PÁL GREGUSS

Fossil Gymnosperm Woods in Hungary from the Permian to the Pliocene

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Summing up his latest results of Xylotomy, the author deals with the gymnosperm fossil woods of Hungary from the Palaeozoic to the Quaternary. In this work he relies on the novel method of Xylotomy, a quite recent discipline which considers the finer structure of the woods examined. For demonstration's sake nearly 100 plates with 600 microphotographs have been introduced. This monograph, filling in a gap in the science of palaeobotany, is serviceable not only for university education and to experts of palaeontology, geology, palaeoclimatology and of phylogenetics, but also has its bearing on the practical life, and especially on mining which can hardly dispense with the inferences contained in it.

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FROM THE PERMIAN TO THE PLIOCENE

by

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CONTENTS

PREFACE

Palaeoxylotomy, a branch of botanical science dealing with the wood anatomy of stems that were living in remote geological ages and have remained in siliceous, calcareous or otherwise fossilized forms, has a history of hardly one hundred years to look back on. It used to be a little cultivated branch, owing to lengthy and underdeveloped methods and other encumbrances that deterred the researchers. Since the beginning of the century, however, several methods have been evolved by means of which the interior structure of the fossil trees can be studied just as simply, quickly and successfully as the inner part of the trees living today. Thus palaeoxylotomy has developed also in Hungary for the benefit of both geology and history of evolution, the former deriving mainly practical, the latter theoretical principles from its results.

Recently, in Hungary attention has been drawn by Elemér Vadász to the geological importance of palaeoxylotomic investigations. Under his directions, particularly in the last 15 years, the systematic collection of fossil woods has set on with due regard to the exact determination of the geological age and stratigraphic position of the sites. Materials in various existing collections have also been taken into account, first of all those of the Botanical Department of the Hungarian National Museum which were made available for us through the courtesy of director Bálint Zólyomi. Further valuable material has been obtained from fellow investigators G. Andreánszky, B. Balkay, L. Bartók, G. Bárdossy, J. Fülöp, Á. Gross, G. Hámor, A. Kaszap, P. Kriván, K. Méhes, G. Pantó, I. Pálfalvy I. Pálfi, M. Pécsi, Klára Rásky, Z. Schréter, J. Szabó, T. Szontágh, A. Tasnádi-Kubacska, E. Vető, G. Zolnai and others. The material collected from about 150 localities was sent by Professor Vadász, with exact geographical information on the sites, to the Botanical Institute, University of Szeged, where their examination as an academical task has been undertaken.

The anatomical analysis of the material received took several years' work, and the results are presented in this book.

The more readily did we undertake this task since to our knowledge no such comprehensive palaeoxylotomic work has been published so far in which a collection of fossil stems brought to light from various sites of a country and within a limited span of subsequent geological epochs were subjected to investigations according to a uniform xylotomic approach. In this work materials originating from the present territory of Hungary and from the Permian to the Pannonian inclusively have been considered. We have disregarded all the wood fossils found in the neighbouring countries.

In the course of this work many obstacles had to be overcome. Owing to the different conditions of preservation of the fossils, we were not always able to prepare suitable microscopic slides and reliable photographs. In the absence of fully convincing comparative material, also the determination of the ancient trees raised serious problems.

Since palaeoxylotomy is a recent branch of science, the difficulty of determination was only aggravated by the fact that comparatively few books of palaeoxylotomic identification exist, and thus we had to rely on scattered descriptions of fossils published in papers and periodicals abroad.

In the xylotomic determination of fossil woods one has to depart from a thorough knowledge of the anatomy of living trees. Since the scope of this volume does not permit us to extend over the various proceedings of palaeoxylotomic methods, we have to content ourselves by making a general reference to the relevant works of Kräusel, Gothan–Weyland and Andreánszky.*

For our examinations we invariably prepared three kinds of slides from each fossil stem (C=cross section; T=tangential section; R=radial section). This work was carefully performed by J. Veress, B. Csepreghy and L. Siprák, to whom the author's sincere thanks are herewith expressed. The microphotos without retouch are the author's work while for the carefully prepared copies thanks are due, in the first place, to Mrs. Gy. Róbert and P. Simoncsics. The author also wishes to thank for the kind assistance of all those who helped him in the typing and technical composition of the work, particularly of Mrs. Th. Greguss née Forray and Mrs. Gy. Tolnai.

It should be stressed that this work is considered by no means as complete. In addition to the comparatively low number of samples examined so far, a great amount of fossil stems call for investigation, and there are several fossil sites known to us where systematic collection is still a task of the future.

December 31, 1966, Szeged.

Pál Greguss

* At the same time we direct attention to the detailed glossary of terms used in identifying wood as were published in a previous work by the author of this book, namely in *Identification of Living Gymnosperms on the Basis of Xylotomy* (Greguss 1955b).

FOSSIL GYMNOSPERM REMAINS IN HUNGARY

The collection of fossil trees in Hungary was sporadically started as early as the second half of the last century when systematic investigations were also undertaken by foreign specialists Goeppert, Unger, Felix, Heer, followed at the beginning of the present century by Lingelsheim, Kräusel, Hofmann, and more recently by Müller-Stoll.

Investigation of charcoal remains began in Hungary with the activities of Hollendonner and was furthered by Greguss, Sárkány, Horváth, Stieber. These sporadic examinations, however, were mainly restricted to the so-called anthracotomical investigations into the Quaternary, and as such are not considered palaeoxylotomic in the proper sense of the word. Therefore they are not being dealt with here.

Examinations of fossil stems found in the present area of Hungary were initiated by the palaeontologist Félix (1884, 1887) who discussed the tissue structure of several fossil stems of Hungary and described some of them as new species. As to the age of the fossils, the last lines of his study states that "in Hungary a luxurious and varied flora existed in the Pliocene".

At the beginning of the century Tuzson was the first Hungarian researcher to deal with the xylotomy of fossil stems in Hungary. He described in 1901 the famous fossil tree of Ipolytarnóc under the name *Pinus tarnócziensis* (Tuzson 1901). Later Greguss (1954) established that it belonged to the form group of *Pinus lambertiana* still living in North America.

Tuzson (1902) qualifies the fossil of Budakeszi as some kind of *Cupressinoxylon*, possibly *Cryptomeria* or *Chamaecyparis*, while the fossil of Balatonkövesd as an *Araucaria*. He does not publish data as to the age of the fossil, but further examinations have revealed that the fossil of Balatonkövesd is Permian to all probability.

He also described the fossils collected at Balatonkövesd, Balatonalmádi, Cserkút and Kővágószöllős (Tuzson 1906). In his opinion all of these belonged to the species *Ullmannites rhodeanus*.

In the same work he describes one of the fossil trees from the mine of Várpalota under the name of *Cupressites* which, however, according to his drawings is not belonging to the *Cupressaceae* but is a *Sequoioxylon*.

Tuzson was closely followed by Hollendonner who primarily in the xylotomical investigation of prehistoric charcoals performed a pioneer work. He regarded the lignite material of the Pogányvölgy valley near Kőszeg as some kind of *Taxodium*.

Although Tuzson's and Hollendonner's investigations into the fossil trees brought remarkable initial results, part of the collections from Hungary was sent abroad for examination. So for example, L. Lóczy sen. sent some silicified woods of Hungary to Lingelsheim.

E. Hofmann (1927–1929) determined the coniferous remains of Vashegy partly as *Taxodioxylon sequoianum*, partly as *Taxodioxylon taxodioides*, relating them to the late Tertiary. The determination of *T. taxodioides* is very plausible.

In another study she describes from the environments of Szombathely a *Sciadopityoxylon wettsteini* Jur., a *Glyptostroboxylon europaeum* (Heer), and a *Taxodioxylon* sp., and besides these a *Quercus cerris* (L) which is easy to identify. Since no photographs or drawings are supplied to these descriptions, the determinations cannot be checked.

Haraszty (1933) determined the wood material of the ligneous browncoal of Gyöngyös and Rózsaszentmárton as *Taxodioxylon sequoianum*. Subsequently, for almost 10 years no palaeoxylotomical studies of consequence appeared, which can be attributed partly to the tension preceding World War II.

Sárkány (1943) by phytohistological examination of the lignites of Várpalota has established that they are exclusively stems of *Taxodioxylon sequoianum*.

Greguss (1949b) described the fusain inclusion of the Upper Cretaceous browncoal of Ajka as *Podocarpoxylon ajkaense*.

Andreánszky (1949) established for the silicified stem found in the manganese mine of Urkut, on the basis of its simple structure, the new generic name *Simplicioxylon*, but by a subsequent verbal declaration has modified this determination.

From the beginning of the fifties palaeobotanical and palaeoxylotomical research work in Hungary has become livelier, and the workers have been more busy to undertake investigations of this kind.

Andreánszky determined from the environments of Mikófalva several silicified stems, thus the species *Pinuxylon bükkense*, *Taxodioxylon sequoiadendri*, *Platanoxylon* sp., *Populoxylon* sp. (cf. *Populus tremula*), *Fraxinoxylon* sp. (cf. *Fraxinus americana*), *Quercoxylon avasense*.

Greguss (1952) re-examined the *Simplicioxylon hungaricum* described by Andreánszky and lists the stem of Urkut under the name of *Agathoxylon hungaricum* (Andreánszky) Greguss. Moreover he discussed an *Araucarioxylon* and a *Podocarpoxylon* from Villány and *Dadoxylon pannonicum* from the Lower Cretaceous of Lábatlan.

Andreánszky describes fossils of *Pinuxylon karancsense* Andreánszky, *Taxodioxylon taxodii* Gothan, *Cupressinoxylon* sp. and gives photographs of the species.

Haraszty (1953) determines a fossil as *Cupressinoxylon* while an other as *Ginkgo*.

Greguss (1954) determines also some characteristic fossilized trees of the silicified Lower Miocene forest of Ipolytarnóc, among others a *Sequoioxylon*, *Pinuxylon albicauloides* and several *Pinuxylon* species.

Andreánszky discusses the silicified stems of the Tertiary. He determines the lignite of Várpalota as *Taxodioxylon sequoianum* (Merklin) Gothan, another from Sajókazinc as *Taxodioxylon taxodii.*

In the same symposium, a study of Stieber determined a fossil of Királd as *Taxus* while another as *Zelkova* or *Celtis.*

Simoncsics (1955) determined the pieces of stems from the Mecsek mountain as belonging to the species *Dadoxylon schrollianum* and *Dadoxylon transdanubicum* Simoncsics. Greguss later (1961) re-examined one of these stems, recording it under the name of *Baieroxylon implexum* (Zimmermann) Greguss.

Maácz (1955a) determined a Lower Helvetian fossilized tree as *Taxodioxylon gypsaceum.*

Kedves and Simoncsics (1957) described from Balatonboglár a piece of wood carried over from Helvetian layers as *Sequoioxylon gregussi.* As to anatomical properties, the fossil undoubtedly belongs to some *Sequoioxylon* and rather to the gigantea than to the sempervireus type.

Kedves (1959b) examined several remains exposed near Herend with a Lower Helvetian bore sample from a depth of about 160 m and found part of them *Sequoioxylon* cf. *gigantea* while others *Sequoioxylon* cf. *sempervirens,* supporting his determination by the height curve of the medullary rays.

Greguss (1955a) in an extensive work discusses the xylotomy of 350 coniferous species which are still extant. This work greatly promotes the determination of fossilized conifers.

Greguss (1956a) determines part of the Cretaceous fossilized stems from Tata as *Araucarioxylon* and *Podocarpoxylon.*

Simoncsics (1956) determined the fusain samples of Kányás in Nógrád county under the name *Taxodioxylon gypsaceum* (Goeppert) Kräusel.

Haraszty (1957) determined the stems of the ligneous browncoal of Hidas as *Taxodioxylon, Glyptostroboxylon* and *Sequoioxylon.*

Haraszty (1958) examined several silicified pieces from the environment of Herend–Szentgál and determined them as *Taxodioxylon taxodii, Taxodioxylon gypsaceum, Cupressinoxylon Palmoxylon* and *Betuloxylon.*

Greguss (1959) examined further pieces of lignite of Várpalota and determined them as *Sequoioxylon,* possibly *Metasequoioxylon, Glyptostroboxylon,* without finding among them any piece that could be safely qualified as *Taxodium.*

Kedves (1959b) determined the xylites as *Sequoioxylon* stems.

Haraszty determined from the Pannonian strata of Rudabánya fossil stems of *Taxodioxylon gypsaceum, Glyptostroboxylon tenerum* and *Palmoxylon.*

*

The present work contains a comprehensive survey of the gymnosperm wood remains exposed in Hungary, determined and classified, in the bulk, by the author whose intention is to publish the material at hand on the angiosperm wood remains in the foreseeable future.

SYSTEMATIC CLASSIFICATION*

1. GINKGOACEAE

Baiera digitata Heer	Boda	Permian	III	
Baieroxylon implexum (Zimmermann) Greguss	Boda	Permian	I—IV	17**
Ginkgoxylon (det. by Haraszty)	Petőfibánya	Pannonian		

2. ARAUCARIACEAE

Agathoxylon hungaricum (Andreánszky) Greguss	Urkut	Upper Liassic	VI	19
Agathoxylon mecsekense n. sp.	Urkut	Upper Liassic	VIII	20
Agathoxylon sp. seu? *Araucarioxylon* sp.?	Urkut	Lower Cretaceous	VII	20
Araucarioxylon resiniferum n. sp.	Urkut	Upper Liassic	IX	21
Araucarioxylon spirale n. sp.	Mánfa	Permian (Helvetian?)	X	22
Araucarioxylon sp. (No. 1)	Cserkút	Permian	XII	23
Araucarioxylon sp. (No. 2)	Pécsbányatelep	Lower Liassic	XII	24
Araucarioxylon sp. (No. 3)	Pécs-Mecsekfalu	Permian (in situ)	XIII	24
Araucarioxylon sp. (No. 4)	Urkut	Upper Liassic	XIII	25
Araucarioxylon sp. (No. 5)	Villány	Upper Dogger	XIV	25
Araucarioxylon sp. (No. 6)	Urkut	Upper Liassic	XIV	26
Araucarioxylon sp. (No. 7)	Vasas	Upper Dogger	XV	27
Araucarioxylon sp. (No. 8)	Hárskút	Cretaceous	XVI	28
Araucarioxylon sp. (No. 9)	Sümeg	Lower Cretaceous	XVI	28
Araucarioxylon sp. (No. 10)	Komló	Lower Liassic	XVII	29
Araucarioxylon sp. (No. 11)	Tata	Lower Cretaceous	XVIII	29
Araucarioxylon sp. (No. 12)	Balatonszepezd	Permian	XIX	30
Araucarioxylon sp. (No. 13)	Urkut	Upper Liassic	XI	30
Araucarioxylon sp.	Cserkút, Hetvehely	Permian	XIX	31
Brachyoxylon urkutense n. sp.	Urkut	Upper Liassic	XX	31
Brachyoxylon sp. seu *Dadoxylon* sp. seu *Baieroxylon* sp.	Urkut	Upper Liassic	XXI	33

* The list contains references to the name of the fossil stems, their locality and geological age, as well as to the numbers of the Plates in Roman numerals.

No number of Plate is given if the fossil stem was collected and identified by other authors and the illustrative materials (photos and drawings) have already been published.

** These numbers refer to pages in the Systematic Description.

Dadoxylon graminovillae Zimmermann	Germany	Cretaceous	II	17
Dadoxylon implexum Zimmermann	Germany	Cretaceous	II	
Dadoxylon pannonicum Greguss	Lábatlan	Lower Cretaceous	V	19
Dadoxylon schrollianum Goeppert	Boda	Permian	IV	17
Dadoxylon transdanubicum Simoncsics	Boda	Permian	IV	17
Ullmannites (Dadoxylon) rhodeanum Goeppert (det. by Tuzson)	Balatonalmádi	Permian		
	Balatonkövesd	Permian		
	Cserkút	Permian		
	Kővágószöllős	Permian		18

3. PODOCARPACEAE

Dacrydioxylon estherae n. gen. et n. sp.	Solymár	Lower Oligocene (in situ)	XXII	34
Dacrydioxylon tasnádi-kubacskanum n. sp.	Üröm	Lower Oligocene	XXIII	36
Podocarpoxylon ajkaense Greguss	Ajka	Senon	XXIV	38
Podocarpoxylon cf. *lilpopi* Kräusel	Darnóhegy	Oligocene (secondary)	XXV	38
Podocarpoxylon sp. (No. 1)	Tata	Lower Cretaceous	XXX	38
Podocarpoxylon sp. (No. 2)	Tata	Lower Cretaceous	XXX	39
Podocarpoxylon sp. (No. 3)	Tata	Lower Cretaceous	XXXI	40
Podocarpoxylon sp. (No. 4)	Zirc	Lower Cretaceous	XXXI	40
Podocarpoxylon sp. (No. 5)	Tata	Lower Cretaceous	XVIII	41
Podocarpoxylon sp. (No. 6)	Mecsekszabolcs	Helvetian	LIII	42
Podocarpoxylon sp. (No. 7)	Lábatlan	Lower Cretaceous	XXVI–XXIX	42
Podocarpoxylon, Cupressinoxylon sp. (det. by Tuzson)	Budapest, Kissvábhegy	Eocene		

4. TAXACEAE, CEPHALOTAXACEAE

Taxus sp. (det. by Stieber)	Királd	Lower Miocene		44
Torreyoxylon boureaui n. sp.	Urkut	Lower Cretaceous	XXXII	44

5. CUPRESSACEAE

Callitroxylon sp.	Gánt	Lower Eocene	XLVIIIa	55
Cupressinoxylon sp. (det. by Haraszty)	Petőfibánya	Pannonian		
?*Cupressinoxylon* sp. (No. 1)	Recsk	Helvetian	LXXVIII	62
?*Cupressinoxylon* sp. (No. 2)	Kazár	Helvetian	LIV	63
?*Cupressinoxylon* sp. (No. 3)	Pesthidegkút	Helvetian	LII	63
Cupressinoxylon secretiferum n. sp.	Mecseknádasd	Lower Helvetian	LI	59
Cupressinoxylon cupressoides n. sp.	Szentendre	Lower Helvetian	LIV	61

Cupressinoxylon sp. (det. by Haraszty)	Szentgál	Tortonian		
Cupressinoxylon pannonicum Ung.	Budapest	Helvetian		
Libocedroxylon gausseni n. sp.	Erdőbénye	Sarmatian	XLIX	56
Libocedroxylon sp.	Szilvásvárad	Sarmatian	L	58
Platyspiroxylon sp. (No. 1)	Litér	Permian	XIX	50
Platyspiroxylon sp. (No. 2)	Pécsbányatelep	Lower Liassic	XLV, XLVI	50
Platyspiroxylon parenchymatosum n. sp.	Urkut	Upper Liassic	XLII–XLIV	47
Platyspiroxylon heteroparenchymatosum Greguss	Kővágószöllős	Permian	XL, XLI	46
Platyspiroxylon heteroparenchymatosum Greguss	Bakonya	Permian	XXXIII–XXXIX	46
Widdringtonioxylon ráskyae n. sp.	Budafok	Helvetian	XLVII	52
Widdringtonioxylon sp.	Budapest	Helvetian	XLVIII	54

6. TAXODIACEAE

?Cryptomerioxylon sp.	Sámsonháza	Helvetian	LIII	66
Cupressites (det. by Tuzson) *Sequoioxylon* (Greguss)	Várpalota	Tortonian		
?Glyptostroboxylon sp. (No. 1)	Várpalota	Tortonian	LXVII	66
Glyptostroboxylon sp. (No. 2)	Várpalota	Tortonian	LXXII	67
Glyptostroboxylon sp. (No. 3)	Várpalota	Tortonian	LXVII	68
Glyptostroboxylon tenerum (Kraus) Conwentz (det. by Haraszty)	Hidas	Tortonian		
Glyptostroboxylon tenerum (Kraus) Conwentz (det. by Haraszty)	Rudabánya	Pannonian		
Glyptostroboxylon europeum Hofmann (det. by Hofmann)	Szombathely	Pannonian		
Glyptostroboxylon sp. (det. by Andreánszky)	Fóny	Pannonian		
Metasequoioxylon hungaricum n. sp.	Karancskeszi	Helvetian	LV	69
?Metasequoioxylon sp.	Sajókazinc	Lower Helvetian	LVI	71
Sciadopityoxylon wettsteini Jurasky (det. by Hofmann)	Szombathely	Pannonian		
*Sequoioxylon** cf. *germanicum* (No. 1) Greguss	Alacska	Helvetian	LV	76
*Sequoioxylon** cf. *germanicum* (No. 2) Greguss	Dorog	Upper Oligocene (Katien)	LXVIII	76
*Sequoioxylon** *medullare* n. sp.	Ipolytarnóc	Burdigalian	LVII	72
*Sequoioxylon** *podocarpoides* n. sp	Salgóbánya	Lower Helvetian	LVIII, LIX	73
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 1)	Sajószentpéter	Helvetian	LXIV	78
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 2)	Litke	Lower Helvetian	LXIII	79

* The *Sequoioxylons* marked with asterics were described as belonging to the genus *Taxodioxylon* in earlier nomenclature.

*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 3)	Várpalota	Tortonian	LXIX	79
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 4)	Ipolytarnóc	Burdigalian	LX	80
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 5)	Várpalota	Tortonian	LXXIV	81
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 6)	Salgóbánya	Lower Helvetian	LXI	82
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 7)	Nagybátony	Lower Helvetian	LXII	83
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 8)	Várpalota	Tortonian	LXXIV	84
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 9)	Várpalota	Tortonian	LXX	85
*Sequoioxylon** *gypsaceum* (Goeppert) n. comb. (No. 10)	Várpalota	Tortonian	LXX	86
*Sequoioxylon** sp. (No. 1)	Várpalota, Rudolftelep	Tortonian	LXV	87
*Sequoioxylon** sp. (No. 2)	Pécsszabolcs	Helvetian	LXV	88
*Sequoioxylon** sp. (No. 3)	Várpalota	Tortonian	LXIX	88
*Sequoioxylon** sp. (No. 4)	Várpalota	Tortonian	LXXII	89
*Sequoioxylon** sp. (No. 5)	Eger	Helvetian	LIV	90
*Sequoioxylon** sp. (No. 6)	Várpalota	Tortonian	LXXIII	90
*Sequoioxylon** sp. (No. 7)	Várpalota	Tortonian	LXXIII	90
*Sequoioxylon** sp. (No. 8)	Becske	Burdigalian	LXXV	91
*Sequoioxylon** sp. (No. 9)	Pestszentlőrinc	Helvetian	LXVI	91
*Sequoioxylon** sp. (No. 10)	Várpalota	Tortonian	LXXI	92
*Sequoioxylon** sp. (No. 11)	Várpalota	Tortonian	LXXI	92
Sequoioxylon Taxodioxylon gypsaceum (Goeppert) Kräusel (det. by Haraszty)	Hidas	Tortonian		
Sequoioxylon gregussi Kedves–Simoncsics (det. by Kedves–Simoncsics)	Balatonboglár	Helvetian		
*Sequoioxylon** sp. (det. by Rákosi)	Dorog	Oligocene		
Taxodioxylon taxodii Gothan	Nagyréde	Tortonian	LXXVI, LXXVII	93
Taxodioxylon cf. *taxodii* Gothan	Buják	Sarmatian	LXXVIII	95
Taxodioxylon gypsaceum (Goeppert) Kräusel (det. by Haraszty)	Petőfibánya	Pannonian		
Taxodioxylon taxodii Gothan (det. by Haraszty)	Hidas	Tortonian		
Toxodioxylon gypsaceum (Goeppert) Kräusel (det. by Haraszty)	Rudabánya	Pannonian		
Taxodioxylon gypsaceum (Goeppert) Kräusel (det. by Maácz)	Pereces	Helvetian		
Taxodioxylon taxodii Gothan (det. by Haraszty)	Szentgál	Tortonian		
Taxodioxylon sequoiadendri Andreánszky (det. by Andreánszky)	Mikófalva	Sarmatian		

Taxodioxylon sequoianum(Mercklin) Gothan (det. by Andreánszky)	Budapest Kamaraerdő	Helvetian		
Taxodioxylon sequoianum (Mercklin) Goathan (det. by Andreánszky)	Sajókazinc	Helvetian		
Taxodioxylon sequoianum (Mercklin) Gothan (det. by Sárkány)	Várpalota	Tortonian		
Taxodioxylon gypsaceum (Goeppert) Kräusel (det. by Haraszty)	Szentgál	Tortonian		
Taxodioxylon taxodioides Hofmann (det. by Hofmann)	Szombathely Vashegy	Pannonian		
Taxodioxylon sequoianum (Mercklin) Gothan (det. by Hofmann)	Szombathely Vashegy	Pannonian		
Taxodioxylon sp. (det. by Hofmann)	Szombathely Vashegy	Pannonian		
Taxodium (Sequoioxylon) (det. by Hollendonner)	Kőszeg Pogányvölgy	Pannonian		

7. PINACEAE

Cedroxylon sp.	Nógrád	Helvetian	LXXIX	95
Cedroxylon sp. (det. by Andreánszky)	Mikófalva	Sarmatian		
Keteleeria sp.	Ipolytarnóc	Burdigalian	LXXV	96
?*Laricioxylon* sp.	Megyaszó	Lower Pannonian	LXXXVI	98
Laricioxylon nógrádense n. sp.	Nógrádszakál	Sarmatian	LXXXVI	97
Pinuxylon albicauloides Greguss	Ipolytarnóc	Burdigalian	LXXXI	100
Pinuxylon haploxyloides n. sp.	Karancsberény	Helvetian	LXXX	99
Pinuxylon bükkense Andreánszky (det. by Andreánszky)	Mikófalva	Sarmatian		
Pinuxylon tarnócziense (Tuzson) Greguss n. comb.	Ipolytarnóc	Burdigalian–Lower Helvetian	LXXXI–LXXXIII	101
Pinuxylon sp. (No. 1), *Pinuxylon* sp. (No. 2), *Pinuxylon* sp. (No. 3)	Ipolytarnóc	Burdigalian	LXXXIV	101–2
Pinuxylon sp. (No. 4)	Pécs, Danicz-puszta	Upper Pannonian	LXXXV	103

SYSTEMATIC DESCRIPTION*

1. GINKGOACEAE

Baieroxylon implexum (G. Zimmermann) Greguss

Plate I, Figs 1–3, 5–9; Plate II, Figs 1–4; Plate III, Figs 1–7; Plate IV, Figs 1, 2, 4, 5, 7 and 8.

Baieroxylon implexum (G. Zimmermann) Greguss–Pg. Abt. B, Bd. 109, pp 131–146.

Dadoxylon graminovillae G. Zimmermann–Pg. Abt. B, Bd. 93.

Note: Mr. B. Gertig collected 22 silicified stems on the hill Jakabhegy in the boundaries of the community Boda, which he handed over for elaboration to Mr. P. Simoncsics.

From these Simoncsics (1956) closely examined 10 pieces and classified most of them to *Dadoxylon schrollianum* Goeppert, as shown also in Plate IV. Figs 1, 2, 4, 5, 7 and 8 of this book. The piece No. 21 differed in its structure from the others, and therefore he described it under the name *Dadoxylon transdanubicum* Simoncsics. This species is represented in Figs 3, 6 and 9 of Plate IV.

The author of this book revised the slides and established that *Dadoxylon schrollianum* Goeppert represented on Plate III in the study of Simoncsics had a structure essentially different from the others and required a more detailed examination. The tangential and radial structures in the cross section of this stem were not identical with those of the other *Dadoxylon* fossils of Boda.

Since important anatomical features of this fossil of Boda show striking resemblance to, or almost complete identity with, the wood of recent *Ginkgo*, and in the same locality–although not side by side–*Baiera* leaves were found, the fossil can be named *Baieroxylon* with great probability. Also on account of the similar, almost identical structure, the *Dadoxylon*s described by Zimmermann (1953) are essentially *Baieroxylons*.

In author's opinion, *Dadoxylon keuperianum* described by Mägdefrau from the environment of Fürth is very similar to the fossil of Boda, so it may be a kind of *Baiera* as well.

It is also author's opinion that primarily those fossils should be ranged under the collective term *Dadoxylon* which have 1–3 (4–10) seriate rays, irrespective of whether there are araucarian, spiral or annular thickenings in the tracheids. The

* Abbreviations used throughout this book are as follows: **C** = cross section; **R** = radial section; **T** = tangential section; **L** = locality; **A** = geological age.

recent *Araucaria–Agathis* species of araucaroid pits have always uniseriate, exceptionally, but even then only partially, biseriate rays.

Since the fossil of Boda almost completely agrees with the species *Dadoxylon graminovillae* and *D. implexum* of Zimmermann, it should be named *Dadoxylon graminovillae* or *D. implexum*. As in our opinion the fossil described is beyond doubt *Baieroxylon*, both the *Dadoxylon*s of Zimmermann and the fossil of Boda had to be designated with a name expressing the *Ginkgo* character.
L. Boda; **A.** Permian.*

INCERTAE SEDIS

Ullmannites rhodeanum Goeppert

Beside the fossil stems collected in 1876, J. Böckh also found leaf imprints. Heer (1878) determined only the leaf imprints. The stems were later handed over by Böckh to Tuzson who established that their structure was *Araucaria*-like and the fossils belonged to the type *Ullmannites rhodeanum*. Tuzson (1906) published two colour pictures and several drawings. Details of the colour pictures and the drawing of *Ullmannites rhodeanum* in the text show interesting agreement with our fossil. Tuzson (op. cit. p. 31) published a drawing of the tangential slide of the *Ullmannites rhodeanum* exposed at Balatonalmádi. In the drawing oblique spiral lines intersect each other, exactly as in our fossil from Bakonya to be dealt with below. Another drawing (op. cit. p. 30) shows the slide of the fossil of Kővágószöllős on which, besides bordered pits, also oblique spiral lines are seen. This structure again highly resembles the striation of our fossil. Tuzson states that in all these fossils the height of the rays ranges between 1 and 33 cells, but most of them are only of 6 to 12 cell-rows high. Also this structure is suggestive of our fossil of Bakonya. All things considered, the fossils of Kővágószöllős and Cserkút, and those of Balatonkövesd and Balatonalmádi which also originate from the Permian, may have been identical with or similar to our fossil, that is *Dadoxylon*s, according to the current terminology. Neither the xylotomy of *Araucaria*, *Podocarpus* and *Ginkgo*, nor the microscope technique having been adequately developed in his time, Tuzson could not observe the fine details on his fossils as we can today. For example, Tuzson does not refer to spiral thickenings, though such are seen on his drawings. However, the analogy of the piece of Tuzson with our specimen of Bakonya does not permit us to apply the name *Ullmannites rhodeanum* for our fossil shows several particulars which were not observed by Tuzson. Could the *Ullmannites* identified hitherto, and the *Dadoxylons* themselves, be re-examined, probably more than one of them would be qualified as *Araucarioxylon* or *Baieroxylon*. Such a work would be already almost unfeasible. Still, the data as pertaining to the Permian of Hungary should be noted here for the sake of completeness.

* Unless stated otherwise, the slides are available at the Hungarian Geological Institute, Budapest.

Dadoxylon pannonicum Greguss

Plate V, Figs 1–9.

Dadoxylon pannonicum Greguss (1952)

Descr. Fig. 9 shows the structure of the rays. In some cross fields several simple pits are adjoining each other, namely 6 to 8 in each field, but there are also such fields in which even 16 small pits can be guessed. And this feature is mainly characteristic of some recent *Araucaria* above all of the *Agathis* species, though such pitting in the cross field can also be found in *Ginkgo*. Taking into account the araucaroid bordered pits of the tracheids, we think it very probable that the fossil is of an *Araucarioxylon* or rather *Dadoxylon* type. None of the living *Agathis* and *Araucaria* species has a wood structure similar to, or exactly identifiable with the fossil described. The bordered pitting of the tracheids, further the honeycomb-like arrangement of the 8 to 16 pits in the cross fields and the rare occurrence of parenchyma cells certainly allow to infer an *Araucaria* or *Agathis* type, respectively. On the other hand, the 2 or 3 seriate rays explicitly differ from the ray structure of recent *Agathis* or *Araucaria.* This ray structure, as also appears from the work of Potonié and Gothan (1920, Fig. 250), is highly suggestive of *Dadoxylon.* Since the whole structure, particularly the presence of wood parenchyma and of the great number of pits in the cross fields, resemble this fossil rather *Agathis* than today's *Araucaria,* it should be simply named *Agathoxylon,* but by the broadness of its rays it is qualified as a *Dadoxylon,* and mainly on the basis of this latter trait we designated it as a new form with the name *Dadoxylon pannonicum.*

Note: The pieces of the size of a nut or hazelnut are completely imbibed with silicic acid. The preservation of some pieces is rather good, while on others, creases and taces of foreign rock material are seen. The slides speak of the *Araucarioxylon* type, though the size and arrangement of the tracheids particularly in the width of the rays, and the presence of the parenchyma cells, suggest a structure somewhat different from recent *Araucaria.*

L. Lábatlan; **A.** Lower Cretaceous.

2. ARAUCARIACEAE

Agathoxylon hungaricum (Andreánszky) Greguss

Plate VI, Figs 1–9.
Agathoxylon hungaricum (Andreánszky) Greguss (1952).
Simplicioxylon hungaricum Andreánszky (1949).

Note: Andreánszky (1949) examined Upper Liassic stems from the manganese mines of Urkut and described the fossils under the name *Simplicioxylon hungaricum.* This name was later modified by him to *Araucarioxylon.* Vadász sent material of the same stem also to me. My investigations did not fully verify the statements of Andreánszky (Greguss 1952, Figs 2, 7, 8).

The structure of the wood suggests that the conifer determined might have lived under an equable climate, perhaps in the tropical or subtropical zone. This is also supported by the present distribution of *Agathis* and *Araucaria*.

L. Urkut, manganese mine, shaft No. I; **A.** Upper Liassic.

Agathoxylon sp. seu? ***Araucarioxylon*** sp.?

Plate VII, Figs 1–9.

Descr. **C.** suggests a perfectly *Araucaria*-like structure. The cross sections of the tracheids are of different size, the corners are rounded off in all of them, they are mainly elliptic or circular. There are no annual rings, the wood is of perfectly uniform structure.

T. The rays are uniseriate, 1 to 15 cells high. The cross section of their cells is a circle or low ellipse. In their vicinity probably parenchyma cells are arranged, this, however, is only an assumption, since the physical processes of silification may have also been responsible for the design similar to the cellular structure. From the design we may infer a parenchyma structure (Figs 5 and 7).

R. In the tracheid walls the bordered pits are arranged seldom in 1, more frequently in 2 rows and according to a characteristically araucaroid pattern (Fig. 6, composed of 3 details). In the cross fields of the rays the pitting is not distinctly visible, therefore it cannot be decided to which genus or species the wood belongs. The cross section structure and the explicitly araucaroid pitting of the tracheids indicate with a high probability *Araucaria* or *Dadoxylon*. Since the rays are only uniseriate, it is more probable that the fossil is an *Araucarioxylon* or *Agathoxylon*. It can be clearly distinguished from the former species mainly in that it has no resin cysts.

L. Urkut, manganese mine; **A.** Lower Cretaceous cover layer.

Agathoxylon mecsekense n. sp.

Plate VIII, Figs 1–11.

Diagnosis: In sectione transversali tracheidae magnitudine formave variae, rotundatae, limites stratorum concentricorum vix conspicui. Radii medullares 1–stratosi, altitudine 1–15-cellulares. Parietes omnes cellularum parenchymae longitudinalis leves tenuesque. In ligno meatus resiniferi. Pori areolati parietum tracheidarum plerumque 2–3-seriati, araucaroiditer ordinati. In zonis ex radiis medullaribus tracheidisque formatis plerumque, 8–10 pori simplices.

Descr. **C.** is by and large similar to that of the other *Araucarioxylon*s; this assumption seems to be verified by the tangential and radial structure. Also in this wood there are resin cysts and more simple pits in the cross fields. Difference appears in that the bordered pits in the radial wall of the tracheids of this wood are arranged entirely according to the araucaroid pattern, not only in 1–2 (Figs 7, 9 and 10) but also in 3 rows (Fig. 11).

Note: The rays are only uniseriate (Fig. 4), and a fairly large number of parenchyma occur in the wood (Fig. 8); there are generally several tiny pits in the cross fields, while in the tracheid walls the bordered pits are arranged in 1 to 3 rows —and this seems to be a distinctive feature (Fig. 7). So this structure is suggestive of *Agathoxylon* rather than of *Araucarioxylon*. It can be less qualified as a *Dadoxylon*, because the rays are only uniseriate. Considering the above features, and similarity with other fossils, we think this is an *Agathoxylon*. Since it was found in the Mecsek, we wish to distinguish it by the name *Agathoxylon mecsekense*.

L. Urkut, István shaft; **A.** Upper Liassic.

Araucarioxylon resiniferum n. sp.

Plate IX, Figs 1–10.

Diagnosis: Inter tracheidas saepe utres resiniferi, granula resinae in illis. Radii medullares latitudine 1–, altitudine 1–6-cellulares. Pori areolati parietum radialium tracheidarum nonnunquam laxe 1-seriati, ceterum 1–, vel 2–seriati, araucaroiditer inter se accommodantes. Parietes omnes cellularum radiorum medullarium tenues levesque. In cellulis multis radiorum medullarium resina fusca.

Descr. **C.** The fossil was received in an entirely compressed condition, so the examination could not definitely decide whether the cross sections of the tracheids were rounded off or somewhat angular. Dispersed among the compressed tracheids, however, there are thin-walled cells, from which we can infer the taxonomy of the wood. There are no explicit annual rings, they can be vaguely guessed at places from the colour and shape of the tracheids only (Figs 1 and 2). The rays are 1–2 cell layers wide and run parallel to each other at a distance of 2–3–6 tracheids. The longitudinal parenchyma cells (resin cysts?), which sometimes are striated very close to each other and almost form a longitudinal duct, are in most cases filled with a resin-like substance (Figs 1–3). These canals are elongated not only in vertical but also in a horizontal direction; the latter position can be readily observed on the tangential side.

No exact dimensions of the compressed tracheids could be determined, but the diameter of the cysts ranges from 30 to 50 μ. In the ducts at some places their content, the resin granules, can be distinctly observed (Figs 4, 5 and 6).

T. The rays are comparatively low, their height ranges between 1 and 6–8 cells. Neither the cross section or the tangential structure, nor the presence of frequent longitudinal parenchyma cells or their resin-like contents allow us to infer some species of *Araucaria*.

R. The bordered pits in the tracheid walls range in 1 or 2 rows according to a characteristic araucaroid pattern (Figs 7 and 8). The apertures of the bordered pits are circular, at some places in the tracheid walls the bordered pits fit to each other not closely, i.e. according to the araucaroid pattern, but somewhat loosely (Fig 10). This in itself, however, would not constitute a distinctive feature, since in some recent *Araucaria* such arrangement is rather frequent. The apertures are sometimes slit-like and form X figures mostly on the opposite side. All walls of the rays are smooth and thin.

Because of the dark content the cross fields could not be established. The height of the rays ranges from 1 to 6 cells; rays of 7 to 8 cell height are very exceptional. The ray cells have a dark-coloured resin content, the resin granules are mostly rounded (Fig. 9) and look as if they had assumed the shape of the pits of the medullary ray cells.

Note: Since the cross sections of the tracheids are rounded or angular, and distinct parenchyma cells with resin contents are very frequent in the wood, and the bordered pits in the longitudinal tracheid walls occasionally join each other according to the araucaroid pattern in 1 or 2 rows, we regard our fossil as an *Araucarioxylon.* The most characteristic property of the wood is that the cells and canals of resin content are very frequent in it; therefore we name it, for distinction from the others, *Araucarioxylon resiniferum* n. sp.

L. Urkut, from manganese clay; **A.** Upper Liassic.

The slides are in the Geological Institute of the Eötvös Loránd University, Budapest.

Araucarioxylon spirale n. sp.

Plate X, Figs 1–11.

Diagnosis: In sectione transversali sine stratis concentricis; tracheidae transversaliter sectae rotundatae, pariete locis nonnullis scalariter (gradibus 15–25) incrassato; locis aliis poris proprie araucaroidibus, in seriebus 1–2 ordinatis instructo; radii medullares 1-stratosi, araucaroides; cellulae parenchymae longitudinalis pariete tenui.

Descr. **C.** No annual rings could be observed (Fig. 1). The cross sections of the tracheids, not only the outer walls but also the lumina are rounded (Figs 2 and 3). The tracheid rows fit each other radially. They are interrupted at some places by creases and in other cases fit each other sinuously. From this uniform structure without annual rings, as well as from the rounded form of the tracheid cross sections, we may infer primarily *Araucariaceae*, then *Podocarpaceae*, or some *Cupressaceae.*

T. The knowledge of the tangential structure gives us more information. On the tangential slide the rays are generally 1–10 cells high (Fig. 4). The upper and lower ends of the rays are suddenly tapering, which is a typical araucarian structure. This is also evidenced by the rays generally merging above each other, and this coalescence can repeat itself several times (Fig. 4). Such fusion of rays only occurs in living *Araucariaceae.* This is the second characteristic feature pointing to this family.

R. Our assumption is further supported by the radial structure where the bordered pits in the tracheid walls are arranged in one or two rows, and always alternating. When arranged in one row above each other, they are mostly in touch, and the border is somewhat compressed so that the bordered pits join each other with horizontal margins (Figs 6 and 11). Among the tracheids thin-walled parenchyma cells occur (Fig. 5). In these also the transverse walls are smooth and thin. This is still more of the *Agathis* character. However, a property not observed in either recent or extinct *Araucariaceae* known so far is that in the walls of some tracheids of our fossil there are spiral or scalariform thickenings also verified by the photographs. It is not likely that the spiral wall structure has anything to do with the micellar structure of the cell wall or a splitting has brought it about in such regular form. We cannot explain this phenomenon, but since it occurs in the fossil it is worth while recording. It is not likely that the fossil is some homoxylous dicotyledonous wood unknown so far.

The *Araucaria* character is also supported by the structure of the cross fields in which the contours of 2–3–4 simple pits can be guessed. Owing to a high degree of disorganization, no finer details could be observed on the fossil.

The above anatomical properties, however, are sufficient for the classification of the silicified stem which, having also such property as differs from recent *Araucariaceae*, could fairly well be designated as *Dadoxylon* according to current practice. Since, however, the rays are only uniseriate, as are in *Araucariaceae*, the denomination *Araucarioxylon* seems to be most appropriate. The presence of the spiral thickenings distinguishes it from other *Araucarioxylon*s, therefore we wish to denominate it *Araucarioxylon spirale* n. sp.

Note: From the gravel layer of the Helvetian a stem redeposited from the Permian came to light. Its colour is dark-grey, in its interior broken in two longitudinal resin stripes are visible. The compressed structure can be observed even with the naked eye. Completely silicified, well preserved.

L. Mánfa; **A.** Permian; detritus layer redeposited into Helvetian gravel.

Araucarioxylon sp. (No. 1)

Plate XII, Figs 1–4.

Descr. **C.** The tracheids are of different shape and size, their lumina being circles and ellipses. The rays are uniseriate (Figs 1–2).

T. The rays are also definitely uniseriate. The height of the rays is 1–20–22 cells (Figs 3–4).

R. The radial structure cannot be established, owing to a high degree of disorganization, but the cross sections of the tracheids and the height and structure of the rays are perfectly *Araucaria*-like, therefore, with no knowledge of the finer structure of the rays, we qualify the fossil simply as *Araucarioxylon* sp. without designation of species.

Note: The record of Cserkút and several others are only mentioned as data, and the designation "No. 1, 2, etc." only means serial numbers.

L. Cserkút; **A.** Permian.

Araucarioxylon sp. (No. 2)

Plate XII, Figs 5–9.

Descr. **C.** The cross sections of the tracheids show a much more varied pattern, and also the height and structure of the rays are significantly different from those of our previous fossil. The height of the rays is at most 6–8 cells as against the 20 cells high rays of the fossil found at Cserkút (Figs 3 and 6). Also the size of the individual ray cells can be readily distinguished. The bordered pitting in the tracheid wall is araucaroid, while in the cross fields the simple pits, the number of which is 6–9, can only be guessed, owing to a high degree of disorganization. Since it definitely differs from the Cserkút fossil, particularly in its ray structure, after the *Araucaria*-like features, and only for separation and as a record, we designate it *Araucarioxylon* sp. (No. 2).

L. Pécsbányatelep; **A.** Lower Liassic.

Araucarioxylon sp. (No. 3)

Plate XIII, Figs 1–5.

Descr. **C.** The annual rings between the compressed tracheids can be distinctly observed at distances of about 40–50 tracheids. In a width of about 5–6 tracheids in the late wood the wall of the tracheids is somewhat thicker than in the others, and the lumen is split-like (Fig. 1). There are no ducts in the wood; the presence of wood parenchyma can only be guessed at some places. The rays might have been uniseriate. Where the wood is completely carbonized, the shape and size of the cells have remained fairly intact, from which conclusion can be drawn as to the cross sections and the original size of the tracheids. In such places the cross sections of the tracheids are definitely circular, and so are most of the lumina, so the honeycomb-like arrangement of the tracheids – as seen in the photographs – can be definitely established. Sometimes the tracheid rows can be followed.

The radial diameter of the tracheids is 52 to 54 μ, their width being about the same.

Since the transverse slides of the tracheids are definitely rounded, probably araucaroid, the fossil is regarded as *Araucarioxylon* and is designated – only as a record – as *Araucaryoxylon* sp. (No. 3).

Note: From the Pécs–Mecsekfalu area a fossil wood came to light. From its surface several protuberances of various size emerge which are situated more or less at the same height. At first glance these could be attributed to creases, but a more exact examination has showed that these protuberances and depressions are, to all probability, marks of some lateral organs (Fig. 1).

L. Pécs–Mecsekfalu; **A.** Permian (in situ).

Araucarioxylon sp. (No. 4)

Plate XIII, Figs 6–9.

Descr. **C.** The tracheids are thoroughly compressed so that their lumina became slit-like (Fig. 7).

Among the compressed tracheids there are cavities of the size of a cell, which to all probability were places of the solitary parenchyma cells. Although their boundaries can be guessed, there are no definite signs of annual rings to be seen. As for the cross-section structure, the fossil may have been some kind of *Araucarioxylon* or *Dadoxylon*.

T. Owing to heavy compression, no important details can be discerned; we may only guess, e.g. the height of the rays to have been 8 to 10 cells. The cross sections of the ray cells are mostly upright ellipses.

R. The bordered pits are definitely araucaroid, and this phenomenon is decisive of the taxonomy of the wood which was probably a driftwood. The bordered pits are comparatively small, only 10 to 12 μ; therefore, without knowledge of finer details, only as a record, the fossil may be named *Araucarioxylon* sp. (No. 4).

Note: From the manganese layers of Urkut an approximately 12 cm long and 2 cm wide fossil wood was exposed (Fig. 6). In conformity to the exterior of the fossil an about 1·5 cm wide court has developed, probably as a result of a chemical change or the infiltration by some sulfide compound of the wood. The transverse slide generally showed the same structure as the previous fossil.

L. Urkut; **A.** Upper Liassic.

Araucarioxylon sp. (No. 5)

Plate XIV, Figs 1–7.

Descr. **C.** The transverse slide (Figs 1, 2 and 3) immediately reveals that the stem is some gymnosperm, for the wood is completely homogeneous and the tracheids follow each other radially. No annual rings could be positively established, since there is no conspicuous difference in the wall thickness of the tracheids, except that in the vicinity of the supposed annual rings, which can be only guessed, the cross sections of some tracheids are smaller and their lumina somewhat narrower. From this completely homogeneous wood structure without annual rings we may infer an equable climate. Some tracheids contain a dark carmine-red, probably resin-like material, though no explicit resin ducts could be observed in the wood. The cross sections of the tracheids are rounded off, and their lumina are mostly circular. Their wall is comparatively thick, owing to a certain degree of disorganization.

T. The ray structure can be regarded as identical with that of the *Araucariaceae*. The araucaroid character is illustrated by Fig. 4, where two rays are seen, one above the other. Such structure is found only in the *Araucariaceae* among the recent conifers. The ray cells are generally 20 to 40 μ high and 17 to 18 μ wide. The rays are generally 1 to 6 cells high. Rays of 10 cell height are seldom. The cross sections of the ray cells are low ellipses, barrel-shaped, the outermost cells are somewhat higher than the interior ones.

In the tangential wall of the tracheids no pits can be observed, which is partly due to the high degree of disorganization.

R. Comparatively very few traces of rays are found, and no pits are seen in the cross fields, which renders a more exact determination impossible. The presence of some sort of pit could be observed only in one case in the cross field, but from this no conclusions of any consequence can be drawn.

Note: The silicified stem from the Villány mine is little suitable for xylotomical examination because the cellular structure is so much disorganized that practically no details of finer structure could be observed.

The cross-section structure of this fossil is entirely of araucaroid character in that the cross sections of the tracheids are rounded and there are no conspicuous annual rings, and on the tangential slides the height of the rays and the shape of their cross sections are also araucaroid; therefore the fossil is safely regarded, though no information on the cross field and the bordered pits of the longitudinal tracheids is available, as some kind of *Araucarioxylon*. Without knowing the most decisive anatomical features, we wish to designate it by the name of *Araucarioxylon* sp. (No. 5).

L. Villány; **A.** Upper Dogger.

Araucarioxylon sp. (No. 6)

Plate XIV, Figs 8 and 9.

Descr. **C.** By and large the same as that of the other *Araucarioxylon*s. The tracheids have rather wide lumina, and their arrangement differs somewhat from the *Araucarioxylon* sp. (No. 5). Its ray cells are wider on the transverse slide (10 to 14 μ), and at some places the rays may be even two or three seriate. This width of the ray cells and the shape of the tracheids and their variability are also suggestive of the cross section of *Ginkgo*. However, no parenchyma cells can be observed among the tracheids.

Note: The xylotomical structure of the stem from the István shaft in the Upper Liassic manganese layers of Urkut hardly differs from that of the previous fossil.

Owing to poor preservation, the original structure of the stem is detectable only at a few places, but even so the piece was suitable for a more exact examination.

A small detail of the longitudinal slide has shown that the wood in question belonged to the *Araucarioxylon* type. On this slide the bordered pits in the tracheid walls were arranged in 2 or 3 rows. Since the araucaroid arrangement of the bordered pits could be established with certainty but, owing to the compression of the wood, it was almost impossible to observe further details, we want to designate the specimen only as a record with the name *Araucarioxylon* sp. (No. 6).

L. Urkut; **A.** Upper Liassic.

Araucarioxylon sp. (No. 7)

Plate XV, Figs 1–9.

Descr. **C.** On some of the slides – in which the cross sections of the tracheids were visible – no annual rings could be established (Fig. 4). In other details fields of various size can be seen among the tracheids, in which the cell structure is visible, but the thickness of the cell walls largely differs from that of the tracheid walls which are thicker in their neighbourhood. At first sight these little fields might be regarded as parenchyma fields, though they were brought about by the disorganization of the cell walls of which only the primary ones were left. At other places 2–3 or 8–10 tracheids were grouped into smaller fields, which are highly suggestive of the hadrocentric vascular bundles of the *Pteridophytes* (Fig. 3).

T. Details could be hardly observed in the section, and the presence and structure of the rays could be guessed only at places (Fig 6). Where ray portions could be observed, the rays were 3–8–10 cells high, the cross sections of their cells were somewhat elongated ellipses, which is probably due to creases.

R. In the wall of some tracheids the bordered pits are arranged in one row, at some places closely adhering to each other, according to the characteristic araucaroid pattern, while at other places the row of bordered pits is interrupted here and there, and the pits are not fitting closely together either (Figs 7 and 8). In some pits the aperture is circular while in others characteristically araucaroid. The aperture is short and rounded, never transgressing the limit of the border. So the pitting of the tracheids exhibited an explicitly araucaroid character (Fig 8) and no such features were found as were not observable on recent *Araucariaceae*.

Note: On the poorly preserved fossils exposed from the Lower Liassic coal layers of Vasas the tracheids are radially arranged, their cross sections are rounded. Indistinct annual rings, height of the rays, the araucaroid structure of the bordered pits, as well as the araucaroid arrangement of the simple pits in the cross fields, are all such features as do occur in recent *Araucariaceae*. Therefore the fossilized pieces of wood are denominated *Araucarioxylon* sp. (No. 7).

L. Vasas; **A.** Upper Dogger.

Araucarioxylon sp. (No. 8)

Plate XVI, Figs 1 and 2.

Descr. **C.** (Figs 1 and 2). The interior structure of the wood could be established from very small portions only. No conspicuous annual rings were observed. The cross sections of the tracheids are rounded and their walls generally thin, which might have been also a consequence of the high degree of disorganization. The diameters of the tracheids are 40 to 50 μ, some of them are radially somewhat wider. In their interior a content of dark colour is accumulated.

T. The structure of the tracheids and rays could hardly be discerned, but at some places the ray skeleton could be clearly observed. The rays are generally lower, most of them 2 to 4 cells high; 8 cell high rays occur very seldom. It is characteristic that above a 2–3 cell high ray, or immediately beneath it, a 5–6 cell high ray is arranged (Figs 4 and 5). The ray skeleton is of entirely araucaroid character. The ray cells are widening more or less in the shape of a barrel (Fig. 5).

Note: We did not succeed in preparing a radial slide of the fossil, and so its finer structure could not be established.

The arrangement of the cross sections of the rounded tracheids, and the araucaroid character of the pit ray skeleton point to some *Araucariaceae* species. Since the radial structure is not known, we determine it as *Araucarioxylon* sp. (No. 8), referring to it only as a record.

L. Szentgál (Hárskút); **A.** Cretaceous.

Araucarioxylon sp. (No. 9)

Plate XVI, Figs 3–9.

Descr. **C.** No annual rings are seen, they can be only guessed at some places where the cross sections of the tracheids are slightly narrowing. The cross sections of tracheids are rounded, their radial diameters being 50–60 μ, their widths 30–40 μ. At the contact of tracheids the tiny triangular intercellulars are very frequent. The structure is of araucaroid pattern.

T. The ray skeleton shows explicitly araucaroid character. The rays are 1 to 8 cells high. It often occurs that above the 2–3 cell high rays, or immediately beneath them, 6–8 cell high rays are adjoining. These two features suggest the fossil may be some kind of *Araucarioxylon.*

R. Uniseriate araucaroid pitting can be established in the tracheid walls. In the width of a tracheid only one row of bordered pits are arranged, compressed in a horizontal contact line. At some places the bordered pits are situated somewhat more loosely. The pitting, however, is generally araucaroid (Fig. 7).

Araucaroid character is reflected also by the pits in the cross fields. Although the fossil is highly disorganized, in some cross fields the places of 4–6 pits could be ascertained (Fig. 6). This structure, too, is an evidence of the araucaroid character.

Note: Cross, tangential and radial slides all support the araucaroid character, so the fossil can be regarded as *Araucarioxylon*, and is indicated as a record by the name *Araucarioxylon* sp. (No. 9).

L. Sümeg; **A.** Lower Cretaceous.

Araucarioxylon sp. (No. 10)

Plate XVII, Figs 1–9.

Descr. **C.** Annual rings can be guessed at most. The cross sections of the tracheids are rounded squares or circles, also the lumina are rounded. Their radial diameter, as well as the width, is 40 to 50 μ, their wall 4 to 5 μ thick. There are some with quite narrow lumina, too. The rays run at a distance of 2 to 8 tracheids and seem to be uniseriate. Both tangential and horizontal walls of the rays are without pits (Figs 1–3). Owing to a high degree of disorganization, at some places the tracheids are completely dissolved. No resin ducts are seen; explicit parenchyma cells cannot be observed either, though a content of dark colour is seen in some cells.

T. The rays are generally 4–6–8 cells high. The cross sections of the cells are somewhat elongated ellipses, circles or squares rounded off (Figs 5 and 6). No finer structure could be observed in them. Some details suggest also longitudinal parenchyma cells (Figs 6 and 9). The horizontal walls of the parenchyma cells appear smooth, but it is possible that they are breakage lines of disorganization.

R. No finer details can be exactly observed, owing to the high degree of disorganization. The ray cells are 22 to 25 μ high, at some places 6–8–10 compressed pits are seen in the cross field, from which *Araucariaceae* can be inferred (see: arrow in Fig. 7). In the wall of the longitudinal tracheids at some places hexagonal fields can be observed. These are probably the contact lines of the araucaroid bordered pits (Fig. 9).

Note: The cross section structure of the fossil is suggestive of *Araucariaceae*. The rays are comparatively low, in the cross fields several simple pits are seen, and at some places parenchyma can be guessed. From these somewhat uncertain information, however, the fossil cannot be exactly determined: it can be regarded with a high degree of probability as *Araucarioxylon* or perhaps *Agathoxylon*. We may qualify the fossil without specific designation as *Araucarioxylon* sp. (No. 10).

L. Komló, Kossuth shaft; **A.** Lower Liassic.

Araucarioxylon sp. (No. 11)

Plate XVIII, Figs 1–6.

Descr. **C.** The presence of the annual rings can be hardly observed, the wood is completely homogeneous. The cross sections of the tracheids are generally rounded, no angles can be distinctly seen. Some tracheids contain dark resin, while at other places there is a darker material among the tracheids, from which the presence of wood parenchyma may be inferred.

T. The structure of the rays is readily discernible. The rays are generally 1–10 cells high, the cross sections of the individual cells are more of the barrel shape and in this respect resemble the ray structure of the *Araucariaceae*. Beside some rays or longitudinal tracheids, thin-walled septate cells can be observed, from which we may infer parenchyma, but these transverse walls may correspond to the resin lamellae in the longitudinal tracheids as well. The transverse and tangential slides clearly display an araucaroid character.

Note: The classification of the wood was settled by the araucaroid pitting of the tracheids on the radial walls. At some places of the walls of the longitudonal tracheids the bordered pits were arranged in 2 or 3 rows as it is clearly seen in Figs 5 and 6 of Plate XXV. Such structure of the tracheids is beyond doubt of araucaroid character, but no more than this can be stated without the knowledge of the cross fields. Therefore we record the fossil simply as *Araucarioxylon* sp. (No 11).

L. Tata; **A.** Lower Cretaceous.

Araucarioxylon sp. (No. 12)

Plate XIX, Fig. 7.

We could prepare only a transverse slide of this fossil, and so establish that it may have originated from some kind of *Araucariaceae*. There are no annual rings in the wood, the cross sections of the tracheids are more or less equally large and rounded. The cross section structure allows us, with some reservation, to infer *Araucarioxylon* (No. 12). We record it only as an occurence.

L. Balatonszepezd; **A.** Permian.

Araucarioxylon sp. (No. 13)

Plate XI, Figs 1–9.

Descr. **C.** The annual rings are distinct. The widths of the annual rings are almost uniform (Fig. 1), and at their boundaries the late wood is somewhat more compact than is the early one (Fig. 2). Still it is interesting to note that a wider annual ring generally follows on 5–6 narrower rings, as if in the periods of each 5–6 or 7 years, the tree lived under identical conditions (Fig. 1). The cross sections of the tracheids, as well as their lumina, are rounded, circular or elliptic, but sometimes the outer walls fit together angularly (Figs 2 and 3). There are no resin cysts or ducts in the wood, but some tracheids are filled with a dark substance. Thus from the cross-section structure we may certainly infer some kind of *Araucaria*.

T. The rays are 1–10 cells high, the cross sections of the ray cells are circles or low ellipses the size of which are variable within the rays. In some ray cells there is a content of dark colour (Fig. 4).

R. The bordered pits in the tracheid walls mostly fit together in 1, occasionally in 2 rows which are generally loose but sometimes compressed in the araucaroid pattern (Fig. 6). Here and there the tracheids are filled with sulphur-yellow resin which is always in the tracheids because the bordered pits are translucent with the light resin content.

The rays are 6–10 cells high, all their walls are smooth and thin, 6 to 8 simple pits are found in each cross field. The ray cells are mostly filled with a dark content, therefore the simple pitting can be established only seldom and with difficulties.

Note: The cross section of the wood and also the tangential structure of the rays are of araucaroid character; in the tracheid walls the bordered pits are arranged in 1 or 2 rows, according to the araucaroid pattern; in the cross fields the number of the simple pits varies from 3 to 8 and the tracheids are generally filled with sulphur-yellow resin; therefore we regard the fossil as an *Araucarioxylon* (No. 13).

L. Urkut; **A.** Upper Liassic.

?Araucarioxylon sp.

Plate XIX, Figs 1–6, 8 and 9.

Descr. **C.** The fossil wood of Cserkút is some kind of *Araucarioxylon* or *Dadoxylon.*

T. Quite disorganized, no finer details were examined.

The same can be stated about the fossils from Hetvehely (Figs 2 and 3).

The fossils Nos 5 and 6 from Hetvehely somewhat resemble *Platyspiroxylon* (Fig. 6), but are not identifiable without the knowledge of finer details. Essential is that the cross section is entirely araucaroid (Fig. 5).

L. Cserkút, Hetvehely, Litér; **A.** Permian.

INCERTAE SEDIS

Brachyoxylon urkutense n. sp.

Plate XX, Figs 1–9.

Diagnosis: Limites stratorum concentricorum conspicui, sed non eximie. Tracheidae in sectione transversali rotundatae: circulares, ellipticae, vel polygonales. Ad limites stratorum concentricorum utres vel meatus resiniferi. Radii medullares 1-stratosi, altitudine 1–15-cellulares, altissimi eorum nonnullis partibus 2-stratosi. Pori areolati parietum radialium tracheidarum plerumque in serie unica dispositi, araucaroiditer inter se accommodantes. Foramina tracheidarum circularia. In zonis e radiis medullaribus tracheidisque formatis 4–8 pori araucaroides. In cellulis nonnullis radiorum medullarium materia resiniformis.

Descr. **C.** The annual rings are 3 to 5 mm wide. Their boundaries are conspicuous either because of the presence of the resin ducts or owing to disorganization. They are arranged densely, almost merging into each other.

The cross sections of the tracheids are of different size and shape, their lumina are rounded, the outer walls being quadrangular, pentagonal or polygonal. They are arranged in radial rows; near the annual ring boundary their lumina are somewhat narrower. Among the tracheids in the annual ring fields there are cavities of various size, due partly to disorganization and partly to resin ducts (Figs 2, 3 and 4). From the cross section structure we may infer some kind of *Araucarioxylon.* The resin ducts are rather frequent. All these are clearly seen in Figs 1–4. The diameters of the tracheids are 45–60 μ; near the annual ring boundary they are somewhat shorter in the radial direction (35–40 μ).

T. The rays are 1–15 cells high, the cross sections of the cells are short ellipses or circles.

Also in the tangential wall of the tracheids bordered pits occur which follow each other loosely at a distance of 2–3 bordered pits. Some tracheids, isolated or grouped, are filled with golden-yellow resin. The ray cells are 17–18 μ high and have about the same width; all their walls are smooth and thin.

R. The arrangement of the pits in the tracheids, the shape and structure of the ray cells and the distribution of their pits are reminiscent of the *Araucariaceae,* first of all of some *Agathis* species. In the wall of the tracheids the bordered pits fit together in one row and compressed in the araucaroid pattern. Some tracheids also seem to be filled with sulphur or golden-yellow resin-like substance when viewed from this side. Thus the resin is in the tracheids – and not in the parenchyma cells – which is also evidenced by the bordered pits which are translucent through this resin substance.

The ray cells are procumbent oblongs, some of which are somewhat broader about the middle, thus their horizontal walls are not entirely parallel. In the cross fields 6–8 simple pits are arranged (lower part of Fig. 9). Sometimes the cross field contains only 4 pits arranged in 4 squares. At the crossing of the tracheids in the early wood even 6 to 10 pits may occur—a structure which is also clearly suggestive of the *Araucariaceae*, more exactly of *Agathis.*

From the arrangement of the pits and also of the structure of the cross fields, the fossil could be named *Araucarioxylon* or *Agathoxylon,* with less justification *Dadoxylon,* because the rays are uniseriate.

Since there is an abundant resin content in the wood and the resin ducts are frequent, which according to Jeffrey is a property of the *Brachyoxylon*s, we regard the fossil as *Brachyoxylon* rather than *Araucarioxylon.* It certainly differs from the *Araucarioxylon*s and *Dadoxylon*s known so far, and therefore, to distinguish it, we propose the name *Brachyoxylon urkutense.*

L. Urkut, manganese mine; **A.** Upper Liassic.

Brachyoxylon sp. seu *Dadoxylon* sp. seu *Baieroxylon* sp.

Plate XXI, Figs 1–10.

Descr. **C.** The cross sections of the tracheids are not of equal size and their circumference is not always rounded either (Figs 1, 2 and 3). At some places the annual ring boundaries are distinct (Fig. 1), some sort of seasonal division can be observed in the growth of the tree.

Its cross section markedly differs from that of the generally known *Araucarioxylons*; also the diameters of the tracheids are different. The radial diameter of the widest ones is 75 to 80 μ, their width 45–50 μ. Near the annual ring boundary the external tracheids of the late wood are radially flattened (Fig. 3), their radial diameter being here 14–16 μ while their width 45–50 μ. Here and there ducts can be observed between the tracheids (Fig. 2) which property in itself contradicts to the true *Araucarioxylons*.

The structure described above is distinct only in a small detail of the fossil, because the tracheid walls are strongly compressed, and the cell lumina look as thin splits.

T. The structure of the heavily compressed wood could be established in some parts only. Here the rays are comparatively low, generally 1–3–5–6 cells high. Nine cell high rays hardly occur. The tangential structure of the rays, the cross section and the shape of the cells are highly reminiscent of recent *Ginkgo* and of the *Baieroxylons*; therefore it is not wholly excluded that the fossil is a *Baiera*. It should be noted, however, that some recent species of *Araucariaceae* have rays 1 or 2 cells high. The resin ducts are distinct also on this side (Fig. 4).

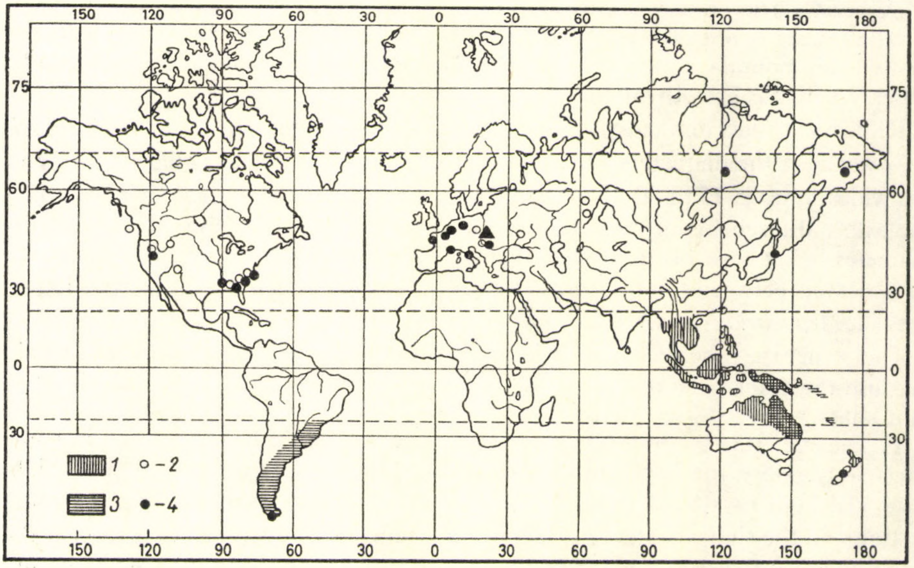
R. The bordered pits in the tracheid walls are sometimes arranged loosely, or somewhat compressed, in one row. If, however, the pits are biseriate, they fit generally together alternating, that is according to the araucaroid pattern (Figs 7 and 8). The aperture of the pits is circular or slightly elliptic. The resin ducts are rather frequent also on this side (Fig. 7).

Owing to the high degree of disorganization, the finer structure of the rays could only be guessed here and there even from this side. All ray walls are smooth and thin. The height of the ray cells is 26–28 μ, the cross fields are mostly disorganized, but at some spots the great ellipses of the podocarpoid or phyllocladoid pitting are seen (Fig. 9). Such circular or ellipsoid pit system only occurs in some recent *Podocarpus* and *Phyllocladus*. Since there are also parenchyma cells in the wood, while no such are present, to our knowledge, in recent *Phyllocladus*, we might regard the fossil, because of its large ovoid pitting, as *Podocarpoxylon*, although these oval designs may be contours of one-time little resin knots, and thus are secondary features. It is a fact, however, that such design is distinctly seen in Fig. 9.

It can be established that the cross section of the tracheids clearly differs from the ordinary cross-section structure of *Araucariaceae*. Since, however, resin ducts occur in the wood, the fossil exposed from the manganese layers should be regarded as

Dadoxylon or *Brachyoxylon* rather than some kind of *Araucarioxylon*. However, the ray structure and the cross section do not preclude *Baieroxylon* either.

L. Urkut, István shaft; **A.** Upper Liassic.



Map 1. Recent distribution of the genera *Agathis* (1) and *Araucaria* (3). Cretaceous sites of *Agathis* (2) and *Araucaria* (4). Permian and Mesozoic sites in Hungary (triangle)

3. PODOCARPACEAE

Dacrydioxylon estherae n. gen. et n. sp.

Plate XXII, Figs 1–14.

Diagnosis: Tracheidae in sectione transversali rotundato-quadrangulares; in stratis concentricis parenchyma frequens, cellulis parenchymae plerumque terminalibus. In sectione transversali radii medullares e cellulis 1–12–14 superpositis, uniserialibus, locis nonnullis biserialibus formati. Cellulae parenchymae longitudinalis parietibus omnino tenuibus levibusque. In section radiali in zonis ex radiis medullaribus tracheidisque formatis porus in genere tantum unus, rotundus, non areolatus, "circoporus", dacrydioides, nonnunquam forte forma erecto-ellipticus.

Descr. **C.** The comparatively thin annual rings are only 5 to 6, or 10–20 tracheids wide. At the annual ring boundary, which is hardly observable, the tracheids of the late wood are somewhat flattened radially, while their cross sections are squares and not rounded off. Their radial extent is about 40 μ, their width about the same

(Fig. 2). The rays run at a distance of 4–6 tracheids. The horizontal and the tangential walls of the cells are thin and quite smooth, and no pits are apparent in them. In some annual rings parenchyma cells are arranged terminally but at some places they are scattered (Fig. 2). Their interior is filled with a dark resin-like substance.

T. The rays in the wood are rather frequent, uniseriate, but sometimes biseriate with a height of 5–6 cells. Their height ranges between 1 and 25 cells, but most of them are only 1 to 3 cells high (Fig. 4). Particularly frequent are the 1 cell high rays. The cross sections of the ray cells are generally circular or square (Figs 5 and 6). The height of the marginal ray cells never reaches the double height of the interior cells. They are 20–30 μ high, 20–28 μ wide. Beside the rays, longitudinal parenchyma cells are rather frequent (Figs 3 and 6). In most of these rounded cell contents are seen, generally 1, in some cases 2–3 in each cell (Fig. 3). The walls of the longitudinal parenchyma cells are thin, without thickenings on the transverse walls. The frequent occurrence of the longitudinal parenchyma is clearly seen also on the tangential section.

R. The height of the rays can be also clearly established. The walls of the ray cells are smooth and thin (Fig. 14), for which a high degree of disorganization may be largely responsible, because no thickening is seen on the parts of wall that have remained intact. In some ray cells there is a dark resin-like content (Figs 5 and 14). Owing to disorganization the pitting can be hardly observed in the cross fields (Fig. 14). However, tiny ray portions have remained, from which reliable conclusions can be drawn. In the cross fields generally only 1, at most 2–3, completely circular pits without border can be seen (Figs 8–13). The diameter of the pits is 6–7 μ, they are sometimes slightly oval, when their longitudinal axis follows the direction of the longitudinal axis of the tracheids (Fig. 13). The longitudinal parenchyma cells are comparatively frequent also on the radial side. In the tracheid walls, owing to the disorganization, intact bordered pits could not be observed, only guessed. The bordered pits are arranged in the tracheid walls, as a rule, in one row, sometimes in pairs, as is general with the *Podocarpaceae*. In such cases the apertures of the bordered pits are almost vertical.

Note: From the above anatomical information the fossil should be classified into the *Podocarpaceae* family.

Scattered parenchyma cells are rather frequent in the annual rings, sometimes they are arranged almost terminally. On the tangential slide, the height of the rays, their cross-section structure, the presence of longitudinal parenchyma cells, the walls of wich are all smooth and thin, and the tiny circular 'circopori' in the cross fields of the radial section, are all precisely suggestive of *Dacrydium*. Indeed, the cross-field structure with its size and position of circular dacrydioid pits fully agrees with that of some recent *Dacrydiums* (Figs 8–13) into the structure of which, according to the photographs compared, this portion could well be fit. Among recent conifers, cross fields of such structure can only be observed in *Dacrydium* therefore this fossil can be designated as *Dacrydioxylon*.

Since *Dacrydium* pollens have already been demonstrated in Hungary from the Lower Miocene, it might be expected that also its fossil stem would be exposed some day. I propose to name this fossil after a one-time student of mine Dr. Eszter Nagy-Kovács.

L. Solymár; **A.** Lower Oligocene.

Dacrydioxylon tasnádi-kubacskanum n. sp.

Plate XXIII, Figs 1–9.

Diagnosis: In sectione transversali in stratis concentricis cellulae parenchymae longitudinalis pro ratione multae, tracheidae in sectione transversali plerumque rotundato-quadratae. Radii medullares e cellulis 1–15 superpositis. Cellulae parenchymae longitudinalis parietibus omnibus levibus tenuibusque. In zona una ex radiis medullaribus tracheidisque formata porus tantum unus circularis, non areolatus, dacrydiodesque; pori diametro unam partem tertiam altitudinis cellularum radiorum medullarium attingenti. Cellulae nonnullae parenchymae longitudinalis radiique medullaris particulas mergaritaceas resinae continentes.

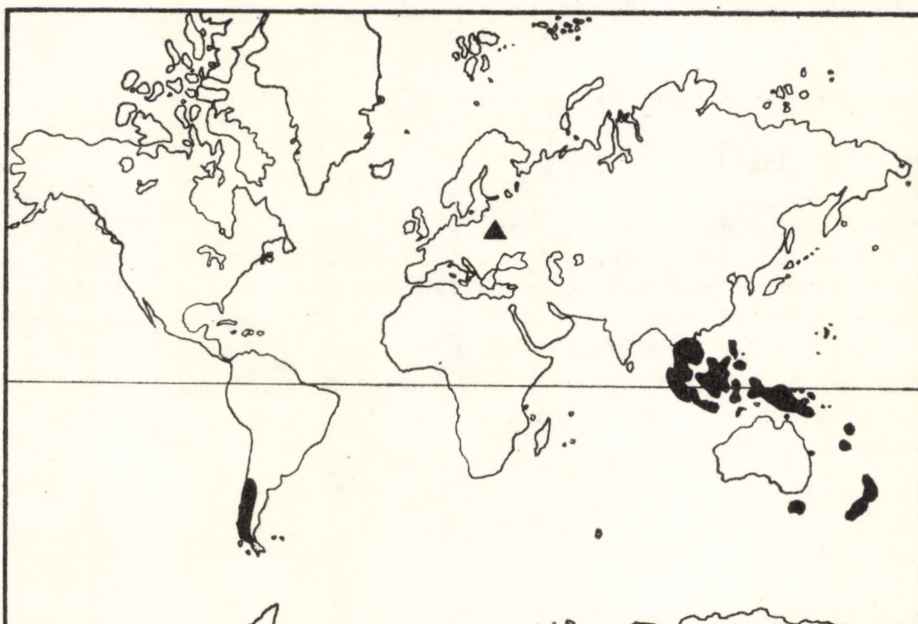
Descr. **C.** In the vicinity of the annual ring boundary, which is not conspicuous but still visible (Fig. 1), the late wood is marked by 4 to 5 tracheid rows of rather thick, radially somewhat flattened walls. The cross sections of the tracheids are squares, a little rounded only at the angles. In this respect it resembles the structure of the fossil of Solymár, only the extension of the tracheids in our sample is 55 to 60 μ, while that of the Solymár species hardly attains 40 μ (Figs 2 and 3). The annual rings are comparatively wide, they can measure 40–60 and even 80 tracheids. In some annual rings there is a very scarce, while in others frequent parenchyma, the cells of which are filled with a dark content (Fig. 1). The parenchyma cells are either scattered or terminally arranged. The tracheid rows frequently extend over the annual ring boundary in the next early wood (Figs 2 and 3).

T. The rays are 1–10, mostly 6–7, and only very rarely 15 cells high. The cross sections of the ray cells are circles or low ellipses, with a height of 22–24 μ. In this respect the species differs from the previous one. Enclosed between the rounded ray cells and the adjacent parenchyma cells or tracheids, small triangles can be observed (Fig. 5). The walls of the longitudinal parenchyma appear to be thin and smooth also on this side. In the transverse walls no pots can be observed. In the parenchyma cells disorganized cell content concentrated in 3–4–5 smaller knots is found.

R. The most essential feature of the wood can be observed on the radial slides where again all the walls of the ray cells appear thin and smooth. In some of them tiny pearl-like resin granules remained (Fig. 9). The cross fields are filled sometimes with great oval pits. But these great ellipsoid pits (latipori) are only apparent. At first glance these could be regarded as phyllocladoid pitting, but a closer observation reveals that in the middle of some of them there are still smaller circular but not bordered pits, just like in the piece of Solymár. Thus in the cross fields invariably one, at most two, small pits occur, the size of which is one third of the ray cell height (5–6 μ). Figures 7 and 8 clearly show that in each cross field there is only one pit without border, which structure is highly suggestive of the dacrydioid pit system with circopori referred to above. Near the pits no borders could be observed.

Note: The dacrydioid pitting is explicit, so the fossil can be qualified as *Dacrydioxylon.* In the cross fields the ellipsoid pit filling the whole cross field is essentially no pit, as has been shown also in the discussion of *Baieroxylon.* The arrows on the photos show the places of these dacrydioid pits, clearly indicating that in each cross field there is one tiny circular pit without border. On the grounds of the above rather scanty antomical features this form must be regarded as *Dacrydioxylon,* but to distinguish it from the fossil of Solymár, I propose to name it after Dr. András Tasnádi-Kubacska, the eminent Hungarian palaeontologist.

L. Üröm; **A.** Lower Oligocene.



Map 2. Recent distribution of the genus *Dacrydium*. Oligocene sites in Hungary (triangle)

Podocarpoxylon ajkaense Greguss

Plate XXIV, Figs 1–9.

Podocarpoxylon ajkaense Greguss (1949b)

The cross sections of the tracheids are rounded. The rays are 1–42 cells high, their cross sections being almost upright ellipses. The radial walls are thin, the horizontal ones are somewhat thicker. In the longitudinal parenchyma cells lacunar and knotty resin content is seen. In the cross fields 1, seldom 2 podocarpoid pits with elliptic borders occur; the aperture is almost vertical. In the tracheid walls the bordered pits are dispersed, sometimes compressed, in the araucaroid pattern.

Tausch stated that the Upper Cretaceous molluscs of the layers at Ajka are limnic and brack water species, showing conspicuous relationship with recent forms of Africa, New Caledonia, the Fidji Islands, Australia, South America and the Lake Baikal region, that is with those areas where, with the exception of the Baikal region, the recent forms of the family *Podocarpaceae* are still extant. The above statement of Tausch greatly supports the correctness of the above determination.

L. Ajka; **A.** Upper Cretaceous (Senon).

Podocarpoxylon cf. *lilpopi* Kräusel

Plate XXV, Figs 1–9.

Podocarpoxylon lilpopi Greguss (1956b)

The fossil does not completely agree with either of the about 80 living *Podocarpus* species examined by myself. Kräusel (1949) described several fossil *Podocarpus* species. According to his key of determination, which regards the occurrence of 1 pit in each cross field as characteristic of *Podocarpoxylon lilpopi,* it is not impossible that our specimen is identical with *Podocarpoxylon lilpopi,* but for lack of comparative material this could not be stated for certain.

L. Darnóhegy; **A.** Oligocene.

Podocarpoxylon sp. (No. 1)

Plate XXX, Figs 1–5.

Descr. **C.** The homogeneous structure of the wood is at first sight revealed. Annual ring boundaries were lacking or hardly perceptible. The cross sections of the tracheids were generally rounded, but at some places also the angular structure could be found (upper right corner in Fig. 2). The cross sections of the tracheids are of various size; wider tracheids alternate with those of narrower lumina.

In the annual ring fields somewhat smaller black cells were found among the tracheids, from which the presence of longitudinal parenchyma could be inferred. The rays were coursing at a distance of 5–10 and even 60 tracheids, in a radial direction.

T. (Fig. 3) The rays are generally 10–15 cells high, but also 25 cell high rays occur. They are invariably uniseriate. The cross sections of the ray cells are low or somewhat elongated upright ellipses. Their height is 16–18 μ, their width 9–10 μ. The rays have by no means an araucaroid character.

