REVISION OF EARLY MIocene PLANTS PRESERVED IN BAKED ROCKS IN THE NORTH BOHEMIAN TERTIARY

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Abstract. Several localities of porcelanite (baked clay) have yielded plant assemblages of Early Miocene age in the Most Basin and its periphery. They have been known since Sternberg’s times and published mainly by Ettingshausen, Velenovsky and Engelhardt in the 19th century. In this revision, detailed descriptions and situation of all plant-bearing sites are given with a review of the megafossil content. Gross morphological characters of impressions enabled identification of 6 pteridophytes, 5 conifers and more than 60 angiosperms, including newly suggested *Rosa europaea* (ETTINGSHAUSEN) comb. n., *Rubus vrsovicensis* nom. n., *Fraxinus bilinica* (UNGER) comb. n., and *Hydrochariphyllum miocenicum* (VELENOVSKY) comb. n. Baked rocks, which were caused by earth fires of coal and adjacent sediments, belong to the Most Formation. The plant assemblages reflect mostly swampy and riparian vegetation.

Introduction

Due to the distinctive nature of baked rocks, porcelanite sites represent the most characteristic geological phenomenon of the periphery of the Most (former North Bohemian) Basin. They were caused by earth fires after exposition of coal seams in the latest Neogene and during the Quaternary to Recent. The coal ignited spontaneously and coal seams burned into ash, melting into slag. Adjacent clay strata and slumps were baked into porcelanite of various, mostly reddish colours. Their occurrences line the southern margin of the Most Basin and are scattered to the south together with small satellite basins into the České středohoří Mountains. They witness a much wider extent of the coal-bearing Miocene deposits beyond the basin, which were removed by denudation processes during the Quaternary.

Although the origin of the porcelanite rocks dates to the Quaternary, the plant remains preserved in them are clearly connected with the original clay of the coal-forming basin fill, Early Miocene in age. Some of the sites are typical of the well-bedded porcelanite overfilled with plant remains. They are noted for nicely preserved leaf impressions. For collection purposes, the porcelanite has advantages over mere clay being very hard, and reflecting very precisely details of venation. The rocks are often split into slabs on the exposures and one only needs to select suitable pieces in clasts. Unfortunately, it is usually difficult to undertake additional mechanical preparation of the specimens due to the very hard consistence of the rock. Leaf impressions often overlie each other concealing details of the margin. They are also unsuitable for obtaining cuticle characters - they may reflect a rough relief of cell structure removable by colodion film technique, but usually without necessary details of pubescence and stomata.

Two of the porcelanite sites - Zelěnky/Zabrusany and Vršovice belong undoubtedly to the most popular and well known sites of the North Bohemian Tertiary. Together with the flora of the Břešťany Clay and that of Kuclin they both are respect ed as world famous “Lagerstätte” of Tertiary plants. Most of the world collections house some pieces, both in private collections and in various institutions. In our republic, the most important collections (including original specimens) are housed in the National Museum (Sternberg 1820-38, Velenovsky 1881), Czech Geological Survey (coll. Běh – Z. Kvacek) and Charles University, Faculty of Science (a part of Engelhardt 1891). Type and figured specimens from the 19th century (Gop pert 1836, Ettingshausen 1866-9, Menzel 1901) are scattered over Europe, e.g., at the Wroclaw University, Hungarian Natural History Museum, Budapest, Natural History Museum, Vienna, Geological Survey (Geologische Bundesanstalt), Vienna and Staatliches Museum für Mineralogie und Geologie, Dresden. Material from old as well as newly discovered sites is concentrated in the County Museum, Most (Hurník 1999), Regional Museum, Teplice, Town Museum, Ústí n/L. and in the collection of the Bílína Mines. Surprisingly, the County Museum in Lou ný, situated only a few km from the Vršovice
site, possesses almost nothing from there. We have tried to look through most of the earlier published material and sort out parts of the available collections. However, a full inventory of all items is beyond the scope of this paper. It must be noted that a large part of the published and figured specimens (e.g., by Engelhardt 1891), originally kept in private collections, is now missing.

The following abbreviations are used in the text, mostly prefixing specimen numbers, for the selected repositories:

BA – Geologische Bundesanstalt, Wien
BP – Hungarian Natural History Museum, Budapest
DB – Bilina Mines
MT – Regional Museum, Teplice
MM – County Museum, Most
MCh – County Museum, Chomutov
NM – National Museum, Palaeontological Department, Praha

History of the research

First it is necessary to review opinions on the origin of baked rocks in North Bohemia. In the 19th century, the explanation for earth (ground) fires was mostly connected with basalt lava flows. F. A. Reuss (1790) was probably the first who saw causes of earth fires in oxidation of iron sulphides in coal matter and combustion of coal deposits into “pseudo-volcanic rocks”. Also Zippe (1831) upheld the same opinion. A protagonist of the view connecting earth fire with basalt eruptions was A. E. Reuss (1840). In his extensive work on the geology of environs of Teplice and Bilina he summarised and challenged various approaches to this problem. And he accepted the direct impact of glowing lava on the coal seam as being the most logical cause. He derived this explanation from the regular association of porcelanite rocks with basalt lava flows of the České Středohoří Mts. on the southern periphery of the basin. In locations, where igneous rocks did not occur, he anticipated existence of such bodies beneath the porcelanite. In his opinion, only glowing lava was hot enough to cause full combustion of coal and melting of ash, clay, and even sand or conglomerate adjacent to the coal seam into slag. Other factors, like oxidation of iron bisulphide or oxidation of coal matter itself, acted in his opinion only exceptionally. He also argued with Haidinger (1839), who believed in the indirect influence of lava flows. Haidinger supposed that igneous bodies initiated spontaneous ignition of coal by raising the seam and disintegrating it by intrusions, thus allowing better access of air to the coal matter.

The problem of the age of origin is also related to the process of combustion. The geological law of “identical fossils” is not valid in this case. The origin of a new rock (porcelanite), which petrologically differs from the previous matter (clay), is not a product of diagenesis, contact or regional metamorphism, nor re-deposition. The porcelanite occurrence arose, like another typical rock of North Bohemia - garnister quartzite, due to an exogenic process. In our case, it is combustion of the coal seam due to spontaneous ignition. If this process were connected with basalt lava, than the age of it would fall into the Oligocene or Miocene. Thus the locality Brezno south of Most cannot come into consideration being Miocene in age.

First Ettingshausen (1866-1869) studied monographically the Tertiary flora of North Bohemia including that from several sites of porcelanite. He included in his monograph an extensive fossil material at that time housed in the collections of Prince Ferdinant von Lobkowicz, Bilina, mostly gathered by A. E. Reuss (now in the Hungarian Natural History Museum, Budapest), the Geological Survey in Vienna, mostly gathered by Haidinger (still partly preserved in the same collection), and the “Hof-Mineralien-Kabinet” (now in the Natural History Museum, Vienna). The sites of porcelanite (“Brandschiefer”) are referred to as Sobrušany (i.e. Želénky), Schelenken (i.e. Želénky), Kutterschitz (i.e. Chuderce) and Straka (i.e. Straký). Ettingshausen sometimes mentions a more general locality “Brandschiefer von Bilin”, which probably means some of the above mentioned sites near Bilina. Most plants have been described from Zabrašany (63 taxa) and Bilina (12). 4 species bear a less precise reference “the Bilina Tertiary Basin”, 2 species come from Straky, 3 species from Chuderce and only one species (Taxodium dubium) from Želénky (see Appendix).

In his textbook on geology of Bohemia, Krejčí (1877: 915-927) summarised the list of plants from the Tertiary of Bohemia adding to the flora of baked rocks Carpinus grandis from
Zabrušany and *Carpinus heerii* and *Castanea atavia* from Hostomice. The latter newly recovered flora from Hostomice (Ober-Hostomitz) is reported also by Engelhardt (in Geinitz 1878), in which *Glyptostrobus europaeus*, *Betula priscia*, *Betula Bronngniartii*, *Carpinus Heeri* and *Castanea atavia* have been included. (The original collection done by the mine manager Klier is at present not available.) Plants from Bohemian porcelanite sites were also mentioned in the textbook on palaeobotany by Schenk (1890).

The posthumous paper by Sieber (1881), read at the session of the Sience Academy in Vienna in 1880, adds 6 more taxa to the flora of Zabrušany, among them also *Hydrangea microcalyx* (a doubtful record of this newly described species typified by another specimen from the Late Eocene diatomite of Kuchlin) and *Rubus meriartii* (i.e. *Rubus meriartii*). Although some of the specimens figured in this account are housed in the National Museum, Prague, those from the porcelanite of Zabrušany have not been recovered so far.

One year later Velenovsky (1881) published an extensive study of the flora of Vršovice (Vršovice bei Laun), in our review included within a broader site Černodoly. About 60 taxa have been reported by Velenovsky from this site, including 14 new species, three being based on fruit remains and 2 uncertain leaf remains (see Appendix). Most of the figured specimens are housed in the National Museum, Praha.

Engelhardt (1891) gave a comprehensive account of the flora from the environs of Duchov (Dux), in which he described also the flora from Želěnky. From this site 50 taxa are given, including 4 as new species. Unfortunately, most of the figured specimens are now missing. The majority were offered to Engelhardt for the study from private collections of mine managers Tobisch, Sieber and Prof. Ulrich from Dux. Only a few specimens from the collections of the Technical University, Prague (coll. Krejčí) survived at the Faculty of Science, Charles University (see Appendix). In the introduction of his study, Engelhardt (1891: 133) mentioned also large slabs of porcelanite from Lišnice-Polerady densely covered by leaf impressions, and identified among them four "Ficus" species (i.e. *F. multirvatis, F. lanceolata, F. Hercules and F. tiliaefolia*).

In his monograph on Gymnosperms from the North Bohemian Tertiary, Menzel (1901) partly revised, partly contributed to the flora of the porcelanite sites Želěnky, Straky, Vršovice and Lišnice-Polerady, having restudied collections of his own, those of Professor Deichmüller and from the Museum in Dresden (now partly in the Staatliches Museum für Mineralogie und Geologie, Dresden), and those from the Charles University, Prague, Regional Museum in Teplice, and Agriculture School in Libverda (now partly in the Town Museum, Ústí n/l.). He reports on *Podostamites miocenica* (i.e. *Hydrochirephyllum miocenicum*) from Vršovice, *Taxodiium distichum miocienicum* (i.e. *Taxodiium dubium*) from Želěnky, Straky, Vršovice and Lišnice-Polerady, having restudied collections of his own, those of Professor Deichmüller and from the Museum in Dresden (now partly in the Staatliches Museum für Mineralogie und Geologie, Dresden), and those from the Charles University, Prague, Regional Museum in Teplice, and Agriculture School in Libverda (now partly in the Town Museum, Ústí n/l.). He reports on *Podostamites miocenica* (i.e. *Hydrochirephyllum miocenicum*) from Vršovice, *Taxodiium distichum miocienicum* (i.e. *Taxodiium dubium*) from Želěnky, Straky, Vršovice and Lišnice-Polerady, having restudied collections of his own, those of Professor Deichmüller and from the Museum in Dresden (now partly in the Staatliches Museum für Mineralogie und Geologie, Dresden), and those from the Charles University, Prague, Regional Museum in Teplice, and Agriculture School in Libverda (now partly in the Town Museum, Ústí n/l.).

Some more specimens from baked rocks were published in several separate taxonomical studies. Z. Kváček and Holy (1974) in the revision of a Tertiary alder *Alnus julianiformis* figured a single specimen from the site Kaškov (coll. Holý at NM). Procházka and Bůžek (1975) revisited all records of *Acer* of the North Bohemian Tertiary including those from baked rocks. They reduced the number of maples in the respective sites as follows: Of five species described by Velenovsky (1881) at Vršovice, two have remained - *Acer tricuspidatum* and *A. integrigrifolium* var. *serratum*. Three species from Želěnky have been reduced to two, *A. tricuspidatum* being represented by two forms (*tricuspidatum* and *productum*). The same number is reported from Zabrušany. Only *A. dascycarpoides* (determined as *A. rueminiatum* by Ettingshausen) is known from Straky. Z. Kváček (1976) figured Sternberg's specimen (neotype) of *Taxodiium dubium* from baked rock of the North Bohemian Basin, probably Bílina. Hurník (1978) in his revision of the fern genus *Woodwardia* included in his study also Velenovsky's specimens from Vršovice (coll. NM). He states that only a single species *W. muensteriana* occurs in the North
The review of the flora preserved in baked rocks in North Bohemia

Since Sternberg’s times about 150 plant species have been described from various sites of porcellanite, which very often represent mere synonyms of newly revised taxa of a different systematic position. In many instances, the species have been based on poorly preserved specimens, not showing diagnostic characters, and their status is problematic. Therefore, an attempt has been made to clarify the so far published lists from the respective sites, in many instances revisiting actual specimens scattered in the collections of various institutions in our country and abroad. We have tried to select reliably documented elements of this flora from those of ambiguous affinities. We have not endeavoured to determine every collected fossil, which in many cases do not show sufficient traits to rely on (young ontogenetic stages of leaves, fragments, many monocots etc.). For convenience of the readers, the systematic revisions of major monographs are attached as Appendix. Three localities are extraordinarily rich both in species and collections - Vršovice, Zabršany and Želénky. These sites are similar to each other in the flora composition, and correspond to similar conditions of fluviolacustrine and coal-forming habitats within the Žatec and Bilina deltas. Their comparisons and vegetation analysis together with other sites are given below in a separate chapter.

The following taxonomic part is arranged according to the current system employed by Tachtadžian (see Brummit 1992). To avoid misunderstandings, a more traditional approach is given preference below over novelties in family treatments (e.g., fusions of Taxodiaceae with Cupressaceae, Arecaceae with Sapindaceae, Tiliaceae with Malvaceae etc.).

Only critical taxa are treated in detail. The flora of the baked rocks thus includes 6 ferns, 5 conifers, and more than 60 angiosperms. Four cumulative units - Leguminosites spp., Dicotylophyllum spp., Carpolithes spp. and Cyperifices spp. incorporate more natural species, which are not differentiated. Some “organ” species for the foliage and fruits (Paliurus tiliae‐folius + P. favonii) are kept apart only for formal reasons, and designate parts of the same plant.

**POLYPODIOPHYTA**

**Osmundaceae** GÉRARDIN et DESW.

**Osmunda L.**

**Osmunda parschlugiana** (UNGER) ANDREÁNSZKY

*Pl. 1, fig. 5*

**Lygodium SW.**

**Lygodium kaulfussii** HEER

*Pl. 1, fig. 6*

Lygodium kaulfussii HEER, 1861, p. 409, pl. 8, fig. 21, pl. 9, fig. 1

Lygodium gaudinii sensu Luft-Hurník, 1957a, p. 284, text-fig. 1/1a-b

The first record found in the Most Basin at Želénky (Luft-Hurník 1957a) can now be complemented by two more specimens from Světce (coll. Črkoš, 1936, NM) and one from Kaňkov (coll. Dvořák, DB). All of them match by rounded tips of digitate fronds the forms assigned by Křausel and Weyland (1920) to L. kaulfussii (contrary to L. gaudinii HEER with narrowly pointed tips).

**Thelypteridaceae** PICH. SERM.

**Pronephrium C. PRESL.**

**Pronephrium stiriacum** (UNGER) KNOBLOCH et Z. KVÁČEK

*Pl. 1, figs 1-2, text-fig. 1.1*

Polypodites stiriacus UNGER, 1847, p. 121, pl. 36, figs 1-5

Lascraea stiriaca (UNGER) HEER, 1835, p. 31, pl. 7-8

Abacopteris stiriaca (UNGER) CHING, 1963, p. 298

Pronephrium stiriacum (UNGER) KNOBLOCH et Z. KVÁČEK, 1976, p. 12, pl. 1, fig. 1

Accumulations of larger and smaller parts of this fern occur in particular layers (e.g., in Dobříč), indicating that P. stiriacum formed dense stands in swamps. Fertile pinnules prove that the records from the North Bohemian Tertiary exactly correspond to those from other parts of Europe (e.g., Barthel 1976).
Blechnaceae (C. PRESL) COPEL.

Blechnum L.

Blechnum dentatum (GÖPPERT) HEER
Pl. 1, fgs 4-7, text-fig. 3.4

Aspidites dentatus GÖPPERT, 1836, p. 355, pl. 21, fig. 7-8
Taeniopteris dentata (GÖPPERT) C. PRESL in STERNBERG, 1838, p. 141
Blechnum goeppertii ETTINGSHAUSEN, 1866, p. 14, pl. 3, fgs 1-4, nom. superfl.
Marratiopsis dentata (GÖPPERT) SCHIMPER, 1869, p. 607
Blechnum dentatum (GÖPPERT) HEER, 1872, p. 11, pl. 1, fgs 1-1b
Blechnum braunii sensu Ettingshausen, 1866, p. 15, pl. 3, fgs 5-8

According to Barthel (1976), who refigured the type specimen of Aspidites dentatus GÖPP. from Teplice, the names B. braunii ETT. and B. goeppertii ETT. fall into the synonymy of this species. However, he indicates A. Braun (1852) as the author of the combination. Although Braun referred to Marratiopsis dentata (GÖPPERT) C. PRESL in STERNBERG to the genus Blechnum, he did not create the respective combination. Hence his treatment is invalid (in the sense of ICZN, Art. 33.1 - Greuter et al. 1994). Heer (1872) was the first who did it, and he must be considered, contrary to the view of Barthel (1976), the author of this recombination.

It is sometimes difficult to differentiate between fragmentary pinnae of Blechnum dentatum (pinnae long, parallel-sided, the base asymmetrical, narrow cuneate on one side, margin markedly dentate) and Osmunda parschlugiana (pinnules shortly elongate, the base also asymmetrical, but usually truncate to cordate, margin smooth to finely crenulate). This is the case of the specimen from Zelénky, identified by Engelhardt (1891) as Pteris penneriformis HEER. An assignment to Blechnum dentatum seems more likely because of the narrow cuneate leaf base, but the specimen is not available to confirm this assumption. B. dentatum is rare at Zelénky (e.g., at NM), the true Osmunda parschlugiana has not been recovered there in pelitic porcelanite.

We were unable to spot any topotypical specimens in the porcelanite occurrences near Teplice. The Göppert’s reference to Teplice may mean also Chudeřice, but still the exact position of the type locality remains uncertain. The occurrence of this fern is more abundant around Bilina, namely in the latter locality. A more complete frond fragment has been found in the Stross collection from the former mine Rudiař II at Světec (pl. 1, fig. 8), where detached pinnae, in some cases fertile, are common. This fern is rare elsewhere (e.g., at Zabrušany, Zelénky, in the seam roof in the Bilina Mine).

Woodwardia SMITH

Woodwardia muensteriana (C. PRESL in STERNBERG) KRÁUSEL
Pl. 1, fig. 3, text-fig. 1.9

Racopetis muensteriana C. PRESL in STERNBERG, 1838, p. 154, pl. 36, f. 2
Woodwaridites muensterianus (C. PRESL); F. BRAUN, 1841, p. 33
Woodwaridites roessnerianus UNGER, 1847, p. 123, pl. 37, fig. 4
Woodwaridites roessnerianus (UNG) HEER, 1855, p. 29, pl. 5, fgs 1-4, pl. 6, fig. 1; Velenovský, 1881, p. 11, pl. 1, fgs 1-8
Woodwaridites muensteriana (C. PRESL) KRÁUSEL, 1921, p. 336, pl. 12, f. 1-5; Humník, 1978, p. 26, pl. 1, text-figs 2 b, 3-5

The monographical treatment of the material from the Most Basin was published by Humník (1978), who also revisited the porcelanite material from Vršovice (Velenovský 1881). In his opinion, which is also followed here, Woodwardia muenstera -na (based on the missing specimen from the Bavarian Micocene, Bullenreuth) and W. roessneriana (based on the specimen from the Croatian Sarmatian, Radoboj) are conspecific. This fern is common in the interseam beds from the Žatec area to Louňy, but very rare in the strata above the main seam roof (e.g., Sakala 2000, this volume). Sometimes the areolae of Woodwardia foliage are weakly developed or even missing (see Humník 1978, pl. 1, fig. 1).

Salviniaeae T. LESTIB.

