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Egerian plant fossils from Vértesszőlős, NW Hungary

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A b s t r a c t: A taxonomic analysis, palaeofloristical and palaeoclimatological reconstruction of a Hungarian Egerian flora is presented. With 143 figures and 40 plates.

INTRODUCTION

During the construction of the road M1 crossing the NW parts of Hungary in 1972, the workers observed leaf prints when scraping away a hill named Baromállás between Tatabánya and Vértesszőlős. They informed dr. István SKOFLEK, collaborator of the Kuny Domonkos Museum (Tata), who collected the plant remains with the help of his students. SKOFLEK published a list on the new palaeofloristical sites of Komárom county including the locality among the relics of Oligocene flora in 1974.

The material published here was given to the author for scientific elaboration by SKOFLEK. Following the first collections, further samples were obtained from the left-overs of the locality. The material is deposited in the collection of the Kuny Domonkos Museum (Tata).

Among the Upper Oligocene floristical assemblages published from Hungary, only the floristical assemblage of Eger - Wind's Brickyard (ANDREÁNSZKY 1966b, NAGY and PÁLFALVY 1963) as well as a minor assemblage of Csörög environs is mentioned (VITÁLIS and ZILAHY 1952). PÁLFALVY (1967) published a floristical list from Kesztölc dated Upper Oligocene, without description and illustrations. HABLY published floristical assemblages of this period from Verőcemaros (1982), Kesztölc (1988) and Nagysáp (1989). The localities of Eger, Csörög, Verőcemaros are located on the northern parts of Hungary, on the territory of the Egerian and Kovačov Formations. Personal communications of the last few years informed us on several more Upper Oligocene outcrops found in course of geological surveys. Taking all these into consideration, still we must emphatically stress the importance of the Vértesszőlős flora, both in respect of its richness and its geographical position. Situated at the westernmost part of the formations of the Egerian stage, the section yielded information on another Egerian formation, the Mány formation and its vegetation.

On some finds of the Vértesszőlős flora, there are only some brief publications available as yet (HABLY 1976, 1979a, AMBRUS and HABLY 1979, HABLY and CSABA 1977). The complete description of the material as well as the evaluation of the flora has been performed recently, during which several new results were achieved enriching our knowledge on the Hungarian Upper Oligocene flora.

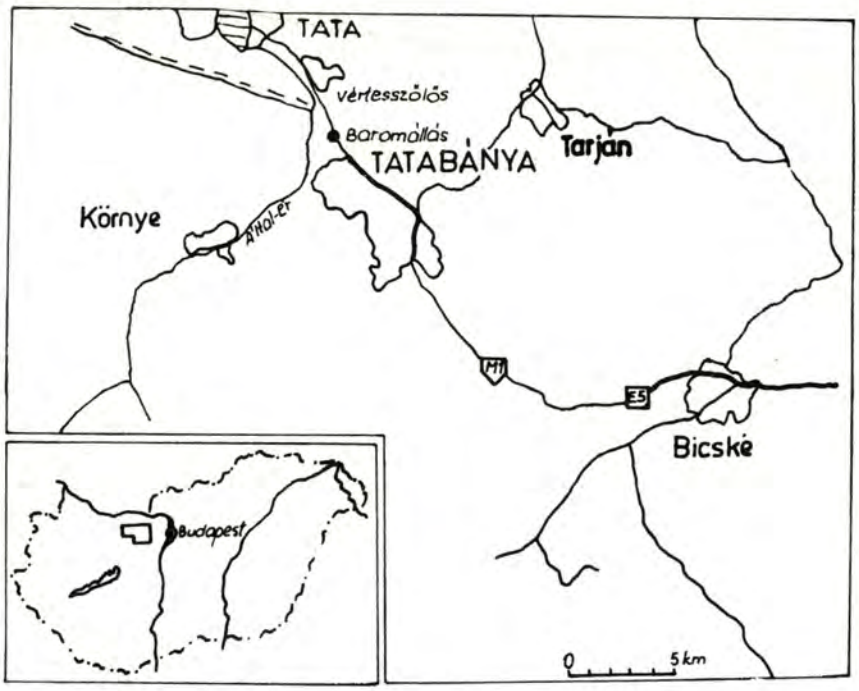


Fig. 1. Location of the plant locality

THE STRATIGRAPHICAL RELATIONS OF THE SITE

There was no real possibility for investigating the exact stratigraphical position of the site during the first collection, because of the large-scale construction works. On one side of the road, however, an artificial exposure was opened, on which the layers associated with the plant remains can be fairly well observed. In course of the collection it could only be observed that the floristical remains originated from a more clayey part of the sandy rock from two areas, that were of 20 x 5-6 m each.

The direction of the artificial exposure is 120/300 . Four kinds of lithological varieties can be separated in them, which are, however, not strictly differentiated. All of them belong to the same lithostratigraphical unit, the Mány Formation.

In the lowermost parts of the exposure lasting till about 74 m we can find unit 'A' consisting of small size gravel comprising pebbles of 2.0 cm maximal diameter, badly sorted, obliquely stratified rough sandstone, intercalating with rough sandstone with pebble lenses. Unit 'B', comprising rough grained sandstone as well, is found between 74-89 m, with limonitic incrustation at the splitting planes. The length of this unit is 15 m in our section. At the following 7 metres again we find the rocks of unit 'A', followed by 57 m long phase of unit 'B' comprising 3 intercalations of gravel of half metres each. These are followed by another unit marked 'C' of roughly 20 m length. This is a medium fine grained sandstone comprising more clayey components than the previous ones, with large concretions of rough sandstone.

The layers comprising Pectunculus are situated within this unit. At some places, there are micaceous seams of clay. Unit 'C' is replaced by unit 'D', lasting till the end of the trench, extending over approx. 112 m. It is comprising a loose, rough grained sandstone with occasional intercalations of clay lenses. After the first 17 metres of unit 'D' we find a rich Molluscan fauna. A fault line is situated here, on the northern part of which we find the Molluscan layers, while on the southern parts the layers with coal seams can be spotted. The angle of dip of the fault line is 310/20 . Considering the dip and the direction of the layer with coal seams, it can be identified with the beds containing the plant remains.

The Molluscan fauna was determined by BÁLDI (1976). The fauna is dominated by Upper Oligocene species, including species encountered in the Lower Oligocene and the Miocene as well. The species Ampullina crassatina Lamarck and Globularia sp. became extinct by the end of the Oligocene, thus we cannot deal with a Miocene sequence here. On the other hand, the species Divalinga ornata Agassiz appears first in the Upper Oligocene, thus excluding the Lower Oligocene age.

The nannoplankton studies on the layer containing the leafprints revealed that the bed in question belongs to zone NP 24-25 (p.c. of A. NAGYMAROSY), i.e. the Egerian stage. Taking into consideration the single uncertain specimen of Coccolithus orangensis Bukry, the age of the sample can be restricted to zone NP 25, that is, the end of the Oligocene. The nannoplankton flora, however, is extremely poor, characterized by small individual number and small diversity.

The nannoplankton assemblage determined denote an euhaline sea water, which is not saying that our layers were necessarily deposited in euhaline waters, because the nannoflora could have been drifted there by single wave-drifts as well. The Molluscan remains denote uneven, changing salinity, anyways, surpassing 10‰. The presence of Tympanotonus and Ampullina denote near-shore or lagoon facies. Lithological remains as well as the macroflora denote the same environmental conditions. The Upper Oligocene flora of Vértesszőlős used to live, seemingly, along the sea-shore.

THE MATERIAL ELABORATED AND METHODS OF INVESTIGATION

The palaeobotanical remains, mainly leaf prints, were preserved in argillaceous sandstone. The platy layers with muscovite denote an undisturbed sedimentation, supported by the leafprints found in good state of preservation. The surface of the bedding planes are crowded with leafprints, many times making the determination and recognition of the remains difficult. In most cases, only the prints of the leaves were preserved, though in some cases remains of the epidermis can be spotted in small patches, oxidized and fragmented. The rock itself was saturated with ferreous solutions. Most of the prints can be characterized by the same rusty colour.

The state of preservation of the finds depends considerably on the rock containing more sandy or clayey particles. As in our case most of the finds were preserved in sandstone, mainly the margin of the leaves and the teeth are injured, sometimes the complete margin is missing.

The rock samples containing leaf prints encountered in the public collections contain, in most cases, several leafprints, thus the inventory number of different species described from the same hand specimen can be identical. Thus the sum of the inventory numbers does not equal with those of the individual remains. Therefore, when listing the inventory number, the number of prints of a given species is also marked. Thus different species can have equal inventory number as well. The inventory number consists of three parts. The first part is the same in case of all remains, i.e., 76, which stands for the year of inventorization. The next number is the serial number itself, while the third number denoted if the piece consists of one rock piece only or if it has a counterpart. In this case, the last figure of the inventory number is 2. Thus on the 337 inventory items there were nearly 600 leafprints determined, as well as several indetermined pieces and log fragments visible.

P t e r i d i a c e a e
Adiantum L.

Adiantum capillus-veneris L.
Pl. I, Fig. 1.

Material: No.: 76.101.1.
1 piece

Description: The margin of the leaflets is crenate. There are two veins running into the leaf from the shaft petiole branching off and running apart in a forking way. The sporangia are placed at the margin of the leaf. Finds of the Adiantum capillus-veneris L. are very rare. It is known from fossil evidence of the Arizona Pleistocene only. The genus itself is known since the Carboniferous period, comprising 27 fossil genera altogether. The species A. capillus-veneris is living recently as well. Its area is determined by micro-climatological factors. This species requires a constantly wet, damp environment and temperate climate. It is currently known in Hungary around thermal springs and inside wells. In the Upper Oligocene, the temperate climate, relatively higher temperature and atmospheric humidity was possibly given around the Taxodium marshes. A single piece of fossil item, however, is not enough to state that it was a rare element of the Tertiary flora. This plant, due to its fine, dissected leaflets was possibly not resistant enough to endure the trials of fossilization.

P i n e a c e a e
Pinus L.

Pinus tuzsoni Novák

1950 Pinus Tuzsoni Novák; Novák, p. 49, Pl. 1, Fig. 1.
1979 Pinus tuzsoni Novák; Hably, p. 34, Pl. 3, Fig. 2.

Material: No.: 76.104.1.
1 piece

Description: There is a three-needles leaf present in the flora. The length of the leaves cannot be established because of their fragmentary state. The length of the most complete needle is nearly 6 cm, but even this one is not complete. Such three-needles leaves are frequently found in the Hungarian Lower Oligocene, mainly in the Tard Clay Formation. NOVÁK (1950) described the species from this formation, from the locality Kiseged. Triple needles were found at the Budapest localities of the Tard Clay Formation as well: VARGA (1956) mentioned it from the Budaújlak Lower Oligocene, ANDREÁNSZKY (1963), PÁLFALVY (1978) from the Buda part of the section opened during the construction of the underground train (METRO). HABLY (1979b) mentioned the species from the borehole marked H.

Probably the same species lived on during the Upper Oligocene of Vértesszőlős as well. Its more specific relations cannot be established lacking the cone. There are several more needles of Pinus encountered in the flora, which are however very fragmentary, therefore we can say nothing for sure about them. The species P. tuzsoni is not very informative in respect of climate and humidity, similar to other fossil Pinus species.

Pinus sp.

Material: No.: 76.8.1.; 76.23.1.; 76.28.1.; 76.59.1.; 76.121.1.
5 pieces

Description: Pine tree fragments and double needles are assigned to this group, where the fragmentary state does not allow a more precise observation on the position of the leaves i.e., their taxonomical position. The length of the needles cannot be ascertained, but they are seemingly very long in some cases. The small number of fragmentary pine needles in the flora denote that they were probably transported to the place of fossilization from more distant areas. Probably they were members of higher lying terrains, probably mountainous areas.

T a x o d i a c e a a e
Taxodium Rich.

Taxodium dubium (Sternberg) Heer
Pl. I, Fig. 3; Pl. II, Fig. 1.

1823 Phyllites dubius Sternb.; Sternberg, p. 37, Pl. 36, Fig. 3.
1825 Phyllites bubius Sternb.; ibid. 4, tent. et index.
1825 Filicites; ibid. 4, Pl. 24, Fig. 2, tent. et index.
1838 Taxodites dubius (Sternb.) Presl in Sternberg, p. 204.
1853 Taxodium dubium (Sternb.) Heer; Heer, p. 136.
1971 Taxodium dubium (Sternb.) Heer; Buzek, p. 37, Pl. 6, Figs. 9-11; Pl. 8, Figs. 1-6.

Material: No.: 76.1.1.(7); 76.2.1.; 76.3.1.; 76.7.1.(2); 76.8.1.(6); 76.9.1.; 76.11.1.; 76.12.1.(2); 76.14.1.; 76.15.1.; 76.19.1.; 76.20.1.; 76.21.1.; 76.26.1.; 76.27.1.; 76.39.1.; 76.48.1.; 76.53.1.; 76.54.1.; 76.59.1.; 76.62.2.; 76.79.1.; 76.82.1.; 76.90.1.; 76.91.1.; 76.95.1.; 76.101.1.(9); 76.103.1.; 76.104.1.(2); 76.105.1.(2); 76.107.1.; 76.109.1.(4); 76.111.1.(2); 76.116.1.(3); 76.119.1.; 76.124.1.; 76.125.1.(2); 76.129.1.; 76.130.1.; 76.131.1.(2); 76.132.1.; 76.141.1.; 76.144.1.; 76.147.1.; 76.151.1.; 76.153.1.(2); 76.154.1.; 76.160.1.; 76.161.1.(2); 76.168.1.; 76.171.1.; 76.177.1.; 76.180.1.(2); 76.182.1.; 76.183.1.; 76.188.1.; 76.189.1.; 76.192.1.; 76.204.1.; 76.210.1.(2); 76.213.1.; 76.215.; 76.216.1.(2); 76. 230.1.; 76.233.1.; 76.234.1.; 76.239.1.(2); 76.240.1.(2); 76.242.1.; 76.243.1.(3); 76.244.1.; 76.247.1.; 76.250.1.; 76.251.1.; 76.254.1.; 76.270.1.; 76.271.1.; 76.272.1.; 76.277.1.; 76.283.1.; 76.291.1.; 76.294.1.; 76.296.1.; 76.298.1.(3); 76.299.1.; 76.300.1.(3); 76.308.1.; 76.309.1.
140 pieces

Description: There were numerous fragments of sprouts found in the Vértesszőlős floristical assemblage. The size of the leaflets is variable, getting narrow and shorter towards the end of the sprout. Their width varies between 0.1-0.3 cm, their length ranging between 0.5-2.5 cm. Thus they can be fairly well differentiated on the basis of size from that of Sequoia abietina and Cephalotaxus harringtonia. The angle of divergence of the leaflets on the sprouts varies between 50-60 , however, it is not to be taken for granted that this is corresponding to the original situation, because this value was possibly distorted during enterrement.

This species is known to occur rarely in the Lower Oligocene. It is not even frequent in the Upper Oligocene of Hungary. Such a great quantity of the species was encountered only on this locality. The acme of the species took place in Hungary as well as several points of Europe during the Miocene, when it served as rock-forming fossil of coal seams.

The abundant occurrence of the species at Vértesszőlős can be explained by local formation of marshes. Parallel to the deterioration of the climate the species became gradually extinct from Hungary. It is no longer met by the end of the Pliocene and during the Pleistocene.

Sequoia Endl.

cf. Sequoia abietina (Brong.) Knobl.
Pl. I, Fig. 2.

1822 Phyllites abietina Brongniart in Cuvier; p. 617, Pl. 11, Fig. 13.
1828 Taxites langsdorfii Brong.; Brongniart, p. 108.
1849 Taxites langsdorfii Brong.; Unger, p. 2, Pl. 13, Fig. 1.
1855 Sequoia langsdorfii Heer; Heer, p. 54. Pl. 20, Fig. 2; Pl. 21, Fig. 4.
1867 Sequoia langsdorfii (Brong.) Heer; Stur, p. 121, 147.
1964 Sequoia abietina (Brong. in Curvier) Knobloch; Knobloch, p. 60-62.

Material: No.: 76.8.1.(3); 76.10.1.; 76.15.1.; 76.21.1.(3); 76.23.1.; 76.39.1.; 76.45.1.; 76.51.1.; 76.53.1.; 76.55.1.; 76.56.1.; 76.59.1.; 76.61.1.; 76.61.1.; 76.64.1.; 76.73.1.(2); 76.75.1.(3); 76.81.1.(2); 76.85.1.; 76.88.1.(2); 76.103.1.; 76.108.1.; 76.116.1.(2); 76.129.1.(2); 76.133.1.; 76.138.1.(8): 76.139.1.(4).
47 pieces

Description: Its occurrence can be considered abundant in the flora of Vértesszőlős. The sprout fragments are present in nearly 50 specimens. The needles are very small, thin, their length is only a few mm. Considering the fact that no cones were actually found here, we cannot be absolutely certain in the taxonomical assignment.

C u p r e s s a c e a e
Libocedrites Endl.

Libocedrites salicornioides (Unger) Endlicher

1838 Hellia salicornioides Ung.; Unger, p. 101.
1841 Thuytes salicornioides Ung.; Unger, p. 11, Pl. 2, Figs. 1-4.
1847 Libocedrites salicornioides (Ung.) Endl.; Endlicher, p.275.
1855 Libocedrus salicornioides (Ung.) Heer; Heer, p. 47, Pl. 21, Fig. 2.
1919 Cupressinocladus salicornioides (Ung.) Sew.; Seward, p. 307.
1964 Libocedrus salicornioides (Ung.) Heer; Kolakovszkij, p. 26, Pl. 1, Figs. 12-14; Pl. 2, Fig. 1.
1969 Libocedrites salicornioides (Ung.) Endl.: Knobloch, p. 45, 63, Pl. 25, Fig. 3.
1971 Hellia salicornioides Unger; Ferguson, p. 55, Pl. 3, Figs. d-g; Figs. 10d-1.
1976 Libocedrites salicornioides (Ung.) Endl.; Knobloch et Kvaček, p. 16, Pl. 3, Figs. 5-8; Pl. 15, Fig. 16; Pl. 18, Fig. 3.
1978 Libocedrites salicornioides (Ung.) Endl.; Mai et Walther, Pl. 14, Figs. 14-18; Pl. 17, Figs. 1-8.
1979 Libocedrites salicornioides (Ung.) Endl.; Hably, Pl. 2, Fig. 1; Pl. 3, Figs. 3-4; Pl. 4, Fig. 2.
1980 Libocedrites salicornioides (Ung.) Endl.; Zastawniak, p. 43, Pl. 1, Figs. 1, 1a.

Material: No.: 76.116.1.
1 piece

Description: Generally there are several leaves occurring together, forming a characteristic branching sprout. Here we have only a whorl of 0.8 cm x 0.5 cm found. The form of the characteristic Libocedrites whorl is cuneiform, the basis is concave, widening towards the apical parts. On the apical margin there are shallow rounded sinuses. Leaf whorls are transversed by 3 major vascular bundles.

From the Upper Oligocene of Hungary, NAGY and PÁLFALVY (1963) mentioned a plant from the outcrop of the Eger-Wind's Brickyard under the name of Calocedrus (Libocedrus) salicornioides Ung. n. comb.

From the Lower Oligocene (Tard Clay Formation) VARGA (1956), ANDREÁNSZKY (1963), NOVÁK (1950) could describe similar plants from the Budaújlak, Csillaghegy and Kiseged floras, as well as several boreholes (HABLY 1979b).

The only print found at Vértesszőlős proves that it was present in very small quantities in the Egerian, playing a very subordinate role in the flora. This is in direct contrast with the Czech Egerian, where the L. salicornioides is one of the dominating species, a marker of the horizon. We have no idea on the causes of withdrawal of L. salicornioides in the Hungarian Egerian. In the Ottnangian Stage (Lower Miocene), again we meet the species in great quantities on the palaeofloristical localities. This is proved by the flora of Ipolytarnóc (JABLONSZKY 1914-15, HABLY 1985) from where several specimens were collected.

It is widely distributed in the Egerian and the Miocene of Europe. There are specimens known even from the Sarmatian Stage and the Pliocene flora of Kodor as well (KOLAKOVSKI 1964).

C e p h a l o t a x a c e a e
Cephalotaxus Siebold et Zuccharini

Cephalotaxus harringtonia (Knight) Koch fossilis
Pl. II, Figs. 2-3; Fig. 2.

1966 Cephalotaxus drupacea Sieb. et Zucc. fossilis Andr.; Andreánszky, p. 141, Pl. 1, Fig. 1.
1978 Cephalotaxus ex. gr. harringtonia (Knight) K. Koch fossilis; Mai & Walther, p. 31.

Material: No.: 76.9.1.(3); 76.131.1.(2); 76.214.1.
6 pieces

Description: The width of the sprout axis is surprisingly great, 0.3 cm. The size of the leaves surpasses that of the other related forms (Taxodium, Sequoia). The width of the leaves is ranging between 0.20-0.22 cm, their length is 2.2-2.6 cm. The leaves are sword-form, arched, getting narrow by the end. Their angle of divergence is 37-40 to horizontal line. At some places, the scars left by the fallen leaves can be observed, while on the opposite side the apices of the rear-side leaves are visible from under the sprout axis. The genus is currently living in Eastern Asia.

ANDREÁNSZKY (1966a) published similar remains from the Sarmatian flora of Bükkszentmárton.

L a u r a c e a e
Daphnogene Unger

cf. Daphnogene cinnamomifolia (Brong. in Cuvier) Unger
Pl. IV, Fig. 2; Pl. VI, Figs. 1-2; Pl. VII, Figs. 1-2; Pl. VIII, Figs. 1-3; Pl. IX, Fig. 2; Figs. 4-5, 7, 9-13, 21, 27, 83.

1822 Phyllites cinnamomifolia Brong. in Cuvier; Brongniart 2 Bd.
1850 Daphnogene cinnamomifolia Unger; Unger, p. 168, Pl. 39, Figs. 7-9.
1873 Cinnamomum rossmässleri Heer; Engelhardt, p. 26, Pl. 5, Fig. 4.
1950 Cinnamomophyllum polymorphum (A. Br.) Kräusel & Weyland; Kräusel & Weyland, p. 70, Pl. 17, Figs. 2-3; Pl. 18, Fig. 1.
1974 Daphnogene cinnamomifolia (Brong. in Cuvier) Unger; Kvaček & Walther, p. 199, Pl. 1, Figs. 1-2; Pl. 2, Figs. 1-5.
1974 Daphnogene cinnamomifolia (Brong. in Cuvier) Unger; Kvaček & Walther, ibid 202, Pl. 1, Fig. 4; Pl. 3, Figs. 1-5.
1974 Daphnogene cinnamomifolia (Brong. in Cuvier) Unger; Kvaček & Walther, ibid. 201, Pl. 1, Fig. 3; Pl. 4, Figs. 1-3.
1978 Daphnogene cinnamomifolia (Brong. in Cuvier) Unger; Mai & Walther, p. 43, Pl. 2, Figs. 24-25; Pl. 20, Figs. 5-9; Pl. 21, Figs. 1-2.
1988 Daphnogene cinnamomifolia (Brong. in Cuvier) Unger; Hably p. 39, Pl. 5, Figs. 1-5; Pl. 6, Fig. 1.

Material: No.: 76.3.1.; 76.5.1.; 76.6.1.(=76.188.1.counterpart); 76.7.1.; 76.11.1.; 76.14.1.; 76.21.1.; 76.101.1.; 76.107.1.; 76.130.1.(2); 76.136.1.; 76.141.1.; 76.153.1.; 76. 160.1.; 76.161.1.; 76.188.1.; 76.194.1.; 76.195.1.(2); 76.223.1.; 76.229.1.; 76.269.1.; 76.272.1.(4); 76.283.1.; 76.291.1.; 76.295.1.(2); 76.296.1.; 76.301.1.; 76.306.1.; 76.310.1.; 76.311.1.; 76.312.1.; 76.315.1.
37 pieces

Description: The leaves are large, found generally without the petiole. Their shape is obovate, reaching their maximal width at the upper third of the lamina. This is 6.3 cm in case of the biggest piece, ranging generally between 3.0-5.0 cm. The complete length of the biggest leaf (76.6.1) complemented could be 16 cm, the total length measurable is 15.5 cm due to the fragmented state of the apex. The completed length of the rest of the leaves is ranging between 10-11 cm. The margin of the leaf is entire, the apex and the basis are acute. The biggest specimen is almost complete, thus the system of the veins can be studied very well. At 1.2 cm from the end of the lamina, there are two strong basal veins branching off asymmetrically from the midvein, having the same width as the midvein itself. The starting point of these veins is not always the same, they are generally starting with 0.2-0.5 cm of difference. In their distance from the basis there are also smaller differences encountered, roughly proportional to the size of the leaf.

On the specimen 76.6.1., the two basal veins are 1.4 cm apart from the midvein and 1.7 cm far from the margin at the widest point of the lamina. In case of some other specimens, however, they are nearer the margin, and in other cases, the distance from the margin and the midvein is roughly equal here.

Around the upper third of the leaf, there is a stronger secondary vein starting from the midvein, which is turning back towards the midvein at a higher point, forming a loop. The basal veins of second order contact this secondary vein, also in a loop-like manner. At the lower two-third of the leaf, veins of the third order are running between the midvein and the basal veins almost horizontally, branching and later anastomizating. At the side facing the margin there is a system of vigorous veins starting from the basal veins, taking an arched course and returning at some distance to the starting vein, creating a more or less regular loop system in the meantime.

Apart from the Vértesszőlős site, the species was found on several Upper Oligocene palaeobotanical localities of Hungary (HABLY 1982, 1988). Close analogies of the species were found in the Zsil-valley (Transylvania) in the form of prints, published by STAUB (1887) under the name of Cinnamomum polymorphum Al. Br. More new finds were published by KVAČEK and WALTHER (1974) from the localities Habichtswald, Meissner, Seifhennersdorf. In the Vértesszőlős flora, it is occurring associated with Palaeotropical and Arctotertiary elements, the composition of which is related in many ways to the Seifhennersdorf and the Zsil-valley floras.

According to the taxonomical system of KVAČEK and WALTHER (1974), the species D. cinnamomifolia is characteristic of the boundary of the Oligocene and the Miocene periods.

Considering the fact that our locality is dated to the Egerian stage, this statement is corroborated by the Vértesszőlős evidence as well. The authors of the cited paper consider these large leaves as mesomorphic shadow leaves, while that of the D. lanceolata Ung. which is smaller and more narrow would be the xeromorphic light-leaf. In the Vértesszőlős flora, both species (or types) are occurring, that is, not excluding that the remains belong to the same species as shadow- and light-leaves, respectively.

From the point of climatology, the D. cinnamomifolia can be regarded as authoritative. In accord with the rest of the plants preferring humid environment we can state that this plant was the constituent of a subtropical forest abounding in humidity, growing D. lanceolata type leaves in the outer parts of the foliage exposed to light.

cf. Daphnogene lanceolata Unger
Figs. 3, 15, 17, 29, 35, 38.

1850 Daphnogene lanceolata Unger; Unger, p. 424.
1850 Daphnogene lanceolata Unger; Unger, p. 167, Pl. 34, Figs. 1-7.
1873 Daphnogene ungeri Heer; Engelhardt, p. 27, Pl. 5, Fig. 5.
1873 Eucalyptus oceanica Unger; Engelhardt, ibid. 29, Pl. 5, Fig. 11.
1934 Daphnogene lanceolata Unger; Weyland, p. 83, Pl. 11, Fig. 6; Pl. 13, Fig. 7; Pl. 14, Fig. 8.
1950 Cinnamomophyllum scheuchzeri (Heer) Kräusel & Weyland; Kräusel & Weyland, p. 68, Pl. 11, Fig. 7; Pl. 16, Figs. 1-6; Pl. 17, Fig. 1; Text-fig. 25.
1963 Cinnamomophyllum scheuchzeri (Heer) Kräusel & Weyland; Mai, Pl. 8, Figs. 4-6.
1963 Laurophyllum acutimontanum Mai; Mai, ibid. Pl. 8, Fig. 10; Text-figs. 11 a-e.
1964 Cinnamomophyllum scheuchzeri (Heer) Kräusel & Weyland; Walther, p. 48, Pl. 17, Figs. 1-4.
1965 Cinnamomophyllum bitterfeldense Schneider; Schneider, p. 1241, Pl. 4, Figs. 11-13.
1976 Daphnogene lanceolata Unger; Bůžek, Holý & Kvaček, p. 100, Pl. 7, Figs. 1-4; Pl. 19, Figs. 3-7.
1978 Daphnogene lanceolata Unger; Mai & Walther, p. 40, Pl. 2, Figs. 1-23; Pl. 19, Figs. 1-15; Pl. 20, Figs. 1-4.

Material: No.: 76.2.1.; 76.3.1.; 76.7.1.; 76.21.1.; 76.49.1.; 76.51.1.(2); 76.82.1.; 76.83.1.; 76.95.1.; 76.101.1.; 76.104.1.; 76.109.1.; 76.115.1.; 76.116.1.; 76.119.1.; 76.128.1.; 76.145.1.; 76.150.1.; 76.153.1.; 76.157.1.; 76.165.1.; 76.180.1.(2); 76.188.1.(2); 76.198.1.; 76.202.1.; 76.214.1.; 76.216.1.; 76.234.1.; 76.243.1.; 76.244.1.; 76.245.1.; 76.246.1.; 76.272.1.(4); 76.287.1.
40 pieces

Description: The leaves are generally of small size, their shape is lanceolate ovate or narrow ovate. This way they can be differentiated from D. cinnamomifolia, apart from their size, on the basis of form as well. The margin of the leaves is entire, the apex and the basis is acute. The strong pair of basal veins is branching off from the midvein at different distances. The leaves are asymmetrical. On some specimens it can be observed that the basal veins join the midvein again in a loop-like manner at the upper part of the leaf through a secondary vein starting from here. This latter vein is running arched towards the apex, forming a loop here again through a higher secondary vein. The basal vein, which is approximately of the same width as the midvein itself is running, in most cases, much nearer the margin than the midvein. On the specimen 76.115.1. this difference is seemingly very sharp. The basal veins here are running only 0.2 cm far from the margin, almost parallel to the margin of the leaf. Their distance from the midvein at the widest point of the leaf is 0.60-0.65 cm. The basal veins have an angle of divergence of 32-34 at their start, becoming almost parallel by a quick arching phase upwards. In the lower two-third of the leaf, the network of tertiary veins is seldom visible. In some cases we can observe a thin horizontal vein here and there between the midvein and the basal veins. Between the basal veins and the margin of the leaves, however we cannot find the loop-like tertiary system as it is apparent in case of the D. cinnamomifolia. The character of the leaves in general is much more skin-like than that of D. cinnamomifolia. This would support the hypothesis according to which the D. lanceolata is a light leaf.

The species was encountered in Upper Oligocene (Egerian) layers from Hungary, from the territory of the Kovacov Formation.

Lauraceous forests today are situated around or under 800 m a.s.l. Their requirement of annual precipitation is around 1000-2000 mm, the mean temperature is around 21-23°C. Even if we do not suppose such a tropical climate for the Hungarian Oligocene, we can suppose that the D. lanceolata was an essential constituent of a humid subtropical forest here.

cf. Daphnogene bilinica (Unger) Kvaček et Knobloch
Pl. IX, Figs. 1, 3; Pl. X, Figs. 1-3; Pl. XI, Figs. 1-3; Pl. XII, Figs. 1-2; Figs. 6, 8, 14, 16, 18-20, 23-26, 28, 30-34, 37, 39.

1847 Ceanothus bilinicus Unger; Unger, p. 145, Pl. 49, Fig. 9.
1950 Cinnamomophyllum scheuchzeri (Heer) Kräusel et Weyland; Kräusel et Weyland, p. 68, Pl. 11; Fig. 7; Pl. 16, Figs. 1-6; Pl. 17, Fig. 1; Pl. 18, Figs. 2-4; Text-figs. 25-26.
1963 Cinnamomophyllum polymorphum (Al. Br.) Kräusel et Weyland ; Weyland et Kilpper, p. 104, Pl. 25, Figs. 28-29, Text-fig. 10.
1964 Cinnamomophyllum bilinicum (Unger) Knobloch; Knobloch, p. 601.
1965 Cinnamomophyllum bitterfeldense Schneider, p. 1241, Pl. 4, Figs. 11-13, Text-fig. 5.
1967 Daphnogene bilinica (Ung.) Knobloch et Kvaček; Knobloch et Kvaček; p. 201.
1971 Daphnogene bilinica (Ung.) Knobloch et Kvaček; Kvaček, p. 67, Pl. 2, Figs. 1-4; Pl. 9, Figs. 4-6; Text-fig. 14.
1978 Daphnogene bilinica (Ung.) Knobloch et Kvaček; Ticleanu et Givulescu, p. 140, Pl. 2, Figs. 1-4, 8-9; Pl. 3, Figs. 6-7.
1979 Daphnogene bilinica (Ung.) Knobloch et Kvaček; Hably, p. 56, Text-fig. 1.
1988 Daphnogene bilinica (Ung.) Knobloch et Kvaček; Hably, p. 36, Pl. 3, Figs. 1-5; Pl. 4, Fig. 6; Pl. 7, Fig. 3.

