two new species of araucarian type of wood. The locality and geological details are commented by Nishida & Tanaka (1982).

4)<sup>1)</sup> ***Araucarioxylon pseudo-hujinamiense***, sp. nov. (Pl. XVII)

Materials. The specimens (nos. 81110-81115) are silicified fragments of secondary wood, 3-8 cm in diameter and 5-12 cm in length, and fairly well preserved. The holotype (no. 81110) is deposited in the Laboratory of Phylogenetic Botany, Chiba University.

Description. Growth rings invisible. Wood consists only of tracheids and rays, and is devoid of wood parenchyma and resin canals. Tracheids are arranged regularly in radial rows, rectangular in shape in cross section, 24-40  $\mu\text{m}$  and 24-40  $\mu\text{m}$  in radial and tangential diameters respectively. Bordered pits on

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<sup>1)</sup> Consecutive number from the first paper of this series (Nishida & Nishida, in press).

radial walls are of typical araucarian type and arranged contiguously in 1-3 rows, and if in more than one, arranged alternately. They are hexagonal, circular or flattened circular in outline, 16-20  $\mu\text{m}$  in diameter, and with circular pit apertures of 3-4  $\mu\text{m}$  in diameter. Bordered pits on tangential walls are not discernible. Many of tracheids are occluded with numerous tyloses and septulated by some false septa which seems to originate in tyloses. Some tracheids are also occluded with brown substances. Rays are all parenchymatous, almost uniseriate, rarely biseriate in part, 2-29 cells high or 37-404  $\mu\text{m}$  in height and run at intervals of 1-9, average 3.8, tracheids, and there are 7-10, average 8.2, rays in 1 mm. Ray cells are rectangular in shape in tangential section, 27-38  $\mu\text{m}$  and 24-40  $\mu\text{m}$  in vertical and horizontal widths respectively. Ray cells are pitted only on radial walls; devoid of abietineous pits. Single large ovoid or oblong pit in the cross field, 16-20  $\mu\text{m}$  and 6-16  $\mu\text{m}$  in long and short diameters respectively.

Affinity. As described above, the present specimens are characterized by having numerous tyloses in many tracheids as well as typical araucarian type of wood structure, and resemble very closely *A. hujinamiense* Ogura from the Lower Cretaceous of Yuasa, Arida, Wakayama Prefecture (Ogura 1960) and of Choshi, Chiba Prefecture (Nishida 1973), in gross morphology except for status of rays. Namely *A. hujinamiense* and our specimens have shared following diagnostic characters: woods composed only of tracheids and rays, tracheids occluded with tyloses which appear often septa, single large ovoid pit in the cross field and height of rays, 2-29 cells high. Our specimens, however, differ from *A. hujinamiense* in having almost uniseriate rays instead of often being biseriate in the latter. Thus our specimens would be a new species belonging to *Araucarioxylon* with tyloses in their tracheids.

5) **Prototaxoxylon japonicum**, sp. nov. (Fig. 1, Pl. XVIII)

Materials. Specimens (nos. 81105-81109) are fragments of secondary wood, 3-8 cm in diameter and 5-10 cm in length, and are fairly well preserved. The holotype (no. 81105) is deposited in the Laboratory of Phylogenetic Botany, Chiba University.

Description. Growth rings are indistinct. Wood consists of tracheids and rays and is devoid of wood parenchyma and resin canals. Tracheids are arranged regularly in radial rows, and are rectangular or radially elongated rectangular in cross section, 40-70  $\mu\text{m}$  and 48-88  $\mu\text{m}$  in tangential and radial di-