R. The ray height is shown by Fig. 5. In the longitudinal tracheid walls the bordered pits are uniseriate and scattered, the borders sometmes touching each other, but sometimes they are somewhat compressed and have ian oblique position, which is probably a result of compression. This structure of the pits is characteristic of *Araucariaceae* and *Podocarpaceae.*

Note: In earlier studies (1956a, p. 39) the present author has described this fossil and determined it as *Podocarpoxylon* sp.

It should be noted here that the designations Nos 1, 2, 3, etc. only mark the serial number of the *Podocarpus* specimens that could not be exactly determined, and by no means separate taxa.

L. Tata; **A.** Lower Cretaceous.

Podocarpoxylon sp. (No. 2)

Plate XXX, Figs 6–9.

The examination of the fossil No. 5 of Tata caused greatest difficulties. From the mass polluted with sandstone we could produce preparations of 4–5 mm only, and we had to make slides of these. It is rather cumbersome to prepare slides for such small pieces, but the examination was the more complicated since even these small pieces were strongly compressed.

Descr. **C.** (Fig. 6) The tracheids, though strongly compressed, present a homogeneous structure. Neither resin ducts nor conspicuous annual rings could be established in them. The conifer structure, however, is beyond doubt, because the cross sections of the compressed tracheids were more or less equal and radially arranged. The rays were uniseriate and ran in general radially at a distance of 2 to 8 tracheids.

T. On a small part of the tangential slide, however, it can be established that the rays are generally 6 to 8 cells high while some of them have attained a height of 20 cells. The rays appeared also on this side uniseriate, the cross sections of the cells were low or somewhat elongated ellipses as seen in Fig. 7.

R. The height of the rays could be better studied. The ray cells are comparatively low, 16–18 μ (Fig. 9). On the radial slides the presence of longitudinal parenchyma cells could be established, and the horizontal walls of the longitudinal parenchyma were perfectly smooth. A comparatively large number of longitudinal parenchyma cells were observed, the lumina of wich not only agreed with those of the tracheids but even substantially exceeded their size (right side in Fig. 9). In

Fig. 8, as a result of a fortunate sliding, a longitudinal resin cyst can be observed. It is probably a resin cyst and no resin duct, the more so since longitudinal resin ducts can be observed, first of all, in conifers showing conspicuous annual rings (*Pseudotsuga*, *Larix*, *Pinus*, *Picea*) while resin cysts are also found in woods without conspicuous annual rings. Since neither conspicuous annual rings nor explicit longitudinal resin ducts can be demonstrated in the fossil, it belongs with great probability to the family *Podocarpaceae*. This assumption is supported by the fact that in the cross fields of some radial slides there appears always only one and rather large pit with a somewhat oblique aperture, which is more like *Podocarpus* in character. Author (1956a, p. 39) described this fossil without any closer determination with a high degree of probability as some *Podocarpoxylon*.

L. Tata; **A.** Lower Cretaceous.

Podocarpoxylon sp. (No. 3)

Plate XXXI, Figs 1 and 2.

Podocarpoxylon sp. Greguss (1956a).

Note: The fossil pieces of wood originate from the Kálvária hill in Tata; they are badly preserved, so no radial slides could be prepared.

It could be established, however, from the transverse slides that the fossil represents some conifer. No conspicuous annual rings and resin cysts were found. As to its cross section structure, and mainly the width of the tracheids, the fossil somewhatdiffers from the previous one (No. 2) and cannot be completely identified with it. The difference is seemingly verified by the tangential slide in which the rays are slightly lower, and also the cross sections of the ray cells are somewhat narrower. This, however, may be due to compression. Finer details could not be observed because of the high degree of disorganization. Since the cross sections of the tracheids are angular rather than rounded and since there are no explicit annual rings or resin cysts, this structure is more of the *Podocarpaceae* character.

Author (1956a, p. 39) regards the fossil described as *Podocarpoxylon*, with the remark that the characteristic ray structure could not be exactly established here either.

L. Tata, Kálvária hill; **A.** Lower Cretaceous.

Podocarpoxylon sp. (No. 4)

Plate XXXI, Figs 7–10.

***Descr.* R.** In the radial wall of the longitudinal tracheids the borders of the pits can be only guessed at some places, and in a width of a tracheid generally only 1 while in the wider ones 2 bordered pits found place one next the other. The radial diameter of the tracheids ranged between 40 and 50 μ. In some longitudinal cells a cell content was seen, from which we may infer the presence of longitudinal parenchyma. So in this case the fossil is suggestive of *Callitris* or *Podocarpus* rather than of *Araucariaceae*. Also the high ray structure supports the assumption of *Podocarpus*.

T. The rays appear to be uniseriate (Fig. 7); from the radial side some of them reach even a 34–35 cell height. All walls are smooth and thin. The height of 3 ray cells is 70 μ, consequently the height of one ray cell about 23 μ. The radial shape of the ray cells rather suggests some *Podocarpus*.

The finer structure of the cross fields could not be exactly observed, but at some places the blurred contours of 1 or 2 pits in a cross field were seen.

Note: According to an earlier statement of the author (1956a, p. 39), the fossilized piece of wood is to all probability a *Podocarpoxylon* sp.

L. Zirc, quarry; **A.** Lower Cretaceous.

Podocarpoxylon sp. (No. 5)

Plate XVIII, Figs 7–10.

Descr. **C.** The annual rings are conspicuous. At the annual ring limit in the late wood there are 4–6 seriate thick-walled tracheids with narrow lumina which zone is suddenly followed by a zone of thin-walled tracheids. The thin-walled tracheids are again followed by zones of tracheids with quite thick walls. Owing to a high degree of compression, the rays do not run regularly in radial direction, and never broaden to form biseriate parts, thus the rays are invariably uniseriate. This does not correspond to the cross-section structure either of *Araucariaceae* or *Taxaceae*; at most in the families *Podocarpaceae*, *Taxodiaceae*, *Cupressaceae* can be found annual rings limited with such thick-walled tracheids. The most significant property of the cross slide is that the thick-walled tracheid zones are followed by thin-walled ones.

T. It appears that the rays are comparatively high (1–30 cells) and uniseriate. The cross sections of ray cells are slightly upright or elongated ellipses, which can be possibly attributed to the high degree of compression. Such high uniseriate rays occur among recent conifers in some species of *Podocarpus*, *Callitris*, in *Taxodia*, and in the genera *Abies* and *Keteleeria*. From Fig. 9, representing the tangential section of a *Podocarpus*, this may be inferred, the more so since among recent *Podocarpaceae* there are some species in which particularly the tangential structures are suggestive of the fossil.

Note: From the fossil No. 4 originating from the Kálvária hill in Tata, cross and tangential slides could be prepared with great difficulties. Radial slide has not been prepared, owing to the insufficiency of the material. According to an earlier statement of the author (1956a, p. 39) the fossil described is some *Podocarpus*.

L. Tata; **A.** Lower Cretaceous.

Podocarpoxylon sp. (No. 6)

Plate LIII, Figs 4–9.

Podocarpoxylon sp. Greguss (1956a)

Descr. **C.** No annual rings could be established. The tracheids are arranged radially, but not quite regularly, because among the tracheids with wider lumina often tracheids of quite narrow lumina are found (Figs 4 and 5). The cross sections of the tracheids are mostly rounded squares which closely fit together, their shape, owing to the high degree of compression, is rather distorted. The uniseriate rays run at a distance of 3–5 tracheids. The transverse walls are definitely smooth, which property must be taken into special consideration. The radial diameters of the tracheids are 50–60 μ, their width is about the same, but also tracheids with much narrower lumina occur. Among the tracheids sporadically longitudinal parenchyma cells are found.

T. The structure of the rays was very difficult to establish. From this structure we could infer *Podocarpaceae* rather than *Araucariaceae*. The rays are 3–10–12 cells high and greatly flattened, owing to the strong compression. It was not possible to determine their structure exactly.

R. In the tracheid walls the pits are arranged in one row and in close touch with each other. At some places it appears as if araucaroid arrangement of the pits were the case. Such occurrence can be established, however, also on some *Podocarpaceae* (Fig. 9). The structure of the cross fields offered some further information. Because of the high degree of disorganization, the structure of the cross fields could hardly be established. In the cross fields generally only the place of 1 or 2 pits could be suspected, which is no more of an araucaroid character. The walls of the ray cells appeared to be thin and smooth.

Note: It is interesting that in the interior of this wood there are cavities which probably correspond to resin cysts. Such resin cysts very exceptionally occur also in *Podocarpaceae*, but such cavities may be due to disorganization as well.

Summing up our observations, the fossil is to all probability some kind of *Podocarpus* sp. It should be noted, however, that such anatomical features might suggest some *Callitris* or *Widdringtonia* species, too.

L. Mecsekszabolcs; **A.** Helvetian.

Podocarpoxylon sp. (No. 7)

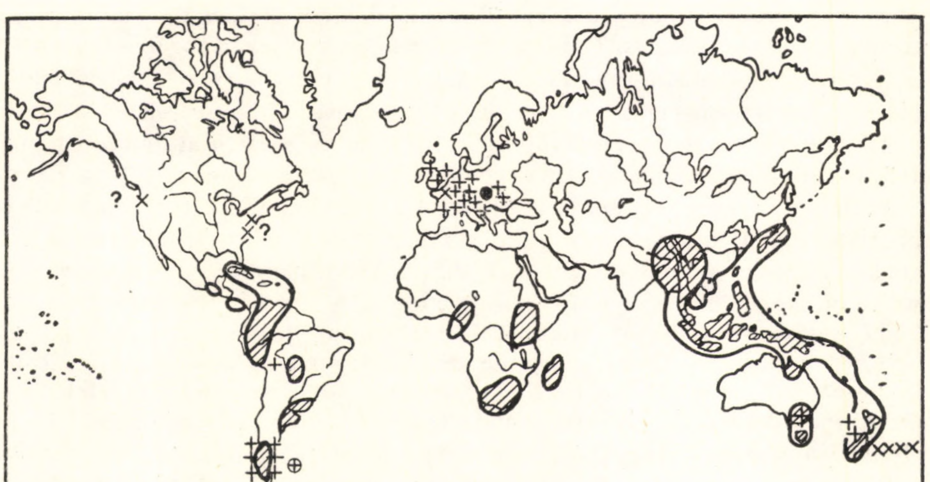
Plates XXVI, Figs 1–8; XXVII, Figs 9–12; XXVIII, Figs 13–16; XXIX, Figs 17–20.

Descr. **C.** It can be established that the tracheids are arranged radially, the cross sections are more or less of equal size. Owing to disorganization, in most cases only the primary walls of the tracheids were left, while the secondary walls were either dissolved or confused. Thus the tracheids and their cross sections are only indicated by the primary walls left. The rays are running at a distance of 2–3 tracheids, not always forming continuous rows.

T. Two rather detached parts could be observed, which at first sight appeared to be piths, so the fossil may be some kind of *Cycas*. But this assumption is disproved by the longitudinal slide, since the bordered pits in the walls of the longitudinal tracheids are either arranged in the araucaroid pattern or – and more frequently – loosely, not even touching each other. Such radial pit structure does not occur in recent *Cycas*. Possibly a particle of some foreign herbaceous plant adhered to the fossil and this portion appeared as pith (see photos). It is interesting to note that one of the cellular accumulations in the pith appeared as a collateral vascular bundle while at another place the annular cell concentration was suggestive of a cortex border. On the transverse slide, however, it could be established beyond doubt that parenchyma cells on the part corresponding to the pith and between them intercellulars were arranged.

Note: For a more exact identification we ought to know also the tangential structure of the rays. Unfortunately, we failed to prepare such slide, therefore we had to consider only the cross sections, the arrangement of the bordered pits of the tracheids, which was suggestive of *Podocarpus*, and the radial structure of the rays. No definite cross fields could be observed. So the fossil may be regarded as some kind of *Podocarpus*. These statements of the author were established in an earlier study (Greguss 1952, p. 177).

L. Grindstone mine in Lábatlan; **A.** Lower Cretaceous.



Map 3. Recent distribution of the genus *Podocarpus* (hachures). Tertiary (×) and Cretaceous sites (+) (after Studt); Mesozoic and Tertiary sites in Hungary (black spot)

4. TAXACEAE

Taxus sp.

Stieber (1955, p. 75) determined a *Taxus* sp. among the fossil woods exposed from the Lower Miocene coal layers of Királd. Unfortunately, no drawings or photographs are published to support the determination.

CEPHALOTAXACEAE

Torreyoxylon boureaui n. sp.

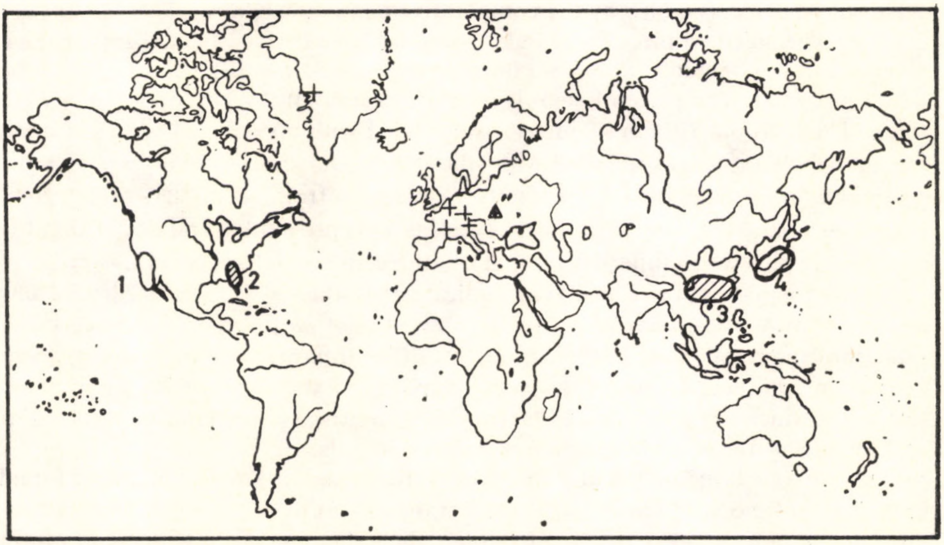
Plate XXXII, Figs 1–11.

Diagnosis: Limites stratorum concentricorum distincti, pori areolati tracheidarum laxe 1–, vel 2–seriati. Areae pororum rotundatae, in zonis e radiis medullaribus tracheidisque formatis pori parvi, in tracheidis asserculi spirales bini, vel terni, similiter Torreyae recenti. Parietes horizontales cellularum parenchymae longitudinalis leves, vel parum foveolati.

Descr. **C.** Definite annual rings are seen (Figs 1 and 2). The annual rings are about 20–60 tracheids wide each, near the annual ring boundaries 4–5 rows of flattened tracheids are seen in the late wood. Their lumina are almost slit-like (Fig. 2). Their cross sections are not always circles or ellipses, they may be triangular, quadrangular or polygonal, but their lumina always follow the outer form of the tracheid cross sections. Thus the cross-section structure of the fossil markedly differs from the characteristic araucaroid structure. Therefore it is possible that the piece of stem belongs to some *Dadoxylon*, *Podocarpus*, *Cupressaceae* or *Taxaceae*.

T. It is difficult to establish the structure of the rays which are uniseriate and 1–8–10 cells high. No finer structure could be established in their wall.

R. In the tracheid walls the bordered pits are uniseriate (Fig. 5), at place biseriate (Fig. 4) and do not fit together in the araucaroid pattern but loosely, at greater or lesser distances from each other. Their apertures are oblique slits which on the opposite side nearly always cross each other. In this respect they are highly suggestive of the pit system in the tracheids of the palaeozoic *Eristophyton beissnerianum*. This will not imply the identity or relationship of the two fossils, because in many tracheids of the fossil examined also quite thin spiral thickenings are found. With such pit system and spiral thickening the fossil cannot be an *Araucaryoxylon* or *Eristophyton*, not even a *Dadoxylon*. In the determination particularly the circumstance supplies food for consideration that in a number of tracheids in general quite thin spiral bars are running in pairs or by threes, sometimes regularly, sometimes irregularly. The thickenings are lacking at places, which is probably due to disorganization or to the slides having been damaged. The height of the ray cells is 18–20 μ, they are horizontally elongated rectangles, with all walls smooth and thin, tiny knotted thickenings are seen at most on the tangential walls, which, however, may have been also caused by disorganization. Among the tracheids there are longitudinal parenchyma cells, all walls of which are smooth and thin (Fig. 11). In the tracheid walls the spirals are generally loose, they run at a distance of 15–20–30 and even 50μ. A spiral thickening of such structure occurs, according to our present knowledge, only in recent *Taxaceae* or *Cephalotaxaceae*. In the cross fields of the ray cells several simple and tiny pits may have developed, as evidenced by the photographs (Fig. 7).



Map 4. Recent distribution of the genus *Torreya*. 1=*T. californica*, 2=*T. taxifolia*, 3=*T. grandis*, 4=*T. nucifera*. Tertiary sites in Europe (+) (after Studt), and in Hungary (triangle)

Note: The loose spirals, running by twos and threes, and the crossing of the apertures of the bordered pits remind us of the structure of the *Torreya*s. The recent species *Torreya nucifera* Sieb. et Zucc. is most similar in its structure to the fossil described. This is evidenced by photos of the living tree (Fig. 8a) and of the fossil (Fig. 8).

Shimakura described a fossil wood from the Pliocene layers of Japan by the name *Taxoxylon torreyanum*. Also according to Kräusel the fossil belongs to *Torreya*.

On the strength of the above anatomical features we regard this fossil wood of Urkut as a *Torreya*, but since it still differs both from *Torreya nucifera* and all other living species of the *Taxales*, we propose to distinguish it by the name of *Torreyoxylon boureaui* n. sp. in honour of the French professor Eduard Boureau.

L. Urkut, Lejtős shaft; **A.** Lower Cretaceous, Aptian stage.

5. CUPRESSACEAE

Platyspiroxylon heteroparenchymatosum Greguss

Plates XXXIII–XXXIX, Figs 1–31; XL and XLI, Figs 1–14.

Platyspiroxylon heteroparenchymatosum Greguss (1961)

Of recent conifers it mostly resembles *Callitris* of the family *Cupressaceae* as seems to be evidenced also by the comparative anatomical data.

Note: The silicified piece from Bakonya must have derived from a rather thick stem as can be concluded also from the slightly arched line of the outer edge of the detail of cortex. The piece of stem is well preserved, 10–15 cm long and 5–7 cm thick. The tortuous rifts in its interior were filled with crystallized silica material, but the whole piece was imbibed with silicic acid. On some breaking surfaces the original woody structure was perfectly visible, and from such parts rather good slides were prepared. The anatomical examinations proved beyond doubt that the structure of this wood differs from that of all recent coniferous genera.

All anatomical features observed indicate that the fossil, disregarding a few dissimilar properties, resembles *Ginkgo*, as well as *Araucariaceae* and *Podocarpaceae*. Still the fossil cannot be classified into the *Araucariaceae* or *Podocarpaceae* because of the broad spiral thickenings running in the walls of its longitudinal tracheids, which are not found in recent representatives of the families referred to and the pits of the cross fields are not araucaroid either.

If only one large pit (eipore) in the cross fields and no smaller pits were found in it, *Phyllocladus* could be thought of. But the large pits of the fossil usually contain one or more smaller simple pits. Such phenomenon can be observed both in the *Araucariaceae* and in *Ginkgo*. The structure of the cross fields of *Callitris glauca* is by and large the same and also contains one pit only (Figs 29, 30 and 31). In the last analysis there is none among the present families and genera the internal structure of which would completely agree with that of our fossil. It possibly shows greatest similarity to *Callitris*, because in author's opinion its spiral thickening can be traced back to the callitroid pit system, and also because in the cross fields there is usually only 1 cupressoid pit. But other morphological features also support this assumption. Such spirally thickened tracheids are – to author's knowledge – not known so far in fossils and are essentially different from those of the *Taxaceae*. Therefore the fossil cannot be classified as e.g. *Taxoxylon*. Here, however, a thought must be given to *Spiroxylon africanum* discussed by Walton which is qualified by Kräusel (Palaeontographica 1949) as *Taxopitys* and not considered as a conifer at all. Because of the great similarity to *Callitris* it could be named also *Callitroxylon*. *Callitris* has already been described from Tertiary layers of Australia. Still the data available are not esteemed sufficient by the author to name the fossil *Callitroxylon*. The most characteristic property of this fossil is, in final issue, the flat spiral cell wall thickening, therefore the denomination as *Platyspiroxylon* seems to be most appropriate. Since the fossil has ray cells of two different wall thicknesses, the specific name *heteroparenchymatosum* seems to be best fitting.

A further fossil came to light from Kővágószöllős (Plates XL–XLI, Figs 1–14) which by its anatomical structure is conformable to *Platyspiroxylon heteroparenchymatosum* Greguss and can be identified with it. Some difference appears perhaps – though not conspicuously – in the height of the rays. While in the fossil of Bakonya they attain a height of 40 cells, in that of Kővágószöllős at most 20–25 cell high rays occur, most of them ranging between 1 and 15 cells.

The peculiar spiral structure of the tracheid walls is clearly visible on the Photos of Plate XLI where the flat cell wall thickenings are branching almost reticularly, and under each of the net meshes 1 bordered pit is arranged on the opposite tracheid side. In the cross fields there is generally 1 pit which is highly suggestive of the pit system in some *Callitris*.

As to the cell wall thickenings, the question again arises whether these have not been caused by bursting. The views expounded in connection with *Platyspiroxylon* are fully justified also in this case. As appears from Figs 8 and 9 in Plate XL, the ends of the apertures formed by the flat thickenings are mostly rounded, which never occurs in splits. This assumption seems to be also justified by the Photos 10, 12, 13 and 14 in Plate XLI, on the spots marked by the white arrows.

The above anatomical properties suggest that the fossil represents the stem of an ancient conifer not known to us up to now. This assumption might be erroneous, but such thought lends itself spontaneously when the researcher is confronted with so many contradictory data.

L. Bakonya, Kővágószöllős; **A.** Permian.

Platyspiroxylon parenchymatosum n. sp.

Plates XLII–XLIV, Figs 1–15.

Diagnosis: Tracheidae in sectione transversali circulares, ellipticae, vel rotundato-quadratae. Strata concentrica nulla, vel vix manifesta. In sectione tangentiali radii medullares e cellulis 3–8 superpositis, in sectione transversali longe, vel breviter elliptici. In radio nunnullo medullari etiam cellula parietem incrassatum habens. In sectione radiali in pariete tracheidarum pori areolati remote, vel sese contingentes seriati, inter eos "linea Sanio" manifesta. Tracheidae pariete externo verruculis, ut apud Callitrichales proprie, cooperto, non paucae earum late depresseque spiraliter structae. Zonae ex radiis medullaribus tracheidisque formatae poris 1–4–6 parvis, simplicibus, nonnunquam incrassationibus spiralibus convenientibus. In zonis iis ex radiis medullaribus tracheidisque formatis, in quibus parenchyma longitudinalis cum parenchyma radii modullaris connectitur, pori nulli. Parietes omnes parenchymae longitudinalis leves tenuesque, poris omnino nullis.

Descr. **C.** Owing to the high degree of disorganization, coherent parts only here and there can be found, while in most places the disorganized tracheids or groups of tracheids are detached and only 1 or 2 tracheids remained in some foci of disorganization (Fig. 1). In some coherent parts the cross sections of the tracheids, as well as their cavities, are rounded. The lumina are circular or ellipsoid; the diameters of the tracheids are radially 45–60 μ, their width 35–40 μ, but there are also much smaller ones of 20–25 $\times$ 15–20 μ. Those of larger and smaller lumina can be situated also beside each other. Their walls are 7–8 μ thick, owing probably to disorganization. The walls of the intact tracheids are 5–7 μ thick. Among the tracheids the rays run radially at a distance of 3–7 tracheids. The radial length of the ray cells is 170–200 μ. Their tangential wall is perfectly smooth, and so seems to be the horizontal wall. Among the tracheids here and there thin-walled cells occur with a content of dark colour; these are probably parenchyma cells.

T. The rays are generally 3 to 8 cells high. Higher ones hardly occur. In this respect the fossil shows a similarity to the specimen of Bakonya. The ray cells are 25 to 35 μ high, 20 to 22 μ wide, thus their cross section is a somewhat elongated ellipse, that of the terminal cells rather ovoid. Their tangential wall seems to be smooth. Between two ray cells situated above each other and the tracheids adjoining them a triangular intercellular can be observed. Among the thin-walled ray cells also thick-walled ones occur in some rays, though not so often as do in the fossil of Bakonya. In the tangential wall of the longitudinal tracheids the oblique striation is of general occurrence also here.

On some tracheids, oblique bands running parallel can be observed which sometimes encircle a pit and are suggestive of the callitroid pit system of the fossil of Bakonya. The surface of the single sectors is covered with fine warts which is also a callitroid character. This structure is clearly visible on Photos 11 and 13 of Plate XLIII. Thus the parallel lines are indicative of the edge of the spiral band portions rather than of independent spirals as seen in the *Torreya*s or *Taxaceae*. Spiral thickenings of such structure are not found in recent forms, only similar ones in some *Callitris* (Fig. 10). These bands run on the internal wall of the tracheids similarly to the spiral chloroplasts of *Spirogyra*. That these are really spirally running bands is evidenced by the edge lines of the band portions proceeding sometimes in the opposite direction below and above while their surface is covered with tiny warts. In the tangential wall of some tracheids also bordered pits can be observed which, however, probably got to the tangential side as a result of distortion. The bordered pits at some places touch each other with their edges (Fig. 8), while in other cases they are situated at distances of 1/2 or 1/4 bordered pit. Consequently, this system of pits is by no means araucaroid, as appears also from the radial slides (Fig. 6).

R. On the surface of the tracheids the dense pitting is markedly seen (Figs 11 and 13). In the radial walls of most tracheids the spiral bands proceed in the same pattern and direction as in the fossil of Bakonya. Among the bands the apertures of the bordered pits below them are seen (Plate XLIV, Fig. 14). At some places even transverse bars can be observed on the spiral bands (Photo No. 5). This structure is by and large suggestive of the similar structure of the spirals of *Ginkgo*. Where no such spirals occur, bordered pits are loosely arranged, at some places they follow each other at a distance of 2–3 bordered pits (Fig. 6). Between the bordered pits the bars of Sanio are clearly seen. Thus this pit system is in no way araucaroid. It is interesting to note that where the spiral thickenings of the longitudinal tracheids contact the ray cells, there the pits in the cross fields are situated in a way corresponding to the spirals (Plate XLII, Figs 7 and 8). Where, however, the not-spirally thickened longitudinal tracheids meet the rays, the cross fields are not of this shape, but 1–2 perhaps 3 round pits occur in each cross field, exactly as in some *Callitris* (Fig. 12).

Here we note that the wood contains many parenchyma cells, all walls of which are thin and smooth (Fig. 9). It is interesting that no pits occur in those cross fields where the longitudinal thin-walled parenchyma cells touch the equally thin-walled ray cells; the same can be observed e.g. in *Callitris glauca.* On Table XLIV, Fig. 14 represents the fossil, while Fig. 15 *Callitris glauca.* As regards ray structure and the connection of the rays with the longitudinal parenchyma cells, the two photos perfectly agree. In both cases 1–2, occasionally 4 pits occur in the cross fields. This structure is by no means araucaroid or podocarpoid but rather of cupressoid character. The presence of longitudinal parenchyma is verified also by Figs 7 and 9 of Plate XLII. Exceptionally in the cross fields of some outermost ray cells as many as 6 pits may occur (Fig. 12) with 3 small pits in 2 vertical rows, which is not unknown phenomenon in the *Cupressaceae* either.

Note: The inner structure of the fossil reveals particular features. First, there are broad, flat spiral thickenings in the longitudinal tracheids, between which the borders, or apertures, respectively, of the bordered pits are everywhere seen, similarly as in the fossil of Bakonya. None of recent conifers has such spiral structure, because spiral thickenings occurring in some genera of *Cycadaceae*, *Taxaceae* or *Pinaceae* are invariably thin bars and not broadened bands. This thickening can also be traced back to the callitroid thickenings of the *Callitris* species, as demonstrated in the discussion of the fossil of Bakonya.

From fossils known up to now *Spiroxylon africanum* Walton may enter into consideration, in the tracheids of which, however, araucaroid pitting is seen, while in the fossil examined so-called modern pit system can be observed, and sometimes between the pits even the bars of Sanio can be clearly recognized. Kräusel qualified *Spiroxylon africanum* as *Taxopitys africana* and does not regard the fossil as conifer at all.

The *Taxoxylon*s known so far cannot be brought into connection with our fossil either, because in *Taxales* and thus also in *Torreya* the spiral thickenings are always thin bars and never broad bands, unless the narrow rim of the bands is regarded as a distinct spiral thickening. The silicified wood described here shows a striking similarity to the fossil of Bakonya, save that no longitudinal parenchyma cells were found in the latter, while in the former they are rather frequent, as seen in the photos. To distinguish the fossil of Bakonya from *Spiroxylon africanum* described by Walton – since our fossil has broad spiral bands – it must be regarded also as *Platyspiroxylon*. But, as distinct from the fossil of Bakonya – since it has abundant parenchyma – we propose to name it *Platyspiroxylon parenchymatosum.*

It is to be noted that our fossil, in addition to what has been said above, shows a great similarity to *Callitris* also inasmuch as in the longitudinal wall of its tracheids the warty structure so characteristic of *Callitris* also occurs. Such warty structure cannot be due to mere chance, but it is a morphological property characteristic of certain genera, and thus it must be taken into consideration when establishing the relationship.

L. Urkut, István shaft; **A.** Upper Liassic.

Platyspiroxylon sp. (No. 1)

Plate XIX, Figs 8 and 9.

Descr. **C.** The cross sections of the tracheids are markedly circular, rounded. There are no annual rings, therefore we may infer some species of *Araucariaceae*, *Podocarpaceae* or *Callitris*.

R. However, at some places it could be established that in the tracheid walls flat spiral thickenings are running. In this respect the fossil resembles *Platyspiroxylons*. But also the pit system of the tracheids suggests a very old type of structure which perfectly fits into the Permian, wherefrom we have already discussed similar fossils.

For want of a more exact knowledge the fossil must be accepted simply as a *Platyspiroxylon* sp. In the wood also resin cysts occur, but these cavities may be due to the high degree of disorganization.

L. Litér; **A.** Permian.

Platyspiroxylon sp. (No. 2)

Plates XLV and XLVI, Figs 1–19.

Descr. **C.** In spite of the high degree of disorganization, in some places the histological structure of the xylem appears to be quite homogeneous with no conspicuous annual rings. The presence of the annual ring limit in 1–2 cell width can be observed only here and there. The tracheids are arranged radially in rows. Their radial diameter ranges from 20 to 60 μ, their width is 20–30–40 μ. They are circular or rounded squares or pentagons. Thus the lumen is seldom circular, in most cases it is an ellipse, or rounded triangle, or polygon. Among tracheids with wide lumina also some with rather narrow lumina occur. The rays run at a distance of 2–8–10 tracheids radially, they are uniseriate and only exceptionally and in short sectors broaden to biseriate (see the middle of Fig. 2). Owing to the high degree of disorganization, the cell walls are disorganized around some tracheids, so that often enough only one tracheid appears detached in the fields of various size. In other cases 4–5 tracheid fields are detached and around them the cell walls of the other tracheids are already completely disorganized. This structure is highly suggestive of the similar structure of the *Araucarioxylon* sp. (No. 7) that came to light from Vasas (Plate XV). In the horizontal walls of the rays no pitting is seen, while the tangential walls are always thin and smooth. The length of the ray cells ranges from 60 to 250 μ. The tangential walls sometimes subtend an oblique angle to the radial walls.

T. The ray structure can be only rarely observed. The rays are generally 3 to 6 cells high, no 15 cells high rays could be observed. The cross sections of the ray cells are exceptionally circular, in general they are somewhat elongated ellipses (Fig. 4). Their height is 25–30 μ but the marginal cells are often still higher and may attain a height of 40–45 μ, they are generally conical (Fig. 3). Their width is 14–15 μ, their walls are completely smooth and thin. In some ray cells there is a dark content. In the walls of nearly all tracheids adhering closely to the rays a spiral thickening is seen; the spiral lines run sometimes at a distance of 40–50, sometimes of only 10 μ (Figs 9, 13, 15, 16 and 17) similarly as in some *Torreya*s (Fig. 1), singly or in pairs. Spirals running singly are less frequent, while those running in pairs are seen in almost all tracheids. The spirals subtend an angle of about 20–25° to the longitudinal axis.

At some places parenchyma cells near the rays conceal themselves (Fig. 8), in which no finer details could be investigated. The horizontal walls, however, are conspicuous. This ray structure differs from that of the *Araucariaceae* and is very much suggestive of the *Platyspiroxylon*s reported from the Permian. Among the thin-walled ray cells also thick-walled ones occur, though very exceptionally, in some rays (see arrow in Fig. 4), similarly as on the Permian *Platyspiroxylon*s. The tangential walls of the ray cells are perfectly smooth, at most covered by needle point-like fine warts (Fig. 10).

R. Unfortunately, no finer details could be observed on the radial slide. In the cross fields, disregarding a single cupressoid pit, no pits appear (Fig. 1). Most ray cells' walls are thin and smooth, though markedly thick-walled ones also occur, so the ray system is heterogeneous (Fig. 12). The slight unevenness of the walls is probably due to disorganization. On the longitudinal tracheids the bordered pits are generally uniseriate but not according to the araucaroid pattern: the borders just touch each other or the pits are detached (Plate XLV, Fig. 6 and Plate XLVI, Fig. 11). Sometimes two spirals surround a bordered pit, exactly as in *Platyspiroxylon heteroparenchymatosum* (Figs 9 and 15).

Note: Considering the morphological data, the fossil of Pécs-Bányatelep exhibits an internal structure similar to that of *Platyspiroxylon parenchymatosum.* This similarity is partly due to the quite loose spiral lines proceeding in the tracheid walls, very often in pairs, suggestive somehow of *Callitris* and *Torreya* (Fig. 18). By a comparison of the radial photo of *Torreya taxifolia* with the photos of the radial slides of our fossil, the similarity becomes strikingly conspicuous (Fig. 19). The relationship with the *Torreya*s, however, is very doubtful. On the other hand, many features support the relationship with the *Platyspiroxylon*s already discussed. It is striking that the spiral lines nearly always run by pairs in the fossil and comparatively near to each other, as in *Platyspiroxylon parenchymatosum.*

The fossil contains ray cells of two different wall thicknesses, similarly to the fossil of Bakonya. It is very probable therefore that it is also a *Platyspiroxylon*, but since no finer details could be observed, we propose to record this fossil by the name *Platyspiroxylon* sp.

L. Pécsbányatelep; **A.** Lower Liassic.

Widdringtonioxylon ráskyae n. sp.

Plate XLVII, Figs 1–12.

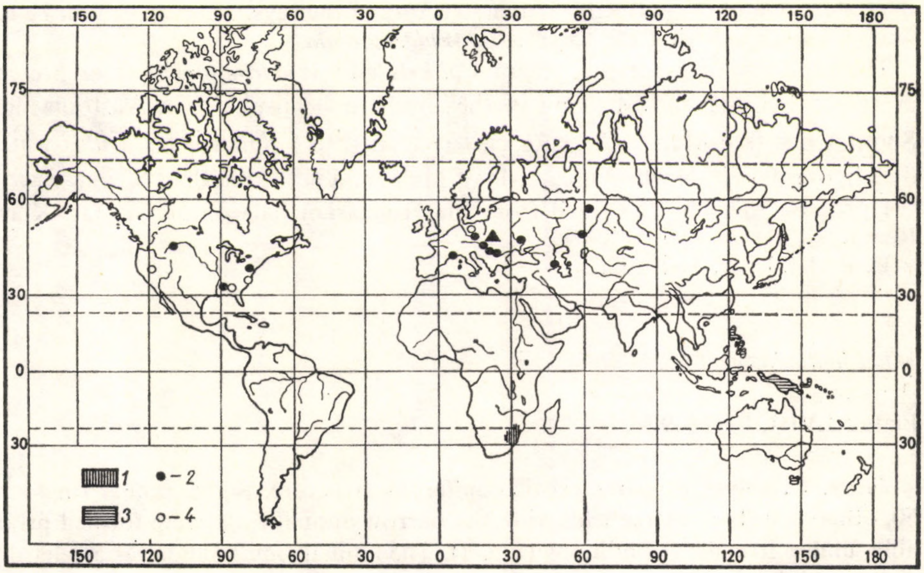
Diagnosis: Strata concentrica conspicua, strata priora et posteriora aequaliter lata, in stratis prioribus cellulae parenchymae solitariae. Tracheidae in sectione transversali quadratae. Radii medullares 1–stratosi, e 1–30 cellulis superpositis, in sectione transversali plerumque circularibus, magnitudine inter se similibus, inter eos raro etiam cellulis multi minoribus. Parietes cellularum parenchymae longitudinalis leves tenuesque. Parietes tracheidarum longitudinalium verruculis cooperti; parietes omnes cellularum radiorum medullarium leves tenuesque, in partis radialibus campis ellipticis vel circularibus magnis.

Descr. **C.** The annual rings could be explicitly established, since after the 10–12 tracheids wide zone of late tracheids with narrow lumina a zone of early tracheids with wide lumina follows (Fig. 1). The radial diameters of the early tracheids are 40–60 μ, their widths 30–40 μ, so that the cross sections are at some places square, at others polygonal, in the early wood as a rule hexagonal. The radial diameters of the late tracheids are 25–30, their widths 35–40 μ. The walls are thick, the lumina almost slit-like. In the late wood the parenchyma cells, which are rather frequent, can be immediately recognized by their dark content. They are arranged scattered in general parallel to the annual ring boundary, i.e. more or less terminally. The tracheids of the early wood are thin walled, highly deformed by compression, the early tracheids remained only here and there in their original condition. Here, too, a few parenchyma cells are seen. The rays are uniseriate and run at a distance of 1–10 tracheids.

T. The rays are 1–15–20, mostly only 8–10 cells high (Fig. 4). The height of the ray cells is 22–29 μ, their cross sections are circular or short upright ellipses, all walls are smooth and thin (Figs 5, 6 and 7).

At the places where the ray cells touch the neighbouring longitudinal elements, triangular intercellulars can be observed (Figs 6 and 7). In some sectors among the ray cells somewhat lower cells are inserted, the structure of which slightly differs from the adjoining ray cells (see the arrow in Fig. 6).

Very similar ray structure is found in some *Widdringtonia* as evidenced by the two photos (Fig. 7). The size and arrangement of the ray cells are strikingly similar to, almost identical with, those of the *Widdringtonia*. This particular structure serves as a guidance for further examination. No bordered pits could be ascertained in the tangential wall of the tracheids. Between the rays longitudinal paren-



Map 5. Recent distribution (1) and Tertiary sites (2) of the genus *Widdringtonia* and *Phyllocladus* (3 and 4). Hungarian Helvetian sites (triangle)

chyma cells occur which are in general high and slightly constricted near the transverse walls. The horizontal walls are always thin and smooth (Fig. 7).

R. It is an interesting feature that the wall of the tracheids is covered by tiny warts suggestive of the similar warty structure of *Callitris* and *Widdringtonia* (Fig. 8). This morphological property is also suggestive of *Widdringtonia.*

The walls of the longitudinal parenchyma cells are also on this side thin and smooth with no thickening on their transverse walls.

The rays consist of elongated parenchyma cells with all walls smooth and thin and without any pitting, or at least no pits could be observed (Figs 11 and 12). It is not likely at all that this thinness of the walls could be a consequence of disorganization. All walls of the ray cells in *Widdringtonia* are equally thin and smooth.

Owing to the high degree of transparency, in the cross field no pits could be exactly observed, but in the ray cells large ellipsoid or circular pits of marked contours spanning sometimes 2–3 cross fields (eipore?) are seen (Fig. 12). If only these are considered the fossil is perhaps either a *Phyllocladoxylon* or *Xenoxylon.* Since, however, these pits fill not only one but even two or three cross fields, they are located to all probability, in the ray cells, and developed later, having no correspondence whatever to the longitudinal tracheids seen immediately behind them. So in author's opinion these pits are no cross field pits.

Note: The structure of the fossil wood is primarily suggestive of *Callitris,* then of *Widdringtonia.* The latter assumption is supported by the fine warty thickening of the tracheids and the perfectly similar structure of the rays. Thus we cannot be far wrong when qualifying the fossil as a *Widdringtonia*.

The representatives of the genera *Callitris* and *Widdringtonia* are at present evergreen trees or shrubs living in the southern hemisphere, in Australia and South Africa (see Map 5). A genus closely related to *Callitris* is *Tetraclinis* which lives in our days in North Africa, Isle of Malta and in the South of Spain.

I propose to name the fossil from the Hungarian palaeontologist Dr. Klára Rásky.

L. Budafok; **A.** Helvetian.

Widdringtonioxylon sp.

Plate XLVIII, Figs 1–9.

Descr. **C.** shows a characteristic coniferous structure. Some annual rings are 50, others hardly 8–10 tracheids wide, the narrow annual rings were formed probably under irregular conditions (Fig. 1). The annual ring boundaries are hardly visible, the late wood is, in general, only 5–6 tracheids wide. There are no resin ducts in the annual rings but in some of them there is remarkably much parenchyma the cells of which are filled with a dark content.

The cross sections of the tracheids are angular, immediately at the beginning of the early wood rather quadrangular, towards the late wood becoming more and more polygonal (Figs 2 and 3). The radial diameter of the tracheids in the spring wood is 60–70 μ, the width 40–50 μ, but there are also larger and smaller ones among them. The tracheids of the late wood are radially flattened oblongs, their radial diameter is 20–22 μ, their lumen sometimes only a narrow oblong. The wall thickness of the tracheids in the early and late wood is much the same, thus the annual ring boundary is due, first of all, to the flattened late tracheids. This phenomenon is indicative of an equable climate. The rays are uniseriate, their horizontal and tangential walls evenly smooth.

T. In spite of the high degree of compression, at some places a tangential picture can be easily observed, from which one can guess the ray structure. The height of the rays ranges from 1 to 45 cells (Fig. 4), but most of them are only 10 to 15 cells high. In the noncompressed portions the cross sections of the rays are circles or procumbent short oblongs. No pitting is seen on the tangential walls; they are perfectly smooth and thin. This structure is suggestive only of *Podocarpaceae*, *Cupressaceae* and some *Taxodiaceae*. Among the tracheids and rays longitudinal parenchyma cells are found with transverse walls perfectly smooth without any pitting (Figs 5, 6 and 7).

R. Owing to disorganization, the finer details, thus the height of the ray cells and the cross fields, could be only guessed. The height of three ray cells is 70 μ, i. e. the height of 1 ray cell varies between 21 and 25 μ. In the tracheid walls the bordered pits are disorganized. A great amount of crystallized hexagonal silica material had deposited in the tracheids. In the longitudinal parenchyma cells the transverse walls were invariably thin and smooth (Figs 8 and 9).

Note: The above anatomical features are not enough for an exact determination, not even the cross section and tangential structures did indicate any coniferous genus or family for certain. Only the *Taxodiaceae*, *Cupressaceae* and *Podocarpaceae* enter into consideration. High rays, thin-walled ray cells and smooth transverse walls in the longitudinal parenchyma occur, first of all, in the *Podocarpaceae* and *Cupressaceae*, thus our fossil may possibly belong to the *Podocarpaceae* or perhaps to the *Cupressaceae*. Of *Cupressaceae* primarily the genera *Callitris* and *Widdringtonia* while of *Podocarpaceae* the *Podocarpus* itself have tangential walls the ray cells of which are smooth and thin, similar to those of our fossil. In some *Callitris* 35 to 45 cell high rays occur, exactly as in some *Podocarpus*.

Nor can we be far wrong, if within *Cupressaceae* we think of *Widdringtonia* in which the anatomical properties as recognized in this fossil occur together. Therefore we regard the fossil with some probability as *Widdringtonia*. The totally silicified piece of wood did not originate at its present site.

L. Budapest; **A.** Helvetian.

?Callitroxylon sp.

Plate XLVIIIa, Figs 1–9.

Descr. **C.** No contiguous portion could be established, save that the xylem is composed of elements of more or less equal size, from which some kind of conifer may be inferred (Fig. 1).

T. also supports the assumption that the fossil is some conifer. In Fig. 2 the two arrows point to 6–8 cell high rays, next to these parenchyma cell chains filled with a dark content are seen. The wood is very rich in parenchyma, the horizontal walls appeared everywhere smooth without any thickenings or knots. It may be assumed that all walls of the parenchyma cells were smooth and thin. However, in the walls of the wider tracheids there are fine, pin-prick like warts (Fig. 5, upper right side) and the cross sections of the ray cells are circles or short ellipses (Figs 5 and 6), which allows to infer *Callitris*.

R. Arrows in Figs 3 and 4 show pair-bordered pits, which fairly well agrees with the above assumption, for in the tracheids of some *Callitris* species the bordered pits are single, while the pair-bordered pits are mostly opposed, similarly to the fusain of Gánt.

In the tracheid walls parallel thickenings characteristic of *Callitris* were found (arrows in Figs 8 and 9). Such thickenings also occur in *Torreya* and *Cephalotaxus* while the so-called Kleeberg-thickenings are frequent in some *Callitris* species.

Note: The material examined was exposed from the bauxite mine of Gánt. Smaller 'nests' of tiny vegetable traces were found in the material of the bauxite mass, which remained either in lamellary form or in small fusain granules. The fusain remains belong to some cormophytes. Unfortunately, the material upon touch was completely pulverized, so that it was hardly possible to save even pieces of the size of a rice grain. Partly palinological, partly xylotonomical examinations were conducted. The small pieces of fusain soaked first in alcohol were placed in xylol and subsequently in Canada balsam, and tiny slides were prepared after desiccation.

The presence of paired pits and the fine point-like thickenings of the tracheids allow to infer some kind of *Callitris*, though with no absolute certainty.

We have demonstrated *Callitris* in Hungary from Pécs, from the Jurassic. Our fusain, however, derives from layers separating the Lower Eocene from the Cretaceous, i.e. beyond doubt from the Palaeocene.

The genus *Callitris* is actually distributed in Australia and Tasmania. A related genus, *Tetraclinis*, on the other hand, occurs in North Africa and in the southern parts of Spain. In the Lower Eocene a genus related to *Callitris* may have lived in the territory of Hungary.

L. Gánt: **A.** Lower Eocene.

Libocedroxylon gausseni n. sp.

Plate XLIX, Figs 1–9.

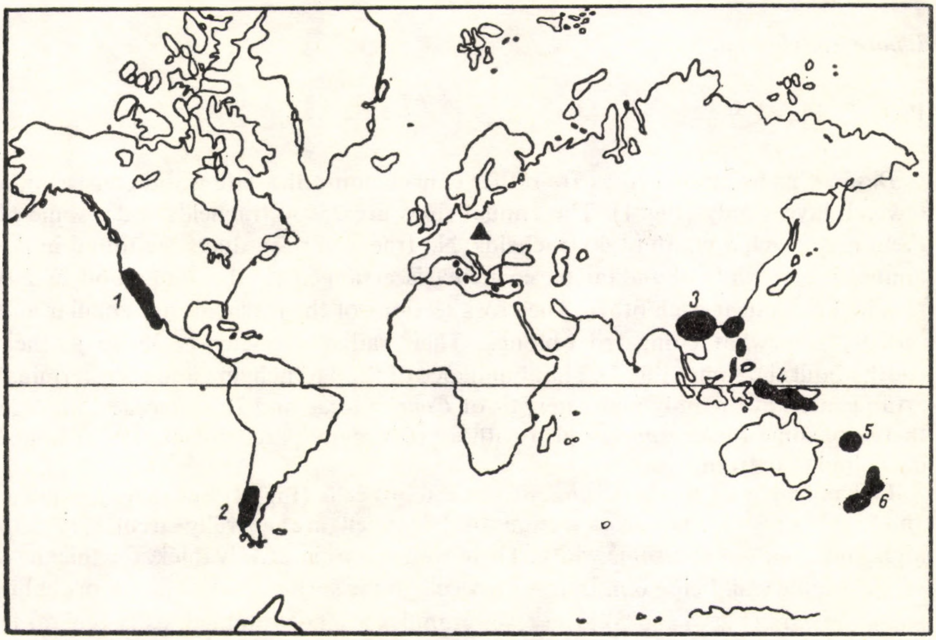
Diagnosis: Limites stratorum concentricorum vix conspicui. Meatus resiniferi nulli. Tracheidae in sectione transversali angulares. Radii medullares altitudine 1–5-cellulares. Parietes horizontales cellularum parenchymae longitudinalis leves. Pori areolati parietum radialium tracheidarum longitudinalium laxe, singulariter vel bini dispositi. In zonis e radiis medullaribus tracheidisque formatis plerumque 1–2, in cellulis extremis 3–4 pori parvi circulares.

Descr. **C.** The section of the piece of stem evidenced at first glance some conifer. The sample is a piece of a stem or branch of about 10 cm diameter, as ascertained from the arches of the annual rings the boundaries of which are blurred. The annual rings are 2–3 or 5 mm thick with no resin ducts in them. The cross sections of the tracheids are squares, or short oblongs, or angular shaped.

The annual ring boundaries are only guessed from the narrow lumina of the tracheids (Fig. 2). Scattered in the annual ring fields, wood parenchyma cells with a dark content occur. The radial diameters of the tracheids are 50–60 μ, their width 40–50 μ. Towards the late wood the lumina are somewhat narrower. Such cross section suggests a near relationship with *Cupressaceae*. The rays which run at a distance of 3–10 tracheids are only uniseriate (Fig. 3). The cavities which suggest ducts, are to all probability resulting from disorganization.

T. This assumption is refuted by the tangential structure which at first glance reveals rays only 1–3 cells high. Hardly 2 rays of 4–5 cells height occur. The height of the rays of one cell height is 30–35 μ, their width 20–22 μ. The height of two cells is 56 μ while that of 3 cells 70 μ. So the average cell height is about 25 μ. Such ray structure only occurs in *Juniperus* and *Libocedrus* of the *Cupressaceae*.

Between the tracheids parenchyma cells occur with tiny, rounded, dark granules in them, indicative probably of the one-time resin content (Fig. 4). *Juniperus* and *Libocedrus* primarily differ by the transverse walls in their longitudinal parenchyma cells, which in *Juniperus* are almost invariably rosary-like thickened, while in *Libocedrus* rather frequently perfectly smooth. The horizontal walls of the longitudinal parenchyma cells in our fossil are smooth, and the rays are low; all these testify to *Libocedrus*. This assumption is supported by the radial structure.



Map 6. Recent distribution of genus *Libocedrus* (1–6). Tertiary sites in Hungary (triangle)

R. In *Juniperus* the bordered pits in the radial wall of the longitudinal tracheids are generally arranged in one row, while in *Libocedrus* sometimes in two side by side, i.e. by pairs, exactly as in our fossil (Fig. 7). The aperture of the pits is a circle, between the pits bars of Sanio are seen. The walls of the rays—although highly disorganized—appear to be perfectly smooth and thin. In the cross fields generally 2–4 circular pits occur. These features again suggest *Libocedrus*.

Note: Our fossil's cross-section structure is highly suggestive of the *Cupressaceae*. The height of the rays is characteristic of either *Juniperus* or *Libocedrus*. The smooth walls of the longitudinal parenchyma cells and of the ray cells and the occurrence of pair-bordered pits in the longitudinal tracheids remind us of *Libocedrus*. So we cannot be far wrong when stating that the fossil of Erdőbénye is some *Libocedrus* species.

This assumption is further supported by Andreánszky (Andreánszky and Sárkány 1955) and Cziffery–Szilágyi (see Andreánszky 1959) having demonstrated also from Erdőbénye, though not exactly from the same site, some 14 leafy shoot remains of *Libocedrus tárkányensis*. All these data classify the fossil into the genus *Libocedrus*; therefore we name it as a new species in honour of Prof. Gaussen as *Libocedrus gausseni*.

L. Erdőbénye, Ligetmajor; **A.** Sarmatian.

Libocedroxylon sp.

Plate L, Figs 1–9.

Descr. **C.** The annual rings are rather conspicuous, the late wood consists of a few cell layers only (Fig. 1). The annual rings are 25–30 tracheids wide, some of them may reach a width of 40 tracheids. No traces of resin ducts are found in the annual rings, while abundant parenchyma is arranged in the late wood in 2–3 terminal rows near each other. The cross sections of the tracheids are angular and radially somewhat elongated oblongs. Their radial diameter is 35–40 μ, their width about the same (Fig. 2). The abundance of the parenchyma and their terminal arrangement are mainly characteristic of *Cupressaceae* and *Taxodiaceae*, although there are some *Podocarpaceae* also with a great many parenchyma cells arranged in a similar pattern.

T. The height of the rays ranges from 6 to 10 cells (Fig. 4) but there are lower and higher rays too. The cross sections of the ray cells are generally circular, 17–20 μ high and about of the same width. Their wall is comparatively thick, the thickness of the double wall being 6 μ. In most ray cells some sort of dark content, probably resin, appears (Figs 4 and 5). The resin granules are not rounded, as is general in *Taxodiaceae*, but lacunar, as in *Cupressaceae*. Biseriate rays hardly occur.

In the longitudinal tracheids the bordered pits are uniseriate (Fig. 3), they do not touch each other, their borders and apertures are conspicuous.

R. A large number of longitudinal parenchyma cells are observed. At some places 6–8 longitudinal parenchyma cells are aligned beside each other, filled with a lacunar content. The most important feature of the parenchyma cells is, however, that their horizontal wall is mostly rosary-like thickened, when on the transverse wall 4–5 or even 6–8 knot-like thickenings can be observed (Figs 6 and 8). This structure testifies that the fossil can only belong to *Cupressaceae*, which assumption is corroborated by the radial structure of the rays. The horizontal walls of the ray cells, owing to disorganization, are pitted, while some tangential walls are perfectly smooth (see the arrow in Fig. 9). In each of the cross fields mostly 2 pits are seen above each other, but sometimes there is 1 pit in each of the four corners of the fields. The aperture of the pits, the size and shape of the borders could not be exactly established, but the structure of the rays are mainly suggestive of *Cupressaceae*.

Note: The abundant parenchyma with terminal arrangement, the remarkable length and lacunar resin content of the longitudinal parenchyma cells, the moderate bead-like thickening of the transverse walls of the latter, as well as the smoothness of the tangential wall of the ray cells, allow to infer the family *Cupressaceae*. Kräusel (1949) lists about 140 *Cupressinoxylon*s from different geological ages. In lack of comparative material, it could not be established with which of these our fossil can be best identified.

Of the genus *Libocedrus* 13 species are known at present wich live under temperate or subtropical climate (see Map 6). On the specimen examined the uniformity of the annual rings and the almost imperceptible transition between the late and early wood also evidence an equable climate. In Hungary several *Libocedrus* remains are known in the form of imprints. Andreánszky (1959) describes *L. tárkányensis*, Pálfalvy *Calocedrus (Libocedrus) salicornioides*, Haraszty (1953) a silicified *Libocedrus* stem from Petőfibánya.

L. Szilvásvárad; **A.** Sarmatian.

Cupressinoxylon secretiferum n. sp.

Plate LI, Figs 1–11.

Diagnosis: Strata concentrica distincta priora posterioraque paries tracheidarum strati posterioris crassus, strati prioris tenuis, in limite stratorum priorum et posteriorum inter tracheidas cava circularis vel elliptica dimensione iis multo maiora. Cava longitudinalis materia subtilis, granulosa repleta. Parietes tracheidarum longitudinalium striati; parietes horizontales cellularum parenchymae longitudinalis parum nodosi. Radii medullares e cellulis 2–20 superpositis. Cellulae parenchymae longitudinalis materiam resinae similem continentes. Parietes tangentiales cellularum radiorum medullarium leves tenuesque, parietes horizontales crassiores, porus angularis adesse potest.

Descr. **C.** The annual rings and the late and early wood are distinct. Conspicuously, the early wood hardly extends over 5–6–10 tracheids, while the late one reaches a width of 35–40 tracheids. The tracheid walls of the former are quite thin while those of the latter are even though, but much thicker. In the late wood the parenchyma cells filled with dark resin substance are rather frequent.

This wood, however, has a property not so far encountered in either recent or extinct conifers. At the boundary of the early and late wood, cells greatly differing in size from the tracheids are arranged, filled with a fine granular substance (see arrows). Their diameter is usually 70–80 μ, sometimes much less, 30–40 μ, and generally they are arranged beside the parenchyma cells filled with a resin content which, sharply differing from the content of the adjacent or nearby cells (Figs 2 and 3), is highly suggestive of the milk tubes or vessels of some dicotyledonous woody plants. Of course, these are no resin ducts, for the longitudinal slides will not allow such proposition. From the cross section we may establish that though the fossil has a rich resin content it also has an other kind of substance similar to resin (see the arrow in Fig. 3).

T. The walls of all longitudinal tracheids are markedly striated, and as such are highly reminiscent of the so-called red species of *Picea* or *Larix*. The outward appearance of the rays 2–12–15–20 cells high is suggestive of *Abies*, *Thuya*, *Cupressus*. The cross sections of the ray cells are short upright ellipses, their width reaches 10–11 μ, their height 17–18 μ. Most of the ray cells are filled with a dense granular substance. The wall of the ray cells is uniformly thick. In some of them there is a yellowish glittering resin substance. Other ray cells are again filled with a whitish granular substance (Figs 4–6). On the tangential slide a few longitudinal parenchyma cells are seen the transverse walls of which are warty or slightly knotted, suggestive of certain *Cupressaceae*.

R. The structure of the ducts containing a milk-like substance, can be definitely established also on the radial slide. These must be some ducts, because no transverse walls could be found in them. The ducts are all filled with a continuous, whitish granular substance (Fig. 7). The width of the ducts which run evenly in a vertical direction is 35–40 μ (Fig. 11). From this the structure of the longitudinal parenchyma cell with resin content decisively differs since, as stated above, their transverse walls are uneven or slightly knotted (Fig. 6). The radial slide verifies our previous statement concerning the longitudinal ducts, since in the interior of the duct, which are 2 or 3 times wider than the tracheids, no transverse walls could be observed, in contrast to the longitudinal parenchyma cells containing resin where transverse walls were found (Fig. 10).

As to the structure of the rays, it can be stated that all walls are smooth. The tangential wall is thin, the horizontal wall is somewhat thicker, and an indenture can be observed in it. In each of the cross fields the contours of 1 pit appear faintly.

The horizontal walls of some ray cells seem to have dentate thickenings (Figs 10 and 11); at first sight they look as transverse tracheids. A closer examination reveals that these dents are the disorganized remains of the granular content. On the other hand, they are highly suggestive of the dentate transverse tracheids of *Pinus*. In this case, however, there can be no question of transverse tracheids, because in some ray cells various degrees of disorganization can be traced, and their content definitely differs from the resin of the longitudinal parenchyma cells, not only as regards structure but also their colour. While the radial diameter of the cells with resin is 7–8 μ, in the ducts it reaches 30–32 μ. It should be noted that the tangential extent of the ducts is about the same, while that of the longitudinal parenchyma cells is 10–15 μ (Figs 7, 10 and 11).

Note: After its cross section the fossil can only be ranged to the family *Cupressaceae*, of which only such genera can enter into consideration where the ray walls are smooth, the tangential walls also smooth and thin while the horizontal walls of the longitudinal parenchyma cells are knotty or mildly thickened. Of these genera, the properties of the fossil are most suggestive of *Cupressus sempervirens*. But the name *Cupressus* cannot be referred to this fossil, for neither longitudinal nor transverse ducts exist in *Cupressus* while these are rather frequent in our fossil.

Such ducts, as mentioned above, exist in no living conifer, therefore the fossil examined requires a new generic name. To find such, however, is a rather difficult undertaking. The facts, by all means, indicate that such ducts really occur in the fossil. As a subsidiary solution we might regard the fossil as *Cupressinoxylon* and record it as such because of the longitudinal duct being its most characteristic feature. Considering all these, we propose to name the fossil, with some reservations, *Cupressinoxylon secretiferum* n. sp.

L. Mecseknádasd, near the highway; **A.** Lower Helvetian.

Cupressinoxylon cupressoides n. sp.

Plate LIV, Figs 1–6.

Diagnosis: In sectione transversali limites stratorum concentricorum distincti, tracheidae angulares, strate concentrica pro ratione tenuina. Radii medullares altitudine 1–8-cellulares, parietes horizontales cellularum parenchymae longitudinalis leves, vel parum nodulosi, radii medullares et axis longitudinalis tracheidarum angulum 15° formentes, parietes omnes cellularum radiorum medullarium leves, in zonis e radiis medullaribus tracheidisque formatis plerumque 2–2 pori ovales. Pori 7–8 μ diam., breviter elliptici, jacentes. Parietes tangentiales tracheidarum poris areolatis parvis (8–10 μ), multis.

Descr. **C.** The cross sections of the tracheids are generally angular, tetragonal or hexagonal. Their radial diameter is 55–60 μ, their width 28–30 μ or even larger than that. At the annual ring boundary in the late wood which is scarcely 2–3 tracheids broad the tracheids radially markedly flatten. In the annual rings there are longitudinal parenchyma cells mostly with a dark content, but also resin cysts occur mainly at the annual ring boundaries in the late wood. Regarding its cross-section structure, the fossil possibly belongs to *Cupressaceae* or *Taxodiaceae*, or is perhaps some *Podocarpus*.

T. The rays are generally very low, 1–6–8 cells high, rays of 10 cell height being very rare. There is a golden-yellow resin content in some of the rays. The height of the ray cells is 14–16 μ, their width is about the same. The parenchyma cells are comparatively numerous. The horizontal walls of the longitudinal parenchyma are generally smooth, moderately knotted at the middle without cog-wheel-like thickening. This allows to infer *Sequoia* as well. Such pitting of the longitudinal parenchyma cells is suggestive of some *Cupressaceae* and particularly of *Taxodiaceae.* The wall of the longitudinal tracheids shows an oblique striation – fine fissures in the wall – which is related to the micellar structure of the wood.

R. The bordered pits of the tracheid walls are mostly arranged in one row, but some broader tracheids comprise two rows of these situated opposite each other, from which we should primarily infer *Taxodiaceae* or perhaps *Cupressaceae.*

An interesting feature is that the rays are not perpendicular to the longitudinal axis of the tracheids but subtend an angle of 70–75°. The horizontal and tangential walls of the rays are smooth. The horizontal walls are about 3 μ, while the tangential walls only 1–2 μ thick. The horizontal walls are smooth, no pitting can be observed in them. In the cross fields there are generally 2–3 circular and not definite taxodioid pits. All tangential walls are smooth and thin. Such ray structure reminds us of *Cryptomeria*, in which the rays are also rather low (1–8 cells high) and the horizontal walls of the parenchyma cells can be not only smooth but also knotted.

Note: Since the rays are comparatively low (1–8 cells high) and most of the horizontal walls of the longitudinal parenchyma cells are not smooth but knotty, and since there are 2 oval or circular pits in each cross field and the annual ring boundary is also distinct, the fossil may have originated from a *Cupressus* species, although for insufficiency of data we cannot claim this decisively. However, considering the height of the rays, the smooth tangential walls of the ray cells and the identity of the cross fields, one may regard this assumption as correct. Thus we conditionally denominate the fossil as *Cupressinoxylon cupressoides*.

L. Szentendre, well of the Villa Dombi, from a depth of 20 m; **A.** Lower Helvetian.

The original material is deposited in the Hungarian National Museum under No. A. 538.

?Cupressinoxylon sp. (No. 1)

Plate LXXVIII, Figs 1–6.

Descr. **C.** There are scattered parenchyma cells in the broad annual rings. The cross sections of the tracheids are angular. These two data are fairly indicative of the family of the tree (Figs 1 and 2).

T. also seems to corroborate this assumption, because here the rays are 1–10–12 cells high, uniseriate, none of them containing a resin duct. This structure resembles somewhat *Cupressaceae* (Fig. 3).

R. We may observe some intact details only here and there. For *Cupressaceae* argues that on the radial side many longitudinal parenchyma cell rows run parallel to each other (Fig. 6). The cells contain a rounded, dark substance. The structure of the cross fields could not be established because of the high degree of disorganization (Figs 4 and 5).

Note: The above anatomical features permit comparison only with *Cupressaceae*, *Taxodiaceae* and some genera of *Pinaceae*. The absence of the resin ducts and the presence and arrangement of the longitudinal parenchyma argues against *Pinaceae*. The xylotomical properties of *Cupressaceae* agree to a certain degree with the structure of the fossil described. In our opinion the tree may have belonged to the genus *Thuya* or *Juniperus* of the family *Cupressaceae*. Therefore we propose to name it conditionally as a *Cupressinoxylon* sp.

L. Recsk, Csákánykő, from Lower Rhylite tuff; **A.** Helvetian.

?Cupressinoxylon sp. (No. 2)

Plate LIV, Figs 7–8.

Descr. **T.** The rays are in general 6–8, exceptionally 10 cell rows high, the cross section of their cells is either a circle or a short ellipse.

R. It was not possible to establish the finer structure of the rays, therefore the remain could not be determined exactly. From the two photos its taxonomy can be only guessed.

Note: Since parenchyma cells which are in contact with each other run parallel with the annual ring boundary, which is primarily a *Cupressaceae* feature, we regard the fossil conditionally as a *Cupressinoxylon.*

L. Kazár, Plant No. III.; **A.** Helvetian.

The material examined is deposited in the Hungarian National Museum under No. A. 940.

?Cupressinoxylon sp. (No. 3)

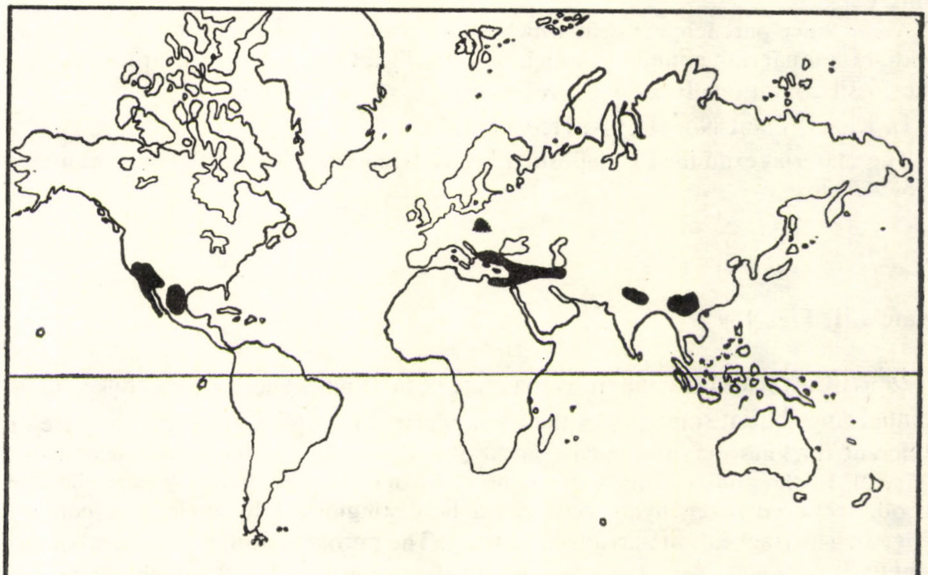
Plate LII, Figs 1–9.

Descr. **C.** reveals the coniferous structure at first sight. There are no conspicuous annual rings but at some places their boundaries are explicit (Fig. 1). They are of different thicknesses, some having a 20–30, while others a 60–80 tracheid width (Fig. 2). In the annual rings there is no resin duct but, particularly near the late wood, scattered parenchyma cells could be distinguished by their dark content (Fig. 3). The tracheids are arranged radially. Their cross section is in general quadrangular, the angles rounded. The radial diameter is 40–50 μ, the width about the same, but in some of them the lumina are somewhat wider or narrower. Their walls are uniformly thick. At the annual ring boundary 2–3 tracheid rows radially flatten when the radial diameter shrinks to 18–20 μ. Adjoining these, the first tracheids of the early wood have a radial diameter of 50–55 μ.

T. The rays are comparatively low, 3–10–12 cells high. Their cross sections are upright, short oblongs or ellipses. On the tangential walls no pits are seen. The horizontal walls of the longitudinal parenchyma cells are perfectly smooth (Fig. 5) and thin with no pits or other thickenings. The cell content is black, globular, rounded, in each cell 1–3 or even more pieces of these may occur. In the tangential wall of the tracheids the bordered pits can be only guessed. They are arranged loosely in a single row.

R. The arrangement of the bordered pits is well visible at some places. They are uniseriate and cover loosely the tracheid walls without touching each other; the aperture is circular (Fig. 6). The contours of the rays are quite distinct. The ray cells are comparatively high, the height of 5 ray cells is 150 μ, that of 1 ray is about 28–30, but lower ones of 24–25 μ height also occur. Both the horizontal and the tangential walls appear completely smooth (Figs 7, 8 and 9).

An interesting feature can be observed however: where the longitudinal tracheids meet the horizontal ray cells, lumina occur, which is a rather frequent phenomenon also in the *Cupressaceae*. The cross fields have 1, possibly 2 pits, which in the latter case are mostly situated above each other. The border of the pits is a horizontally elongated ellipse, but the aperture is not horizontal but somewhat oblique, which cannot be always observed since the borders of the pits are also blurred.



Map 7. Recent distribution of the genus *Cupressus* (after Krüssmann). Hungarian Tertiary sites (triangle)

Note: The exterior of the completely silicified stem examined is yellowish brown, the interior dark, black, probably as a result of burning. In some details traces of creasing are seen. Because of the tangential structure of the rays and the pitting of the cross fields of the ray cells, *Thuya*, *Chamaecyparis*, perhaps also *Podocarpaceae* and *Taxodiaceae* may enter into consideration. Also the horizontal walls of the longitudinal parenchyma cells are all smooth and thin. The occurrence of 1 possibly 2 cupressoid pits in the cross fields, the quadrangular lumina at the intersection of the longitudinal tracheids and the walls of the horizontal ray cells, the uniseriate arrangement of the bordered pits in the tracheid walls are all such features which, on the other hand, allow to infer the *Cupressaceae*.

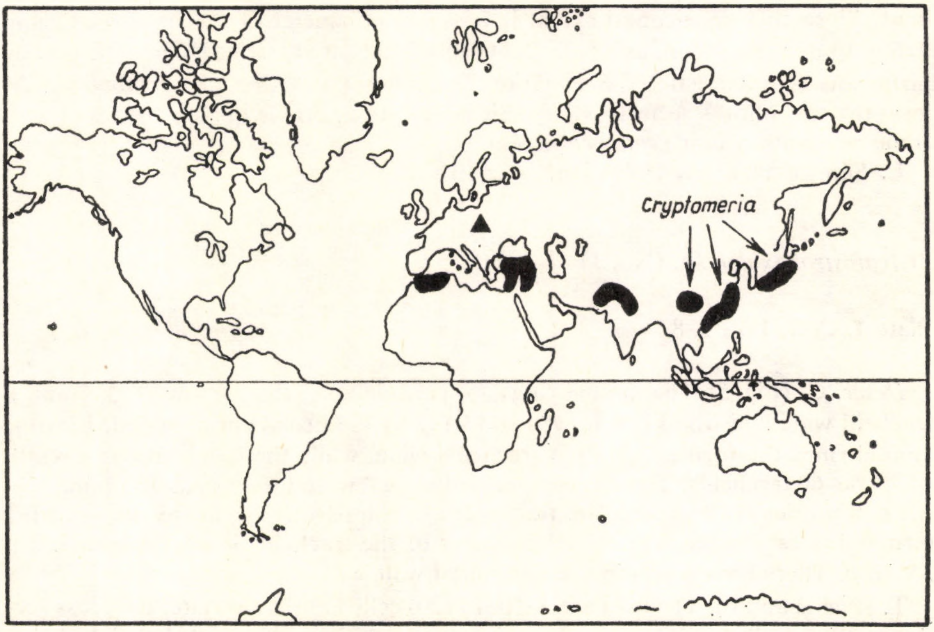
Of the mentioned genera we may think of *Libocedrus*, *Cupressus*, *Widdringtonia*, *Thuya* and *Chamaecyparis*. Lacking exact knowledge of the cross field, however, we dare not identify the fossil with either of these genera. It is most probably related with *Cupressus*, and we freely may regard it as *Cupressinoxylon*, without a more precise indication of genus and species.

L. Pesthidegkút; **A.** Helvetian.

Haraszty (1953, 1958), when determining a *Cupressinoxylon* from Petőfibánya and another questionable one from Szentgál, found no thickening or pitting in the horizontal and tangential walls of the ray cells, nor in the horizontal walls of the longitudinal parenchyma, although in most of the *Cupressaceae* such pitting occurs. There are, however, such *Cupressus* species, as *Callitris*, *Widdringtonia* in which both the walls of the rays and the longitudinal parenchyma rays are thin.

The species described as *Cupressinoxylon pannonicum* Ung. originating from the Mount Gellérthegy in Budapest is represented only by a portion of a cortex of a conifer.

The xylem has been described by Félix (1884).



Map 8. Recent distribution of the genera *Cedrus* and *Cryptomeria* (after Krüssmann). Helvetian and Sarmatian sites in Hungary (triangle)

6. TAXODIACEAE

?Cryptomerioxylon sp.

Plate LIII, Figs 1–3.

Descr. **C.** No conspicuous annual rings could be established; the cross sections of the tracheids were angular and rounded, from which *Araucariaceae* could be guessed. On the other hand, only the *Podocarpaceae* and *Cupressaceae* are such families in the wood of which there are no conspicuous annual rings.

T. Marks of compression appeared on the tangential slide, so the structure of the ray skeleton was observable over very small sectors only (Fig. 1). The rays are 6–10–12 cells high; in this respect the fossil is suggestive of *Sequoia gigantea.*

R. The cross fields were detectable here and there only. In each cross field 2–3 comparatively large bordered pits are seen, the shape of which is a slightly procumbent ellipse, their thorizontal extent is 7–8 μ, the diameter of the small axis being 5–6 μ. In one cross field, as a rule, 2, at most 3, pits are arranged. The pitting is by no means characteristic of *Sequoia* or *Taxodium*, but rather of *Cryptomeria.* At least the two photos seem to verify this assumption. So we qualify the fossil with some reservation as *Cryptomerioxylon.*

L. Sámsonháza; **A.** Helvetian.

?Glyptostroboxylon sp. (No. 1)

Plate LXVII, Figs 5–8.

Descr. **C.** (Fig. 5). The annual rings are conspicuous; the narrow, 2, 3, 7 and 8 tracheid wide late wood is followed suddenly by the broad spring wood. In some annual rings the former is only 4 tracheids wide, while the latter attains a width of 20–50–60 tracheids. The parenchyma cells are few and scattered. The lumina in the 6–8 μ thick walls of the late tracheids are comparatively narrow, those of the terminal ones slit-like. The radial diameter of the tracheids is 40–60, their width 35–36 μ. There are no pits in the horizontal wall.

T. (Figs 2 and 6). The rays are 3–10–15 (20) cells high, uniseriate, the cross section of their cells, owing to compression, is an upright ellipse, their height being 10–27 μ, their width 6–13 μ. The abundant resin content of the wood-parenchyma is generally rounded and of a dark-orange colour. The horizontal walls of the longitudinal parenchyma cells are, in general, smooth or unevenly thickened, but no cog-wheel-like thickening is found. The diameter of the bordered pits is 10–13 μ in the tracheid walls.

R. (Figs 7 and 8). In the radial wall of the longitudinal tracheids the bordered pits are 2–3 seriate, the bars of Sanio are conspicuous (Fig. 8). The height of the ray cells is 22–28μ. Their horizontal walls are smooth at some places pitted, while the tangential walls are always smooth and thin. In each cross field there are 1–2 (3–6) taxodioid pits arranged in one or two rows. Their diameter is 10–15 μ, but in some cross fields only 1 or 2–3 taxodioid or glyptostroboid pits are seen. In some tracheids also uniseriate bordered pits occur, their diameter is 13–14 μ. The horizontal wall of the longitudinal parenchyma is smooth or mildly knotted also on this side. Very exceptionally transverse tracheids occur.

L. Várpalota fossil marked H; **A.** Tortonian.

Glyptostroboxylon sp. (No. 2)

Plate LXXII, Figs 1–4.

Descr. **C.** (Fig. 1). The annual rings may have been rather wide, because the late wood is 15–30–35 tracheids wide while the spring wood is quite compressed and might have probably the same width. The tracheids of the late wood are thick walled (10–13 μ), their lumina are conspicuous also at the boundary of the early wood, their diameter is 27–80 μ. Especially in the spring wood the wood parenchyma filled with resin is very abundant while there were none or very few in the late wood.

T. (Fig. 2). The rays are 1–10–15 cells high, but also 40–50 cell high ones occur. The cross sections of the ray cells are elongated ellipses, their horizontal walls thickened, the triangular intercellular can be explicitly observed between the two ray cells at both sides, while the radial wall is very thin. The rays are uni- or biseriate; some biseriate ones can attain a height of 10 to 12 cells. In the longitudinal parenchyma cells the resin substance is granular, the horizontal wall is smooth or mildly knotted. The individual parenchyma cells are 35–100–270 μ high. The height of the ray cells is 20–27, their width 12–18 μ. There are no or few pits in the radial wall of the longitudinal tracheids of the early wood, while in the late wood they are scattered in one or two rows and their apertures are narrow slit-like and vertical, their diameters being 13–16 μ.

R. (Figs 3 and 4). Owing to compression, the cross fields and the finer structure of the rays could be observed only at some places. The horizontal walls are in general smooth and rather thick, while the tangential walls are always smooth and thin. In one cross field there were generally 1, exceptionally 2 circular pits of 6·5 to 8 μ diameter. No border can be seen, and the aperture is almost vertical. In the radial wall of the tracheids there is, in general, only one row of bordered pits, the pits are scattered, their diameter being 8–10 μ.

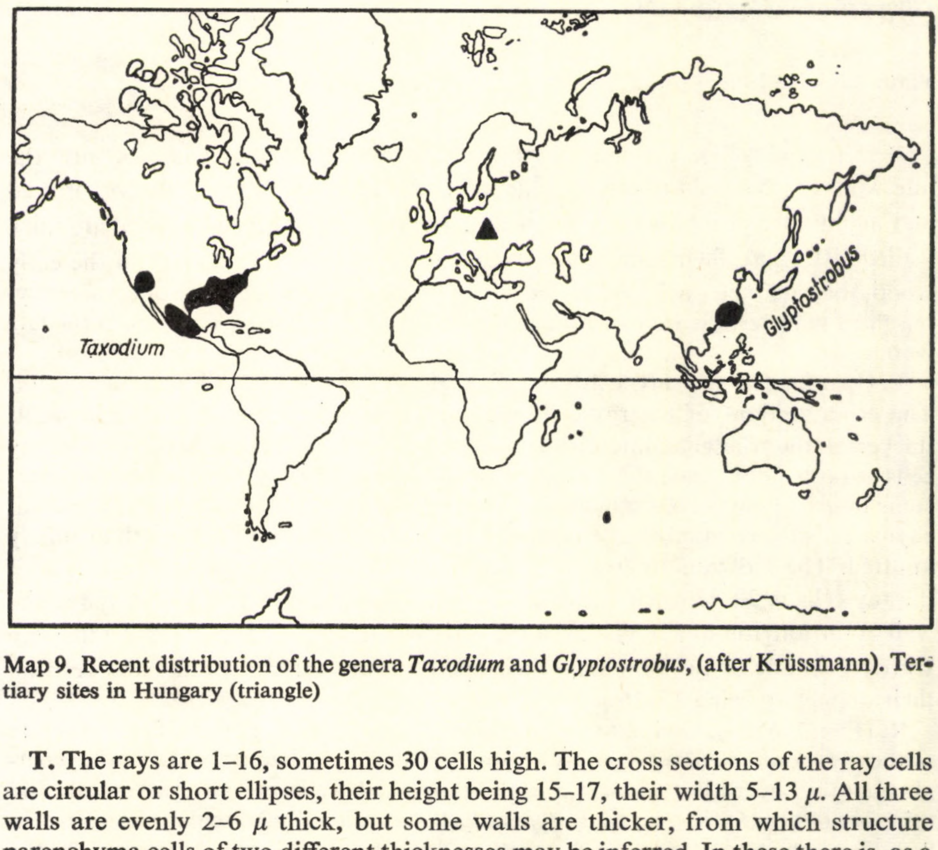
Note: The ray structure of the silicified wood is most suggestive of the structure of *Glyptostrobus*.

L. Várpalota, fossil marked **C**; **A.** Tortonian.

Glyptostroboxylon sp. (No. 3)

Plate LXVII, Figs 1–4.

Descr. **C.** (Fig. 1). The annual rings are 10–30 tracheids wide. In the early wood there is a gradual transition into the late wood wich is sometimes only 3–4, and sometimes 8–10 tracheids wide, but the annual ring boundary is always definite. In the annual rings, especially of the early wood, there is a scattered rich longitudinal parenchyma with a dark resin content. The cross sections of the tracheids in the early wood are generally oblongs arranged in regular longitudinal rows.



