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THE NATURE OF PODOZAMITES OBTUSUS VELENOVSKÝ

Introduction

In „Die Gymnospermen der böhmischen Kreideformation“, VELENOVSKÝ (1885) described the species *Podozamites obtusus* VEL. based on an impression of single oblanceolate coriaceous leaf from the Cenomanian freshwater sandstones (Peruc Formation) found near Nehvizdy (east of Prague, Bohemia, Czechoslovakia). The quotation of Velenovský's description is as follows:

„Das Blatt aus verkehrt eiförmiger Spitze allmählig in einem langen Stiel verschmälert, ganzrandig, derb lederartig. Die Blattspreite grob und ziemlich lockert genervt.“ (l. c. page 9.)

The holotype refigured here (Pl. I, fig. 1) is identical with the leaf impression described and figured in VELENOVSKÝ (l. c. Pl. I, fig. 8). The leaf impression is 100 mm long and 23 mm wide, about 19 dichotomously branched veins run parallel with a longitudinal axis from the petiolate base to the apex of the lamina.

Although VELENOVSKÝ originally placed *Podozamites obtusus* VEL. in the *Cycadales*, he admitted affinities to *Bayera* HEER, *Feildenia* HEER and even *Kranera* CORDA ex VEL. During his later studies of Bohemian Cretaceous plants VELENOVSKÝ found *P. obtusus* VEL. at some new localities. E. BAYER (in FRIČ & BAYER 1901, 1903) recorded two other finds from Nehvizdy. In the *Flora cretacea Bohemiae* vol. I (VELENOVSKÝ & VINIKLÁŘ 1926) the authors presumed the relations between small rounded fruits of hypothetical ginkgoalian character and the leaves of *P. obtusus* VEL., both found at the locality Kralupy (north of Prague). There exists no direct evidence that these remains belonged together since they have never been found in a direct natural connection being solitarily dispersed in the same bedding plane. Similarly the au-

thors inferred the connection of the leaves of *P. obtusus* VEL. to a fragmentary twig with spirally arranged rhombic leaf scars with supposed spiral phyllotaxy, though this connection has not been proved either. The leaves, fruits and shoot are figured in the mentioned paper (Pl. IV, figs. 1, 2, Pl. VI, figs. 11, 12, 13). On the basis of these presumption the authors removed the species from the *Cycadales*, and being sure of the ginkgoalian character of *P. obtusus* VEL., they suggested provisionally a new genus *Pseudozamites* (see Note, p. 175).

In the vol. II of the monograph (VELENOVSKÝ & VINIKLÁŘ 1927) the authors described new abundant finds of small rounded fruits and twigs from the Kralupy locality and assigned them to the ginkgoalian genus *Phylloenia* SALFELD from northern Germany. This opinion is shared by KNOBLOCH (1968) without any additional commentary (see Note, p. 175).

Since that time the species has not attracted much interest of the specialists studying Bohemian Cretaceous plants (except the cuticle studies of BAYER 1921, mentioned in p. 181). In 1965 I started collecting plant remains from the Cenomanian freshwater beds in Central Bohemia and found a lot of partly or fully preserved cuticle membranes of *P. obtusus* VEL. beside the others. The remains were found in clayey sediments, mostly in a special dark claystone horizon of probably important stratigraphical significance. The greatest number of cuticles that are described in this paper originate from the locality Hloubětín brickkiln (Prague). Several specimens come from the Vyšerovice locality (east of Prague). The epidermal membranes are heavily cutinized so that their structural details are well preserved.

After the detailed morphological and anatomical studies a new genus and a specific binomial is suggested as follows.

Nehvizdya gen. nov.

Coriaceous oblanceolate single leaves with petiolar base and round apex. Veins dichotomously branched forming longitudinal parallel venation in the leaf lamina, slightly convergent in the apex. Epidermal cells polygonal, heavily cutinized. Stomata of perigenous type, sunken, evenly distributed between veins. Guard cells in stomatal pits forming irregularly orientated stomatal apertures.

Type species: *Nehvizda obtusa* (VEL.) comb. nov.

Derivatio nominis: after the name of type locality — Nehvizdy, east of Prague, Bohemia.

Nehvizdya obtusa (VELENOVSKÝ) comb. nov.

Figs. 1—10, Pls. I—IV.

1885 *Podozamites obtusus* VELENOVSKÝ, pp. 9—10, Pl. I, figs. 8—9.

1900 *Podozamites obtusus* VEL.: BAYER in FRIČ & BAYER, p. 90.

1902 *Podozamites obtusus* VEL.: BAYER in FRIČ & BAYER, p. 88.

1921 *Podozamites obtusus* VEL.: BAYER, pp. 44—46, textfigs. 3, 4.

1926 *Podozamites obtusus* VEL.: VELENOVSKÝ & VINIKLÁŘ, pp. 7—8, 34—35, Pl. IV, figs. 1, 2. Pl. VI, figs. 11, 12, 13.

1927 *Podozamites obtusus* VEL.: VELENOVSKÝ & VINIKLÁŘ, p. 6. 33.

Note: In VELENOVSKÝ & VINIKLÁŘ (1926, 8, 5) *P. obtusus* VEL. is assigned to the genus *Pseudozamites* provisionally suggested by the authors. Similarly VELENOVSKÝ & VINIKLÁŘ (1931, 43, 93) named the species as *Feilendia obtusa* in the List of probably correctly determined Moravian and Bohemian Cretaceous plants. E. KNOBLOCH (1968) has introduced the binominal *Phyllotenia obtusa* (VEL.) KNOBL. All these names were not published in accordance with the *International Code of Nomenclature*, and therefore I do not respect them as valid synonyms.

Holotype: The specimen described and figured by VELENOVSKÝ (1885, 9–10, Pl. I, figs. 8, 9), Palaeobotanical collection of the Department of Paleontology, National Museum, Prague, Czechoslovakia, No. F 03, and refigured here (Pl. I, fig. 1).

Locus typicus: Nehvizdy, east of Prague, Czechoslovakia.

Occurrence: Czechoslovakia, Central Bohemia, Upper Cretaceous, Cenomanian freshwater beds (Peruc Formation), clays, claystones, sandstones.

Description

Leaf morphology. — Single leaves, coriaceous, widely or narrowly oblanceolate (to lanceolate), with petiolarly tapering base and roundish apex (fig. 1, Pl. I, figs. 1–6). The length varies from 30 to 100 mm, the width from 5 to 30 mm. Entire margins are asymmetrically waved (very flat lobes) in the upper half of the lamina (fig. 1). The petiole is from 1,5 to 3 mm wide and its length attains about 1/3 to 1/4 of the leaf length. It is penetrated by two parallel veins. They are dichotomously branched forming longitudinal parallel venation in the lamina (figs. 2, 3, 4, Pl. I, II). Longitudinal leaf axis is straight or bent a little in the lamina level (sickle-shaped or S-shaped leaves) (fig. 1).

