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ON SOME NEW SPECIES FROM THE MASTIXIACEAE-FLORA TAPHOCENOSE FROM THE MIOCENE NEAR HRÁDEK NAD NISOU (ZITTAU BASIN, NORTH BOHEMIA)

Ve výběžku žitavské pánve v severním okolí Hrádku nad Nisou byla v poslední době těžena xylitová sloj, součást svrchního slojového pásma. Její bezprostřední nadloží odkryté bývalým povrchovým dolem Kristina tvoří velmi složité souvrství uhelných slojek, jílu a hrubozrnných písků: klustické sedimenty tvoří čočky a polohy, jež se vklíní do nejsvrchnějších poloh xylitu. Tak vznikají drobné slojky odštěpené až 15 i více metrů vysoko nad hlavu těžené slaje.

Hrubozrnné písky a štěrčinky obsahují paleokarpologickou tafocenózu, vymykající se běžným faciím uhlotvorného močálu. Semena a plody nalezené v píscích byly naplaveny do říční delty z okolních hor či pahorkatiny. Zbytky uhlotvorných elementů jsou v nich zatlačeny do pozadí a zřetelně se zde uplatňují pozůstatky rostlin klimaticky velmi náročných a některých vymřelých rodů. Velmi významné jsou nálezy rostlin z čeledí *Illiciaceae*, *Lauraceae*, *Mastixiaceae*, *Menispermaceae*, *Symplocaceae*, *Theaceae* atd. Tyto vysloveně teplomilné elementy jsou doprovázeny pozůstatky některých temperátních angiosperm. Prostudovaná tafocenóza je pravděpodobně dokladem existence mimořádně teplomilných smíšených mezofytních lesů hornatiny subtropického pásma, vroubících na exponovaných stanovištích miocénní uhlotvornou pánev. Flóra je doložena více než šedesáti rody a druhy.

Z facie hrubozrnných písků a jílu pochází sedm nových, zevrubně popsaných druhů: *Myrica cestmiri* sp. n., *Cyclocarya nemejcii* sp. n., *Cinnamomum zlatkoi* sp. n., *Ocotea dorofeevit* sp. n., *Ternstroemia chandleri* sp. n., *Rehderodendron custodum* sp. n., *Rutaspermum kristinae* sp. n. Fossilní příbuzní těchto rodů často pocházejí z *mastixiových* květen eocénních a oligocénních, případně obdobných společenstev miocénních. Téměř totožné květeny byly popsány z některých lokalit žitavské pánve v NDR a z hnědouhelného velkolomu Turów v PLR. Popsané květeně se přisuzuje ottnangské stáří.

The sandy deposits of the Upper brown coal seam complex, overlying the lignitic seam, have yielded an assemblage of small-sized plant remains floated into deltaic deposits of the extensive Miocene Zittau basin. The coarse-grained sands contain unusually rich flora drifted probably from the highland or mountain area bordering the basin. This assemblage of fruits and seeds differs markedly from the palaeocarpo-

logical taphocenoses from the characteristic facies of the brown coal marshland. In the assemblage there are represented some important taxa (e.g. *Illicaceae*, *Lauraceae*, *Mastixiaceae*, *Menispermaceae*, *Symploceae*, *Theaceae* etc.), valuable climatic indicators. These pronounced thermophyllic elements are followed by many representatives of temperate trees. The assemblage is to be explained as an expression of thermophyllic Mixed Mesophytic Forests with numerous temperate elements. There are described seven new species of *Cinnamomum*, *Cyclocarya*, *Myrica*, *Ocotea*, *Rehderodendron*, *Rutaspermum* and *Ternstroemia*. Very similar floras were described from various localities of the Zittau basin in G.D.R. and Poland. Suggested age for the flora of the Upper brown coal seam complex is the Ottnangian.

BRIEFLY ON HITHERTO PALAEOONTOLOGICAL INVESTIGATIONS

The Miocene deposits of Zittau basin extend from the G.D.R. and Poland into the northern Bohemian promontory near the town Hrádek nad Nisou. By means of drilling for the geological prospection (1957—1963) there was proved about 400 m thick sedimentary complex (bordered by radial faults), accumulated probably as a deltaic fan (VÁCL, ČADEK 1962); the whole section comprises usually 3—4 brown coal seams complexes, but only the lignite from the Upper brown coal seam complex had been exploited economically.

The lignite was excavated in open coal pit Kristina, N. of Hrádek nad Nisou, closely to the Bohemian — German state boundary. This seam is covered by sandy clays and coarse-grained sands to pea-gravels. The clays bear sometimes concretions of the clay-irestone with leaf-impressions. Palaeobotanical investigations in G. D. R. were made by POPPE (1866), ENGELHARDT (1870, 1878), KIRCHHEIMER (1938), HEINKE (1932) and MAI (1960, 1964 etc.), in Poland by CZEZCOTT, SKIRGIELLO and ZALEWSKA (1959, 1967, 1975), CZEZCOTT (1970), KOSTYNIUK (1967), ZALEWSKA (1953, 1967, 1956). The palaeobotanical finds from Hrádek nad Nisou were published as preliminary reports (HOLÝ 1964, BŮŽEK, HOLÝ, KVAČEK 1966), some leaf remains were described thoroughly (KVAČEK, BŮŽEK 1966, KVAČEK 1971).