Map 9. Recent distribution of the genera *Taxodium* and *Glyptostrobus*, (after Krüssmann). Tertiary sites in Hungary (triangle)

T. The rays are 1–16, sometimes 30 cells high. The cross sections of the ray cells are circular or short ellipses, their height being 15–17, their width 5–13 μ. All three walls are evenly 2–6 μ thick, but some walls are thicker, from which structure parenchyma cells of two different thicknesses may be inferred. In these there is, as a rule, a resin content of dark-orange colour. The longitudinal parenchyma cells are 120–240 μ long and have a dark resin content which is generally lacunar (Fig. 2). In the tracheid walls there are tiny bordered pits (6–17 μ).

R. (Figs 3 and 4). In the walls of the tracheids the bordered pits are generally uniseriate and 5–6 μ wide. The horizontal walls of the ray cells are thick and smooth while the tangential walls are thin and smooth. In each cross field there are mostly 1, exceptionally 2 circular pits, slightly procumbent ellipses or circles measuring 5–6 μ. Among the thick-walled parenchyma cells also thin-walled ones occur which sometimes are arranged so that two of them surround a thin-walled one. The horizontal walls of the longitudinal parenchyma cells are, in general, smooth but sometimes show 2–3 bead-string-like thickening. Most transverse walls, however, are smooth or mildly thickened.

Note: This fossil most resembles some *Chamaecyparis* or *Glyptostrobus*. To this point the low number (1–2) of the pits in the cross fields, the arrangement of the uniseriate bordered pits in the longitudinal tracheid wall and the conspicuous lacunar structure of the resin content. The wood anatomy of the *Glyptostrobus* and *Chamaecyparis* resembles that of the *Sequoiae* even in that transverse tracheids may occur in both of them. A difference between the fossil and *Sequoiae* is that while the xylem of the *Sequoia* is liable to split longitudinally, similarly to the cortex, this fossil falls rather in transverse pieces as shown by the photos. This gives no decisive evidence for separation but is by all means a remarkable phenomenon. Since the inner structure of the fossil is more similar to *Glyptostrobus* than to *Sequoia*, we apply the denomination *Glyptostroboxylon*.

L. Várpalota; **A.** Tortonian.

Metasequoioxylon hungaricum n. sp.

Plate LV, Figs 3 and 4, 8–12.

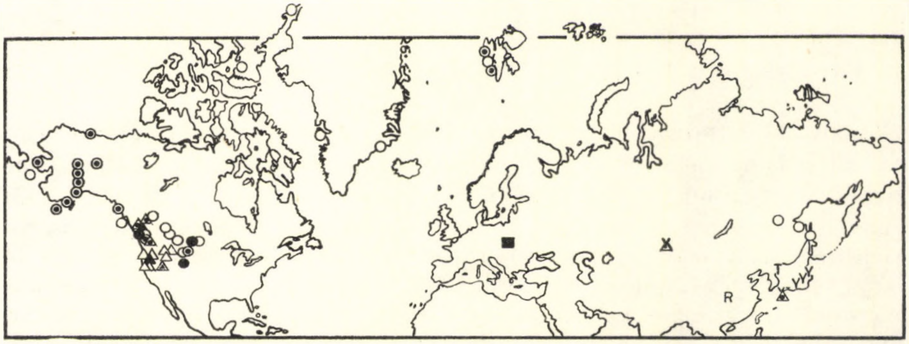
Diagnosis: In stratis concentricis pars prior et posterior bene distinctae. Pars posterior in latitudine ex 8–12 tracheidis formata, tracheidae hic radialiter compressae, cavum earum baculi, vel fissuraeforme; radii medullares altitudine 1–32 cellulares, paries horizontalis cellularum parenchymae longitudinalis levis, vel parum tuberculatus; cellulae radiorum medullarium in sectione transversali circulares, vel breviter ellipticae; paries radialis tracheidarum poris areolatis plerumque geminis in seriebus 1, vel 2 dispositis; paries tangentialis cellularum radiorum medullarium levis tenuisque; in zonis e radiis medullaribus tracheidisque formatis 3–6 pori circulares, vel breviter elliptici, ad margines radiorum medullarium nonnunquam tracheida transversalis humilis.

Descr. **C.** The annual rings are wide enough also in this wood and separate into wider early and narrower late zones. The late wood is about 8–10 tracheids wide, their lumen at the annual ring boundary almost slit-like. The cross-section structure may suggest some kind of *Sequoioxylon* (Figs 3 and 4).

T. The rays are 1–32 cells high, their cross sections are circles or ellipses. The average height of the rays is 14–20 cells. The horizontal walls of the parenchyma cells are, as a rule, smooth, pits or other kinds of thickenings occur only very rarely. This is a *Sequoia*, *Metasequoia* or *Cryptomeria* character (Fig. 12). In the longitudinal parenchyma the dark resin content is rounded or globular (Figs 8 and 9).

R. Owing to the high degree of disorganization, only few, as a rule 2–3 or 6, circular pits in each cross field can be observed, while in the marginal cells generally six in two rows (Figs 11 and 12). In the longitudinal wall of the tracheids there is usually 1 bordered pit, but also 2 pits occur beside each other (Fig 12).

Note: Also in this fossil the bordered pits are generally arranged by pairs in the longitudinal wall of the tracheids, and are separated by bars of Sanio (Fig. 12), which is more of *Metasequoia* than *Sequoia sempervirens* or *S. gigantea* character. In the cross fields there are 2–3, and in the marginal cells 6 circular simple pits, respectively (Fig. 12), which also corresponds to the *Metasequoia* character. The transverse walls of the longitudinal parenchyma cells are smooth or very mildly thickened, which again is suggestive of the *Metasequoia* character (Figs 9 and 10), and so are the heights of the rays (Fig. 8). We cannot therefore be far wrong when regarding the fossil as *Metasequoia*, with the remark that it bears resemblance to *Cryptomeria*, too. We have to add that in the fossil very seldom also low transverse tracheids occur (arrow in Fig. 11), which structure can be observed also in *Metasequoia*. Indeed, there is no such anatomical property in the fossil as would not fit into the histological structure of the recent *Metasequoia*, but it positively differs from *Metasequoioxylon germanicum* determined by Schönfeld (1955) as was established by Greguss earlier. Therefore we propose the name *Metasequoioxylon hungaricum* n. sp.



Map 10. Recent distribution of *Metasequoia glyptostroboides* (R) and fossil sites of the genus *Metasequoia*. Helvetian sites in Hungary (square)

The map clearly illustrates that *Metasequoia* remains from the Palaeocene to the Pliocene were mainly found at several places of the western North America, in East Asia, and according to Schönfeld (1955) even in Germany. So it is not unlikely that one or several *Metasequoia* species lived also in the territory of Hungary.

L. Karancskeszi; **A.** Helvetian.

?Metasequoioxylon sp.

Plate LVI, Figs 1–9.

Descr. **C.** reveals that the fossil must have originated from some older stem, for the annual rings are very narrow. The annual rings are 5 to 20 tracheids thick, their boundary is definite; the early wood is much more developed than the late one which is mostly only 5 to 6 tracheids thick (Fig. 1). Here we find parenchyma cells with a dark resin content, mainly arranged parallel to the annual ring boundary, i.e. terminally (Fig. 2). The cross sections of the tracheids are angular and quadrangular. Their radial diameter is 65–70 μ in the early wood while immediately at the annual ring boundary 15–20 μ. Their width is 50–55 μ.

T. (Figs 3–5). The rays are 1–14 cells high and rather frequently widen at their middle to become biseriate. Shape and structure of these allow to infer *Taxodiaceae*. The cross sections of the ray cells are, in general, circles or low ellipses in which the dark resin content is not rounded but lacunar. The transverse walls of the longitudinal parenchyma cells are mostly smooth, but sometimes bead-string-like thickened (Fig. 5). This cell-wall structure of the parenchyma allows to infer *Taxodiaceae* or some *Cupressaceae*.

R. The bordered pits of the tracheid walls are arranged mainly in pairs, and the bars of Sanio are conspicuous between them (Figs 6 and 9). Moreover, particularly in the late wood, the bordered pits are uniseriate, while in the early wood, very infrequently though, even 3 pit rows are found. This character precludes *Cupressaceae* in which 2 pits never or very rarely occur on the width of one tracheid.

Note: The ray structure is mainly decisive for the family character. In the cross fields 2–3, while in the marginal cells 4–6 taxodioid pits are found, so the fossil highly resembles *Sequoia*, *Metasequoia* and *Glyptostrobus*. The height of the rays varies between 1–10–12 cells, the bordered pits are arranged by pairs in the tracheid walls, the transverse walls of the longitudinal parenchyma are smooth or somewhat knotted, in the cross fields there are 2–4 (6) taxodioid pits. All these features allow to infer *Glyptostrobus* or *Metasequoia*. In the last resort, however, the structure of the longitudinal parenchyma cells are decisive, in so far as the transverse walls of these in *Glyptostrobus* are rather frequently knot-like thickened. The transverse walls of our fossil are mostly smooth or moderately knot-like thickened, which is general in *Metasequoia*; therefore we rather tend towards the opinion that the silicified wood examined may have been *Metasequoia* with which no anatomical properties preclude connection. The fossil is highly suggestive of the *Sequoioxylon germanicum* species described from Germany, from which it differs, however, by the height of its rays and the size of the pits of the cross fields. So we cannot be far wrong when regarding the fossil as some kind of *Metasequoia*, with the restriction that it shows a great similarity to *Sequoia sempervirens*, because in its tracheid walls the bordered pits are arranged in 2 or 3 rows.

By the xylotomical features discussed we regard the fossil as *Metasequoioxylon* sp.

L. Sajókazinc, Herbolya mine; **A.** Lower Helvetian.

The material is deposited in the botanical collection of the Hungarian National Museum under No. A. 105.

Sequoioxylon medullare n. sp.

Plate LVII, Figs 1–9.

Diagnosis: Strata concentrica posteriora per latitudinem 2–4 tracheidas continentes, inter tracheidas parenchyma ligni frequens. Radii medullares in latere tangentiali e cellulis 1–60 superpositis, sectione cellularum transversali circulari, vel late elliptica, parietes horisontales cellularum parenchymae longitudinalis nodosi, vel leves, sed nunquam ad instar rotae denticulatae incrassati. In pariete tracheidarum longitudinalium 1–4 pori areolati, in una altitudine positi. In zonis ex radiis medullaribus tracheidisque formatis 2–5 pori taxodioides, uniseriati. Parietes horisontales poris praediti, tangentiales leves.

Descr. **C.** In the annual rings, which are comparatively narrow, most of them being 8–10 tracheids wide, some even slightly broader, a very extensive early zone and a late zone of hardly 2–3 tracheid width can be clearly observed. The cross sections of the tracheids of the early wood are, in general, radially somewhat elongated oblongs, their radial extent is 9–10 μ, their width 50–60 μ, their shape is sometimes hexagonal. The regular rows of the tracheids are arranged in the radial direction. The rays which are uniseriate, at some places broadening to biseriate, run at a distance of 2–3 tracheids (Fig. 2). From the cross slides we can infer some kind of *Sequoia*. The wall thickness of the tracheids of the early wood is 5–6 μ while that of the late tracheids may be 12–14 μ. The lumen in the early part of the autumn wood is a circle or ellipse, but immediately before the early wood it is slit-like. The tangential extent of four late tracheids measure 190 μ, so the width of one tracheid is about 50 μ. Towards the end of the early wood the longitudinal parenchyma cells are scattered but often enough arranged parallel to the annual ring boundary; detached parenchyma cells are rather frequent also among the thick-walled tracheids of the late wood.

T. One of the most conspicuous properties is the denseness of the rays. They can be 1–40 and even 60 cells high, which is not characteristic of either *Sequoia sempervirens* or *Sequoia gigantea*. Such high rays occur in *Taxodium distichum*, in some *Callitris* and in *Podocarpus*. The cross sections of the ray cells are circles or low ellipses; 7 ray cells cover 140 μ, so the average height of each, including the walls, is about 20 μ. The marginal ray cells are sometimes slightly higher than the interior ones. In some ray cells a dark, rounded content is found. Between the tracheids and rays wood parenchyma cells of 55–60 μ width are rather frequent. Their transverse walls are slightly knotted or uneven, but rather often completely smooth. In the walls of the longitudinal tracheids at some places tiny bordered pits are arranged in one row.

The tangential slide, as well as the cross slide, shows a *Taxodiaceae* character. The longitudinal parenchyma cells are filled with a golden-yellow resin-like substance of either tiny globular or ellipsoid, or irregular shape. In the tangential wall of the late tracheids the tiny bordered pits are sometimes arranged in two rows, the size of the bordered pits being 12–14 μ.

R. The bordered pits are arranged in double or exceptionally in three rows in the walls of the longitudinal tracheids. They do not fit closely together. The width of two bordered pits is 35 μ, that of one being about 15–16 μ. The height of the ray cells is 20–22 μ, they are horizontally greatly elongated oblongs. In their horizontal walls the simple pits are rather frequent, but their tangential walls are invariably smooth. In the cross fields there are 2–4–5 simple pits always arranged in one row, never in two. No transverse tracheids could be established.

Note: The structure of the fossil cannot be identified with any recent species of *Sequoia*, owing to the extraordinary height of its rays. In none of the *Sequoia* can 60 cell high rays be found, such can be observed among *Taxodiaceae* only in *Taxodium distichum*. The fossil, however, shows in every respect a *Sequoia* character as distinct from *Taxodium*, and this is why it obtained the name *Sequoioxylon*. A comparison with the photos of Plate LX makes the difference obvious, particularly in the height of the rays, but also in the pitting of the horizontal walls of the frequent longitudinal parenchyma. Therefore we describe the fossil as a new species.

L. Ipolytarnóc; **A.** Burdigalian.

Sequoioxylon podocarpoides n. sp.

Plates LVIII and LIX, Figs 1–18.

Diagnosis: In sectione transversali stratis concentricis prioribus posterioribusque bene distinctis; stratum posterius in nonnullis locis etiam 20 tracheidas, sed stratum perius 20–40 cellulas per latitudinem continens. Parenchyma terminalis; radii medullares ad latus tangentiale e cellulis 1–45 superpositis, cellulis in sectione transversali erecto-ellipticis, parietibus omnibus parenchymae longitudinalis levibus tenuibusque. In sectione radiali in zonis e radiis medullaribus tracheidisque deformatis plerumque porus unus, in cellulis angularibus pori duo taxodioides, podocarpoides, vel cupressoides, orificio botuliformi, obliquo, vel perpendiculari, in zonis strati concentrici prioris ex radiis medullaribus tracheidisque formatis magis pori elliptici decumbentes.

Descr. **C.** The single annual rings are of different widths: some were 8–10 while others 25–30 tracheids wide. Most conspicuous in the cross-section structure is the early and late zones' sharp separation from each other (Fig. 1). The late wood is sometimes only 1/5, sometimes 1/8 or 1/10 of the annual ring (Fig. 1). Such a difference between the late and early woods renders the annual ring boundary conspicuous. In the early wood parenchyma cells arranged parallel to the annual ring boundary, i.e. terminally, are rather frequent. The cross sections of the tracheids are not rounded but always angular (Fig. 3). They are generally quadrangular, pentagonal or hexagonal; their radial extent is 70–80 μ in the early wood, their width 40–50 μ. In the late wood the radial diameter of the tracheids is 20–30 μ, their width 40–50 μ. In the late wood the tracheid walls are thick, their lumina often appear as narrow slits (Fig. 2). The rays are, as a rule, uniseriate, biseriate portions appear only very exceptionally at a height of 1–2 cells.

T. The height of the rays may reach 1–42–45 cells. Generally they are 8–10 cells high (Figs 4, 5 and 6). The cross sections of the ray cells are elongated ellipses. The height of four ray cells is 100 μ, so the average height of one ray cell is 25 μ. The walls are quite thin, only the horizontal wall is somewhat thicker. Where the ray cells touch the neighbouring parenchyma cells or tracheids, the triangular intercellular is distinctly seen (Fig. 6).

In the tangential wall of the tracheids bordered pits are rather frequent, they measure 10 to 12 μ. The aperture of the pits is, in general, a circle or a somewhat upright ellipse. Parenchyma cells are arranged between the tracheids, all three walls of which are very thin and smooth (Fig. 6). No thickening can be observed on the transverse walls either. In the interior of the parenchyma cells the globular, dark-coloured resin granules are rather frequent. This character suggests some genera of *Cupressaceae* and *Taxodiaceae*, while the high rays are indicative of *Podocarpus*.

R. In the early tracheid wall the bordered pits are arranged loosely, sometimes by threes at a width of one tracheid (Fig. 8) while in the walls of the late tracheids the pits are arranged in one row, hardly in touch with each other, and are not compressed, so this pitting is by no means araucaroid but a modern one. The aperture of the pits is a circle or a short ellipse.

The cross fields supply ampler information on the internal structure of the wood. In general, the cross fields of the late wood have one pit each, very seldom 2, but if so, they are arranged above each other (Figs 9 and 12). The apertures of these pits are generally vertical. Almost the same arrangement is seen in the late part of the early wood, while in the cross fields of the very wide spring wood 2 or even 3 pits occur beside each other (Fig. 7). The pits measure 7–8 μ. The border is circular or a somewhat oblique ellipse, but sometimes the cross fields show an explicitly cupressoid pitting with the characteristic that the rod-shaped aperture in the ellipsoid border is in the small axis and mostly has an oblique position (Figs 15, 16, 17 and 18).

As already mentioned, in the cross fields of the late wood usually 1 pit is found, the aperture of which has almost invariably an upright or oblique position. But the marginal cells have, as a rule, 2 pits each, situated above each other (Fig. 18). Sometimes only the place of the circular border is seen in the single cross fields when it appears as if there were a glyptostroboid pitting in the cross field.

Seen from the radial side the ray cells appear to be strongly elongated procumbent oblongs with quite thin and smooth tangential walls. No pitting on the walls could be observed. The horizontal wall is thicker and sparsely pitted (Fig. 7).

Note: As for the angular cross sections of some tracheids, the fossil might belong to *Cupressaceae*, *Podocarpaceae* or to the *Taxodiaceae*. This fact shows that a fossil can be determined on the basis of the cross section in the rarest cases.

The tangential structure brings us somewhat nearer to the determination. 40 to 50 cell high rays do not occur in *Cupressaceae*, such are only found in *Podocarpaceae* and *Taxodiaceae*. The ellipsoid cross sections of the ray cells, the thin tangential walls and the thick horizontal walls are more of the taxodiaceous character. A further similarity to *Taxodiaceae* is represented by the longitudinal parenchyma cells, having thin horizontal walls without any thickenings in them. So the tangential slides cannot supply information enough for the classification of the fossil either.

We obtain a more plausible answer when examining the structure of the tracheids and rays on the radial slides. In the cross fields of the late wood there are 1 or perhaps 2 pits (Figs 10 and 18), the apertures of which are generally upright ellipses. In the marginal cells the lumina of the tracheids are narrow, owing to which two pits are arranged above each other, as frequently is the case with *Sequoiae*.

Most characteristic, however, is the pitting of the cross fields, when examined in the early wood. Such structure with a definite taxodioid pitting (Figs 7 and 8) occurs primarily in *Sequoiae*, but also in *Metasequoia*. The same is found in the fossil No. 6 from Salgóbánya as shown in Figs 1–9 of Plate LXI. The ray structures of the radial slides of the fossils perfectly agree. If we add that the walls of the longitudinal parenchyma cells are also smooth and thin – an almost general feature in *Sequoiae* – then we cannot be far wrong when qualifying the fossil as some kind of *Sequoia* with the remark that it also has properties suggesting *Podocarpaceae*.

On the ray structure of the fossil Photos 10–18 of Plate LIX supply information but the question is decided by Photos 7 and 8 of Plate LVIII where the taxodioid or *Sequoia* pitting is clearly seen, which is most characteristic for the *Taxodiaceae*. In Fig. 7 even three pits are side by side in the cross fields, as in recent *Sequoia sempervirens*.

Summing up our statements, the fossil from the Lower Helvetian of Salgóbánya must have been some kind of *Sequoia*. The problem was finally decided by the radial wall of the longitudinal tracheids having 3 and even 4 pit rows and by the cross fields where 3 or occasionally 4 pits appear beside each other, which is only found in living *Sequoiae*. Since in the cross fields cupressoid pits occur (Figs 10–18), but such pits are found also in *Podocarpaceae*, while in the tracheids of *Cupressaceae* 3 pits never occur, though this is the case in some *Podocarpus*, therefore to distinguish the fossil of Salgóbánya from others we propose the name *Sequoioxylon podocarpoides* n. sp.

L. Salgóbánya, cover of deposit No. III.; **A.** Lower Helvetian.

Sequoioxylon cf. *germanicum* (No 1.) Greguss

Plate LV, Figs 1, 2, 5, 6 and 7.

Descr. **C.** The annual rings are distinct. They are 50–60–70 tracheids wide; the spring and autumn woods can be readily distinguished from one another. The tracheids of the former are thin-walled, their cross section angular, radially elongated oblongs or squares. The radial diameter of the larger ones is 60–70 μ, their width 50–50 μ. The late wood is 8–10 tracheids wide, the tracheid walls are thick, their lumina almost slit-like. Parenchyma cells occur both in the spring and the late wood. This cross-section structure greatly reminds us of *Metasequoia* (Figs 1 and 2).

T. The rays are 1–16–20–24 cells high, uniseriate, the longest ones in the middle become biseriate at a height of 1–2 cells. The cross sections of their cells are rather upright ellipses, their height being 20–22 μ, their width 14–15 μ, but also lower and higher ones occur. In the longitudinal parenchyma cells a dark, rounded resin content is seen. The transverse walls are thin or knottedly thickened. Also in this respect they greatly remind us of recent *Metasequoia.* The transverse walls of the longitudinal parenchyma cells do not allow of any *Taxodium.* Thus by the transverse walls of the longitudinal parenchyma we may infer primarily *Metasequoia,* then *Cryptomeria* and only in the third place *Sequoia.*

R. All walls of the ray cells are smooth, at least no pitting could be established in them. In the cross fields we find 1 or 2 procumbent ellipsoid pits, while 3 or 4 pits only occur in the marginal cells. Thus the living *Sequoiae* can hardly be inferred.

Note: By a more exact examination, the fossil may perhaps be derived from *Metasequoia,* though *Cryptomeria* is not unlikely either. But we cannot be far wrong when stating a closer relationship with *Sequoioxylon germanicum* Greguss. The record of Rixhöft described by Greguss (1957) perfectly agrees with the fossil of Alacska. So in the last analysis we regard the fossil as *Sequoioxylon* cf. *germanicum.*

L. Alacska; **A.** Helvetian.

The slides are in the Hungarian National Museum under No. A. 109.

Sequoioxylon cf. *germanicum* (No. 2) Greguss

Plate LXVIII, Figs 1–8.

Descr. **C.** The annual rings are distinct, and generally 6–8 mm wide, while the late wood hardly extends over a few cells. There are no resin ducts, and the parenchyma cells are arranged parallel to the annual ring boundary, bearing in most cases a rounded, dark-red content. The cross sections of the tracheids are generally squares, though radially somewhat elongated rectangles and hexagons are also rather frequent. Their radial diameter is 60–65 μ, their width 30–40 μ. The radial diameter of the flattened tracheids of the late wood is 14–16 μ, their width 30–40 μ. It is noteworthy that the wall of the tracheids of the late wood is as thick as that of the early wood. The rays running at a distance of 2 to 10 tracheids are uni- and biseriate. Their horizontal wall is generally smooth, but at some places tiny circular pits are arranged in them (Figs 5 and 6). The radial wall is always smooth, at most tiny warts can be observed in them.

Since no tangential slide was obtained, the ray skeleton could not be exactly determined. The radial slides supplied an ampler information on the structure of the rays.

R. The height of the rays were easy to establish. The rays are 1–10 cells high, their average height being 20–22 μ; the marginal cells are somewhat higher than the internal ones. For example, the height of a 14 cell high ray is 300 μ, which corresponds to an average cell height of 22–23 μ. The length of the ray cells varies between 140 and 150 μ. Their tangential walls are perfectly smooth, somewhat arched, and no pit can be observed in them. In most cases they are almost perpendicular to the horizontal wall, but sometimes subtend an acute angle to it. In the cross fields generally 2–4, in the marginal cells 4–6 characteristic taxodioid pits are arranged. The pits are procumbent ellipses, the crescent-shaped edges of the border are easy to recognize on both sides. This pitting of the cross fields is suggestive of recent *Sequoiae* as well as of *Metasequoia.* By the structure of the cross fields the fossil could be safely regarded as *Metasequoia.* Between the bordered pits the bars of Sanio can be clearly established, which feature again is more of *Metasequoia.* No transverse tracheids were observed. There are a great many longitudinal parenchyma cells whose height is 110–140 μ; all their horizontal walls are smooth without knots or pits, from which feature we may infer *Sequoia* and some species of *Cupressaceae.*

Note: The cross-section structure of this fossil, the rather conspicuous annual ring boundary, the lack of a developed late wood, the simple pitting of the horizontal wall of the uni- and biseriate rays, the arrangement of the bordered pits in 2–3 rows in the longitudinal tracheids and that of the characteristic taxodioid pits in the cross fields are greatly suggestive of *Sequoia* and *Metasequoia.* So we cannot be far wrong when inferring a closer relationship primarily with *Sequoiae* or *Metasequoiae.* As to the pitting of the cross fields, it mostly resembles *Metasequoia,* which is verified by the photos. The stem is most similar to *Sequoioxylon germanicum* of Rixhöft described by Greguss (1957). In establishing this similarity, difficulties are only raised by the narrowness of the late wood and the thinness of the tracheid walls in this zone. In the late wood of *Metasequoia* the tracheid walls are thick and the lumen is a narrow slit, while in our fossil the tracheid wall is thinner and the lumen is not slit-like either. Therefore we regard the fossil, with reservation, as a *Sequoioxylon* cf. *germanicum.* Nor can we be far wrong when relating it to *Taxodioxylon metasequoianum* described by Schönfeld (1955). This latter supposition seems to be also verified by the photos.

L. Dorog; **A.** Upper Oligocene.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 1)

Plate LXIV, Figs 1-9.

Taxodioxylon gypsaceum (Goeppert) Kräusel (1949)

Descr. **C.** The annual rings are comparatively narrow but separate clearly into an early and a late wood. Some annual rings are only 8–10 while others 25–30 tracheids wide. The wall of the tracheids of the early wood is thin while that of the late one is much thicker. The radial diameter of the early tracheids is 70–80 μ, their width 50–60 μ. The cross sections are radially elongated rectangles or polygons. The late tracheids are radially strongly flattened, their radial diameter is 20–22 μ, and their lumina are almost slit-like. Between the tracheids of the late wood longitudinal parenchyma cells are frequent. They are filled with a dark content.

T. The rays are only 1 to 15, mostly 8 to 10 cells high. The cross section of the cells is a circle or a somewhat elongated ellipse. The height of one ray cell is 23–24 μ, its width 20–22 μ. The walls have uniform thicknesses. In the longitudinal parenchyma cells dark-orange-coloured, rounded resin knots occur. The horizontal walls are perfectly smooth, only sometimes thickening at the centre, which is definitely *Sequoia* character. In the walls of the tracheids of the late wood tiny bordered pits are scattered; their diameters are 14–15 μ, their apertures circles. The tracheid walls of the late wood are sometimes strongly striated (Figs 4 and 5).

R. In the wall of the longitudinal tracheids the bordered pits fit together by twos or threes at the same height; among them the bars of Sanio are distinctly seen (Figs 3 and 6). The diameter of the bordered pits is 16–17 μ, their lumen a circle, the margin of the torus is entire. The rays are 23–24 μ high horizontally elongated rectangles. In their horizontal walls pits scarcely occur, but their tangential walls are perfectly smooth. In the cross fields of the internal cells 2–4 taxodioid pits while in the marginal ones 4, often 6 are arranged in 2 rows, 3 each beside each other.

Note: On the grounds of the above anatomical feature this fossil, as well as that of Litke, can be classified into the form group of *Sequoia sempervirens*. Similar fossils have been determined generally as *Taxodioxylon sequoianum* or *T. gypsaceum*. In our opinion stems recorded under the name *Taxodioxylon*, which have no relationship with the genus *Taxodium* but agree in almost every respect with *Sequoiae*, should not be called *Taxodioxylon*. Such name can be related only to one genus of the *Taxodiaceae*, to *Taxodium*. In all recent species of this genus the horizontal walls of the longitudinal parenchyma cells are not smooth, since 1–2 and even 4–5 knotted or cog-wheel-like thickenings are invariably observed in them, as demonstrated by Kedves (1959a) and by Kräusel (1949). In contrast, the horizontal walls of the longitudinal parenchyma cells of *Sequoiae* are perfectly smooth, and thickenings can be found only exceptionally in them. Since in the fossil exmined these are smooth and have no pits, they primarily resemble *Sequoia* and not *Taxodium*, therefore the name *Sequoioxylon* fits them rather than that of *Taxodioxylon*. This view is further supported by the cross fields having simple pits in the same number and arrangement, and by the radial walls of the tracheids having bordered pits of 2–3 rows, as are common in recent *Sequoia sempervirens*. On these grounds the author, in contrast to the current denomination, proposes that these stems, which are almost identical, as regards structure, with *Sequoia sempervirens*, should be named as *Sequoioxylon gypsaceum* (Goeppert) n. comb.

L. Sajószentpéter; **A.** Helvetian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 2)

Plate LXIII, Figs 1–9.

Descr. **T.** The height of some rays may reach even 45–50 cells though there are much lower ones, the bulk averaging at 10–15 cells (Fig. 6). The cross sections of the rays are mostly short ellipses or rectangles; some of them have a dark cell content. Such high rays only occur in some *Podocarpus*, *Sequoia sempervirens* or in some *Taxodia*. To the rays of finer structure very often longitudinal parenchyma cells adhere, in which the dark resin content has a rounded shape (Figs 6 and 7).

R. All walls of the longitudinal parenchyma cells are smooth and thin, no thickenings or knots can be established in the transverse walls either. From this viewpoint only *Podocarpus* and *Sequoia* can enter into consideration.

The ray structure suggests some kind of *Sequoia* rather than *Podocarpus* the more so since in the radial wall of the tracheids most of the bordered pits are arranged in two rows, while in the early spring wood in three parallel rows hardly touching one another (Figs 8 and 9). Such character does not occur in *Podocarpus*, though it does in *Sequoia sempervirens*, which is also supported by the structure of the cross fields, because in the late part 1, while in the early part mostly 3 or 6 pits are arranged.

Note: The cross sections of the tracheids are angular, quadrangular, pentagonal or hexagonal. The noticeable annual ring boundary is primarily due to the tracheids of the late wood being radially flattened, and not to the different wall thicknesses. In the annual rings the wood parenchyma cells (which have a dark content) are arranged fairly parallel to the annual ring boundary (Fig. 4). The radial diameter of the single tracheids is 100–110 μ, their width 70–80 μ.

L. Litke; **A.** Lower Helvetian.

The material examined is in the Hungarian National Museum under No. A. 535.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 3)

Plate LXIX, Figs 1–4.

Descr. **C.** (Fig. 1). The annual rings are conspicuous, there is a gradual transition of the late wood into the growth ring limit; the tracheids of the late wood are thick walled but their lumina are always clearly visible. It is sometimes 10–12 tracheids wide, while the early wood can reach a width of 18 tracheids; in some cases the early wood is 35–40 tracheids wide. The radial diameter of the tracheids of the early wood is 40–80 μ, their width 50–60 μ. A number of scattered wood parenchyma cells with a dark resin content can be established.

T. The rays are 3–8–10 cells high (Fig. 2), but some of them may reach a height of 20–22 and even 42 cells. Some lower rays may widen to biseriate. The cross section of the ray cells is more of a circle or low ellipse, their height being 12–17 μ, their width 10–17 μ. In the longitudinal parenchyma cells the resin content is in general rounded and of a dark orange or brown colour, and only very exceptionally lacunar. The transverse walls of the parenchyma cells are mostly smooth and thin, sometimes uneven, very exceptionally knotted, but never cog-wheel-like thickened. The resin content of the longitudinal parenchyma cells is generally covered with a highly refractive layer. In the tangential wall of the tracheids the diameter of the bordered pits is 12–16 μ.

R. (Figs 3 and 4). In the radial wall of the longitudinal tracheids the bordered pits are generally arranged in 1–2, exceptionally in 3 (4) rows, their diameter is 13–18 μ, but twin pits with bars of Sanio very frequently occur. In one cross field there are generally 2–5 taxodioid pits, mostly arranged in one horizontal row. The border is a horizontal ellipse, the aperture of the same direction, so the longitudinal axis of the border and the aperture coincide. In rare cases they are circular, that is of glyptostroboid character. The horizontal walls of the ray cells are generally smooth, very rarely pitted, while the tangential walls are always smooth and thin. In the marginal cells 4–8 pits may occur. The height of the ray cells is 12–27 μ. The horizontal walls of the longitudinal parenchyma cells appear smooth also from this side, while the inner resin content is globularly rounded and not lacunar. Smooth-walled transverse tracheids are rather frequent (Fig. 3).

L. Várpalota, fossil marked **J**; **A.** Tortonian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 4)

Plate LX, Figs 1–7.

Descr. **C.** The annual rings are 1, 2, 3 mm wide. Their boundary is blurred, hardly noticeable. Abundant terminal parenchyma occur, the cells of which are arranged generally parallel with the annual ring boundary, almost lamellae-like. The thinness of the tracheid walls and particularly of their lumen is conspicuous. Some tracheids reach in their cross section radially 80–100 and even 120 μ. Their tangential extent is somewhat shorter, so the cross sections of the tracheids are radially elongated, at the corners somewhat rounded squares. The rays are uni- in rare cases biseriate, no pits can be observed in their horizontal walls. Similarly, the tangential walls look perfectly smooth. A darker content appears in the wood parenchyma cells.

T. The height of the rays is 3–16–18 cells, the width of the ray cells 13–15 μ, their height 18–20 μ, that of the marginal cells sometimes even more, 30–32 μ. Most rays are 8–10 cells high. Bordered pits are rather frequent in the tangential walls of the tracheids. Their diameter is 10–11 μ, their aperture a circle around which the torus sometimes is distinctly seen. In a width of 1 tracheid sometimes even 2–3 bordered pits occur, mostly arranged in loose rows or irregularly, touching each other only in exceptional cases. There are no spiral thickenings in the tracheids.

The wood parenchyma cells are rather frequent also on this slide, their interior is filled mostly with some granular content (probably starch). All the horizontal walls are smooth and very thin.

R. The horizontal walls of the radial cells are perfectly smooth, pits can be only guessed in them (Figs 4, 5, 6 and 7). So are the tangential walls (Figs 6 and 7). In each cross field 3–5 pits are arranged in 1, in the higher ones in 2 or 3 or even 6–8 rows. The border is circular while the apertures are generally of a horizontal position, sometimes rod-shaped but hardly reaching the limit of the border, at most approaching it, that is they are characteristically taxodioid pits (Figs 4, 5, 6 and 7).

In the radial walls of the tracheids the bordered pits are generally arranged in 1–2 rows (Fig. 7), there are also paired pits, but in the broader tracheids even 3 pits occur beside each other. The bars of Sanio are fairly distinct (Fig. 4). Such arrangement of the pits is more suggestive of *Sequoia sempervirens* than of *Metasequoia*. The horizontal walls of the wood parenchyma are also on this side perfectly smooth, sometimes with tiny pits in their radial walls. At some places it appears as if transverse tracheids were present.

Note: The silicified wood No. 4 was exposed in the valley Katlan-völgy at Ipolytarnóc, from the right hand locality No. I. The fossil of 12–14 cm length and 6–7 cm thickness is probably a piece of branch or root because there are traces of small branch-stumps on the surface. The fossil does not agree in its structure with any of recent *Sequoiae*. It most resembles *Sequoia sempervirens* and *Metasequoia*, which is verified by the photos.

L. Ipolytarnóc; **A.** Burdigalian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 5)

Plate LXXIV, Figs 1–4.

Descr. **C.** The annual rings, though comparatively thin, are conspicuous. Some of them are 1·5, others 0·7 mm wide. The comparatively narrow late wood measures 5–12 cell layers, while the early wood is 14–18 cells wide. The numerous wood parenchyma cells are sometimes denser in the early wood, sometimes in the late wood in which also resin cysts occur, though very rarely. The cell wall of the late tracheids is very thick, 10–12 μ, their lumen is a narrow slit or ellipse, occasionally a circle. The horizontal wall of the rays is generally smooth without pits. The tangential walls also appear to be smooth. The cross sections of the tracheids are quadrangular or polygonal with larger or smaller intercellulars at the places of contact.

T. The greatest height of the rays is 32 cells, but they are mostly 8–10 cells high.

Rays higher than 12 cells are rather seldom. They are uniseriate and only exceptionally widen to biseriate and even then only at a height of 1 or 2 cells. The cross sections of the ray cells are generally circular, their height being 16–17 (32) μ, their width 18 μ. The tangential wall is thin and smooth. The marginal cells are upright ellipses. In the interior of the numerous parenchyma cells the orange-brown resin content is lacunar and only exceptionally rounded and homogeneous. The transverse walls of the parenchyma cells are almost smooth, hardly perceptibly knotted, though 2–3–5 tiny knots may occur. The knots, however, are never cog-wheel-shaped, as would be characteristic of *Taxodia*. The heights of the ray cells are different, 20–28–37 (17–20–22); their diameter is 17–20 μ. A lacunar resin content fills most of the cells, and the cell content is rounded in the shortest cells only. Here and there the low rays are biseriate. In the tangential wall of the tracheids bordered pits can be hardly observed, their diameter is 10–18 μ. There is a red-brown resin content in some ray cells (Fig. 2).

R. In the radial wall of the tracheids the bordered pits are arranged in 2–3, exceptionally in 4 rows. The bars of Sanio are distinctly seen, particularly when there are 2 pits beside each other (Fig. 3). The diameter of the bordered pits is 14–21 μ, their aperture is a circle. The rays are homogeneous without transverse tracheids. The exterior walls of the marginal cells are undulating, but in the radial walls the pits are always simple, circular or taxodioid. The horizontal and tangential walls of the ray cells are smooth but at some places in the exterior walls of the marginal cells these appear as unevennesses. There are generally 2–6 circular pits in one cross field. The borders are sometimes clearly visible on both sides of the circular aperture, while in other cases the border is a procumbent ellipse, so the pits are typically taxodioid. The two-rowed arrangement of the pits is the greatest rarity. In the cross fields of the wide tracheids 3–4, exceptionally 5 taxodioid pits occur beside each other. There is a dark resin content in some ray cells. The horizontal walls of the longitudinal parenchyma cells are also on this side smooth or slightly warted.

Note: As to the age of the wood, the cross section supplies some information. As seen from the cross section, the annual rings are 1 mm wide or even narrower. According to Hollendonner, if the thickness of the annual rings in *S. gigantea* is approximately 1 mm, the age of the wood is about 1300–1400 years. Thus judged by the thickness of its annual rings the *Sequoia* stem examined might have been a least 1300 year old and 3–3·5 m of diameter (Fig. 1).

L. Várpalota, surface mining of Cser; **A.** Tortonian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 6)

Plate LXI, Figs 1–9.

Descr. **C.** The annual rings are distinct and conspicuous. In all annual rings the two kinds of wood are well separated from each other (Fig. 1). The thick-walled tracheids of the late wood are arranged radially (Fig. 2). The width of this zone is

20–25 tracheids. The parenchyma cells filled with a dark content are scattered. The tracheid walls of the early wood are thin, owing to the high degree of compression their cross sections are rather distorted (Figs 1 and 2). Parenchyma cells occur only sporadically in the early wood (Fig. 2). No resin ducts were found either in the late wood.

T. The rays are 8–10, but rather often 25–30–35 and even 40 cells high. Owing perhaps to the fortunate cutting, the longitudinal parenchyma cells are conspicuously numerous. These are comparatively low, and have a rounded dark content. Their horizontal walls are smooth with no thickenings or pits whatever (Figs 4 and 5).

R. While the cross and tangential slides do not supply any reliable guidance, the structure of the radial slide is more revealing. In the radial walls of the longitudinal tracheids the bordered pits are arranged in the early wood by threes and fours, very exceptionally by fives, which feature occurs only in *Sequoia sempervirens* among recent conifers.

With such arrangement of the bordered pits, the pitting of the cross fields presented most important charachteristics. In the cross fields of the rays 2–3 and even 4–5 pits occurred, and in the marginal cells – as seen in Photo 8 – even 2 × 4 and 2 × 5 simple pits were found. These are characteristically taxodioid pits inasmuch as the borders are horizontally somewhat elongated procumbent ellipses and the apertures are of the same direction or of a slightly oblique position.

Note: The silicified stem pieces of about the size of a hazelnut or a walnut have been broken off a stem of 1·5 m diameter which was discovered in the roof of the deposit No. III of Salgóbánya. Their colour was greyish black and their interior here and there quite crumbling. Some creases were seen on the annual rings of some pieces. As measured with the naked eye, the annual rings are 2–3 and even 4 mm wide.

L. Salgóbánya, roof of the deposit No. III.; **A.** Lower Helvetian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 7)

Plate LXII, Figs 1–9.

Descr. **C.** The annual rings are comparatively very narrow, yet each of them is separated into two layers. In one layer the cross sections of the tracheids are more or less distinct, while in the early part the thin-walled tracheids are greatly compressed (Fig. 1). The late wood is 10–12 tracheids wide, and the spring wood has about the same width (Fig. 2). The tangential width of the tracheids of the late wood is 70–80 μ, while their radial diameter is only 35–40 μ. So the cross sections are radially flattened oblongs. There were no resin ducts in the annual rings. The rays are compressed, and run sinuously at a distance of 2–3–6 tracheids. From the shattered inner structure of the wood one may suspect symptoms of burning which were apparent also on the exterior of the fossil (Figs 1 and 2).

T. The height of the rays ranges between 1 and 20 cells. Biseriate rays were not found. The cross sections of the ray cells are also deformed by compression, they are mostly squares, circles or upright ellipses. In the tangential walls of the tracheids the bordered pits are arranged in longitudinal rows. Their aperture is cirular. Beside the rays also longitudinal parenchyma cells occur, the transverse walls of which are somewhat uneven, and occasionally knots can be distinctly observed (Fig. 3).

R. In the longitudinal wall of the tracheids the bordered pits are arranged either in single rows or as paired pits, sometimes, however, they are irregularly scattered. The arrangement in pairs allows to infer *Podocarpus*. But paired pits occur also in *Sequoia*.

A better approach is offered by the cross field structure. The height of a 20 cell high ray was 440 μ, that of one ray cell being about 22 μ. In the cross fields 2–3 pits are arranged, but in some of them rather often only a single pit is found (Fig. 7). The pits are short procumbent ellipses or circles, the borders of which are not visible so they are rather suggestive of *Glyptostrobus*, though similar pits may also occur in some *Podocarpus*.

On the radial slide only very few longitudinal parenchyma cells could be observed. These contain a dark resin content. The transverse walls are smooth, occasionally 1–2 knots are seen on them (Fig. 3).

Note: The lignite of Várpalota was determined by Sárkány (1943) as *Taxodioxylon sequoianum*, which he brought into closer relationship with *Sequoia sempervirens*.

Varga (1942) regards the lignite exposed at Köpec in Háromszék county as the tertiary form of *Sequoia sempervirens*, i. e. *Sequoia langsdorfi*. The piece examined in many respects resembles this, as well as the lignite exposed from the Petőfi mine. Haraszty (1953) determined part of these lignites as *Taxodioxylon gypsaceum*, part as *T. taxodii*.

L. Nagybátony; **A.** Lower Helvetian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 8)

Plate LXXIV, Figs 5–8.

Descr. **C.** (Fig. 5). This fossil definitely differs from the silicified stem *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 5) of Várpalota (Photos 1–4). In the cross-section structure of our fossil the annual rings are much wider, and also the proportion between late and early woods is significantly different. It may have originated from a younger specimen of the same species, though the details seem to preclude this assumption. The annual rings may be 25–70 tracheids wide. The late wood in the narrower annual rings contains 8–10, while in the wider ones 25–30 thick-walled tracheids (Fig. 5). The annual ring boundaries are remarkably sharp, the thick-walled late tracheids with discernible lumina are followed almost abruptly by thin-walled early tracheids. In the annual rings parenchyma cells filled with a dark resin content are scattered.

The cross sections of the spring tracheids arranged in radial rows are generally rectangles. Their wall is, particularly in the early part of the spring wood, rather thin. The autumn wood presents a straight line only at the annual ring boundary, while the spring wood is remarkably undulating, which indicates that the tracheids of the autumn wood do not begin to thicken at the same time in the whole circumference (Fig. 5).

T. The rays are (Fig. 6) generally 8–10–15–20 cells high, but also 45, 50 and even 62 cell heights occur. The cross sections of the ray cells are upright rectangles or ellipses, their height is 13–27 (32), their width 10–18 μ, but they may be also lower, to the same proportion, their cross section, however, is never circular, rather it is an upright ellipse. In some ray cells a dark resin content can be observed. On the tangential wall of the tracheids the bordered pits are arranged in one, sometimes in two rows (Fig. 6). Their diameter is 10–16 μ. The aperture is circular with a 4 μ diameter. The resin content is meagre. In the longitudinal parenchyma cells it is nearly always rounded, without cavities. The horizontal walls of the ray cells are fairly smooth and even, thickenings and knots are very rare. The round form of the resin content in the longitudinal parenchyma cells and the lack of cavities in them sharply distinguish the fossil from the specimen represented in Photos 1–4, although this appears to be highly characteristic of the *Sequoia* species.

R. In the radial wall of the tracheids the bordered pits are arranged in two or three, exceptionally in four rows (Figs 7 and 8). The bars of Sanio are readily discernible, particularly between the paired pits. Both the horizontal and the tangential walls of the ray cells are smooth, a pitting can be very rarely observed; 2–3 and even 5 pits may be arranged in one row in a cross field, in other cases 5–7 pits are found in two rows or in 2–3 groups. These are typical taxodioid pits, their apertures being mostly procumbent elliptic or eye-shaped slits. The borders are distinct on both sides of the aperture. No transverse tracheids are seen. The size of the pits in the cross field is 8·6–10 μ, the aperture 4–4·5 μ. Some pits are cupressoid, when the border appears to be a somewhat oblique ellipse. The spring tracheids may be 55–80 μ wide.

Note: This lignite almost perfectly agrees with the specimen of *Taxodioxylon gypsaceum* (Goeppert) Kräusel found in the Turov mine in Poland and described by Zalewska (1953).

L. Várpalota, stem with insect remain; **A.** Tortonian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 9)

Plate LXX, Figs 1–4.

Descr. **C.** (Fig. 1). The annual rings are 6–8, in other cases 10–12 tracheids wide, 2–3 tracheids belong to the late wood. Between the early and the late woods a broad transition can be seen only in the rarest cases. The cross sections of the tracheids are generally rectangular. Their radial diameter is 30–65, their tangential diameter 35–40 μ. The rare sporadic parenchyma in the early zone is arranged beside one another and parallel to the annual ring boundary. No resin ducts or cysts are found in them.

T. (Figs 2 and 3). The rays are 1–15–30–45 cells high, but also 8–10 cell high and biseriate rays are rather frequent. Rather often the upper and lower portions of the biseriate rays become uniseriate at a height of 6–12 cells. The cross sections of the ray cells are short ellipses, their longitudinal diameters being 10–27 μ, their widths 10–20 μ. All walls are evenly thin. In the longitudinal parenchyma cells a lacunar dark orange or dark brown resin content is seen. The cells are comparatively short, 100–120–150 μ. The resin content is generally lacunar and not rounded. In the longitudinal tracheid walls the diameter of the bordered pits is **6–8 μ.**

R. (Fig. 4). In the longitudinal tracheids the bordered pits are generally arranged by threes, frequently enough by fours, very exceptionally by fives beside each other. No tracheids with one pit row occur. The rays are homogeneous. The tangential wall of the ray cells is always smooth and thin. In the cross fields 2–3, very exceptionally 4 pits are beside each other, and in the marginal cells 5–6 pits occur, the diameter of which is 9–13 μ. The pits are generally taxodioid, occasionally circular, that is glyptostroboid. The aperture is never slit-like, but a broad ellipse, around the aperture in most cases crescent-shaped borders are seen at both sides. The longitudinal parenchyma cells are sometimes remarkably large, their horizontal wall is always thin and perfectly smooth.

Note: The structure of this wood is suggestive primarily of *Sequoia sempervirens*, it has, however, many features in common with *Metasequoia*, from which it differs mainly by its very narrow late wood.

L. Várpalota, fossil marked E; **A.** Tortonian.

Sequoioxylon gypsaceum (Goeppert) n. comb. (No. 10)

Plate LXX, Figs 5–8.

Descr. **C.** The annual ring boundary is conspicuous, the annual rings are (Fig. 5) only 5–6, very exceptionally 20–25 tracheids wide. The late zones are also narrow, some of them are 2–3, others 5–6 tracheids wide. The transition is not gradual but in most cases sudden. Both in the autumn and in the spring wood the longitudinal parenchyma cells filled with a reddish-brown resin content are rather frequent. The radial diameter of the tracheids is 40–50 μ, their width in general 40–45 μ. Their lumina are narrowing towards the annual ring boundary, where they are almost slit-like. The walls of the late tracheids are 11–14, those of the spring tracheids scarcely 4–6 μ thick.

T. (Fig. 6). The rays generally 6–8–15 cells high are often biseriate. Others are

30–40 cells high and may broaden here and there to 2 cell layers. In the high rays there is nearly always a biseriate sector, and in some cases this repeats itself 2 or 3 times, which is probably due to the coalescence of 2–3 rays above each other. The wood is rich in parenchyma, and the parenchyma cells are generally filled with a reddish-brown resin content shaped as rounded knots. The transverse walls of the parenchyma cells are smooth or warty (Fig. 7), uneven, but thickenings never occur in them. The cross sections of the ray cells are generally circular or short upright ellipses. Their height is 16–27 (40) μ, their width 10–16 μ. In the tangential wall of the tracheids the diameter of the bordered pits is 10–12 μ.

R. (Fig. 8). In the walls of the longitudinal tracheids the bordered pits are arranged in 2–3, occasionally in 4 rows. Here and there simple pits appear in the horizontal walls of the rays. There are 2–3 tiny taxodioid pits beside each other in the cross fields but sporadically almost round glyptostroboid pits occur.

Note: The structure of the wood is more similar to *S. sempervirens* than to *Taxodium*, though *Glyptostrobus* may also enter into consideration.

L. Várpalota, fossil marked F; **A.** Tortonian.

Sequoioxylon sp. (No. 1)

Plate LXV, Figs 1–6.

Descr. **C.** The periodicity of the late and early wood in the annual rings could be established at some places. The late wood has a width of scarcely 3–4 tracheids, while the early wood is wider than that, even in its compressed state. The parenchyma cells containing dark resin are scattered in the annual rings but sometimes are arranged parallel to the annual ring boundaries. Half of the tracheids of the late wood are evenly thick, the lumina are sometimes slit-like, owing partly to compression.

T. The height and arrangement of the compressed rays could not be determined, the presence of longitudinal parenchyma cells is suspected from the shape and arrangement of the dark resin granules.

R. The same refers to the radial slide. The longitudinal parenchyma cells and the majority of the ray cells are filled with a dark resin substance; the resin content is rounded or of lacunar structure. The bordered pits are generally arranged in one row in the longitudinal tracheids, the taxodioid pits in the cross fields are solitarily or arranged in pairs. No finer details could be established either in the ray cells or on the transverse walls of the longitudinal parenchyma cells.

Note: From the above data we may safely infer that the fossil is some sort of *Sequoioxylon* with the restriction that it is more suggestive of *Sequoia gigantea* than of *Sequoia sempervirens.*

L. Várpalota, Rudolftelep, eastern main line of the shaft Lejtősakna, silicified part of the deposit; **A.** Tortonian.

Sequoioxylon sp. (No. 2)

Plate LXV, Figs 7 and 8.

Note: The fossil was so compressed that its structure could not be made out. Neither the cross slides nor the longitudinal ones present the characteristic properties of the histological structure of the wood. Only the resin content and the shape of the wood parenchyma cells could be definitely established. By the numerous comparative material, and by the shape of the resin-like substance in the longitudinal parenchyma cells, this fossil must be regarded as some *Sequoioxylon*. In support of this, another portion of the slide supplies some information on the rays, which are generally 6–10 cell layers high, corresponding more to the features of *Sequoia gigantea.*

Without exact knowledge of the finer structure of the rays, we regard the fossil characterized by the above features as some kind of *Sequoioxylon.*

L. Pécsszabolcs, István shaft; **A.** Helvetian.

Sequoioxylon sp. (No. 3)

Plate LXIX, Figs 5–8.

Descr. **C.** (Fig. 5). The autumn zones are almost intact, while the spring zones, which might have been at least 25–30 tracheids wide, are greatly compressed. In the annual rings there are rather many scattered parenchyma cells filled with a dark resin content. The walls of the late tracheids are thick (6–13 μ), but their lumen is always readily discernible and only exceptionally narrow slit-like. There is a gradual transition from the spring wood into the late one.

T. (Figs 6 and 7). The rays are comparatively low, 1–8, mostly 7–8 cells high, though 20–35 cell high ones also occur. The cross sections of the ray cells are circular, their height being 22–27, their width 17–21 μ. The horizontal walls are strongly thickened, while the radial walls are thin. In the longitudinal parenchyma cells the resin content is always globular, the transverse walls are sometimes unevenly thickened (Fig. 7). The parenchyma cells may attain a height of 16–20–30 μ. In the tracheids of the late wood the bordered pits are arranged in 1 or 2 rows, their diameter is 10–13 μ, their lumina are circles or somewhat vertical slits.

R. The rays are heterogeneous, here and there the contours of the transverse tracheids are visible (Fig. 8). The horizontal walls of the ray cells are thick and smooth, while the tangential walls are thin and smooth. In the cross fields there are 1 or 2 taxodioid pits, in the marginal cells 3–4 pits occur. In the radial wall of the longitudinal tracheids the bordered pits are scattered and arranged in 1, rarely in 2 rows. Among the paired pits the bars of Sanio are usually well discernible. The aperture of the bordered pits is circular.

Note: The structure of this wood is suggestive of *Sequoia*, though by no means of those species in which all walls of the rays are thin and smooth and in whose cross fields there are 6–8 pits. The wood resembles *S. gigantea* rather than *S. sempervirens*.

L. Várpalota, fossil marked K; **A.** Tortonian.

Sequoioxylon sp. (No. 4)

Plate LXXII, Figs 5–8.

Descr. **C.** (Fig. 5). The annual rings are comparatively narrow, 8–10–15 tracheids wide. The annual ring boundary is conspicuous, the late wood is sometimes only 2–3, sometimes 5–6–7 tracheids wide. The wood contains many longitudinal parenchyma cells filled with a dark-orange resin content. The tracheids of the late wood are thick walled, but their lumina are always easily discernible. Slit-like lumina very seldom occur. The radial diameter of the tracheids is 55–60, their width 50 μ.

T. (Fig. 6). The rays are 3–15–20 cells high, but 30–40 cell high rays also occur. The cross sections of the ray cells are generally circular. 7 ray cells are found within 142 μ, so the height of one ray cell is about 20–27 μ, the width is 14–16 μ. In the tangential wall of the longitudinal tracheids of the late wood the bordered pits are scattered in 1–2 rows. Their aperture in the late wood is a vertical slit. In the longitudinal parenchyma there is a dark-orange resin content which is mostly rounded, globular; lacunar structure only exceptionally occurs. The longitudinal parenchyma cells are comparatively low, their length is 270–150–100–80–60 μ. The horizontal walls are generally smooth, but there are rather many transverse walls of uneven or knotted surface (Fig. 6). The thickenings, however, are never cog-wheel-like, so they are more of *Sequoia* than of *Taxodium* character.

R. In the radial wall of the longitudinal tracheids the bordered pits are arranged in 2–3 rows (Figs 7 and 8), not compressed, the bars of Sanio are rather distinct between them. In the longitudinal parenchyma cells the resin content is fairly often lacunar and nearly fills the whole of the cell. In the cross fields 3–4–7 taxodioid pits alternate in two rows. The horizontal wall is generally smooth, while the tangential wall is always smooth and thin. In the marginal cells sometimes 6 taxodioid pits are arranged in 2 × 2 rows, while in other cases the arrangement is irregular. In the cross fields the borders of the pits are always elliptic, the aperture in most cases fills the border. The diameter of the pits is 9–12 μ. Some rays are flanked by a thin-walled parenchyma. Also this fossil must be some kind of *Sequoia*, resembling mostly *S. gigantea*.

L. Várpalota, fossil marked A; **A.** Tortonian.

Sequoioxylon sp. (No. 5)

Plate LIV, Fig. 9.

Note: The fossil was received in so disorganized a state that hardly any slides suitable for determination could be prepared of it. Yet from the radial slide it could be established that the fossil derived from some conifer. In the longitudinal wall of the tracheids the bordered pits are arranged either above each other or beside one another in 1–2 rows, and the bars of Sanio are visible; in the cross fields 1–2 taxodioid pits can be guessed; therefore the fossil may be regarded as a *Sequoioxylon*.

L. Eger; **A.** Helvetian.

The original material is in the Hungarian National Museum under No. A. 538.

Sequoioxylon sp. (No. 6)

Plate LXXIII, Figs 1–4.

Descr. **C.** (Fig. 1). The annual rings, on account of the strong compression, are comparatively narrow. The 2–8 rows of the thick-walled late tracheids sharply differ from the thin-walled tracheids of the early wood. The wall thickness of the thick-walled tracheids is 6–13 μ. The annual rings abound in longitudinal parenchyma which in the early wood is somewhat more plentiful than in the late one. The radial diameter of the tracheids is 65–80 μ, their width 50–55 μ. The lumen of the autumn tracheids is relatively narrow, often – particularly at the inner limit of the autumn wood – only slit-like.

R. (Figs 3 and 4). In the tracheid walls the bordered pits are exceptionally arranged in 4–5 rows, not compressed, the bars of Sanio are readily discernible. There are 2–3–4 typical taxodioid pits in the cross fields, so in a somewhat elliptic border the aperture is a procumbent ellipse. The pits alternate in one or in two rows. The horizontal walls of the ray parenchyma cells are generally smooth, very exceptionally with 1–2 simple pits, sometimes also indentures can be observed; the radial wall always thin and smooth has no knots or thickenings. The resin content in the parenchyma cells is not lacunar, it is perfectly homogeneous and only rarely oblong; it is not rounded either.

Note: The whole structure of the wood is *Sequoia*-like and belongs to all probability to *S. gigantea*.

L. Várpalota II.; **A.** Tortonian.

Sequoioxylon sp. (No. 7)

Plate LXXIII, Figs 5–8.

Descr. **C.** (Fig. 5). The late wood in this specimen is also 10–15 tracheids wide, and includes scattered parenchyma cells with a dark resin content. The tracheids are 28–30 μ wide, while their radial diameter is only 15–16 μ.

T. (Figs 6 and 7). The rays are 6–10, exceptionally 30 cells high. The cross section of the cells is rather an upright ellipse, their height being 13–18 (27) μ, their width 6–13 μ. In the tracheid walls the bordered pits are arranged in 1–2 loose rows, their diameter is 8–13 μ. In some ray cells a dark resin content is found.

R. (Fig. 8). The bordered pits are arranged in single or paired longitudinal rows in the radial wall of the tracheids, in some wider tracheids even 3 bordered pits are situated beside each other, but the borders of the pits are never compressed. There are 2–3 (4) taxodioid pits in the cross fields, so the borders are procumbent ellipses with a diameter of 5–8 μ. The height of the ray cells varies between 13 and 27 μ. The tangential walls of the ray cells are perfectly smooth and thin. The longitudinal parenchyma cells contain 5–6 smaller resin granules, sometimes only 1–2, which are always rounded. The transverse walls of the parenchyma cells are smooth and even (Fig. 7). The cross sections of the ray cells are upright and narrow ellipses, which is partly due to the strong compression. The tangential wall of the ray cells is perfectly smooth. It is interesting that the wall of some tracheids is densely warted. No bead-string- or cog-wheel-like thickenings could be observed in the transverse wall of the longitudinal parenchyma cells. Thus the fossil examined is of *Sequoia* character.

L. Várpalota, fossil marked **IV.**; **A.** Tortonian.

Sequoioxylon sp. (No. 8)

Plate LXXV, Figs 1–4.

Note: The fossil was so disorganized and carbonified that no useful slides could be prepared from it. So we can only ascertain that the fossil belongs to *Taxodiaceae.* In the definite annual rings the late wood is always much narrower than the spring one.

T. The rays are 3–8–10 cells high (Fig. 4). No more exact details of the structure of the rays and of the longitudinal parenchyma cells could be established. But since the fossil, disorganized as it is, almost perfectly agrees with the *Sequoioxylons* examined so far, we propose merely for mention's sake to record it as *Sequoioxylon* sp.

L. Spoil-bank of the Becske coal mine; **A.** Burdigalian.

Sequoioxylon sp. (No. 9)

Plate LXVI, Figs 1–9.

Note: In addition to the anatomical features (broad autumn wood, definite annual ring boundary, longitudinal parenchyma with smooth horizontal walls, smooth tangential walls of the ray cells), the presence of a single pit in the cross fields allows to infer the genera *Sequoia*, *Thuja* or *Chamaecyparis*, respectively. In *Sequoiae*, the transverse walls of the longitudinal parenchyma cells are smooth, though sometimes slightly thickened at the middle, and also pits may occur in them, which could not be observed in the fossil. But in some of the *Chamaecyparis* and *Thuja* the morphological properties are similar to those in our fossil, therefore it must be regarded as *Sequoioxylon*, in the second place as *Cupressinoxylon*, and within this family mainly as *Chamaecyparis*. On the other hand, the pits arranged in pairs and threes in the longitudinal tracheids allow to infer *Taxodiaceae* and primarily *Sequoia*.

L. Pestszentlőrinc, gravel of Mount Sashegy; **A.** Originating from Helvetian layers and transferred into Pleistocene gravel.

Sequoioxylon sp. (No. 10)

Plate LXXI, Figs 1–4.

Note: As regards anatomical structure, the wood beyond doubt belongs to the genus *Sequoia*, and it is a *Sequoioxylon*, though it shows a great similarity to *Metasequoia*.

L. Várpalota, fossil marked **C**; **A.** Tortonian.

Sequoioxylon sp. (No. 11)

Plate LXXI, Figs 5–8.

Descr. **C.** (Fig. 5). The high degree of compression is conspicuous, particularly in the spring wood. The annual ring boundary is sharp, the tracheids of the spring wood are quadrangular and polygonal. The autumn wood begins abruptly and is generally 5–10 tracheids wide. In the spring wood there is a comparatively scarce, dark-coloured longitudinal parenchyma.

T. The rays are 1–8 cells high (Fig. 6), but 20 and even 30–32 cell heights rather often occur. The cross sections of the ray cells are circular or short ellipses, their height being 17–20 (30) μ, their width 13–18 μ. The terminal cells are somewhat elongated ellipses. Their horizontal and radial walls are thin and smooth. The bordered pits in the wall of the longitudinal tracheids are arranged in one or two rows, their diameter is 9·5–16 μ. The resin content of the longitudinal parenchyma cells is mostly globular and of a dark-orange colour. The height of the cells ranges from 20–22 μ to 60–70 μ. Their horizontal wall is generally smooth, but at some places, particularly in the broader parenchyma cells, rather conspicuous bead-like thickenings are seen.

R. The bordered pits in the radial wall of the tracheids are either single (Figs 7 and 8) or paired, but fours may also occur; their diameter is 12–18 μ. The horizontal walls of the ray cells are smooth, at some places rather thick. There are 1, occasionally 2 taxodioid pits in the cross fields; in the marginal cells there may be 6–7 pits arranged in two rows (Fig. 8). The diameter of the pit measures 6–9 μ. The border is circular in most cases and is sometimes easily discernible.

Also this fossil can be related, primarily by the structure of its rays, with *Sequoia gigantea*, but it resembles somewhat *Metasequoia*, too.

L. Várpalota, fossil marked D; **A.** Tortonian.

Map 11. Recent and fossil distribution of the genus *Sequoia*. Sites from the Cretaceous to the Pliocene. Tertiary sites in Hungary (square)

Taxodioxylon taxodii Gothan

Plates LXXVI–LXXVII, Figs 1–9.

Descr. **C.** manifests the conifer character at first glance. The uniseriate rays run in the radial direction at a distance of 6–10 tracheids. The width of the annual rings is 40–60 tracheids, of which 5–6 tracheid rows belong to the late wood. The autumn wood is not conspicuous, the annual ring boundary is fairly well perceptible. The radial diameters of the tracheids are 50–60 μ in the spring wood, 25–40 μ in the late one, where the lumina of the tracheids appear as narrow slits. There are no resin ducts in the annual rings, but the spots corresponding to some tracheids are filled with a dark resin content, which probably indicates parenchyma. Disorganization of the annual rings was so strong in some patches that the tracheid walls almost completely disappeared.

T. Some of the rays are 50–60 cells high, but most of them have a height of 10 to 15 cells, in some places they widen to become biseriate. Of recent conifers only some *Podocarpus* and in *Taxodiaceae* only *Taxodium distichum* have such high rays. The cross sections of the ray cells are generally circular, their height ranges from 18 to 20 μ. In the tangential walls of the tracheids, the spots of tiny bordered pits are seen occasionally. The longitudinal parenchyma cells contain tiny, rounded, dark resin knots.

This tangential structure perfectly agrees with that of the recent *Taxodium distichum* as demonstrated by the Figs 2a and 2b in Plate LXVI. The left-hand picture represents the fossil, the right one the recent *Taxodium distichum*, both in 1 to 100 magnification. These two pictures so fully agree that they are hard to be distinguished from one another. In recent *Taxodium distichum* there are perhaps more low rays of two or three layers than are in our fossil, which, however, does not make any difference.

The fossil has plenty of longitudinal parenchyma cells, the transverse walls of which are most characteristically thickened in the bead-like pattern. On one transverse wall even 6–8 knots of different size may occur, large ones alternating with smaller ones, as seen in Fig. 4b of Plate LXXVII. This pitting, or thickening respectively, perfectly agrees with that observed in recent *Taxodium distichum* as shown by Fig. 3 of identical magnification. Also the horizontal walls of the longitudinal parenchyma cells of recent *Taxodium distichum* show a bead-like thickening in most cases. Figures 3 and 4 prove an almost full identity of the tangential structure of the fossil of Nagyréde with that of recent *Taxodium distichum*.

R. A striking similarity, almost identity, is shown also by the radial structures. The horizontal walls of the considerably disorganized ray cells appear to be smooth, but a closer examination reveals a definite pit system, though the tangential walls are invariably smooth (Fig. 8b).

The pitting of the cross fields is most peculiar in the fossil. Generally one, exceptionally two circular circopore pits are found in the early wood, while in some cross fields of the late wood and in the marginal cells 3–4 tiny, completely circular pits without border are seen. The extent of the pits is 7–8 μ,which is only half or rather one-third of the 18–22 μ high ray cell. No perfect taxodioid pits could be observed. Sometimes two circular pits seem to appear beside each other, probably because such pits occur also on the opposite wall of the ray cell, though in a somewhat different position, as seen in the marginal ray cell in Fig. 8a, Plate LXXVII.

Also perfectly circular pits of the same size but without any taxodioid character are found in the cross fields of the ray cells of the recent *Taxodium distichum*. Both in this and in the fossil the sizes of these circular pits completely agree. The only difference is perhaps that in the cross fields of the recent *Taxodium distichum* these tiny circular pits appear in a somewhat greater number.

The similarity becomes only more conspicuous when the size and arrangement of the bordered pits in the longitudinal tracheids are examined. In the walls of these the bordered pits are arranged either in a single longitudinal row or by pairs. When arranged thus the bars of Sanio are always distinct between them, as shown in Fig. 9, Plate LXXVII. The diameter of the bordered pits is 19–20 μ, their lumina are circular; there are tiny warts arranged radially on the surface of the border pits. More than two bordered pits never occur beside each other, not even in the widest tracheids of the spring wood. This phenomenon again allows to infer *Taxodium* rather than *Sequoia*.

Note: The above xylotomy is definitely suggestive of some kind of *Taxodium*, the structure being most similar to that of the recent *Taxodium distichum*, though not in perfect agreement with it. The name best corresponding to *Taxodium distichum* being *Taxodioxylon taxodii* Gothan, we propose to designate the fossil by this denomination.

L. Nagyréde; **A.** Tortonian.

Taxodioxylon cf. *taxodii* Gothan

Plate LXXVIII, Figs 7–9.

T. The most conspicuous feature is the height of the rays, the pitting of the horizontal wall of the longitudinal parenchyma cells and the presence of bordered pits in the tangential wall of the longitudinal tracheids. The rays are 1–40–45 cells high (Fig. 13), the cross sections of the cells are circles, short upright of procumbent ellipses. The high rays generally broaden at the middle to 2 cells. The horizontal walls of the longitudinal parenchyma cells are smooth or warty (Fig. 3), or cog-wheel-like thickenings, mostly 1 or 2, are seen in them (Fig. 2). These features are suggestive of *Taxodiaceae*, particularly of *Taxodium*.

Note: Only a tangential slide could be prepared from this fossil which, however, was sufficient to establish the approximate place of the fossil.

The structure of the cross fields is not known, but by the above anatomical features the fossil may be regarded simply as *Taxodioxylon*. From recent *Taxodia* it is most suggestive of *Taxodium distichum*.

L. Buják; **A.** Sarmatian (secondary).

7. PINACEAE

Cedroxylon sp.

Plate LXXIX, Figs 1–9.

Note: As regards anatomical structure, the fossil may belong to *Cupressaceae*, *Taxodiaceae* or *Pinaceae*. The tangential rows of the resin cysts are highly suggestive of *Cedrus* and some *Abies* in which similar features occur. The location of the resin cysts, the presence of parenchyma cells, the identical diameters of rays and ray cells make it very probable that the fossil is a kind of *Cedrus*. The observable anatomical properties present the greatest similarity to recent *Cedrus*, therefore we name the fossil *Cedroxylon*. No more exact specific determination is possible, since the finer structure is not known.

The resin cyst in tangential arrangement is identical with that of the recent *Cedrus libani* or *Cedrus deodara*. (See Map 8.)

About 40 species of *Cedroxylons* are known to have come up from the Oligocene, and according to some authors even from the Cretaceous. With which one of these the fossil may have been identical could not be decided, since the comparative material is lacking.

The present geographical distribution of the genus *Cedrus* is widely scattered. *Cedrus libani* is found in the Mediterranean area, in the Taurus and Antitaurus mountains, *Cedrus deodara* in North-Western India, Afganistan and Beludjistan, while *Cedrus atlantica* in North Africa in the Atlas mountains.

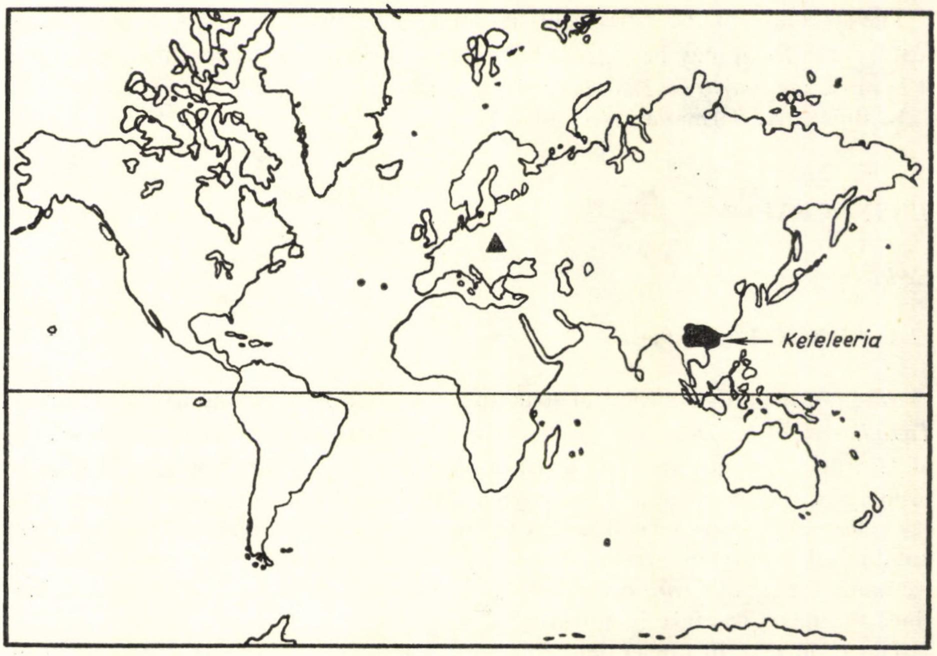
L. Nógrád; **A.** Helvetian.

Andreánszky (1959, p. 51) records a *Cedroxylon* from Mikófalva.

Keteleeria sp.

Plate LXXV, Figs 5–7.

Descr. **C.** The periodicity of the annual rings is conspicuous (Fig. 5). The spring wood is somewhat compressed, while a broader late wood clearly shows the coniferous structure. No resin ducts or longitudinal parenchyma cells were found in the slide.



Map 12. Recent distribution of the genus *Keteleeria*. Hungarian fossil site (triangle)

T. Figure 6 presents the tangential structure of the wood. Its rays are generally uniseriate, but at a height of 2–3 cells they may broaden to biseriate (Fig. 7). Some rays may reach a height of 28–30 and even 40 cells. Generally they are 8–10–12 cells high.

R. Unfortunately, the radial slide was not suitable for an adequate study of the radial structure of the rays.

Since in the silicified wood examined there are no resin ducts and the rays are uni-, exceptionally biseriate, it is probable that the fossil in question originates from some *Abies*, possibly *Keteleeria.*

Keteleeria lived during the Tertiary in the area of Central Europe as verified by some record. Thus Mrs Nagy and Pálfalvy demonstrated pollen grains from the Upper Oligocene of Eger, Pálfalvy winged seeds from the Helvetian sediments of the Mecsek mountain, Pop *Keteleeria* needles and pollens from Borszék. *Keteleeria leehri* also lived in Germany in the Upper Pliocene.

L. Ipolytarnóc, site No. V., fossil marked Katlanvölgy 6–7; **A.** Burdigalian.

Laricioxylon nógrádense n. sp.

Plate LXXXVI, Figs 1–6.

Laricioxylon nógrádense Greguss n. sp.

Diagnosis: Tractus resiniferi plerumque in zona posteriore, plus-minus alius iuxta alium seriati 170–180 μ diam. intrinsecus cellulis crassis epithelicis cooperti. Radii medullares 1–stratosi, altitudine ex 1–20 cellulis constructi, radii medullares tractus resiniferes continentes aliquantulum crassiores altioresque. Cellulae radiorum medullarium 20–24 μ altae, in zonis ex radiis medullaribus tracheidisque formatis 4–6 (8) pori simplices piceoides, apices tracheidarum transversalium longe, rostriformiter alter alterum obtegentes. Paries tracheidarum transversalium levis.

Descr. **C.** The annual ring boundary is rather conspicuous (Figs 1 and 2), the widths of the spring and the late wood are about the same. The cross sections of the tracheids are generally angular and arranged radially in parallel rows. Their radial diameter is 35–40 μ, their width 35–38 μ. The resin ducts situated mostly in the late wood run more or less parallel to the annual ring boundary, their diameter is 170–180 μ but larger and smaller ones also occur. The ducts are lined with thick-walled epithelial cells.

T. Two kinds of rays can be easily distinguished by their structure and size. The simple rays are 1 layers wide and 1–15–20 layers high (Fig. 4). The cross sections of their cells are generally circles or short ellipses. The horizontal resin ducts run in the interior of the broader rays (right side in Fig. 4). The resin duct is situated at the middle of the ray, its epithelial cells are thick walled. The rays containing the ducts have an elongated spindle shape which form is particularly characteristic of the recent *Larix*. Scarce parenchyma cells also occur whose finer structure, however, owing to disorganization, is not easy to discern.

R. The cross and tangential structures show *Larix* origin. This assumption is also supported by the pitting of the tracheids and by finer structure of the rays. The bordered pits in the tracheid walls are arranged in 1 or 2 longitudinal rows opposed to each other (Fig. 3). The bars of Sanio are fairly well visible between the single pits.

Features most characteristic of the genus are displayed by the ray structure. The simple pits in the cross fields are arranged by fours to sixes, possibly by eights, generally in 2 rows. Although the borders of the tiny pits are not visible, still one may infer *Larix* from the arrangement of the pits (Fig. 5).

Larix properties are best revealed, however, by the shape and structure of the adjoining tracheids, in so far as the end of the one tracheid elongated like a crooked beak covers the tapering end of the opposite transverse tracheid (lower part of Fig. 6). This structure is so characteristic of almost all recent species of *Larix* that they can be distinguished at first glance from other conifers with resin ducts such as *Pinus*, *Picea*, *Pseudotsuga*, particularly from the last mentioned one in whose tracheids and transverse tracheids there run spiral thickenings. Since the fossil examined is a *Larix* by all certainty, we propose to name it as *Laricioxylon*.

Note: According to the current practice of determination, we ought to range this fossil under the collective generic name *Piceoxylon*. Since, however, the finer anatomical features ascertain the character of the genus *Larix*, it obtains the more exact denomination *Laricioxylon*.

L. Nógrádszakál; **A.** Sarmatian.

The original material is in the Hungarian National Museum under No. 6140/1.

?Laricioxylon sp.

Plate LXXXVI, Figs 7–9.

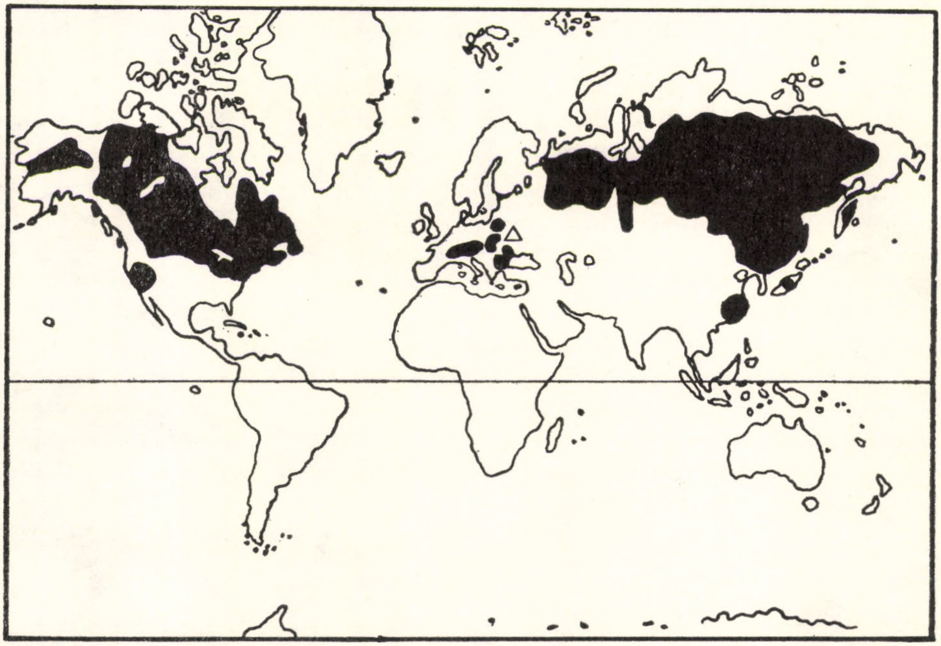
Descr. **C.** It somewhat differs from the previous fossil, since the tracheids in its late wood have much thicker walls and the resin ducts are located directly along the annual ring limits. The diameter of the resin duct is 80–90 μ.

T. The genus can be inferred from the tangential structure. The rays with resin ducts are somewhat lower than they are in the species discussed above, but rays are also frequent in which 2 or even 3 resin ducts run above each other (Fig. 8). The wall of the epithelial cells are thick, so we may infer *Picea* or *Larix*, but the elongated spindle shape of the rays with resin ducts is suggestive of *Larix* rather than *Picea*.

The height of the ray cells is 20–22 μ, and 4–6 simple pits can be guessed in the cross fields. Some difference as against the previous species is that in this one the transverse tracheids are much lower and more elongated than are the parenchyma cells of the rays.

L. Megyaszó; A. Lower Pannonian.

The original material is in the Hungarian National Museum under No. 61. 15. 1.



Map 13. Recent distribution of the genus *Larix* (after Krüssmann). Miocene sites in Hungary (triangle)

Pinuxylon haploxyloides n. sp.

Plate LXXX, Figs 1–7.

Diagnosis: In stratis concentricis zona prior in posteriorem gradatim transiens. Limes stratorum concentricorum distinctus. Meatus resiniferi pauci, diametro 130–140 μ. Radii medullares simplices altitudine ex 8–12 cellulis constructi, iidem meatus resiniferos continentes aliquantulum altiores latioresque. In zonis ex radiis medullaribus tracheidisque formatis plerumque 1, raro 2 pori pinoides, totam hanc zonam implentes. Radii medullares tracheidae transversales apicibus valde elongatis poris foveolatis inter se conjunctae.