Salvinia SÉGUIER

Salvinia reussii ETTINGSHAUSEN
Pl. 2, fgs 1-2, text-fig. 1.22

Salvinia reussii ETTINGSHAUSEN, 1866, p. 18, pl. 2, fgs 21-22; Sieber, 1881, p. 73, pl. 1, fig 5; Engelhardt, 1891, p. 144, pl. 1, fgs 22-25
Salvinia cordata ETTINGSHAUSEN, 1866, p. 18, pl. 2, fgs 19-20
Salvinia mildeana sensu Engelhardt, 1891, p. 144, pl. 1, fgs 26-27
Salvinia formosa sensu Velenovský, 1881, p. 12, pl. 1, fgs 14-17

Accumulations of whole plants and detached elliptical reticulate fronds of Salvinia are most typical of aquatic plant horizons in the Bilina area, including occurrences of baked rocks, but are also commonly found elsewhere. In the study by Bůžek et al. (1971), S. reussii typified by the specimens from North Bohemia was treated as different from the species described in the later Miocene (S. mildeana GÖPP. - Sošnica, S. formosa HEER - Schrotzurg), and this approach is followed here.

PINOPHYTA

Taxodiaceae WARM.

Taxodium RICH.

Taxodium dubium (STERNBERG) HEER
Text-figs 1.24, 3.5, 5.1

Phylites dubius STERNBERG, 1823, p. 37; 1825, Tent. 39, pl. 36, fig. 3
Filicites sp. STERNBERG, 1821, p. 29; index icon., pl. 24, fig. 2
Taxodium dubium (STERNBERG) HEER, 1853, p. 136; Z. Kvaček, 1976, p. 290, text-fig. 5-6b, e. J. Kvaček and Straková, 1997, p. 69, pl. 23, fig. 3
Taxodium distichum micconicum auct. (non HEER); Engelhardt, 1891, p. 151, pl. 2, fgs 23-34, pl. 3, fgs 9-10; Menzel, 1901, p. 85
Sequoia langsdorffii auct. (non BRONGNIART) HEER; Ettingshausen, 1866, p. 29, pl. 13, fig. 10 (non fig. 9); Velenovský, 1881, p. 16, pro parte, pl. 1, fgs 28-29; Menzel, 1901, p. 89, pro parte

Deciduous shoots of bald cypress occur commonly in the baked rocks of North Bohemia. T. dubium is actually typified by the material from porcelanites at Bilina (Z. Kvaček 1976). Leaf cuticular study of the coalified foliage from the same area (Z. Kvaček, personal observation) proved that even broader needles recalling Sequoia sempervirens (LAMB.) ENDL., which regular accompany the typical shoots, do not belong to Sequoia. The seed cones, their fragments and seeds of Taxodium are exceptionally preserved, which puzzled Ettingshausen.
(1866), Velenovsky (1881) and Menzel (1901), who connected this more robust twigs with the Sequoia-like seed cones (now Quasequoia).

**Quasequoia SRINIVASAN et FRIS**

**Quasequoia couttsiae** (HEER) KUNZMANN

Pl. 2, figs 3-4, text-fig. 1.6

Sequoia couttsiae HEER, 1862, pp. 1051-1055, pls. 59-61
Atheutos couttsiae (HEER) GARDNER, 1884, p. 90, pl. 6, figs 1-9, pl. 10, figs 6-9
Quasequoia couttsiae (HEER) KUNZMANN, 1999, p. 57, pl. 10, figs 5-6, pls. 11-13, text-fig.13-14
Taxodium dubium sensu Ettinghausen, 1866, p. 34, pro parte, pl. 10, figs 8-9, 20-22
Sequoia langsdorfii sensu Velenovsky, 1881, p.16, pro parte, pl. 1, figs 30-35

This coal-forming conifer, which is spread in the coal facies and the Břešťany Clay of the Most Basin, is safely recognizable only in more complete specimens with seed cones attached to the foliage. Sequoia-like seeds, which occur often in association, belong obviously to the same plant. Kunzmann (1999) was able to remove such seeds from similar, better preserved seed cones and proved the affinity of this so far enigmatic member of the Taxodiaceae to an extinct Sequoia-like genus Quasequoia. Sterile foliage is not safely distinguishable from Glyptostrobus on the basis of its morphology alone.

**Glyptostrobus ENDL.**

**Glyptostrobus europaeus** (BRONGNIART) UNGER

Pl. 6, fig. 7, text-fig. 1.5

Taxodium europaeum BRONGNIART, 1833, p. 168-175, pl. 30
?
Musees stolzi STERNBERG, 1833, p. 38, pl. 17, figs 2-3
Glyptostrobus europaeus (BRONGNIART) UNGER, 1850 b, p. 434; Velenovsky, 1881, p. 15, pl. 1, figs 21-26; Menzel 1901, p. 87, pl. 5, figs 1-3
Glyptostrobus bilinicus ETTINGSHAUSEN, 1866, p. 39, pl. 11, figs 1-2; Engelhardt 1891, p. 152

Glyptostrobus europaeus is the most common conifer in the Most Basin. Its seed cones and seeds are very distinct, contrary to the sterile foliage, and allow safe identification. Only these organs prove its presence on respective sites. Glyptostrobus europaeus occurs in most of the sites of baked rocks.

**Pinaceae LINDL.**

**Pinus L.**

**Pinus rigios** (UNGER) ETTINGSHAUSEN

Pl. 2, fig. 7

Pinus rigios UNGER, 1850a, p. 362
Pinus rigios (UNGER) ETTINGSHAUSEN, 1866, p. 41, pl. 13, figs 11-12

The occurrence of this terminal pine foliage in baked rocks of the Most Basin is rarer (e.g. Nechvalice). Menzel (1901) reports this species also from a porcellanite site of the Doupov Mts., but the exact position of the locality is vague.

**Pinus engelhardtii MENZEL**

Pl. 2, fig. 6

Pinus engelhardtii MENZEL, 1901, pl. 3, fig. 28

A single seed cone mold of this pine is housed in the County Museum, Most. It is preserved in baked rock, but its exact locality is unknown. Accumulations of P. engelhardtii line the NW border of the basin at the foot of the Krušně hory Mts., where they occur in pelocarbonate nodules and mica clay and sand facies.

**MAGNOLIOPHYTA**

**Lauraceae JUSS.**

**Laurophyllum GÖPP.**

**Laurophyllum cf. saxonicum LITKE**

Pl. 2, fig. 8, text-figs 1.23, 3.16

*Laurophyllum saxonicum LITKE, 1968, p.176, pl. 36, figs 8-11, text-figs 9-17
Ficus lanceolata sensu Velenovsky, 1881, p. 27, pl. 4, figs 15-16 (non 17)
Terminalia radobojensis sensu Velenovsky, 1881, p. 46, pl. 10, figs 1-4 (non pl. 9, fig. 25)
Rhamnus dechenii sensu Engelhardt, 1891, p. 189, pl. 17, fig. 1

The coalified specimens safely determined by cuticle structure (Z. Kvaček 1971, as Laurophyllum nemejici Z. KVAČEK; Hurník and Z. Kvaček 1999) suggest that this fossil member of the laurel family, closely recalling *Persea*, was spread in the coal facies both in the interseam and overlying beds. We suspect its common occurrence, according to the irregular camp­todromous venation of large obovate leaves, at Vršovice and Želénky, rarely elsewhere.

**Daphnogene UNGER**

**Daphnogene polymorpha** (A. BRAUN) ETTINGSHAUSEN

Text-figs 4.11, 5.4

Ceanothus polymorpha A. BRAUN, 1845, p. 171
Daphnogene polymorpha (A. BRAUN) ETTINGSHAUSEN, 1851, p. 16, pl. 2, figs 23-25
Cinnamomum schleicheri sensu Velenovsky, 1881, p. 33, pl. 4, figs 21-25

This cinnamomoid foliage occurs only occasionally in baked rocks, namely in more sandy layers, together with other riparian and mesophytic elements, e.g., at Vršovice and Zábrušany.

**Berberidaceae JUSS.**

**Berberis L.**

**Berberis berberidifolia** (HEER) PALAMAREV et PETKOVA

Pl. 2, fig. 5, text-fig. 5.13

*Berberis berberidifolia* HEER, 1859, p. 72, pl. 122, figs 12-18 (non Ettinghausen, 1869, p. 38, pl. 46, fig. 16)
Celastrus arethusa ETTINGSHAUSEN, 1869, p. 34, pl. 48, fig. 16
Berberis berberidifolia (HEER) PALAMAREV et PETKOVA, 1987, p.47, pl. 1, fig. 7

A single leaf impression from Zabrusany matches this barberry in the venation and spiny remote marginal teeth, although it deviates somewhat from the standard by its ovate form. Typical specimens occurred in sandy facies and pelocarbonate in the former Julius Fučík Mine, Zelenky (Z. Kvaček 1960) and the Bíllina Mine (Bůžek et al. 1992).

Cercidiphyllaceae ENGL.
Cercidiphyllum SIEB. et ZUCC.

Cercidiphyllum crenatum (UNGER) R. BROWN
Text-figs 3.1, 4.10

Dombeoypsis crenata UNGER, 1850a, p. 448
Grewia crenata (UNGER) HEER, 1859, p. 42, pl. 109, fig. 12, pl. 110, figs 1-5, 7-11; Velenovsky, 1881, p. 36, pl. 9, figs 10-14; Engelhardt, 1891, p. 30, pl. 14, fig. 1
Grewia ovalis HEER, 1859, p. 44, pl. 110, fig. 2; Velenovsky, 1881, p. 37, pl. 9, fig. 15
Cercidiphyllum crenatum (UNGER) R. BROWN, 1935, p. 575, pl. 68, figs 1, 6, 8-10

Thanks to the typical leaf form, which can be distinguished from similar Palurus tiliaefolius by crenulate margin and irregularly reticulate tertiary venation, Cercidiphyllum is easy to recognize even in fragmentary specimens. It occurs in most of the sites of fine-grained porcelanite and seems to have been growing in moist habitats, as it does today. No fruit and flower remains have been recovered in porcelanites, contrary to occurrences in clays (Ettingshausen 1866), but can be safely distinguished by finely crenulate margin. This tree obviously accompanied Parrotia in similar habitats, as the leaves of these two elements occur often together.

Hamamelidaceae R. BR.
Parrotia C. A. MEY.

Parrotia pristina (ETTINGSHAUSEN) STUR
Pl. 3, fig. 2, text-figs 4.16, 5.2

Styrax pristinus ETTINGSHAUSEN, 1851, p. 19, pl. 3, fig. 9
Parrotia pristina (ETTINGSHAUSEN) STUR, 1867, p. 192-193, pl. 5, figs 2-3; Ettingshausen 1869, p. 4, pl. 39, fig. 23, pl. 40, fig. 24-25; Engelhardt, 1891, p. 178, pl. 14, fig. 18
Parrotia pseudo-populus ETTINGSHAUSEN, 1869, p. 5, pl. 39, fig. 20
Viburnum dubium Velenovsky, 1881, p. 35, pro parte, pl. 7, fig. 10 (non pl. 6, fig. 19, pl. 7, fig. 11, pl. 10, fig. 18)

There are some doubts, as to the generic assignment of the leaf fossils called Parrotia pristina (Bůžek 1971). In spite of rather unique combination of gross morphological characters: opposite basal secondarys descending a little below the base of the leaf blade, simple undulate margin, lobes often mucronate, a very similar leaf form is developed in three genera - Parrotia, Shantiiodendron and Fothergilla. The latter genus endemic to North America deviates above all by its roundish ovate symmetrical leaf form and much longer petiole in relation to the leaf lamina (Meyer and Manchester 1997). On the other hand, Shantiiodendron, a Chinese endemic, is practically indistinguishable from Parrotia. In our opinion, these two genera are so closely related that the subgeneric rank would be more appropriate for the Chinese representative. Solution of this problem requires a detailed comparable study of both extant representatives. Parrotia is a typical member of riparian forests in the Miocene of the Most Basin. It occurs in sandy baked rocks, e.g., at Zabrusány/Zelenky and Vršovice.

Liquidambar L.

Liquidambar europaea A. BRAUN
Pl. 3, fig. 1, text-fig. 5.9

Liquidambar europaea A. BRAUN in BUCKLAND, p. 513; Ettingshausen, 1866, p. 84, pl. 29, fig. 1; Engelhardt 1891, p. 133, pl. 10, fig. 22
Acer räumianum sensu Ettingshausen, 1869, p. 23, pro parte, pl. 48, fig. 8 (non fig. 9)

Mostly trilobate leaves have been encountered in the Most Basin. Liquidambar foliage can be easily mistaken for maples (Ettingshausen 1866), but can be safely distinguished by finely crenulate margin. This tree obviously accompanied Parrotia in similar habitats, as the leaves of these two elements occur often together.

Fagaceae DUMORT.

Quercus L.

Quercus rhenana (KRÄUSEL et WEYLAND) KNOBLOCH et Z. KVAČEK
Pl. 3, fig. 3, text-fig. 1.25

Illicium rhenanum KRÄUSEL et WEYLAND, 1950, p. 50, pl. 9, figs 5-7, pl. 10, figs 1-2, pl. 11, fig. 8, text-fig. 14
Quercus rustica JAHNICHEN, 1966, p. 478, pls. 1-4, 8, pl. 9, figs 21-22, text-figs 1, 3-4
Quercus rhenana (KRÄUSEL et WEYLAND) KNOBLOCH et Z. KVAČEK, 1976, p. 41, pl. 17, fig. 6, 8, 14, pl. 21, figs 5-6, pl. 24, fig. 10
Laurus primitiva sensu Velenovsky, 1881, p. 30, pl. 5, figs 1-5

The leaves of this swamp oak may attain a considerable size and accumulate in particular clay layers in the Most Basin (the association Quercus rhenana sensu Z. Kvaček and Bůžek 1982). They are recognized from other entire-margined simple leaves by regular arc-like secondaries diverging at wider angles. Despite lacking cuticles we can be sure that Velenovsky (1881) misinterpreted this foliage for the Lauraceae (see Appendix).

Quercus sp.
Pl. 3, fig. 6

Sparagnanum (?) sensu Velenovsky 1881, p. 22, pl. 8, fig. 25

Cupules of this sort were found in association with abundant leaves of Quercus rhenana at Skyfice (Hurník and Z. Kvaček 1999). Also in the case of Vršovice, the cupule, although a little smaller, which was not recognized by Velenovsky (1881), belongs undoubtedly to the same swamp oak.
**Betulaceae GRAY**

*Alnus MILL.*

*Alnus julianiformis* (STERNBERG) Z. KVAČEK et HOLÝ  
Pl. 3, figs 5, 7-8, text-figs 1.16, 3.9, 5.12

*Phyllites julianiformis* STERNBERG, 1823, p. 37, 39, pl. 36, fig. 2

*Fagus foresti* UNGER, 1845, p. 106, pl. 28, figs 3-4; Ettingshausen, 1866, p. 126, pl. 1, fig. 18, pl. 2, figs 7-8, pl. 15, figs 12-20, 22, pl. 16, fig. 1; Velenovsky, 1881, p. 23, pl. 3, figs 7-8; Engelhardt, 1891, p. 158, pl. 7, figs 32-34, pl. 8, figs 4-8, 10

*Fagus tenuifolia* BETTUNHUSEN, 1869, p. 25, text-figs 1.36, fig. 9

*Alnus julianiformis* (STERNBERG) Z. KVAČEK et HOLÝ, 1974, p. 367, pl. 1-3, pl. 4, fig. 1, text-fig. 1

This alder is a typical element of riparian and swamp forests in the Most Basin. Although variable in size of the leaves, it can be recognized by small number of secondaries (mostly 5-7), an oval outline and usually fine teeth on the margin. The associated infructescences belong to *Alnus gracilis* UNG. The leaves occur in masses near Bilina (e.g., Světce), but they are less frequent elsewhere.

*Alnus gaudinii* (HEER) KNOBLOCH et Z. KVAČEK  
Pl. 4, figs 1-2, text-figs 1.13, 1.20, 5.6

*Rhamnus gaudinii* HEER, 1856, p. 79, pl. 124, figs 4-15, pl. 125, figs 1-7, 13  
*Fagus ettingshainii* VELONOVSKÝ, 1881, p. 24, pl. 3, figs 10-12, pl. 4, figs 1-2  
*Rhamnus fricii* VELONOVSKÝ, 1881, p. 42, pl. 8, figs 7-16, pl. 10, fig. 18d  
*Alnus gaudinii* (HEER) KNOBLOCH et Z. KVAČEK, 1976, p. 33, pl. 6, figs 1, 3, pl. 7, figs 1, 5, pl. 13, fig. 4, pl. 15, figs 1-4, 7-8, 10-11, 13, 15, 17, pl. 16, figs 1-5, pl. 19, fig. 15m pl. 20, fig. 10, text-figs 11-12  

cf. Rhamnus sensu Buzek, 1971, p. 72, pl. 32, figs 1-11

Narrow oval, long petiolate leaf forms with numerous arch-like secondaries, which enter fine marginal teeth by numerous side veinlets, prevail in most populations in Europe, although some broader, even subcordate leaves can be encountered. Most frequent occurrence of this alder, which is also here associated with big infructescences of *A. kefersteini* (GÖPP.) UNG. (see text-fig. 7.2), is Vršovice (Velenovsky 1881). *Alnus gaudinii* is scattered in other parts of the basin, usually outside swampy habitats.

*Alnus cf. rostaniana* SAPORTA  
Pl. 4, figs 3-6,7, text-fig. 1.15

*Alnus rostaniana* SAPORTA, 1891, p. 50, pl. 14, figs 1-2  
*Alnus cf. rostaniana* SAPORTA; Humík and Z. Kvaček, 1999, p. 64, pl. 2, figs 2-4

Broader and larger alder leaves used to be assigned to *A. kefersteini*, an organ species now employed only for infructescences. Some of them belong to the above form, provisionally compared with the Oligocene *A. rostaniana* (type locality Manosque, France). They are not identical with this species, newly re-defined by Walther (1991). Our populations deviate in less numerous secondaries from all the so far known occurrences of *A. rostaniana*. They are typical of the sites of the interseam beds, e.g. at Skyřice (Humík and Z. Kvaček 1999), or in porcelainite at Dobříč. The associated infructescences (*Alnus* sp. 1-pl. 4, fig. 4) are of medium size. Although *Alnus* cf. *rostaniana* is similar to larger leaves of *A. julianiformis*, it differs in higher number of secondaries and cuticle structure (Humík and Z. Kvaček 1999). Already Buzek (1971 - as *Alnus* sp.) was aware of this peculiar alder, occurring also in the Pětipsy area.

*Alnus menzeli* RANIECKA-BOBROWSKA  
Text-fig. 3.14

*Alnus menzeli* RANIECKA-BOBROWSKA, 1954, p. 11, figs 11-13, text-fig. 4

*Alnus kefersteini* sensu Engelhardt, 1891, p. 156, pl. 4, figs 25-26  
*Carpinus granitis* sensu Engelhardt, 1891, p. 156, pl. 5, figs 8-9, pl. 6, figs 2-4  

*Fagus foresti* sensu Engelhardt, 1891, p. 158, pl. 5, fig. 10.

Another broad-leaved alder, but usually with coarsely double serrate margin and cordate leaf base is typically associated with long cylindric infructescences, which obviously belong to the same plant (see *Alnus* sp. 2 - pl. 4, fig. 5). It occurred in masses in the coal clay of the former mine Julius Fučík, Želénky (Z. Kvaček 1960) and also in the porcelainite of Želénky. Its cuticle structure is more similar to a birch (own observation) and also by its infructescences it deviates from the standard alders. It is found as a swampy element not only in the Most Basin, but also in some other lignite basins, namely in Poland (Raniecka-Bobrowska 1954, at Konin; Kownas 1955, as *Betula macrophylla* HEER, Dobrzn).
**Fig. 2.** *Phyllites juglandiformis* STERNBERG, Bilina - the re-figured original painting reproduced in Sternberg (1825, pl. 35, fig. 1), x 1.5.

### Carpinus L.

**Carpinus grandis** UNGER

*Text-fig. 5.15*

*Carpinus grandis* UNGER, 1850a, p. 408, pro parte; 1852, p. 39, pl. 20, fig. 4

*Carpinus heerii* ETTINGSHAUSEN, 1866, p. 48, pro parte, pl. 15, fig. 11

Hornbeam foliage is difficult to differentiate from *Ostrya* and some other Betulaceae. A finely double serrate margin and dense and straight secondaries are helpful criteria to trace this mostly riparian to mesophytic element. The foliage is in any case not determinable to species and hence *C. grandis* represents a typical morphotaxon. It is rare in porcelanite assemblages. The leaves interpreted as hornbeam by some earlier authors (e.g., Velenovský 1881) have been in most cases transferred to *Ulmus* (see Bůžek 1971).

