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DRAHOMÍRA BŘEZINOVÁ – NADĚŽDA GABRIELOVÁ
Národní muzeum, Praha – Ústřední ústav geologický, Praha

PALEOBOTANICKÝ VÝZKUM NEOGENNÍCH SEDIMENTŮ V OKOLÍ STOJČÍNA

A PALEOBOTANICAL RESEARCH OF NEOGENE SEDIMENTE IN THE ENVIRONS OF THE VILLAGE OF STOJČÍN

Neogenní uloženiny východně od Jindřichova Hradce tvoří nesouvislé ostrůvky, které představují denudační zbytky dřívějších rozsáhlejších pánviček. Z této oblasti byl studován materiál z okolí obce Stojčína jz. od Počátek. V práci jsou předloženy výsledky palynologického a xylotomického výzkumu neogenních sedimentů. V uhelných polohách se ojediněle vyskytly zbytky dřev — málo prouhelněných xylitů s dobře zachovanou anatomickou stavbou a byly určeny jako *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949.

Pylové spektrum dokládá zbytky vegetace bažinných lesů s poměrně hojným podrostem kapradinové a bryofytní flóry. Většina zjištěných rodů a druhů se shoduje se společenstvem pylových zrn a spór ze sedimentů jihočeských pánví, zvláště z mydlovarského souvrství. Zajímavý je i shodný výskyt mikroorganizmu označený N. Gabrielovou jako „forma A“. Výsledky xylotomického studia odpovídají zcela nálezům rostlinných mikrofosilií a dokreslují tak celkový obraz tehdejší vegetace.

Na základě těchto fakt lze studované sedimenty porovnat se sedimenty mydlovarského souvrství a stratigraficky je zařadit do období středního miocénu — badenu.

ABSTRACT

The Neogen deposits east of the town Jindřichův Hradec form uncontinuous islets, which represent remains of denudation of former more extensive basins. The research concerning this region was performed on the material from the village of Stojčín sw. from Počátky. Our work presents resuts of palynological and xylotomical method of research of Neogene sediments. Fragments of wood-slightly carbonized xylites with well preserved anatomical structure occuring sporadically in carbonatious positions were classified as *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949.

Pollen spectrum testifies to remains of swamp forest vegetation with relatively abundant undergrowth of fern and bryophytic flora. Most of the genera and species discivered accord with the assemblage of pollen grains and spores of the south Bohemian sediments especially those of the Mydlovary series of strata. An interesting fact is also a coincident occurrence of microorganism designated by N. Gabrielová as "Form A". The results of xylotomic study accord completely with findings of plant microfossils and complete the image of that time vegetation.

On basis of these fact the sediments examined can be compared with the sediments of the Mydlovary series of strata and at the same time stratigraphically classified as Baden Age (Middle Miocene).

INTRODUCTION AND GEOLOGY

The Neogene deposits east of the town of Jindřichův Hradec form uncontinuous islets, which represent remains of denudiation of former more extensive basins. A research concerning this region was performed on material from the environs of the village of Stojčín se. of Počátky, where Geoindustria Prague carried out a deposit examination for brick raw material (fig 1).

The Neogene remains lie on moldanubic crystallinicum formed mostly of cordieritical biotite gneiss to migmatites. Basal sediments of Neogene are formed by stratas of coarse-grained sands to gravel, with the approximate thickness of 1—2 m. These stratas pass into clays sometimes containing arenous ingredient. Dark humus clays most probably representing swamp sedimentation that arose as a result of basin shallowing also occur in the profile.

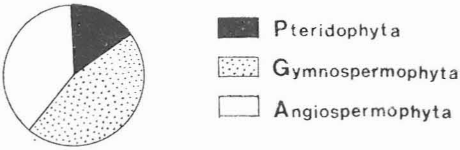
A more detailed geological study can be found in a unpublished reports of Geoindustria Prague and further there exists a general survey published in Comments to a general geological map (A. Dudek et al. 1962).

Our study also presents results of palynological and xylotomical research of Neogene sediments.

THE PALYNOLOGICAL PART OF THE RESEARCH

Specimens of carbonatious sediments containing a very a — bundant assemblage of sporomorphs were studied in detail. The sporomorphs were classified partly by Krutzsch's work (1962, 1963, 1970—1972) and R. Potonié's work (1956, 1958, 1960, 1966, 1970) partly by the recent botanical system.

QUANTITATIVE REPRESENTATION OF PLANTS GROUPS



System of sporomorphs

(Pl. V.—VIII.)

I. Bryophytina: *Stereisporites (Stereisporites) stereoides* (R. POT & VEN.) TH. & PF. *subsp. stereoide* W. Kr.

II. Phyllophytina: *Baculatisporites quintus* (PF. & TH.) W. Kr., *Leiotriletes fsp., Trilites fsp., Triplanosporites fsp., Laevigatosporites haardti* (R. POT.& VEN.) TH. & PF., *Laevigatosporites fsp.*

III. Coniferophytina: *Pityosporites microalatus* (R. POT.) TH. & PF., *Pityosporites labdacus* (R. POT.) TH. & PF., *Pityosporites alatus* (R. POT.) TH. & PF., *Pityosporites fsp., Cedripites miocaenicus* W. KR., *Podocarpidites fsp., Abiespollenites absolutus* THIERG. (non in RAATZ), *Zonalapollenites fsp., Inaperturopollenites hiatus* (R. POT.) TH. & PF., *Inaperturopollenites fsp., Psophosphaera fsp., cf. Sequoiapollenites fsp.*

IV. Angiospermophytina: *Momipites punctatus* (R. POT. NAGY, *Momipites coryloides* WODEHOUSE, *Momipites fsp., Triatriopollenites bituitus* (R. POT.) TH. & PF., *Triatriopollenites — Myricaceae forms, Triatriopollenites fsp., Intratriporopollenites instructus* (R. POT. & VEN.) TH. & PF., *Caryapollenites simplex* (R. POT.) RAATZ, *Caryapollenites fsp., Pterocaryapollenites stellatus* (R. POT.) RAATZ, *Pterocaryapollenites fsp., Alnipollenites verus* (R. POT.) ex R. POT., *Ulmipollenites undulosus* WOLFF, *Ulmipollenites fsp., Multiporopollenites fsp., Tricolpopollenites liblarensis* (THOMS.) TH. & PF., *Tricolpopollenites henrici* (R. POT.) TH. & PF., *Tricolpopollenites microhenrici* (R. POT.) TH. & PF., *Tricolpopollenites fsp., Tricolporopollenites cingulum* (R. POT.) TH. & PF., *Tricolporopollenites pseudocinguum* (R. POT.) R. POT. *Tricolporopollenites megaexactus* R. POT.) TH. & PF., *Tricolporopollenites microreticulatus* PF. & TH., *Tricolporopollenites fsp., Tetradopollenites fsp., Monoporopollenites fsp., Asteraceae, Nymphaeaceae.*

V. Incertae sedis: Form A

VI. Other organic remains: spores of Fungi, carbonized fragments of plant tissue.

A STRATIGRAPHICAL CLASIFICATION OF SPECIMENS

The assemblage of pollen grains and spores discovered in specimens examined is very abundant and varied as to genera and species.