Material: No.: 76.1.1.; 76.6.1.(4); 76.8.1.; 76.11.1.; 76.12.1.; 76.21.1.; 76.28.1.; 76.49.1.; 76.66.1.; 76.70.1.; 76.72.1.; 76.77.1.; 76.83.1.; 76.92.1.; 76.105.1.; 76.116.1.; 76.134.1.(=76.145.1.)(3); 76.140.1.; 76.141.; 76.144.1.; 76.148.1.(6); 76.161.1.(5); 76.162.1.(2); 76.180.1.; 76.188.1.(5); 76.194.1.; 76.195.1.(2); 76.202.1.(2); 76.217.1.(2); 76.239.1.; 76.242.1.; 76.243.1.; 76.247.1.; 76.267.1.; 76.283.1.; 76.291.1.; 76.313.1.; 76.314.1.
59 pieces

Description: The leaves are generally large, their complete length extending to 8-11 cm, width ranging between 1.8-3.8 cm. Their greatest width is reached in the upper third of the leaf, thus their shape is obovate, generally elongated obovate. In the Vértesszőlős flora two types of the species could be differentiated, with transitionary forms between them. The first type is wider, mesomorphic in character, e.g. 76.195.1, 76.8.1., 76.194.1. and an intensively elongated narrow type like 76.161.1., 76.188.1 (4 pieces) and 76.195.1. All of them have an obovate form and the character of the vein system is similar.

The basal veins which are very strong are branching off in a V-shape from the midvein, that is, getting gradually further from it towards the apex. In the upper third of the leaf, at the widest point, they are forming a loop with another considerably strong pair of secondary veins starting from the midvein. Their further loop-like connections can be traced till the apex. Between the midvein and the basal veins there is a nearly horizontal system of tertiary veins, while towards the margin, veins from the basal veins can be observed, arching upwards. In case of these veins, however, the formation of loops can be observed very rarely, only in the upper half of the wider type leaves.

D. bilinica was found in Hungary at the Verőcemaros site as well, also in Egerian layers. In the neighbouring countries (Czechoslovakia, Romania, GDR) it is widely distributed in the Upper Oligocene, though according to the system of KVAČEK and WALTHER (1974) it is more typical for the Miocene. Apart from their frequent occurrence in the Miocene, they are dominant elements at some places already in the Upper Oligocene, e.g., in Hungary. In the Egerian of Central Europe it can be found mainly among the Arctotertiary elements already. In the Vértesszőlős and Verőcemaros floras the species used to live among subtropical conditions, in case of Vértesszőlős, among considerably humid climatic relations. In the latter flora it can be considered as dominating species due to its great individual number.

Daphnogene sp.
Pl. XII, Fig. 3; Figs. 22, 36.

Material: No.: 76.105.1; 76.229.1; 76.293.1.
3 pieces

Description: Characterless small leaves, the exact taxonomical position of which is hard to specify. The two strong basal secondary veins offer some guidance in establishing the Daphnogene character of the pieces.

Apart from these, there are a number of fragments present in the assemblage the correct assignment of which is impossible, lacking the characteristic details.

Laurophyllum Goeppert

Laurophyllum sp. I.
Pl. V, Fig. 1; Fig. 40.

Material: No.: 76.151.1(=76.152.1.counterpart).
1 piece

Description: Only the basal half of the lamina was preserved. Its width is 7 cm, the completed original length could have been about 16 cm. The basis is acute, the apex missing, the margin of the leaf is entire. Because we have the frontal side of the leaf preserved, the tertiary vein system and the endings of the secondary veins are visible only in a gliding light at correct angle. The midvein is strong, 1.5 mm wide at the basis, getting narrow towards the apex. The veins of the secondary order are very thin, their straight phase is still observable; however, the camptodromous vein system is very difficult to trace. The distance between the secondary veins is very great. At the left side of the lamina, proceeding from the basis till the apex, their distance measured on the midvein is 1.8 cm, 2.4 cm, 2.5 cm, while on the right side, 1.6 cm, 2.1 cm, 2.5 cm, respectively. The angle of divergence of the veins is 45 , 45 , 50 and 55 on the left side while 43 , 48 , 52 and 49 on the right side, also proceeding from the basis towards the apex. Between the midvein and the secondary veins there are further intermediate veins starting, which are, however, very thin. These can be further connected to other intermediate veins or secondary veins to form loops.

Starting from the secondary veins, there is a very fine system of tertiary veins connecting the secondary veins with each other, forming, in the meantime, loop-like patterns.

Laurophyllum sp. II.
Pl. XXII, Fig. 1; Pl. XXIII, Figs. 2-4; Figs. 41-43, 46-47.

Material: No.: 76.106.1; 76.107.1; 76.195.1.; 76.200.1; 76.300.1.
5 pieces

Description: The form of the leaves is narrow elliptic, the apex and the basis are acute, the margin of the leaves is entire. The midvein is strong, the secondary veins are turning upwards in an arch, their connecting each other very rarely visible, that is, the camptodromous character generally cannot be established, due to poor state of preservation. At some places, there are further intermediate veins randomly branching out of the midvein.

Laurophyllum sp. III.
Pl. XXI, Fig. 4; Figs. 44-45.

Material: No.: 76.146.1.; 76.190.1.
2 pieces

Description: The leaves are large, long, one of them is 13.6 cm while the other one cannot be exactly measured due to the lack of the basal parts, but its total length probably reached as much as 17-18 cm. The width of the leaves is only 2.6 and 3.4 cm, respectively. Their form is elongated, the margin of the leaves is entire. The midvein is very strong, mainly at the basal parts, but also at the medial parts as well. The angle of divergence of the secondary veins on the species 76.147.1. is somewhat steeper than on the other. Here we are facing an angle of divergence well under 60 , while in case of the specimen 76.190.1. the same angle is about 63-69 . The camptodromous venation is not striking, we can observe loops only in case of some secondary veins. The secondary veins branching of the midvein follow each other at relatively regular intervals.

Laurophyllum sp. IV.
Pl. XXIV, Fig. 1; Pl. XXV, Fig. 1; Figs. 48-52.

Material: No.: 76.1.190.1.; 76.200.1.(2).
3 pieces

Description: The form of the leaves is elongated ovate. Their length is 9-12 cm, their width ranging about 3-5 cm. The basis is acute, fragmented at all the three specimens. The apex is missing. The margin of the leaves is entire. The venation system seems to be, at a quick glance, craspedodromous, because the veins are strong enough only at the straight phase. In fact, the leaf is camptodromous. A characteristic feature of the species, however, that the loop-like connection of the secondary veins are very thin, poorly visible to the naked eye. Over the loop-like connection of the secondary veins there are further loop systems formed at a longer phase. The number of loops can reach 6-7 at the medial phase of the leaf. The secondary veins are very regular, running parallel to each other at no great distances. They are rigid and form no arched curvature opposed to most of the leaves with a camptodromous venation. (Fig. 49).

The entire margin and the character of the venation denotes the family of Lauraceae. Unfortunately, the rigid secondary vein system does not allow us to identify our specimens with any of the known species of this taxon. Lacking the epidermis it would be hazardous to bring it into close connection with any species.

Laurophyllum cf. acutimontanum Mai
Pl. XII, Fig. 4.

1950 Laurophyllum phoeboides (Ett.) Kräusel et Weyland; Kräusel et Weyland (ex parte), p. 58, Pl. 15, Figs. 5-8.
1963 Laurophyllum (Tetradenia) acutimontanum Mai; Mai, Pl. 8, Figs. 7-9, 12; Pl. 9, Figs. 1-4; Figs. 11f-h.
1964 Laurophyllum princeps (Heer) sensu stricto Walther; Walther, Pl. 16, Figs. 1-5.
1971 Laurophyllum acutimontanum Mai; Kvaček, p. 53, Pl. 2, Fig. 5; Pl. 6, Figs. 4-6; Pl. 7, Figs. 1-2; Figs. 3-4.
1976 Laurophyllum acutimontanum Mai; Bůžek, Holý et Kvaček, p. 96, Pl. 8, Figs. 4-5; Pl. 18, Figs. 3-5.

Material: No.: 76. 130.1.; 76. 154.1.(4).
5 pieces

Description: The most complete specimen is a 12.8 cm long, 1.9 cm wide leaf. Its form is lorate. The apex and the basis are equally acute. The basis is a little bit fragmented, but seemingly symmetrical. The margin of the leaf is entire. The midvein is well observable, while among the secondary veins, only a few are visible, and even they cannot be observed at full length. The entire margin, acute apex and the character of the secondary veins denote the above mentioned genus. Having no remains of the epidermis, the precise assignment of the piece is uncertain.

On some other fragmented specimens found in the assemblage, the character of the secondary veins can be observed more easily. They are branching off the midvein rather regularly, turning in an arch upwards. MAI and WALTHER (1978) described the species on the basis of epidermis remains from the Haselbach flora. There were further pieces described from the Egerian flora of Markvatice (BŮŽEK, HOLÝ and KVAČEK 1976) and Linz environs (KOVAR 1982). The determination of the pieces was performed by the help of epidermis analysis, and these types of leaves can be properly determined only using epidermis remains even today. Therefore the Vértesszőlős pieces cannot be unambiguously assigned to the species mentioned. Their assignment to the family of Laureaceae, however, seems to be well founded, thus yielding important ecological information. Together with the other laurel-leaf trees it could possibly contribute the forest- forming species of the subtropical forest.

Sassafras Nees

Sassafras tenuilobatum Andreánszky
Pl. XXVI, Fig. 2.

1959 Sassafras tenuilobatum Andr.; Andreánszky, p. 6, Pl. 1, Fig. 2.

Material: No.: 76.34.1.
1 piece

Description: 3-lobed leaf, the lobes are very thin, the lamina is deeply dissected. The central lobe is the longest one, 7.0 cm long, while the two side lobes are 6.0 and 6.5 cm, respectively. The width of the lobes is 0.5-0.7 cm. The veins running along the two side-lobes enclose an angle of 44 with each other, that is, the angle of divergence from the midvein is 22 . The margin of the leaf is entire. The species was described from the Lower Oligocene flora of Kiseged by ANDREÁNSZKY (1959), similar prints were found also in the Upper Oligocene layers of the Wind's Brickyard section described under the name of Sassafras lobatum Sap. (ANDREÁNSZKY 1966b).

P l a t a n a c e a e
Platanus L.

Platanus neptuni Bůžek, Holý et Kvaček
Pl. XIII, Figs. 1-3; Pl. XIV, Figs. 1-3; Pl. XV, Figs. 1-3; Pl. XVI, Figs. 1-3; Pl. XVII, Figs. 1-2; Pl. XVIII, Fig. 1; Figs. 53-82.

1866 Sparganium neptuni Ett.; Ettingshausen, p. 31, Pl. 7, Figs. 9-15.
1866 Sparganium extinctum Ett.; ibid, p. 31, Pl. 7, Fig. 8.
1869 Bombax chorisiaefolium Ett.; Ettingshausen, p. 11, Pl. 42, Figs. 2, 4-5.
1869 Quercus arctocarpites Ett.; ibid, p. 63, Pl. 55, Fig. 19.
1869 Ceratopetalum haeringianum Ett.; ibid. p. 6, Pl. 40, Figs. 27-28; Pl. 41, Figs. 4-5.
1885 Ceratopetalum cundraticense Engerhardt; Engerhardt, p. 48, Pl. 11, Fig. 2.
1898 Viburnum oligocenicum Engerhardt; Engerhardt, p. 96, Pl. 9, Fig. 61.
1898 Ampelopsis bohemica Engerhardt; ibid. p. 101, Pl. 10, Figs. 23-26.
1898 Elaeodendron grandifolium Engerhardt; Engerhardt, p. 107, Pl. 10, Fig. 30.
1898 Phyllites quercoides Engerhardt; ibid., p. 116, Pl. 11, Fig. 29.
1898 Phyllites amphirocioides Engerhardt; ibid., p. 116, Pl. 11, Figs. 47, 68, 79.
1898 Equisetites ettingshauseni Engerhardt; ibid., p. 85, Pl. 9, Figs. 6, 8, 11, 30-31, 36-37.
1967 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Bůžek, Holý et Kvaček, p. 205, Pl. 1, Figs. 1-6; Pl. 2, Figs. 1-9.

1973 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Knobloch, p. 281, Figs. 1-2, 4.
1975 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Knobloch et al., p. 88, 89, 91.
1978 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Kvaček et Walther, p. 91, Text-fig. 5.
1978 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Bůžek, Kvaček et Walther, Pl. 3, Fig. 6.
1979 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Hably, Pl. 8, Figs. 1-5; Pl. 9, Figs. 2-3, 5-6; Pl. 10, Figs. 1-5; Pl. 11, Figs. 1-3.
1980 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Hably, p. 300, Pl. 1, Figs. 1-8; Pl. 2, Figs. 1-9; Pl. 3, Figs. 1-6; Pl. 4, Figs. 1-5; Pl. 5, Figs. 1-6; Pl. 6, Figs. 1-4; Pl. 7, Figs. 1-4; Pl. 8, Figs. 1-4; Pl. 9, Figs. 1-4; Pl. 10, Figs. 1-4.
1982 Platanus neptuni (Ett.) Bůžek, Holý et Kvaček; Hably, Pl. 1, Figs. 4, 6, 9-11; Pl. 2, Figs. 1-2; Pl. 5, Figs. 1-6; Pl. 6, Figs. 1-6; Pl. 7, Figs. 2-4; Pl. 8, Fig. 1.

Material: No.: 76.2.1.; 76.7.1.(2); 76.8.1.; 76.10.1.; 76.12.1.(7); 76.21.1.; 76.23.1.; 76.27.1.; 76.43.1.; 76.47.1.; 76.54.1.; 76.55.1.; 76.58.1.; 76.66.1.; 76.69.1.; 76.71.1.; 76.74.1.; 76.85.1.; 76.86.1.; 76.103.1.; 76.106.1.; 76.108.1.(2); 76.112.1.; 76.115.1.; 76.116.1.; 76.117.1.; 76.121.1.; 76.124.1.; 76.127.1.; 76.134.1.; 76.135.1.; 76.144.1.(=76.187.1.counterpart); 76.145.1.; 76.150.1.; 76.153.1.; 76.155.1.(=76.156.1.counterpart); 76.180.1.(5); 76.181.1.; 76.184.1.; 76.187.1.; 76.190.1.(2); 76.225.1.; 76.237.1.; 76.241.1.; 76.243.1.; 76.251.1.; 76.254.1.; 76.268.1.; 76.270.1.(3); 76.272.1.(3); 76.282.1.; 76.285.1.; 76.288.1.; 76.300.1.(2); 76.302.1.; 76.304.1.; 76.305.1.
75 pieces

Description: The size of the leaves is changing amidst broad frames. Their width is changing between 0.95 cm and 5.4 cm, their length is 4.5 to 14 cm. The mean value of their width is 2.9 cm, that of their length is 8.6 cm. The lamina is asymmetrical, the form of the leaf is generally elongated obovate or considerably elongated ellipsoid, pointed at both ends. The venation is camptodromous. The margin of the leaves is entire on the lower third, sometimes even above this part. Generally, the teeth appear from the upper third, set fairly distant from each other. At the medial parts, mainly on the smaller leaves we can speak of very small, blunt teeth only. The teeth are getting more distinct towards the apex, most characteristic on the parts near the apex. The best identifying features of the fragmented prints are these teeth, provided the margin of the leaf was preserved.

The apex of the teeth is obtuse, their apical side is essentially shorter than the basal one. The apical side can be straight or concave, winding a little bit upwards, terminating in the obtuse apex. The basal side is moderately concave, almost parallel to the margin of the leaf. The sinuses are rounded. On the whole, one single tooth has a mild S-form curvature, starting from the apical side till the sinus. This feature of the teeth can be studied on large specimens mainly. On smaller leaves and on the basal part of the leaves the teeth are rudimentary. They are present in such cases only in form of a small tumification. The rounded sinuses and the S-form curvature can give, in most cases, good guidance for assignment.

The basis and the apex are acute. The leaf is simple. It is frequently occurring together with the petiole or, parts of the petiole.

Among the numerous remains found in the Vértesszőlős assemblage, there are very large specimens as well, similar to which were collected only in the Lower Miocene flora of Ipolytarnóc (HABLY 1985). At the same time, the leaves of the minimum width reach the minimum value of the pieces in the Tard Clay (H boreholes). The smallest pieces are 4.5 cm long, that is, under the smallest length values of the Tard Clay Platanus pieces. (Table I., Fig. 134).

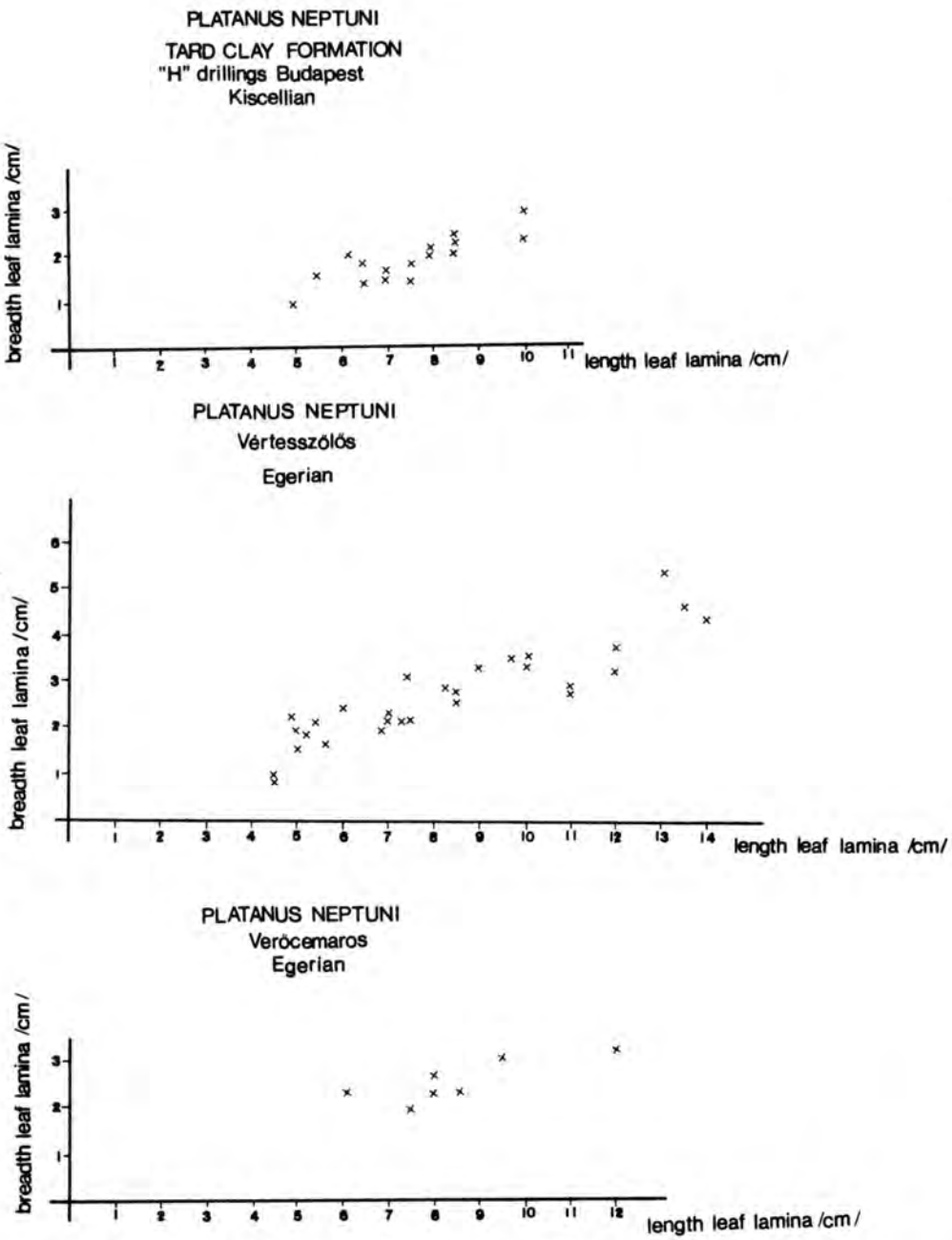


Fig. 134. Breadth and length of the leaf lamina of Platanus neptuni

Table I. The leaf-size of the Platanus neptuni

Locality	Age	Minimum breadth	Mean breadth	Maximum breadth	Minimum length	Mean length	Maximum length
Budapest, H-drillings	Kiscellian	0.9	1.87	2.9	5.0	7.55	10.0
Verőcemaros	Egerian	1.9	2.6	3.3	6.0	8.6	12.0
Vértesszőlős	Egerian	0.95	2.9	5.4	4.5	8.6	14.0

The mean value of width and length of the pieces is interesting as well; we can see that the mean values for the Egerian floras are almost identical, but they are considerably different from that of the Kiscellian mean value of the Platanus neptuni, being more than a whole unit longer. This fact seems to support the statement that the formation of the leaf surface of P. neptuni is considerably depending on the climate. In the dry climate of the Kiscellian, a much smaller surface of the leaf was adequate, while in the more humid Egerian not only the maximal leaf size is more than in the Kiscellian, but also the mean value is well surpassing the Kiscellian average. The two Egerian floras are situated in different formations. During the Egerian, possibly a continuous forest of P. neptuni could exist here. The actual distance between the localities is certainly not so great that we would be compelled to suppose disjunct areas. This hypothesis is further supported by the occasional occurrence of P. neptuni in the Egerian assemblages of the localities lying between them.

The species is very abundant in the Hungarian Oligocene. It was found practically at all sites of the Lower Oligocene Tard Clay Formation (Kiscellian Stage), e.g., from the Budapest surface outcrops and boreholes, as well as the Kiseged flora lying close to the town Eger. From the Upper Oligocene (Egerian), apart from the locality of Vértesszőlős, it is known from Verőcemaros, Pomáz, Kesztölc, Nagysáp (HABLY 1980, 1982, 1988) and the Wind's Brickyard section from Eger. These sites are practically covering the complete extent of the Hungarian Oligocene. The westernmost occurrence of P. neptuni in Hungary is, according to our present knowledge, that of Vértesszőlős. Its easternmost occurrence - so far the easternmost occurrence of the species in Europe - is that of the Wind's Brickyard section.

The P. neptuni is a thermophylous Palaeotropical element. According to KNOBLOCH (1973) it is appearing bound to definitely warm periods. On the territory of Hungary, it used to live amidst subtropical climatic relations in the Kiscellian, the Egerian as well as the Lower Miocene. In respect of precipitation, the plant could adapt to varying circumstances, because it was characteristic of the dry Kiscellian as well as the humid Egerian and the Lower Miocene as well. The recent equivalent of the P. neptuni is P. kerrii, currently living in South-Eastern Asia, on the territory of Laos under subtropical, tropical climate as an evergreen member of the forest. BŮŽEK (1971) considered it to be a Palaeotropical element. It is known to occur in Hungary in the Lower Kiscellian amidst palaeotropical elements only, while later, during the Egerian (in the first place, on this site) it is mixed with Arctotertiary elements.

U l m a c e a e
Ulmus L.

Ulmus pyramidalis Goeppert
Pl. XVII, Figs. 3-4; Pl. XVIII, Figs. 2-3; Pl. XIX, Figs. 1-3; Pl. XX, Figs. 1-2; Pl. XXI, Fig. 1; Figs. 84, 87-93, 110.

1845 Ulmus bronni Ung. partim ; Unger, Pl. 26, Fig. 1., non Figs. 2-4.
1845 Ulmus longifolia Ung.; ibid., Pl. 26, Figs. 5-6.
1847 Ulmus bronni Ung. partim; ibid., p. 100.
1847 Ulmus longifolia Ung.; ibid., p. 101.
1855 Ulmus pyramidalis Goepp.; Goeppert, p. 28, Pl. 13, Figs. 10-12.
1859 Carpinus pyramidalis (Goepp.) Heer; Heer, p. 177, Pl. 87, Fig. 7f; Pl. 150, Figs. 27-28.
1866 Ulmus pyramidalis Gaudin; Ettingshausen, p. 49, Pl. 15, Figs. 5-9, Fig. 21.

1866 Ulmus bronni Ung.; ibid., p. 62, Pl. 17, Figs. 9-10.
1866 Ulmus longifolia Ung.partim; ibid., p. 62, Pl. 18, Figs. 7, 9-11.
1866 Ulmus plurinervia Ung.; ibid., p. 63, Pl. 18, Figs. 12-13.
1866 Ulmus minuta Goepp.; ibid., p. 64, Pl. 18, Figs. 21-22.
1866 Ulmus brauni Heer; ibid., p. 64, Pl. 18, Figs. 23, 25(?), 26, 27(?).
1866 Planera Ungeri Ett. partim; ibid., p. 65, Pl. 18, Figs. 14-16, 18(?), 19(?).
1881 Carpinus grandis Ung. partim; Velenovsky, p. 23, Pl. 2, Fig. 25(?); Pl. 3, Figs. 1-5.
1881 Ulmus longifolia Ung. partim; ibid., p. 25, Pl. 4, Figs. 3-13.
1881 Planera ungeri Ett. partim; ibid., p. 26, Pl. 3, Figs. 19-21, 22(?).
1881 Betula brongniartii Ett. partim; Engelhardt, p. 78, Pl. 1, Fig. 13.
1881 Carpinus grandis Ung.; ibid., p. 81, Pl. 1, Figs. 9-10.
1891 Ulmus longifolia Ung. Engelhardt, p. 160, Pl. 9, Figs. 14, 16-20, 24(?).
1971 Ulmus pyramidalis Goepp.; Bůžek, p. 56, Pl. 19, Figs. 3-18; Pl. 20, Figs. 1-17; Pl. 21, Figs. 1-8.

Material: No.: 76.1.1.; 76.6.1.; 76.10.1.; 76.12.1.; 76.13.1.(2); 76.15.1.; 76.20.1.; 76.31.1.; 76.35.1.; 76.40.1.; 76.43.1.; 76.59.1.; 76.63.1.; 76.64.1.; 76.65.1.; 76.76.1.; 76.93.1.; 76.101.1.; 76.108.1.; 76.109.1.; 76.115.1.; 76.132.1.; 76.137.1.; 76.142.1.; 76.144.1.; 76.147.1.; 76.150.1.; 76.174.1.; 76.175.1.; 76.180.1.; 76.184.1.; 76.187.1.; 76.191.1.; 76.193.1.; 76.194.1.; 76.198.1.(2); 76.199.1.; 76.212.1.; 76.215.1.; 76.238.1.; 76.243.1.; 76.250.1.; 76.268.1.; 76.269.1.; 76.272.1.(3); 76.283.1.; 76.284.1.; 76.287.1.; 76.290.1.; 76.292.1.; 76.297.1.; 76.300.1.; 76.303.1.; 76.304.1.
59 pieces

Description: The length of the leaves can reach 10 cm, their width ranging between 2.5-3.8 cm. The margin of the leaves is toothed, their form is narrow elliptic or ovate. The formation of length and width are demonstrated on Table III. The apex is acute, the basis is asymmetrical. The venation is craspedodromous, the veins of the secondary order follow each other relatively densely. On the major pieces, the number of secondary vein pairs can be 16-20. The formation of the distance between the secondary veins are presented on the graphs (Figs. 135-140). The veins of the secondary order are rigid, the angle of divergence varying between 30 - 60 degrees. The value of the angles are summarized on Table II.

The U. pyramidalis is a widely distributed and characteristic species of the Egerian of Hungary. It was not found in older layers from Hungarian territory, younger occurrences are known from Ipolytarnóc, where some badly preserved specimens were found in the Eggenburgian sandstone. During the Egerian, however, it is present on all palaeobotanical localities. ANDREÁNSZKY mentioned it from the Wind's Brickyard under the name of Carpinus grandis, HABLY mentioned it from Kesztölc (1988), Nagysáp (1989) Csörög and Pomáz (under elaboration).

The U. pyramidalis is the only constant and, sometimes dominant Arctotertiary species of the Hungarian Upper Oligocene. As a typical riparian plant, possibly it could penetrate the subtropical forests following the riversides. Thus its presence can be interpreted as a member of an intrazonal assemblage.

Table II. The angle of divergence of Ulmus pyramidalis

76.1.1.
left side: - 57 50 41 39 38 37 35 37 37 36 38 37 38 38 37 40
right side: - - - 43 41 41 41 39 37 34 34 36 37 37 42

76.6.1.
left side: 30 33 34 33 33 32 38 35 - -
right side: 35 36 39 40 36 33 27 33 32 34 37

76.15.1.
left side: 47 46 45 43 42 39 40 35 38
right side: - - 45 45 42 39 41 37 37 37 34

76.31.1.
74 64 53 52 47 46

76.59.1.
43 40 45 44 44

76.132.1.
left side: 40 40 35 32 37 38 36 34
right side: 41 39 41 42 36 37 38

76.137.1.
left side: 32 37 34 33 32 28 27
right side: 36 - - - 30 35 38 36 36

Table III. Leaf-size of the flora

Species	Minimum breadth	Mean breadth	Maximum breadth	Minimum width	Mean width	Maximum width
"Acacia" parschlugiana	1.0	1.0	1.0			
Betula prisca	3.6	3.73	3.8	6.4	6.93	8.0
Betula sp. type I.	5.4	5.4	5.4	8.1	9.63	10.8
Betula sp. type II.	4.4	4.4	4.4	7.2	7.2	7.2
Betula sp. type III.	4.6	4.6	4.6			
Cassia sp.	0.7	0.7	0.7	1.3	1.3	1.3
Cornus praeamomum	6.4	6.4	6.4	15.0	15.0	15.0
Cornus sp.	3.6	3.6	3.6	8.0	8.0	8.0
Cornus cf. wrightii	3.4	3.4	3.4	8.0	8.0	8.0
Daphnogene bilinica	1.2	2.2	3.6	4.0	7.55	12.3
Daphnogene cinnamomifolia	2.8	4.32	6.3	7.3	11.45	16.0
Daphnogene lanceolata	1.2	1.68	3.0	4.5	6.61	9.2
Daphnogene polymorpha	3.0	3.1	3.3	7.6	7.93	8.5
Daphnogene sp.	1.4	1.45	1.5			
Debeya hungarica	1.5	1.8	2.1	7.1	8.65	10.2
Dicotylophyllum sp. 2.	4.8	4.8	4.8	6.1	6.1	6.1
Laurophyllum cf. acutimontanum	1.7	1.8	1.9	9.4	11.05	12.7
Laurophyllum sp. 1.	7.0	7.0	7.0	16.0	16.0	16.0
Laurophyllum sp. 2.	3.0	3.1	3.2	8.0	8.0	8.0
Laurophyllum sp. 3.	2.5	3.0	3.4	12.2	13.4	14.5
Laurophyllum sp. 4.	3.1	3.3	3.5	10.1	11.65	13.2
Palmae	3.2	3.2	3.2	22.0	22.0	22.0
Platanus neptuni	0.8	2.81	4.6	4.3	8.47	13.7
Phyllites skofleki	5.7	6.22	7.2	4.8	8.88	11.7
Quercus sp. type II.	2.8	2.8	2.8	7.2	7.2	7.2
Quercus sp. type III.	3.0	3.0	3.0	5.8	5.8	5.8
Rosa lignitum	1.3	1.3	1.3	2.0	2.0	2.0
Smilax tataensis	3.7	8.4	11.5	3.7	7.1	13.2
Sterculia sp.	6.0	6.0	6.0	5.6	5.6	5.6
Ulmus plurinervia	1.2	1.52	1.8	2.5	3.76	4.5
Ulmus pyramidalis	1.6	3.25	4.1	4.2	7.65	10.3
Wisteria aff. fallax	1.2	1.2	1.2	2.0	2.0	2.0
Zelkova zelkovaefolia	1.4	1.4	1.4	2.8	2.8	2.8

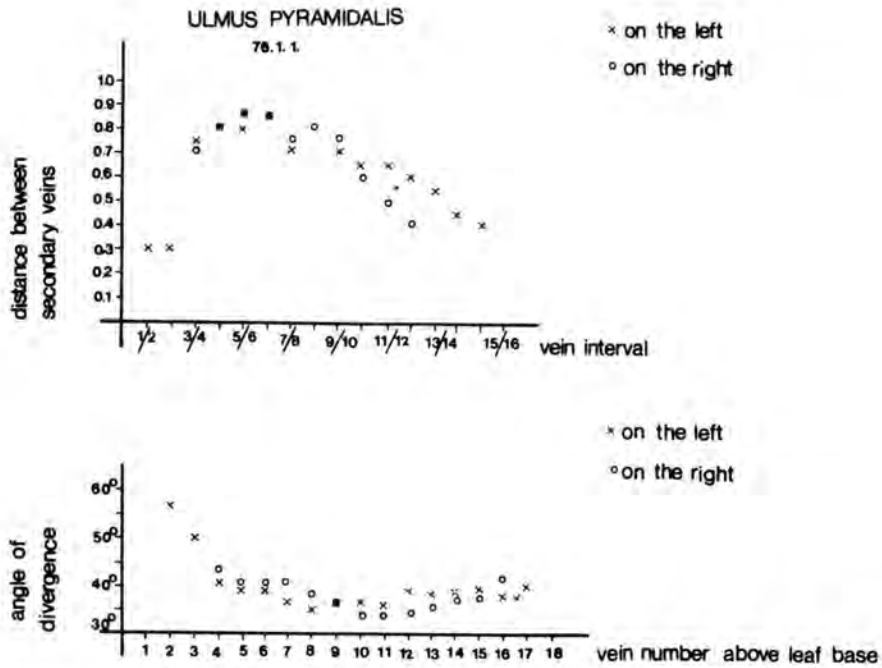


Fig. 135. Leaf parameters of Ulmus pyramidalis No. 76.1.1.

