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Re-examination of Prof. Shimakura's coniferous fossil wood microscope slides deposited in Tohoku University Museum

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Introduction

Fossil woods are formed through the permineralization of secondary xylem of woody plants and deposited in sedimentary rocks. Secondary xylem is composed of various tissues and cells that are taxon specific on the kinds, shapes, arrangement and relative compositions between them. Thus precise identification of the source plant is possible from the excavated fossil wood based on the anatomical features. In addition to that woods are formed by the annual increment in every year. Thus the environment of a given growth season influences the growth layer that is formed on that year. In the result, an accumulated wood anatomy offers important information for the study of the reconstruction of paleoenvironment because it reflects the past environments.

In addition, the wood is composed of cells that have lignified secondary walls, which result in very hard and stable tissue of wood. Therefore, it is very useful to study for its histological characteristics due to the well-preserved anatomical characteristics in its taphonomy. Moreover, wood tissue usually required a very strong power for the burying in taphonomy. Therefore, it sometimes becomes an important material for the study of fossil plants in the sedimentary layer, which has not contained any ordinary plants fossils, because it can easily preserved in tuff that can hardly contain the leaves, generative organs, and other plant organs.

The study of fossil woods began from the end of 17C in Europe (in Seward, 1919). In the case of Northeast Asia, Japan has a lot more materials than that of Korea or China because it began early in Japan from the end of 19C (Felix, 1882, 1883 ; Reiss, 1907 ; Stopes & Fujii, 1910 ; Yasui 1917 ; Takamatsu, 1929 ; Shimakura, 1936, 1937 ; Ogura, 1944).

The early study of Professor Shimakura on the fossil woods that were excavated from Japan and adjacent regions was the widest and most detailed study among the studies of Japanese researchers (1936, 1937). His first report concerning fossil wood is a miscellaneous note on fossil woods from various areas and of various ages in Japan (Shimakura 1933).

Therefore, it is an important starting point for the study of the fossil woods that were excavated from the Northeast Asia. His microscope slides of fossil woods that were well preserved in the Tohoku University Museum especially become an important material for the study of a junior scholar.

In the case of Korea's fossil woods, there are few studies except for the early studies done by Japanese researchers like Shimakura (1936) or Ogura (1927, 1944). In recent years, however, the study continued again by Kim et al. (2002) and Jeong et al. (2003, 2004) in Korea. Although the study of fossil woods in the study of the fossil plants in the middle and late Mesozoic period of the Northeast Asia can offer very important information, there are few full-scale studies on the issue except for the studies in Japan. Therefore, the study of fossil woods in the Korean peninsula and the east northern area of China is an essential study for the fossil plants of the late Mesozoic period of these areas. In addition, the descriptions of the quantitative approaches have been performed besides the qualitative approach of the past in the descriptions of its anatomical characteristics for the studies of fossil woods in recent years and verified as an important characteristic form and quality in the recognition of species of fossil woods and methodical study (Falcon-Lang & Cantrill, 2000, 2001).

Therefore, this paper attempts to review the fossil wood slides studied by the late Professor Shimakura and deposited in the Tohoku University Museum as a part of the study for the comparison of fossil woods between Korea and Japan by following the results of the study of Korea's fossil woods in the Mesozoic period compared with the Japan's fossil woods. This paper especially examines the quantitative approaches that were not verified and described from the Shimakura's studies in 1936 and 1937, such as 1) the contiguity of tracheids pitting, 2) the ratio of tracheid pit seriation, and 3) the ratio of alternate or opposite tracheid pitting and attempts a new description by excepting the descriptions that have little importance in the study of the recognition of species and methodical study.

(A brief profile of Prof. Shimakura)

The Late Prof. Dr. Misaburo SHIMAKURA was born on 1906 in Niigata Prefecture. He graduated Tohoku Imperial University (Department of Geology, Faculty of Science) on 1932. The title of his graduation thesis is "Studies on Fossil Woods, Part I : Fossil woods from the vicinity of Heijo, Part II : Studies on the structure and affinities of fossil woods in Japan, Korea, Saghalien, and Manchuria". After the graduation, he worked as Assistant Lecturer in the Department of Geology until 1937. During those years, he studied fossil woods more minutely and published many papers as shown in the references. And finally he published two big papers, that is :

Shimakura, M., 1936. Studies on fossil woods from Japan and adjacent lands. Contribution I. Science Reports of the Tohoku Imperial University, Series 2, Vol. 18, pp. 267–310.

Shimakura, M., 1937. Studies on fossil woods from Japan and adjacent lands. Contribution II. Science Reports of the Tohoku Imperial University, Series 2, Vol. 19, pp. 1–73.

In the following descriptions, these two papers are conveniently indicated as SHIMAKURA 1936 and SHIMAKURA 1937, respectively.

The list and re-description of fossil woods in the present paper are the all of Dr. Shimakura's collection during those days when he was in the Tohoku Imperial University. All microscopic slides that he studied were deposited in the Institute of Geology and Paleontology, Faculty of Science, Tohoku (Imperial) University, Sendai (IGPS) till now, although some of them have been missed.

He got position in Shaghai Institute of Natural History and moved China on 1939. After the end of the World War II, he returned Japan in 1947(?) and worked as a professor during 1953 and 1972 in Nara University of Education, Nara, Japan. After the war, his research was shifted from the fossil woods to pollen analysis of young sediments and excavated woods from archeological sites. He has gone on October 1997 in Nara.

Material and Method

In order to perform this study, one of the authors, K. Kim was invited to the Tohoku University Museum from July 1, 2003 to February 29, 2004 as a guest professor for study fossil wood collection in the museum. The microscopic slides of coniferous fossil woods used in the Shimakura's 1936 and 1937 papers were hired from the Tohoku University Museum and reviewed and newly described. In addition, all of the samples were pictured by using a microscopic photographing system installed in the botanical garden of Tohoku University. In this paper prepositive abbreviation of registration numbers (IGPS coll. cat no.) are left out.

(Missing slides)

As the following samples used in the Shimakura's papers have been missed from the fossil wood collection of the Tohoku University Museum, there is no description of them in the present paper.

57601, 57602 *Xenoxylon latiporosum*
57603 *Cupressinoxylon* sp.
58485 *Cupressinoxylon vectense*
58497 *Brachioxylon* sp.
58498 *Paracupressinoxylon cryptomeriopsoides*

Description

1. *Dadoxylon (Araucarioxylon) japonicum* SHIMAKURA Nos. 53325 (holotype), 58419. Plate 1.

SHIMAKURA 1936 : pp. 268–273, Pl.XII, figs. 1–6, text-fig. 1
SHIMAKURA 1937 : pp. 5–6, Pl.I, figs. 7–10.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (61.33%), biseriate (37.76%), or triseriate (0.1%) bordered pitting. Where they occur in two or multiple rows, tracheid pits are squarish or hexagonal (16–28 μm in diameter) with circular, oval apertures, and are usually oppositely (83.4%) arranged or partly alternately (16.6%) arranged (but No. 58419 most alternately (95%) arranged). Where they are arranged in single rows, pits are longitudinally flattened (26.4 μm wide by 20.2 μm high) with circular or oval apertures. Pit contiguity is very high with values ranging from 1–55 more (mean 27.72). Rays are composed of parenchymatous cells, 12–34 μm wide and 24–44 μm high with relatively thin and smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting is consisted of 5–12 (mean 8) circular pits (5.7–9.5 μm in diameter) with obliquely oval to slit like apertures (0.95–5.7 μm in diameter) in each field. Axial parenchyma is absent.

In TLS, tangential bordered pits (12–28 μm in diameter) usually present on latewood. Rays are uniseriate and 1–25 more cells high (mean 10.66) with short biseriate portions.

In TS, growth rings have a mean width of 1.21 mm (n=21), and possess subtle boundaries defined by only 2–7 rows of latewood cells. Maximum earlywood tracheid radial diameter is 80 μm and minimum latewood tracheid radial diameter is 3 μm. Mean tracheid diameter is 27 μm.

2. *Dadoxylon (Araucarioxylon) sidugawaense* SHIMAKURA No. 44234 (holotype) Plate 2.

SHIMAKURA 1936 : pp. 273–276, Pl.XII, figs. 7–8, Pl.XIII, figs. 1–7, text-fig. 2.

In RLS, earlywood tracheid pitting is characterized by uniseriate (54.2%) or biseriate (45.8%) bordered pitting and they are alternately (about 100%) arranged. Where they are arranged and contacted in single rows, pits are longitudinally flattened (23.5 μm wide by 18.07 μm high) with circular apertures. Pit contiguity is very high with values ranging 1–50 more (mean 15.35?). Rays are composed of parenchymatous cells, 18–32 μm wide and 20–30 μm high with smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting is large oval or circular ; consisting of 1–3 in each field. Axial parenchyma is absent but traumatic ? Parenchymatous cells rarely present.

In TLS, tracheid walls exhibit uniseriate sequences of pits (13–25 μm in diameter). Rays are uniseriate, 1–14 cells high (mean 6.5) with partly biseriate.

In TS, growth rings have a mean width of 1.6 mm (n=37.54), and possess subtle boundaries defined by only 4–14 rows of latewood cells. Maximum earlywood tracheid radial diameter can't measure because of they are extremely irregularity and so incline. Minimum latewood tracheid radial diameter is 12 μm.

3. *Dadoxylon* cfr. *tankoense* STOPES et FUJII No. 58446. Plate 3.

Araucarioxylon tankoense STOPES et FUJII : Studies on the Structure and Affinities of Cretaceous Plants. Phil. Trans. Roy. Soc. London, Ser.B, , Vol. CCI, pp. 41–42, Pl. III, fig. 17–18, 1910.

Dadoxylon tankoense (STOPES et FUJII) SEWARD : Fossil

Plants, Vol. IV, p. 185, 1919.
SHIMAKURA 1937 : pp. 2-4, Pl.I, figs. 1-6.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (10.06%), biseriate (25.74%), triseriate (42.9%), 4-seriate (19.23%) and 5-seriate (2.07%) bordered pitting. Where they occur in multiple rows, tracheid pits are hexagonal (17.48 μm wide by 14.96 μm high) with circular apertures and are mostly alternately (94.9%) arranged. Where they are arranged in single rows, pits are longitudinally flattened (17.13 μm wide by 12.6 μm high) with circular apertures. Pits are always contiguous. Rays are abundant (up to 1.327 mm long) and are composed of parenchymatous cells, 10-36 μm wide and 24-60 μm high with slightly thick horizontal cell walls. Cross-field pitting is not clear. Just Its shape seems to be oval or circular. Axial parenchyma is absent.

In TLS, Tracheid bordered pits are small, contiguous and slightly compressed (about mean 8 μm in diameter). Rays are uniseriate but it is hard to count the number.

In TS, growth ring is interminable. Maximum earlywood tracheid radial diameter is 118.5 μm and minimum earlywood tracheid radial diameter is 31.6 μm. Mean whole earlywood ring tracheid diameter is 76.1 μm.

4. *Dadoxylon* sp. indet. (Cfr. *japonicum* SHIMAKURA) Nos. 58484, 58408. Plate 4.

SHIMAKURA 1937 : pp. 6-7, Pl.V, figs. 7-10.

This specimen is badly preserved.

In RLS, earlywood tracheid pitting is characterized by uniseriate(?) bordered pitting. Pit contiguity is seemed to be high. Rays are composed of parenchymatous cells (about 22 μm in diameter). Cross-field pitting is not clear.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate or sometimes biseriate, and 1-20 cells high.

In TS, growth rings are indistinct. Maximum earlywood tracheid radial diameter is 63.2 μm, and minimum earlywood tracheid radial diameter is 15.8 μm. Mean whole earlywood ring tracheid diameter is 36.7 μm.

5. *Brachoxylon* aff. *woodworthianum* TORREY No. 58409. Plate 5.

Brachoxylon woodworthianum TORREY : Mesozoic and Tertiary Coniferous Woods. Mem. Boston Soc. Nat. Hist., Vol. 6, no. 2, pp. 80-82, Pl.XII, figs. 37-40, Pl.XIII, figs. 41-43, 1923.
SHIMAKURA 1937 : pp. 7-10, Pl.II, figs. 1-7, text-fig. 1.

This specimen is badly preserved.

In RLS, earlywood tracheid pitting is characterized by uniseriate (77.08%) or biseriate (22.92%) bordered pitting. Where they occur in two rows, tracheid pits are hexagonal (18.66 μm wide by 16.66 μm high) with oval, lenticular apertures and most alternately (93.18%) arranged. Where they are arranged in single rows, pits are longitudinally flattened (22.66 μm wide by 16 μm high) with oval, lenticular apertures. Pit contiguity is very high. Rays are abundant (up to 1.6 mm long) and are composed of parenchymatous cells, 10-32 μm wide and 20-36 μm high with thin horizontal cell walls. Ray tracheids are absent. Cross-field pitting is not clear. Axial parenchyma is absent.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate, biseriate or triseriate and 1-65 cells high (mean 17.06).

In TS, growth rings present, but their widths unascertainable. Maximum earlywood tracheid radial diameter is 56 μm and minimum earlywood tracheid radial diameter is 24 μm. Mean whole earlywood ring tracheid diameter is 34.6 μm.

6. *Xenoxylon latiporosum* (CRAMER) GOTHAN Nos. 44490, 6870, 30558, 30559, 57601, 51721, 51722, 57602. Plate 6.

Pinites latiporosum CRAMER : In Herr's Flora fossilis arctica I, p. 176, Pl.XL. figs. 1-8, 1968
Xenoxylon latiporosum (CRAMER) GOTHAN : Zur Anatomie lebender und fossiler Gymnospermenhölzer. L.c., p. 38, 1905.
SHIMAKURA 1936 : Vol. 18, pp. 278-281, Pl.XIV, figs. 7-8, Pl. XV, figs. 1-8, Pl.XVI, figs. 1-3, Pl.XVII, figs. 6-7, text-fig. 4.

In RLS, earlywood tracheid pitting is characterized by uniseriate (99.1%) or partly biseriate (0.9%) bordered pitting. Where they occur in two rows, tracheid pits are conical ? shape with circular or oval apertures and they are alternately (100%) arranged. Pit contiguity is high with values ranging from 1-40 (mean 9.1). Rays are abundant (up to 1.03 mm long) and are composed of parenchymatous cells, 16-20 μm wide and 18-32 μm high with thin and smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting is window-like ? type, consisting of 1-2 (mean 1.06) in each field. Axial parenchyma is absent.

In TLS, Tracheid bordered pits can't identify. Rays are uniseriate and 1-43 cells high (mean 8.8)

In TS, growth rings have a mean width of 1.2 mm (n=74.78), and possess subtle boundaries defined by only 2-5 rows of latewood cells. Maximum earlywood tracheid radial diameter is 92 μm and minimum latewood tracheid radial diameter is 16 μm. Mean whole-ring tracheid diameter is 48.15 μm.

7. *Xenoxylon phyllocladoides* GOTHAN No. 6869. Plate 7.

Xenoxylon phyllocladoides GOTHAN : Fossile Hölzer von König-Karles-Land. L.c.,p. 10, figs. 3-9, 1908.
SHIMAKURA 1936 : pp. 276-278, Pl.XIII, figs. 8-9, Pl.XIV, figs. 1-6, text-fig. 3

In RLS, earlywood tracheid pitting is characterized by uniseriate (about 100%) bordered pitting. Where they are arranged in single rows, pits are longitudinally flattened (22.73 μm wide by 17.50 μm high) with circular or oval apertures. Pit contiguity is low with values ranging from 1-12 (mean 2.6). Rays are composed of parenchymatous cells, 16-28 μm wide and 16-20 μm high with thin and smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting is window-like type, consisting of 1-2 (mean 1.06) in each field. Axial parenchyma is absent.

In TLS, Tracheid bordered pits are not observable because of it is bad preservation. Rays are uniseriate or rarely partly biseriate, and 1-4 cells high (mean 4.5).

In TS, growth rings have a mean width of 0.94 mm (n=26), but there are sometimes rarely more than 10 mm width. And growth rings possess subtle boundaries by only 1-3 rows of latewood cells. Maximum earlywood tracheid radial diameter is 60 μm and minimum latewood tracheid radial diameter is 12 μm. Mean whole-ring tracheid diameter is 31.4 μm.

8. *Planoxylon Inaii* SHIMAKURA No. 58445 (holotype). Plate 8.

SHIMAKURA 1937 : pp. 11-14, Pl.III, figs. 1-6, text-fig. 3.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (21.98%), biseriate (50.25%) or triseriate (19.13%) bordered pitting. Where they occur in multiple rows, tracheid pits are hexagonal (28.92 μm wide by 25.84 μm high) with circular or oval apertures. Where they are arranged in single rows, pits are longitudinally flattened (32 μm wide by 24 μm high) with circular or oval apertures. Pit contiguity is very high. Rays are abundant (up to 4.38 mm long) and are composed of parenchymatous cells, 20-40 μm wide and 32-56 μm high with small thick horizontal cell walls. Cross-field pitting is consisted of 1-5 (mean 2.5), and the shape is circular (10-20 μm in diameter). Axial parenchyma is present but is not abundant.

In TLS, rays are uniseriate, biseriate or rarely partly triseriate and 1-66 cells high (mean 18).

In TS, growth rings have a mean width of 610.4 μm (n= 7.12) and possess boundaries defined by only 1-2 rows of latewood cells. Maximum earlywood tracheid radial diameter is 110.6 μm and minimum latewood tracheid radial diameter is 16 μm. Mean whole-ring tracheid diameter is 51.19 μm.

9. *Protocedroxylon araucarioides* GOTHAN No. 58415. Plate 9.

Protocedroxylon araucarioides GOTHAN : Die fossilen Holzreste von Spitzbergen, Kgl. Svensk. Vetensk. Akad. Handl., Vol. XLV, No. 8, pp. 27-34, PL.V, figs. 3-5, PL.VI, fig. 1, 1910.

SHIMAKURA 1937 : Vol. 19, pp. 15-17, Pl.III, figs. 7-10, text-fig. 4.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (65%) or biseriate (35%) bordered pitting. Where they occur in two rows, tracheid pits are hexagonal (20-24 μm in diameter) with oval apertures and are always alternately arranged. Where they are contacted in single rows, pits are longitudinally flattened (19.5 μm wide by 16.8 μm high) with oval apertures. Pit contiguity is very high with values ranging from 1-49 (mean 19.52). Rays are not abundant (up to 987.5 μm long) and are composed of parenchymatous cells, 10-36 μm wide and 20-32 μm high with thick horizontal cell walls. Ray tracheids are absent. Cross-field pitting is consisted of 1-2 (mean 1.76) in each field. Axial parenchyma is absent.

In TLS, rays are uniseriate and 1-41 cells high (mean 17.5).

In TS, growth rings have a mean width of 0.9 mm (n= 21.68), and possess boundaries defined by 1-6 rows of latewood cells. Maximum earlywood tracheid radial diameter is 72 μm and minimum latewood tracheid radial diameter is 16 μm. Mean whole-ring tracheid diameter is 42.24 μm.

10. *Cedroxylon* cfr. *Yendoi* STOPES et FUJII No. 58401. Plate 10.

Cedroxylon Yendoi STOPES et FUJII : Studies on the structure and affinities of Cretaceous plants. Phil. Trans. Roy. Soc. London, Ser.B, Vol. CCI, pp. 44-456, figs. 24-26, 1910.

SHIMAKURA 1937 : pp. 18-20, Pl.IV, figs. 1-5, text-fig. 5.

In RLS, earlywood tracheid pitting is characterized by uniseriate (100%) bordered pitting. Pits are circular (10-18 μm in diameter) with oval apertures. Pit contiguity is very low with values ranging from 1-2 (mean 1.06). Rays are moderate (up to 355.5 μm long) and are composed of parenchymatous cells, 8-24 μm wide and 8-32 μm high with thick horizontal cell walls. Ray tracheids are absent. Cross-field pitting is consisted of 1-2 (mean 1.16) in each field. Pit diameter is 10-20 μm (mean 14.8 μm). Axial parenchyma is rarely present.

In TLS, tracheid pits are separated and their diameter is about 8 μm. Rays are uniseriate or rarely multiseriate and 1-15 cells high (mean 7.36).

In TS, growth rings have a mean width of 1.77 mm. Maximum earlywood tracheid radial diameter is 48 μm and minimum latewood tracheid radial diameter is 4 μm. Mean whole-ring tracheid diameter is 18.38 μm. Traumatic RD is present.

11. *Cedroxylon* sp. indet. No. 58417. Plate 11.

SHIMAKURA 1937 : pp. 20-22, Pl.IV, figs. 6-8.

This specimen is ill preserved.

In RLS, earlywood tracheid pitting is characterized by uniseriate (97.5%) or biseriate (2.5%) bordered pitting. They are usually separated (17.28 μm wide by 16.77 μm high) or sometimes contiguous (19.12 μm wide by 16 μm high). Pit contiguity is low with values ranging from 1-3 (mean 1.08). Rays are not abundant (up to 505.6 μm long) and are composed of parenchymatous cells, 16-52 μm wide and 20-48 μm high with irregularly thick horizontal cell walls. Ray tracheids are apparently absent. Cross-field pitting is consisted of 2-4 (mean 2.6), circular pits (8-16 μm in diameter) with oblique, oval or lenticular apertures in each field. Axial parenchyma is apparently absent.

In TLS, tracheid pits are not clear (about 4-20 μm ? in diameter). Rays are uniseriate or biseriate and 1-29 cells high (mean 8.24 cells)

In TS, growth ring width can not measure because of it is ill preserved. Maximum earlywood tracheid radial diameter is 64 μm and minimum latewood tracheid radial diameter is 12 μm. Mean whole-ring tracheid diameter is 35.04 μm. Traumatic RD is present.

12. *Pinoxylon dakotense* (KNOWLTON) READ No. 57693. Plate 12.

Pinoxylon dakotense KNOWLTON : In WARD's Studies of Mesozoic flora of the United States. 20th Ann. Rep. U. S. Geol. Surv., Pt.II, pp. 420-422, Pl. CLXXIX, figs. 1-6, 1900.

Pinoxylon dakotense READ : *Pinoxylon dakotense* KNOWLTON : from the Cretaceous of the Black Hills. Bot. Gaz., Vol. XCIII, pp. 175-178, figs. 1-12, 1932.

SHIMAKURA 1937 : pp. 22-24, Pl.V, figs. 1-6, text-fig. 6.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (51.68%), biseriate (46.34%) or triseriate (1.98%) bordered pitting. Where they occur in multiple rows, tracheid pits are squarish or oval (17.49 μm wide by 15.45 μm high) with circular apertures and are usually opposite (93.16%) or rarely alternate (6.84%). Where they are contacted in single rows, pits are longitudinally flattened (19.33 μm wide by 14.4 μm high). Where they are separated in single rows, pits are circular (16–22 μm in diameter) with circular apertures. Pit contiguity is low with values ranging from 1–3 (mean 1.08). Rays are not abundant (up to 387.1 μm long) and are composed of parenchymatous cells, 8–32 μm wide and 20–40 μm high with irregularly thick horizontal cell walls. Ray tracheids are present. Ray tracheid pits are 5.7–7.6 μm (mean 6.88) in diameter. Cross-field pitting is consisted of 2–5 (mean 2.3), small and half-bordered pits (3.8–5.7 μm in diameter). Axial parenchyma is present at terminal wood. Crassulae is clearly present.

In TLS, tracheid pits are small and circular (about 5.7 μm in diameter). Rays are uniseriate or rarely partly biseriate and 1–24 cells high (mean 10 cells)

In TS, growth rings have a mean width of 1.58 mm (n= 43.42), and possess boundaries defined by 7–13 rows of latewood cells. Maximum earlywood tracheid radial diameter is 70 μm and minimum latewood tracheid radial diameter is 14 μm. Mean whole-ring tracheid diameter is 43.36 μm. Normal and traumatic RD are present.

13. *Pinoxylon Yabei* SHIMAKURA No. 30556 (holotype). Plate 13.

SHIMAKURA 1936 : pp. 289–295, Pl. XIX, figs 1–8, text-figs. 8, 9.

In RLS, tracheid pitting is variable across growth ring increments. Earlywood is characterized by uniseriate (26.96%), biseriate (41.34%), triseriate (30.23%) or multiseriate (1.47%) bordered pit arrangement. Pit contiguity is very low with values ranging one, and when they occur in multiple rows, tracheid pits are arranged opposite (97%) and rarely arranged alternate (3%). Tracheid pits are circular or oval (16–24 μm in diameter) with circular apertures. Rays are abundant (up to 1.1 mm long) and are composed of parenchymatous cells, 12–20 μm wide and 16–28 μm high with irregularly thick horizontal cell walls and distinctly pitted (nodular) end cell wall. Marginal ray-tracheids present. Cross-field pitting is consisting of 1–6 (mean 2.87), circular pits (3.8–7.6 μm in diameter) with very small, circular apertures in each field. Axial parenchyma is present in growth ring boundaries. Crassulae is present.

In TLS, rays are usually uniseriate, sometimes biseriate or triseriate and 1–70 cells high (mean 12.4)

In TS, growth rings have a mean width of 3 mm (n=39.44), and possess sharply marked boundaries defined by 3–25 more rows of latewood cells. Maximum earlywood tracheid radial diameter is 160 μm and minimum latewood tracheid radial diameter is 12 μm. Mean whole-ring tracheid diameter is 63.26 μm. Normal and traumatic RD are present in growth rings, either isolated or in tangential rows.

14. *Piceoxylon scleromedullosum* SHIMAKURA No. 58478 (holotype). Plate 14.

SHIMAKURA 1937 : pp. 28–30, Pl.VII, figs. 1–6, text-fig. 8.

In RLS, tracheids exhibit uniseriate (100%), circular bordered pits (12–24 μm in diameter) with oval apertures in the earlywood. Pit contiguity is low with values ranging from 1–8 (mean 1.12). Rays are at least 268.6 μm long, and composed of parenchymatous cells 8–30 μm wide and 15.2–28.8 μm high with thick horizontal cell walls. Cross-field pitting is piceoid ?, consisting 2–6 (mean 3.86), circular to oval pits (3.8–5.7 μm in diameter) in each field. Axial parenchyma is present and consists of resin-filled cells.

In TLS, tracheid walls locally exhibit circular bordered pits (12–16 μm in diameter). Rays are uniseriate and partly biseriate, and 1–12 (mean 6.46) cells high.

In TS, growth rings possess well-marked boundaries defined by 4–10 rows of latewood cells and have a mean ring width of 1.90 mm (n=68.42). Maximum earlywood tracheid radial diameter is 30.4 μm and minimum latewood tracheid radial diameter is 5.7 μm. Mean whole-ring tracheid diameter is 17.86 μm. Normal and traumatic RD are present. Tyloses ? rarely present in resin canals.

15. *Piceoxylon transiens* SHIMAKURA No. 58450 (holotype). Plate 15.

SHIMAKURA 1937 : pp. 24–28, Pl.VI, figs. 1–9, text-fig. 7.

In RLS, earlywood tracheid pitting is characterized by uniseriate (96.16%) or biseriate (3.84%) bordered pitting. Where they are separated in single rows, pits are circular (15.2–20.8 μm in diameter) with circular apertures. Where they are contacted in single rows, pits are longitudinally flattened (18.4 μm wide by 13.84 μm high) with circular apertures. Pit contiguity is low with values ranging from 1–13 (mean 1.95). Rays are not abundant (up to 268.6 μm long) and are composed of parenchymatous cells, 10–28 μm wide and 16–30 μm high with thick horizontal cell walls. Ray tracheids are present. Ray tracheid pits are small and circular. Cross-field pitting is piceoid(?), consisting of 2–4 (mean 3.6), circular or oval (about 4–8 μm in diameter) pits in each field. Axial parenchyma is present.