### Myricaceae BLUME

**Myrica L.**

**Myrica lignitum** (UNGER) SAPORTA

*Pl. 5, fig. 3*

*Quercus lignitum* UNGER, 1847, p. 113, pl. 31, figs 5-7

*Myrica lignitum* (UNGER) SAPORTA, 1865, p. 102

The foliage belonging to *Myrica* is most easily determinable with the aid of cuticle structure (peltate trichomes with biserrate stalks). *Myrica lignitum* is the most common species in the European Tertiary, typically variable in the leaf margin (both entire and dentate forms). In the Most Basin, the occurrence of this species is limited to the mica and Břešťany clay facies. Hence it is extremely rare in porcelanite (e.g., Nechvalice).
Myrica cf. integrerrima KRÄUSEL et WEYLAND
Pl. 5, figs 1-2, text-fig. 1.19

Dryandroides laevis VELENOVSKY, 1881, p. 33, pl. 9, figs 17-22

Myrica integrerrima KRÄUSEL et WEYLAND, 1954, p. 128, pl. 17, figs 4, pl. 27, figs 4-7; Z. Kvaček, 1960, p. 25, pl. 4, fig. 1-3

Anatomically defined leaf taxa are difficult to apply to this impression material. The above designation is applied because M. integrerrima occurred commonly in the coal facies of the Most Basin, e.g., at Želenky and Bilina (Z. Kvaček 1960, own observation). This species matches well by entire leaves and dense venation some of the impressions in porcelanite. It should be noted that the population at Vrsovice has narrower leaves than the standard of the species. Better preserved compression material from the Upper Interseam Beds is needed to elucidate this problem. We hesitate to assign to this species also *Ficus archinevis* sensu Velenovsky (1881, pl. 4, figs 18-20) because of the lack of reticulate higher-order venation. The affinity to *Decodon* is more likely (see Appendix).

**Comptonia L’HÉRIT. ex AITON**

Comptonia difformis (STERNBERG) BERRY
Pl. 5, fig. 7

Asplenium difforme STERNBERG, 1822, p. 29, 33, pl. 24, fig. 1, nom. illegit.

Asplenopteris difformis STERNBERG, 1825, p. 21, pl. 24, fig. 1

Comptonia acutidoba BRONGIART, 1828, pp. 143, 209

Comptonia difformis (STERNBERG) BERRY, 1906, p. 495 ("difforme")

This very distinct foliage typically occurs in the Břešťany clay and "overlying clay" facies, rarely elsewhere within the Most Basin. It was rarely found in the porcelanite belonging to the Overlying Beds (Dolany, Nechvalice). The epithet "difformis" must be applied for the correct name for priority reasons (see J. Kvaček and Straková 1997).

**Juglandaceae A. RICH. ex KUNTH.**

*Carya* NUTT.

Carya cf. serrifolia (GÖPPERT) KRÄUSEL
Text-fig. 3.8

Quercus serrifolia GÖPPERT, 1855, p. 17, pl. 5, fig. 14 ("serraefolia")

Carya serrifolia (GÖPPERT) KRÄUSEL, 1921, p. 389, pl. 5, fig. 2

Pterocarya denticulata nct. (nom WEBER); Ettingshausen, 1869, p. 47, pl. 53, figs 11-15; Engelhardt, 1891, p. 193, pl. 17, fig. 15, 17

We follow Bůžek (1971) to assign this kind of the Juglandaceae leaflets to Carya, although the exact indentity with the typical specimens of *C. serrifolia* is not guaranteed. These leaflets may belong to the fruits of different kinds, e.g., *C. bohemica* BRABENEC, *C. costata* (C. PRESL ex UNGER) UNGER or some other species. They are rarely found in porcelanite sites as a typical riparian-mesophytic element.
Tiliaceae JUSS.

_Craugia_ W. W. SMITH et W. E. EVANS

_Craugia bronnni_ (UNGER) Z. KVAČEK, BŮŽEK et MANCHESTER

_Pl. 5, fig. 11, text-fig. 1.12_

_Ulmus bronnni_ UNGER, 1845, p. 79, pro parte, pl. 25, figs 2-4 (non fig. 1); Ettingshausen, 1866, p. 62, pro parte, pl. 18, figs 1-5

_Pteleocarpum bronnni_ (UNGER) WEYLAND, 1948, p. 130, pl. 21, fig. 5, text-figs 5-9

_Craugia bronnni_ (UNGER) Z. KVAČEK, BŮŽEK et MANCHESTER, 1991, p. 522

_Ulmus longifoliula_ auct. (non UNGER); Ettingshausen, 1866, p. 62, pro parte, pl. 18, fig. 8; Velenovský, 1881, p. 25, pro parte, pl. 3, figs 24-25

These very characteristic fruit remains were misinterpreted for elm samaras, and recently recognized as isolated detached valves of capsules (Bůžek et al. 1893 as _Pteleocarpum bronnni_ (UNG.) WEYL.). They match the fruits of an extant relictual genus _Craugia_, endemic to southern China (Z. Kvaček et al. 1991). This fossil plant occurs as an important accessory element in swamp and riparian assemblages of the Most Basin, and also in many porcelanite sites.

**Dombeypopsis UNG.**

_Dombeyopsis lobata_ UNGER

_Pl. 5, fig. 12, textfigs 1.17, 3.7_

_Dombeyopsis lobata_ UNGER, 1850a, p. 447

_Dombeyopsis sidaefolia_ UNGER, 1850a, p. 448

_Ficus dombeyopsis_ UNGER, 1860, p. 13, pro parte, pl. 5, figs 1-5 (non 6-7), pl. 6, fig. 1

_Cecropia heeria_ ETTINGSHAUSEN, 1866, p. 82, pl. 27, pl. 28, fig. 7

_Cecropia europaea_ ETTINGSHAUSEN, 1866, p. 82, pl. 28, fig. 1-2

_Ficus tileaefolia_ auct. (non (A. BRAUN) HEER); Unger, 1860, p. 14, pl. 6, fig. 2; Ettingshausen, 1866, p. 80, pl. 25, figs 4-5, 7, 10; Velenovský, 1881, p. 28, pl. 6, figs 1-4; Engelhardt, 1891, p. 162, pl. 7, fig. 9

These large trilobate to unlobed, mostly symmetrical, entire-marginated, rarely slightly toothed leaves with a long petiole and typical palmate venation are commonly associated with the above fruit remains. In some places, the foliage is accumulated in thin layers (e.g. at Želénky), suggesting that it was a deciduous woody element. The cuticle structure brought evidence of the affinity to the Malvales (Knobloch and Z. Kvaček 1976).

Unger (1850a, 1860) kept apart trilobate and non-lobate leaf forms, which he designated as _Dombeyopsis lobata_ (= _Ficus dombeyopsis_ UNGER, 1860, nom. superfl., pl. 6, fig. 1, TYPE BP 59.666 - Břežánky), and _Dombeyopsis sidaefolia_ (= _Ficus tileaefolia_ sensu Unger 1860, pl. 6, fig. 2, TYPE BP 64.300 - Břežánky) respectively. They represent a mere natural variation of the foliage and belong to the same plant as fruits of _Craugia bronnni_.

_Ulmaceae MIRB._

_Ulmus pyramidalis_ GÖPPERT

_Pl. 5, fig. 6, text-figs 4.4, 5.10_

_Ulmus pyramidalis_ GÖPPERT, 1855, p. 28, pl. 13, figs 10-12.

_Ulmus crassinervia_ ETTINGSHAUSEN, 1866, p. 63, pl. 18, figs 28-29.

_Ulmus longifoliula_ UNGER, 1845 (non RAFFINESQUE), pl. 26, figs 5-6; 1847, p. 101, pro parte; Ettingshausen, 1866, p. 62, pl. 18, figs 7, 9-10; Velenovský, 1881, p. 25, pro parte, pl. 4, figs 3-13; Engelhardt, 1891, p. 160, pl. 9, figs 14, 16-20.

_Carpinus grandis_ sensu Velenovský, 1881, p. 23, pl. 2, fig. 25, pl. 3, figs 1-5

Elm leaves of the longly ovate form, nearly symmetrical at the base, and partly with simple toothed margin have been often mistaken for hornbeam foliage (Heer 1859, Velenovský 1881), from which it can be differentiated by more distinct venation and the form of teeth. Contrary to opinions of other authors, we consider shorter and strongly asymmetrical forms occurring in the same layers (partly referred to _Zelkova_) as natural variation of the same species. Only one kind of elm samaras (_Ulmus sp._ - pl. 5, fig. 9) has been found in the association in the Most Basin, e.g., at Želénky and elsewhere (Bůžek 1971) and we do not hesitate to connect it with this foliage. Elms are typically connected with the alluvial sandy-clayey facies.

_Zelkova_ SPACH

_Zelkova_ zelkovifolia_ (UNGER) BŮŽEK et KOTLABA

_Text-fig. 4.12_

_Ulmus zelkovifolia_ UNGER, 1843, pl. 24, figs 9-13 (non fig. 7); 1845, pl. 26, fig. 7 (non 8); 1847, p. 94, pro parte ("zelkovifolia")

_Planera_ ungueri_ ETTINGSHAUSEN, 1851, p. 14, pl. 2, figs 5-14, 16 (non 15, 17-18); 1866, p. 65, pro parte, pl. 18, figs 17, 20; Velenovský, 1881, p. 26, pro parte, pl. 3, fig. 23 ("16")

_Zelkova_ ungueri_ (ETINGSHAUSEN) KOVATS, 1856, p. 27, pl. 5, figs 1-12, pls. 6, figs 1-6

_Zelkova_ zelkovifolia_ (UNGER) BŮŽEK et KOTLABA in KOTLABA, 1963, p. 59, pl. 3, figs 7-8 ("zelkovifolia")

Typical leaves of this species are coarsely simple toothed. Less convincing are records of finely toothed forms, unless they are attached to the twigs (deciduous, often fruiting ultimate shoots). Most finely toothed specimens interpreted as _Zelkova_ (and _Planera_) by some authors (Ettingshausen 1866, Velenovský 1881) are in fact short forms of _Ulmus pyramidalis_. True _Zelkova_ occurs extremely rarely in porcelanite sites (e.g., Vršovice), being more or less mesophytic.

_Rosaceae JUSS._

_Rosa_ L.

_Rosa europaea_ (ETINGSHAUSEN) comb. n.

_Pl. 6, figs 1, 9, textfigs 3.3, 4.8, 5.11, 5.14_

_Myrsine europaea_ ETTINGSHAUSEN, Denkricht, K. K. Akad. Wiss. math.-naturwiss. Cl. 28. 1868, p. 225, pl. 37, fig. 22 (basionym)

_Quercus pseudo-ulmus_ ETTINGSHAUSEN, 1866, p. 60, pro parte, pl. 17, fig. 6
Leaflets of roses are not difficult to recognize by dense venation and characteristic simple fine serration. Sometimes they are still partly attached to the leaf rachis. Previous records from the Most Basin have been usually referred to as *Rosa bohonica* ENGELHARDT (Bůžek 1971) or *Rosa* ligustum HEER (Bůžek et al. 1992), but the basionym *Myrsine europaea* has priority over the mentioned names. The type specimen (BA 6043) is fragmentary, with hardly visible venation, but its affinity to roses is certain because of the typical form and dentation of the lamina. Of course, the foliage of roses is not characteristic enough to allow discrimination at the species level. Thus *Rosa europaea* suggested above must be taken as a morphotaxon, unless more complete material including fruits is available.

**Rubus L.**

*Rubus merianii* (HEER) KOLAKOVSKIJ

*Rubus merianii* HEER, 1859, p. 82, pl. 126, figs 5-11; Sieber, 1881, p. 24, pl. 5, figs 39-40; Velenovsky, 1881, p. 44, pro parte, pl. 7, figs 16-20; Engelhardt, 1891, p. 193, pl. 14, figs 16, 18, 20, 22-23, pl. 15, figs 1, 3, 8-9, 11, 17

*Rubus merianii* (HEER) KOLAKOVSKIJ, 1964, p. 131

*Rubus quercifolia* sensu Engelhardt, 1891, p. 193, pl. 18, fig. 23

*Rubus longifolius* sensu Engelhardt, 1891, p. 187, pl. 10, fig. 17

Blackberries are common plants in swamps of the North Bohemian Tertiary, as documented by fruitlets, and mainly the foliage. *R. merianii* has narrow leaflets, which may bear an additional asymmetrical lobe. In calm sedimentary conditions, complete compound leaves may remain preserved, e.g. in the Bilina Mine (Sakala 2000, this volume) or Zelénky (coll. Charles University). Zelenky is the site with the richest occurrence of this plant. Fruitlets (pl. 6, fig. 7) are commonly associated there and may aid to resolve its affinities. Similar compressions are known from the coal facies of the basin (Bůžek and Holý 1964, as *Rubus* sp. div.). Some prickle twigs (pl. 6, fig. 6) may also belong to this blackberry. In view of complicated taxonomy of extant *Rubus*, we do not attempt to discuss systematic affinities without looking at the compression material.

**Rubus vrsovicensis** nom. n.

*Rubus vrsovicensis* nom. n.

*Rubus vrsovicensis* nom. n.

*Rubus elegans* VELENOVSKÝ, 1881 Abb. K. Böhm. Gesell Wiss. math. nat. Cl. VI. 11. p. 45, pl. 10, figs 5-11 (non AIT.), nom. illegit (basionym)

*Rubus merianii* sensu Velenovsky, 1881, p. 44, pro parte, pl. 8, fig. 27, pl. 10, fig. 12

Lectotype: NM G 1891 (pl. 6, fig. 8)

At Vršovice, rarely elsewhere (Dobrčice, Zelénky) a broad-leaved blackberry occurs. Its leaflets are sometimes revolute at margin and seem to be entire. A pronounced asymmetry and the prominent venation are suggestive of compound leaves of *Rubus*. Compression specimens of the same species were recovered in the coal clay in the Bilina Mine (Sakala 2000, this volume). Similar, but coarsely toothed leaflets of *Rubus* were misinterpreted for leaves of *Corylus* by Bůžek (1971, as cf. *Corylus insignis* HEER) in the Pětipasy area.

The epitheton "elegans" cannot be used in a new combination with *Rubus*, because *Rubus elegans* VELENOVSKÝ is an illegitimate later homonym, and the combination is pre-occupied by *Rubus elegans* P. J. MUELL.

**Lythraceae J. ST. HILL.**

**Decodon J. F. GMEL.**

*Decodon gibbosus* (E. M. REID) E. M. REID in NIKITIN

*Decodon gibbosus* (E. M. REID) E. M. REID in NIKITIN, 1929, p. 82, pl. 4, figs 23, 25, text-fig. 1 left

*Decodon gibbosus* (E. M. REID) E. M. REID in NIKITIN, 1929, p. 37, pl. 5, figs 8-9; Z. Kvaček and Sakala, 1999, p. 202, pls. 1-2, pl. 3, figs 1-5, pl. 4, figs 1-6, text-fig. 1-3

*Ficus multinervis* auct. (non HEER); Ettingshausen, 1866, p. 68, pl. 20, figs 5-6; Bůžek, 1971, p. 94, pl. 48, figs 5-8

*Ficus arctinervis* sensu Velenovsky, 1881, p. 28, pl. 4, figs 18-20

*Salix angusta* sensu Engelhardt, 1891, p. 164, pl. 10, fig. 16

*Decodon* sp. (non HEER) ; Ettingshausen, 1866, p. 68, pl. 20, figs 5-6; Bůžek, 1971, p. 94, pl. 48, figs 5-8

*Ficus arctinervis* sensu Velenovsky, 1881, p. 28, pl. 4, figs 18-20

*Salix angusta* sensu Engelhardt, 1891, p. 164, pl. 10, fig. 16

*Decodon* sp. (non HEER) ; Ettingshausen, 1866, p. 68, pl. 20, figs 5-6; Bůžek, 1971, p. 94, pl. 48, figs 5-8

*Ficus arctinervis* sensu Velenovsky, 1881, p. 28, pl. 4, figs 18-20

*Salix angusta* sensu Engelhardt, 1891, p. 164, pl. 10, fig. 16

*Decodon* sp. (non HEER) ; Ettingshausen, 1866, p. 68, pl. 20, figs 5-6; Bůžek, 1971, p. 94, pl. 48, figs 5-8

*Ficus arctinervis* sensu Velenovsky, 1881, p. 28, pl. 4, figs 18-20

*Salix angusta* sensu Engelhardt, 1891, p. 164, pl. 10, fig. 16

A recent study of the compression material from the Bilina Mine (Z. Kvaček and Sakala 1999) has shown that the leaves of the "*Ficus multinervis*" type, which are fairly common in alluvial and swampy facies of the Most Basin, belong in fact to the genus *Decodon*, today monotypic, endemic to North America. Although we were unable to trace molds of *Decodon* seeds in porcelanite, leaves with typical dense secondaries and an intramarginal vein occur sporadically in layers with monocots, e.g., at Zelénky and Světec. Due to delicate nature of the foliage, the venation is sometimes hardly visible and the identification doubtful.

**Leguminosae JUSS.**

**Leguminosites BOWERBANK**

**Leguminosites tobischii** ENGELHARDT

*Leguminosites tobischii* ENGELHARDT, 1891, p. 198, pl. 18, figs 19-20

*Acacia beneschii* BRABENC, 1904, p. 16, pl. 1, fig. 5

The pods described under the above names were found only once in the porcelanite at Zelénky and occur only very rarely elsewhere (Bůžek 1971). They belong to the moniliform type (strongly constricted between seeds). Such fruits are more frequent among Papilionoideae, namely in *Sophora* L., *e.g.*, *S. japonica* L. (Herendeen 1992 b).
Leguminosites spp. (foliola)
Pl. 7, figs 2-4

Several leaflets, either emarginate or acuminate have been rarely noticed among the studied material. They undoubtedly belong to some of the large group of Leguminosae because of the form and venation. Their closer determination is out of the question on the basis of available characters.

Podocarpium A. BR.

Podocarpium podocarpum (A. BRAUN) HERENDEEN
Pl. 7, fig. 5

Gleditschia podocarpa A. BRAUN (in BUCKLAND 1836, p. 513, nom. nud.); 1845, p. 173
Podocarpium knorrii A. BRAUN in STIZENBERGER, 1851, p. 90
Podogonium knorrii (A. BRAUN) HEER, 1859, p. 114, pl. 134, figs 22-26a, pl. 135 (except fig. 19), pl. 136, figs 1-9 (nom. Velenovsky 1881)
Podogonium lyellionum (HEER) HANTKE in GREGOR et HANTKE, 1980, p. 167
Gleditsia lyelliana (HEER) GREGOR in GREGOR et HANTKE, 1980, comb. illegit., p. 166
Gleditsia lyelliana (HEER) HANTKE in GREGOR et HANTKE, 1980, p. 167
Podocarpium podocarpum (A. BR.) HERENDEEN, 1992c, p. 731-736

According to the recent revision of this plant (Herendeen 1992 a, c), it represents an extint legume related to the African representatives of Caesalpinioideae, trib. Detarieae or Amherstieae. Podocarpium occurs in the Most Basin mostly in sandy-clayey facies (Bůžek 1971) as a typical mesophytic element. Its meagre remains, namely leaflets, have been recorded in the baked rocks at Zelénky and Mirosovice. Inspection of the specimens from Vrsovice (Velenovsky 1881) revealed that the fruits are in fact fragmentary maple samaras and the leaflets represent indeterminable fragments (see Appendix).

Aceraceae JUSS.

Acer L.

Acer tricuspidatum BRONN emend. WALThER
Text-figs 1.11, 1.10
Acer tricuspidatum BRONN, 1838, p. 865, pl. 25, figs 10 a, b; Walther, 1968, p. 636, pls 1-2; Procházká et Bůžek, 1975, p. 24, pls 22-24, text-figs 2, 3, 4, 5-13
Acer trifloratum A. BRAUN, 1845, p. 172; Velenovsky 1881, p. 37, pl. 7, figs 1-2, pl. 8, fig. 26, pl. 9, figs 2-4; Engelhardt, 1891, p. 182, pl. 11, figs 10-11, 13, 18-19, 21-23, 26-27, pl. 12, figs 15-17, pl. 13, fig. 24
Acer magnum Velenovsky, 1881, p. 38, pl. 17, figs 7-9; Engelhardt, p. 182, pl. 12, figs 12-13

This is a most common maple, usually connected with swamp facies. The full synonymy is included in the monograph by Procházká and Bůžek (1975). Their treatment of this variable species is followed also here. The porcelanite sites are not very rich in maple leaves except perhaps for Zelénky, where they cover some particular layers. Rare maple fruits accompany the foliage (e.g., Velenovsky 1881, pl. 7, fig. 3), yet the correlation to the species based on leaves is uncertain.