The venation is observable on leaf impressions or cuticles. It is best seen on naturally translucent leaf remains (figs. 2, 3, 4, Pl. I, figs. 2–6, Pl. II.). At the boundary between the petiole and the lamina there are two parallel petiolar veins dichotomously branching into four veins at first. The branching continues more or less symmetrically to the place of the maximal width of the lamina. The veins are very abundant there. They are regularly spaced and their number is in proportion to the width of the lamina. Only the longest central veins reach to the normally developed leaf apex. The others incline rather both to the leaf axis and to the converging margin. In divided leaves the veins end at regular intervals in the lobes margins (figs. 2, 3, 4). The width of the veins is about 0,5 mm. In my opinion they are expresively distinct only on one side of the lamina under the lower cuticle membrane; the other side is smooth.

Cuticular characteristics. — The leaf epidermis is heavily cutinized. The cuticle thickness varies from 0,005 to 0,006 mm on the upper side and from 0,006 to 0,010 mm on the lower side of the lamina (the lower cuticle is relatively thicker because of thicker cutinization of stomatal regions). The upper epidermal cells are polygonal, more or less isodiametric (in a pavement pattern), sometimes elongated, arranged in longi-

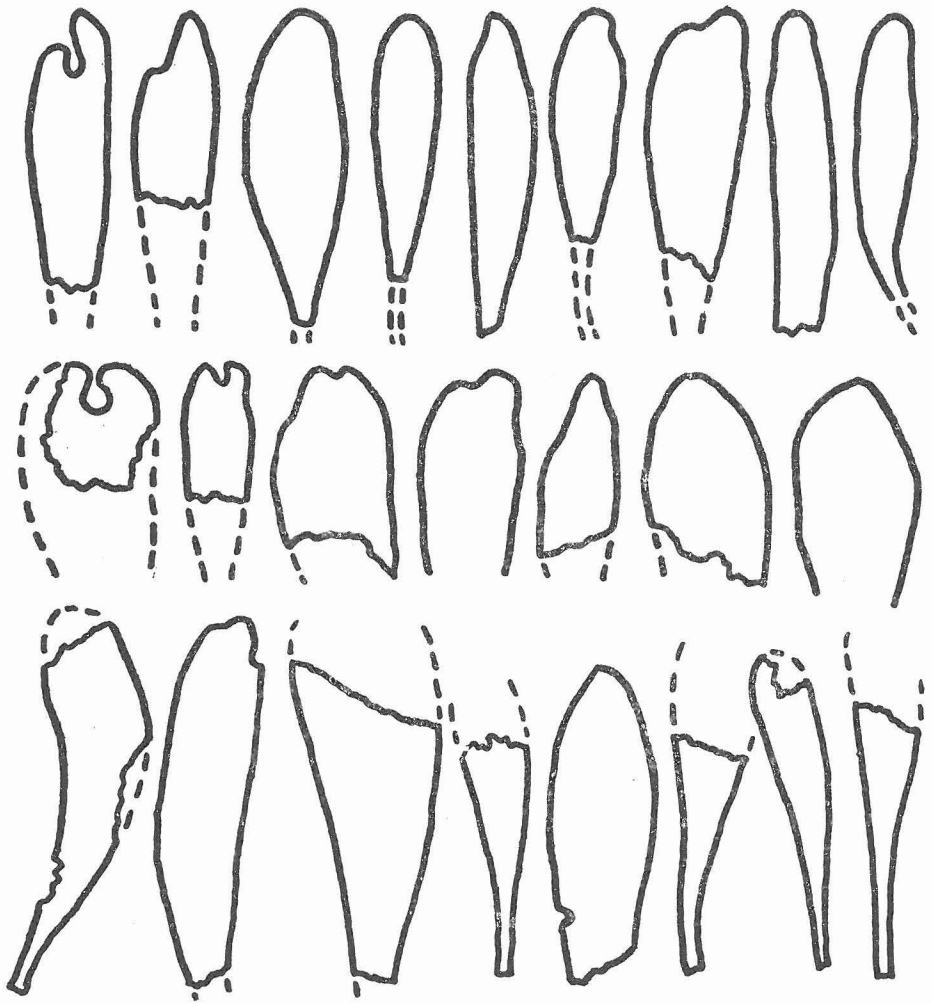
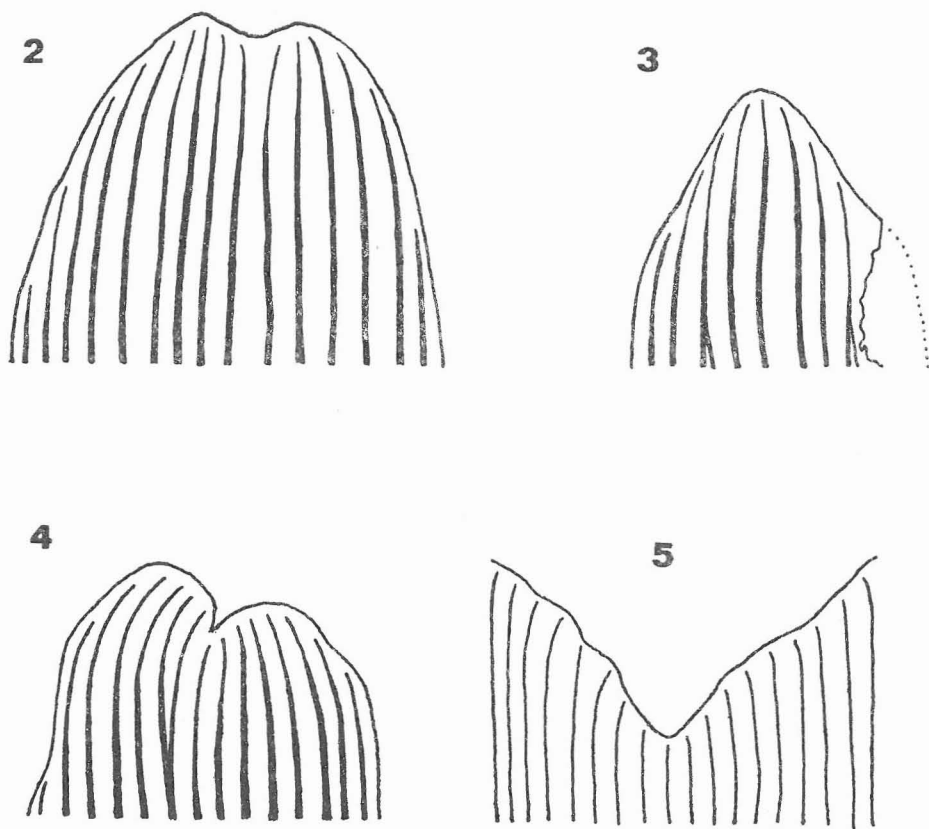


Fig. 1.
Nehvizdya obtusa [VEL.] comb. nov. — The size and shape variations of the blades. After specimens from Hloubětín - brickkiln, Prague, freshwater claystones, Cenomanian, Perucer Beds, nat. size. Figured by author.

tudinal wedge-shaped rows. The cell size varies from 0,04 to 0,07 across. Anticlinal cell walls straight or slightly curved with blunt corners without thickenings. Stomata absent (Pl. III, fig. 1). The lower epidermal cells are of two kinds:

a) polygonal, isodiametric to twice (three times) longer than wide cells above the veins, arranged also in longitudinal rows. The width of the vein zones varies from 0,3 to 0,8 mm (Pl. III, fig. 2).



