

FAGACEAE FROM SOŚNICA AND MALCZYCE (NEAR
WROCLAW, POLAND). A REVISION OF ORIGINAL
MATERIALS BY GOEPPERT 1852 AND 1855 AND A STUDY
OF NEW COLLECTIONS

Fagaceae ze Sośnicy i Malczyc. Rewizja oryginalnych materiałów
Goeperta 1852 i 1855 i badania nowych kolekcji

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ABSTRACT. The macrofossils of the family *Fagaceae* from the Neogene flora of Sośnica and Malczyce, derived from Goepert's original materials, were subject to a revision. The macrofossils of this family from the abundant post-war collections were also taken into consideration. A morphological analysis of the remains of leaves and fruits and a cuticular analysis of the remains of leaves show that the flora of Sośnica contained leaves of *Fagus silesiaca* sp. nov., *Quercus gigas* Goep. emend. Walther et Zastawniak, *Q. pseudocastanea* Goep. emend. Walther et Zastawniak, cupules of *Quercus sapperi* (Menzel) Mai ex Hummel and *Q. microcerraecarpa* Kolakovsky and acorns of *Quercus* sp. div. As a result of the revision of the holotype of *Fagus attenuata* Goep. it was found that this leaf belongs to the genus *Alnus*. Therefore beech leaves from Sośnica were named *Fagus silesiaca* sp. nov. and characters of their morphology and anatomy were defined. The leaf impressions from Malczyce represent the taxa *Quercus gigas* and *Q. pseudocastanea*. The lectotype of *Q. pseudocastanea* was indicated and the diagnosis widened by the addition of the epidermal structure. The holotype of *Q. gigas* was indicated and the range of this taxon modified. The species *Q. microcerraecarpa* is new to the Tertiary of Poland.

KEY WORDS: leaves, fruits, *Fagaceae*, Tertiary

INTRODUCTION

Goepert's publications (1852b, 1855) on the leaf flora from Sośnica in Lower Silesia give the impression that the family *Fagaceae* constitutes a significant element of this fossil flora. Such an appraisal was soon called in question by Heer (1856-1859), by

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Table 1. Result of revision of fossil remains of *Fagaceae* illustrated in the paper of H. R. Goepfert "Die tertiäre Flora von Schossmitz in Schlesien" (1855) by the previous author and in this paper

Determination of Goepfert 1855	Pl./fig. in Goepfert 1855	No in the collection MGUWr	Result of revision	Authors
<i>Fagus attenuata</i> Goepfert	5/9	2584p	<i>Alnus julianaeformis</i> (Stemb.) Kvaček et Holý	this paper
<i>Fagus inaequalis</i> Goepfert	5/10	740p + 818p	non <i>Fagaceae</i>	Reichenbach 1919, p. 126
<i>Fagus dentata</i> Goepfert	5/11	556p	<i>Alnus</i> sp.	it is being studied
<i>Castanea atavia</i> Ung.	5/12	847p	<i>Zelkova zelkovaefolia</i> (Unger) Bůžek et Kotlaba	Heer 1855, p. 60 (as <i>Planera ungeri</i> Ett.)
" "	5/13	843p	" "	" "
<i>Quercus serraefolia</i> Goepfert	5/14	lost	<i>Carya serraefolia</i> (Goepfert) Kräusel	Kräusel 1920, p. 389
<i>Q. microphylla</i> Goepfert	6/1	lost	non <i>Fagaceae</i>	Reichenbach 1919, p.135
" "	6/2	755p	" "	" "
" "	6/3	746p	" "	" "
<i>Q. semielliptica</i> Goepfert	6/4	754p	<i>Zelkova zelkovaefolia</i> (Unger) Bůžek et Kotlaba	Heer 1856, p. 44 (as <i>Planera ungeri</i> Ett.)
" "	6/5	lost	" "	" "
<i>Q. ovalis</i> Goepfert	6/6	lost	non <i>Fagaceae</i>	" " - p. 19
<i>Q. similis</i> Goepfert	6/7	lost	non <i>Fagaceae</i>	Reichenbach 1919, p. 135
<i>Q. integrifolia</i> Goepfert	6/8	lost	" "	Heer 1856, p. 44
<i>Q. fagifolia</i> Goepfert	6/9	lost	<i>Parrotia pristina</i> (Ett.) Stur	Reichenbach 1919, p. 136, 139
" "	6/10	750p	" "	" "
" "	6/11	747p	" "	" "
" "	6/12	lost	" "	" "
<i>Q. triangularis</i> Goepfert	6/13	753p	" "	" "
" "	6/14	lost	" "	" "
" "	6/15	749p	" "	" "
" "	6/16	751p	" "	" "
" "	6/17	748p	" "	" "
<i>Q. undulata</i> Goepfert	7/1	lost	" "	" "
" "	7/2	761p/1+2	" "	" "
<i>Q. platyphylla</i> Goepfert	7/3	lost	non <i>Fagaceae</i>	" " - p. 135

cont.

Table 1. Continued.

Determination of Goeppert 1855	Pl./fig. in Goeppert 1855	No in the collection MGUWr	Result of revision	Authors
<i>Q. platyphylla</i> Goeppert	7/4	lost	non <i>Fagaceae</i>	Heer 1856, p. 44
<i>Q. platanoides</i> Goeppert	7/5	756p	<i>Platanus leucophylla</i> (Unger) Knobloch	- " - p. 71 (as <i>Platanus aceroides</i> Goepp.)
- " -	7/6	758p	- " -	- " -
<i>Q. subrobur</i> Goeppert	7/7	lost	<i>Zelkova zelkovaefolia</i> (Unger) Bůžek et Kotlaba	Reichenbach 1919, p. 136 (as <i>Zelkova ungeri</i> Kov.)
- " -	7/8	759p	- " -	Heer 1856, p. 60 (as <i>Planera ungeri</i> Ett.)
- " -	7/9	757p	- " -	- " -
- " -	7/10	760p	- " -	Reichenbach 1919, p. 136 (as <i>Zelkova ungeri</i> Kov.)
Fructus <i>Q.</i>	7/11 *	lost	non <i>Fagaceae</i>	this paper
<i>Quercus crassinervia</i> Goeppert	8/1	lost	<i>Quercus gigas Goeppert</i> emend. Walther et Zastawniak	- " -
<i>Q. gigas</i> Goeppert	8/2	742p (twin impression)	- " -	- " -
<i>Q. venosa</i> Goeppert	8/3	lost	non <i>Fagaceae</i>	Reichenbach 1919 p. 135
<i>Q. attenuata</i> Goeppert	8/4	743p	<i>Alnus julianaeformis</i> (Stemb.) Kvaček et Holý	Knobloch & Kvaček 1976, p. 29
- " -	8/5	lost	- " -	- " -
<i>Q. microdonia</i> Goeppert	8/6	744p	<i>Carya serraefolia</i> (Goeppert) Kräusel	-
<i>Q. acuminata</i> Goeppert	8/7	lost	non <i>Fagaceae</i>	Reichenbach 1919, p. 135
<i>Q. ovata</i> Goeppert	8/8	lost	<i>Alnus</i> sp.	It is being studied
<i>Q. rotundata</i> Goeppert	8/9	745p	<i>Platanus leucophylla</i> (Unger) Knobloch	Heer 1856, p. 71 (as <i>Platanus aceroides</i> Goepp.)
Semen <i>Querc.</i>	26/21	lost	non <i>Fagaceae</i>	this paper
- " -	26/22	lost	- " -	- " -
- " -	26/23	lost	<i>Quercus</i> sp. div.	- " -
- " -	26/24	lost	- " -	- " -
- " -	26/25	lost	- " -	- " -

Goeppert himself (1861, p. 197) and Ettingshausen (1872) because of the incorrectness of some of Goeppert's identifications (comp. Table 1). As a matter of fact, the *Fagaceae* play a secondary role in the Sośnica flora both in quantitative respect and as regards their specific differentiation. On the basis of the results obtained from the studies of the Tertiary floras of Silesia Reichenbach (1919) and Kräusel (1920) found that leaves of the species *Castanea atavia* Ung., *Quercus pseudocastanea* Goepp. and *Fagus attenuata* Goepp. occur at Sośnica (Schossnitz) and in several other sites in Silesia: Malczyce (Malsch), Kokoszyce (Kokoschütz), Brzeg Dolny (Dyhernfurth) and Trzebnica (Treb-nitz). The identifications of leaves were based exclusively on morphological characters.

The present study deals with fossil specimens from Sośnica and Malczyce from Goeppert's original material and new collections (Łańcucka-Środoniowa et al. 1981). The remains of *Fagaceae* leaves from the other sites in Silesia, studied by Reichenbach (1919) and Kräusel (1921), have not been found in the collections of the Geological Museum, Wrocław University, after 1945.

MATERIAL AND METHODS

Plant remains from Sośnica and Malczyce are preserved as impressions with the carbonized organic matter present only in the form of small fragments. Before the present study was undertaken most specimens in all collections were coated with varnish dissolved in acetone. Both these circumstances made the determination of the epidermal structures extremely difficult, systematic sampling being possible only in exceptional cases. Best results were obtained by treating the samples with hydrofluoric acid (HF) and maceration in Schulz's mixture (cf. Walther 1972). In this way the authors partly managed to isolate organic matter attached to the varnish film.

The fossil specimens and cuticular preparations come from the following collections: Geological Museum, Wrocław University, Wrocław (MGUWr), W. Szafer Institute of Botany, Polish Academy of Sciences, Cracow (IB), Museum of the Earth, Polish Academy of Sciences, Warsaw (MZ), Paläontologisches Museum, Museum für Naturkunde der Humboldt-Universität zu Berlin (MP), Staatliches Museum für Mineralogie und Geologie zu Dresden (MMG).

DESCRIPTION OF TAXA

Fagus L.

Fagus silesiaca sp. nov.

Pl. 1, figs 1-6, Pl. 2, fig. 1; Fig. 1

Holotypus. Specimen No MZ. VII/53/239, prep. MMG, So 1/79-4/79, Pl. 1, figs 1, 4-6; Fig. 1: 1; Museum of the Earth, Polish Academy of Sciences, Warsaw.

Topotypi. Specimens No 54/396 IB, No 820p/2 MGUWr, No 1825p MGUWr, Pl. 1, fig. 2, 3, Pl. 2, fig. 1; Fig. 1: 2-6.

Locus typicus. Sośnica, Wrocław voivodship, Lower Silesia, Western Poland.

Stratum typicum. Poznań series, variegated clay horizon, Upper Miocene.

Derivatio nominis. After the name of the region of Silesia.

