A silicified stem of *Podocarpoxylon helmstedtianum* Gottwald, 1966 from the Palaeogene site Kučlín (NW Bohemia)

Zkřemenělý kmen *Podocarpoxylon helmstedtianum* Gottwald, 1966 z paleogénního naleziště Kučlín (sz. Čechy) (Czech summary)

(1 text–fig., 4 plates)

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A large portion of the silicified stem has been recovered at the base of diatomite on the Trupelník Hill at Kučlín situated on western periphery of the České středohoří Mts. Its wood structure corresponds with *Podocarpoxylon helmstedtianum* Gottwald. Twigs and cone scales of the same plant belong to *Doliostrobus* Marion, an extinct conifer of taxodialean affinity, and occur frequently in adjacent diatomite layers. Fossilization took place stepwise starting with carbonization, several phases of silicification and variously intensive recrystallization. Beside carbonized tissue, fossil wood is converted mostly into opal. Cristobalite, ? tridymite, chalcedon, quartzine, quartz and xonotlite have also been recognized in wood and cavities. From stratigraphical and palaeoecological correlations the Late Eocene to Sanoisian age is assumed for the Kučlín flora.

Introduction

In 1976 diatomite layers on the Trupelník Hill at Kučlín near Bílina (NW Bohemia) were exposed for exploitation carried out by the North Bohemian Ceramic Works (Severočeské keramické závody n.p.). One of the authors (F. H.) recovered a large silicified stem lying on the bottom of the clay pit just between the diatomite and the underlying tuffite. The stem was later uncovered by the staff of the Palaeontological Department of the National Museum, Praha (F. Holý, K. Drábek, A. Skalický). In its original position (pl. I) the stem was divided into the stump and the trunk parts, the latter broken into pieces. The stump was transported to Teplice in front of the entrance of the County Museum. Most pieces of the trunk as well as thin sections and mineralogical samples are deposited in the collections of the National Museum, Praha.

The silicified stem was burried in the tuffite for the most part. The preserved portions together attain 7.5 m in length. The stump is 1.6 m wide, the trunk gently narrows, the preserved upper part is little compressed, 0.5 m across.

The outer, mostly carbonized, partly limonitized layer of the cortex was very soft while the inner woody part was compact, but porous. Numerous fraction cracks arose during diagenesis, filled by opal and other Si–minerals. Concretions containig chalcedon and quartz were recovered during the excavations in rock layers adjacent to the stem.

In the present account the wood anatomy (D. Březinová) and mineralogy (A. Kužvartová) is given together with general information (F. Holý – Z. Kvaček) and stratigraphical–palaeoecological considerations (F. Holý). The final version of the manuscript was prepared and translated by Z. Kvaček.

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The diatomite of Kučlín

The site Kučlín represents a relict of the Volcanogenic Complex of the České středohoří on the top of the Trupelník Hill (Trippelberg in German) near Bílina. Tertiary strata are underlain by the Upper Cretaceous (Upper Turonian to Coniacian) marlstone that crops out at the foot of the hill.

Three levels can be recognized within the relict and belong to Palaeogene: at the base about 16 m thick layer of the sandy limestone and marl with intercalations of coaly clay, the middle part about 10 to 15 m thick, built of vari–

ous types of diatomite and tuffite, and the top layer with the rest of the basaltoid sheet. The radiometric age is so far not available. The basal level of calcareous deposits is palynologically dated as the Late Eocene to Early Oligocene (Konzalová 1981).

The diatom flora includes (according to Řeháková in Malkovský 1985) abundantly *Melosira distans* (Ehr.) Kutz., *Fragillaria acuta* Ehr., *Gomphonema longipes* Ehr., *Navicula semen* Ehr. and *Pinnularia viridis* (Nitzsch.) Ehr. Various diatomite layers yielded diversified woody flora, mostly leaf imprints, including a variety of angiosperms. Among recognizable entities those with palaeotropical affinities prevail: *Platanus neptuni* (Ett.) Bůžek, Holý et Kvaček, *Engelhardia orsbergensis* (Weber) Jähnichen, Mai et Walther, *E. macroptera* (Brongn.) Ung., *Hooleya hermis* (Ung.) Reid et Chandler, *Nymphaea polyrrhiza* Sap., ? *Dusambaya* sp., *Daphnogene cinnamomifolia* (Brongn.) Ung., *Sterculia labrusca* Ung., *Hosiea bilinica* (Ett.) Holý, *Ziziphus ziziphoides* (Ung.) Weyl., *Chamaerops kutschlinica* Ett., and many doubtful forms – *"Quercus" cruciata* A. Br., *"Magnolia" longipetiolata* Ett., *Callistemophyllum bilinicum* Ett., *"Cissus" nimrodi* Ett., *"Ficus" daphnogenes* Ett., *Sterculia crassinervia* (Ett.) Procházka et Bůžek, etc. The occurrence of an enxtinct conifer *Doliostrobus* Marion, and a mangrove fern *Acrostichum lanzeanum* (Vis.) Reid et Chandler are noteworthy. Abundant fish fauna with the cha-

Table 1

X-ray analysis of the silicified material from Kučlín

(1 – silicified wood with cristobalite and quartz, 2 – silicified wood with cristobalite, ? tridymite and quartz, 3 – cavity filling with quartz, 4 – separated sample with quartz and xonotlite, 5 – 7 mineral standarts (JCPDS 1974), 5 – quartz (tab. 490), 6 – cristobalite (tab. 359),7 – xonotlite (tab. 488), 8 – tridymite (Michejev 1957)).