The age of deposits in Zittau basin was regarded by KREJČÍ (1877) for the Oligocene, by KATZER (1892, 1897) for the Oligocene at first, than for the Lower Miocene. KIRCHHEIMER (1937, 1938) determined it as the Upper Oligocene, HUNGER (1951, 1953, 1954) applied KIRCHHEIMER'S stratigraphical dogma too. MAI (1964) assigned the flora of Zittau-basin for the Lower Miocene (older than the Helvetian). The Lower Miocene age of the basin is mentioned by HURNÍK and KNOBLOCH (1966) too. GRAHMANN (1937) looked on the Zittau basin as the continuation of the North Bohemian basin (Chomutov—Most—Teplice—Ústí nad Labem brown coal basin). CZEZCOTT'S recent opinion (1970) is similar and she determined the age as the Lower Miocene, the Burdigalian.

SHORT REVIEW OF THE PALAEOCARPOLOGICAL TAPHOCENOSE FROM THE OVERLYING SANDS

The coarse-grained sands and pea-gravels with lenticles and schliers of clay overlying the lignitic coal seam had yielded unusually rich assemblage of mostly carbonaceous seeds and fruits. Their mode of preservation is quite variable: some specimens are preserved even with soft

layers of testa or epicarp, in another cases even the woody layers of the seeds and fruits are much worn, abraded and pitted by grains of the sand.

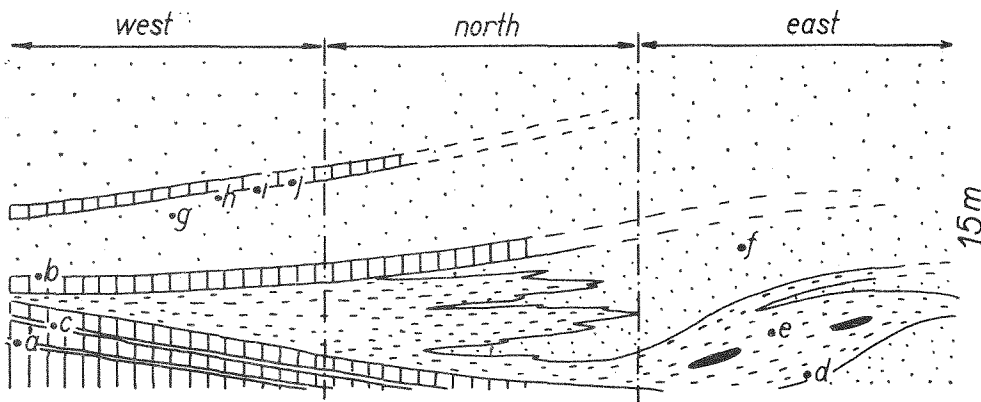


Fig. 1 — schematic section through the lignite-pit Kristina near Hrádek nad Nisou; ratio height: length = 3 : 1.

Vertical hatching: lignite seam, seamlet; dotted: coarse-grained sand, pea-gravel; short lines: sandy clay; white: clay; black lines: clay-irestone concretion; black rings: points of sampling.

A: plastic clay from the upper parting of the main xylitic seam (about 5 m under the seam-surface).

B: clay and „Blätterkohle“ from the uppermost part of the 1st seamlet (splitted off from the main seam).

C: slightly sandy cacao-brown clay under the uppermost part of the main seam.

D: base of the sandy clay with big concretions of the clay-irestone above the main seam.

E: sandy clay (event. with clay-irestones) yielding much of cuticles.

F: 1—2 cm thin schliers, lenticles or thin beds of the sandy clay with xylites and *Eomastixia* within pea-gravels and coarse-grained sands.

G: coarse-grained sand with clayish schliers with *Fagus*, *Ocotea*, *Pterocarya*, *Tectocarya*.

H: cacao-brown sandy-clay underlying the uppermost seamlet.

I: carbonaceous clay, base of the uppermost seamlet.

J: *Glyptostrobus* — „Blätterkohle“, base of the uppermost seamlet.

Having regards to the composition of the following very mixed taphocenose it is to be interpreted as a highly characteristic expression of climatically very sensitive flora with representatives of important families, like *Lauraceae*, *Mastixiaceae*, *Symplocaceae* etc.:

Pinaceae: *Pinus* cf. *thomasi* (GOEPP.) REICHENBACH

Taxodiaceae: *Glyptostrobus europaeus* (BGT.) UNG.

Sequoia couttsiae HEER

Cupressaceae: *Tetraclinis* sp.

Coniferae inc. sedis: *Cupressospermum saxonicum* MAI

Magnoliaceae: *Magnolia burseracea* (MENZEL) MAI

Liriodendron sp.

Nymphaeaceae: *Pseudoeuryale* sp.