Diagnosis. Leaf simple, slightly asymmetrical, elliptic, 5.8 cm long and 3.0 cm

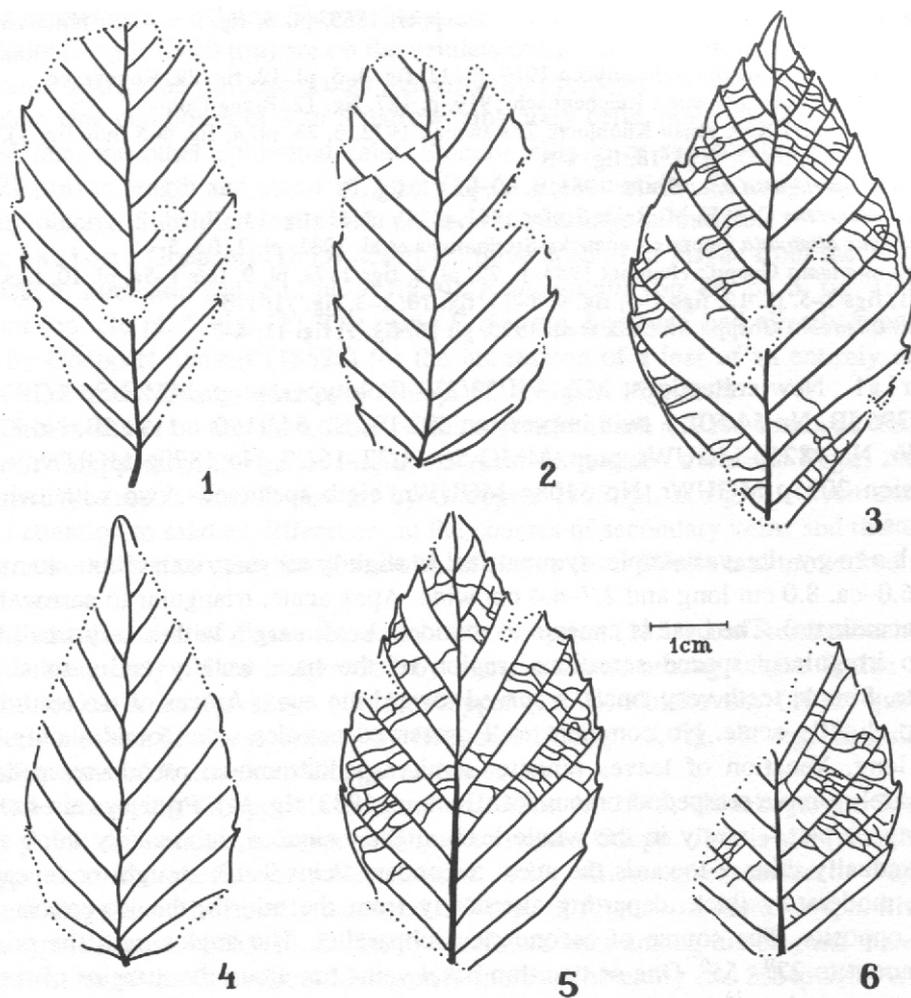


Fig. 1. Leaves of *Fagus silesiaca* Walther et Zastawniak sp.nov. from Sośnica. 1 – holotype, No MZ. VII/53/239, 2 – topotype, No 1825p MGUWr, 3 – topotype, No 54/396 IB, 4 – topotype, No 1878p MGUWr + twin impression No 2095p MGUWr, 5 – topotype, No 820p/2 MGUWr, 6 – topotype No 54/501 IB + twin impression No 54/502 IB

wide. Apex presumable acute, basis rounded cuneate. Leaf margin serrate, teeth small, regularly spaced, region of the base entire. Venation pinnate, semicraspedodromous, primary vein straight, in the upper part slightly sinuous, 10 pair of secondary veins. Leaf hypostomatous. Upper epidermis with isodiametric to rectangular, rounded to undulate-walled cells. Simple trichome bases rarely on the veinlets. Lower epidermis cells the same shape as the upper ones. Stomatal apparatus in loose groups, imperfectly cyclocytic, subsidiary cells narrow 3 to 5. Stomatal apparatus 15–22 μm in length and 12–21 μm in width. Simple trichome bases distributed on veinlets, uniseriate glandular hairs on the veinlets or in intercostal files.

- = *Fagus attenuata* auct. (non *Fagus attenuata* Goepfert 1855, pl. 5, fig. 9 = *Alnus julianaeformis* (Sternb.) Kvaček et Holý.
- = *Fagus attenuata* Goepf.: Reichenbach 1919, pl. 11, fig. 4, 5, pl. 12, fig. 22, Kokoszyce non *Fagus attenuata* Goepf.: Reichenbach 1919, p. 127, fig. 12, Brzeg Dolny
- = *Fagus haidingeri* Kov. sensu Knobloch: Zastawniak 1972, p. 23, pl. 4, fig. 4–5 (non fig. 3), pl. 5, fig. 1–6, pl. 17, fig. 5, 6, pl. 18, fig. 1–5
- = *Fagus cf. ferruginea* Ait.: Szafer 1961, p. 40, pl. 11, fig. 11
- = *Fagus decurrens* C. et E. M. Reid: Szafer 1961, p. 40, pl. 11, fig. 14 non *Fagus attenuata* Goepf.: Łańcucka-Środoniowa et al. 1981, pl. 2, fig. 5
- = *Fagus attenuata* Goepf.: Hummel 1983, p. 22, pl. 8, figs 1–7a, pl. 9, figs 1–5a, pl. 10, figs 1–6a, pl. 11, figs 1–5, pl. 12, figs 1–5; fig. 9: 1–25, fig. 10: 1–3, fig. 11: 1–5
- = *Fagus attenuata* Goepf.: Stuchlik et al. 1990, pl. 10, fig. 1; fig. 11: 4–7

Material. New collections: MZ. VII/53/239 (holotype), prep. MMG So 1/79–4/79; No 54/396 IB, No 54/501 + twin impression 502 IB, No 54/1190 + 1191 IB, No 820p/2 MGUWr, No 1825p MGUWr, prep. MMG So 14/77–16/77, No 1878p MGUWr + twin impression 2095p MGUWr, No 5108p MGUWr; eighth specimens, two with twin impressions.

Morphology. Leaves simple, symmetrical to slightly asymmetrical, elliptic to narrow ovate, 6.0–ca. 8.0 cm long and 2.7–4.4 cm wide. Apex acute, triangular to narrow triangular (acuminate). The base is cuneate to rounded. Leaf margin with a very small regularly to irregularly spaced serrations, region of the base usually entire to slightly undulate. Simple teeth very small, recurved toward the apex. Apices of the teeth triangular to slightly acute. No complete well preserved petioles were found – only parts 2 mm long. Venation of leaves pinnate, semicraspedodromous, pseudo-craspedodromous, rarely simple craspedodromous (cf. Hummel 1983, fig. 11). Primary vein straight, in the upper part – rarely in the whole leaf – slightly sinuous, moderately thick at the base, gradually thinner towards the apex. Secondary veins 9–10, straight or repeatedly curved, moderately thick, departing alternately from the midrib, the lowermost pairs mostly opposite. The course of secondaries subparallel. The angles with the primary vein amount to 27°–55°. One or two thin basal veins run along the margins of the leaf base. Intersecondary veins not present. The tertiary veins poorly preserved, thinner than the secondaries, simple or, more frequently, forked, 11 to 14 per 1 cm of the length of the secondary vein. At the leaf margin the tertiaries form small loops with higher order veins.

Anatomy. The cuticle is delicate and difficult to prepare. Only small fragments are preserved. The upper epidermis (Pl. 1, fig. 4) is composed of isodiametric to rectangular, rounded to undulate-walled epidermal cells. Surface ornamentation lacking. The cells are about 25 µm to 45 µm across. Simple trichome bases (mean diameter 9–10 µm) occur rarely on the upper epidermis of the veinlets. These bases are characterized by the deposition of cutin of considerable thickness in the cuticular flanges marking the boundary between the basal cell and the surrounding epidermal cells. The leaves are hypostomatous. The lower cuticle (Pl. 1, fig. 5, 6) is thin and extremely fragile. The lower epidermal cells have the same shape as the upper epidermal cells, but are somewhat smaller. Simple trichome bases are distributed on the veinlets. They are thick-walled,

with a diameter of 7–10 μm . Narrow bases with uniseriate remains of glandular filamentous hairs (length: 7–10 μm) are on the veinlets or between the epidermal cells. Stomatal apparatus distributed in loose groups, imperfectly cyclocytic, surrounded by a single incomplete ring composed of 3 to 5 narrow subsidiary cells, much smaller and more cutinised than the other epidermal cells. Stomata elliptic or subcircular, about 17.9 μm (15–22 μm) in length and about 16.7 μm (12–21 μm) in width. Stomatal ledge aperture usually oblong. Subsidiary cells with uniform thickenings of cuticle.

Discussion. Goepfert (1855) described three species of *Fagus* from the Tertiary of Sośnica: *F. attenuata* (op. cit., pl. 5, fig. 9), *F. inaequalis* (op. cit. pl. 5, fig. 10) and *F. dentata* (op. cit. pl. 5, fig. 11). The name *F. dentata*, however, had already been earlier used by Goepfert himself (1852a) for the impression of a leaf of an entirely different type found in the locality Malczyce (comp. Pl. 4, fig. 1; Fig. 4: 2).

In his revision of the flora from Sośnica Reichenbach (1919) removed *Fagus inaequalis* Goepf. from the genus *Fagus*; however he retained the name *Fagus attenuata* and synonymized it with *F. dentata* by Goepfert 1855, pl. 5, fig. 11, even though he called attention to marked differences in the courses of secondary veins and the shape of margins in relation to other fossil remains of *Fagus* from Silesia and to modern species of this genus.

The identification of *Fagus* leaves by both Goepfert (1855) and Reichenbach (1919) were subsequently called in question by many authors, among others Tralau (1962), Kryshtofovich & Baykovskaya (1965), Kilpper (1971). Kolakovsky (1972) questioned the determination of *Fagus dentata* by Goepfert 1855, pl. 5, fig. 11, regarding the other identifications of *F. attenuata* Goepf. as correct.