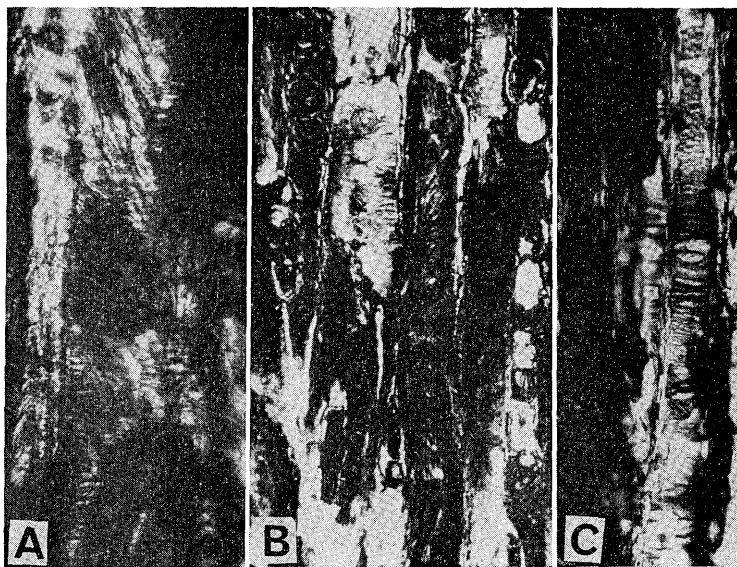


Fig. 1. *Prototaxoxylon japonicum*, sp. nov. A-C. Tertiary spiral thickenings on tangential walls of tracheids. Spiral thickenings like annular thickenings and oblique striation are seen in A. Spiral thickenings on the inner side of bordered pits are seen in B. A,  $\times 360$ . B & C,  $\times 180$ .

ameters respectively. Bordered pits on radial walls of tracheids are arranged contiguously in one to three, or more frequently in two rows, and if in two rows, the arrangement of pits is usually opposite or often alternate. Pits in two rows are mostly square in outline. Pits in one row are compressed circular and pits in three rows are somewhat hexagonal, 16-24  $\mu\text{m}$  in diameter with ovoid or circular pit aperture of 6-7  $\mu\text{m}$  in long diameter. Bordered pits on tangential walls of tracheids are arranged sparsely in irregular one row or slightly contact with each other, circular in outline and 12-20  $\mu\text{m}$  and 12-16  $\mu\text{m}$  in horizontal and vertical diameters respectively, and with circular pit aperture of 4-6  $\mu\text{m}$  in diameter. Tracheids often have tertiary spiral thickenings which are single spirals running almost horizontally with intervals of 1-5  $\mu\text{m}$ . Rays always uniseriate, 1-26, usually 4-10, cells high or 36-808  $\mu\text{m}$  in height. Ray cells are rectangular in shape in tangential section, 18-36  $\mu\text{m}$  and 16-35  $\mu\text{m}$  in vertical and horizontal widths respectively. Walls of ray cells are somewhat thin, and pitted only on radial walls, and devoid of abietinuous pits. There

are 7-15, rarely only 5, half-bordered pits in the cross field, which are arranged in two to three, rarely four, horizontal rows,  $6 \times 6 \mu\text{m}$  in diameter. Rays run at intervals of 1-17, average 5.0, rows of tracheids; there are 4-8, average 5.9, rays in 1 mm.

Affinity. As described above, our specimens exhibit diagnostic characters of trunks of the Araucariaceae in the arrangement of bordered pits on tracheids and in lacking wood parenchyma, and resemble very closely *Dadoxylon* (*Araucarioxylon*) *japonicum* Shimakura (1936) in having often contiguously and oppositely arranged bordered pits on radial walls of tracheids, in the height of rays and the number and arrangement of half-bordered pits in the cross field. Our specimens, however, differ clearly from the latter in having tertiary spiral thickenings on some tracheids.

There have been, hitherto, many reports concerning petrified woods with tertiary spiral thickenings on tracheids from Mesozoic strata as well as Palaeozoic. Of these, *Taxaceoxylon* Kräusel & Jain (1964) (*Taxoxylon* Unger 1947), *Torreoxylon* Greguss (1967), some species of *Piceoxylon* Gothan (1906), and *Protopiceoxylon* Gothan (1907) exhibit ordinary coniferous type of pitting on tracheids and are distinguished from our specimens. The latter two genera differ also from our specimens in having resin canals either normal or traumatic.

Araucarian type of wood with tertiary spiral thickenings have been described under following genera: *Prototaxoxylon* Kräusel & Dolianiti (1958) (*Spiroxylon* Walton 1925), *Tikioxylon* Goswami (1973), *Taxopitys* (Kräusel 1928) and *Parataxopitys* (Kräusel & Dolianiti 1958). Of these, *Taxopitys* and *Parataxopitys* have been found only from Permo-Carboniferous strata (Kräusel & Dolianiti 1958). *Taxopitys* has been found hitherto from Africa (Kräusel 1928), Siberia (Shilikina 1960) and Brasil (Kräusel & Dolianiti 1958), and is characterized by having sclerenchymatous cell groups in the pith and mesarch primary xylems. *Parataxopitys* has been described only from the Carboniferous of Brasil (Kräusel & Dolianiti 1958) and has scattered stone cells in the pith. Araucarian type of secondary wood with tertiary spiral thickenings and without pith ought to be placed in *Prototaxoxylon* or *Tikioxylon*.