Descr. C. The annual rings are comparatively broad (10–15 mm), their boundary is distinct; the spring wood shows a gradual transition into the late wood in the outer part of the annual ring (Fig. 1). There are few resin ducts, the cross sections of the tracheids are more or less isodiametric, their corners rounded (Fig. 3). At the annual ring boundary, the radial diameter of the tracheids of the spring wood is

45–50 μ, that of the late wood 24–26 μ; the walls of the latter are very thick, their aperture in most cases slit-like. The rays are uniseriate, at some places slightly broadening. The resin ducts are comparatively small (Fig. 2), their diameter may reach 130–150 μ, the walls of the epithelial cells are thin.

T. The rays are 1–10–12 cells high, those containing resin ducts sometimes thicker than that (Fig. 4). Transverse tracheids with thicker walls are seen at the margin of the wider rays containing resin ducts, while in the interior thin-walled epithelial cells are found. Judged by the tangential ray structure, the fossil belongs to the genus *Pinus*.

R. Quite low parenchyma cells occur in the middle of the broader rays; these are the epithelial cells of the resin ducts; pinoid pits completely filling the cross fields are arranged in the cross fields of the somewhat higher rays (Figs 5–7). The rays are bordered both above and below by transverse tracheids with perfectly smooth walls; thus the wood belongs to the *Haploxylon* type (Figs 5 and 6). A *Pinus* of the *Haploxylon* type, namely *Pinuxylon tarnócziense*, occurred among the fossils of Ipolytarnóc. The present fossil, however, substantially differs from the former, because there is only one large pinoid pit in its cross fields each, while the number of these in *Pinuxylon tarnócziense* is mostly 2, sometimes 3. We propose to distinguish the silicified wood from other *Pinus* species by the name of *Pinuxylon haploxyloides*.

L. Karancsberény; **A.** Helvetian.

The original material is in the Hungarian National Museum under No. 208.

Pinuxylon albicauloides Greguss

Plate LXXXI, Figs 6–9.

Pinuxylon albicauloides Greguss (1954)

Descr. **C.** shows the characteristic features of the genus *Pinus*. The single annual rings are generally narrow, the resin ducts run mostly in the late wood (Fig. 6). Their cross sections are somewhat flattened ellipses. There is a gradual transition of the spring wood into the autumn one; at some places the former is heavily compressed (Fig. 6).

Note: According to my examinations (1954), the fossil marked No. 5 well fits into the group *Pinus strobus*, for the walls of the transverse tracheids are perfectly smooth and there is 1 pinoid pit filling the whole cross field. It is occasionally filled by two large pits. The examination of the comparative material revealed the structure of the fossil to be highly suggestive of the interior structure of *Pinus albicaulis*.

This species lives together with *Pinus lambertiana* and *Sequoia sempervirens* in the Sierra Nevada mountains.

The only difference in the structure of the two woods is that the tracheids bordering the rays form sometimes 3–4 layers in the silicified wood which can be rarely observed in *Pinus albicaulis* where the transverse tracheids are arranged only in 1, occasionally in 2 layers.

Since this silicified wood shows only partial agreement with *Pinus albicaulis*, we designate it by the name *Pinuxylon albicauloides*.

L. Ipolytarnóc, Borókásárok; **A.** Burdigalian.

Pinuxylon tarnócziense (Tuzson) Greguss n. comb.

Plate LXXXI, Figs 1–5; Plate LXXXII, Figs 6–14; Plate LXXXIII, Figs 1–9.

Pinus tarnócziensis Tuzson (1901)
Pinuxylon lambertoides Greguss (1954)

Descr. Since the radial structure of the rays and the perfectly smooth walls of the transverse tracheids and their arrangement in 2–3 layers fully agree with the recent *Pinus lambertiana*, we may regard this living species as a late successor or very near form of *Pinus tarnócziensis*. This statement would be justified only if in addition to the records from Tarnócz not only 12–14 cm long shoots with 5 needles but also characteristic strobiles were found.

According to the rules of nomenclature, the correct denomination of *Pinus tarnócziensis* Tuzson is *Pinuxylon tarnócziense* (Tuzson) n. comb.

Note: Tuzson (1901) deals in detail with a silicified wood found in a gully near the village Tarnócz in Nógrád County. The fossil stem was discovered by F. Kubinyi in 1837 and named *Petrefactum giganteum humboldti*. According to contemporary descriptions, the whole stem might have been about 46 m long, together with the crown the tree may have had a height of 56 m. The circumference of the stem at an 8 m height was 3·8 m, which corresponds to a diameter of 1·2 m. Félix (1887) ranged the stem into genus *Pityoxylon* Krauss, but did not determine it as a species.

Tuzson later (1902) detailed the cross section, and the radial and tangential structure of the wood. He concluded that the fossil resembled no recent conifers, save *Pinus longifolia* growing in the southern parts of the Himalaya mountains. This assumption, however, could not be supported by the anatomical description of the stem of *Pinus longifolia* which was not available for him. Kräusel (1949) ranged *Pinus tarnócziensis* into the collective genus of *Pinuxylon* and in the form group of *Pinus succiniferum* (Goeppert) Kräusel, in which the walls of the transverse tracheids are perfectly smooth and more than 3 pits occur in each cross field.

From Kubinyi's site originates also the fossil No. 1 described above, the xylotomy of which fully agrees with that of the fossil described by Tuzson in 1901. Since the specimens examined differ from the species *Pinuxylon succiniferum*, we propose as correct denomination *Pinuxylon tarnócziense* (Tuzson) n. comb.

L. Ipolytarnóc; **A.** Burdigalian–Lower Helvetian.

Pinuxylon sp. (No. 1)
Plate LXXXIV, Figs 1–3.

Pinuxylon sp. (No. 2)
Plate LXXXIV, Figs 4–6.

Pinuxylon sp. (No. 3)
Plate LXXXIV, Figs 7–9.

Note: Beside those discussed above, there lived at least three other species of *Pinus* in the lower Miocene in the environments of Ipolytarnóc. This seems to be verified by the microphotos of the slides of the fossils listed. Three kinds of cross slides of the same magnification are shown in Plate LXXXIV. In Fig. 1 the resin duct very distinctly appears. Also this piece originates from the fossil site of Kubinyi. There is no resin duct shown in Fig. 3, simply because the annual rings are so broad as to leave no room for the representation of the resin ducts. The annual rings, however, are conspicuous (Fig. 4).

Figure 7 made from the slide of another stem, namely No. 8 originating from the Katlanvölgy valley, shows the structure of a complete annual ring. The spring wood also here exhibits a gradual transition into the late wood, the annual ring boundary is conspicuous. The resin duct is comparatively narrow and is concealed more in the late wood. The cross section pictures of *Pinus* Nos 1, 4 and 7 in Plate LXXXIV show three kinds of structure in identical magnification from which three different *Pinus* species may be inferred.

This is fully verified also by the tangential slides. Figures 2, 5 and 8 of Plate LXXXIV show the tangential structure of the three woods previously dealt with. In Fig. 2, besides the uniseriate rays, short sturdy rays with resin ducts are seen. The height of the rays is 6–8 cells, the rays containing resin ducts are somewhat higher. In Fig. 5 of Plate LXXXIV the ray structure definitely differs from that of the stems discussed above, because here the rays may be even 15–20 cells high. The resin ducts run at the middle of the broad rays. The widened part narrows down to uniseriate both upwards and downwards at a height of 8–10 cells. Thus the structure distinctly differs from that of the previous fossil.

The ray structure of the wood in Fig. 8 is different from both previous ones. The middle part of the spindle-shaped rays with resin ducts is filled with parenchymatic ray cells; the cross sections of the transverse tracheids and their thick walls are distinctly seen on both the upper and the lower part. While in the two woods discussed above the height of the simple rays may reach 8–10 or even 20–25 cells, in the third one the rays are comparatively low, 2–6–8 cells high and, what is most conspicuous, thin-walled parenchyma cells are alternating in them with thick-walled ones or with transverse tracheid rows, respectively.

Thus the tangential structures of the three kinds of rays shown in Plate LXXXIV definitely argue for three different *Pinus* species. Figure 9 of Plate LXXXI represents the structure of *Pinuxylon albicauloides*, the finer details of which have been discussed above. The ray structure of the three other *Pinus* species could not be established with the same precision, so no specific determination was possible. It is certain, however, that all three *Pinus* structures differ from one another, therefore we propose to designate species No. 1, 2, 3 of Plate LXXXIV and those of the Figures 4, 5, 6 and 7, 8, 9 as *Pinuxylon* sp. (No. 1) (Figs 1, 2, 3); *Pinuxylon* sp. No. 2) (Figs 4, 5, 6) and *Pinuxylon* sp. (No. 3) (Figs 7, 8, 9).

L. Ipolytarnóc; **A.** Burdigalian.

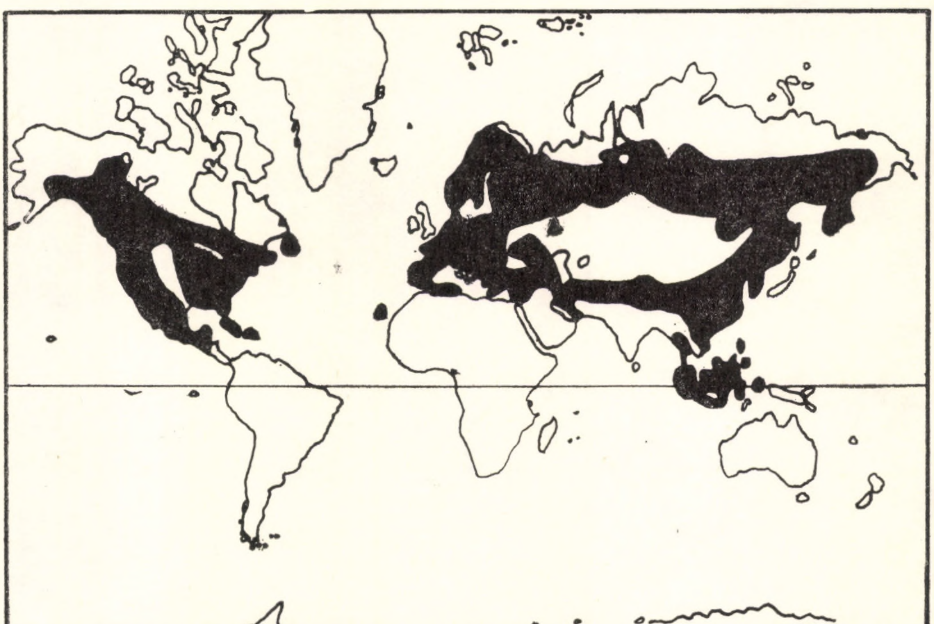
Pinuxylon sp. (No. 4)
Plate LXXXV, Figs 1–9.

Descr. The tangential shape and structure of the rays, the presence of elements of two different wall thicknesses in them, the structure of the longitudinal resin ducts allow to conclude that the fossil may be some kind of *Pinus*. In the radial structure of the rays tiny teeth in the wall-portions could be observed, from which it was possible to infer *Diploxylon*.

Note: The silicified wood was examined in small pieces of the size of a toothpick, because the material was crumbling, particularly in the longitudinal direction. With careful proceeding we succeeded in making such preparations as enabled us to specify the genus.

L. Pécs, Daniczpuszta; **A.** Upper Pannonian.

Beside the above fossils, Andreánszky describes *Pinuxylon bükkense* from Mikófalva. The following statement of this author is probably erroneous: "Am Tangentialschliff ist deutlich sichtbar, daß zwischen den Tracheiden reichlich Holzparenchym vorhanden ist." In *Pinus* there is no longitudinal wood parenchyma and even if such occurs it does so at most as epithelial parenchyma of the resin ducts. The author does not mention whether the walls of the transverse tracheids are smooth or cogged, i.e. whether the fossil belongs to the *Haploxylon* or *Diploxylon* group, since *Pinus* cannot be determined without the exact knowledge of the transverse tracheids.



Map 14. Recent distribution of the genus *Pinus* (after Krüssmann). Tertiary sites in Hungary (triangle)

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SUBJECT INDEX

LEGENDS TO THE PLATES

The measurement data of the photos refer to magnifications higher by some 15 per cent than were available within the scope of this volume and should be considered accordingly (i.e. 85 instead of 100).

Figs of Plate I.

1–3, 5–9. *Baieroxylon implexum* (G. Zimmermann) Greguss (Boda, Permian).
1. *R.* Bands spirally running in the longitudinal tracheids (200×) — 2. *C.* The cross sections of the tracheids are angular and rounded (200×) — 3. *T.* The rays are 1–8 cells high. Their cross sections are more circular (100×) — 4. *R.* In the living *Ginkgo biloba* the ends of the tracheids are archedly opposed to each other (200×) — 5. *R. Baieroxylon.* The ends of the tracheids are archedly opposed to each other (200×) — 6. *T.* The contact walls of the thin-walled ray cells are smooth and thin (300×) —7. *R.* In straight cross fields elliptic pits appear which fill the whole cross field (300×) — 8. *R.* In the radial wall of the tracheids the bordered pits are arranged in one row, contacting each other (200×) — 9. *R.* The ends of the longitudinal tracheids fit to the ray cells elongated and sole-like (200×).

Figs of Plate II.

1–4. *Baieroxylon implexum* (G. Zimmermann) Greguss.
1 and 4. *Dadoxylon graminovillae* G. Zimmermann (Germany, Cretaceous).
2 and 3. *Dadoxylon implexum* G. Zimmermann (Germany, Cretaceous).
5–9. Recent *Ginkgo biloba* L.
1 and 4. *R.* In *Dadoxylon graminovillae* the endings of the longitudinal tracheids are attached to the ray cells archedly and elbow-like, similarly as in *Ginkgo biloba* in Fig. 5. (200×). Figure 1 from Zimmermann — 2 and 6. *R.* In *Dadoxylon implexum* the tracheids are ending exactly so as in the living *Ginkgo biloba* (200×). Fig. 2 from Zimmermann — 3. From Zimmermann (300×) — 4 and 8. *R.* In the longitudinal tracheids of *Dadoxylon graminovillae* the spiral thickenings are of the same kind and run similarly as in the recent *Ginkgo biloba* (300×). Figure 4. from Zimmermann — 7. Band of the tracheid ends in *Ginkgo biloba* (300×) — 9. In the living *Ginkgo biloba* the tracheid endings when encountering, the ray cells recur elbow-like so that the tracheids contact the rays with their faces and with their endings (300×).

Figs of Plate III.

1–7. *Baieroxylon implexum* (G. Zimmermann) Greguss.
1–3. *Dadoxylon implexum* G. Zimmermann (Germany, Cretaceous).
4–7. *Baieroxylon implexum* (G. Zimmermann) Greguss (Boda, Permian).
8–11. Living *Ginkgo biloba* L.
12. *Baiera digitata* Heer (Boda, Permian).
1. *R.* In the tracheid walls spiral thickenings beside the bordered pits (300×) — 2. *T.* The rays are 1–6 cells high. Their cross sections are more circular (100×) — 3. *R.* The ends of the tracheids are attached elbow-like, archedly to the rays (200×) — 4. *R.* In the walls of the longitudinal tracheids spirally running flat cell-wall thickenings (200×) — 5. *T.* The rays are 1–6 cells high, the cross sections of the cells more circular (100×) — 6. *R.* The endings of the longitudinal tracheids are attached elbow-like, archedly and sole-like to the ray cells (200×) — 7. *R.* In some cross fields large elliptic pits filling out the whole cross field (300×) —

8. *R.* In the longitudinal tracheids flat, spiral thickenings (200×) — 9. *T.* The rays are 1–8 cells high, the cross sections of the ray cells are more circular (100×) — 10. *R.* The endings of the longitudinal tracheids are fitted archedly, elbow- and sole-like to the horizontal ray cells (200×) — 11. *R.* Upper figure: R. *Ginkgo biloba.* In the cross field in the interior of the elliptic border filling the whole cross field 3–4 araucaroid pits (300×). Lower figure: R. *Ginkgo biloba*, elliptic or circular pits filling almost completely the cross fields, similarly as in Fig. 7 (300×) — 12. *Baiera digitata* Heer. Originating also from Boda as the fossil *Baieroxylon.* Fig. 1 natural size, Fig. 2 2× magnification (from Heer).

Figs of Plate IV.

1, 2, 4, 5, 7 and 8. *Dadoxylon schrollianum* Goeppert (Boda, Permian).
1. *C.* Cross sections of the tracheids rounded off (100×)—4. *R.* In the tracheid walls araucaroid pitting (200×) — 2. *T.* 25 cell high 1-2-seriate ray (100×) — 5. *R.* In the tracheids and ray cells araucaroid pittings (200×) — 7. *R.* In the cross fields 1–4 pits (300×) — 8. *R.* In the cross fields 1–4 pits, in the tracheid walls araucaroid pits in two rows (300×).
3, 6 and 9. *Dadoxylon transdanubicum* Simoncsics (Boda, Permian).
3. *R.* Cross sections of the tracheids rounded off (100×)—6. *T.* The rays are 1–15 cells high (100×) — 9. *R.* In the cross fields 3–6 araucaroid pits (300×).

Figs of Plate V.

1–9. *Dadoxylon pannonicum* Greguss (Lábatlan, Lower Cretaceous).
1. *C.* Annual ring boundary noticeable, late wood 2–3 cell layers wide (30×) — 2. *C.* Detail from Fig. 1. (100×) — 3. *T.* The rays are 1–2-seriate (100×) — 4. *T.* Biseriate low ray (200×) — 5. *T.* Coalescence of two biseriate rays (100×) — 6. *T.* Biseriate ray, on the right-side parenchyma cell, transverse wall smooth (200×) — 7. *R.* In the longitudinal trancheids the compressed bordered pits are arranged in two rows and beside each other (200×) — 8. *R.* In the radial wall of the tracheids the bordered pits are arranged in three rows and according to the araucaroid pattern (300×) — 9. *R.* In the cross field several pits, on the left side longitudinal parenchyma cell (300×).

Figs of Plate VI.

1–9 *Agathoxylon hungaricum* (Andreánszky) Greguss (Urkut, Upper Liassic).
1. *C.* The cross sections of the tracheids are rounded off (30×) — 2. *C.* Annual ring boundary blurred, cross sections of tracheids rounded off (100×) — 3. *T.* Thin-walled longitudinal parenchyma cell (100×) — 4. *T.* The rays are 1–10 cells high, on the tangential walls of the tracheids araucaroid pits (100×) — 5. *T.* Characteristic araucaroid ray (200×) — 6. *R.* In the tracheid walls the bordered pits are arranged in 1–2 rows according to the araucaroid pattern. In the cross fields several pits (300×) — 7. *R.* Ray structure. The tracheids with bordered pits in one row (200×) — 8. *R.* In the cross fields 8–10 pits (300×) — 9. *R.* Detail of Fig. 8. (600×).

Figs of Plate VII.

1–9 *Agathoxylon* sp. seu? *Araucarioxylon* sp.? (Urkut, Lower Cretaceous).
1. *C.* No annual ring boundaries, the cross sections of the tracheids rounded off (30×) — 2. *C.* The same (100×) — 3. *T.* The rays are uniseriate and 1–20 cell layers high (100×) — 4. *T.* The same. Beside the rays thin-walled parenchyma cells. The cross section of the ray cells is a circle or low ellipse (200×)— 5. *T.* Beside the uniseriate rays (5a) thin-walled parenchyma

cells (200×, composed of two parts) — 6. *R*. In the tracheid walls the bordered pits (6a, b) are attached to each other in 1–2 rows according to the araucaroid pattern (a and b). The picture is composed of three photographs (300×) — 7. *R*. Among the tracheids thin-walled parenchyma cells (?) (200×) — 8. *R*. Ray structure. The cross field is disorganized (300×) — 9. *R*. The same (300×).

Figs of Plate VIII.

1–11. *Agathoxylon mecsekense* n. sp. (Urkut, Upper Liassic).
1. *C*. The cross sections of the tracheids are of various size and shape, rounded off. Annual ring boundary noticeable (50×) — 2. *C*. The same (10×) — 3. *T*. The pith rays are low, uniseriate — here and there resin tubes (50×) — 4. The rays are uniseriate, 1–15 cells high, on the left side the thin transverse walls of the longitudinal parenchyma cells appear (100×) — 5. *T*. In the upper third thin transverse wall of the longitudinal parenchyma (300×) — 6. *T*. Five cell high ray (right side) and resin cyst (upper left side) (300×) — 7. *R*. Resin cyst, in the tracheid walls 1–2 rows of bordered pits, in the cross field 2–4 pits (300×) — 8. *T*. The transverse walls of the parenchyma cells are smooth and thin (300×) — 9. *R*. In the tracheid walls the bordered pits are arranged in 2 rows; in the cross fields 8–10 simple pits (300×) — 10 and 11. *R*. In the tracheid walls the bordered pits are arranged in 2–3 rows, according to the araucaroid pattern (300×).

Figs of Plate IX.

1–10. *Araucarioxylon resiniferum* n. sp. (Urkut, Upper Liassic).
1. *C*. The tracheids are compressed, between them tubes with resin content (50×) — 2. *C*. The same (100×) — 3. *C*. The same (200×) — 4. *T*. The rays are 1–3–8 cells high with a dark content. The white details are resin cysts (100×) — 5. *T*. Framed detail of Fig. 4. In the cysts the resin grains are conspicuous (300×) — 6. *T*. In the resin cysts resin granules (300×) — 7 and 8. *R*. In the radial walls of the tracheids the bordered pits are arranged in 1–2 rows according to the araucaroid pattern. All walls of the pith ray cells smooth and thin — 9. *R*. In the ray cell a dark, rounded off content (300×) — 10. *R*. The walls of the ray cells are smooth and thin. On the right and left side of the picture the bordered pits are arranged in loose rows (300×).

Figs of Plate X.

1–11. *Araucarioxylon spirale* n. sp. (Mánfa, Permian [Helvetian?]).
1. *C*. Structure without annual rings (10×) — 2. *C*. The same. The cross sections of the tracheids are rounded off (50×) — 3. *C*. Among the tracheids here and there parenchyma cells (P) (100×) — 4. *T*. Characteristic araucaroid ray structure. In the rays a dark content (100×) — 5. *T*. Among the tracheids thin-walled parenchyma cells. (100×) — 6. *R*. In the tracheids characteristic araucaroid pits (200×) — 7. *R*. In the tracheid walls bordered pits in one row, on the left side in the tracheids spiral thickening (200×) — 8. *R*. The same. In the tracheids fine spiral thickening (200×) — 9. *R*. In the tracheids spiral thickening (200×) — 10. *R*. Ray structure. In the cross field on the left side several tiny pits (200×) — 11. *R*. In the radial wall of the tracheids araucaroid bordered pits (200×).

Figs of Plate XI.

1–9. *Araucarioxylon* sp. (No. 13) (Urkut, Upper Liassic).
1. *C*. Annual ring border definite, within each broader annual ring several narrower growth

rings can be observed (65×) — 2. *C.* Cross-section structure of the tracheids. The annual ring boundary is conspicuous (100×) — 3. *C.* The same (200×) — 4. *T.* The rays are 1–12 cells high. In the tracheids dark yellow resin (100×) — 5 and 6. *R.* In the tracheid walls the bordered pits are attached to each other loosely or compressed (200×) — 7. *R.* In the tracheid walls the bordered pits from 1–2 rows (300×) — 8. *R.* Ray structure. In the cross fields several simple pits (300×) — 9. *R.* In the longitudinal tracheids and in the rays dark resin content (300×).

Figs of Plate XII.

1–4. *Araucarioxylon* sp. (No. 1) (Cserkút, Permian).
5–9. *Araucarioxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic).
1. *C.* The cross sections of the tracheids are of different shapes but rounded off. The rays are uniseriate (50×) — 2. *C.* The same (100×) — 3. *T.* The rays are uniseriate, 1–20 cells high (100×) — 4. *T.* The same (50×) — 5. *C.* The cross sections of the tracheids are of different shape and size. The rays are uniseriate (100×) — 6. *T.* The rays are uniseriate, 1–8 cells high. Their cross section a circle or ellipse (100×). (cf. Fig. 3.) — 7. *T.* The same (100×) — 8. *R.* In the tracheid walls the bordered pits are arranged in one row and attached to each other according to the araucaroid pattern (300×) — 9. *R.* Ray structure. The cell walls are thin and in the smooth cross fields the number and shape of the pits can be only suspected (6–8).

Figs of Plate XIII.

1–5. *Araucarioxylon* sp. (No. 3) (Pécs–Mecsekfalu, Permian).
6–9. *Araucarioxylon* sp. (No. 4) (Urkut, Upper Liassic).
1. The silicified wood piece examined in natural size — 2. *C.* The cross sections of the tracheids and their lumina are rounded off (100×) — 3. *C.* The rounded-off tracheids are arranged radially (200×) — 4. *C.* In another part of the silicified wood the tracheids are strongly compressed, the annual ring boundary is conspicuous, the late wood is 3–4 tracheids wide (100×) — 5. *T.* The rays are 1–8 cells high (100×) — 6. The embedded silicified stem piece in natural size — 7. *C.* The lumen of the compressed tracheids is slit-like (100×) — 8. *R.* In the tracheid walls the bordered pits are attached to each other according to the araucaroid pattern (300×) — 9. *R.* The same (300×).

Figs of Plate XIV.

1–7. *Araucarioxylon* sp. (No. 5) (Villány, Upper Dogger).
8 and 9. *Araucarioxylon* sp. (No. 6) (Urkut, Upper Liassic).
1. *C.* The cross sections of the tracheids are rounded off (50×) — 2. *C.* The cross sections of the tracheids are rounded off (100×) — 3. *C.* The cross sections of the tracheids (250×) — 4. *T.* The connection of a biseriate and a uniseriate ray. Characteristic araucaroid ray (200×) — 5. Three and eight cell high rays (250×) — 6. *T.* 14 cell high ray (200×) — 7. *T.* Characteristic araucaroid ray (200×) — 8. *C.* The cross sections of the tracheids are rounded off (100×) — 9. *R.* In the radial wall of the tracheids the bordered pits are arranged in 2–3 rows and attached to each other according to the araucaroid pattern (200×).

Figs of Plate XV.

1–9. *Araucarioxylon* sp. (No. 7) (Vasas, Upper Dogger).
1. *C.* The tracheids are arranged in longitudinal rows, their cross sections are rounded off (50×) — 2. *C.* The thin-walled cells in the middle of the picture are not parenchyma cells. As a result of disorganization only the primary walls remained (100×) — 3. *C.* The detached tracheid groups resulted from disorganization are not hadrocentric bundles (100×) — 4. *C.*

The tracheids are arranged in longitudinal rows, their lumina are more or less rounded off. The disorganization is not so advanced as in the three previous slides — 5. *R.* In one of the tracheid endings the bordered pits are arranged in two rows and contacting with their borders (200×) — 6. *T.* The rays are 6–10 cells high (100×) — 7. *R.* In the tracheid walls the bordered pits are arranged in one row and according to the araucaroid pattern (200×) — 8. *R.* Five bordered pits are attached to each other according to the araucaroid pattern, the aperture is oblique, not transgressing (200×) — 9. *R.* In each cross field there are 5–6 simple pits above each other (araucaroid character) (600×).

Figs of Plate XVI.

1 and 2. *Araucarioxylon* sp. (No. 8) (Hárskút, Cretaecous).
3–9. *Araucarioxylon* sp. (No. 9) (Sümeg, Lower Cretaceous).
1. *C.* The cross sections of the tracheids are rounded off, there are no conspicuous annual ring boundaries (100×) — 2 and 2a *T.* Characteristic araucaroid ray skeleton (100×) — 3. *C.* The cross sections of the tracheids are rounded off, no noticeable annual ring boundaries (100×) — 4. *T.* 1–6 cell high characteristic araucaroid ray skeleton (100x) — 5. *T.* Characteristic araucaroid ray skeleton (200×) — 6. *R.* In the cross fields 5–6 araucaroid pits (300×) — 7. *R.* In the longitudinal tracheids the bordered pits are compressed and arranged according to the araucaroid pattern (100×) — 8. The same with 200× magnification — 9. *R.* In the longitudinal tracheids the bordered pits are aligned somewhat oosely but in one row (300×).

Figs of Plate XVII.

1–9. *Araucarioxylon* sp. (No. 10) (Komló, Lower Liassic).
1. *C.* The cross sections of the tracheids are rounded off (50×) — 2. *C.* Detail of Fig. 1 (200×) — 3. *C.* The walls of the ray cells are smooth (250×) — 4. *T.* The rays are 6–8 cells high (100×) — 5. *T.* The cross sections of the ray cells are shorter or longer ellipses (200×) — 6. *R.* Two longitudinal parenchyma cells beside each other; on two more the smooth and thin transverse wall of the parenchyma cell is seen (200×) — 7. *R.* In the cross fields 8–10 simple pits (at the point of the arrow) (300×) — 8. *R.* In the cross fields several pits (300×) — 9. *R.* On the left side two thin transverse walls of longitudinal parenchyma cells (at the point of the arrow) (300×).

Figs of Plate XVIII.

1–6. *Araucarioxylon* sp. (No. 11) (Tata, Lower Cretaceous).
7–10. *Podocarpoxylon* sp. (No. 5) (Tata, Lower Cretaceous).
1. *C.* The cross sections of the tracheids are rounded off, no conspicuous annual ring boundary (300×) — 2. *C.* Detail of Fig. 1. (100×) — 3. *T.* 3–10 cell high rays, the cross sections of the ray cells are barrel-shaped (100×) — 4. *R.* Ray structure, cross fields (100×) — 5. *R.* In the walls of the longitudinal tracheids the bordered pits are compressed according to the araucaroid pattern, and hexagonal (200×) — 6. *R.* In the walls of the longitudinal tracheids the bordered pits are arranged in 1–2 rows and according to the araucaroid pattern (200×) — 7 and 8. *C.* Conspicuous annual ring boundary, the thick-walled late wood is 6–8 cell layers wide, the spring wood about the same (100×) — 9. *T.* 25 cell high uniseriate ray from one of the *Podocarpus* (100×) — 10. *T.* 28 cell high uniseriate ray from the fossil (100×).

Figs of Plate XIX.

1–6. *?Araucarioxylon* sp. (Hetvehely, Cserkút, Permian).
7. *Araucarioxylon* sp. (No. 12) (Balatonszepezd, Permian).
8 and 9. *?Platyspiroxylon* sp. (No. 1) (Litér, Permian).
1, 2, 3–5. *C. ?Araucarioxylon* (Hetvehely, Permian) (100×) — 4. *C. ?Araucarioxylon* sp. (Cserkút, Permian) (100×) — 6. *C. ?Araucarioxylon* sp. (Hetvehely, Permian) (100×) — 7. *C. Araucarioxylon* sp. (No. 12) (Balatonszepezd, Permian). The cross sections of the tracheids are of the same size, rounded off; no noticeable annual ring boundary. *Araucaria* type (100×) — 8. *C.* The cross sections of the tracheids are rounded off. *Araucaria* type (100×) — 9. *C.* In the tracheid walls the bordered pits are loose or compressed, in the walls flat spiral thickenings (300×).

Figs of Plate XX.

1–9. *Brachyoxylon urkutense* n. sp. (Urkut, Upper Liassic).
1. *C.* Growth ring boundary noticeable, at the boundaries resin ducts or ducts originating from disorganization (5×) — 2. *C.* Cross section of the tracheids of different size, rounded off or somewhat angular, at the growth ring limits resin duct or duct caused by disorganization (50×) — 3 and 4. *C.* The same (100×) — 5. *T.* Rays uniseriate, 1–20 cells high (10×) — 6. *T.* Biseriate ray (200×) — 6/a. *T.* In the longitudinal tracheids (right side) golden yellow (on the picture black) resin content (200×) — 7. *R.* In the walls of the tracheids the bordered pits are uniseriate, according to the araucaroid pattern (300×) — 8. *R.* In the cross field 3–4 pits are closely fitting to each other (300×) — 9. *R.* All walls of the ray cells are smooth and thin. In the cross fields 4–6 simple pits (see lower right corner) (300×).

Figs of Plate XXI.

1–10. *Brachyoxylon* sp. seu *Dadoxylon* sp. seu *Baieroxylon* sp. (Urkut, Upper Liassic)·
1. *C.* Annual ring boundaries are noticeable, cross sections of the tracheids of different size and shape (50×) — 2. *C.* In the annual ring probably resin duct (100×) — 3. *C.* On the annual ring boundary the tracheids are compressed (100×) — 4. *T.* In the interior of the wall probably resin tubes (100×) — 5. *T.* The rays are uniseriate, 1–5 cells high (100×) — 6. *T.* The same (200×) — 7. *R.* In the tracheid walls the bordered pits fit together according to the araucaroid pattern (300×) — 8. *R.* The same. The apertures of the bordered pits are tiny circles (300×) — 9. *R.* Ray structure. In the ray cells elliptic fields, probably resin content (330×) — 10. *R.* All walls of the ray cells are smooth and thin (300×).

Figs of Plate XXII.

1–14. *Dacrydioxylon estherae* n. gen. et n. sp. (Solymár, Lower Oligocene).
1. *C.* Blurred annual ring boundary, in the annual rings many parenchyma cells (50×) — 2. *C.* Blurred annual ring boundary, among the tracheids parenchyma (100×) — 3. *R.* In the middle longitudinal parenchyma cell, all walls of which are smooth and thin, in the cells a round resin content (200×) — 4. *T.* The rays are 1–15 cells high, at some places 2 cells broad (50×) — 5. *R.* Detail of Fig. 4. (100×) — 6. *T.* Partially biseriate ray (200×) — 7. *R.* Section of the living *Dacrydium pierreioides*. In the cross field 1–2 circular tiny dacrydioid pits (200×) — 8–13 *R.* In each cross field of the fossil 1 tiny circular dacrydioid pit (300×) — 14. *R.* All walls of the ray cells are smooth and thin (300×).

Figs of Plate XXIII.

1–9. *Dacrydioxylon tasnádi-kubacskanum* n. sp. (Üröm, Lower Oligocene).
1. *C.* Noticeable annual ring boundary, in the annual rings many parenchyma cells (50×) — 2. *C.* Annual ring boundary noticeable, cross sections of tracheids angular or rounded off (100×) — 3. *C.* Annual ring boundary. The cells with dark content are parenchyma cells (200×) — 4. *T.* The rays are 1–15 cells high, uniseriate (100×) — 5. *T.* Besides the rays the horizontal wall of the parenchyma is smooth and thin (200×) — 6. *R.* On the left side longitudinal parenchyma, on the right side 15 cell high ray. The walls of the ray cells are thin and smooth (200×) — 7. *R.* In the cross fields generally 1 tiny circular dacrydioid pit (right side) (300×) — 8. *R.* In the cross fields 1 tiny circular pit (250×) — 9. *R.* In each cross field generally 1 tiny circular dacrydioid pit (300×).

Figs of Plate XXIV.

1–9. *Podocarpoxylon ajkaense* Greguss (Ajka, Upper Cretaceous [Senon]).
1. *C.* The annual ring boundary is hardly conspicuous, the late wood consists only of a few cell layers (100×) — 2. *T.* The uniseriate rays are 8–10 cells high (100×) — 3. *T.* Four cell high ray; the tangential wall is smooth, next to it longitudinal parenchyma with lacunar resin content and smooth transverse wall (500×) — 4. *R.* The wall of the ray cells is smooth, in the longitudinal tracheids the bordered pits are arranged in one row, at places compressed. In the longitudinal parenchyma cells resin content (200×) — 5. *R.* In the cross fields 1 podocarpoid pit each (200×) — 6. *R.* Several cell high ray, in each cross field a podocarpoid pit (100×) — 7. *R.* Two cell high ray; in each cross field a podocarpoid pit (300×) — 8. *R.* In each cross field a podocarpoid pit, the horizontal wall is comparatively thick (300×) —9. *R.* In each cross field a podocarpoid pit (200×).

Figs of Plate XXV.

1–9. *Podocarpoxylon* cf. *lilpopi* Kräusel (Darnóhegy, Oligocene).
1. *C.* The cross sections of the tracheids are angular. Among the tracheids the dark cells are parenchyma cells (100×) — 2. *R.* Very high ray (100×) — 3. *R.* In the middle a longitudinal parenchyma cell, transverse wall smooth and thin (300×) — 4. *T.* Very high rays. In the longitudinal parenchyma cells a globular resin content (100×) — 5. *R.* In the cross fields podocarpoid pits. The aperture is almost vertical (200×) — 6. *R.* Three longitudinal parenchyma cells beside each other. The horizontal walls are smooth and thin. In the cells a globular resin content (300×) — 7. *R.* In the tracheid walls (above) the bordered pits are arranged in pairs (300×) — 8. *R.* In the cross fields 1–2 podocarpoid pits (300×) — 9. *R.* All walls of the ray cells are smooth and thin. In the ray cells the larger cavities are perhaps phyllocladoid pits (300×).

Figs of Plate XXVI.

1–8. *?Podocarpoxylon* sp. (No. 7). (Lábatlan, Lower Cretaceous).
1. *C.* The tracheid zones are situated loosely above each other, among them probably parenchyma cells (50×) — 2. *C.* Detail of Fig. 1. The cross sections of the tracheids are rounded off. Among them probably parenchyma cells (150×) — 3. *R.* The bordered pits are arranged in the tracheid walls in two rows, at places somewhat compressed, according to the araucaroid pattern (300×) — 4. *R.* Ray structure (300×) — 5. *C.* Idioblast (?) or transfusion cell (?) in the ground tissue. Reticular cell wall thickening (600×) — 6, 7 and 8. *R.* In the radial wall of the tracheids the bordered pits are arranged in 1–2 rows loosely or compressed (200×).

Figs of Plate XXVII.

9–12. *?Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous).

9. *C.* On the left side as if a pith portion were detached (50×) — 10. *C.* Detail (a) of Fig. 9. On the upper part of the picture the parenchyma tissue (?) is visible, as well as the layer bordering the pith (300×) — 11. *C.* Detail from Fig. 9. The white cavities are probably ducts (600×) — 12. *C.* Magnified picture of the pith detail (600×).

Figs of Plate XXVIII.

13–16. *?Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous).
13. *C.* Below and above separated pith detail (50×) — 14. *C.* Parenchyma cells of the ground tissue arranged perpendicularly to the rays, possibly, however, artificial product (300×) — 15. *C.* Magnified picture of the area marked (a) on Fig. 13. Inside the arch-shaped pith limit loose ground tissue cells (300×) — 16. *C.* Magnified picture of the frame marked (b) in Fig. 13. collateral bundle (?) (300×).

Figs of Plate XXIX.

17–20. *?Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous).
17. *C.* In the upper left corner a pith-detail (?). Below a thin tracheid layer, above it loose cells, then again (wood) tracheid layer, further above loose parenchyma cells. The fossil is strongly compressed (50×) — 18. *C.* Detail of Fig. 17. The tracheid rows are arranged radially in smaller or larger groups (100×) — 19. *C.* Detail of Fig. 18. The tracheid rows are solitary and running radially. Between the rows parenchyma cells (?) (200×) — 20. *C.* Detail from the uniseriate tracheid rows running somewhat detached beside each other; this is rather *Cycas* than *Conifer* character (300×).

Figs of Plate XXX.

1–5. *Podocarpoxylon* sp. (No. 1) (Tata, Lower Cretaceous).
6–9. *Podocarpoxylon* sp. (No. 2) (Tata, Lower Cretaceous).
1. *C.* The cross sections of the tracheids are partly angular, partly rounded off. Annual ring boundary blurred (100×) — 2. *C.* The cross sections of some tracheids are angular (200×) — 3. *T.* Uniseriate rays, 20–25 cell layers high (100×) — 4. *R.* In the radial walls of the tracheids the bordered pits are arranged in one row, dispersed or compressed (100×) — 5. *R.* 23 cell high ray, the structure of the cross fields does not appear (100×) — 6. *C.* A wood without conspicuous annual ring boundary (100×) — 7. *T.* 27 cell high uniseriate ray (100×) — 8. *R.* Resin cyst or wound parenchyma (100×) — 9. *R.* On the right side a longitudinal parenchyma cell with smooth and thin transverse wall (300×).

Figs of Plate XXXI.

1 and 2. *Podocarpoxylon* sp. (No. 3). (Tata, Lower Cretaceous).
7–10. *Podocarpoxylon* sp. (No. 4) (Zirc, Lower Cretaceous).
3–6. Various *Foraminifera* among the particles of the fossil — 7. *T.* Eight cell high ray (100×) — 8–9. *R.* In the longitudinal tracheid wall the bordered pits are arranged in 3–4 rows according to the araucaroid (?) pattern (600×) — 10. *R.* All walls of the ray cells are thin, the pitting of the cross field is uncertain, probably one pit in each of them (200×).

Figs of Plate XXXII.

1–11. *Torreyoxylon boureaui* n. sp. (Urkut, Lower Cretaceous).
1. *C.* Definite annual ring boundary. The tracheids of the late wood are compressed (30×) —

2. *C*. Detail of Fig. 1. (100×) — 3. *T*. Ray structure (10×) — 4. *R*. In the tracheid walls the bordered pits are attached to each other loosely and in two rows (300×) — 5. *R*. The borders of the pits are rounded off and attached to each other loosely in one row. The apertures cross each other — 6. *R*. Ray structure. At the ends of the arrows the tangential walls are smooth or bead string-like finely thickened (300×) — 7. *R*. Ray structure. In the cross field (at the arrow) small pits (300×) — 8. *R*. In the tracheid walls the spirals run by twos or threes (at the arrow) (300×) — 8a. *R*. Ray structure and spiral thickening from the recent *Torreya nucifera*. The spirals run also here by twos or threes (at the arrow). In the tangential wall a mild knot (at the arrow) (300×) — 9 and 10. *R*. In the tracheid walls the spirals run by threes (at the arrow) (300×) — 11. *R*. Spiral thickening in the tracheids (at the arrow), longitudinal, and transverse walls of the longitudinal paranchyma cell are smooth (300×).

Figs of Plate XXXIII.

1–9. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
1. Cross slide 25× magnification — 2. *C*. Cross sections and lumina of the tracheids rounded off. Ray uniseriate (100×) — 3. *T*. Low, biseriate ray, including two thick-walled ray parenchyma cells (200×) — 4. *T*. The left side represents a detail of *Callitris glauca*, on the right side a 32 cell high ıay of the fossil with 3 thick-walled ray parenchyma cells (200×) — 5. In the middle of the left side high ray a thick-walled ray cell (100×) — 6. *T*. In three rays thin- and thick-walled parenchyma cells (200×) — 7. *T*. In the tracheid walls spirally running cell-wall thickenings (200×) — 8. *T*. In the tracheids flat, split-up spiral thickenings (200×) — 9. Detail of Fig. 6. The thick-walled medium ray cell definitely differs from the two thin-walled ray cells (400×).

Figs of Plate XXXIV.

10–18. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
10. *R*. In the tracheid walls the bordered pits are arranged according to the araucaroid pattern, in 1 and 2 rows (300×) — 11. *R*. In the tracheid walls the flat cell thickenings are at places branching tree-like (100×) — 12. *R*. In the cross fields 1–2–3 pits (300×) — 13. *R*. In the tracheid walls flat, spiral cell thickenings; between the thickenings the apertures of the bordered pits appear (100×) — 14. *R*. Detail of Fig. 13. Between the spiral bars the apertures of the bordered pits are seen. In the middle of the spirals a black line, to the right and left of the latter the edge of the cell-wall thickenings (300×) — 15a. *R*. Detail of tracheid cell-wall thickening from the recent *Callitris glauca*. Below a callitroid cell-wall thickening is flanking a bordered pit aperture. On the upper part from the coalescence of three callitroid pits similar spiral bars develop as in the fossil (600×) — 15b. *R*. Spiral thickening from the recent *Callitris glauca* (600×) — 16. *R*. In the cross fields an elliptic pit filling the whole field; in its middle one simple pit each appears. These ray cells are thin-walled (300×) — 17. *R*. In the rays the thick- and thin-walled parenchyma cells alternate. The longitudinal tracheids are archedly bending to the rays and penetrate among pith ray cells. The longitudinal tracheids sole-like broaden at the rays or elongate. Below, the bordered pits are not always definitely attached to each other according to the araucaroid pattern (300×)—18. *R*. In the elliptic area filling the whole cross-field 1–2 simple pits. In the cross fields of the left-side tracheid 2 cupressoid pits each appear.

Figs of Plate XXXV.

19–20. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
19. *R*. Between the spiral cell-wall thickenings of the longitudinal tracheids the borders of the bordered pits appear (a). In the middle in a white frame a tracheid of the recent *Callitris*

glauca (b) (600×). On the right side the spiral thickening of a longitudinal tracheid (1200×). In the middle of the spiral bars the black line marks the limit of the contacting bars (600×) — 20. *R.* Figure 18 in 600× magnification. In each of the left-side cross fields 2 cupressoid pits. In some of the large ellipse-shaped areas no simple pit (c)(600×).

Figs of Plate XXXVI.

21 and 22. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
21. *T.* Figure 6 magnified 600×. The tracheid walls are smooth but appear verrucose at some places (*Callitris* character). In three of the four rays thin- and thick-walled ray cells — 22. *R.* The ends of the tracheids are archedly bending towards the rays or penetrate into these. In the walls of the thick-walled ray cells there are 2–3 smaller simple pits. Besides, in the cross fields of the thin-walled parenchyma cells large oval areas are seen. At the place marked with an arrow, there is a half-moon shaped design in the thick-walled ray cells (*Callitris* character) (600×).

Figs of Plate XXXVII.

23 and 24. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
23. *R.* The structure of the spirally thickened tracheids magnified 600×. The spirally running bands are definite, broad (600×) — 24. *R.* In the tracheids the bordered pits are apparently arranged in one row according to the araucaroid pattern. At some places the spiral bands are well visible next to the apertures of the bordered pits (600×).

Figs of Plate XXXVIII.

25 and 26. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
25. *R.* In the cross fields one cupressoid pit each. In the marginal cells there are 2 pits above each other. Below three thick-walled ray cells. In the cross fields elliptic simple pits of various size. On the right side of the picture in the middle an elliptic pit appears which fills the cross field (600×) — 26. *R.* In the cross fields of the thin-walled ray cells the great elliptic areas are conspicuous, in the middle one cupressoid pit each is translucent. Below in the walls of the longitudinal tracheids bordered pits are arranged according to the modern pattern (600×).

Figs of Plate XXXIX.

27–31. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian).
27a, b. *R.* A detail of Fig. 22 in greater magnification. At the spots marked with an arrow in the thick-walled ray cells towards the lumen half-moon shaped cell-wall thickenings appear. This structure can be observed also in the thick-walled ray cells of the recent *Callitris glauca* (lower picture). The tracheids both in the fossil and in the living *Callitris* archedly curve towards the rays (600×) — 28. *R.* Four thick-walled ray cells, in their walls rounded simple pits of various size appear (300×) — 29. *R.* In the cross fields of the thin-walled ray parenchyma cells one cupressoid pit each. In the lower marginal one there are 2 pits above each other. The pits are definitely cupressoid (600×) — 30. *R.* From the living *Callitris glauca.* The cross fields of the thin-walled ray cells are filled with a great elliptic area similarly as in the fossil. In the middle of some of them one simple pit each is translucent (300×) — 31. *R.* In each cross field there is 1 cupressoid pit in *Callitris glauca* similarly as in Fig. 29 of the fossil (300×).

Figs of Plate XL.

1–9. *Platyspiroxylon heteroparenchymatosum* Greguss (Kővágószöllős, Permian).
1. *C.* The cross sections of the tracheids are of various size, their lumina rounded off (100×) — 2. *C.* The same (200×) — 3. *T.* The rays are 1–12 cells high and broaden at places to two cells (100×) — 4. *T.* 2–4 cell high rays, in the left side 4 cell high ray, the wall of one cell (at the arrow) substantially thicker than the others (300×) — 5. *T.* Ray structure. The walls of some of the ray cells are thicker than the others (300×) — 6. *R.* The walls of some of the ray cells are thin, while the others thick (300×) — 7. *R.* At the ending of some tracheids the bordered pits are attached to each other in two rows (300×) — 8. *R.* In the tracheid walls the flat spiral thickening is clearly seen (300×) — 9. *R.* In the tracheid walls the bordered pits are arranged in one row, above them flat spiral thickening (300×).

Figs of Plate XLI.

10–14. *Platyspiroxylon heteroparenchymatosum* Greguss (Kővágószöllős, Permian).
10. *R.* In the tracheid walls the spiral thickenings sometimes reticulately merge (see right side) (300×) — 11. *R.* In the cross fields in most cases 1 simple (cupressoid?) pit (300×) — 12. *R.* In the tracheid walls above the bordered pits flat spiral thickening (400×) — 13. *R.* In the tracheid walls the flat spiral thickenings at some places reticulately merge — 14. *R.* The same (300×).

Figs of Plate XLII.

1–9. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic).
1. *C.* The cross sections of the tracheids are rounded; uniseriate wide ray (100×) — 2. *T.* 3–5 cell layer high rays (100×) — 3. *R.* In the radial walls of the tracheids the bordered pits are arranged in one row and according to the araucaroid pattern; in some tracheids spiral thickenings (200×) — 4. *R.* In the tracheid walls broad spiral bars are running, between them bordered pits (200×) — 5. *R.* In the tracheid walls spiral thickenings are running, in the bars transverse walls appear (see point of arrow) (200×) — 6. *R.* In the longitudinal walls of the tracheids the bordered pits are loosely aligned after each other (300×) — 7. In the cross fields 3–6 pits, on the left side longitudinal parenchyma cell. Here no pits in the cross fields (300×) — 8. *R.* In the cross fields 3–6 pits with oblique aperture (300×) — 9. *R.* 3 smooth and thin transverse walls of a longitudinal parenchyma cell (300×).

Figs of Plate XLIII.

10–13. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic).
10a. *T.* Callitroid cell wall thickening from the living *Callitris glauca* (600×) — 10b. *T.* Spiral thickening from the fossil. Below the broad spiral bars bordered pits (600×) — 11. *R.* Spiral bars or bands in the longitudinal tracheid walls. The surface of the bars is covered by fine warts (*Callitris* character) (600×) — 12. In the cross fields 4–6 pits in two rows above each other (600×) — 13. *R.* The tracheid surafce is densely covered by tiny warts (*Callitris* character). On the right side recent *Callitris* pitting (600×).

Figs of Plate XLIV.

14 and 15. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic).
14. *R.* In the cross fields 3–4 cupressoid pits. In the longitudinal tracheid walls spiral bars

or bands running by pairs in the cross field of the longitudinal parenchyma and the rays no pitting (600×) — 15. *R.* Section from the recent *Callitris glauca.* The great similarity of the two pictures is remarkable (600×).

Figs of Plate XLV.

1–9. *?Platyspiroxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic).
1. *C.* The cross sections of the tracheids are rounded off (50×) — 2. *C.* The cross sections of the tracheids are rounded off, the ray is 1–2-seriate (100×) — 3. *T.* The rays are 3 cells high. On the radial walls araucaroid pitting (200×) — 4. *T.* In the 10 cell high thin-walled ray one of the cells is thick walled. (At the point of the arrow) (100×) — 5. *T.* The rays are 2–10 cells high (100×) — 6. *R.* In the tracheid walls the bordered pits are compressed (araucaroid pits) (300×) — 7. *R.* On the left side of the picture the smooth transverse walls of the longitudinal parenchyma cells appear (at the point of the arrow) (300×) — 8. *T.* A longitudinal parenchyma transverse wall is apparent (200×) — 9. *T.* In the wall of the median longitudinal tracheid spiral thickening (200×).

Figs of Plate XLVI.

10–19 *?Platyspiroxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic).
10. The upper cells of the three cell high ray are thick walled, the tangential wall is smooth (200×) — 11. *R.* In the longitudinal tracheid two pits (300×) — 12 *T.* Ray structure (300×) — 13. *T.* In the middle of the 6 cell high ray thick-walled ray cell (300×) — 14. *R.* At some places araucaroid pits (300×) — 15. *R.* In the left side tracheids a pit between two spiral bars (300×) — 16 and 17. *T.* The surface of the left-side tracheid is densely covered by tiny warts (*Callitris* character). In the next tracheid spiral bars similarly in the right-side tracheid (300×) — 18. *T.* Callitroid pitting from the recent *Callitris glauca.* The similarity with the fossil is remarkable (300×) — 19. *T.* Spiral thickenings running by pairs of the recent *Torreya taxifolia.* The similarity with the fossil is also conspicuous (300×).

Figs of Plate XLVII.

1–12. *Widdringtonioxylon ráskyae* n. sp. (Budafok, Helvetian).
1. *C.* The annual ring is composed of early and late wood, the latter is comparatively broad (30×) — 2. *C.* The tracheid wall of the late wood is thick, the cross sections of the tracheids are angular (100×) — 3. *C.* Detail of the spring wood (100×) — 4. *T.* 8–20 cell high rays (100×) — 5. *T.* The walls of the rays are uniformly thin, the horizontal wall of the longitudinal parenchyma cell is thin (see point of the arrow) — 6. *T.* The cross sections of the ray cells are more circular. In the middle at the arrow and below, ray cell of different shape (200×) — 7. *T.* Ray structure of the recent *Widdringtonia.* The ray structure perfectly agrees with that of the fossil, the horizontal wall of the wood parenchyma cell is also perfectly smooth (200×) — 8. *T.* The tracheid walls are finely verrucose as in *Widdringtonia* (300×). This can be, however, a consequence of disorganization — 9–10. *R.* The horizontal wall of the longitudinal parenchyma cells is smooth (300×) — 11. *R.* All walls of the ray cells are smooth and thin 300×) — 12. *R.* In the ray cells large oval pits, but not in the cross fields (300×). Probably tyloses.

Figs of Plate XLVIII.

1–9. *? Widdringtonioxylon* sp. (Budapest, Helvetian).
1. *C.* Conspicuous annual ring boundary, narrow late wood, abundant parenchyma (10×) —

2. *C.* Cross sections of the tracheids, angular. In the late wood abundant parenchyma (50×) — 3. *C.* Cross-section structure of tracheid (200×) — 4. *T.* 1–50 cell high uniseriate rays (70×) — 5. *T.* 1–2-seriate ray, all walls of the ray cells are thin and smooth (150×) — 6. *T.* 1–2-seriate ray, the walls of the ray cells are smooth and thin (150×) — 7. *T.* Horizontal wall of the longitudinal parenchyma is smooth and thin (200×) — 8. *R.* Ray structure. In the cross field hardly noticeably one pit each (200×) — 9. *R.* Ray structure. Horizontal wall of the longitudinal parenchyma, smooth (200×).

Figs of Plate XLVIIIa.

1–9. *?Callitroxylon* sp. (Gánt, Lower Eocene).
1. *C.* The *Gymnosperm* structure can be only suspected (100×) — 2. *T.* Parenchyma cells with dark content (100×) — 3 and 4. *R.* At the arrows, twin bordered pits — 5 and 6. *T.* The transverse walls of the longitudinal parenchyma cells are smooth and thin. In the parenchyma cells a dark content (300×) — 7. *R.* Ray detail (300×) — 8. *R.* Callitroid cell wall thickening (300×) — 9. *R.* Callitroid spiral cell wall thickening (300×).

Figs of Plate XLIX.

1–9. *Libocedroxylon gausseni* n. sp. (Erdőbénye, Sarmatian).
1. *C.* Cross-section picture (7×) — 2. C. Annual ring boundary hardly noticeable. No resin duct (50×) — 3. *C.* Cross sections of tracheids angular (100×) — 4. *T.* 1–3 cell high rays, on the left side in the longitudinal parenchyma tiny grains (100×)—5.*T.* 1–3 cell layer high rays (100×) — 6. *R.* The horizontal wall of the longitudinal parenchyma cell is smooth (300×) — 7. *R.* In the longitudinal wall of the tracheids the bordered pits are arranged in 1–2 rows (300×) — 8. *R.* 2 cell high ray. In the cross field 3–4 tiny round pits (300×) — 9. *R.* The same (600×).

Figs of Plate L.

1–9. *?Libocedroxylon* sp. (Szilvásvárad, Sarmatian).
1. *C.* Noticeable annual ring boundary, narrow late wood, terminal parenchyma (10×) — 2. *C.* Blurred annual ring boundary, rich terminal parenchyma (100×) — 3. *R.* In the width of one tracheid a single row of loosely arranged bordered pits (100×) — 4. *T.* 1–10 cell high rays, in the longitudinal parenchyma cells lacunar resin content (100×) — 5. *T.* Ray skeleton. In the ray cells dark resin content (200×) — 6. *T.* In the longitudinal parenchyma cells lacunar resin content, the transverse wall rosary-like thickened (200×) — 7. *R.* Ray structure. One of the tangential walls is smooth (200×) — 8. *R.* Horizontal wall of the longitudinal parenchyma cells rosary-like thickened (200×) — 9. *R.* Ray structure. Horizontal and tangential wall at places pitted. In 1 cross field 2–4, probably cupressoid, pits (200×).

Figs of Plate LI.

1–11. *Cupressinoxylon secretiferum* n. sp. (Mecseknádasd, Lower Helvetian).
1. *C.* Pronounced annual ring borders, remarkably broad late and narrow spring wood, with wide lumina on the border of the two separated cells (30×) — 2. *C.* The same, magnified 100×, in the spring and in the autumn wood the cross sections of separated larger cells (100×) — 3. *C.* In the spring wood two cells with wide lumina and whitish granular content, near to them dark cells with resin content. The whitish granular content of the cell of wide lumen is conspicuous (200×) — 4. *T.* The walls of the longitudinal tracheids are without exception striated, between them uniseriate 1–12 cell high rays with a dark content (50×) — 5. *T.*

Uniseriate high ray (100×) — 6. *T.* The horizontal wall of the longitudinal parenchyma is uneven, mildly knotty or verrucose (200×) — 7. *R.* The interior of the longitudinal duct is filled with a white granular content, the arched tangential wall of the ray cell is perfectly smooth (200×) — 8. *R.* All walls of the ray cells, also the tangential walls are smooth and thin, a single pit can be guessed in each cross field (200×) — 9. *R.* Ray structure. In the cross fields generally one pit each can be suspected (200×) — 10. The dried up content remained on the ray cell walls similarly to a dentate thickening, but the cell walls themselves exhibit no dentate thickening. On the right side the horizontal wall of a longitudinal parenchyma is smooth (200×) — 11. *R.* At the left-side border in a longitudinal duct the content is whitish and finely granulated, below in the middle longitudinal parenchyma with dark resin content. The horizontal walls of the ray cells appear to be dentately thickened (300×).

Figs of Plate LII.

1–9. *? Cupressinoxylon* sp. (No. 3) (Pesthidegkút, Helvetian).
1. *C.* Broad annual ring, noticeable annual ring boundary. Narrow late wood, dispersed wood parenchyma (300×) — 2. *C.* The cross sections of the tracheids are angular and rounded off, dispersed parenchyma cells (100×) — 3. *C.* Among the tracheids in the parenchyma cells dark content (200×) — 4. *T.* Low uniseriate rays, in the parenchyma cells tiny rounded off resin content (200×) — 5. *T.* In low longitudinal parenchyma cells a rounded off dark content, the horizontal wall is smooth (300×) — 6. *R.* In the tracheid walls bordered pits arranged in one row (200×) — 7. *R.* Ray structure. In the cross fields 1–2 (cupressoid?) pits (300×) — 8 and 9. *R.* Ray structure. In each cross field 1, in the marginal cells 2 pits above each other (300×).

Figs of Plate LIII.

1–3. *? Cryptomerioxylon* sp. (Sámsonháza, Helvetian).
1. *T.* 10 cell layer high ray, the cross sections are circles, among them tiny triangles (100×) — 2. *C.* The cross sections of the tracheids are angular (100×) — 3. *R.* In the cross fields 1–2 pits suggestive of *Cryptomeria* (300×).
4–9. *? Podocarpoxylon* sp. (No. 6) (Mecsekszabolcs, Helvetian).
4. *C.* No conspicuous annual ring boundary, the cross sections of the tracheids are angular (50×) — 5. *C.* The same magnified 100× — 6. *R.* The walls of the ray cells are smooth and thin, in a cross field the contours of 1–2 pits can be guessed (200×) — 7. *T.* The rays are 15–20 cell rows high (100×) — 8. *R.* In the wood resin ducts or other cavities above each other (100×) — 9. *R.* In the longitudinal tracheids the bordered pits in one row, but not compressed. No araucaroid pitting (200×).

Figs of Plate LIV.

1–6. *Cupressinoxylon cupressoides* n. sp. (Szentendre, Lower Helvetian).
7 and 8. *?Cupressinoxylon* sp. (No. 2) (Kazár, Helvetian).
9. *? Sequoioxylon* sp. (No. 5) (Eger, Helvetian).
1. *C.* At the annual ring boundary, definite narrow autumn wood (50×) — 2. *T.* The rays are 1–8 cells high. The horizontal wall of the longitudinal parenchyma cells is smooth or moderately knotted (100×) — 3. *T.* 5 cell high ray (300×) — 4 and 5. *R.* The walls of the rays are smooth, in the cross fields 2 taxodioid pits each (300×) — 6. *R.* The same. The pits of the cross field are circles or short procumbent ellipses. In each cross field 2 pits. The rays sustend a moderate angle to the tracheid axis (300×) — 7. *C.* Annual ring boundary noticeable, cross sections of tracheids angular, in the annual ring field dispersed parenchyma cells. No resin ducts — 8. *T.* The rays are 1–8 cells high, their cross sections circles or short ellipses (100×) — 9. *R. Sequoioxylon* (No. 5.). In the tracheid walls bordered pits arranged in two rows.

Figs of Plate LV.

1, 2, 5, 6 and 7. *Sequoioxylon* cf. *germanicum* (No. 1) Greguss (Alacska, Helvetian).
3 and 4, 8–12. *Metasequoioxylon hungaricum* n. sp. (Karancskeszi, Helvetian).
1. *C.* Broad early and narrow late wood. The cross sections of the tracheids are angular (30×) — 2. *C.* Detail of the vicinity of the annual ring boundary. Narrow late wood (100×) — 5. *T.* The rays are 1–15 cells high. The horizontal wall of the longitudinal parenchyma is somewhat knotted (100×) — 6. *T.* The wall of the longitudinal parenchyma cell is knotted, resin content rounded off (300×) — 7. *T.* In the cross fields 1–2 piriform pits (300×) — 3. *C.* The cross sections of the tracheids are angular, the late wood is 8–10 tracheids wide (30×) — 4. *C.* The same (100×) — 8. *T.* The rays are 1–10 cells high, the horizontal wall of the longitudinal parenchyma cell is smooth or moderately knotted (100×) — 9. *T.* The horizontal wall of the longitudinal parenchyma is smooth or moderately knotted, the cross sections of the ray cells circles or low ellipses (300×) — 10. *R.* The wall of the longitudinal parenchyma cell is moderately knotted (300×) — 11. *R.* In the longitudinal wall of the tracheids the pits are arranged in 1 or 2 rows in pairs, there are 4–6 short procumbent elliptic pits in each cross field (300×) — 12. *R.* At the margin of the ray cells low transverse tracheids (300×).

Figs of Plate LVI.

1–9. *?Metasequoioxylon* sp. (Sajókazinc, Lower Helvetian).
1. *C.* Annual ring boundary conspicuous, spring wood wide, autumn wood narrow (50×) — 2. *C.* The same. In the autumn wood parenchyma cells with dark content (100×) — 3. *T.* The rays are 1–12 cells high (100×) — 4. *T.* The cross sections of the ray cells are generally circles or short ellipses (200×) — 5. *T.* In the parenchyma cells the resin content is lacunar, the horizontal wall of the parenchyma cells is smooth or moderately knotted (300×) — 6. *R.* In the tracheid walls the bordered pits are arranged by pairs (200×) — 7. *R.* The same (300×) — 8. *R.* The same. In the cross fields 2–3 (6) taxodioid pits, the horizontal wall of the ray cells is smooth (300×) — 9. *R.* The same. In the tracheid walls paired bordered pits, the tangential wall of the ray cells is smooth, in the cross fields 3–6 taxodioid pits (300×).

Figs of Plate LVII.

1–9. *Sequoioxylon medullare* n. sp. (Ipolytarnóc, Burdigalian).
1. *C.* The annual rings are comparatively narrow, the late wood is narrow (30×) — 2. *C.*The same magnified 100× — 3. *T.* High rays, the cross sections of the rays rounded off (100×) — 4. *T.* 35–40 cell high rays (30×) — 5. *T.* 45 cell high ray (100×) — 6. *T.* The horizontal walls of the longitudinal parenchyma cells are moderately knotted, in the cells rounded off resin content (200×) — 7. *R.* In the walls of the longitudinal tracheids 3–4 bordered pits beside each other (200×) — 8. *R.* In the cross fields 4–5 taxodioid pits beside each other, the tangential walls are smooth and thin (300×) — 9. *R.* The same (300×).

Figs of Plate LVIII.

1–9. *Sequoioxylon podocarpoides* n. sp. (Salgóbánya, Lower Helvetian).
1. *C.* Conspicuous annual ring boundary, broad autumn wood (300×) — 2. *C.* Thick-walled tracheids of the autumn wood (100×) — 3. *C.* Thin-walled tracheids of the spring wood. Above a longitudinal parenchyma with dark content (200×) — 4. *T.* Uniseriate, high (40 cells) ray (50×) — 5. *T.* The tangential wall of the tracheids is dispersely pitted (100×) — 6. *T.* In the middle longitudinal parenchyma cell, all walls are thin, rounded off cell content. Beside, the ray with thin horizontal walls (200×) — 7. *R.* In the cross fields 1–3 taxodioid

pits. In the tracheid walls 2–3 bordered pits (200×) — 8. *R*. In the tracheid walls 1–3 bordered pits (150×) — 9. *R*. In the late wood 1–2 pits above each other in the cross fields (300×).

Figs of Plate LIX.

10–18. *Sequoioxylon podocarpoides* n. sp. (Salgóbánya, Lower Helvetian).
10. *R*. In the cross fields as a rule 1 pit each (200×) — 11. *R*. The horizontal and tangential walls of the ray cells are thin and smooth (200×) — 12. *R*. In the cross fields 1–2 pits above each other (300×) — 13. *R*. In the cross fields generally 1 cupressoid or podocarpoid pit. The aperture is vertical (300×) — 14. *R*. In each cross field a cupressoid or podocarpoid pit, the aperture is stick or circle-like (300×) — 15. *R*. In the cross fields 1–2 pits beside each other. The horizontal walls of the ray cells are smooth and thin (300×) — 16. *R*. In each cross field a cupressoid or podocarpoid pit. Aperture vertical (800×) — 17. *R*. The radial wall of the ray cell is smooth or contains 1–2 cupressoid, podocarpoid pits (800×) — 18. *R*. The horizontal wall of the ray cells is smooth and thin, 1–2 mostly podocarpoid or cupressoid pits in each cross field (800×).

Figs of Plate LX.

1–7. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 4) (Ipolytarnóc, Burdigalian).
1. *C*. Annual ring boundary hardly noticeable, in the annual ring terminal parenchyma (50×) — 2. *C*. The rays are uniseriate, in the horizontal walls tiny pits (100×) — 3. *T*. Uniseriate, 20 cell high ray, beside parenchyma cell (100×) — 4. *R*. In the radial wall of the tracheids 1–3 rows of bordered pits, the horizontal wall of the parenchyma is smooth. In its interior a granular content (the picture is composed of two portions) (300×) — 5–6–7. *R*. The tangential walls of the ray cells are smooth and thin. 3–6 taxodioid pits in a cross field. On the left side of Fig. 5 longitudinal parenchyma with granular content (300×).

Figs of Plate LXI.

1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 6) (Salgóbánya, Lower Helvetian).
1. *C*. In broad annual rings wide late and spring zones (300×) — 2. *C*. Late wood, among thick-walled tracheids some longitudinal parenchyma cells (100×) — 3. *T*. 10–25 cell high rays on the average (100×) — 4. *R*. Three longitudinal parenchyma cells, their transverse walls are smooth and thin (100×) — 5. *T*. In longitudinal parenchyma cells the horizontal walls are smooth and thin (200×) — 6. *R*. In a tracheid width 1–4 bordered pits beside each other (200×) — 7. *R*. In each cross field 3–4 pits beside each other (200×) — 8. *R*. In each cross field 3–4 pits beside each other. In the uppermost marginal cell 8 pits in two rows (200×) — 9. *R*. Cross field structure; on the right side longitudinal parenchyma with rounded off content (200×).

Figs of Plate LXII.

1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 7) (Nagybátony, Lower Helvetian).
1. *C*. In the narrow annual rings no resin ducts (10×) — 2. *C*. Late wood of thin-walled tracheids (100×) — 3. *T*. The horizontal wall of the longitudinal parenchyma cell is moderately knotted (200×) — 4. *T*. 2–30 cell high rays (100×) — 5. *T*. The tangential walls of the tracheids are sparsely pitted (100×) — 6. *R*. In the tracheid walls the bordered pits are arranged in 1 row (100×) — 7. *R*. In the cross fields 3–4 pits beside each other (200×) — 8. *R*. In the longitudinal wall of the tracheids 2–3 bordered pits beside each other (300×) — 9. *R*. In the tracheid walls 2–3 pits beside each other (200×).

Figs of Plate LXIII.

1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 2) (Litke, Lower Helvetian).
1. *C.* Habitus pictura (10×) — 2. *C.* Detail from the proximity of the annual ring boundary (100×) — 3. *T.* Uniseriate and high ray (100×) — 4. *C.* Annual ring boundary noticeable, no conspicuous difference between spring and late wood, in the annual ring a great number of parenchyma cells (30×) — 5. *C.* The same (100×) — 6. *T.* Comparatively high rays, beside them longitudinal parenchyma cells with dark cell content (100×) — 7. *R.* All walls of the longitudinal parenchyma cell are smooth and thin, in the parenchyma cell coarse resin content (300×) — 8. *R.* In a cross field 2–3 taxodioid pits (300×) — 9. *R.* In the radial wall of the tracheids 2–3 bordered pits beside each other (300×).

Figs of Plate LXIV.

1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 1) (Sajószentpéter, Helvetian).
1. The cross sections of the tracheids are angular, the late wood narrow (30×) — 2. Structure of an annual ring. Broad early and narrow late wood, in the spring zone wood parenchyma is frequent (100×) — 3. *R.* In the longitudinal tracheids the bordered pits are attached per 2 or 3 to each other, the bars of Sanio distinctly appear (300×) — 4. *T.* The rays are 1–15 cells high, in the longitudinal parenchyma rounded off cell content (30×) — 5. *T.* The horizontal wall of the longitudinal parenchyma is moderately uneven, somewhat knottedly thickened (200×) — 6. *R.* In the longitudinal tracheids the bordered pits are arranged by twos or threes, the bar of Sanio distinctly appears (300×) — 7. *R.* In the cross fields 3–6 taxodioid pits in one or two rows (300×) — 8. In the cross fields 3–4 somewhat glyptostroboid pits which are highly suggestive of *S. sempervirens* (300×) — 9. In the cross fields 1–6 pits (300×).

Figs of Plate LXV.

1–6. *Sequoioxylon* sp. (No. 1) (Várpalota, Rudolftelep, Tortonian).
7 and 8. *Sequoioxylon* sp. (No. 2) (Pécsszabolcs, Helvetian).
1. *C.* Conspicuous annual ring boundaries, broad spring and narrow autumn wood, among the tracheids many parenchyma cells with dark resin content (30×) — 2. The same, magnified 100× — 3. The same, magnified 200×, the walls of the late tracheids uniformly thickened, the shape of the cavities similar to the external wall — 4. *T.* The ray structure does not appear, the presence of the longitudinal parenchyma can be only inferred from the dark content (50×) — 5. *R.* In the longitudinal parenchyma cells and in the horizontal ray cells rounded off dark resin content (200×) — 6. *R.* In the longitudinal tracheids uniseriate arrangement of the bordered pits can be suspected. In the cross fields the place of 1–2 pits can be guessed (200×) — 7. *T.* 6–10 cell high rays, in the longitudinal parenchyma dark rounded off resin content (100×) — 8. *R.* The resin content in the longitudinal parenchyma cells is suggestive of *Sequoioxylon* (100×).

Figs of Plate LXVI.

1–9. *Sequoioxylon* sp. (No. 9) (Pestszentlőrinc, Helvetian).
1. *C.* Conspicuous annual ring boundary, broad autumn wood (30×) — 2. *C.* In the broad autumn wood at places thin-walled parenchyma cell (100×) — 3. *C.* The same (150×) — 4. *R.* The horizontal wall of the longitudinal parenchyma cells is smooth and thin (200×) — 5. *R.* 2–3 bordered pits per one tracheid width (200×) — 6. *R.* The same (200×) — 7. *R.* In a cross field generally one circular pit (200×) — 8. *R.* Ray structure. Tangential wall smooth (200×) — 9. *R.* Ray structure. Tangential wall smooth (200×).

Figs of Plate LXVII.

1–4 *Glyptostroboxylon* sp. (No. 3) (Várpalota, Tortonian).
5–8 *? Glyptostroboxylon* sp. (No. 1) (Várpalota, Tortonian).
1. *C.* Annual ring boundary conspicuous, in the annual rings scarce parenchyma (300×) — 2. *T.* Comparatively low rays (500×) — 3. *R.* In the tracheids bordered pits arranged in one row. In the cross fields 1–2 pits (300×)—4. *R.* The horizontal wall of the longitudinal parenchyma is smooth, in the cross field 1–2 pits (300×) — 5. *C.* Annual ring boundary conspicuous, in the annual ring parenchyma (100×) — 6. *T.* Medium high rays. The horizontal wall of the longitudinal parenchyma is smooth (100×) — 7. *R.* In the cross fields 4–6 taxodioid, glyptostroboid pits (300×) — 8. *R.* In the cross fields 2–3 loose bordered pits (300×).

Figs of Plate LXVIII.

1–8. *Sequoioxylon* cf. *germanicum* (No. 2) Greguss (Dorog, Upper Oligocene).
1. *C.* Noticeable annual ring boundary, narrow late wood. In the annual ring dispersed parenchyma cells (50×) — 2. *T.* Cross sections of tracheids angular (100×) — 3. *R.* In the tracheid walls 2–3 rows of bordered pits (200×) — 4. *R.* In the cross fields 2–3 taxodioid or glyptostroboid pits, the tangential wall of the ray cell is smooth (200×) — 5. *C.* 1–2 seriate ray, in the annual ring parenchyma (100×) — 6. *C.* Biseriate ray, in the horizontal wall pits (300×) — 7. *R.* In the radial wall of tracheids three bordered pits beside each other (300×) — 8. *R.* In the cross fields 1–3 taxodioid pits (200×).

Figs of Plate LXIX.

1–4. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 3) (Várpalota, Tortonian).
5–8. *Sequoioxylon* sp. (No. 3) (Várpalota, Tortonian).
1. *C.* Conspicuous annual ring boundary, in the annual rings wood parenchyma (100×) — 2. *T.* The walls of the longitudinal parenchyma cells are smooth in the cells rounded off resin content (100×) — 3. *R.* In the cross fields 4–5 taxodioid or glyptostroboid pits, above: two transverse tracheids (300×) — 4. *R.* In a cross field 4–5 taxodioid or glyptostroboid pits (300×) — 5. *C.* Annual ring boundary conspicuous, spring and late wood well separated (100×) — 6. *T.* Medium high 1–2 seriate rays (100×) — 7. *T.* The horizontal walls of the longitudinal parenchyma cells are thin and smooth (150×) — 8. *R.* In a cross field 2–3 taxodioid or glyptostroboid pits (300×).

Figs of Plate LXX.

1–4 *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 9) (Várpalota, Tortonian).
5–8 *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 10) (Várpalota, Tortonian).
1. *C.* Annual ring boundary conspicuous, the late wood consists of hardly a few tracheids. In the broad annual ring wood parenchyma (100×) — 2. *T.* 1–2-seriate medium size rays (100×) — 3. *T.* Biseriate ray, the wall of the longitudinal parenchyma is smooth and thin (300×) — 4. *R.* Tangential wall of the ray parenchyma is smooth, in the cross field 3–4 taxodioid pits (300×) — 5. *C.* Annual ring boundary conspicuous, in some annual rings abundant parenchyma (100×) — 6. *T.* In the longitudinal parenchyma cells rounded off and lacunar resin content. 1–2 seriate ray (100×)— 7. *T.* The horizontal wall of the longitudinal parenchyma cell is thin and smooth (300×) — 8. *R.* For one tracheid width 2–3 bordered pits, in 1 cross field 3–4 taxodioid pits (300×).

Figs of Plate LXXI.

1–4. *Sequoioxylon* sp. (No. 10) (Várpalota, Tortanian).
5–8. *Sequoioxylon* sp. (No. 11) (Várpalota, Tortonian).
1. *C.* Conspicuous annual ring boundary, in the annual ring wood parenchyma (100×) — 2. *T.* Medium high rays, the horizontal wall of the longitudinal parenchyma is smooth and thin (100×) — 3. *R.* 2–3 bordered pits per one tracheid width (300×) — 4. *R.* In a cross field 3–4 taxodioid pits, the tangential wall is smooth (300×) — 5. *C.* Remarkably broad late wood, in the annual rings parenchyma (100×) — 6. *T.* Horizontal wall of longitudinal parenchyma is smooth. Tangential wall of tracheids is pitted (100×) — 7. *R.* 2–3 bordered pits per tracheid width (300×) — 8. *R.* In the cross field 3–4 circular pits. Tangential wall smooth (300×).

Figs of Plate LXXII.

1–4. *Glyptostroboxylon* sp. (No. 2) (Várpalota, Tortonian).
5–8. *Sequoioxylon* sp. (No. 4) (Várpalota, Tortonian).
1. *C.* Broad autumn wood, tracheids thin-walled (50×) — 2. *T.* High rays, horizontal wall of parenchyma cell smooth (100×) — 3–4. *R.* Tangential walls smooth, in the cross fields 1–3 taxodioid or circular pits (300×) — 5. *C.* Among the tracheids wood parenchyma (100×) — 6. *T.* The horizontal walls of the longitudinal parenchyma cells moderately pitted (100×) — 7. *R.* 3–4 bordered pits per one tracheid width (300×) — 8. *R.* 4–7–8 taxodioid pits in a cross field (300×).

Figs of Plate LXXIII.

1–4. *Sequoioxylon* sp. (No. 6) (Várpalota, Tortonian).
5–8. *Sequoioxylon* sp. (No. 7) (Várpalota, Tortonian).
1. *C.* Annual ring boundary conspicuous, late wood narrow, in the annual rings dispersed parenchyma (100×) — 2. *T.* 1–2 seriate ray, in the parenchyma cells rounded off content, horizontal wall of parenchyma cell smooth (100×) — 3. *R.* 2–3 bordered pits per one tracheid width, in the cross field 2–3 glyptostroboid pits (300×) — 4. *R.* 3–4 bordered pits beside each other per one tracheid width (300×) — 5. *C.* Conspicuous annual ring boundary, broad late wood (100×) — 6. 1–12 cell high rays, in the wood parenchyma cell tiny rounded off content (100×) — 7. *T.* The horizontal wall of the longitudinal parenchyma cell is somewhat uneven, knotted (300×) — 8. *R.* In the cross field 1–2 glyptostroboid pits, in the tracheid wall generally 1 bordered pit (300×).

Figs of Plate LXXIV.

1–4. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 5) (Várpalota, Tortonian).
5–8. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 8) (Várpalota, Tortonian).
1. *C.* Conspicuous annual ring boundary, narrow autumn wood, in the annual rings wood parenchyma (100×) — 2. *T.* High rays, horizontal wall of wood parenchyma smooth, lacunar resin content (100×) — 3. *R.* In the tracheid wall 2–3 bordered pits (300×) — 4. *R.* Tangential wall smooth, in the cross field 2–4 taxodioid or glyptostroboid pits (300×) — 5. *C.* Conspicuous annual ring boundary, broad autumn wood. In the annual ring wood parenchyma (30×) — 6. *T.* High rays (100×) — 7. *R.* 3–4 bordered pits per 1 tracheid width (300×) — 8. *R.* Tangential wall smooth, 3–6 taxodioid pits in a cross field (300×).

Figs of Plate LXXV.

1–4. *Sequoioxylon* sp. (No. 8) (Becske, Burdigalian).
5–7. *Keteleeria* sp. (Ipolytarnóc, Burdigalian).
1. *C.* Annual ring boundary definite, early wood broad, the late one narrow (50×) — 2. *T.* The rays are 3–10 cells high (100×) — 3. *R.* In the longitudinal tracheids the bordered pits are arranged in one row (100×) — 4. *R.* In the cross field only the site of one pit can be suspected (300×) — 5. *C.* Annual ring boundary definite, no resin duct (100×) — 6. *T.* Height of the rays up to 20–25 cells, cross sections more circular (100×) — 7. *T.* Besides the uniseriate rays sometimes biseriate ones occur (100×).

Figs of Plate LXXVI.

1–4. *Taxodioxylon taxodii* Gothan (Nagyréde, Tortonian).
1. *C.* 47 tracheid wide annual ring with dispersed parenchyma cells (75×) — 2a. *T.* 45 cell high ray from the fossil. On the right edge in the longitudinal parenchyma cells rounded off cell content (100×) — 2b. *T.* 45 cell high ray. From the recent *Taxodium distichum* (100×) — 3. *T.* Longitudinal parenchyma cells from the living *Taxodium distichum*, the horizontal walls are knottedly thickened (300×) — 4a. and b. *T.* Longitudinal parenchyma cells from the fossil. The transverse walls are knottedly thickened (300×) — *Note:* The structure of Figs 3, 4a and 4b is remarkably similar.