Acer dasycarpoideas HEER emend. PROCHÁZKA et BUZEK
Text-fig. 5.8
Acer dasycarpoideas HEER, 1859, p. 198, pl. 114, figs 3, 9, pl. 115, fig. 6, pl. 155, figs 6-8; Ettingshausen 1869, p. 19, pl. 44, figs 16-17; Procházká and Bůžek, 1975, p. 25, pl. 21, figs 6-10, text-figs 4a-c, 14-15
Acer angustilobum HEER, 1859, p. 57, pl. 117, fig. 25a, pl. 118, figs 4-7; Sicher, 1881, p. 84, pl. 12, fig. 13; Engelhardt, 1891, p. 180, pl. 14, fig. 2-3
Acer ruematinum HEER, 1859, p. 59, pl. 118, figs 11-13; Ettingshausen, 1869, p. 23, pro parte, pl. 46, fig. 9 (non 8); Engelhardt, 1891, p. 181, pl. 14, fig. 16

Maple leaves of the European Tertiary with narrow dentate lobes are sometimes split in more species. Walther (1972) attempted to support this interpretation by differences in cuticle structure (A. haselbachense WALThER, A. engelhardtii WALThER and A. angustilobum HEER with the papillate underside vs. A. ruematinum HEER without papillae). In our case the lack of anatomical details prevents us to adhere to his system. Therefore a more or less artificial species A. dasycarpoideas is applied for the scanty material from the porcelainite occurrences. Maples of this group occur mostly in alluvial facies and silty-sandy baked rocks (e.g., Zabrůšany).

Acer integerrimum (VIVIANI) MASSALONGO
Text-fig. 4.14
Acerites integerrimus VIVIANI, 1833, p. 131, pl. 11, fig. 6
Acer integerrimum (VIVIANI) MASSALONGO, 1858, p. 94; Procházká and Bůžek, 1975, p. 15, text-fig. 1 a-b
Acer nervatum Velenovsky, 1881, p. 39, pl. 7, figs 5-6

This type of maple leaf is characterized by entire acuminate to cuspidate lobes. It occurs in general infrequently in the Most Basin, usually in the alluvial facies, in baked rocks only rarely (Vršovice).

Rutaceae JUSS.

Todalia JUSS.

Todalia maii GREGOR
Pl. 7, figs 6-7
Todalia maii GREGOR, 1975, p. 125, text-fig. 5; 1979, p. 323, 338-339, text-figs 22, 36-37
cf. Citrus latifolia a sensu Bůžek et Holý, 1964, p. 120, pl. 6, fig. 5, text-figs 2/9a-c

Accumulations of typical reniform seeds belonging to Todalia, a tropical-subtropical liana, have been recently found by Z. Dvořák in the baked rocks at Zelénky and Dobřice. The compression material of this plant, allowing a more precise identification, comes from mica-sandy facies of the Krušné hory piedmonts, less frequently in the Bílina delta (Z. Kvaček and Bůžek 1982)

Rhamnaceae JUSS.

Paliurus MILL.

Paliurus iliaefolius (UNGER) BUZEK
Pl. 7, fig. 10, text-figs 3.15, 4.3, 5.7
Ceanothus tiliaefolius UNGER, 1847, p. 143, pl. 49, figs 1-6
Zizyphus tiliaefolius (UNGER) HEER, 1859, p. 75, pl. 123, figs 1-7; Ettingshausen, 1869, p. 39, pl. 50, figs 8, 14-15, 17-18; Velenovsky 1881, p. 41, pl. 8, figs 22-23; Engelhardt, 1891, p. 189, pl. 13, figs 6-16
Cinnamomum subrotundum sensu Engelhardt, 1891, p. 168, pl. 8, fig. 7
Paliurus tiliaefolius (UNGER) BŮZEK, 1971, p. 74, pro parte (fruct. excld.), pl. 33, figs 1-3, 5, 8, 14 right, pl. 34, figs 1-17

Characteristically broad ovate to cordate trivedine leaves of *P. tiliaefolius* recall (and can be mistaken for) *Cercidiphyllum* and cinnamonoid forms (Engelhardt 1891). They are common in the alluvial sandy facies, less frequent in the coal clay (Sakala 2000, this volume). Thorny twigs occurring in the association (Engelhardt 1891, pl. 13, figs 11, 13-14) may belong to the same plant. The fruits, which afforded the main argument for the change of systematic position, have not been found so far in the natural connection, and according to the current palaeobotanical practice, they must be treated as a separate entity. The richest occurrences of *P. tiliaefolius* in baked rocks is Želénky.

**Paliurus favonii** UNGER
Pl. 7, fig. 9, text-fig. 5.6

*Paliurus favonii* UNGER, 1847, p. 147, pl. 50, figs 7-8; Ettingshausen, 1869, p. 39, pl. 50, figs 6-7
*Paliurus fructif* BRABENEC, 1904, p. 18, pl. 1, fig. 11a
*Paliurus tiliaefolius* (UNGER) BŮZEK, 1971, p. 74, pro parte (fol. excld.), pl. 33, figs 4, 6-7, 9-21

"Trilocular fruits of *Paliurus* with a circular wing in the equatorial position occur regularly in association with the leaves. As found by Manchester (personal communication in 1999) they were mistaken for similar but trilocular nuts of *Cyclocarya* by Bůžek et al. (1992, Z. Kvaček 1998). Hence the latter genus must be excluded from the floral list of the Most Basin. The fruits of *Paliurus* prevail in the alluvial facies of the Záteč and Bílina delta, they are rare in baked rocks (e.g., at Želénky).

**Berchemia** NECK. ex DC.

**Berchemia multinervis** (A. BRAUN) HEER
Pl. 7, fig. 8, text-figs 4.9, 5.5

*Rhamna multinervis* A. BRAUN in BUCKLAND, 1836, p. 513
*Berchemia multinervis* (A. BRAUN) HEER, 1859, p. 77, pl. 128, figs 9-18; Velenovsky 1881, p. 42, pl. 4, figs 26-27; ? Engelhardt, 1891, p. 188, pl. 12, figs 2, 19-28; Bůžek 1971, p. 73, pl. 32, figs 12-15, pl. 33, figs 22-23
*Quercus pseudo-burana* ETTINGHAUSEN, 1866, p. 60, pro parte, pl. 17, fig. 13

These elliptic rhamnoid leaves with delicate and dense tertiary veins are generally assigned to the genus *Berchemia*, and compared with *B. scabdens* (HILL) K. KOCH, a liana growing in swamps of SE USA. They occur also but rarely in the coal clay facies (Sakala 2000, this volume), more frequently in alluvial deposits of the Záteč and Bílina deltas. The records in baked rocks are exceptional (e.g., Zabrušany, Vršovice).

**Vitaceae JUSS.**

? *Vitis* L. var *Ampelopsis* MICHT.

cf. *Vitis* var *Ampelopsis* sp.
Pl. 7, fig. 12

*Ciclophelis recurvi* ENGELHARDT, 1891, p. 171, pl. 7, fig. 9
*Diochenioides ovalis* ENGELHARDT, 1891, p. 171, pl. 7, fig. 20

Molds of seeds recalling the Vitaceae have been rarely found in several sites of porcelanite. Their attribution to a particular genus or species is doubtful due to poor preservation. Seed compressions of *Vitis teutonica* A. BRAUN have been safely documented from the Most and Chomutov parts of the basin (Bůžek and Holý 1964).

? *Ampelopsis* MICHT.

cf. *Ampelopsis* sp.
Pl. 7, fig. 11

A single poorly preserved leaf impression from Světce matches a previously reported leaf form from the Pětípky area (Bůžek 1971, as cf. *Ampelopsis* sp.). The affinity to the Vitaceae is probable in view of the dentation and large size of the specimens.

**Cornaceae** (DUMORT.) DUMORT.

*Nyssa* GRONOV ex L.

*Nyssa haidingeri* (ETTINGHAUSEN) Z. KVAČEK et BŮZEK
Pl. 8, fig. 1, text-figs 1.3, 3.18

*Laurea haidingeri* ETTINGHAUSEN, 1866, p. 174, pl. 30, figs 5, 8-9
*Bomox longifolium* ETTINGHAUSEN, 1869, p. 12, pl. 42, figs 8-9; Engelhardt, 1891, p. 178, pl. 13, figs 14-16
*Nyssa haidingeri* (ETTINGHAUSEN) Z. KVAČEK et BŮZEK, 1972, p. 373, pl. 1, figs 1-2, 3, figs 1-3, pl. 4, figs 1-5, text-figs 1-2
*Persica speciosa* sensu Ettingshausen, 1868, p. 197, pl. 32, figs 15-16
*Velenovsky, 1881, p. 32, pro parte, pl. 6, fig. 6
*Corchona sp. sensu* Velenovsky 1881, p. 98, pl. 6, figs 17-18
*Apelopis desclousi* (?) sensu Engelhardt, 1891, p. 179, pl. 10, fig. 19
*Juglans acuminata* sensu Engelhardt, 1891, p. 192, pro parte, pl. 15, fig. 7

Large, mostly entire-margined leaves, recognized by Z. Kvaček and Bůžek (1972) on the basis of leaf anatomy as the foliage of *Nyssa*, are spread in coal clay facies over the whole Most Basin (Z. Kvaček and Bůžek 1982). It is more difficult to recognize this species in impression material, such as occurs in baked rocks, which is often fragmentary due to the large size of the foliage. Associated *Nyssa* endocarps are helpful. Another distinguishing character from a similar *Laurophyllum saxonicum* is fairly dense secondary venation diverging in the lower part of the blade at wider angles. Even then the determination of many specimens is uncertain.

*Nyssa* sp.
Text-fig. 1.7

*Nyssa verticillata* sensu Velenovsky, 1881, p. 37, pl. 6, figs 20-24
Echitonioum ssp. sensu Engelhardt, 1891, pl. 7, fig. 19
Nyssa disseminata sensu Büzek and Holy, p. 123, pl. 6, figs 6-9
Nyssa sp. sensu Büzek, 1971, pl. 48, fig. 10; Z. Kvaček and Büzek, 1972, pl. 37, pl. 2, figs 3-9, pl. 3, figs 4-8

Flattened Nyssa endocarps have been commonly found in coal and coal clay strata of the Most Basin, unfortunately in poor state of preservation. Z. Kvaček and Büzek (1972) were unable to decide which species they actually belong. They are certainly different from the record of the Middle Miocene Salzhausen site, which yielded another kind of foliage (mostly toothed leaves with the striate-papillate underside). The molds of endocarps from baked rocks (Vršovice, Zelénky) are still less suitable to decide this question.

**Oleaceae** Hoffmanns et Link

**Fraxinus L.**

**Fraxinus bilinica** (Unger) comb. n.

Pl. 8, figs 7-8, text-figs 4.2, 4.7

Juglans bilinica Unger, 1849, Naturwiss. Abh. 3(6), p. 126, pro parte (non pl. 14, fig. 20) (basionym); Unger, 1850a, p. 469, pro parte (syn. excl.); Engelhardt, 1891, p. 192, pro parte, pl. 18, fig. 4

Carya bilinica (Unger) Ettingshausen, 1852, pl. 12 (non pl. 2, fig. 17). Unger, 1850, p. 39, pro parte, pl. 17, figs 1-8 (non 9-10); Ettingshausen, 1859, p. 46, pro parte, pl. 51, figs 6, 13-15, (non fructus figs 9-10), pl. 52, figs 4, 7-11 (non fig. 3); Velenovsky, 1881, p. 44, pro parte, pl. 8, figs 1, 3 (non pl. 9, fig. 16)

Carya ungeri Ettingshausen ex Unger, 1860, p. 40, pl. 18, figs 1-4

? Fraxinus ungeri (Gaudin) Knobloch et Z. Kvaček, 1976, p. 63, de typo solo (non Lesquereux)

Fraxinus lonchoptera Ettingshausen, 1868, p. 25, pro parte, pl. 36, fig. 22 (non fructus figs 11-12)

Quercus laurifolia sensu Ettingshausen, 1866, p. 60, pl. 17, fig. 1

Juglans juglandiformis auct. (non Sternberge) Giebel; Bůzek, 1971, p. 44, pl. 11, figs 4-7, pl. 23, fig. 1

Lectotype: BP 55.2252 (Unger, 1860, pl. 17, fig. 7)

Paratypotype: BA 6215 (Unger, 1860, pl. 17, fig. 2)

Leafflets of ash have been previously misinterpreted for the Juglandacea, in spite of the fact that ash samaras occur often in association. The above list of synonyms is certainly incomplete as the venation of the foliage is often not well visible, particularly in baked rocks, due to tough texture of the lamina. Thus the determination of such specimens is uncertain. Small peltate trichomes and their characteristic basess preserved in compression material in the Bilina Mine corroborate the affinity to Fraxinus (Sakala 2000, this volume). Ash foliage is a regular component of leaf assemblages from coal clay as well as alluvial facies.

We consider the treatment of Juglans bilinica Unger by Iljinskaja (1964) and Knobloch and Z. Kvaček (1976) not fully correct. Although this species was first published in connection with the flora of Swoszowice, Unger (1849) based the diagnosis of his Juglans bilinica (repeated also in Unger 1850a and 1860) beyond any doubt on the material from Bilina, as it follows also from the epithet and the discrepancy between the diagnosis ("J. foliolis...ovato-oblongis v. ovato-lanceolatis") and the figured elliptical leaflet from Swoszowice (Unger 1849, pl. 14, fig. 20). Unger admitted only that this specimen from Swoszowice corresponds with *J. bilinica*. The species concept suggested by us above, i.e. with the type from Bilina, was in current use of most earlier authors till Iljinskaja's (1964) misleading re-interpretation. Hence we re-typefy the name Juglans bilinica by the specimens from Bilina (contrary to the opinion of Iljinskaja 1964), and we exclude this species from the synonyms of *Pterocarya paradoxica* (Unger) Iljinskaja. Phyllites juglandiformis Sterngberg, included as a synonym of *J. bilinica* by Unger (1850a), and others, differs from it, as far as can be assumed from the original painting of the missing holotype (text-fig. 2), by craspedodromus venation and fewer secondaries (see Knobloch and Z. Kvaček 1976). Fraxinus ungeri (Gaudin) Knobloch et Z. Kvaček is based on the specimen from the Late Neogene of Toscana and its identity with Fraxinus bilinica in our sense is not guaranteed, and not even probable. Moreover, the combination is illegitimate, being a later homonym of Fraxinus ungeri Lesquereux (S. G. Zilin, personal communication). A broader cuticular and carpological study of ash populations in the European Tertiary is needed to clarify their relationship.

**Fraxinus macroptera** Ettingshausen

Pl. 8, fig. 2

Fraxinus primigenia Unger, 1850a, p. 431, pro parte; 1860, p. 22, pro parte, pl. 8, fig. 2 (non figs 1, 3-8)

Fraxinus macroptera Ettingshausen, 1868, p. 213, pro parte, pl. 36, fig. 10 (non 9)

Fraxinus lonchoptera Ettingshausen, 1868, p. 213, pro parte, pl. 36, figs 11-12 (non 22)

Ash samaras occurring in association with the above foliage belongs undoubtedly to the same plant. The records from the porcelanite sites are extremely rare (e.g., Zelénky).

**Dicotyledonae** inc. fam. and gen.

**"Ficus" truncata** Heer

Pl. 8, fig. 10, text-figs 4.15, 5.17

Ficus truncata Heer, 1859, p. 183, pl. 152, fig. 15; Velenovsky 1881, p. 29, pl. 6, fig. 5; Bůzek, 1971, p. 92, pl. 466, figs 1-9, pl. 47, figs 1-8, pl. 48, figs 1-4; text-figs 15 a-f

Ficus titanum Ettingshausen, 1866, p. 77, pl. 22, fig. 12; Engelhardt, 1891, p. 163, pl. 10, fig. 17.

A very characteristic, but still enigmatic leaf form is spread in the Most Basin in sandy facies of the Žatec and Bilina deltas. The strictly symmetric blade base varies from cuneate to cordate, as was first demonstrated on the rich material from the former mine Julius Fučík at Zelénky (Z. Kvaček 1960). Another characteristic feature is an inconspicuous pulvinus just below the lamina base on the petiole (Bůzek 1971, pl. 46, fig. 8, pl. 48, fig. 3). Compression specimens are needed to obtain information on the epidermal structure, which would aid in resolving the systematic affinities. Deeply cordate forms of "Ficus" truncata are sometimes similar to non-lobate leaves of Dombeypoias lobata, which differs in a more regular pattern of a "spider-net" type of venation. Only very few records of this element come from baked rocks (Vršovice, Zelénky/ Zábřšany, Dobřeč).
"Juglans" acuminata A. BRAUN ex UNGER
Pl. 8, fig. 3, pl. 9, figs 8-9

Juglans acuminata A. BRAUN ex UNGER, 1850a, p. 468; Ettingshausen 1869, p. 45, pl. 12; Velenovsky, 1881, p. 44, pro parte, pl. 8, figs 2, 6; Bůžek, 1971, p. 42, pl. 9, figs 9-15, pl. 10, figs 1-6, pl. 11, figs 1-3, text-figs 3a-f.

Juglans parschugiana sensu Ettingshausen 1869, p. 46, pl. 51, figs 7-10

Such entire-margined leaflets assigned previously to the Juglandaceae differ from the only possible match, "Juglans regia" L., and have been recently compared with another tree with markedly asymmetric base and regular dense secondary venation of leaflets - Cedrela P. BR. of the family Meliaceae (e.g., Andreanszky 1955, Z. Kvaček and Hably 1991, as Cedrela macrophylla ANDREÁNSZKY, Palamarèv and Petkova 1987, as Cedrela attica (UNGER) PALAMAREV et PETKOVA). Yet evidence from epidermal structure is still lacking and characteristic seeds of Cedrela (see Meyer and Manchester 1997) have not been found associated with this foliage in the European Tertiary. The fragmentary specimens of Nyssa or Lauraceae have often been mis-identified as "Juglans acuminata" (see Appendix), which in its typical leaflet form was rarely encountered in baked rocks.

"Viburnum" atlanticum ETTINGSHAUSEN
Text-fig. 3.11

"Viburnum" atlanticum ETTINGSHAUSEN, 1868, p. 209, pl. 36, fig. 2; Engelhardt, 1891, p. 172, pl. 8, figs 15-16; Bůžek, 1971, p. 96, pro parte, pl. 49, figs 1-10, 12.

The leaves in question are bluntly irregularly dentate, often with a gland on the tooth. Poorly preserved cuticle structure (Z. Kvaček, own observation) suggests a probable affinity to the Theaceae. This plant is again a more or less mesophytic element, connected with the riparian forests of alluvial plains and levees. Its occurrence in baked rocks is very limited.

Dicotylyphllum SAPORTA

Dicotylyphllum spp.
Pl. 9, figs 1-7, text-fig. 1.21

A considerable part of the so far recovered, and partly described plants from the baked rocks belong to uncertain entities, mostly indeterminable because of poor preservation or merely because they do not show diagnostic characters. They are quoted in the appendix and some of them are reproduced here for illustration to show diversity of the assemblages. Only a few are of more interest. One of them is a single fragmentary specimen, described as Paulinia fucinervis VELENOVSKY (1881) from Vršovice (pl. 9, fig. 1). The enlarged picture shows crenulate margin and cordate base. We cannot rule out an affinity to Rosa europaea. Another single leaf impression from Světka (pl. 9, fig. 2) is noteworthy because of broadly spatulate blade, and five primaries running from the petiole. Such leaves used to be interpreted as Viscaceae or Loranthaceae. In cases of leaves with entire margin (pl. 9, figs 3-9, text-fig. 1.21) we are mostly at a loss to decide their affinities.

Carpolithes STERNBERG

Carpolithes spp.
Pl. 8, figs 4-6, 9

Pramus denticulata VELENOVSKY, 1881, p. 47, pl. 7, fig. 19; Curen sp. sensu Velenovsky, 1881, p. 18, pl. 1, figs 36-38; Pianera angesi sensu Velenovsky, 1881, p. 26, pro parte, pl. 3, fig. 18; Fructus div. sensu Velenovsky, 1881, p. 49, pl. 7, fig. 21, pl. 9, figs 7, 26-27.