An important component is represented by *Sphagnum Stereispor. (Stereispor.) stereoides subsp. stereoides),* that take to 6 per cent of the total number of sporomorphs. The ferns are represented on the spectrum structure by spores of the *Polypodiaceae family (Laevigatospor. haardti)* to a considerable extent. Other genera as e.g. *Osmunda, cf. Lygodium, Gleicheniaceae* family occur in a smaller quantity. The gymnospermous microflora takes the greatest part on pollen spectrum. It is represented above all by specimens of genera characterized by bladders, i. e. *Pinus*

Table 1.

Diagram of numerical and percentual values of spores and pollen grains

Sporomorphs	Botanical affinity	P	%
Stereispor. (Stereispor.) stereoides subsp. stereoides	Sphagnum	110	6,05
Leiotriletes fsp.	cf. Lygodium	12	0,66
Trilites fsp.	cf. Lygodium	18	0,99
Baculatispor. quintus	Osmunda	1	0,05
Triplanospor. fsp.	cf. Gleicheniaceae	11	0,60
Laevigatospor. haardti	Polypodiaceae	85	4,67
Laevigatospor. fsp.	Polypodiaceae	56	3,08
Pityospor. microalatus	Pinus haploxylon	274	15,07
Pityospor. labdacus	Pinus diploxylon	172	9,46
Pityospor. alatus	Picca	38	2,09
Pityospor. fsp.	Pinaceae	241	13,25
Cedripites miocaenicus	Cedrus	78	4,29
Podocarpidites fsp.	Podocarpus	1	0,05
Zonalapollenites fsp.	Tsuga	1	0,05
Inaperturopoll. hiatus	Taxodium	6	0,35
Inaperturopoll. fsp.	Taxodiaceae	22	1,21
cf. Psophosphaera fsp.	cf. Larix	1	0,05
cf. Sequoiapoll. fsp.	cf. Sequoia	1	0,05
Momipites punctatus	Myricaceae	61	3,35
Triatriopoll. bituitus	Myricaceae	68	3,74
Triatriopoll. fsp.	Myricaceae	9	0,49
Momipites coryloides	Corylus	9	0,49
Momipites fsp.	?	67	3,68
Triatriopoll. fsp. — Myrikoidní formy	Myricaceae	7	0,38
Caryapoll. simplex	Carya	1	0,05
Caryapoll. fsp.	Carya	22	1,21
Intratriporopoll. instructus	Tilia	31	1,70
Alnipoll. verus	Alnus	83	4,56
Ulmipoll. undulosus	Ulmus	8	0,44
Ulmipoll. fsp.	Umaceae	6	0,33
Multiporopoll. fsp.	cf. Juglandaceae	1	0,05
Pterocaryapoll. stellatus	Pterocarya	15	0,82
Pterocaryapoll. fsp.	Pterocarya	11	0,60
Tricolpopoll. liblarensis	Fagaceae	31	1,70
Tricolpopoll. henrici	Fagaceae	9	0,49
Tricolpopoll. microhenrici	? Quercus	24	1,32
Tricolpopoll. fsp.	cf. Cupuliferae	47	2,58
Tricolporopoll. cingulum	Castanca	62	3,41
Tricolporopoll. fsp.	?	23	1,26
Tricolporopoll. pseudocingulum	Rhus	10	0,55
Tricolporopoll. megaexactus	Cyrilla	29	1,59
Tricolporopoll. microreticulatus	Oleaceae	3	0,16
Tetradopoll. fsp.	Ericaceae	2	0,11
Monoporopoll. fsp.	Graminae	13	0,71
Ateraceae	Asteraceae	2	0,11
Nymphaeaceae	Nymphaeaceae	1	0,05
Forma A	?	3	0,16

P = number of grains

Pityospor. microlatus and *labdacus)*, *Cedrus (Cedripites miocaenicus)* and *Picea (Pityospor. alatus)*. Other genera as *Podocarpus* and *Tsuga* were found only in negligable quantity.

Pollen grains without bladders representing the families *Taxodiaceae* and *Cupressaceae (Inaperturopoll. fsp., Inaperturopoll. hiatus)* occur in a distinctly smaller quantity (fig. 2).

Angiospermous microflora makes generically the most numerous group. Even in comparison with gymnospermous microflora it is generically more varied. Above all the family Myricaceae is more significantly represented consisting of a nnumber of forms. Other genera and families are represented by *Alnus, Carya, Tilia, Rhus, Castanea, Quercus* and *Fagaceae*.

The microflora discovered is most probably a remains of vegetation from quite irrigated areas with relatively rich fern element. The composition of assemblage is characteristic for Miocene deposits assemblages of Baden Age.

Table 1 demonstrates general generic and specific composition of pollen assemblage. Individual genera and species are given numerically and percentually.

SYSTEMATIC DESCRIPTION OF THE WOODS

Gymnospermae

Family Pinaceae

Piceoxylon GOTHAN 1905

Piceoxylon arcticum (SCHMALHAUSEN 1890) KRÄUSEL 1949

(Pl. I.—IV. Figs. 1—17)