1		2		3		4		5		6		7		8	
CuKα/Ni		CuKα/Zr		CuKα/Ni		CuKα/Ni		CuKα_1/Ni		(500^0)MoKα_1/Zr		CuKα/Ni		CuKα/Ni	
dĹ	I(10)	dĹ	I(10)	dĹ	I(10)	dĹ	I(10)	dĹ	I(100)	dĹ	I(100)	dĹ	I(100)	dĹ	I(10)
						8.50						8.50	20		
						7.05						7.05	40		
		7.82	1												
				4.226	3	4.27	4	4.26	35			4.27	40	(4.8)	(5)
4.15	dif.5	4.148	4							4.15	100			4.39	10
		4.11	4											4.12	10
						3.96	0.5					3.96	20var.		
		3.75	2											3.73	9
						3.61	2					3.65	70		
		3.503	1												
3.34	1	3.360	1	3.348	10	3.34	10	3.343	100						
		3.275	1												
						3.23	1					3.23	70	3.23	5
		3.195	0.5												
						3.07	3					3.07	100		
2.88	1									2.92	5			2.94	5
						2.83	1					2.83	50		
						2.71	st.					2.71	40	2.77	2
						–	–					2.65	20var.		
2.52	2.5					2.51	1			2.53	80	2.51	40		
		2.506	1											2.49	7
				2.453	1	2.466	1.5	2.458	12						
						2.366	0.5					2.34	30		
2.32	1														
2.22	1			2.274	1	2.285	2	2.282	12					2.28	5
				–	–	2.241	1	2.237	6			2.25	30		
				2.123	1	2.132	1.5	2.128	9	2.17	10			2.11	2
						2.04	0.5			2.07	30	2.04	85	2.07	2
				1.975	0.5	1.983	1	1.980	6	1.99	5			1.95	5
						1.95						1.95	85		
						1.92									
						1.883	1					1.84	10	1.88	2
				1.816	2	1.819	2.5	1.817	17						
				–		–		1.801	1	1.795	5			1.77	2
				1.671	0.5	1.674	1	1.672	7	1.69	5			1.69	7
				–		1.658	0.5	1.659	3	1.641	60				

racteristic assemblage of ancient aspects *Amia macrocephala* (Reuss, 1844), *Bilinia uraschista* (Reuss, 1844) and *Thaumaturus furcatus* Reuss, 1844 has been known from the same diatomite (Laube 1901, Obrhelová 1979). The only mammalian representative has been recorded in the last years , a middle–sized herbivore, cf. *Palaeotherium* sp. according to G. Storch (Fejfar – Kvaček 1993).

Fossilization and mineralogy

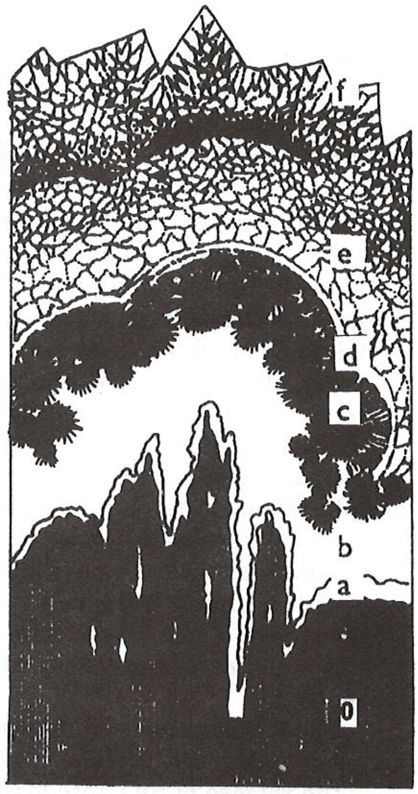
The recovered mineralized stem consists of secondary xylem, light to dark beige brown, at places rusty, compact, partly porose, silicified to high degree. Anatomical details, as tissue structure and its elements, are mostly well preserved in yellowish brown opal, with inclusions of coalified matter and mineral pigments (Fe–oxides). Pigments follow outlines of wood structure (pl. II, fig. 1). In secondarily mineralized or disturbed parts, the pigments are distributed irregularly, in the fillings of cavities the pigments cover surfaces of successional mineral layers.

Unstable opal matter underwent partial recrystallization during diagenesis. It shows at places irregular anisotropy parallel to tracheids. This may be due to partial recrystallization into chalcedon, but typical fibrous structure is not recognizable in extremely fine–grained aggregates in cell tissue.