Molds of seeds and endocarps are not attractive objects for collecting in baked rocks and have often been neglected. Only Velenovsky (1881) noticed and illustrated a considerable number. Some characteristic fruit and seed remains are treated in the above described material. The rest represent mainly indeterminable fossils, which may be deciphered only by experienced carpologists. One sort - fructus sensu Velenovsky (1881, p. 9, fig. 7) seems to be a trilocular endocarp of spherical form recalling Symlocos satzhausensis (LUDWIG) KIRCHH. This species is known e.g., from Brandis in Saxony (Maier and Walther 1991), i.e. from the levels equivalent to the Most Formation. Similar objects have been found among the material from Světka. Unfortunately, the late Č. Bůžek was unable to finish his carpological studies in the European Basin and we lack comparable compression material. In the first account (Bůžek and Holý 1964) no similar type of endocarps has been mentioned. There will certainly be considerably more carpological material in the collections which we overlooked or set aside for further studies for specialists in carpology. A calyx-like inflorescence found at Dobřečice (pl. 8, fig. 9) is indeterminable, because of lack of pollen in situ.

Hydrocharitaceae JUSS.

Hydrochariphylum Z.KVAČEK

Hydrochariphylum miocenicum (VELENOVSKY) comb. n.
Pl. 10, figs 1-4

Podocamites miocenicus VELENOVSKY, 1881, Abh. K. böh. Ges. Wiss. VI, p. 13, pl. 1, figs 18-20 ("miocenicus") (basionym)

Lectotype: NM G 1845 (pl. 10, fig. 1)

A detailed study of the type specimens from Vršovice revealed fine parallel veins throughout the lamina. There are no cross veins and very indistinct differentiation of parallel primaries in their thickness. The leaf lamina was probably thin, not leaving a deep impression in the baked rock. Thus the original interpretation by Velenovsky (1881) as the foliage of a Gymnosperm is highly improbable. On the other hand, such rounded - elliptical shapes are common among some aquatic monocots. The remains of Hydrochariphylum bueckii Z. Kvaček, recently described from the Bilina Mine (Z. Kvaček 1995a), show various preservation modes of the venation. Many specimens of this plant have indistinctly preserved cross-veins, and longitudinal veins are expressed as fine striation - like in Podocamites miocenicus. Although the genus Hydrochariphylum was created originally for suborbicular leaf forms, broadly elliptical can be accepted as an extreme variant. Among the extant Hydrocharitaceae, such variation is common (e.g., in Limnobium RICH., Ottelia PERSUNO). We do not attempt to match these rare fossils with a particular...
extant genus, but believe that our interpretation fits better with the associated flora.

**Hydrochariphyllum buzekii** Z. KVAČEK
Pl. 10, fig. 5

Hydrochariphyllum buzekii Z. KVAČEK, 1995, p. 23, pls 1-2, text-fig. 1

Only three slabs (an impression and its counterimpression, and another fragment) from Želénky with a few leaves of this plant have been recovered during many years of collecting at this site (coll. Z. Dvorák 1990). Contrary to (Holy and et al. 1971) discussed in detail the occurrences of Buzek 1-3 Velenovsky, 1881, p. 19, pl. 2, figs 18-20 et WEYLAND 1971) and newly KRAuSEL KRAuSEL extant genus, but believe that our interpretation fits better with the associated flora. This aquatic plant is widely spread in standing waters of the southeastern and eastern USA (Cook and Urmi-König 1983).

**Smilacaceae VENT.**

**Smilax L.**

**Smilax weberi** WESSEL in WESSEL et WEBER
Pl. 10, fig. 6, text-figs 1.4, 3.13

Smilax grandifolia (UNGER) HEER, 1855, p. 82, pl. 30, fig. 8 (non BUCKLAND); Velenovsky, 1881, p. 19, pl. 2, figs 18-20 Smilax weberi WESSEL in WESSEL et WEBER, 1855, p. 127, pl. 21, fig. 1

Smilax convallium sensu Velenovsky, 1881, p. 20, pl. 2, figs 21-23 Cinnamomum buchii sensu Engelhardt, 1891, p. 167, pl. 8, fig. 5

Bůžek (1971) discussed in detail the occurrences of Smilax in the Most Basin. He suggests that large and rounded forms and smaller and slender (S. convallium HEER) belong to the same plant and express only variation in leaf morphology. Such a variation is commonly developed in extant representatives of this genus.

**Zingiberaceae LINDL.**

**Spirematospermum** CHANDLER

Spirematospermum wetzleri (HEER) CHANDLER

Gardensia wetzleri HEER, 1859, p. 192, pl. 141, figs 81-103.

Spirematospermum wetzleri (HEER) CHANDLER, 1925, p. 17, pl. 1, figs 8-10.

Seeds with typical spiral striation on the surface have been reported from coke coal of Čermničky (Bůžek 1971) and newly recovered also from Černodol (coll. S. Hurník). Objects similar to the seeds of Spirematospermum were identified as Corpolithes striatus ENGELHARDT (1891, pl. 15, fig. 27) from Želénky. The pictures are too imperfect, and the actual specimens are missing to allow a serious revision.

? Zingiberoideophyllum KRÄUSEL et WEYLAND
cf. Zingiberoideophyllum liblarense KRÄUSEL et WEYLAND
Pl. 12, fig. 3, text-fig. 1.8

? Zingiberoideophyllum liblarense KRÄUSEL et WEYLAND, 1954, p. 120, pl. 23, figs 1-4

Musa bilinea sensu Velenovsky, 1881, p. 21, pl. 2, figs 16-17.

Large multiveined leaves, where the parallel venation runs from a medial costa are typical of the monocots allied to Zingiberales. They may achieve a considerable size and thus the fragments look as ordinary strap-like foliage. Such fragments were recognized as belonging to the Zingiberaceae on the basis of leaf anatomy by Kräusel and Weyland (1954). The same structure was found in similar, but much more complete fossils in the coal facies within the Most Basin, mostly in association with the fruits and seeds of Spirematospermum wetzleri (own observation). Therefore, we do not hesitate to consider similar leaf impressions as belonging to the same plant. Leaf impressions of this sort, but without any anatomical evidence were referred to as Zingiberites HEER, or Zingiberopsis Hickey (see Hickey and Peterson 1978), mostly from the Upper Cretaceous and Palaeogene of North America and Arctic regions. Musa bilinea ETTINGSHAUSEN from the Upper Eocene of Kuclín differs from Zingiberoideophyllum by much finer venation (type specimens at BP), but certainly belongs to the same group of fossil monocots.

**Palmae JUSS.**

**Calamus L.**

sensu lato

**Calamus noszkyi** JABLONSZKY
Pl. 11, figs 1-2, 6

Calamus noszkyi JABLONSZKY, 1914, p. 236-244, pl. 9, figs 1-3

The foliage of calamoid palms with fine spines on the edge of the leaf segments has not been so far described in the North Bohemian Basin, although typical groups of thorny spines and fruits do occur in the coal facies (Holy and Bůžek 1964). Sheeth fragments with such spines are also well known in the European Tertiary and are usually identified as Calamus daemonorops (UNG.) CHANDLER.

Huard (1967) suggested that it is impossible to differentiate between the genera of calamoid palms, namely Calamus and Daemonorops, on the basis of such fragments, and established a formal genus Spinothyllum HUARD for such remains (see also Czeczott and Juchniewicz 1975, Mai and Walther 1978). We agree with Mai and Walther (1978) to accept a broader concept of the genus Calamus (incl. Daemonorops).

The foliage at hand probably belongs to the same calamoid palm as the shear remains. As it represents a different organ, it should be given a separate morphospecies. A very similar foliage of this kind occurs in the Lower Miocene of Hungary (Hably 1983) and Slovakia (Sitár and Z. Kvaček 1997).

**Sabal ADANS.**

**Sabal tamannonis** (BRONGNIART) HEER
Pl. 11, figs. 3, 5, 7

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Remains of sabaloid palms are difficult to identify to the species level, and several entities - morphospecies - are currently used in the literature (for the review see Knobloch et al. 1996). The above designation is employed here for forms with a less developed costa, like in the extant Sabal minor (Jacq.) PERS. Some other, partly coarsely leaf remains of sabaloid palms (Sabal major - type) have been found in the roof of the coal seam in the Bilina Mine (coll. Dvořák), and the former mine Ležáky near Most (Hurník 1973). Ettingshausen (1866-9) reports them from the Brešťany Clay.

**Araceae JUSS.**

**Limnobiophyllum KRASSILOV emend. Z. KVAČEK**

**Limnobiophyllum expansum (HEER) Z. KVAČEK**

*Fig. 10, pl. 7*

This aquatic plant, which forms rows of orbicular leaves, interconnected with stolons, is extremely rare in Europe (Z. Kvaček in press), while its ancestor occurs in masses in the Early Tertiary of North America and East Asia (Stockey et al. 1997). This extinct genus links the Araceae and Lemnaceae families. In the baked rocks it was found only once at Želénky (Engelhardt 1891).

**Typhaceae JUSS.**

? *Typha* L. vel *Sparganium* L.

**"Typha" latissima A. BRAUN**

*Pl. 12, fig. 2, text-fig. 1.18*

*Typha latissima A. Braun in HEER, 1855, p. 98, pls. 43-44; Vedenovský, 1881, p. 22, pl. 2, figs 1-3; Engelhardt, 1891, p. 130, pl. 2, figs 21-22*

Similar strap-like monocot leaves with the venation of Sparganium and Typha are widely dispersed in the horizons with aquatic plants. As the anatomically preserved remains of this kind suggest - *Typhaeloipum* UNGER (1850a, 1852) - their relationship to Sparganium is more probable. Thus the name *Typha latissima* is actually misleading. Meyer and Manchester (1997) assigned leaf impressions of this kind to a new entity *Typhoides haxekii* gen. et sp. n. Unfortunately, the name *Typhoides* is pre-occupied (*Typhoides* MOENCH = *Phalaris* L., Gramineae). In our opinion the type specimens of *Typhaeloipum lacustrum* UNG. need to be revisited and then this name would suit for the above entity. In the meantime we employ the traditional designation, stressing that "Typha" latissima is a morphotaxon, which may represent partly the foliage of Sparganium.

**Monocotyledoneae inc. fam. et gen.**

**Cyperacites SCHIMPER sensu novo**

**Cyperacites spp.**

*Pl. 12, fig. 4, 5, text-figs 3.17, 5.3*

Some layers in the Most Basin, particularly in the Žatec and Bilina deltas are overfilled with remains of aquatic plants and strap-like monocot leaves of dubious affinity ("horizons with aquatic plants" sensu Hurník 1961, association Decodon - Poaceae vel Cyperaceae sensu Z. Zvaček and Bůžek 1982). Such layers appear also in the sites of baked rocks, namely at Vršovice, Želénky and others. Previous authors attempted to recognize among such monocot remains genera and species, which in our opinion is not realistic. Therefore we refrain from a detailed analysis of this sort of leaf fossils, which requires a special comparative study of venation patterns. Instead of calling them awkwardly Monocotyledoneae gen. et sp., we employ the genus Cyperacites SCHIMPER (1870-1872) in a wider sense to include such fossils, mostly assigned to a number of species of *Poacites* BRONGNIART and *Cypertites* LINDELEY et HUTTON (These two latter genera are typified by Carboniferous lycopod leaves and are inappropriate for angiospermous remains; Monocotyledophyllum REID et CHANDLER is an invalid name without any species attached.). With some efforts, even strap-like foliage may bring some information on the diversity of the monocot flora, if detailed venation patterns (Zastawniak 1972) and/or epidermal structures are employed.

**Palaeobotanical sites in baked rocks of the North-Bohemian Tertiary**

To avoid misunderstandings and inconsistencies of the stratigraphical position of respective porcelanite sites, we review various stratigraphical schemes of the Most Basin (Table 1) and explain the system we employ. The most commonly used litostratigraphic divisions, both formal and informal, are the modified versions of that by Procházka (1954), which was based on his geological research of the Žatec delta. Our division conforms to the informal stratigraphy suggested by Elzníc et al. (1986) and the formal subdivision by Klominský (1994). The detailed units for the designation of the split main coal seam correspond to those suggested by Hurník and Marek (1962).

Most localities of the fossil flora in baked rocks belong to two groups, and two stratigraphical levels within the Most Formation. According to the lithostratigraphy of the basin (Elzníc et al. 1986, Klominský 1994) the older suite of sites is situated within the deposits of the Main Coal Seam (i.e., Middle Most Fm.): Vršovice, Dobříčice, Svinčice, Lajšník, Lišnice-Polerady and Dolany (pro parte). The younger sites are confined to the Upper Sandy-Clayey Beds: Zabrůšany, Želénky, Straky, Chudeřice, Hostomice, Bilina, Dolany (pro parte), Čermínek, Kaňkov, and the Overlying Beds: Dolany (pro parte), Nechvalice. The secondary accumulation of baked rocks at Mirošovice is of an uncertain stratigraphical position.

The periphery of the basin, where some of the sites are situated, shows discontinuous basin fill and these parts are
Table 1. Stratigraphical distribution of plant-bearing baked rocks in the basin fill
(1 - Vršovice/Černodoly, Dobrcice, Sviněčice, etc., 2 - Želénky/Zabrušany, Chudeřice, etc., 3 - Nechvalice, etc.)

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<td>Upper Seam Beds</td>
<td>Lower Seam Beds</td>
<td>Brown-coal Seams Fm.</td>
<td>Holešovice Mb.</td>
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<td>Liptice-Bilina</td>
<td>Holesovice Mb.</td>
<td>Most Fm.</td>
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<td>Duchcov Mb.</td>
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<td>Underlying Fm.</td>
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<td>Střezov Fm.</td>
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- Overlying Beds
- Most Fm.
- (Middle)
- (Lower)
- Upper Sandy-Clayey Beds
- Subbasinal Volcanic Complex
- Oligocene
- Eocene
difficult to assign to a particular lithostratigraphical unit. So for example the Dobříč locality was classified by Kopecký et al. (1990) as a part of the Upper Sandy-Clayey (or Overlying) Beds (two seams were developed in this outcrop, of which only the upper one and adjacent clay were burned). However, frequent occurrence of ferns suggests that, in fact, it belongs in the Main Coal Seam. Three facies in the sediments above the main seam can be recognised, and also in the porcelanite occurrences. They are partly connected with different plant assemblages: back swamp clay, often transitional with the Main Coal Seam (e.g., Želénky, Bílina), alluvial sand and clay of the Bílina delta (i.e., Upper Sandy-Clayey Beds), considered by Elznic (1973) and others an equivalent of the Main Coal Seam (e.g., Želénky, upper part, Křemýž), and the lacustrine clay, i.e., the Overlying Beds pro parte (e.g., Nechvalice, Dolany, upper part).

Most of the localities are at present exhausted by exploitation (stone quarries or balast pits) and re-cultivated, or inaccessible. Only the sites at Černodoly near Louny (i.e., Vršovice) are exposed and promising for collecting. In the 1980s a new site - Dobříč south of Most - was opened by quarries, which remained still uncovered. Both localities should be designated as “natural monuments”. In other sites, plant fossils occur very rarely. So for instance a new stone pit at Svinčice was long considered sterile, but in 1999 by chance the first author (Z.K.) was fortunate in recovering a florula.

The survey given below treats individual sites together with their history, exact geological setting, aspects of fossil plant assemblages, and references to the palaeobotanical studies (incl. collections). The geographic position is shown in textfigs 6-9. For the orientation of the readers in older literature, translations of Czech and German geographic names are given in table 2. Table 3 gives an overview of the selected localities according to their position in the basin fill.

Vršovice near Louny (i.e., Černodoly near Nečichy)

When Prof. A. Fríč suggested that a young Czech botanist Velenovský should study the Tertiary flora of Bohemia, the latter decided to start this project with the Vršovice locality near Louny. Contrary to other sites already described by Ettingshausen (1866-9), this was untouched and at that time unknown. Although Krejčí (1877: 904) describes in detail baked rocks at Vršovice, he does not mention the occurrence of fossil plants: “Very interesting are such [baked] seams in environs of Louny at the southernmost limit of the Tertiary basin, where they lay immediately on the Bacculites clay marl, and having been later much eroded, they cover only tops of some hills, while the slopes are built by the Bacculites beds. In such a way burned seams appear on the Krížový or Červený hills west of Louny, and particularly on several hills, appearing reddish in colour from a long distance, on the left bank of the Oharka river near Vršovice”. Krejčí (1878) did not mention the locality of Vršovice even in his list of the Bohemian Tertiary flora. His description suggests that the hills were not covered by woody vegetation at those times, and hence collecting was easy. The quotation of Krejčí (1877) also suggests that he is the author of the locality name, which he visited obviously from the south, i.e. from Vršovice. According to Velenovský (1881) the site lies NE of the village of Dobroměřice (i.e., Dobroměřice) on the Červený hill and on several hills eastwards next to the settlement of Černomoly and the village Nečichy. He refers to the site he worked on as Vršovice after the Schwarzen-
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<th>Czech name</th>
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<th>German name</th>
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</table>
berg's castle (now outside the suburbs of the town Louny) more than 1 km S from the hills (see also Váně 1999: 239). At the present time, an easier access to one of the hills leads from the village of Nečichy to the former settlement of Cernodoly (see also Reuss 1790), which was later abandoned and in the 1960s destroyed (text-fig. 7).

The position of porcelanite with the flora was described by Hurník (1978). The slope of a hill on the south-east (above a shooting gallery) exposes the base of the Tertiary strata, formed by dark brown sand about 3 m thick with organic admixture and frequent limonite inter-beds, which weather out. It recalls "the basal sandstone in the area of the Zatec beds, cropping out in the Hofenec gorge". There is a layer approximately 5 m thick of sand, sandy clay and clay of various colours over it. Some levels were overfilled with plant remains. The burned coal seam above is often baked into slag. Overlying strata are also baked and bedding is disturbed. Several slag and ash layers at various heights suggest several coal seamlets over each other. Hurník collected a rich fossil flora on the highest hill south of Nečichy (probably the same as mentioned by Velenovsky), where a stone pit was active a few years ago and the northern quarry face has remained. Luft-Hurník (1957b) assigned the geological section to the upper inter-seam beds on the basis of mass occurrence of Woodwardia. Bůžek (in Malkovský et al. 1985) considers assignment to both the lower or upper inter-seam beds as possible on the basis of the occurrence of entire leaves of bay-berry (Dryandroides lounensis). (He finds no paleo floristic difference between these two stratigraphical levels.) As the entire leaves of bay-berry are common in coal facies, he does not rule out a position partly within the middle seam beds. Bůžek also noted an interchanging petrological character of fossiliferous strata at Vršovice and assigned particular index elements to various facies: Dombeyopsis lobata to coal facies, Ulmus pyramidalis to sandy-clayey facies.

Velenovsky (1881) described from Vršovice 71 taxa, of which he lists only 60 in his summary table, omitting Butomaceae, Poaceae and Cyperaceae, as well as Paulinia furcinaeflora (three taxa) and folium. After our revision, the number of well defined taxa has lowered (about 40 species). However, most of the grass-like remains are included in a single cumulative unit. In his summary table including also frequency, Velenovsky (1881) considers as most frequent Woodwardia roesneriana (i.e. W. muensteriana), Salvinia formosa (i.e. S. reussii), Sequoia langsdorfii (i.e. Taxodium dubium), Phormium affine (i.e. Cyperacites sp.), Typha latissima, and Dryandroides lounensis (i.e. Myrica cf. integerrima) and also Nyssa vertumnii (endocarps assigned now to Nyssa sp.), leaves of maple (i.e. Acer tricuspidatum), Rhamnus fricii (i.e. Alnus gaudini), Tornamental raodobojensis (i.e. Laurophyllum cf. saxonicum) and Ulmus pyramidalis. Common are Alnus kefersteinii (i.e. Alnus cf. rostaniana), Carpinus grandis (i.e. Ulmus pyramidalis), Fagus fereonicae (i.e. Alnus jilianiformis), Salix macrophylla (partly Salix haidingeri), Laurus primigena (i.e. Quercus rhenana), Acer nervatum (i.e. A. integerrimum), Rhus merianii (i.e. Rubus merianii), Rhus elegans (i.e. Rubus vrsovicensis) and Ficus tilliaeolens (i.e. Dombeyopsis lobata).
The collections made by Velenovsky personally are nearly complete and housed in the National Museum, Praha. Kotlaba (1959, 1960) published an inventory of this collection but many additional specimens were recovered after this revision, because Kotlaba overlooked a part of the figured specimens situated in some cases together on one slab (see Appendix). Outside the National Museum, there are larger or smaller collections designated as from Vrsovice, Nečíchy or Černodoly in the County Museum, Most, the Regional Museum, Teplice, and the headquarters of the Bilina Mines, Bilina (made by Z. Dvorák). New field activities brought two additional taxa: Osmunda parschlugiana, and Spirematospermum wetzleri.