Illiciaceae: *Illicium germanicum* MAI
 Menispermaceae: *Parabaena europaea* CZECOTT - SKIRGIELLO
 Myricaceae: *Myrica ceriferiformis* KOWNAS
 Myrica cestmiri sp. n.
 Juglandaceae: *Cyclocarya nemejci* sp. n.
 Pterocarya raciborskii J. ZABLOCKI
 Fagaceae: *Trigonobalanus exacantha* MAI
 Hamamelidaceae: *Corylopsis* sp.
 Distylium cf. *uralensis* KOLESNIKOVA
 Altingiaceae: *Liquidambar europaea* AL. BR. in BUCKLAND
 Ulmaceae: *Trema lusatica* MAI
 Lauraceae: *Cinnamomum zlatkoi* sp. n.
 Cinnamomum lusaticum MAI
 Ocotea rhenana MENZEL
 Ocotea dorofeevii sp. n.
 Sassafras cf. *lusaticum* MAI
 Phoebe bohemica MAI
 Rosaceae: *Rubus* sp.
 Theaceae: *Ternstroemia chandleri* sp. n.
 Eurya stigmosa MAI
 Ericaceae: *Leucothoë* sp.
 Symplocaceae: *Symplocos wiesaensis* KIRCHHEIMER
 Symplocos schereri KIRCHHEIMER
 Symplocos lignitarum (QUENSTEDT) KIRCHHEIMER
 Symplocos salzhauseensis (LUDWIG) KIRCHHEIMER
 Symplocos poppeana KIRCHHEIMER
 Symplocos minutula (STBG.) KIRCHHEIMER
 Sphenotheca incurva KIRCHHEIMER
 Styracaceae: *Rehderodendron custodum* sp. n.
 Euphorbiaceae: *Sapium germanicum* KIRCHHEIMER
 Rutaceae: *Rutaspermum kristinae* sp. n.
 Toddalia latisiliquata (LUDWIG) GREGOR
 Illicaceae: *Ilex saxonica* MAI
 Staphyleaceae: *Turpinia ettingshauseni* (ENGELHARDT) MAI
 Lythraceae: *Microdiptera parva* CHANDLER
 Microdiptera elongata (DOROFEEV) DOROFEEV
 Vitaceae: *Vitis lusatica* CZECZOTT - SKIRGIELLO
 Vitis parasilvestris KIRCHHEIMER
 Ampelopsis ludwigii (A. BR.) DOROFEEV
 Ampelopsis rotundata CHANDLER
 Tetrastigma lobata CHANDLER
 Tetrastigma chandleri KIRCHHEIMER
 Sabiaceae: *Meliosma miessleri* MAI
 Nyssaceae: *Nyssa ornithobroma* UNGER
 Mastixiaceae: *Mastixia lusatica* MAI
 Eomastixia saxonica (MENZEL) comb. n.
 Mastixicarpum limnophilum (UNGER) KIRCHHEIMER
 Tectocarya elliptica (UNGER) comb. n.
 Retinomastixia schultei KIRCHHEIMER

Cornaceae: *Swida gorbunowii* (DOROFEEV) NEGRU

Araliaceae gen. indet.

Caprifoliaceae: *Sambucus pulchella* C. et E. M. REID

Cyperaceae: *Dulichium marginatum* (C. et E. M. REID) DOROFEEV

Sparganiaceae: *Sparganium camenzianum* KIRCHHEIMER

As seen, this palaeocarpological assemblage consists mostly of the extraallochthonous elements: we may presume those fossils were drifted into the deltaic-fan by torrential water streams from exposed periphery of the river-delta and from the surrounding mountain-valleys. Almost the same palaeocarpological assemblages are well known from the various localities of Zittau-basin in G.D.R. and Poland. Such a type of vegetation we can follow in floras of Mixed Mesophytic Forests to Mist or Rain Valley Forests of the mountains or highland in subtropical zone in S.E. Asia.

SYSTEMATIC DESCRIPTIONS

MYRICAEAE

MYRICA L. 1753

Myrica cestmiri sp. n.

(Pl. 1, f. 1—19)

Diagnosis: Endocarps elongate-ovate, suboval to ovate-spindle-shaped in outline, 1.4—2.3 mm long, 0.8—1.3 mm broad, straight, but very often slightly obliquely asymmetrical in view of the dehiscence plane; locule drop-shaped, sometimes with truncate base, thin-walled sutures 0.1—0.3 mm broad; surface smooth; apex quickly narrowed, rounded, sometimes finely pointed, base rounded, rarely with an indication of very little stalk. Epicarp verrucate.

Holotype: Nr. G 4281 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus., Pl. 1, f. 9. **Locus typicus et stratum typicum:** Brown coal pit Kristina near Hrádek nad Nisou, N. Bohemia; Zittau basin; Upper brown coal seam complex, overlying sands, layer F; Ottnangian.

Material: More than 100 fruits.

Description: *Endocarps* suboval, elongate-ovate, spindly-elongate-ovate, broadly fusiform. Maximum diameter in the half or lower third, 1.4—2.3 mm long, (0.8—) 0.9—1.1 (—1.5) mm broad. Ratio of length:

The results of the preliminary investigation (HOLÝ 1964, BŮŽEK - HOLÝ - KVAČEK 1966) were used without corrections by KNOBLOCH - BŮŽEK - HOLÝ - KVAČEK - NĚMEJČ and SITÁR in: Significant megafloreal assemblages in the Neogene of Central Europe, pp. 92—93 (CICHA I. et. al.: Biozonal division of the Upper Tertiary basins of the Eastern Alps and West Carpathians. — Geol. Surv. Prague, 1975). Some specific determinations are to be corrected. As follows from the foregoing list of fossils, the palaeocarpological assemblage contains many components related to the more archaic forms the Palaeogene (e.g. *Parabaena*, *Ternstroemia*, *Rehderodendron*, *Rutaspermum*, *Ampelopsis*, *Tetra stigma*). The author's contemporary paper about the representatives of the family *Mastixiaceae* proves the exceptionality of the *Mastixiaceae*-flora from Hrádek nad Nisou and its probable older age.

breadth (below see: L:B ratio) (1.6—) 1.8 (—2.0). Frequently slightly compressed, often a little obliquely to the plane of dehiscence: that is why both valves used to be somewhat asymmetrical one to another towards this plane. Apex quickly narrowed, rounded (not elongated), very finely pointed, base usually rounded, quickly narrowed, sometimes with a very little stalk.

Locule drop-shaped (to elongate-ovoid), truncate (or slightly emarginate) to rounded on its base, upwards tapering into about 0.15 mm long and 0.09 mm broad stylar canal. Suture of the dehiscence often followed by a fine rib on the outer surface, mostly \pm gapping from the apex to two thirds of the length of the endocarp. The suture is the thinnest near the base (basilaterally) and in the lower fourth (0.1—0.13 mm), the thickest it used to be in the upper third (0.2—0.25 mm).