In TLS, tracheids walls locally exhibit circular bordered pits (12–16 μm in diameter) with vertically elongate oblong or lenticular apertures. Rays are uniseriate or partly biseriate and 1–14 cells high (mean 5.36 cells)

In TS, growth rings have a mean ring width of about 2.44 mm ? Maximum earlywood tracheid radial diameter is 52 μm and minimum latewood tracheid radial diameter 10 μm. Mean whole-ring tracheid diameter is 32.24 μm. Normal and traumatic RD are present and both horizontal and tangential resin canals present in normal wood.

16. *Piceoxylon* sp. (*P. antiguius* GOTHAN ?) no. 58448. Plate 16.

SHIMAKURA 1937 : pp. 30–31, Pl.VI, figs. 10–11.

This specimen is ill preserved.

In RLS, tracheids exhibit uniseriate (about 100%), circular to oval bordered pits (12–20 μm in diameter) with oval apertures in the earlywood. Rays are 474 μm long and are composed of parenchymatous cells, 8–24 μm wide and 16–

40 μm high with thick horizontal cell walls. Cross-field pitting is not clear. Axial parenchyma is present.

In TLS, Tracheid bordered pits are unascertainable. Rays are uniseriate and partly biseriate and 1-24 (mean 10.4) cells high.

In TS, growth rings are ill preserved. Maximum earlywood tracheid radial diameter is 40 μm and minimum latewood tracheid radial diameter is 10 μm. Mean whole-ring tracheid diameter is 22.35 μm. Normal RD is present and scattered singly throughout rings.

17. *Phyllocladoxylon* cfr. *eboracense* HOLDEN No. 30557. Plate 17.

Paraphyllocladoxylon eboracense HOLDEN : Contribution to the Anatomy of Mesozoic Conifers I. L.c., p. 536, Pl. XXXIX, fig. 7-9, 1913.

SHIMAKURA 1936 : 285-287, Pl.XVI, fig. 7, Pl.XVIII, figs. 1-3, text-fig. 6.

In RLS, earlywood tracheid pitting is characterized by uniseriate (99%) bordered pitting. Where they are arranged in single rows, pits are circular and oval (12-24 μm in diameter) with circular or elliptical apertures. Pit contiguity is very low with values ranging one. Rays are not abundant (up to 213.3 μm long) and are composed of parenchymatous cells, 24-42 μm wide and 18-32 μm high with thin and smooth horizontal cell walls. Rays tracheids are absent. Cross-field pitting is consisted of one (rarely two), large, oval or fusiform simple pit in each field. Axial parenchyma is absent.

In TLS, tracheid walls locally exhibit isolated circular bordered pits. Tracheid bordered pits are on latewood. Rays are uniseriate and 1-12 cells high (mean 4.6).

In TS, growth rings have a mean width of 1.33 mm (n= 28.22), and possess subtle boundaries defined by only 1-3 rows of latewood cells. Maximum earlywood tracheid radial diameter is 52 μm and minimum latewood tracheid radial diameter is 12 μm. Mean whole-ring tracheid diameter is 31.76 μm.

18. *Phyllocladoxylon* aff. *Gothani* (STOPES) KRÄUSEL No. 58402. Plate 18.

Podocarpoxylon Gothani STOPES : Cat. Mes. Plants Brit. Mus., loc. Cit., pp. 228-234, figs, 65-66, 1915.

Phyllocladoxylon Gothani (STOPES) KRÄUSEL : Die fossilen Koniferenhölzer. Palaeontogr., , Vol. LXII, p. 236, 1919.

SHIMAKURA 1937 : pp. 31-34, Pl.VIII, figs. 1-5, text-fig. 9.

In RLS, earlywood tracheid pitting is characterized by uniseriate (100%) bordered pitting. Where they are arranged in contacted single rows, pits are longitudinally flattened (14.56 μm wide by 10.13 μm high) with oval or lenticular apertures. Where they occur in separated single rows, pits are circular (9.5-13.3 μm in diameter) with oval or lenticular apertures. Pit contiguity is moderate with values ranging from 1-38 (mean 11.27). Rays are not abundant (up to 308.1 μm long) and are composed of parenchymatous cell, 8-20 μm wide and 12-28 μm high with thin horizontal cell walls. Ray tracheids are absent. Cross-field pitting is large, circular, oval or spindle (14.98 μm wide by 15.41 μm high), consisting of 1-2 (mean 1.1) in each field. Axial parenchyma is rarely present.

In TLS, tracheid walls locally exhibit isolated circular bordered pits (5.7-9.5 μm in diameter). Rays are uniseriate or rarely partly biseriate and 1-18 cells high (mean 7.84).

In TS, growth rings possess well-marked boundaries defined by 1-14 rows of latewood cells and have a mean ring width 918 μm (n=20.46). Maximum earlywood tracheid radial diameter is 56 μm and minimum latewood tracheid radial diameter is 10 μm. Mean whole-ring tracheid diameter is 31.23 μm.

19. *Phyllocladoxylon heizyoense* SHIMAKURA Nos. 6871, 6872, 6873, 6874, 6875, 6876, 6877, 6878, 6879. Plate 19.

SHIMAKURA 1936 : pp. 281-285, Pl.XVI, figs. 4-6, Pl.XVII, figs. 1-5, text-fig. 5.

In RLS, earlywood tracheid pitting is characterized by uniseriate (97.72%) or biseriate (2.28%) bordered pitting. Where they occur in two rows, tracheid pits are oval (20-40 μm in diameter) with oval or somewhat circular apertures and always opposite arranged. Where they are arranged in single rows, pits are oval (20-40 μm in diameter). Pit contiguity is very low with values ranging about one. Rays are moderate (up to 355.5 μm long) and are composed of parenchymatous cell, 12-20 μm wide and 20-28 μm high with thin horizontal cell walls. Ray tracheids are absent or very rare. Cross-field pitting is window-like ? type and consisting of 1-2 (mean 1.08). Axial parenchyma is absent. Crassulae is clearly present.

In TLS, tracheid pits (mean 8.23 μm) are elliptical or circular with oval or lenticular apertures. Rays are usually uniseriate or sometimes partly biseriate and 1-18 cells high.

In TS, growth rings have a mean width of 2 mm (n=27), and boundaries defined by 1-5 rows of latewood cells. Maximum earlywood tracheid radial diameter is 84 μm and minimum latewood tracheid radial diameter is 8 μm. Mean whole-ring tracheid diameter is 41.37 μm.

20. *Phyllocladoxylon* ? species indet. No. 30555. Plate 20.

SHIMAKURA 1936 : pp. 287-288, Pl.XVIII, figs. 7-8, text-fig. 7.

These slides show very poor preservation.

In RLS, tracheids exhibit dominantly uniseriate (92.26%) bordered pitting with a few biseriate (7.74%), and alternately (about 100%) pitted tracheids in the earlywood. Uniseriate pits are small, circular or elliptical (12-20 μm in diameter). And pit contiguity is very low with values ranging one, and cross-field pitting looks like window-like type and it is consisted of usually one pits per field.

In TLS, Tracheid bordered pits and rays can not measure because of they are very poor preservation.

In TS, growth rings are indistinguishable and tracheids shape just looks like round, and somewhat squarish.

21. *Podocarpoxylon* cfr. *dakotense* TORREY No. 58406. Plate 21.

Podocarpoxylon dakotense TORREY : Mesozoic and Tertiary coniferous woods. Mem. Boston Soc. Nat. Hist., , Vol.VI, no.

2, pp. 73–74, 1923.
SHIMAKURA 1937 : pp. 36–37, Pl.XI, figs. 7–9, text–fig. 11.

In RLS, tracheids exhibit uniseriate (99%) or biseriate (1%), circular bordered pits (10–18 μm in diameter) with circular or oval apertures. Where biseriate, bordered pits are always arranged oppositely each other (100%). Pit contiguity is very low, with values ranging one. Rays at least 1.1 mm long, and 16–40 μm high with thin and smooth horizontal cell walls. Cross–field pitting is large, circular (12–16 μm in diameter), consisting of 1 (rarely 2 ; mean 1.1) in each field. Axial parenchyma is apparently absent.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate, biseriate or rarely partly triseriate and 1–60 cells high.

In TS, growth rings possess moderately well marked boundaries and their width is very broad (9.85 mm more, 435 cells more). Maximum earlywood tracheid radial diameter is 36.1 μm and minimum latewood tracheid radial diameter is 8 μm. Mean whole–ring tracheid diameter is 19.96 μm.

22. *Podocarpoxylon woburnense* STOPES No. 58481. Plate 22.

Podocarpoxylon woburnense STOPES : The Cretaceous flora, pt.II, Lower Greesand (Aptian) plants of Britain. Loc. Cit., p. 211, Pl.XX, figs. 1–2, text–figs. 60–63, 1915.
SHIMAKURA 1937 : pp. 34–36, Pl.IX, figs. 1–4, text–fig. 10.

In RLS, tracheids exhibit uniseriate (85.5%) or biseriate (14.5%) circular bordered pitting. Where they are contacted in single rows, tracheid pits are 20 μm wide by 15.34 μm high with circular or oval apertures. Where they are separated in single rows, tracheid pits are circular (12–24 μm in diameter) with circular apertures. Where they occur in couple rows, tracheid pits are 19.2 μm wide by 16.56 μm high with circular or oval apertures and are usually oppositely (98%) arranged. Pit contiguity is low with values ranging from 1–8 (mean 1.25). Rays are at least 1.13 mm long, and are composed of parenchymatous cells, 10–34 μm wide and 16.8–40 μm high with thin horizontal cell walls. Cross–field pitting is large, circular or oval (about 13.56 μm wide by 12.11 μm high), with large oval apertures in each field. Axial parenchyma is scattered and is sometimes more or less zonate.

In TLS, tracheid walls locally exhibit isolated circular bordered pits (9.5–15.2 μm in diameter). Rays are uniseriate or rarely partly biseriate and 1–45 (mean 14.13) cells high.

In TS, growth rings possess well–marked boundaries defined by 3–8 rows of latewood cells and have a mean ring width of 3.27 mm (n=48) (but growth rings are only four). Maximum earlywood tracheid radial diameter is 80 μm and minimum latewood tracheid radial diameter is 16 μm. Mean whole–ring tracheid diameter is 48.96 μm.

23. *Podocarpoxylon* sp. indet. No. 58404. Plate 23.

SHIMAKURA 1937 : pp. 37–38, Pl.VIII, figs. 7–9.

In RLS, tracheids exhibit uniseriate (97.23%) or biseriate (2.77%) bordered pitting. Where they are contacted in single rows, tracheid pits are longitudinally flattened (18.66 μm wide by 11.33 μm high) with oval apertures. Where they are separated in single rows, tracheid pits are circular or oval (22.33 μm wide by 15.33 μm high) with oval apertures. Where they are arranged in two rows, always oppositely arranged. Pit contiguity is very low with values ranging from 1–8 (mean 1.25). Rays are moderate (up to 344 μm long) and are composed of parenchymatous cells, 30–40 μm wide and 20.8–28 μm high with thin smooth horizontal cell walls. Cross–field pitting is comparatively large, circular or oval (8 μm–14 μm in diameter), consisting of 1–2 (rarely 3 ; mean 1.37) in each field. Axial parenchyma is scattered throughout rings.

In TLS, tracheid walls locally exhibit circular bordered pits (12–20 μm in diameter) with oval or lenticular apertures. Rays are uniseriate and 1–16 (mean 3.95) cells high.

In TS, growth rings possess well–marked boundaries defined by 2–10 more rows of latewood cells and have a ring width of 9.22 mm more (n=286 more). Maximum earlywood tracheid radial diameter is 60 μm and minimum latewood tracheid radial diameter is 8 μm. Mean whole–ring tracheid diameter is 28.24 μm.

24. *Paracupressinoxylon cryptomeriopsoides* SHIMAKURA No. 6961. Plate 24.

SHIMAKURA 1937 : pp. 38–41, Pl.X, figs. 1–5, text–fig. 12.

The slides are ill–preserved.

In RLS, tracheids exhibit usually uniseriate or rarely biseriate, circular or oval bordered pits (8–12 μm in diameter) with oval apertures. Where biseriate in contiguous, bordered pits are dominantly arranged alternate each other and where biseriate in separated, bordered pits are arranged opposite each other. Rays are at least 128 μm long, and are composed of parenchymatous cells, 5.7–13.3 μm wide and 9.5–26.6 μm high with thin and smooth horizontal cell walls. Cross–field pitting is circular, consisting of 2–4, with oblong, slit–like, obliquely or vertically elongate apertures in each field. Axial parenchyma is scattered throughout rings.

In TLS, tracheid walls locally exhibit isolated circular bordered pits with oblique or slit–like apertures. Rays are uniseriate and 1–8 cells high (mean 3.18?).

In TS, growth rings possess poorly marked boundaries.

25. *Paracupressinoxylon Solmsi* (STOPES) SHIMAKURA No. 58480. Plate 25.

?*Podocarpoxylon Solmsi* STOPES : The Cretaceous flora, Pt. II, Lower Greensand (Aptian) of Britain. Cat. Mes. Plants Brit. Mus., pp.XXII, text–fig. 67–70, 1915.
SHIMAKURA 1937 : pp. 41–44, Pl.IX, figs. 5–8, text–fig. 13.

In RLS, tracheids exhibit only uniseriate (100%), circular to oval pits (12–20 μm in diameter) with small circular apertures. Rays are at least 209.35 μm long, and are composed of parenchymatous cells 8–20 μm wide and 12–32 μm high with thin and smooth horizontal cell walls. Ray tracheids are absent. Cross–field pitting is poorly preserved, consisting of 1–2, circular to oval pits in each field. Axial parenchyma is scattered throughout rings.

In TLS tracheid walls locally exhibit isolated circular bordered pits (about 4–10 μm in diameter). Rays are uniseriate or partly biseriate and 1–12 cells high (mean 5.8).

In TS, growth rings are ill–preserved. Maximum earlywood tracheid radial diameter is 32.3 μm and minimum latewood tracheid radial diameter is 5.7 μm. Mean whole–

ring tracheid diameter is 19.64 μm. Traumatic RD is arranged in tangential direction.

26. *Paracupressinoxylon* sp. (HOLDEN's species) No. 58410. Plate 26.

Paracupressinoxylon sp. HOLDEN : Contributions to the anatomy of Mesozoic conifers II. Bot. Gaz., , Vol. LVIII, p. 173, Pl.XIV, fig.s 20–24, 1914.

SHIMAKURA 1937 : pp. 44–45, Pl.X, figs. 6–9.

In RLS, earlywood tracheid pitting is characterized by uniseriate (88.71%) or biseriate (11.29%) bordered pitting. Where they are contacted in single rows, pits are longitudinally flattened (15.82 μm wide by 11.83 μm high) with oval or oblong apertures. Where they are separated in single rows, pits are circular or oval (8–16 μm in diameter) with oval or oblong apertures. Pit contiguity is low with values ranging from 1–10? (mean 1.47). Rays are sparse (up to 165.9 μm long) and are composed of parenchymatous cells, 12.8–26 μm wide and 12.8–32 μm high with thin and smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting is rarely preserved but locally 2–4 circular pits (5.7–7.6 μm in diameter) are present. Axial parenchyma is present.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate and 1–10 (mean 4.64) cells high.

In TS, growth rings possess well marked boundaries defined by 2–10 rows of latewood cells and have a mean ring width of 0.74 mm but the earlywood region is somewhat crushed so that only minimum estimates of ring tracheid number are possible ; a mean minimum ring tracheid is 19. Where locally preserved uncrushed, maximum earlywood tracheid radial diameter is 40 μm and minimum latewood tracheid radial diameter is 4 μm. Mean uncrushed whole-ring tracheid diameter is 24.24 μm

27. *Taxodioxylon albertense* (PENHALLOW) SHIMAKURA Nos. 7699, 58482. Plate 27.

Sequoia albertensis PENHALLOW : Report on a collection of fossil woods from the Cretaceous of Alberta. Ottawa Naturalist., Vol. XXII, no. 4, pp. 83–84, figs. 1–6, 1908.

SHIMAKURA 1937 : pp. 45–48, Pl.IX, figs. 9–10, Pl.XI, figs. 1–6, text-fig. 14.

In RLS, tracheids exhibit uniseriate (88.84%) or biseriate (11.16%), circular bordered pits (16–24 μm in diameter) with circular or oval (3.8–7.6 μm in diameter). Where biseriate, bordered pits are most oppositely arranged each other (99%). Pit contiguity is low, with values ranging from 1–7 (mean 1.25). Ray are moderate (up to 608 μm long), and are composed of parenchymatous cells, 10–36 μm wide and 16–34 μm high with smooth or slightly thick horizontal cell walls. Cross-field pitting is taxodioid, consisting of 1–2 (mean 1.07), circular pits (8–12 μm in diameter) with oblique, oblong or lenticular apertures in each field. Axial parenchyma is squarish and scattered throughout rings, and is sometimes zonate.

In TLS, tracheid walls locally exhibit isolated circular bordered pits (4–16 μm in diameter). Rays are uniseriate, biseriate or partly triseriate and 1–61 (mean 15.76) cells high.

In TS, growth rings are distinct and the earlywood regions are often compressed and curved (0.5–10 mm width). Maximum earlywood tracheid radial diameter is 60 μm and minimum latewood tracheid radial diameter is 10 μm. Mean whole-ring tracheid diameter is 39.84 μm. Traumatic RD is abundantly present.

28. *Cupressinoxylon sachalinense* SHIMAKURA No. 58403 (holotype). Plate 28.

SHIMAKURA 193 : pp. 50–53, Pl.XII, figs. 1–4, text-fig. 17.

This specimen is poorly preserved.

In RLS, tracheids exhibit uniseriate (92.13%) or biseriate (7.87%), circular bordered pits (16–20 μm in diameter) with small, apparently oval apertures. Where biseriate, bordered pits are mostly arranged opposite each other (about 100%). Rays are moderate (up to 655.7 μm long) and are composed of parenchymatous cells, 12–40 μm wide and 16–48 μm high with thin and smooth horizontal cell walls. Cross-field pitting is consisted of 1 (rarely 2 or 3), small circular or oval pits with obliquely, lenticular or linear apertures in each field. Axial parenchyma is small squarish, and it is diffuse or is terminal.

In TLS, tracheid walls locally isolated exhibit circular bordered pits (about 8 μm in diameter). Rays are uniseriate, biseriate or triseriate and 1–27 (mean 10.36) cells high.

In TS, growth rings possess well-marked boundaries defined by 3–10? rows of latewood cells and have a mean ring width of 2.61 mm (n=57.66). Maximum earlywood tracheid radial diameter is 110.6 μm and minimum latewood tracheid radial diameter is 10 μm. Mean whole-ring tracheid diameter is 52.48 μm.

29. *Cupressinoxylon vectense* BARBER Nos. 58407, 58545. Plate 29.

Cupressinoxylon vectense BARBER : Cupressinoxylon vectense, a fossil conifer from the Lower Greensand of Shanklin in the Isle of Wright. Ann. Bot. Vo. XII, pp. 329–361, Pl.XXIII–XXIV, figs. 1–15, 1898.

SHIMAKURA 1937 : pp. 31–34, Pl.VIII, figs. 1–5, text-fig. 9.

In RLS, tracheids exhibit uniseriate (96%) or biseriate (4%), circular bordered pits (6–14 μm in diameter) with small oval apertures. Where biseriate, bordered pits are dominantly arranged opposite each other (92%). In a few tracheids, pits are also partly alternately arranged (8%). Pit contiguity is low, with values ranging from 1–13 (mean 1.58). Rays are sparse (up to 221.2 μm long) and are composed of parenchymatous cells, 12–28 μm wide 16–36 μm high with thin and smooth horizontal cell walls. Ray tracheids are absent. Cross-field pitting looks like pinoid ?, consisting of 1–3 (rarely 4 ; mean 1.81), oblique pits (3.8–11.4 μm in diameter) in each field. Axial parenchyma is present and scattered throughout rings, or is more or less zonate.

In TLS, tracheid walls locally isolated exhibit circular bordered pits (about 6 μm in diameter) with oval or lenticular apertures. Rays are uniseriate or rarely partly biseriate and 1–12 (mean 5) cells high.

In TS, growth rings possess well-marked boundaries defined by 3–9? rows of latewood cells and have a mean ring width of 0.99 mm (n=45.71). Maximum earlywood tracheid radial diameter is 36 μm and minimum latewood tracheid radial diameter is 8 μm. Mean whole-ring tracheid diameter is 20.94 μm.

30. *Cupressinoxylon* sp. (*C. sachalinense* SHIMAKURA ?) Nos. 30880, 58418. Plate 30.
SHIMAKURA 1937 : pp. 53-54, Pl.XIII, figs. 1-3, text-fig. 16.

In RLS, tracheids exhibit uniseriate (70%) or biseriate (30%), circular bordered pits (10-16 μm in diameter) with small circular apertures. Where biseriate, bordered pits are most oppositely arranged each other (99%). Pit contiguity is low, with values ranging one. Rays are moderate (up to 576.7 μm long), and are composed of parenchymatous cells, 6-32 μm wide and 8-28 μm high with thin and smooth horizontal cell walls. Cross-field pitting is small, circular or oval (about mean 9.5 μm in diameter), consisting of 1-2 (rarely 3 ; mean 1.35), with oblique or oblong apertures in each field. Axial parenchyma is scattered throughout rings.

In TLS, tracheid walls locally exhibit circular bordered pits (about 8-12 μm in diameter) with oval apertures. Rays are uniseriate or sometimes partly biseriate and 1-25 (mean 10.92) cells high.

In TS, growth rings possess well-marked boundaries defined by 2-8 rows of latewood cells and have a mean ring width 4.91 mm (n=126.25). But growth rings are only four. Maximum earlywood tracheid radial diameter is 80 μm and minimum latewood tracheid radial diameter is 8 μm. Mean whole-ring tracheid diameter is 37.29 μm.

31. *Cupressinoxylon* sp. indet No. 58416. Plate 31.
SHIMAKURA 1937 : p. 54, Pl.XII, figs. 10-11.

Slides are all ill-preserved.

In RLS, earlywood tracheid pitting is characterized by uniseriate (97%) or biseriate (3%), circular or oval bordered pits (12-20 μm in diameter) with small oval apertures. Where biseriate, bordered pits are always oppositely arranged each other (100%). Pit contiguity is low with values ranging from 1-3 (mean 1.02). Rays are sparse (up to 276.5 μm more long) and are composed of parenchymatous cells with smooth horizontal cell walls. Cross-field pitting is small oval and half-bordered, consisting of 1-2 (rarely 3-4 ; mean 1.05) with circular or oval apertures in each field. Axial parenchyma is scattered throughout rings.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate and 1-10 more cells high (mean 5.55)

In TS, growth rings are not clear. Tracheid pits are strongly deformed, just they are seemed to be squarish and thin-walled.

32. *Cupressinoxylon* ? sp. indet. No. 58449. Plate 32.
SHIMAKURA 1937 : pp. 54-55, Pl.XIII, figs. 6-9.

This specimen is very ill-preserved.

In RLS, earlywood tracheid pitting is characterized by uniseriate, circular bordered pits (about 12-16 μm in diameter) with oval apertures. Pits are separated or slightly contiguous. Cross-field pitting is oval or oblong and apparently simple, consisting of 1-2 in each field. Axial parenchyma is diffused or is somewhat zonate

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate.

In TS, growth rings are present but much region of earlywood and latewood are crushed so that only minimum estimates of tracheids radial diameter. Maximum tracheid radial diameter is 28 μm and minimum tracheid radial diameter is 12 μm. Mean tracheid diameter is 19.06 μm.

33. Indeterminable coniferous wood No. 50288. Plate 33.
SHIMAKURA 1936 : pp. 297-298.

This specimen shows very bad preservation. So it can not be observed mostly things. Only in TLS, rays seem to be arranged in uniseriate.

34. Indeterminable wood (A coniferous wood, gen. et sp. indet.) No. 58411. Plate 34.
SHIMAKURA 1937 : p. 62, Pl.VII, figs. 7-9.

This specimen is poorly preserved.

In RLS, tracheids exhibit uniseriate, circular or oval bordered pits (12-18 μm in diameter). Rays are sparse (about up to 244 μm long) and are composed of parenchymatous cells, 12-24 μm wide and 20-36 μm high with thin and smooth horizontal cell walls. Cross-field pitting is not clear. Axial parenchyma is absent.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate and 1-12 (mean 5.38) cells high.

In TS, growth rings are ill-preserved. Maximum tracheid radial diameter is 48 μm and minimum tracheid radial diameter is 16 μm. Mean whole-ring tracheid radial diameter is 30.8 μm.

35. Indeterminable wood (*Cupressinoxylon* type wood, a) No. 58447. Plate 35.
SHIMAKURA 1937 : pp. 62-63, Pl.VIII, fig. 6.

In RLS, tracheids exhibit uniseriate, circular bordered pits (about 12-20 μm in diameter) with circular or oval apertures. Rays are not clear, they just seem to be uniseriate and 1-8 more cell high. Cross-field pitting is large circular or oval, consisting of only one, with lenticular oblique apertures in each field. Axial parenchyma is present.

In TLS, Tracheid bordered pits are not clear.

In TS, growth rings are mostly crushed so that only somewhat region estimates of latewood ring width are possible ; a mean latewood ring width of 27.46 μm was obtained (n=2.6). Where locally preserved uncrushed, maximum tracheid radial diameter is 40 μm and minimum tracheid radial diameter is 12 μm. Mean tracheid radial diameter is 27.06 μm.

36. Indeterminable wood (*Cupressinoxylon* type wood, b) No. 58412. Plate 36.
SHIMAKURA 1937 : p. 63, Pl.XIII, figs. 10-11.

In RLS, tracheids exhibit uniseriate or rarely biseriate, circular to oval bordered pits (about 16 μm in diameter). Where biseriate, bordered pits are dominantly arranged opposite each other. Rays are moderate (up to 434.5 μm more long) and composed of parenchymatous cells, 8-46 μm wide and 20-48 μm high with smooth horizontal cell walls. Cross-field pitting is not well preserved.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate.

In TS, growth rings possess well marked boundaries defined by 1-9? rows of latewood cells and have a mean ring width of 1.35 mm (n=45.27). Maximum earlywood tracheid radial diameter is 52 μm and minimum latewood tracheid radial diameter is 12 μm. Mean whole-ring tracheid radial diameter is 35.68 μm.

37. Indeterminable wood (*Cupressinoxylon* type wood, c) No. 7700. Plate 37.

SHIMAKURA 1937 : p. 63, Pl.XIII, figs. 4-5.

In RLS, tracheid pits are separated and circular bordered pitting. Cross-field pitting is indistinct.

In TLS, Tracheid bordered pits are not clear. Rays are uniseriate and 1-10 (mean 4.7) cells high and 16-28 μm wide and 16-32 μm high with thin ? horizontal cell walls.

In TS, growth rings are indeterminable and tracheids are small, irregular. Axial parenchyma is diffused and is sometimes zonate.

Notes

Professor Shimakura collected fossil woods from 1928 to 1934 throughout the areas of Japan, Korea, and Manchuria. The results of his study were published in 1936 and 1937 in which he produced 480 slides based on his study. Almost of the slides deposited in the Tohoku University Museum.