At present the most accessible collecting site is on the northeastern hill with an abandoned quarry on the top. The upper part of the hill was lowered by exploitation into a flat surface bordered with small remnants of baked rocks. Only some places are rich in plant remains, mostly roots and grass-like monocots. A typical assemblage of the Vrsovice flora can be found only in the NE corner of the quarry, where a quarry face, about 5 m high, with talus remained. Most slabs of bedded porcellanite are full of impressions. Among them, Betulaceae and other broad-leaved elements (Salix, Myrica, Acer, Rubus, Dombeyopsis, Nyssa, Fraxinus, Ulmus) prevail. Other plant taxa listed as common by Velenovsky, e.g. Woodwardia, Salvinia, Glyptostrobus, "Terminalia", are rare, particularly the ferns, which may have been confined to a particular level, not accessible today. In the wooded slopes around the outcrop, only pieces of slag, sometimes in large boulders, and underneath the strata of the Cretaceous marl occur. The base of the Tertiary is covered by talus.

Zelenky (incl. Zabrusany)
Collections designated as Zelenky were made in the immediate environs of this village, on outcrops of baked rocks on the Červený hill E of the village, which continued further eastwards into the periphery of the neighbouring village of Zabrusany (text-fig. 8). In the geological (and also palaeontological) point of view both sites can be united. For the same reason, also Všeňlapy (Bůzek 1962) and probably Hostomice (Engelhardt in Geinitz 1878) belong to the same large body of baked rocks, namely its southern part. The geological prospection revealed continuation of porcellanite layers over the coal seam buried under 10 m thick loess between Hostomice and Tuchlov (Zelenka and Martinovská 1995). The extent of the baked rocks
is shown in text-fig. 8. In post-war times, a florula was collected in an outcrop about 300 m away from the road crossing Hostomice–Zelenky by Bůžek (1961, 1962). Procházka (1951) reported baked rocks containing rare plant remains on the left side of the road from Zelenky to Hostomice. The continuity of the baked rocks between Zelenky and Zabrusany was clearly seen during advancing surface exploitation of the deposits. This single body of porcelanite is also indicated in the old geognostic map by A. E. Reuss (1840) (see also F. A. Reuss 1790).

Exact locations of the material described by Ettingshausen (1866-9) and Sieber (1881) as from Zabrašany, and Engelhardt (1891) as from Zelenky (coll. Tobisch), is not indicated in the pertinent text. It is noteworthy that Ettingshausen indicates only one taxon as occurring from Zelenky (Taxodium dubium var. e), while Engelhardt notes only Zelenky. Ettingshausen did not make his own collection there, because he obtained the studied material from Zabrašany mostly from the collections of the Geological Survey, Vienna, and a few specimens from the Lobkowicz collections. He did not obviously differentiate between the sites Zabrašany and Zelenky, as he states (Ettingshausen 1869: 75) “unter der Bezeichnung “Branchschiefer von Sobrusan” vereinigen ich die nahe beisammen liegenden und die gleiche Flora einschliessenden Localitaten Sobrusan, Schelenken, Kutterschutz und Straka.” It seems certain that in this case the specimens come from the same porcelanite spread on the slopes between those two villages (see Bůžek 1962). Also Engelhardt (1891) was surely acquainted with this area, because he introduced his discussion with Reuss (1840) on the origin of baked rocks with a statement that rocks of the ground fires of coal (“Kohlenbrandtgesteine”) near Zelenky form an elongate ridge between Zelenky and Zabrašany. He notes that the material includes various levels of the baked rocks overlying the burned coal seam, which is transformed into slag. The mentioned ridge was probably not wooded in the 19th century, as it can be assumed by small pits as remnants of old exploitation in the woods on the right side of the road between Zelenky and Zabrašany. The specimens designated by Engelhardt (1891) as “Schellenken- Sphärosiderit” (coll. Sieber) are not included in our revision and may come from the local coal mine from the clay ironstone above the coal.

After the World War II, Zelenky attracted the attention of several palaeobotanists, mainly Procházka, Hurník and Bůžek. In the 1950s and 1960s, the richest site was easily accessible on the eastern side of the soccer playground north of the village (Hurník 1964). In other places, only rare plant remains were reported by Procházka (1951). A stone pit at Všeichlapy, which was opened in 1959 was also visited by Bůžek in the 60s. Later a large stone quarry operated at Zelenky for the Bilina Mines. This was a most fruitful period of collecting (Holý, Bůžek, the authors, several excursions), which ended several years ago. Today the whole porcelanite body is removed and the quarries re-cultivated. Only very small remnants of the baked rocks are accessible on the road crossing on the northern periphery of Zelenky.

Ettingshausen (1866-9) described 74 species from Zabrašany, Engelhardt (1891) 69 taxa from Zelenky. In our revision the number of species from Zelenky has been reduced. According to the list including the sites Zabrašany and Hostomice, the flora contains about 55 taxa (see also Appendix for the taxonomic revisions).

According to Engelhardt (1891) the assemblages at Zelenky were dominated by Taxodium dubium, Betula priscæ (i.e. Alnus julianiformis), Alnus kefersteinii (i.e. Alnus menzelii), Acer trilobatæ (i.e. Acer tricuspidatum), Zizyphus tiliæfoliæ (i.e. Palturus tiliæfoliæ), Juglans bilinæa (i.e. Fraxinus bilinæa), Pyracarya denticulata (i.e. Caryæ cf. serrfoliæ). In the post-war collections, layers were overfilled with leaf impressions of Salvinia reussii, Blechnum dentatum, Taxodium dubium, Glyptostrobus europæus, Myrica cf. integerrima, Alnus menzelii, Alnus julianiformis, Acer tricuspidatum, Rubus merianii, Dombeyopsis lobata, Palurus tiliæfoliæ, Decodon gibuskus, and various monocots. In the sandy facies, Ulmus pyramidalis, Zelkova zelkovofoliæ, Acer dasyacarpoidæ, “Ficus” truncata, Parrotia pristina, and Carpinus grænus occurred. The flora of Všeichlapy was tentatively identified by Bůžek (1962): the assemblage from the quarry face includes Alnus feronïæae (i.e. Alnus julianiformis), Salix lavateri (i.e. Salix haidingeri), Parrotia pristina, Zizyphus tiliæfoliæ (i.e. Palurus tiliæfoliæ), and Ficus truncata and conforms to that from sandy layers of Zelenky. The assemblage from the bottom layers at the NE margin differs in occurrence of Salvinia mildeana (i.e. S. reussii), Taxodium dubium, Alnus feronïæae (i.e. A. julianiformis), Rhus merianii (i.e. Rubus merianii) and Acer trilobatæ (i.e. A. tricuspidatum), and corresponds to a standard flora of Zelenky.

Despite non-selective field collections, which would allow direct reconstruction of plant association, the list of taxa and lithological character of fossiliferous slabs suggest that similar associations have been present at Zelenky as those described in detail in the open-cast mine Bilina (the former Maxim Gorki). In fine-grained porcelanite, the prevailing vegetation must have been bound to a swampy coal-forming environment, which has been assigned by Bůžek et al. (1992) to Glyptostrobus-Quasisequoia swamp forest with aquatic horizons of the Salvinia and monocots/Decodon associations, including rare specimens of Limnothrophymum. In back swamp vegetation, Salix, Quercus robæa and Taxodium-Nyssa forests with Alnus menzelii, Dombeyopsis and Rubus dominated. Sandy facies reflects also at Zelenky the levee riparian deciduous forest of the Ulmus pyramidalis-Parrotia association on damp soils. It is richer than the previous units, including Salix haidingeri, Acer dasyacarpoidæ, Carpinus grænus, Zelkova, Parrotia and the enigmatic “Ficus” truncata.

Animal fossils are extremely rare at Zelenky. The first report was published by Engelhardt (1891), who announced a mollusc of the genus Anatorda. Bůžek (1962) mentioned an impression of another mollusc (together with Alnus) in the Bilina museum. Hurník recovered in the 60s a big shell of cf. Margaritana (pl. 12, fig. 1). Bůžek (1962) reports from Všeichlapy a fragment of tortoise shell.

The figured specimens published by Ettingshausen (1966-9) also from Kučín, Brčžany, Zíchov and Kostomlaty are partly preserved in the Hungarian Natural History Museum, Budapest (Lobkowicz collection), Geological Survey, Vienna, and Natural History Museum, Vienna (together with undetermined material), some illustrated specimens sold by Ettingshausen to Great Britain are housed in British Natural History Museum, London. A part of the specimens figured by Engelhardt (1891) has been preserved at the Faculty of Science, Charles University, Prague (coll. Krejči of “Polytechnicum”). Maple impressions revisited by Procházka (Procházka and Bůžek 1975) and
a *Lygodium* frond (Luft-Hurnik 1957) have been recovered also at the National Museum, Prague, where an extensive but not determined material is deposited since the activities of the late F. Holý and earlier collectors. An extensive collection from Zelénky made by the late Č. Bůžek is placed in the repository of the Czech Geological Survey at Lužná. Undetermined pieces from Zelénky are scattered in many other museum collections, e.g. Staatliches Museum für Mineralogie und Geologie zu Dresden, Joanneum, Graz, County Museum in Most (coll. F. Thoma, S. Hurník), in the Regional Museum, Teplice, in the Bilina Mines, in the Town Museum, Ústí n.L. etc. Most interesting documents are included in the present revision, which enrich the flora of Zelénky by *Woodwardia, Alnus gaudinii, Acer integerrimum, Fraxinus macroptera, Podocarpium podocarpum, Rosa europaea, Paliurus favonii, Hydrochariphylllum buzekii, Craigia brunii, Nyssa sp., Todalia maii* and some others.

**Straky.**

The palaeobotanical material from this locality was collected by Reuss (Ettingshausen 1866: 15), and the figured specimens are a part of the Lobkowicz collection (now at the Hungarian Natural History Museum, Budapest). In his text, Ettingshausen refers to this locality only in the descriptions of *Blechnum braunii* (i.e. *Blechnum dentatum*), which is its type locality, and *Acer rueminianum*. Bůžek (1962) suggested that these old gatherings studied by Ettingshausen were made from the other side of the same baked rock deposits at Kladruby. He assigned to the same name his own collections from an old stone pit “east of the settlement Straky”. We consider the new name (i.e., Kladruby) superfluous, and from the geographical point of view not founded. Hence the name Kladruby is excluded from the list of palaeobotanical sites of baked rocks.

Bůžek’s collections reported by him in Bůžek (1961) are housed in the repository of Czech Geological Survey in Lužná. A few specimens including *Ulmus pyramidalis* and *Quercus rhenana* have been found in the collections of the Regional Museum, Teplice.

**Český Újezd at Chabaňovice**

Plant fossils have been reported from this place only by Bůžek (1962). The locality was discovered by F. Mačák in an abandoned stone pit on the left bank of the Podhořany brook. In spite of the very scanty occurrence of plant fossils in the claystone of the lacustrine facies (“Overlying Clay”) in the Ústí-Teplice part of the basin, Bůžek was able to find *Glyptostrobus europaeus, Alnus feroniae* (i.e. *A. julianiformis*), *Comptonia difformis, Cinnamomum polymorphum* (i.e. *Daphnogene polymorpha*), and Poaceae gen. et sp. div. The material, which should also be in the repository of Czech Geological Survey in Lužná, has not been revisited by us.

**Nechvalice - Nové Dvory**

Zelenka and Martinovská (1995) incorporated this porcelaneous occurrence into a large deposit called Nechvalice near Bystřany - Malhostice. According to these authors it is the largest body of caustically metamorphosed Miocene sediments in central Europe. It is to be noted, however, that the body is discontinuous, being divided during denudation into several isolated occurrences (like in the environs of Most or Duchcov). The disintegration may be also due to uneven relief of the neovolcanites beneath the coal-bearing basin fill. The largest deposit within this body occurs at Nechvalice - Nové Dvory, forming two isolated islands of the porcelaneous. Therefore Macůrek and Zelenka (1985) recognised the Nové Dvory and Nechvalice parts of the deposit. Plant remains have been discovered by Radoň (1999) in the Nové Dvory part.

The exploitation was carried out for several decades. The stone pit is situated about 0.5 km E of the village Nové Dvory. The last owner of the quarry Palivový kombinát, Ústí/L. used the stone for railway stabilisation in the strip mine Chabaňovice (now closed).

The uniform coal seam about 15 m thick underwent burning due to denudation of overlying sediments and exposures of coal by erosion of the river Bílina and its tributaries. In the case of this locality, it was eroded by the Bystrice brook. Due to variable thickness of the seam and irregular burning, the caustic influence reaches various heights of the clay. And the transition between the baked and fresh clay is relatively sudden. The maximum thickness verified by geological prospection was 25 m.

During the exploitation no plant remains were recovered there. Only lately Radoň (1999) recovered a flora (housed in the Regional Museum, Teplice), which is included in this revision. The following elements have been safely determined: *Taxodium dubium, Glyptostrobus europaeus, Quasisequoia coultiae, Pinus rigios, Quercus rhenana, Myrica ligitum, Comptonia difformis, Engelhardia orbisegensis, Alnus julianiformis, Leguminosites spp., Acer tricuspidatum, Paliurus tillaegolius, and Cyparicites sp.* As stated by Radoň (1999), this assemblage is typical of the *Břešťany* clay. Z. Kvaček and Bůžek (1982) assigned such a mixture of swamp and upland elements to their *Engelhardia-Taxodium* association.

**Křemýž**

This site has also been reported by Bůžek (1962) in connection with old collections housed in the 60s in the Duchcov museum, and own field work. He did not mention identification of the old museum collection. His material, recovered in a small pit about 400 m NE of the road curve leading into the village, includes only *Alnus cf. feroniae* (i.e. *A. cf. julianiformis*).

The abandoned open-cast mine *Jirásek*

This mine was operated in a large area NNE of Bílina and embraced also several smaller occurrences of porcelaneite, where Bůžek (1961, 1962) collected. Some of the locate sites are also referred to in the old collections of the National Museum, Praha, Charles University, and literature as Svetec, Chotověnkà, Chudečice (Kutterschitz), Chotějovice and Lískovice (text-fig. 9).

Plant fossils from Svetec near Bílina housed in the above two institutions are not specifically localised on the labels. A specimen of molluscs was also recovered there by Bůžek and transferred into the Geological Institute of the Academy of Sciences, Praha. Some other specimens were gathered during constructions and exploitation in the mine Ruday II. Particularly a collections made by Štros 1936 (NM) is rich. In several hundreds of specimens, *Alnus julianiformis* dominates, followed by *Blechnum dentatum, Quasisequoia coultiae, and Myrica cf. integerrima*. All other elements were recorded less often: *Lygodium kauflusti, Pronumprhium striacum, Glyptostrobus europaeus, Taxodium dubium, Decodon gibbosus*, etc.
Rubus merianii, Nyssa haidingeri, Salix varians, Dombeyopsis lobata, Ulmus pyramidalis, "Juglans" acuminata, Sabal major, Calamus noszkyii, Smilax weberti and several doubtful dicot leaves (e.g., cf. Ampelopsis sp., Leguminosites sp., ? Viscaceae) and endocarps (Carpolithes spp.). The surface of a few slabs was covered by Salvinia reussii. Bůžek collected in re-deposited material in the southern part of the Lotta Marie open-cast mine. The Chudeřice site was mentioned by Reuss (1840) in connection with the occurrence of a fossil seed similar to Foliculites kaltenndheimensis (i.e. Stratiotes kaltenndheimensis). Other plant fossil from there were described by Ettingshausen (1866–1869) and survived in Budapest as a part of the Lobkowicz collection. In older Czech literature (e.g. Brabenec 1909), the name Chudeřice is often misspelled as "Kutršice" from the German version of this village. Scanty fossil plants were recorded by Bůžek from the former strip mines Eleonora at Chotejovice and Jindřich from Chotověnka. Noteworthy is a steep mine face at the Jirásek mine, which was accessible on the NW margin of the village of Lyskovice. Bůžek identified in his collection from this site: Blechnum braunii (i.e. B. dentatum), Salvinia mildeana (i.e. S. reussii), Taxodium dubium, Glyptostrobus europaeus, Salix macrophylla, Alnus feroniae (i.e. A. julianiformis), Persea speciosa (i.e. Nyssa haidingeri), Pterocarya sp. (i.e. Carya cf. serrifolia), Ficus multinervis (i.e. Decodon gibbosus), Ulmus sp., Zizyphus tiliaefolius (i.e. Paliurus tiliaefolius), Dombeyopsis dechentii (i.e. Dombeyopsis lobata), Smilax sp., and Poaceae gen. et sp. Bůžek kept all his collection including the above mentioned in the repository at Lužná, but we were unable to revisit all this material. Today most of these occurrences are
covered by the Radovesice dump and other properties of the Bilina open-cast mine and have been destroyed by re-cultivation. Original location is shown in text-fig. 9.

Bilina

There are several fossils referred to as coming from Bilina by Ettingshausen (1866-9). Their exact position cannot always be assumed from the text. Although old geological maps (Wolf 1880, Anonymous 1898) do not show any occurrence of baked rock in the environs of Bilina, there are several reported in new publications. Zelenka and Martinovská (1995) described an occurrence NE of Bilina as Bilina-Chudeč (today covered by the Radovesice dump). According to unverified information, a tiny “island” of porcelanite occurs also on the western limit of the hill Chlum. Hibsch (1924), as the above mentioned authors, and Kopeczyk et al. (1990), and even Reuss (1840) draw on the geological maps a few occurrences of porcelanite on the western part of Bilina. It is possible that even Ettingshausen refers to such occurrences. First reports of mining in the Bilina town date to the 18th and beginning of the 19th century, when the mine of Lobkowicz Carolina (later renamed to Rudolice I) was opened by an inclined gallery situated near the present-day railway station (Luxa et al. 1997). It cut through probably one porcelanite body in this part of Bilina, from which Sternberg received some material, and described a few plants: Phylitis dubius (i.e. Taxodium dubium), Phylitis julianiformis (i.e. Alnus julianiformis), Phylitis juglandiformis (i.e. cf. Betula sp.), and Muscetes stolzii (i.e. Glyptostrobus europaeus vel Quasisequoia coussitiae). These collections are only partly housed in the National Museum, Prague.

Ettingshausen (1866-1869) refers as from the locality Bilina: Panicum macellum (not figured, probably at BA), Poaetes acuminatus (in the figure caption Zabrušany), P. rigidus (in the figure caption Zabrušany), Cyperus Chavanensis (not figured, probably at BA), Juncus retracatus (in the figure caption Zabrušany), Litorella Baldassari (not figured, probably at BA), A. kefersteini (not figured, probably at BA), Fagus caesareaefolia (not figured, probably at BA) - Velenkovsky 1881 transferred this species to his Fagus Ettingshausenii), and Fagus foroniae (not figured, probably at BA). The references to Bilina by Ettingshausen are probably only simplifications as he did not indicate any particular occurrence of baked rock directly from Bilina in his survey of the local floras (Ettingshausen 1869: 69).

Kaňkov

A relatively large deposit of baked rocks was developed on the outcrop of the coal seam E of Bráňany near the settlement of Kaňkov. Only a few plant fossils have been collected from there and this locality is not known in older literature. First collections were made by Holý in the 1970s and partly included in the study of Alnus julianiformis (Z. Kvaček and Holý 1974). Later also Z. Dvořák collected there and recovered Lygodium kaufmannii, Alnus julianiformis, Acer tricuspidatum and Poaceae vel Cyperaceae. This material is housed in the Bilina Mines collections.

Lajšník near Most

The Lajšník hill, partly covered by woods, lies on the outskirts of the new town of Most (former Rudolice) at the road leading to Praha. A remnant of the burned coal seam rests on weathered volcanite rocks exposed at the foot of the hill. This occurrence was probably connected before erosion with another one on the Skřivánči hill, exploited in the 80s. This is a continuation of porcelanites from the southern limits of Most and from Vtelno, which did not yield any fossils. Only Hurník was able to recover some identifiable plants from the eastern margin of the former Benedikt open-cast mine in Vtelno. This collection, which is housed in the County Museum, Most, includes roots determined as Pteridophytes oenogines A. BR. sensu Ettingshausen (1866), Taxodium dubium, Betula sp., Alnus julianiformis, Cercidiphyllum crenatum, Zelkova zelkovicifolia and Rubus merianii.