1890 *Pinus (Larix) arctica* SCHMALHAUSEN; Pl. II., Figs. 35—43: 17—21
1919 *Piceoxylon laricinum* KRÄUSEL; Pl. 17, Fig. 6., Pl. 18, Fig. 9, 10: 241, Textabb. 29—31
1919 *Piceoxylon sp.* (laricinum?) KRÄUSEL; Taf. 17., Fig. 5, Taf. 18., Fig. 11.: 245
1924 *Piceoxylon laricinum* KRÄUSEL; RUBCYNSKA & ZABLOCKI; Pl. 31., Fig. 1—3:433, Textabb. 1
1932 *Piceoxylon laricinoides* HØEG; Pl. I.—III. Figs. 1—4., Pl. IV. Figs. 6—7, Text. Figs. 1—6: 366—375
1932 *Piceoxylon laricinoides* HØEG; Pl. V. Figs. 1—5: 376
1932 *Piceoxylon cf. laricinoides* HØEG; Pl. I. Figs. 1—8: 4—5
1936 *Piceoxylon aff. laricinum* KRÄUSEL; SHIMAKURA: 276
1949 *Piceoxylon arcticum* (SCHMALHAUSEN) KRÄUSEL; 129, 161
1954 *Piceoxylon laricinoides* BEYER (nom. illeg); Figs. 3, 4, 21: 556—7
1967 *Piceoxylon arcticum* (SCHMALHAUSEN) KRÄUSEL: BURGH van der J. Taf. XII. Fig. 3, 5, 6, 8, 9; Abb. 8, 9: 124—7

MATERIAL

The present fossil woods are hemixylite of a light brown colour. They are fragments probably from a stem, about 12×9×2 cm and 12×8×1,5 cm in size. The anatomical structure is excellently preserved with the effect o some pressure. The annual rings are well markered an rather wide, measuring more than 1 mm.

Occurence: Stojčín east of Jindřichův Hradec, borehole V 105, depth 6,30—6.40 m

Age: Baden, Miocen
Specimen: No. G 17142 National Museum, Praha

Description

C: The annual ring boundary is rather conspicuous (Pl. I., Fig. 2), the spring wood is very much compressed and folded (Pl. I., Fig. 2), the summer wood is well preserved and 16 celle broad. The cross sections of the tracheids of the late wood are generally angular but sometimes quadraangular and arranged radially in parallel rows (Pl. I., Fig. 2). Their radial diametr is 43 μ, their width 35 μ. Vertical resin canals are relatively numerous and conspicuous, and are distributed chiefly in the late wood or in the lately formed early wood in somewhat wavering tangential bands; they usually occur singly, but sometimes two or three are arranged in a tangential series (Pl. I., Figs. 2,5). The resin ducts are surrouded by thickwalled epithelial cells; their diametr is about 145—170 μ, but also larger and smaller ones. The abietinean pitting of these thick-walled cells is distinctly visible, in transversal sections as well as in longitudinal ones. The rays are normal and fusiform. The horizontal walls of the rays are smooth, sometimes with pits (Pl. I., Fig. 4). The tangential walls are also smooth. Dispersed wood parenchyma cells (Pl. I., Fig. 5) with dark resin contents can be observed among the tracheids.

T: There are medullary rays of two kinds, that is uniseriate rays and the multiseriate ones containing a horizontal resin canal. The horizontal resin ducts run in the interior of the broader rays; the resin ducts are situated in 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 (Greguss 1967). Uniseriate rays occasionally become biseriate in part length of ray cells radially correspond two to eight, usually five or six tracheids; rays are separated by one to nineteen, usually three to eight tracheids; 1—18—27, mostly 2—11 cells high; 55—80 a little more rays in 1 square mm; form of the ray cells in tangential section is round, oval or sqarish with rounded corner, sometimes much elongated, the triangular intercellular spaces being usually very clear (Pl. II., Figs. 7,8); their width 5—7 μ varies to a considerable extent. The scarce parenchymatous cells with dark resin contents, forming by far the major part of the rays, are some 20 μ in height, varying from about 15 μ to about long in the spring wood, and short in the summer wood, where they may measure only 45 μ (Pl. II., Figs. 6,7). On the tangential walls bordered pits have not been observed at all. The walls of tracheids have a very delicate and dense striation, but real thickenings have not been observed (Pl. II., Figs. 6,7).

R: On the spring tracheids there are bordered pits in great number, equally distributed along their radial walls. In many instances they form a single row, but it is not uncommon, in the more vigorously developed parts, that there is a double series; if so they are strictly opposite or approximately so (Pl. III., Fig. 11). In the middle part of the year-ring there are pits in great numbers, but details of their distribution cannot be ascertained on account of the compression and to disorganization of the cells layers. In the first tracheids of the summer wood there are also pits, but usually in single rows only. The pits are circular, sometimes slightly flattened horizontaly, but never angular. Rims of Sanio are well developed above and below each pit. or in the double rows, each pair of pits (Pl. III., Fig. 11). The tracheidal cells of the medullary rays are few, forming, as a rule, one row in each end. The outer wall is thin and much curved (Pl. III., Fig. 14), and it is not dentate on the inside. The wall between the tracheidal elements themselves is somewhat curved and inclined, and it sometimes shows a slight dentation; in relation to the parenchymatous cells it forms an angle opening towards the surface of the wood. The abietinean pitting is abundant and distinct an all walls; in the crossing with he tracheids there are from one to four pits in each field (Pl. II., Fig. 10., Pl. III., Fig. 13.). Wood parenchyma occurs regularly at the periphery of a layer. They are particularly well recognizable in the radial section, where they may be found between the summer wood and next year spring wood. The cross-walls between the parenchymatous cells are horizontal or nearly so; the size of the cell varies rather much, those in the row figured measuring, say, from 120 μ to 185 μ by width of about 20 μ. In other places they are shorter, to even only 85 μ. Small simple pits are observable in many cases, but not always.

AFFINITIES AND DISCUSSION

Consistently with the work of J. van der BURGH (1973) can be the above described findings classified as *Piceoxylon arcticum* (SCHMALHAUSEN 1890) in accordance with KRÄUSEL 1949. The comparison Tables 2. demonstrate evidently that all these findings do not fundamentally differ in anatomical sence and so they can be classed with the following generic description.

Description: Coniferous wood with distinct annual rings and vertical and horizontal resin canals. Bordered pits on the radial walls of the spring tracheids, in one row, more rarely in two rows. Tangential pits very scarce. Medullary rays fusiform, with resin ducts, or linear; a small percentage is biseriate. Perenchyma of the medullary rays with abietinean pits, tracheidal elements constantly present, but few. Epithelial cells of the resin canals thick-walled. Wood parenchyma present along the periphery of the annual rings. In the crossing with the tracheids there are from one to four pits in each field.