From the published 34 kinds of fossil woods, *Xenoxylon latiporosum*, *X. phyllocladoides*, and *Phyllocladoxylon heizyoense* were collected from Korea in which Phyllocladoxylon heizyoense was a newly collected species, 11 kinds were collected from Japan, 15 kinds were collected from Sakhalin, and 7 kinds were came from Manchuria. In addition, the newly collected species were 8 kinds, such as *Dadoxylon* (*Araucarioxylon*) *japonicum, Dadoxylon* (*Araucarioxylon*) *sidugawaense, Phyllocladoxylon heizyoense, Pinoxylon Yabei, Planoxylon Inaii, Piceoxylon transiens, P. scleromedullosum*, and *Cupressinoxylon sachalinense*, and two species, such as *Paracupressinoxylon Solmsi* (Stopes) and *Taxodioxylon albertense* (Penhallow) were recombined. Moreover, 11 kinds were included to the upper classes due to the poor state of preservation.

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PLATE 1 *Dadoxylon (Araucarioxylon) japonicum* SHIMAKURA (Slide No. 53325, 58419)
Figs. 1–2. Transverse section–1 & 2 : More or less abrupt transition of growth rings and tracheids. Figs. 3–8. Radial section. –3 & 4 : Cross–field pits and radial tracheid pits. –5–8 : Opposite and alternate TRPits. Figs. 9–12. Tangential section. – 9–12 : Rays and TTPits.

PLATE 2 *Dadoxylon (Araucarioxylon) sidugawaence* SHIMAKURA (Slide No. 44234)
Figs. 1–6. Transverse section – 1 & 2 : Gradual transition of growth rings and latewood. – 3 : Traumatic RDs. – 4 : Tracheids. – 5 : Pith. – 6 : Phloem. Figs. 7–9. Radial section – 7–9 : Cross–field pits and TRPits. Figs. 10–12 : Tangential section – 10–12 : Rays and TTPits.

PLATE 3 *Dadoxylon* cfr. *tankoense* STOPES et FUJII (Slide No. 58446)
Figs. 1–3 Transverse section – 1–3 : Tracheids. Figs. 4–5 Radial section – 4 & 5 : Multiseriate TRPits and cross–field pits. Figs. 6 Tangential section – 6 : Rays and TTPits.

PLATE 4 *Dadoxylon* sp. indet. (Cfr. *japonicum* SHIMAKURA) (Slide No. 58484, 58408)
Figs. 1–2 Transverse section – 1 & 2 : Gradual (?) of growth ring and tracheids. Figs. 3–4 Radial section – 3 & 4 : TRPits and cross–field. Figs. 5–6 Tangential section – 5 & 6 : Rays.

PLATE 5 *Brachoxylon* aff. *Woodworthianum* TORREY (Slide No. 58409)
Figs. 1–2 Transverse section – 1 & 2 : Growth ring and tracheids. Figs. 3–5 Radial section – 3–5 : Cross–field pits and TRPits. Figs. 6–9 Tangential section – 6 & 7 : Uni–, bi–, or triseriate rays. – 8 & 9 : TTPits.

PLATE 6 *Xenoxylon latiporosum* (CRAMER) GOTHAN (Slide No. 44490, 6870)
Figs. 1–3 Transverse section – 1 & 2 : Abrupt transition of growth rings. – 3 : Gradual transition of growth rings. Figs. 4–6 Radial section – 4 & 5 : Cross–field pits and TRPits. – 6 : Biseriate TRPits. Figs. 7–9 Tangential section – 7–9 : Uniseriate and biseriate rays and TTPits.

PLATE 7 *Xenoxylon phyllocladoids* GOTHAN (Slide No. 6869)
Figs. 1–2. Transverse section – 1 & 2 : Growth rings and tracheids. Figs. 3–4. Radial section – 3 & 4 : Cross–field pits and TRPits. Figs. 5–6. Tangential section – 5 & 6 : Rays

PLATE 8 *Planoxylon Inaii* SHIMAKURA (Slide No. 58445)
Figs. 1–4 Transverse section – 1–4 : Abrupt transition of growth rings and tracheids. Figs. 5–9 Radial section – 5–9 : Cross–field pits and uni–, bi–, or triseriate TRPits. Figs. 10–12 Tangential section – 10–12 : Rays and TTPits.

PLATE 9 *Protocedroxylon araucarioides* GOTHAN (Slide No. 58415)
Figs. 1–3 Transverse section – 1–3 : More or less abrupt transition of growth rings and tracheids. Figs. 4–9 Radial section – 4–6 : TRPits. – 7 & 9 : Cross–field pits. Figs. 10–12 Tangential section – 10–12 : Uniseriate rays and TTPits.

PLATE 10 *Cedroxylon* cfr. *Yendoi* STOPES et FUJII (Slide No. 58401)
Figs. 1–5 Transverse section – 1–3 : Gradual transition of growth rings, tracheids and traumatic RDs. – 4 : Pith. – 5 : Phloem. Figs. 6–7 Radial section – 6 & 7 : Radially traumatic RD, cross–field pits and TRPits. Figs. 8–12 Tangential section – 8–12 : Tangentially traumatic RD, rays and TTPits.

PLATE 11 *Cedroxylon* sp. indet. (Slide No. 58417)
Figs. 1–3 Transverse section – 1–3 : Tracheids and traumatic RDs. Figs. 4–8 Radial section – 4–8 : Cross–field pits and TRPits. Figs. 9–12 Tangential section – 9–12 : Rays and TTpits.

PLATE 12 *Pinoxylon dakotense* (KNOWLTON) READ (Slide No. 57693)
Figs. 1–6 Transverse section – 1 : Abrupt transition of growth rings. – 2–4 : Normal RDs. – 5 & 6 : Traumatic RDs and tracheids. Figs. 7–9 Radial section – 7–9 : Cross–field pits and TRPits. Figs. 10–12 Tangential section – 10–12 : Rays and TTPits.

PLATE 13 *Pinoxylon Yabei* SHIMAKURA (Slide No. 30556)
Figs. 1–5 Transverse section – 1–4 : Growth rings, tracheids, normal RDs and traumatic RDs. – 5 : Parenchyma cells. Figs. 6–9 Radial section – 6 : uni–, bi– or triseriate TRPits. – 7 : Cross–field pits. – 8 : Radially traumatic RD. – 9 : Nodula lateral and end walls. Figs. 10–12 Tangential section – 10–12 : Fusiform ray, rays and TTPits.

PLATE 14 *Piceoxylon scleromedullosum* SHIMAKURA (Slide No. 58478)
Figs. 1–3 Transverse section – 1 : Growth rings – 2 : Pith. – 3 : Normal RD. Figs. 4–6 Radial section – 4 : Radially pith. – 5 : Cross–field pits. – 6 : TRPits. Figs. 7–9 Tangential section – 7–9 : Rays and TTPits.

PLATE 15 *Piceoxylon transiens* SHIMAKURA (Slide No. 58450)
Figs. 1–3 Transverse section – 1–3 : Growth rings, normal and traumatic RDs. Figs. 4–9 Radial section – 4 : Cross-field pits and TRPits. – 5 : Spiral check. – 6 & 7 : TRPits. – 8 : Spiral thick – 9 : Radially traumatic RD. Figs 10–12 Tangential section – 10–12 : Rays and TTPits.

PLATE 16 *Piceoxylon* sp. (*P. antiquius* GOTHAN?) (Slide No. 58448)
Figs. 1–4 Transverse section – 1–4 : Tracheids and normal RD. Figs. 5–8 Radial section – 5–8 : Cross-field pits (?) and TRPits. Figs. 9 Tangential section – 9 : Rays.

PLATE 17 *Phyllocladoxylon* cfr *eboracense* HOLDEN (Slide No. 30557)
Figs. 1–3 Transverse section – 1–3 : Growth rings and tracheids. Figs. 4–5 Radial section – 4 & 5 : Cross-field pits and TRPits. Figs. 6 Tangential section – 6 : Rays and TTPits.

PLATE 18 *Phyllocladoxylon* aff. *Gothani* (STOPES) KRÄUSEL (Slide No. 58402)
Figs. 1–2 Transverse section – 1 & 2 : Growth rings and tracheids. Figs. 3–6 Radial section – 3–5 : Cross-field pits and TRPIts. – 6 : TRPits. Figs. 7–9 Tangential section –7–9 : Rays and TTPits.

PLATE 19 *Phyllocladoxylon heizyoense* SHIMAKURA (Slide No. 6878, 6873, 6877)
Figs. 1–3 Transverse section – 1 & 2 : Abrupt transition of growth rings. – 3 : Gradual transition of growth rings. Figs. 4–5 Radial section – 4 & 5 : Cross-field pits and TRPits. Figs. 6 Tangential section – 6 : Rays and TTPits.

PLATE 20 *Phyllocladoxylon*? species indet. (Slide No. 30555)
Figs. 1–2 Transverse section – 1 & 2 : Tracheids. Figs. 3–7 Radial section – 3–5 : Cross-field pits and TRPits. – 6 : Alternately biseriate TRPits. – 7 : Cross-field pits and TRPits. Figs. 8–9 Tangential section – 8 & 9 : Rays (?)

PLATE 21 *Podocarpoxylon* cfr. *dakotense* TORREY (Slide No. 58406)
Figs. 1–2 Transverse section – 1 & 2 : Tracheids. Figs. 3–7 Radial section – 3–5 : Cross-field pits and TRPits. – 6 : Spiral check. – 7 : TRPits. Figs. 8–9 Tangential section – 8 & 9 : Rays and TTPits (?)

PLATE 22 *Podocarpoxylon woburnense* STOPES (Slide No. 58481)
Figs. 1–2 Transverse section – 1 & 2 : Gradual transition of growth ring and tracheids. Figs. 3–7 Radial section – 3–5 : Cross-field pits. – 6 & 7 : TRPits. Figs. 8–9 Tangential section – 8 & 9 : Rays and TTPits.

PLATE 23 *Podocarpoxylon* sp. indet. (Slide No. 58404)
Figs. 1–4 Transverse section – 1–3 : Gradual transition of growth rings and tracheids. – 4 : RD(?). Figs. 5–6 Radial section – 5 & 6 : Cross-field pits and TRPits. Figs. 7–9 Tangential section – 7–9 : Rays and TTPits

PLATE 24 *Paracupressinoxylon cryptomeriopsoides* SHIMAKURA (Slide No. 6961)
Figs. 1 Transverse section – 1 : Tracheids. Figs. 2 Radial section – 2 : Cross-field and TRPits. Figs. 3 Tangential section – 3 : Rays.

PLATE 25 *Paracupressinoxylon Solmsi* (STOPES) SHIMAKURA (Slide No. 58480)
Figs. 1–4 Transverse section – 1 & 2 : Pith. – 3 : Traumatic RD. – 4 : Growth ring, tracheids and traumatic RDs. Figs. 5–7 Radial section – 5–7 : Cross-field pits, TRPits and radially traumatic RD. Figs. 8–9 Tangential section – 8 & 9 : Rays and TTPits.

PLATE 26 *Paracupressinoxylon* sp. (HOLDEN's species) (Slide No. 58410)
Figs. 1–3 Transverse section – 1–2 : Abrupt transition of growth rings and tracheids. – 3 : Pith. Figs. 4–8 Radial section – 4–8 : Cross-field pits and TRPits. Figs. 9 Tangential section – 9 : Rays and TTPit (?)

PLATE 27 *Taxodioxylon albertense* (PENHALLOW) SHIMAKURA (Slide No. 58482)
Figs. 1–3 Transverse section – 1–3 : Growth rings, traumatic RDs and tracheids. Figs. 4–7 Radial section – 4–6 : Cross-field pits and TRPits. – 7 : Radially traumatic RDs. Figs. 8–9 Tangential section – 8 & 9 : Rays and TTPits.

PLATE 28 *Cupressinoxylon sachalinense* SHIMAKURA (Slide No. 58403)
Figs. 1–2 Transverse section – 1 & 2 : Abrupt transition of growth rings and tracheids. Figs. 3–4 Radial section – 3 & 4 : Cross-field pits and TRPits. Figs. 5–6 Tangential section – 5 & 6 : Rays and TTPits.

PLATE 29 *Cupressinoxylon vectense* BARBER (Slide No. 58485)
Figs. 1–2 Transverse section – 1 & 2 : Growth rings, tracheids and parenchyma cells. Figs. 3–7 Radial section – 3–7 : Cross-field pits and TRPits. Figs. 8–9 Tangential section – 8 & 9 : Rays and TTPits.

PLATE 30 *Cupressinoxylon* sp. (*C. sachalinense* SHIMAKURA ?) (Slide No. 30880)
Figs. 1–2 Transverse section – 1 & 2 : Gradual transition of growth ring and tracheids. Figs. 3–6 Radial section–3–6 : Cross–field pits and TRPits. Figs. 7–9 Tangential section – 7–9 : Rays and TTPits.

PLATE 31 *Cupressinoxylon* sp. indet. (Slide No. 58416)
Figs. 1 Transverse section – 1 : Tracheids. Figs. 2–5 Radial section – 2–5 : Cross–field pits and TRPits. Figs. 6 Tangential section – 6 : Rays.

PLATE 32 *Cupressinoxylon* ? sp. indet. (Slide No. 58449)
Figs. 1 Transverse section – 1 : Growth ring and tracheids. Figs. 2–3 Radial section – 2 & 3 : Cross–field pits and TRPits. Figs. 4–6 Tangential section – 4 & 6 : Uniseriate rays.

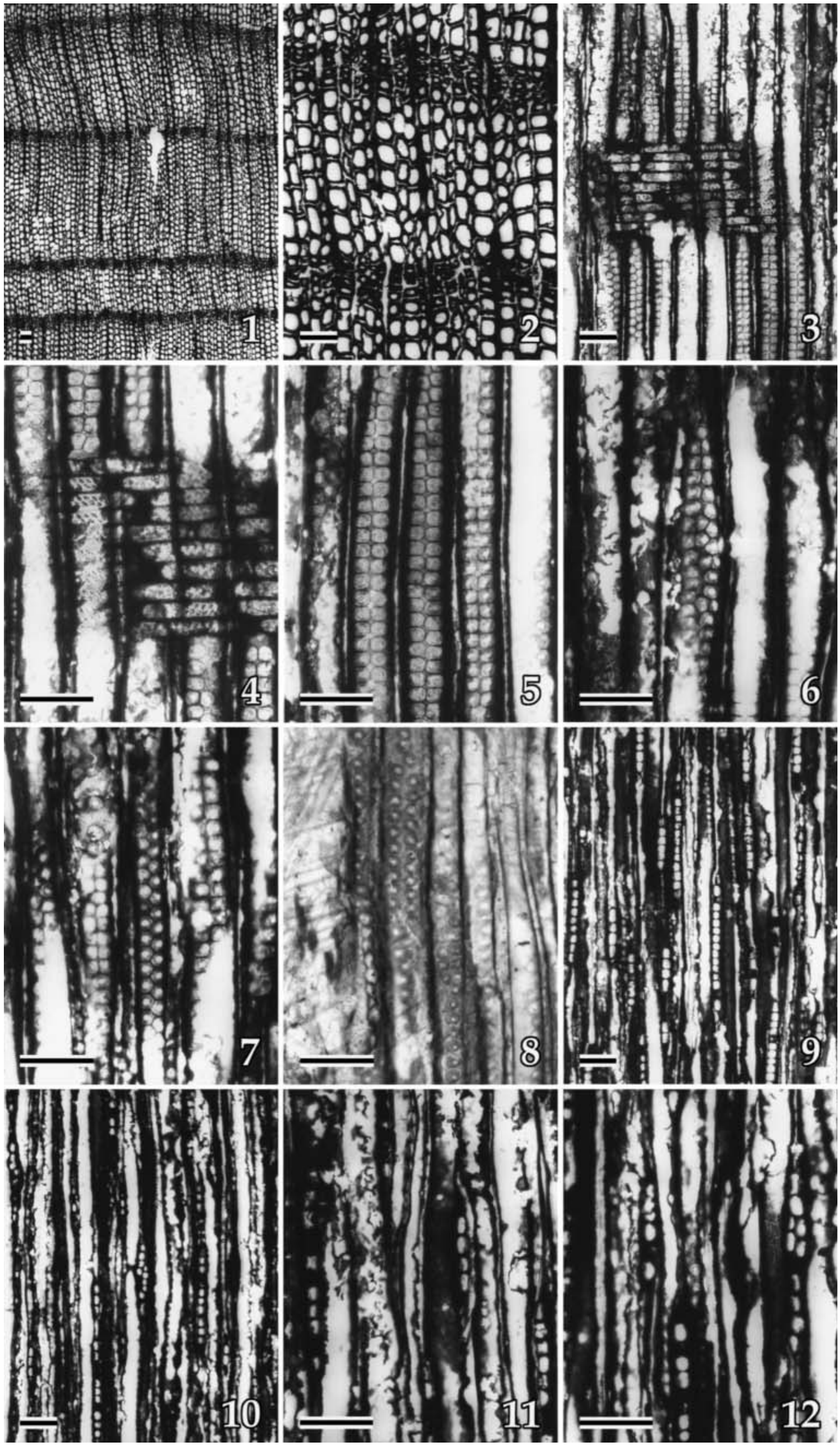
PLATE 33 Indeterminable coniferous wood (Slide No. 50288)
Figs. 1 Transverse section – 1 : Growth rings. Figs. 2 Radial section. Figs. 3 Tangential section – 3 : Uniseriate rays.

PLATE 34 Indeterminable wood (A coniferous wood, gen. et sp. indet.) (Slide No. 58411)
Figs. 1 Transverse section – 1 : Tracheids. Figs. 2 Radial section – 2 : Cross–field pits and TRPits. Figs. 3 Tangential section – 3 : Uniseriate rays.

PLATE 35 Indeterminable wood (*Cupressinoxylon* type wood, a.) (Slide No. 58447)
Figs. 1–2 Transverse section – 1 & 2 : Tracheids. Figs. 3–4 Radial section – 3 & 4 : Cross–field pits and TRPits. Figs. 5–6 Tangential section – 5 & 6 : Uniseriate rays.

PLATE 36 Indeterminable wood (*Cupressinoxylon* type wood, b.) (Slide No. 58412)
Figs. 1 Transverse section – 1 : Gradual transition of growth ring and tracheids. Figs. 2 Radial section. Fig. 3 Tangential section.

PLATE 37 Indeterminable wood (*Cupressinoxylon* type wood, c.) (Slide No. 7700)
Figs 1–2 Transverse section – 1 & 2 : Tracheids and parenchyma cells. Figs. 3–5 Radial section – 3–5 : TRPits and cross–field. Figs. 6 Tangential section – 6 : Rays.



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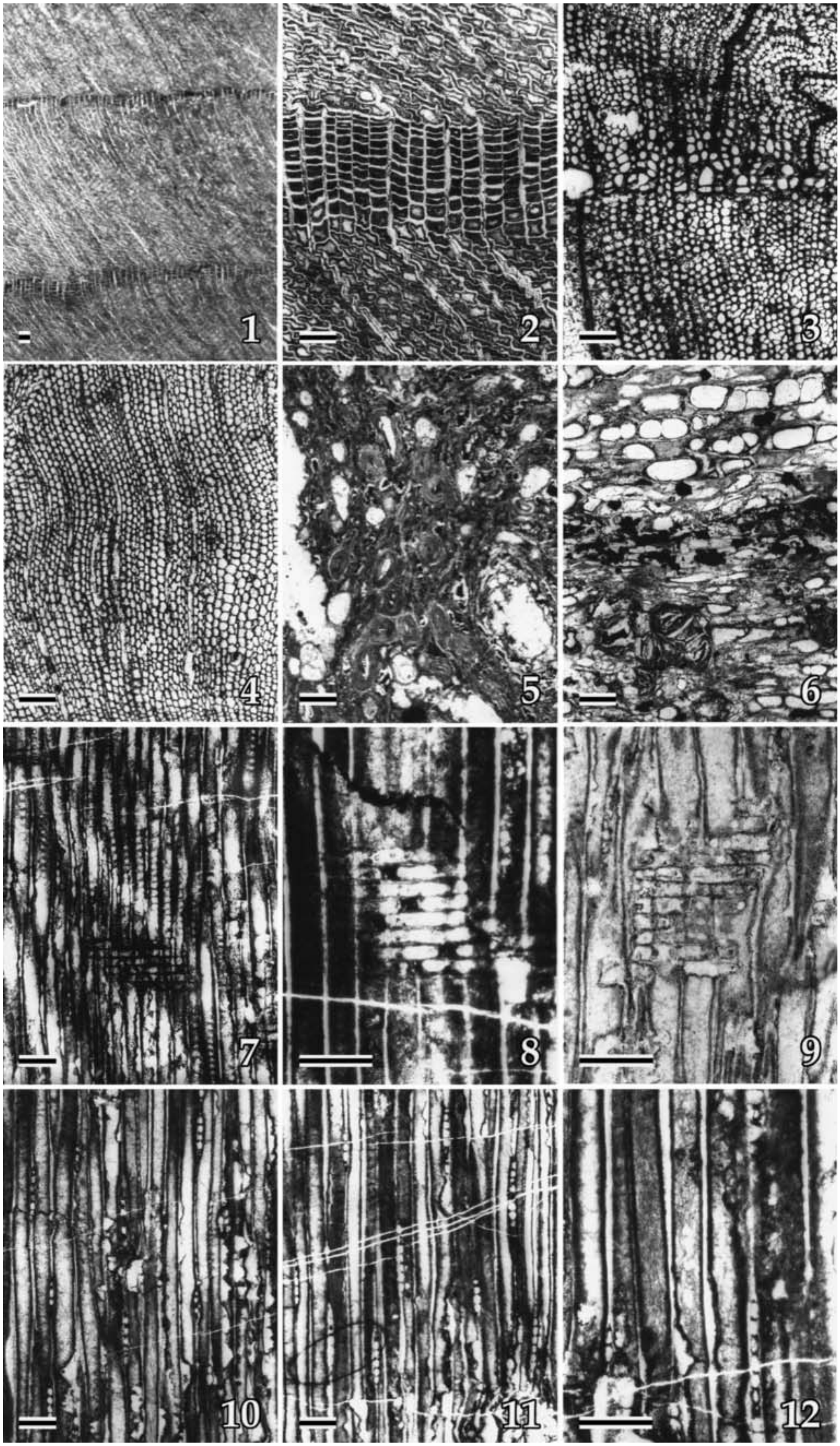

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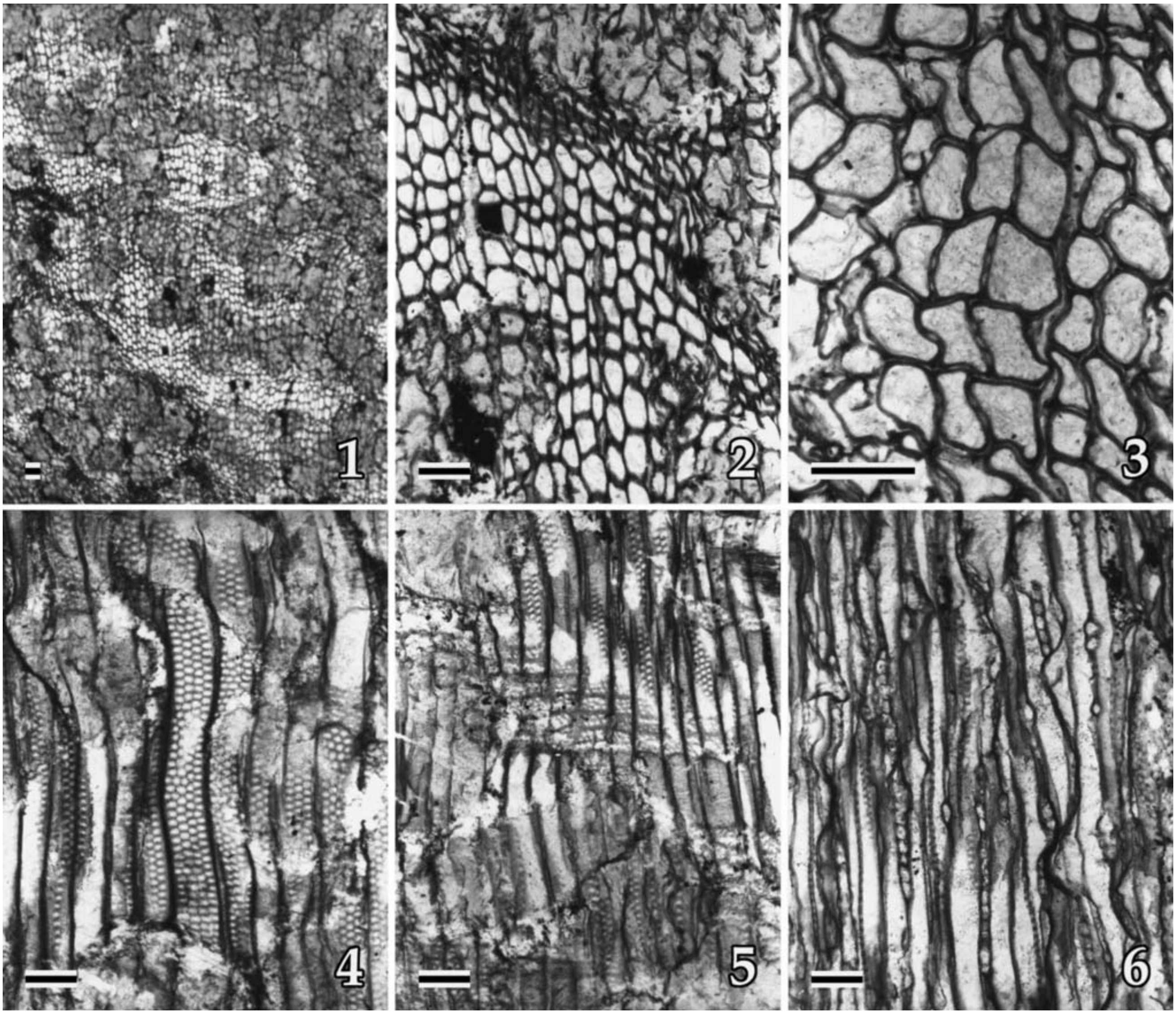