The flora from the site Lajšník (Luft 1955) was tentatively determined as Glyptostrobus europaeus, Ulmus longifolia (i.e. U. pyramidalis), Zelkova ungerii (i.e. cf. Z. zelkovicifolia), Acer trifolatum (i.e. A. trifoliatum), Liquidambard europaeae, and Dryandrodes louensis (i.e. Rubus merianii). This collection is also housed in the County Museum, Most.

Baked rock on the Lajšník hill was considered as belonging to the strata overlying the coal seam. However, there is no exposed geological section on the wooded hill to corroborate this idea. The porcelanite preserved there is only few meters thick and can hardly belong to the strata overlying the main seam. Also a fragment of Woodwardia was recovered in the collection suggesting that the fossiliferous rocks represent in fact sterile layers within the coal.

The chance to obtain richer plant collections at this site is now very low.

Lišnice-Polerady

This site is introduced into the literature by Engelhardt (1891: 133), who was unable to get more material from the environs of Most, "in welcher Nichtdeutsche viel versprachen, aber trotz wiederholter Besuche und oftmaliger Bitte ihr Wort nicht hielten". From baked rocks of Lišnice Polerady (Lischitz-Polerad) he lists Ficus multiflora (i.e. Decodon gibbosus), Ficus lancelolata (? Quercus rhenana), Ficus hercula (? Laurophyllum saxonicum vel Quercus rhenana) and Ficus tiliaefolia (i.e. Dombeyopsis lobata). We have not been able to find this collection.

Hurník (Luft 1956b) designated under the same name outcrops of clay, sandy clay and weathered coal clay with the fossil flora on slopes north of the road from Lišnice to Polerady. Porcelanite bodies occurred in the past on a ridge N of Lišnice (today the southern part of the Velbudice dump pile). In the remnants of this deposit, no identifiable plant remains, except for roots and wood, have ever been found. Small occurrences of porcelanite were scattered on the fields N of the village, as they can be traced today in small fragments of the rock with indeterminable plant remains. Bůžek (in Týráček et al. 1988) did not mention any flora from there. Today the only accessible site is caustically influenced sandstone in pits after exploitation of oxihumolite between the two villages. It contains masses of leaf impressions belonging to Quercus rhenana.

Dobřeč

Two large deposits of porcelanite are situated E of Korozluky in the Most region (text-fig. 6). Both were exploited in stone pits for balast under mine railways. One is situated on a ridge
### Table 3

Distribution of plant species in the main localities of baked rocks

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between Korozluky and Skršín near the road leading to Praha. This site was nearly barren except for fossil roots and twigs. The other deposit on the opposite ridge along the Korozluky brook was accessible by a road leading from Dobřice to Korozluky castle. The baked rocks fill a satellite basin oval in outline, 600 x 1200 m in size. Geological prospection (Martnovská and Zelenka 1989) verified two coal seams, mostly weathered into oxihumolite. Larger parts of the upper seam were burned, and this baked the adjacent clay into porcelanite.

In spite of its location in the cadastral district of Korozluky, the current name of the latter site is known as Dobřice (given during the geological prospection and deposit evaluation) and we maintain this name. Bůžek (in Kopecký et al. 1990) applied a different designation "Spicak NE of Korozluky". During the exploitation a rich flora has appeared there, but it has not been collected systematically. Bůžek (in Kopecký et al. 1990) lists fronds of the fern *Pronephrium striacum*, and leaflets of cf. *Fraxinus ungeri*. He noted that the vegetation corresponds to riparian forests with fern undergrowth.

At present the quarry is re-cultivated, but plant impressions can be found in two places, in the upper old quarry and the lower slightly depressed quarry. The baked rock of sandy clay underlying the upper seam is accessible between both places on the northern margin. Larger or smaller slabs of porcelanite with plant fossils lie on re-cultivated flattened pit faces in the lower quarry (coll. Z. Kvaček, Sakala). The other site is a steep colourful pit face on the NE margin the older quarry (coll. Radoň). The composition of the flora has not been published before except for a preliminary paper by Humník (1999) and is included in the present study. Collections from this site are housed in the Regional Museum, Teplice (coll. Radoň), in the County Museum, Most (coll. Humník) and the Bílina Mines (coll. Dvořák, Z. Kvaček, Sakala). In some layers (e.g. in the uppermost part of the colourful face, coll. Radoň) the fern fronds, partly almost complete, of *Pronephrium striacum* cover bedding planes. Some additional fern species have been recovered - *Woodwardia muensteriana*, *Osmunda parschlugiana* and

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Salvinia reussii. Commonly occurring are cone scales and foliage of Taxodium dubium, seed cones and foliage of Glyptostrobus europeaus and Quasisequioa courtissae, leaves of Alnus julianiformis, Alnus cf. rostaniana, Salix macrophylla and Cyperaceae. In the collections of the Bilina Mines, specimens of Toddalia malti, Decodon gibbous (foliage), Laurophyllum cf. saxonicum and Paliturus tiliaefolius, of the animal fossils a molusc and an impression of the caterpillar are also available. The collection of the County Museum, Most (Humík 1999) includes mostly well preserved fern fronds, and similar elements mentioned above, with additional Salix varians, Acer tricuspidatum and Dombeyopsis lobata.

In the past, stratigraphical position of this flora was equivocal. During geological prospection (Janěček 1986, Martinovská and Zelenka 1989), two coal seams were verified. It was logical to place the flora within the roof of the main seam (here split into two seamlets). In this concept the flora would correlate with those in the region of Bilina and Duchcov (see also Kopecký et al. 1990). However, the flora of Dobřice corresponds in its composition with those from the inter-seam beds. Noteworthy is a mass occurrence of ferns including Woodwardia. The dominant fern Pronerphrium stiriacum and other elements suggest an affinity and correlation with the flora of the satellite basin at Skyřice (Humík and Z. Kváček 1999), which fails unequivocally into the inter-seam beds. Hence three coal seamlets possibly occurred at Dobřice, of which the uppermost one was removed by erosion. The detailed geological evaluation indicates a 1 m thick coal clay about 1-3 m above the upper seam weathered into the oxihumolite. The fossil flora comes probably from this layer, a situation which repeats in the Skyřice satellite basin. Elznic and Zelenka (1987) mentioned two to three coal seamlets from Dobřice. Therefore we can be sure that the Dobřice flora is an assemblage coming from the upper inter-seam beds. At this time, we also mention a florula from the baked rocks on the SW margin of the Skyřice basin. It also contained dominant ferns Pronerphrium and Woodwardia. The porcelanite was accessible in the 1950s before it was buried by the Vele­budice dump.

Svinčice

This new palaeobotanical site lies about 2.5 km S from the site Dobřice. Although the deposit of baked rocks has been exploited there for several decades, fossil plants were recovered in 1999 by Z. Kváček, J. Sakala and J. Prokop. The stone pit is exploited in the above stone pit, owned today by Equi Boreri limited.

Porcelanite strata are disturbed, mostly as slag and porcelanite of various reddish colours. Only thin well bedded layers are rich in plant impressions. The first expedition on 4th August, 1999, revealed a suite of elements characteristic of swampy habitats: Pronerphrium stiriacum, Woodwardia muensteriana, Osmunda parcshlugiana, Glyptostrobus europaeus, Laurophyllum sp., Laurophyllum cf. saxonicum, Alnus julianiformis, Alnus gaudini, Alnus cf. rostaniana, Nyssa haidingeri, Cragia brommit, Dombeyopsis lobata, Ulmus pyramidalis, Monocotyledoneae (coll. Bilina Mines). Humík recovered in other levels an occurrence of Sabal lamananis, rare in porcelanite sites, and a large-leaved Fraxinus bilinica.

Mirošovice

In 1998 M. Pletichová collected between Mirošovice, Žichov and Lužice on the fields of the same upland flat as mentioned above a small collection of fossil plants. We inspected this locality on the right bank of the Lužice brook and found only heaps of fragments of porcelanite, obviously redeposited, probably transported during the building of a small dam of the stream in the 1970s. The nearest deposit of porcelanite lies S of Mirošovice on the northern slope of a ridge between Lužice and Mirošovice.

In spite of the position of this secondary site within the Lužice valley, we designated it as Mirošovice. We want to avoid confusion with the classic sites Lužice and Žichov, that yielded fossils in silicie (“Halbopal”) nodules from the Oligocene volcanic strata (see e.g., Ettinshausen 1869).

The Pletichová’s collection (at DB) includes Taxodium dubium, Myrta sp., Alnus julianformis, Rubus sericius, Podocarpus podocarpum, Craizia bromnii, Paliturus tiliaefolius, Smilax weberi and Monocotyledoneae gen. et sp.

Chomutov environments

Although the Žatec delta facies south of Chomutov includes one of the largest porcelanite deposits, only two sites yielded plant remains. They have been described in the literature as Dolany and Cerminiky (see Bůžek 1971). Both sites are today flooded by the Nechanice dam on the Óehr river. First Procház­ka (1954), and later Bůžek (1971) collected at a small occurrence of baked rocks on the SW margin of the “amphitheatre”, assigned by Bůžek to his site No. Ce 155c at Cermniky. At Dolany (see Váně 1961) the baked rocks belonging to the upper inter-seam as well as overlying strata were exposed by the gully in steep slopes above the river curving west of the village (Bůžek 1971: 23). Fossil plants were collected both by Procházka and Bůžek, and are housed in the repository of the Czech Geological Survey at Lužiá.

The flora of Dolany, according to the list by Bůžek (1971), includes in the upper inter-seam strata: Woodwardia muensteriana, Abacopteris (i.e. Pronerphrium stiriacum), Taxodi­um dubium, Glyptostrobus europaeus, Juglans acuminata, Juglans juglandiformis (i.e. Frazimus bilinica), Ulmus pyramidalis, Dombeyopsis lobata, Acer triscuspidatum, “Persea” speciosa (i.e. Nyssa haidingeri), in the overlying strata: Comptonia acutiloba (i.e. C. diffornis), Alnus sp., and Ulmus pyramidalis. The character of the respective florulae does not differ from those known in other parts of the basin.

Finally, we refer to the occurrences called “porcelanites in the Doupov Ms.” or “baked claystone at Doupov” (Brabenec 1909). Brabenec merely translated the original German version of these occurrences given by Menzel (1901) as “Erbrandez­ steine des Duppauer Gebirge” (as one of the occurrences of Pinus rigois), and “Brandgestein von Duppau” (in case of Glyptostrobus europaeus). The exact position of these baked rocks in the Doupov Ms. is unknown to us and Menzel gives no other details of the geography, or any reference to the collection.
Vegetation analysis

Reconstruction of vegetation cover in respective sites requires systematic collecting from particular fossiliferous layers and facies. This rarely occurs in older collections and even recent outcrops of baked rocks. Therefore, one must rely on the lithological type of slabs bearing plant fossils, or on reported assemblages by earlier authors. For instance Z. Kvaček and Bůžek (1982) in their vegetational analysis of the Most Basin reassessed assemblages reported by Velenovsky (1881) from Vršovice. These assemblages do not automatically reflect natural vegetation units because of taphonomic bias. The more authochthonous the fossiliferous deposit (fine-grained porcelanite, coal, coal clay) yields the assemblage, the nearer the assemblage reflects the respective original plant cover. In general, sandy/silty baked rocks reflect riparian forests on fertile alluvial plains and levees; pelitic porcelanite, which prevails in most sites, incorporates either swampy and aquatic vegetation or, in case of equivalents of the Overlying Beds (Nechvalice, Dolany) also forests, that surrounded the lake on acidic soils. We may attempt to apply the units defined by Z. Kvaček and Bůžek (1982) subjectively, and those derived by statistical multivariate analysis (Boulter et al. 1993) to the data of the present study.

The pure coal-forming association with dominating Glyptostrobus and Quaisisequoia is not characteristic developed in any of the studied sites. However, another swampy association dominated by Quercus rhenana (identified as Laurus primigenia) was noticed by Velenovsky (1881: 30) at one location at Vršovice. Engelhardt (1891: 133) mentioned (in a footnote) another site of this association at Liščí-Polerady. Pure stands of swampy ferns Pronephiprium and Woodwardia revealed by multivariate analysis (Boulter et al. 1993 - "fern marsh") can be assumed by accumulations of these plants in particular layers in Vršovice and Dobřice (uppermost layers in the "colour" wall - according to Radoň, pers. comm., and also in the lower pit - coll. Bílina Mines). Velenovský (1881: 6) reports also various assemblages dominated by Myrica ("Dryandroideae"), Alnus ("Fagus") and Salix, or Paliurus ("Ziziphus"), Typha and Dombeyopsis ("Ficus" tiliaefolia), or Cercidiphyllum ("Grewia"), Pronephiprium ("Goniopetis"), Rubus ("Rhus") etc. together with Glyptostrobus, Taxodium ("Sequoia" pro parte) and Woodwardia (text-fig. 1). Similar composition (except Woodwardia) is known from pelitic layers from Želénky (text-fig. 3). We can relate this mixture to various kinds of swamp forests (Nyssa-Taxodium association sensu Z. Kvaček and Bůžek 1982), in which the share of broad-leaved trees varied depending on the degree of flooding. This is also the site where palms grew - like Sabal stands (Sviničice) or cane breaks of Calamus (Světce). In some layers of Želénky, and particularly at Chuděřice and Světce, we can assume a less flooded forest of alder (Alnus julianiformis, Alnus menzeli) with swampy ferns (Blechnum) and Decodon in undergrowth. It is a new association corresponding to alder stands (Alnetea). It can be found also in Dobřice, where another combination of species - Alnus cf. rostaniara and A. julianiformis occurred. Velenovsky (1881) also mentioned an aquatic plant horizon dominated by Gramineae, Cyperaceae and Salvinia. Similar horizons are developed also at Želénky, but to a lesser extent. Our experience of plant assemblages in the Bílina Mine indicates that grass-like accumulations together with Decodon, Potamogeton, i.e. rooted heliophytes (Cyperaceae/ Poaceae - Decodon association of Z. Kvaček and Bůžek) are usually separated from free-floating carpet-like masses of Salvinia, Azolla and Limnobium (Salvinia-Azolla association). Passing on to more silty/sandy facies (Vršovice, Želénky, Zabrušany, rarely in Dobřice), assemblages change conspicuously in composition. Velenovsky (1881: 6) lists Acer, Alnus ("Fagus"), Ulmus (incl. "Carpinus"), Fraxinus ("Carpinus"), Zelkova ("Planera") and Salix hainingeri (S. macrophylla pro parte). We may add Parrotia and "Ficus" truncata depending on the lithology of the slab (text-fig. 4). A greater number of additional trees and shrubs occur in the association (Parrotia-Ulms sensu Z. Kvaček and Bůžek), which represents the riparian, only briefly flooded forest on alluvial plains and levees. Osmunda, Liquidambar, Corya, Rosa, Podocarpium, "Ficus" truncata and "Viburnum" atlanticum are regularly associated (text-fig. 5). This kind of vegetation is usually situated in beds higher above the seam, which are only rarely influenced by ground fire. One site of baked rocks at Nechvalice (coll. Radon) has yielded an assemblage corresponding precisely to those met in the Bílina Clay (Pinus Engelhardi association sensu Z. Kvaček and Bůžek). It is characterised by a mixture of swamp trees (Glyptostrobus, Quaisisequoia, Quercus rhenana, Palirus, Acer tricuspis -) with newly appearing elements of acidic soils - Pinus, Myrica lignitum, Comptonia, Engelhardia. It is an assemblage characteristic of lower levels of the Overlying Beds both in the Most - Teplice and Chomutov areas. Still higher in the section of the Most Basin, assemblages rich in Lauraceae and other termophilous elements, and containing Quercus cubinii have been recovered, mostly from the cores in the basin centre near Lom and Mariánské Radčice (Bůžek et al. 1993). These levels of the basin fill have not undergone baking.

Conclusions

World famous palaeobotanical sites of baked rocks in North Bohemia have been known for over two centuries, although most are now vanishing from the earth's surface. Progressive mining followed by re-cultivation causes large-scale changes of landscape around and within the basin. It has not spared the special locations which are considered to be natural monuments by most European palaeobotanists and palaeontologists. It is thanks to the long-term collecting activities of earlier and present generations of scientists and amateur collectors, that thousands of plant fossils are housed at several universities, museums and other scientific, industrial and cultural institutions. In spite of our attempt to review all these scientific treasures and to record the present situation on most of these sites by our own field studies, a full re-evaluation of all the material has not been achieved.

Porcelanites, as remnants of ground fire of the Miocene coal, initiated on denudation outcrops during the Pleistocene, are a specific type of baked rocks typical of the North Bohemian Tertiary. Due to high temperature, combustion products of coal seams include not only ash and slag, but also baked clay containing at several places plant fossils, rarely molluscs and insects. Some of the sites - Želénky and Zabrušany in particular - are only parts of larger deposits, which were mostly removed during recent decades for industrial purposes, such
as road metal for railway in open-cast mines. In the case of Želénky, there are hardly any remains of what formerly represented the richest locality of fossils of this type. Another site Vršovice, near Louny, has had nearly the same fate. Today, after long years of intensive exploitation, only one quarry face, a few meters high and tenth of meters long, remained accessible to obtain the typical plant assemblage of Vršovice. And year after year forestry re-cultivation continues, preventing further palaeontological field work. Newly exposed deposits at Dobrcice and Svinčice in the Most area are in fact the only sites offering a good opportunity to collect. It is sad to observe that the former fame associated with earlier occurrences of fossiliferous porcelanite is now at an end. We urge our generation to try to preserve these remaining localities in the form of protected areas within a nature conservation policy. Our study does not fully cover the revision and evaluation of the fossil flora, and many scientific problems concerning animal fossils, palaeoecology or sedimentology/petrology remain to be solved in the future.

Acknowledgments

We are indebted for help and facilities to the curators and technicians of the respective collections, particularly to J. Sieber, Geologische Bundesanstalt, Wien, J. Eder-Kovar, Naturhistorisches Museum, Wien, L. Hably, Hungarian Natural History Museum, Budapest, Z. Dvořák, Bilina Mines, M. Radoň, Regional Museum, Teplice, J. Kvaček, R. Pátová and H. Pražanová, Národní muzeum, Praha. Discussions on fossil plant affinities, nomenclature and geology with S.M. Manchester, H. Walther, S. G. Zilin and M. Vaneč are greatly appreciated. This study was financially supported by the Charles University (Grand No. GAUK 266, and J13/98: 113100006).

Appendix

The following review gives our opinion on the identifications of the specimens described and illustrated in the earlier works starting with Sternberg (1820-1838) and ending with Engelhardt (1891). Also inventory numbers, if available, and abbreviations of the collections are given. A considerable part of the specimens are not identifiable because of fragmentary nature or poor preservation. In cases that only an illustration is available, our judgement must be taken as very tentative. No judgement can be given on the records not accompanied by the illustration unless the specimen with the label written by the author has been found.

Sternberg (1820-1838)

Sternberg described only very few taxa from the Tertiary strata, although in his old collection a large material remained undetermined. He did not obviously trust possibilities that the fossil foliage of angiosperms could be safely assigned to natural taxonomic entities (Sternberg 1825: "In Scillam et Charibdom incidit, siquis Phyllolites ad species referre conatur"). The type specimens are only partly available in the National Museum, Praha (1. Kvaček and Strakova 1997).

| Filicites sp. | 1821, p. 29, pl. 24, f. 2 | ? Bilina | NM G 2114 | Taxodium dubium (neotype) |
| Phyllites dubius | 1823, p. 37, pl. 36, f. 3 | Bilina | missing | Taxodium dubium |
| Phyllites juglandiformis | 1823, p. 39, pl. 35, f. 1 | Bilina, "Neue Stolle" | missing | ? Betula sp. |
| Phyllites julianiformis | 1823, p. 39, pl. 36, f. 2 | Bilina, "Neue Stolle" | missing | Alnus julianiformis |
| Muscites stolzii | 1833, p. 38, pl. 17, f. 3 | Bilina | NM E 24 | Glyptostrobus europaeus vel Quaßissequata couttsiae |

Göppert 1836

The monograph of fossil ferns by Göppert (1836) includes only a single taxon, based on the material from the Tertiary baked rocks of North Bohemia. The town Teplice is indicated as its locality (Barthel 1976). However, we expect that the true locus typicus is either Chuderice or Straky, where this plant occurs most frequently.

| Aspidites dentatus | p. 355, pl. 21, f. 7-8 | Teplice | Univ. Wroclaw | Blechnum dentatum |

Ettingshausen 1866-69

We were able to recover most of the specimens figured and determined by Ettingshausen (1866-9) in the Hungarian Natural History Museum, Budapest (Lobkowicz collection), the Natural History Museum, Vienna ("Mineralien-Kabinet"), the Geological Survey (Geologische Bundesanstalt), Vienna, and British Natural History Museum, London. The material from Želénky/Zabrušany was determined by Ettingshausen also in the Joanneum Museum, Graz, and the University in Graz.
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<th>Page</th>
<th>Plate</th>
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Sieber 1881

A young palaeobotanist Johann Sieber, who died May 30th, 1880 in the age of 23 years, worked as an assistant of Prof. G. C. Laube at the Charles University, Prague. The documentation material of his posthumously published study (Sieber 1881) was later transferred to the National Museum, Prague, but only those specimens, which could be safely recognised. They mostly come from the sites Kučín, Brčeťany, Braňany, and Valeč. Only a single specimen from this collection is from Zabrušany. Many recorded species were not accompanied by illustrations. There is hardly any chance that the remaining material can ever be find in the collections of the Charles University.