A systematic comparison of the fossil wood with the extinct (KRÄUSEL 1919, 1949) and modern woods of conifers (TANG 1933, PHILLIPS 1941, GREGUSS 1955) indicates that it belongs to the *Abietoideae* of the family *Pinaceae* (PHILLIPS 1941). The woods of the *Abietoideae* can be classified into two groups according to the presence of "traumatic" vs. "normal" resin ducts. As the fossil wood is characterised by "normal" resin ducts with thick-walled epithelial cells it belongs to the second group. This group comprises the genera *Keteleeria, Picea, Larix* and *Pseudotsuga.* The genus *Keteleeria* is featured by the possession of only vertical canals in the normal wood. On the other hand the genera *Picea, Larix* and *Pseudotsuga* are characterised by both vertical and horizontal resin cannals. Further separation of these three genera on the basis of anatomical features is rather a dificult task. WATARI (1956) has reviewed the possible metods and different views expresed with regard to the separation of those genera. These take into consideration the mode of transition from early to late wood, presence or absence of spiral thickenings in the tracheids, presence or absence of terminal parenchyma, the frequency of biseriate opposite pits the radial walls of the tracheids, the member of epithelial cells surrounding the horizontal canals and the position of these ducts in relation to the two tips of the rays.

Numerous both older and more recent works (HØEG 1932, SLYPER 1933, BROWN and PASHIN 1940, BEYER 1954, GREGUSS 1955, WATARI 1956, PRAKASH 1968 and others) clearly evidence the difficulty of stating microscopically the characteristic and distinct features distinquishing these genera, especially those of *Larix* and *Picea.*

Most of the defined and described features are not of a great diagnostical value, they rather show quantitative than qualitative differences (as a number of resin canals, number of the epithelial cells surrounding resin canals, pits of tracheids, pits of medullary rays cells etc.). Especially concerning fossil woods it is a dificult task to ascertain the outer influences that can have caused these differences.

However, it seems possible to distinquish the genus *Pseudotsuga* from *Larix* by the constant occurence of spiral thickenings in the tracheids at least in the early wood. BAILEY (1909) showed the sporadic occurence of spiral thickenings in the late wood of some species of *Larix* and in many species of *Picea.* He further demonstrated their occurence both in the early and late wood of *Picea maximowiczii* REGEL and *P. sitchensis* CARR. In view of these fact it does not seem possible to distinquish *Pseudotsuga* from *Picea* satisfactorily on the basis of wood structure.

In view of this rather unsatisfactory and inconclusive status of its identification, the fossil wood is assigned to the form genus *Piceoxylon* GOTHAN (1905), the original description of which embraces the essential anatomical features of the wood.

The genus *Piceoxylon* GOTHAN it should be noted was originally instituted to include the fossil woods of the modern genera *Picea, Larix* and *Pseudotsuga.*

The wood specimen is a typical *Piceoxylon* as evident from the above given anatomical description. When compared with the living genera *Larix, Picea* and *Pseudotsuga,* our specimen shows the greatest resemblance with *Larix* and *Picea.* The presence of wood parenchyma sometimes with resin contents as well as pits of tracheids of spring wood (small and abundant bordered pits often arranged in pairs) but above all radial diameter of spring tracheids (0,020—0,060 mm) shows a considerable conformity with *Larix.* On the other hand, there are some anatomical features, as e. g. a great number of uniseriate medullary rays, that resembles *Picea.*

The absolute absence of piral thickenings in ray tracheids excludes a possibility of *Pseudotsuga.* Numerous species of *Piceoxylon* GOTHAN are known from Mesozoic and Tertiary formations in various parts of the world. Our specimen shows in substantial features, the greatest conformity and resemblance among all the known described fossils of *Piceoxylon,* with *Piceoxylon laricinum* KRÄUSEL (1919) and *Piceoxylon laricinoides* (HØEG 1932, BEYER 1954) and *Laricioxylon nógrádense* GREGUSS (1967). The anatomical comparison of these founds can be distinctly seen on Table 2. At the same time it can be stated that the examined wood resembles rather *Larix* than *Picea.*

Evidences:

1. Transition between spring and summer wood is contrasting.
2. The cells of wood parenchyma are present in all annual rings in many places even filled with redbrown to brown resinuous filling.
3. A small number of simple pits in cross section, though the fact does not exclude Picea, it substantiates our hypothesis that our specimen is either *Larix* or species very resembling *Larix,* because just *Larix* has usually a smaller quantity of simple pits than Picea.
4. It has neither spiral striation nor helical thickenings.

In spite of the considerable resemblance of our wood and *Larix* it cannot be positively presumed that a closer affinity with a species resembling *Picea* should be excluded especially when contex is not accessible. The sudden transition of annual rings can have been caused by ecological changes, and some other obscure anatomical features (pits of cross section) were partly obliterated during the process of fossilisation. For these reasons and in spite of slight anatomical deviation (the structure of medullary rays) the author classis the examined wood with *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949.

Note: From the Sarmatian of Nógrádszakál Hungarian describes P. GREGUSS (1967) finding *Laricioxylon nógrádense* (Plate L XXXVI, Figs. 1—6, 97—98) and from Lower Pannonian — occurence Megyaszó? *Laricioxylon sp.* (Plate LXXXVI., Figs. 7—9: 98—99). In the first case, according my opinion, the mentioned description is not satisfactory and the author is not quit sure about the authorization of the new genera. Thers' even a problem if the specific diagnostic is entitled to eliminate a new species. The described anatomic features correspond with the *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949 as far the more numerous pits in the cross fields (fours to sixes, possibly by eights, generelly in 2 rows — GREGUSS, 1967: 98).

I don't discuss in this paper the botanic relationship of the Greguss species.

In any case *Laricioxylon nógrádense* GREGUSS deserves a systematic and nomenclatoric attention.

Table 2.
The anatomical comparison of genera Piceoxylon

SPECIES	OCCURENCE	AGE	ANNUAL RINGS DISTINCT	RESIN DUCTS WITH THICK EPITHELIAL CELLS	WOOD PARENCHYMA	UNISERIATE	MEDULARY RAYS BISERIATE	MULTISERIATE WITH RESIN DUCTS	CROSS FIELD-PITS
Pinus (Larix) arctica SCHMALHAUSEN 1890	Insel Neusibirien	Tertiary	+	+	+	+	?	+	2—4
Piceoxylon laricinum KRÄUSEL 1919	Gliwice (Gleiwitz) Poland	Tertiary Miocen	+	+	+	+	—	+	2—4
Piceoxylon sp. (laricinum) KRÄUSEL 1919	Saarau	Tertiary	+	+	+	+	—	+	?
Piceoxylon laricinoides HØEG 1932	East Greenland	Tertiary	+	+	+	+	+	+	1—4
Piceoxylon cf. laricinoides HØEG 1932	East Greenland	Tertiary	+	+	+	+	+	+	?
Piceoxylon laricinoides BAYER 1954	Riedge area of Yellowstone National Park	Tertiary Miocen	+	+	+	+	+	+	2—4
Piceoxylon arcticum (SCHMALHAUSEN 1890) KRÄUSEL 1949	Stojčín Czechoslovakia	Tertiary Baden	+	+	+	+	+	+	1—4

\+ present — absent ? not given

SUMMARY

Polen spectrum of the specimens examined preserved remains of swamp forest vegetation with relatively abundant undergrowth of fern and bryophytic flora. Most of the found genera and species are of Baden Age — Middle Miocene. A similar assemblage of pollen grains and spores was found also in the sediments of the South Bohemian basins, but above all in the Mydlovary series of strata (Třeboň basin). The differences in occurence that are evident in comparison of these two spectra, were most probably caused by different ecological conditions.