Most of the wood is not recrystallized and consists of opal (SiO_2. n $Si(OH)_4$), isotropic, considered as amorphous. Reflex lines 4.15 + (4.148 +) and 2.53 + (2.52 +) suggest a small amount of disordered submicroscopical ß–cristobalite. Another sample shows two peaks – line 4.148 + corresponds with ß–cristobalite, less distinct line 4.11 + indicates tridymite. Opal structures, which were studied from elsewhere (Levin – Ott 1933, Flörke 1959, Jones – Segnit 1971, Mitchell – Tufts 1973, Langer – Flörke 1974), may vary from cristobalite (mostly –cristobalite characterized by the line 4.05 +) to fully or almost amorphous matter, or disordered cristobalite – tridymite opal. Tridymite was traced in opal by several authors (e. g. Jones – Segnit 1971), also in fossil wood (Mitchell – Tufts 1973), usually disordered, showing lines 4.32 + and 4.10 +, but not 3.00 + (planes 202 and 112).

Mineral fillings of cracks, usually transversal, 0.01–10 mm wide, or irregular cavities within silicified wood are not pigmented, heterogenous in mineralogical composition, with concentrical zonal structure. Very fine cracks pass irregularly, fork and wedge out. They are filled with grey–blue opal, with very small ad-

Fig. 1. Incrustation in cross section (0 – wood silicified by opal with narrow zones of recrystallized SiO_2, probably chalcedon, a – pigmented opal, b – non–pigmented opal, c – chalcedon and quartzine aggregates, d – opal, e – quartz aggregates, f – quartz crystals), x10



ditions of microfibrous disordered chalcedon, exceptionally authigene allotriomorphous quartz. Wider cracks may contain breccia–like angular fragments of silicified wood, cemented by not pigmented opal (pl. II, fig. 2).

Incrustations on the wood surface possess the same mineral character as the fillings. The normal succession is shown in text–fig. 1. The film adhearing immediately the wood is composed of fine opal coloured by organic pigment (pl. 2, fig. 3, text–fig. 1a). It is overlain , parallel with the wood surface, by a 0.3–1 mm thick layer of non–pigmented opal (text–fig. 1b). The next layer sharply stands out being composed of quartz (chalcedon, quartzine) of concentric–radial habit (text–fig. 1c). Chalcedon spherolites are often incomplete, at the bottom of the layer they form fan–like hemispheric bodies, towards the surface then radially disposed aggregates of chalcedon and fibrous quartz with the positive length, i. e. quartzine. Well developed quartzine spherolites are covered by a thin layer of shortly fibrous chalcedon. The same type of chalcedon forms irregular outer cover of the whole spherolite layer. The spherolites vary in size between 0.007–0.6 mm, fibres attain a length of 0.25 mm. The next layer of brownish opal, distinctly limited on either side, is strongly pigmented by organic matter. It still follows the original surface of wood and recalls the film adhearing the wood (text–fig. 1d). Above it is an aggregate of allotriomorphous, shallowly lobed quartz grains, at places partly recrystallized (text–fig. 1e). The size of grains deminish towards the periphery. The layer includes irregular spots of the remaining not recrystallized disordered chalcedon, which show undulatory extinction. These chalcedon parts gradually pass into aggregates of allotriomorphous quartz grains. The outermost member of the mineral fillings is composed of small, to 2 mm large crystals of quartz with well defined crystal planes (text–fig. 1f).

The above described mineral sequence in complete set can be found only within larger cavitites. In narrow cracks a reduced succession of colourless opal, spherolite layer and allotriomorphous quartz develops. Beside SiO_2–minerals, the last succession phase of mineralization may contain colourless amorphous mineral mixture with a higher refraction index as well as birefringence. The X–ray analysis indicated beside the quartz also the xonotlite ($C_6Si_6O_{17}(OH)_2$) there.

The fossilization and diagenetic processes may have taken place in the following stages:

- the release of SiO_2 into fossilization environment. Volcanic accumulations of highly alcaline pyroclastics mobilized SiO_2 in water reservoirs. Diatom flora thrived under such conditions.
- concentrated solutions of SiO_2 penetrated into dead, fallen stem. Gel colloids concentrated in the wood structure, which acted as growing centre. Original opal accumulations transferred gradually into a metastabilized chalcedon, or rarely into incompletely crystallized quartz.
- secondary diagenetical recrystallization took place.
- repeated silicification and recrystallization stages. The sedimentary environment allowed, after wood had been fully mineralized, repeating mobility of silica, forming several generations of infilling within cavities or larger cracks. Simultaneous recrystallization of opal into chalcedon, quartzine and quartz occurred.

Wood anatomy

Wood anatomical studies in the Bohemian Tertiary are very scanty (e. g. Ortman 1922, Prakash – Březinová – Awasthi 1974). Silicified wood from the volcanogenic complexes in NW Bohemia were described by Prakash – Březinová – Bůžek (1971) from the Doupov and České středohoří Mts. but they belong to younger strata of Oligocene than the site of Kučlín. The wood described below has been taken from the trunk part of the recovered stem. No other samples of silicified wood have been found in the same strata.