While surveying Goepfert's original materials in 1975, Iliinskaya (in Takhtayan 1982, p. 65) did not find holotype of *Fagus attenuata* Goepf. This is why she chose the neotype from the specimens collected after 1945, which corresponded to Goepfert's original diagnosis. The heavily damaged holotype of *Fagus attenuata* Goepf. illustrated in Goepfert's paper (1855, pl. 5, fig. 9) was found later among his original materials in the collection of the Geological Museum, Wrocław University (No 2384p MGUWr, Fig. 2, cf. Łańcucka-Środoniowa et al. 1981, pl. 3, fig. 5). Detailed investigation of this specimen has proved that it is a leaf of alder (*Alnus julianaeformis* (Sternb.) Kvaček et Holý). A fine hook-shaped tooth can be seen in the apical part of the leaf and single triangular main tooth and subsidiary teeth are preserved at basal part of the leaf. The secondary veins fork in their course, the leaf base is cuneate, with thin vein parallel to it. Neither Goepfert (1855) nor Reichenbach (1919) took these features into consideration. Since the foregoing characters exclude the reference of this leaf to the genus *Fagus*, the specimen illustrated by Goepfert (1855, pl. 5, fig. 9) cannot be the type of that species. Therefore it was necessary to designate a new holotype and create the new name *Fagus silesiaca*. Regarding both morphology and anatomic structure, the leaf specimens from Sośnica quite agree with the leaves described as *Fagus attenuata* Goepf. from the Pliocene flora of Ruszów (Hummel 1983).

The presence of this fossil beech species is proved by the epidermal structures and characteristic morphological features of leaves in the Tertiary of Europe starting from

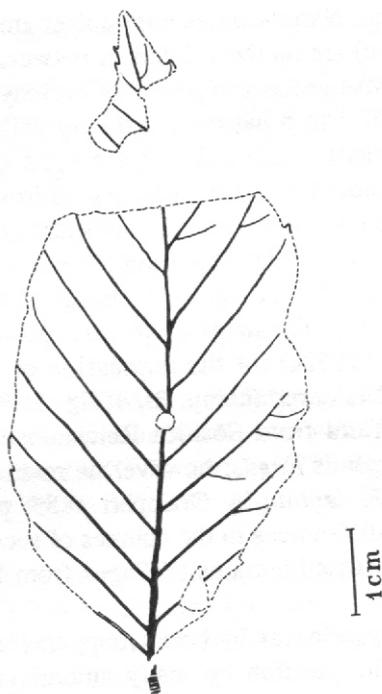


Fig. 2. *Alnus julianaeformis* (Stemb.) Kvaček et Holý. The original of „*Fagus attenuata* Goepfert, No 2584p MGUWr (Goepfert 1855, pl. 5, fig. 9, Reichenbach 1919, p. 127, fig. 13)

the Upper Oligocene. It was a component of the then prevailing Arcto-Tertiary deciduous geoflora. Kvaček & Walther (1989) regard *Fagus attenuata* Goepf. (= *F. silesiaca* sp. nov.) as an evolutionary lineage, which occurred in Europe from the Upper Oligocene to the Upper Pliocene (Mai & Walther 1988), the leaves of this species being characterized by the limited variability of morphological characters and the identical structure of epidermis.

Quercus L.

Section *Cerris* Oersted – leaves

Quercus gigas Goepfert emend. nov.

Pl. 4, fig. 1–3, Pl. 5, 6, 7, fig. 1–3, pl. 8–10; Fig. 3–7

Isotype. Specimen No 742p MGUWr, Pl. 8, fig. 1, twin impression of the specimen of *Quercus gigas* Goepfert 1855, pl. 8, fig. 2.

- = *Myrica deperdita* Ung.: Unger 1849, p. 3, pl. 13, fig. 2
- = *Quercus furcinervis* Ung.: Unger 1849, p. 3, pl. 13, fig. 5
- = *Quercus grandidentata* Ung.: Unger 1849, p. 3, pl. 13, fig. 6, 7
- = *Fagus dentata* Goepfert 1852a, p. 274, pl. 34, fig. 3 (Malczyce, No 2839 MGUWr, pl. 4, fig. 1, Fig. 4: 2)
- = *Castanea atavia* Ung.: Goepfert 1852a, p. 274, pl. 34, fig. 4 (Malczyce)

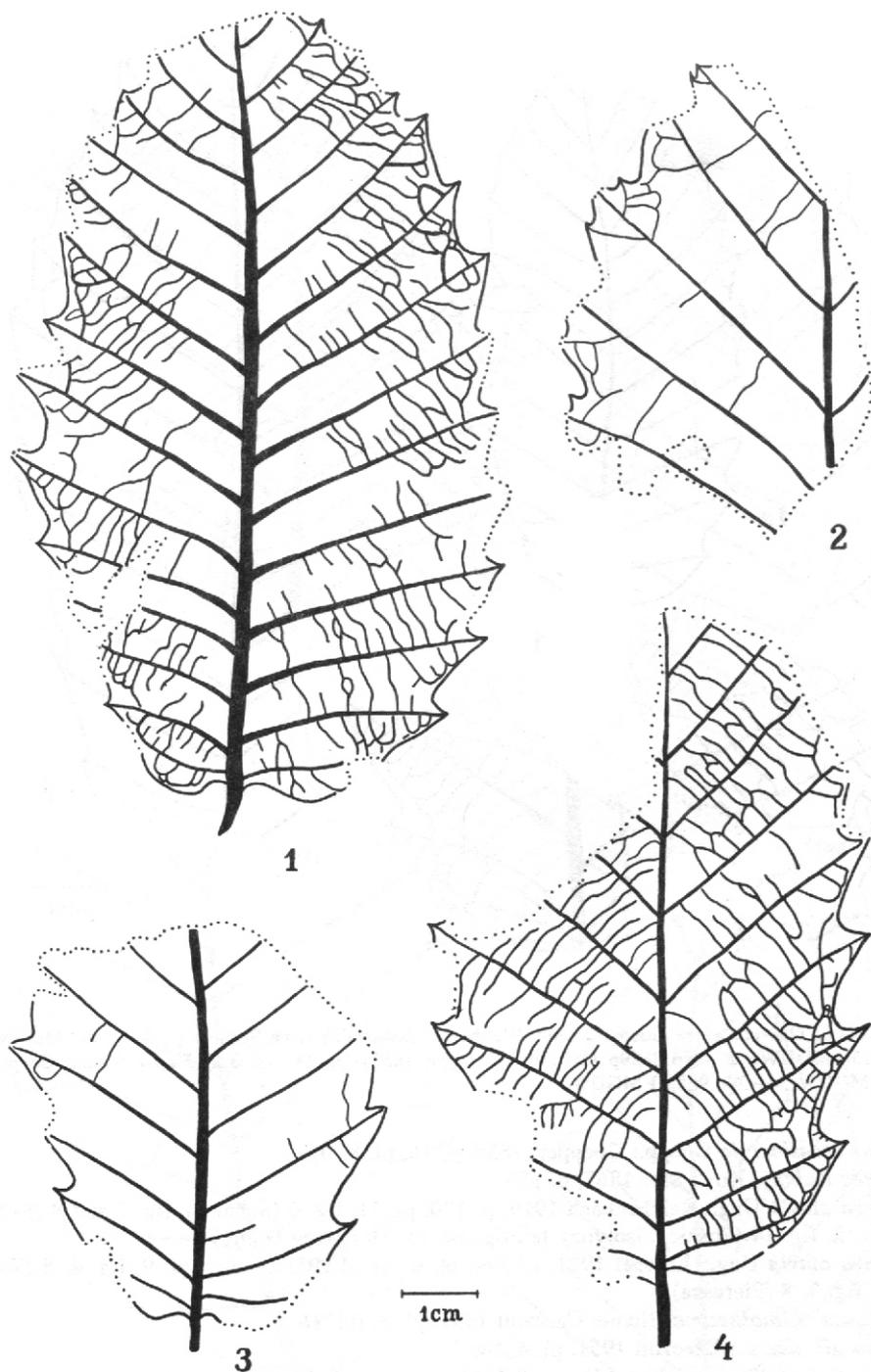


Fig. 3. Leaves of *Quercus gigas* Goep. emend. Walther et Zastawniak from Sošnica. 1 – izotype, No 742p MGUWr, twin impression of Goepert's original (Goepert 1855, pl. 8, fig. 2; Reichenbach 1919, as *Castanea atavia* Ung., pl. 12, fig. 14), 2 – No 1011p/19 MGUWr, 3 – No 54/389 IB, 4 – sine numero, MP, as *Castanea atavia* Ung.

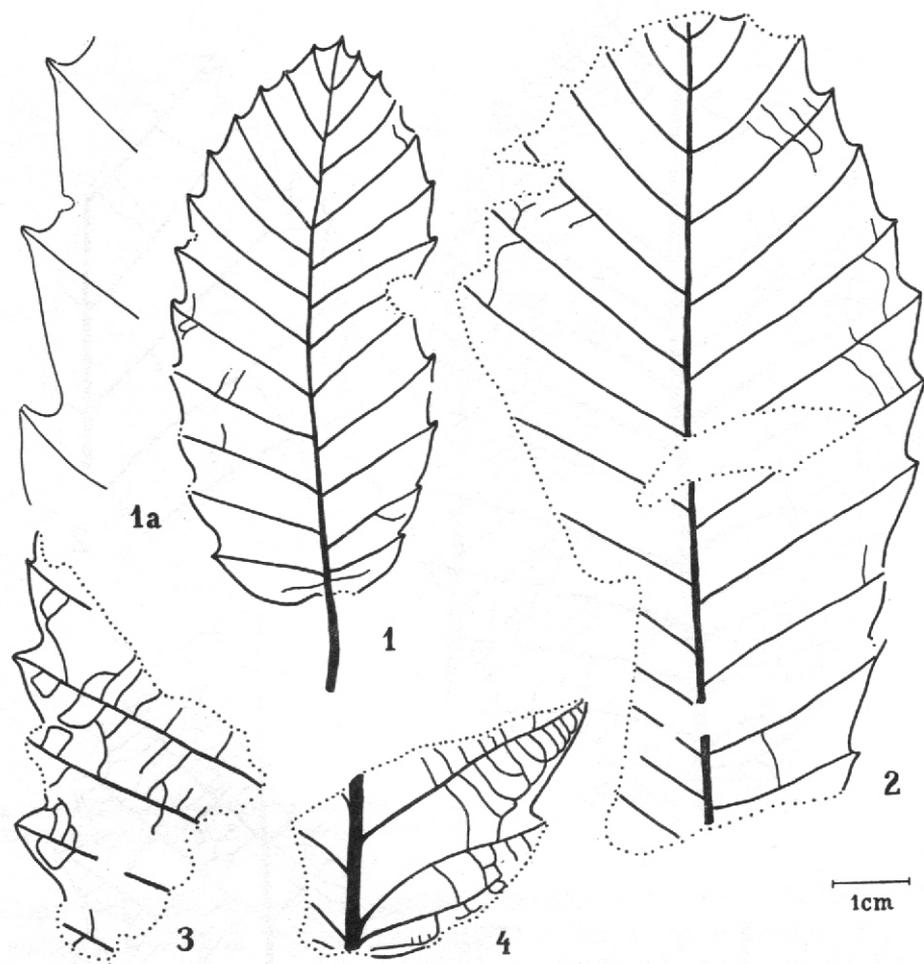


Fig. 4. Leaves of *Quercus gigas* Goep. emend. Walther et Zastawniak from Sońnica (1, 3, 4) and Malczyce (2). 1 – No 1073p MGUWr, 2 – No 2839p MGUWr (Goepfert 1852a, pl. 34, fig. 3 as *Fagus dentata* Goep.), 3 – No 982p/4 MGUWr, 4 – No 968p/1 MGUWr

