

Structure and Affinities of the Petrified Plants from the
Cretaceous of Northern Japan and Saghalien IV*
Petrified Plants from the Upper
Cretaceous of Saghalien (2)**

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Four species including two new species, *Araucarioxylon pseudochohiense* sp. nov., *Taxodioxylon pseudoablertense* Nishida et H. Nishida, *Taxodioxylon nihongii* Nishida et H. Nishida and *Taxaceoxylon saghalienense* sp. nov., were described from the Upper Cretaceous (Late Turonian-Santonian) of southern Saghalien.

Key words: Coniferous woods — Cretaceous — Petrified plants — Saghalien.

Following the preceding report on the description of five species of petrified plants from Saghalien (Nishida and Nishida, 1986), this paper deals with four species including two new species; *Araucarioxylon pseudochohiense* sp. nov. and *Taxaceoxylon saghalienense* sp. nov. The locality map of the fossil collecting sites has been shown in the previous paper (Nishida and Nishida, 1986)

***Araucarioxylon pseudochohiense* sp. nov.** (Figs. 1 and 2).

Araucarioxylon sp. in Nishida, Bot. Mag. Tokyo 80: 491 (1967).

Material. The specimen, no. 11003 (holotype) is a fragment of twig consisting of secondary wood, 7×17 mm in diameter and 2.5 cm long, with histology fairly well preserved.

Description. Secondary wood of araucarian type. Growth rings absent. Wood consists of tracheids and rays; lacking wood parenchyma and resin canals. Tracheids round, rectangular or polygonal in outline in cross section, 17-36 μm in tangential and 14-30 μm in radial diameters. Bordered pits on radial walls 12-15 μm in diameter, arranged contiguously in a single row and more or less compressed horizontally. Pits on tangential walls also arranged contiguously in a single row, rather small, 10 μm in diameter. Shape of pit aperture not discernible. Rays exclusively uniseriate, 1-6,

* Consecutive number from the previous paper (Nishida and Nishida, 1986).

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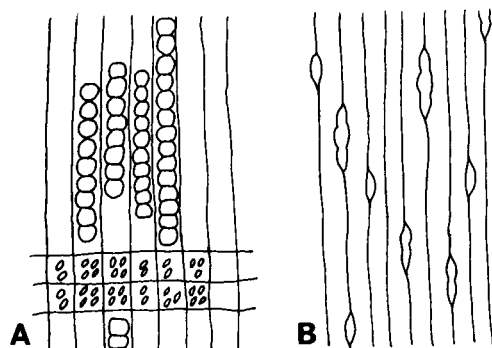


Fig. 1. *Araucarioxylon pseudochohiense* sp. nov. Radial (A) and tangential (B) sections. A, $\times 190$; B, $\times 96$.

usually 2-3 (80%), cells high, or 20-120 μm in height. Rays occur at intervals separated by 2-13, in average 6.8, rows of tracheids, or there are 5-7, in average 5.8, rays per 1 mm. Ray cells elliptical or barrel-shaped in tangential section, variable in size, 20-40 μm in vertical and 9-19 μm in horizontal widths. Ray cell walls smooth except in radial view. Horizontal endwalls between ray cells are badly preserved or completely destroyed. Two to five elliptical pits in the cross field obliquely inclined, 7-9 μm in long diameter, and arranged in two vertical rows.

Affinity. The newly examined specimen is characterized by low rays, usually 2-3 cells high. *Araucarioxylon choshiense* Nishida from the Lower Cretaceous of Choshi, Chiba Prefecture shows similar characteristics (Nishida, 1965). The specimen resembles *A. choshiense* also in cross field pitting; 2-5 pits arranged in two vertical rows, in having small sized tracheids, usually 20-25 μm in diameter, and in the arrangement of bordered pits on tracheids. The specimen, however, differs from *A. choshiense* in the absence of wood parenchyma and septulated tracheids. Nishida (1967) reported another specimen with low rays and bordered pits on tangential walls of some tracheids, *Araucarioxylon* sp., from Choshi. The present specimen has the same diagnostic characters as those of *Araucarioxylon* sp. by Nishida (1967). We therefore, assign *Araucarioxylon* sp. by Nishida (1967) to *A. pseudochohiense*. The present specimen resembles also *A. parachoshiense* Nishida et H. Nishida (1985a) from the Upper Cretaceous of Chile in having low rays and 2-4 pits in the cross field, but differs from the latter in having bordered pits on tangential walls of tracheids. Specific epithet is derived from *A. choshiense*.