Podocarpoxylon Gothan 1905

Podocarpoxylon helmstedtianum Gottwald, 1966

Pls. III, IV

D e s c r i p t i o n : Tracheids in cross section square–roundish, 45 μm across (to 25 μm in latewood), walls incompletely preserved, in latewood still 8 μm thick. The length of tracheids to 2.5 mm, tracheidal pits bordered, not contiguous, radial pitting uniseriate, at places in earlywood biseriate, opposite, Sanio bars distinct, pits 15–20 μm across (pl. IV, figs 5–6), tangential pitting poorly preserved, 7–10 μm across (pl. III, fig. 7, pl. IV, fig. 2). Wood parenchyma in all growth zones, particularly in earlywood scattered, by redbrown filling well apparent (pl. III, fig. 7, pl. IV, figs 1–3), walls smooth and thinner than those of tracheids, cells 30–40 μm across, to 200 μm long. Pith rays homogene, uniseriate and conspicuously low, (1–)2–6(–12) cell high (pl. III, fig. 6), cells oval, 16–20 μm wide and 20–28 μm high. Pits of rays bordered, with narrow–oval pore, also in earlywood quite steeply orientated, in cross–fields in the marginal cells 2–3, in the middle 1–2 cupressoid, rarely taxodioid pits 10–15 μm across (pl. III, figs 4–5, pl. IV, figs 7–8), the cross–fields usually poorly preserved. Ray cell walls both tangential and horizontal smooth and thin. Growth rings regular, on one side sharply demarcated. Latewood 3–7 cells wide, well apparent (pl. III, fig. 1). The widest growth rings around 1.5 mm (a mean value of 20 measurements). Resin ducts absent.

M a t e r i a l : thin sections Nos G 4700–4710, G 4715–4726, coll. palaeontological department, National Museum, Prague.

L o c a l i t y : Kučlín, the Trupelník Hill, NW Bohemia, Czech Republic.

A g e : Palaeogene, Late Eocene to earliest Oligocene.

I d e n t i f i c a t i o n : Wood parenchyma with smooth walls, cross–field pitting and tracheids as well as the absence of resin ducts suggest the formal genus *Podocarpoxylon* Gothan (see Kräusel 1949). Well developed wood parenchyma does not contradict this identification as this genus includes species with poorly as well as richly developed parenchyma. The modern members of Taxodiaceae and Cupressaceae mostly differ in pitting and parenchyma walls (Philips 1949).

Among the so far described *Podocarpoxylon* wood forms several do not allow more precise comparisons due to poor preservation. Most species differ by rare wood parenchyma or cross-field pitting. They share but very low rays, typical of the modern Podocarpaceae. The only well comparable wood corresponding in most anatomical traits (distinct growth rings, uniseriate radial pitting, in earlywood sometimes biseriate, rich wood parenchyma with red brownish filling, conspicuously low rays, to 12 cells high, uniseriate rays, cross-field pits cupressoid to taxodioid, pores steeply oblique to upright, parenchyma walls smooth without thickenings) is *Podocarpoxylon helmstedtianum* Gottwald (1966), described from the Eocene lignite at Helmstedt, Germany. Rüffle (1976) found a very similar kind of wood in thicker twigs of *Doliostrobus* Marion in the Eocene lignite of Geiseltal, Germany. He also suggests that *Podocarpoxylon helmstedtianum* Gottwald might belong to the same plant.

This type of wood has been described from the Bohemian Tertiary for the first time. Distinct growth rings suggest a seasonal climate.

More detailed comparisons with various species of *Podocarpoxylon* are difficult by the fact that fossilization processes influence to a high degree distinctness of traits, particularly cross-field, tracheid pitting, cell walls, and may lead in extreme cases to establishing very formal species. It seems quite unrealistic to recognize four *Podocarpoxylon* species in the Miocene lignite at Turów (Zalewska 1953). Kostyniuk (1967) excluded two of them from this genus. These and some others differ from our material by higher rays (table 2). Only in rare cases they share some

Table 2

Comparison of selected fossil *Podocarpoxylon* records ([1]Greguss, 1967, Senonian, [2]Baranov – Nikolaeva , 1956, U. Cretaceous, [3]Larishchev, 1956, Palaeocene, [4]Gottwald, 1966, M. Eocene, [5]this report, [6]Schönfeld, Oligocene, 1955, [7]Greguss, 1956, Oligocene, [8]Zalewska, 1953, Miocene; characters: 1 pitting of radial tracheid walls, Ar=araucaroid or number of abietoid pit rows, 2 pitting of tangential tracheid walls + present, (+) exceptional, 3 number of pits in cross-field , T=taxodioid, C=cupressoid, P=podocarpoid, S=simple, E=in earlywood, L=in latewood, 4 tangential ray walls + smooth or (+) with slight thickenings, 5 horizontal ray walls smooth, 6 ray width in number of cells, 7 ray height in number of cells, 8 wood parenchyma with smooth walls, 9 growth rings distinct).