Figs of Plate LXXVII.

5–9. *Taxodioxylon taxodii* Gothan (Nagyréde, Tortonian).
5. *R.* At the arrow in the cross field 4 circular simple pits — 6. *R.* In the cross fields generally 1–2 tiny circular pits (see the arrows) (300×) — 7. *R.* In the cross fields of the recent *Taxodium distichum* tiny circular simple pits (see the arrows). The tangential wall is smooth (300×) — 8a. *R.* In the cross field tiny circular pits (see the arrow) (300×) — 8b. *R.* The tangential walls of the ray cells are smooth (see the arrows) (350×) — 9. *R.* In the longitudinal tracheid walls the bordered pits are arranged in one row and loosely, on the right as twin pores. The bars of Sanio are distinctly seen (see the arrow). The borders of the pits are radially verrucose (300×).

Figs of Plate LXXVIII.

1–6. *?Cupressinoxylon* sp. (No. 1) (Recsk, Helvetian).
7–9. *Taxodioxylon* cf. *taxodii* Gothan (Buják, Sarmatian).
1. *C.* The cross sections of the tracheids are angular, in the annual rings dispersed parenchyma cells (50×) — 2. *C.* The same (100×) — 3. *T.* The rays are 1–10 cells high (100×) — 4. *T.* Longitudinal parenchyma rows (arrows) (100×) — 5. *T.* Shape of the ray cells and disorganized cross fields (300×) — 6. *R.* In the tracheid walls the bordered pits are in one row (300×) — 7. *T.* The height of the rays is 1–30 cells (100×) — 8. *T.* The cross sections of the ray cells are circles or ellipses; the wall of the longitudinal parenchyma cells is knotted or cog-wheel-like thickened (see the arrow) (300×) — 9. *T.* The same. The horizontal wall of the longitudinal parenchyma cell is uneven (300×).

Figs of Plate LXXIX.

1–9. *Cedroxylon* sp. (Nógrád, Helvetian).
1. *C.* Near the annual ring boundary resin cyst zone (30×) — 2. *C.* Noticeable annual ring boundary, above it resin cyst zone (50×) — 3. *C.* Above a resin cyst zone solitary resin

cyst (100×) — 4. *T.* 1–2-seriate 10–15 cell high rays (50×) — 5. *T.* The transverse wall of longitudinal parenchyma cell at places appears knotted (200×) — 6. *T.* Ray structure. On the right side low parenchyma cells (200×) — 7. *T.* Ray structure. 20 cell high detail of a high ray (200×) — 8. *R.* Ray structure. In the cross fields 2–3 blurred pits (300×) — 9. *R.* Ray structure disorganized (300×).

Figs of Plate LXXX.

1–7. *Pinuxylon haploxyloides* n. sp. (Karancsberény, Helvetian).
1. *C.* Annual ring boundary conspicuous, broad late wood (5×) — 2. *C.* In the early wood resin duct (50×) — 3. *C.* On the annual ring boundary thick-walled autumn and thin-walled early tracheids are contacting (100×) — 4. *T.* The rays are 8–10 cells high, the ray containing the resin duct is of the same diameter or much higher (lower and right side of the picture) (100×) — 5. *R.* The cross fields are filled with a pinoid pit each, on the lower and upper edge of the ray smooth-walled transverse tracheids (300×) — 6 and 7. *R.* The cross fields are filled with great elliptic pinoid pits (300×).

Figs of Plate LXXXI.

1–5. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Lower Helvetian).
6–9. *Pinuxylon albicauloides* Greguss (Ipolytarnóc, Burdigalian).
1. *C.* In the broad annual ring a gradual transition of the early wood into the late one, at the lower part of the picture resin duct (30×) — 2. *C.* In the resin duct thin-walled epithelial cells, *Pinus* character (100×) — 3–4. *T.* Uni- and biseriate simple rays, in those at the left edge horizontal resin ducts (100×) — 5. *R.* In the cross fields 1–2 tiny pinoid pits. Wall of the transverse tracheid smooth (200×) — 6. *C.* In the annual ring resin ducts (100×) — 7. *T.* In the left side broad ray resin duct (100×) — 8. *R.* In the longitudinal tracheid walls 1–2 rows of bordered pits (100×) — 9. *R.* In the cross field 1 large pinoid pit. Transverse tracheid wall smooth (200×).

Figs of Plate LXXXII.

6–14. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Burdigalian).
6. *R.* In cross fields 2 pinoid pits each. In the tracheid walls bordered pits in pairs (250×) — 7. *R.* Detail from the recent *Pinus lambertiana.* Perfectly agrees with the pitting of the previous picture (170×) — 8. *R.* In the cross fields 2–3 pinoid pits agree with the recent *P. lambertiana* (150×) — 9, 10 and 11. *R.* The walls of the transverse tracheids are smooth (*Haploxylon* character) (250×) — 12. *R.* Left-side picture from our *Pinuxylon tarnócziense*, right-side picture Tuzson's drawing from *Pinus tarnócziensis.* The two pictures are of identical structure (150×) — 13. *R.* The walls of the transverse tracheids are smooth (150×) — 14. *R.* The paired pores of broader tracheids with bars of Sanio (250×).

Figs of Plate LXXXIII.

1–9. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Burdigalian).
1. *C.* Remarkably broad late wood, about equally broad early wood (10×) — 2. *C.* A resin duct (30×) — 3. *C.* Thin-walled tracheids of the spring wood (150×) — 4. *T.* Low, uniseriate rays (150×) — 5. *T.* Uniseriate rays (100×) — 6. *R.* In a cross field 2–3 pinoid pits (300×) — 7. *R.* In the longitudinal wall of the tracheids 2 pits each beside each other (200×) — 8. *R.* In the tracheid walls one row and paired bordered pits (250×) — 9. *R.* In the cross fields 2–3 oval pinoid pits (250×).

Figs of Plate LXXXIV.

1–3. *Pinuxylon* sp. (No. 1)
4–6. *Pinuxylon* sp. (No. 2) } (Ipolytarnóc, Burdigalian).
7–9. *Pinuxylon* sp. (No. 3)

1. *C.* In the broad annual ring resin duct (50×) — 2. *T.* Simple ray and ray with resin duct (100×) — 3. *R.* Pit of cross field indistinct (300×) — 4. *C.* Detail of a broad annual ring (50×) — 5. *T.* On the left side high ray with resin duct (100×) — 6. *R.* Structure of cross field is not visible (250×) — 7. *C.* In the middle of annual ring resin duct (50×) — 8. *T.* Uni- and biseriate ray. In the broad one resin duct and heterogeneous ray skeleton (100×) — 9. *R.* In cross fields a large pinoid pit (250×).

Figs of Plate LXXXV.

1–9. *Pinuxylon* sp. (No. 4) (Pécs, Daniczpuszta, Upper Pannonian).

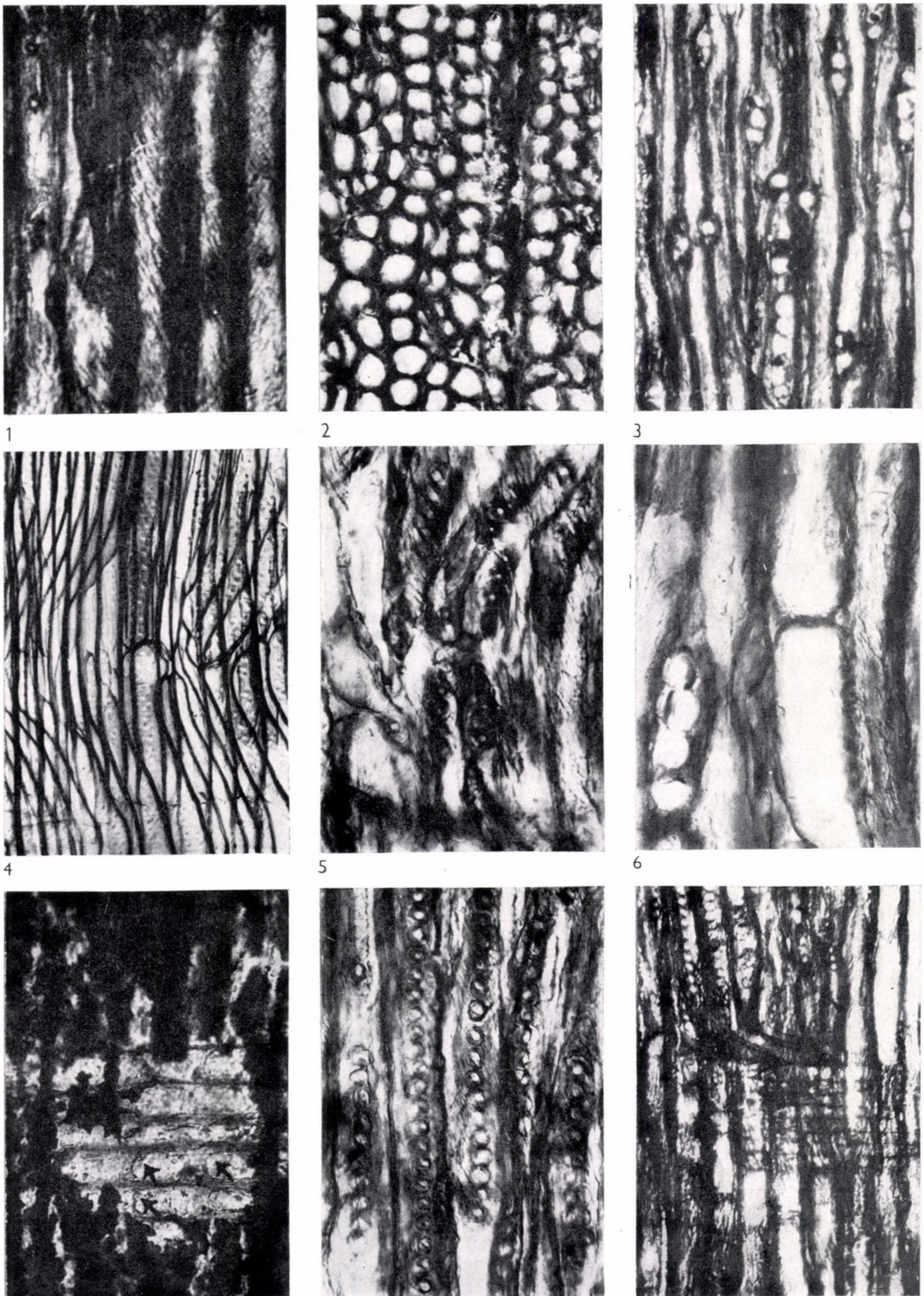
1. *C.* In broad annual ring solitary resin duct (50×) — 2. *C.* The cross sections of the tracheids are rounded off, the contour of the resin duct is distinct (100×) — 3. *C.* Two resin ducts near each other (100×) — 4. *T.* Two kinds of rays. On the right side in the broad ray resin duct (100×) — 5. *T.* Near the resin duct thick-walled ray tracheid (?) (100×) — 6. *C.* Cross section structure of tracheids (100×) — 7. *T.* In the simple ray thick-walled transverse tracheid (200×) — 8. *R.* In the longitudinal resin duct thin-walled epithelial parenchyma cells (200×) — 9. *T.* In the broad ray containing resin duct thick-walled transverse tracheid cells or thick-walled parenchyma cells occur (200×).

Figs of Plate LXXXVI.

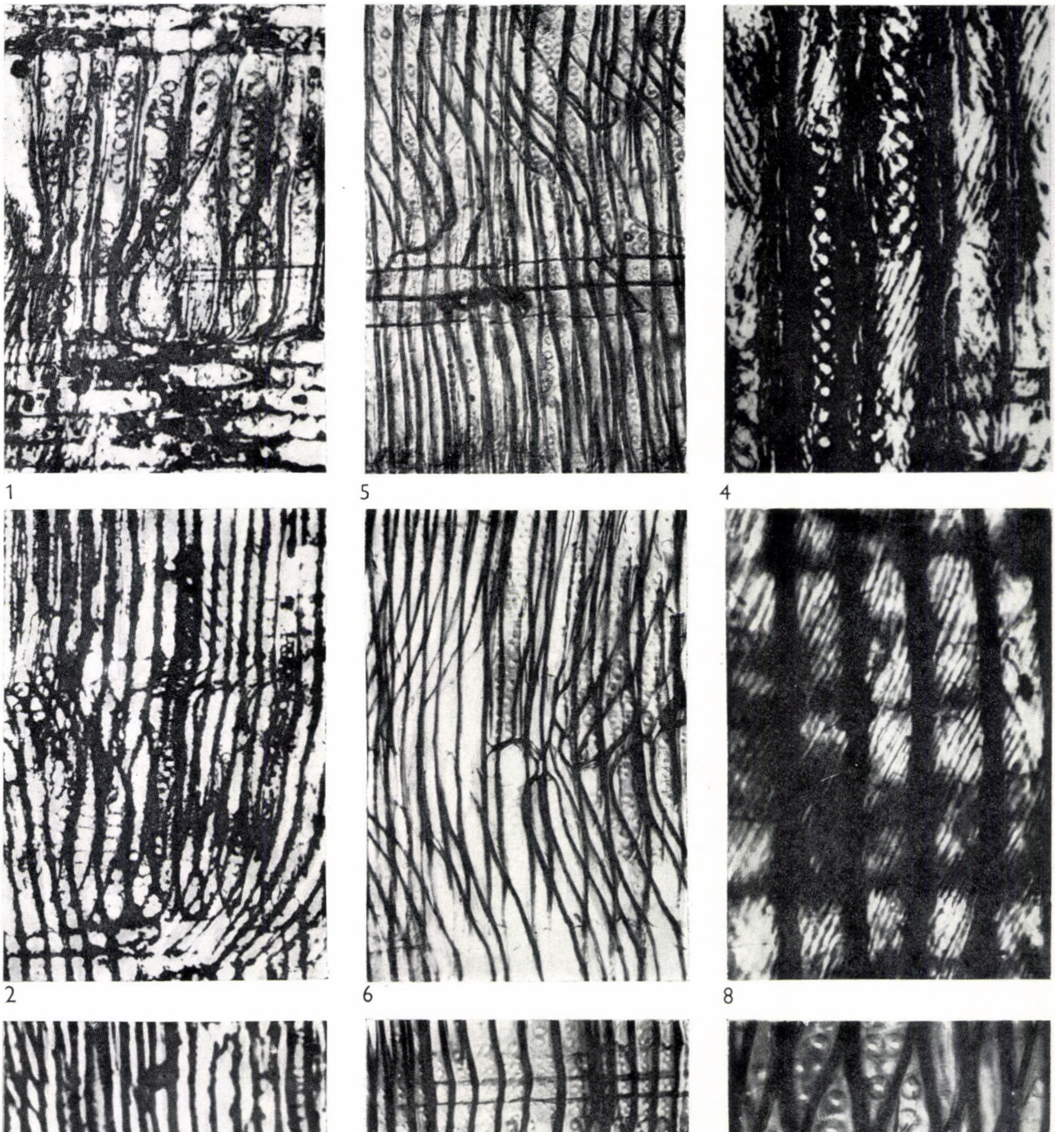
1–6. *Laricioxylon nógrádense* n. sp. (Nógrádszakál, Sarmatian).
7–9. *? Laricioxylon* sp. (Megyaszó, Lower Pannonian).

1. *C.* Cross section structure. Resin ducts in the late wood (30×) — 2. *C.* Resin duct row in the late wood (100×) — 3. *R.* In the tracheid walls the bordered pits are arranged in one row. Their aperture is circular (300×) — 4. *T.* Two kinds of rays. In the middle of the broader one horizontal resin duct (100×) — 5. *R.* Ray structure. In the cross fields 4–6 simple pinoid pits in 2 rows. In the upper part 2 tracheids cover each other beak-like (300×) — 6. *T.* Ray structure. The walls of the ray parenchyma cells are densely pitted, on the lower edge the transverse tracheids cover the endings of each other beak-like (300×) — 7. *T.* Uni- and biseriate rays with resin ducts (at the arrow) (100×) — 8. *T.* The same (100×) — 9. *C.* In the autumn wood resin duct (100×).

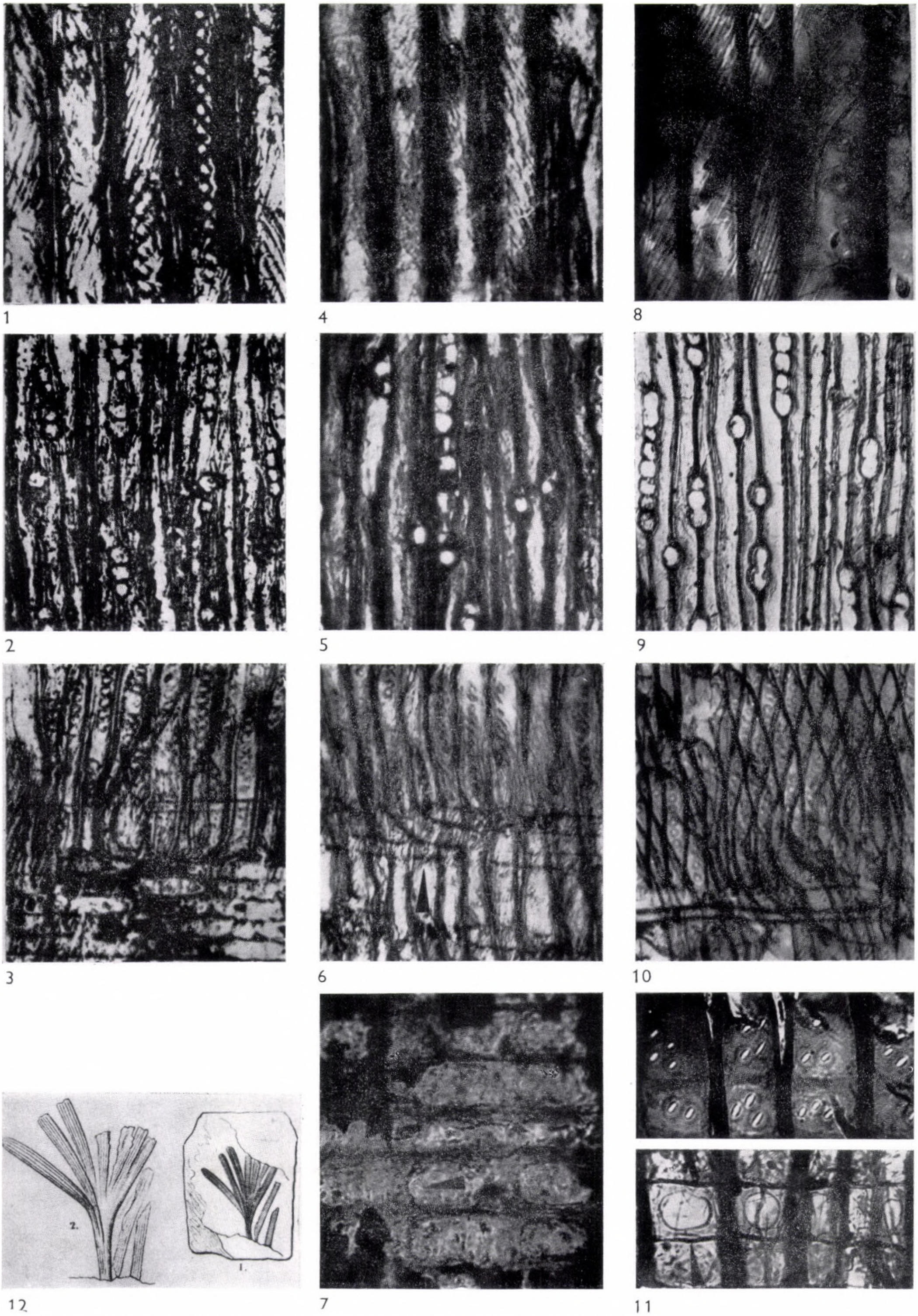
PLATES



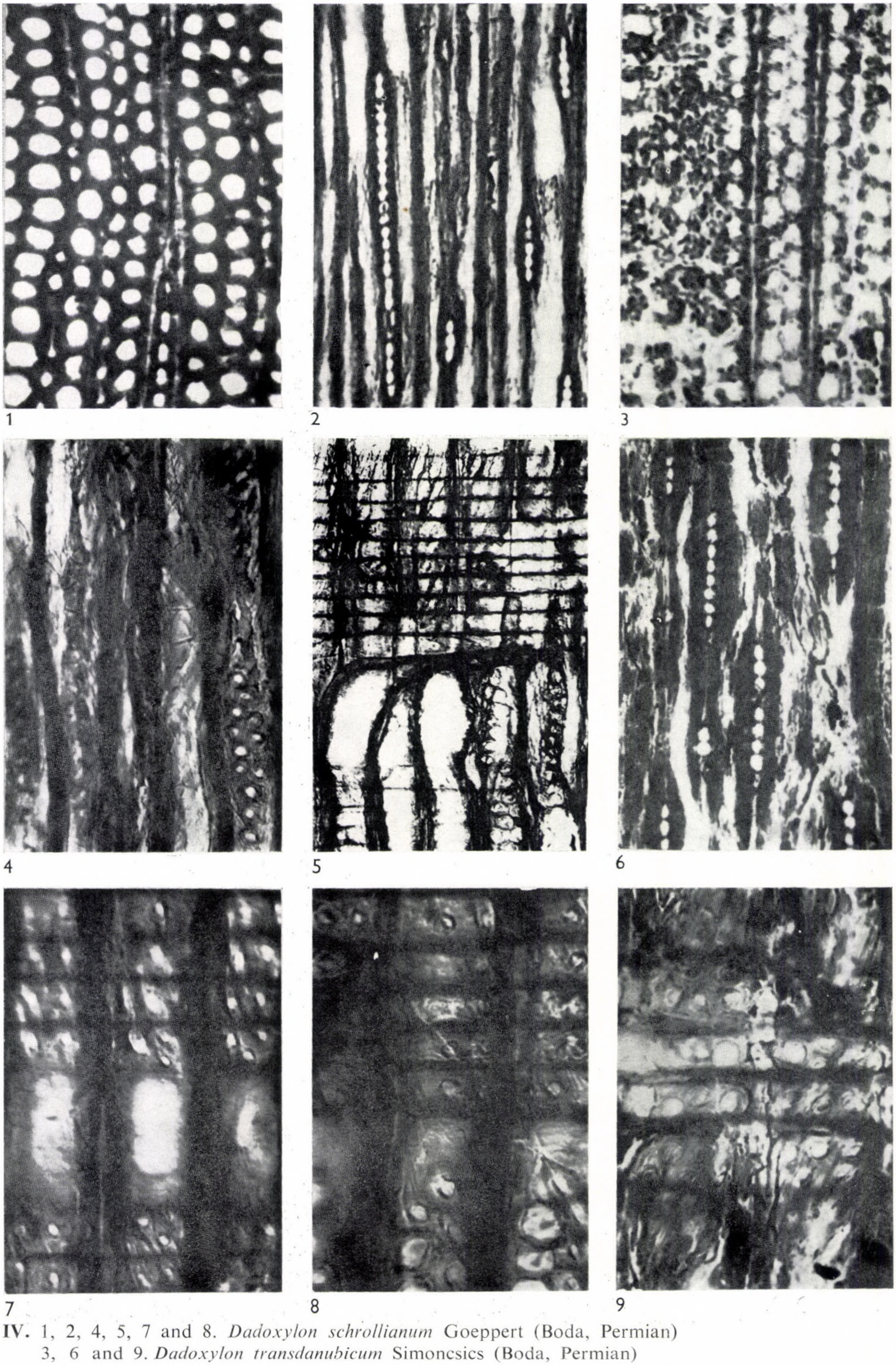
I. 1–3, 5–9. *Baieroxylon implexum* (Zimmermann) Greguss (Boda, Permian)
4. Recent *Ginkgo biloba* L.



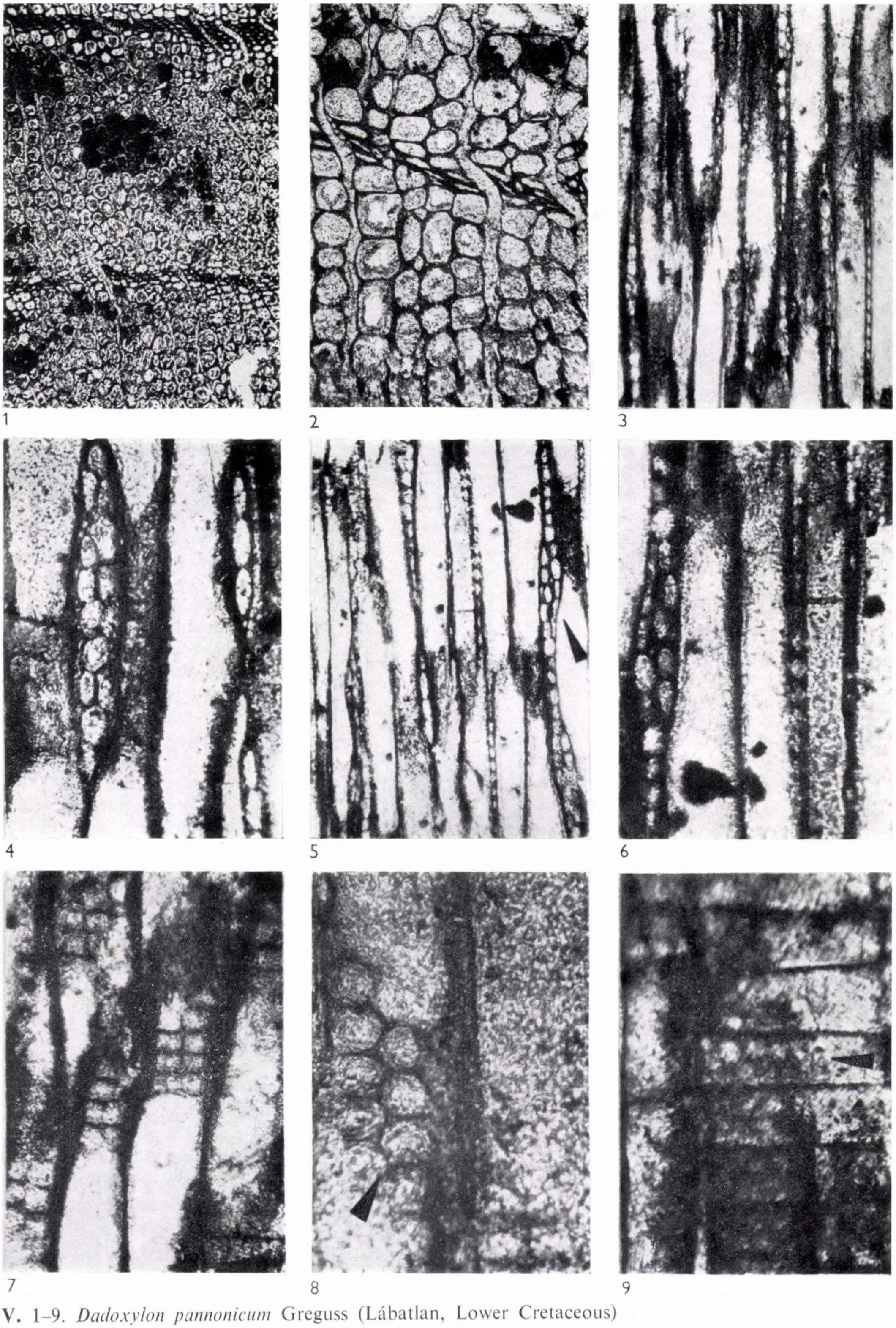
II. 1. *Dadoxylon graminovillae* (Zimmermann, Cretaceous) 2. *Dadoxylon implexum* (Zimmermann, Cretaceous) 3. *Dadoxylon implexum* (Zimmermann, Cretaceous) 4. *Dadoxylon graminovillae* (Zimmermann, Cretaceous) 5–9. Recent *Ginkgo biloba* L.



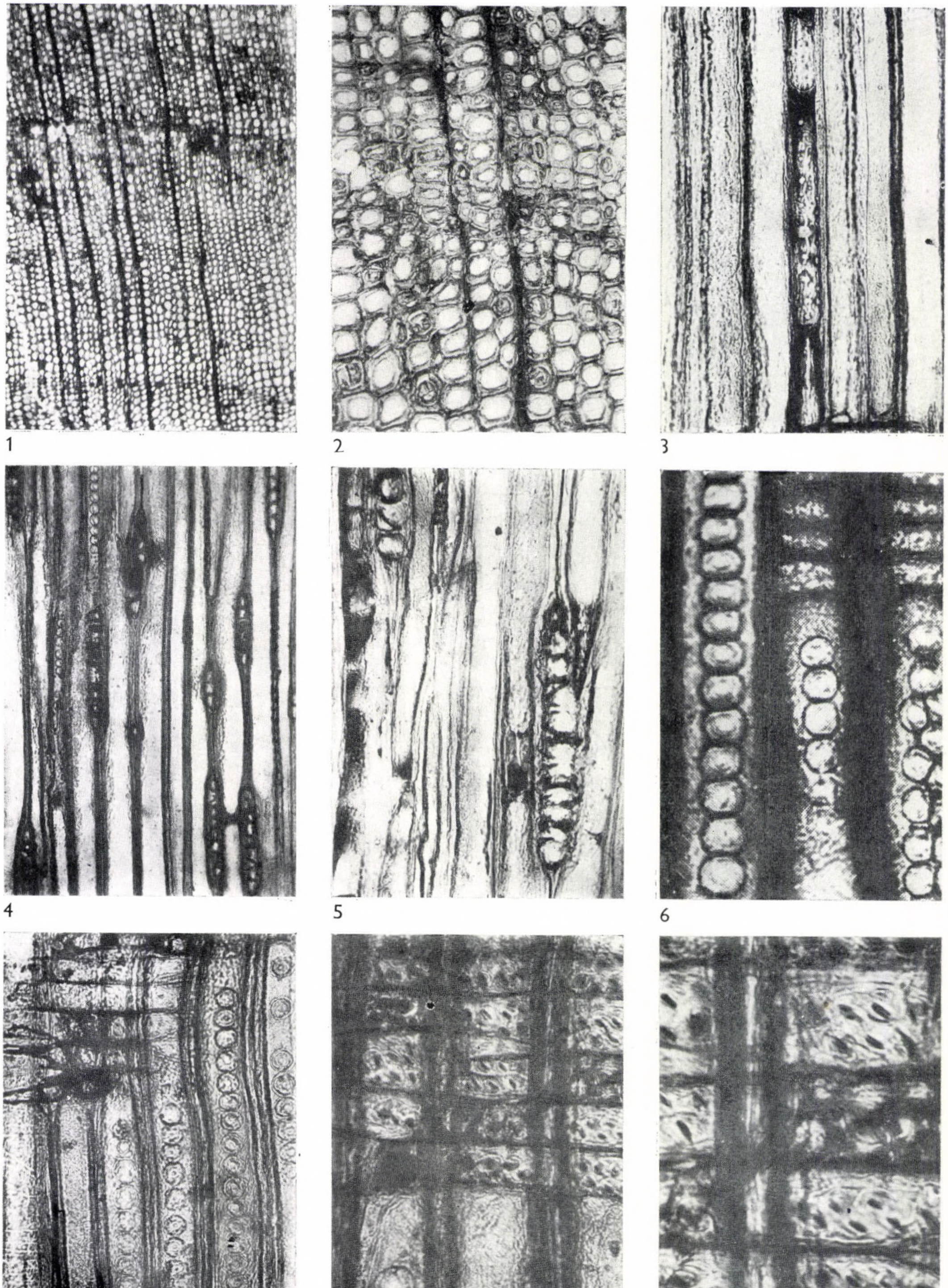
III. 1–3. *Dadoxylon implexum* Zimmermann (Germany, Cretaceous)
4–7. *Baieroxylon implexum* (Zimmermann) Greguss (Boda, Permian)
8–11. Living *Ginkgo biloba* L.
12. *Baiera digitata* Heer (Boda, Permian)



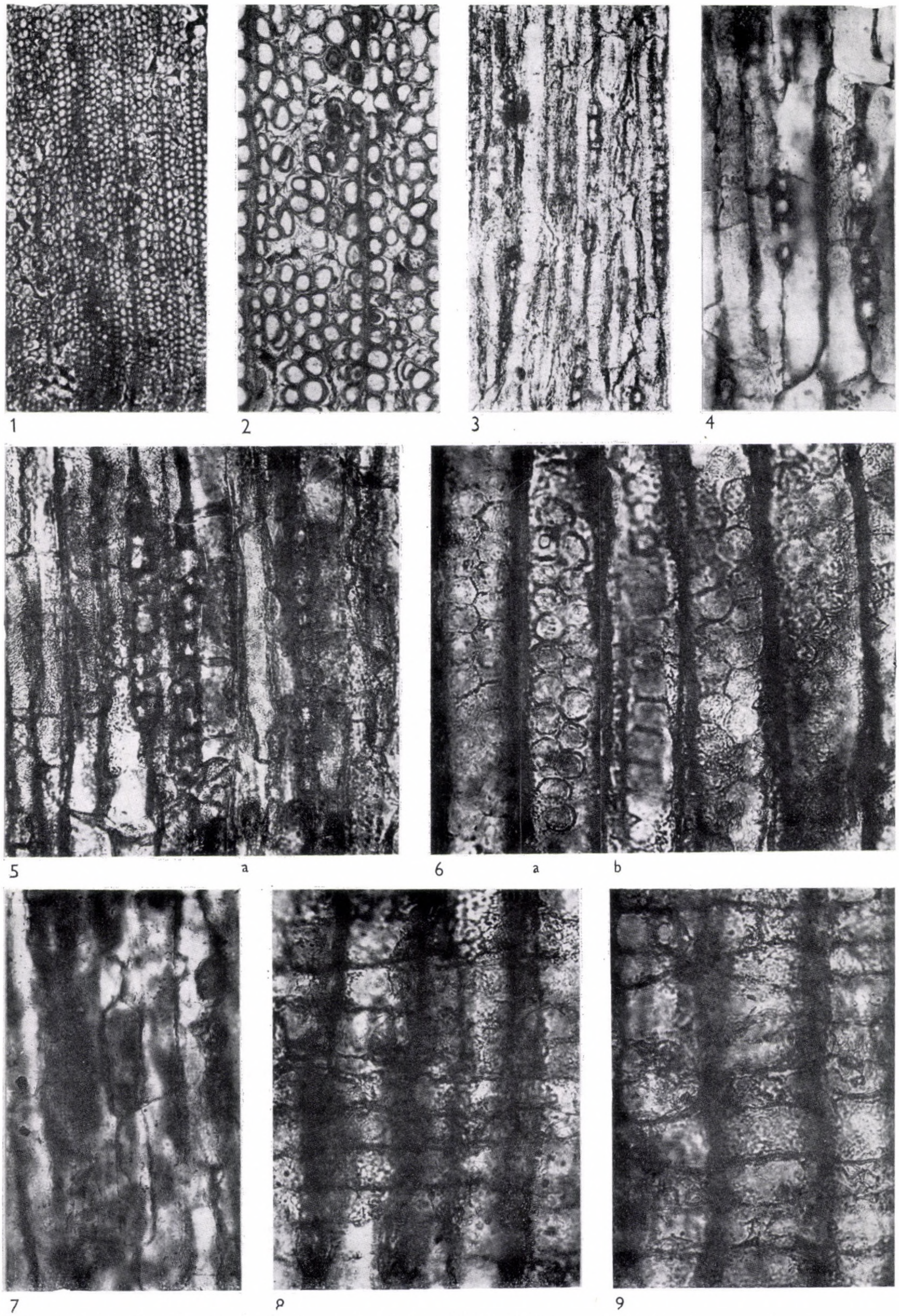
IV. 1, 2, 4, 5, 7 and 8. *Dadoxylon schrollianum* Goeppert (Boda, Permian)
3, 6 and 9. *Dadoxylon transdanubicum* Simoncsics (Boda, Permian)



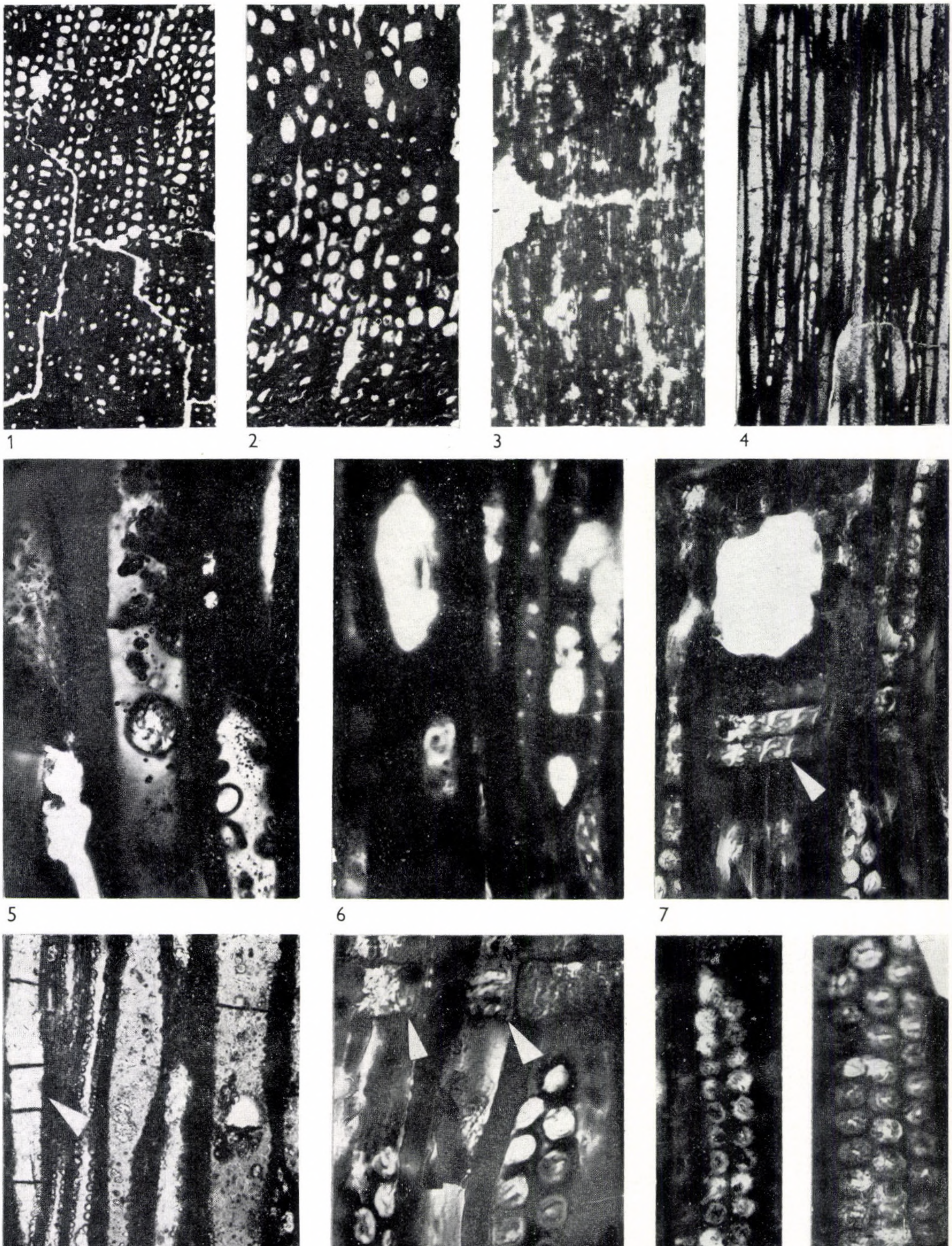
V. 1–9. *Dadoxylon pannonicum* Greguss (Lábatlan, Lower Cretaceous)



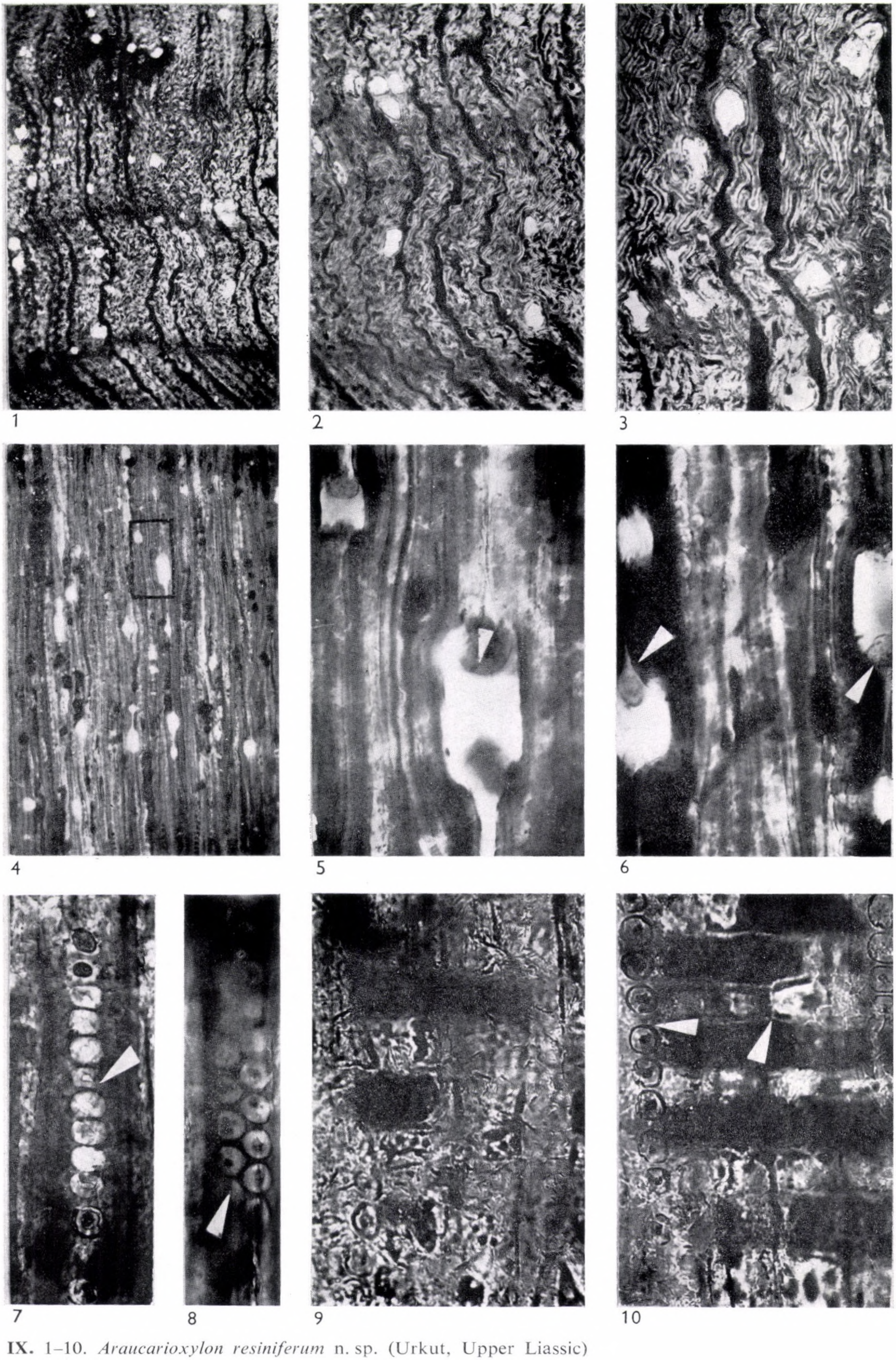
VI. 1–9. *Agathoxylon hungaricum* (Andreánszky) Greguss (Urkut, Upper Liassic)



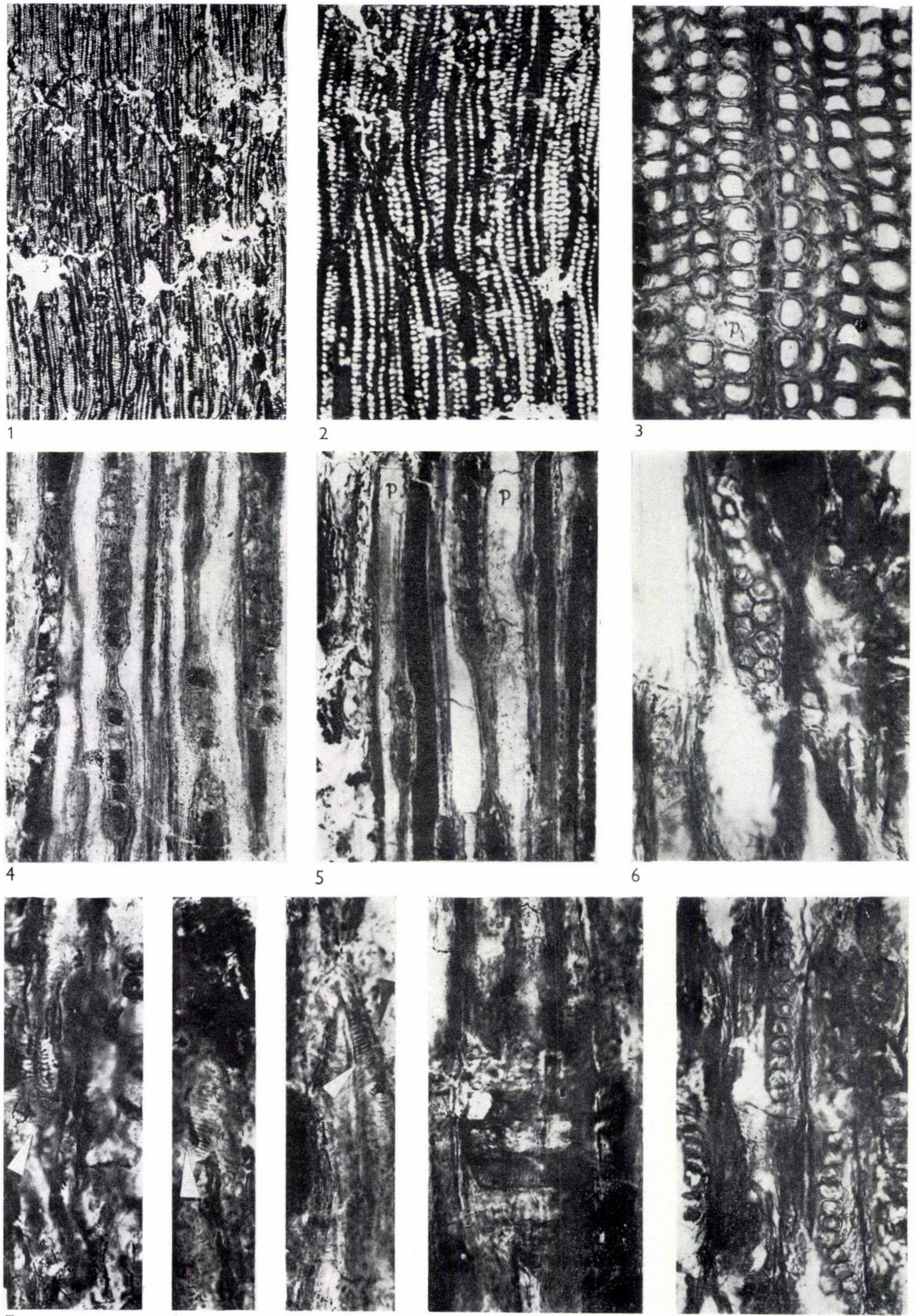
VII. 1–9. *Agathoxylon* sp. seu? *Araucarioxylon* sp.? (Urkut, Lower Cretaceous)



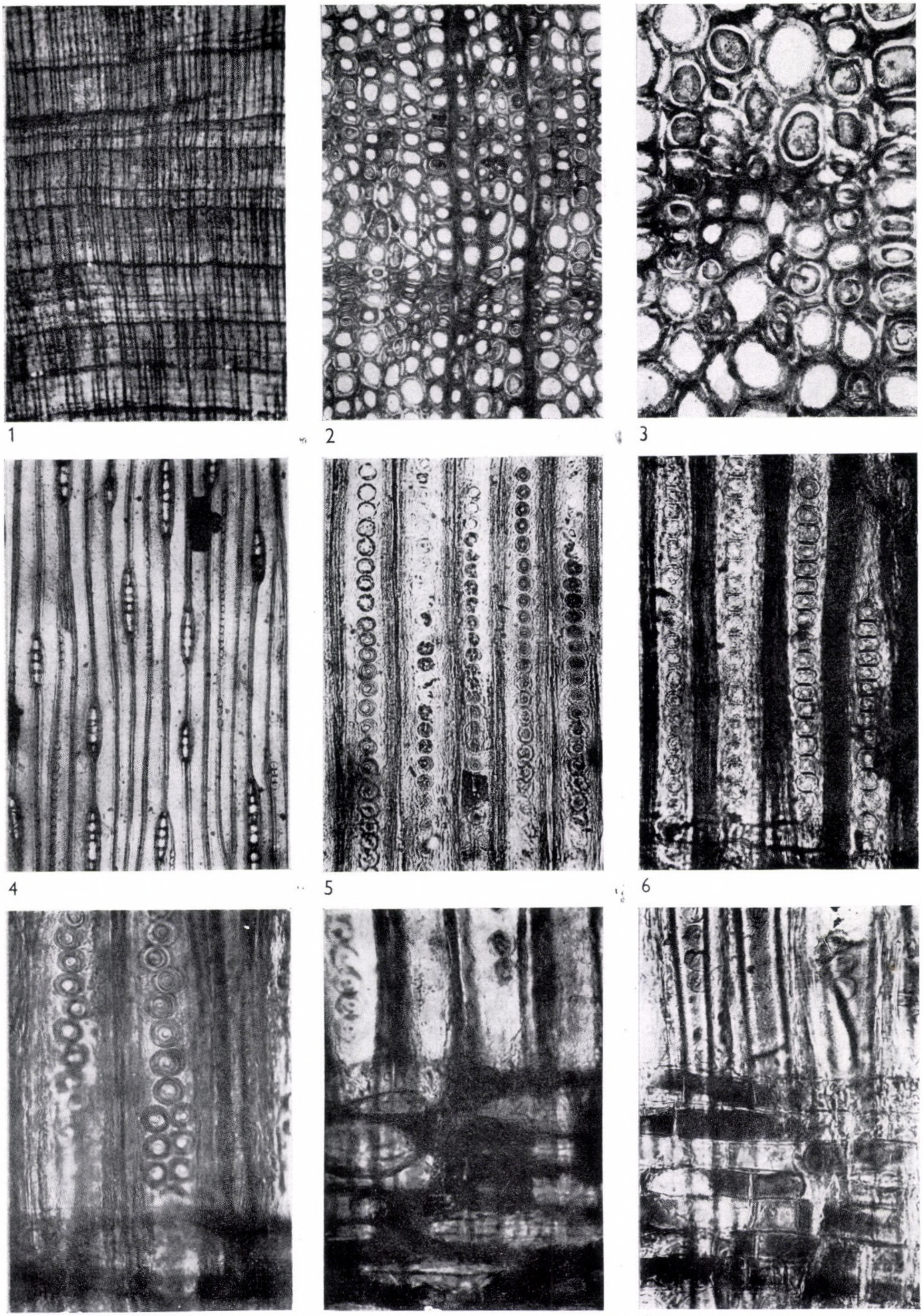
VIII. 1–11. *Agathoxylon mecsekense* n. sp. (Urkut, Upper Liassic)



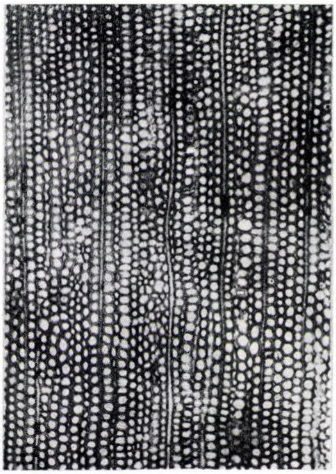
IX. 1–10. *Araucarioxylon resiniferum* n. sp. (Urkut, Upper Liassic)



X. 1–11. *Araucarioxylon spirale* n. sp. (Mánfa, Permian) (Helvetian?)



XI. 1–9. *Araucarioxylon* sp. (No. 13) (Urkut, Upper Liassic)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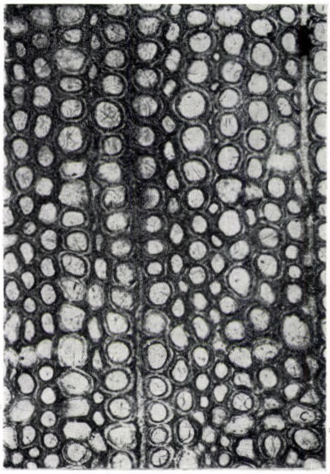
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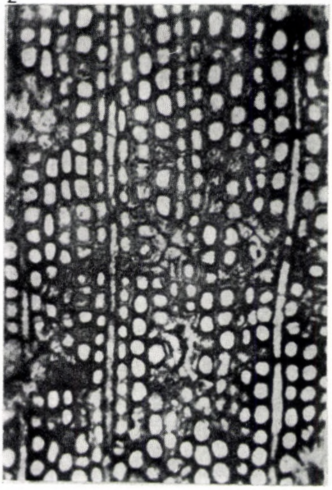
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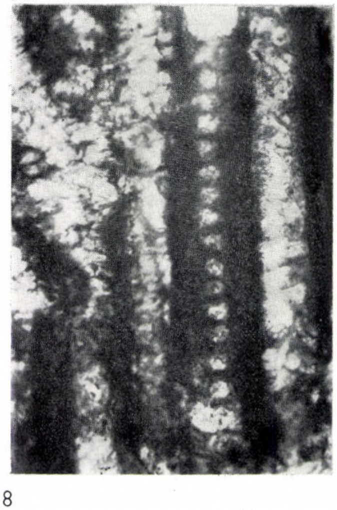
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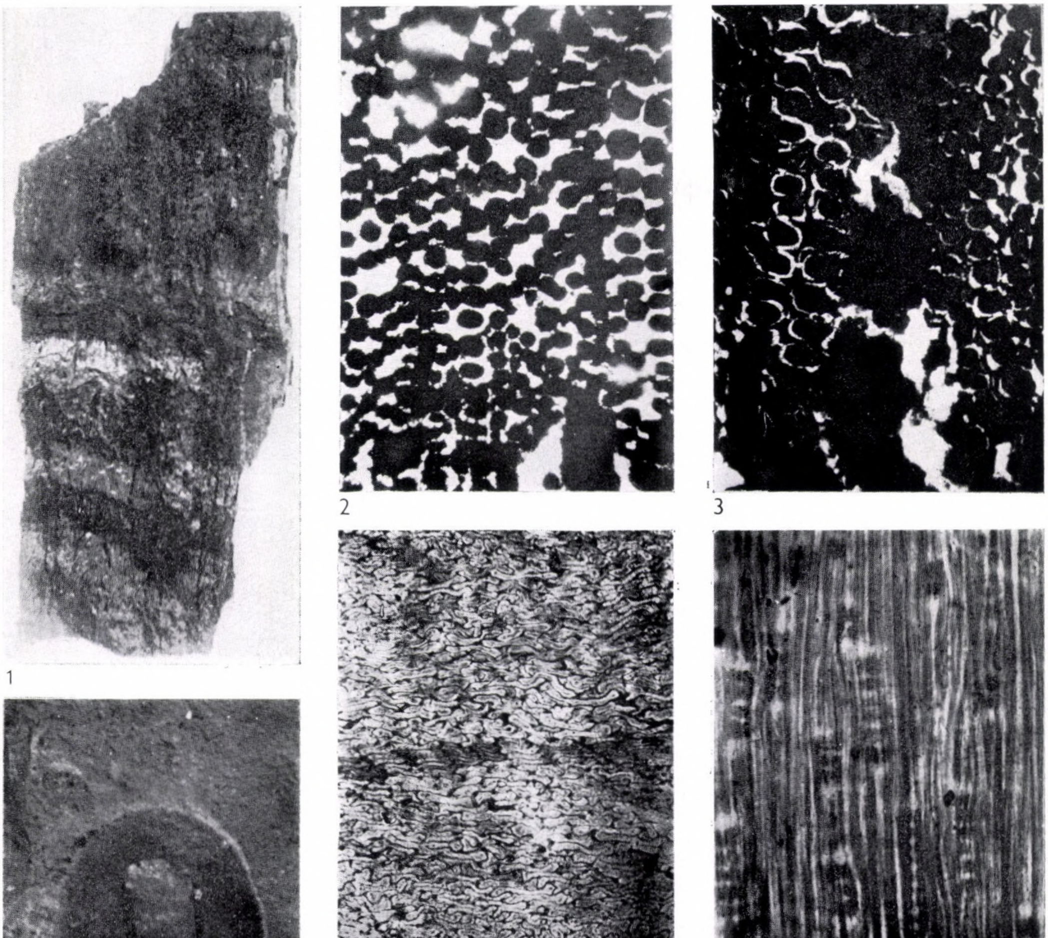
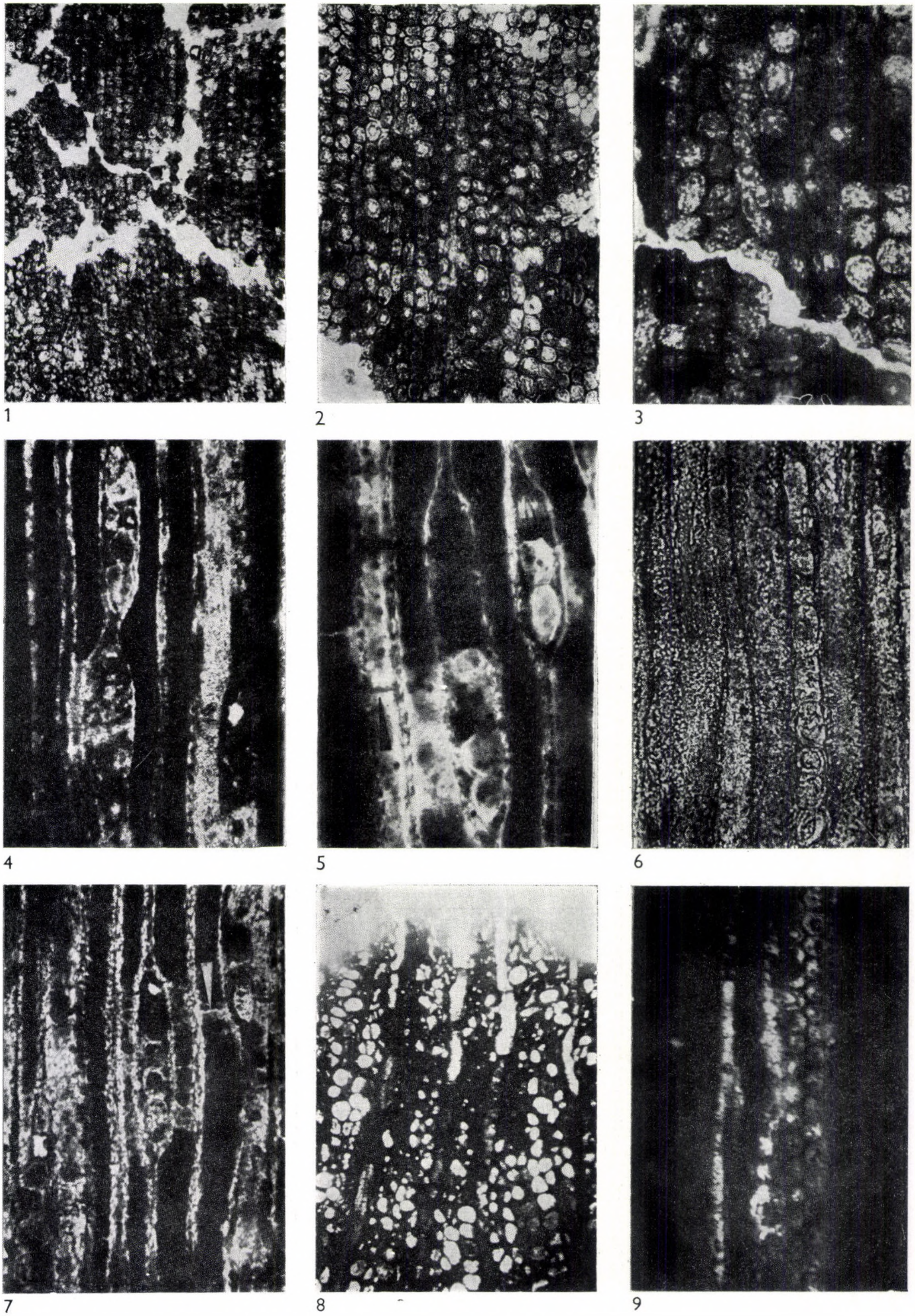
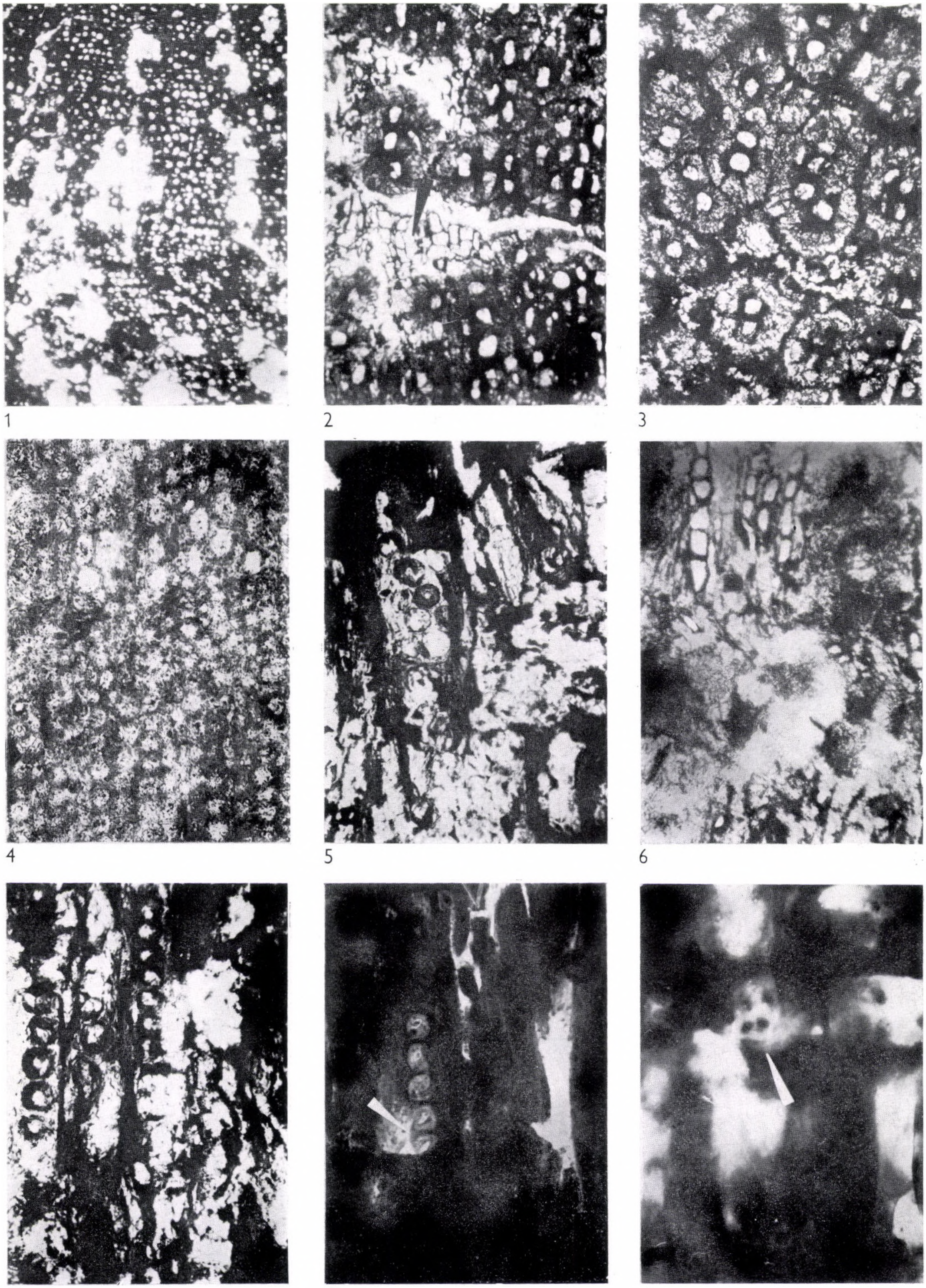
XII. 1–4. *Araucarioxylon* sp. (No. 1) (Cserkút, Permian)
5–9. *Araucarioxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic)



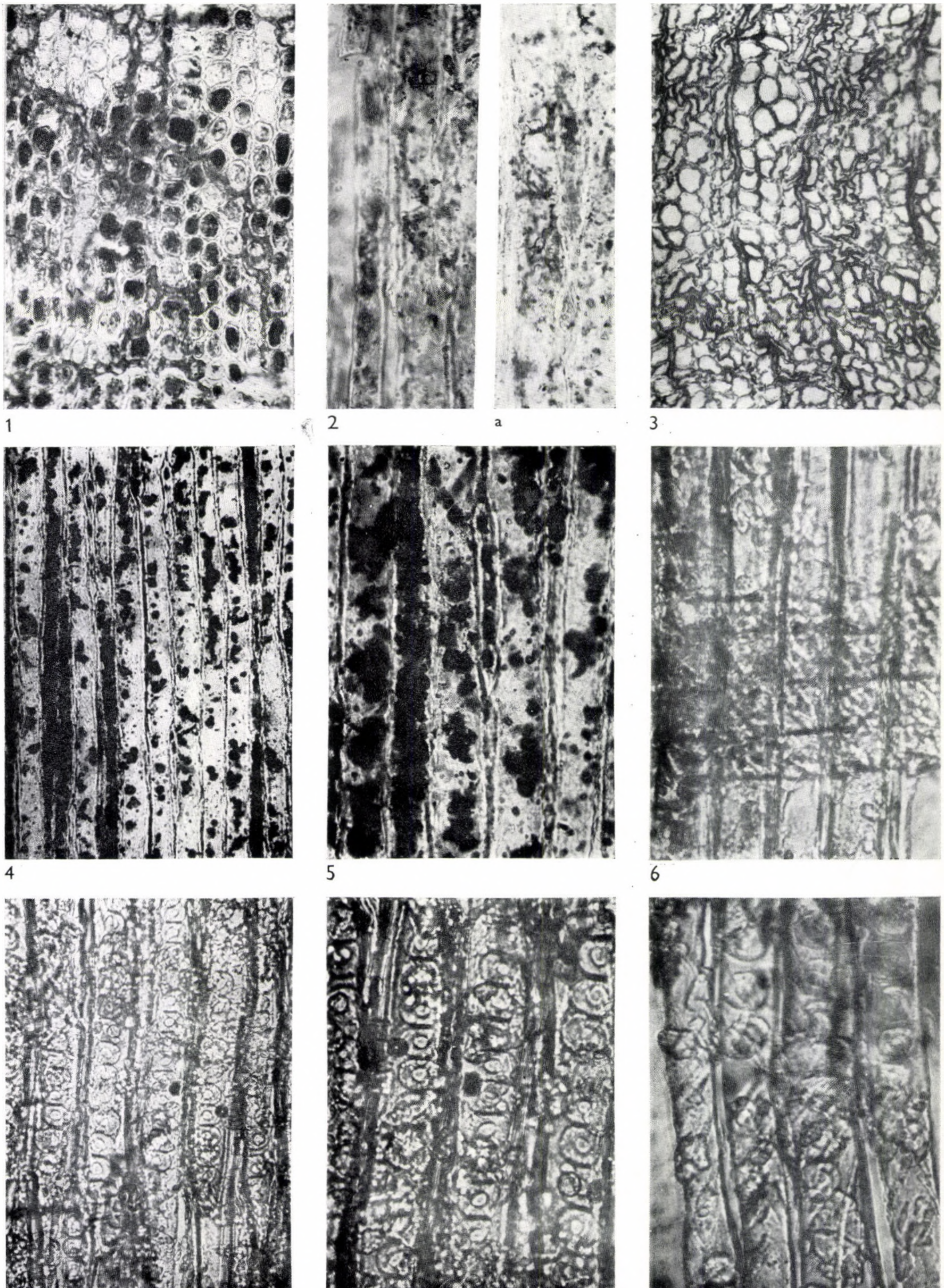
XIII. 1–5. *Araucarioxylon* sp. (No. 3) (Pécs–Mecsekfalu, Permian [in situ])
6–9. *Araucarioxylon* sp. (No. 4) (Urkut, Upper Liassic)



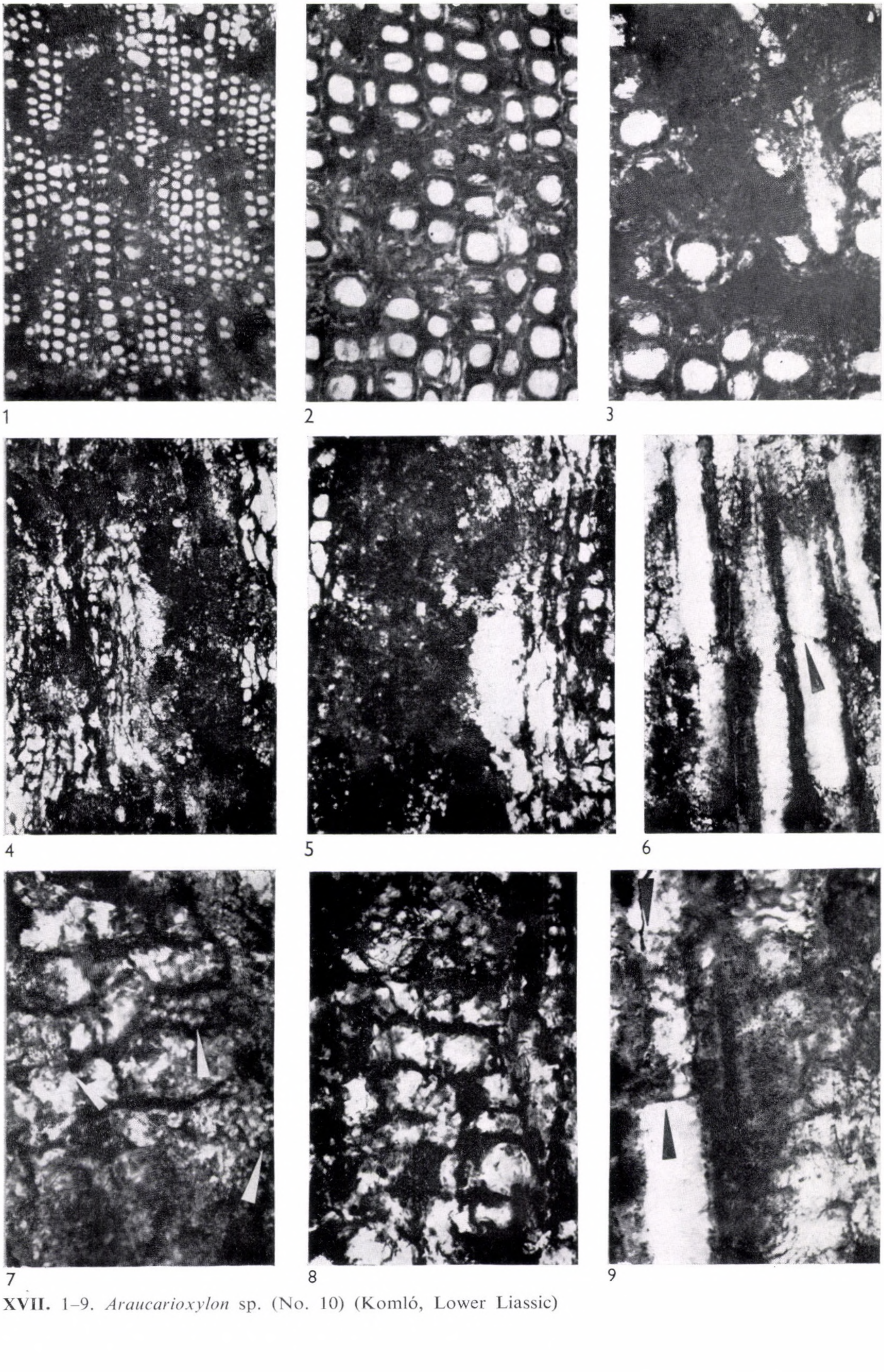
XIV. 1–7. *Araucarioxylon* sp. (No. 5) (Villány, Upper Dogger)
8 and 9. *Araucarioxylon* sp. (No. 6) (Urkut, Upper Liassic)



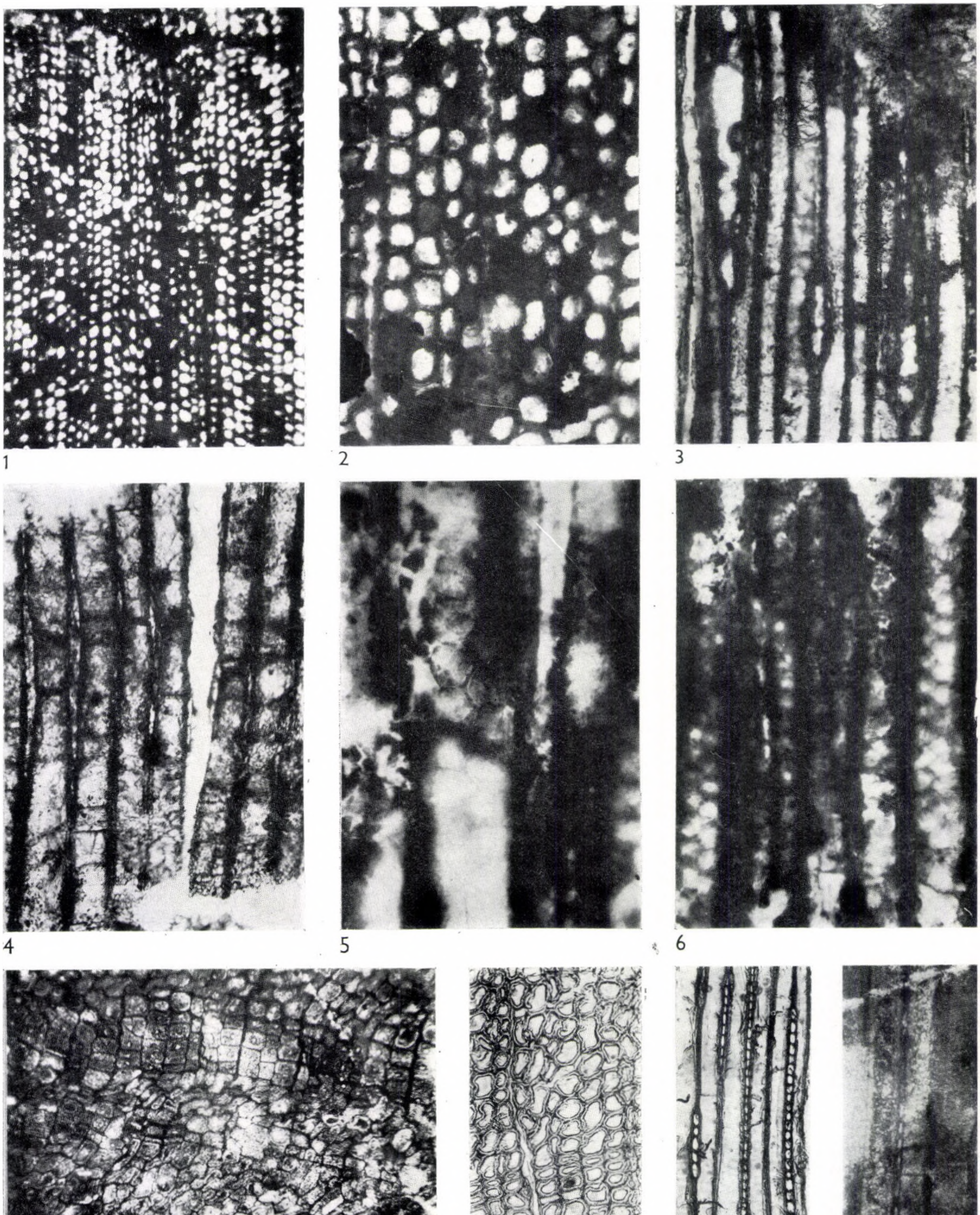
XV. 1–9. *Araucarioxylon* sp. (No. 7) (Vasas, Upper Dogger)



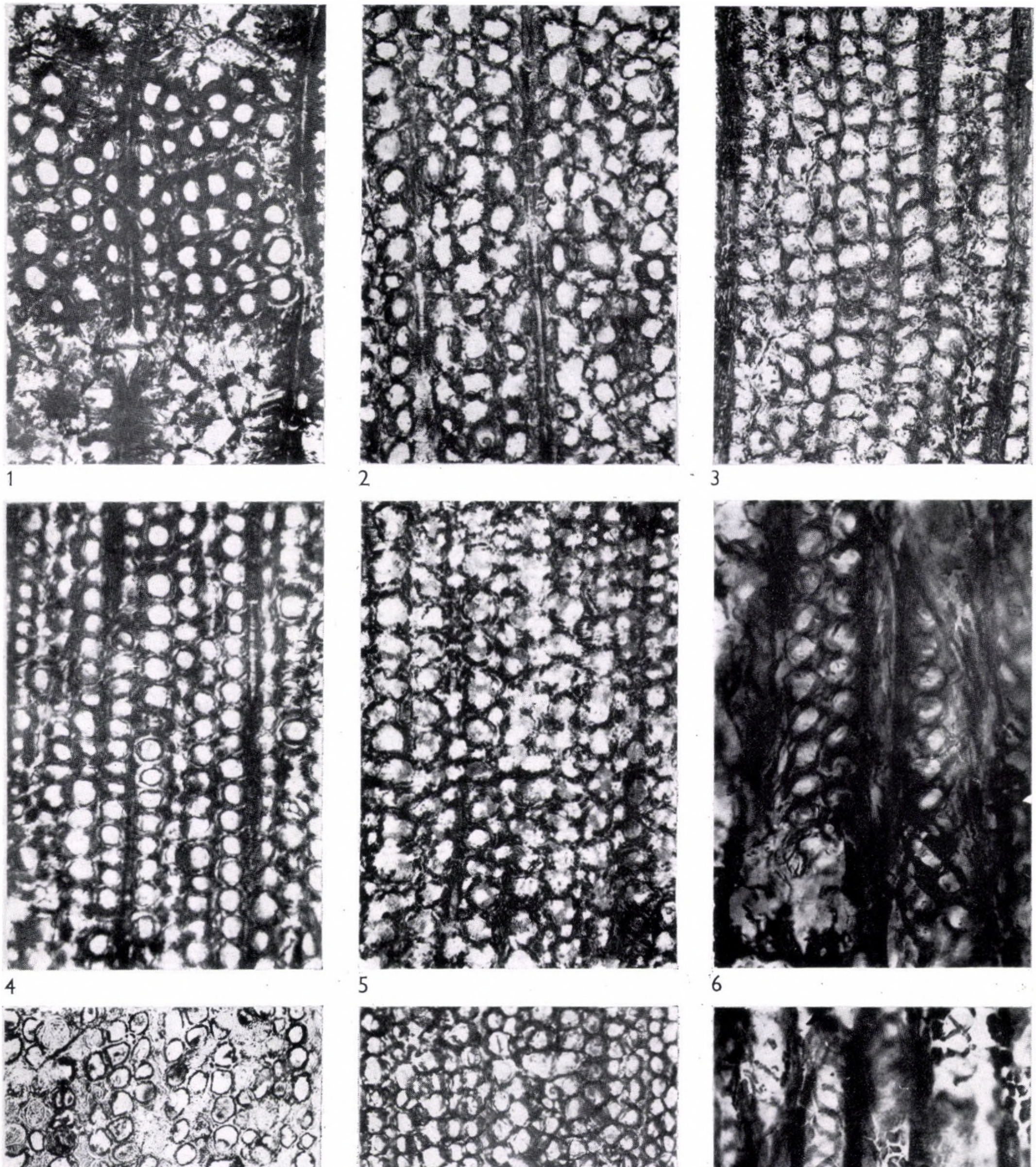
XVI. 1 and 2. *Araucarioxylon* sp. (No. 8) (Hárskút, Cretaceous)
3–9. *Araucarioxylon* sp. (No. 9) (Sümeg, Lower Cretaceous)