Figs. 2—5.

Nehvizdya obtusa (VEL.) comb. nov. — Assortment of the leaf apices in comparison to the same part of the blade of *Ginkgo biloba* LINNÉ [5]; 2 — slightly divided apex, 3 — apex waved in three flat lobes, 4 — distinctly divided blade, 5 — deeply divided blade of *Ginkgo biloba* LINNÉ (the center of apical part), after natural state, $\times 3$. Figured by author.

b) polygonal, more or less isodiametric cells between the stomata in non-venous areas. They are more strongly cutinized and smaller than the upper epidermal cells (Pl. III, fig. 3).

Stomata of haplocheilic (perigenous) type, surrounded by 4 to 6 subsidiary cells, monocyclic or incompletely dicyclic (*Kranzzellen* after FLORIN 1931), irregularly orientated, sunken in stomatal pits. Subsidiary cells strongly cutinized with papillous thickenings of outer tangential walls often partly overhanging the guard cells (fig. 6). Stomatal pits are formed by cuticular ring elevations on the cuticle surface (fig. 7, Pl. III, fig. 7). They could arise by coalescence (fusion) of subsidiary cell syncline papillae. The depth of stomatal pits is rather variable but in the majority it is about 0,009 mm. The remains of guard cell cutinization have been observed on the surface or inside view as in transverse sec-

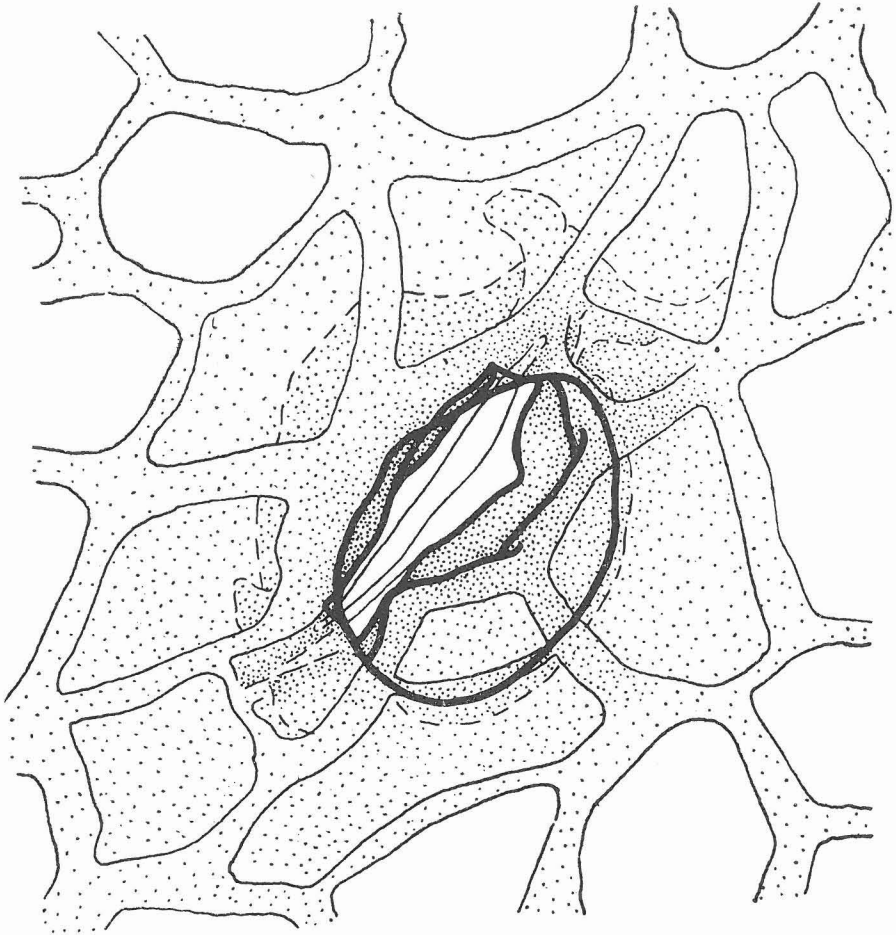
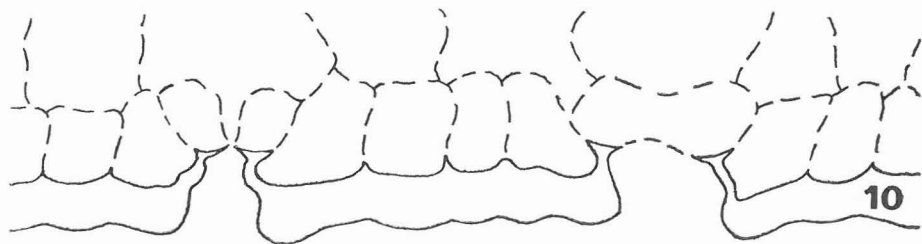
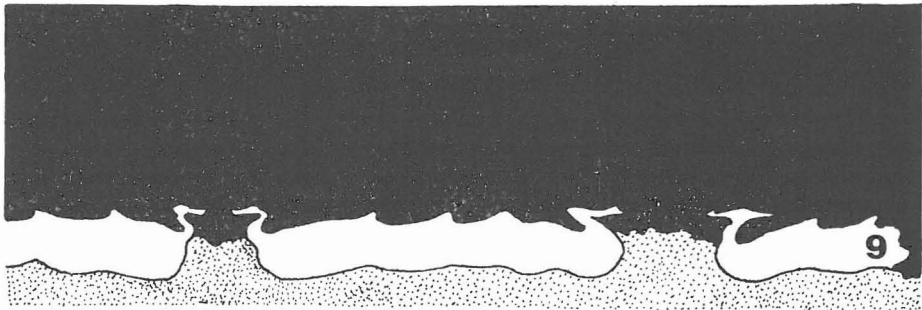
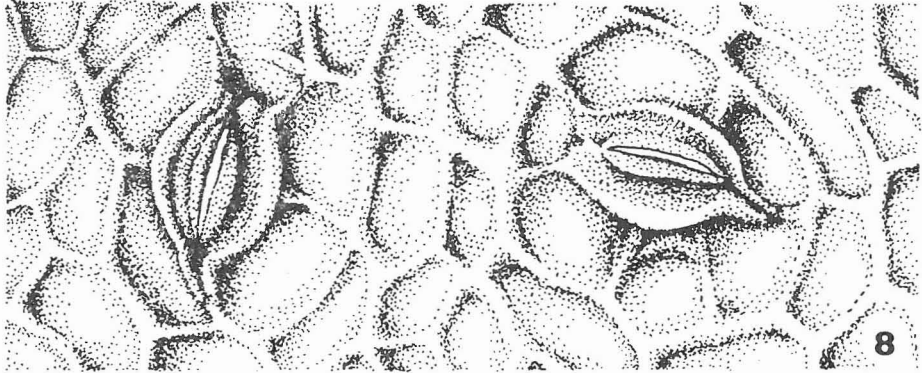
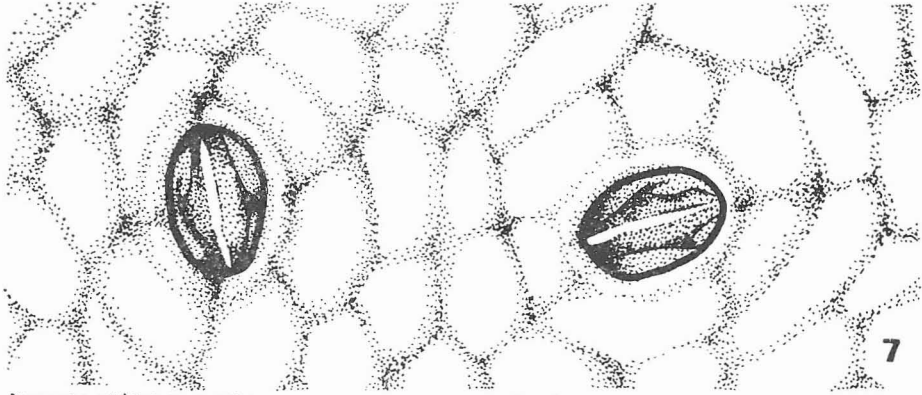