The assemblage of pollen grains and spores the examined locality being compared with that of the Ledenice series — upper Pliocene, there can be seen a distinct difference. In our examined sediments there were found typical Miocene elements quite commonly occuring and in a considerable quantity, e. g. *Momipites punctus, Triatriopoll. bituitus, Tricolpopoll. henrici* and *microhenrici. Tricoloporopoll. cingulum* and *pseudocingulum* and others. Another difference is in the occurence of herbs (NAP). The herbs of the Ledenica series are present in a great number and in many genera and species. The specimen of Bonětice locality (N. GABRIELOVÁ 1970)showed only sporadic monoporous pollen grains of grass and the family *Asteraceae.* The agreeing occurence of microorganism called by N. GABRIELOVÁ "Form A" is also an interesting fact.

The results of xylotomical examinations entrely correspond with findings of plant microfossils and help to complete the image of that time vegetation.

On basis of these facts the studied specimens can be compared with the sediments of the Mydlovary series and stratigraphically classed with the Baden Age — Middle Miocene.

Translated by D. Černohorská

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EXPLANATIONS OF THE PLATES

PLATE I.

Fig. 1. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Fossil wood in natural size, a part of drill care.

2. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Cross-section of the fossil wood with distinct annual rings and resin canals, x 50.
3. *Larix decidua.* Cross-section of the modern wood, x 50.
4. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Cross-section, details of the cells of the medullary ray, x 180.
5. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Cross-section, detail of the late wood with two vertical resin canals, x 180.

Photographs by D. BŘEZINOVÁ

PLATE II.

Fig. 6. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Tangential section showing uniseriate medullary rays and a fusiform one. The dark contents of some of the cells are plainly visible, x 50.

7. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. As fig. 2. One medullary ray with a resin canal, x 180.
8. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Details of the cells of the biseriate medulary ray, x 420.
9. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Details of a medullary ray in a radial section of the stem. Parenchymatous cells with poorly visible pits, x 190.
10. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Radial section, details of the cross fields with 1—5 pits in each field, x 190.

Photographs by D. BŘEZINOVÁ

PLATE III.

Fig. 11. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Radial section the tracheids of the spring wood showing the bordered pits arranged in 2 rows with bars of Sanio distinctly seen, x 180.

12. *Larix decidua.* Radial section of the modern wood, x 180.
13. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Radial section showing the details of the cross fields of the rays with 1—2 the abietinean pits, x 420.

Piceoxylon arcticum (SCHMALHAUSEN 1890) KRÄUSEL 1949. Details of the cross fields of the rays with rest of ray tracheids, x 560.

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PLATE IV.

Fig. 15. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949, x 420.

16. As Fig. 15. Details, x 560.
17. *Piceoxylon arcticum* (SCHMALHAUSEN 1890) KRÄUSEL 1949. Radial section, details of the cross fields with pits and the horizontal resin canal, x 180.

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PLATE V.

Fig. 1, 2. *Laevigatospor. haardti* (R. POT. & VEN.) TH. & PF.
3-6. *Laevigatospor fsp.*
7, 8. *Laevigatospor. haardti* (R. POT. & VEN.) TH. & PF.
9, 10. *Stereispor. (Stereispor.) stereoides* (R. POT. & VEN.) TH. & PF. *subsp. stereoides* W. KR.
11. *Trilites fsp.*
12, 13. *Pityospor alatus* (R. POT.) & VEN.) TH. & PF.
14. *Pityospor. fsp.*

All photographs x 1000
Photographs by D. BŘEZINOVÁ

PLATE VI.

Fig. 1. *Pityospor. fsp.*
2. *Pityospor. alatus* (R. POT.) TH. & PF.
3. *Abiespoll. absolutus* THIERG. (non in RAATZ)
4. *cf. Abiespoll. fsp.*
5, 6. *Tricolpopoll. fsp.*
7. *Multiporopoll. fsp.*
8. Spores of Fungi

All photographs x 1000
Photographs by N. GABRIELOVÁ

PLATE VII.

Fig. 1, 2. *Abiespoll. cf. absolutus* THIERG. (non in RAATZ)
3, 4. *Tricolpopoll. liblarensis* (THOMS.) TH & PF.
5-7. Tricolpopoll. fsp.

All photographs x 1000
Photographs by N. GABRIELOVÁ

PLATE VIII.

Fig. 1, 2. *cf. Abiespoll. absolutus* THIERG. (non in RAATZ)
3, 4. *Tricolporopoll. cingulum* (R. POT.) TH. & PF.
5, 6. *Triatriopoll. bituitus* (R. POT.) TH. & PF.
7, 8. *Triatriopoll. fsp.*
9, 10. *Tricolpopoll. fsp.*
11, 12. *Intratriporopoll. instructus* (R. POT. & VEN.) TH. & PF.
13, 14. *Momipites punctacus* (R. POT.) NAGY
15. *Alnipoll. verus* (R. POT.) ex R. POT.
16, 17. *Intratriporopoll. instructus* (R. POT. & VEN.) TH. & PF.
18, 19. *Ulmipoll. fsp.*

All photographs x 1000
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Pl. I.