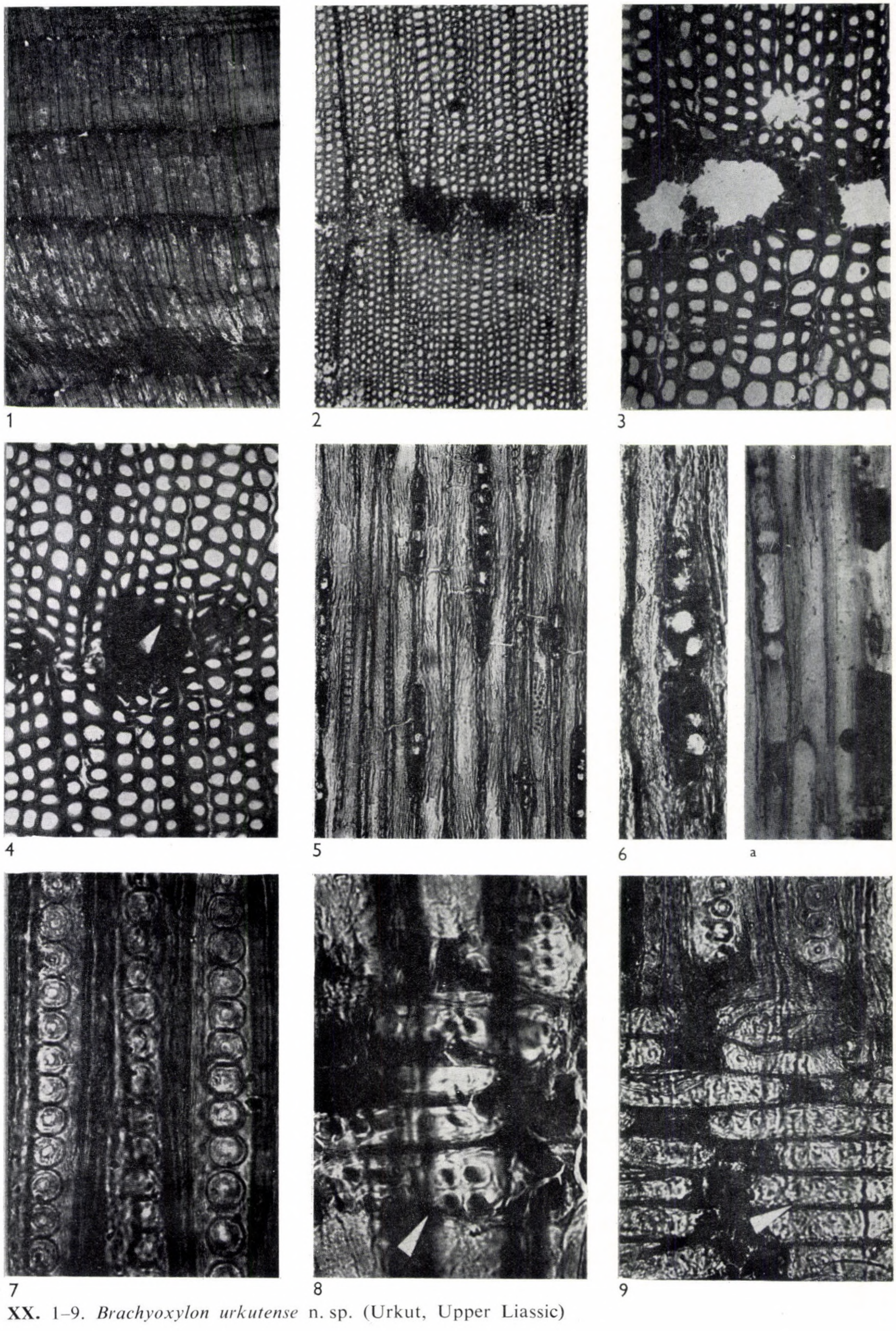
XVII. 1–9. *Araucarioxylon* sp. (No. 10) (Komló, Lower Liassic)



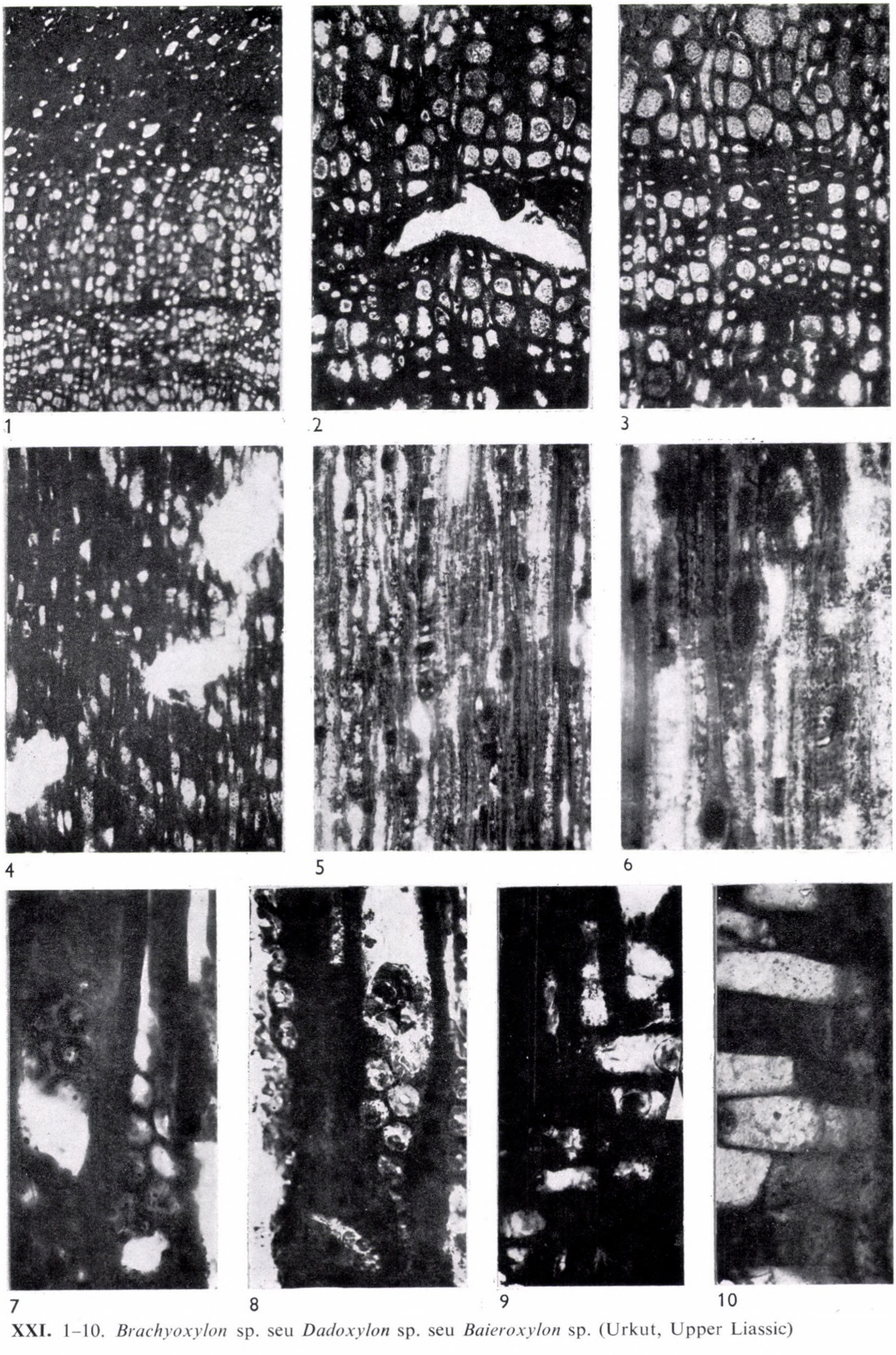
XVIII. 1–6. *Araucarioxylon* sp. (No. 11) (Tata, Lower Cretaceous)
7–10. *Podocarpoxylon* sp. (No. 5) (Tata, Lower Cretaceous)



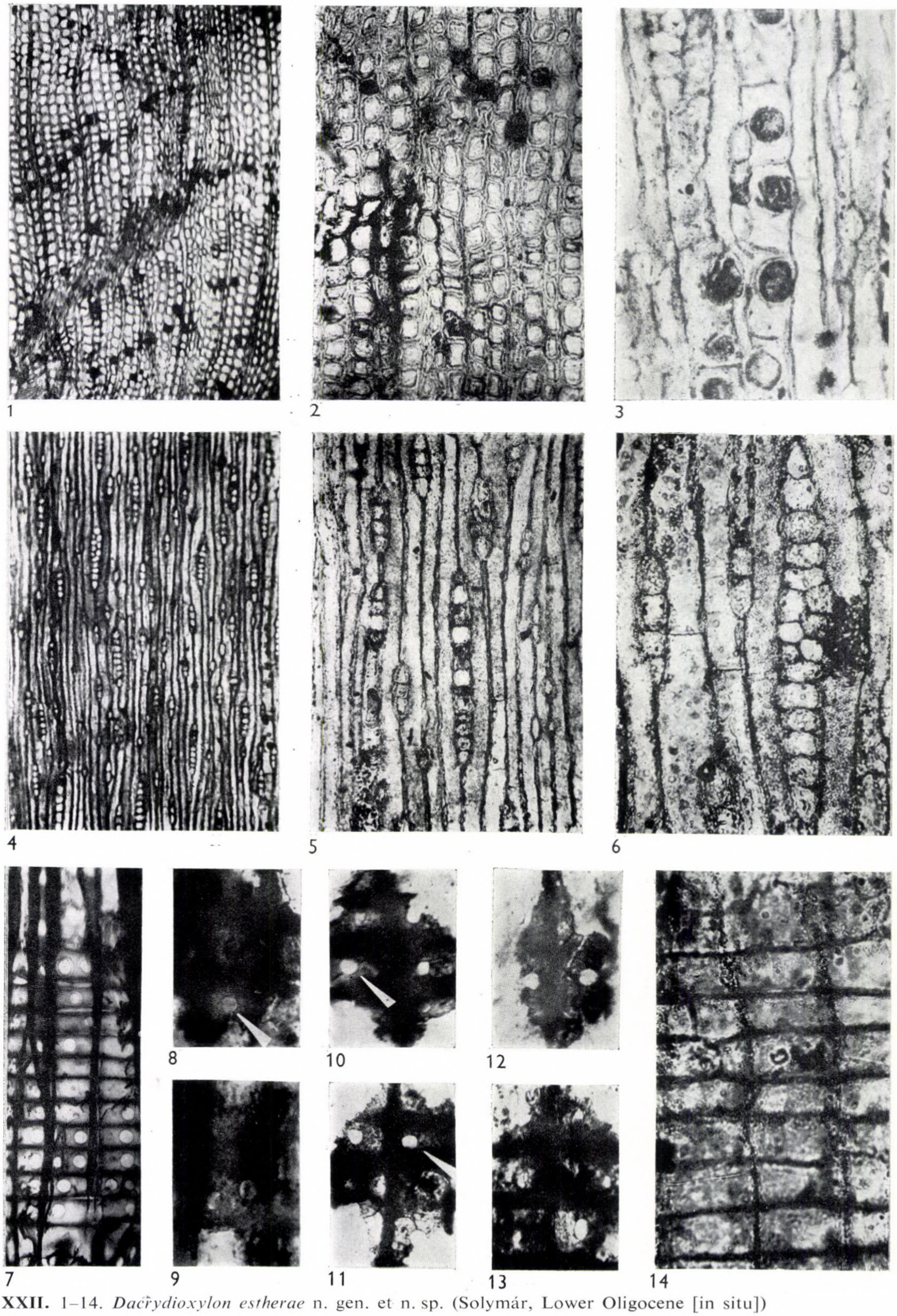
XIX. 1–6. ? *Araucarioxylon* sp. (Hetvehely, Cserkút, Permian)
7. *Araucarioxylon* sp. (No. 12) (Balatonszepezd, Permian)
8 and 9. ? *Platyspiroxylon* sp. (No. 1) (Litér, Permian)



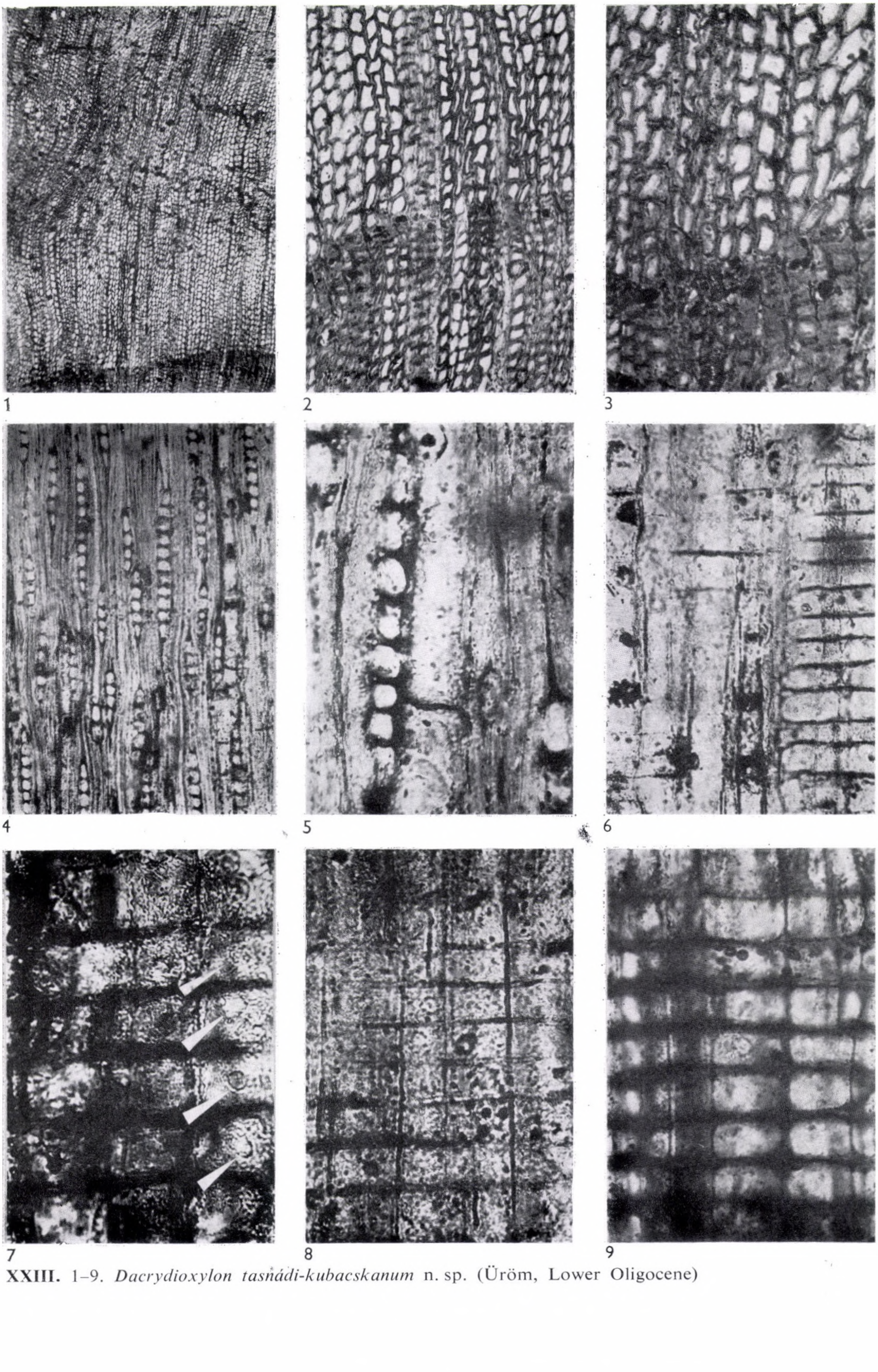
XX. 1–9. *Brachyoxylon urkutense* n. sp. (Urkut, Upper Liassic)



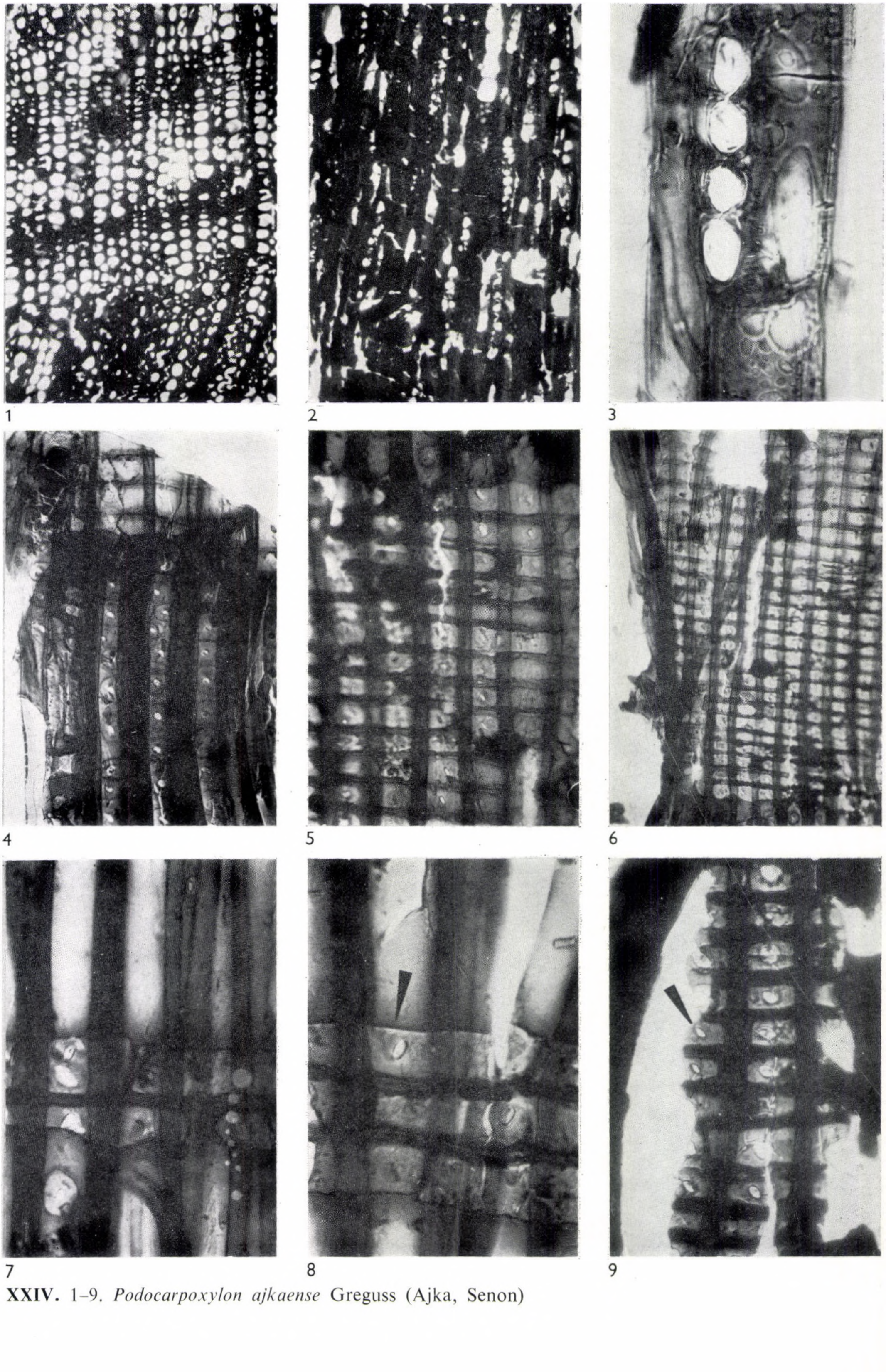
XXI. 1–10. *Brachyoxylon* sp. seu *Dadoxylon* sp. seu *Baieroxylon* sp. (Urkut, Upper Liassic)



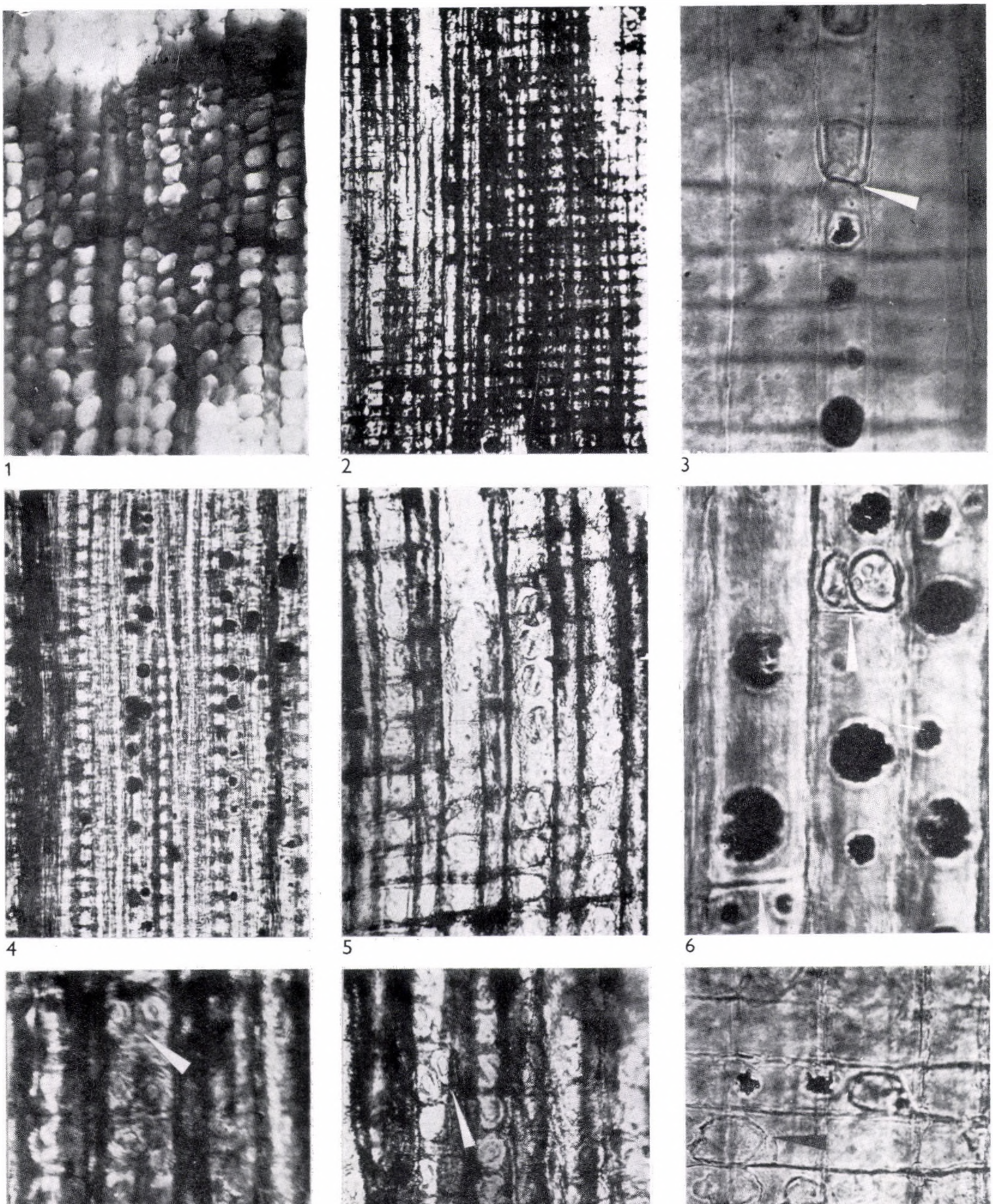
XXII. 1–14. *Dacrydioxylon estherae* n. gen. et n. sp. (Solymár, Lower Oligocene [in situ])



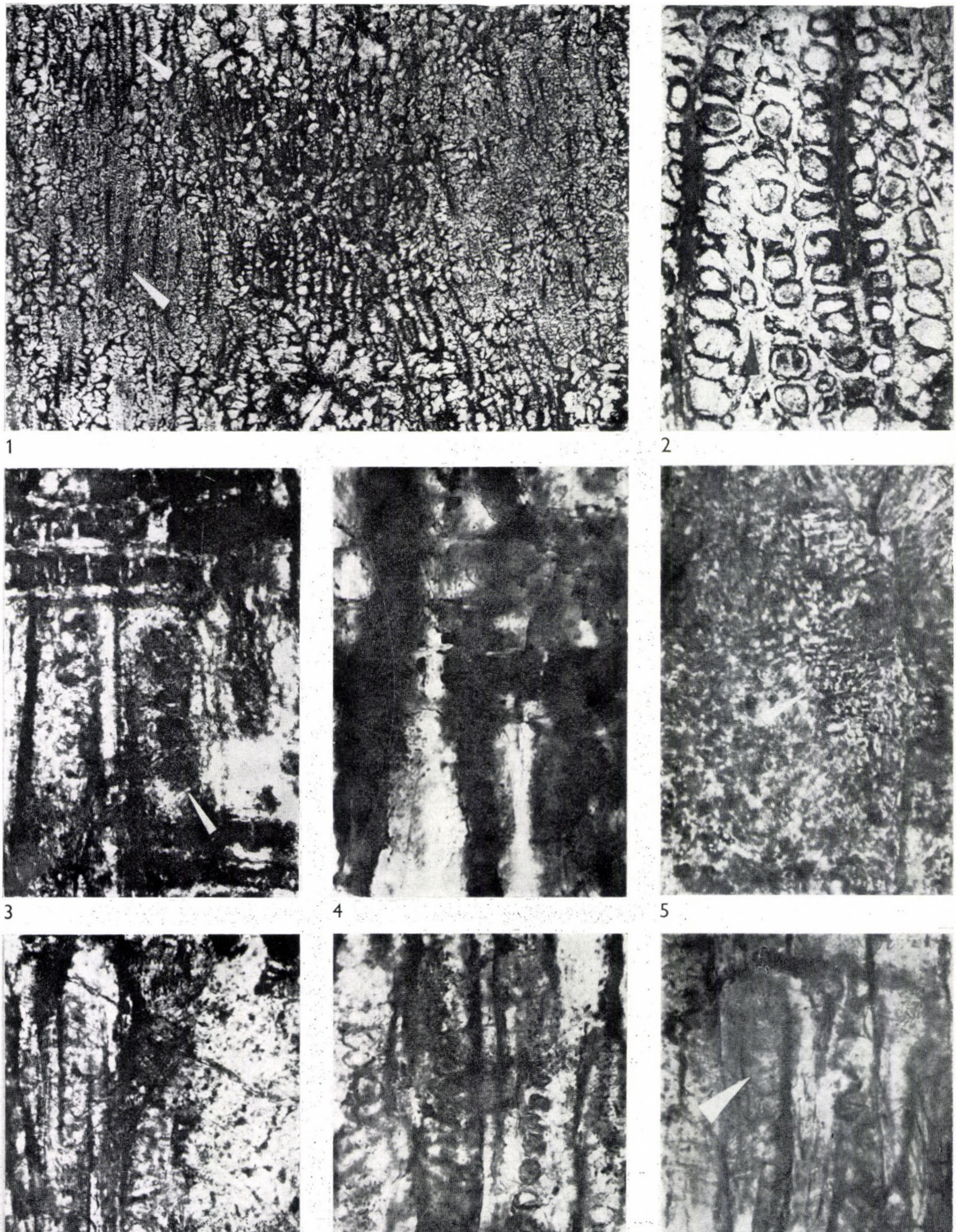
XXIII. 1–9. *Dacrydioxylon tasnádi-kubacskanum* n. sp. (Üröm, Lower Oligocene)



XXIV. 1–9. *Podocarpoxylon ajkaense* Greguss (Ajka, Senon)



XXV. 1–9. *Podocarpoxylon* cf. *lilpopi* Kräusel (Darnóhegy, Oligocene)



XXVI. 1–8. ?*Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous)

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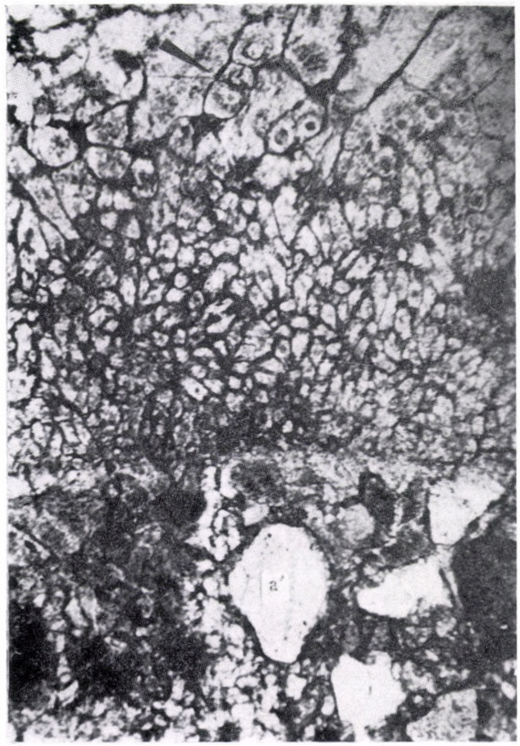

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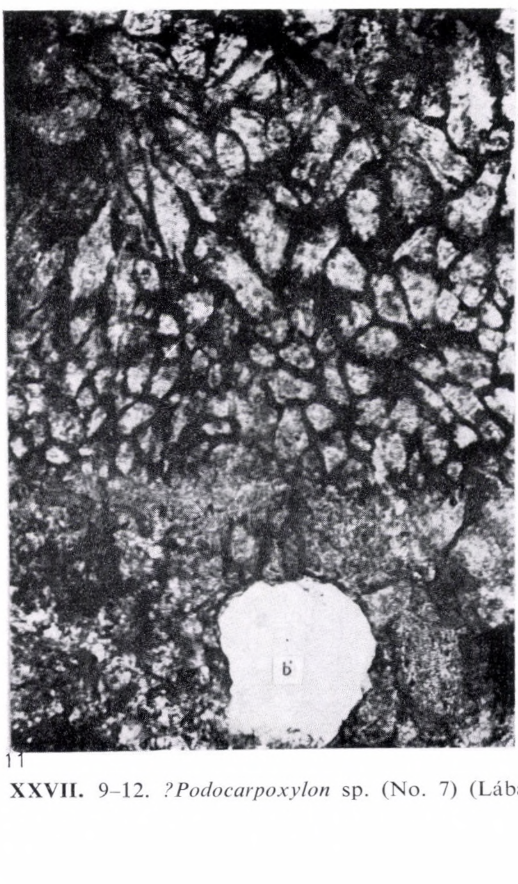

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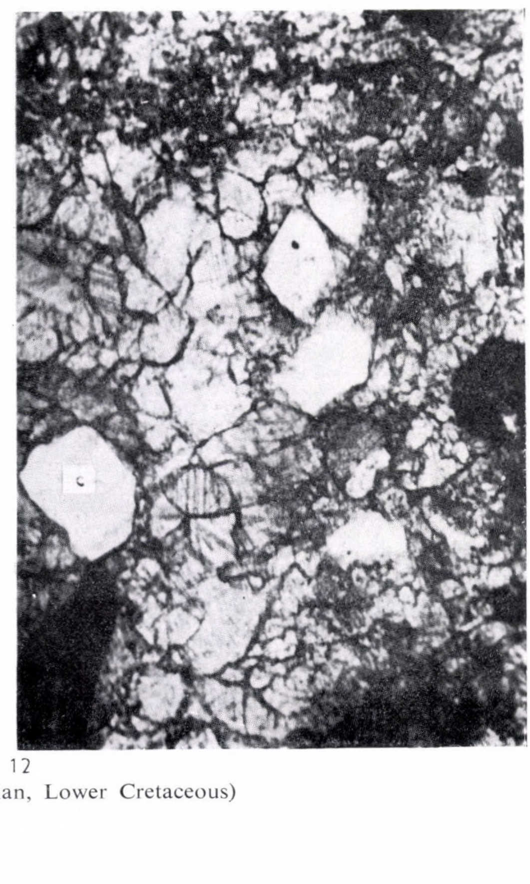

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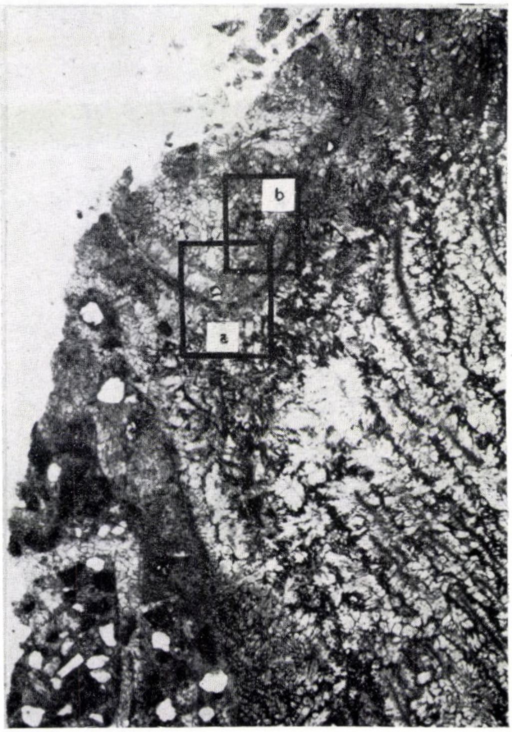
XXVII. 9–12. ?*Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous)



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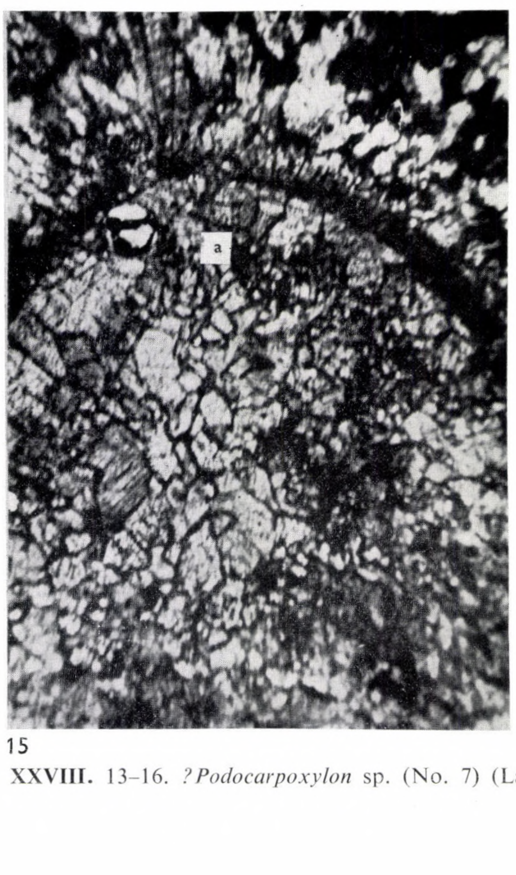

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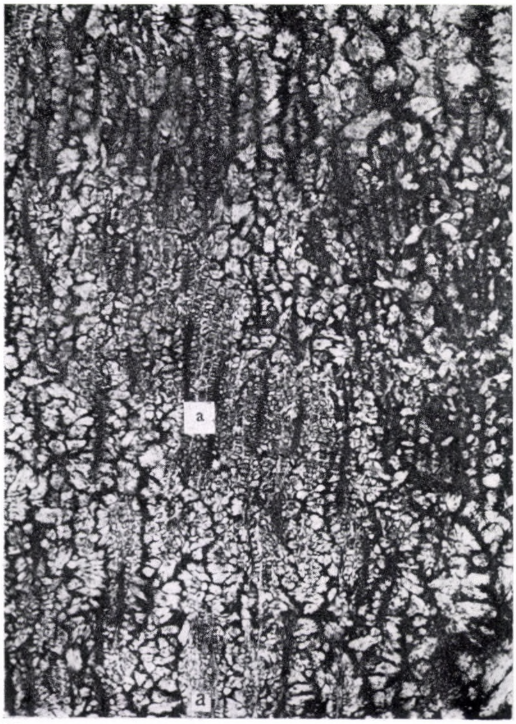
XXVIII. 13–16. *?Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous)

17



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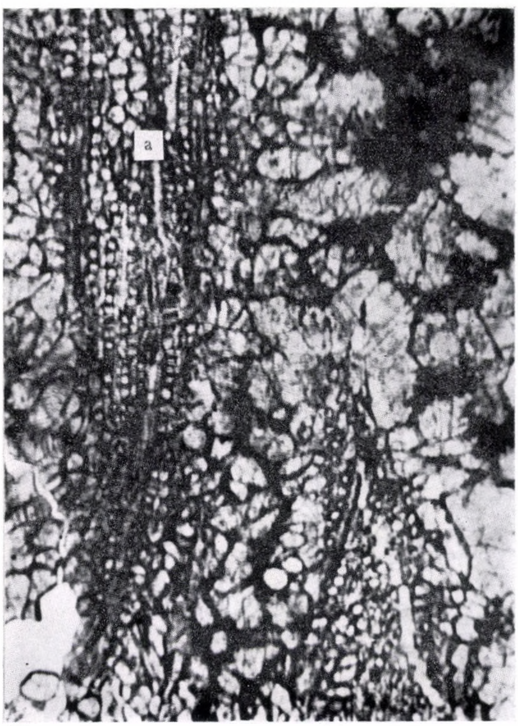

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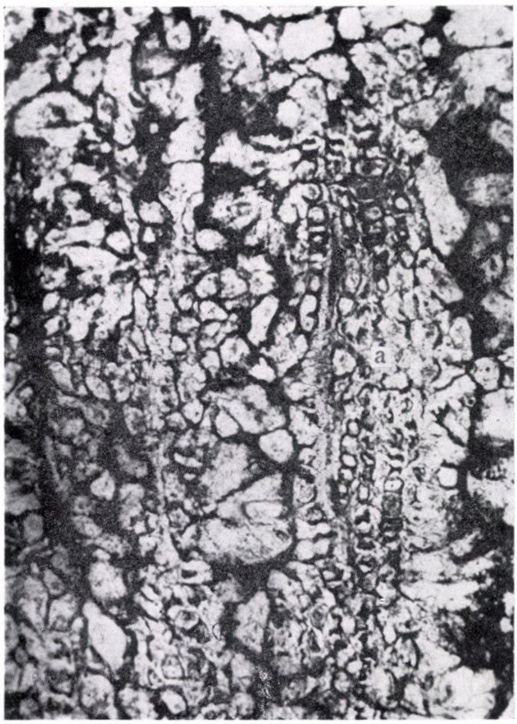

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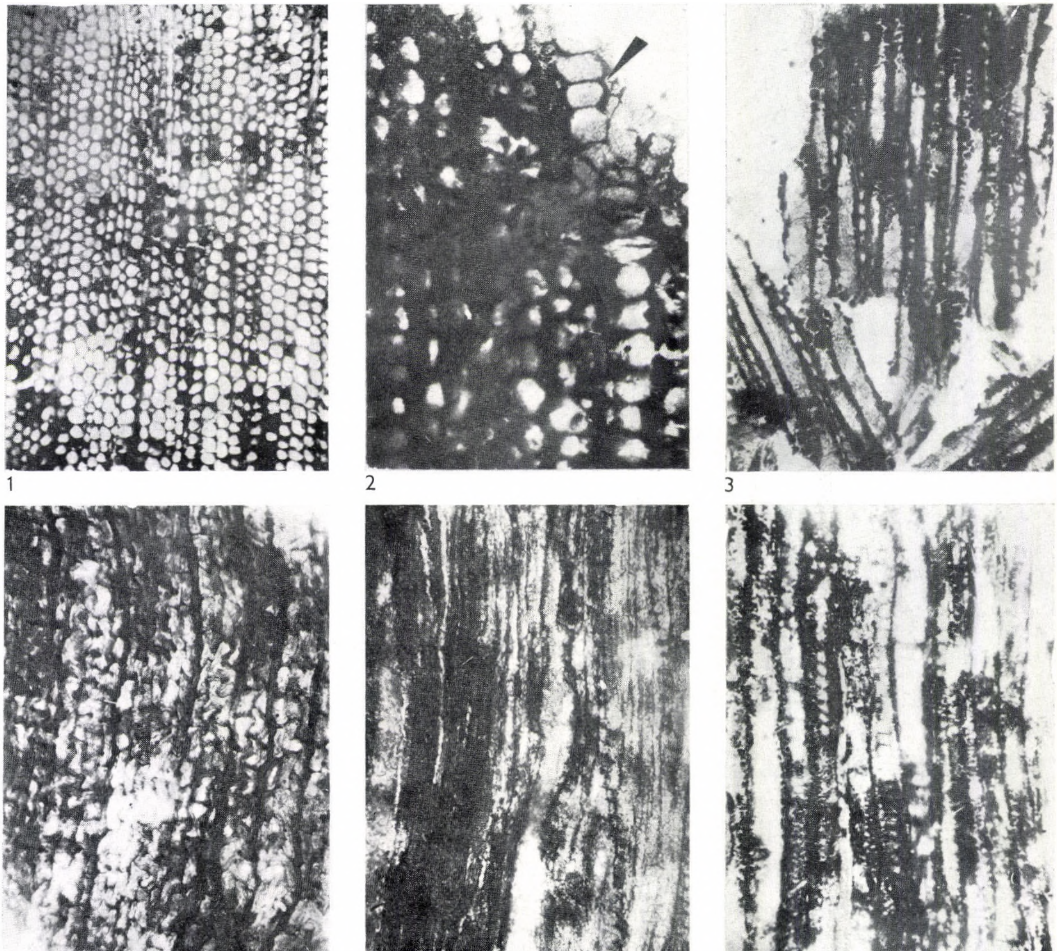
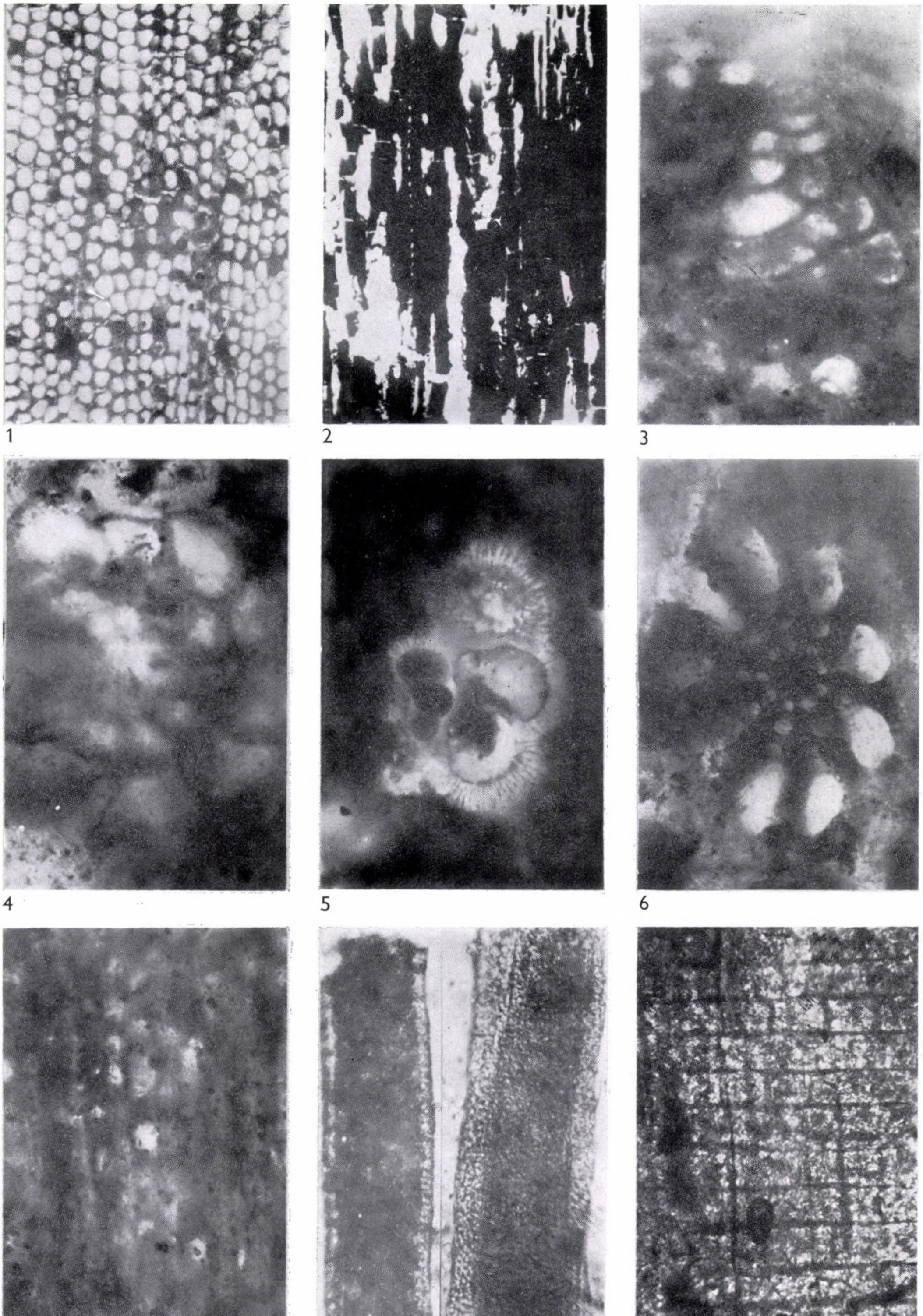
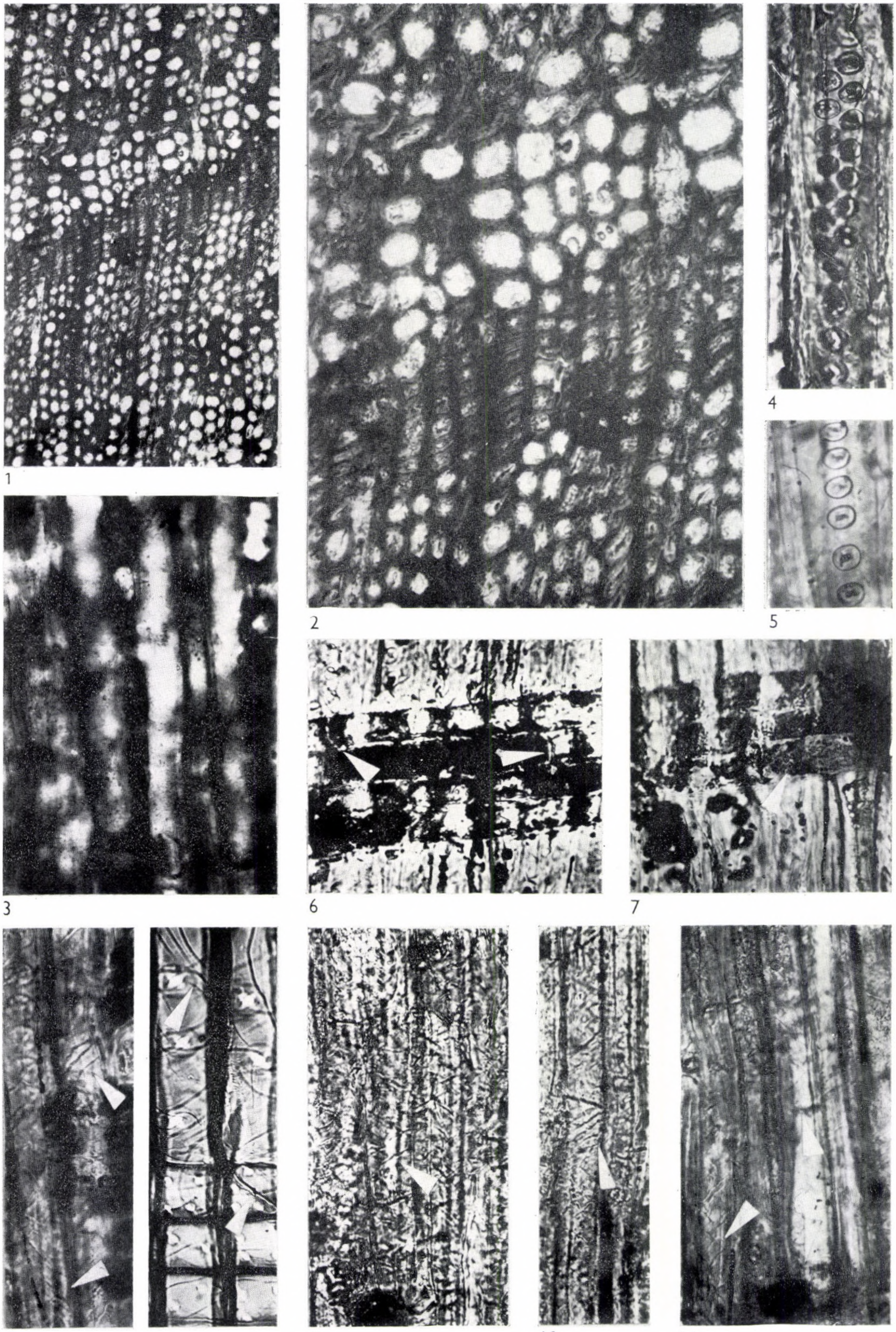
XXIX. 17–20. ?*Podocarpoxylon* sp. (No. 7) (Lábatlan, Lower Cretaceous)



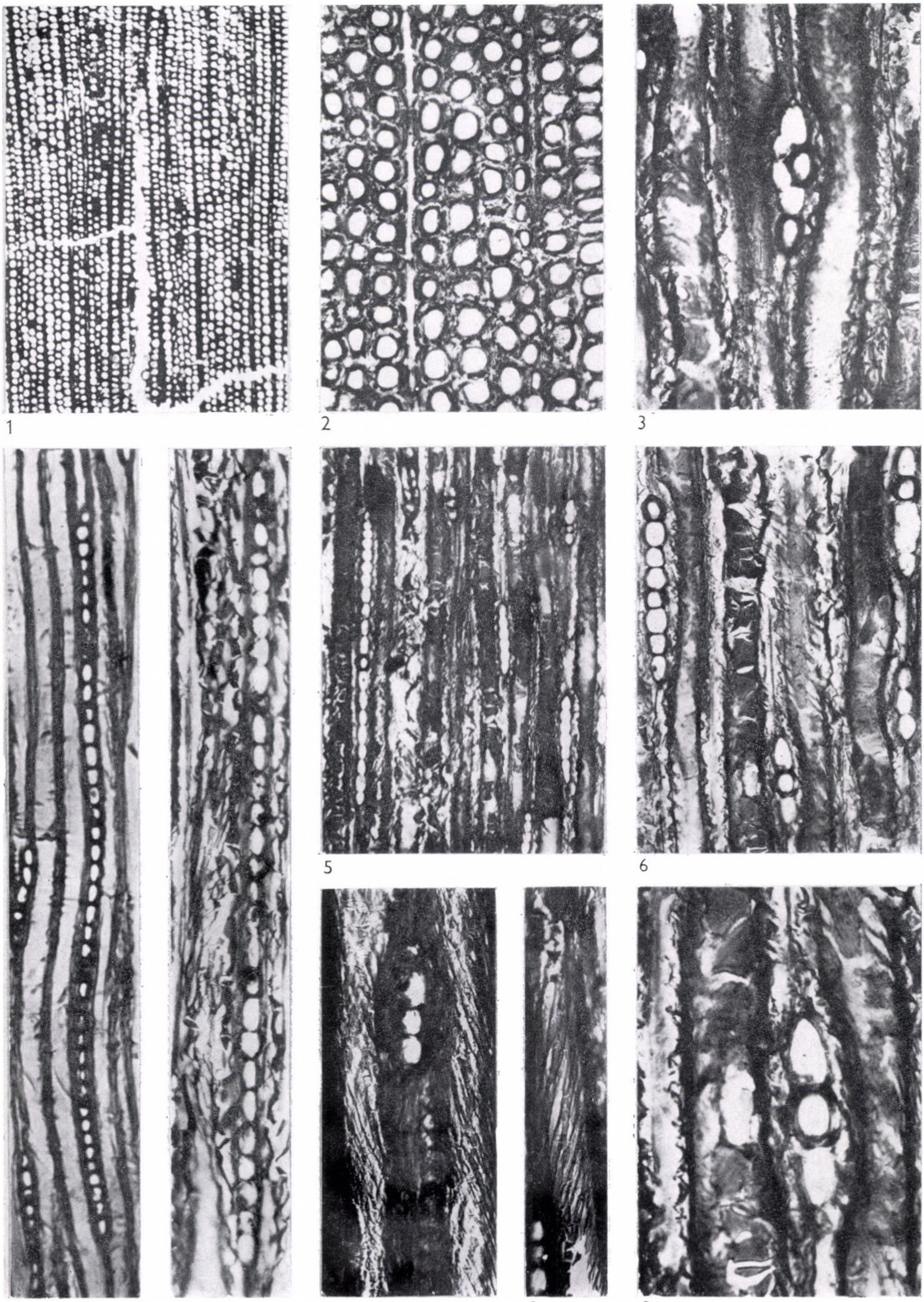
XXX. 1–5. *Podocarpoxylon* sp. (No. 1) (Tata, Lower Cretaceous)
6–9. *Podocarpoxylon* sp. (No. 2) (Tata, Lower Cretaceous)



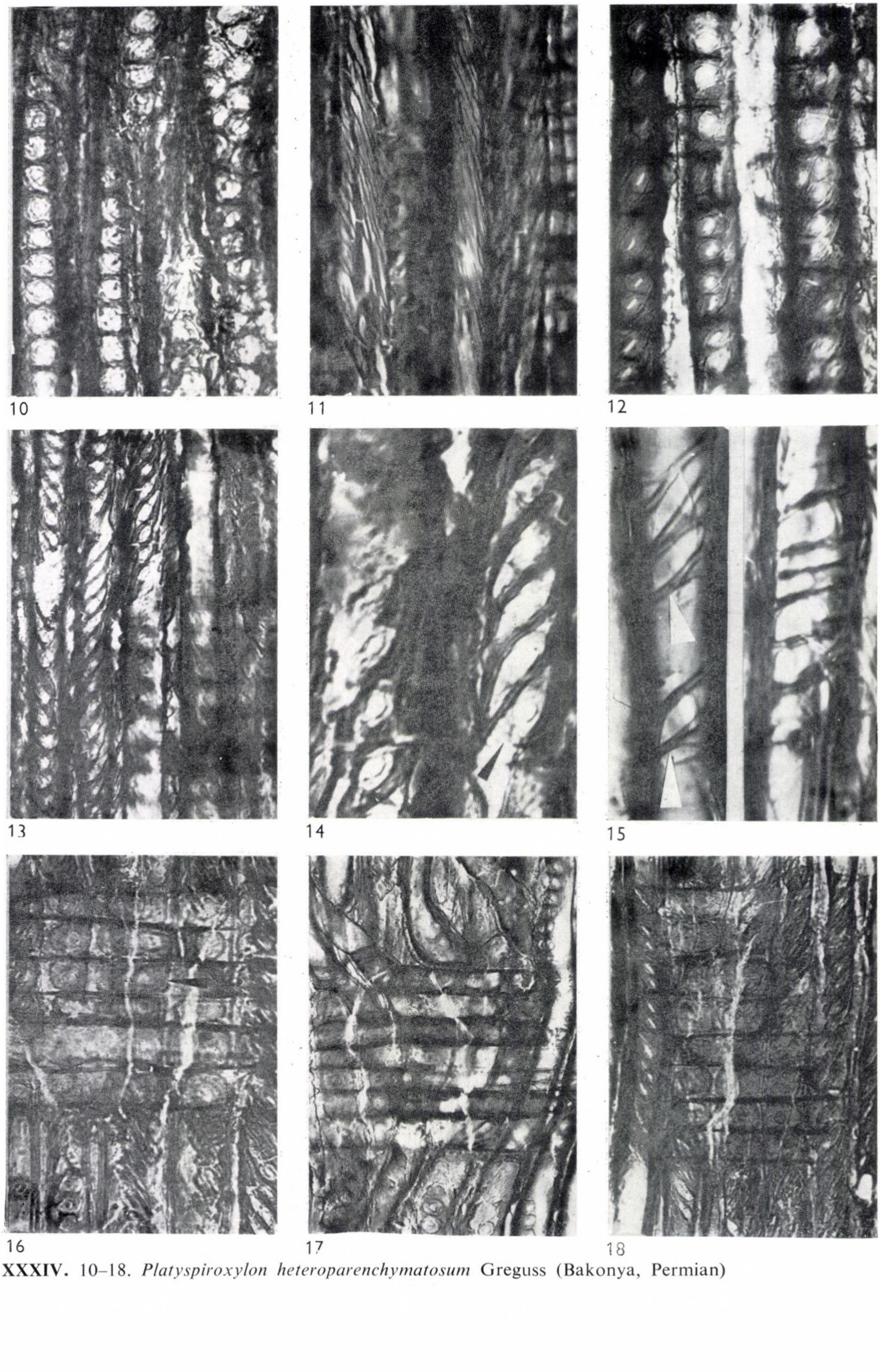
XXXI. 1 and 2. *Podocarpoxylon* sp. (No. 3) (Tata, Lower Cretaceous)
3–6. *Foraminiferae* (Tata, Lower Cretaceous)
7–10. *Podocarpoxylon* sp. (No. 4) (Zirc, Lower Cretaceous)



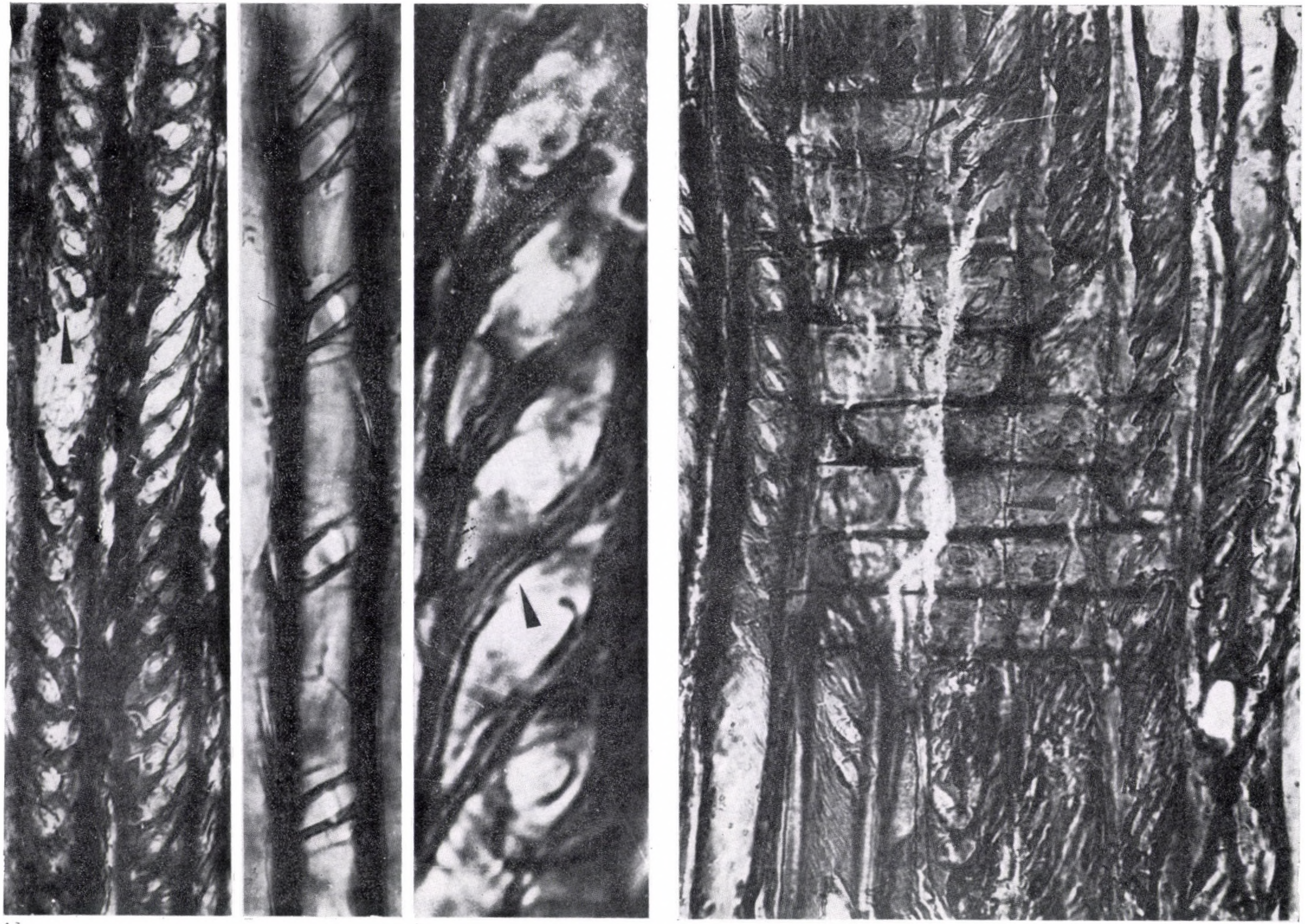
XXXII. 1–11. *Torreyoxylon boureaui* n. sp. (Urkut, Lower Cretaceous)



XXXIII. 1–9. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)



XXXIV. 10–18. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)



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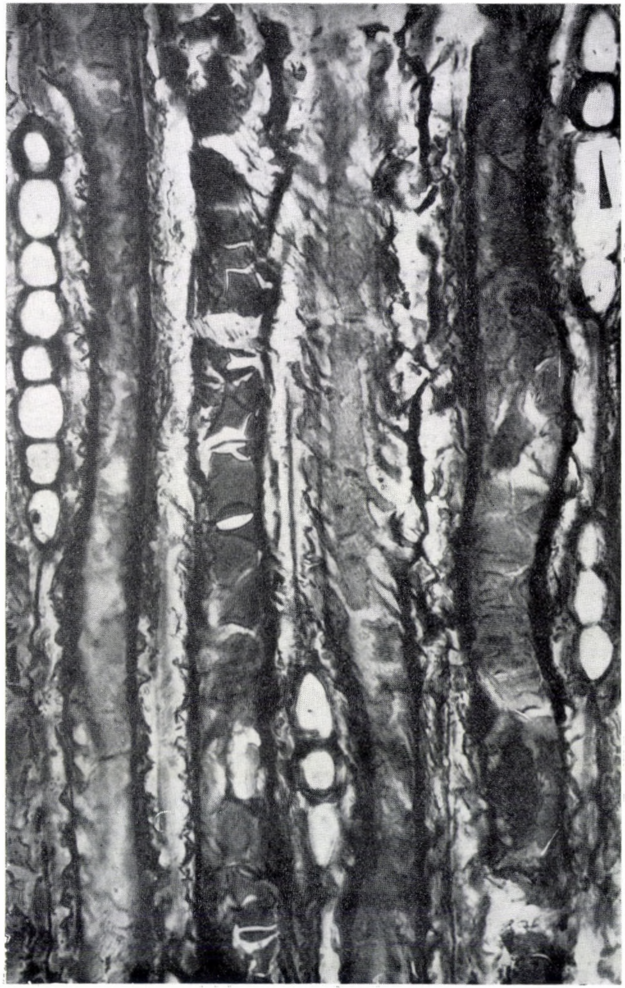
XXXV. 19–20. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)



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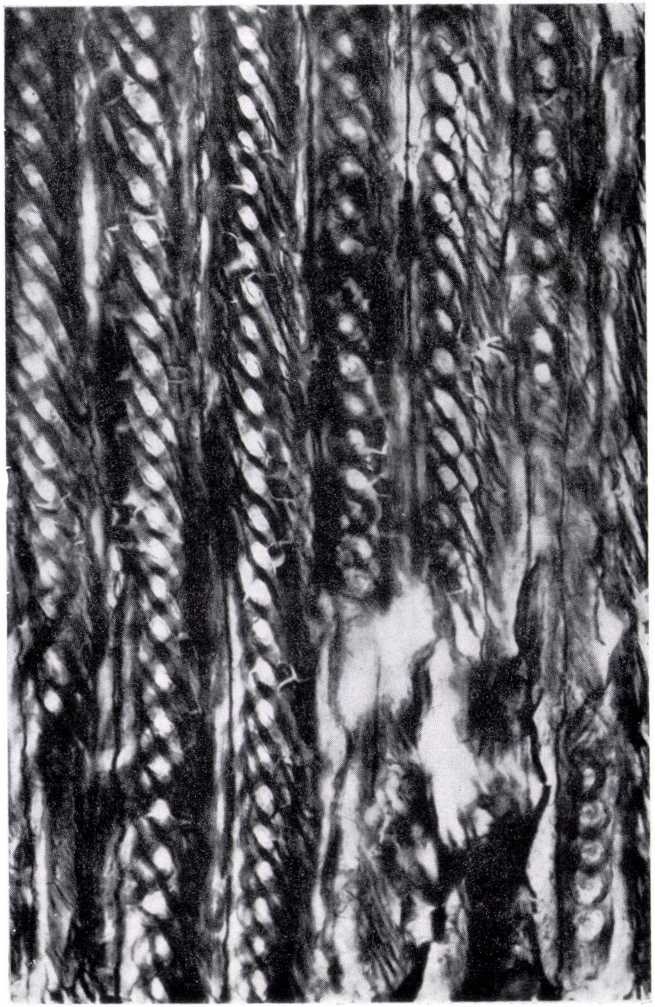
XXXVI. 21 and 22. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)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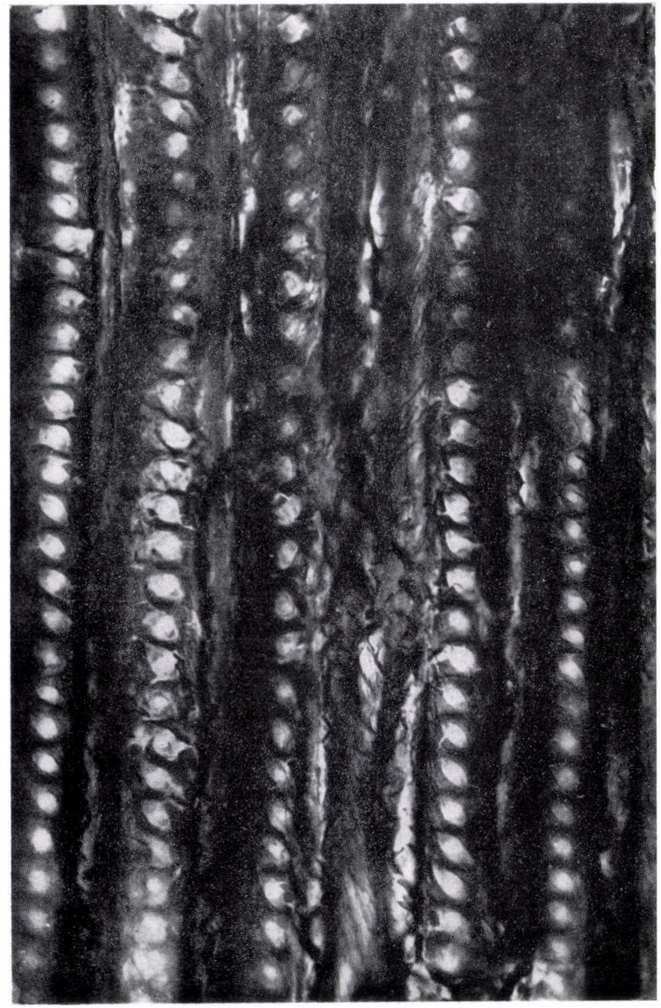
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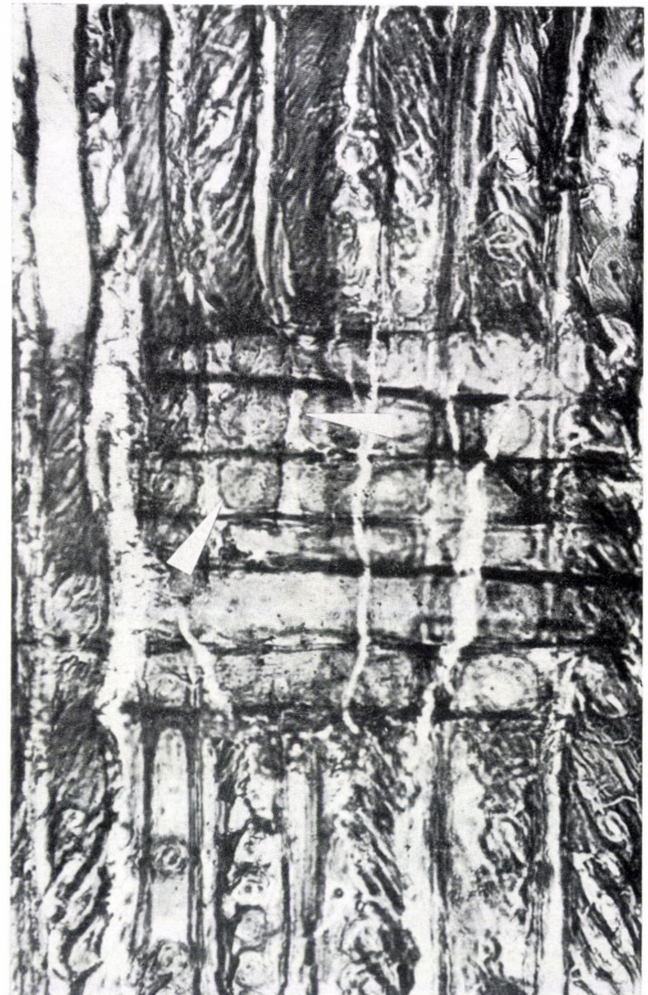
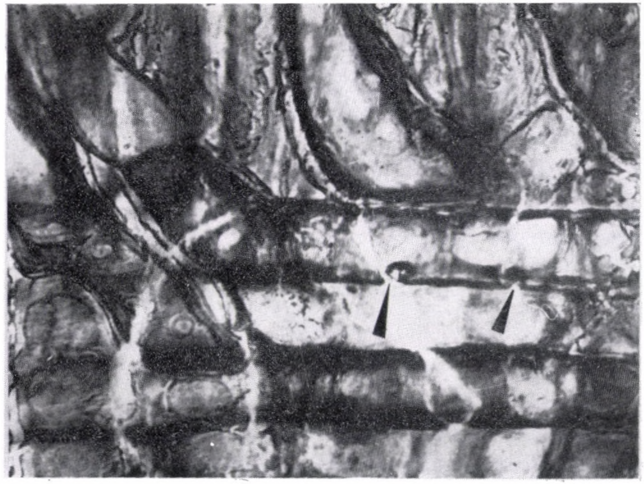
XXXVII. 23 and 24. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)

25



26

XXXVIII. 25 and 26. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)



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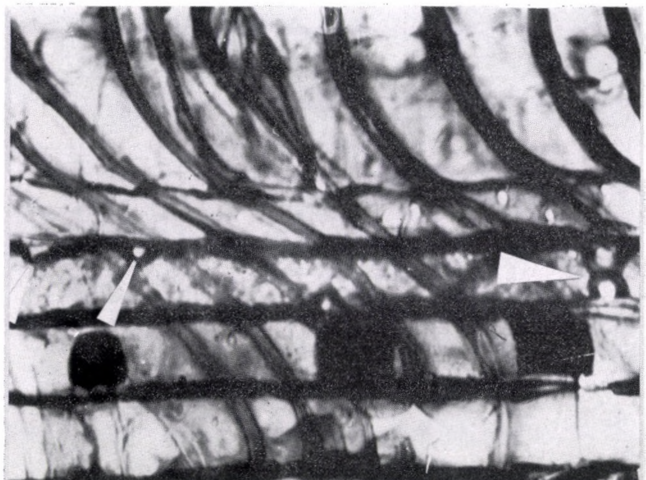

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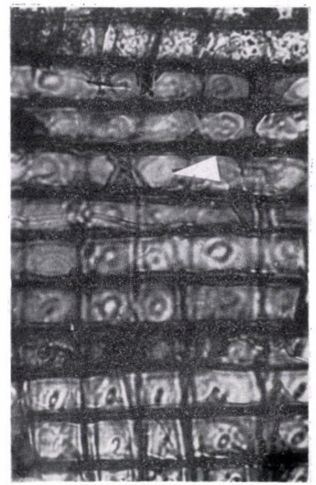

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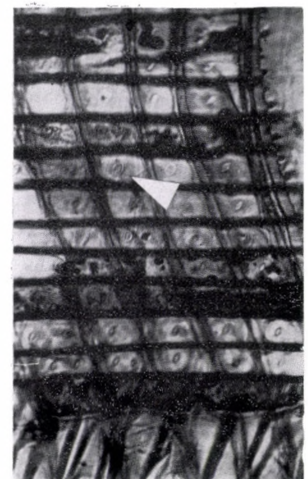
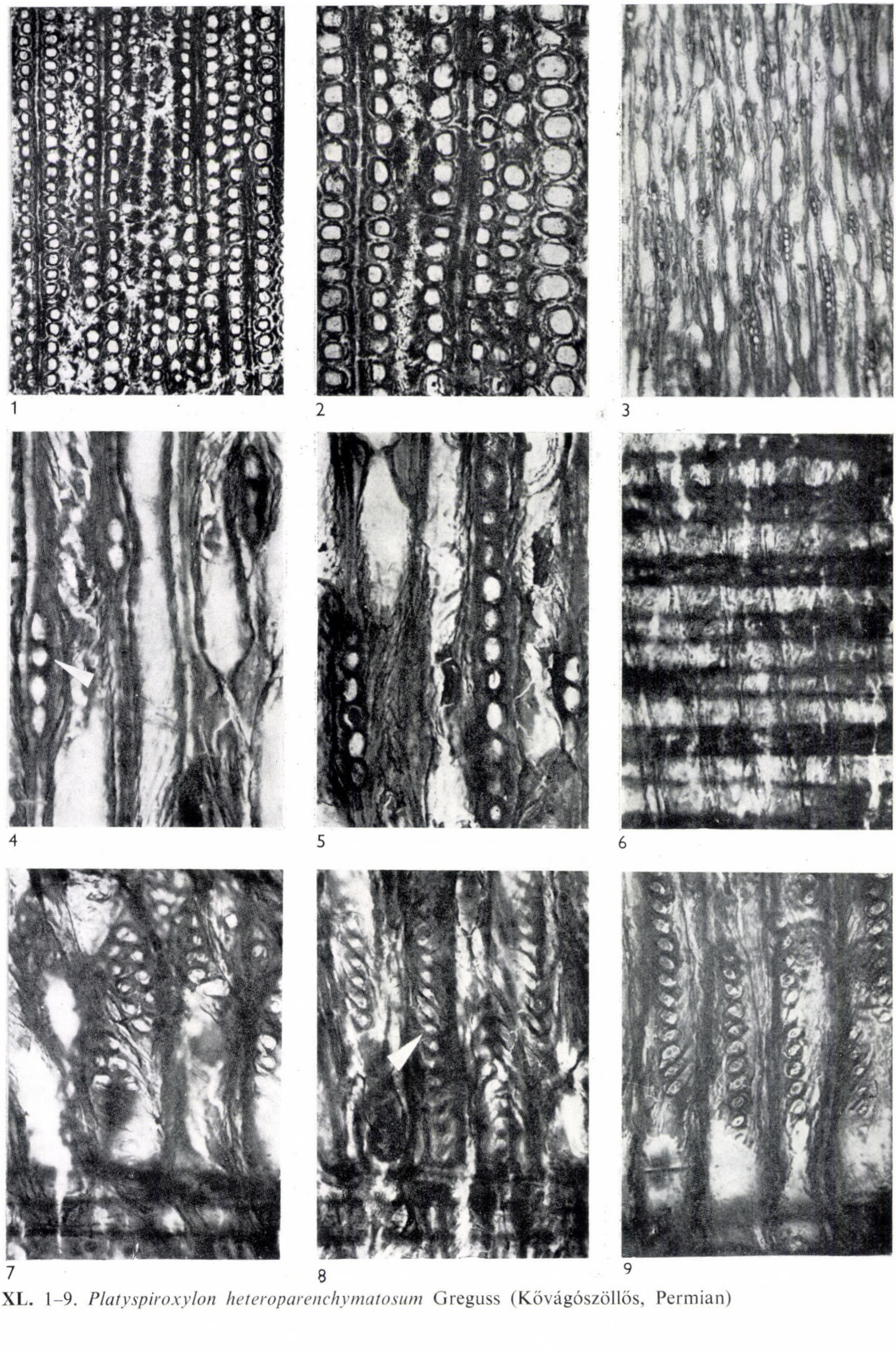
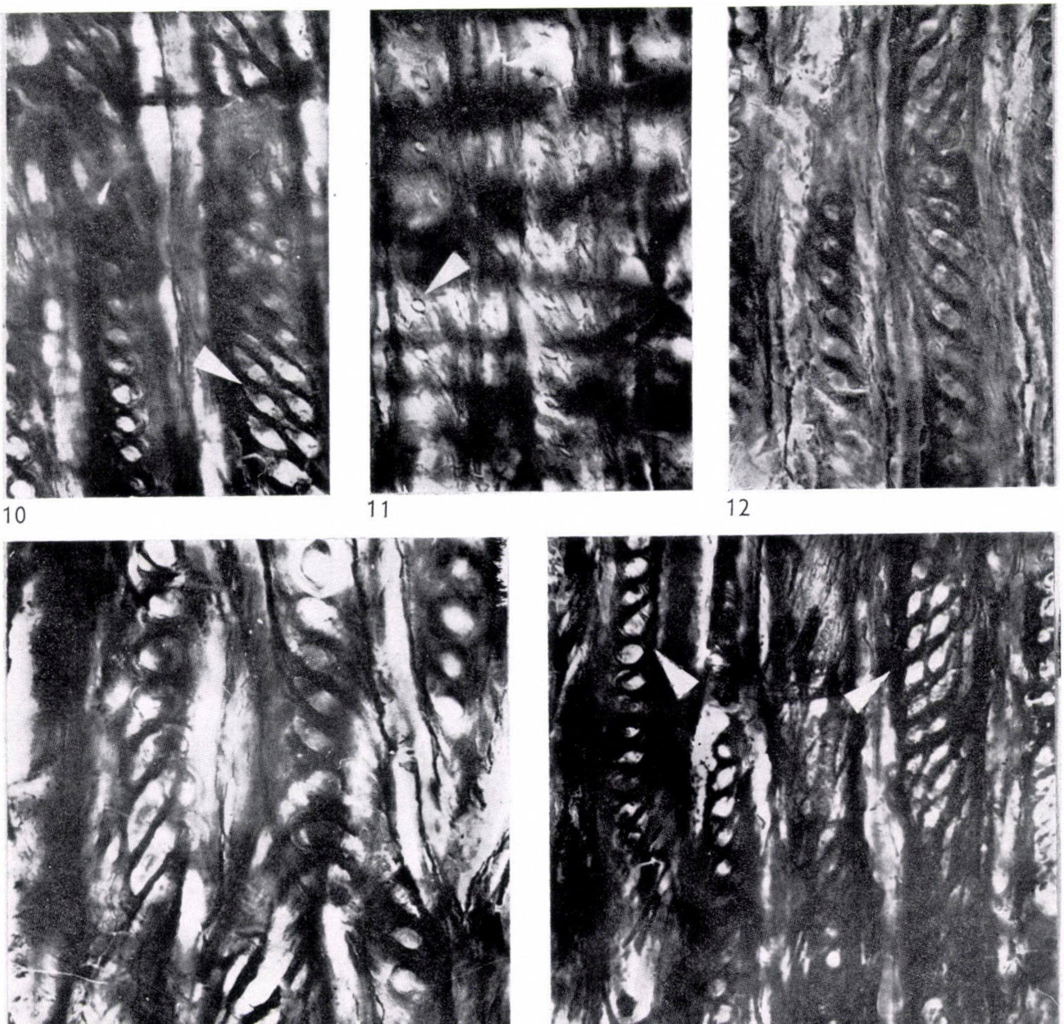