Fig. 6.
Nehvizdya obtusa (VEL.) comb. nov. — Surface view of the stoma (lower cuticle). Strongly cutinized parts are dotted, dashed line indicates the remains of guide cells cutinization, thick black line shows the margins of stomatal pits, after macerated specimen, prep. 4, F 112, X 1000. Figured by author.

tions (fig. 6, Pl. III, figs. 5, 6, Pl. IV, figs 1—4). In some cases stomatal aperture can be recognized between the remains of slightly cutinized outer walls of guard cells. The extent of cutinization and organization of stomatal cells are schematically sketched (figs. 7—10).

Figs. 7—10.
Nehvizdya obtusa (VEL.) comb. nov. — Schematical view of the same part of lower cuticle with two stomata; 7 — surface view, 8 — inside view, 9 — transversal section of unmacerated leaf: cuticle is white, coal matter of mesophyllous part is blackened, the sediment is dotted, 10 — reconstruction of living leaf epidermis (transversal section), X 300. Figured by author.



Variability

The leaves of *Nehvizdya obtusa* (VEL.) comb. nov. show the form and size variations. They were destroyed partly during the sedimentation in the Cenomanian basins, partly during the diagenesis. These causes influence the selection for statistical studies on variability. Preliminary results are summarized here as follows: The size variability (of 150 specimens):

- 1) the leaf length varies from 25 to 100 mm;
- 2) the leaf width varies from 5 to 30 mm;
- 3) the leaf length: the leaf width ratio varies from 8:1 to 3:1 (2:1 extremely);
- 4) the leaf apex length varies from 5 to 30 mm;
- 5) the leaf apex length: the leaf width ratio varies from 2:1 to 1/1,5 (1:2 extremely);
- 6) the petiole length: the leaf length ratio varies from 1:4 to 1:3;
- 7) the vein number: the leaf width ratio varies from 1,5:1 to 1:1,3.

The form of variability:

- 1) The natural shape of leaf lamina varies mainly as far as the leaf apex is concerned (from the place of maximal leaf width to the top) in comparison with the hypothetical ideal form;
- 2) the margins of the leaf lamina are usually rather asymmetrically waved in very flat lobes (figs. 1, 2, 3);
- 3) it is possible to find occasionally divided leaves (fig. 4).

Statistical studies have revealed no more important differences. Because of that *Nehvizdya obtusa* (VEL.) comb. nov. seems to be a homogenous single leaf form with wider variability.

Discussion

The genus *Podozamites* BRAUN is established on the basis of *Zamites distans* PRESL (= *Podozamites distans* (PRESL) BRAUN). Many species have been described since that time from the sediments of Triassic to Cretaceous age. NĚMEJC (1950) suggested the family *Podozamitaceae* as a special group of gymnosperms. They were probably woody, not deciduous plants with lanceolate pointed leaves without petioles. The leaves were arranged closely and spirally. In the base of the lamina there are two or more veins, the venation is dense, parallel or rather fan-shaped. The maximal width is in the lower half of the lamina.

After DOLUDENKO (1966) the leaves of *P. aff. eichwaldii* SCHIMPER are hypostomatic with thin cuticle. Epidermal cells are rectangular, isodiametric or slightly elongated, arranged in distinct longitudinal rows. Stomata are orientated transversally.

HARRIS (1935) described longitudinally and transversally orientated stomata with four subsidiary cells of *P. stewartensis* HARRIS and *P. punctatus* HARRIS from the Jurassic of Greenland.

Even though the cuticles of *Podozamitaceae* are not well known, as yet, it is possible to say they have closely coniferous character.

Morphological comparison between the species *Podozamites* BRAUN and *Nehvizdya obtusa* (VEL.) comb. nov. shows many differences. The distinct oblanceolate tapering form of the lamina is atypical of *Podozamites* ssp. The apices of the described leaf lamina are never pointed like those in *Podozamitaceae*; thick coriaceous leaves of *Nehvizdya obtusa* (VEL.) comb. nov. differ from the delicate character of the remains of *Podozamites* ssp. The described venation is different from that of *Podozamitaceae* due to the vein branching in the whole lamina level. The leaves of *Nehvizdya obtusa* (VEL.) comb. nov. are not found in any direct connection with a shoot. They probably belong to some deciduous plant in comparison to the remains of *Podozamites* ssp. which are found mostly like foliage shoots. All these differences suggest the affinity of the described species with some other plant group of similar morphology than *Podozamitaceae*.

E. BAYER (1921) first made cuticular analysis of the species in his preparations from 1899. He compared *Podozamites obtusus* as to the cuticle structure with *Hakea incrassinata* and the *Proteaceae*, as to the leaf form with *Agathis ovata*. However, he suggested some relations to the *Cycadales*. In my opinion these comparison are not convincing. The conclusions of BAYER did not influence VELENOVSKÝ'S observations in his later papers.