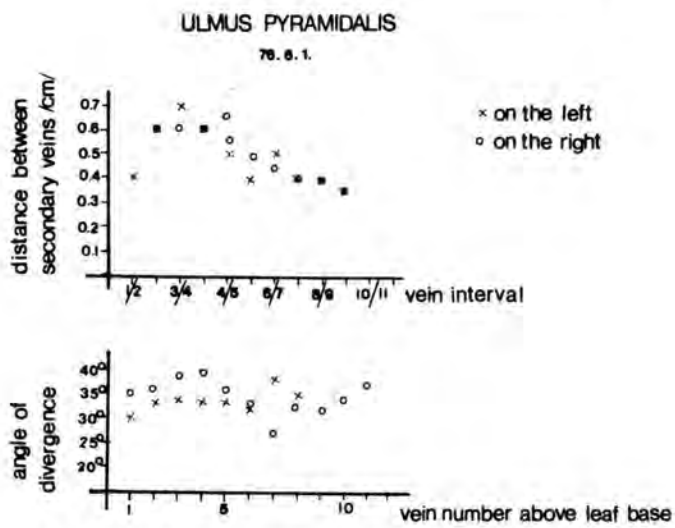


Fig. 136. Leaf parameters of Ulmus pyramidalis No. 76.6.1.

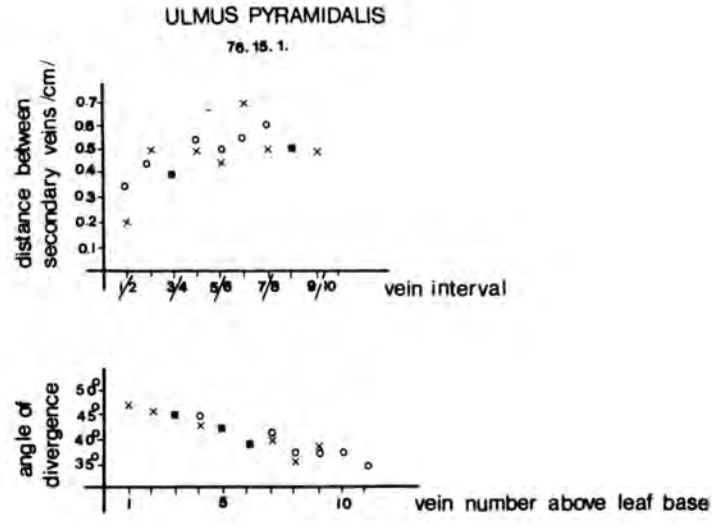


Fig. 137. Leaf parameters of Ulmus pyramidalis No. 76.15.1.

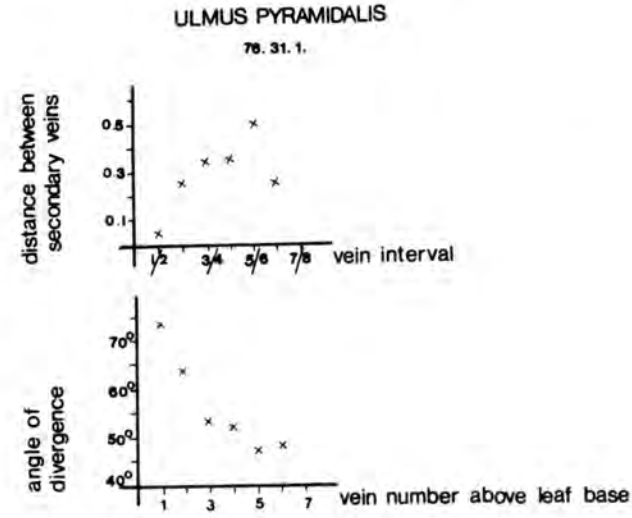


Fig. 138. Leaf parameters of Ulmus pyramidalis No. 76.31.1.

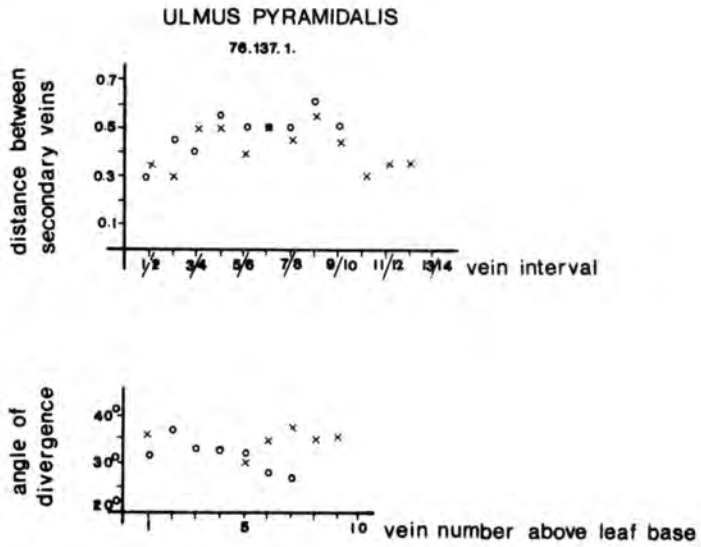


Fig. 139. Leaf parameters of Ulmus pyramidalis No. 76.137.1.

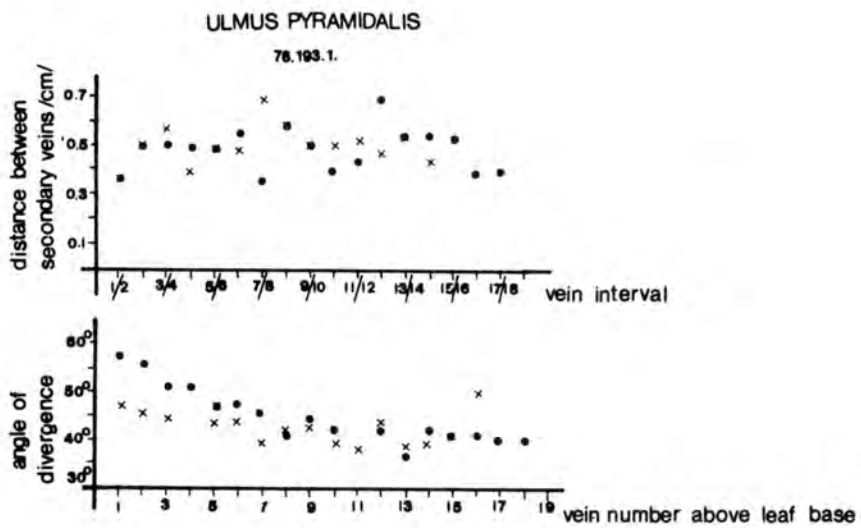


Fig. 140. Leaf parameters of Ulmus pyramidalis No. 76.193.1.

Ulmus plurinervia Ung.
Pl. XX, Fig. 3.

1847 Ulmus plurinervia Ung.; Unger, p. 95, Pl. 25, Figs. 1-4.
1980 Ulmus plurinervia Ung.; Zastawniak, p. 58, Pl. 2, Figs. 3-5; Fig. 7: 4-11.

Material: No.: 76.98.1.; 76.101.1.; 76.111.1.; 76.132.1.; 76.233.1.; 76.299.1. 6 pieces

Description: Very small leaves, their length is smaller than 5 cm, and their width is less than 2 cm. Their shape is narrow ovate, the apex is acute, the basis is cordate. In case of most pieces the basis is fragmented, thus this feature can be observed only in a few instances. The secondary veins are starting densely from the midvein. They are straight, rigid and form no arch or curvature. The distance of the veins are demonstrated on a graph (Fig. 141). Apparently after a slight rise the row of dots is gradually declining. The formation of the angle of divergence is presented on a graph. Palaeobotanical literature refers to these Ulmus leaves as U. plurinervia, U. bronnii, U. minuta. The margin of the leaves is very poorly preserved, thus the toothing of the leaves cannot be evaluated.

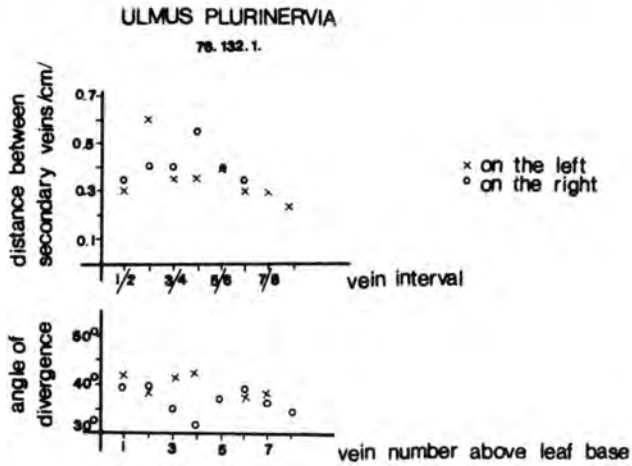


Fig. 141. Leaf parameters of Ulmus plurinervia No. 76.132.1.

Similar leaves were found in the Upper Oligocene flora of Pomáz (HABLY, under elaboration), the state of preservation of which is essentially better than that of these. Considering that they are occurring here, as well as at Pomáz, together with numerous leaves of Ulmus pyramidalis, we cannot exclude the possibility that they belong to the same species as smaller and bigger leaves. It is possible that we are dealing with size differences between leaves situated at different parts of the sprout axis.

Anyway, the U. plurinervia occurs at more sites of the Egerian, comprising more specimens, in general, only in minor quantities.

Zelkova Spach

Zelkova zelkovaefolia (Unger) Bůžek et Kotlaba in Kotlaba
Pl. XX, Fig. 4; Pl. XXI, Figs. 2-3.

1843 Ulmus zelkovaefolia Ung. partim; Unger, Pl. 24, Figs. 9-13, non Fig. 7.
1845 Ulmus zelkovaefolia Ung. partim; ibid., Pl. 26, Fig. 7, non Fig. 8.
1847 Ulmus zelkovaefolia Ung. partim; ibid., p. 94.
1851 Planera ungeri Ett.; Anonymus (ref. Ettingshausen), p. 145.
1851 Zelkova ungeri (Ett.) Kov.; Anonymus (ref. Kováts), p. 178.
1851 Planera ungeri Ett.; Ettingshausen, p. 14, Pl. 2, Figs. 5-6 (?), 7-9, 10-11, 12 (?), 13-14, 16, non Figs. 15, 17-18.
1856 Zelkova ungeri (Ett.) Kov.; Kováts, p. 27, Pl. 5, Figs. 1-12; Pl. 6, Figs. 1-6.
1866 Planera ungeri Ett. partim; Ettingshausen, p. 65, Pl. 18, Figs. 17, 20, non Figs. 14-16, 18-19.
1881 Planera ungeri Ett.; Velenovsky, p. 26, Pl. 3, Fig. 23, sub Fig. 16, non Figs. 18-22, non Pl. 4, Fig. 14.
1963 Zelkova zelkovaefolia (Ung.) Bůžek et Kotl.; Kotlaba, p. 59, Pl. 3, Figs. 7-8.

Material: No.: 76.261.1.; 76.285.1.; 76.299.1.
3 pieces

Description: The leaves are small, their shape is ovate. The apex of the leaf is acute, the basis is cordate.
The state of preservation of the prints is fairly poor in the sandstone, thus the margin of the leaves are dim. The relatively large teeth are placed far from each other, all of the apices of the teeth having a secondary vein running up till them. The secondary veins are placed relatively far from each other (Fig. 142).

length of the leaves (cm)	width of the leaves (cm)
2.9	1.6
2.8	1.4
3.3	1.8

The distance of the secondary veins on the specimen 76.285.1.:
on the left side 0.3 0.5 0.45 0.4 0.2 (cm)
on the right side 0.3 0.3 0.3 0.55 0.35 (cm)
The veins of the secondary order are arched,not so rigid as that of the U. plurinervia.

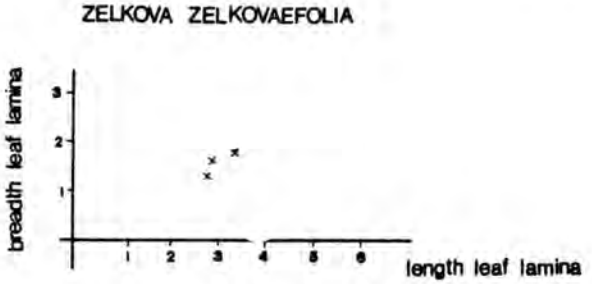


Fig. 142. Breadth and length of the leaf lamina of Zelkova zelkovaefolia

The species Zelkova zelkovaefolia appears in Hungary first during the Upper Oligocene. ANDREÁNSZKY (1967) mentioned it from the Noszvaj section of Middle Oligocene age (Lower Egerian).

Though RÁSKY (1943) mentioned under the name of Zelkova a fragmented leaf from the Lower Oligocene, it is uncertain. The species is relatively rare in the Upper Oligocene as well. There was a single specimen found at Verőcemaros (HABLY 1982) and three specimens at Vértesszőlős. From the Wind's Brickyard, ANDREÁNSZKY did not mention Zelkova, only a leaf-print similar to Zelkova described under the name of Ulmus type IV. This leaf is widening to wards the basis terminating in a rounded basis, thus it is essentially different from the Vértesszőlős specimens. The species Z. zelkovaefolia is very frequent during the Miocene, mainly, the Sarmatian throughout Europe. It is present on some localities of the Sarmatian of Hungary as dominant species. On the basis of the Hungarian material it seems that the genus Zelkova arrived simultaneously with the infiltration of the Arctotertiary elements during the Egerian. Its boom took place during the Sarmatian. Probably not the deterioration of the climate presented more favourable circumstances but that was the time when the concurrent subtropical elements disappeared from the assemblage. As the plant is known to be thermophylous even today, it could have lived among optimal conditions during the Upper Oligocene as well, but there were still several tropical elements present in the flora preventing their sudden advance. Parallel to the decrease of tropical elements the species gradually became more and more frequent, attaining a dominant role during the Sarmatian Stage. From the Pannonian Stage, still we have numerous representatives of the species at many sites.

F a g a c e a e
Quercus L.

Quercus sp. type I.
Pl. XXII, Fig. 3; Fig. 108.

Material: No.: 76.8.1.
1 piece

Description: Almost intact specimen, the apex is somewhat fragmented, the basis is more intensively injured. The form of the leaf is oblong, its length is 13.5 cm, width 3.4 cm. The margin of the leaf is irregular wavy, otherwise entire. The lamina is randomly protruding at some places. There are no lobes on the leaf, opposed to most oak species in general, but the margin is already not smooth. The midvein is very strong, mainly at the lower part of the leaf, its width reaching 2 mm. It is getting narrow towards the apex, in the upper third of the leaf it is already quite thin.

The secondary vein system is apparent but not very strong, which can be a consequence of the fact that we have the frontal part of the leaf printed and not the reverse part. The veins are running out till the margin, that is, a craspedodromous venation is formed, and not a camptodromous one as in case of the Q. neriifolia or the Q. apocynophyllum. It is possible, however, that on the medial parts of the leaf a camptodromous type was formed. The vein system here cannot be properly observed. On the intersecondary area there are weak intermediate veins branching off the midvein. From some of the secondary veins, there is a Y-form forking starting near the margin.

cf. Quercus sp. type II.
Pl. XXII, Fig. 2; Fig. 113.

Material: No.: 76.116.1
1 piece

Description: Length of the leaf is 7.3 cm, its width is 2.8 cm. Its form is ovate, the basis rounded, the apex acute. The margin of the leaf is intact at the lower two-third of the lamina and toothed in the upper third. It can be wavy on these parts as well: the character of the margin cannot be ade-

quately determined, because it was preserved only at a short phase. The midvein is fairly strong, the secondary veins are very thin, The veins are branching off the midvein in an arch, running into obtuse teeth in the part near the margin here they are already extremely thin. The veins of secondary order can be connected in the teeth or, they can be also connected through the veins of the tertiary order. The margin and the vein system of the leaf is very specific, the exact analogy of which was not met in previous descriptions. Considering that we have only one specimen at hand containing no traces of the epidermis, we cannot give its more exact taxonomical assignment.

Quercus sp. type III.
Pl. XXIII, Fig. 1; Fig. 109.

Material: No.: 76.101.1.
1 piece

Description: The length of the leaf is 5.8 cm, its width is about 3 cm. The apex is acute, the basis fragmented. The shape of the lamina is obovate, the margin of the leaf is fragmented, still the lobes are fairly well visible, though being injured, they do not show their original form. The venation is craspedodromous, the secondary veins terminating in the apex of the lobes. The print reminds in some features to Q. pseudorobur. The species was described by KOVÁTS (1856) from the Sarmatian flora of Erdőbénye. It was mentioned from the European parts of the USSR, later from Western Siberia and the Southern Altai. ZASTAWNIAK (1980) mentioned it from the Sarmatian flora of Poland. It can be recognized under several synonyms in several floras of the European Miocene and Pliocene.

B e t u l a c e a e
Betula L.

cf. Betula prisca Ettingshausen
Pl. XXIV, Fig. 3; Figs. 94-98.

1851 Betula prisca Ett.; Ettingshausen, p. 11, Pl. 1, Figs. 15-17.
1852 Betula prisca Ett.; Ettingshausen, p. 5, Pl. 1, Fig. 3.
1852 Carpinus betuloides Unger; Unger, p. 40, Pl. 20, Figs. 6-8.
1855 Betula subtriangularis Goepp.; Goeppert, p. 10, Pl. 3, Fig. 2.
1855 Betula prisca Ett.; Goeppert, ibid, p. 11, Pl. 3, Figs. 11-12.
1866 Betula prisca Ett.; Ettingshausen, p. 47, Pl. 14, Figs. 14-16.
1868 Betula prisca Ett.; Heer, p. 148, Pl. 25, Figs. 9a, 20.
1869 Betula prisca Ett.; Ettingshausen, p. 29, Pl. 1, Figs. 24-26.
1919 Betula prisca Ett.; Reimann in Kräusel, p. 37, Pl. 1, Fig. 5; Pl. 2, Fig. 12.
1956 Betula prisca Ett.; Kristofovich et al., p. 92, Pl. 22, Figs. 1v, 2, 4-8; Text-fig. 38.

Material: No.: 76.21.1.; 76.64.1.; 76.150.1.; 76.189.1.; 76.190.1.; 76.301.1.
6 pieces

Description: The bulk of the pieces are medial fragments, thus neither the basis, nor the apex is visible. The toothed margin can be studied in case of a single specimen, in all other cases the margin of the leaf is missing. The vein system is craspedodromous. The secondary veins are branching off from the midvein more densely than in case of any other leaves of Betula sp. The leaves can be considered of small and medium size, though their real length cannot be measured, due to their fragmentary state. The tertiary veins are not visible on the print. The secondary veins are rigid, reaching the margin practically straight from the margin. The fragments bear the nearest resemblance to Betula prisca, however their fragmentary state does not allow us to identify them with this species unambiguously.

Betula sp. type 1.
Pl. XXIV, Fig. 2; Pl. XXVI, Fig. 1; Figs. 99-100, 102-103.

Material: No.: 76.11.1.; 76.84.1.; 76.125.1.; 76.149.1.
4 pieces

Description: Three leafprints of relatively poor state of preservation as well as a small fragment was assigned to this taxon. The length of the leaves is around 10-12 cm, their width ranging between 6-6.5 cm. The apex is acute, the basis is fragmented at all specimens. The margin of the leaf is toothed as it is observable on one of the specimens, in case of the other two prints the margin is dim. The venation is craspedodromous. The secondary veins are branching off from the midvein relatively far from each other.

The distance of the secondary veins on the specimen 76.11.1, starting from the basis towards the apex is as follows: 1.0, 1.1, 1.05, 1.0, 0.85, 0.8, 0.7 cm.

The veins start from the midvein with a slight arch, they are bent again near the margin, in the medial parts, however, they are straight.

Lacking important characteristic marks, the specimens were not assigned to species.

Betula sp. type II.
Pl. XXV, Fig. 2; Fig. 101.

Material: No.: 76.119.1.
1 piece

Description: The length of the leaf is 7.3 cm, its width is 4.5 cm. The lamina is fairly asymmetrical, the midvein is dividing it into two unequal parts. The form of the leaf, due to the considerable asymmetry, is difficult to determine; reminding, however, most to elliptic or ovate. The basis and the apex are fragmented, but the apex used to be in all probability acute. The venation is camptodromous. The secondary vein system is fairly irregular, the distance of the starting points from the midvein are changeable and there are considerable differences in the curvature of their line as well. Some of the secondary veins are relatively straight, other reach the margin in a bent arch. The margin of the leaf is toothed, the teeth are small. As the distance of the veins is great, not all of the teeth have a secondary vein running up to its top. The teeth are frequently composite, that is, under them a smaller tooth is visible in some cases. The apical side of the teeth is generally concave or straight while the basal side is convex or straight. The apex of the tooth is acute, the sinuses between the teeth also being acute.

Betula sp. type III.
Pl. XXVII, Fig. 1.

Material: No.: 76.216.1.
1 piece

Description: The form of the leaf cannot be exactly determined, due to its fragmentary state. Only a 1.5 cm long phase of the margin was preserved, where the teeth are fairly well visible. They are set at equal distances from each other, but they are not regular. The secondary veins join only every second teeth, the tooth between these receiving a branch-off from the vein lying immediately over it. This tooth is , however, no smaller than the rest. The shape of three subsequent, complete teeth are considerably differing from each other. One of them seems to be obtuse, however, it is possible that the apex of the tooth is broken, because the other two teeth are acuminate. The apical side of the teeth having the secondary vein running up to them is acuminate, their lower side is also acuminate or convex. The intermedial tooth having no vein of the secondary order attached to it is different, both of its sides being concave. The sinuses are obtuse.

The secondary vein system is very regular. The pairs of vein are starting from the same point, or nearly the same point. The distance of the secondary veins from the basis till the apex is as follows: 0.75, 0.9, 1.1, 0.8, 0,9 cm, angles of divergence: 50 , 46, 45, 40 .
The veins of the tertiary order have not been preserved. The form of the teeth denote the genus Betula, the size of them being, however, fairly large. As we have no information on the shape of the leaf and other important features, it is not assigned to any species.

Betula sp. type IV.
Pl. XXV, Fig. 3; Figs. 104-106.

Material: No.: 76.40.1.; 76.207.1
2 pieces

Description: Medial fragments containing neither the apex nor the basal parts. The veins of the secondary order are apparent, starting at fairly large distances from each other from the midvein. All of the secondary veins terminate in a tooth after an arched divergence. These great composite teeth are generally composed of three small teeth of irregular shape, and there is no piece of distinguished size among them. The presence of large composite teeth is ceased by the basal parts of the leaf, here we have a simple toothed margin only.

J u g l a n d a c e a e
Juglans L.

cf. Juglans acuminata Al. Braun ex Unger
Pl. XXVII, Fig. 2; Pl. XXVIII. Fig. 1; Fig. 107.

1845 Juglans (Carya ?) acuminata Al. Br.; Braun, p. 170. (nomen nudum)
1845 Juglans latifolia Al. Br.; ibid., p. 170. (nomen nudum)
1850 Juglans acuminata Al. Br.; Unger, p. 468.
1850 Juglans latifolia Al. Br.; ibid., p. 470.
1854 Juglans latifolia Al. Br.; Unger, p. 25, Pl. 6, Fig. 2.
1855 Juglans pallida Goepp.; Goeppert, p. 36, Pl. 25, Fig. 3.
1855 Juglans sieboldiana Goepp.; ibid., p. 36, Pl. 25, Fig. 2.
1855 Juglans salicifolia Goepp.; ibid., p. 36, Pl. 25, Figs. 4-5.
1859 Juglans vetusta Heer; Heer, p. 90, Pl. 127, Figs. 40-44.
1869 Juglans acuminata Al. Br.; Ettingshausen, p. 45, Pl. 51, Fig. 12.
1869 Juglans parschlugiana Ung.; ibid., p. 46, Pl. 51, Figs. 7-10.
1881 Juglans acuminata Al. Br.; Velenovsky, p. 44, Pl. 8, Figs. 2, 4-6.
1891 Juglans vetusta Heer; Engelhardt, p. 191, Pl. 17, Figs. 11-12.
1971 Juglans acuminata Al. Br.; Bůžek, p. 42, Pl. 9, Figs. 9-15; Pl. 10, Figs. 1-6; Pl. 11, Figs. 1-3; Text-fig. 3.

Material: No.: 76.222.1.(=76.223.1.counterpart)
1 piece

Descripton: A leaf with almost complete counterpart, only the tip of the apex is missing, and the margin is fragmented at some places. The complete length of the leaf is 14.5 cm, its width is 4.0 cm. The margin of the leaf is entire. The basis is asymmetrical and acute. The form of the leaf is lanceolate. The vein system is camptodromous, the secondary veins running out of the midvein in an alternating manner, their angle of divergence ranging between 60 and 80. At the intersecondary areas of the apical and basal parts the intermediate veins are seemingly frequent, forming no loops and running only till the quarter or half of the lamina. The midvein is considerably thick at the lower third of the leaf. At about the same part it is considerably curved, and this curvature can be observed along the rest of the leaf in the form of a slight arch. The distance between the secondary veins is fairly great, smaller towards the basal parts, where it is 0.8 cm. On the medial parts it is greater, 1.2-1.8 cm (Fig. 143).

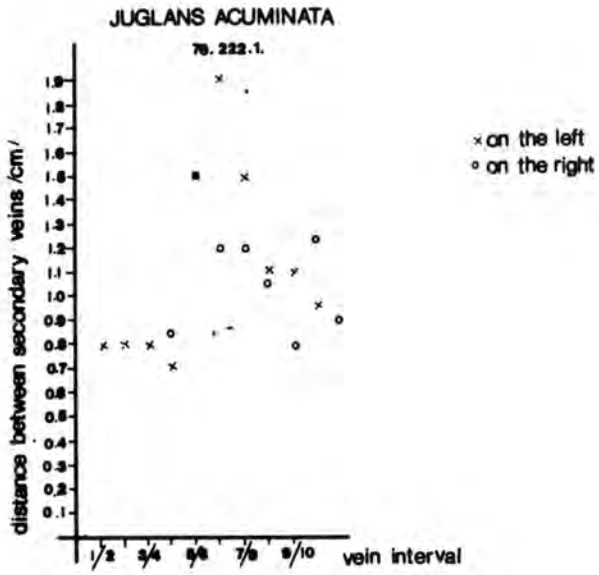


Fig. 143. Leaf parameters of Juglans acuminata No. 76.222.1.

This distance is decreasing again towards the apex. The morphology of the leaf agrees with the species description of BŮŽEK (1971), only the angle of divergence is somewhat steeper on the Vértesszőlős specimen. This is, however, not excluding their taxonomical identity, because in case of some other finds a similarly steeper secondary vein system is met as well.

According to BŮŽEK, it cannot be excluded that different taxonomical groups are lumped together on morphological basis under this name. A safe determination can be expected again by the help of epidermis analysis. The leafprint offers no possibilities on the execution of this test.

J. acuminata was found in the oldest Neogene sections of Europe. The distance of the veins of secondary order starting from the basis till the apex is as follows:

on the left side: 0.8; 0.8; 0.8; 0.7; 1.5; 1.9; 1.5; 1.1; 1.1; 0.95 cm
on the right side: -, -, -, 0.85; 1.5; 1.2; 1.2; 1.05; 0.8; 1.25; 0.9 cm

Cedrela L.

cf. Cedrela macrophylla Andreánszky
Pl. XXVIII, Fig. 4.

1955 Cedrela macrophylla Andr.; Andreánszky, p. 44-45, Fig. 5.
1966 Cedrela macrophylla Andr.; Andreánszky, p. 93.

Material: No.: 76.123.1.
1 piece

Description: The original length of the leaf could be around 15 cm, its width is 3.8 cm. The shape of the leaf is elongated ovate. Only the apical part was preserved. The apex is acute, the margin of the leaf is entire. The midvein is considerably strong, the secondary veins are branching off the midvein relatively densely. The angle of divergence is fairly large, sometimes close to perpendicular.

The species was described by ANDREÁNSZKY (1955) from the Eger-Wind's Brickyard section, where it is frequently found in the upper flora. It has not been found on other Upper Oligocene floras of Hungary as yet. As we have only a fragmented single specimen here, and the characteristic basal parts are missing, we cannot unambiguously state the presence of C. macrophylla in the Vértesszőlős assemblage.

F a b a c e a e

Leguminosae I.
Pl. XXVIII, Fig. 2.

Material: No.: 76.10.1.
1 piece

Description: The basis of the leaf is missing; thus we can only estimate its length, approx. 9 cm. The width of the leaf is 4.5 cm. The margin is entire, the apex is emarginate, the basis is missing.

The state of preservation of the leaf is poor, the veins of the secondary order are visible only at some parts: they are thin, set at relatively great distance from each other, running till the margin of the leaf. The form of the leaf is oblong, on the medial phase of the leaf the margins are nearly parallel to each other along a longer phase. The leaves with emarginate apex found in the Lower Oligocene were mainly described under the name of Dalbergia bella. These leaves, however, are considerably differing from this specimen. The leaves of D. bella found in the Tard Clay do not exceed 5 cm, their shape is obovate, the basis is considerably narrow.

There were several leguminose fruits found in the flora, supporting considerably the presence of the family, however, we could establish no direct connection between the fruits and the leaf, all the more because several other remnants of leaves were found in the flora that could be equally associated with these fruits.

Leguminosae II.
Fig. 112.

Material: No.: 76.263.1.
1 piece

Description: The apical and basal parts of the leaf are missing, the medial part is intact. The lamina is narrow oblong-lorate. The margins of the leaf are parallel to each other throughout the complete medial fragment, probably narrowing towards the apex and the basis. The margin is entire. The midvein is apparent, the secondary vein system is much more weaker. The camptodromous character of the venation is still fairly well observable. The secondary veins branching off the midvein flatly, getting thinner at the bend, and the loop can be observed only by the help of microscope already. The measurable length of the fragment is hardly reaching 4 cm, anyway, it could be probably essentially longer because there is no sign of either of the ends getting narrow as yet. The width of the lamina is 1.3 cm.

Similar small, camptodromous veined leaves are most frequently encountered under the name of Sophora in palaeobotanical literature. These remains are, however, though similar in size and venation, not so long. Their shape is much rather ovate or elliptic.

Most features in common were observed with the species Sophora multiformis described from the Tertiary flora of Alaska by HOLLICK (1936). Opposed to the rest of the Sophora species, the leaves of this species are elongated, their form is oblong, and the venation is camptodromous. The length of the leaves varies between 1.8-7.5 cm, their width is 1.75-5 cm.

There were no more remains found of this type in the Vértesszőlős flora, at least none of the reminiscent forms were in adequate state of preservation for assignment. Remains of Sophora from Hungary are known mainly from the Miocene, in the first place, the Sarmatian period.

M i m o s a c e a e

"Acacia" parschlugiana Unger
Pl. XXVII, Fig. 3; Pl. XXVIII, Fig. 3; Pl. XXX, Figs. 1-2.

1859 Acacia parschlugiana Ung.; Heer, p. 130, Pl. 139, Figs. 45-59.

Material: No.: 76.227.2.; 76.314.2.
2 pieces (with counterparts)

Description: There were two leguminose fruits of the same species found with counterparts in the flora. The bigger one is a pod, 6.5 cm long and 1.1 cm wide, almost intact. On this piece, the place of 9-10 seeds could be counted. The other specimen is fragmented, the part of the fruit towards the peduncle is broken. The width of the pod here is also 1.1 cm. The width of the pod is uniform along the whole length of the fruit, getting narrow only by the two ends, having, consequently, no medial constrictions or widening towards the apex of the fruit. The apex is regularly rounded on both specimens. The seeds could be relatively large, their form being slightly oval. They were situated in the direction of the axis of the pod, i.e., in horizontal position. The best analogy of the Vértesszőlős specimens is probably that of the Acacia parschlugiana found among the many leguminose fruits published by HEER (1859).

The taxonomical position of the Acacia parschlugiana is still fairly obscure. The leguminose fruit, however, proved that the representatives of the family of Mimosaceae were equally present in the flora.

V i c i a c e a e
Wisteria Nutt.

cf. Wisteria aff. fallax (Nathorst) Tanai et Onoe
Pl. XXIX, Figs. 3-4; Fig. 114.

1883 Sophora (?) fallax Nathorst; Nathorst, p. 58, Pl. 10, Figs. 11-12; Pl. 11, Fig. 2.
1961 Wisteria fallax (Nath.) Tanai et Onoe; Tanai et Onoe, p. 45, Pl. 10, Fig. 6; Pl. 14, Figs. 2-4.
1971 Wisteria aff. fallax (Nath.) Tanai et Onoe; Bužek, p. 61, Pl. 25, Figs. 1-15; Text-fig. 8.

Material: No.: 76.56.1.
1 piece

Description: The length of the lamina is 2 cm, its width is 1.25 cm. The apex is missing, but probably it used to be rounded. The basis is rounded as well. The petiole of the leaf is nearly 0.5 cm long. The width of the petiole is surprisingly great compared to the size of the leaf. The midvein is also very strong, the veins of the secondary order are also visible. The venation is camptodromous, however, this cannot be observed on all of the secondary veins. The angle of divergence of the secondary veins is gradually decreasing from the basis upwards: 62 , 45 , 38 , 32 . The distance between the veins in the same direction are the following: 0.3, 0.45, 0.45 cm. The vein system of the tertiary order is fairly irregular; on one hand, forming minor loops on the intersecondary area or running straight, on the other hand, running towards the margin forming loops here and there.

The plant was described first from the Japanese flora under the name of Sophora fallax, later assigned to the genus Wisteria by TANAI and ONOE (1961). BUŽEK (1971) published it for the first time from the European flora. In his opinion it is not absolutely sure that the same species was spotted in the Japanese and the European flora, respectively. The Vértesszőlős piece agrees considerably with the specimens described by BUŽEK, therefore we are using the name W. aff. fallax as well. Only a single specimen was found here, thus probably it could play only an inferior role in the Vértesszőlős Upper Oligocene flora.