The outer surface of the endocarp quite smooth, only here and there very finely striate. There were found two specimens with remains of *epicarp* formed of big, low warts.

Remarks and affinities: *Myrica wiesaensis* KIRCHHEIMER from the Upper Lusatia is about twice larger, much broader, thickset and conspicuously more thick-walled. DOROFEEV described more similar species from the Byelorussia (U.S.S.R., Pliocene) — *Myrica goretskyi* (1967, p. 108) and from the Upper Miocene of West Siberia (U.S.S.R.) — *M. omoloica* (1972, p. 84). *M. goretskyi* DOROFEEV is somewhat smaller and more thickset than our species, provided with a short thick stalk on its base, with apex narrowed into a distinct stylar base, with fusiform locule and distinct median ridge. The epicarp of *Myrcia omoloica* DOROFEEV is smooth, outgrowing into a conspicuous, thin, wing-shaped excrescens; the valves of its endocarp used to be very concave, superficially often with a median rib; it is larger than our species.

It could seem difficult to differ our new species from some representatives of *Comptonia*: living *Comptonia peregrina* (L.) COULT. is similar enough, though much larger, with relatively thin-walled endocarp and quite smooth epicarp. Fossil species usually put into *Comptonia* are mostly very conspicuously ribbed.

Myria cestmiri sp. n. originates from the nearest exposure in G.D.R., Hartau (not described material observed in Mai's collection, Berlin).

JUGLANDACEAE

CYCLOCARYA ILINSKAJA 1953

Cyclocarya nemejcii sp. n.

(Pl. 2, f. 1—14)

Diagnosis: Endocarps very broadly turbinate to disc-shaped and high, pentagonal in lateral view; base broadly rounded, with central pit, apex very broadly conical, pointed; the largest diameter 3.45—4.6 mm, height 2.05—2.55 mm; about 14—16 meridional inflated ribs, pronounced especially in equatorial region.

Holotype: Nr. G 4309 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus., Pl. 2, f. 1.

Locus typicus et stratum typicum: Brown coal pit Kristina near Hrádek nad Nisou, N. Bohemia; Zittau basin; Upper brown coal seam complex, overlying sands, layer G; Ottnangian.

Material: 4 complete carbonaceous fruits, 3 valves.

Description: *Endocarps* bisymmetric, turbinate (to globosely disc-shaped), in apical view rounded, in lateral view pentagonal; 3.45—4.6 mm broad and 2.05—2.55 mm high on the plane of dehiscence. Base rounded to flat, with a distinct central pit (insert scar). Apical half usually somewhat depressed, with a sharp, broadly conical, 0.4—0.6 mm high central apex. The lower half of the endocarp with 10 to 12 rounded, broadly inflated meridional ribs: their number grows to 14 to 16 by intercalated ribs on the upper half. The ribs reach the border of broadly conical apex. Somewhat gapping dehiscence (plane of the symmetry) begins on the apex reaching the equator. Sutures about 0.4 mm broad. Locula divided by a broad, incomplete columnar septum. In one case there was observed imperceptible passing 0.3 mm high secondarily septum on the base of the locule.

Remarks and affinities: MAI (1964, p. 20) legitimately separated the finds of fossil leaves of *Cyclocarya cyclocarpa* (SCHLECHT.) KNOBLOCH and for the endocarps he elected the epitheton of original species *Zizyphus nuciferus* LUDWIG. Into such defined species he fused MÄDLER'S (1939), KIRCHHEIMER'S (1942) and his own (MAI 1964) finds. The fruits from brown coal pit Kristina seem to be similar to MAI'S photographs (pl. III, f. 3—5), but according to his description *Cyclocarya nucifera* (LUDWIG) MAI differs in its broadly ovate shape, in only 5 to 7 ribs on the surface and somewhat larger height.

More similar *Cyclocarya sibirica* was described by DOROFEEV (1963, p. 144) from the Upper Oligocene to the Lower Miocene of Siberia (U.S.S.R.); but its endocarps are twice larger, with a narrow, sharp-pointed apex and about 20 rounded inflated ribs.

Living *Cyclocarya* is an element of Mixed Mesophytic Forests from the Upper and Lower Yangtse (China). In layer G in the high overlying of the lignitic brown coal seam the author has not found the typical *Mastixiaceae-flora*. The palaeocarpological assemblage is poor and consists of rich *Fagus*, *Glyptostrobus*, *Nyssa*, *Pterocarya*, followed by *Ocotea*, *Magnolia*, *Sequoia* and *Trigonobalanus*. Only rarely there were found *Symplocos lignitarum* and *Tectocarya elliptica*!

LAURACEAE

CINNAMOMUM BOEHMER 1760,

***Cinnamomum zlatkoi* sp. n.**

(Pl. 3, f. 14—16)

Diagnosis: Thin-walled cupules, 7.0—7.3 mm long, 5.0—5.8 mm broad (secondarily compressed) smooth, obconical in outline; the upper margin somewhat constricted; peduncle short, broad, blunt on the base; the margin of the cupule straight, entire.

Holotype: Nr. G 4305 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus. Pl. 3, f. 16.

Locus typicus et stratum typicum: Brown coal pit Kristina near Hrádek nad Nisou, N. Bohemia; Zittau basin; Upper brown coal seam complex, overlying sands, layer F; Ottnangian.

Material: 3 compressed carbonaceous cupules.

Description: *Cupules* secondarily almost compressed, smooth, thin-walled, roundly obconical in outline. Length 7.0—7.3 mm, breadth 5.0—5.8 mm. Cupule slightly narrowed just below the berry, with shallow pit and the margin (encircling the berry) slightly gripped inwards, so that the berry protrudes out only a little. The peduncle broad and short, downwards slightly narrowed, with a blunt base. The *berry* (globose originally) ca 4—5 mm in diameter, with a smooth, glossy, semitranslucent and leathery epicarp; endocarp granulate.