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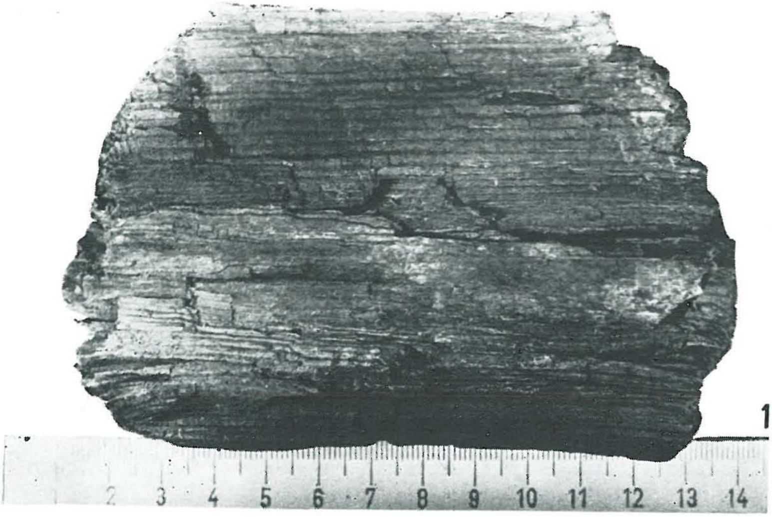

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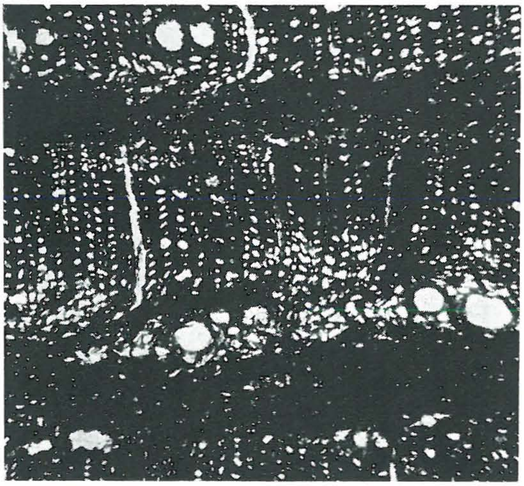

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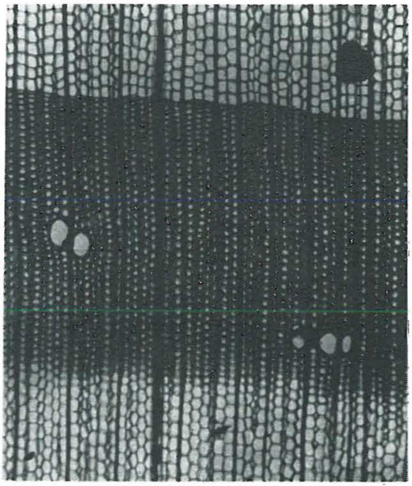

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Pl. II.

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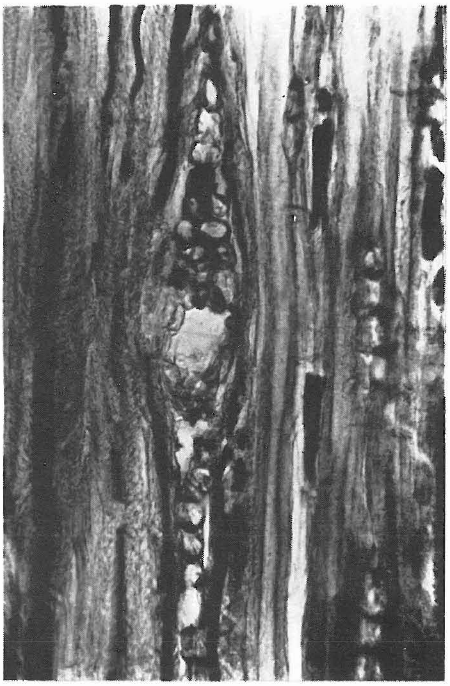

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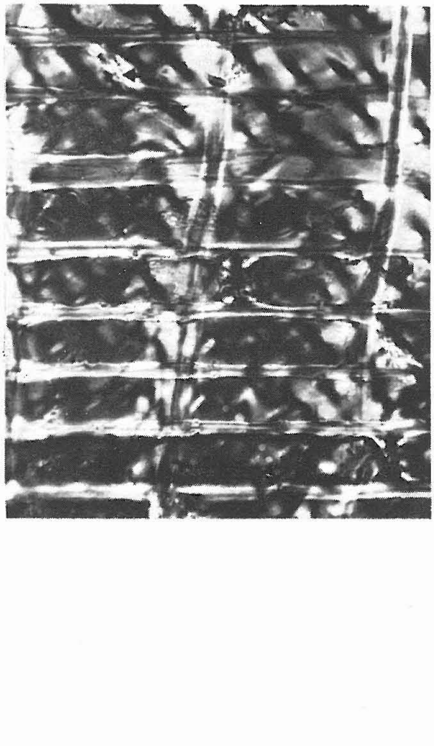

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Pl. III.

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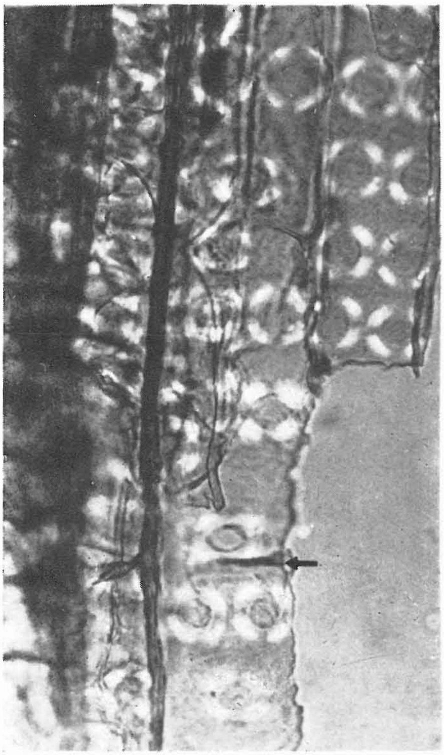

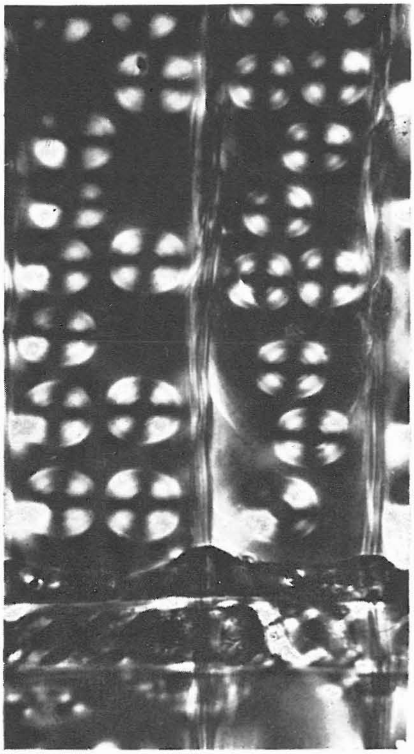

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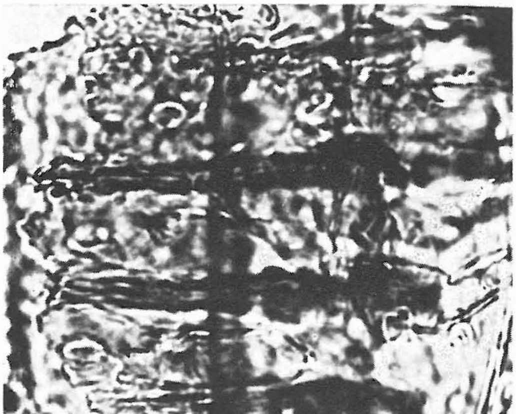