S t e r c u l i a c e a e
Sterculia L.

Sterculia sp.
Pl. XXXI, Figs. 1-2; Figs. 85-86.

Material: No.: 76.115.1(=76.121.1.counterpart)
1 piece

Description: A very interesting print of the Vértesszőlős flora, which is reminding us with its triple lobes to several genera. (e.g., Acer, Hedera), the venation, however, is different from that of the mentioned taxa. The margin of the leaf is entire, thus we can exclude species with a lobed or toothed margin. In case of the lobed leaf structure we can generally observe, that starting from the basis of the leaf, besides the midvein, there are two (or more) strong secondary veins starting which run directly into the lobes, i.e., the venation is actinodromous. This phenomenon can be observed even at the Sterculias as well. In case of this species, however, a basically different venation can be observed. Unfortunately, the basis is fragmented, but still we can observe that the venation is not actinodromous, but craspedodromous, that is, at some distances from the midvein, there are secondary veins branching off at the following angles of divergence: 56 , 50 , 48 , 45 . The venation of the side lobes are very specifically formed from the three veins of the second order. There are branches running in the direction of the secondary veins from the right and the left side in the form of tertiary veins originating from the neighbouring secondary veins, and at these branches the secondary veins themselves are turning a little bit inside. The apex of the central lobe of the leaf is acute, that of the two side lobes is obtuse. The widest part of the leaf is 6 cm, its length cannot be measured with certainty. The other important feature of the species is, that the curvature between the lobes is not acute, but obtuse. The angle between the central and the side lobes is about 115 .

The species is essentially different from the rest of the Sterculia species known so far. Sterculia labrusca Ung., for example, is of completely different character with its narrow, thin, acute lobes. The species S. tenuinervis Heer is also completely different from this species. Neither the venation, nor the form of the lobes are identical. In case of the S. tenuinervis, the angle between the lobes is acute. The Sterculiphyllum sp. published by KNOBLOCH (1969) from the Moravian flora does not agree with this species. The medial lobe here is essentially wider than the side ones, and it has more apices. The form published by MAKULBEKOV (1972) under the name of S. kalkamanica is essentially different in its form as well as the vein system from the Vértesszőlős specimen. It cannot be related either to the species S. rarinervia Kol., described from the Pliocene flora of Kodor by KOLAKOVSKI (1964), which has a simple leaf construction.

R o s a c e a e
Rosa L.

Rosa lignitum Heer 1869
Pl. XXIX, Fig. 3.

1869 Rosa lignitum Heer; Heer, p. 98, Pl. 30, Fig. 33.
1971 Rosa bohemica Engelhardt; Bůžek, p. 61, Pl. 24, Figs. 1-9.
1978 Rosa lignitum Heer; Mai et Walther, p. 101, Pl. 4, Figs. 8-10; Pl. 40, Figs. 3-11.

Material: No.: 76.116.1.
1 piece

Description: There were three apical leaflets of an oddly pinnated leaf remaining here, The form of the leaflets is elliptical, their apex and basis is rounded. The basis of the side leaves is slightly asymmetrical. The midvein is strong, the venation is craspedodromous. The margin of the leaves are toothed, the secondary veins terminating in the teeth.

The apices of the teeth are acute, their apical side is slightly convex, the basal side is convex. The sinuses between the teeth are acute. The length of the apical leaflet is 2 cm, its width is 1.3 cm. The two side-leaflets are hardly smaller.

The leaflets correspond to the rounded type leaflets published by BUZEK (1971). The species itself is fairly variable, there are longer leaflets and pieces with acute basis equally assigned to this taxon.

In Hungary, the species Rosa legányii Andreánszky was described from the Sarmatian flora. The morphology of this species, however, is completely different from the piece found in the Vértesszőlős assemblage.

Rosa bohemica was amply found in the Bohemian Miocene floras. Its recent equivalent could be defined with great difficulties only, all the more because the recent species of roses are also very variable. The clarification of their taxonomy is further complicated by the existence of many natural hybrids.

In respect of climatic requirements, however, the genus is more unified. They do not need very high temperature, but they are not resistant to long cold periods. In the natural vegetation they prefer the sunny hillsides, sparse vegetation.

A c e r a c e a e
Acer L.

Acer angustilobum Heer sensu Hantke
Pl. XXXII, Figs. 1-3; Pl. XXXIII, Fig. 1; Figs. 115, 117-120.

1859 Acer angustilobum Heer; Heer, p. 57, Pl. 117, Fig. 25a; Pl. 118, Figs. 4, 7, 13.
1860 Acer angustilobum Heer; Ludwig, p. 131-132, Pl. 52, Figs. 3, 8; Pl. 53, Figs. 1-4.
1870 Acer angustilobum Heer; Engelhardt, p. 27, Pl. 7, Fig. 26.
1885 Acer angustilobum Heer; Engelhardt, p. 349, Pl. 13, Figs. 9, 11-13, Fig. 16.
1891 Acer angustilobum Heer; Engelhardt, p. 180, Pl. 11, Figs. 2-3.
1910 Acer angustilobum Heer; Engelhardt, p. 21, Pl. 2, Figs. 15-16.
1930 Acer angustilobum Heer; Kräusel, p. 41, Fig. 12.
1954 Acer angustilobum Heer; Hantke, p. 77, Pl. 13, Figs. 2, 4-5.
1955 Acer angustilobum Heer; Nötzold, Pl. 3, Figs. 7-8.
1961 Acer cf. angustilobum Heer; Knobloch, p. 285, Pl. 11, Fig. 4; Pl. 19, Fig. 4.
1963 Acer angustilobum Heer; Mai, Pl. 10, Fig. 17.
1964 Acer angustilobum Heer; Walther, Pl. 19, Figs. 1, 3, 5; Pl. 20, Fig. 4.
1965 Acer angustilobum Heer; Hantke, p. 86-88, Pl. 15, Figs. 6-8, 10.
1972 Acer angustilobum Heer; Walther, p. 40, Pl. 3, Figs. 1-6; Pl. 4, Figs. 1-7; Pl. 6, Figs. 1-5; Pl. 33, Figs. 1-7; Pl. 34, Figs. 1-6; Pl. 35, Figs. 1-10; Pl. 36, Figs. 1-4.

Material: No.: 76.51.1.; 76.101.1.; 76.127.1.; 76.209.1.; 76.270.1.; 76.285.1.; 76.302.1.
7 pieces

Description: Generally, these leaves are small and, with one exception, fragmented. Their most characteristic feature is the narrow lobes and the characteristic venation. The angles between the midvein and the central vein of the lobe is as follows: 52 , 41 , 47 , 40 , 39 . Apparently, these values are ranging around 40 , thus the leaves are fairly narrow. An exception under this rule is the print 76.51.1., where the angle between the midvein and the

secondary vein is 52 . This divergence of more than 10 on both sides is yielding a considerably wider leaf. While the rest of the remains enclose 80 between the secondary veins, the same value at this piece is more than 100 . In spite of this, we cannot exclude that the piece belongs equally to A. angustilobum, because the lobes are narrow, deeply incised into the lamina, the margin of the leaf is toothed. The teeth are visible on this specimen only, because the margin of the other pieces is dim.

The venation is actinodromous, the secondary veins starting from the primary veins are proceeding towards the margin of the leaves not straight and rigid like in case of less toothed maples, but arching considerably upwards, forming a loop with the vein situated immediately over it. This feature, i.e., that the secondary veins do not reach the margin, is characteristic of the Acer angustilobum (HANTKE 1965, Pl. 15, Fig. 8).

The most significant occurrences of the species are known from the Upper Miocene (Tortonian) of Switzerland, the Egerian of Seifhennersdorf (GDR), Egerian and Miocene of Kundratice and Čermniky (Czechoslovakia). Its distribution known so far is confined therefore from the Upper Oligocene till the Upper Miocene.

On the basis of the anatomical studies of WALTHER (1972), the species belongs to the Spicata section, demonstrating a morphological similarity with the species Acer kwangsii living in Eastern Asia (China). This latter species is a constituent of the evergreen forests at the altitude of 1300-1700 m.

Acer sp.

Material: No.: 76.60.1.
1 piece

Description: The fossilization of the piece probably took place amidst interesting circumstances. Namely, the leaf is bent at the middle, thus the basis and the apex are situated on two different bedding planes, separated by 1 cm of sediment. In spite of the strange position of the piece, the state of preservation of the leaf is fairly good at its medial parts. Probably, the rapid flow of silt erected and preserved the piece in this unique position. The two lateral primary veins enclose an acute angle, as opposed to the A. angustilobum. The apical part of the leaf is fairly fragmented, still we can observe small teeth on one side of the central lobe. On some specimens of the A. tricuspidatum, the angle enclosed by the lateral primary veins is known to be very small, however, more than 40 . Because of the fragmentary state of the piece, it could not be assigned to any species.

C o r n a c e a e
Cornus L.

Cornus praeamomum É. Kovács
Pl. XXXIII, Fig. 3; Fig. 116.

1959 Cornus praeamomum É. Kov.; Andreánszky, p. 177, Pl. 56, Fig. 6; Pl. 57, Figs. 1-2; Pl. 58, Fig. 2.

Material: No.: 76.112.1.
1 piece

Description: A large, fragmented piece, the basis is completely missing. The apex is acute. The original total length of the leaf could be around 15 cm, its width is about 6.4 cm. The secondary veins are running arched towards the apex, characteristic of the Cornus species in general. The margin of the leaf is entire. Around the midvein, the leaf is injured at the lower parts, thus the distance between the starting points of the secondary veins cannot be measured. The angle of divergence observable on the leaf, however, let us suppose that the distance between the veins is gradually increasing towards the apical parts, which is also fairly typical of the Cornus genus.

The species was described from the Badenian flora of Nógrádszakál, Hungary (KOVÁCS 1959 in ANDREÁNSZKY 1959), where 14 specimens were found. Their dimensions were changing amidst fairly large intervals, however, they are generally large. The recent equivalent of the species, according to Kovács, is the species C. amomum, which is a widely distributed plant of the North-American marshy regions.

Cornus cf. wrightii Knowlton
Pl. XXXIV, Fig. 2.

1899 Cornus Wrigtii Knowl.; Knowlton, p. 749, Pl. 103, Fig. 4.
1974 Cornus Wrigtii Knowl.; Bajkovskaya , p. 93, Pl. 23, Figs. 1, 6.

Material: No.: 76.129.1(2)
2 pieces

Description: One of the leaves is narrow elliptic, the lamina is getting narrow towards the apex and the basis. The apex is acute, probably, the basis is also acute but it is fragmented. The length of the leaf is 8 cm, its width is 3.4 cm. The widest point of the lamina is somewhat below the medial line. Because of the fragmentary state of the basis, the position of the widest point cannot be exactly determined. There are only three pairs of secondary veins visible on the piece, placed fairly distant from each other. The distance between the first two veins is 1.8 cm, between the second and the third veins, 1.9 cm. 1.3 cm far from the apex we find the highest secondary vein, thus - typical of the Cornus - there are no further secondary veins starting at the apical region. The divergence of the veins is arched, the most intensively curved pair of veins being the highest one, while the other two pairs are less intensively curved. The margin of the leaves is entire.

The form of the print is very similar to that of the species Elaeocarpus palaeolanceolatus Kolak., though that one is more elongated and its leaves are more narrow, and the system of the secondary veins is more densely set. Another important difference can be observed in the angle of divergence of the secondary veins, which are steeper in case of the E. palaeolanceolatus, forming a loop near the margin, thus their system is camptodromous. In case of the Vértesszőlős flora, the connection of the secondary veins can be observed at the other specimen of C. wrightii as well. The veins here are much more arched than those of the E. palaeolanceolatus and also more sparse. The latter specimen is smaller than the other one, its width is 2.4 cm, its length cannot be established due to the lack of the apex as well as the basis. On this specimen, the tertiary venation connecting the secondary veins is visible at some places.

Cornus sp.
Pl. XXXIV, Fig. 1; Fig. 121.

Material: No.: 76.4.1.(=76.32.1.counterpart)
1 piece

Description: The form of the leaf is obovate, its length is 8 cm, width is 3.6 cm. The distance of the secondary veins are fairly large, similar to the other two Cornus taxa, namely: 1.15; 1.3; 1.7 cm.

The secondary veins are running towards the margin in a wide arch, that is the angle of divergence is relatively wider than in case of the other Cornus species. The sparse vein system running towards the very edge of the margin renders it similar to C. wrightii, the form of the leaf, however, is different. The state of preservation of the print is not so good that we could exactly determine the correct taxonomical position. It is possible that the piece is only a smaller specimen of C. praeamomum.

Cornus species are not known from the Lower Oligocene of Hungary as yet. According to recent evidence, their first appearance can be dated to the Upper Oligocene. From this period on, there are several occurrences of the genus known from the Miocene. Nowhere in Hungary was it found dominant. The genus could possibly arrive to Hungary as a member of the Arctotertiary wave. Numerous representatives of Cornus used to live, during the Miocene, in the neighbouring Czechoslovakian territories. The genus is mainly known from the Miocene at other regions of Europe and Asia as well.

Probably, the genus occupied a similar place in the vegetation ever since the Egerian and the Miocene. It is recently known from the bush level of the sunny hill-side forests. On the basis of its quantity, we can suppose similar role within the vegetation since the Egerian.

S m i l a c a c e a e
Smilax L.

Smilax tataensis Hably et Csaba
Pl. XXXV, Fig. 1; Pl. XXXVI, Fig. 1; Pl. XXXVII, Fig. 1; Pl. XXXVIII, Fig. 1; Figs. 128-133.

1977 Smilax tataensis Hably et Csaba; Hably et Csaba, p. 23, Text-figs. 1-8.

Material: No.: 76.180.1.; 76.189.1.; 76.229.1.; 76.230.1.; 76.231.1.; 76.232.1.; 76.252.1.; cf. 76.177.1.
8 pieces

Description: in HABLY et CSABA (1977). The leaves are essentially different from those of S. weberi, as well as S. grandifolia generally considered as synonim of S. weberi. One of its most distinctive features, observable on one of the leafprints published by BŮŽEK (1971 p. 90, Text-fig. 4.) that the basis is short, in spite of the widening of the lower parts of the leaf, terminating in an acute peak, i.e., decurrent. On the specimens of S. tataensis the starting point of the vein system - that is, the contact of the shaft and the lamina - is placed well over the end of the shoulders of the lamina. Typical of the S. tataensis, is the regular vein system between the primary veins Nr. 1 and 2 from the midvein, consisting of acutely terminating loops.

S. tataensis is nearest to the form mentioned under the name of S. grandifolia at HEER (1855) Pl. 30, Fig. 8, STAUB (1887) Pl. 20-21, Figs. 1-7; Pl. 22-23, Figs. 1-5; Pl. 24, Fig. 1. This species in our opinion is not the same as S. weberi. Accordingly, the specimens published under the name of S. weberi and S. grandifolia cannot be lumped together under the name of one species. STAUB (1887) mentioned and demonstrated several Smilax species from the Upper Oligocene flora of the Zsil valley. These specimens are probably the nearest kins of S. tataensis, on the basis of their form and vein system. For example, on one specimen of the Zsil valley (STAUB 1887, Pl. 22, Fig. 2) we can find the loop-form vein system near the margin while, however, on the Zsil valley specimens the connecting veins are almost horizontal (branching out at an angle of 90) and they are fairly densely placed, in case of S. tataensis, the angle of divergence is steep (enclosing 35 - 45 with the horizontal direction) and they are fairly far from each other.

Concluding from the large leaves of the S. tataensis as well as the recent representatives of the genus we can say that most likely it was a creeper plant of the subtropical, humid vegetation.

P l a n t a e i n c e r t a e s e d i s

Dicotylophyllum sp. I.
Pl. XXXVI, Fig. 2.

Material: No.: 76.208.1.
1 piece

Description: There was only one fragmentary specimen found of this kind. The form of the leaf is ovate. The apex is fragmented, the basis is cuneate. The midvein is strong. The pair of secondary veins running the nearest to the basis has an acute angle of divergence, the veins running up very high on the lamina, forming a loop near the margin with the next pair of secondary veins, which is less steep than the former one. Starting from the lowermost secondary veins, there are tertiary veins running towards the margin, enclosing a loop with each other. At the intersecondary area, the network of tertiary veins is equally visible. Our specimen reminds in some feature to Phyllites nemejci, the margin of which is toothed. On the basis of the specimens delineated by BŮŽEK (1971) it seems that the basal part is intact at some specimens here as well (Pl. 52, Fig. 10).

The species was described from the Bohemian Petipsy Area by BUZEK, from Miocene layers. Its taxonomical position is not determined, the auctor of the species compared the pieces in question to Rhamnus alaternus, which is an evergreen species of the Eastern Mediterranean region.

The dimensions of the Vértesszőlős specimen can be given only approximately, anyway, they are essentially larger than the specimens described from the site Čermniky. Its length might have been somewhat over 9 cm, the length about 5 cm.

We have to mention here another find from Hungary, seemingly very similar to this specimen. ANDREÁNSZKY and NOVÁK (1957) described it under the name of Dolichites triangularis from the Lower Oligocene flora of Kiseged. They published two specimens of the species (p. 49, Text-fig. 4 and Pl. 3, Fig. 8). Among them, the latter piece is completely different from Phyllites nemejci, neither the form nor the vein system is similar, but the other specimen is very close to it. The character of the secondary vein system at the upper parts of the leaf, however, is different here as well, which however, can be ranged within the variations of one species. The size of the piece is nearer to that of the Vértesszőlős piece; its width is 4.5 cm, the length is about 8.5 cm.

Dicotylophyllum sp. II.
Pl. XXXIII, Fig. 2; Fig. 111.

Material: No.: 76.126.1.
1 piece

Description: Only a small fragment was found, on which there is hardly any characteristic feature preserved, therefore, lacking the epidermis, it is very difficult to identify the species. The form of the leaf cannot be ascertained. The midvein is very strong, its width can surpass 1 mm. The venation is camptodromous, the secondary veins are branching off from the midvein fairly far from each other, connected to each other by wide loops. The margin of the leaf is fragmented, at some places we can spot teeth. In the vicinity of the basis, the margin of the leaf is entire. Starting from the secondary veins, there are further tertiary veins starting. The secondary veins are also connected by tertiary veins.

Debeya Miguel

Debeya hungarica Hably
Pl. XXXVII, Fig. 2.

1982 Debeya hungarica Hably; Hably, p. 96-97, Pl. 2, Figs. 8, 10; Pl. 3, Figs. 1-3, 5-8; Pl. 9, Figs. 4-5; Pl. 10, Figs. 1-4; Pl. 11, Figs. 1-4; Pl. 12, Fig. 1.

Material: No.: 76.105.1.
1 piece

Description: There were only two leaflets of the leaf remaining, among them, the central one is complete, only covered by, on the basal parts, a bit of the right side leaflet. The margin of the leaflets is entire. The veins of the secondary order are hardly visible, spotted sometimes in the vicinity of the midvein only. Their angle of divergence is larger than 60 . The length of the central leaflet is 9 cm, its width is 2 cm. The side leaflet is fragmented, probably it was shorter than the central one. The two leaflets meet without any petiole, thus they were probably placed very near to each other. This is the reason for their position, i.e., covering each other to some extent. The form of the leaflets is elongated elliptic, their basis and apex is acute.

The species was encountered at the Egerian flora of Verőcemaros for the first time, described by HABLY (1982). The age of the two finds therefore is equal, however they come from different lithostratigraphical formations. Besides the D. hungarica, at Verőcemaros we can find the plants present in the Vértesszőlős flora, i.e., Platanus neptuni, Daphnogene, Ulmus, Acer species.

Still we cannot draw an immediate relation between the flora of Vértesszőlős and Verőcemaros, because the difference in the individual- and species number of the two is so large that it might lead to serious errors as well.

Phyllites skofleki n.sp.
Pl. III, Figs. 1-2; Pl. IV, Fig. 1; Pl. V, Fig. 2; Figs. 122-127.

Holotype: No.: 76.20.1
Deposited in the palaeobotanical collection of the Kúny Domonkos Museum (Tata).
Locus typicus: NNW Hungary, Baromállás hill between Tatabánya and Vértesszőlős
Stratum typicum: Egerian (Upper Oligocene), Mány Formation
Derivatio nominis: After István Skoflek, Hungarian palaeobotanist, collector of the flora.

Material: No.: 76.12.1.; 76.20.1.; 76.180.1.(2); 76.206.1.; 76.217.1.; 76.301.1.; 76.307.1.
8 pieces

Description: The form of the leaves is slightly obovate. Their length is ranging between 8-12 cm, their width is between 4.8-7.4 cm. The proportions of the lamina is 1.6-1.8 cm, that is, between the wide and narrow obovate. The apex is fragmented at all specimens. The basis of the leaves is obtuse, the margin entire. The vein system is camptodromous. In the continuation of the secondary veins, there are further loops formed towards the margin. At the intersecondary area we can observe a relatively dense network of tertiary veins. The tertiary veins are basically perpendicular to the secondary ones. In between the veins, however, anastomoses can be formed, even branching.

The distance of the secondary veins from each other is partly depending on the size of the leaf, but anyway, it is smaller at the basal parts than at the medial region. The distance between the veins is typically around 1 cm at most specimens, only at the holotype we find this value around 1.5 cm or over it.

The angle of divergence of the secondary veins is one of the most characteristic features of the species.

76.20.1. Holotype. The angle of divergence of the secondary veins, measured from the basis till the apex is as follows:
left side: - , 76 , 58 , 51 , 37 , 31 .
right side: 65 , 65 , 58 , 50 , 44 , 42 , 35 .

76.12.1. left side: 59 , 52 , 42 , 37 , 37 .
right side: 58 , 50 , 47 , 43 , 40 , 37 .

76.307.1. left side: 74 , 65 , 60 , 51 , 48 , 42 .
right side: 76 , 68 , 67 , 58 , 55 , 47 .

It can be observed, that from the basis towards the apex the secondary veins are branching off from the midvein at ever steeper angle. This feature can be met at several specimens, however, not with so great differences. Between the angles of divergence measurable at the lowermost and the top veins can be 20 -30 , or, at the most complete specimen where the most of the veins could be measured, there is a difference of more than 40 .

This is fairly well observable at the widening phase of the lamina, that is, the part nearer to the apex. The veins of the secondary order are branching off, seemingly, in a more arched way than in the vicinity of the basis.

The dense system of tertiary veins situated between and running parallel to the secondary veins, i.e., the intercoastal area denote the genus Alnus. Large leaves of the species belonging to Alnus are fairly frequently met at the similarly Upper Oligocene section of the Wind's Brickyard, which are, however, toothed on the margin and their venation is craspedodromous. The camptodromous vein system and the entire margin contradict an assignment to the genus of Alnus. These features would indicate a relationship with the family of Lauraceae, but the regular secondary vein system, the angle of divergence of the secondary veins and the tertiary vein system observable at the intercoastal areas exclude this possibility.

Palmae
Pl. XXXVIII, Fig. 2.

Material: No.: 76.205.1.; 76.208.1.; 76.219.1.(12); cf. 76.220.1.; 76.221.1.; cf. 76.271.1.; 76.274.1.; 76.276.1.; 76.278.1.; 76.279.1.; cf. 76.289.1.
22 pieces

Description: The most complete and largest leaf fragment is 22.5 cm long and 3.5 cm wide. In longitudinal direction, prominent ribs are running along the leaf, flattened by the pressure of the layers, however, still observable. On our leafprint there are four such prominent ribs observable. The pattern system consisting of smaller lines enclosing 60 with the ribs is extending over the whole surface, on the basis of which it is easy to characterize the species even on the small fragments. The stripes are situated fairly densely, at 0.5 mm intervals from each other, running parallel to each other. The stripes are dissected by weak perpendicular transversal walls set at irregular paces. The delineation of this fine structure, however, is not presented so far in palaeobotanical literature. On the basis of morphological features, probably, it is the nearest to the species Flabellaria Rüminiane (HEER 1855). Similar remains were described by HOLLICK (1936) from the Tertiary flora of Alaska under the name of F. alaskana. More precise assignment of the fragments is not possible. What we can say for sure is, that palm trees were obviously present in the assemblage as direct proofs of the warm climate.

cf. Fructus
Pl. XXXI, Fig. 3.

Material: No.: 76.109.1.
1 piece

Description: The form of the fructus is elliptic, its length is 1.3 cm, its width is 0.8 cm. At about the middle of the piece, a depression is visible, forming a roughly 1.5 mm wide stripe along the edges. Starting from the margin of the fructus, there are extensions running at every direction the length of which cannot be exactly ascertained. The longest measurable one is 0.6 cm long.

FLORISTICAL EVALUATION

Evaluating any of the floristical assemblages we are facing the problem of the distorting effect of fossilization on the complete flora. Our fossil floristical assemblages are, at the very best, taphocoenoses, including those plants mainly that were nearer to the place of fossilization, or their transport to the place was rendered possible by some media. Estimating the extent of selection would be tentative, as we have no direct proofs on this fact. Perhaps nearest to the truth, we can adopt the principle 'many out of many, few out of few'. Therefore we cannot neglect the individual number when evaluating the assemblages.

For an adequate separation of the taphocoenosis according to biocoenoses we should be aware of the ecological requirement of the very species, whereas we are confined here to hypotheses on morphological basis as well as the principle of actualism. This principle can be applied already with acceptable certitude to Tertiary floristical assemblages; however, in many cases it is difficult to judge, which is the recent equivalent of a given fossil species, or, define its nearest relatives. If we cannot do this, we have to face the possibility of another source of error considering, in general, the ecological demands of a genus or a family.

Still there are certain genera or even families which are very consistent and unified concerning their ecological requirements , therefore even a loose determination of the members is enough without making great errors or ecological inconsistencies in our deductions.

There are 48 species present in our fossil flora, assigned to 20 families. In respect of individual number, there are members of the families Lauraceae, Taxodiaceae, Platanaceae and Ulmaceae present in the greatest quantity. While the Lauraceae are represented by many species of several genera in the assemblage, Taxodiaceae and Ulmaceae are represented by two species each, Platanaceae by a single species only.

The number of Arctotertiary species, or rather, genera is higher than in other Hungarian floras of the Egerian period Verőcemaros (HABLY 1982), Kesztölc (HABLY 1988), Nagysáp (HABLY 1989), but in respect of individual number, it is only the species Ulmus pyramidalis playing a more important role among them within the assemblage. The family of Betulaceae is present with various forms having, however, only one specimens of each here. The same can be stated concerning the rest of the Arctotertiary element in the flora.

The bulk of the flora was composed of, correspondingly, the Palaeotropical elements. The high diversity and great individual number of the family of Lauraceae is undoubtedly testifying that the genus was in its prime during the Egerian Stage. The same can be said about the Platanus neptuni as well. Consequently, the flora was dominated by thermophylous elements supported by the presence of palm trees as well.

From the point of a floristical evaluation it is remarkable that Palaeocarya orsbergensis is missing from the assemblage, a species which is generally spread in great quantities within the Egerian floras of Hungary. We have to mention the presence of the family of Leguminosae here, represented by several leaf forms and fruits, similar to other Egerian floras in Hungary, thus it can be regarded as a characteristic member of the assemblage.

From the point of floristical composition, the presence and diversity of the family of Betulaceae should be stressed as the major difference in respect of the other Egerian assemblages of Hungary, as well as the presence of Acer angustilobum and the high individual number of the representatives of the Taxodiaceae family.

THE PHYTOCOENOSES OF THE VÉRTESSZŐLŐS FLORA AND THE PALAEOGEOGRAPHICAL RECONSTRUCTION

The dominant species in our assemblage are of fairly different ecological requirements. The differences existing between their ecological demands should be explained, first of all, not by climatological, much rather, eda-

phic factors, because they were living under the same climatological endowments. The dominant species are seemingly separable according to biotope as swampy, riparian and hillside vegetation.

The dominant species of the swampy vegetation was the species Taxodium dubium. Ulmus pyramidalis constituted the riparian forests, while the species of Daphnogene and Laurophyllum, as well as Platanus neptuni were the typical plants of the hillsides lying further from the shores.

Among the three coenoses, the swampy and riparian ones can be considered as intrazonal ones. It is only the forest composed of Platanus neptuni - Daphnogene div. sp. which can be considered as real zonal assemblage here, distributed on hilly parts already not influenced by soil water. In these latter forests, Platanus neptuni constituted the dominant tree of the forest, building up the foliage level whereas the Daphnogene species occupied the lower foliage level, mainly the bush level. At the higher foliage level we find the species of Laurophyllum as well as Sterculia inhabiting the lower foliage level. Mixed arboreal component of the forest were, apart from these, the evergreen species of Quercus as well as the Sassafras tenuilobatum, forming a higher foliage level. In the bush level there were the species of Daphnogene and Debeya hungarica growing, the liana of the forest was the Smilax tataensis.

The palaeogeographical picture can be fairly authentically drawn after the vegetation. At the lower lying riparian regions there were forests of Betula, on the higher levels, that of Ulmus, Zelkova species formed, further from them, groves of Acer and Juglans were living.

The dominant zonal assemblage was composed of a forest of Platanus neptuni - Daphnogene div. sp., up till an elevation of 800 m a.s.l.

The humidity requirements here were supplied by the precipitation of the subtropical rain forest and not the soil water only, coupled with the humid atmosphere due to frequent rainfalls.

Apart from the evergreen laurel-leaf tree forests, there were deciduous species equally present in the forest, similar to the situation observed recently as well. Probably, the species Sassafras was also deciduous, which is known to be of the same character even today, and the type of the vegetation can be defined as subtropical rain forest.

The levels of the forest have been presented in the preceding parts, thus they will not be presented here again. Our fossil assemblage contains, however, certain species that were not assigned to vegetation types as yet. Among them, we can associate the genera Rosa and Cornus as well as the family of Leguminosae, on the basis of their recent biotopes, to the sunny (southern) hill-sides. Recently, Cornus and Rosa are encountered at the bush level of sparse forests as well. In the rich bush level of the Oligocene forests, however they seem not to be able to concur with the Lauraceae.

The species of Pinus and Sequoia were probably living at higher level, far from the shore. Remains of Pinus are generally known from higher elevations. Its small individual number in the fossil flora proves that it was transported from relatively distant localities to the place of fossilization.

Overlooking the biotope of the Arctotertiary elements we can see that they probably intruded not into the zonal assemblages but the intrazonal ones, occupying the places that were not favourable for the Palaeotropical elements.

CLIMATOLOGICAL EVALUATION

From the climatological point of view we cannot consider the intrazonal assemblages as markers of the dominant climate because they are dependent on edaphic factors. When evaluating the climate, the zonal assemblages must have a decisive part. The dominant species, Platanus neptuni is typically bound to warm periods. Thermophylous elements of the flora comprise the members of the family of Laureaceae, the evergreen Quercus species as well as the Juglans. The species composition of the forest testifies a subtropical climate. The humidity requirement of the plants needs more explanation. During the Lower Oligocene (Tard Clay Formation) there are xerophylous floras encountered.

They contain typical xerophylous elements like Zizyphus, Dryophyllum and even those plants are armed with xerophylous features which have no xerophylous character at some other contemporary assemblages or in other periods.

Such species are the Platanus neptuni and the Paleocarya orsbergensis. The Upper Oligocene floras have no xerophylous character at all. Generally we meet with large leaf surfaces, at some Daphnogene finds we can even recognize a drip apex as well. Smilax is present, which is a tropical - subtropical liana. It has species living recently in the Mediterranean region, but the leaves of these ones are always small and prickled. Its large leaves with intact margin denote a humid climate abounding in precipitation.

The Upper Oligocene flora of Vértesszőlős does not indicate a strong deterioration of the climate as it was measured on the basis of O isotope measurements indicating the temperature of the sea water. If we are assigning the flora, according to zones of vegetation, to subtropical forests, more exactly speaking, subtropical rain-forests, we can roughly outline the climate on the basis of recent analogies. The subtropical zone is formed at the boundary of the tropical and temperate zones in a wide belt. In this 'transitional zone', one season is dominated by the tropical, the other one, by the temperate elements. The climate is warm, humid, mild frost can possibly occur sometimes. In our days, we can meet this climatical and floristical zone from the spatial respect.

In my opinion, we can interprete this climatic model in temporal dimension as well. As we know about a wide transitional zone between the tropical regions and the temperate zone, the same way we have a temporal transition between the Cretaceous-Eocene tropical floras and the temperate Pliocene floras in a broad temporal interval. This state was existing during the Oligocene and the Miocene as well. As there are different vegetation zones within the subtropical regions like subtropical rain forests, laurophylous forest, hard-leaf evergreen forests etc., the same way we can meet different types of assemblages during the Oligocene and the Miocene, respectively, on a given area. These are governed partly by climatical factors, ecological space as well as competition within the populations clustered in assemblages and, inside and outside the assemblages.

During the Egerian, a subtropical rain forest used to exist around Vértesszőlős. The intruding Arctotertiary elements were faced not with a withdrawing but a dominant subtropical flora, thus they were condensated into intrazonal assemblages occupying the biotopes unfavourable for the Palaeotropical elements.