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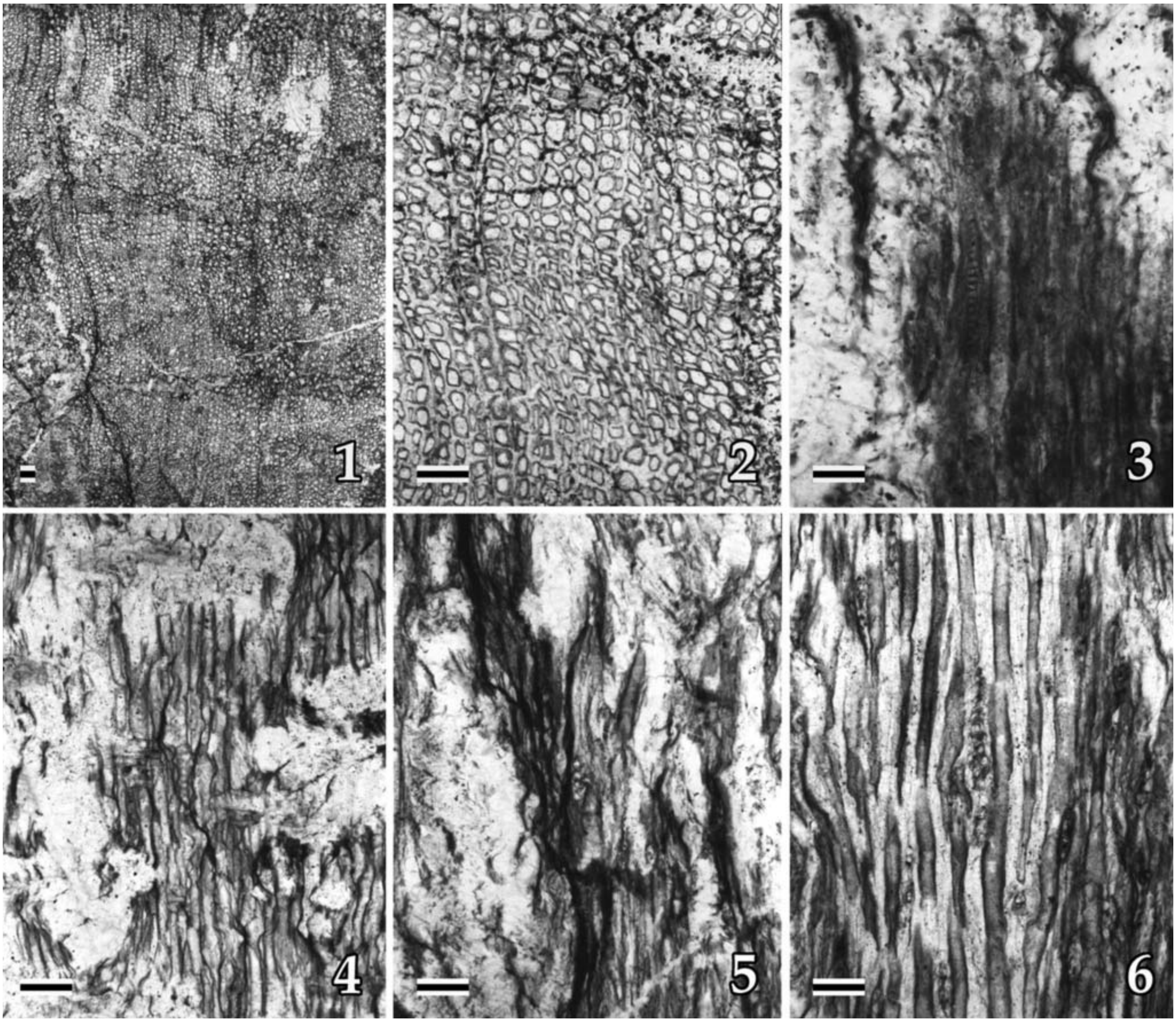

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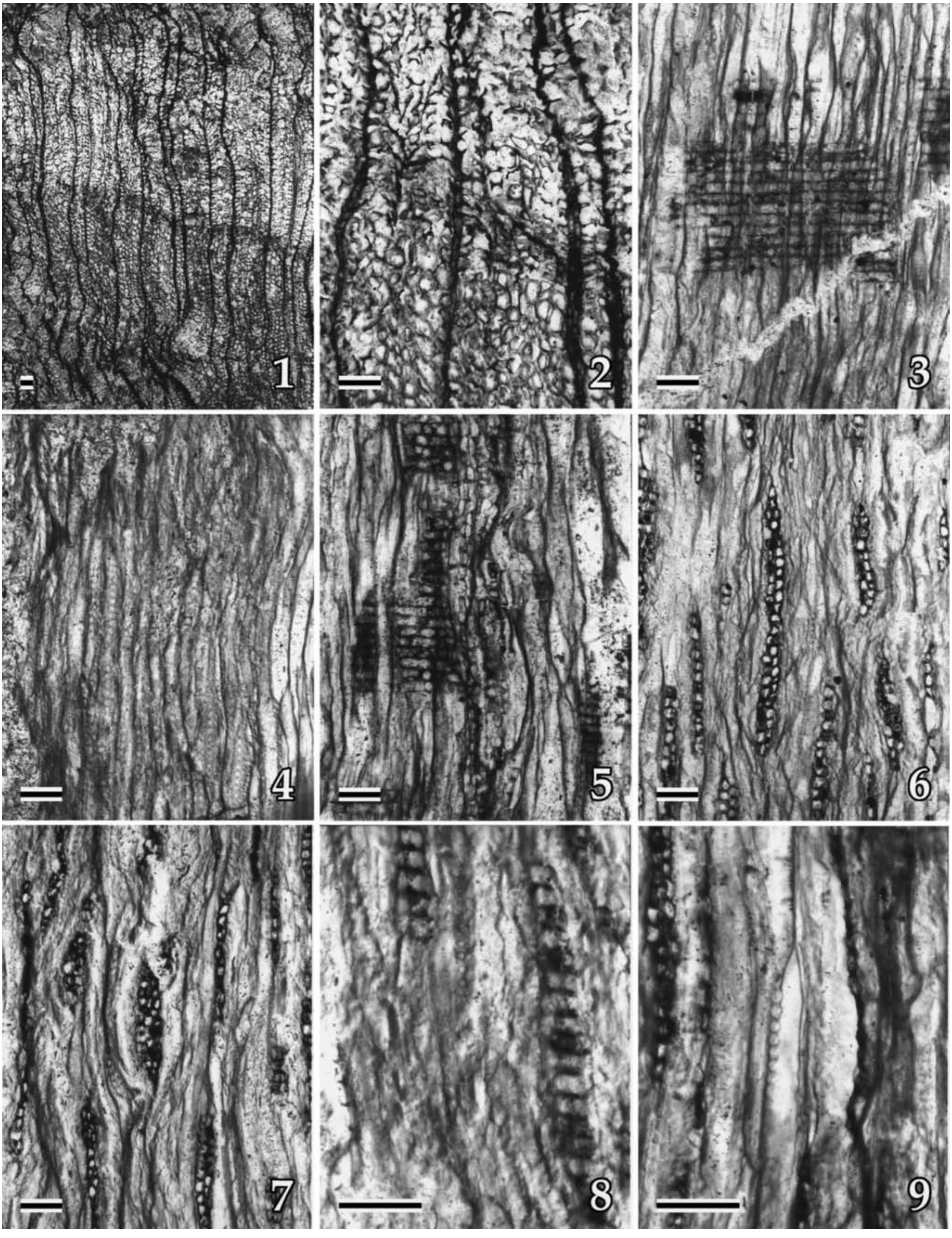

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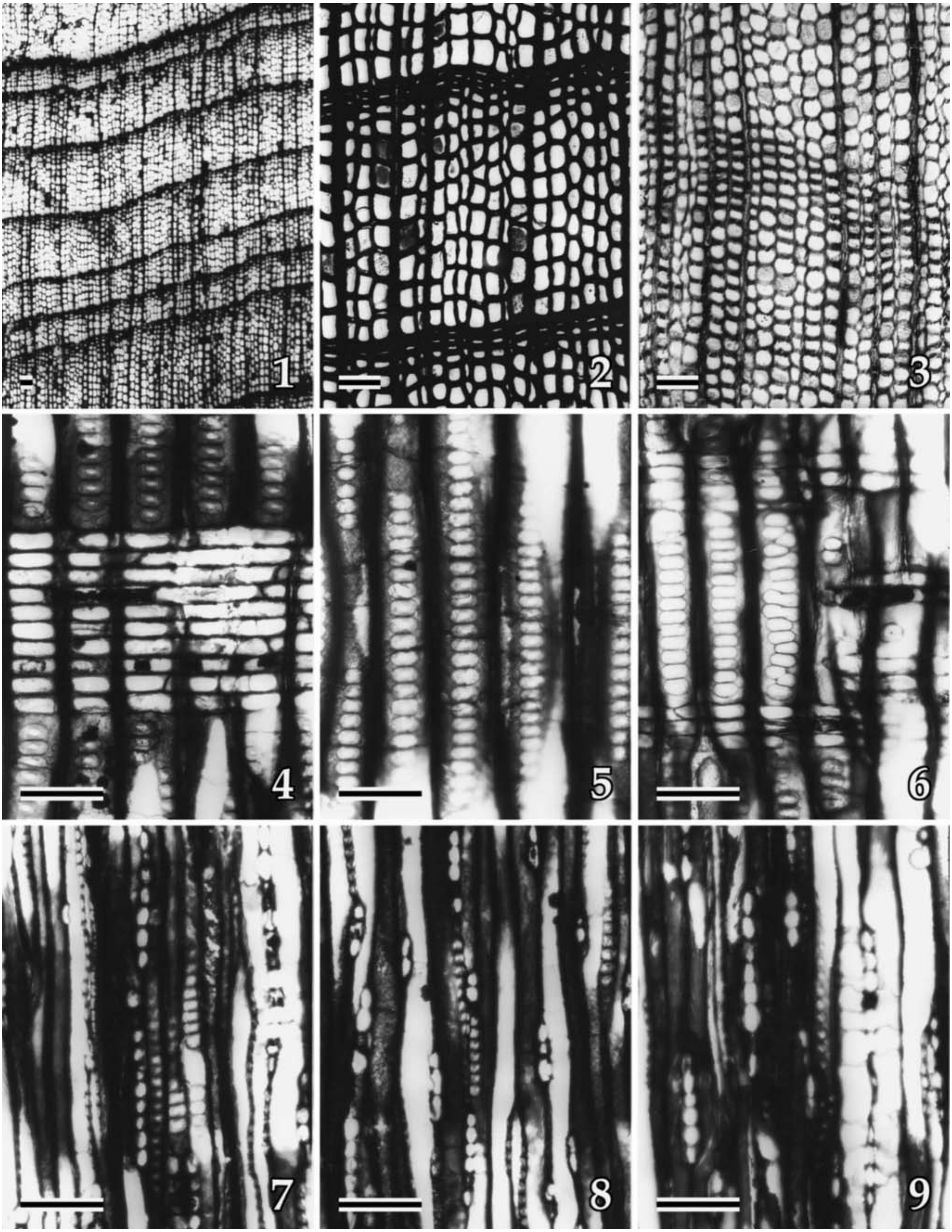

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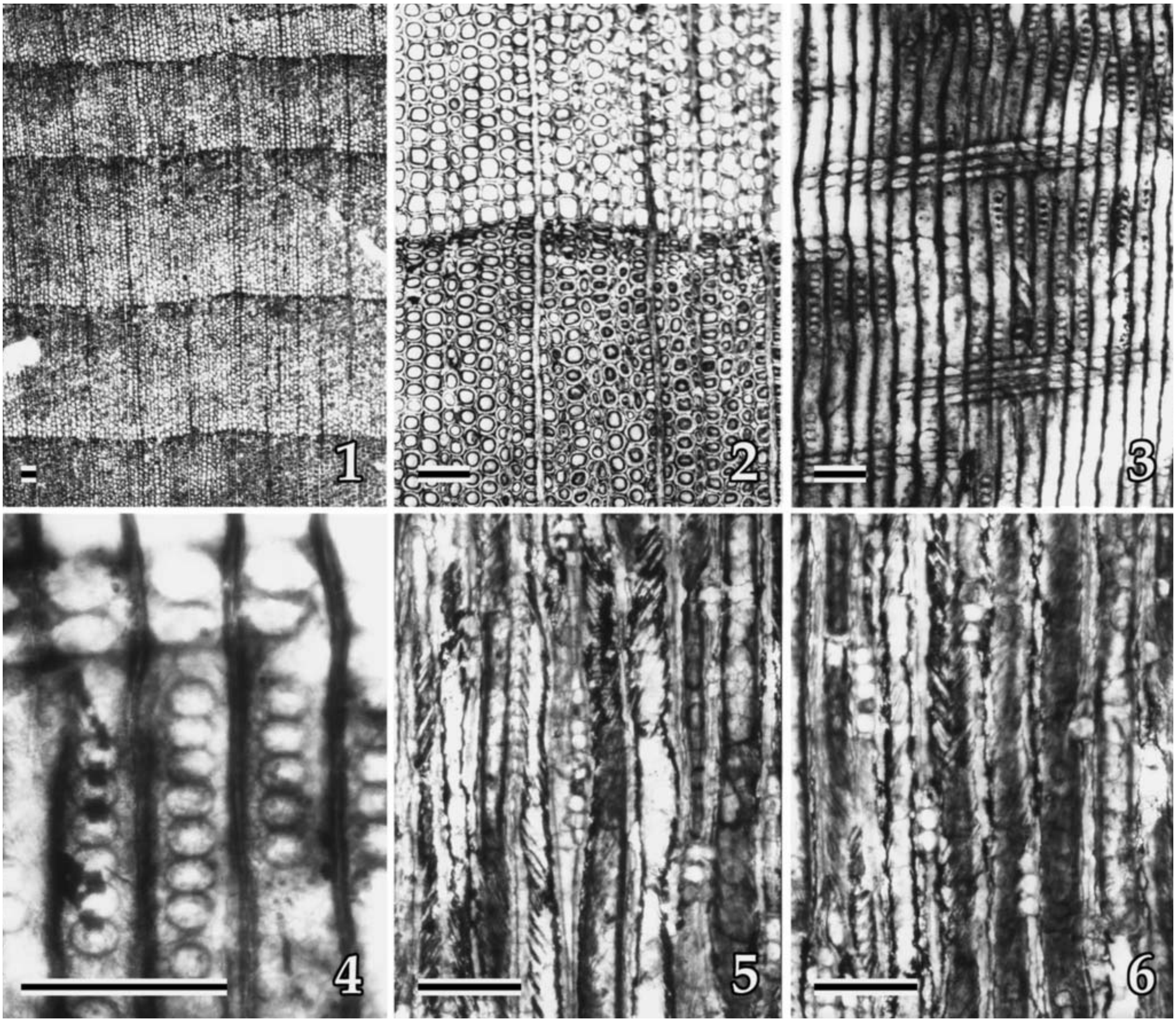

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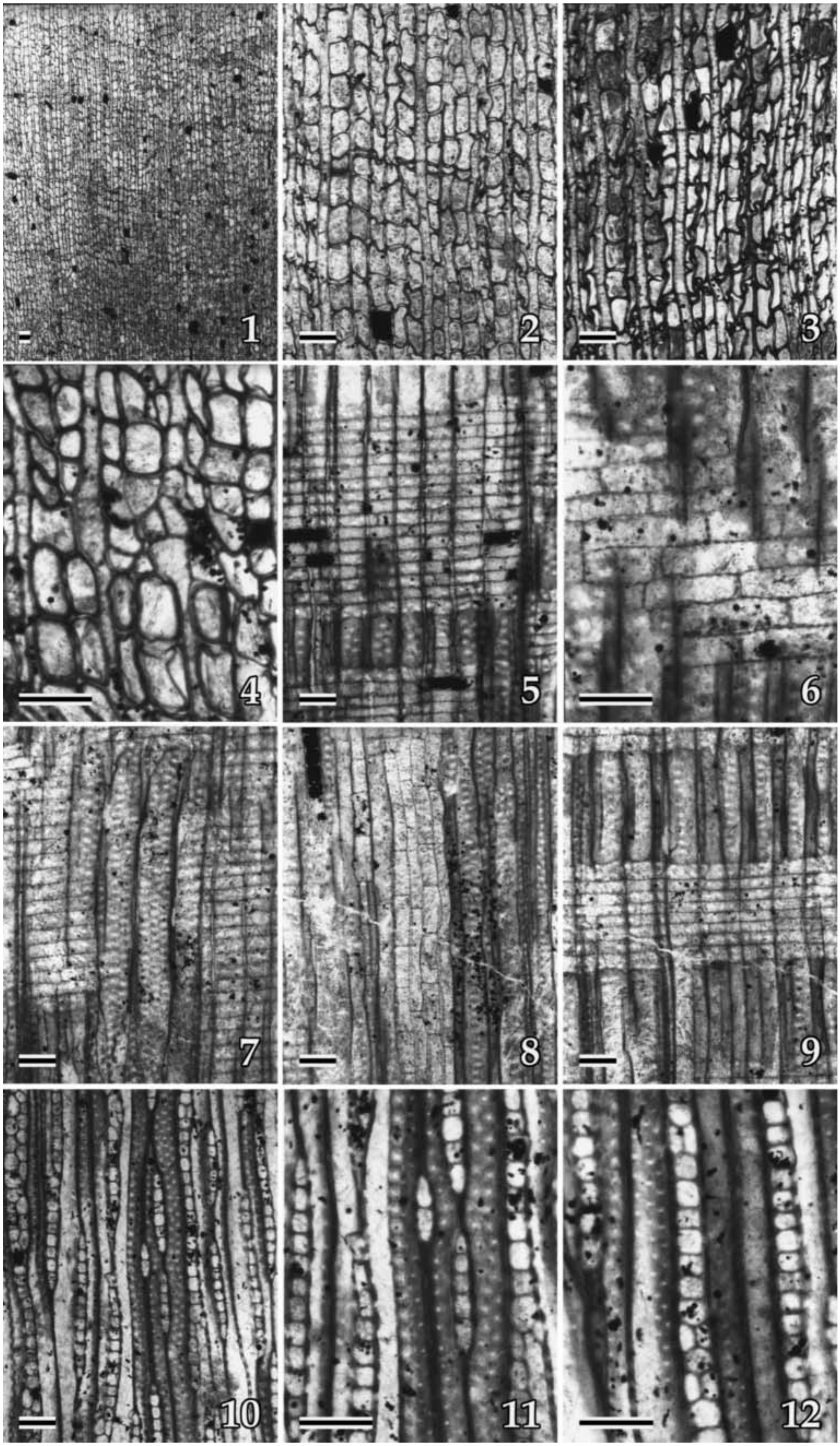

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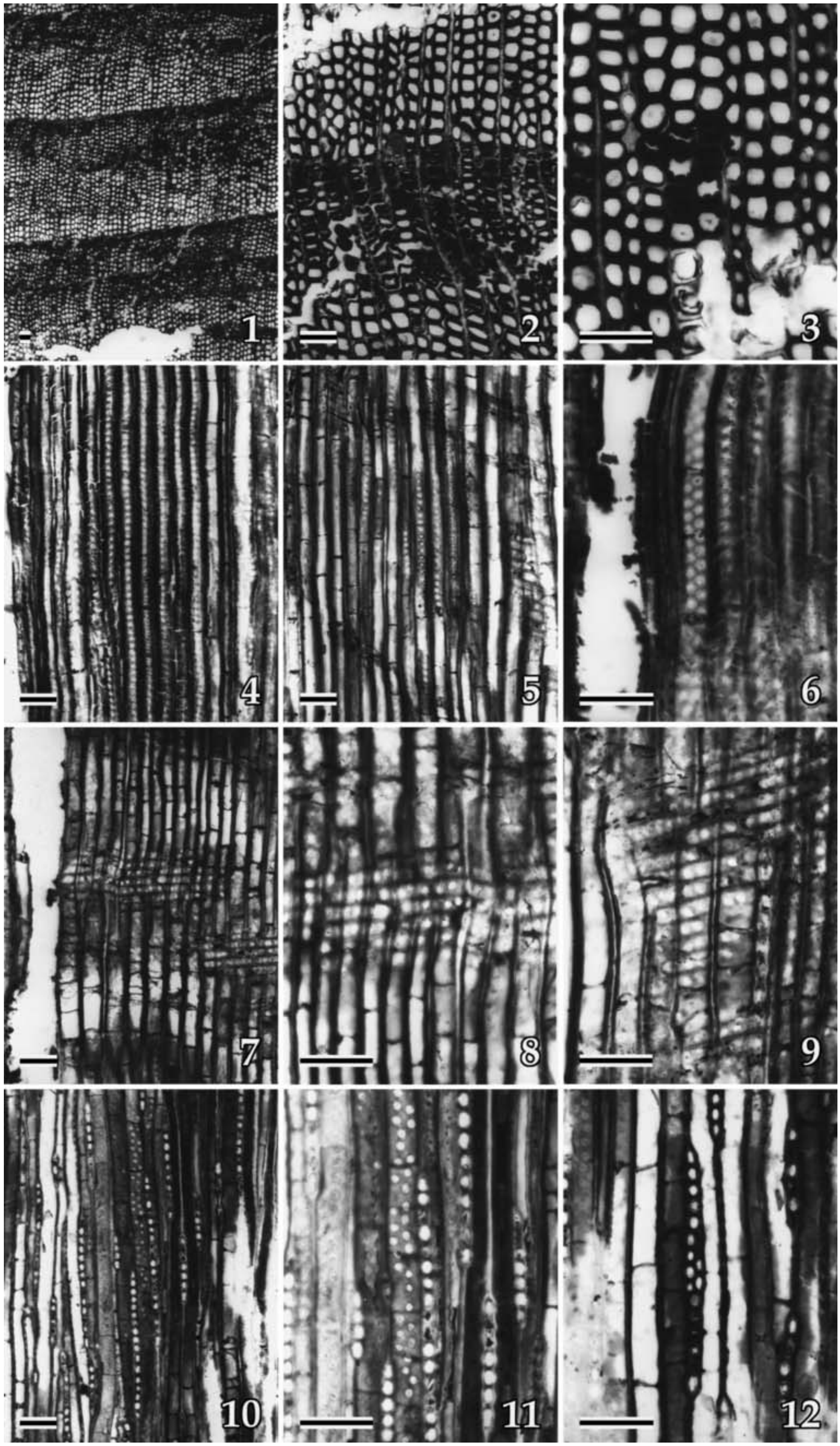

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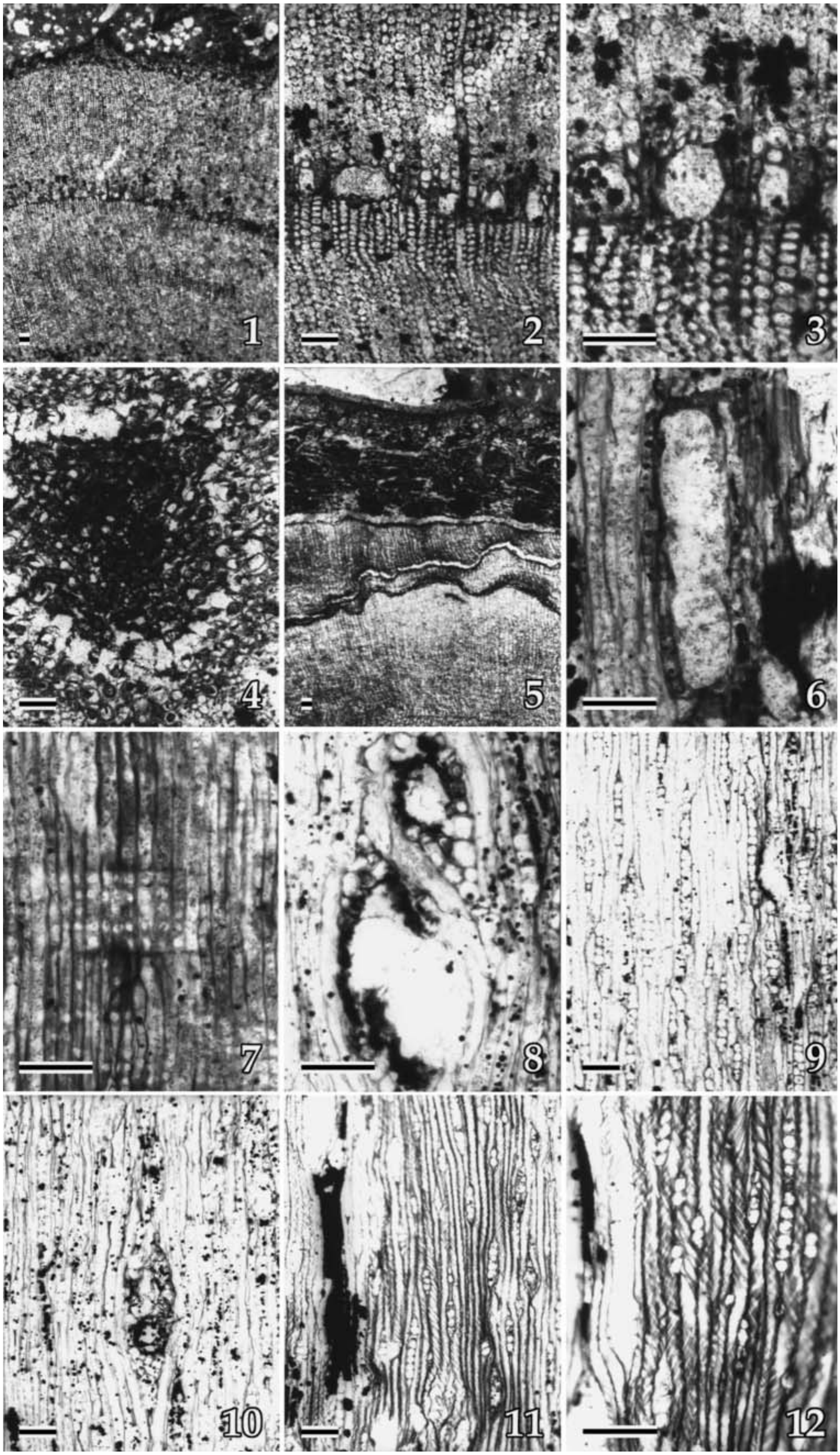

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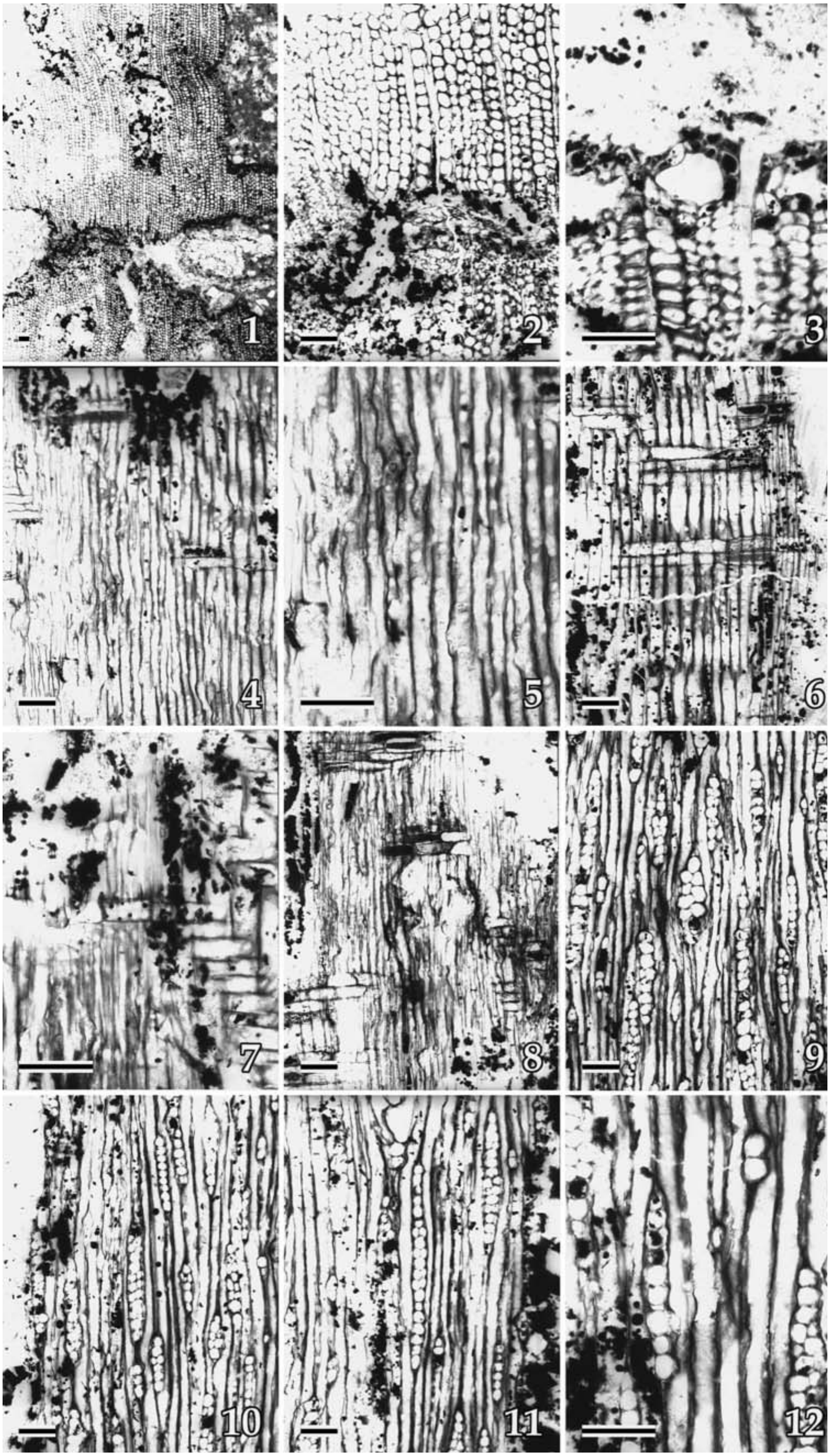