- = *Quercus crassinervia* Goep.: Goepfert 1855, p. 16, pl. 8, fig. 1
- = *Castanea Kubinyi* Kov.: Stur 1867, p. 156
- = *Castanea atavia* Ung.: Reichenbach 1919, p. 130, pl. 11, fig. 6 (Sońnica), fig. 7 and 8 (Kokoszyce), pl. 12, fig. 14 (Sońnica, isotype), textfig. 14, 15, 16 (Brzeg Dolny)
- = *Castanea atavia* Ung.: Kräusel 1921, p. 396, pl. 6, fig. 4 (Bluszczów), pl. 9, fig. 4, 5 (Wołów), pl. 13, fig. 7, 8 (Pierusza)
- = ? *Castanea* cf. *mollissima* Blume: Czechtz 1951, pl. 3, fig. 16
- = *Quercus* aff. *ilex* L.: Czechtz 1951, pl. 4, fig. 1
- = *Castanea* cf. *mollissima* Blume: Czechtz 1951, pl. 4, fig. 2–6
- = *Quercus* aff. *libani* Oliv. (= *Quercus Kubinyi* Kov.): Czechtz 1951, pl. 5, fig. 1–8, 9–15
- = *Quercus* aff. *libani*?: Czechtz 1951, pl. 5, fig. 9
- = *Aesculus* aff. *hippocastanum* L.: Czechtz 1951, pl. 12, fig. 1 (MZ. 6/III/230)
- = *Castanea* cf. *mollissima* Blume: Szafer 1961, p. 40, pl. 11, fig. 6, 7

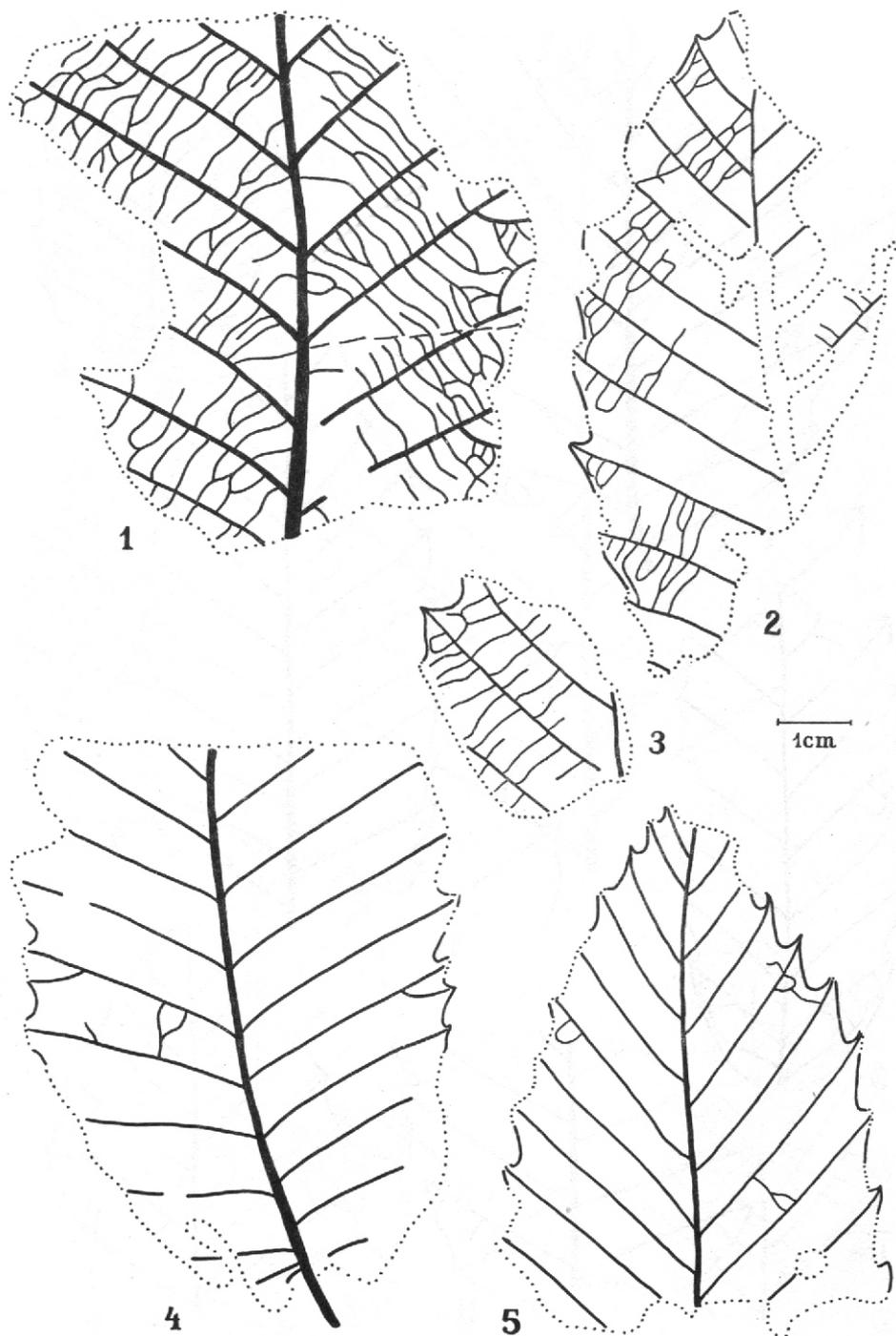


Fig. 5. Leaves of *Quercus gigas* Goep. emend. Walther et Zastawniak from Sośnica. 1 – No 1010p/7 MGUWr, 2 – No 551p MGUWr, 3 – No 982p/9 MGUWr, 4 – No 54/390 IB + twin impression No 54/391 IB, 5 – No 675p/8 MGUWr

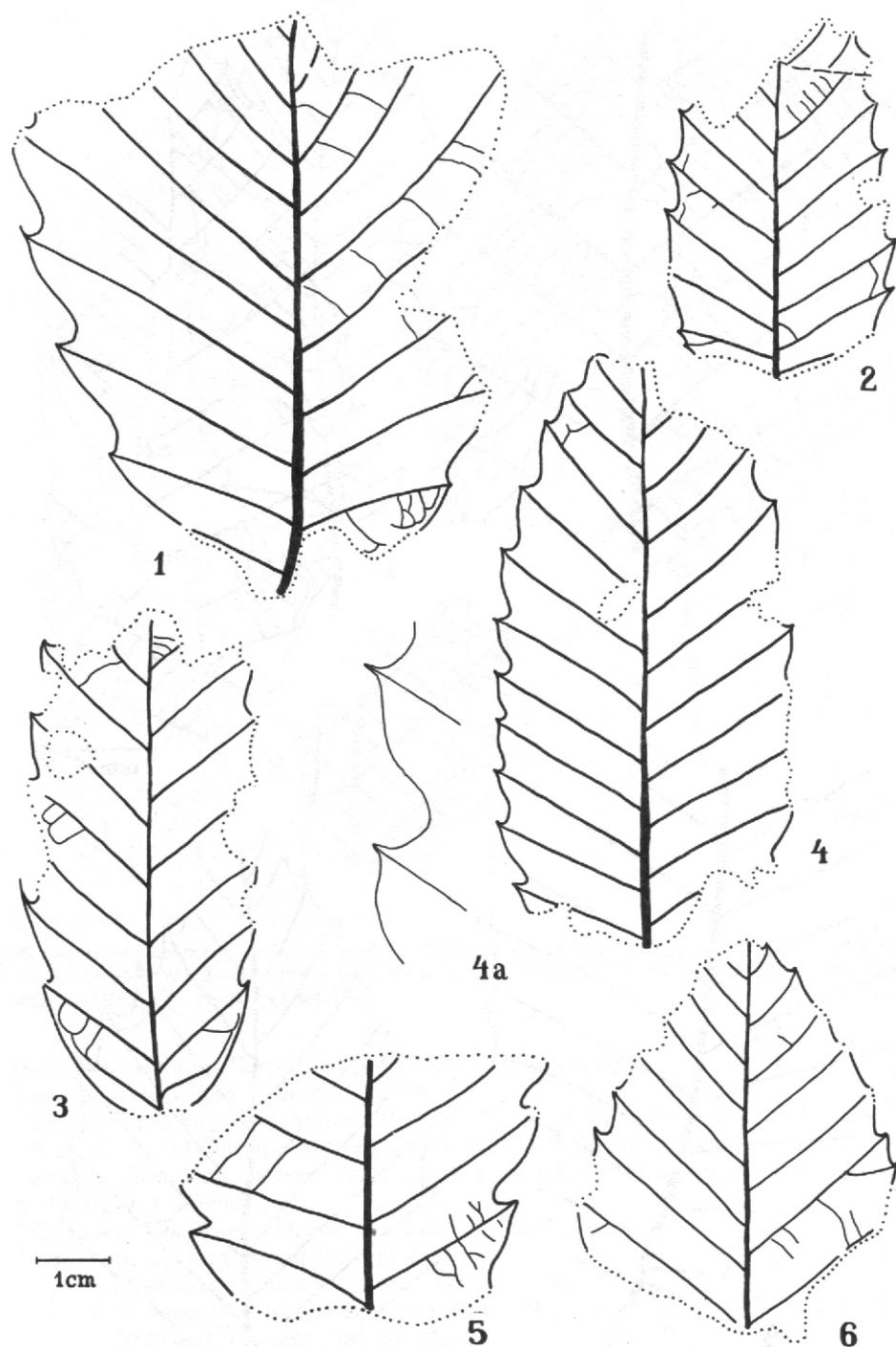


Fig. 6. Leaves of *Quercus gigas* Goepp. emend. Wölther et Zastawniak from Sośnica. 1 – No 1072p MGUWr, 2 – No 2362p MGUWr, 3 – No 1403p MGUWr, 4 – No 911p MGUWr, 4a – enlargement of teeth, x 6, 5 – No 54/554 1B, 6 – No 1169p MGUWr