31

XXXIX. 27–31. *Platyspiroxylon heteroparenchymatosum* Greguss (Bakonya, Permian)

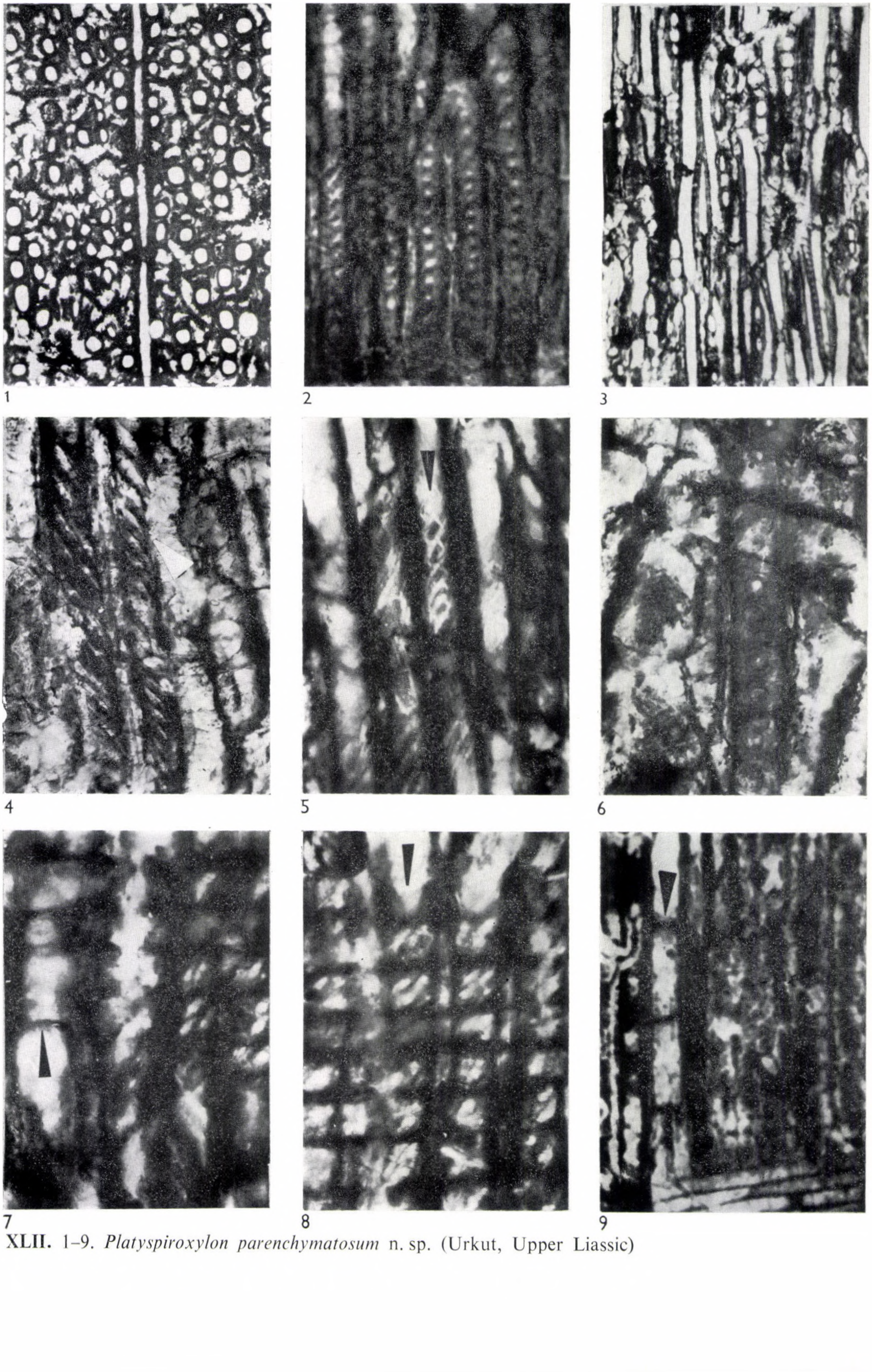


XL. 1–9. *Platyspiroxylon heteroparenchymatosum* Greguss (Kővágószöllős, Permian)

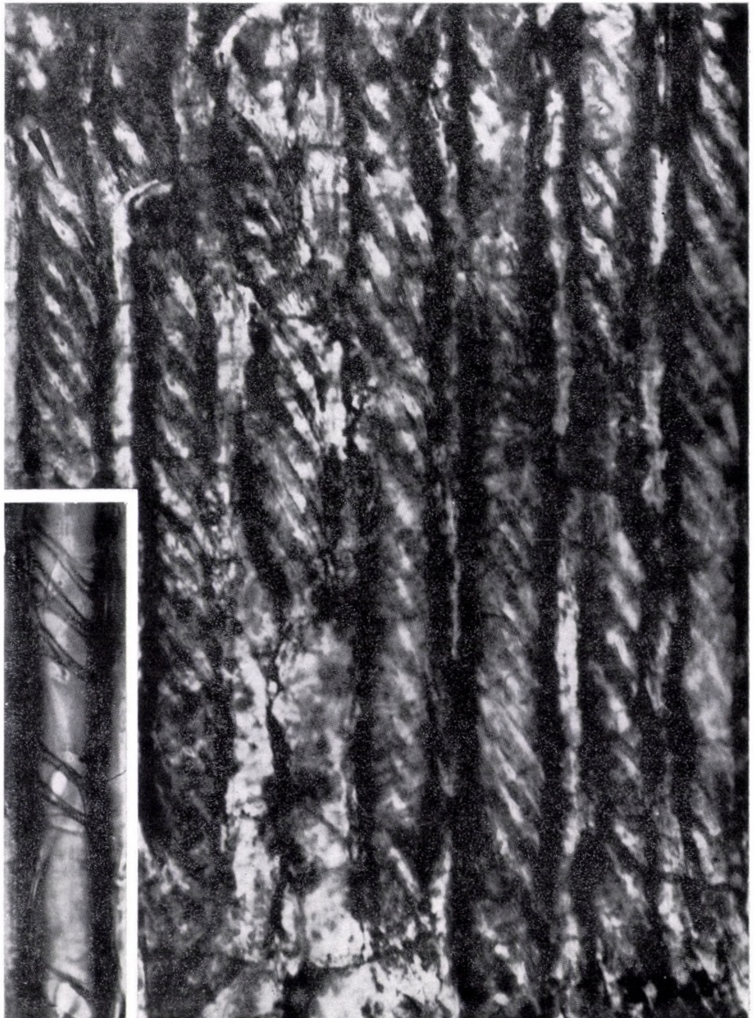


10 11 12 13 14

XLI. 10–14. *Platyspiroxylon heteroparenchymatosum* Greguss (Kővágószöllős, Permian)



XLII. 1–9. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic)



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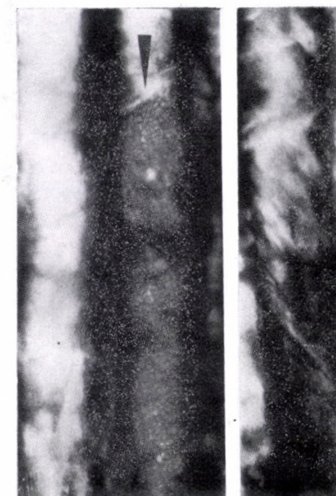

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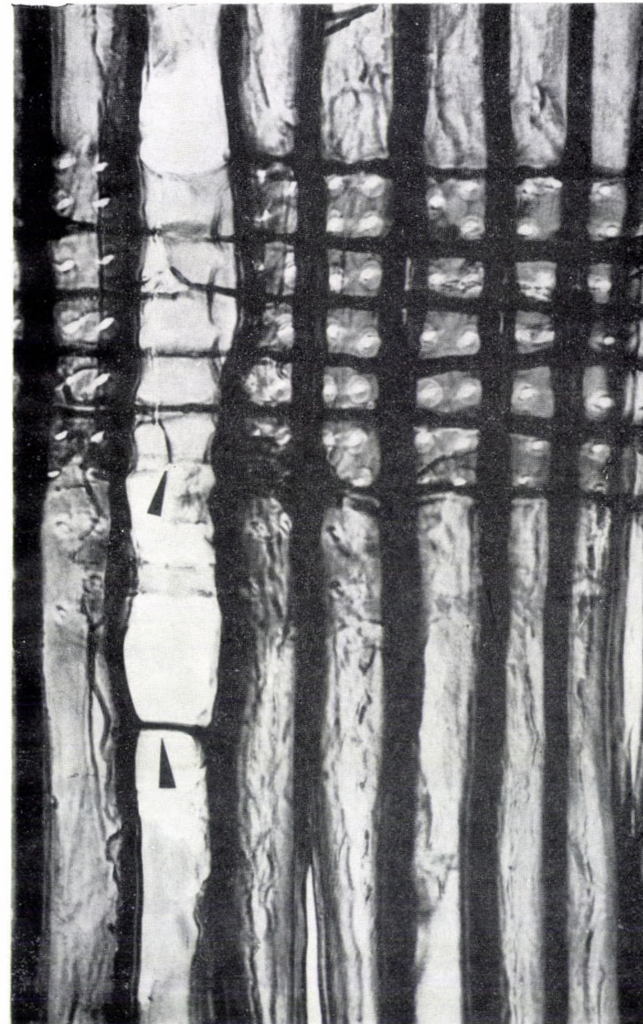
XLIII. 10–13. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic)


14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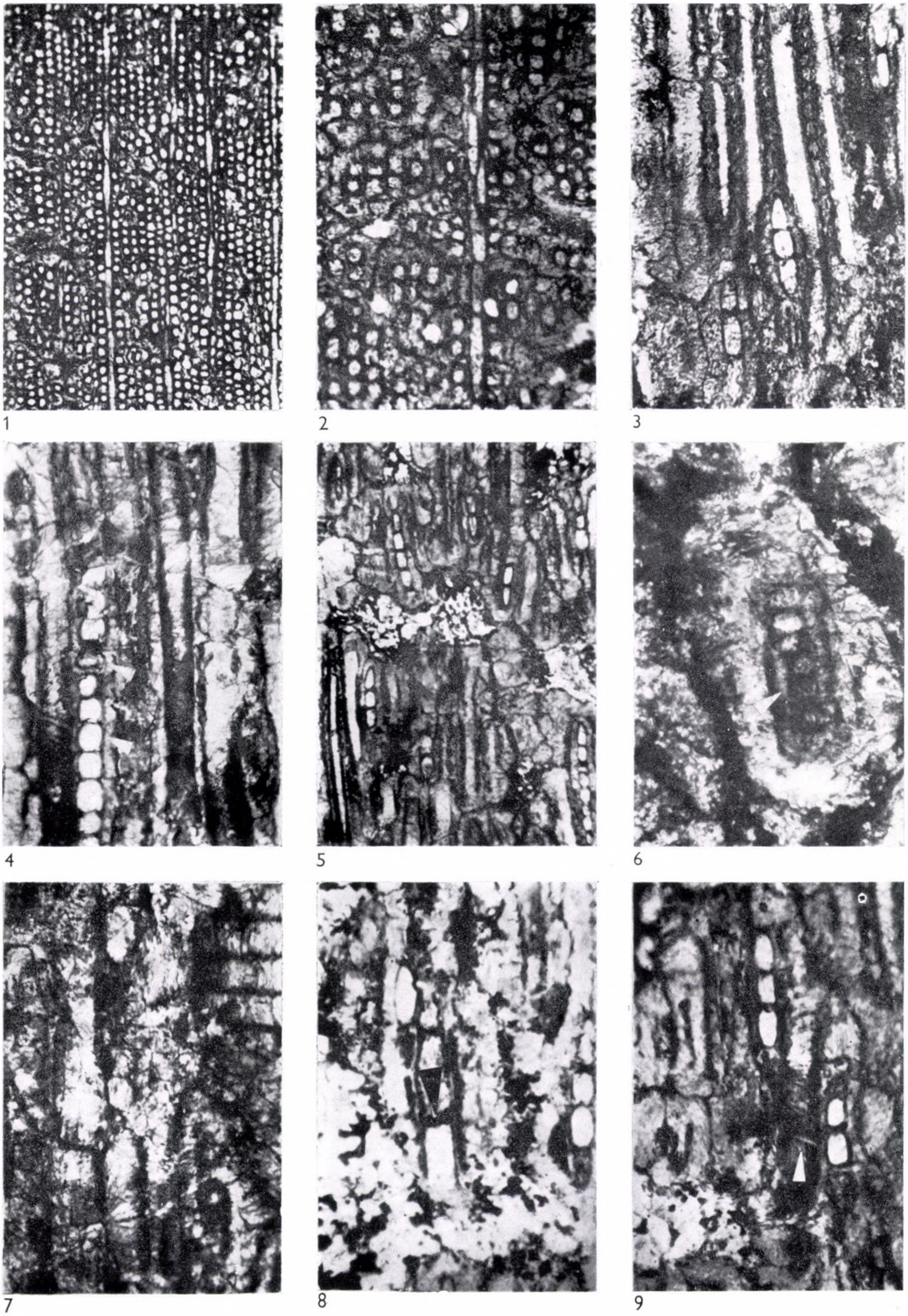
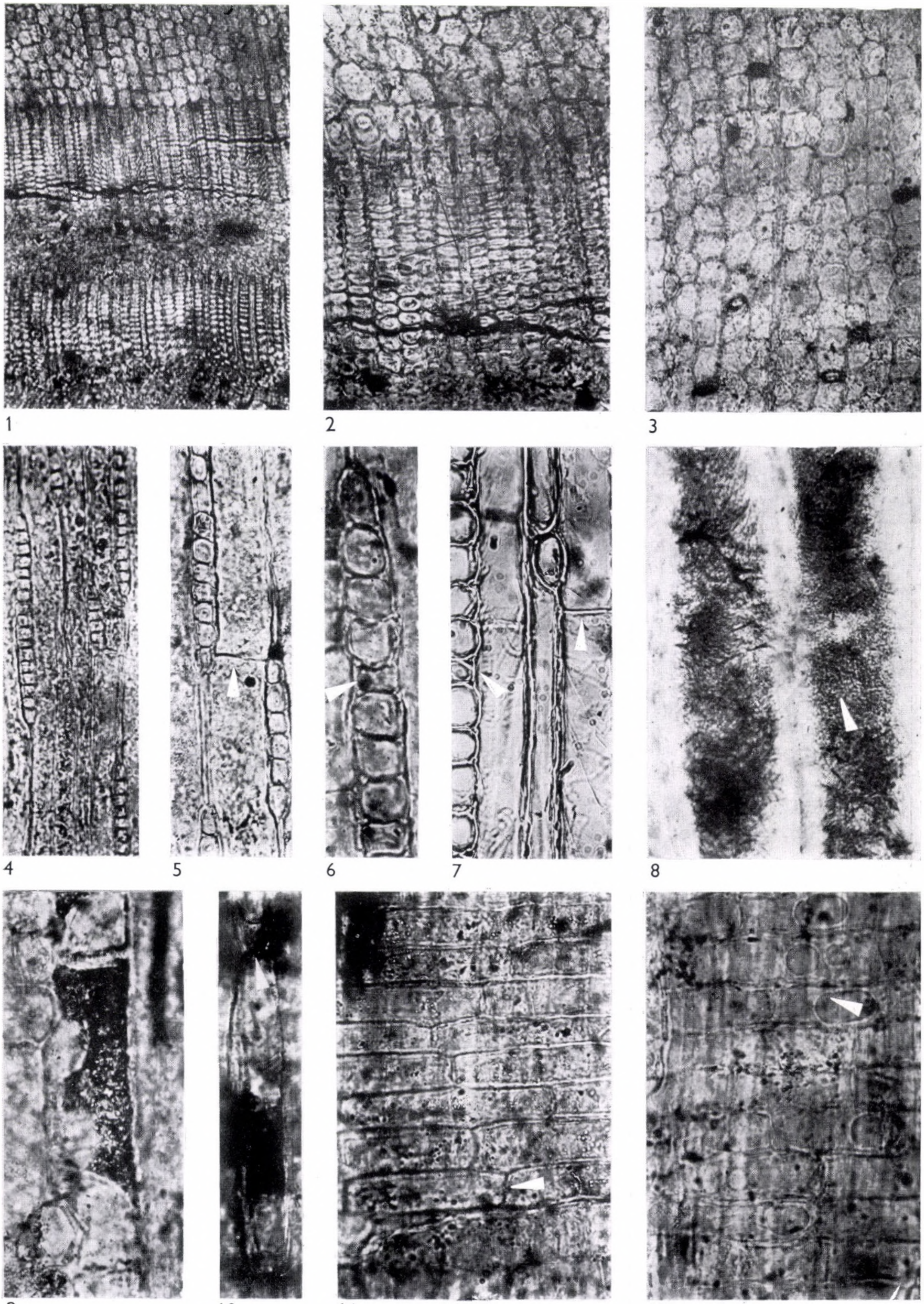
XLIV. 14 and 15. *Platyspiroxylon parenchymatosum* n. sp. (Urkut, Upper Liassic)



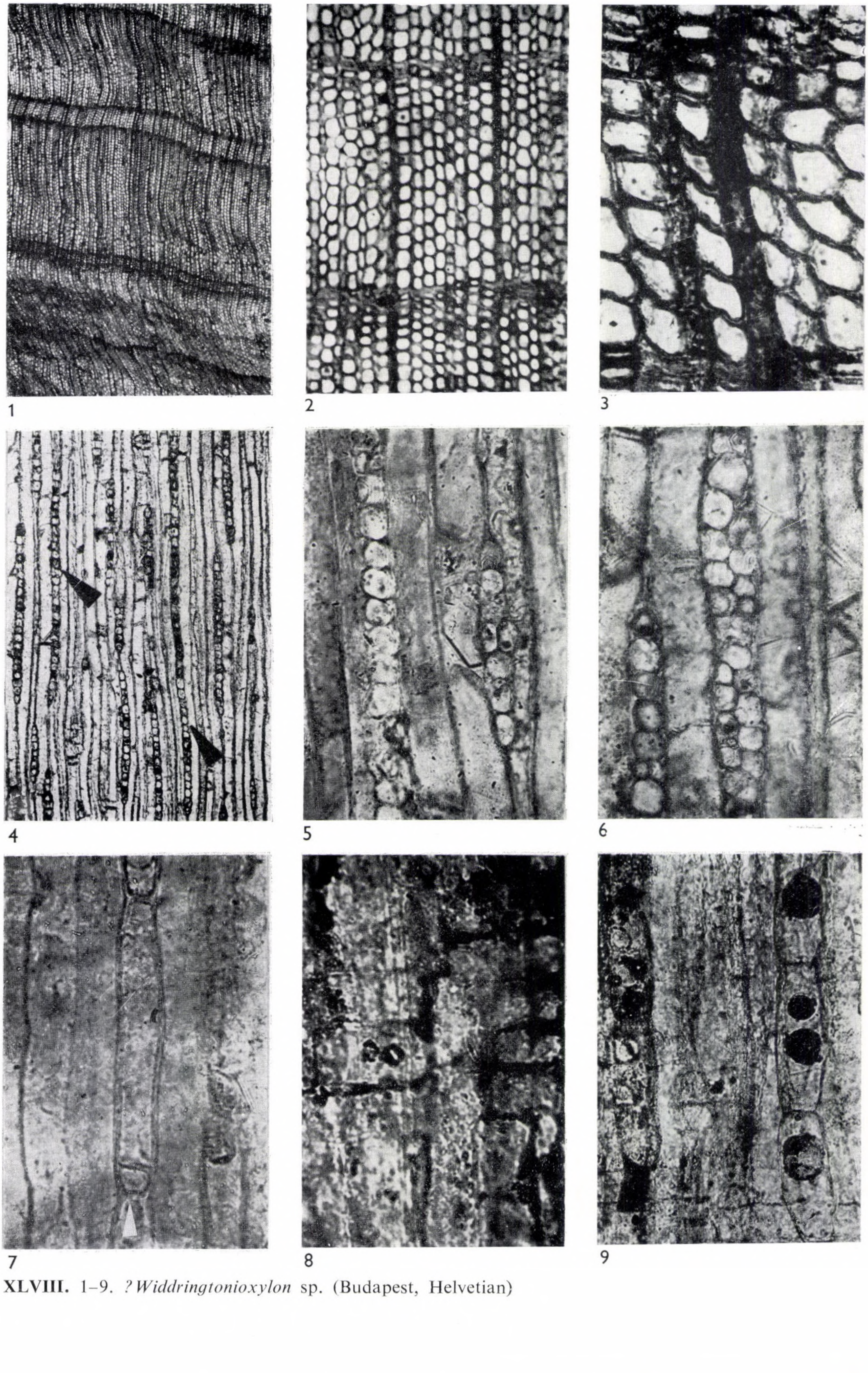
1 2 3 4 5 6 7 8 9

XLV. 1–9. *?Platyspiroxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic)

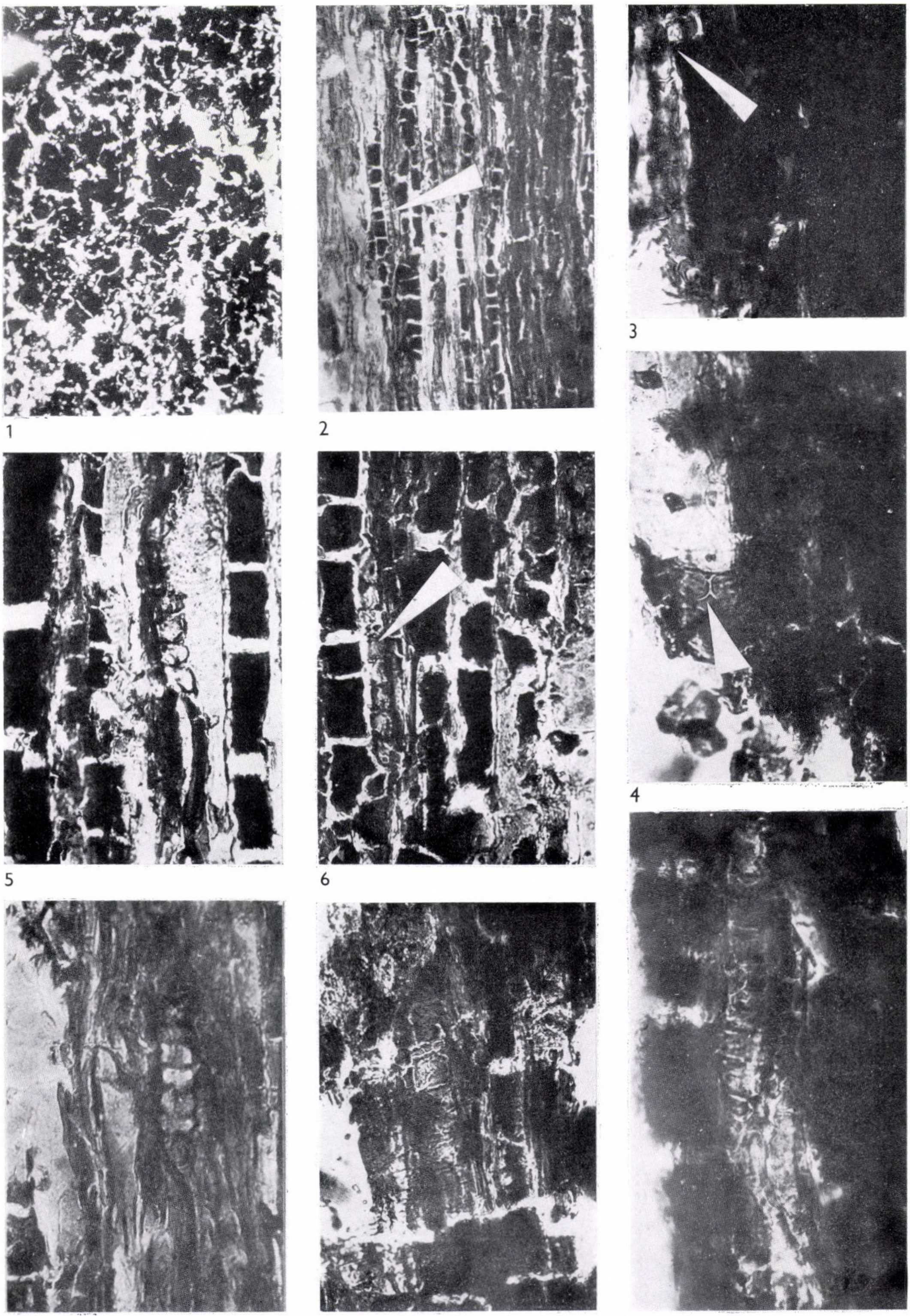
XLVI. 10–19. *?Platyspiroxylon* sp. (No. 2) (Pécsbányatelep, Lower Liassic)



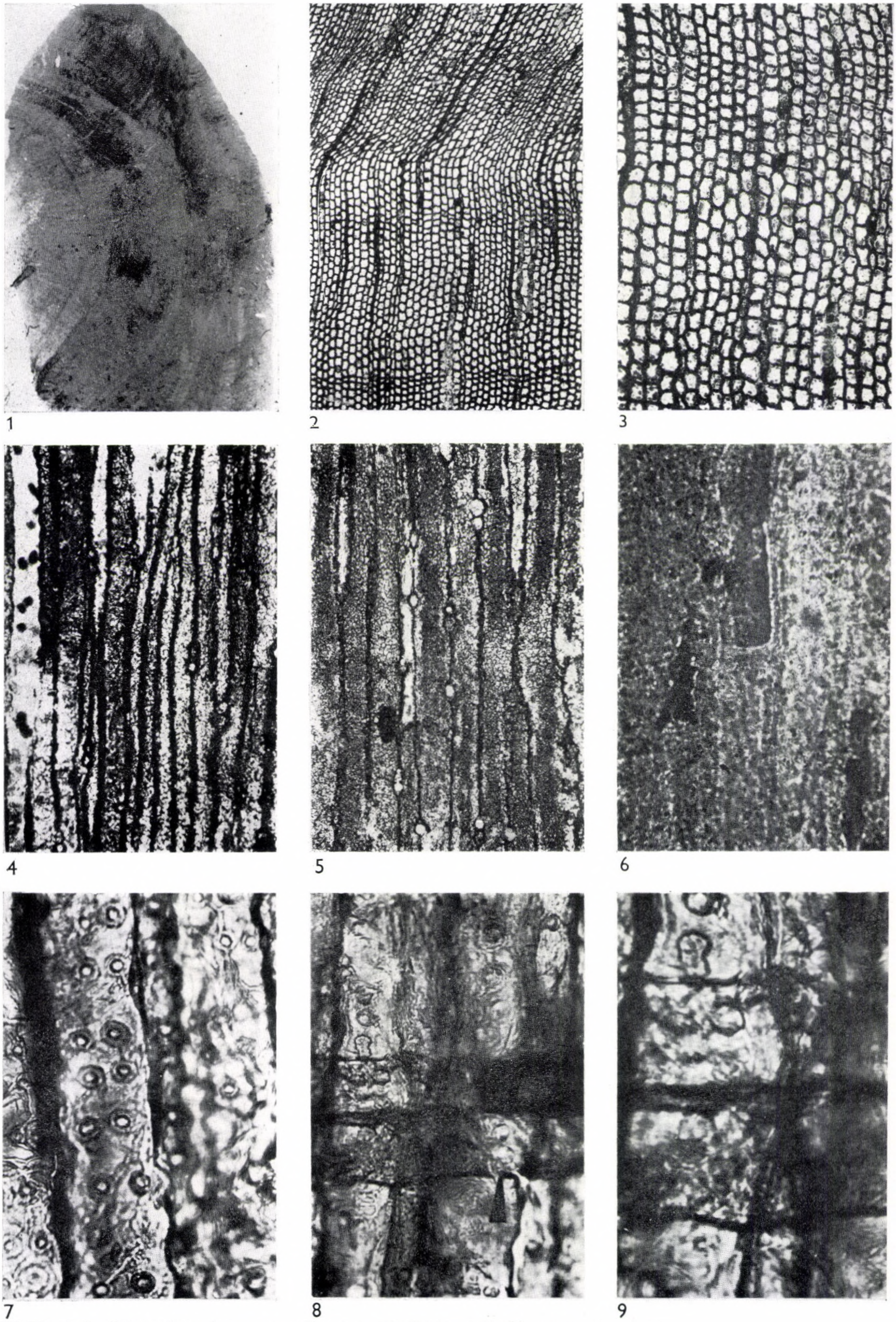
XLVII. 1–12. *Widdringtonioxylon ráskyae* n. sp. (Budafok, Helvetian)



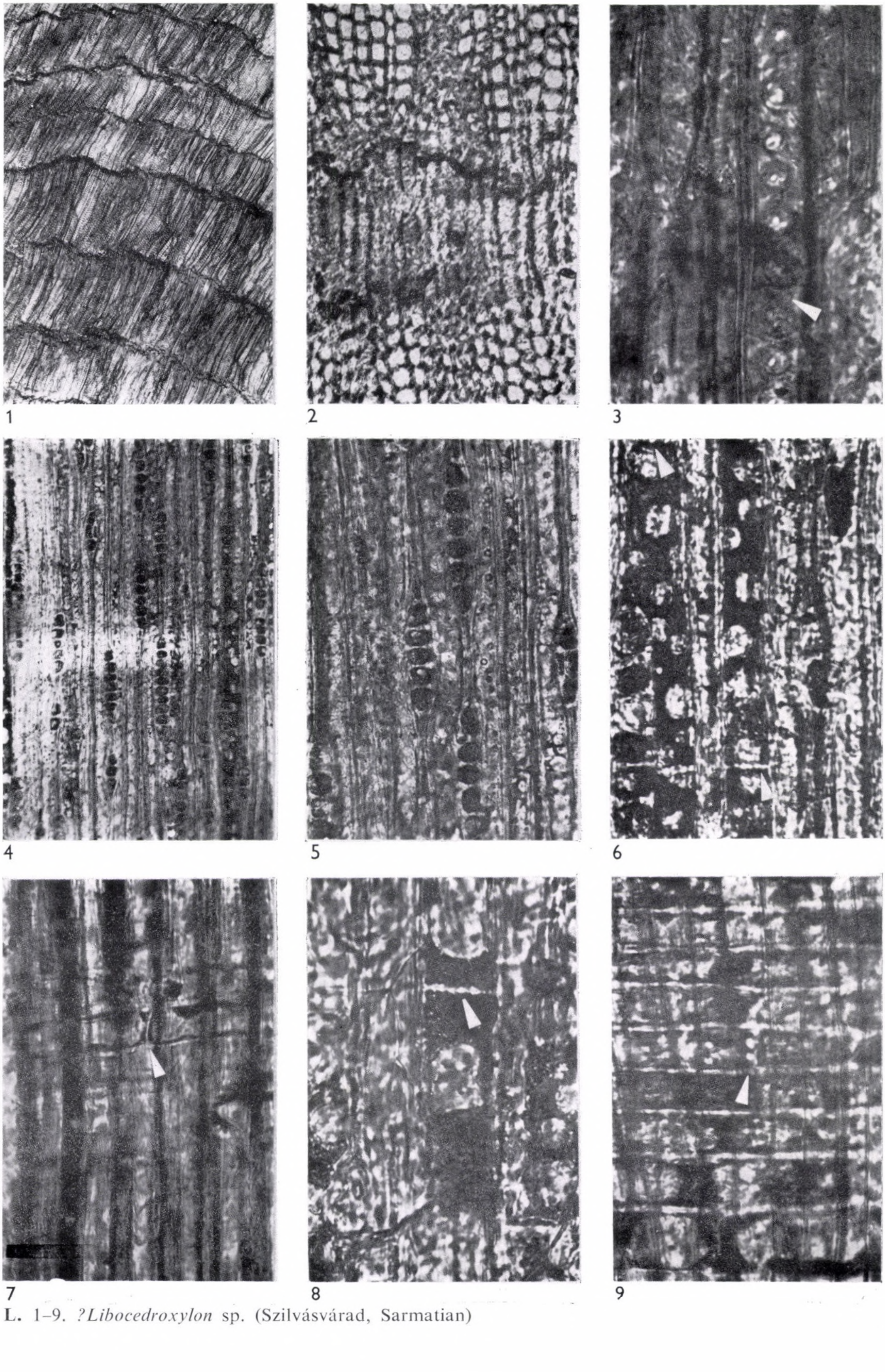
XLVIII. 1–9. *?Widdringtonioxylon* sp. (Budapest, Helvetian)



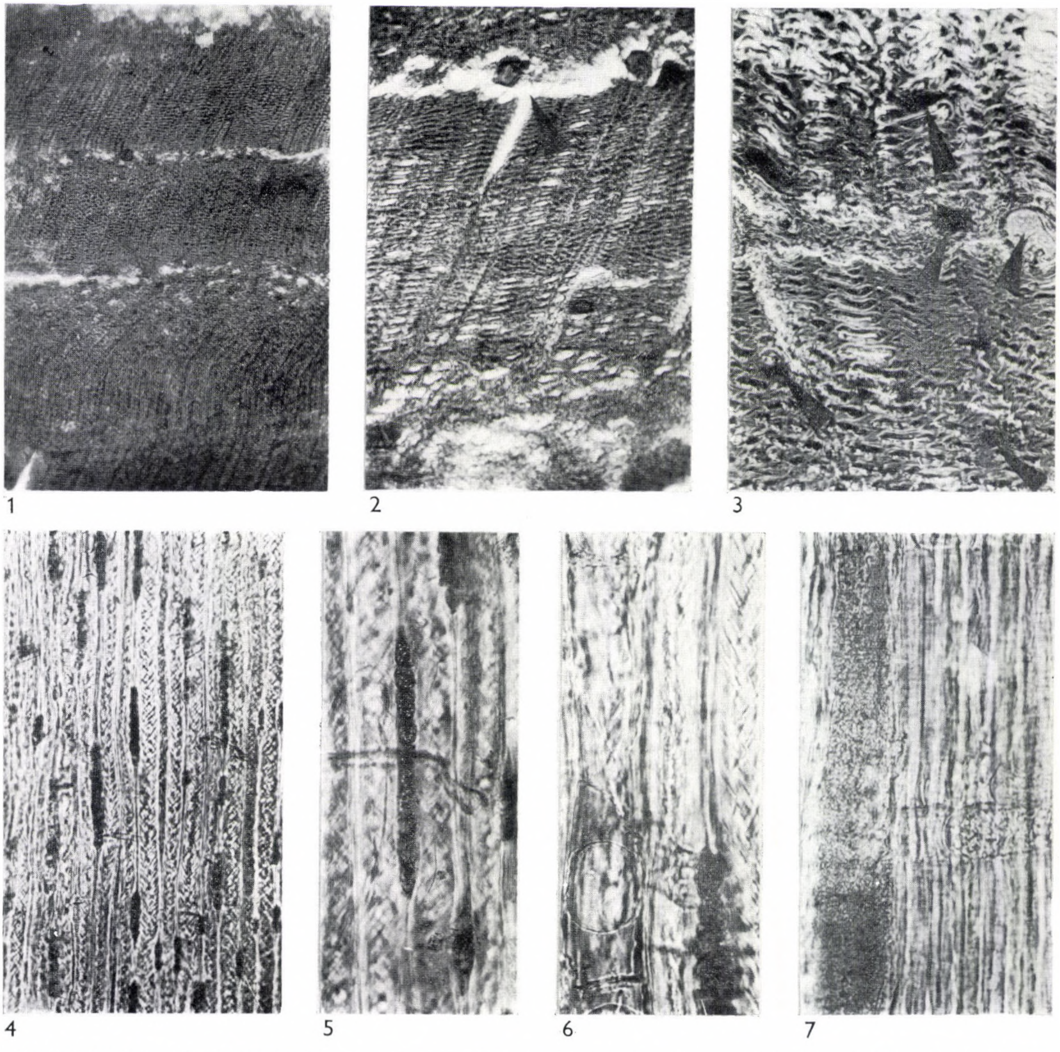
XLVIIIa. 1–9. ?*Callitroxylon* sp. (Gánt, Lower Eocene)



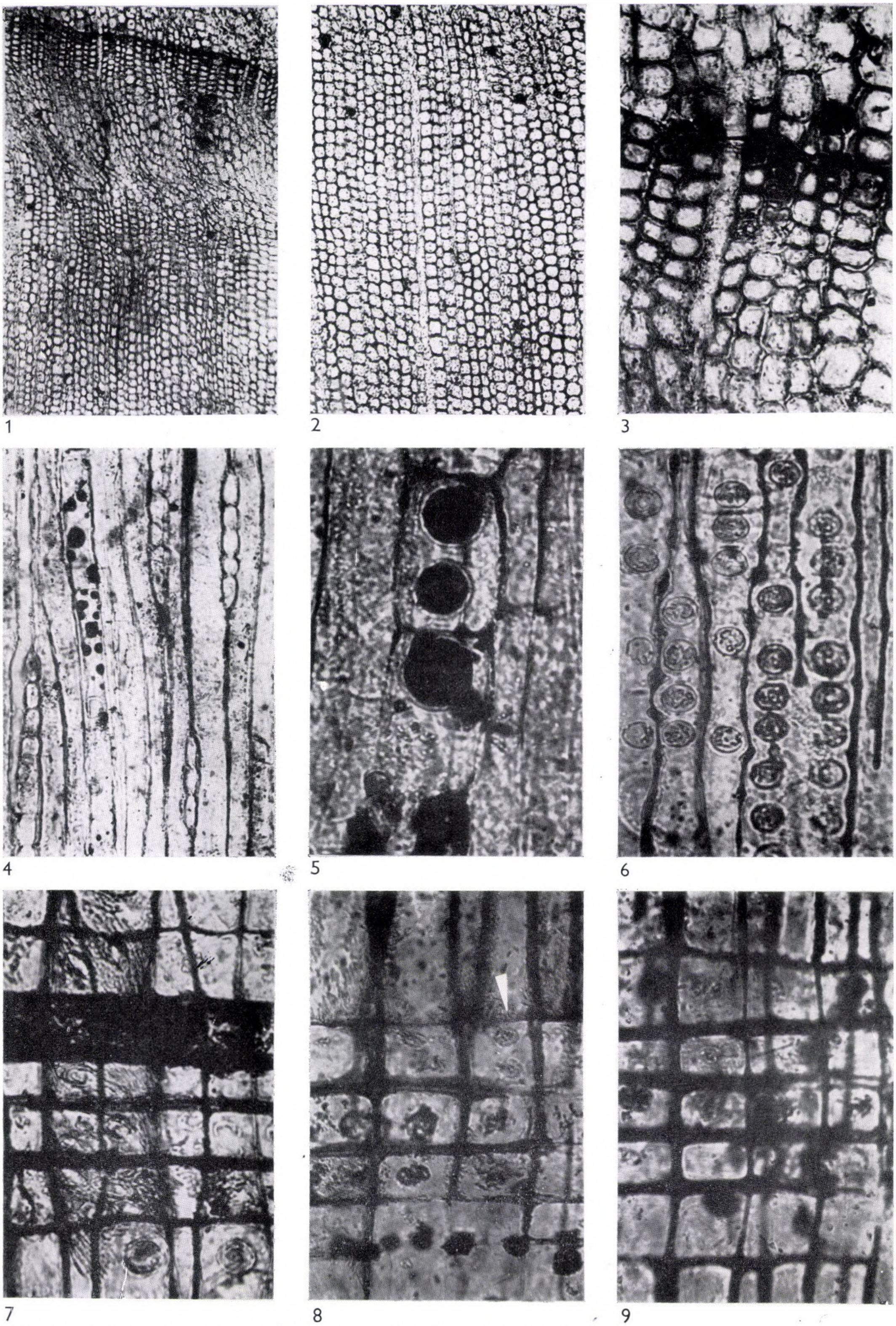
XLIX. 1–9. *Libocedroxylon gausseni* n. sp. (Erdőbénye, Sarmatian)



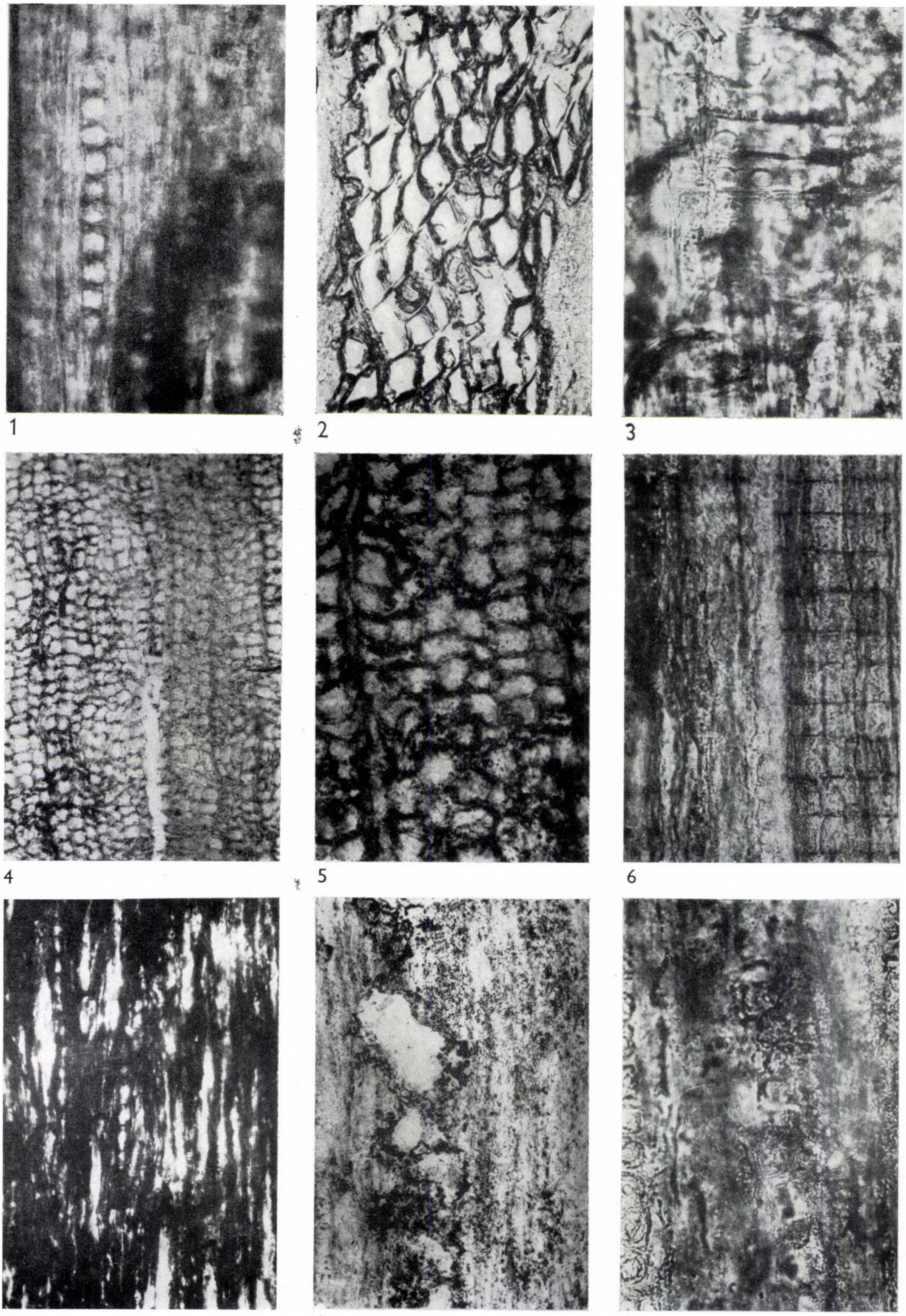
L. 1–9. *?Libocedroxylon* sp. (Szilvásvárad, Sarmatian)



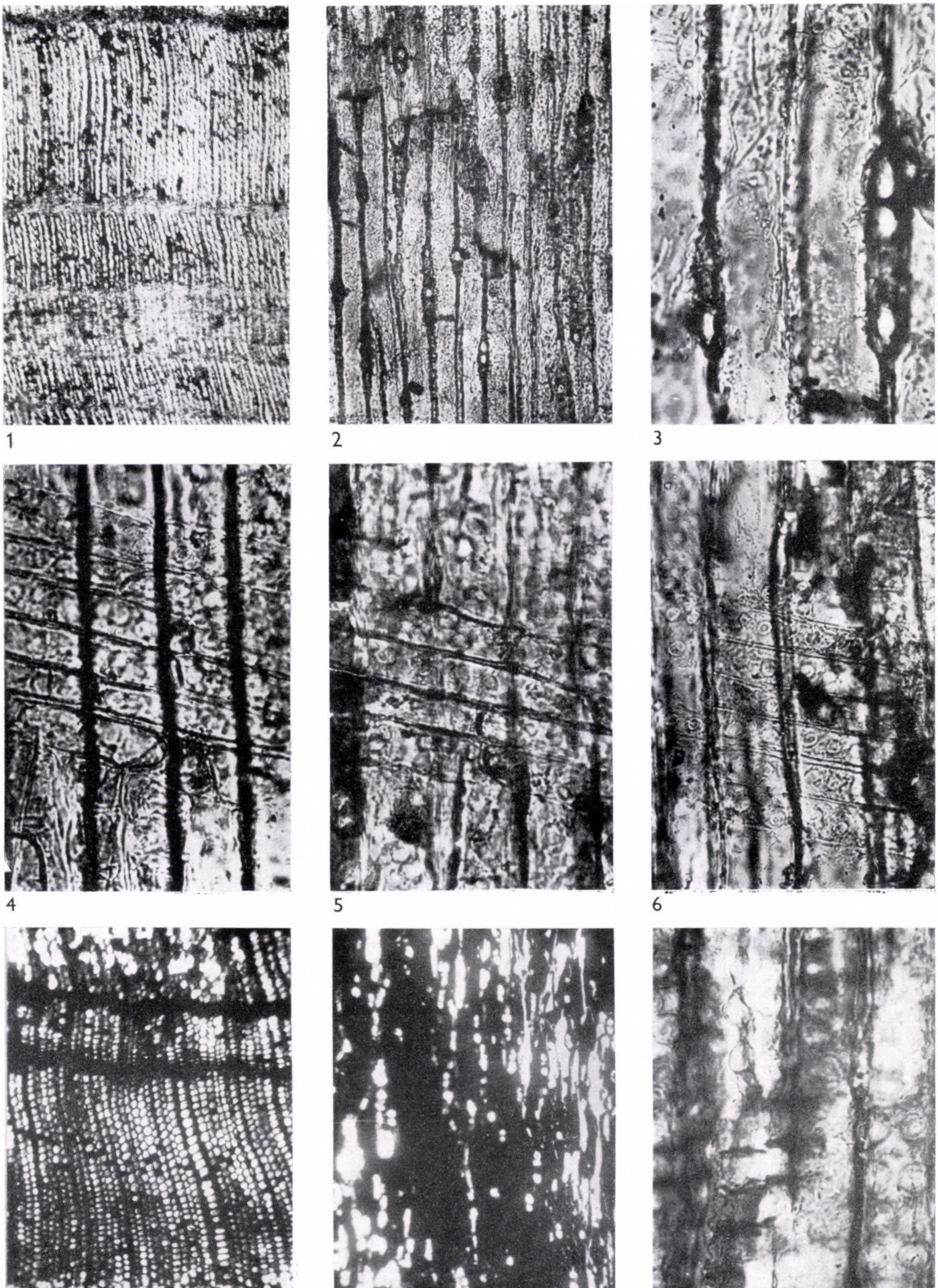
LI. 1–11. *Cupressinoxylon secretiferum* n. sp. (Mecseknádasd, Lower Helvetian)



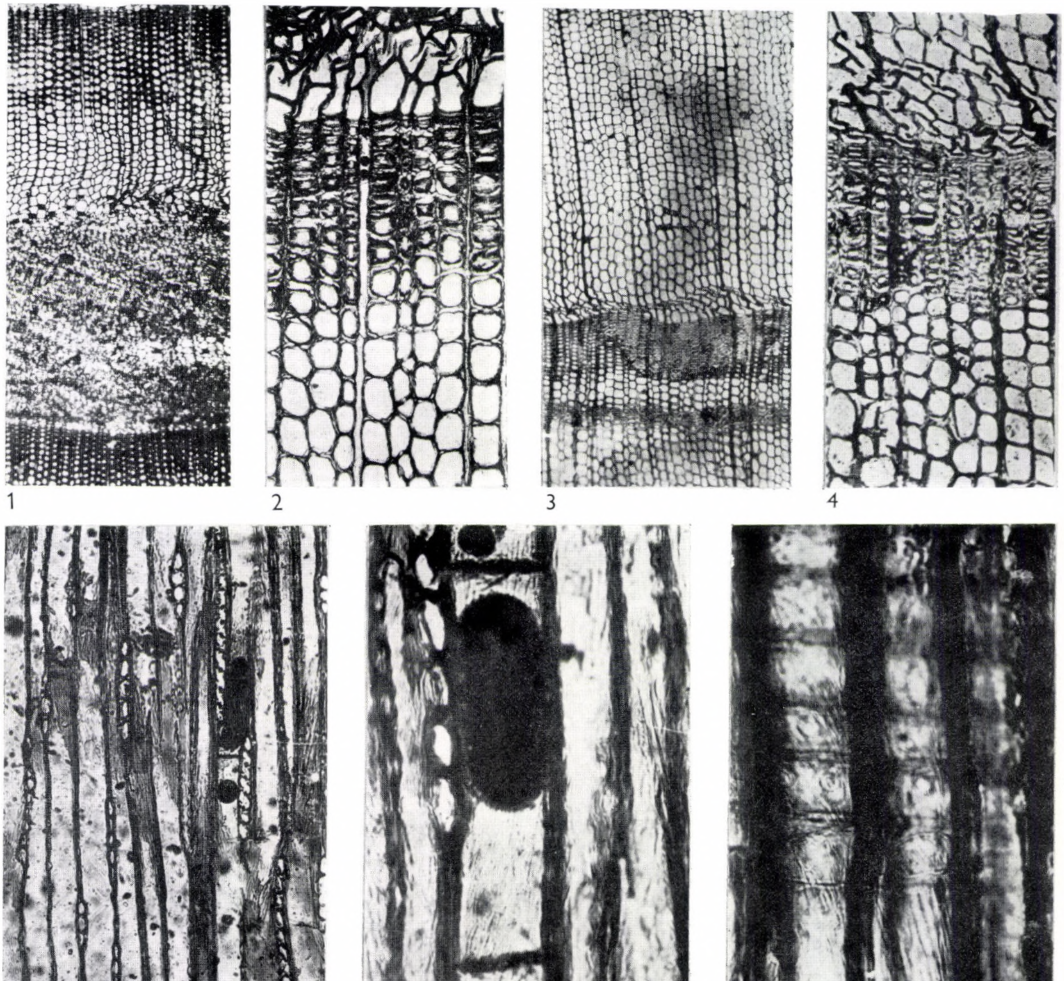
LII. 1–9. *?Cupressinoxylon* sp. (No. 3) (Pesthidegkút, Helvetian)



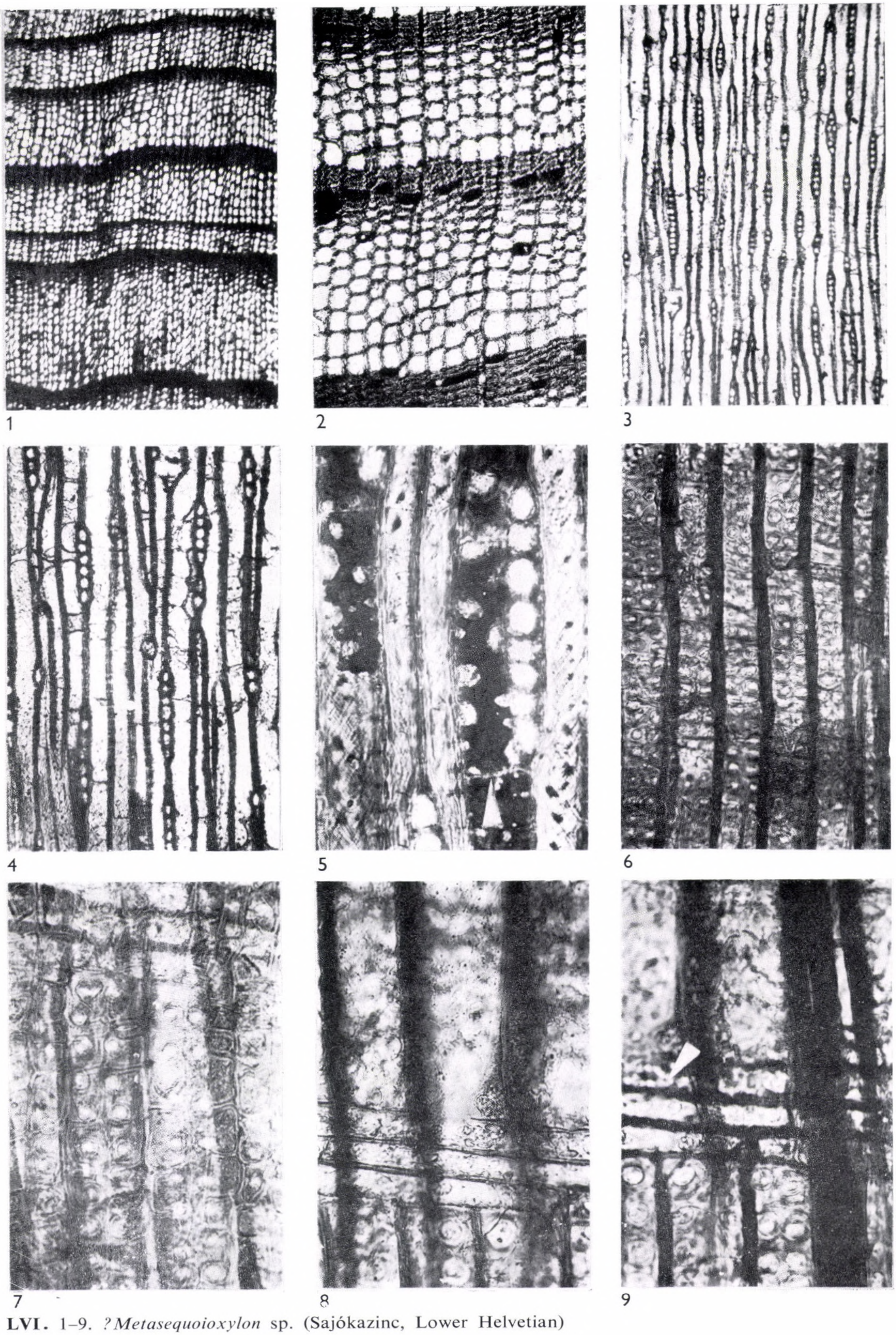
LIII. 1–3. ?*Cryptomerioxylon* sp. (Sámsonháza, Helvetian)
4–9. ?*Podocarpoxylon* sp. (No. 6) (Mecsekszabolcs, Helvetian)



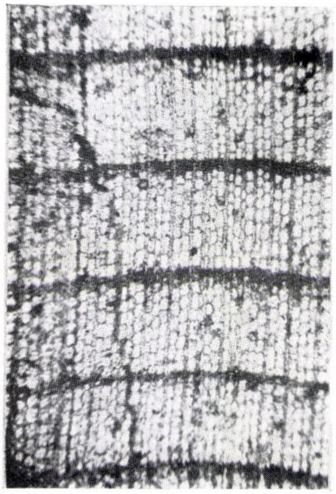
LIV. 1–6. *Cupressinoxylon cupressoides* n. sp. (Szentendre, Lower Helvetian)
7 and 8. ?*Cupressinoxylon* sp. (No. 2) (Kazár, Helvetian)
9. *Sequoioxylon* sp. (No. 5) (Eger, Helvetian)



LV. 1, 2, 5, 6 and 7. *Sequoioxylon* cf. *germanicum* (No. 1) Greguss (Alacska, Helvetian)
3 and 4, 8–12. *Metasequoioxylon hungaricum* n. sp. (Karancskeszi, Helvetian)



LVI. 1–9. *?Metasequoioxylon* sp. (Sajókazinc, Lower Helvetian)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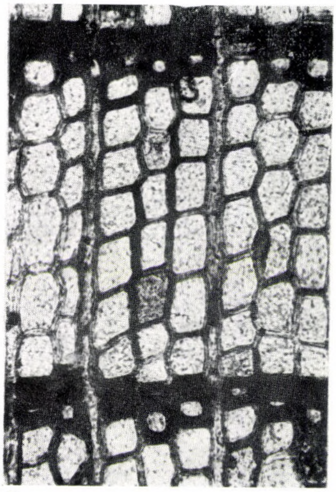
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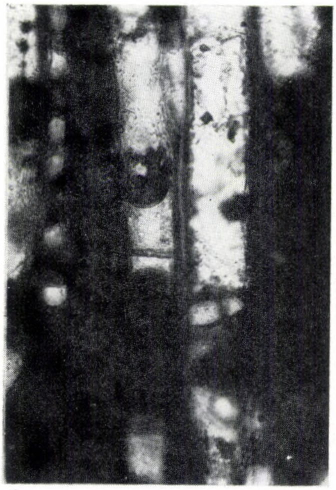
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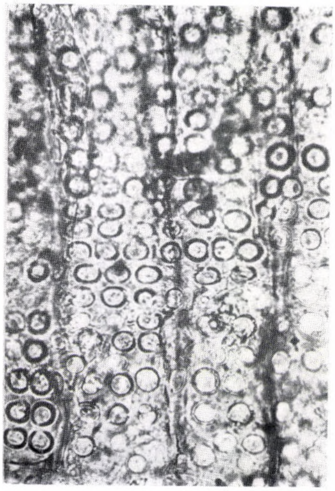
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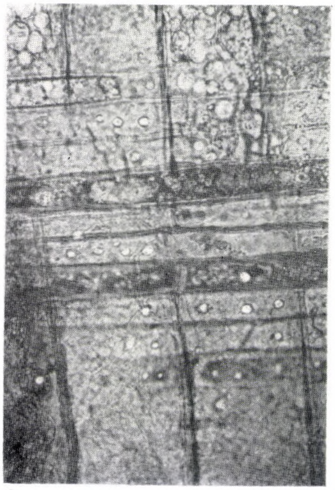
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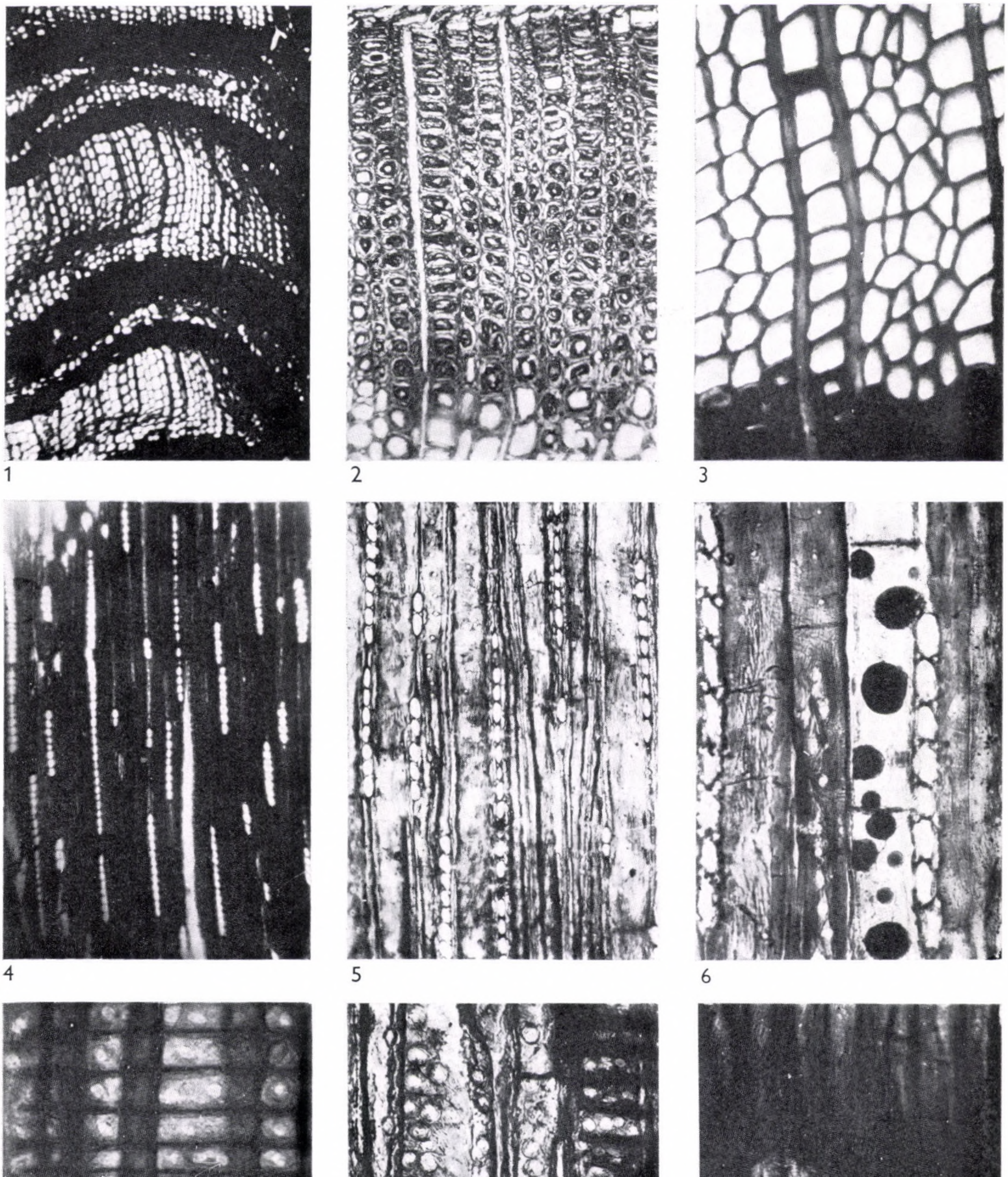
LVII. 1–9. *Sequoioxylon medullare* n. sp. (Ipolytarnóc, Burdigalian)



LVIII. 1–9. *Sequoioxylon podocarpoides* n. sp. (Salgóbánya, Lower Helvetian)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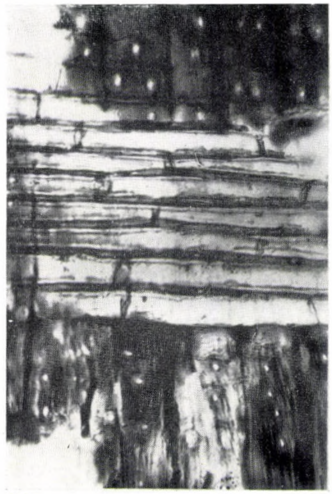
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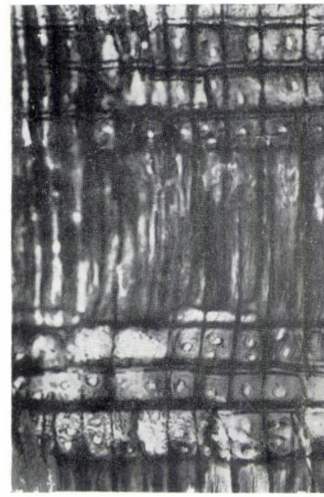
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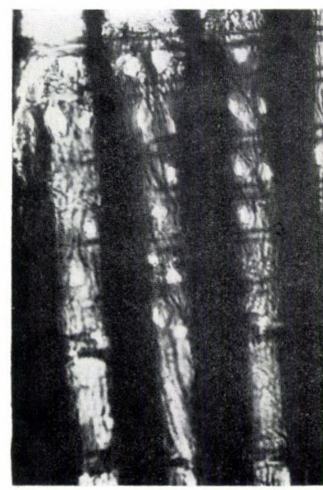
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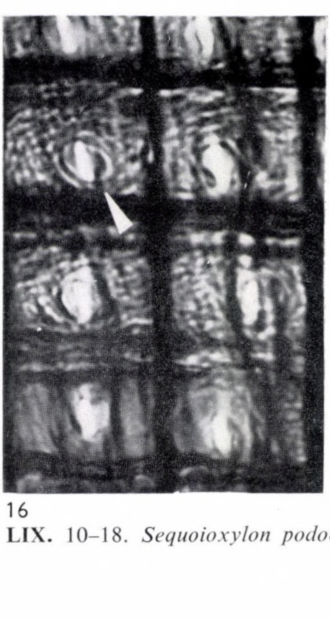
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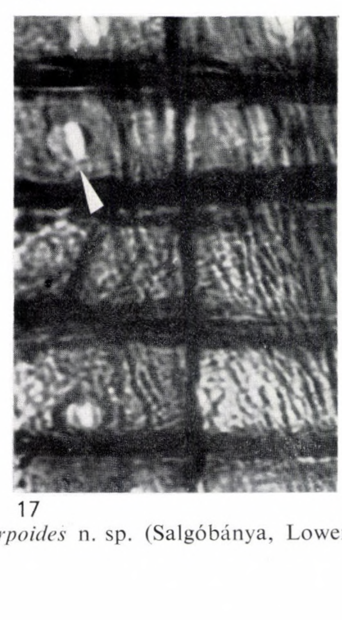
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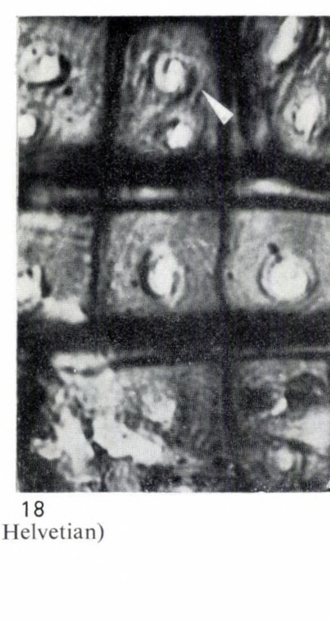
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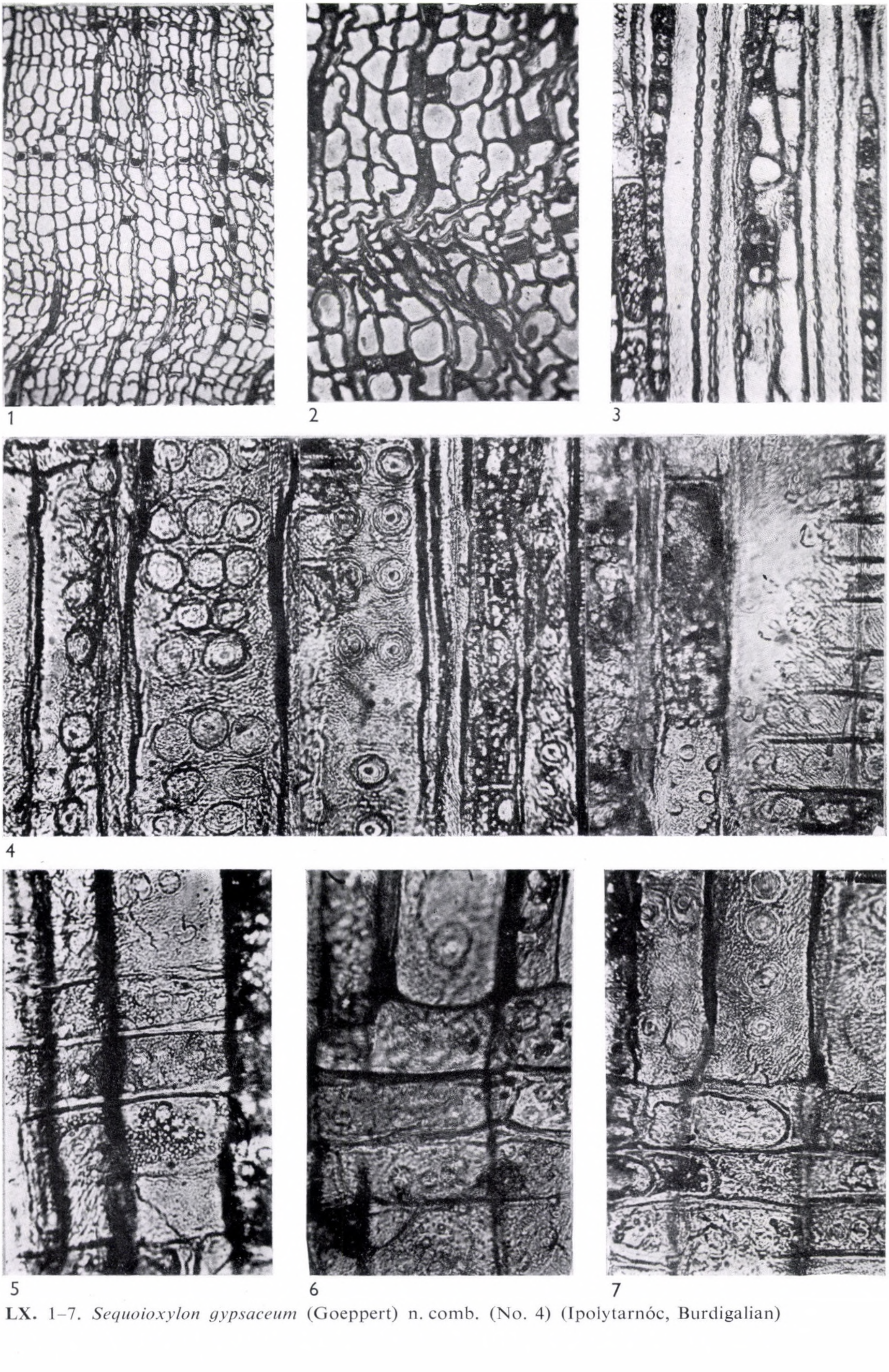
LIX. 10–18. *Sequoioxylon podocarpoides* n. sp. (Salgóbánya, Lower Helvetian)



LX. 1–7. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 4) (Ipolytarnóc, Burdigalian)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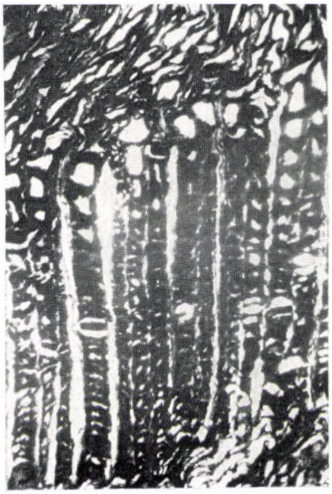
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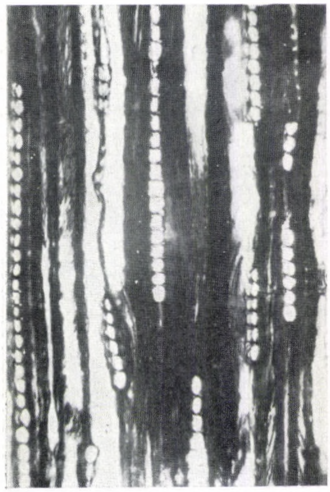
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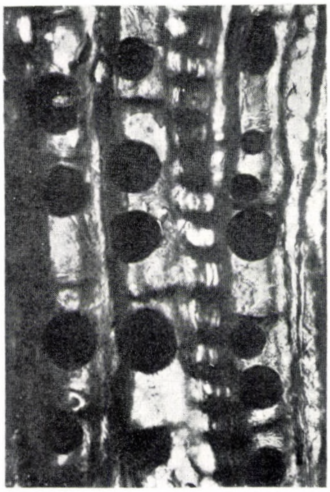
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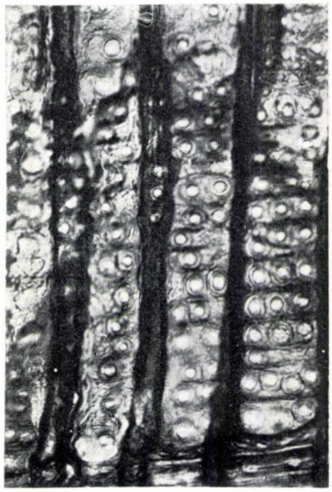
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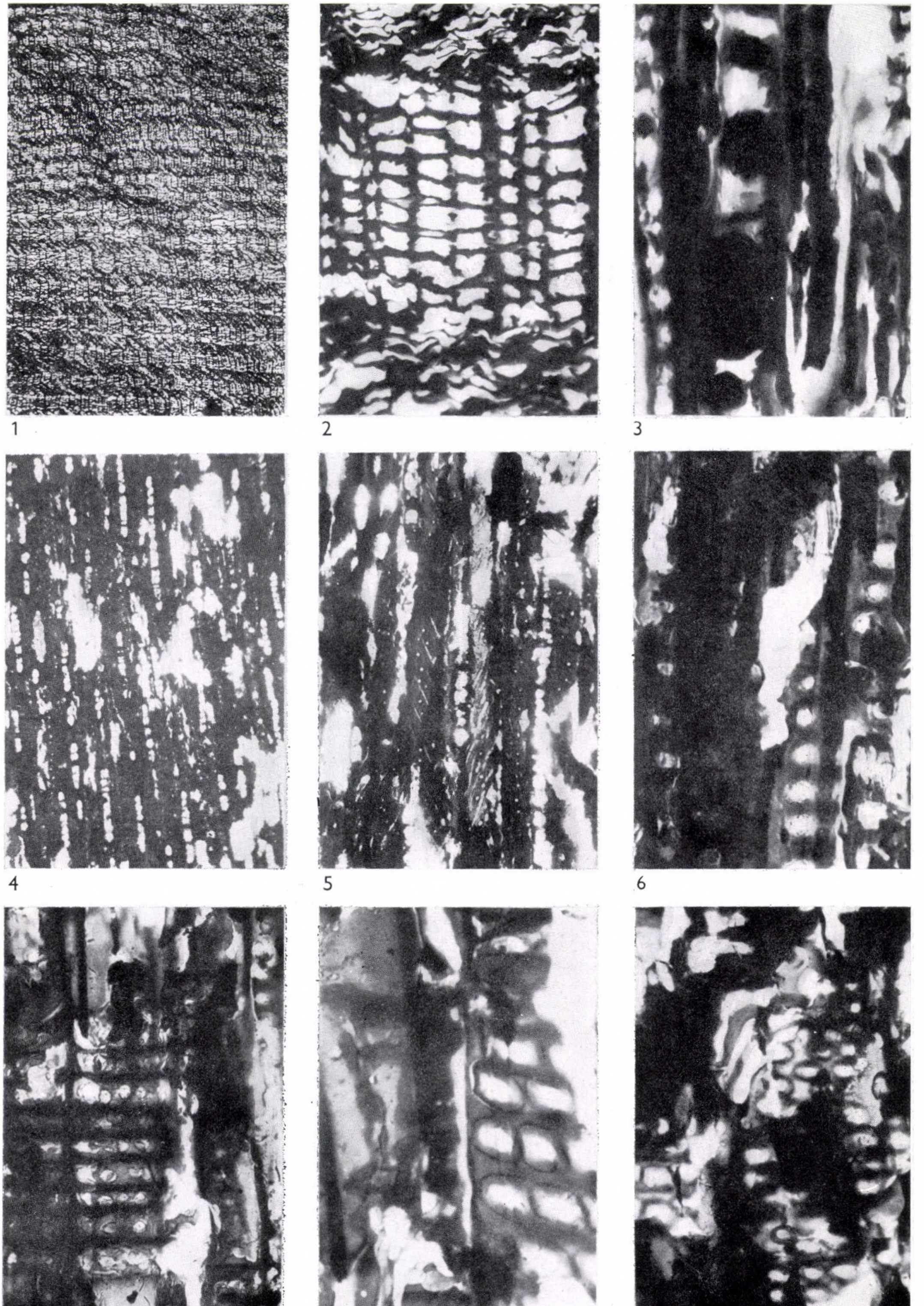
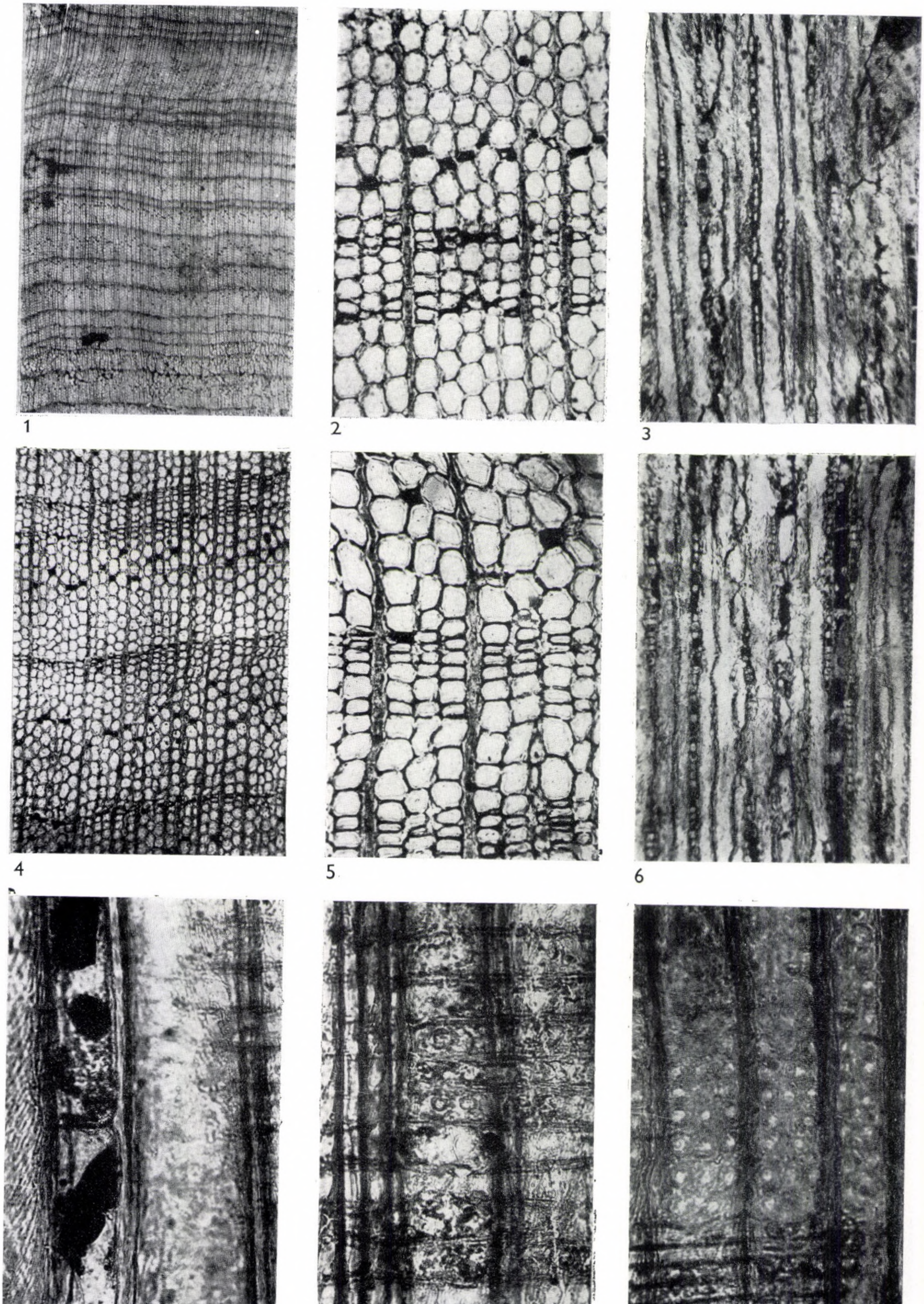
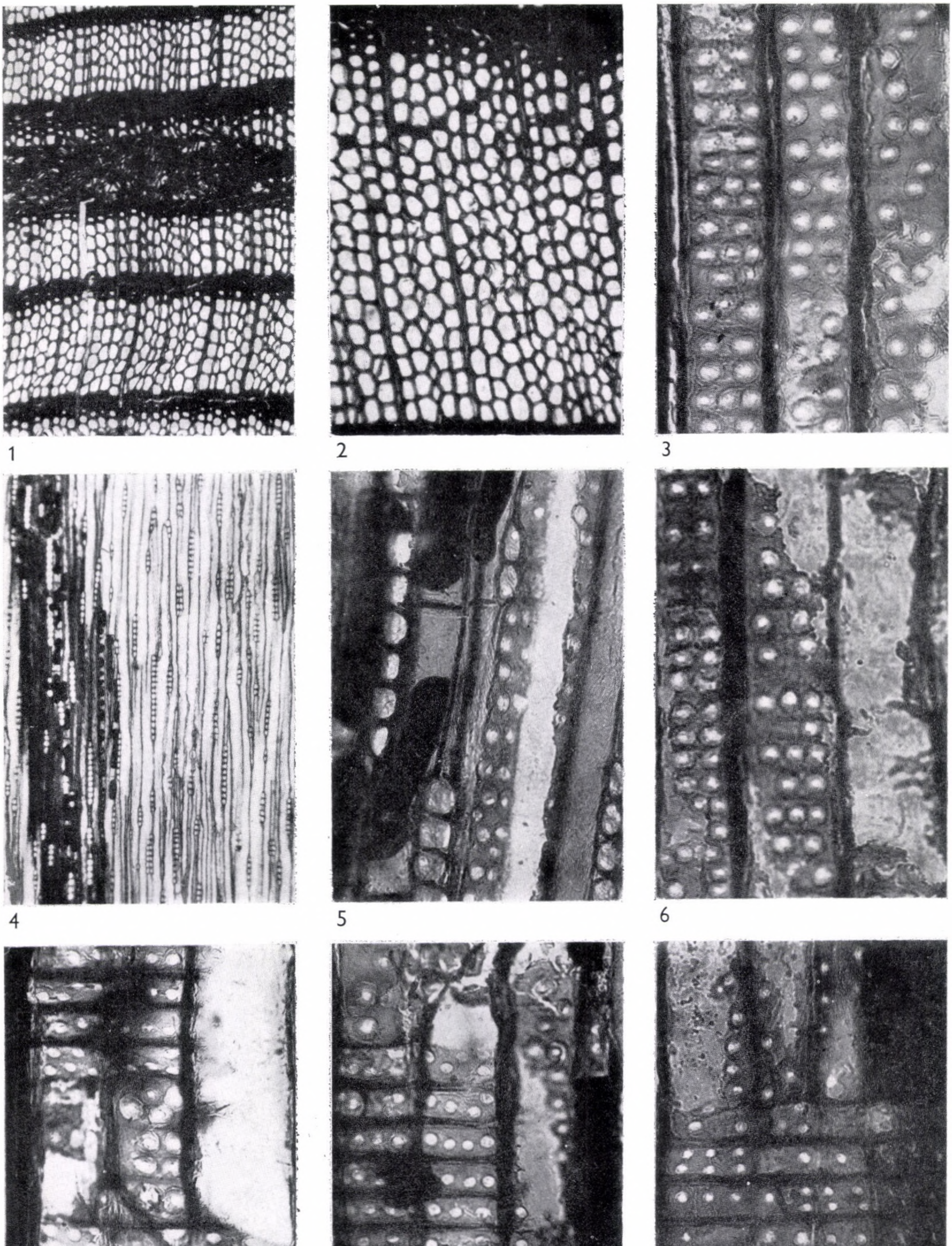
LXI. 1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 6) (Salgóbánya, Lower Helvetian)