Locality. Miho River, a tributary of the Nayba (Naibuchi River).

Horizon. Miho Group, Upper Cretaceous (Late Turonian-Santonian).

Distribution. Japan: Chiba Prefecture (Lower Cretaceous) and Saghaliën.

Taxodioxylon pseudoalbertense Nishida et H. Nishida, *J. Jap. Bot.* **60**: 313 (1985). (Fig. 3A, B)

Material. The specimen, no. 11073, is a fragment of branch showing taxodioid wood structure, 3.5 \times 5.6 cm in diameter and 7.0 cm long, and well preserved histologically.

Brief note. Growth rings faintly visible. False growth rings present at places.

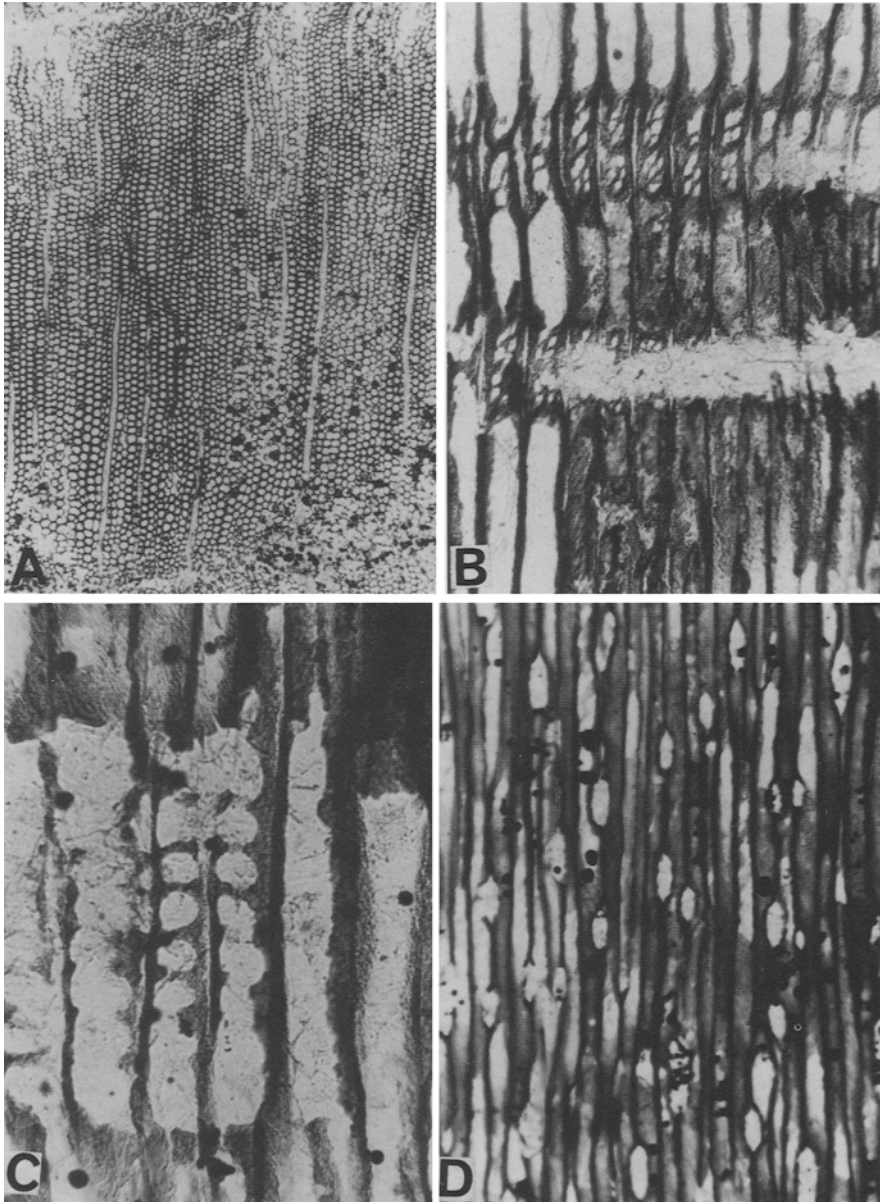


Fig. 2 *Araucarioxylon pseudochohiense* sp. nov. A: Cross section. B: Radial section showing four or five pits in the cross field. Horizontal end walls between ray cells are destroyed. C: Radial section showing contiguously arranged uniseriate bordered pits on tracheids. D: Tangential section showing lower rays. A, $\times 38$; B, $\times 190$; C, $\times 380$; D, $\times 96$.