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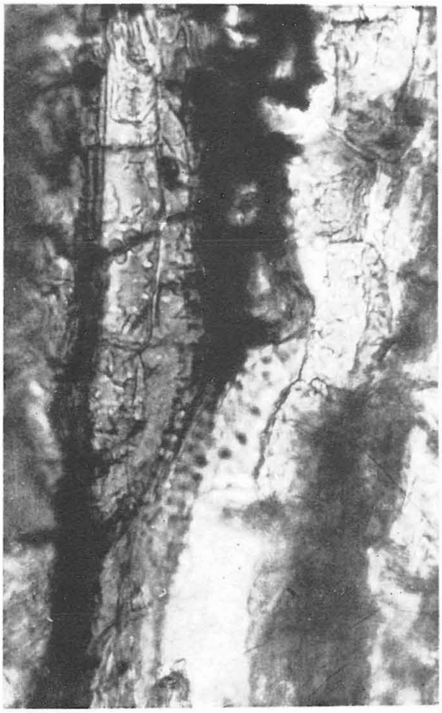

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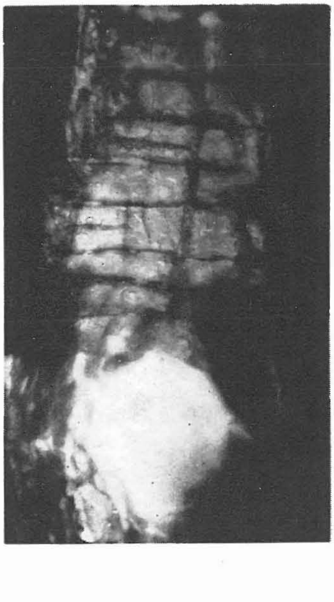

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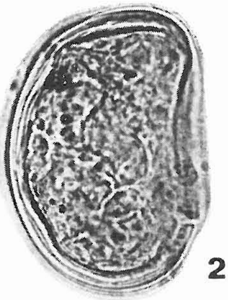
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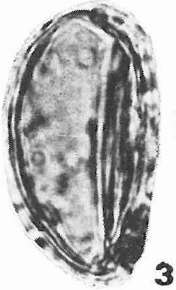
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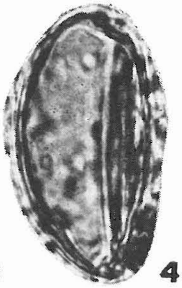
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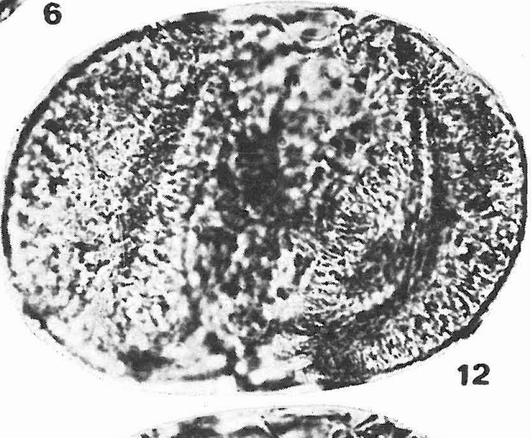
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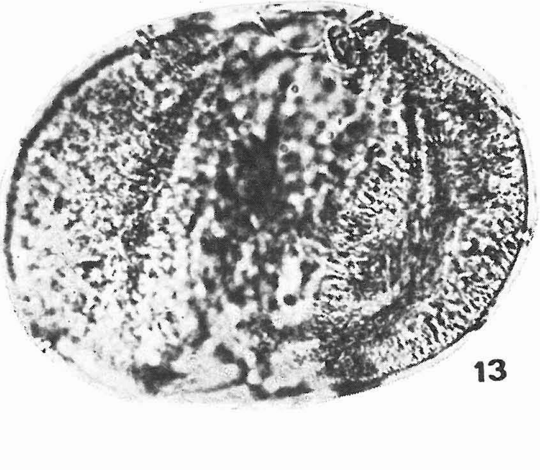
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Pl. VI.