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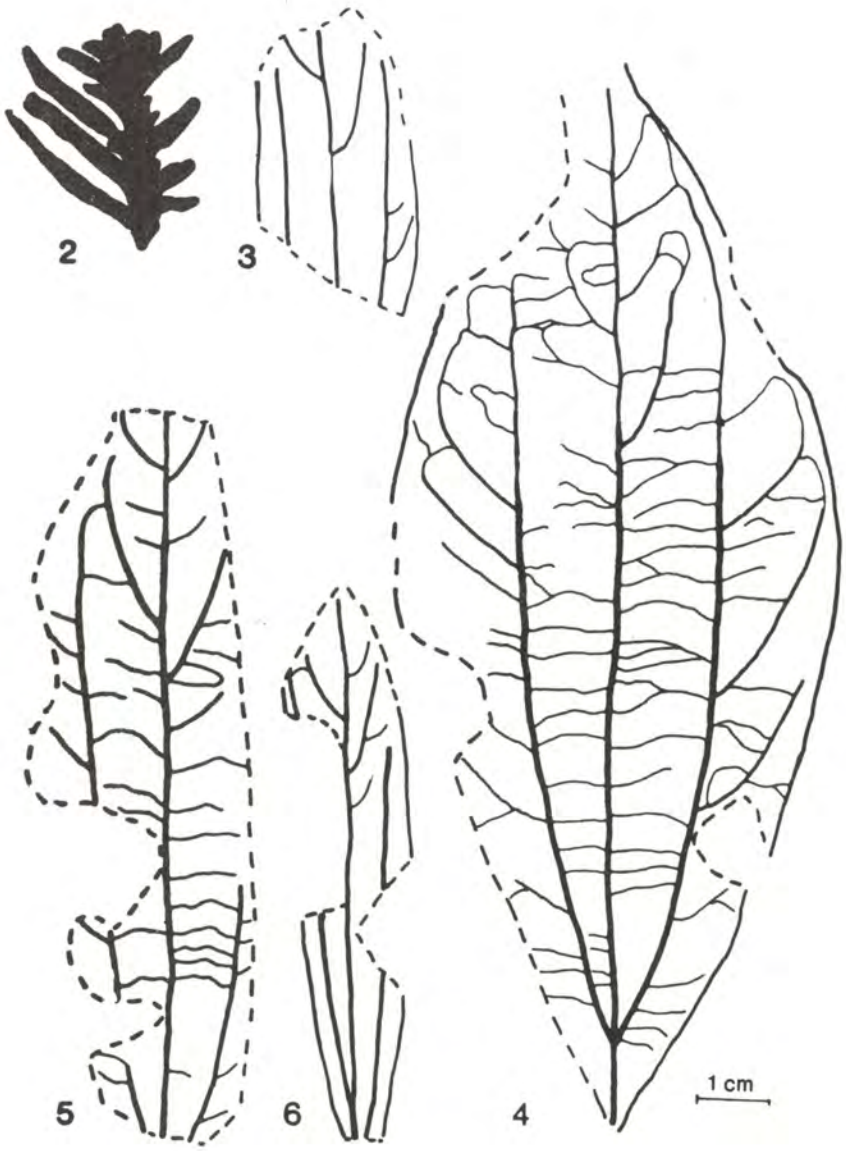


Fig. 2. Cephalotaxus harringtonia 76.131.1.; Fig. 3. Daphnogene lanceolata 76.271.1.;
Fig. 4. Daphnogene cinnamomifolia 76.188.1. Fig. 5. Daphnogene cinnamomifolia 76.223.1.;
Fig. 6. Daphnogene bilinica 76.188.1.

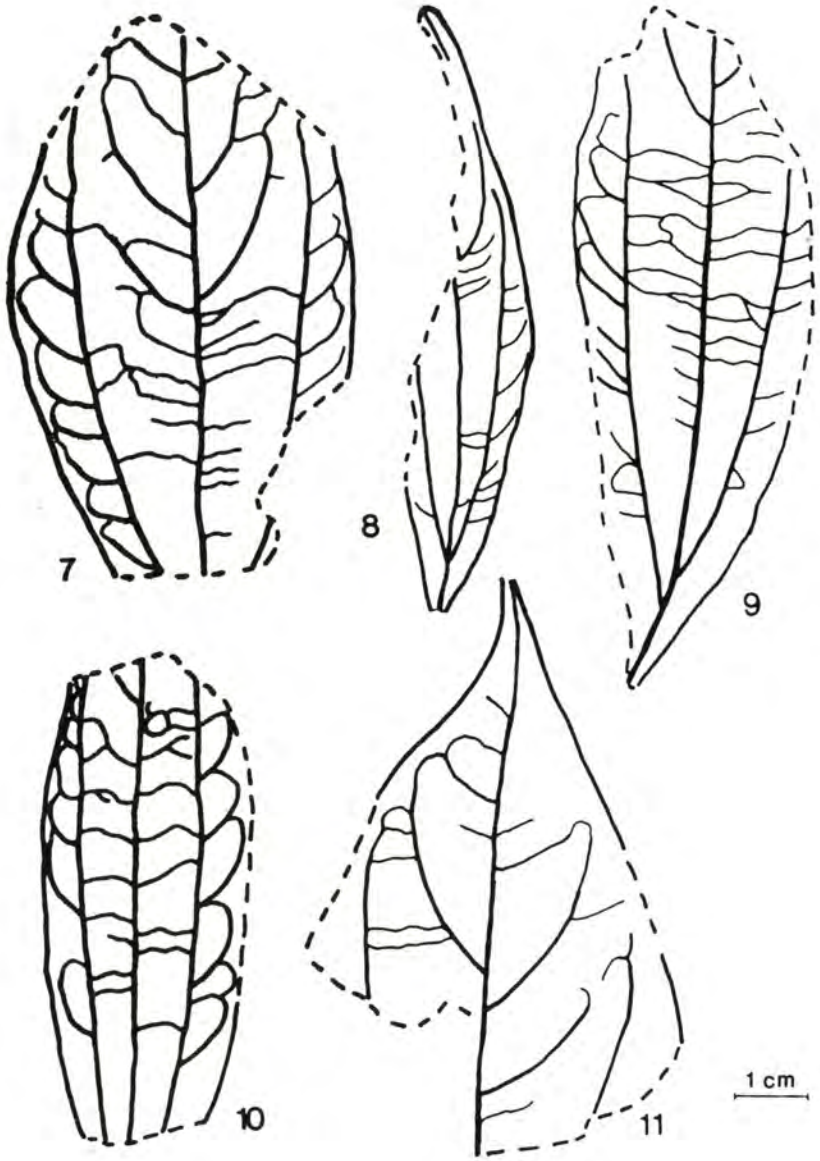


Fig. 7. Daphnogene cinnamomifolia 76.306.1.; Fig. 8. Daphnogene bilinica 76.188.1.; Fig. 9. Daphnogene cinnamomifolia 76.188.1.; Fig. 10. Daphnogene cinnamomifolia 76.161.1.; Fig. 11. Daphnogene cinnamomifolia 76.5.1.

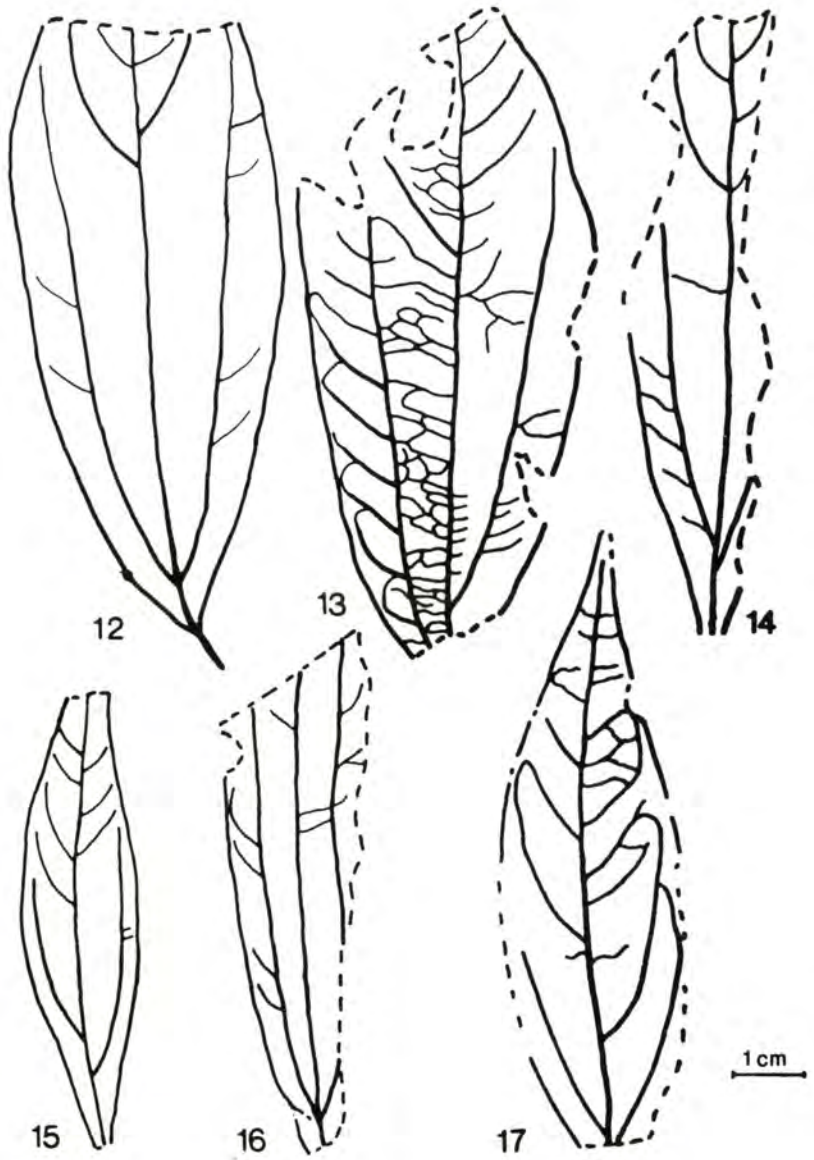


Fig. 12. Daphnogene cinnamomifolia 76.195.1.; Fig. 13. Daphnogene cinnamomifolia 76.3.1.; Fig. 14. Daphnogene bilinica 76.161.1.; Fig. 15. Daphnogene lanceolata 76.115.1.; Fig. 16. Daphnogene bilinica 76.161.1.; Fig. 17. Daphnogene lanceolata 76.272.1.

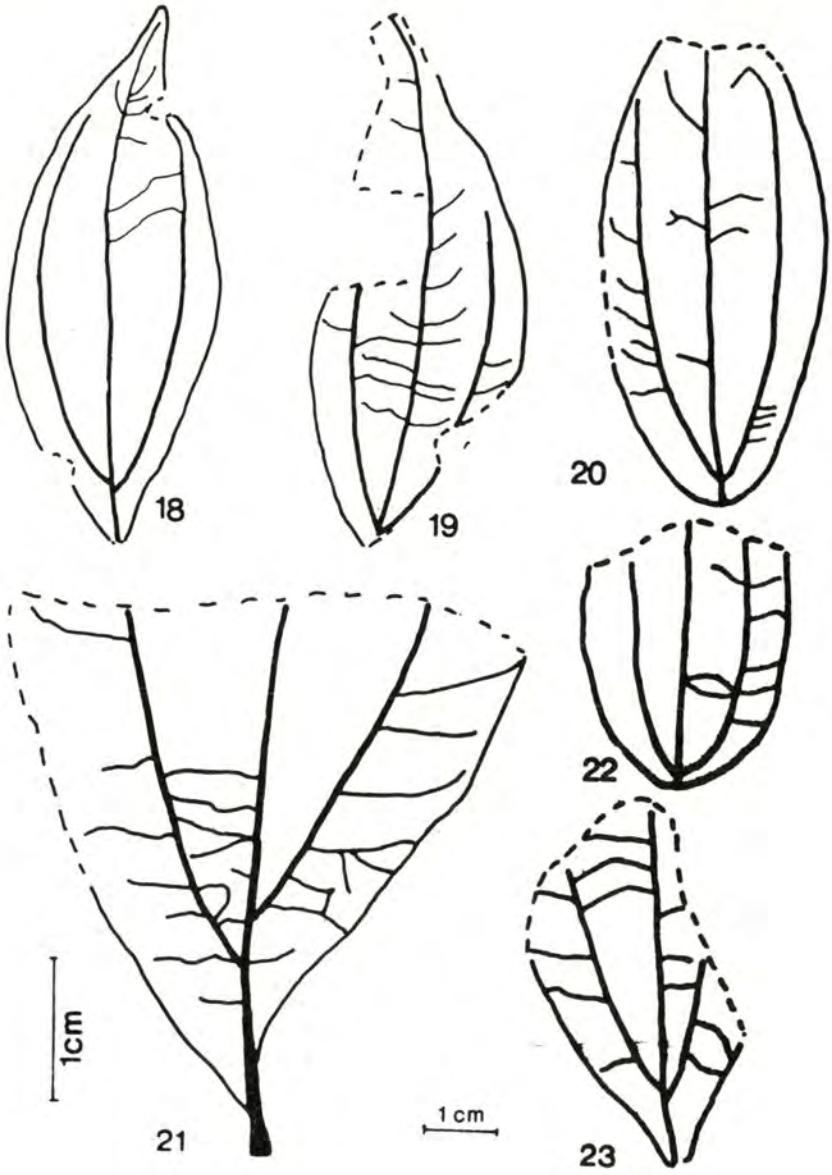


Fig. 18. Daphnogene bilinica 76.12.1.; Fig. 19. Daphnogene bilinica 76.1.1.; Fig. 20. Daphnogene bilinica 76.134.1.; Fig. 21. Daphnogene cinnamomifolia 76.229.1.; Fig. 22. Daphnogene sp. 76.229.1.; Fig. 23. Daphnogene bilinica 76.188.1.

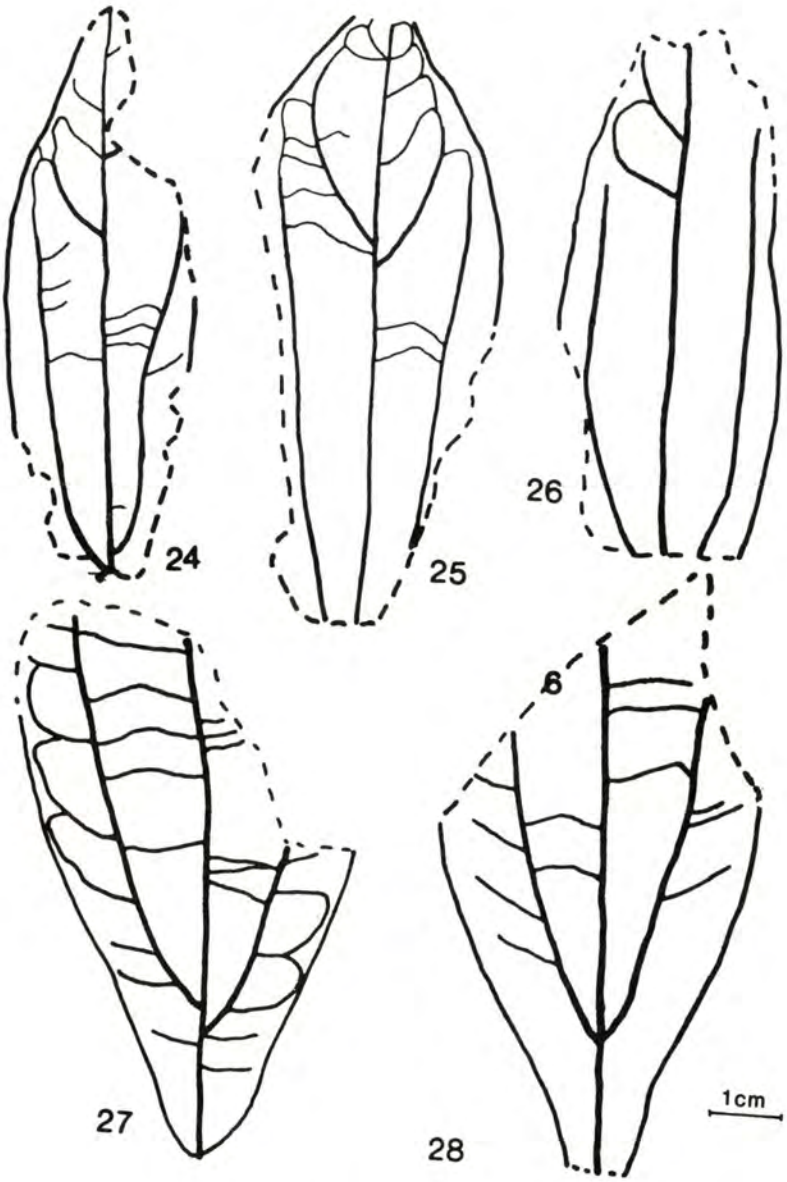


Fig. 24. Daphnogene bilinica 76.242.1.; Fig. 25. Daphnogene bilinica 76.194.1.; Fig. 26. Daphnogene bilinica 76.202.1.; Fig. 27. Daphnogene cinnamomifolia 76.269.1.; Fig. 28. Daphnogene bilinica 76.188.1.

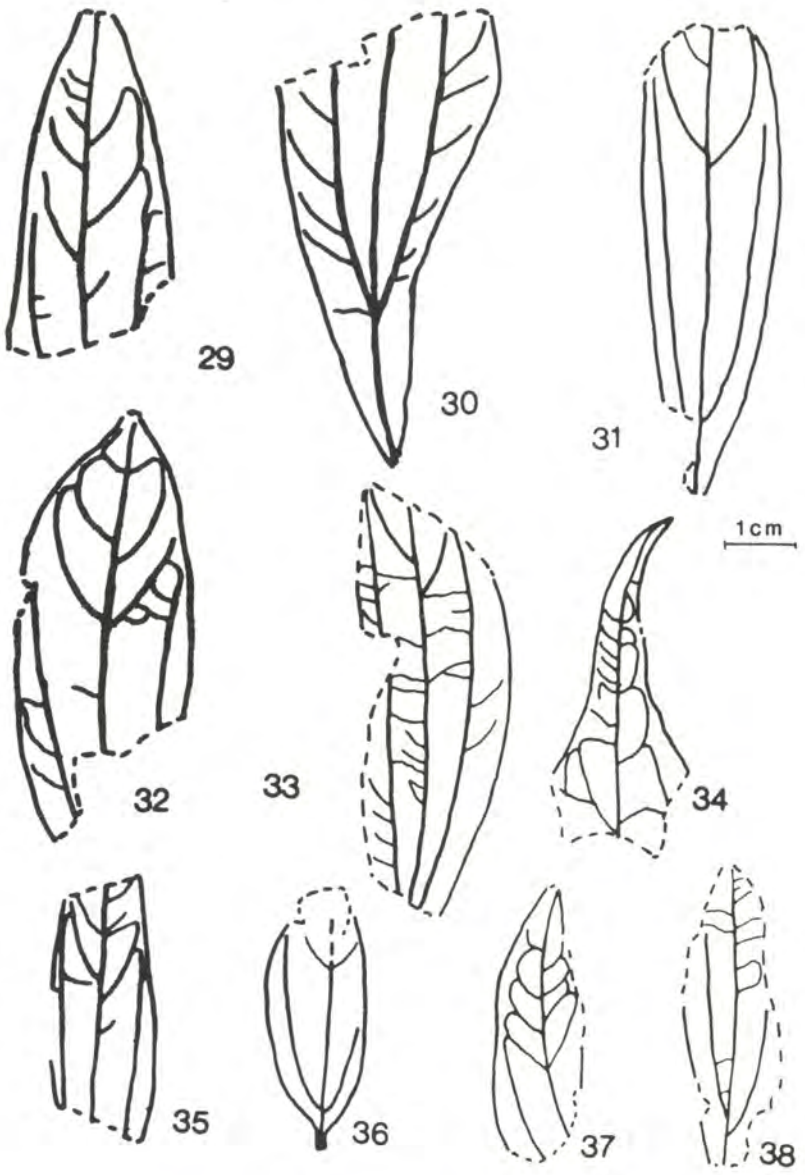


Fig. 29. Daphnogene lanceolata 76.188.1.; Fig. 30. Daphnogene bilinica 76.105.1.;
Fig. 31. Daphnogene bilinica 76.195.1.; Fig. 32. Daphnogene bilinica 76.8.1.;
Fig. 33. Daphnogene bilinica 76.188.1.; Fig. 34. Daphnogene bilinica 76.66.1.;
Fig. 35. Daphnogene lanceolata 76.95.1.; Fig. 36. Daphnogene sp. 76.105.1.;
Fig. 37. Daphnogene bilinica 76.28.1.; Fig. 38. Daphnogene lanceolata 76.188.1.

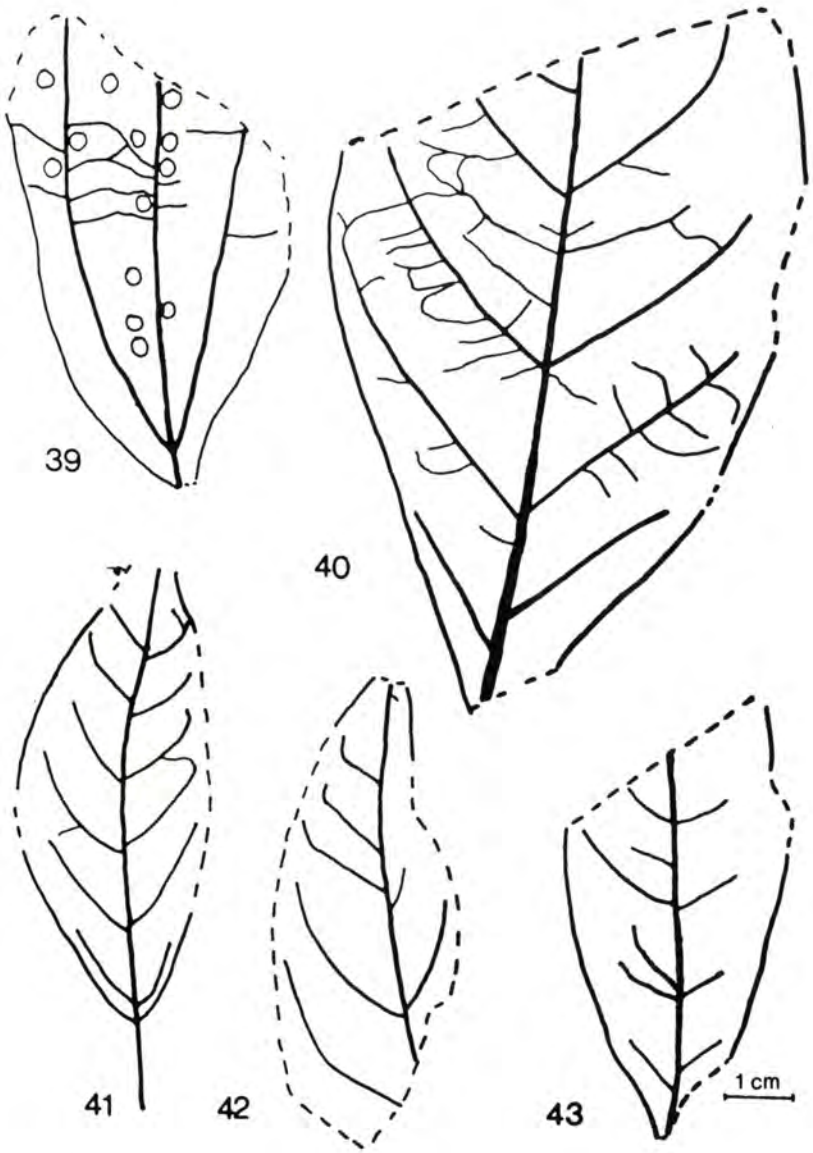


Fig. 39. Daphnogene bilinica 76.92.1.; Fig. 40. Laurophyllum sp. I. 76.151.1.; Fig. 41. Laurophyllum sp. II. 76.195.1.; Fig. 42. Laurophyllum sp. II. 76.200.1.; Fig. 43. Laurophyllum sp. II. 76.300.1.

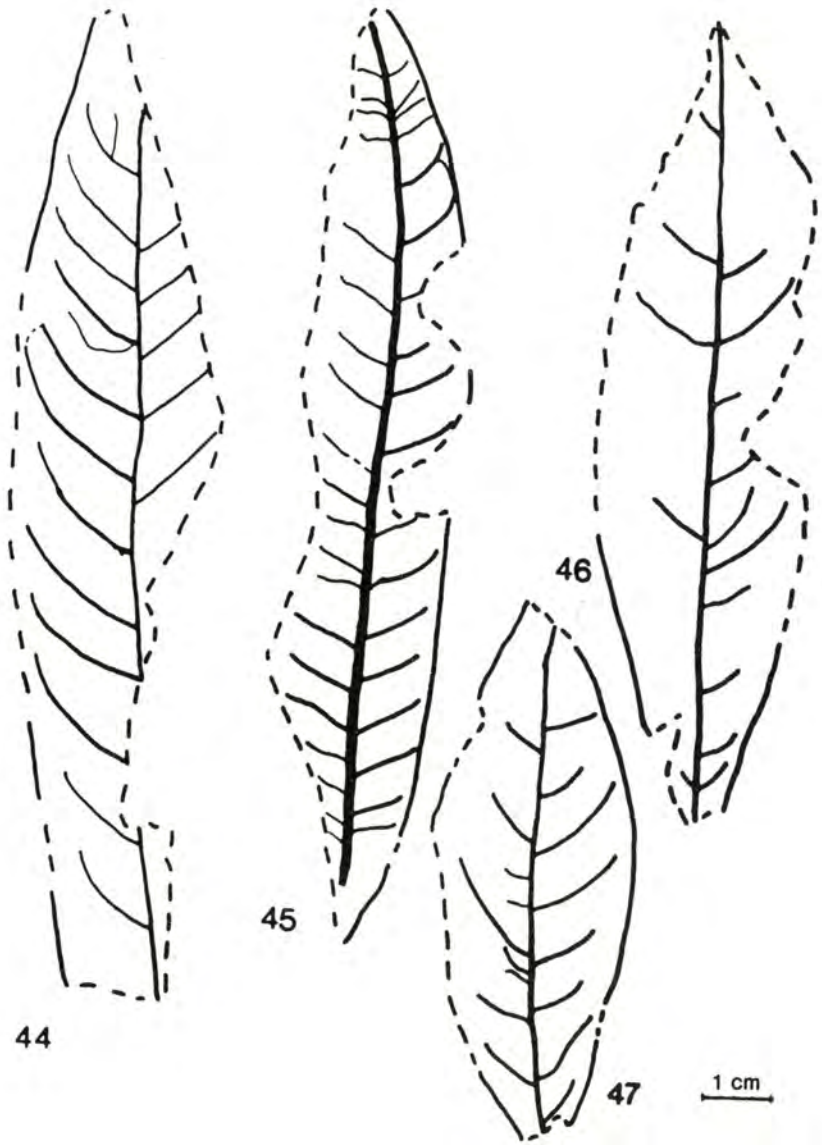


Fig. 44. Laurophyllum sp. III. 76.146.1.; Fig. 45. Laurophyllum sp. III. 76.190.1.; Fig. 46. Laurophyllum sp. II. 76.106.1.; Fig. 47. Laurophyllum sp. II. 76.107.1.

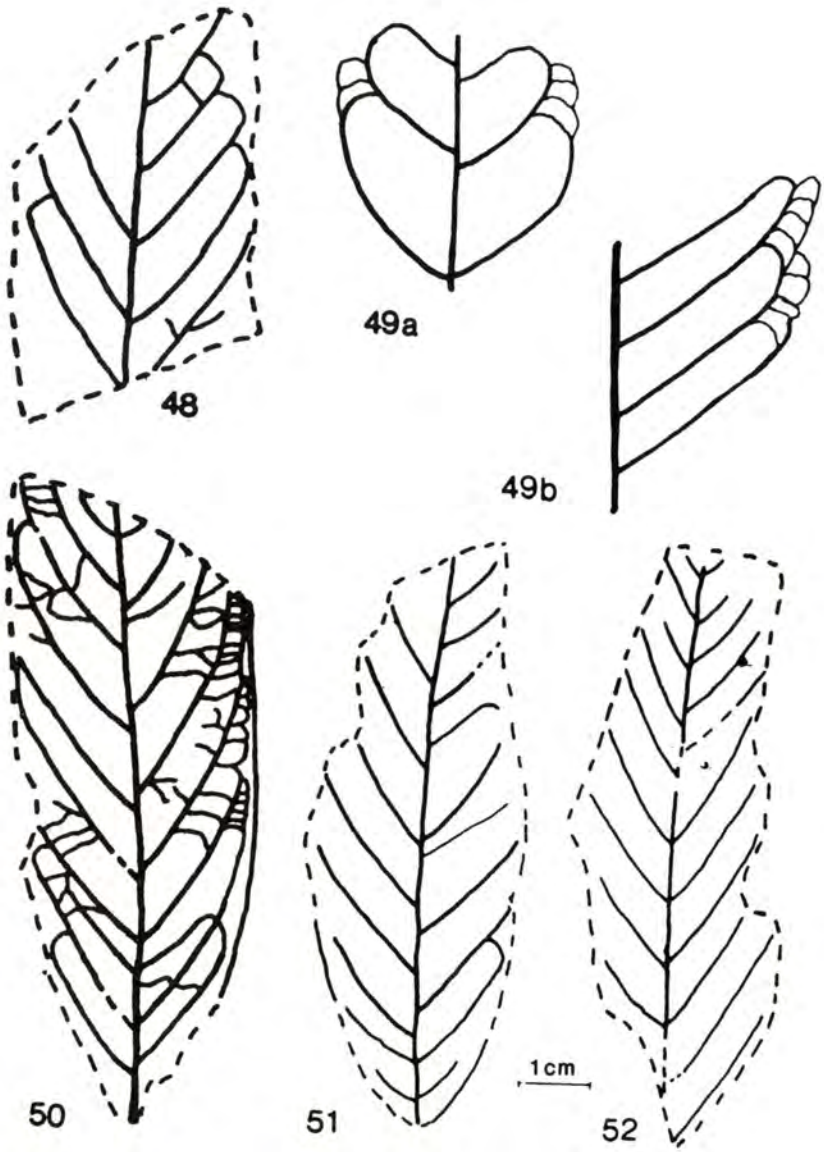


Fig. 48. Laurophyllum sp. IV. 76.201.1.; Fig. 49. Laurophyllum sp. IV.; Fig. 50. Laurophyllum sp. IV. 76.200.1.; Fig. 51. Laurophyllum sp. IV. 76.200.1.; Fig. 52. Laurophyllum sp. IV. 76.190.1.

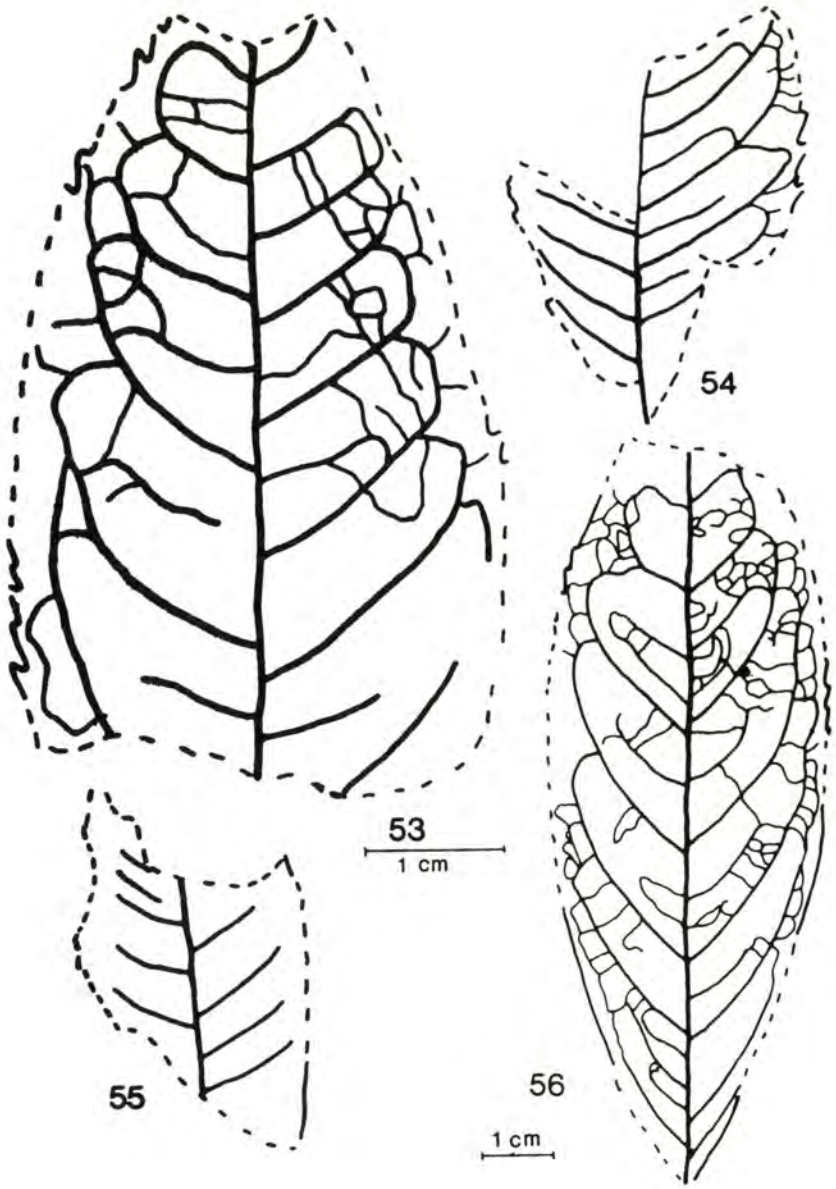


Fig. 53. Platanus neptuni 76.116.1.; Fig. 54. Platanus neptuni 76.154.1.; Fig. 55. Platanus neptuni 76.121.1.; Fig. 56. Platanus neptuni 76.135.1.