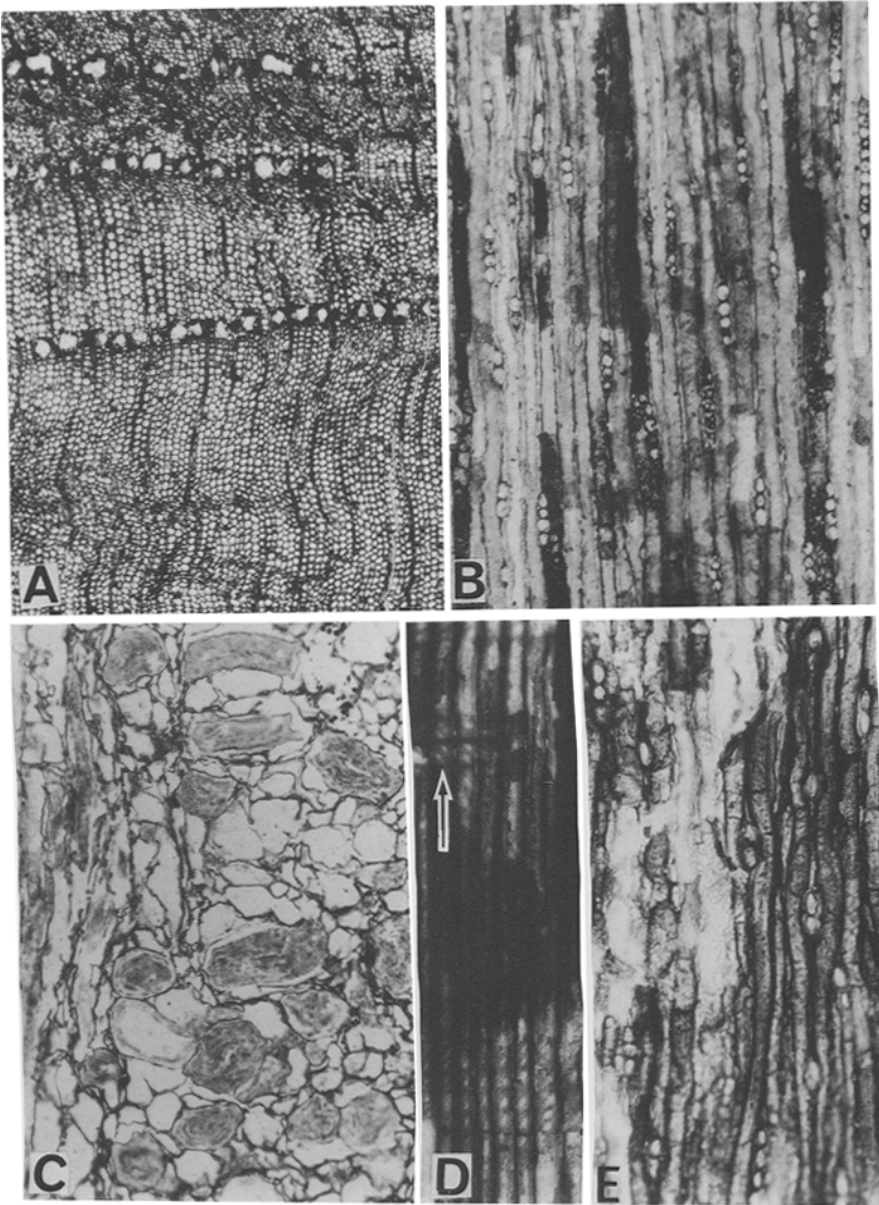


Fig. 3. *Taxodioxyton pseudoalbertense* Nishida et H. Nishida (A, B) and *Taxodioxyton nihongi* Nishida et H. Nishida (C-E). A: Cross section showing traumatic resin canals. B: Tangential section showing rays ranging up to 11 cells high. C: Radial section of pith showing huge mucilaginous cells. D: Radial section showing one or two pits in the cross field. (arrow). E: Tangential section showing rays less than four cells high. A, $\times 38$; B, $\times 96$, C-E, $\times 190$.