record	characters								
	1	2	3	4	5	6	7	8	9
ajkaense Greguss[1]	Ar	+	1–3 C–T	+	+	1	1–42	+	+
murashiense Bar. & Nikol.[2]	1	+	1–2	+	+	1	1–10	+	+
severzovii (Merck.) Jarm.[3]	1	+	1–6 T	+	+	1	1–8	+	+
helmstedtianum Gottwald[4]	1(–2)	+	1–3 C–T	+	+	1	1–8	+	+
helmstedtianum Gottwald[5]	1(–2)	+	1–2 C–T	+	+	1	1–12	+	+
angustiporosum Schönfeld[6]	1–2	(+)	2–3 (–4)	+	+	1(–2)	6–8	+	+
cf. *knowltonii* Kräusel[6]	1–3	+	1–3 C–T	(+)	+	1(–2)	1–30	+	+
cf. *lilpopii* Kräusel[7]	2	–	1–2 P	+	+	1	1–40	+	+
turowiense Zalewska[8]	1(–2)	+	1–2 ES–LC	(+)	+	1	1–45	+	+
dacrydoides Zalewska[8]	1(–2)	+	0–2(–3) ES–LP	+	+	1–2	1–31	+	(+)
sp. 1[8]	1(–2)	+	1–5 ES–LP	+	+	1	1–26	+	+
sp. 2[8]	1–2 (–3)	(+)	1–3 ES–LP	(+)	+	1	1–30	+	+

more characters, e. g. *P. angustiporosus* Schönfeld (1955) with low rays and similar cross–field pitting from Böhlen, Germany, Oligocene in age, or *P. severzovii* (Merkl.) Jarmolenko that differs by cross–field pitting (1–6 taxodioid pits) – see Larishchev (1956).

Beside the extant Podocarpaceae this combination of characters (low uniseriate rays, similar cross–field pitting, wood parenchyma) can be found also among some extant Cupressaceae, particularly in those members growing as relicts in the Southern Hemisphere [*Austrocedrus chilensis* (D. Don) Florin et Boutelje, *Libocedrus austrocaledonica* Brongn. et Gris., *L. plumosa* (D. Don) Sarg.] – see table 3.

Palaeoecological and stratigraphical remarks on the flora of Kučlín

The so far obtained picture of the Kučlín flora is unusually exotic. Collections described by Ettingshausen (1866–1869) and newly made by Bůžek and Holý (1964) corroborate thermophilous character nearly without Arcto–Tertiary elements. Taphocoenoses include beside subtropical plants also extinct and tropical elements. Konzalová (1976, 1977, 1981) described from there sporomorphs of entomophilous plants that cannot be compared with any of living or form taxa. The leaf assemblage has not been so far revised. Preliminary observations allow to name prevailing forms: *Daphnogene, Laurophyllum, "Ficus", Sterculia, Engelhardia, Platanus neptuni, "Musa"* and palms. Gymnosperms are represented by *Doliostrobus* and *Tetraclinis* (Bůžek – Holý – Kvaček 1967, 1968). *Acrostichum ("Lomariopsis" bilinica* Ett.) is noteworthy among ferns (Bůžek et al. 1990). This flora possesses most ancient aspects among other volcanogenic sites of the České středohoří. Only few other florulas (Lbín, Hlinná, the deeper horizon at Kundratice) make poor paralells to this stratigraphical level (Kvaček – Walther – Bůžek 1989). Their exact palaeoecological characteristics appears difficult or even problematic to assess due to high proportion of extinct and systematically unknown components. Actualistic principle (living analogon method) is much risky and uncertain in such cases.

Of the two conifers that occur at Kučlín, *Doliostrobus* was quite common and appeared in other Eocene to Early Oligocene floras of

Table 3

Comparison between *Podocarpoxylon helmstedtianum* Gottwald and selected extant species of *Podocarpus* L. and *Libocedrus* L. s. l. (according to Greguss 1955)

(characters: 1 growth rings distinct, 2 ray height in cell number , 3 cross–field pits, number and size in µm, 4 wood parenchyma with smooth walls, 5 row number of pits on radial tracheid walls).

species	1	2	3	4	5
P. macrophyllus (Thunb.) D. Don	+	1–20	0–1 6–7	+	1(–2)
P. minor (Carr.) Parl.	+	1–20	2–3 10–12	+	1–2
P. blumei Endl.	–	1–10	1–2 14–20	+	1–2
P. elatus R. Br.	–	1–9	1(–2) 9–14	+	1
P. falcatus (Thunb.) R. Br.	(+)	7–10	1–2 7–9	+	1–2
P. gracilior Pilger	–	1–8	1(–2) 8–14	+	1
P. longefoliatus Pilger	(+)	1–11	0–1 8–12	+	1–2
P. mannii Hook. f	–	1–8	1 6–8	+	1
P. montanus Lodd.	–	1–8	0–1 6–8	+	1–2
P. neriifolius D. Don	–	1–8	1 10–13	+	1–2
L. austrocaledonensis Brongn. & Gris.	(+)	2–4 (–6)	1–2(–4) 8–12	+	1–2
L. plumosa Druce	(+)	1–4	1–4 5–9	+	1–2
L. chilensis (D. Don) Endl.	+	1–10	1–2 4–5	+	1–2
P. helmstedtianum Gottwald	+	1–6 (–12)	1–2 10–15	+	1–2

thermophilous character. *Tetraclinis salicornioides* (Ung.) Kvaček, distributed in the Late Eocene to Pliocene floras of Europe as a more thermophilous plant, was found at Kučlín only exceptionally.