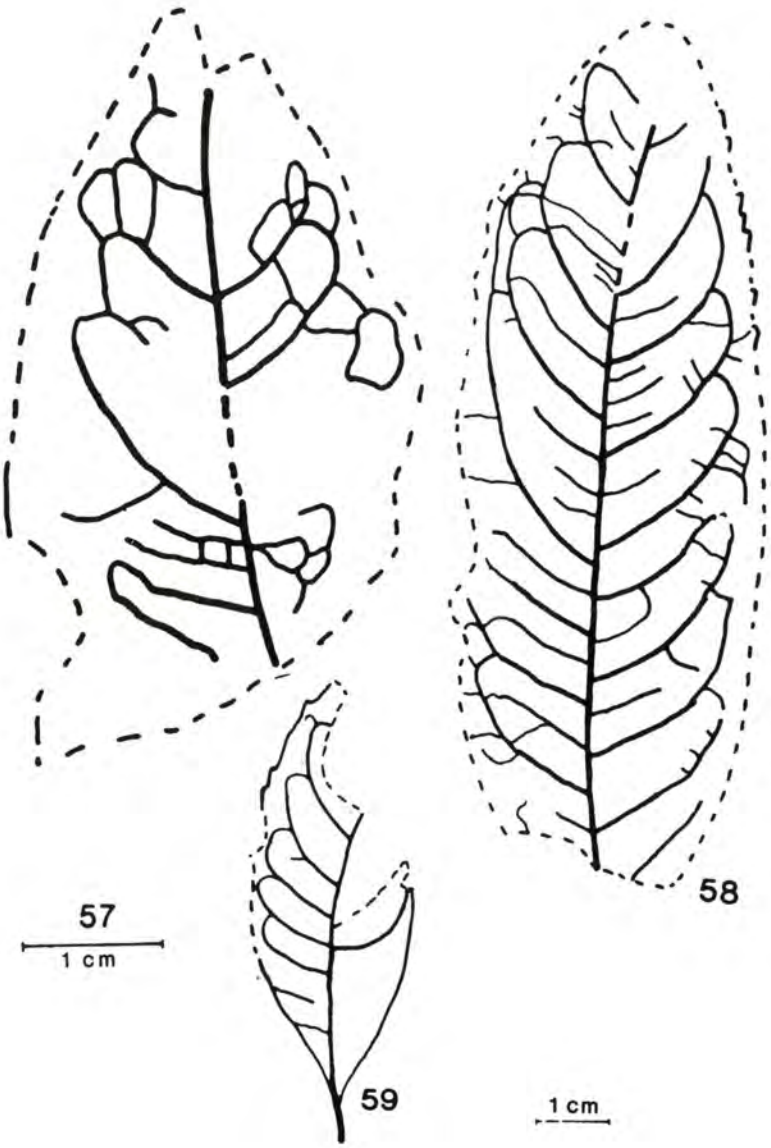


Fig. 57. Platanus neptuni 76.190.1.; Fig. 58. Platanus neptuni 76.300.1.; Fig. 59. Platanus neptuni 76.10.1.

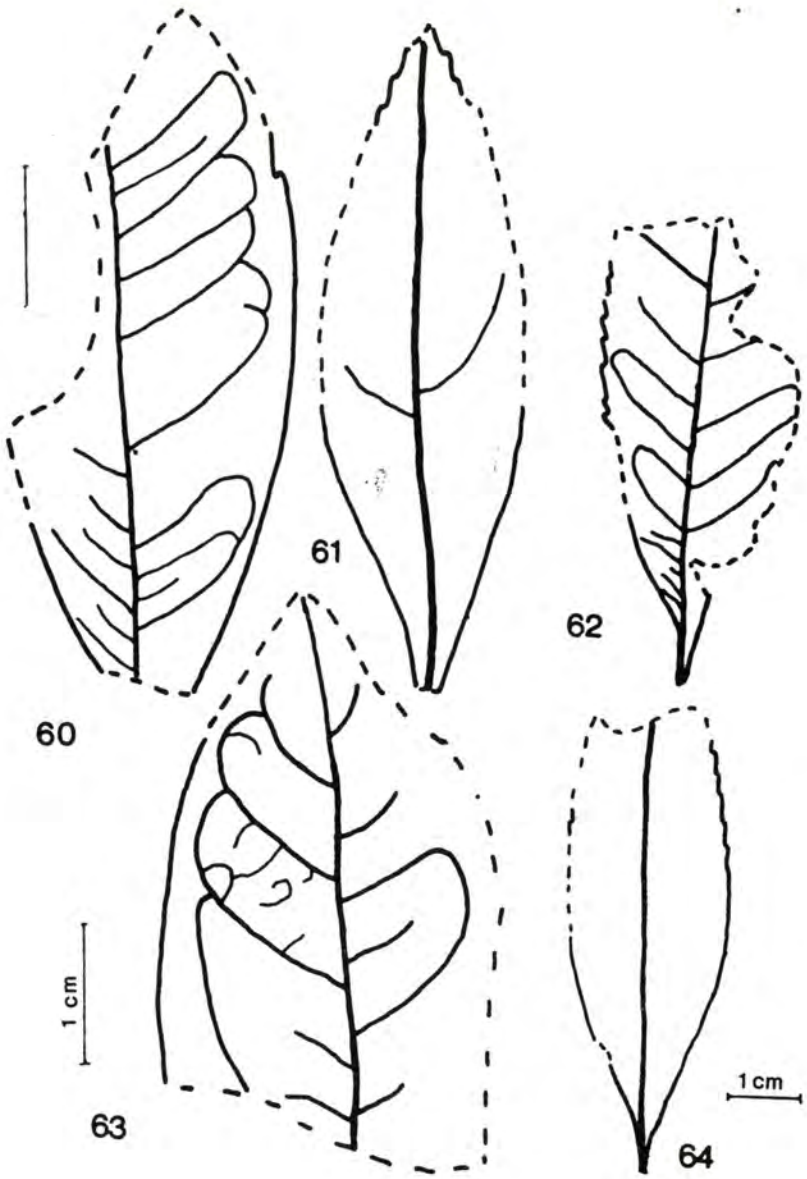


Fig. 60. Platanus neptuni 76.121.l.; Fig. 61. Platanus neptuni 76.108.l.; Fig. 62. Platanus neptuni 76.283.l.; Fig. 63. Platanus neptuni 76.135.l.; Fig. 64. Platanus neptuni 76.58.l.

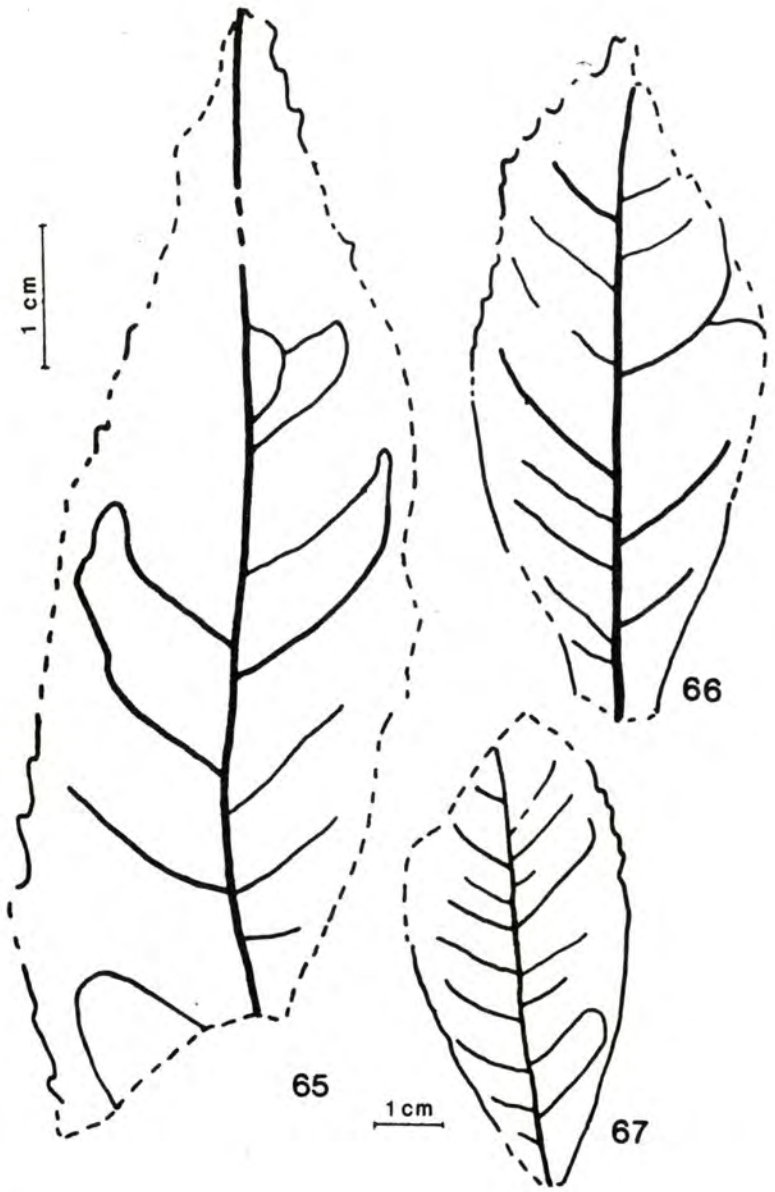


Fig. 65. Platanus neptuni 76.54.1.; Fig. 66. Platanus neptuni 76.71.1.; Fig. 67. Platanus neptuni 76.304.1.

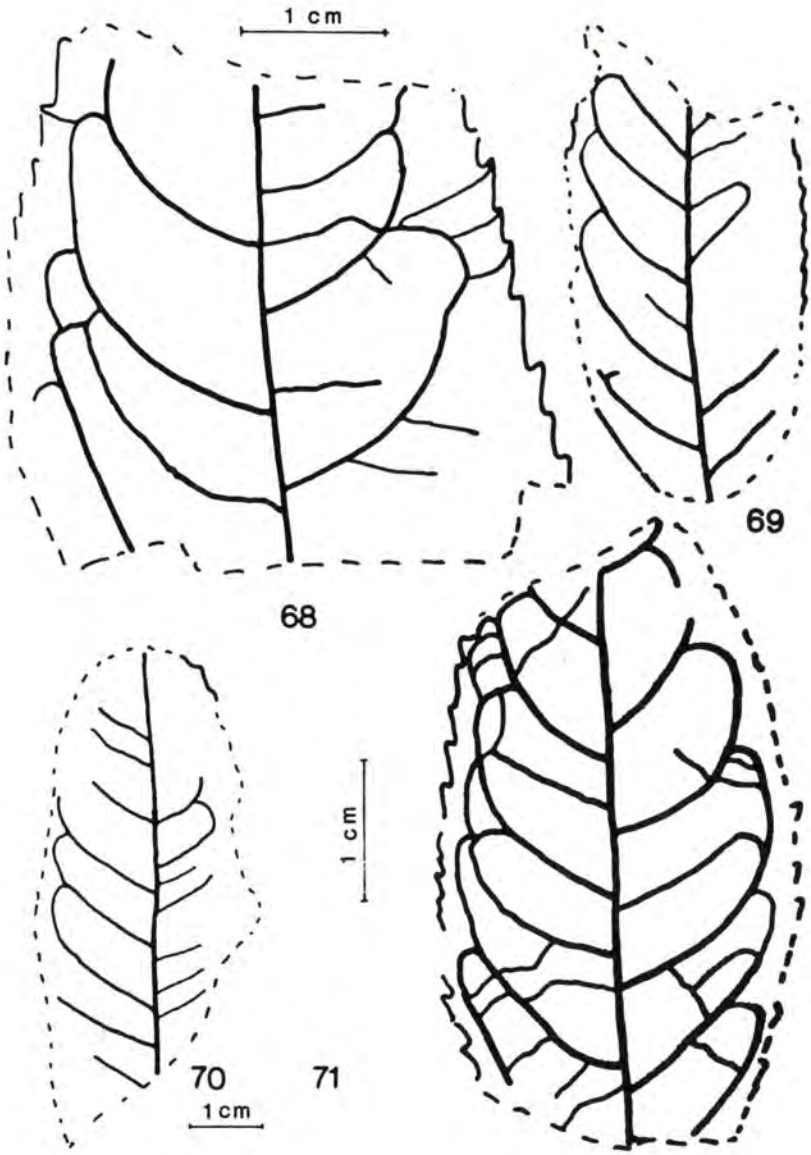


Fig. 68. Platanus neptuni 76.124.1.; Fig. 69. Platanus neptuni 76.150.1.; Fig. 70. Platanus neptuni 76.115.1.; Fig. 71. Platanus neptuni 76.7.1.

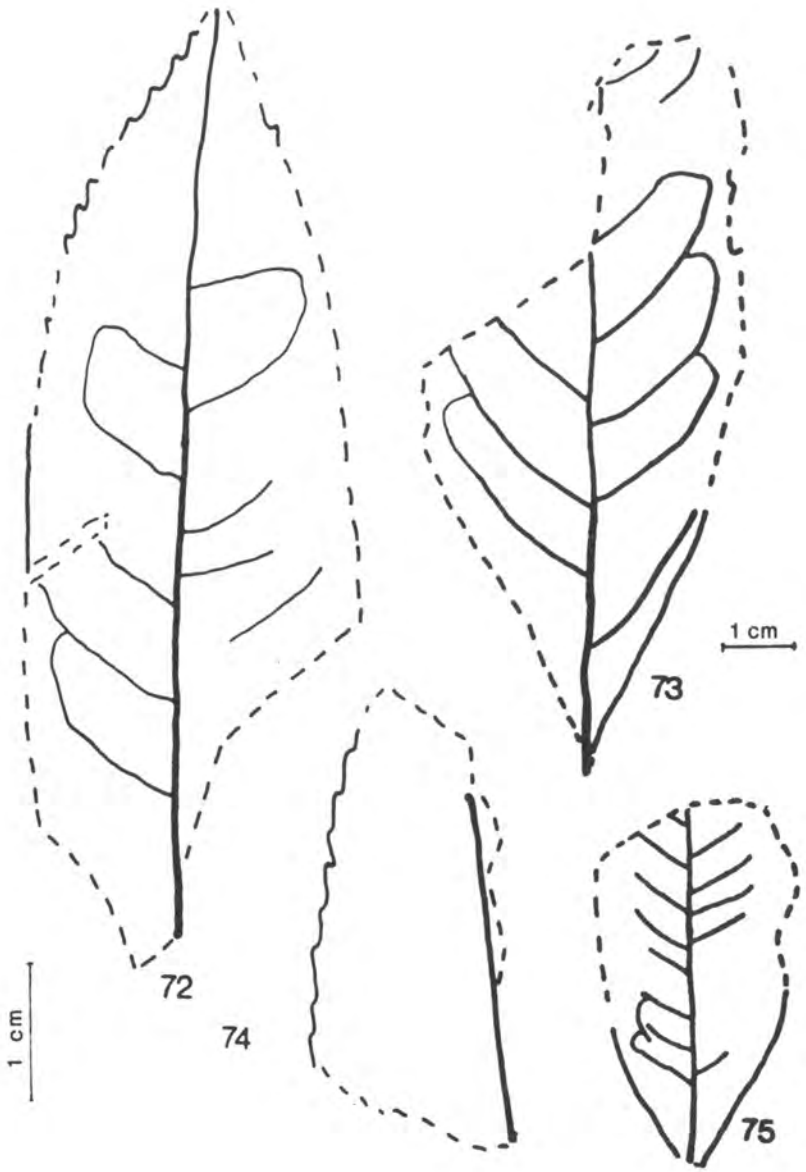


Fig. 72. Platanus neptuni 76.108.1.; Fig. 73. Platanus neptuni 76.103.1.; Fig. 74. Platanus neptuni 76.47.1.; Fig. 75. Platanus neptuni 76.135.1.

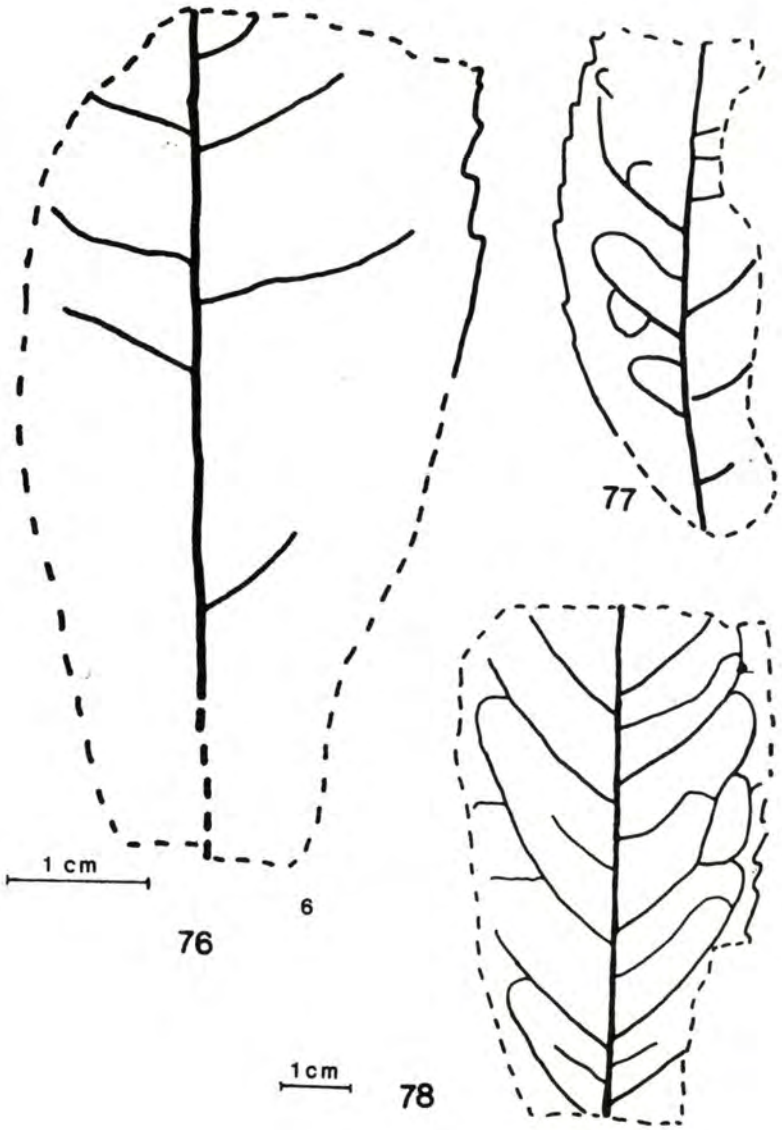


Fig. 76. Platanus neptuni 76.200.1.; Fig. 77. Platanus neptuni 76.127.1.; Fig. 78. Platanus neptuni 76.300.1.

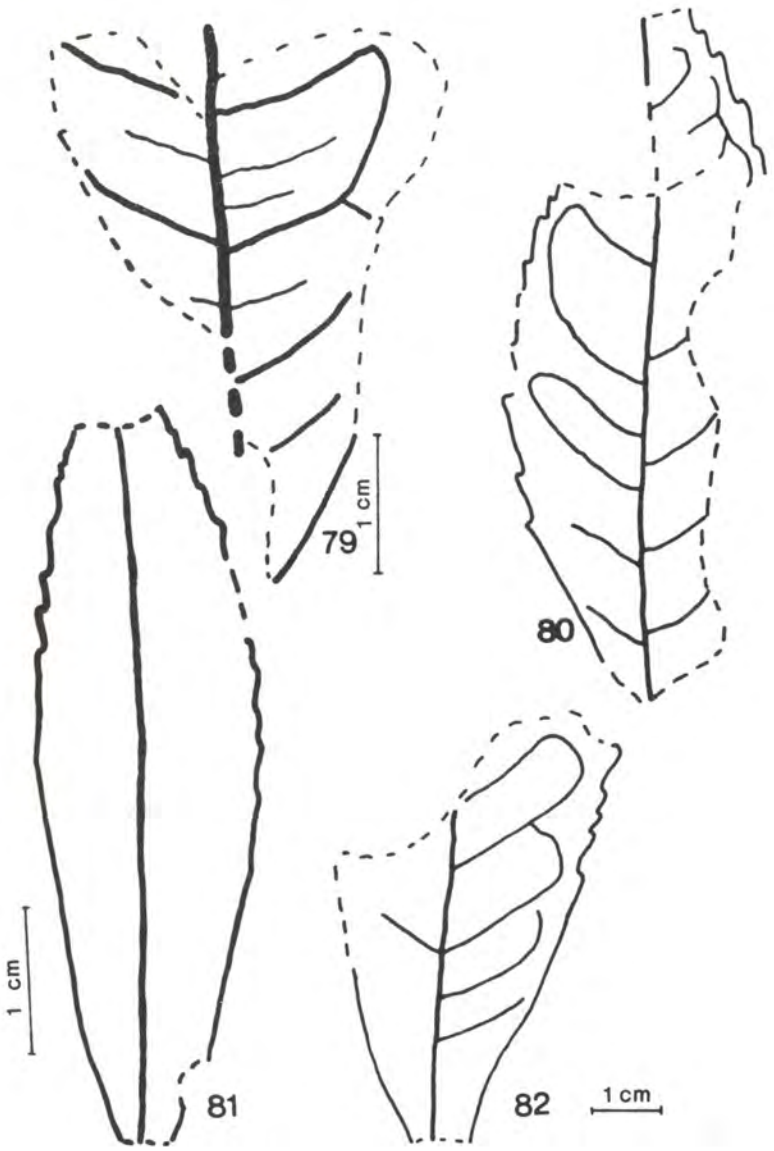


Fig. 79. Platanus neptuni 76.129.1.; Fig. 80. Platanus neptuni 76.127.1.; Fig. 81. Platanus neptuni 76.145.1.; Fig. 82. Platanus neptuni 76.112.1.

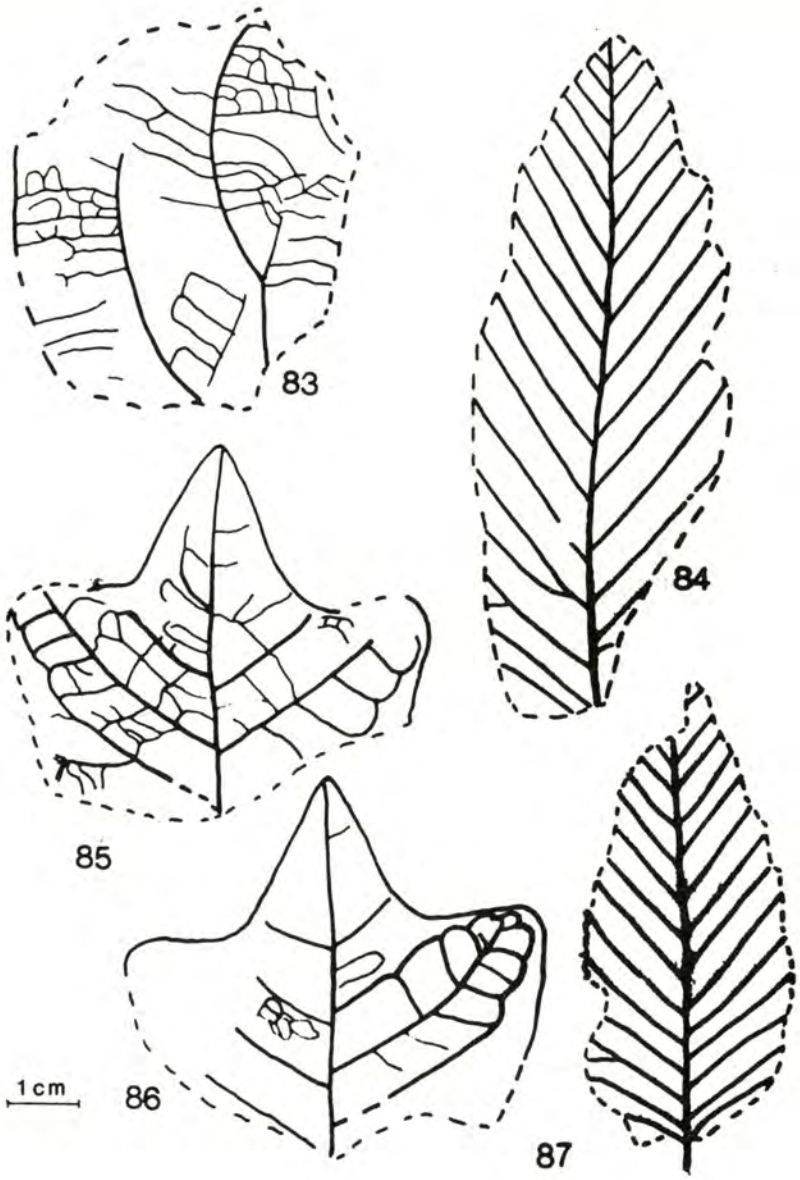


Fig. 83. Daphnogene cinnamomifolia 76.107.1.; Fig. 84. Ulmus pyramidalis 76.1.1.; Fig. 85. Sterculia sp. 76.115.1.; Fig. 86. Sterculia sp. 76.121.1.; Fig. 87. Ulmus pyramidalis 76.13.1.

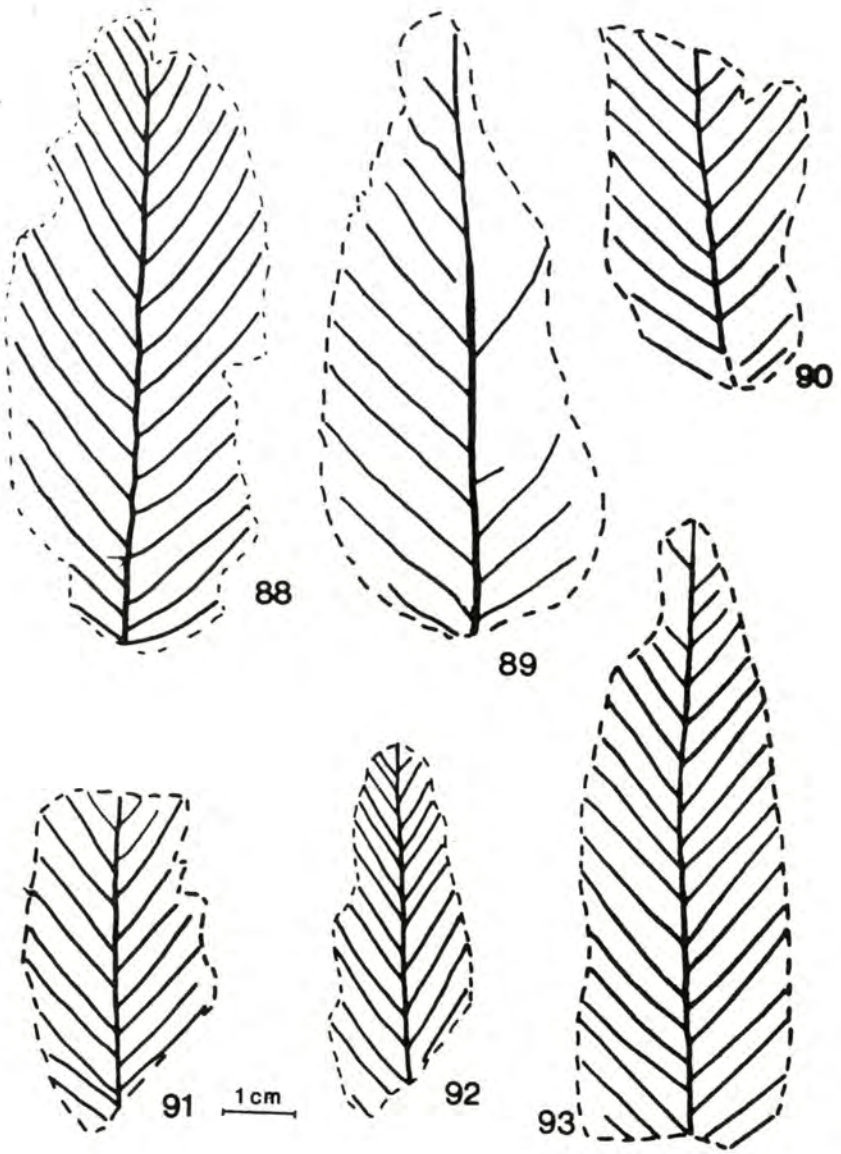


Fig. 88. Ulmus pyramidalis 76.271.1.; Fig. 89. Ulmus pyramidalis 76.142.1.; Fig. 90. Ulmus pyramidalis 76.150.1.; Fig. 91. Ulmus pyramidalis 76.15.1.; Fig. 92. Ulmus pyramidalis 76.180.1.; Fig. 93. Ulmus pyramidalis 76.193.1.

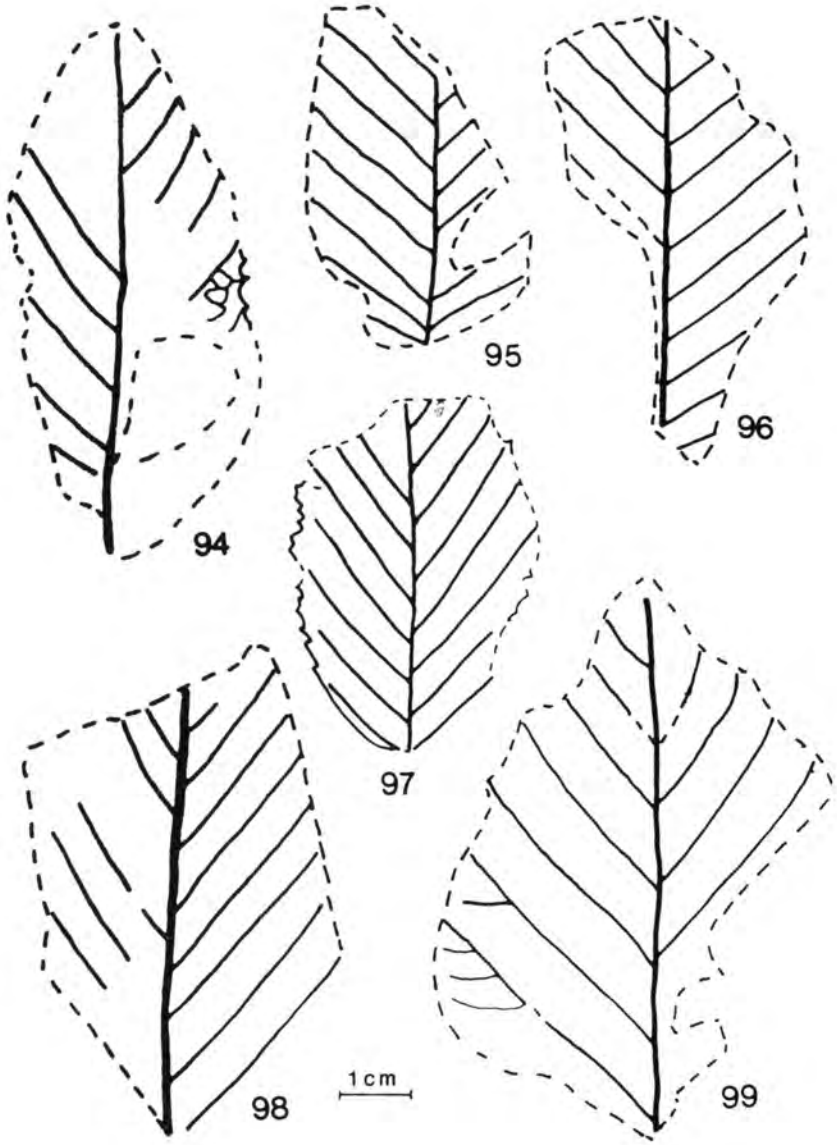


Fig. 94. cf. Betula prisca 76.189.1.; Fig. 95. cf. Betula prisca 76.21.1.; Fig. 96. cf. Betula prisca 76.190.1.; Fig. 97. cf. Betula prisca 76.150.1.; Fig. 98. cf. Betula prisca 76.301.1.; Fig. 99. Betula sp. type I. 76.11.1.