Transition from early to late wood abrupt. Wood parenchyma abundant, scattered throughout the increments. Tracheids pitted on both radial and tangential walls. Bordered pits on radial walls arranged separately or sometimes contiguously in a single row or sometimes in two rows. Tangential walls sparsely pitted by small bordered pits. Rays uniseriate, 1-14, usually 1-5 (88%), cells high. Traumatic resin canals often formed, surrounded by 8-11 epithelial cells and arranged in tangential series. Diagnostic characters of the specimen are the same as those of *Taxodioxyton pseudoalbertense* from the Upper Cretaceous of Hokkaido (Nishida and Nishida, 1985b). The rays of the specimen are somewhat lower than those of the Hokkaido specimen, where rays are up to 20 cells high.

Locality. Jyuhachirinpan-zawa, a tributary of the affluent of the Nayba (Naibu-chi River).

Horizon. Miho Group, Upper Cretaceous (Late Turonian-Santonian).

Distribution. Japan: Hokkaido (Upper Cretaceous). New to Saghalien.

Taxodioxyton nihongii Nishida et H. Nishida, J. Jap. Bot. **60**: 314 (1985). (Fig. 3C-E)

Material. The specimen, no. 12029, is a part of a twig consisting of secondary wood and pith, 9 mm in diameter and 30 mm in length, and well-preserved histologically.

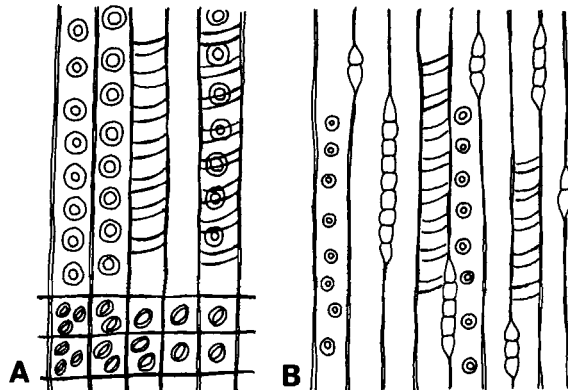
Brief note. Taxodioid wood with traumatic resin canals. Tracheids small, generally 20-30 μ m in diameter, pitted on both radial and tangential walls. Pits on tangential walls distributed sparsely. Rays always uniseriate, very low, 1-8, usually 1-4 cells high. One or two pits occur in the cross field. Pith composed of parenchymatous cells and large mucilaginous cells occluded with brown substances. Our specimen is characteristic in having large mucilaginous cells in the pith, and its diagnostic characters coincide with those of *Taxodioxyton nihongii* Nishida et H. Nishida (1985b) from the Upper Cretaceous of Hokkaido, Japan.

Locality. The Chishima River, a tributary of the Fukuryu River.

Horizon. Miho Group, Upper Cretaceous (Late Turonian-Santonian).

Distribution. Northern Japan: Hokkaido (Turonian-Campanian). New to

Fig. 4. *Taxaceoxyton saghalienense* sp. nov. Radial (A) and tangential (B) sections showing pairing tertiary spiral thickenings on some tracheids. A, $\times 340$; B, $\times 200$.