Remarks and affinities: The related species not very well described as *Cinnamomum buchii* HEER*) differs in larger diameter of cupule, very long, slender peduncle, its cupule is quickly narrowed, the berry is larger, oval. Cupules of *C. crassipedicellatum* MAI (MAI 1971, p. 323) are more shallow, their surface is characteristically wrinkled and their peduncles are considerable longer.

OCOTEA AUBLET 1775

***Ocotea dorofeevii* sp. n.**

(Pl. 3, f. 1—7)

Diagnosis: Cupules roundly cup-shaped in outline, 9.0—12.6 mm long, 8—13 mm broad, the broadest in half or somewhat higher; with about 12 external longitudinal ribs.

Holotype: Nr. G 4321 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus. Pl. 3, f. 1, 3.

Locus typicus et stratum typicum: The same as in foregoing species.

Material: 8 carbonaceous, compressed cupules, various states of ripeness.

Description: *Cupules* roundly cup-shaped, 9.0—12.6 mm long and 8.0—13.0 mm broad, secondarily compressed. Towards the base they are suddenly narrowed into the thick peduncle (in unripe specimens it amounts one half to two thirds of the length of cupule). The cupules are the broadest in the half or somewhat higher. The \pm thick margin is almost even, slightly undulating on ribs only. There are about 12 conspicuous longitudinal ribs or inflated combs on the surface (in unripeness decurrent down to the peduncle, in ripeness ribs sometimes furcating up-

*) Naturally, the epitheton is unacceptable from the nomenclatorial reasons: HEER (1856, pl. XCIV, f. 17, 17b) based this species on the leaves-outprints. He had expressed only the possibility that some fruits could belong to this species; but from the same locality HEER described several species of *Cinnamomum* basing the species on leaves-remains too.

wards). Furrows between the ribs sometimes with little protuberances, occasionally transversally orientated. Peduncle 3.5—4 mm long, almost absent in ripe cupules. *Berry* ovate to broadly oval in outline, less protruding out from the cupule.

Remarks and affinities: *Ocotea rhenana* MENZEL (MENZEL 1913, p. 30) differs from this new species in its more capacious cupules, which are broader than high, in smooth (at most only secondarily wrinkled) surface, in thinner upper margin and very strong narrowing into the peduncle. Also *O. heeri* (GAUDIN) MAI (MAI 1971, p. 321) differs in its thin-margined cupules with smooth surface. The same we can say eventually about cupules of *O. pyriformis* (REID et CHANDLER) MAI and *O. bowerbankii* (REID et CHANDLER) MAI (MAI 1971, p. 320).

THEACEAE

TERNSTROEMIA NUTIS ex L. 1781 nom. cons.

Ternstroemia chandleri sp. n.

(P. 3, f. 8—13)

Diagnosis: Seeds nearly flat, obovate to elongate-obovate obliquely and only slightly bent; with U-shaped curved cavity; both limbs, contiguous together, form a condyle; micropylar limb slightly bent parallelly with the margin of more convex side; the shorter limb somewhat S-bent; surface warted; length 3.9—5.4 mm, breadth 2.7—3.2 mm.

Holotype: Nr. G 4304 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus., Pl. 3, f. 8, 9.

Locus typicus et stratum typicum: The same as in foregoing species.

Material: 7 carbonaceous seeds and valves.

Description: Seeds ovate to elongate ovate (obliquely), 3.9—5.4 mm long, 2.7—3.2 mm broad, L:B ratio 1.45—1.7: the broadest in the half or somewhat farther to the convex side. The embryonal cavity U-shaped, of unequal limb: the micropylar limb is longer and slightly bent parallelly with the outer outline, the second one is shorter and slightly S-curved; their ends converging at first, then slightly diverge towards the hilar scar. The margin with the hilar scar is straight or only gently emarginate. Both limbs nearly of the same breadth. Condyle (formed by incurved cavity) is only moderately bent, parallelly with the more convex margin of the longer, micropylar limb. The condyle is the most slender in the middle dilating to both ends: a very broad hilar scar narrowing suddenly into the condylar canal. Superficially the condyle appears as a longitudinal, slightly bent flat elevation.

Testa papillate, warted externally, breadth of the bases of warts ca 0,09 mm. These thin epidermal excrescences are aligned parallelly with the outline of the seed and limbs.

Remarks and affinities: Very similar species *Ternstroemia boveyana* (CHANDLER) MAI (CHANDLER 1957, p. 98) is smaller (2.75—3.75 mm), more thickset (L:B ratio 1.25—1.53), its condyle is conspicuously curved, the limbs are of unequal breadth. *Ternstroemia rugata*

(REID et CHANDLER) comb. n. (basonym: *Acanthus rugatus* REID et CHANDLER 1926, p. 131) is very similar too: it differs in conspicuously emarginate hilum, rugose surface, slightly concave margin of the shorter limb and in generally broadly oval outline. *Ternstroemia bartonensis* (CHANDLER) MAI (CHANDLER 1960, p. 230; MAI 1971, p. 333) differs in its more thickset shape (L:B ratio 1.25), very broad condyle, in unequal breadth of limbs, extremely broad suture, almost terminal hilum and in epidermal excrescences aligned obliquely to the margin.

There were described five species occurring mostly in the Palaeogene from the Lower Eocene to Middle Oligocene, only one of them survived till the younger Miocene. Living counterparts (e.g. *T. japonica* THUNB., Central China, Southern Japan, Farther India, Sumatra) are the inhabitants of the Mixed Mesophytic Forests (or Rain Forests) of the temperate zone reaching 600 m. a.s.l. (WANG 1961).