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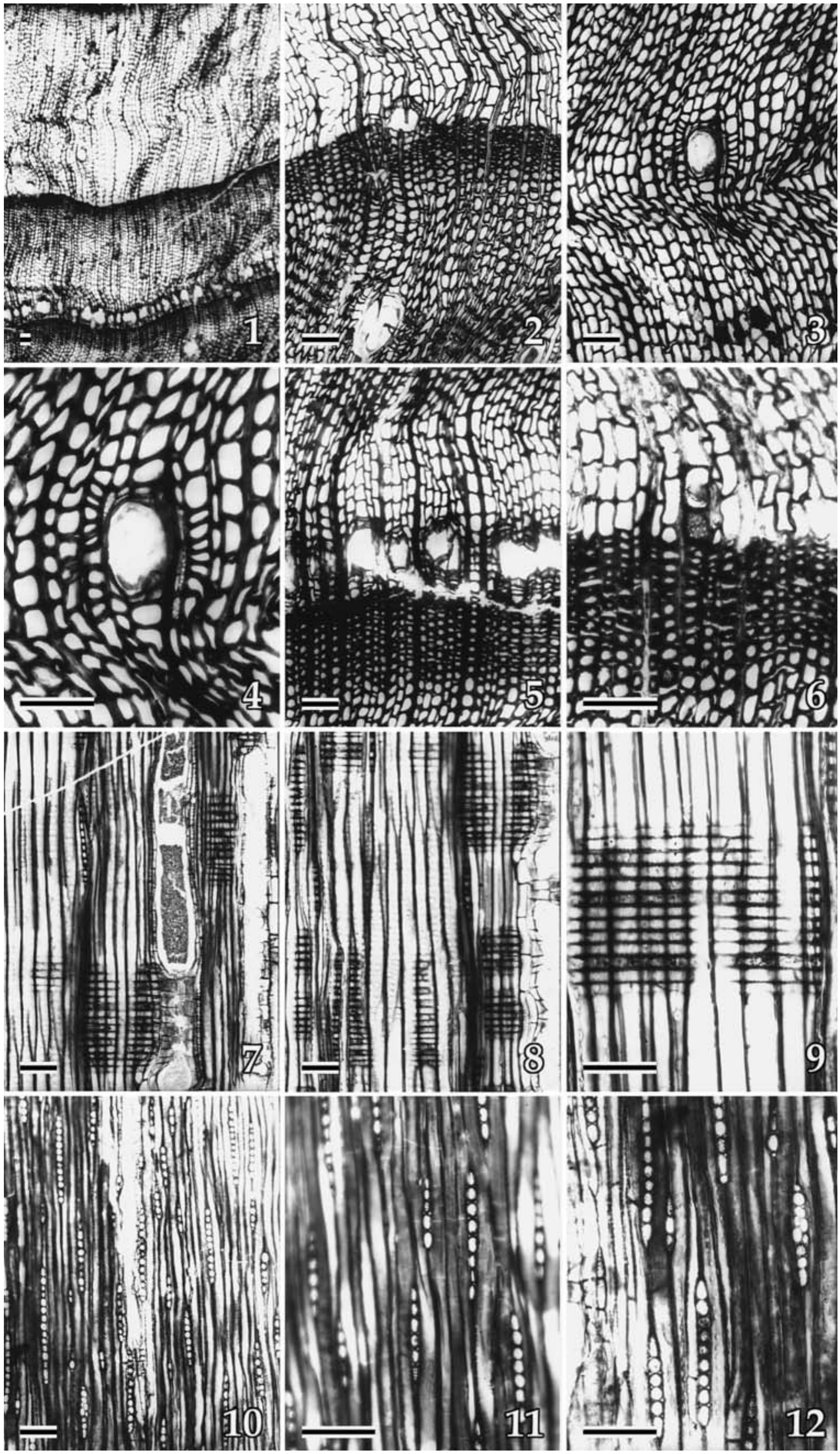

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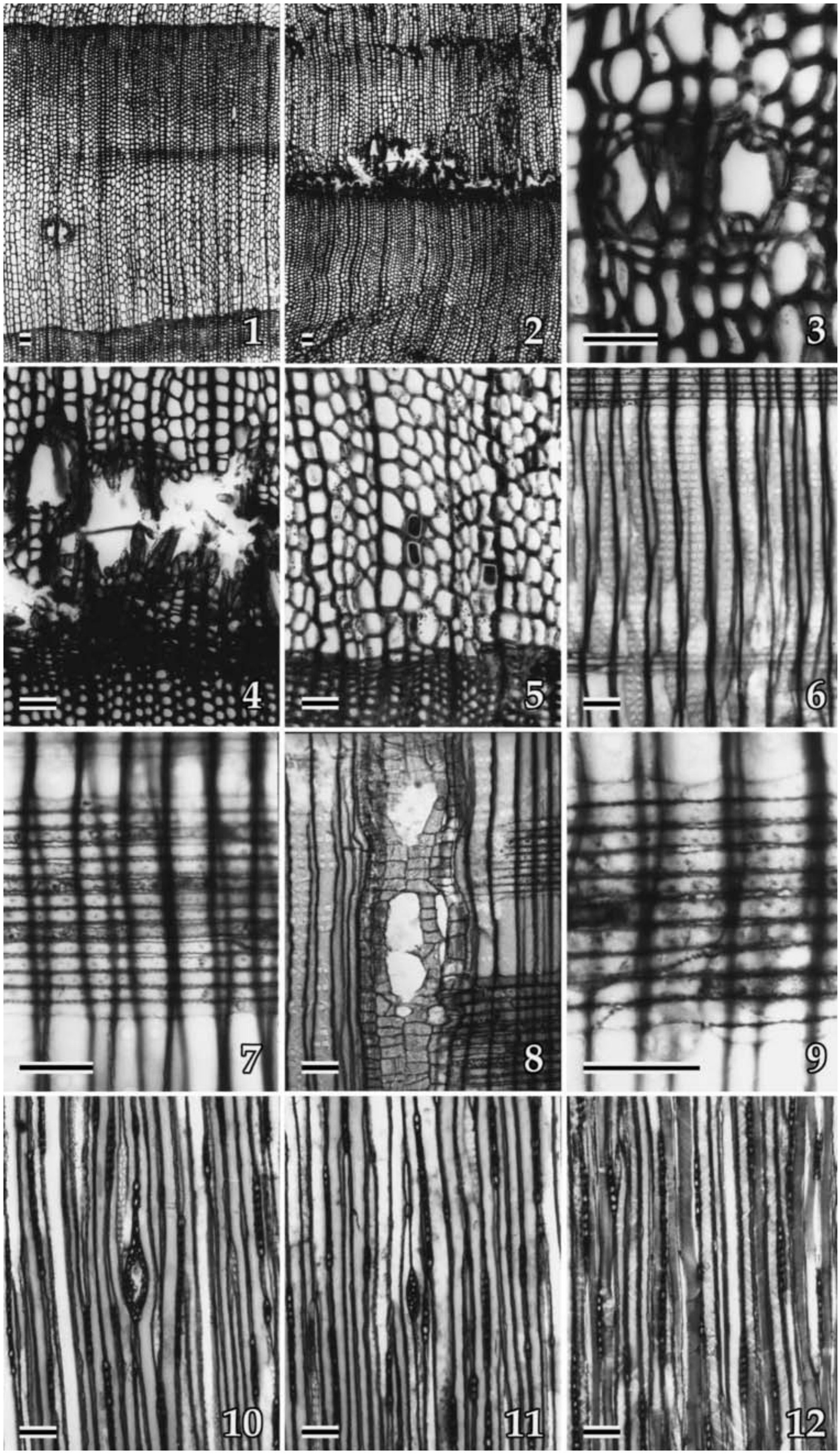

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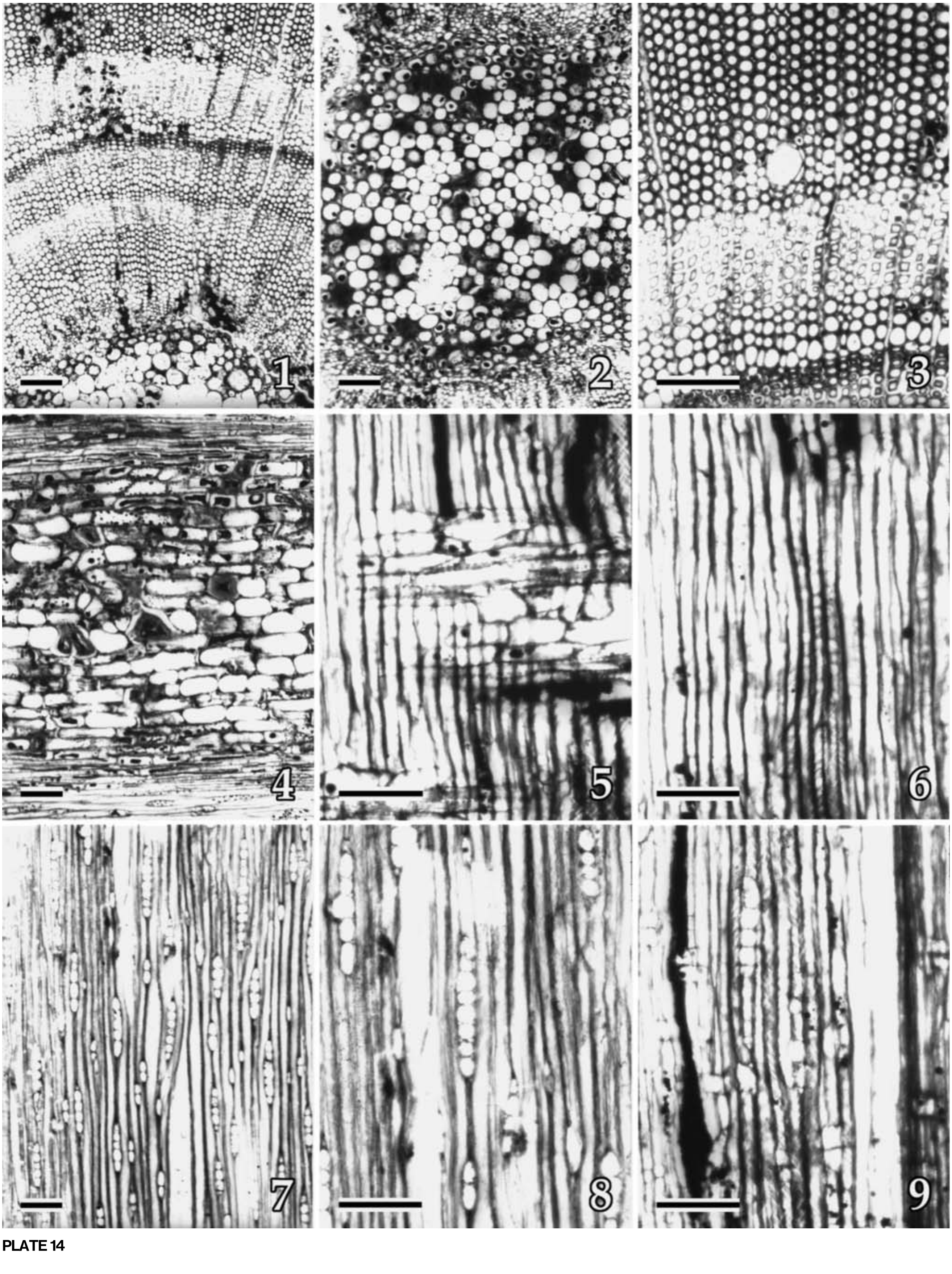

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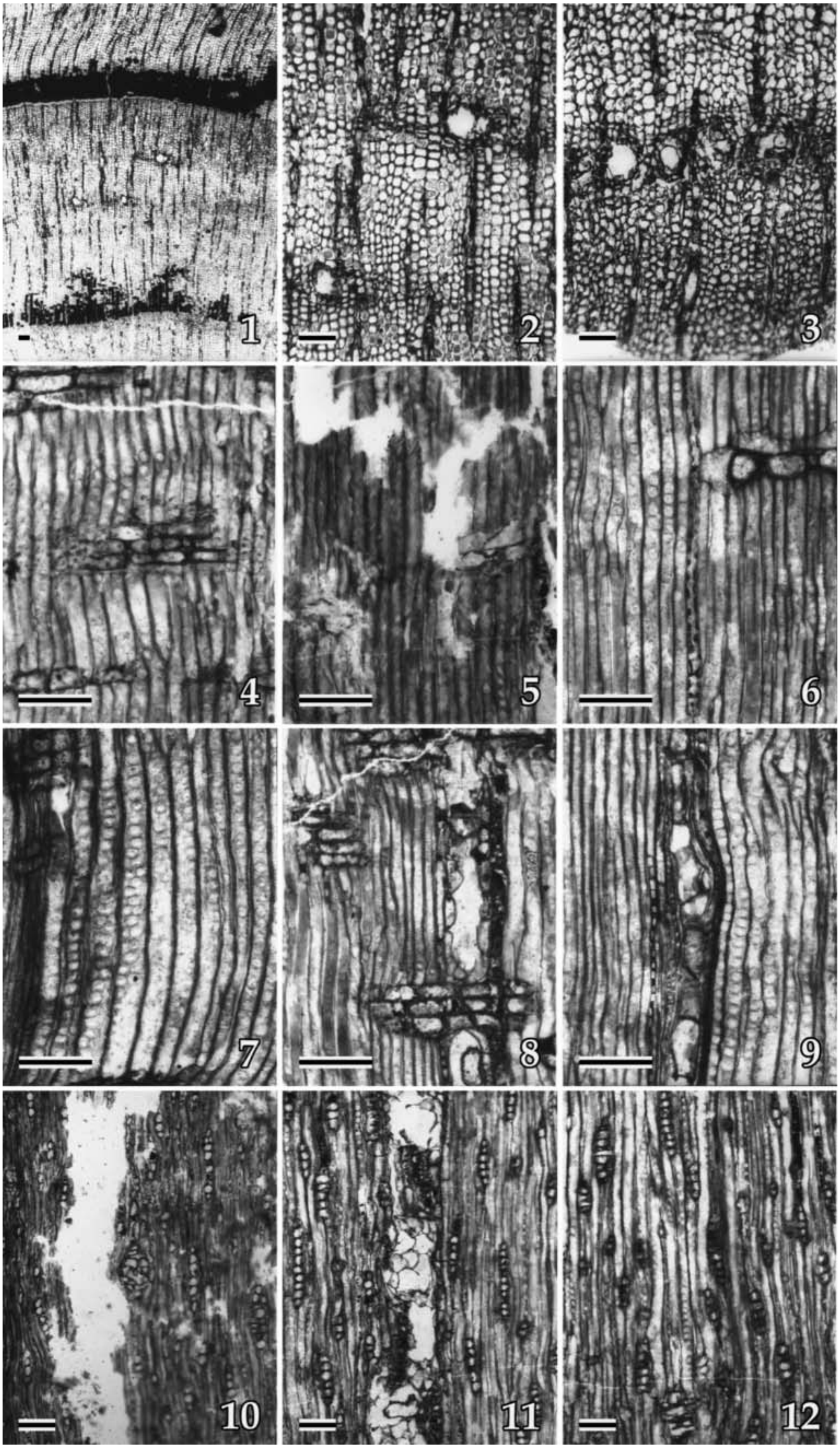

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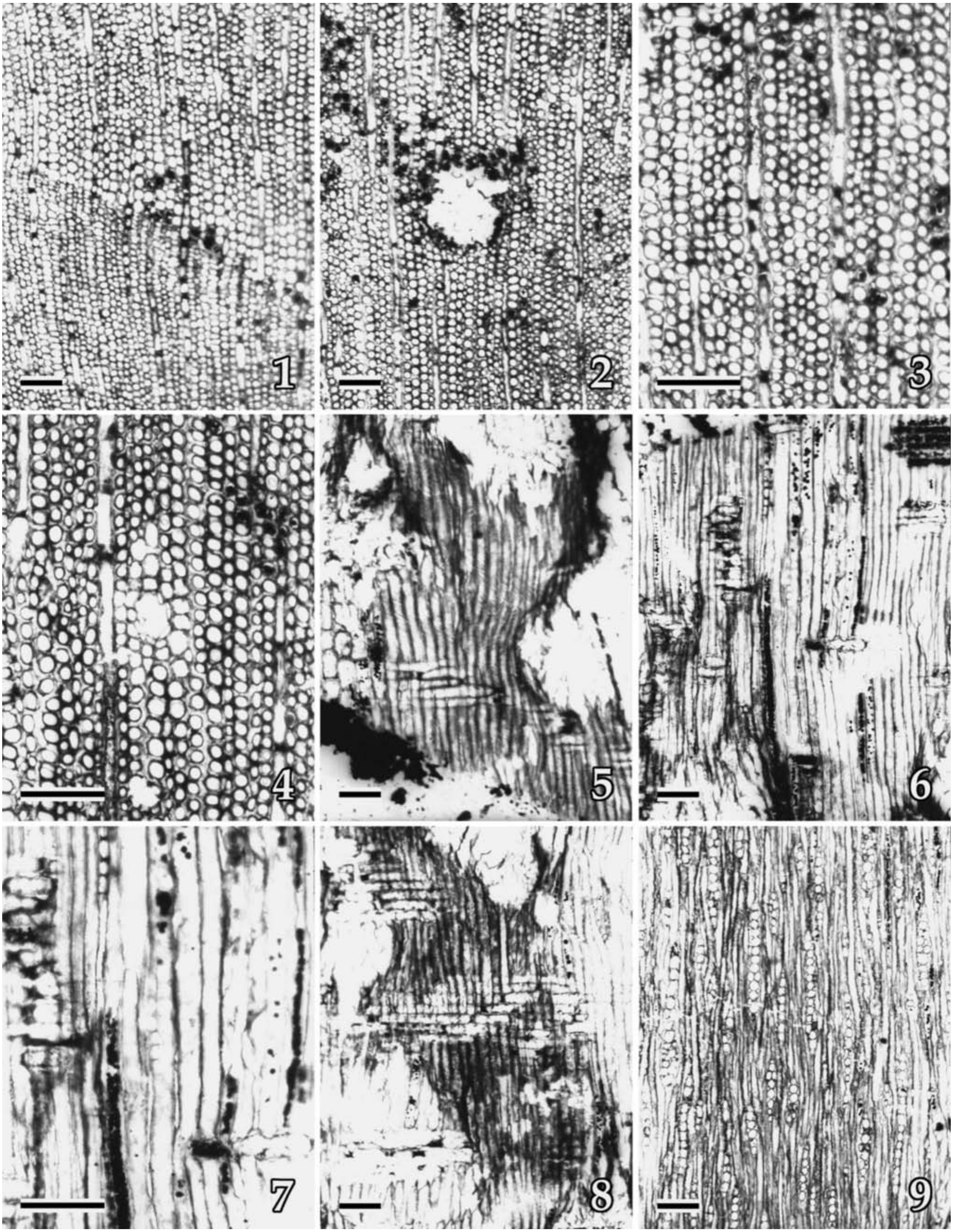

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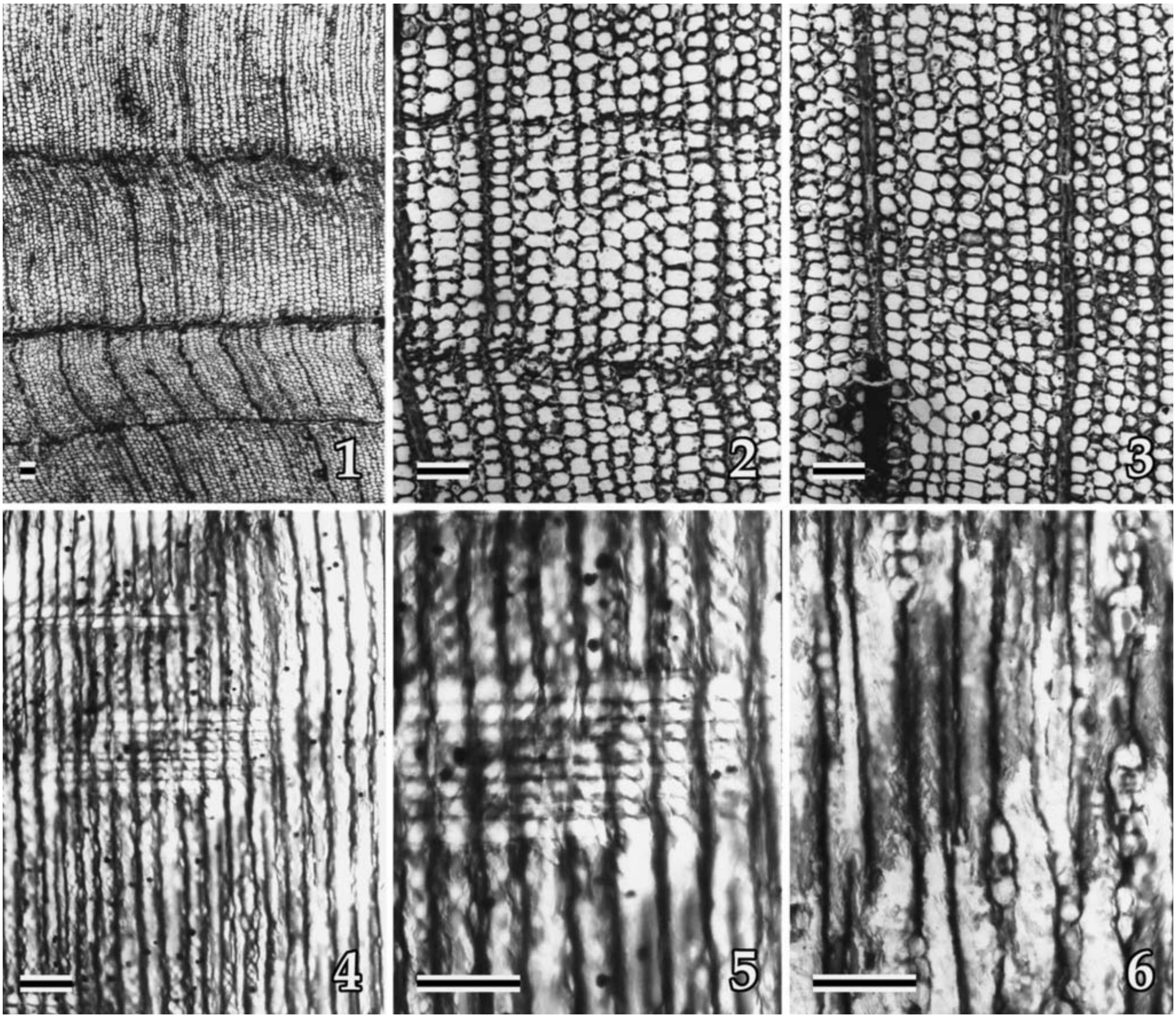

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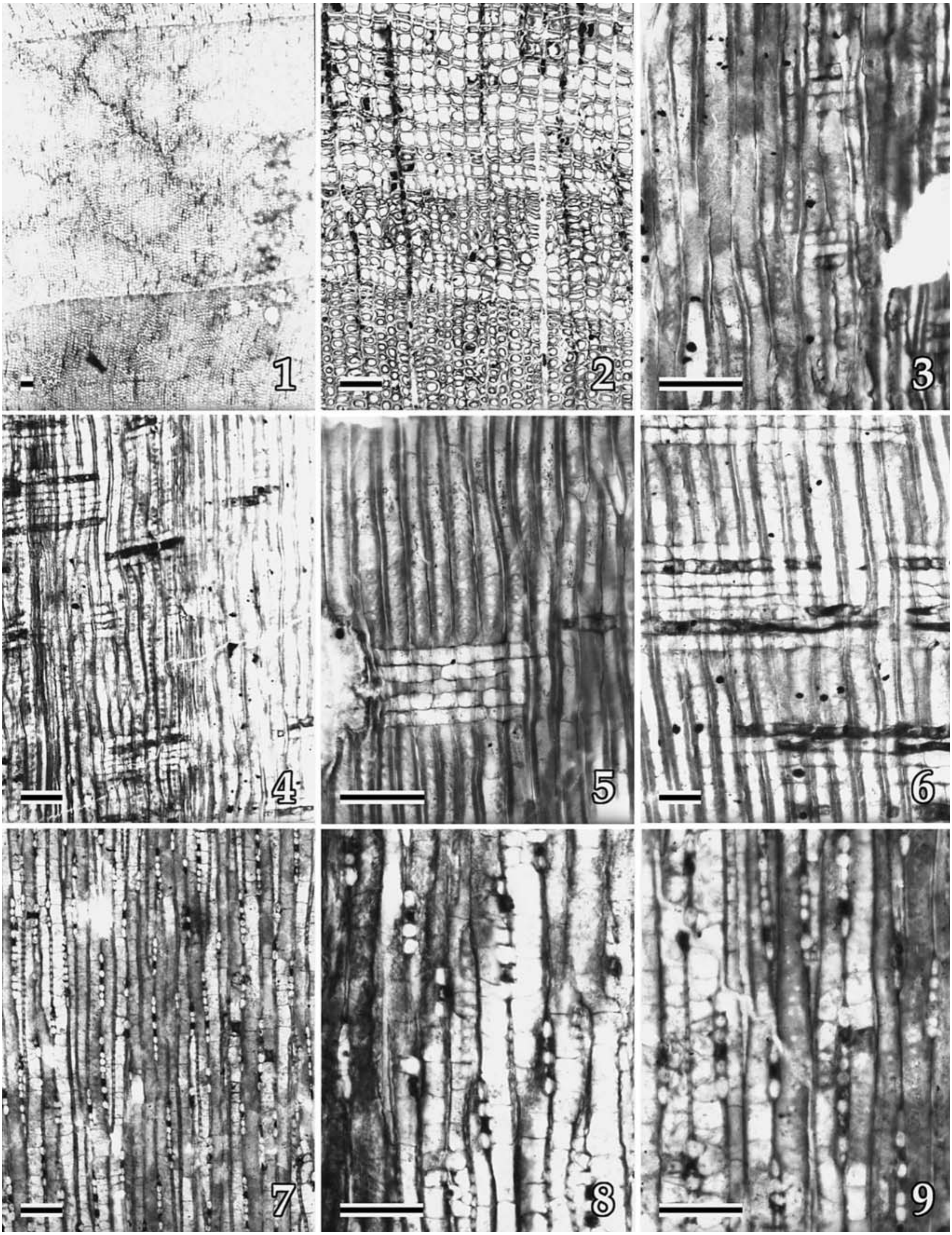