Among revised angiosperms, *Platanus neptuni* is quite common. This successor of *P. fraxinifolia* (Johnson et Gilmore) Walther is widely spread in the Oligocene in the České středohoří and elsewhere in Europe. It survived till the Late Miocene in southern Europe. As well as *Tetraclinis* and *Platanus neptuni* took part in mixed floras with higher share of Arcto-Tertiary elements. The recent analogon, *Platanus kerrii* Gagnep. grows today in riparian subtropical forests in mountain valleys of northern Vietnam and Laos.

Similarly *Engelhardia*, an accessory element of the Kučlín flora, shows similar distribution in time and space, i. e. Eocene–Oligocene and optimal climatic phases of Miocene in Central Europe. Its living analogons in East Asia and Central America are components of upland subtropical forests.

Stratigraphically important is also a newly recognized plant, *Hosiea bilinica* (Ettingshausen) Holý, comb. n. (see Mai – Walther 1978), based on fruits from Kučlín . Ettingshausen (1869) assigned it originally to the genus *Amygdalus* L. (syn. *Amygdalus bilinica* Ettingshausen, 1869, p. 55, pl. 53, fig. 22 – the type missing; *Amygdalus bilinica* Ett. – Sieber 1881, p.92 under *Carpolithes amygdaliformis,* pl. 4, fig. 24 – the neotype, No. G 364, coll. National Museum, Praha; *Natsiatum eocenicum* Chandler, 1925, p. 29, pl. 4, fig. 7a–b, text–fig. 11; *Prunus bilinica* (Ett.) Mai, 1963, p. 75, pl. 10, figs 1–2). Another, not yet published record of this species comes from the Volcanic (Střezov) Formation in the North Bohemian Basin (core KV-15, Kvítkov) at Teplice. The associated carpological assemblage (? Late Eocene to Middle Oligocene) is dominated by Palaeotropical elements and includes: *Alnus* sp., *Ampelopsis rotundata* Chandler, *Athrotaxis couttsiae* (Heer) Gardner, *Cornus* sp. div., *Hosiea bilinica* (Ett.) Holý, *Iodes* sp., *Parabaena europaea* Czeczott et Skirgiello and *Sambucus colwellensis* Chandler. *Hosiea bilinica* occurs in the English Late Palaeocene (Sparnacian) and particularly in the Eocene as well as in the German Early Oligocene (Haselbach, Seifhennersdorf). The living genus *Hosiea* Hemsley et Wilson belongs to the Chinese-Japanese floristic region and occupies a narrow but extensive area from Himalayas to Japan. *Hosiea* thriwes in the extratropical Mixed Mesophytic Forest zone (Maekawa in Numata 1974).

The absence of Arcto–Tertiary elements at Kučlín is very conspicuous and gives doubtlessly extraordinarily thermophilous character to the assemblage of flora. Very narrow zone of latewood may acount for short unfavourable season. Although edaphic influence of volcanic environment must be taken into account, the Kučlín flora does not include typical elements of the Eocene *Dryophyllum* assemblages. The best stratigraphical index fossil appears *Doliostrobus,* which survives to Early Oligocene. Bůžek, Kvaček and Walther (1978) supposed on this basis at least the Early Oligocene age of Kučlín. The above listed examples of other plants allow to assume the Sanoisian age as most probable. In view of palynological evidence (Konzalová 1981) also the Eocene age must be admitted. Mai – Walther (1978) ranged Kučlín into the Middle Eocene.

Translated by Z. Kvaček

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Zkřemenělý kmen *Podocarpoxylon helmstedtianum* Gottwald, 1966 z paleogenního naleziště Kučlín (sz. Čechy)

Na paleogenním nalezišti Kučlín (z. okraj Českého středohoří) byl nalezen zkřemenělý ležící kmen při bázi diatomového ložiska. Svou stavbou dřeva odpovídá typu *Podocarpoxylon helmstedtianum* Gottwald. K němu náležejí větvičky a šupiny šištic vymřelého jehličnanu rodu *Doliostrobus* Marion, které se vyskytují v okolní hornině. Dřevo prodělalo opakovaný proces silicifikace a různě intenzívní rekrystalizace hmoty SiO_2. Na fosilizaci se podílejí: zuhelnatělá rostlinná hmota, opál, cristobalit, ? tridymit, chalcedon a kvarcin, křemen a vzácný xonotlit. Vlastní dřevo je převážně přeměněno v opál. Doložena je sukcese nerostů. Podle souhrnu stratigrafických a paleoekologických dat lze předpokládat stáří nálezu v rozmezí svrchní eocén až sanois.

Explanations of plates

Plate I

1. *Podocarpoxylon helmstedtianum* Gottwald, the exposed upper part of the silicified stem in the diatomite pit on the Trupelník Hill at Kučlín. Most parts deposited in the National Museum, Praha.
2. A complete picture of the excavated stem. The stump part deposited in front of the County Museum, Teplice.