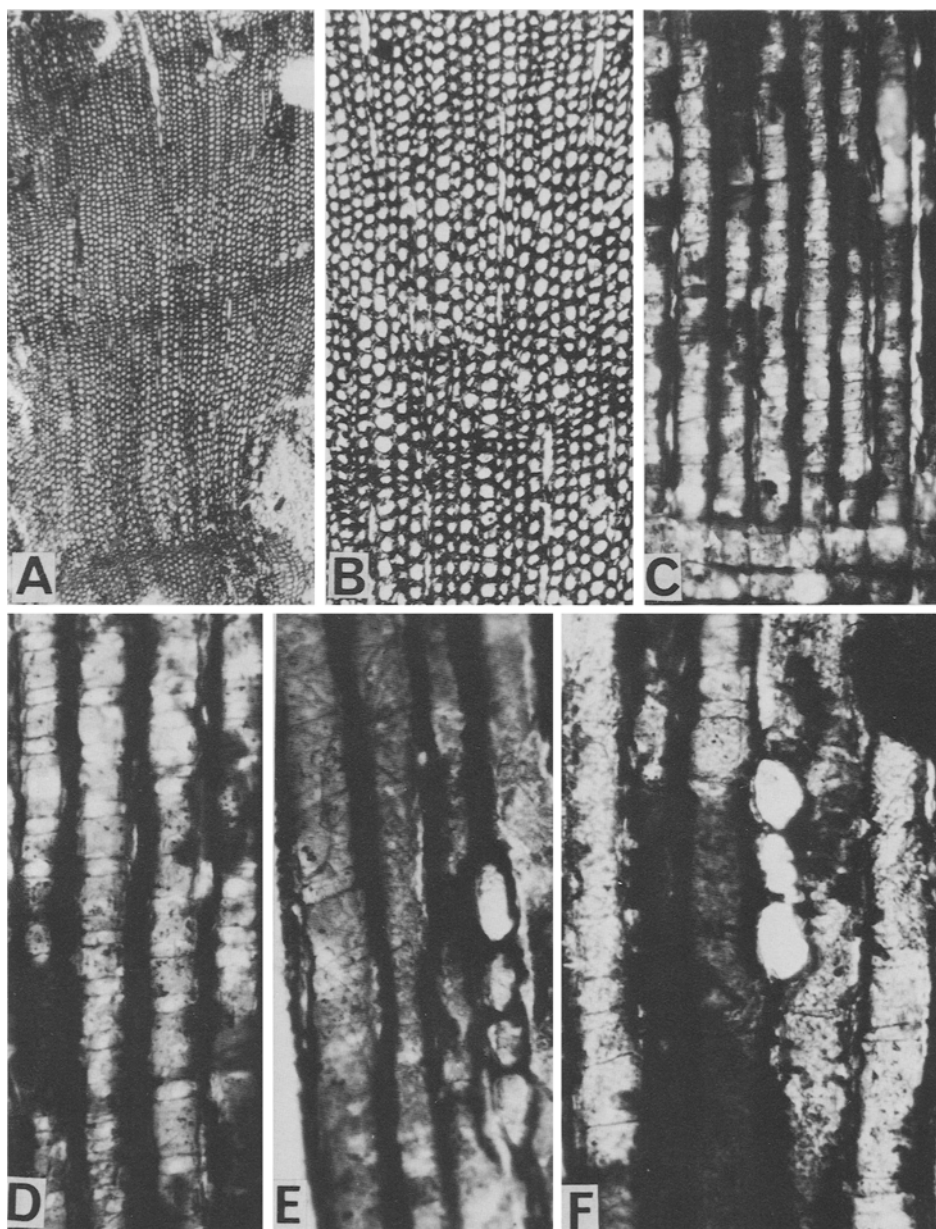


Fig. 5. *Taxaceoxylon saghalienense* sp. nov. A, B: Cross section. C, D: Radial sections showing pairing tertiary spiral thickenings. E, F: Tangential sections showing lower rays and pairing spirals. A, $\times 40$; B, $\times 105$; C, $\times 205$; D-F, $\times 410$.

Saghalien.

***Taxaceoxylon* (*Torreyoxylon*) *saghalienense* sp. nov.** (Figs. 4 and 5).

Material. The specimen, no. 11029 (holotype) is a piece of the secondary wood, 2.5×3.3 cm thick and 5.6 cm long, and fairly well-preserved histologically.