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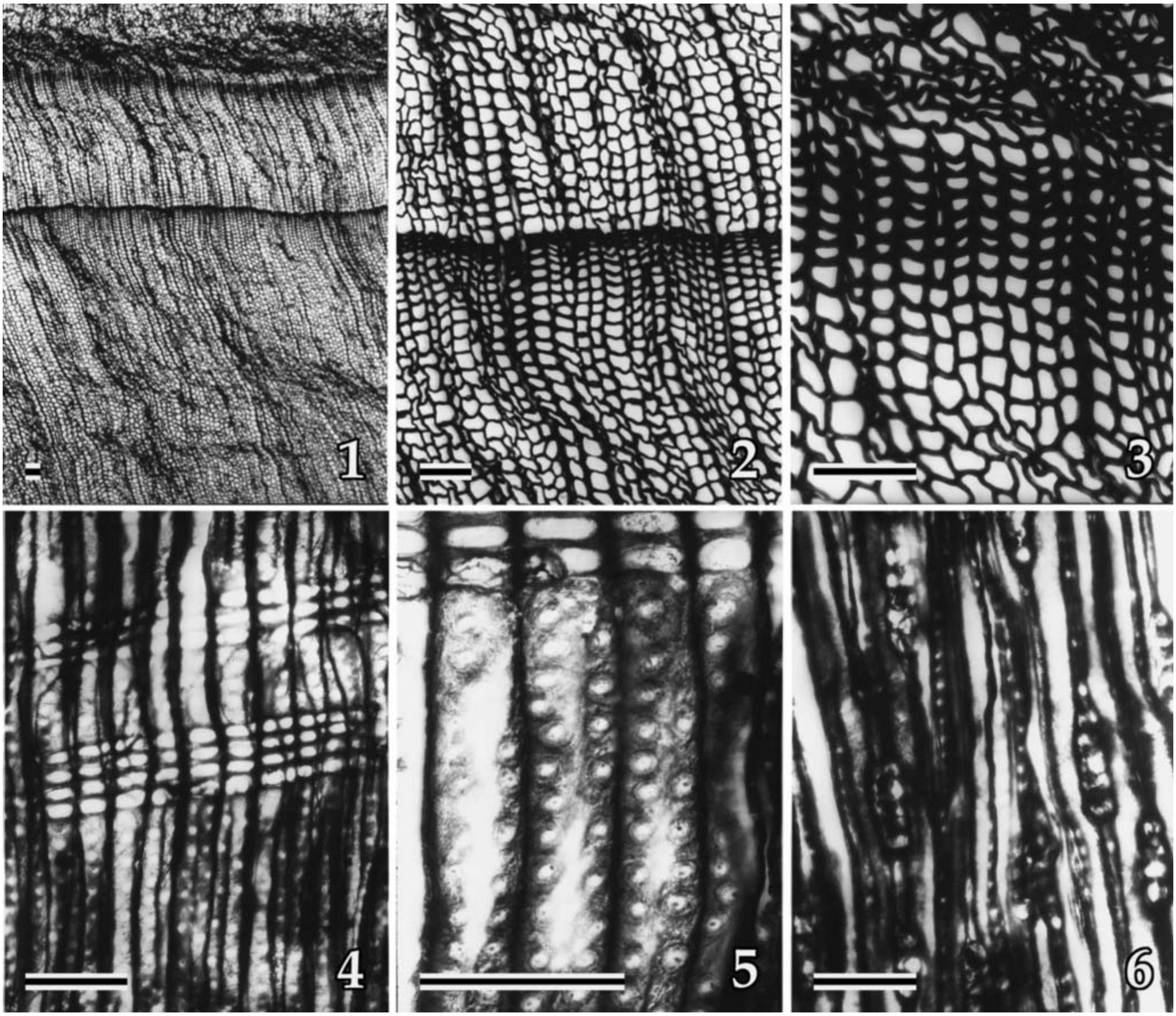

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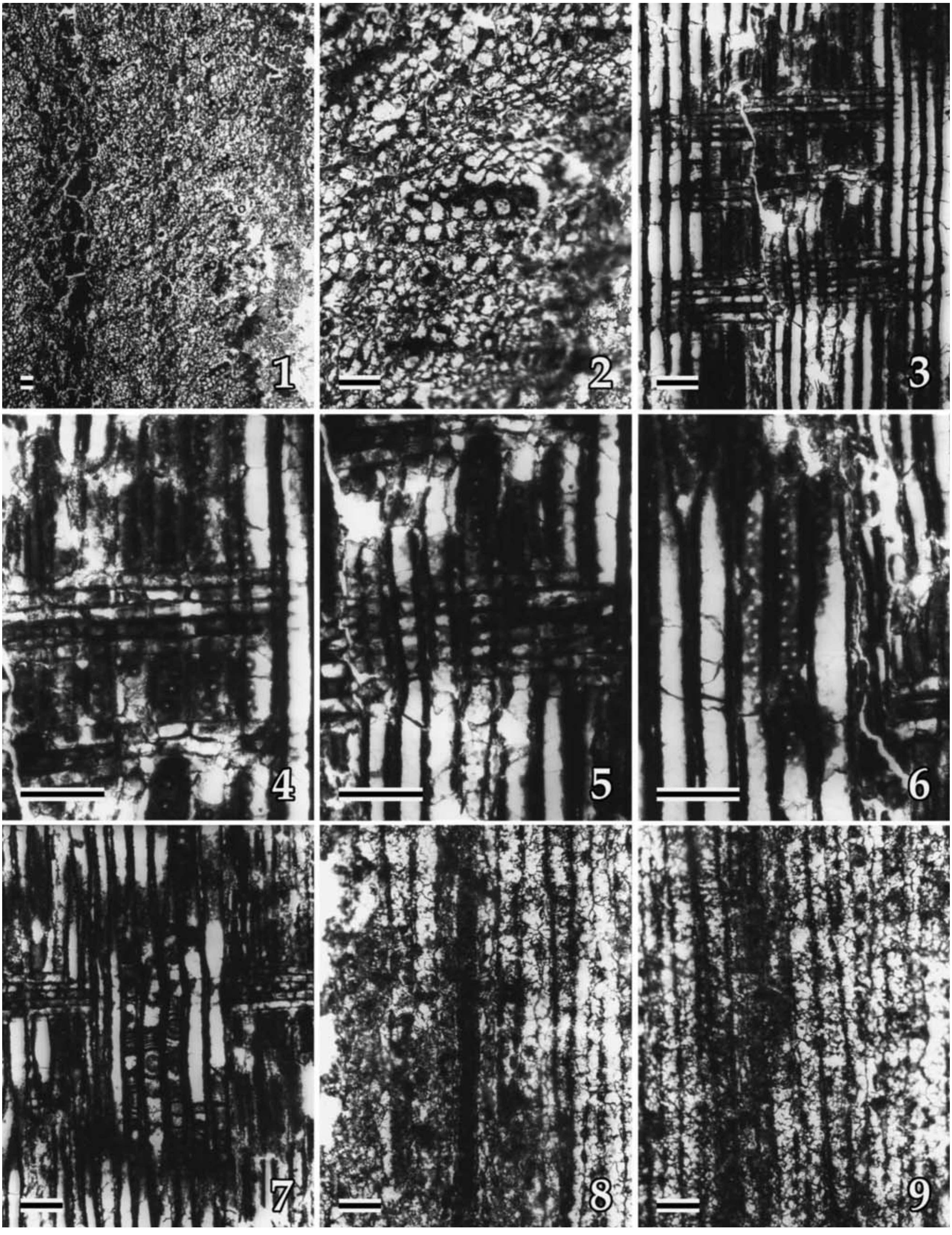

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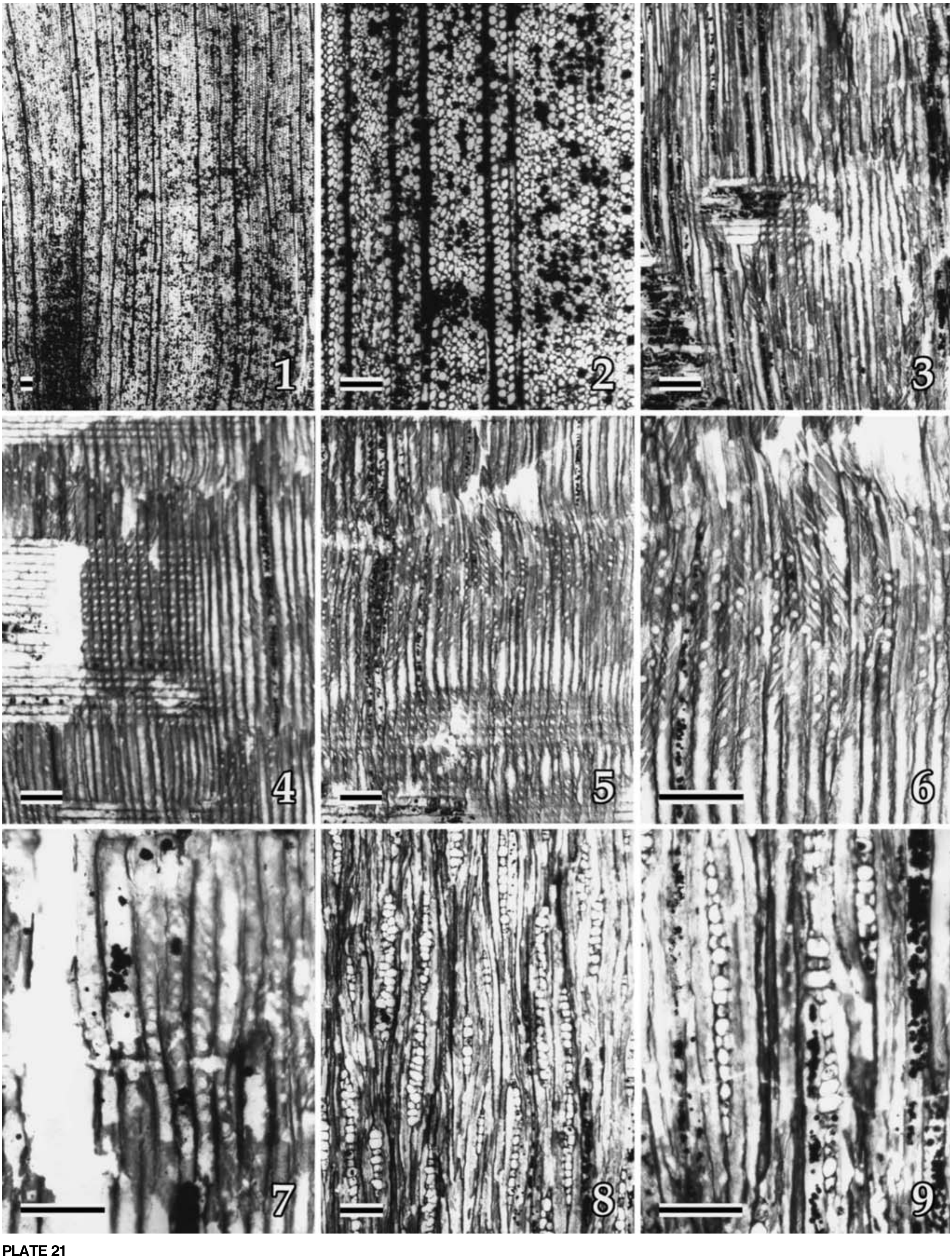

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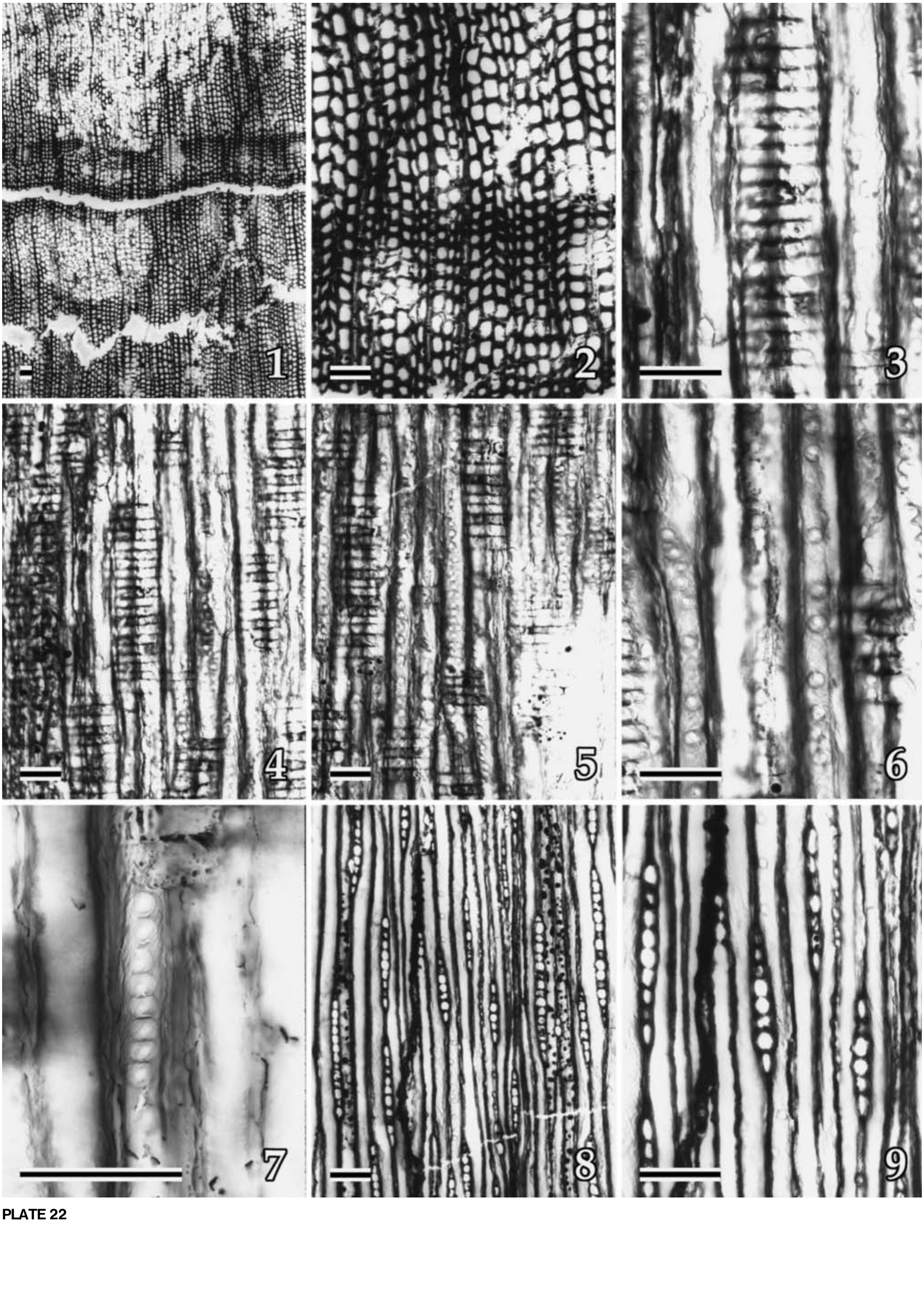

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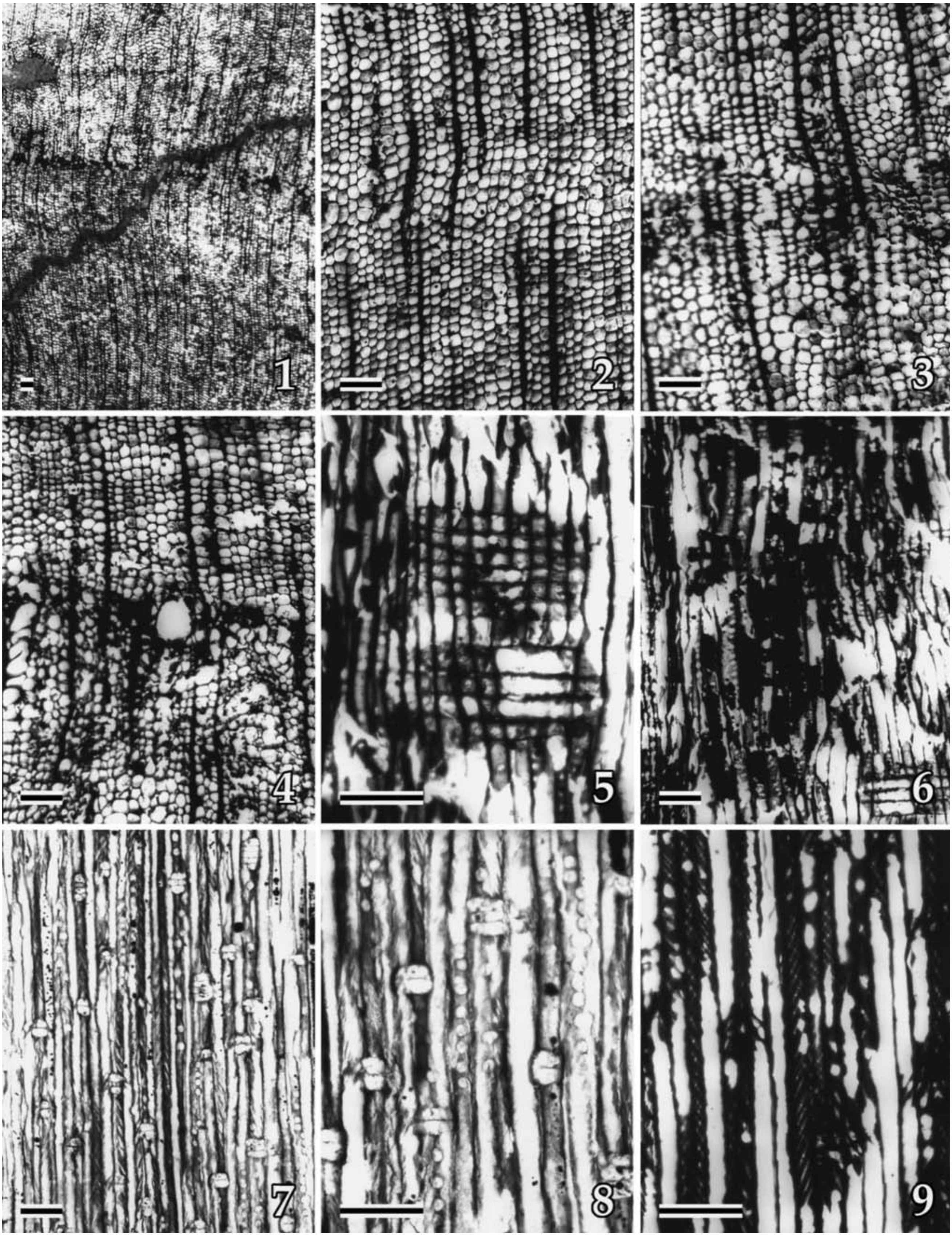

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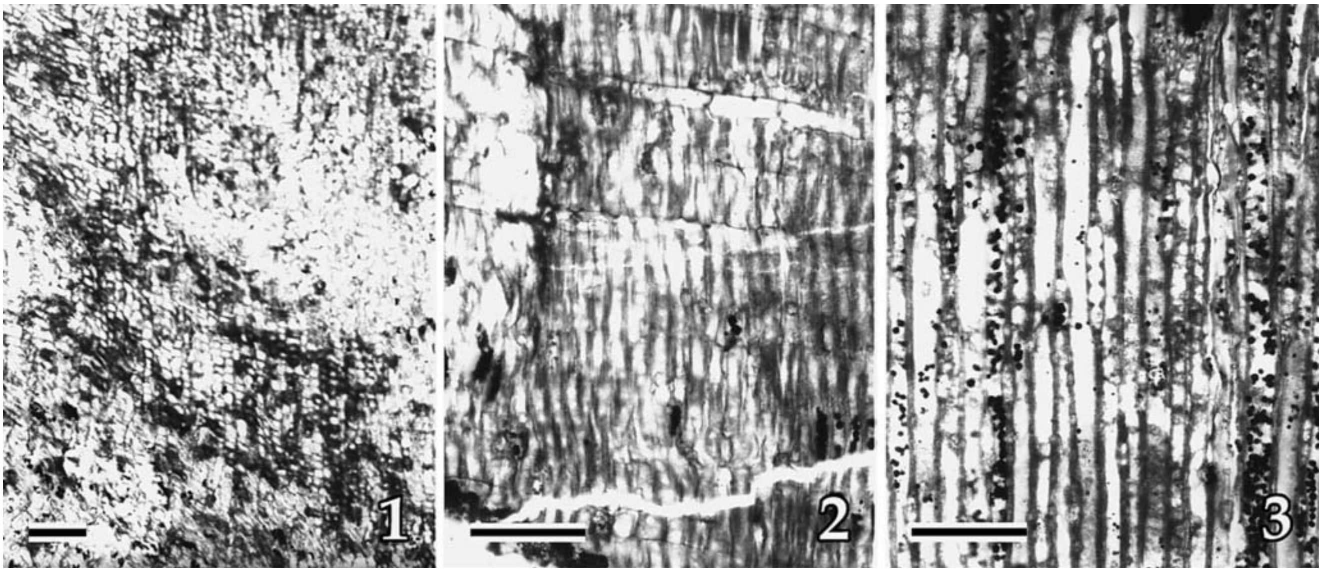

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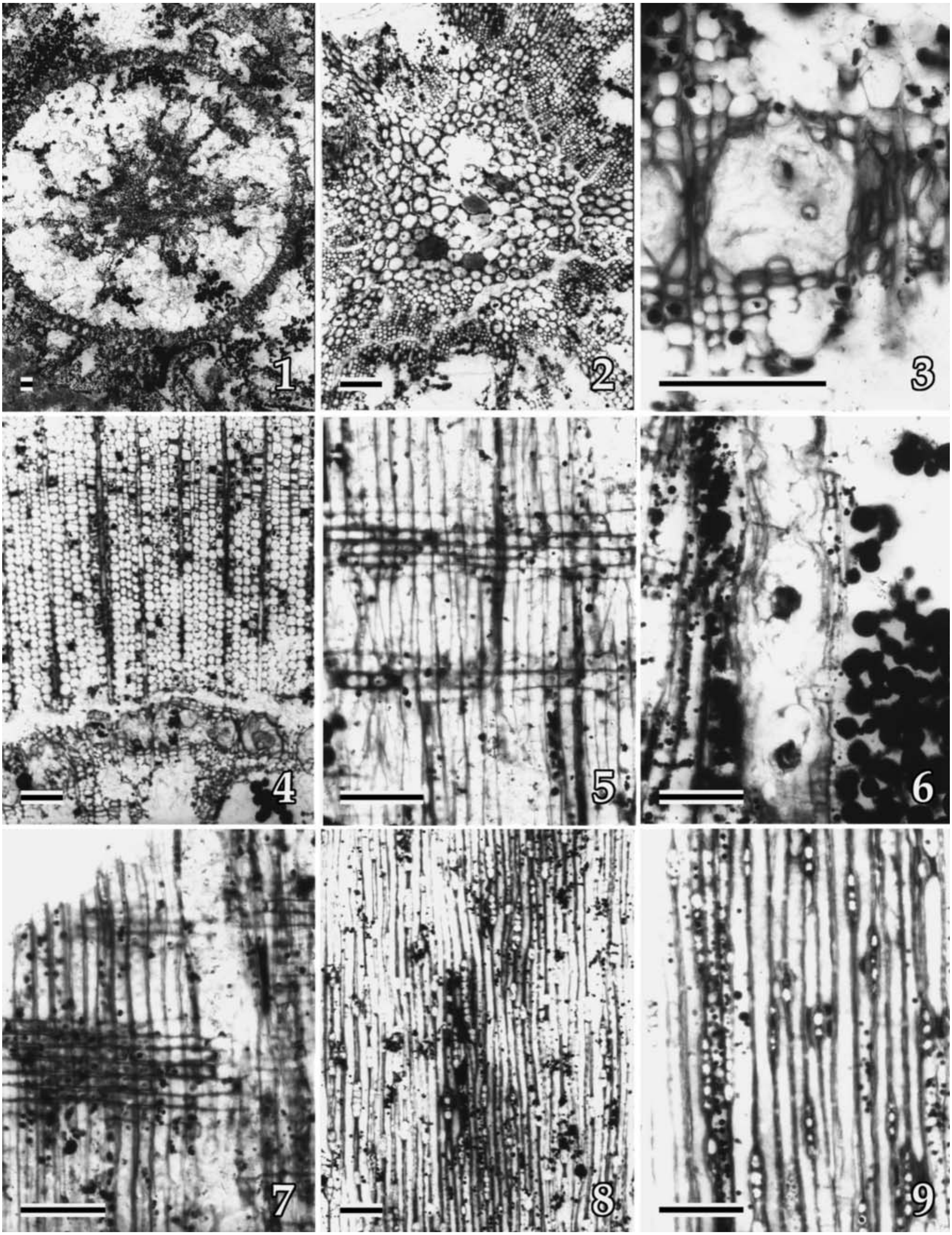

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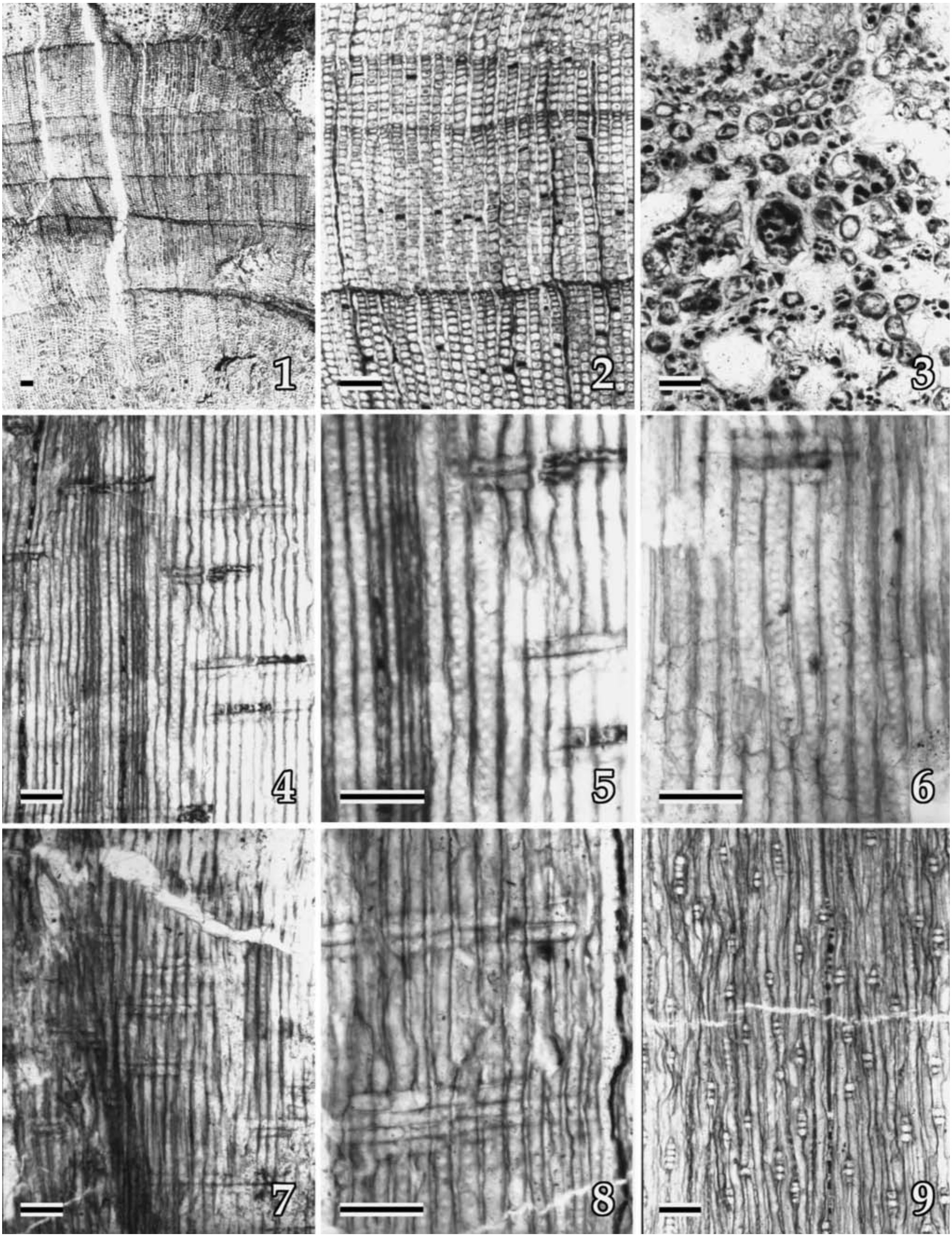