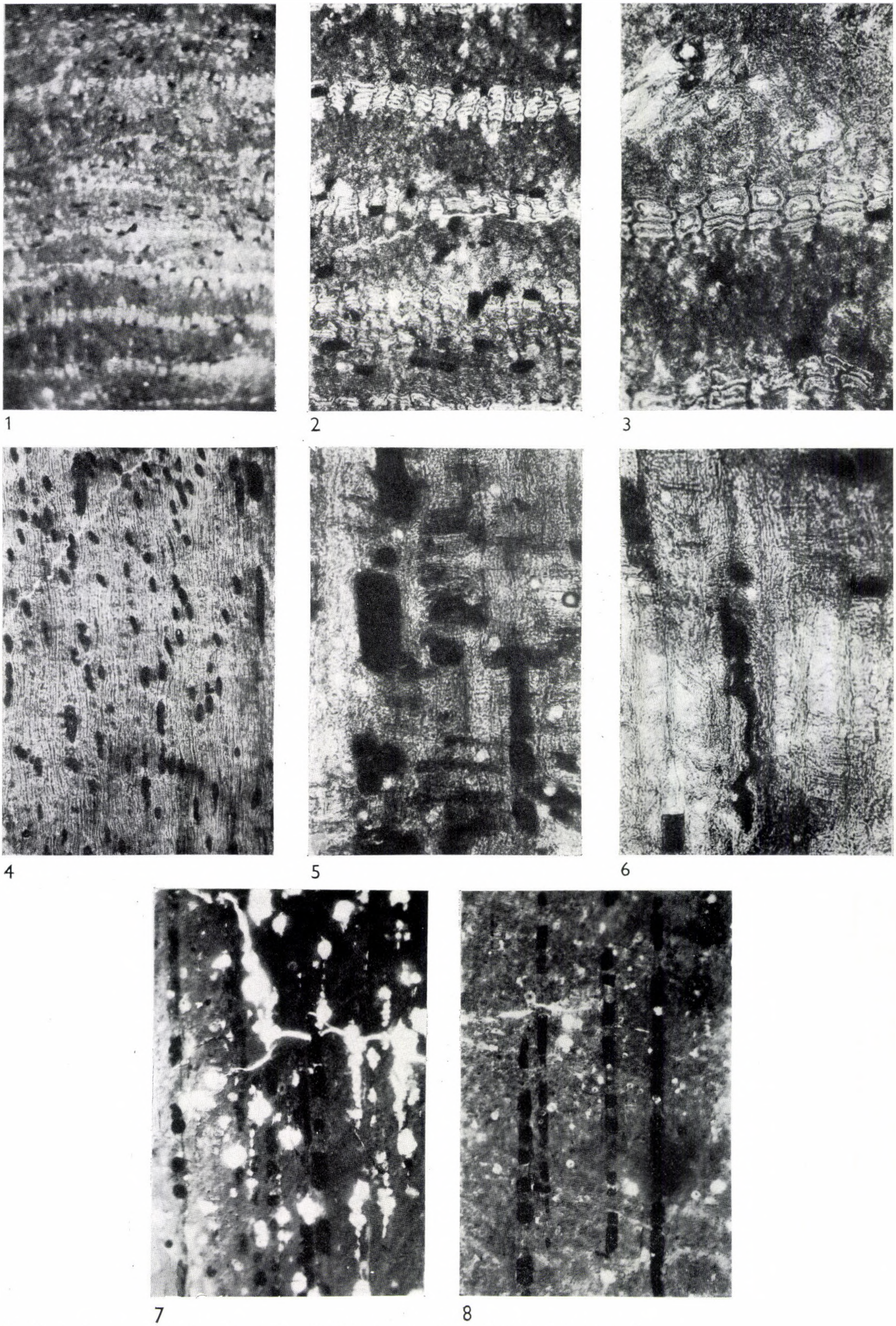
LXII. 1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 7) (Nagybátony, Lower Helvetian)



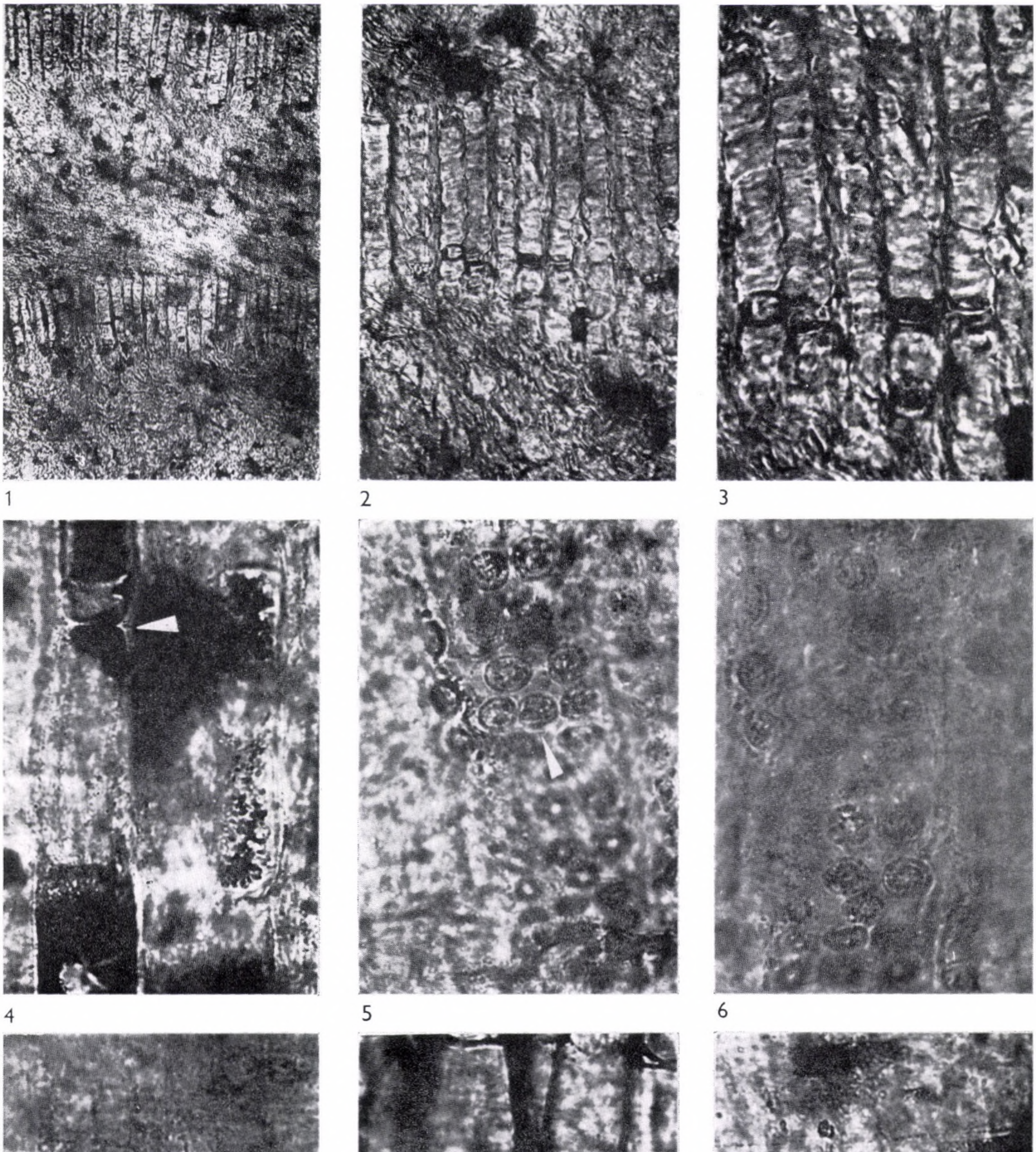
LXIII. 1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 2) (Litke, Lower Helvetian)



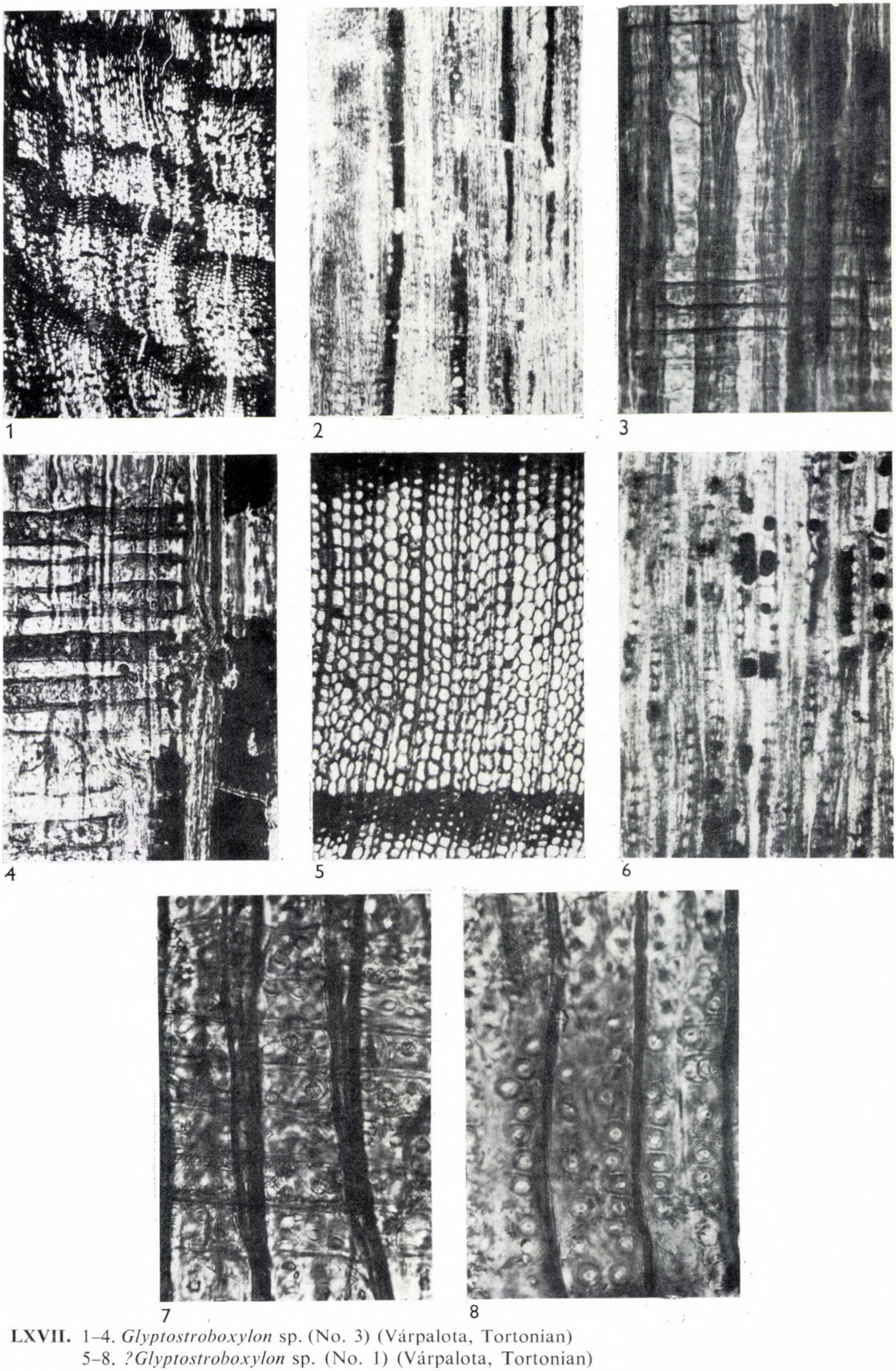
LXIV. 1–9. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 1) (Sajószentpéter, Helvetian)



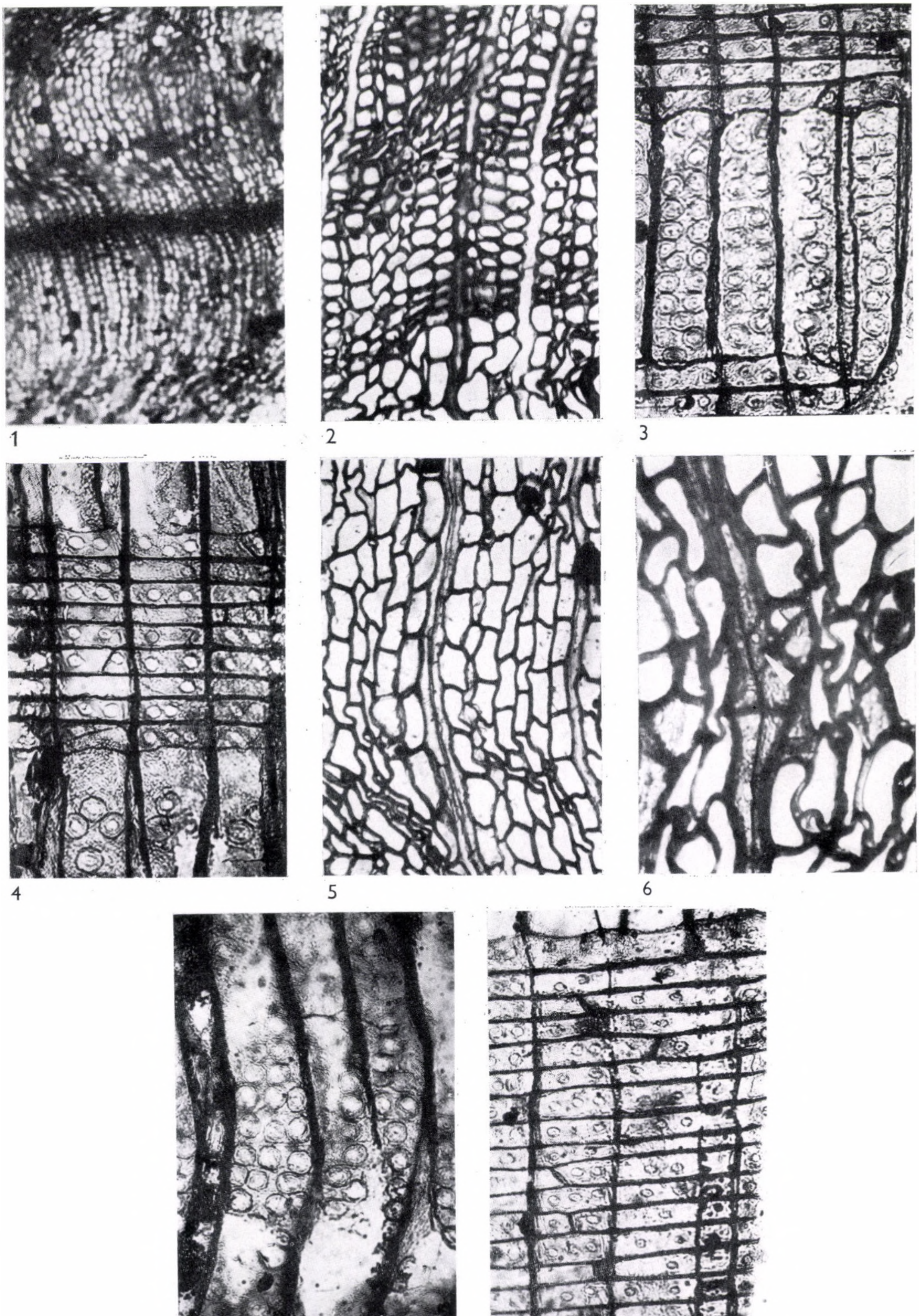
LXV. 1–6. *Sequoioxylon* sp. (No. 1) (Várpalota, Rudolftelep, Tortonian)
7 and 8. *Sequoioxylon* sp. (No. 2) (Pécsszabolcs, Helvetian)



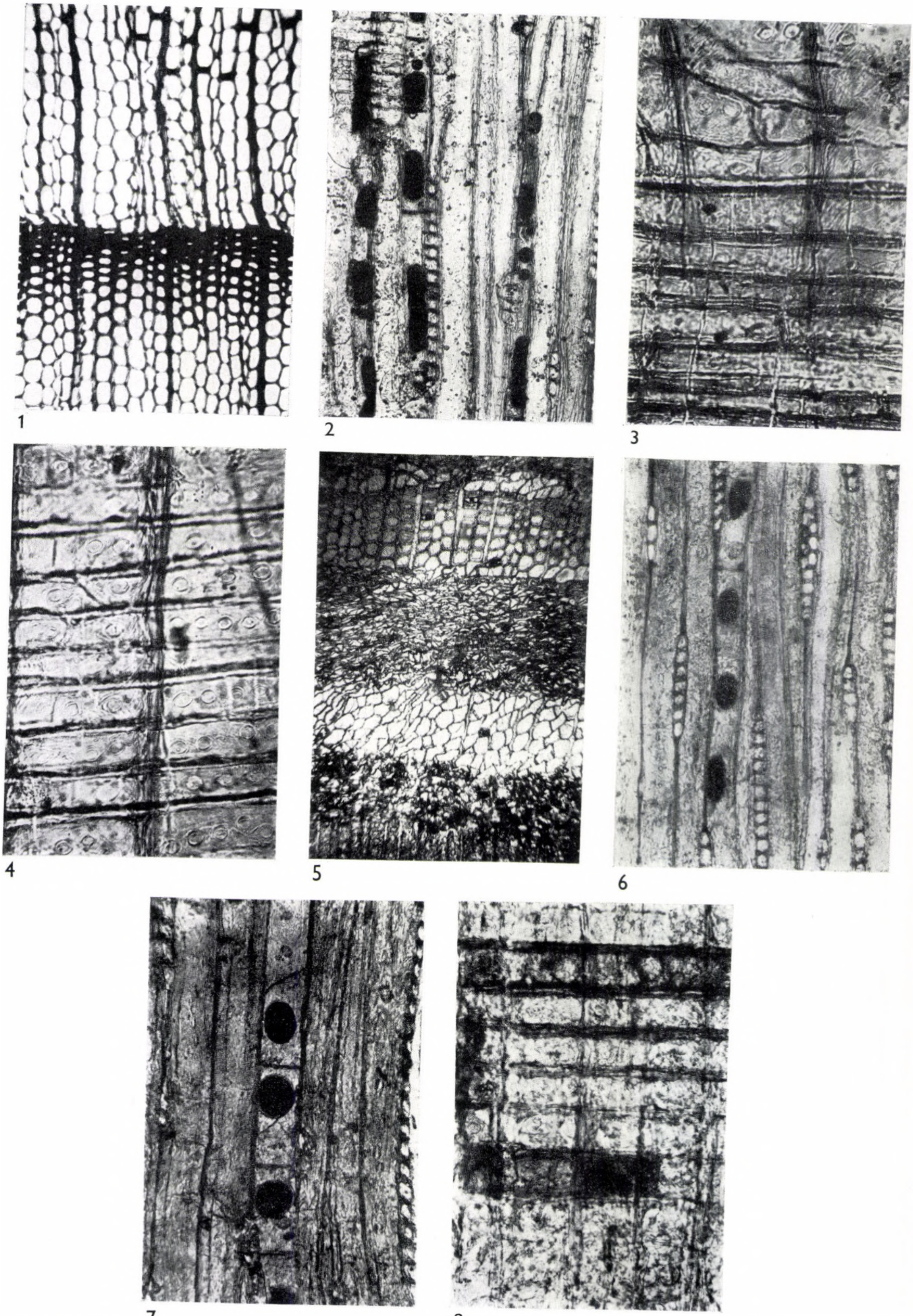
LXVI. 1–9. *Sequoioxylon* sp. (No. 9) (Pestszentlőrinc, Helvetian)



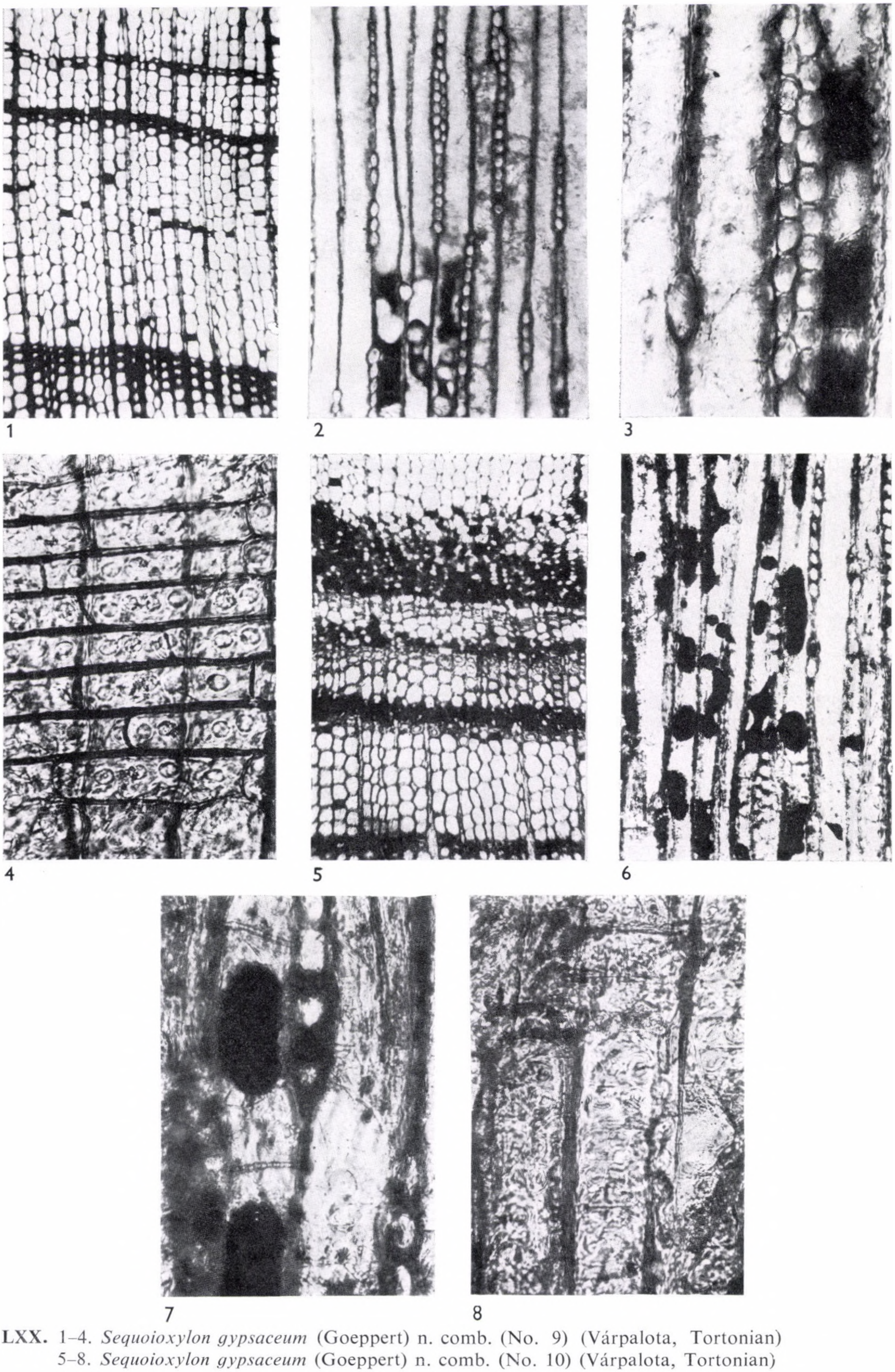
LXVII. 1–4. *Glyptostroboxylon* sp. (No. 3) (Várpalota, Tortonian)
5–8. ?*Glyptostroboxylon* sp. (No. 1) (Várpalota, Tortonian)



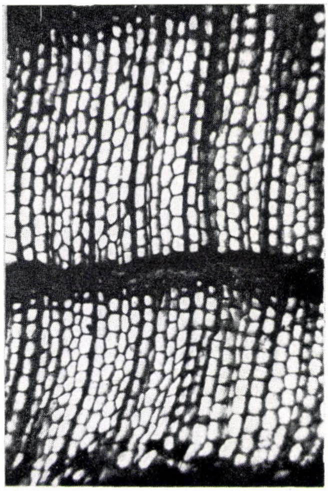
LXVIII. 1–8. *Sequoioxylon* cf. *germanicum* (No. 2) Greguss (Dorog, Upper Oligocene)



LXIX. 1–4. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 3) (Várpalota, Tortonian)
5–8. *Sequoioxylon* sp. (No. 3) (Várpalota, Tortonian)



LXX. 1–4. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 9) (Várpalota, Tortonian)
5–8. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 10) (Várpalota, Tortonian)



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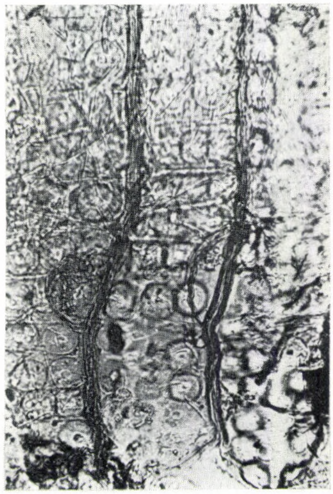

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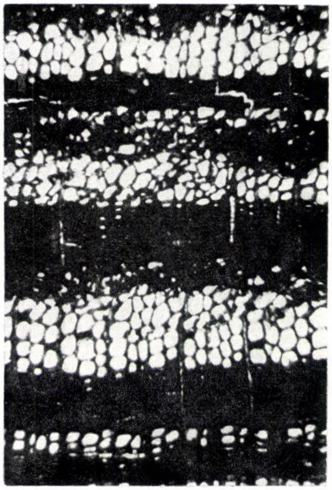

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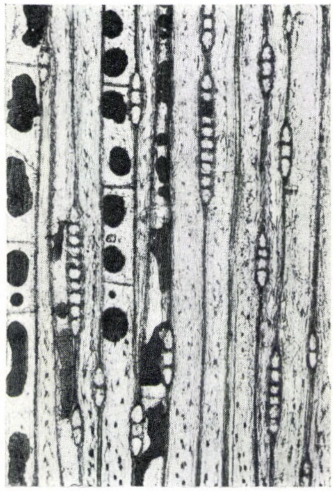

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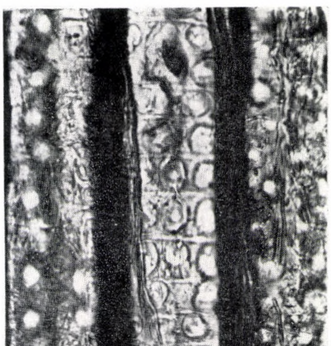

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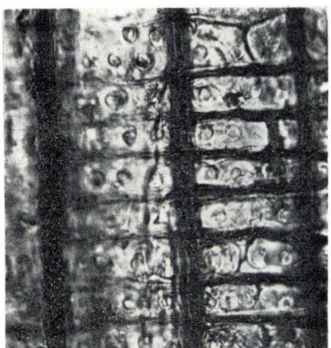

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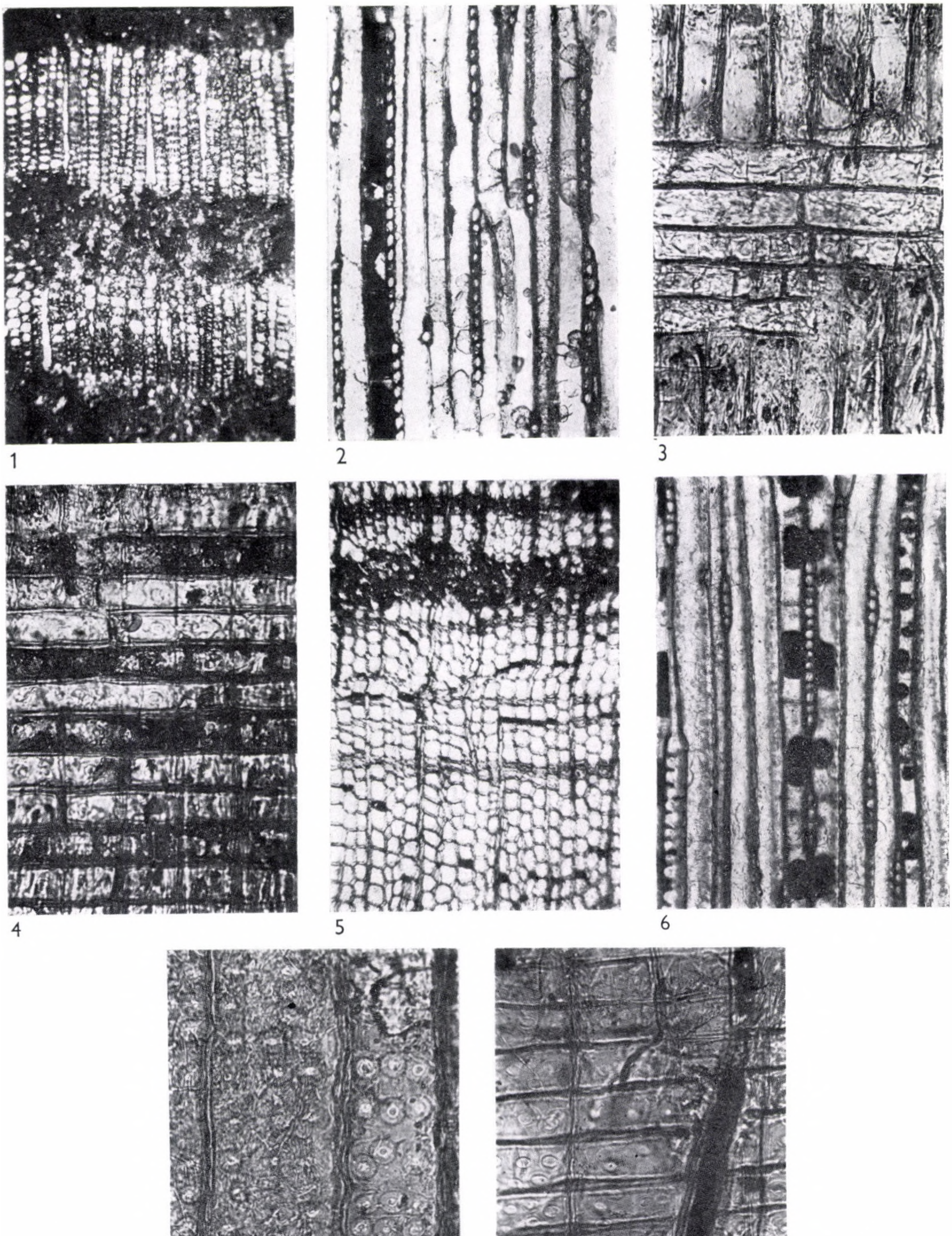
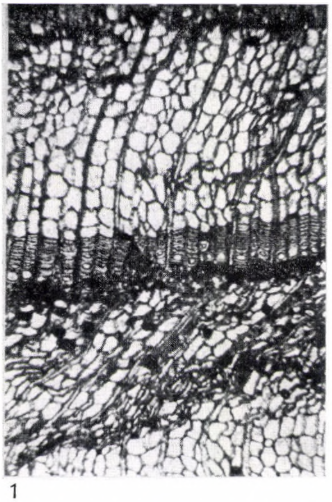
LXXI. 1–4. *Sequoioxylon* sp. (No. 10) (Várpalota, Tortonian)
5–8. *Sequoioxylon* sp. (No. 11) (Várpalota, Tortonian)



LXXII. 1–4. *Glyptostroboxylon* sp. (No. 2) (Várpalota, Tortonian)
5–8. *Sequoioxylon* sp. (No. 4) (Várpalota, Tortonian)



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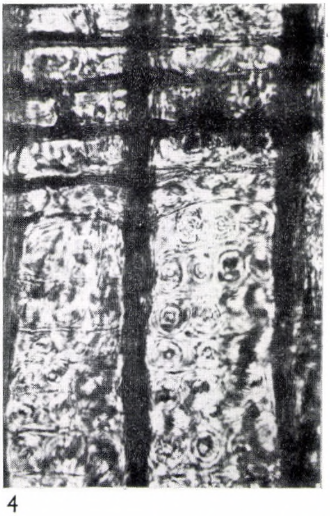

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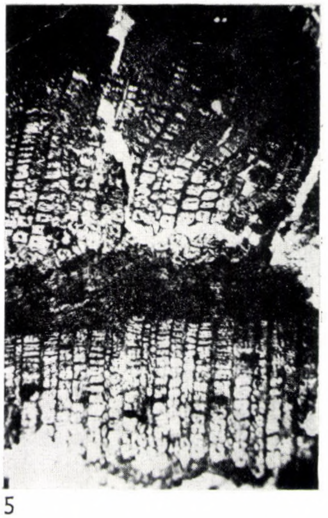

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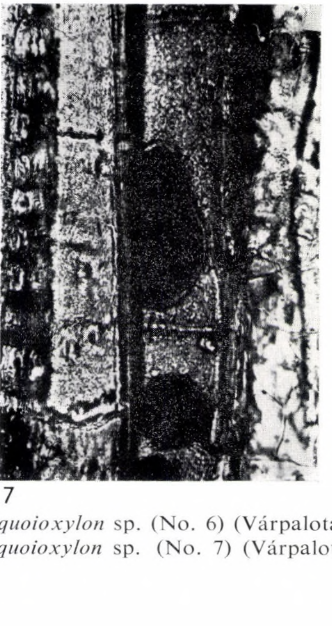

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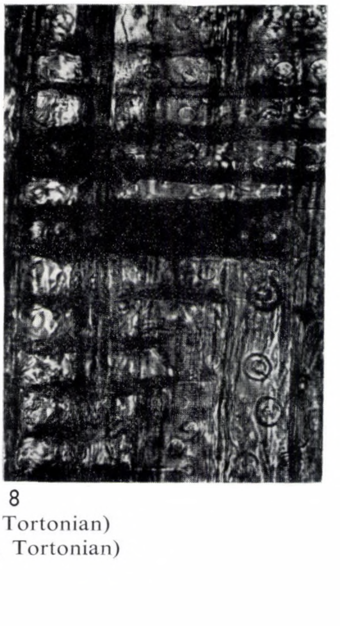

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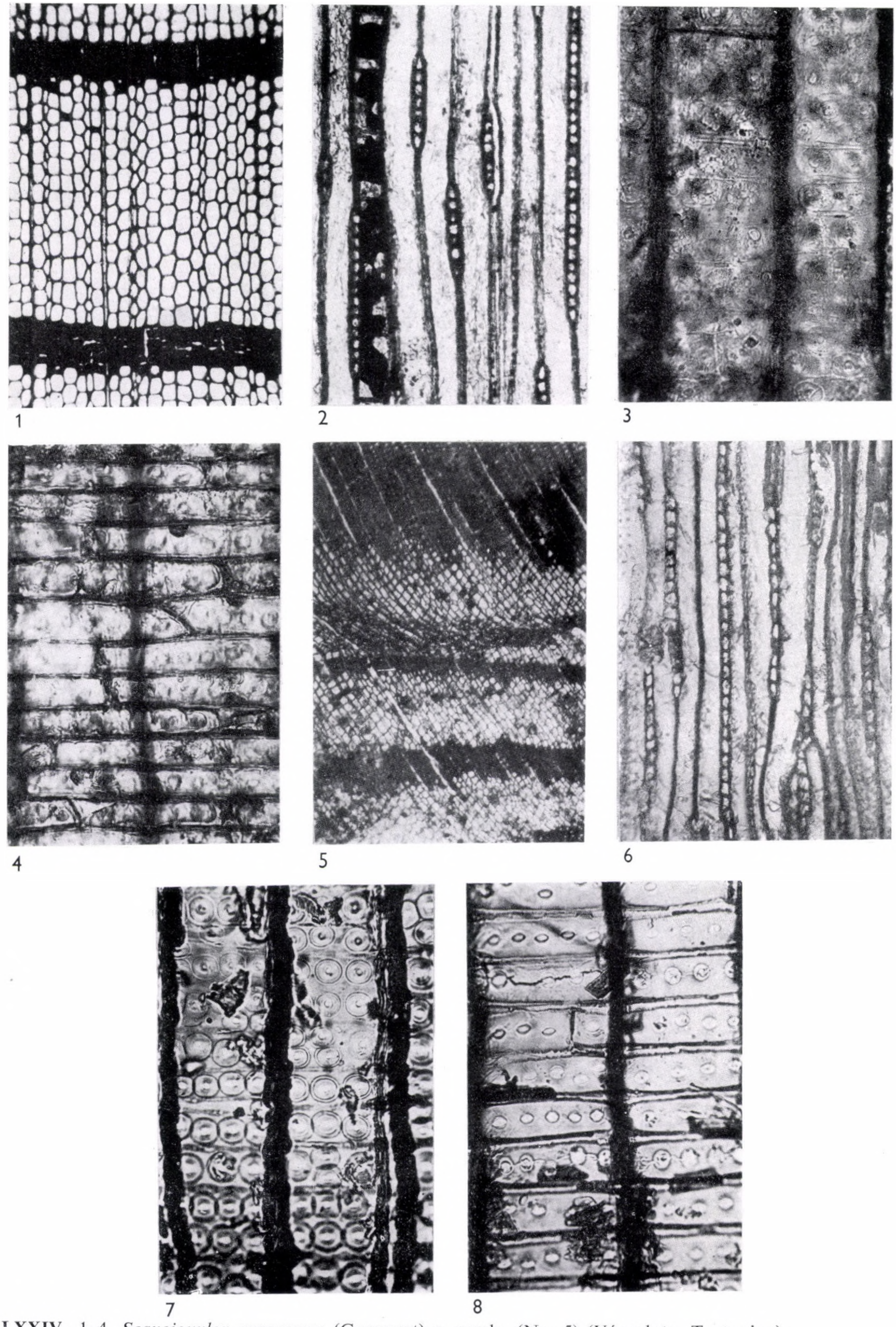
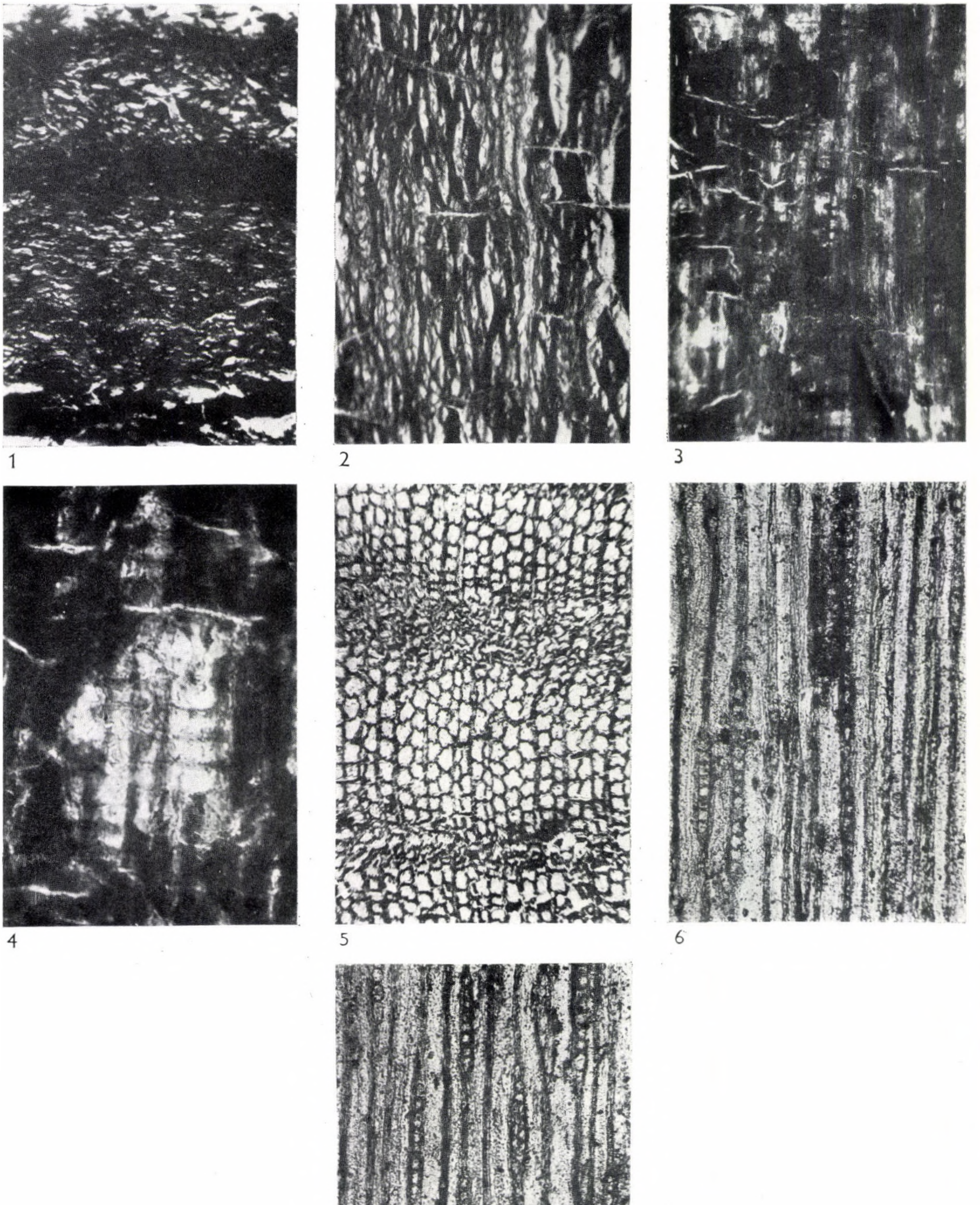
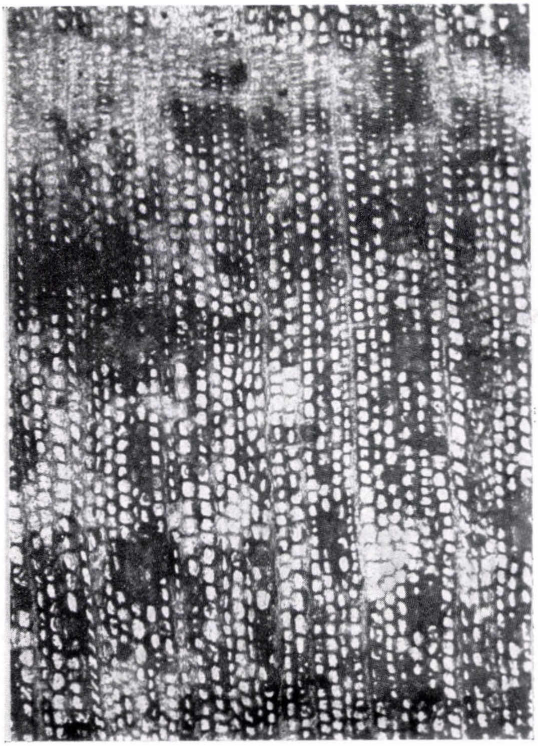
LXXIII. 1–4. *Sequoioxylon* sp. (No. 6) (Várpalota, Tortonian)
5–8. *Sequoioxylon* sp. (No. 7) (Várpalota, Tortonian)



LXXIV. 1–4. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 5) (Várpalota, Tortonian)
5–8. *Sequoioxylon gypsaceum* (Goeppert) n. comb. (No. 8) (Várpalota, Tortonian)



LXXV. 1–4. *Sequoioxylon* sp. (No. 8) (Becske, Burdigalian)
5–7. *Keteleeria* sp. (Ipolytarnóc, Burdigalian)



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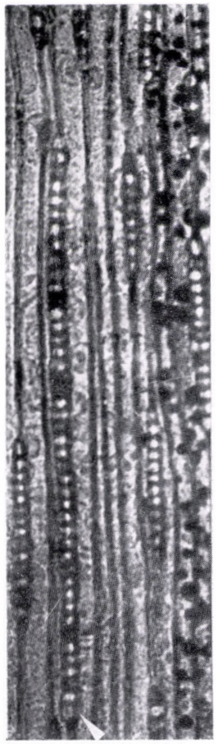

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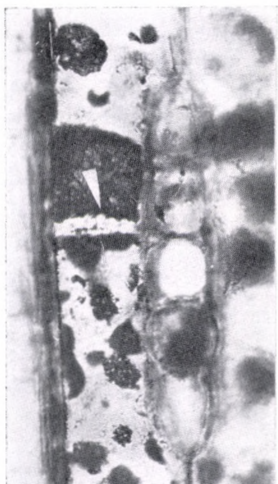

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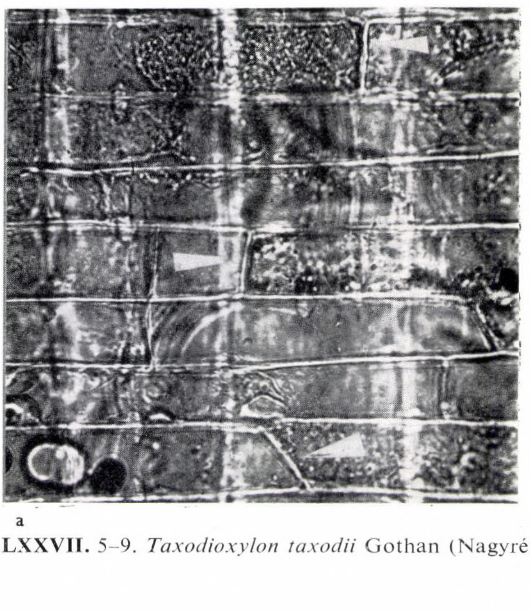
LXXVI. 1–4. *Taxodioxylon taxodii* Gothan (Nagyréde, Tortonian)


5


6


7


8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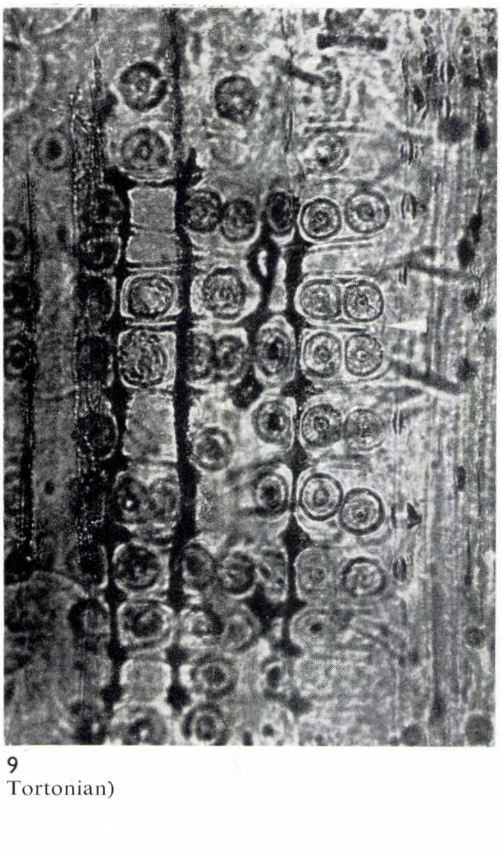
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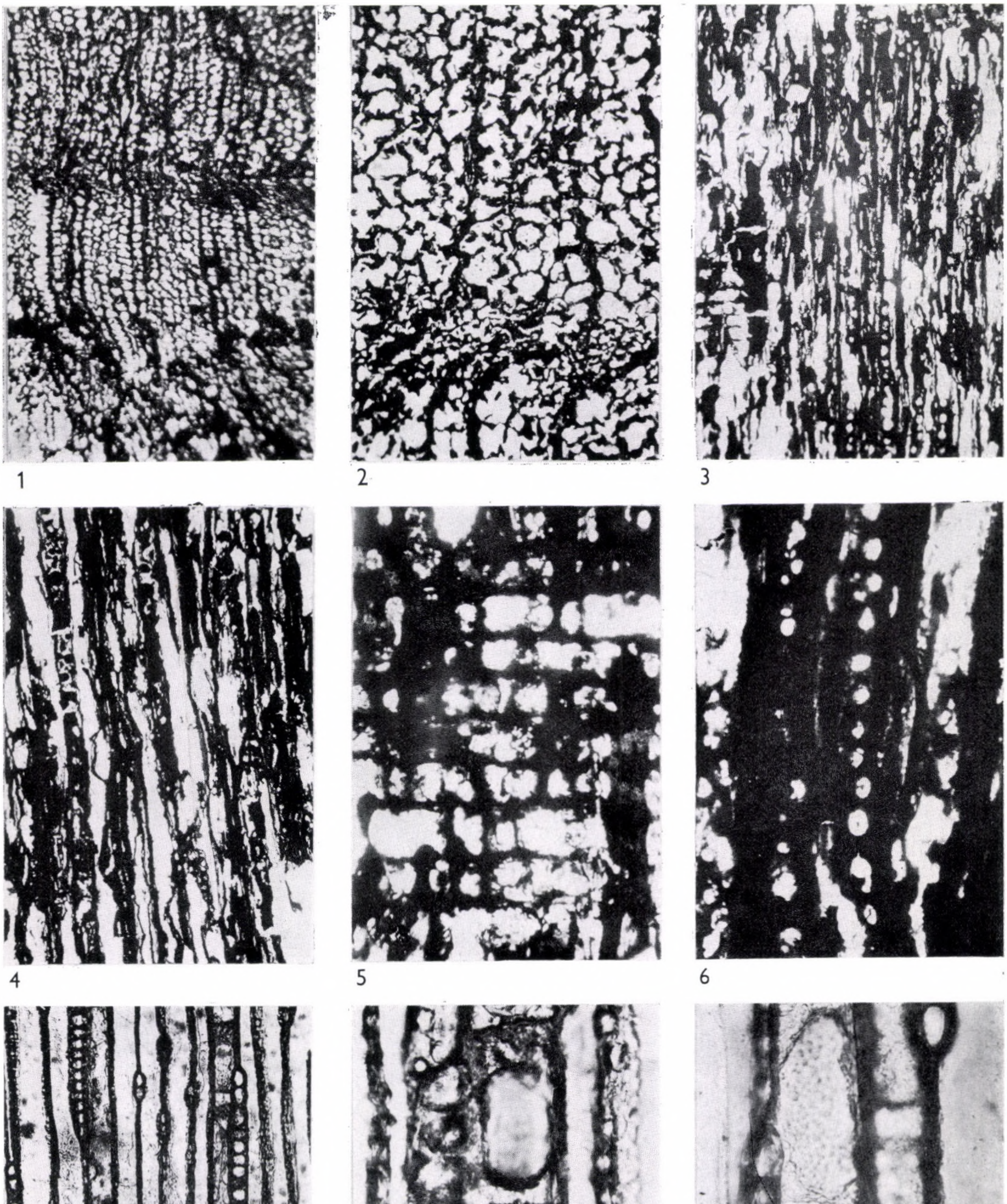
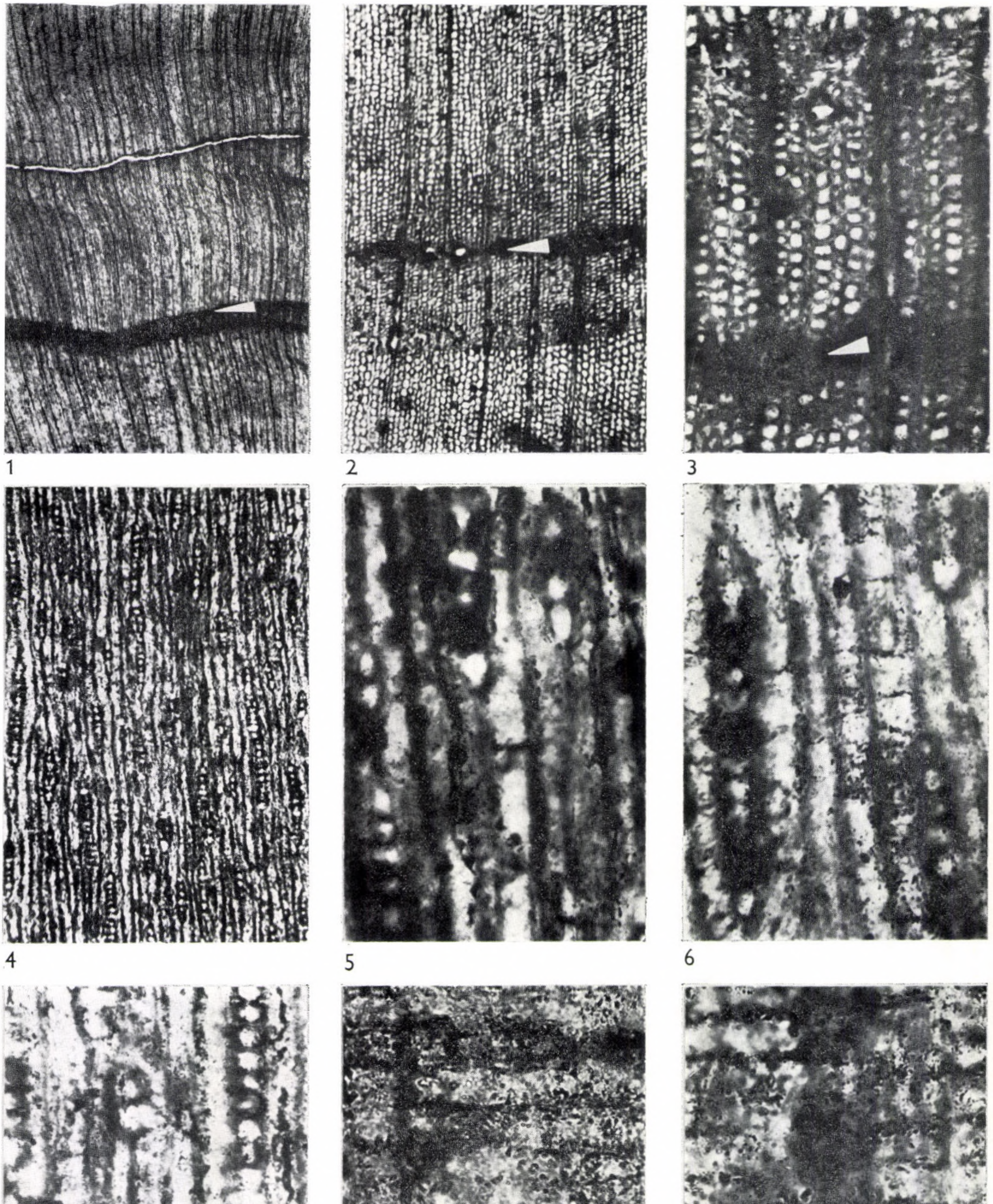
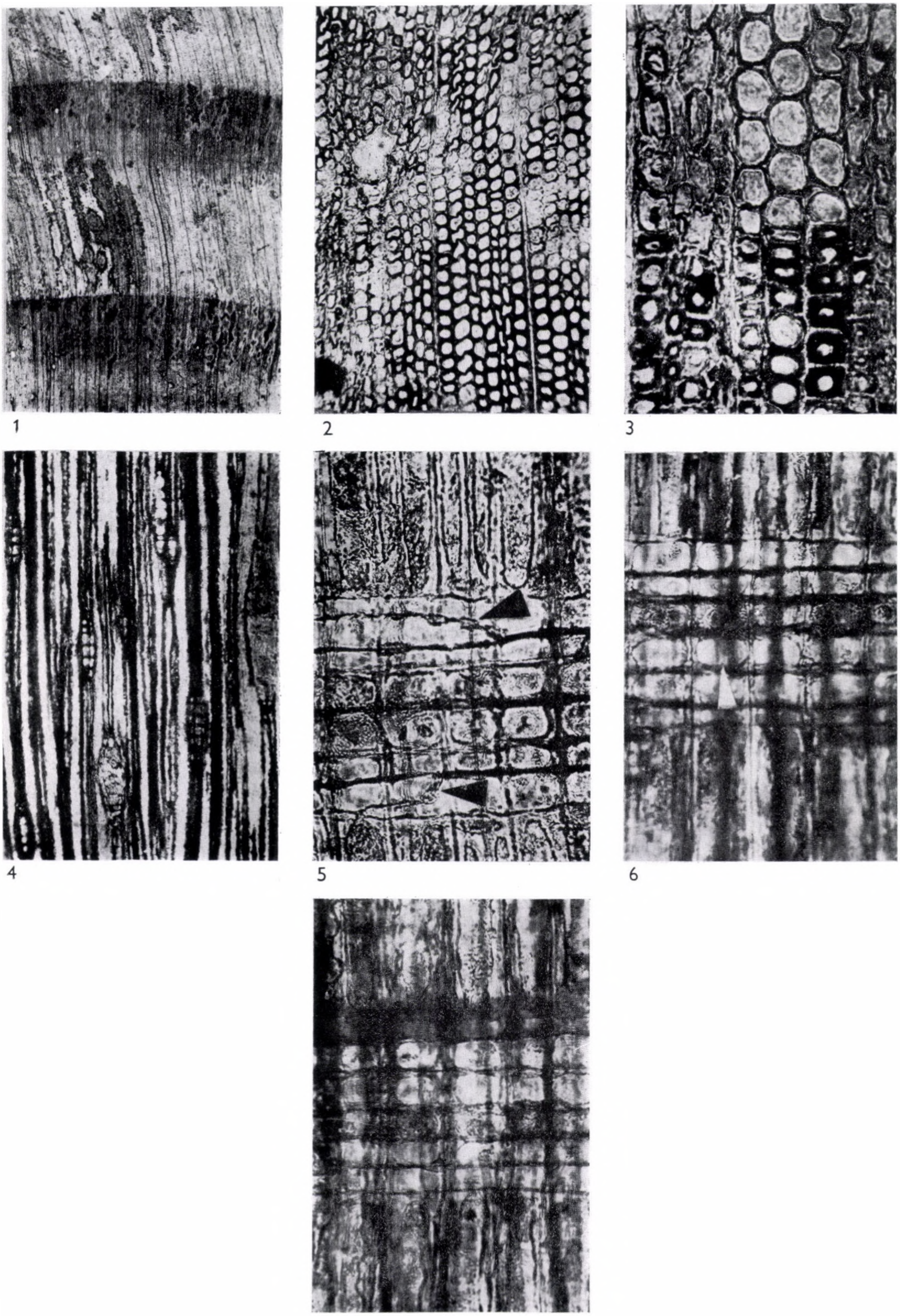
LXXVII. 5–9. *Taxodioxylon taxodii* Gothan (Nagyréde, Tortonian)



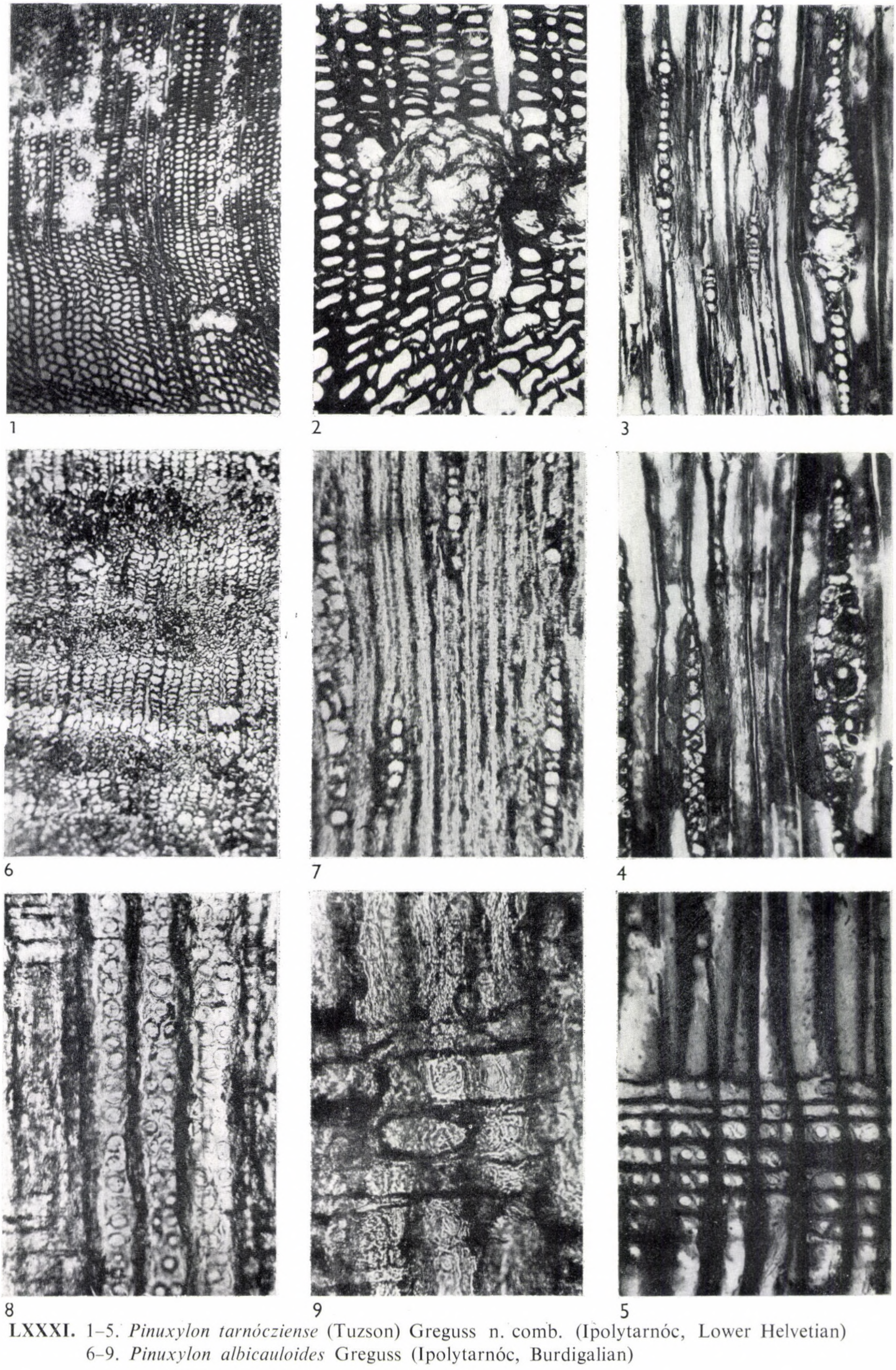
LXXVIII. 1–6. ?*Cupressinoxylon* sp. (No. 1) (Recsk, Helvetian)
7–9. *Taxodioxylon* cf. *taxodii* Gothan (Buják, Sarmatian) (secondary)



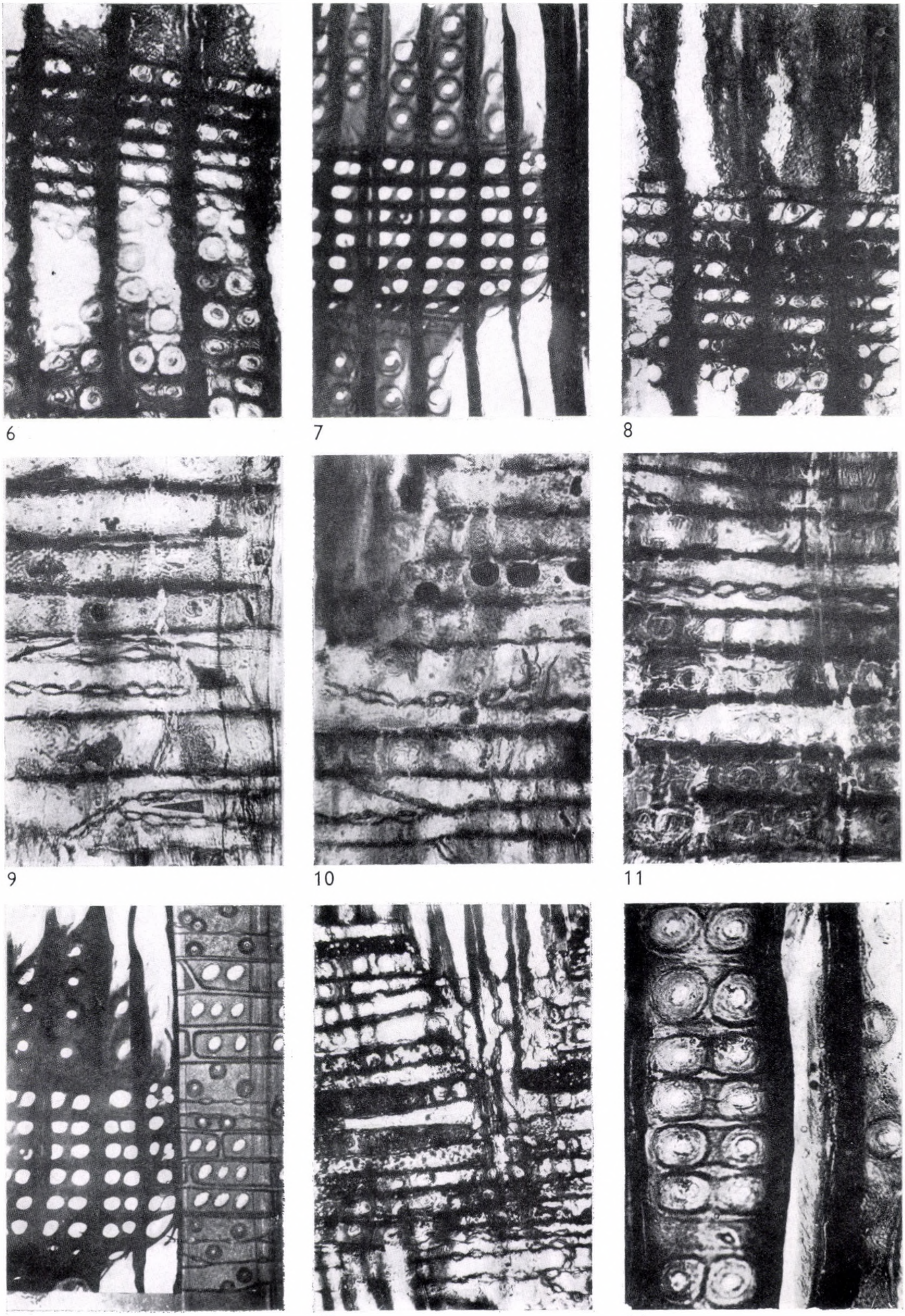
LXXIX. 1–9. *Cedroxylon* sp. (Nógrád, Helvetian)



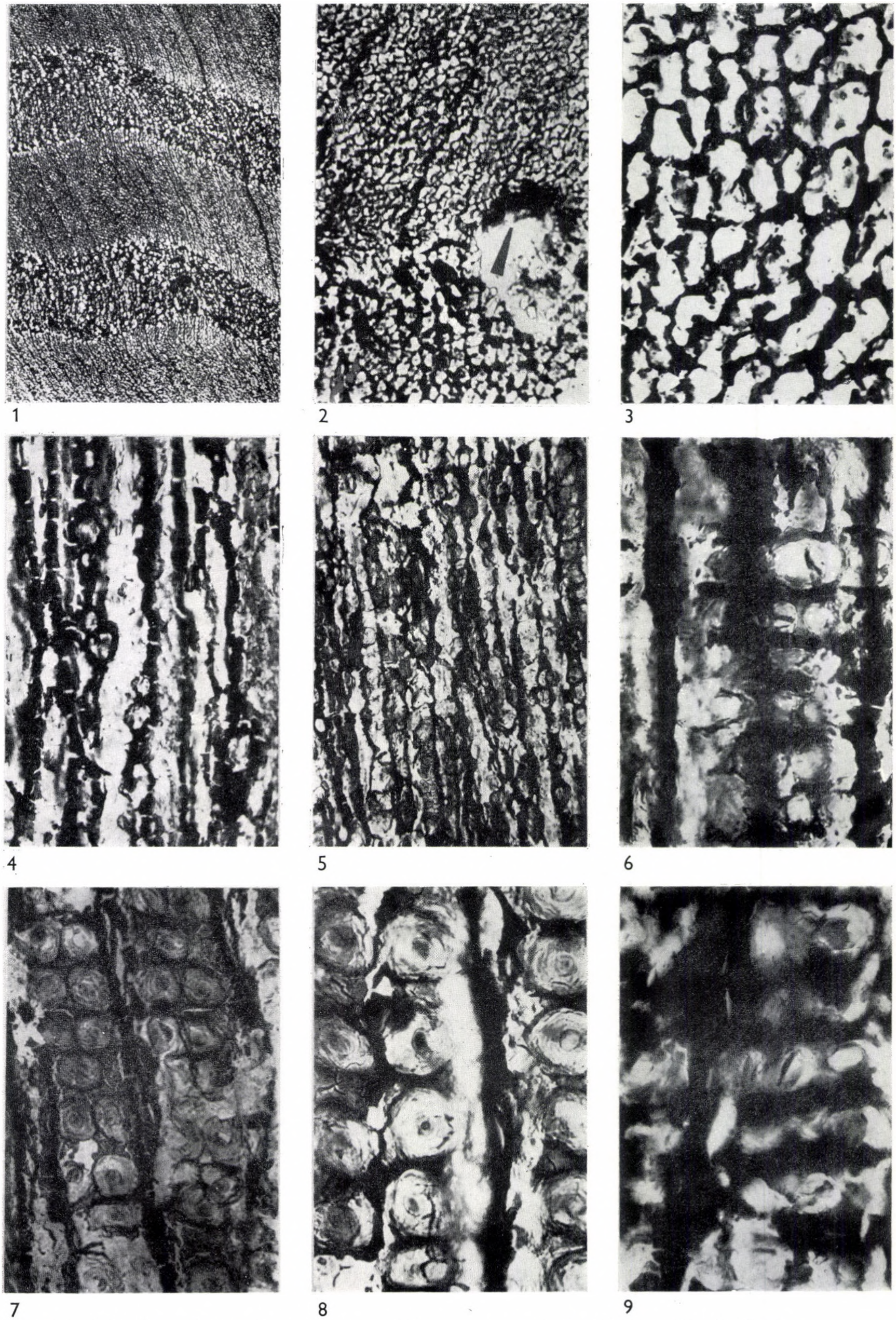
LXXX. 1–7. *Pinuxylon haploxyloides* n. sp. (Karancsberény, Helvetian)



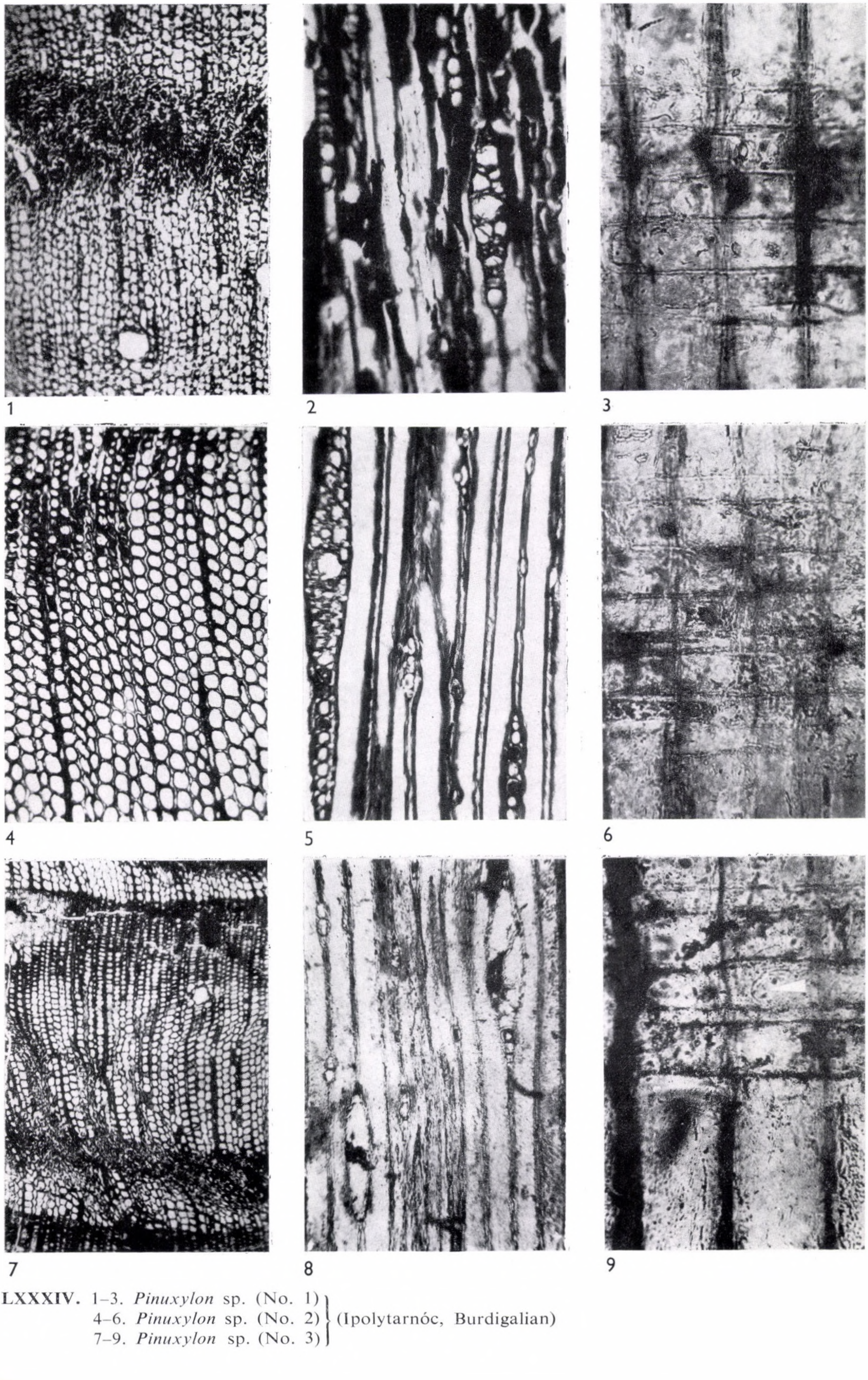
LXXXI. 1–5. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Lower Helvetian)
6–9. *Pinuxylon albicauloides* Greguss (Ipolytarnóc, Burdigalian)



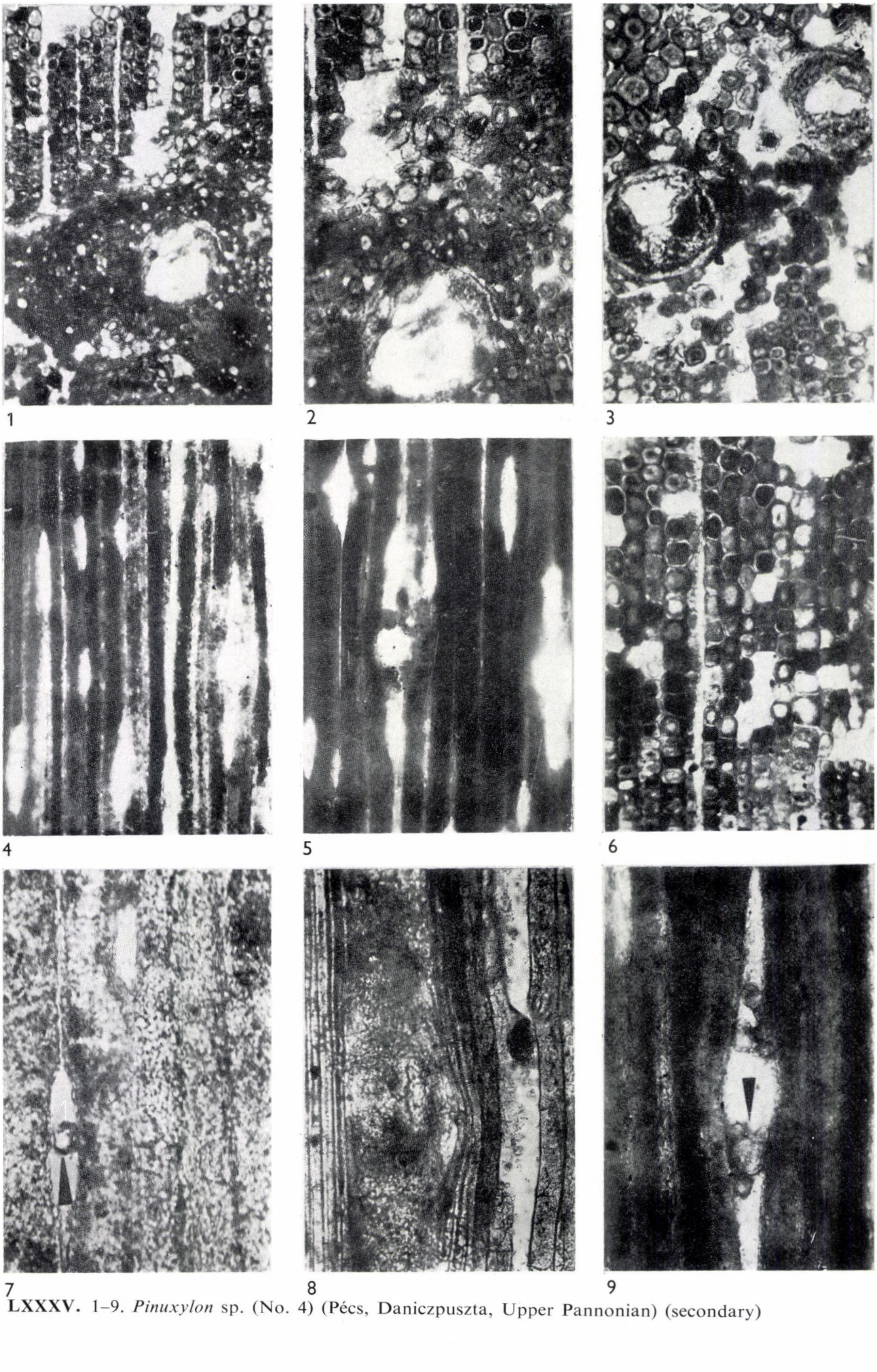
LXXXII. 6–14. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Burdigalian)



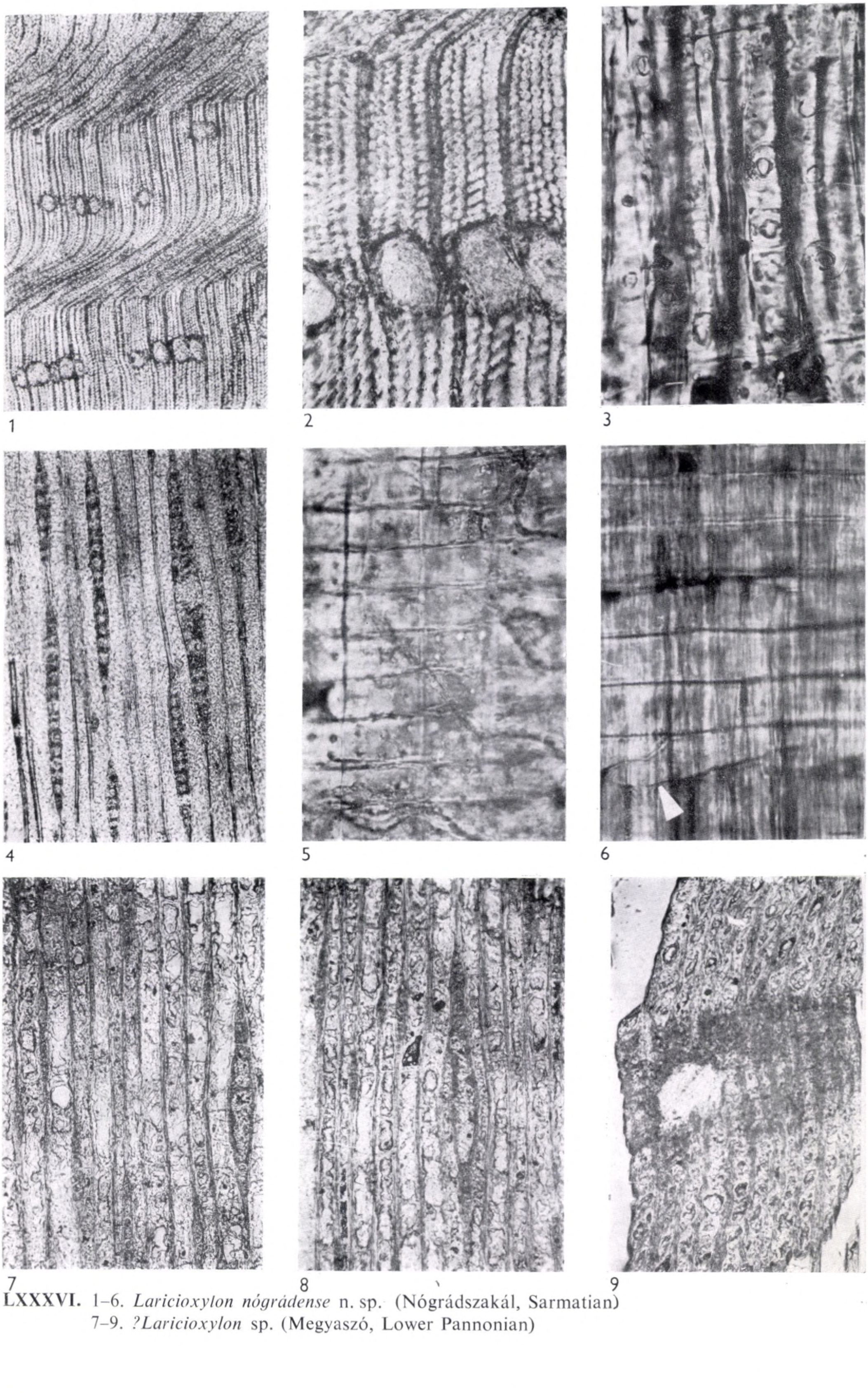
LXXXIII. 1–9. *Pinuxylon tarnócziense* (Tuzson) Greguss n. comb. (Ipolytarnóc, Burdigalian)



LXXXIV. 1–3. *Pinuxylon* sp. (No. 1)
4–6. *Pinuxylon* sp. (No. 2) } (Ipolytarnóc, Burdigalian)
7–9. *Pinuxylon* sp. (No. 3)



LXXXV. 1–9. *Pinuxylon* sp. (No. 4) (Pécs, Daniczpuszta, Upper Pannonian) (secondary)



LXXXVI. 1–6. *Laricioxylon nógrádense* n. sp. (Nógrádszakál, Sarmatian)
7–9. ?*Laricioxylon* sp. (Megyaszó, Lower Pannonian)

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