Photos by M. Mág

Plate II

1. Fine crack filled by opal in the longitudinal section of wood, parallel nicols, x60.
2. Large crack filled with angular fragments of wood and not pigmented opal in matrix, parallel nicols, x60.
3. Succession of minerals in wood and crack filling showing ground film of pigmented opal as well as layers of chalcedon and quartzine, parallel nicols, x60.
4. Succession of minerals in a larger filling showing layers of chalcedon – quartzine aggregates, pigmented opal and allotriomorphous quartz, parallel nicols, x60.
5. The above picture in crossed nicols, x60.
6. Surface of a cavity within silicified wood showing quartz crystals, x10.

Photos 1–5 by A. Kužvartová, 6 by V. Turek

Plate III

Podocarpoxylon helmstedtianum Gottwald, Kučlín

1. Distinct growth rings, wood parenchyma scattered (darker spots), cross section, x54.
2. Detailed view on a growth ring with square–roundish outlines of tracheids, cross section, x185.
3. Tracheids of earlywood with uniseriate, rarely biseriate opposite pitting, radial section, x54.
4. Cross–field with one or two pits showing steeply orientated pores, radial section, x185.
5. Poorly preserved cross–field pitting showing one cupressoid pit, radial section, x400.
6. Uniseriate, low rays, tangential section, x185.
7. Tracheids with solitary pits and wood parenchyma with redbrown filling, tangential section, x185.

Photos by D. Březinová

Plate IV

Podocarpoxylon helmstedtianum Gottwald, Kučlín

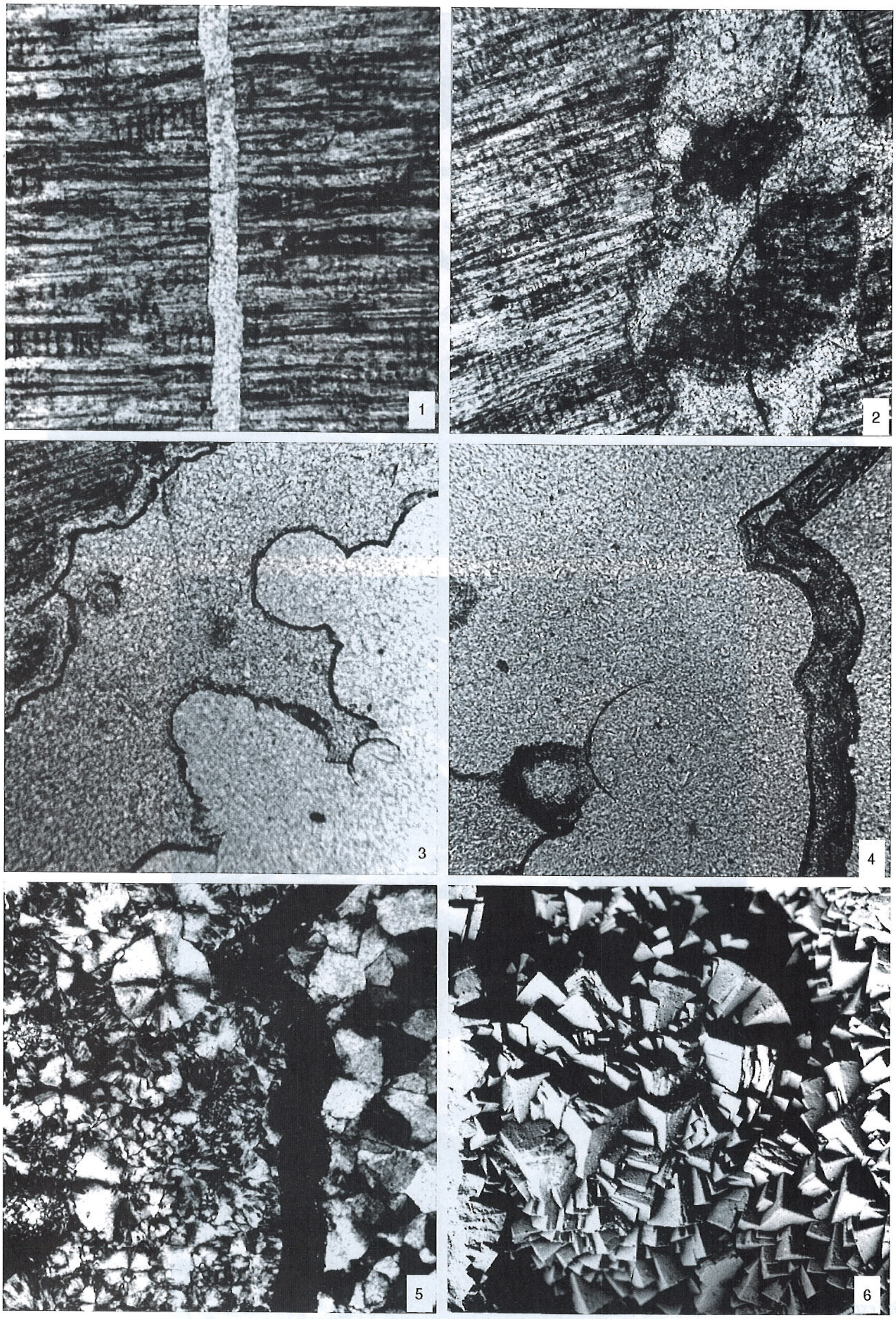
1. Wood parenchyma with filling, tangential section, x400.
2. Rays and pitting of tracheids, tangential section, x400.
3. Wood parenchyma with smooth walls, tangential section, x400.
4. Diatoms that penetrated into the wood, tangential section, SCAN, x720.
5. Biseriate pitting of tracheids showing Sanio bars, radial section, x400.
6. The same , SCAN, x900.
7. Cross–field pitting, poorly preserved, x500.
8. Cross–field pitting consisting of one cupressoid pit with steep pore, x500.