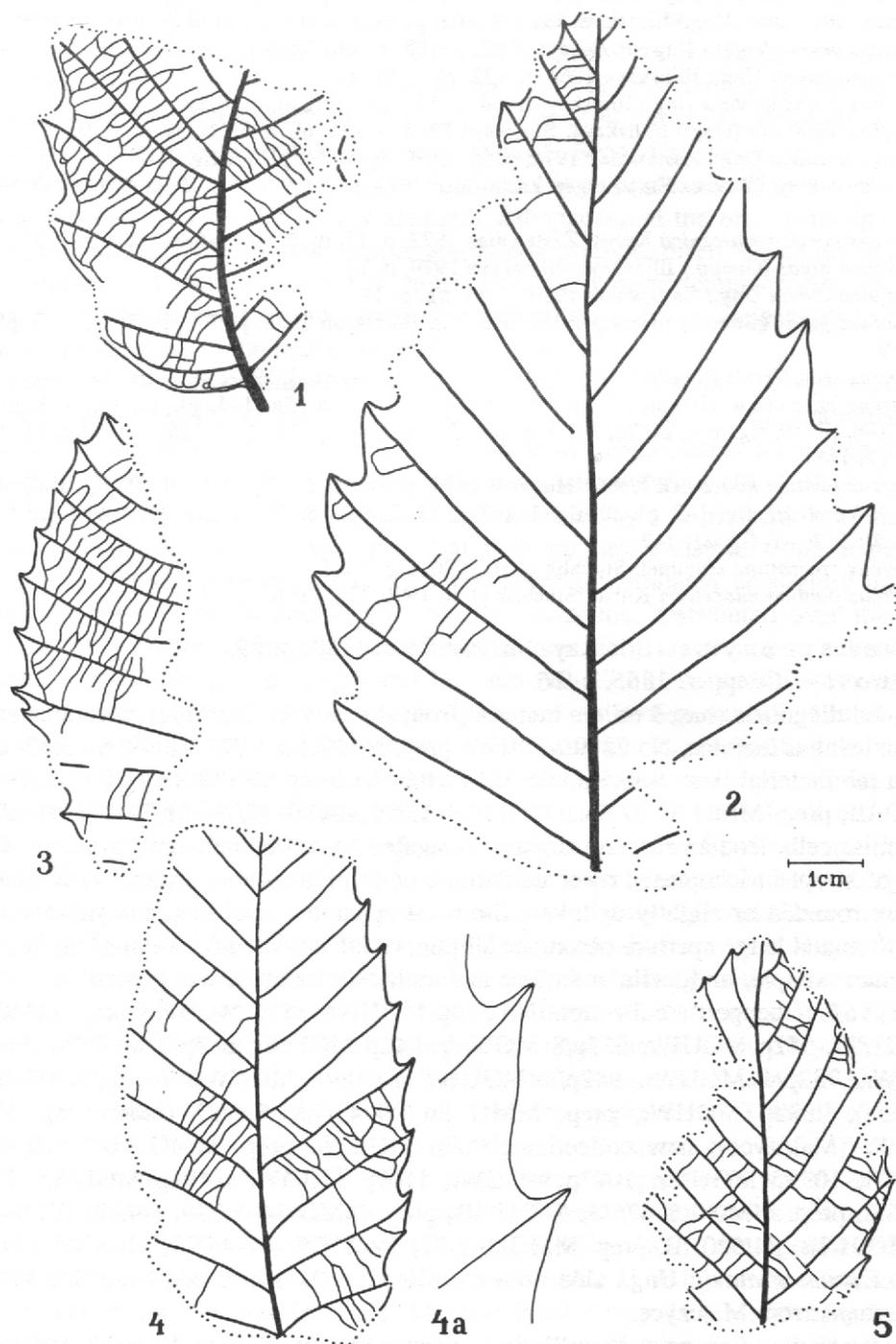


Fig. 7. Leaves of *Quercus gigas* Goepf.emend. Walther et Zastawniak from Sońnica. 1 – No 907p MGUWr, 2 – No 54/311 IB, 3 – No 510p MGUWr, 4 – No 54/500 IB, 4a – enlargement of teeth, x 6, 5 – No 552p MGUWr, with original Goepfert's label *Quercus gigas*

- = *Quercus Kubinyi* Kov. (= *Q. libani* Oliv. foss.): Szafer 1961, p. 42, pl. 12, fig. 4–6
- = *Quercus deperdita* (Ung.) Illinskaya 1962, p. 105, pl. 10, fig. 6
- = *Quercus grandidentata* Ung.: Illinskaya 1962, p. 105, pl. 10, fig. 1
- = *Castanea atavia* Ung.: Illinskaya 1964, p. 132, pl. 6, fig. 8
- = *Quercus grandidentata* Ung.: Illinskaya 1964, p. 133, pl. 1, fig. 4, pl. 6, fig. 1
- = *Quercus deperdita* (Ung.) Illinskaya: Illinskaya 1964, p. 134, pl. 1, fig. 5, 5a, pl. 6, fig. 5
- = *Castanea atavia* Ung.: Zastawniak 1972, p. 21, pl. 4, fig. 8–14, pl. 17, fig. 1–4
- = *Quercus kubinyi* (Kov. ex Ett.) Berger: Zastawniak 1972, p. 26, pl. 4, fig. 15, pl. 5, fig. 7, 8, pl. 21, fig. 1–3
- = *Quercus pontica miocenica* Kubát: Zastawniak 1972, p. 27, pl. 6, fig. 3–6, pl. 20, fig. 1–3
- = *Castanea gigas* (Goep.) Illinskaya: Illinskaya 1980, p. 23
- = *Castanea atavia* Ung.: Zastawniak 1980, p. 50, fig. 5: 11
- = *Castanea gigas* (Goep.) Illinskaya: Illinskaya, in Takhtayan 1982, p. 75, pl. 33, fig. 1–3, pl. 37, fig. 9
- = *Quercus* sect. *Cerris* (Spach) Oerst.: Łańcucka-Środoniowa et al. 1981, pl. 2, fig. 1a
- = *Quercus czeczottiae* Hummel: Hummel 1983, p. 34, pl. 16, fig. 1–4, pl. 17, fig. 1–3, pl. 18, fig. 1–8, pl. 19, fig. 1–6, pl. 20, fig. 1–4, pl. 21, fig. 1–6; fig. 14: 2, fig. 15: 1–16, fig. 16: 1–10, fig. 17: 1–11
- = *Quercus pontica miocenica* Kubát: Hummel 1983, p. 44, pl. 26, fig. 1–6, pl. 27, fig. 1–6, pl. 28, fig. 1–42, pl. 29, fig. 1–5, pl. 30, fig. 1–4; Fig. 13: 2, fig. 16: 11, 12, fig. 18: 1–9, fig. 19: 1–7, fig. 20: 1, 22–7, fig. 21: 1–7
- = *Quercus czeczottiae* Hummel: Stuchlik et al. 1990, Fig. 12: 5
- = *Quercus pontica miocenica* Kubát: Stuchlik et al. 1990, Fig. 11: 8

Further synonyms. Illinskaya, in Takhtayan 1982, p. 75.

Diagnosis. Goepfert 1855, p. 16.

Expanded diagnosis (based on the material from the locality Malczyce, the same stratigraphic level as Sośnica, No 2839 MGUWr, prep. MMG So 39/79–43/79, So 5/87–6/87, and on the material from Sośnica, No 551p MGUWr, prep. MMG So 9/79 – 21/79; No 54/500 IB, prep. MMG So 1/77–3/77, 14/79–15/79, 44/79–45/79, 51/79–53/79). Upper epidermis: cells isodiametric or slightly elongated to hexagonal, not numerous small bases of simple trichomes. Lower epidermis: cells of the same shape, walls of cells straight, rounded or slightly undulate. Stomatal apparatus rarely anomocytic or cyclocytic. Stomatal ledge aperture oblong or elliptic, small T-shaped thickenings are present. Trichomes: simple, multicellular stellate and multicellular uniseriate glandular.

Material. Goepfert's collection, No 510p MGUWr, 551p MGUWr, prep. MMG So 9/79–21/79, 552p MGUWr, 675p/8 MGUWr, 742p MGUWr, 888p/2 MGUWr, 968p/1 MGUWr, 982p/4 MGUWr, 982p/9 MGUWr, 1010p/7 MGUWr, 1011p/19 MGUWr (Sośnica), 2839p MGUWr, prep. MMG So 39–43/79, 5–6/87 (Malczyce), 5195p MGUWr (Malczyce); new collections: 907p MGUWr, prep. MMG 26–39/79, 911p MGUWr, 1072p MGUWr, 1073p MGUWr, 1169p MGUWr, 1403p MGUWr, 2362p MGUWr, prep. MMG 45–47/77, 54/311 IB, prep. MMG 54–57/79, 54/389 IB, 54/390 IB, 54/391 IB, 54/500 IB, prep. MMG 1–3/77, 14–15/79, 44–45/79, 51–53/79, 54/554 IB; as *Castanea atavia* Ung., sine numero, MP (2x). 24 specimens from Sośnica and 2 specimens from Malczyce.

Morphology. Leaves ovate, elliptic to narrow obovate, 7.5–ca 13 cm in length and 3.0–7.5 cm in width, with acute apex and rounded or subcordate base. Leaf margin simple

serrate, sometimes dentate, entire at the base. Teeth mostly large, upcurved, up to 5 mm high and 14 mm wide at the base, acute or acuminate, sometimes end in a bristle. Apical angle of teeth acute or almost right. Apical sides of teeth concave, basal sides convex or acuminate. Sinuses between teeth rounded and more or less shallow. Small additional teeth are visible on some specimens (Fig. 3: 2, Fig. 5: 4, Fig. 7: 3). Venation craspedodromous. Primary vein straight, tapering upward. Secondary veins up to 14 pairs, branching from midvein at intervals of 6–15 mm at an angle of 60° (basal region) to 26° (apical region). They are mostly alternate, subopposite at the base, running straight or slightly curved. Tertiary veins percurrent, almost straight, often branch and join each other midway between the secondary veins. They are \pm perpendicular to the secondary veins. Very characteristic are the short branches of secondaries, subparallel to sinuses between teeth, close to the leaf margin (Fig. 3: 1, 4).