STYRACACEAE

REHDERODENDRON HU 1932

Rehderodendron custodum sp. n.

(Pl. 4, f. 1—20)

Diagnosis: Fruits obovate, elongate-obovate, obovate fusiform to fusiform in outline, 17—23—36 mm long, 8—10—15 mm broad, one- to two-loculed; longitudinally angled, with 8 to 10 meridional, wing- to ledge-shaped ribs; apical perianth disc prominent, 3—6 mm high.

Holotype: Nr. G 4326 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus., Pl. 4, f. 1.

Locus typicus et stratum typicum: The same as in foregoing species.

Material: About 40 carbonaceous fruits in various mode of preservation.

Description: *Fruits* one- to two-loculed, 17—23—36 mm long, 8—10—15 mm broad, L:B ratio 1.8—2.2—2.5. More or less secondarily compressed; elongate-obovate, elongate-obovate fusiform or fusiform in outline (the outline depending on the grade of abrassion); straight or only slightly curved.

Epicarp thin, leathery, rarely preserved. *Mesocarp* soft, formed of parenchymous cells, sometimes preserved between the wing-shaped ribs of the endocarp.

Endocarp thick-walled, woody, elongate-obovate-fusiform in outline, ribbed by 8 to 10 longitudinal wing-shaped ledges or ribs (with fine short ledges obliquely decurrent on their sides). Base narrowed (rounded or blunt in the lateral view), bi- or tripartite, sometimes with a deep pit. Apex suddenly narrowed or truncate, with 3—4—6 mm long conspicuous perianth disc. Diameter of the locule about 2 mm in the cross-section.

Remarks and affinities: The new species is very similar to the Eocene *Rehderodendron stonei* (REID et CHANDLER) MAI (see: CHANDLER 1961, p. 292), but our species is generally slender, more elongate (to fusiform), with very conspicuous perianth disc and never

three-loculed. The second well known species from the Middle European Neogene, *Rehderodendron ehrenbergii* (KIRCHHEIMER) MAI is much larger (about 24 to 45 mm long), ovate to broadly fusiform.

Modern representative of *Rehderodendron* lives in Evergreen Broad-leaved Forests of the laurophyllic region in Southern China, entering the Mixed Deciduous Forests and ascends up to 2000 m a.s.l.

RUTACEAE

RUTASPERMUM CHANDLER 1957

Rutaspermum kristinae sp. n.

(Pl. 5, f. 1—12)

Diagnosis: Seeds ovate to subovate in lateral outline, mostly 3.2—3.9 mm long, 2.3—2.8 mm broad, the broadest across the hooked end of the keel: elongate-triangular hilar scar begins at this place; it is longer than one half of the seed-length; micropylar end rounded, lateral sides unequally inflated; ribs on the pitted surface forming a reticulum of longitudinally elongate lacunae.

Holotype: Nr. G 4349 deposited in the collection of the Palaeontological Department, National Museum Prague, Nat. Hist. Mus.. Pl. 5, f. 1, 2, 8.

Locus typicus et stratum typicum: The same as in foregoing species.

Material: About 30 specimens of the well preserved carbonaceous seeds.

Description: Semianatropous, ovate, broadly ovate to subovate seeds (3.0—) 3.2—3.9 (—4.0) mm long, (2.0—) 2.3—2.8 (—2.9) mm broad. Dorsal side convex to semicircular, ventral side somewhat truncate, only slightly convex, nearly straight on the hilar scar. Both lateral sides mostly unequally inflated; L:B ratio (1.1—) 1.3—1.4 (—1.7).

Hilar scar like a smooth depressed furrow with raised rims (longer than one half of the seed-length), roundly-triangulate to sharply-oblong in outline; bordered by high crest usually. Micropyle subapical, indistinct, placed on rounded prominence. Raphe-canal enters the testa at basal rounded and shallow chalaza, archedly tending to the base of the hilar scar: it is closed into a conspicuous and prominent keel, leading into the funnel-shaped cavity gaped to the base of the hilar scar; the cavity is hollowed in the hooked end of the keel; the keel reaching up to the lower third or to the half of the length of seed.

Dorsal side sculpted by sinuous anastomosing ridges forming a reticulum of longitudinally aligned narrow lacunae. The ridges running along the dorsal side or obliquely over the lateral sides from the micropyle to the chalazal area. The reticulum on the lateral sides between the chalaza and hilar scar is rather irregular. The whole surface is pitted. The prominent keel without any ornamentation with exception of the pitting.

The outer coat preserved rarely: a very thin, leathery, highly glossy layer made of rounded cells (0.03—0.04 mm in diameter).

Splitting for germination into two unequal valves: the suture runs along the left raised rim of the hilar scar passing the micropyle laterally, towards the dorsal side.

Remarks and affinities: The most closely related species originate from the English Middle Eocene (Cuisian) to the Lowermost Oligocene (Lattorfian). They include especially *Rutaspermum ornatum* (CHANDLER) CHANDLER and *R. rugosum* CHANDLER. The first one (CHANDLER 1961, p. 126) is considerably larger (ca 4—7.25 × 3.5—4 mm) and differs in the semiluminar outline, in the hooked ventral side at the micropyle. *R. rugosum* (CHANDLER 1963, p. 94) is more inflated, subovoid (or gibbous) in outline, more thickset, its keel is shorter and inconspicuous (extending for the one fourth to one third of the length of the seed), hilar scar is convex, the superficial crested ridges are much stronger (showing the transverse branches only occasionally). *R. excavatum* (CHANDLER 1962, p. 73) is smaller, reniform, with deeply sunk hilar scar on the concave and gibbous ventral side, its rugosities are markedly crested or nodular. The other species are quite different. GREGOR (1975, p. 116—119) emended the generic diagnosis but making some inaccuracies in the description of the shape and outline of the seeds. He has grouped all species into four formal subunits. His two new species from the German Miocene are without any relation to our species. *Rutaspermum kristinae* sp. n. is to be regarded as a Lower Tertiary relic: in those floras the species mentioned above are connected namely with the representatives of the families like *Symplocaceae*, *Epacridaceae*, *Mastixiaceae*, *Cornaceae*, *Theaceae*, *Vitaceae*, *Rutaceae* etc.