Photos 1–3, 5 by D. Březinová, 4, 6 by J. Hurda, 7–8 by Z. Kvaček

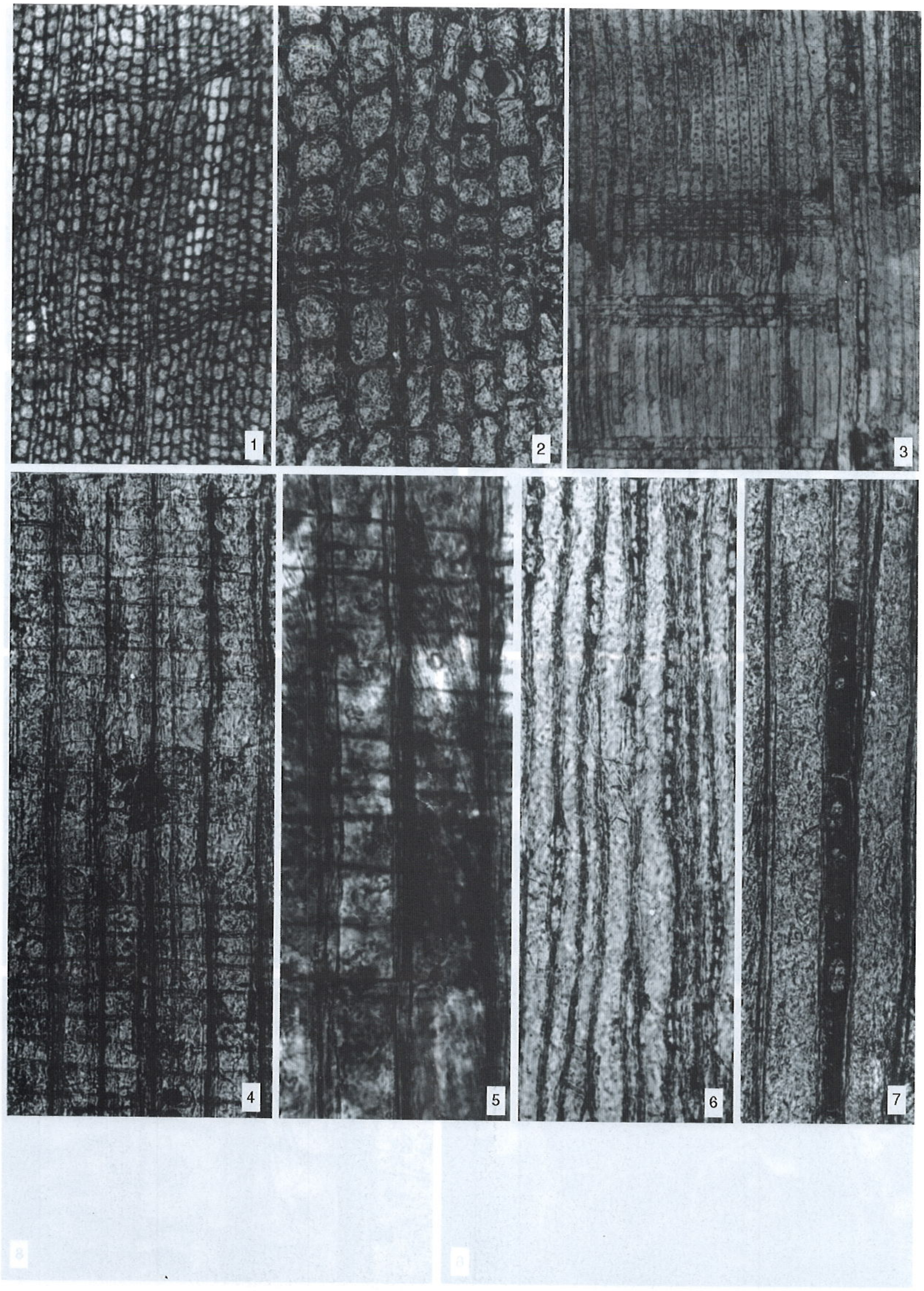
D. Březinová et al.: A silicified stem of *Podocarpoxylon helmstedtianum* Gottwald, 1966.. (Pl.I)

For explanation see p. 229

D. Březinová et al.: A silicified stem of *Podocarpoxylon helmstedtianum* Gottwald, 1966.. (Pl.II)



D. Březinová et al.: A silicified stem of *Podocarpoxylon helmstedtianum* Gottwald, 1966.. (Pl.III)



D. Březinová et al.: A silicified stem of *Podocarpoxylon helmstedtianum* Gottwald, 1966.. (Pl.IV)