The cuticle of *N. obtusa* (VEL.) comb. nov. differs considerably from that of the true *Podozamites* species. The thick cuticle membrane has deep stomatal pits, sunken stomata and pure hypostomy. The appearance of the leaves suggests very probable xeromorphic characters of *N. obtusa* (VEL.) comb. nov. Similar structures to *Podozamites* ssp. are not recorded. The position of the described leaves on the plant is not known. No foliage twigs or shoots have been found so far. The leaves are dispersed singly in the sediments. There is no proof of the connection of the leaves to the leafless shoots with spirally detached rhombic sears, suggested by VELENOVSKÝ & VINIKLÁŘ (1926); nevertheless it is necessary to emphasize VELENOVSKÝ'S idea as to the affinities to Ginkgoaceae. All the facts about the morphology and cuticular structure are atypical for true *Podozamitaceae* and eliminate or make doubtful any relations to them.

Morphological comparison of the leaves of *Nehvizdya obtusa* (VEL.) comb. nov. and those of *Agathis* ssp. (especially with *Agathis ovata* — BAYER 1921) are problematical, mainly as to the venation. As to the cuticular characteristics the differences are still more pronounced.

On the contrary, among the Ginkophylla [NĚMEJC 1968] with petiolar bases there are several leaves resembling *Nehvizdya obtusa* (VEL.) comb. nov. especially in the leaf-shape and cuticle. *Glossophyllum florini* KRÁUSEL from the Lunzer Beds (Keuper) in Austria has a petiolar base of lamina, dichotomous venation and similar epidermal structures. It differs from the described species by longer leaves, amphistomatal character and papillae distinctly overhanging the guard cells. It is very difficult to find any phyletic relations between both species. The described species also resembles isolated lobes of *Ginkgoites dilatata* (HEER) TEIX. described from the Jurassic of Portugal (HEER 1881, TEIXEIRA

1948). But these lobes are only segments of deeply lobed leaf blade (like in some other species of *Ginkgophylla*).

The leaves of *Ginkgodium* YOKOYAMA differ from the described species as to the kind of venation with interstitial veins.

The comparison between the species of the genera *Torellia* HEER and *Pseudotorellia* FLORIN and the described species show not only their morphological affinity (oblanceolate leaves, venation), but also the differences in the leaf anatomy (waved walls of epidermal cells, delicate cutinization). *Eretmophyllum pubescens* THOMAS and *E. withbiense* THOMAS from the Middle Jurassic of England resemble *N. obtusa* (VEL.) comb. nov. especially in its leaf morphology (petiolar base, waved margins, divided lamina, venation). The cuticles of both eretmophyllous species are not so thick, only papillously thickened above the epidermal cells. But both the species of *Eretmophyllum* and the described species have epidermal cell forms and stomatal composition similar. The epidermis is built of cells without undulate walls, which are so typical for many Ginkgoaceae. Subsidiary cells are radially arranged around the stomatal pits and are more strongly cutinized. Neither interstitial veins (*E. withbiense* THOMAS) nor the secretory tracts (*E. pubescens* THOMAS) have been observed in *Nehvizdya obtusa* (VEL.) comb. nov.

Distant relations between *E. saighanense* and the eretmophyllous leaves described from the U. S. S. R. may be seen as well.

Nevertheless *N. obtusa* (VEL.) comb. nov. stays rather apart from the known eretmophyllous leaves. The occurrence of *Eretmophyllum* ssp. are limited mainly to rocks of Jurassic age.

The leaves of *N. obtusa* divided into two lobes or with the indications of the dividing (figs 2, 3, 4) resemble similar feature of *Ginkgo biloba* (fig. 5), where the variation of the dividing is observable. Deep lobes overlapping each other might be interpreted as pathological changes of leaf apices. These changes, however, were not observed on the epidermides or on the venation of divided leaves. It is impossible to prove the teratology either. Waved margins and divided apices of the described leaves seem to correspond to the same phenomena in *Ginkgophylla*. The arrangement of the described leaves is not so far known. Their spiral position is not proved and dwarf-shoots have not been found, although they are frequently met in Ginkgoaceae. The species appears to be a deciduous plant.

It is difficult to place *Nehvizdya obtusa* (VEL.) comb. nov. into the grouping of the known ginkgoalian leaves suggested by NĚMEJC (1968) or by TRALAU (1968). In my opinion it would be most convenient to assign it to the Division 2 of the Mesozoic group near to *Eretmophyllum pubescens* THOMAS (TRALAU 1968). As to anatomical structures there are no reliable direct links to any known *Ginkgoaceae* or to their con-runners. *N. obtusa* (VEL.) comb. nov. has been found up to know in a large quantity just in a short stratigraphical range (Cenomanian of Bohemia). It appears to represent a specialized taxon with outlined ginkgoalian features. Therefore it is suggested as a new genus with probable affinities to the *Ginkgoaceae*.

Assemblage

Nehvizdya obtusa (VEL.) comb. nov. forms characteristic association with the shoots of *Frenelopsis alata* (K. FESTM.) KNOBLOCH in clayey sediments of Bohemian freshwater Cenomanian (Perucer Beds) as determined by KNOBLOCH (1971).

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O PODSTATĚ DRUHU PODOZAMITES OBTUSUS VEL.

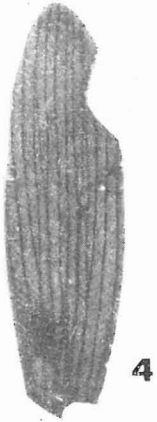
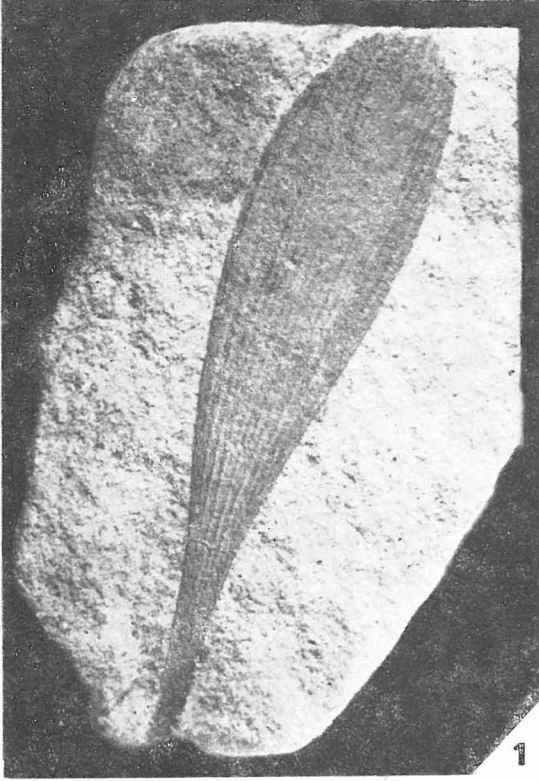
J. VELENOVSKÝ (1885) popsal otisk opakvejčitého kožovitého listu z pískovců cenomanského stáří od Nehvizd [východně od Prahy, Čechy]. Původně jej zařadil jako zbytek většího vějíře k cykasovitým, i když nevyklučoval příbuznost s listy typu Bayera HEER, Fildendia HEER, případně Krannera. Na základě nálezu stejných listů v blízkosti malých kulatých otisků plůdků u Kralup bylo později uvažováno o příslušnosti obou rostlinných zbytků k čeledi Ginkgoaceae (VELENOVSKÝ & VINIKLÁŘ 1926). V blízkosti plůdků a listů byl také nalezen úlomek bezlisté větévky se spirálně sestavenými rombickými jizvami, což vedlo k úvahám o možnosti šroubovitého rozestavení listů *Podozamites obtusus* VEL. na ose. Na základě těchto závěrů byly listy, plůdky a větvička přisuzovány jediné rostlině z příbuzenstva jinanovitých. VELENOVSKÝ a VINIKLÁŘ (1927) srovnávají *Podozamites obtusus* VEL. s listy rodu *Phyllotenia* SALFELD, což se později odrazilo ve vytvoření neplatně publikovaného binomu *Phyllotenia obtusa* (VEL.) KNOBLOCH (KNOBLOCH 1968). Na lokalitě Hloubětín (Praha) sbíral autor této práce zbytky listů *P. obtusus* VEL., na nichž je zachována kutikula. Navázal proto ve svých výzkumech na studii E. BAYERA (1921) a provedl podrobnou kutikulární analýzu. Výsledkem je tato studie, v níž se stanoví nový rod *Nehvizdya* s typickým druhem *Nehvizdya obtusa* (VEL.) comb. nov. (= *Podozamites obtusus* VEL.).