Anatomy. Cuticle sometimes well preserved but difficult to laboratory preparation. Upper epidermis. Cells isodiametric or slightly elongated to hexagonal. Anticlinal walls straight or rounded, slightly cutinized, 8–34 μm across. Small bases with thick walls of simple trichomes rare on the upper leaf surface. Lower epidermis (Pl. 5, Pl. 6, fig. 4, 5, Pl. 7, fig. 2, 3). The lower leaf surface is characterized by a large quantity of different trichome elements. Therefore the epidermal cells are hardly visible. Cells of the same shape as the upper epidermis cells. Cell walls straight, rounded or slightly undulate. Stomatal apparatus rarely anomocytic, mostly cyclocytic, distributed over the whole epidermis, sometimes forming groups of two or four. They are oblong to suborbicular, about 25 μm (17–35 μm) in length and 19.4 μm (12–29 μm) in width. Stomatal ledge aperture usually oblong or elliptic, small. Epidermal walls of guard cells thin. T-shaped thickenings rarely preserved. Sporadic, up to 5 subsidiary cells surrounding the stomatal apparatus. Hairs of various types are frequent. Most frequent are multicellular stellate trichomes with circular or slightly elongated bases varying in size. Small bases about 10–15 μm , medium-sized about 20–25 μm and the larger ones 27–50 μm in diameter, the last two strongly cutinized. The trichome-base cells arranged radially. Larger trichome bases encircled by a ring of cutin, sometimes slightly elevated above the epidermal cells. They are frequently subject to suberization. The size and shape of bases depend on the number of arms (trichome-elements), their arrangement, fusing with each other and degree of cutinization. Trichomes composed of four, six, mostly eight and twelve, rarely of eighteen arms. Undamaged hairs have thick walls, they are straight with a rounded apex, 27–65 μm long. Besides stellate hairs there are also simple trichomes of which only the bases (10 μm in diameter) are preserved. Their distribution is sporadic. Multicellular uniseriate glandular trichomes frequent (Pl. 5, fig. 1–3, Pl. 7, fig. 2, 3). The bases are small, 7–15 μm in diameter, the preserved glands of three or four cells, about 22–24 μm long, mostly only the lowermost bulbous cell is preserved.

Discussion. In the Sošnica flora Goeppert (1852b, 1855) distinguished and described 24 fossil species of *Quercus* leaves (comp. Table 1) and gave illustrations of six fossil fruits of oak (“Semen *Querc.*”). The leaf species were later verified by Reichenbach (1919). In consequence of his revision only two of the species distinguished by Goeppert: *Quercus crassinervia* Goepp. and *Q. gigas* Goepp. remained in the family

Fagaceae. However, Reichenbach (op. cit.) included them in the taxon *Castanea atavia* Ung., just as he included the leaf of *Fagus dentata* Goep. by Goepert 1852a from Malczyce. Kräusel (1921) was of the same opinion and, besides, he placed numerous leaf specimens of this type from other Tertiary sites in Silesia in the species *Castanea atavia* Ung. In his study on fossil oaks of the *Cerris* section in Eurasia Kolakovsky (1974) expressed opinion, that the leaves of *Q. gigas* and *Q. crassinervia* little differ from each other and that they resemble the leaves of *Quercus kubinyi*. Illinskaya (1980, in Takhtayan 1982) assigned the leaf of *Q. gigas* to the genus *Castanea* and created a new combination *Castanea gigas* (Goep.) Illinskaya, synonymizing, among other names, *Castanea atavia* Ung. and *Quercus crassinervia* Goep. with it.

Out of the original specimens of *Quercus* leaves published by Goepert (1852, 1855) were preserved: a twin impression of *Quercus gigas* Goep. from Sośnica (Pl. 8, fig. 1; Fig. 3: 1, Goepert 1855, pl. 8, fig. 2, cf. Illinskaya, in Takhtayan 1982, pl. 33, fig. 1-3) and *Fagus dentata* Goep. from Malczyce (Pl. 4, fig. 1; Fig. 4: 2; Goepert 1852a, pl. 34, fig. 3). The leaf fragment of *Q. crassinervia* was lost. Furthermore, eleven impressions of fragmentary leaves of the same type were found in Goepert's collection of which one (No 552p MGUWr, pl. 8, fig. 4, Fig. 7: 5) was provided with its original label: *Quercus gigas*. In the new collections, which are in the possession of the Geological Museum, Wrocław University and the W. Szafer Institute of Botany, Polish Academy of Sciences another 11 specimens were identified and so were two large leaf fragments from the collection of the Paläontologisches Museum, Museum für Naturkunde in Berlin (Pl. 4, fig. 2, Pl. 10, fig. 2). Some of these specimens have their plant tissue preserved.

A detailed anatomic study of the topotypical material from Sośnica and Malczyce shows that the features of the epidermis are characteristic of the genus *Quercus*. The character typical of *Castanea*, namely, the asymmetric bases of glandular hairs (Hummel 1983, Kvaček & Walther 1989) is missing. The analysis of the morphological characters of leaves, especially the arrangement of veins of the third order at the leaf margins, also indicates the genus *Quercus* (cf. Hummel 1983, fig. 13).

The specific name *Quercus gigas* Goepert is used, although the name *Fagus dentata* Goepert was published earlier (Goepert 1852a). There existed, however, a recent species *Q. dentata* described by Thunberg in 1784. There remains to be explained the question of the taxon *Q. grandidentata* given by Unger (1849) to leaf remains from Swoszowice (Badenian), very similar to *Q. gigas*. The priority of the name *Q. grandidentata* could be considered only when details of its epidermal structure are known.

The leaves of a similar morphology and epidermis structure as *Q. gigas* Goep. were comprehensively described as *Quercus czeczottiae* Hummel and *Q. pontica miocenica* Kubát by Hummel (1983) from the Pliocene flora of Ruszów. These species show the same structure of epidermis, while slight differences exist between some of their morphological characters, e.g. leaf size and tooth shape. A comparison of these *Quercus* species with the leaf specimens from Sośnica and Malczyce shows their complete resemblance sufficient for the statement of their utter conformity. There is also an utter conformity to the species from Ruszów in respect of the structure of epidermis. The differences in leaf size and the shape of teeth on margins might lie inside the range of

variation of *Quercus* leaves. Nonetheless, attention should be given to the fact that the two taxa described on the basis of leaves are accompanied by as many as four taxa of fossil fruits in the flora of Ruszów (Hummel op. cit.). Because of the lack of distinctly defined diagnostic characters parallel to the great morphological variation of oak leaves of this type we must put up with the fact that taxonomy based on fossil leaves will never be as precise as taxonomy based on fossil fruits. According to the authors of the present paper, *Quercus gigas* Goepp. emend. Walther et Zastawniak is a good fossil species which includes most of the leaf remains of this type from the Younger Tertiary of Europe, known under the name of *Quercus kubinyi*, *Q. pontica miocenica* and *Castanea atavia*.

The recent species of the *Cerris* section are taken into account as comparative species (cf. Hummel 1983).

Section ? *Cerris* Oersted – leaves

Quercus pseudocastanea Goeppert emend. Walther et Zastawniak

Pl. 2, fig. 2, 3, 5, 6, Pl. 3, fig. 1–6; Fig. 8

Type-material. Goeppert 1852a, p. 274, pl. 35, fig. 1, 2 (Malczyce).

Lectotype. Goeppert 1852a, p. 274, pl. 35, fig. 1 (Illinskaya, in Takhtayan 1982, p. 92). Specimen No 2859p MGUWr, pl. 2, fig. 6; Fig. 8: 1 (Malczyce).

Syntype. Goeppert 1852a, p. 274, pl. 35, fig. 2 (Illinskaya, in Takhtayan 1982, p. 92). Specimen No 2838p MGUWr, pl. 2, fig. 5; Fig. 3: 6.

- = *Quercus pseudocastanea* Goepp.: Reichenbach 1919, p. 134, pl. 11, fig. 9 (Kokoszyce), pl. 11, fig. 10 (Sośnica, No 902p MGUWr), fig. 17 (Brzeg Dolny)
- = *Quercus pseudocastanea* Goepp.: Kräusel 1921, p. 398, pl. 9, fig. 6 (Malczyce), specimen No 2859p MGUWr
- ? *Quercus pseudocastanea* Goepp.: Kräusel 1921, p. 398, pl. 13, fig. 9, 10 (Pierusza)
- = *Quercus* sp. (sect. *Roburoides* Schwarz): Czechtz 1951, pl. 6, fig. 1–3
- = *Quercus* aff. *vallonea* Ky.: Czechtz 1951, pl. 6, fig. 6
- = *Quercus pseudocastanea* Goepp.: Zastawniak 1972, p. 25, pl. 6, fig. 1, 2, pl. 7, fig. 1–6, pl. 19, fig. 1–4
- = *Quercus pseudocastanea* Goepp.: Raniecka-Bobrowska 1957, p. 284, fig. 10, pl. 4, fig. 34
- = *Quercus pseudorobur* Kov.: Zastawniak 1980, p. 51, fig. 5: 12, 13
- = *Quercus pseudocastanea* Goepp.: Stuchlik et al. 1990, pl. 10, fig. 5, pl. 18, fig. 12(II); Fig. 12: 1–4, 8

Further synonyms. Menzel 1906, Kryštofovich & Baykovskaya 1965, Illinskaya, in Takhtayan 1982

Diagnosis. Goeppert 1852a, p. 274

Expanded diagnosis (based on the material from the locality Sośnica, the same stratigraphic level as Malczyce; No 1037p/4 MGUWr, prep. MMG So 7/79, So 60/79). Cuticle rather thick. Upper epidermis fragile, cells isodiametric with straight anticlines, 10–40 µm across. Simple trichome bases, thick-walled, normally distributed. Lower epidermis: in shape and diameter cells resemble those of upper epidermis. Simple uniseriate glandular trichomes scattered on the whole epidermis. Bases with normally developed walls, about 5–10 µm in diameter, length of trichomes about 25 µm. There