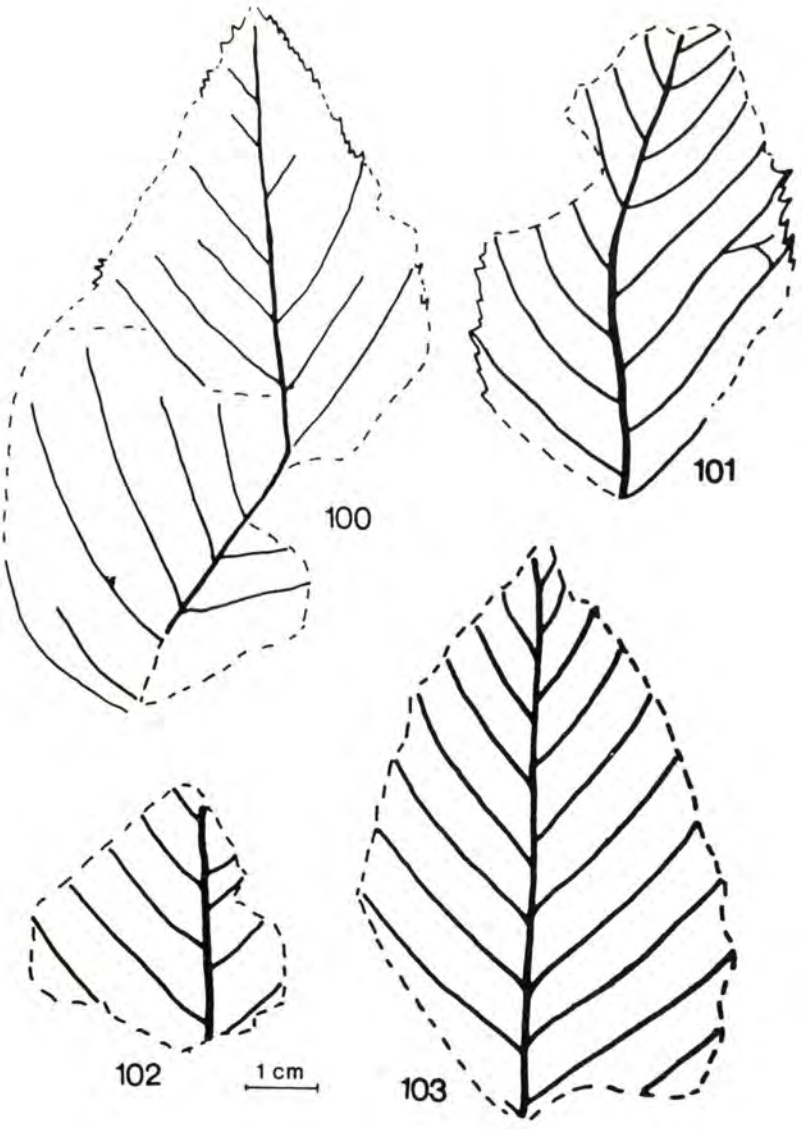


Fig. 100. Betula sp. type I. 76.149.1.; Fig. 101. Betula sp. type II. 76.119.1.; Fig. 102. Betula sp. type I. 76.84.1.; Fig. 103. Betula sp. type I. 76.125.1.

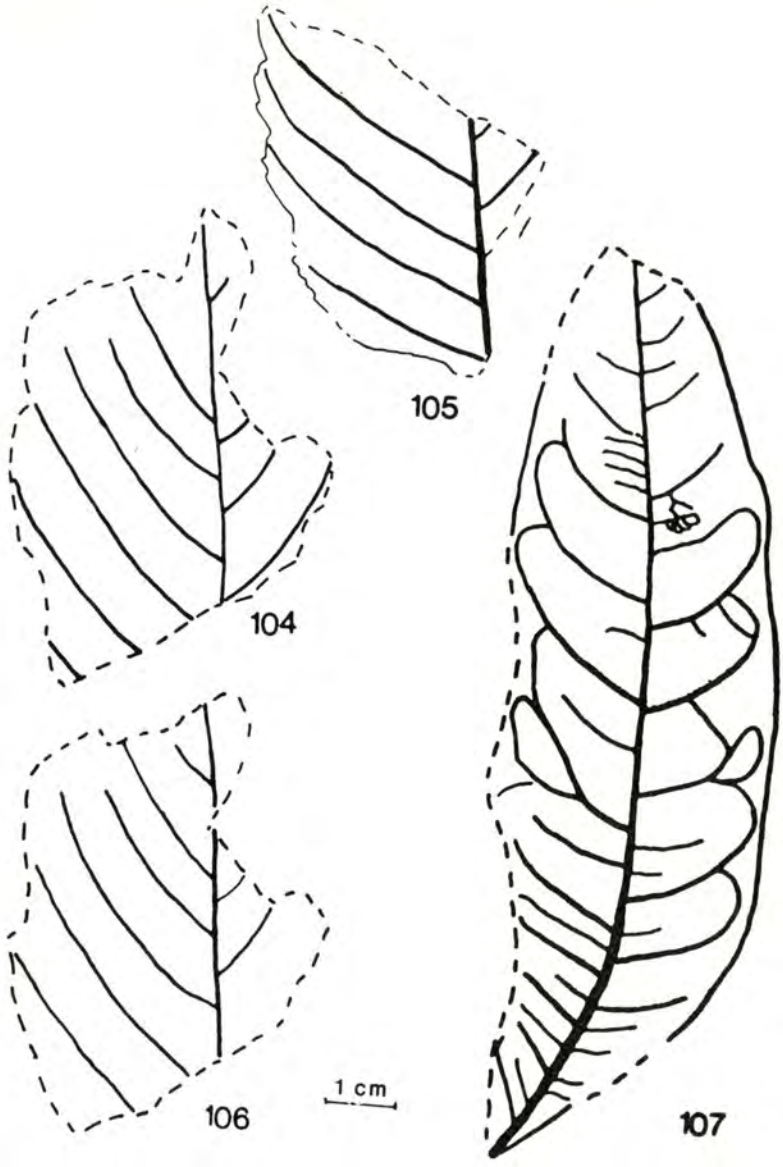


Fig. 104. Betula sp. type IV. 76.40.1.; Fig. 105. Betula sp. type IV. 76.207.1.; Fig. 106. Betula sp. type IV. 76.40.1.; Fig. 107. Juglans acuminata 76.222.1.

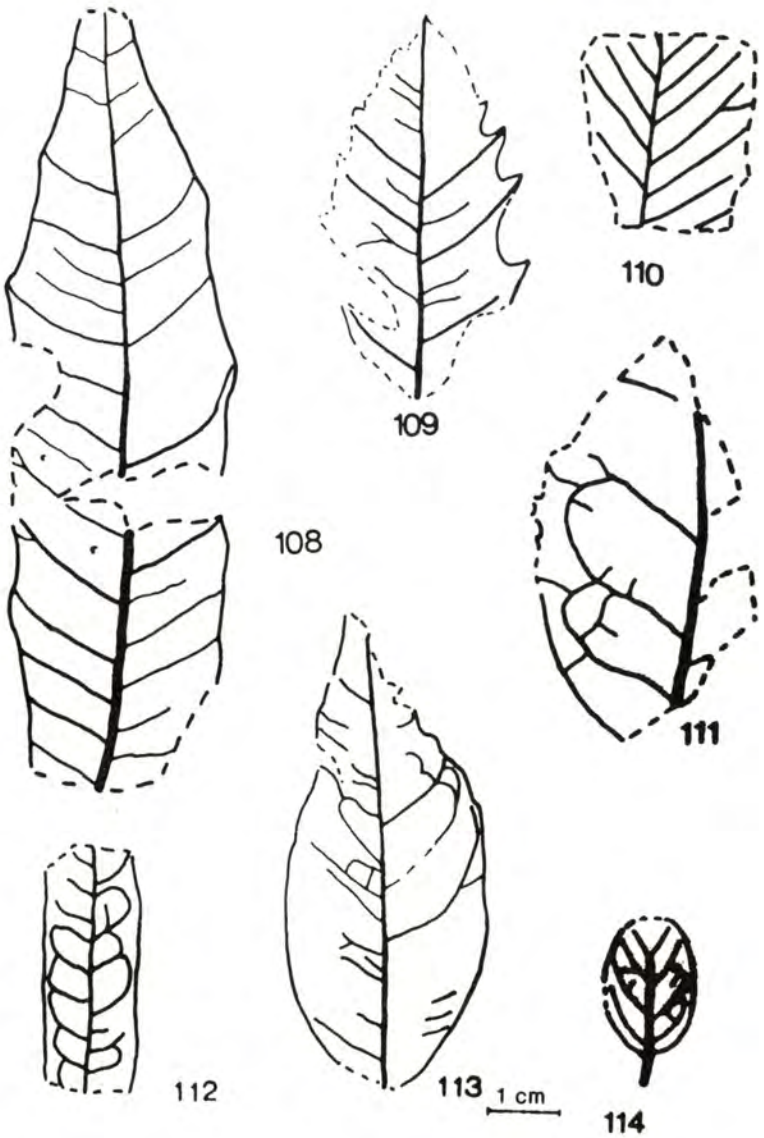


Fig. 108. Quercus sp. type I. 76.8.1.; Fig. 109. Quercus sp. type III. 76.101.1.; Fig. 110. Ulmus pyramidalis 76.121.1.; Fig. 111. Dicotylophyllum sp. II. 76.126.1.; Fig. 112. Leguminosae II. 76.263.1.; Fig. 113. cf. Quercus sp. type II. 76.116.1.; Fig. 114. Wisteria aff. fallax 76.56.1.

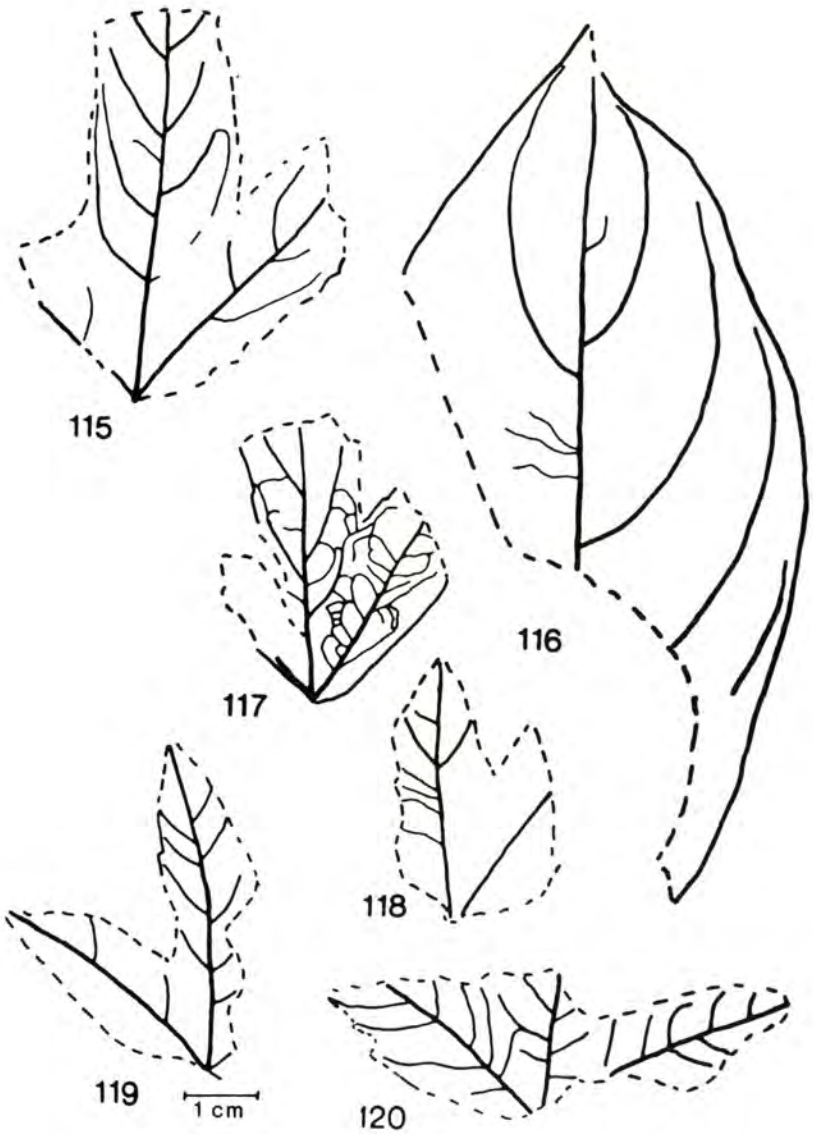


Fig. 115. Acer angustilobum 76.209.1.; Fig. 116. Cornus praeamomum 76.112.1.; Fig. 117. Acer angustilobum 76.285.1.; Fig. 118. Acer angustilobum 76.101.1.; Fig. 119. Acer angustilobum 76.121.1.; Fig. 120. Acer angustilobum 76.51.1.

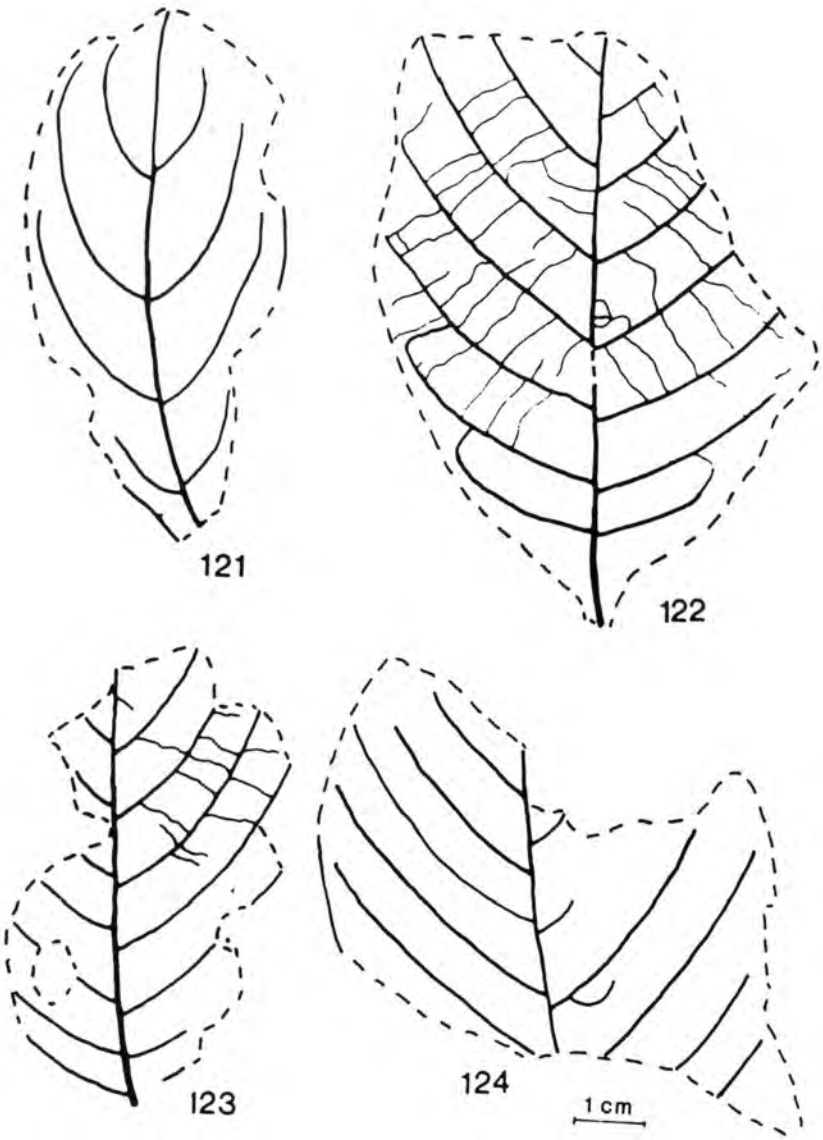


Fig. 121. Cornus sp. 76.4.1.; Fig. 122. Phyllites skofleki 76.307.1.; Fig. 123. Phyllites skofleki 76.217.1.; Fig. 124. Phyllites skofleki 76.206.1.

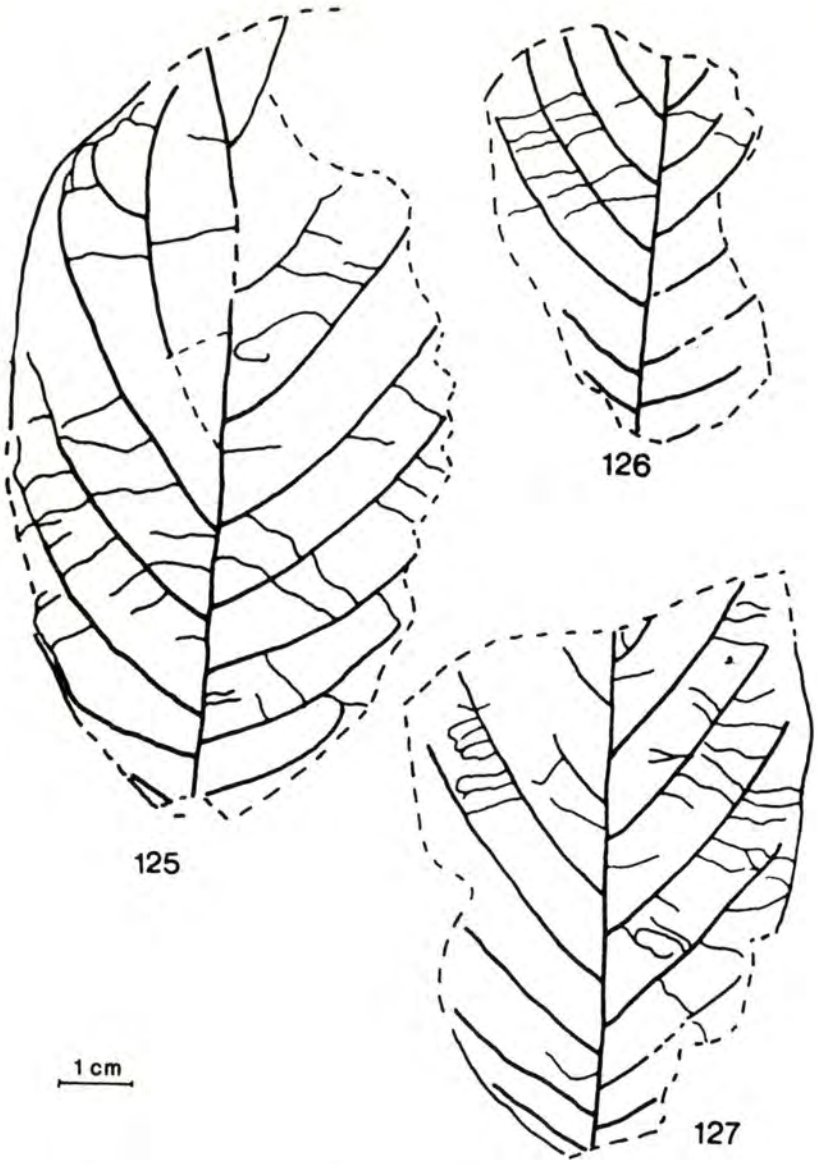


Fig. 125. Phyllites skofleki (Holotype) 76.20.1.; Fig. 126. Phyllites skofleki 76.300.1.;
Fig. 127. Phyllites skofleki 76.12.1.

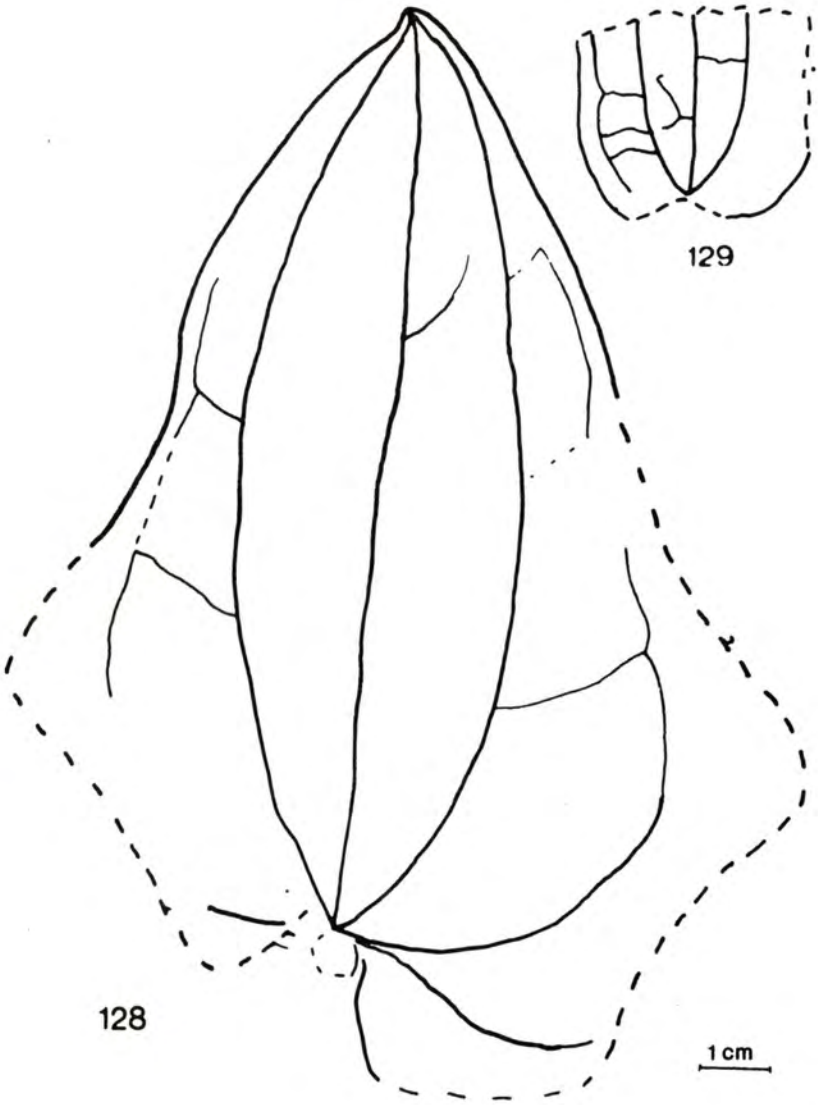


Fig. 128. Smilax tataensis 76.230.1.; Fig. 129. Smilax tataensis 76.189.1.

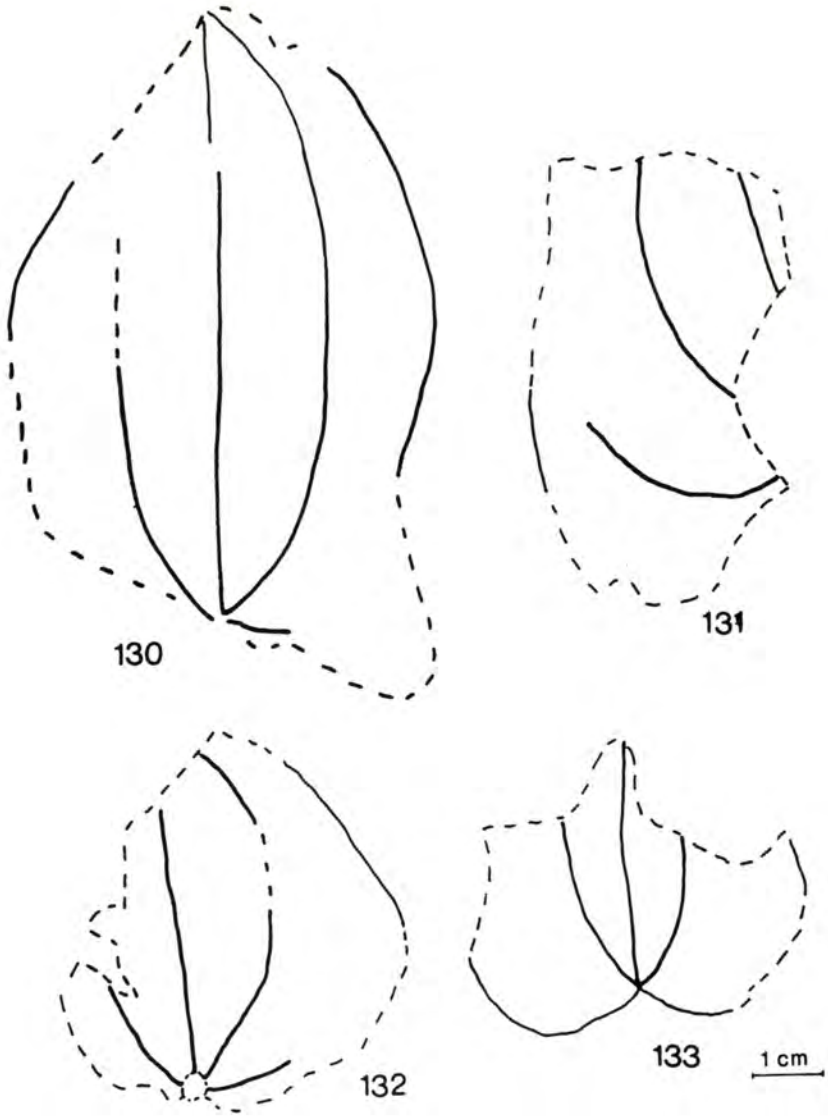


Fig. 130. Smilax tataensis 76.232.1.; Fig. 131. Smilax tataensis 76.229.1.; Fig. 132. Smilax tataensis 76.252.1.; Fig. 133. Smilax tataensis 76.180.1.

Explanation of plates

Plate I.	1. Adiantum capillus veneris	5x	76.101.1.
	2. cf. Sequoia abietina	1x	76.138.1.
	3. Taxodium dubium	1.5x	76.141.1.
Plate II.	1. Taxodium dubium	1.5x	76.2.1.
	2. Cephalotaxus harringtonia	2x	76.131.1.
	3. Cephalotaxus harringtonia	2x	76.9.1.
Plate III.	1. Phyllites skofleki n. sp.	1.2x	76.206.1.
	2. Phyllites skofleki n. sp.	1.2x	76.307.1.
Plate IV.	1. Phyllites skofleki n. sp. (Holotype)	1x	76.20.1.
	2. Daphnogene cinnamomifolia	1.2x	76.223.1.
Plate V.	1. Laurophyllum sp. I.	1x	76.151.1.
	2. Phyllites skofleki n. sp.	1.5x	76.217.1.
Plate VI.	1. Daphnogene cinnamomifolia	1x	76.6.1
	2. Daphnogene cinnamomifolia	1x	76.141.1.
Plate VII.	1. Daphnogene cinnamomifolia	1.5x	76.5.1.
	2. Daphnogene cinnamomifolia	1.5x	76.160.1.
Plate VIII.	1. Daphnogene cinnamomifolia	1x	76.195.1.
	2. Daphnogene cinnamomifolia	2x	76.291.1.
	3. Daphnogene cinnamomifolia	2x	76.3.1.
Plate IX.	1. Daphnogene bilinica	2x	76.8.1.
	2. Daphnogene cinnamomifolia	1.5x	76.161.1.
	3. Daphnogene bilinica	1.5x	76.195.1.
Plate X.	1. Daphnogene bilinica	1.5x	76.6.1.
	2. Daphnogene bilinica	1.5x	76.134.1.
	3. Daphnogene bilinica	1x	76.194.1.
Plate XI.	1. Daphnogene bilinica	1.5x	76.105.1.
	2. Daphnogene bilinica	3x	76.92.1.
	3. Daphnogene bilinica	2.5x	76.66.1.
Plate XII.	1. Daphnogene bilinica	1.5x	76.134.1.
	2. Daphnogene bilinica	1x	76.21.1.
	3. Daphnogene sp.	1.5x	76.293.1.
	4. Laurophyllum cf. acutimontanum	1x	76.130.1.
Plate XIII.	1. Platanus neptuni	1.2x	76.300.1.
	2. Platanus neptuni	1.5x	76.3001.1
	3. Platanus neptuni	2x	76.108.1.
Plate XIV.	1. Platanus neptuni	1.5x	76.304.1.
	2. Platanus neptuni	1.2x	76.103.1.
	3. Platanus neptuni	2x	76.124.1.
Plate XV.	1. Platanus neptuni	2x	76.108.1.
	2. Platanus neptuni	2x	76.288.1.
	3. Platanus neptuni	1x	76.135.1.
Plate XVI.	1. Platanus neptuni	1.5x	76.54.1.
	2. Platanus neptuni	1.5x	76.150.1.
	3. Platanus neptuni	1.5x	76.10.1.
Plate XVII.	1. Platanus neptuni	2x	76.58.1.
	2. Platanus neptuni	2x	76.134.1.
	3. Ulmus pyramidalis	2x	76.137.1.
	4. Ulmus pyramidalis	2x	76.303.1.
Plate XVIII.	1. Platanus neptuni	2x	76.302.1.
	2. Ulmus pyramidalis	1x	76,1.1.
	3. Ulmus pyramidalis	2x	76.15.1.
Plate XIX.	1. Ulmus pyramidalis	1.5x	76.150.1.
	2. Ulmus pyramidalis	1.5x	76.137.1.
	3. Ulmus pyramidalis	1x	76.193.1.
Plate XX.	1. Ulmus pyramidalis	2x	76.6.1.
	2. Ulmus pyramidalis	1.5x	76.13.1.
	3. Ulmus plurinervia	2x	76.233.1.
	4. Zelkova zelkovaefolia	3x	76.299.1.
Plate XXI.	1. Ulmus pyramidalis	2x	76.108.1.
	2. Zelkova zelkovaefolia	3x	76.285.1.
	3. Zelkova zelkovaefolia	3x	76.261.1.
	4. Laurophyllum sp. III.	1x	76.190.1.

Plate XXII.	1. Laurophyllum sp. II.	1x	76.106.1.
	2. Quercus sp. type II.	1.5x	76.116.1.
	3..Quercus sp. type I.	1x	76.8.1.
Plate XXIII.	1. Quercus sp. type III.	2x	76.101.1.
	2. Laurophyllum sp. II.	1.5x	76.200.1.
	3. Laurophyllum sp. II.	1.5x	76.195.1.
	4. Laurophyllum sp. II.	1.5x	76.107.1.
Plate XXIV.	1. Laurophyllum sp. IV.	1.2x	76.200.1.
	2. Betula sp. type I.	1x	76.149.1.
	3. Betula cf. prisca	2x	76.150.1.
Plate XXV.	1. Laurophyllum sp. IV.	1.5x	76.200.1.
	2. Betula sp. type II.	1.5x	76.119.1.
	3. Betula sp. type IV.	2x	76.207.1.
Plate XXVI.	1. Betula sp. type I.	1.5x	76.125.1.
	2. Sassafras tenuilobatum	1x	76.34.1.
Plate XXVII.	1. Betula sp. type III.	1.5x	76.216.1.
	2. Juglans acuminata	1x	76.223.1.
	3. "Acacia" parschlugiana	2x	76.227.2.
	4. cf. Cedrela macrophylla	1x	76.123.1.
Plate XXVIII.	1. Juglans acuminata	1x	76.222.1.
	2. Leguminosae I.	1.5x	76.10.1.
	3. "Acacia" parschlugiana	2x	76.227.2.
Plate XXIX.	1. Wisteria aff. fallax	3x	76.56.1.
	2. Wisteria aff. fallax	2x	76.56.1.
	3. Rosa lignitum	2x	76.116.1.
Plate XXX.	1. "Acacia" parschlugiana	2x	76.314.2.
	2. "Acacia" parschlugiana	2x	76.314.2.
Plate XXXI.	1. Sterculia sp.	1.2x	76.115.1.
	2. Sterculia sp.	1x	76.121.1.
	3. Fructus	3x	76.109.1.
Plate XXXII.	1. Acer angustilobum	2.5x	76.209.1.
	2. Acer angustilobum	1.5x	76.302.1.
	3. Acer angustilobum	1.5x	76.51.1.
Plate XXXIII.	1. Acer angustilobum	2.5x	76.285.1.
	2. Dicotylophyllum sp. II.	1.5x	76.126.1.
	3. Cornus praeamomum	1x	76.112.1.
Plate XXXIV.	1. Cornus sp.	1.5x	76.32.1.
	2. Cornus cf. wrightii	1.5x	76.129.1.
Plate XXXV.	1. Smilax tataensis	1x	76.231.1.
Plate XXXVI.	1. Smilax tataensis	1.2x	76.232.1.
	2. Dicotylophyllum sp. I.	1.5x	76.208.1.
Plate XXXVII.	1. Smilax tataensis	2x	76.252.1.
	2. Debeya hungarica	1.5x	76.105.1.
Plate XXXVIII.	1. Smilax tataensis	1x	76.230.1.
	2. Palmae	0.5x	76.205.1.
Plate XXXIX.	Daphnogene cinnamomifolia	1x	76.6.1.
	Daphnogene bilinica	1x	76.6.1.
	Ulmus pyramidalis	1x	76.6.1.
Plate XL.	Bedding-plane with leaf imprints	1x	76.105.1.

EXPLANATION OF PLATES

PLATE I.

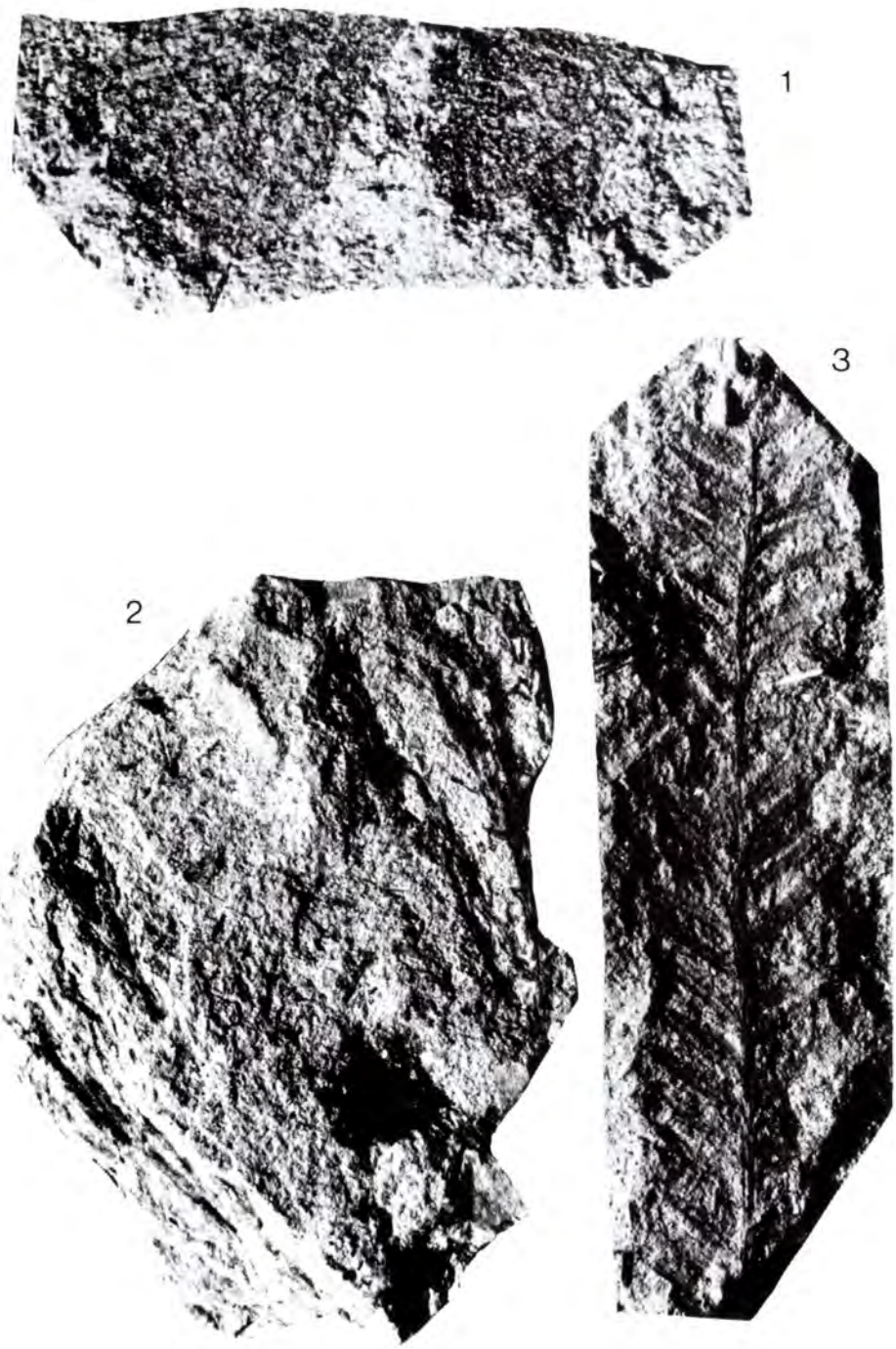


PLATE II.