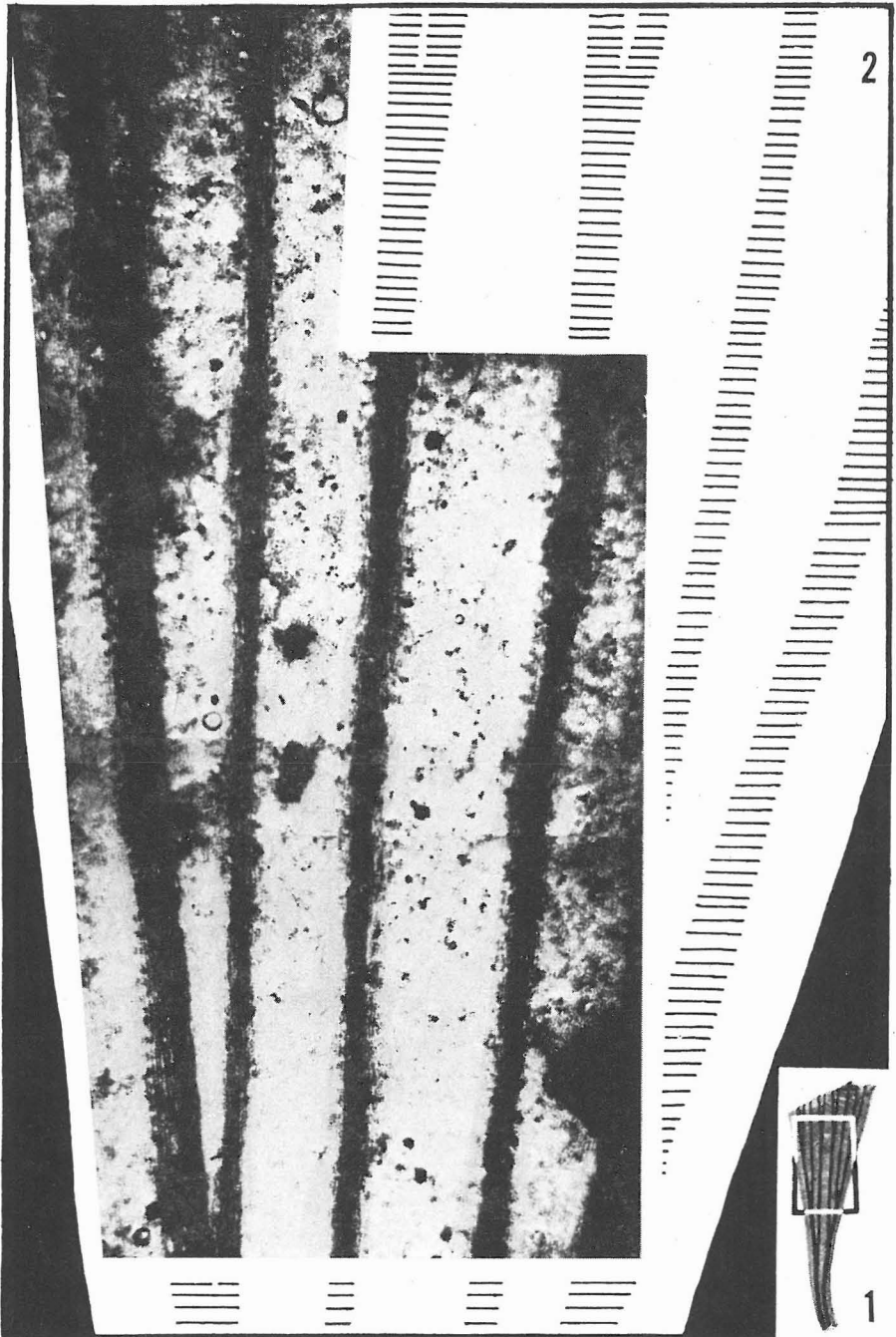
Listy *N. obtusa* (VEL.) comb. nov. jsou hypostomatické, silně kutinizované, průduchy jsou neorientované sestaveny v pásech mezi žilkami na spodní straně listu. Svěrací buňky jsou ponořené v jamce, tvořené kutikulárním valem nad průduchovou štěrbínou, jsou obklopeny 5 či více vedlejšími buňkami, kolem nichž bývá vytvořen ve vždy úplný kruh buňek věncových. Průduchy jsou *perigenní*, typické pro nahosemenné rostliny. Epidermální buňky svrchní strany listu jsou nejčastěji pravoúhlé, podélně protažené a seřazené v podélných klínovitých řadách. Podobný obraz mají i buňky nad žilkami na spodní straně listu. Epidermální buňky, obklopující průduchy, jsou obrysu mnohoúhelníkového a silněji kutinizované.