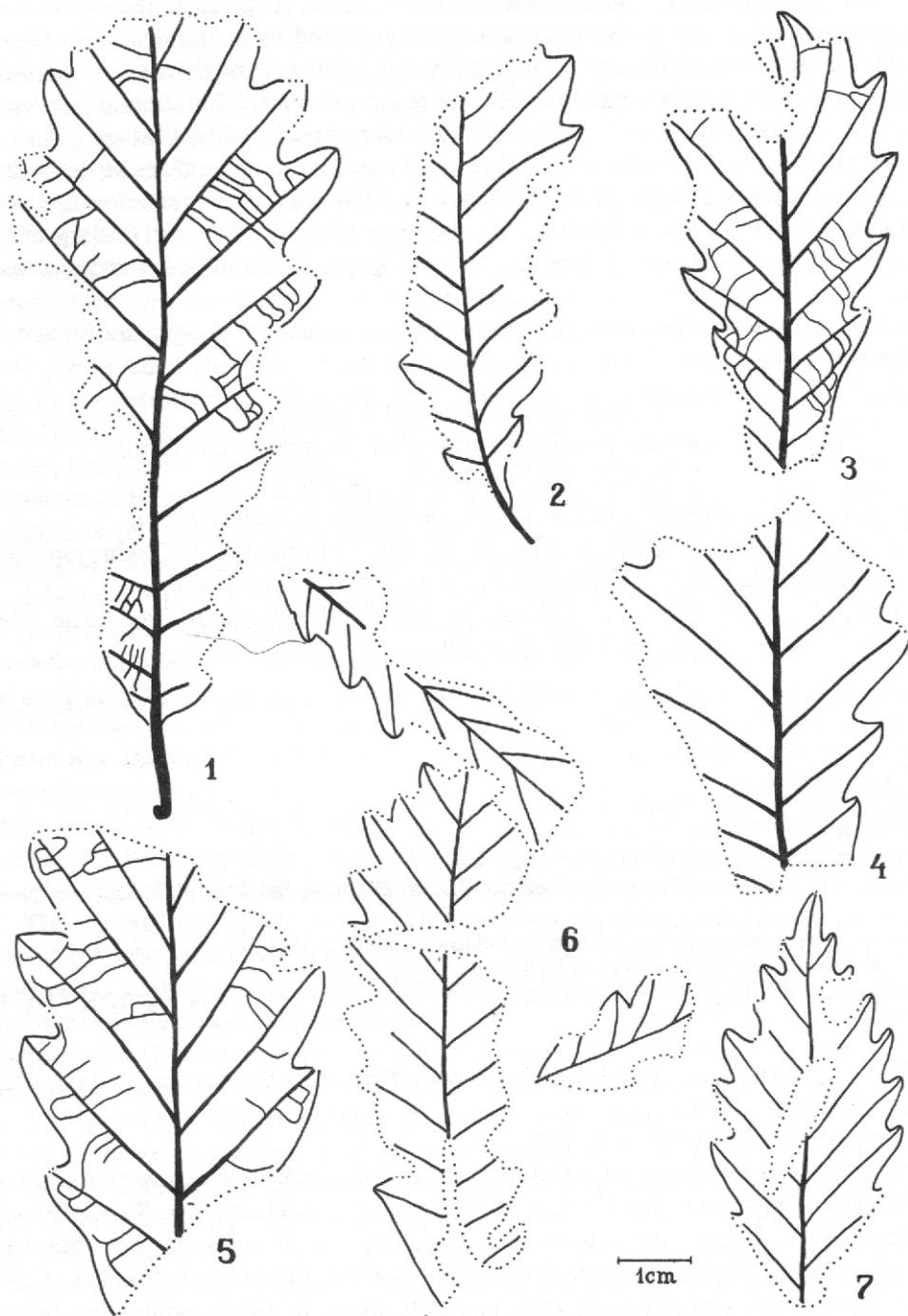


Fig. 8. Leaves of *Quercus pseudocastanea* Goep. emend. Walther et Zastawniak from Sońnica (2–5, 7) and Malczyce (1, 6). 1 – Lectotype, No 2859p MGUWr (Goepfert 1852a, pl.35, fig.1, Kräusel 1921, pl. 9, fig. 6), 2 – No 1067p MGUWr, 3 – No 902p MGUWr (Reichenbach 1919, pl. 11, fig. 10), 4 – No 1095p MGUWr, 5 – No 824p MGUWr, 6 – syntype, No 2838p MGUWr (Goepfert 1852 a, pl. 35, fig. 2), 7 – No 1037p/4 MGUWr

are two types of non-glandular trichomes: solitary unicellular, with thick-walled bases, 8–12 μm in diameter, and trichomes with thin walls, about 40–60 μm long. Fasciculate to stellate trichomes, with two or four unicellular elements joined together only at the base. Base with thick walls, 30–70 μm long. Stomatal complexes densely distributed over the epidermis, anomocytic to cyclocytic, of ovate or subcircular shape, about 17.3 μm (15–21 μm) in length and 13.3 μm (11–15 μm) in width. Some of them surrounded by a ring of cutinized subsidiary cells. Stomatal ledge aperture usually narrow, ovate, with thick walls.

Material. Goeppert's collection: Nos 824p MGUWr, 902p MGUWr (Sośnica), Nos 2838p MGUWr, 2859p MGUWr (Malczyce). New collections: No 1037p/4 MGUWr, prep. MMG So 7/79–8/79, 58/79 – 62/79, 1/88–7/88; 1067p MGUWr, 1095p MGUWr, MZ. VII/53/172 (Sośnica). Six specimens from Sośnica and two from Malczyce.

Morphology. Leaves obovate to ovate, more than 10 cm long and 2.5–4.5 cm wide, with slightly attenuate apex and cuneate base. Petiole ca 13 mm long. Leaf margin simple dentate. Teeth large, mostly slightly upcurved, acute or acuminate, sometimes with a bristly apex, 2–9 mm high and 2.5–8.0 mm wide at bases. Sinuses between teeth mostly acute. Apical sides short and convex, basal sides long, convex, only in the apical region slightly concave. Venation craspedodromous. Primary vein straight, tapering upwards. About 12 pairs of secondary veins, which are alternate, running straight towards the apices of the teeth, in the region of the apex more or less upcurved. Angles between midvein and secondary veins up to 51° (base) and to 35° (apex). Tertiary veins perpendicular or slightly oblique to the secondaries. They are mostly connected by short forks occurring usually halfway their length. No higher order venation is preserved.

Anatomy. See expanded diagnosis, p. 169

Discussion. The leaf remains described represent one, relatively well defined Neogene species of oak. *Quercus pseudocastanea* Goepp. was reported from the fossil flora of Malczyce (Goeppert 1852a), however Goeppert (1855) did not determine it from the flora of Sośnica. This was done later by Reichenbach (1919, p. 134). By determining the epidermis structure characters, an additional complex of features was acquired (Bůžek et al. 1985, Mai & Walther 1988), such as characterizes, above all, *Q. pseudocastanea* Goepp. According to Schwarz (1936–1939), this type of oak, marked by relatively narrow sinuses between the teeth on the leaf margins and by the lack of true intersecondary veins, is considered to be a primitive form related to the roburoidal oak. In Mai and Walther's (1988) opinion, so far as the number of pairs of lateral veins and, related to it, the number of teeth on the leaf margins are concerned, there is a comparatively wide range of variation, typical of the leaves of the genus *Quercus* L. The most important morphological character is the obovate shape of the leaves in conjunction with the biconvex shape of the teeth. This notwithstanding, it is uncertain within what limits the range of the taxon *Q. pseudocastanea* Goepp. may be extended. The opinions of particular authors (e.g. Laurent & Marty 1923, Knobloch 1969) differ very much of this point. The attempts to compare the fossil plant with the modern species of *Quercus* lead to no satisfactory results (Mai & Walther 1988). On the basis of the results obtained so far from studies of abundant comparative materials of modern oaks it can only be

stated that there is a great similarity of the morphological characters of these leaves to those of the members of the *Cerris* Oersted section (Kolakovsky 1974). An analysis of the structural characters of the epidermis of *Q. pseudocastanea* Goep. leaves shows similarities to those of modern oaks from the *Cerris* Oersted section but this does not settle the problem of their belonging to this section conclusively. More fossil findings are necessary to solve this question.

Quercus pseudocastanea Goep. occurs, varying in frequency, in the fossil floras of Europe from the Middle Miocene to the Upper Pliocene.

Section *Cerris* Oersted – fruits*

Quercus sapperi (Menzel) Mai ex Hummel

Pl. 7, fig. 1B, 1a; Fig. 9: 1

- = *Nephelium sapperi* Menzel: Menzel et al. 1933, p. 24, pl. 6, fig. 4, 5
- = *Quercus sapperi* (Menzel) Mai: Mai 1967, p. 77
- = *Quercus sapperi* (Menzel) Mai ex Hummel 1983, p. 54
- = *Quercus* sect. *Cerris* (Spach) Oersted: Łańcucka-Środoniowa et al. 1981, pl. 2, fig. 1b

Material. Goepert's collection, No 551p MGUWr, a fragment of one cup.

Description. The cupule was probably about 20.0 mm in diameter; only a small portion of its organic matter is preserved (it may be a trace of middle sclae). Upper scales well visible, radially arranged, lanceolate-mucronate, about 7.0 mm long and 1.5–2.0 mm wide at base. They are mostly damaged at ends; remnants of tissue are preserved on some of them.

Discussion. The cupules of *Q. sapperi* bear characteristic features of the *Cerris* section. Two subspecies, i.e. ssp. *sapperi* Hummel and ssp. *latisquamosa* Hummel were distinguished in the abundant material very well preserved in the Pliocene flora of Ruszów (Hummel 1983). They differ only in the shape of scales, which are somewhat shorter and wider and sometimes triangular in ssp. *latisquamosa*. Hummel (op. cit.) referred the cupule of *Quercus* from the Pliocene of Domański Wierch (Zastawniak 1972) to this subspecies. The specimen from Sońnica is fragmentary and so ill-preserved that it is difficult to assign it unquestionably in either of these subspecies.

The cupule of *Q. sapperi* and leaves of *Q. gigas* belong, most probably, to the same plant. It should be added that there is an impression of *Quercus gigas* Goep. emend. nov. leaf a distance of 2 cm from the cupule on the same specimen (Pl. 7, fig. 1).

Quercus microcerrisaecarpa Kolakovsky

Pl. 7, fig. 4, 4a; Fig. 9: 2

- = *Quercus microcerrisaecarpa* Kol.: Kolakovsky 1964, p. 86, pl. 29, fig. 6–8

Material. Goepert's collection, No 981p/3 MGUWr, a fragment of one cup.

Description. It is hard to determine the size of the cupule exactly, only a small fragment of it being preserved. Presumably, however, the cupule was small, little ex-

* All oak fruits were identified and described by M. Łańcucka-Środoniowa



Fig. 9. Cupules of fossil oaks from Sošnica, drawn by J. Wieser. 1 – *Quercus sapperi* (Menzel) Mai ex Hummel, No 551p MGUWr, 2 – *Quercus microcerraecarpa* Kolakovsky, No 981p/3 MGUWr

ceeding 10.0 mm in diameter. The upper scales, arranged densely side by side, about 10.0 mm long and 0.8 mm wide, are preserved on a part of the cupule circumference. The scales are ensiform, slightly bent in the upper part. The middle and lower scales are not visible, their traces may be present on the surface of the cupule.