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Aspidium fischeri  p. 73  Zabrušany  missing  ?  
Salvinia reussii  p. 73  Zabrušany  missing  ?  
Ulmus minuta  p. 77  Zabrušany  missing  ?  
Persea speciosa  p. 79  Zabrušany  missing  ?  
Hydrangea microcalyx  p. 82, p.p., pl. 26a, 31  Zabrušany  missing  indetermined plant remains  
Acer crenatifolium  p. 86  Zabrušany  missing  ?  
Rhus meriani  p. 90, pl. 5, f. 39-40  Zabrušany  NM G 374, missing  Rubus merianii  

Velenovský 1881

Most of the documentation material is housed in the National Museum, Praha, besides many other not illustrated specimens. Velenovský used a special numbering of species written on the slabs. In this way, his view can be detected even in the cases, when no identification is attached on the label. The type of the rocks (grain size, colour) varies in a large extent and it can be assumed that the material was collected at different places in the Louňy environs.

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<td>Salix varians</td>
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<td>NM G 2030-2031</td>
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| Juglanis acuminata   | p. 44, pl. 8, f. 2, 6 pl. 8, f. 4-5 | Vršovice | NM G 2035, 2038 NM G 2036-2037 | “Juglanis” acuminata?
| Carya bilinica       | p. 44, pl. 8, f. 1, 3 pl. 9, f. 16 | Vršovice | NM G 2039-2040 2041 | Fraxinus bilinica |
| Rhus merianii        | p. 44, pl. 7, f. 16-20 pl. 8, f. 27, pl. 10, f. 12 | Vršovice | NM G 2042.1, missing, 2043.1-2, 2044 2067, 2045 | Rubus merianii |
| Rhus elegans         | p. 45, pl. 10, f. 5-11 | Vršovice | NM G 1902.1, 1892, 2068, 1894, 1891, 1903.1, 1893 | Rubus vrsovicensis |
| Zanthoxylon serratum | p. 45, pl. 5, f. 18 | Vršovice | NM G 2047 | Rosa europaea |
| Terminalia radobojana | dito | pl. 10, f. 1-4 | Vršovice | NM G 2048 2049-2052 | ? Myrica cf. integerrima
| Prunus denticulata   | p. 47, pl. 8, f. 17-18 pl. 8, f. 19, TYPES | Vršovice | NM G 1897, 1896 1898 | Alnus gaudinii |
| Podogonium knorrii   | p. 48, pl. 10, f. 13-14 pl. 10, f. 15-17 | Vršovice | NM G 1876.3, 2054 missing, missing, 1876.1 | Acer sp., fruits |
| Cinchona sp.         | p. 98, pl. 6, f. 17-18 | Vršovice | NM G 2055, 2018.2 | Nyssa haldingeri |
| folium               | p. 49, pl. 3, f. 26-27 | Vršovice | NM G 2056-2057 | ? Alnus gaudinii |
| fructus              | p. 49, pl. 9, f. 26-27 | Vršovice | NM G 3735, 3732 | indeterminate fruit |
| fructus              | p. 49, pl. 7, f. 21 | Vršovice | NM G 3733 | indeterminate fruit |
| fructus              | p. 49, pl. 9, f. 7 | Vršovice | NM G 2058 | indeterminate fruit |

Engelhardt 1891

This work includes only few figured and type specimens of plant fossils from baked rocks, namely from Želénky. They were originally deposited in two collections: one of mine manager Tobisch, Duchcov, at present missing, and at the “Böhmisches Polytechnikum”, at that time supervised by prof. J. Krejčí. This collection was later transferred to the Faculty of Science, Charles University, Praha, where it is kept in part till now.

<table>
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<td>Betula prinsa</td>
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41
Revue spodnomiocénních rostlin zachovaných ve vypálených horninách severočeského terciéru
Zlatko Kvaček - Stanislav Hurník

Vypálené horniny, zvláště zvrstvené porcelanité, jsou typickým zjevem severočeských třetihor a byly předmětem zájmu paleontologů pro svůj obásněná rostlinných zko­menelin. Pro svůj využití jako podpůrného materiálu pod kote­je na povrchových dolech byla jejich ložiska v posledních desetiletích ve velkém rozsahu těžena a zbývá jen několik málo lokalit zachovaných pro přístup generace. Známé výskytu, např. u Zabrusan, Želénka nebo v okolí Loun, byly v podstatě zcela odteženy.

V práci podáváme revizi většiny spodnomiocénních rostlin zaznamenaných v dřívějších studiích od doby Sternbergovy (Sternberg 1820–1838), kde se objevují první popsané druhy, do dnešní doby. Studované doklady jsou uloženy v sbírkách Národního muzea v Praze, Přírodovědeckého muzea ve Vídni, Spolkového geologického ústavu ve Vídni, Maďarského příro­dovědeckého muzea v Budapešti (Labkovická sbírka z Bilíny) a řadě dalších našich i zahraničních institucí. Až na některé

| Ficus tiliæfolia | p. 162, pl. 7, f. 9 | Želénky missing | Dombovyopsis lobata |
| Heliotropites reussii | p. 171, pl. 7, f. 18 | Želénky missing | cf. Vitis vel Ampelopsis sp. |
| Diachenites ovalis | p. 176, pl. 7, f. 20 | Želénky missing | cf. Vitis vel Ampelopsis sp. |
| Celastrus deucalitionis | p. 187, pl. 7, f. 31 | Želénky missing | indetermined dicot leaf |
| Laurus lalages | p. 166, pl. 8, f. 5 | Želénky missing | indetermined dicot leaf |
| Cinnamomum buchii | p. 167, pl. 8, f. 6 | Želénky missing | |
| Viburnum atlanticum | p. 172, pl. 8, f. 16 | Želénky missing | Viburnum atlanticum |
| Parrotia pristina | p. 178, pl. 9, f. 18 | Želénky missing | Parrotia pristina |
| Paliurus tiliaefolius | p. 187, pl. 10, f. 17 | Želénky missing | Rubus merianii |
| Apeibopsis descloesi (?) | p. 179, pl. 10, f. 19 | Želénky missing | Nyssa haidingeri |
| Grewia crenata | p. 180, pl. 11, f. 1 | Želénky missing | Cercidiphyllum crenatum |
| Acer grossidentatum | p. 181, pl. 11, f. 12 | Želénky | Charles Univ. Acer tricuspisatum |
| Acer trilobatum | p. 182, pl. 11, f. 10 | Želénky | Charles Univ. Acer tricuspisatum |
| Hiraea expansa | p. 183, pl. 13, f. 2-3 | Želénky | Charles Univ. Limnobiyphyllum expansum |
| Zizyphus tiliaefolius | p. 189, pl. 13, f. 12 | Želénky missing | Palntus tiliaefolius |
| Rhamnus dechenii | p. 189, pl. 14, f. 1 | Želénky missing | Laurophyllum cf. saxonicum |
| Pterocarya denticulata | p. 193, pl. 14, f. 15, 17 | Želénky missing | Carya cf. serrifolia |
| Rhus rmentani | p. 193, pl. 14, f. 23 | Želénky | Rubus merianii |
| Juglans bilinica | p. 192, pl. 15, f. 4 | Želénky | Fraxinus bilinica |
| Juglans acuminata | p. 192, pl. 15, f. 7 | Želénky | Nyassa haidingeri |
| Leguminosites tobischii | p. 198, pl. 15, f. 19-20, TYPES | Želénky missing | Leguminosites tobischii |
| Rhus quercifolia | p. 193, pl. 15, f. 23 | Želénky missing | Rubus merianii |
| Carpolithes striatus | p. 198, pl. 15, f. 27, TYPE | Želénky missing | indetermined seed |

sbírky soukromých sběratelů popsaných Engelhardt (1891) se podařilo dohledat mnoho typových kusů z děl Velenovského (1881), Ettingshausenová (1866–1869) i dokladový materiál k předběžným zprávám Procážkuvým a Bůžkovým (depozitář Ukášského geologického ústavu v Lužné). V rámci revize bylo zjištěno 6 druhů kapradin, 7 jehlicnanu a více než 60 krytosemenných rostlin (viz tabulka 3), a z nich navrženo přeřazení tří druhů: *Rosa europea* (ETTINGSH.) comb. n., *Fraxinus bilinica* (UNGER) comb. n., *Hydrochary­phyllum mioenium* (VELENOSKY) comb. n. a navrženo jed­no nové jméno: *Rubus vrsovicensis* nom. n.


V závěru shrnujeme význam flóry porcelanitů, a to hlavně z hlediska mezinárodního věhlasu. V současné době, kdy výskyty rychle zanikají, považujeme za nezbytné vyhlasit některé z nich za chráněná naleziště.
PLATE I

Prochnophyllum striatum (UNGER) KNOBLOCH & KVAČEK

1. Frond fragment, Dobříč, MT PA 1025, x 0.7.
2. Fertile pinna, Dobříč, MT PA 1022, x 3.
Woodwardia muensteriana (C. PRESL) KRÄUSEL
3. Fertile pinnule, Vršovice, NM G 1906 (Velenovský 1881, pl. 1, fig. 5), x 5.

Blechnum dentatum (GÖPPERT) HEER
4. Fertile pinna, Světce, NM G 7732, x 2.5.
5. Straky, BP 56.1177 (Ettingshausen 1866, pl. 3, fig. 7, as Blechnum braunii ETTINGSHAUSEN), x 1.5.
6. Frond fragment, Světce, NM G 7715, x 0.9.

Osmunda parschlugiana (UNGER) ANDREANSZKY
5. Dobrcice, DB Do 9, x 1.5.

Lygodium kaulfussii HEER
6. Svetec, NM G 7726, x 2.0.

PLATE 2
Salvinia reussii ETTINGSHAUSEN
1. Chudeřice, BP 56.1200 (Ettingshausen 1866, pl. 2, fig. 19, TYPE of Salvinia cordata ETTINGSHAUSEN), x 2.0.
2. Ditto, nat. size.

Quasisequoia couttsiae (HEER) KUNZMANN
3. Shoot with seed cones, Vršovice, NM G 1921, x 1.1.
4. Isolated seed, Dobrcice, MT PA 1026, x 10.0.

Berberis berberidifolia (HEER) PALAMAREV et PETKOVA
5. Zabrusany, BA 6067 (Ettingshausen 1869, pl. 48, fig. 6, TYPE of Celastrus arethusaee ETTINGSHAUSEN), x 1.5.

Pinus engelhardti MENZEL

Pinus rigida ETTINGSHAUSEN
7. Needle fascicle, Nové Město, MT PA 1019, x 1.8.

Laurophyllum cf. saxonicum LITKE
8. Vršovice, NM G 2051 (Velenovský 1881, pl. 10, fig. 3, as Terminalia radobojensis UNGER), nat. size.

PLATE 3
Liquidambar europaea A. BRAUN
1. Zabrusiány, BP 56.1217 (Ettingshausen 1869, pl. 46, fig. 8, as Acer ruminianum HEER), x 1.2.

Parrotia pristina (ETTINGSHAUSEN) STUR
2. Zabrusiány, BP 56.1195 (Ettingshausen 1869, pl. 40, fig. 25), x 1.5.

Quercus rhenana (KRÄUSEL et WEYLAND) KNOBLOCH et Z. KVAČEK
3. Želénky, DB Že 1, x 0.7.

Betula sp.
4. Želénky, MT PA 1028, x 1.3.

Alnus julianiformis (STERNBERG) Z. KVAČEK et HOLÝ
5. Bílina, NM G 3813, x 1.4.
7. Bílina, NM G 3815, x 1.3.
8. Dobřečice, DB Do 1, x 1.3.

Quercus sp.
6. Cupule, Vršovice, NM G 1937 (Velenovský 1881, pl. 8, fig. 25, as Sparganium (?)!), x 4.0.

PLATE 4
Alnus gaudinii (HEER) KNOBLOCH et Z. KVAČEK
1. Vršovice, NM G 1853 (Velenovský 1881, pl. 4, fig. 1, TYPE of Fagus ettingshausenii VEL NOVSKÝ), x 1.5.
2. Vršovice, NM G 1882 (Velenovský 1881, pl. 8, fig. 16, TYPE of Rhamna fricii VEL NOVSKÝ), x 1.6.

Alnus cf. rostoviana SAPORTA
3. Dobřečice, DB Do 2, x 0.9.
6. Dobřečice, DB Do 3, x 0.9.
7. Shade leaf, Dobřečice, MT PA 1024, x 0.8.

Alnus sp. 1
4. Infructescence, Dobřečice, DB Do 4, x 2.

Alnus sp. 2
5. Infructescence, Zabrusiány, coll. MCh, x 2.

PLATE 5
Myrica cf. integerrima KRÄUSEL et WEYLAND
1. Vršovice, NM G 1865 (Velenovský 1881, pl. 9, fig. 20, TYPE of Dryandroidei lonenensis VEL NOVSKÝ), nat. size.
2. Vršovice, NM G 1858 (Velenovský 1881, pl. 9, fig. 17, TYPE of Dryandroidei lonenensis VEL NOVSKÝ), nat. size.

Myrica lignonitum (UNGER) SAPORTA
3. Nechvalice, MT PA 1009, x 1.6.

Engelhardia orsbergensis (WEBER) JÄHNICHEN, MAI et WALTHER
4. Nechvalice, MT PA 1017, x 2.0.

Salix variaens GÖPPERT
5. Dobřečice, DB Do 6, x 1.5.

Ulmus pyramidalis GÖPPERT
6. Short leaf form, Straky, MT PA 1036/1, x 1.2.

Comptonia difformis (STERNBERG) BERRY
7. Nechvalice, MT PA 1014, x 2.

Salix macrophylla HEER
10. Vršovice, NM G 1981 (Velenovský 1881, pl. 5, fig. 9), x 7.

Ulmus sp.

Craigiabronnii (UNGER) Z. KVAČEK, BŮŽEK et MANCHESTER
11. Fruit valve, Mimošovice, DB Mi 1, x 2.

Dombeyopsis lobata UNGER
12. Svinčice, DB Sv 1, x 1.5.

PLATE 6
Rosa europaea (ETTINGSHAUSEN) comb.n.
1. Želénky, DB Že 2, x 2.0.
9. Zabrusiány, BA 6043 (Ettingshausen 1868, pl. 37, fig. 22, TYPE of Myrsine europaea ETTINGSHAUSEN), x 1.3.

Rubus merianii (HEER) KOLAKOVSKII
2. Vršovice, NM G 2044 (Velenovský 1881, pl. 7, f. 20, as Rhus merianii HEER), x 1.5.
5. Želénky, NM G 7734, x 1.2.
Rubus vrsovicensis nom. n.
3. Vrsovice, NM G 1902.1 (Velenovský 1881, pl. 10, f. 5, TYPE of Rhus elegans VELENOVSKÝ), nat. size.
4. Dttő, x 2.5.
8. Vrsovice, NM G 1891 (Velenovský 1881, pl. 10, f. 9, TYPE of Rhus elegans VELENOVSKÝ), x 1.6.
10. Vrsovice, NM G 2045 (Velenovský 1881, pl. 7, f. 20 as Rhus merianii HEER), x 3.0.
Rubus sp.
6. Prickly twig, Černodoly, DB Nc 1, x 2.3.
7. Fruitlets and an associated cone scale of Glyptostrobus europaeus (BRONGNIART) UNGER, Zabrusany, Mus. Joan­ neum (coll. Wiesbauer 4329), x 4.0.

Plate 7

Decodon gibbosus (E. M. REID) E. M. REID
1. Foliage, Svetec, NM G 7717, nat. size.
Leguminosites spp.
2. Leaflet, Nechvalice, MT PA 1018, x 2.5.
3. Leaflet, Svetec, NM G 7731, x 1.4.
4. Leaflet, Mirosovice, DB Mi 2, x 2.5.
Podocarpium podocarpum (A. BRAUN) HERENDEEN
5. Leaflet, Želénky, DB Že 3, x 2.5.
Toddalia maii GREGOR
6. Group of seeds, Dobřeč, DB Do 7, x 4.
7. Group of seeds, Želénky, DB Že 4, x 4.
Berchemia multinervis (A. BRAUN) HEER
8. Zabrusany, BA 6045 (Ettingshausen 1866, pl. 17, fig. 13, TYPE of Quercus pseudo-laurus ETTINGHAUSEN), nat. size.
Palurus favonii UNGER
9. Fruit, Želénky, NM G 7733, x 2.5.
Palurus tiliaefolius (UNGER) BŮŽEK
10. Leaf, Nechvalice, MT PA 1013, x 1.8.
cf. Ampelopsis sp.
cf. Vitis vel Ampelopsis sp.
12. Seed molds, Dobřeč, MT PA 1027, x 10.0.

Plate 8

Nyssa haidingeri (ETTINGHAUSEN) Z. KVAČEK et BŮŽEK
1. Zabrušany, BP 56 1194 (Ettingshausen 1866, p. 54, as Quercus neriifolia A. BRAUN), nat. size.
Fraxinus macroptera ETTINGHAUSEN
2. Fruits, Želénky, DB Že 5, x 2.0.
“Juglans” acuminata A. BRAUN
3. Svetec, NM G 7723, x 5.0.
4. Svetec, NM G 7723, x 9.0.

Plate 9

Hydrochariphyllum miocenicum (VELENOVSKÝ) comb. n.
1. Vrsovice, NM G 1845 (Velenovský 1881, pl. 1, fig. 18, TYPE of Podozamites miocenicus VELENOVSKÝ), x 2.0.
2. Dttő, x 6.0.
3. Vrsovice, NM G 1846 (counterpart of the type specimen shown in figs 1-2), x 5.0.
4. Vrsovice, NM G 1847 (Velenovský 1881, pl. 1, fig. 19, TYPE of Podozamites miocenicus VELENOVSKÝ), x 6.0.
Hydrochariphyllum buzekii Z. KVAČEK
5. Želénky, NM G 7737, x 6.
Smilax weberi WESSEL in WESSEL et WEBER
Limnobioiphyllum expansum (HEER) Z. KVAČEK
7. Želénky, coll. Charles University (Engelhardt 1891, pl. 13, fig. 2, as Hiera expansa HEER), nat. size.

Plate 11

Calamus noszkyi JABLONSKY
1. Svetec, NM G 5623, nat. size.
2. Svetec, NM G 7727, x 0.8.
3. Svetec, NM G 7727, x 0.8.

Sabal lamanonis (BRONGNIART) HEER
5. Sviňčice, MM G/pa 773/6, nat. size.
6. Sviňčice, MM G/pa 773/1, nat. size.
7. Sviňčice, MM G/pa 773/3, nat. size.

Unioid mollusc
4. Shell impression, Svetec, NM G 7730.2, x 2.0.
PLATE 12

cf. *Margaritana* sp.

"*Typha* latissima* A. BRAUN
2. Venation, Vršovice, NM G 1934 (Velenovský 1881, pl. 2, fig. 2), x 7.5.

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*cf. Zingiberoideophyllum liblarense* KRÄUSEL et WEYLAND
3. Venation, Vršovice, NM G 1934 (Velenovský 1881, pl. 2, fig. 16, as *Musa bilimica* ETTINGSHAUSEN), x 7.0.

*Cyperacites* spp.
4. Vršovice, NM G 1849 (Velenovský 1881, pl. 2, fig. 15, TYPE of *Phormium affine* VELENOVSKÝ), x 1.2.

5. Dtto, venation, x 4.5.