REFERENCES

- BŮŽEK, Č., HOLÝ, F., KVAČEK, Z. (1966): Zpráva o paleobotanickém výzkumu terciéru hrádecké části žitavské pánve. — Zpr. geol. Výzk. (Ústř. Úst. geol.) **1964**, 256—257. Praha.
- CHANDLER, M. E. J. (1957): The Oligocene flora of the Bovey Tracey Lake basin, Devonshire. — Bull. Brit. Mus., natur. Hist., Ser. Geol. **3**, (3), 71—123. London.
- CHANDLER, M. E. J. (1960): Plant remains of the Hengistbury and Barton Beds. — Bull. Brit. Mus., natur. Hist., Ser. geol. **4**, (6), 191—238. London.
- CHANDLER, M. E. J. (1961): Flora of the Lower Headon Beds of Hampshire and Isle of Wight. — Bull. Brit. Mus., natur. Hist., Ser. Geol. **5**, (5), 93—157. London.
- CHANDLER, M. E. J. (1962): The Lower Tertiary Floras of Southern England II. — Brit. Mus., natur. Hist. London.
- CHANDLER, M. E. J. (1963): The Lower Tertiary Floras of Southern England III. — Brit. Mus., natur. Hist. London.
- DOROFEEV, P. I. (1963): Tretičnije flory Zapadnoj Sibiri. — Izd. Akad. Nauk SSSR. Moskva—Leningrad.
- DOROFEEV, P. I. (1967): O pliocenovej flore Bělorussii. In: Nižnij plejstocen lednikovych rajonov Russkoj ravniny. — Izd. Nauka. Moskva.
- DOROFEEV, P. I. (1972): Istorija flory i rastitělnosti Evrazii. — Izd. Nauka. Akad. Nauk SSSR. Leningrad.
- GREGOR, H. J. (1975): Die mittelmiozäne Mastixioideen-Flora aus dem Braunkohlen-Tagebau Oder II bei Wackersdorf (Oberpfalz). — Inaugural-Dissertation. Ludwig-Maximilians Universität zu München.
- GREGOR, H. J. (1975): Die Rutaceen aus dem Mittel-Miozän der Oberpfälzer. — Cour. Forsch. — Inst. Senckenberg, **13**, 119—128. Frankfurt a. M.

- GRAHMANN, R., EBERT, H. (1937): Erläuterungen zur geologischen Karte von Sachsen 1 : 25 000, Nr. 89, Bl. Hirschfelde. Leipzig.
- HEER, O. (1856): Flora tertiaria Helvetiae. 2. — Winterthur.
- HOLÝ, F. (1984): Zpráva o paleontologických výzkumech terciérních a kvartérních usazenin žitavské pánve (lom Kristina). — Zpr. geol. Výzk. (Ústř. Úst. geol.) **1983**, 218—220. Praha.
- HUNGER, R. (1951): Alterbestimmung und Flözgenese der Oberlausitzer Braunkohlenvorkommen von Zittau und Berzdorf auf Grund pollenanalytischer Untersuchungen. — Bergakad., Ausg. C 3, Geologie, 61—66. Freiberg i. Sa.
- HUNGER, R. (1953): Mikrobotanisch-stratigraphische Untersuchungen der südlichen Oberlausitz und die Pollenanalyse als Mittel zur Deutung der Flözengeneese. — Freiberg. Forsch., R. C, **8**, 5—38. Freiberg.
- HUNGER, R. (1954): Zur Stratigraphie und Fazies der Lausitzer Braunkohlen. — Freiberg. Forsch., R. C, **9**, 5—22. Freiberg.
- HURNÍK, S., KNOBLOCH, E. (1966): Einige Ergebnisse paläontologischer und stratigraphischer Untersuchungen im Tertiär Böhmens. — Abh. Staatl. Mus. Mineral. Geol., **11**, 17—161. Dresden.
- KIRCHHEIMER, F. (1937): Grundzüge einer Pflanzenkunde der deutschen Braunkohlen. — Halle/S.
- KIRCHHEIMER, F. (1938): Beiträge zur näheren Kenntnis der Mastixioideen-Flora des deutschen Mittel- bis Oberoligozäns. — Beih. Bot. Zbl., B, **58**, 363—375. Dresden.
- KIRCHHEIMER, F. (1942): Zur Kenntnis der Alttertiärflora von Wiesa bei Kamenz (Sachsen). — Planta, **32**, 4, 418—446. Berlin.
- KREJČÍ, J. (1877): Geologie čili nauka o útvarch zemských se zvláštním ohledem na krajiny československé. — Praha.
- KVACEK, Z. (1971): Fossil Lauraceae in the stratigraphy of the North-Bohemian Tertiary. — Sbor. geol. Věd, Ř. P, **13**, 47—86. Praha.
- MÄDLER, K. (1939): Die pliozäne Flora von Frankfurt am Main. — Abh. Senckenberg. naturforsch. Gesell., **446**, 1—102. Frankfurt/M.
- MAI, D. H. (1960): Über neue Früchte und Samen aus dem deutschen Tertiär-Paläont. Z., **34**, (1), 73—90. Stuttgart.
- MAI, D. H. (1964): Die Mastixioideen-Floren im Tertiär der Oberlausitz. — Paläont. Abh. (Geol. Gesell. DDR) Abt. B, **2**, (1), 1—192. Berlin.
- MAI, D. H. (1970): Subtropische Elemente im europäischen Tertiär. — Paläont. Abh. Geol. Gesell. DDR Abt. B, **3**, (3—4), 441—503. Berlin.
- MAI, D. H. (1971): Über fossile Lauraceae und Theaceae in Mitteleuropa. — Feddes Rep., **82**, (5), 313—341. Berlin.
- MANZEL, P. (1813): Beitrag zur Flora der niederrheinischen Braunkohlenformation. — Jb. Preuss. geol. Landesanst., **1913**, (34), 1—98. Berlin.
- REID, E. M., CHANDLER, M. E. J. (1926): The Bembridge Flora. — Catalogue of Cainozoic Plants in the Department of Geology. British Museum [N. H.] — London.
- VÁCL, J., ČADEK, J. (1962): Geologická stavba hrádecké části Žitavské pánve. — Sbor. Ústř. Úst. geol., Odd. geol., **27**, 331—383. Praha.
- WANG, CHI WU (1961): The forests of China with a survey of grassland and desert vegetation. — Harvard univ. Press. Cambridge.