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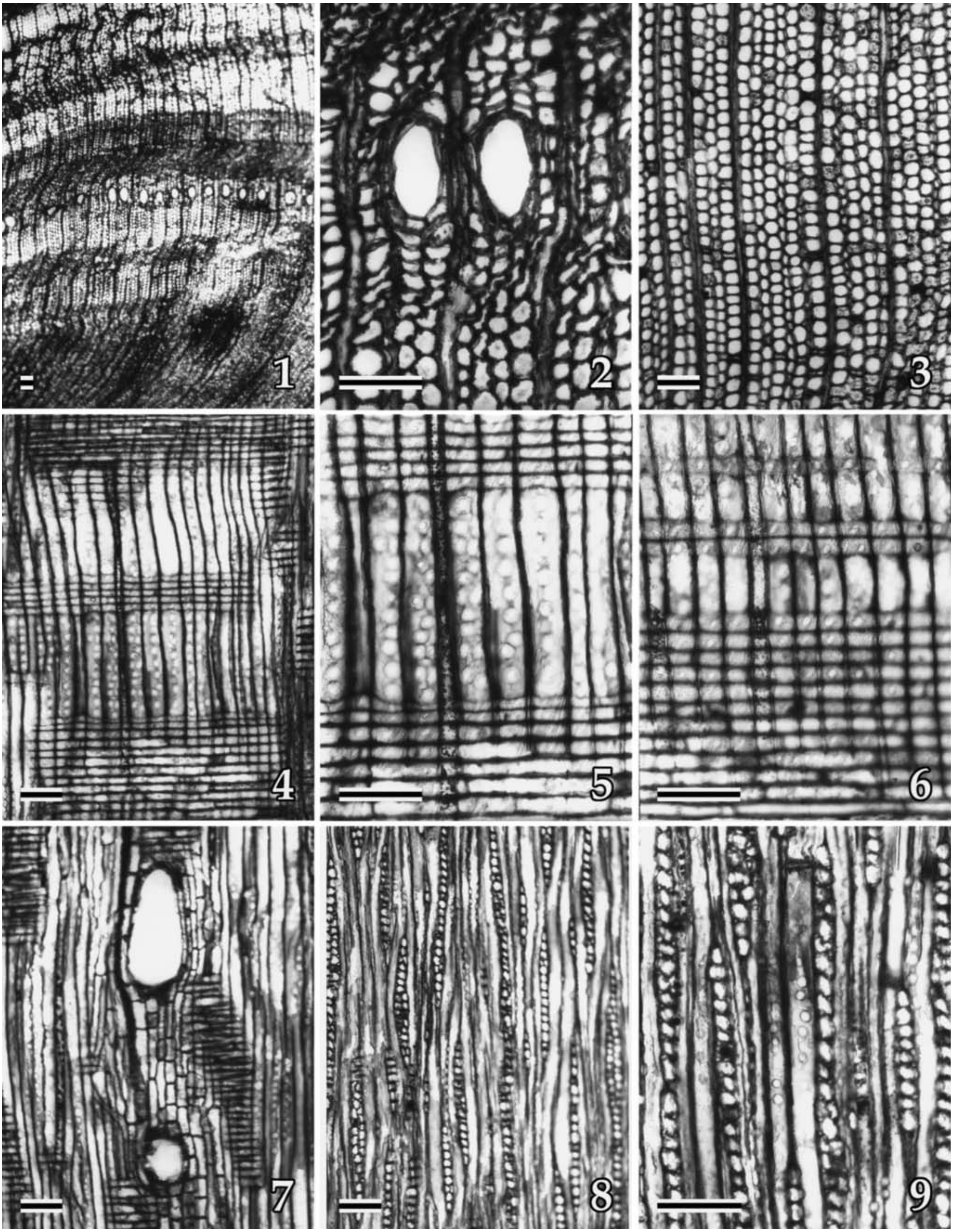

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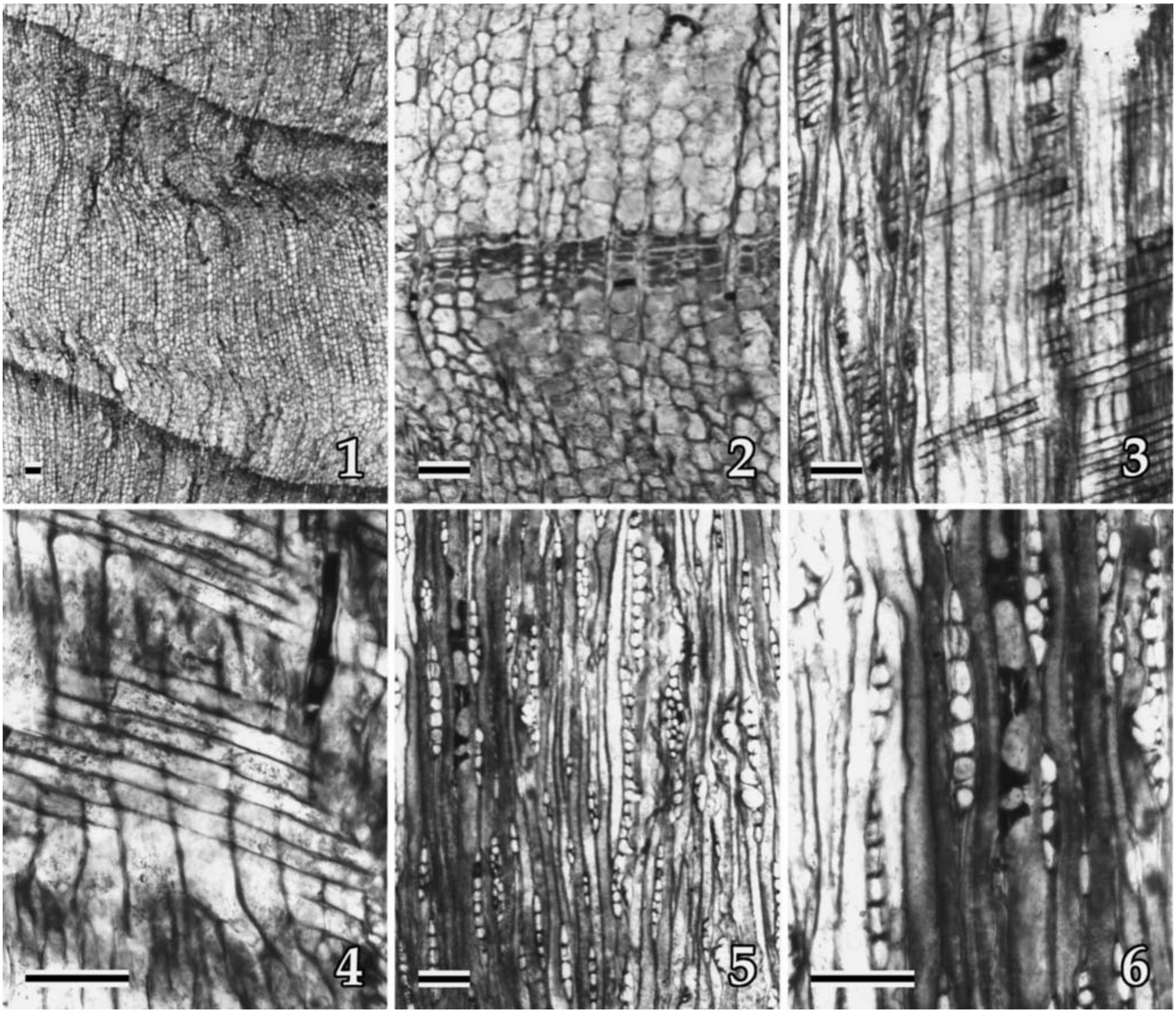

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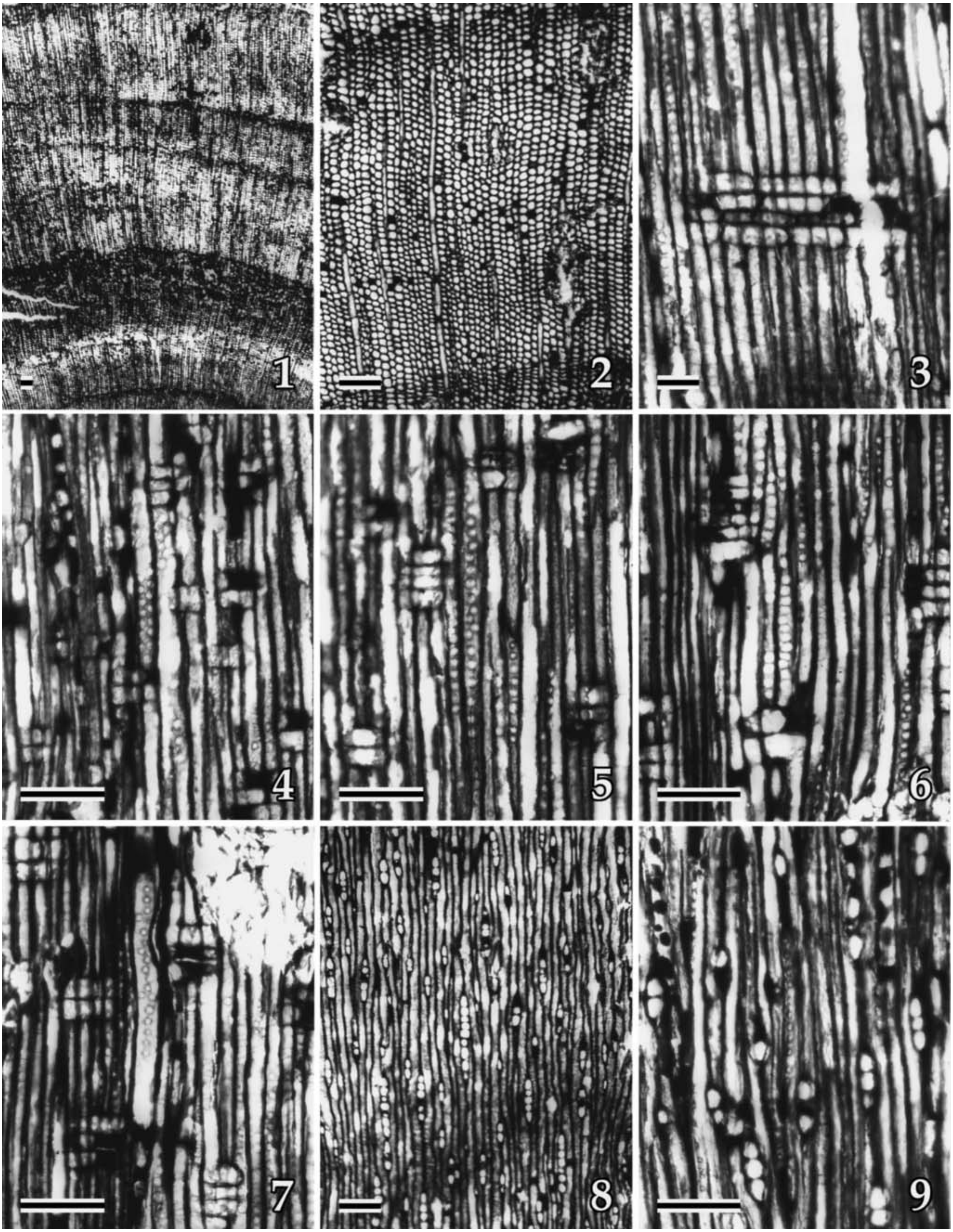

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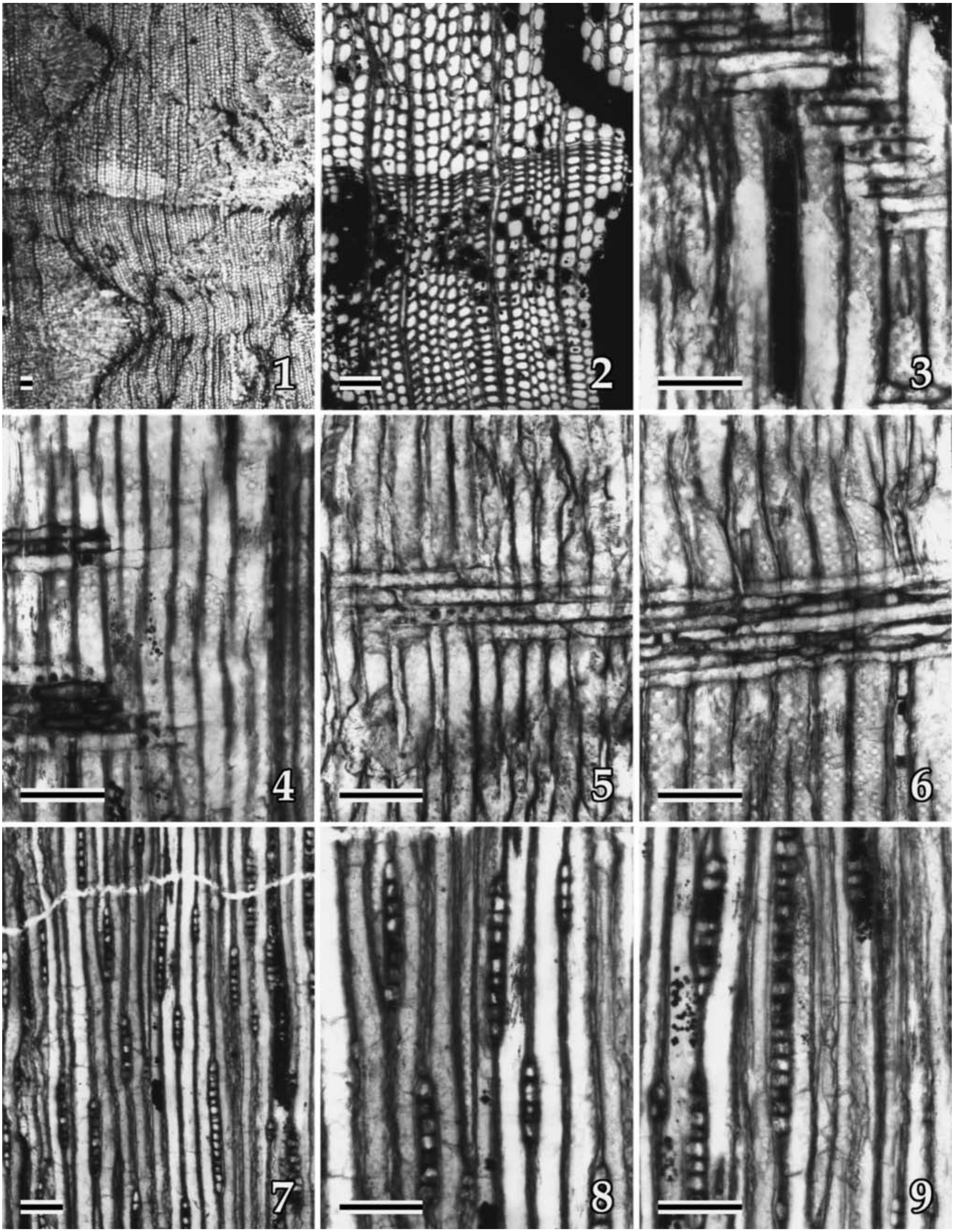

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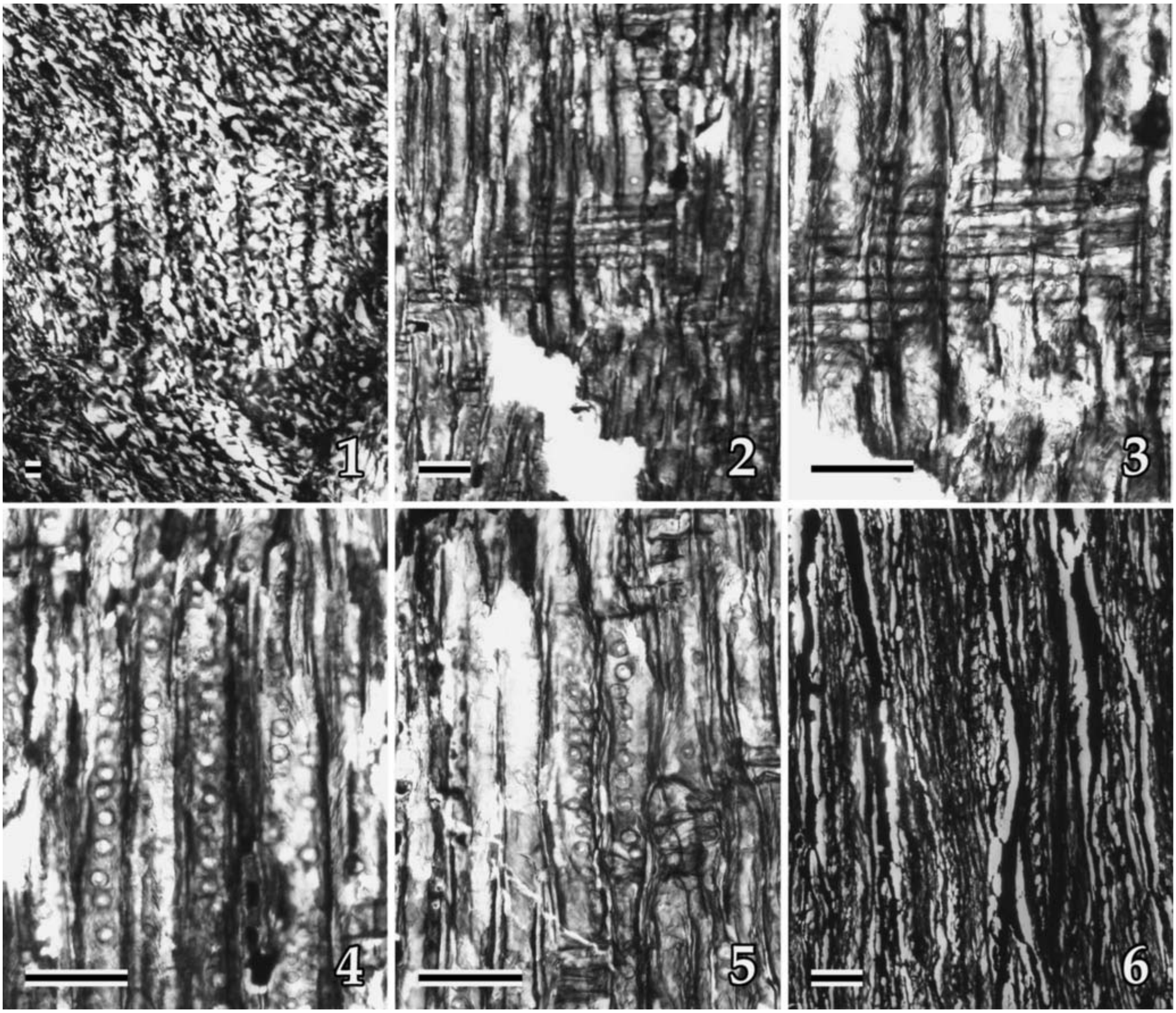

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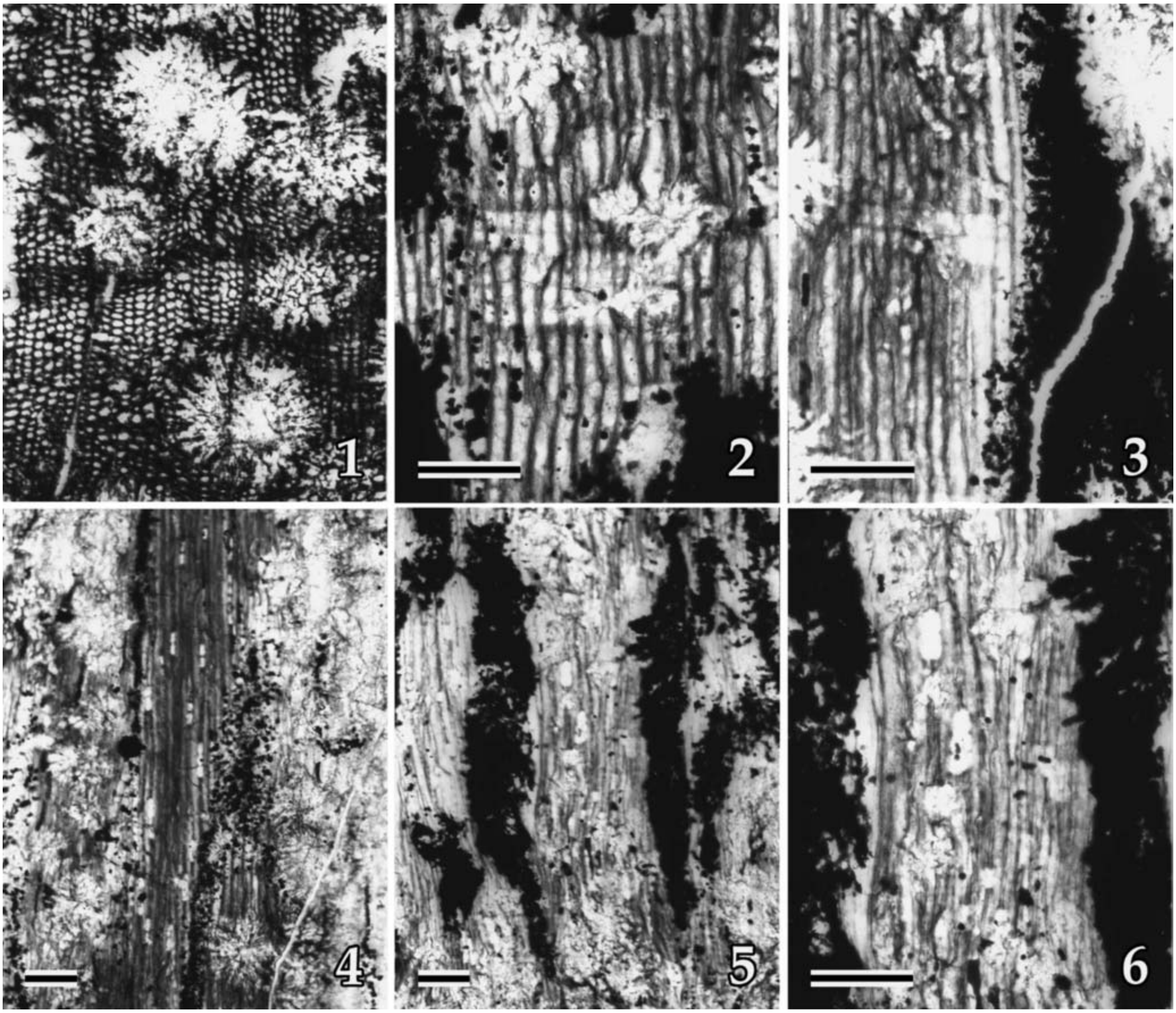

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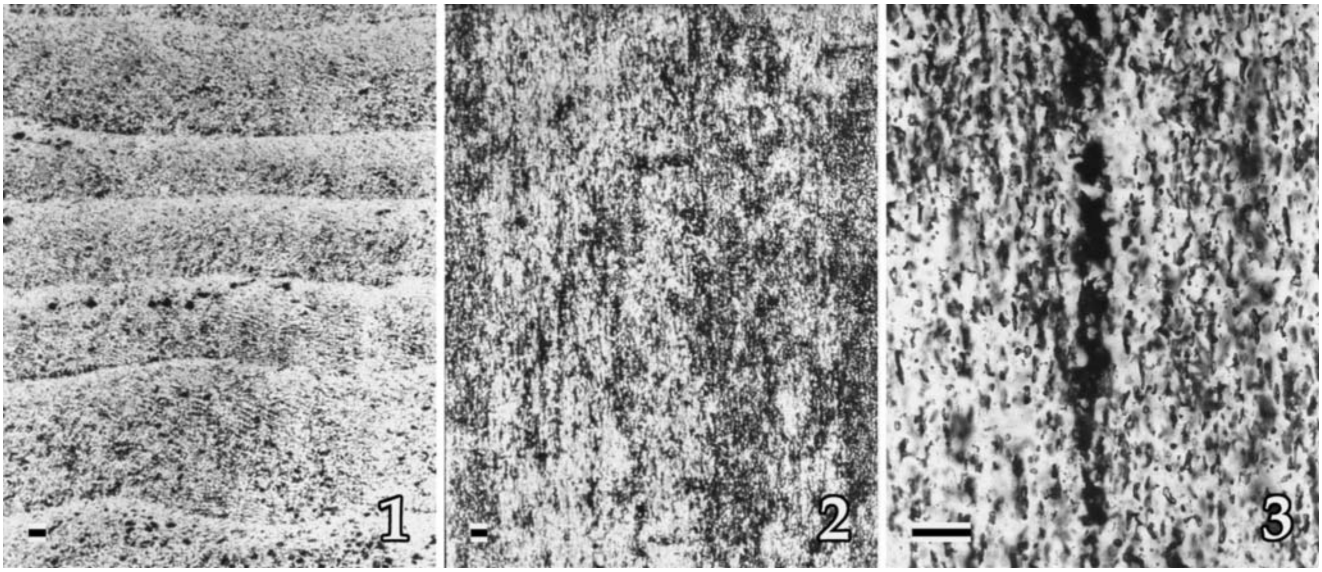

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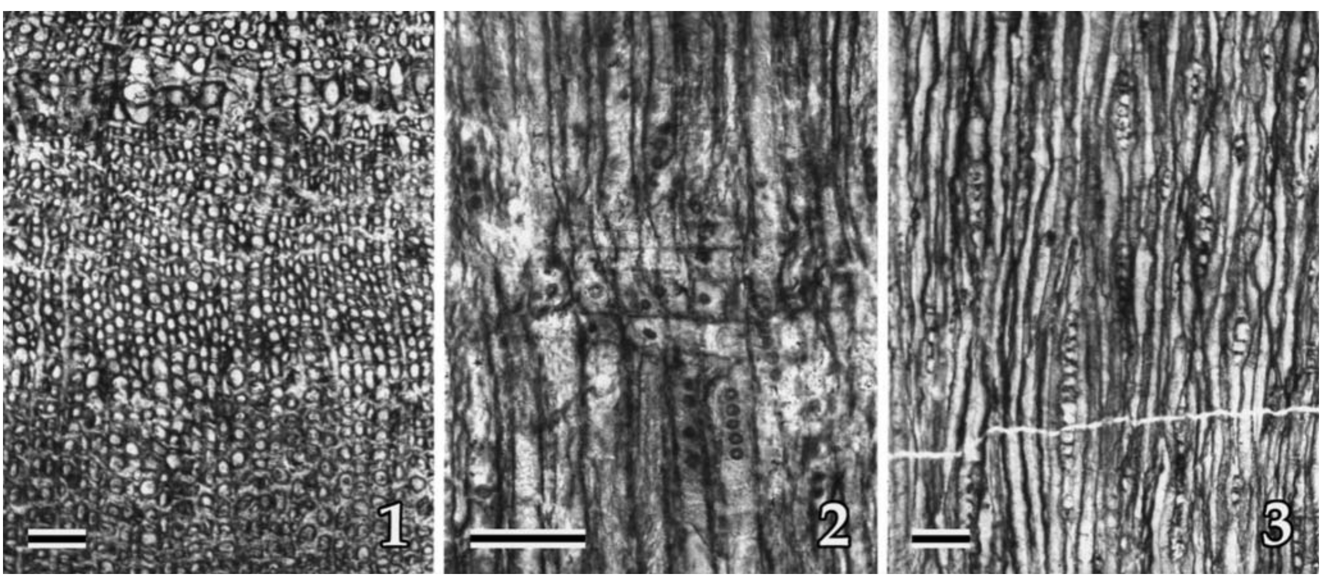