Description. Growth rings faintly visible. Transition from early to late wood

abrupt. Secondary wood consisting of tracheids and rays. Wood parenchyma and resin canals absent. Tracheids rectangular in outline in cross section, variable in size, 17-38 μm in radial and 16-43 μm in tangential diameters. Bordered pits on radial walls of tracheids circular, 12-16 μm in diameter, arranged separately in a single row, with circular pit aperture of 4-5 μm in diameter. Crassulae not visible. Bordered pits often occur on tangential walls, especially in the late wood. Pits small, sparsely arranged in one row. Tracheids often with tertiary double spiral thickenings on the walls. Spirals running with a pitch of 12-24 μm , and inclined 10-30 degrees or sometimes nearly horizontal. Distance between each component of the double spiral is 5-8 μm . Rays parenchymatous, always uniseriate, usually 1-7 cells high or 20-164 μm in height, sometimes up to 12 cells high or 232 μm in height. Rays run at intervals of 1-16, in average 7.3, rows of tracheids or there are 3-7, in average 5.0, rays in 1 mm. Ray cells barrel-shaped in tangential section, 12-20 μm in horizontal and 20-38 μm in vertical widths, pitted only on radial walls. One to three cupressoid or taxodioid half-bordered pits occur in the cross field.

Affinity. The examined specimen closely resembles *Taxaceoxylon japonomesozoicum* Nishida (1973) from the Lower Cretaceous of Choshi, Chiba Prefecture, in general structure. Our specimen, however, differs from *T. japonomesozoicum* in having double spiral thickenings on tracheid walls. The spiral thickenings of *T. japonomesozoicum* are single. In this respect our specimen belongs to *Torreoxylon* sensu Greguss (1967). In the Mesozoic, there are only two or three species of taxaceous woods that have plural spiral thickenings. *Torreoxylon boureaui* Greguss (1967) from the Lower Cretaceous of Hungary has two or three rows of spiral thickenings which run at an interval of 15-30 μm or even 50 μm , and several small pits in the cross field. *Taxaceoxylon rajmahalense* Kräusel et Jain (1964) from the Jurassic of India also has double spiral thickenings. It, however, differs from our specimen in having a steep inclination of spirals (more than 40-70 degrees) on tracheid walls and higher rays, up to 22 cells high instead of 1-7 cells high in our specimen. *Taxaceoxylon mcmurrayensis* Roy (1972) from the Lower Cretaceous of Canada is also distinguished from our specimen in having 1-3 spiral thickenings which run almost horizontally or sometimes steeply inclined, and 4-6 pits in the cross field. Based on the characteristics mentioned above we designate the specimen as a new species of *Taxaceoxylon*.

Locality. Jyuhachirinpan-zawa, an affluent of the Nayba (Naibuchi River).

Horizon. Miho Group, Upper Cretaceous (Late Turonian-Santonian).

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References

- GREGUSS, P. 1967. Fossil Gymnospermous Woods in Hungary, from the Permian to the Pliocene. Akademiai, Kiado, Budapest.
 KRÄUSEL, R. AND K.P. JAIN. 1964. New fossiliferous woods from the Rajmahal Hills, Bihar,

- India. *Palaeobotanist* **12**: 59-66.
- NISHIDA, M. 1965. On some petrified plants from the Cretaceous of Choshi, Chiba Prefecture II. *Bot. Mag. Tokyo* **78**: 138-146.
- . 1967. On some petrified plants from the Cretaceous of Choshi, Chiba Prefecture IV. *Bot. Mag. Tokyo* **80**: 487-497.
- . 1973. On some petrified plants from the Cretaceous of Choshi, Chiba Prefecture VI. *Bot. Mag. Tokyo* **86**: 189-202.
- NISHIDA, M. AND H. NISHIDA. 1985a. Petrified woods from the Upper Cretaceous of Quiriquina Island. *Rep. Bot. Survey Bolivia and Southern Chile. Fac. Sci. Chiba Univ.* p. 27-34.
- AND ———. 1985b. Structure and affinities of the petrified plants from the Cretaceous of Northern Japan and Saghalien II. Petrified plants from the Upper Cretaceous of Hokkaido (2). *J. Jap. Bot.* **60**: 312-320.
- AND ———. 1986. Structure and affinities of petrified plants from the Cretaceous of Northern Japan and Saghalien III. Petrified plants from the Upper Cretaceous of Saghalien (1). *Bot. Mag. Tokyo* **99**: 191-204.
- ROY, S.K. 1972. Fossil wood of Taxaceae from the McMurray formation (Lower Cretaceous) of Alberta, Canada. *Can. J. Bot.* **50**: 349-352.

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