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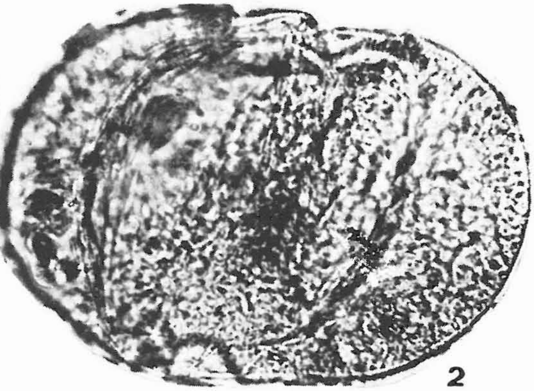
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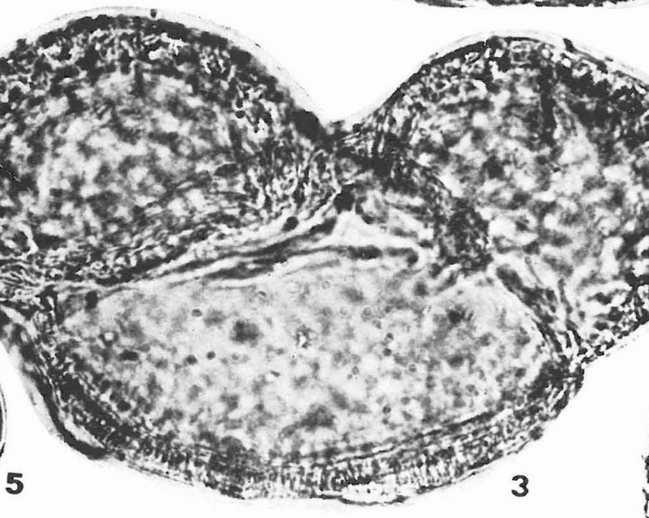
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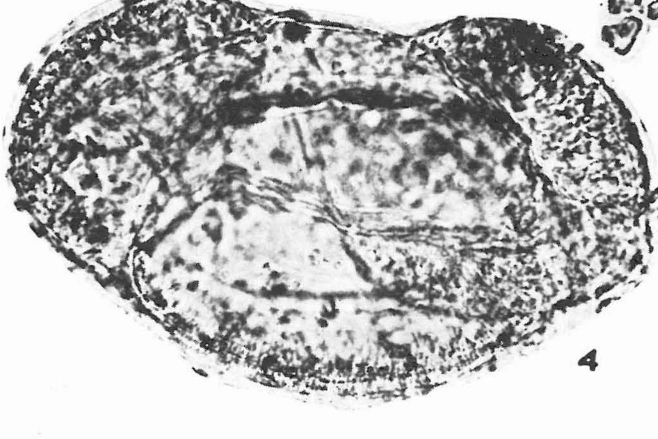
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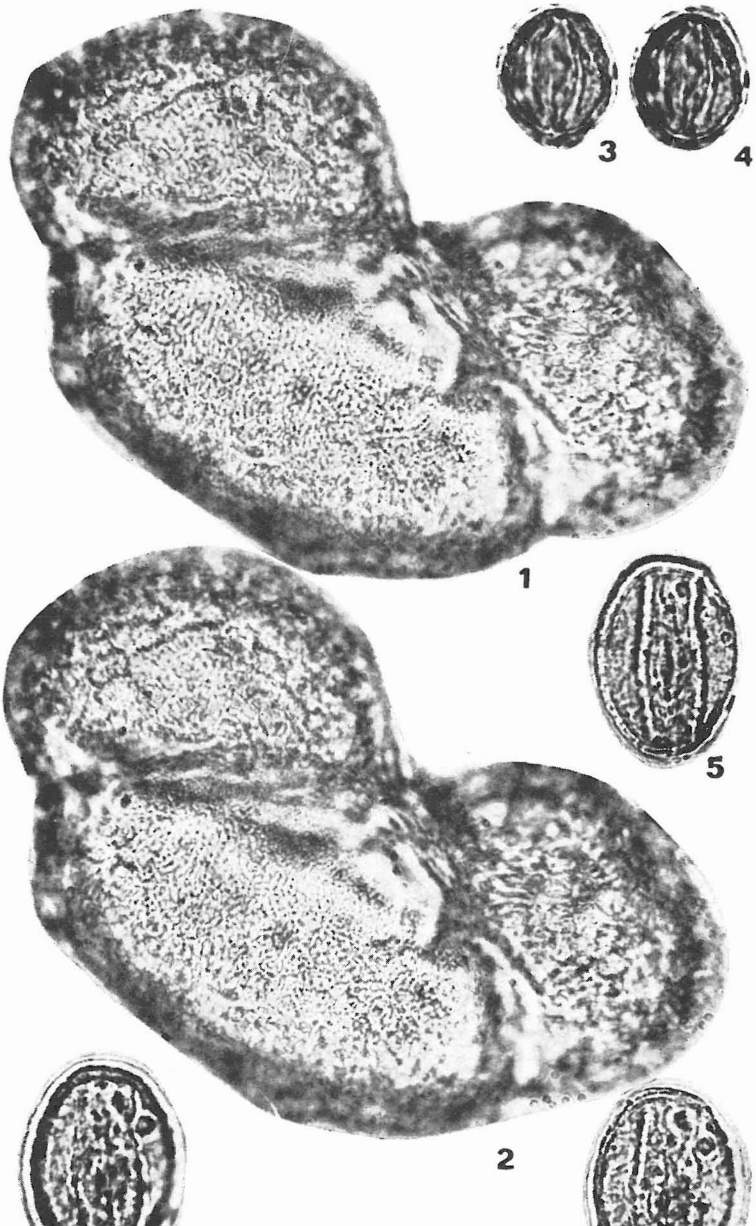
Pl. VII.



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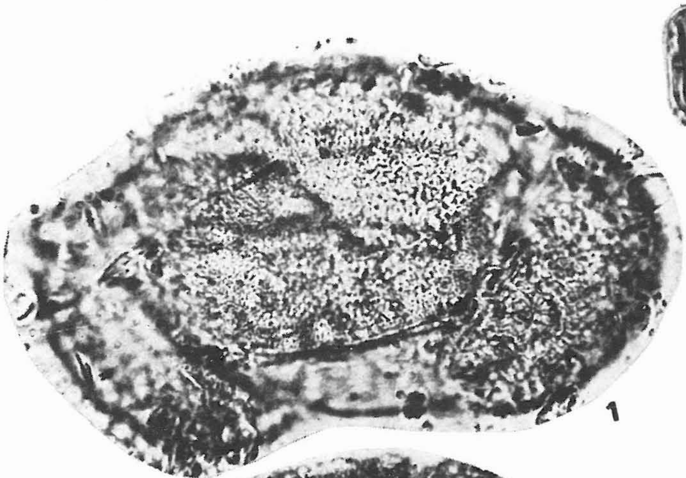
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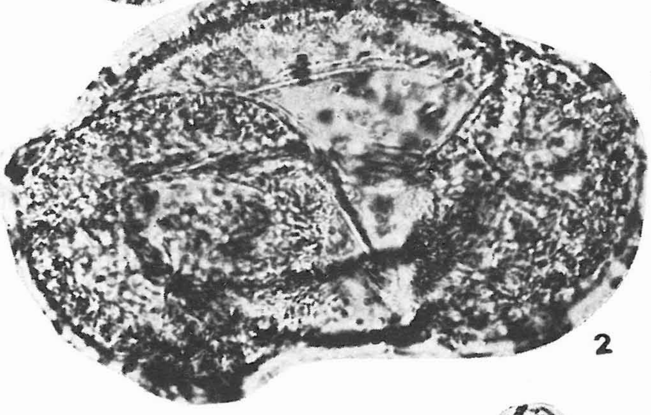
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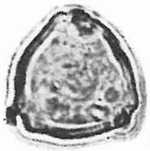
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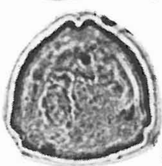
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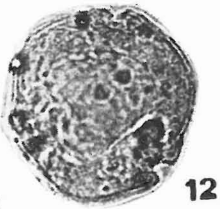
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