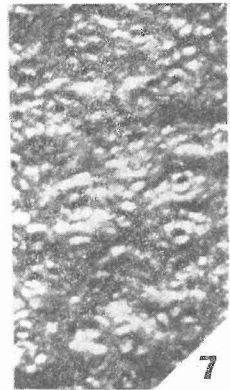
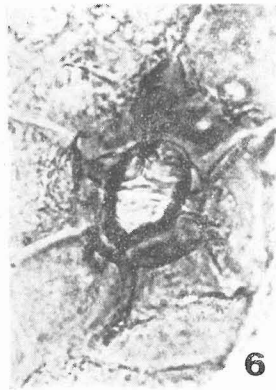
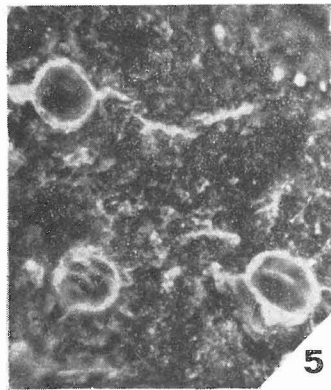
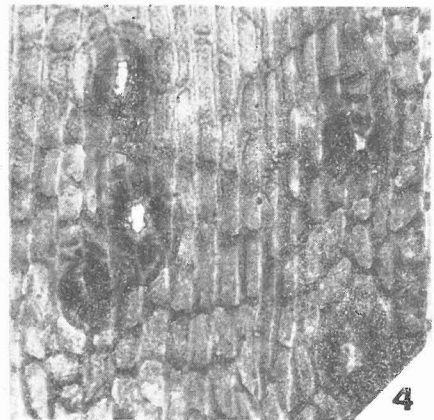
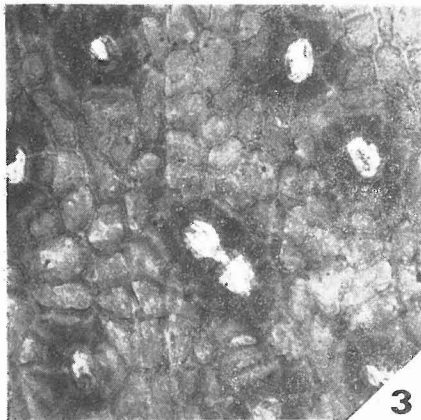
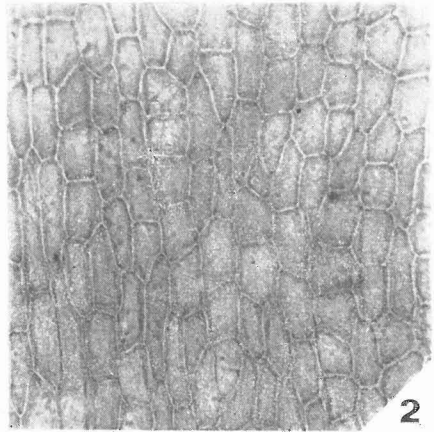
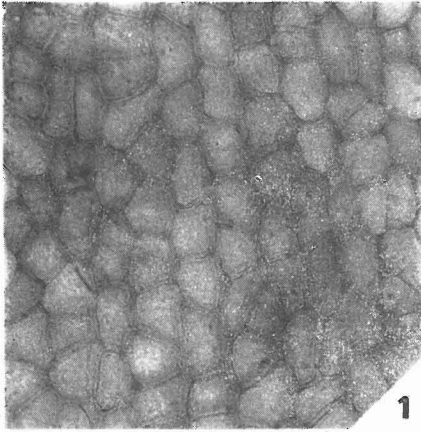
Morfologicky jsou popisované listy zcela shodné s holotypem. Opakvejčitá čepel listu se pozvolna řapíkatě zužuje k bázi listu. Žilnatina je souběžná, vidličnatě dělená. Okraje čepelce jsou pravidelně mírně zvlněné, ve špičce listu může dokonce dojít i k rozštěpení. Toto rozštěpení není podle anatomických pozorování ani původu teratologického, ani výsledkem nějakých patologických změn. Statistická měření prokázala, že se jedná o jednotlivý typ listů s větší variabilitou tvaru.

Podrobné zkoumání dokázalo, že popisované listy není možno dále považovat za druh rodu *Podozamites* BRAUN. Čeleď *Podozamitaceae* NĚMEJC tvoří samostatnou skupinu jehličnatých rostlin převážně triasového a jurského stáří. Podle údajů některých autorů (DOLUDĚNKO 1966, HARRIS 1935) jsou pokožky podozamitů velmi slabě kutinizované a jeví odlišnou stavbu. Průduchy jsou příčně či podélně orientované v řadách, což je typické pro jehličnaté. Čepel listová je spíše kopinatého tvaru, bez řapíkatého zúžení, souběžná žilnatina je velmi hustá a vidličnaté dělení žilek se odehrává převážně v dolní polovině čepelce (u *Nehvizdya obtusa* (VEL.) comb. nov. se žilky dělí po celé ploše čepelce). Pokožka *N. obtusa* (VEL.) comb. nov. má jinou stavbu než druhy rodu *Agathis* SALISB. Spíše se nabízí srovnání s některými opakvejčitými, řapíkatě zúženými listy, přiřazovanými k čeledi *Ginkgoaceae* (*Ginkgophylla* I. skupiny — NĚMEJC 1968). Nejblíží analogie nalézáme u rodu *Eretmophyllum* THOMAS z anglické jury, jehož listy mají podobný tvar listů i stavbu pokožky. V detailech je však možno najít některé odlišnosti (*Nehvizdya obtusa* (VEL.) comb. nov. nemá sekreční kanálky a nepravé žilky, liší se tloušťkou kutinizace) a v neposlední řadě je i svým výskytem časově velmi vzdálena od jurských druhů rodu *Eretmophyllum* (nalézána je pouze v českém sladkovodním cenomanu). Mimo uvedená fakta charakterem celé kutikuly odpovídá jen velmi vzdáleně poměrům u typických jinanovitých. Nejsou zároveň známy poměry fylotaktické, neboť nebyly dosud nalezeny listy příslušné na větvičkách. Šroubovitě uspořádání listů, předpokládané *Velenovským* a *Viniklářem* (1. c.) nelze mít za prokázané z důvodu, že listy nebyly nalezeny v přímé souvislosti s popisovanou větvičkou. To však nepochybně nasvědčuje tomu, že listy patřily k opadavé rostlině.