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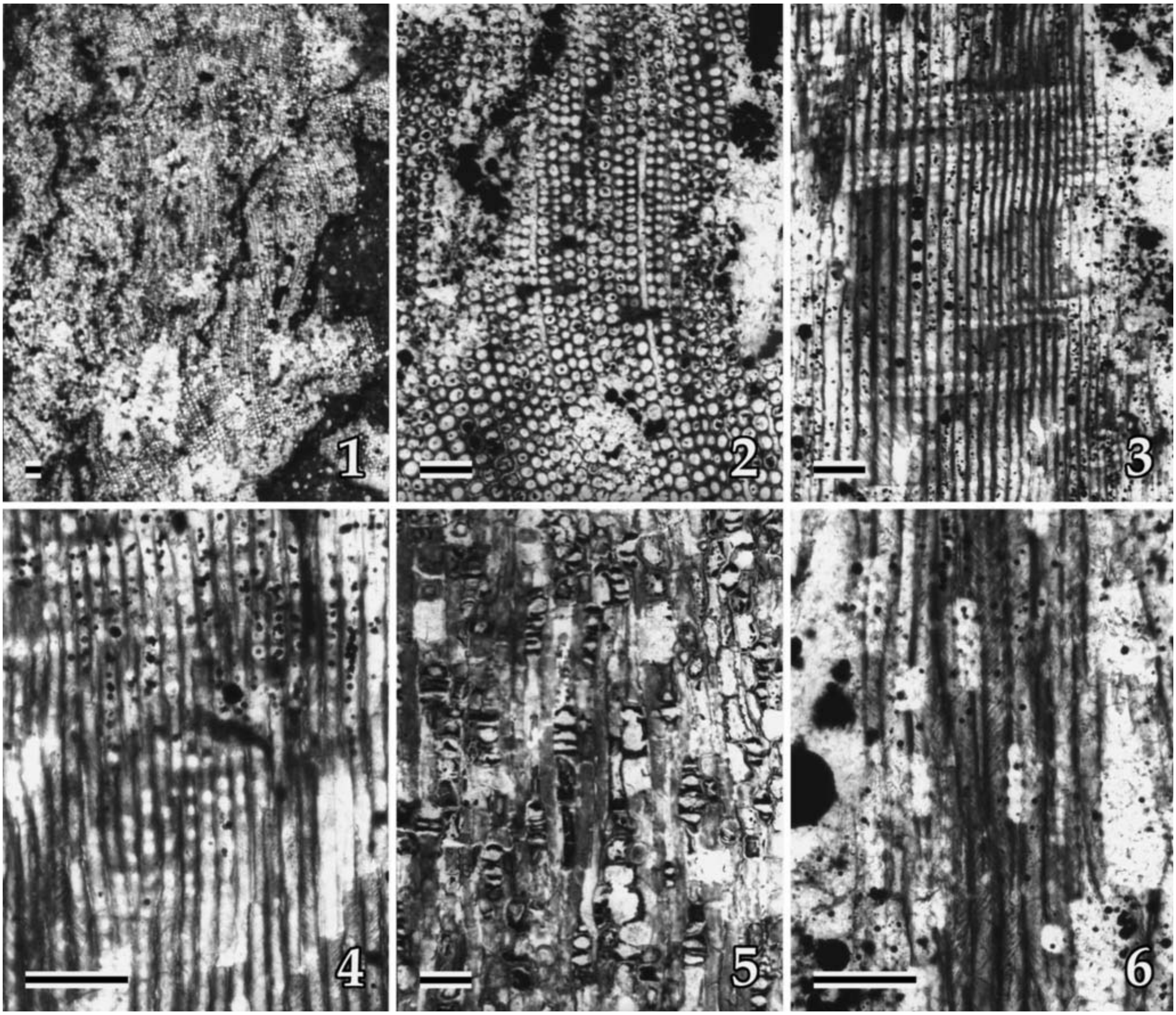

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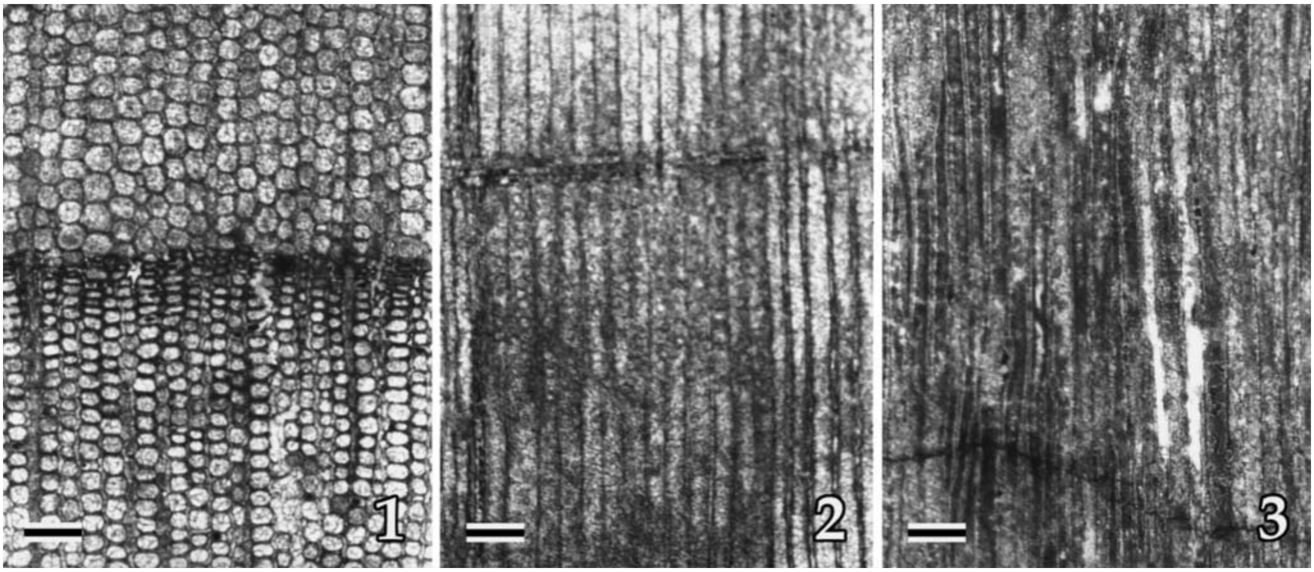

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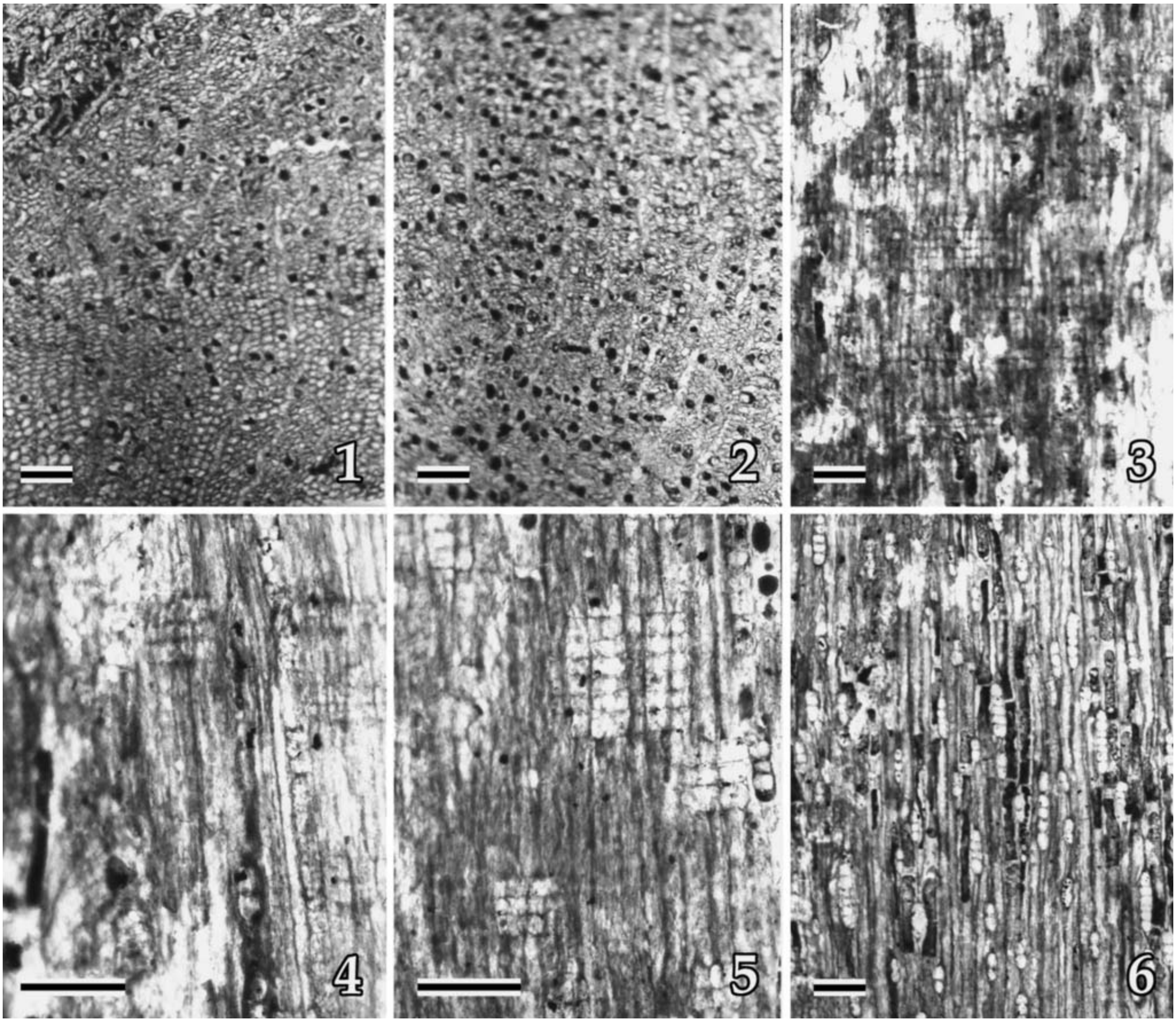

PLATE 37

Appendix. List of Microscopic Slides of Professor Shimakura's Fossil Woods deposited in University Museum, Tohoku University

No.	Botanic Name	SN	Remakrs	PR	Locality	Formation	References
534	coniferous wood	4		B	樺太内淵川三炭川支流	unknown	no
6858	Celtis sp.	3		M	missed	unknown	no
6869	Xenoxylon phyllocladoides	12		M	The Banks of the Daiddko-river, Heizyo-city, Tyosen (Korea)	Lowae Daido Formation (L Jr)	1936(278)
6870	Xenoxylon latiporosum	7		M	The quarry of Botandai, Hiezyo-city, Tyosen (Korea)	Tetori Series (U Jr)	1936(281)
6871	Phyllocladoxylon heizyoense	5	sp.nov	B	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6872	Phyllocladoxylon heizyoense	3		G	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6873	Phyllocladoxylon heizyoense	6		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6874	Phyllocladoxylon heizyoense	4		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6875	Phyllocladoxylon heizyoense	5		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6876	Phyllocladoxylon heizyoense	4		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6877	Phyllocladoxylon heizyoense	7		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6878	Phyllocladoxylon heizyoense	3		G	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6879	Phyllocladoxylon heizyoense	2		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	1936(285)
6881	Dryoxylon cfr. Yezoense	5		M	The Yubari-gawa, Oyubari, Yubari-gun, Hokkaido	Upper Ammonite Beds (Senonian)	1937(57)
6882	coniferous wood	1		B	石狩河	unknown	no
6883	Phyllocladoxylon sp.	2		M	石狩国ホロムイ上流●●ノ沢*	unknown	no
6905	Araucarioxylon schrollianus	1		B	unknown	unknown	no
6961	Paracupressinoxylon cryptomeriopsoides	6	sp.nov	B	Saghalien	Urakawa Series (Senonian)	1937(41)
7699	Taxodioxylon albertense	19		B	The second valley, soth of the Oriki Mineral-spring, Hirono-mura, Hutaba-gun, Hukusima-ken	Urakawa Series (Senonian)	1937(45)
7700	Cupressinoxylon type wood	16		B	Dogihara, Ohisa-mura, Hutaba-gun, Hukusima-ken	Urakawa Series (Senonian)	1937(63)
22178	Ficoxylon sp.?	2		M	Green label, unreaderble	unknown	
30555	Phyllocladoxylon sp.	4		B	Huo-shih-ling, Chu-jin, Manchoukuo	Middle Jurassic	1936(298)
30556	Pinoxylon yabei	13		G	Huo-shih-ling, Chu-jin, Manchoukuo	Middle Jurassic	1936(295)
30557	Phyllocladoxylon cfr. Eborasense	7		M	Huo-shih-ling, Chu-jin, Manchoukuo	Middle Jurassic	1936(287)
30558	Xenoxylon latiporosum	5		B	Shahotsu, Shang-tu, Chu-lin, Manchoukuo	Middle Jurassic	1936(281)
30559	Xenoxylon latiporosum	4		B	Shahotsu, Shang-tu, Chu-lin, Manchoukuo	Middle Jurassic	1936(281)

No.	Botanic Name	SN	Remakrs	PR	Locality	Formation	References
30880	Cupressinoxylon sp.	4		B	The Santan-gawa, a tributary of the Naibuti-gawa, Miho, Otiai-mati, Sakaehama-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937 (54)
38405	Unidentified	1		B	unknown	unknown	
38419	Unidentified	1		B	unknown	unknown	
44234	Dadoxylon sidugawaense	12	sp.nov	G	The Coast of Hosoura, Sidugawa-mati, Miyagi-ken, Japan	Sidugawa Seires (Liassic)	1936(276)
44490	Xenoxylon latiporosum	8		M	Kuwasima-mura, Noumi-gun, Isikawa-ken, Japan	Tetori Series (U Jr)	1936(281)
50288	Unidentified	3		B	北满興安省達頼湖附近		no
51721	Xenoxylon latiporosum	3		M	Ta-yang, Shu-kou, Chao-yan, Jehol	Jurassic	1936(281)
51722	Xenoxylon latiporosum	6		M	Ta-yang, Shu-kou, Chao-yan, Jehol	Jurassic	1936(281)
53325	Dadoxylon japonicum	5		M	Yatuzi, zihara-mura, Takaoka-gun, Koti-ken, Japan	Torinosu-Group (Upper Jr.)	1936(273)
57693	Pinoxylon dakotense	9		G	Pen-his-hu, Pen-his-hsien, Feng-tien Province, Manchoukuo	Honkeiko Bed (Lower Cretaceous)	1937(24)
58401	Cedroxylon cfr. Yendoi	12		M	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(18)
58402	Phyllocladoxylon aff. Gothanii	14		M	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(34)
58403	Cupressinoxylon sachalinense	9	sp.nov	M	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(53)
58404	Podocarpoxylon sp.	6		B	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(38)
58405	Aptiana ? Sp. Indet.	7		M	Kikumen-zawa, a branch of the Ikusyunbetu, Mikasayama-mura, Sorati- gun, Hokkaido	Upper Ammonite Beds (Senonian)	1937(59)
58406	Podocarpoxylon dakotense	8		M	The Kisegawa, a tributary of the Naibuti- gawa, Miho, Otiai-mati, Sakaehama-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(37)
58407	Cupressinoxylon vectense	6		M	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(50)
58408	Dadoxylon sp. Indet. (cfr.japonicum)	7		B	Mosi-Matusima, Omoto-mura, Simo-Hei-gun, Iwate-ken	Monobegawa Series	1937(7)
58409	Brachyoxylon aff. Woodworthianum	15		B	Mosi, Omoto-mura, Simo-Hei-gun, Iwate-ken	Monobegawa Series	1937(10)
58410	Paracupressinoxylon sp.	11		M	Tanohata-mura, Simo-hei-gun, Iwate-ken	Monobegawa Series	1937(45)

No.	Botanic Name	SN	Remakrs	PR	Locality	Formation	References
58411	coniferous wood	9		B	Haipe, Tanohata-mura, Simo-Hei-gun, Iwate-ken	Monobegawa Series	1937(62)
58412	Cupressinoxylon type wood	6		M	The North of the large Sertunai River, naear Mgach, North Saghalien	Gyliak Series	1937(63)
58413	Casuaroxylon japonicum	12	sp.nov		Kikumen-zawa, a branch of the Ikusyunbetu, Mikasayama-mura, Sorati-gun, Hokkaido	Upper Ammonite Beds (Senonian)	1937(60)
58414	dicotyledonous wood	2		B	常磐廣野村上ケ目木		no
58415	Protocedroxylon araucarioides	11		G	Tiao-wo-kou, Chao-yang-ssu-hui, Kwanto-syu, Liao-tung Peninsula	Basal conglomerate of the Cretaceous (?) deposit	1937(17)
58416	Cupressinoxylon sp.	7		B	Toptoeusinai, Pommosiri, Asibetu-mura, Ishikari-gun, Hokkaido	Gyliak Series	1937(54)
58417	Cedroxylon sp.	8		B	The Kikumen-zawa, Mikasayama-mura, Sorati-gun, Hokkaido	Upper Ammonite Beds (Turonian -Senonian)	1937(22)
58418	Cupressinoxylon sp.	1		B	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(54)
58419	Dadoxylon japonicum	7		M	Koikorobe, Tanohata-mura, Simo Hei-gun, Iwate-ken	Momobegawa Series	1937(6)
58439	dicotyledonous wood	3		M	仙台郊外行燈松北方谷	unknown	
58445	Planoxylon inaii	9	sp.nov	G	Right valley of the 10th Bridge, Ikusa-gawa, Toyohara-mati, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(14)
58446	Dadoxylon cfr. Tankoense	9		M	The Minami-Rokusen-zawa, Toyohara-mati, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(4)
58447	Cupressinoxylon sp.	5		B	Minami-Rokusen-zawa, Namikawa, Toyohara-mati, Toyohara-gun, Karahuto	Urakawa Series (Senonian)	1937(63)
58448	Piceoxylon sp.	14		M	Minami-Hassen-zawa, Toyohara-mati, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(31)
58449	Cupressinoxylon sp.	4		B	Minami-Hassen-zawa, Namikawa, Toyohara-mati, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(55)
58450	Piceoxylon transiense	9	sp.nov	M	The left valley of the Utasinai-gawa, Sunakawa-mura, Sorati-gun, Hokkaido	Upper Ammonite Beds (Turonian -Senonian)	1937(24)
58478	Piceoxylon scleromedullosum	12	sp.nov	G	The Santan-gawa, a brtanch steam of the Naibuti-gawa, Miho, Otiai-mati, Sakaehama-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(30)
58479	dicotyledonous wood	4		B	Santan-gawa, a tributary of the Naibuti- gawa, Miho, Otiai-mati, Sakaehama-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	no

No.	Botanic Name	SN	Remakrs	PR	Locality	Formation	References
58480	Paracupressinoxylon solmsi	9	comb. Nov	M	The Santan-gawa, a tributary of the Naibuti-gawa, Otiai-mati, Sakaehama-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(44)
58481	Podocarpoxylon cfr. Woburnense	8		M	Minaziri, Huzinami-mura, Arita-gun, Wakayama-ken	Minaziri Bed(?) of the Monobe-rawa Series(?) (Barremian)	1937(36)
58482	Taxodioxylon albertense	9		G	The south bank of the Asami-gawa, Hirono-mura, Hutaba-gun, Hukusima-ken	Urakawa Series (Senonian)	1937(45)
58484	Dadoxylon sp. Indet. (cfr.japonicum)	7		B	Hidesima, Sakiyama-mura, Simo-Hei-gun, Iwate-Ken	Momobegawa Series	1937(7)
58485	Cupressinoxylon vectense ?	3		M	樺太豊原郡川上郡奥川上	unknown	
58495	Paracupressinoxylon cryptomeriopsoides	6	sp.nov	M	Kawakami Coal-mine, Kawakami-mura, Toyohara-gun, Karahuto (South Saghalien)	Urakawa Series (Senonian)	1937(41)
61201	Dadoxylon japonicum	5		B	Iwato-mura, kitakanri-gun, Gunma-ken	unknown	no
61202	Phyllocladoxylon heizyoense	12		M	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)	Middle Daido Formation	no
[s.n.]	Juglans angustiparenchymatosa	9	holotype	B	Tobishima Island, Aumi-gun, Yamagata-ken	Tobishima Formation	Terada1998(21)

SN : number of slides
PR : the state of preservation
References : 1936 (page) = Studies on Fossil Woods from Japan and Adjacent Lands Contribution I. Sci. Rep. Tohoku Imp. Univ. Ser. 2. (Geology) 18 : 267-310
1937 (page) = Studies on Fossil Woods from Japan and Adjacent Lands Contribution II. Sci. Rep. Tohoku Imp. Univ. Ser. 2. (Geology) 19 : 1-73
*unreadable

Missing Slides

58497	Brachioxylon sp.
58485	Cupressinoxylon vectense
57601	Xenoxylon laitporosum
57602	Xenoxylon laitporosum
57603	Cupressinoxylon sp.
50288	indeterminable coniferous
58418	dicotyledonous wood
58499	dicotyledonous wood
58450	Aptiana

List of Uncertain Microscopic Slides

SN			slide no.	Locality
62001	conifer	Taxodioxylon ?	3	No information
62002	conifer		2	No information
62003	conifer		2	No information
62004	conifer	Taxoxylon ?	1	No information
62005	conifer	Cupressinoxylon ?	2	No information
62006	conifer		2	No information
62007	conifer	Cupressinoxylon sp.	2	滿州本溪縣田師付溝
62008	conifer		2	ニラノ浜
62009	conifer	Araucarioxylon arizonicum	1	北米 Arizona 州
62010	conifer		23	南樺太川上炭坑
62011	conifer	Taxodioxylon ?	4	No information
62012	conifer	Taxodioxylon ?	4	越後谷澤村寺
62013	conifer		1	No information
62014	conifer		1	No information
62015	conifer		1	No information
62016	conifer	Cupressinoxylon ?	3	樺太川上炭坑
62017	conifer	Cupressinoxylon ?	4	No information
62018	conifer	Brachyoxylon sp.	2	樺太川上炭坑
62019	conifer		9	樺太川上炭坑
62020	conifer		9	No information
62021	conifer		1	樺太豊原町
62022	conifer	Podocarpoxylon ?	1	No information
62023	conifer	Taxodioxylon ?	1	No information
62024	conifer	Cupressinoxylon sp.	4	松島馬淵氏
62025	conifer		1	No information
62026	conifer		1	No information
62027	conifer		1	No information
62028	conifer	Xenoxylon latiporosum	1	No information
62029	conifer		4	Petrified forest near Adamana Arizona
62030	conifer		3	七北田
62031	conifer	Taxodioxylon ?	4	廣瀬川オタマヤ 橋下
62032	conifer		2	岩手県氣仙郡末崎村
62033	conifer		1	仙台市向山東洋館の東 fossil valley
62034	conifer		1	No information
62035	conifer	Glyptostroboxylob	1	No information
62036	conifer	Taxodioxylon sequoianum	2	塩釜古墳
62037	conifer		4	北樺太 Aguneo 海岸
62038	conifer	Taxodioxylon sequoianum	3	越後谷澤村寺，阿賀ノ川岸，阿賀野川
62039	conifer		1	樺太 アグネラ
62040	conifer		1	青森
62041	conifer		1	No information
62042	conifer		1	No information
62043	conifer		1	No information
62044	conifer		1	No information
62045	conifer		1	No information
62046	Dicotyledon	Ring ?	1	松島浜町停留所北 Kutling 尾山
62047	Dicotyledon	Diffuse	3	No information
62048	Dicotyledon		1	No information
62049	Dicotyledon	Ring	2	No information
62050	Dicotyledon	Diffuse	1	No information
62051	Dicotyledon		2	No information
62052	Dicotyledon		1	No information
62053	Dicotyledon		1	南樺太川上炭坑

SN			slide no.	Locality
62054	Dicotyledon		1	樺太豊原郡川上炭坑
62055	Dicotyledon	Diffuse	1	No information
62056	Dicotyledon		1	No information
62057	Dicotyledon	Diffuse	4	No information
62058	Dicotyledon		1	No information
62059	Fern ?		2	No information
62060	Unidentified		1	滝ノ口 Tuff 中炭
62061	Unidentified		1	樺太豊原町並川南_線澤
62062	Unidentified		1	岩手県小本村師松島
62063	Unidentified		1	桐谷戸富山県
62064	Dicotyledon		1	No information
62065	Dicotyledon	Arthropitys	11	Suzuri Sasagaya (硯笹谷)
62066	conifer	Dadoxylon sp	1	No information
62067	Protopinaceae	Xenoxylon latiporosum	4	The court of the Heizyo Middle school, Heizyo-city, Tyosen (Korea)
62068	Protopinaceae	Xenoxylon latiporosum	4	滿州鐵嶺県大寶山炭坑
62069	Protopinaceae	Xenoxylon latiporosum	5	熱河省西興隆溝

31 slides were not numbered due to be impossible to identify and no information.

List of Microsocpic Slides of Some Lower Vascular Plants from England

44	Sigillariostrobus horburyensis, M.S. Megaspore	1		G	Middle Coal Measures Yorkshire England
75	Stigmaria ficoides	1	T. SN of axis	G	Halifax Hard Coal, Lanarkian Series Yorkshire England
76	Lyginodendron oldhamium Lagenostoma lomaxi	1		G	Upper Foot Coal, Colne, Lancashire
77	Rachiopteris bibractiensis	1		G	Dulesgate
78	Lepidodendron pettycurense Kidston Sphenophyllum insigne Astromyeton pettycurense Stauropteris burritistandica	1		G G	Yorkshire
79	Calamostachys binneyana	1		G	Carbon, Dulesgate, England
80	Thaloxylon thokeri	1		G	Carbon, Dulesgate, England
81	Calamites sp.	1		G	Carbon, Shore Littleborough, England
82	Lepidodendron seleginordes	1		G	Halifax Hard Bed

遠藤誠道先生 Cycadeoidea Preparates List

	No.	Label 1	Label 2
1.	Green	Cycadeoidea nipponica Endo 1	Cycadeoidea nipponica Endo III
2.	green	Cycadeoidea nipponica Endo	Tangential section of the stem
3.	white	Unidentified	Unidentified
4.	Green	Cycadeoidea nipponica n.sp.	Tangential longitudinal section of the stem
5.	White	Unidentified	Unidentified
6.	Green	Cycadeoidea nipponica Endo	Label missed
7.	White	Cycadeoidea nipponica	登川函淵砂岩
8.	White	Cycadeoidea nipponica Endo	北海道夕張郡函淵砂岩
9.	White	Cycadeoidea nipponica Endo	北海道夕張郡函淵砂岩層
10.	White	Cycadeoidea nipponica Endo	Sanusibe 函淵砂岩
11.	White	Cycadeoidea nipponica Endo	膽振郡勇拂郡サヌシベ川上流
12.	White	Cycadeoidea nipponica Endo 22179	Longitudinal section, through armour
13.	Green	Cycadeoidea nipponica Endo	Cross section of the cortex
14.	White	Cycadeoidea nipponica Endo	Longitudinal section, through armour
15.	Green	Cycadeoidea nipponica Endo	Longitudinal section, through armour
16.	Green	Cycadeoidea nipponica n.sp.	Tangential section through armour 1.5 cm inside from the surface
17.	Green	Cycadeoidea nipponica Endo	Longitudinal section, through armour
18.	Green	(Label missed)	Cross section througn armour (Leaf base Vascular bundle)