There have been hitherto described four species of *Prototaxoxylon*. *P. brasilianum* Kräusel & Dolianiti (1958) from Permo-Carboniferous of Brasil resembles our specimens in having close, narrow and nearly horizontal spirals which are seemingly annular thickenings, but differs distinctly in having one-

rowed, occasionally two-rowed alternate bordered pits, often biseriate rays of lower, 1-6 cells in height and one to four pits in the cross field, and being devoid of bordered pits on tangential walls, instead of one to three, if in two, oppositely arranged bordered pits, rays of 1-26 cells in height, 5-15 pits in the cross field and bordered pits on tangential walls in the latter. *P. africanum* (Walton) Kräusel & Dolianiti from the Permian of Africa exhibits also often biseriate rays of 1-18 cells in height, 2-8 pits in the cross field and usually one-rowed, occasionally two-rowed and alternate bordered pits on radial walls but not on tangential walls. *P. indicum* (Mehta) Prakash & Srivastava (1961) from the Lower Permian of India resembles our specimens in having uniseriate rays, but differs from the latter in having very low rays, double (bi-seriate) spirals running inclined at 30-50°, usually one-rowed, occasionally two-rowed, and separately or contiguously arranged bordered pits on radial walls. *P. intertrappeum* (Prakash & Srivastava) Prakash & Srivastava (1961) from the Triassic of India is distinguished from our specimens in having uni-, bi- and triseriate rays of 2-30, often upto 50 cells in height, and 1-10 pits in the cross field. Moreover, *P. intertrappeum* is characterized by having bi- or triseriate spirals, both left and right handed, running inclined at 50-70°. *Tikioxylon* was described from the Triassic of India and exhibits araucarian structure of wood with spiral thickenings. All diagnostic characters described by Goswami (1973), however, would be common to those of *Prototaxoxylon*. The former, hence, would be synonymous with the latter. Two species hitherto described of *Tikioxylon*, *T. hughesii* Goswami and *T. spiralli* Goswami, are distinguished from the present specimens by having less than six pits in the cross field and lower, 1-16 cells high, rays. As mentioned above, our specimens does not coincide with any other species of *Prototaxoxylon* in important diagnostic characters. Thus we believe our specimens to be a new species belonging to *Prototaxoxylon*. This finding is new to the Cretaceous as well as to Japan.

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### Explanation of plates XVII—XVIII

Plate XVII. *Araucarioxylon pseudo-hujinamiense*, sp. nov.

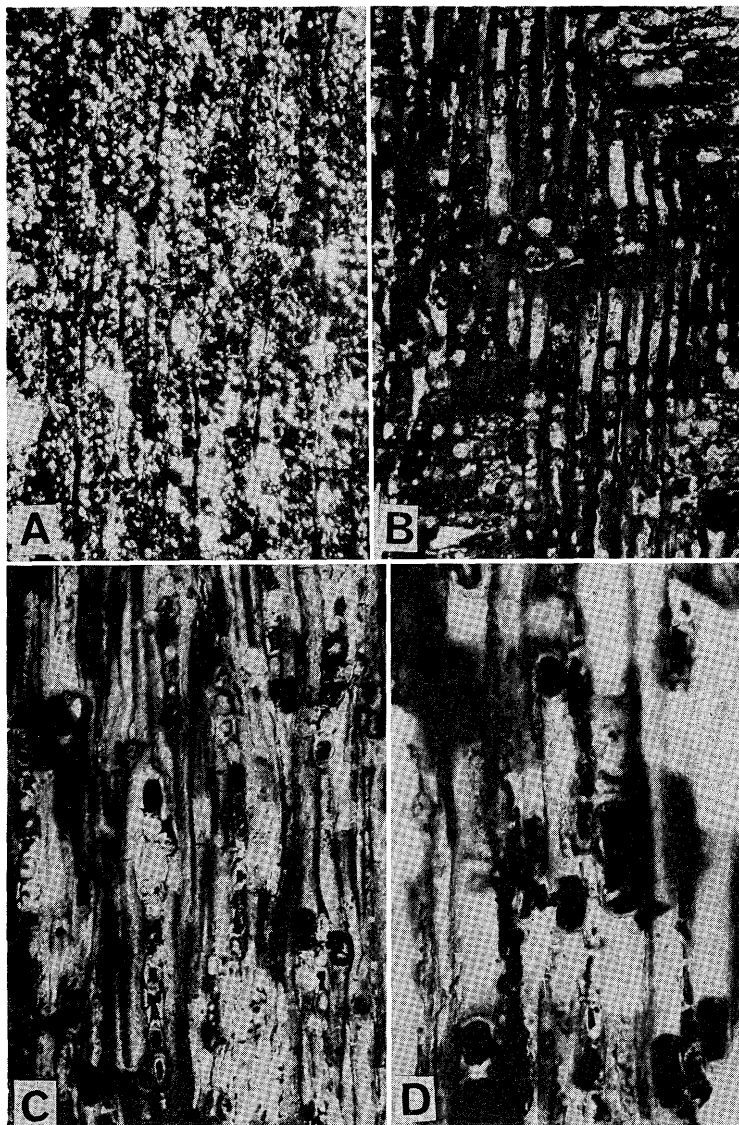
A. Cross section. B. Radial section. C & D. Tangential sections. Several pits in the cross field are seen on left below of B. Septulate tracheids and tyloses in tracheids are seen in B & D. A,  $\times 40$ . B & C,  $\times 90$ . D,  $\times 180$ .