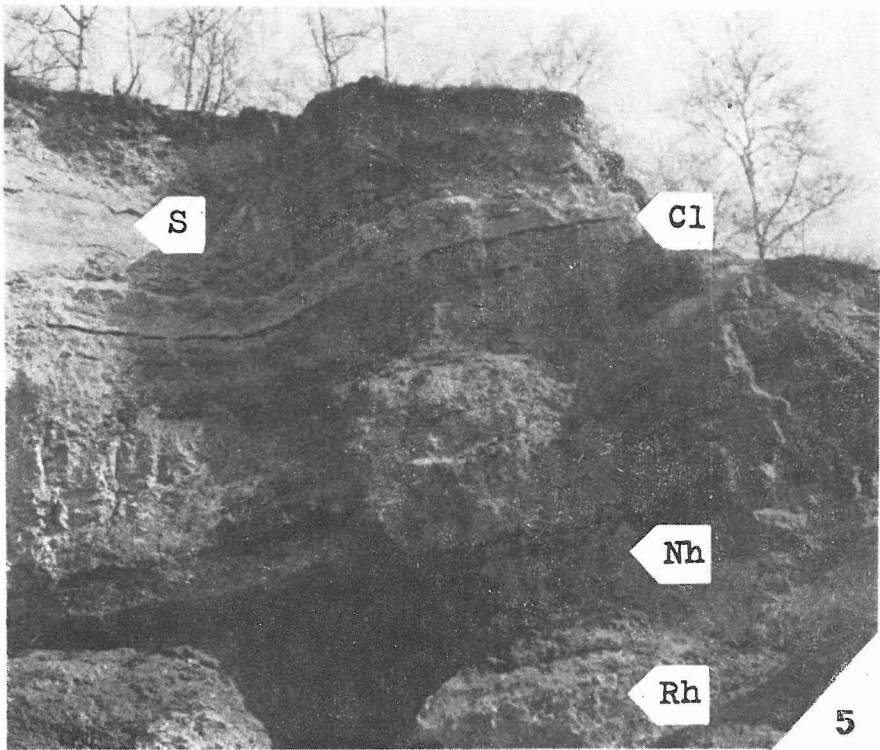
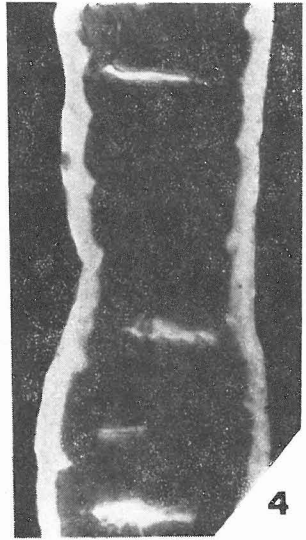
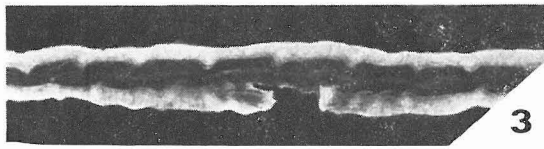
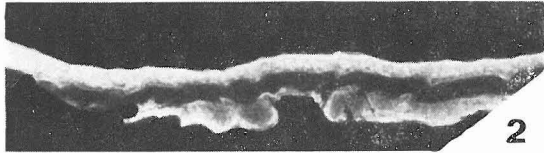
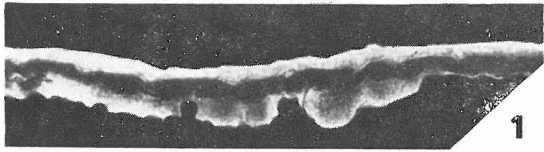
Po zvážení všech faktů lze listy *Nehvizdya obtusa* (VEL.) comb. nov. charakterizovat jako *xeromorfní* (silná kutinizace), *opadavé*, příslušející vzdáleně k čeledi *Gink-*







Pl. IV.



goaceae, rozhodně však k rostlině *nahosemenné* (stavba průduchů). Nacházejí se v jílovitých i písčitých usazeninách sladkovodního cenomanu na Českém masívu, zpravidla však hojněji v určitém horizontu tmavého jílovce společně s větvičkami *Frenelopsis alata* (K. FEISTM.) KNOBLOCH, což uvádí i E. KNOBLOCH (1971). Tento typ listů je v usazeninách křídového stáří ojedinělý a svědčí o svérázné specializaci, již několikrát konstatované při výzkumech české křídové květeny.

EXPLANATION OF PLATES

Original specimens and preparations figured here are deposited in palaeobotanical collection of the Department of Palaeontology, National Museum, Prague, Václavské nám. 68, Czechoslovakia (collection signature is indicated here under the numbers of Inv. Cat. F.)

PLATE I.

1. *Nehvizdya obtusa* (VEL.) comb. nov., holotype, the leaf impression in sandstone, freshwater Cenomanian, Perucer Beds, locality Nehvizdy east of Prague, Bohemia. The specimen was figured by VELENOVSKÝ [1885, p. 9, Taf. I, fig. 8] as *Podozamites obtusus* VEL., F 3, nat. size. The impression represents ideal form of the blades. Photo M. Páralová.
- 2—6. *Nehvizdya obtusa* (VEL.) comb. nov. Naturally translucent leaves showing parallel dichotomous venation. F. 115—119, X 1,5. Photo M. Páralová.

PLATE II.

1. *Nehvizdya obtusa* (VEL.) comb. nov. Fragment of naturally translucent leaf (see Plate I, fig. 5). Nat. size. Photo M. Páralová.
2. Part of the same leaf, showing details of the venation. Coal matter of the veins is black (photograph) and shared (sketch), X 20. Photo and sketch by the author.

PLATE III.

Nehvizdya obtusa (VEL.) comb. nov. Locality Hloubětín-brickkiln, Prague, claystones, freshwater Cenomanian, Perucer Beds.

1. Inside view of the upper cuticle, longitudinal wedge-shaped rows of epidermal cells, prep. 25, F 112, X 160. Photo author.
2. Inside view of the lower cuticle, elongated epidermal cells of nonstomatal area up to the vein, prep. 25, F 112, X 160. Photo author.
3. Inside view of the lower cuticle, irregularly orientated perigenous stomata of non-venous area (among the veins), prep. 5, F 113, X 160. Photo author.
4. Inside view of lower cuticle of petiolar base of the blade, longitudinally orientated stomata along the vein, prep. 5, F 113, X 160. Photo author.
5. Surface view of lower cuticle (under incident light), showing stomatal pits and apertures, macerated cuticle, prep. 35, F 112, X 160. Photo author.
6. Detail of the stoma, prep. 4, F 112, X 300. Photo author.
7. Surface view of lower cuticle (incident light), showing stomatal pits between the veins, prep. 34, F 112, X 70. Photo author.

PLATE IV.

Nehvizdya obtusa (VEL.) comb. nov. Locality Hloubětín-brickkiln, Prague, claystones, freshwater Cenomanian, Perucer Beds.

1. About 0,004 mm thick transverse section of non-macerated leaf, showing stomatal pits, compressed remains of guard cells cutinization at the center of the photograph and different thickness of both cuticles, prep. 4, F 112, X 300. Photo author.
2. About 0,004 mm thick transverse section of non-macerated leaf (approximately longitudinal to stomatal aperture), showing thick cutinization of subsidiary cells (polar) in comparison to the delicate upper cuticle, prep. 4, F 112, X 300. Photo author.
3. Similar transverse section of non-macerated leaf, showing especially the kind of cutinization of the upper epidermis, prep. 4, F 112, X 300. Photo author.
4. Transverse section of unmacerated leaf with heavily preserved coal matter among the cuticles (coal matter is vertically cracked), X 400. Photo author.
5. Hloubětín brickkiln, Prague. Profil of the clayey freshwater deposits of Perucer Beds, Cenomanian. Rh — lower rootlet horizon, Nh — dark claystone horizon with *Nehvizdya obtusa* (VEL.) comb. nov. and *Frenelopsis alata* (K. FEISTM.) KNOBLOCH association, Cl — about 1 dm thick coal layer in light claystones, S — sandstones.

Photo author, 1968.