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PLATE III.

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PLATE IV.

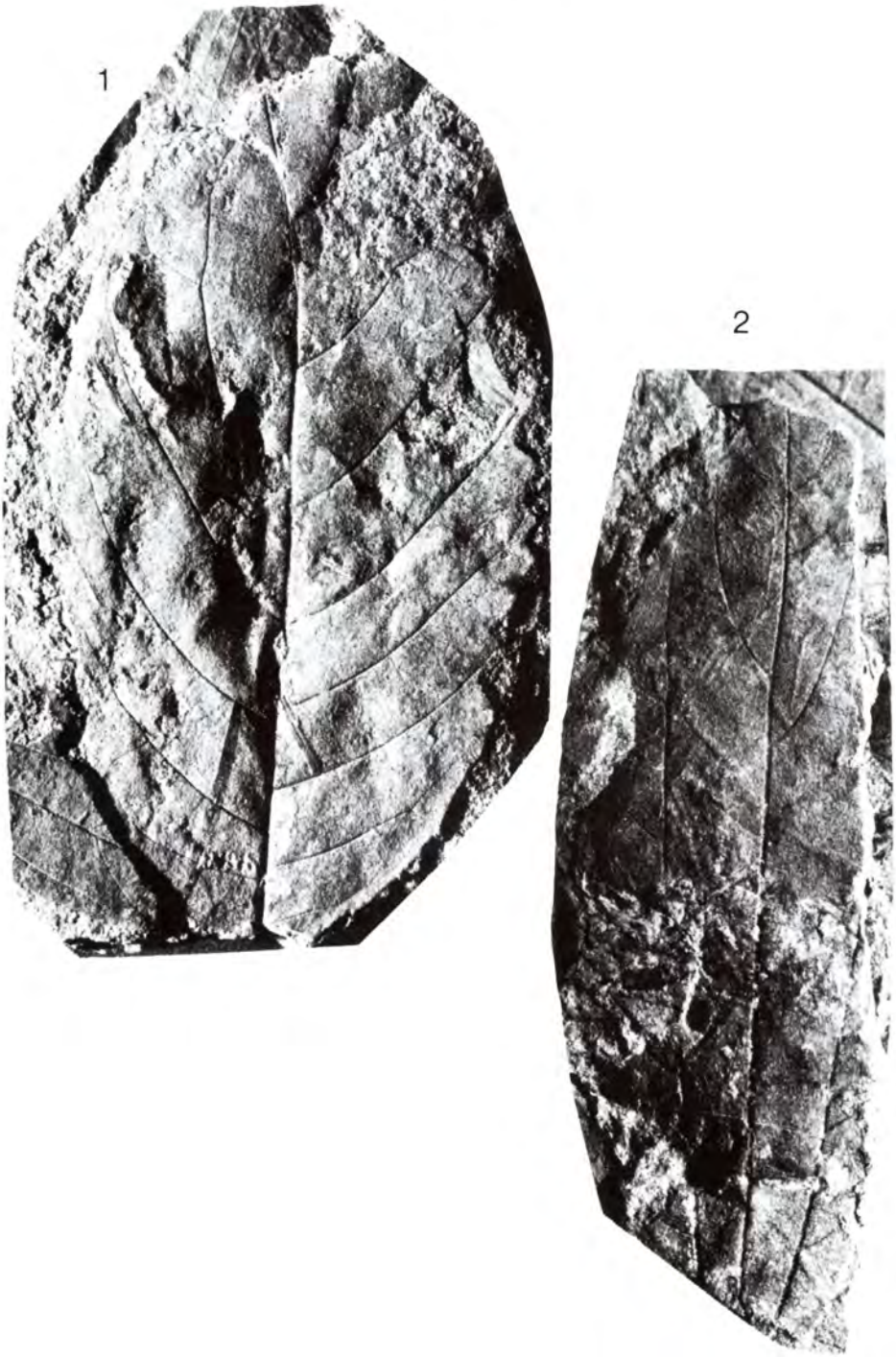


PLATE V.

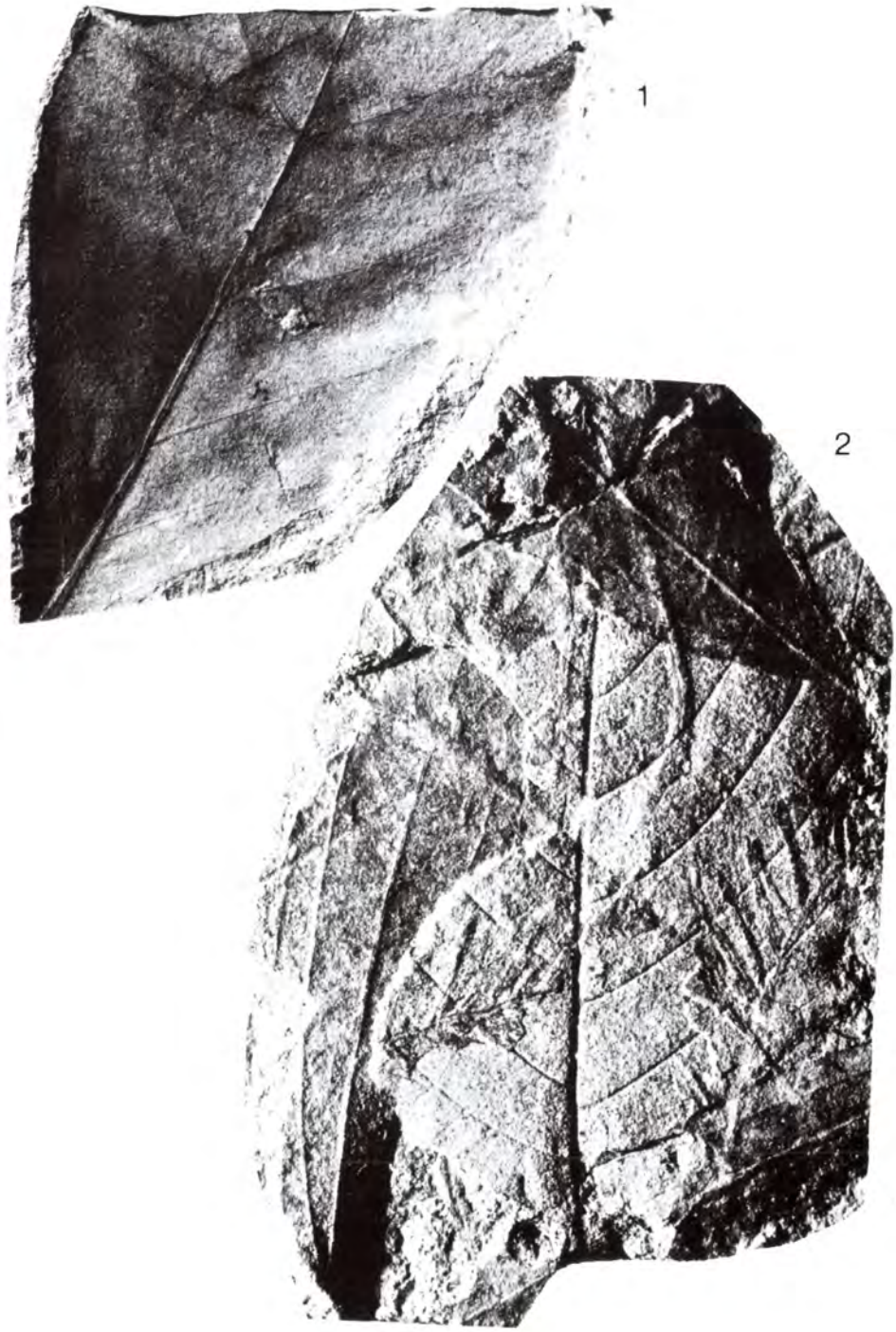


PLATE VI.



PLATE VII.



PLATE VIII.

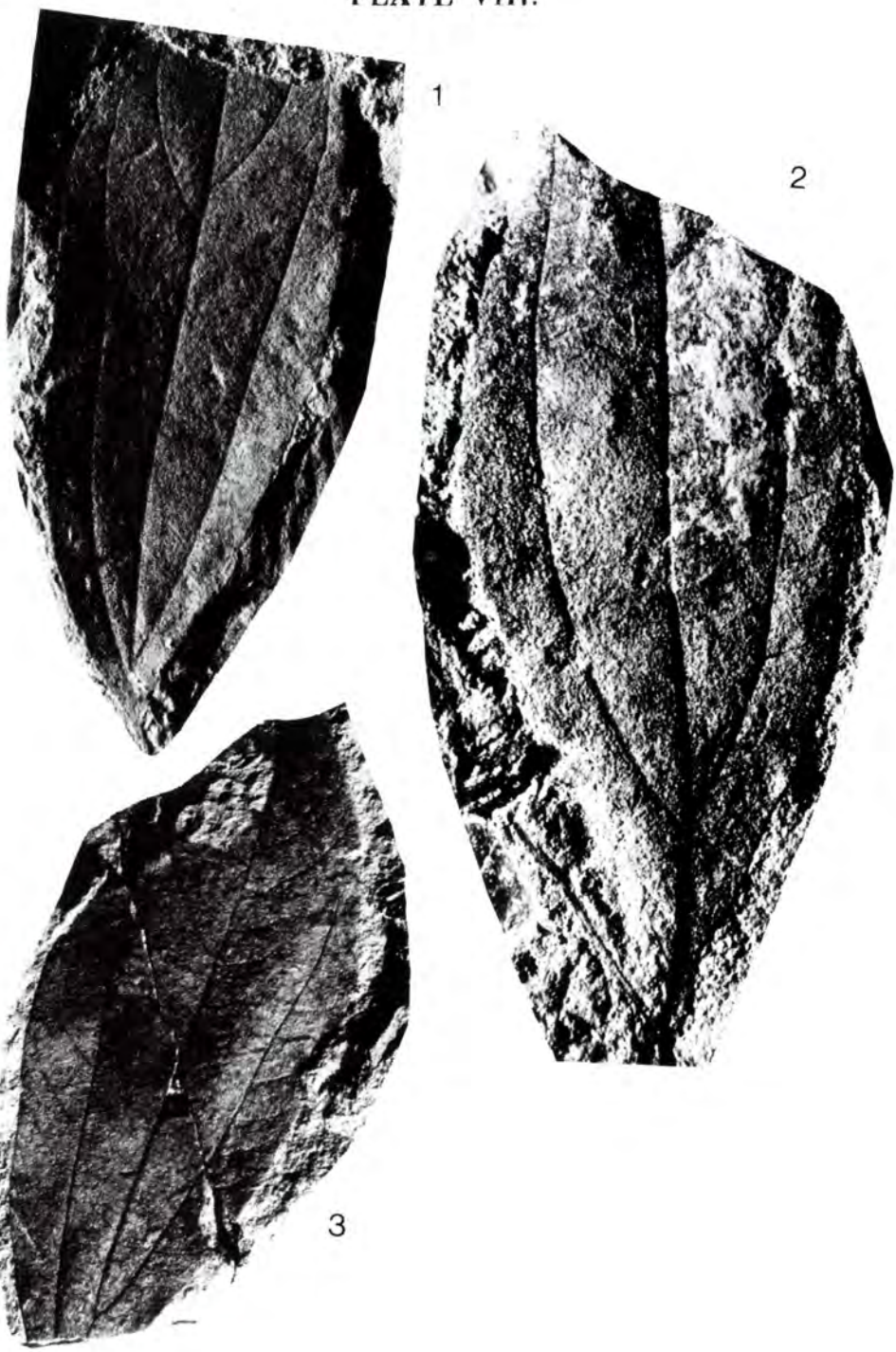


PLATE IX.



PLATE X.



PLATE XI.

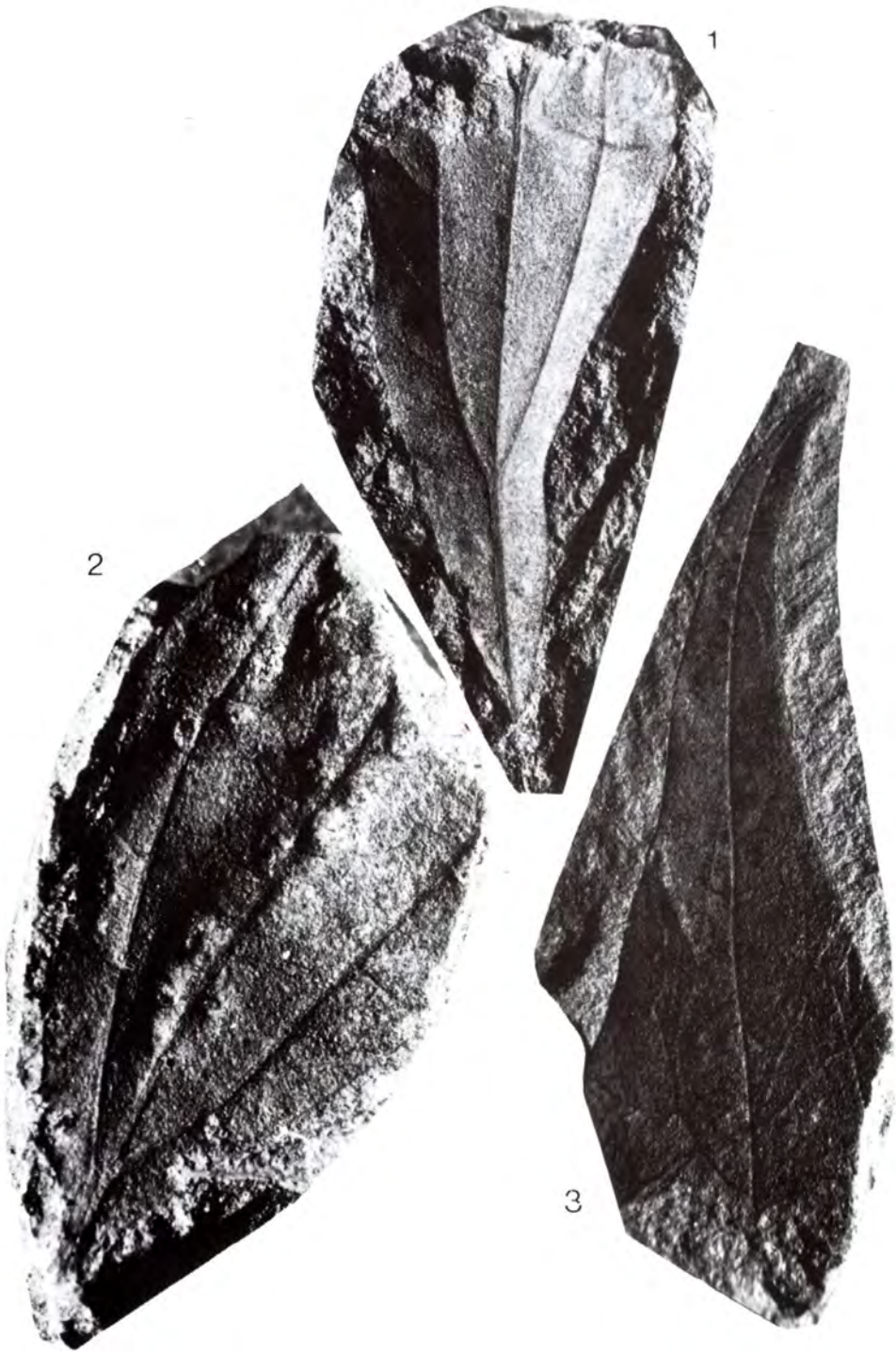


PLATE XII.



PLATE XIII.



PLATE XIV.



PLATE XV.



PLATE XVI.



PLATE XVII.



PLATE XVIII.



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PLATE XIX.



PLATE XX.



PLATE XXI.



PLATE XXII.



PLATE XXIII.



PLATE XXIV.



PLATE XXV.



PLATE XXVI.



PLATE XXVII.

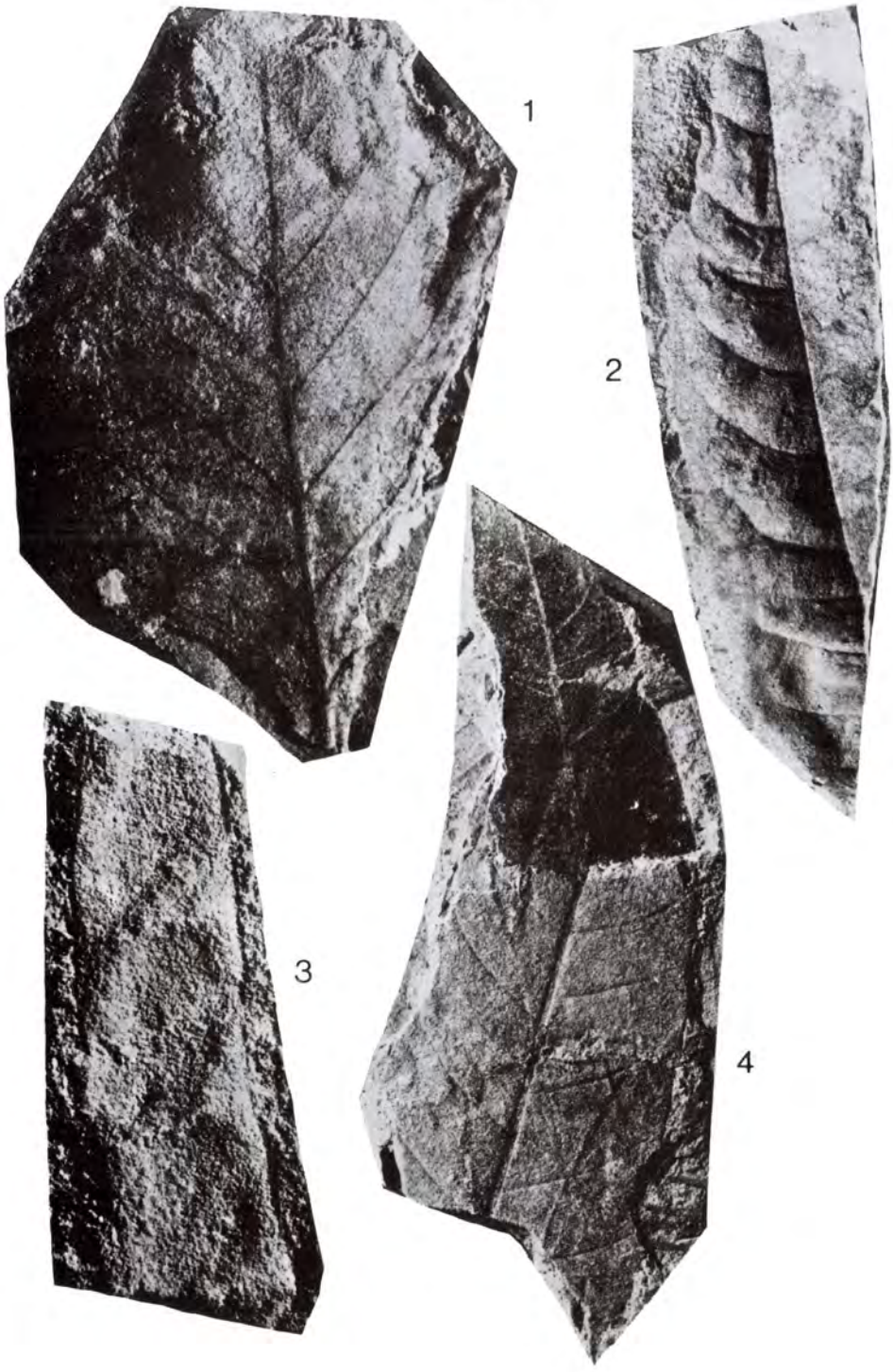


PLATE XXVIII.



PLATE XXIX.



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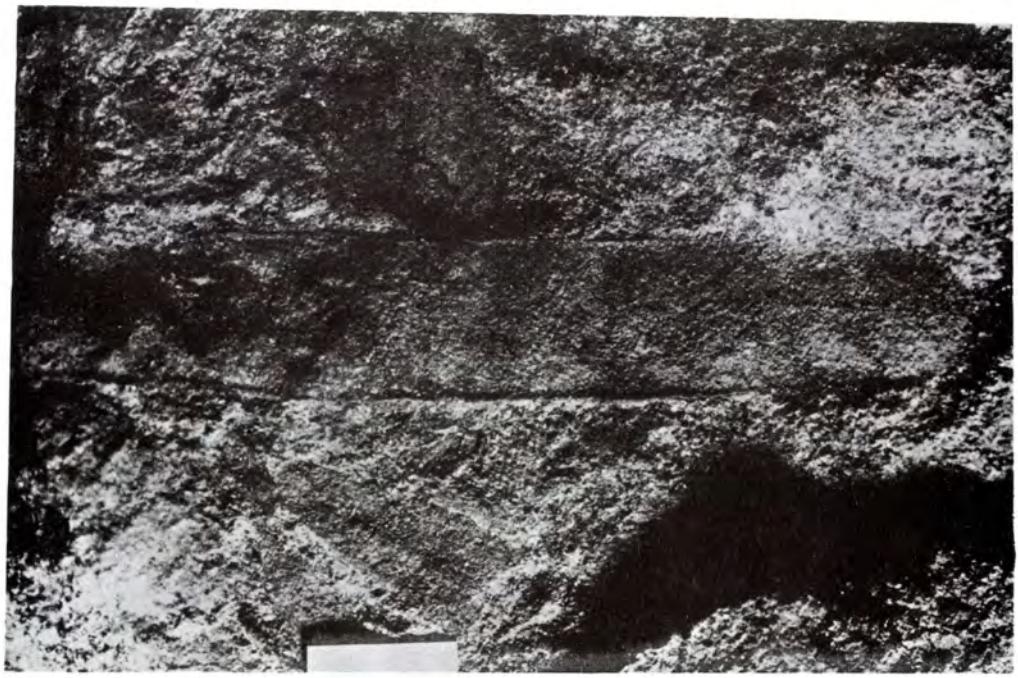
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PLATE XXX.

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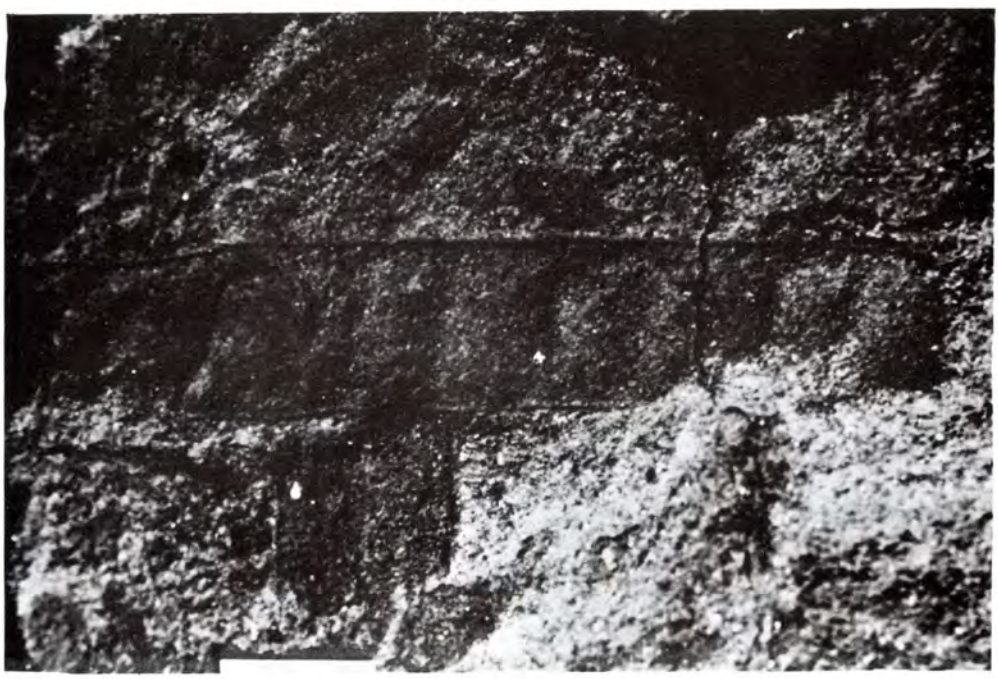


PLATE XXXI.

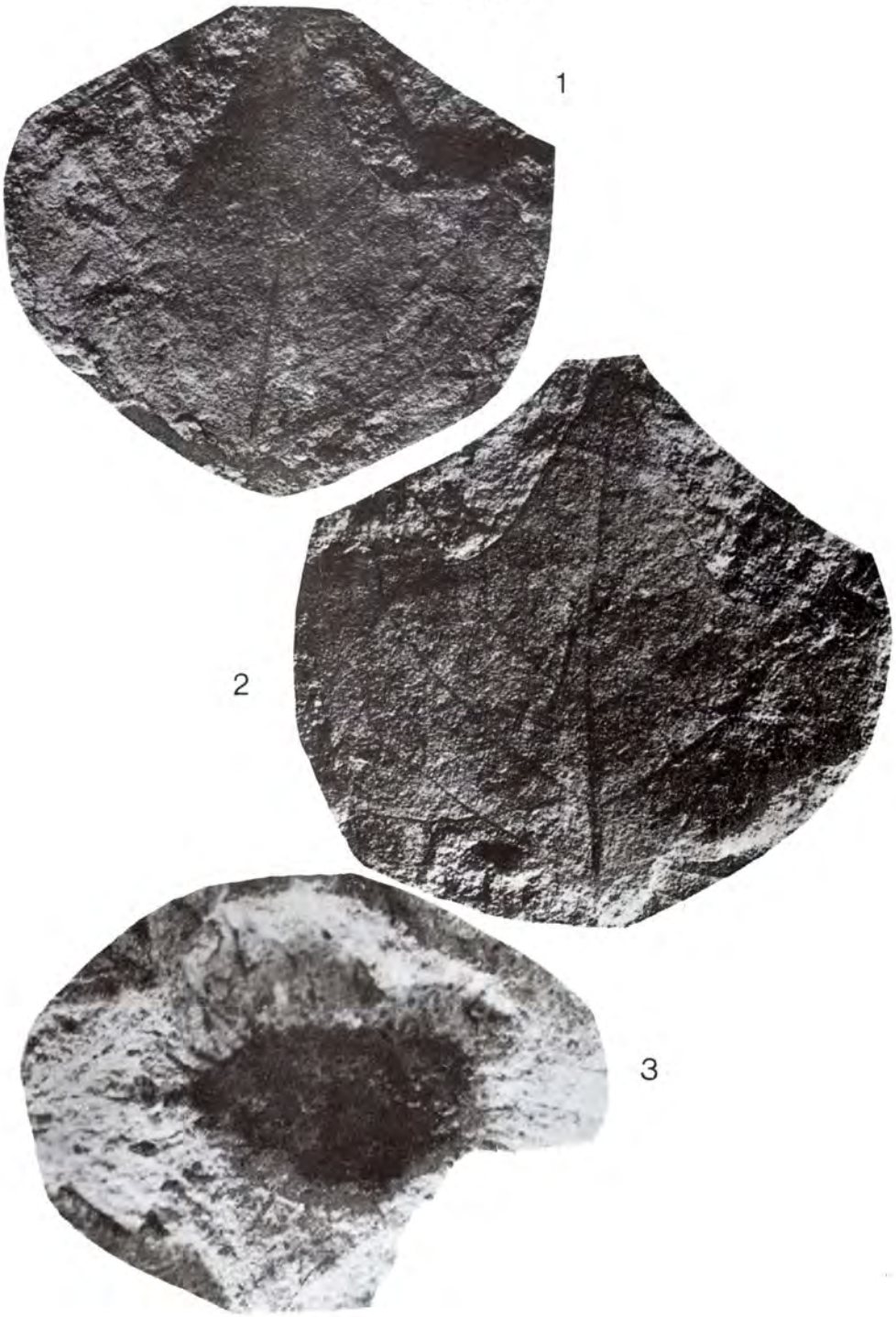


PLATE XXXII.



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PLATE XXXIII.



PLATE XXXIV.



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PLATE XXXV.

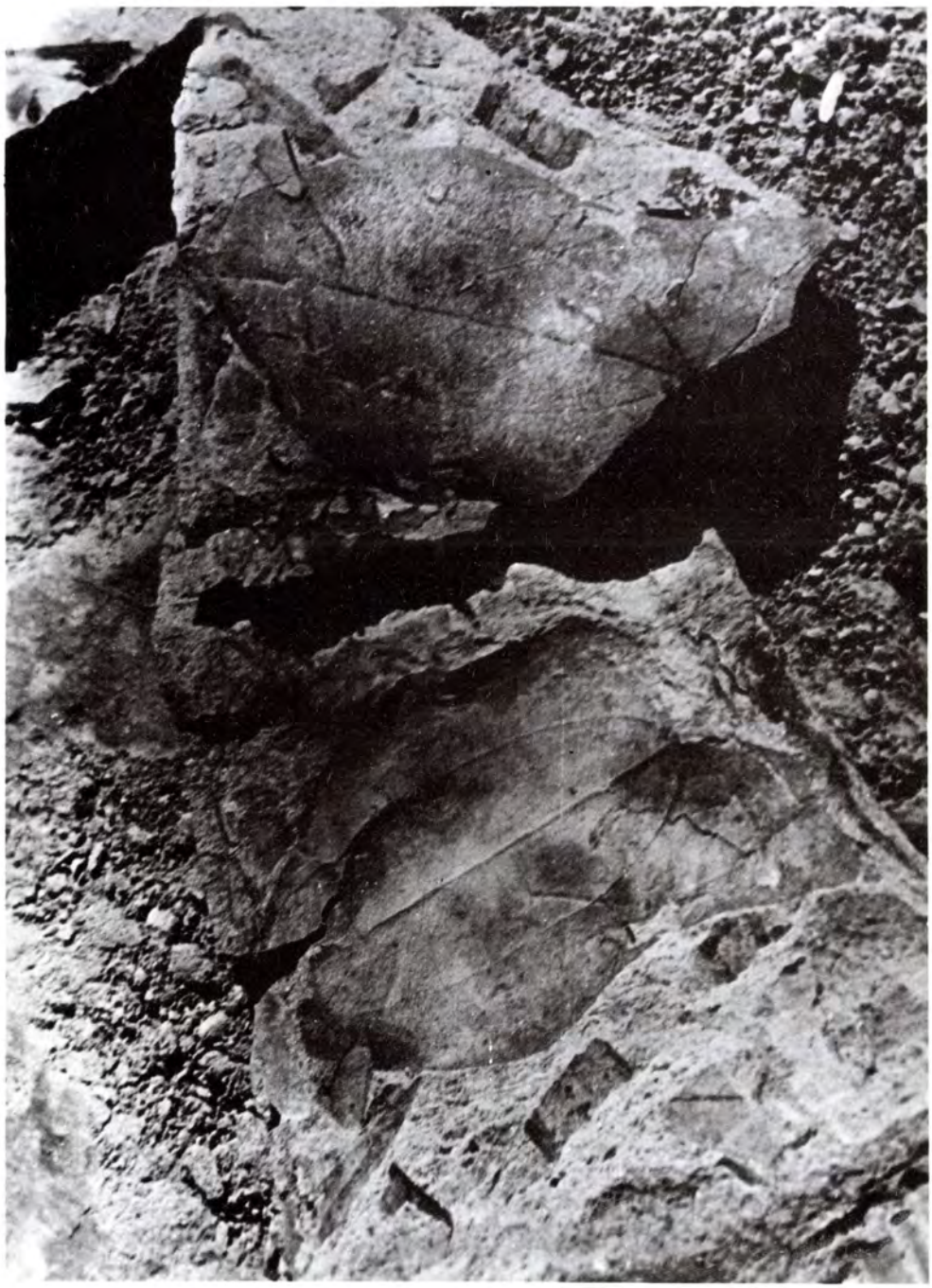


PLATE XXXVI.



PLATE XXXVII.



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PLATE XXXVIII.



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PLATE XXXIX.



PLATE XL.