EXPLANATIONS OF PLATES

PLATE 1

Myrica cestmiri sp. n.: figs. 1—19

1—9, 14: endocarps in various views, sometimes showing the dehiscence (gapping or followed by very fine rib). x12.

11: endocarp with a remain of warted epicarp. x12.

10, 12, 13, 15—18: endocarps showing the general shape of locules as well as the breadth of sutures. 13, 15, 17, 18: with truncate or somewhat emarginate base. x12.

19: average endocarps. x6.

1-G 2483, 2-G 4285, 3-G 4278, 4-G 4274, 5-G 4280, 6-G 4286, 7-G 4279, 8-G 4277, 9-G 4281 holotype, 10-G 4275, 11-G 4282, 12-G 4287, 13-G 4274, 14-G 4288, 15-G 4273, 16-G 4276, 17-G 4270, 18-G 4272, 19-G 3043.

PLATE 2

Cyclocarya nemejcii sp. n.: figs. 1—14

1, 2, 4, 5: endocarps in apical view, more or less splitting. x9.

3, 6, 8: endocarps in basal view, showing a distinct insert scar. x9.

7, 9, 10—12, 14: lateral views, showing the discoid or turbinate shape, pentagonal outline, apical cone and more or less gapping dehiscence-fissure. x9.

13: locule of somewhat compressed endocarp with columnary septum. x9.

1, 11, 13-G 4309 holotype, 2, 3, 9-G 4307, 4, 7—8, 12—14-G 3049, 5, 6, 10-G 4308.

PLATE 3

Ocotea dorofeevii sp. n.: figs. 1—7

Various modes of ripeness and preservation: 1—4: ripe specimens almost without stalk, 5—7: younger or unripe specimens with stalks and slender ribbing. x3. 1, 3 — holotype.

Ternstroemia chandleri sp. n.: figs. 8—13

8, 9, 12: seeds with more or less well preserved papillate warts. x9.

10, 11, 13: internal view, showing very well the hilar cavity, slightly bent condyle, moderately bent micropylar limb, S-curved shorter limb. x9. 8, 9 — holotype.

Cinnamomum zlatkoi sp. n.: figs. 14—16

Compressed cupules, 14, 15: without berry, with many secondarily fissures on the surface. 16: with sitting berry. x4. 16 — holotype.

1, 3-G 4321, 2-G 4324, 4-G 4328, 5-G 4325, 6-G 4322, 7-G 4318, 8, 9-G 4304, 10-G 4300, 11-G 4301, 12-G 4303, 13-G 4302, 14, 15-G 4306, 16-G 4305.

PLATE 4

Rehderodendron custodum sp. n.: figs. 1—20

Fruits in various mode of abrasion and compressing: 7, 9, 10, 12, 14: very compressed fruits. 1, 2, 3, 5, 6, 12—16: with conspicuous, very characteristic perianth disc. 4, 8: cross-section, showing the ledges of endocarp, remains of meso-, epicarp and 1 or 2 locules. 17—20: deeply abraded endocarps. x1. 6. 1 — holotype.

1-G 4326, 2, 4-G 4344, 3-G 4342, 5-G 4336, 6-G 4332, 7-G 4333, 8-G 4343, 9-G 4228, 10-G 4330, 11-G 4329, 12-G 4335, 13-G 4337, 14-G 4327, 15-G 4331, 16-G 4334, 17-G 4311, 18-G 4339, 19-G 4338, 20-G 4330.

PLATE 5

Rutaspermum kristinae sp. n. figs. 1—12

1—5: lateral view showing the ornamentation, more or less hooked keel. 1, 2: with glossy outer coat on the basal and terminal part.

6: broken seed with visible oval chalaza — white ring.

7: longitudinally aligned ornamentation on the dorsal side.

8, 9: seeds splitting for germination. 9: view into the funnel-shaped cavity on the base of hilar scar. 8, 11, 12: ventral view showing the large hilar-scar and the moderate asymmetry of both lateral sides. 10: locule of a broken seed: very broad and flat sub-basal chalaza, curved raphe entering the large cavity in the very thick keel. x13.

1, 2, 8 — holotype.

1, 2, 8-G 4349, 3-G 4315, 4-G 3085, 5-G 4310, 6-G 4320, 7-G 3038, 9-G 4316, 10-G 4319, 11-G 4311, 12-G 4314.