Plate XVIII. *Prototaxoxylon japonicum*, sp. nov.

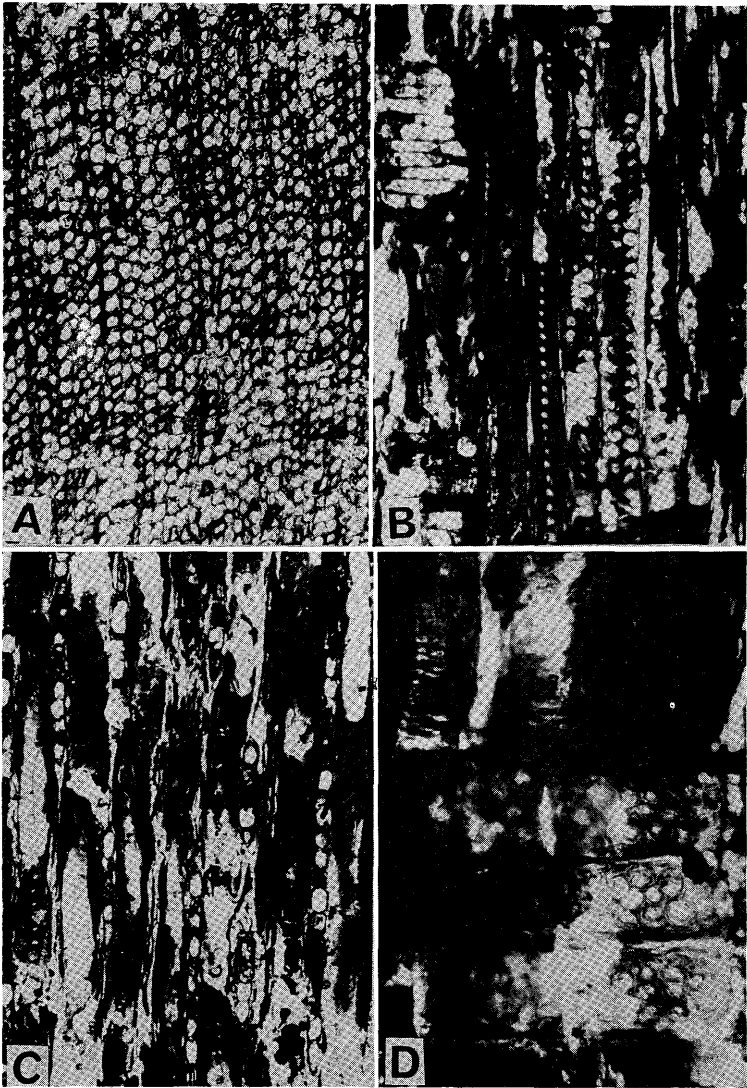
A. Cross section. B & D. Radial sections. C. Tangential section. Numerous pits in the cross field are seen in D. Spiral thickenings like annular thickenings are seen on left above of D. A,  $\times 48$ . B & C,  $\times 88$ . D,  $\times 360$ .

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関東山地、いわゆる山中部溝帯の下部白亜紀（バレミアン〜アプチアン）から得た材化石の第2報で、*Araucarioxylon pseudo-hujinamiense*, sp. nov. および *Prototaxoxylon japonicum*, sp. nov. の2新種を記載した。前者は和歌山県有田及び千葉県銚子の下部白亜紀産 *A. hujinamiense* Ogura (1960) と基本構造はよく似ているが、放射組織が常に1列である点で区別できる。*P. japonicum* はナンヨウスギ型の材に第三次らせん肥厚が現れるものとしては日本及び白亜紀からものはじめての記録で、いままでにブラジルの石炭紀、インドの二疊紀、三疊紀から4種記載されている。基本構造は *Dadoxylon japonicum* Shimakura (1936) によく似ているが、仮道管にはほぼ水平な環紋に似たらせん肥厚をもつので区別できる。



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