Discussion. The specimen from Sošnica bears features characteristic of *Quercus microcerraecarpa* Kol. described from the Pliocene of Kodor (Kolakovsky 1964). This

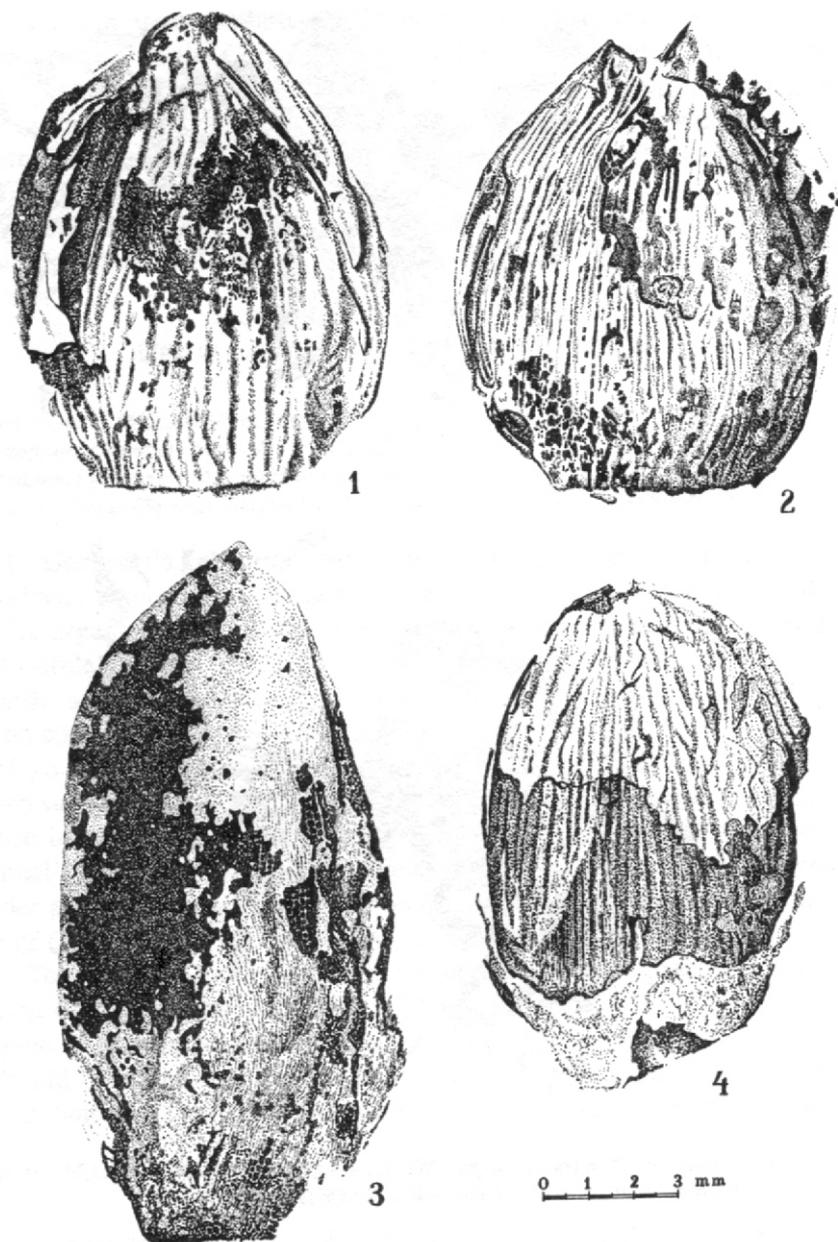


Fig. 10. Acorns of fossil oaks from Sošnica, drawn by J. Wieser. 1 - No 2242p MGUWr, 2 - No 2244p MGUWr, 3 - No 2509p MGUWr, 4 - No 698p/2 MGUWr

species is characterized by small cupules, 8.0–13.0 mm in diameter, surrounded by long ensiform upper scales, which are slightly bent in the upper part. Inside the cupules described by Kolakovský there are small ovate acorns, tapering in the apical part. Accor-

ding to Kolakovsky (1964, p. 87) similar remains were reported from the Sarmatian of Moldavia and the Tertiary of France.

Probably, *Q. microcerrisaecarpa* Kol. corresponds with the *Q. pseudocastanea* Goepf. emend. Walther et Zastawniak.

Q. microcerrisaecarpa Kol., new species for the Tertiary of Poland, belong to *Cerris* Oersted section.

Quercus L.

Quercus sp. div. – fruits

Pl. 2, fig. 4, Pl. 4, fig. 4–8; Fig. 10

Material. Goeppert's collection: 698p/2 MGUWr, 5161p MGUWr; new collections: 1882p MGUWr, 2094p MGUWr, 2242p MGUWr, 2244p MGUWr, 2469p MGUWr, 2509p MGUWr, 54/359 IB, 54/472 IB, 54/476 IB, 54/1192–1195 IB, MZ. VIII53/217, 218a, b; 18 acorns, including 2 with twin impression.

Description. Acorns (in part their impressions) strongly flattened, mostly wide ovate in shape; some specimens are tapering towards the top. All acorns have small dimensions: 9–15.5 x 5.5–10.0 mm. One specimen (No 54/1195 IB) is distinctly conical in shape but it is difficult to establish its exact length. Another specimen (Pl. 4, fig. 8, Fig. 10: 3) differs somewhat in shape, it is narrow ovate, 15.5 x 7.0 mm, tapering in the apical part. Traces of finely longitudinally striated pericarps or distinct impressions of this striation are partly preserved on the surface of all specimens.

Discussion. Acorns of similar size and shape are presented as "Semen *Querc.*" in Goeppert's paper (1855, pl. 26, fig. 21–25). Three of them are wide ovate and one is considerably narrower and elongate. The determination of species is impossible, but they belong probably to the oaks from the *Cerris* section, just as do the cupules found. The small measurements of the acorns exclude their relationship with *Q. sapperi* (Menzel) Mai ex Hummel, whereas some specimens might be referred to *Q. microcerrisaecarpa* Kolakovsky, which has very small dimensions of the acorn cupules.

The specimen "fructus *Q.*" in Goeppert's paper (1855, pl. 7, fig. 11) has been lost. Nothing can be determined on the basis of the figure presenting this fossil remain.

The specimen from Sośnica figured in Kräusel's study (1921, pl. 7, fig. 11 "Frücht einer Eiche") is much larger, 12.0 x 16.5 mm, wide ovate, slightly narrowed in the upper part. Presumably it may be referred to *Q. sapperi* (Menzel) Mai ex Hummel, whose cupules and acorns are considerably larger.

Many fossil acorns from the *Cerris* section are preserved in the Pliocene of Ruszów (cf. Hummel 1983, p. 52–58, fig. 23, pl. 31–35).

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STRESZCZENIE

H. Goepfert opisał z flor Sośnicy (1852b, 1855) i Malczyc (1852a) 23 taksony liści z rodziny *Fagaceae*, zaliczając je przede wszystkim do rodzaju *Quercus*, w większości błędnie (m.inn. Heer 1855–1859, Ettingshausen 1872). W wyniku rewizji materiałów z flor trzeciorzędowych Śląska Reichenbach (1919) i Kräusel (1921) zredukowali tę liczbę do trzech taksonów: *Castanea atavia* Ung., *Fagus attenuata* Goepf. i *Quercus pseudocastanea* Goepf. (Tabela 1).

Przystępując do ponownej rewizji oryginalnych okazów Goepferta uwzględniono również okazy pochodzące z nowych kolekcji, znajdujących się w Muzeum Geologicznym Uniwersytetu Wrocławskiego, w Instytucie Botaniki im. Władysława Szafera Polskiej Akademii Nauk w Krakowie, w Muzeum Ziemi Polskiej Akademii Nauk w Warszawie oraz w Muzeum Przemysłowym Uniwersytetu Humboldt w Berlinie. W badaniach materiałów kopalnych uwzględniano oprócz cech morfologicznych także cechy budowy epidermy w tych nielicznych przypadkach, kiedy zachowała się na okazach zwęglona tkanka roślinna, z której udało się wykonać preparaty mikroskopowe.

Na podstawie szczegółowej analizy cech morfologicznych holotypu *Fagus attenuata* Goepf. (Fig. 2) okazało się, że nie jest to liść buka, lecz kopalnej olchy *Alnus julianaeformis* (Sternb.) Kvaček et Holý. W związku z tym liście buka ze Sośnicy musiały zostać nazwane nową nazwą *Fagus silesiaca*. Nazwa *Fagus "attenuata"* Goepf. używana w literaturze paleobotanicznej dla określenia liści kopalnego buka, jako źle zastosowana, nie może być utrzymana, zgodnie z zasadami Międzynarodowego Kodeksu Nomenklatury Botanicznej (Greuter 1988).

Szczałki liści *Fagus silesiaca* sp. nov. ze Sośnicy, zarówno pod względem morfologicznym, jak i struktur anatomicznych są całkowicie zgodne ze szczytkami liści *Fagus attenuata* Goepf. z pliocenu Ruzowa, wszechstronnie zbadanymi przez Hummel (1983). Gatunek ten był charakterystycznym składnikiem arktotrzeciorzędowej geoflory i występował na obszarze Europy środkowej od górnego oligocenu po górny pliocen (Mai & Walther 1988).

Wszystkie pozostałe okazy liści *Fagaceae* ze Sośnicy i z Malczyc należą do rodzaju *Quercus* L., w tym także liście *Fagus dentata* Goepf. i *Castanea atavia* Ung. z Malczyc (Goepfert 1852a) oraz *Castanea atavia* Ung. ze Sośnicy i innych stanowisk na Śląsku (Reichenbach 1919, Kräusel 1920).

Wyróżniono dwa taksony liści dębów. Jednym z nich jest *Quercus gigas* Goepf. emend. nov. z sekcji *Cerris* Oersted. Wyniki badań anatomicznych szczytków liści tego taksonu pozwoliły na uzupełnienie diagnozy o cechy budowy epidermy i potwierdziły ich przynależność do rodzaju *Quercus*. Na epidermie liści *Q. gigas* brak jest asymetrycznych podstaw włosków gruczołowych, które są typowe dla epidermy liści *Castanea* (Hummel 1983, Kvaček & Walther 1988). Analiza cech nerwacji liści kopalnych także wskazuje na rodzaj *Quercus*, a zwłaszcza układ nerwów trzeciego rzędu przy brzegach liści (por. Hummel op. cit., fig. 13).

W opinii autorów niniejszego opracowania *Q. gigas* Goepf. emend. nov. należy uznać za dobry kopalny gatunek, do którego należałaby większość szczytków liści tego typu z młodszego trzeciorzędu Europy, znanych pod nazwami *Quercus kubinyi* (Kov.) Berger, *Q. kubinyi* (Kov.) Czeczott, *Quercus pontica miocenica* Kubát, *Q. czeczottiae* Hummel i *Castanea atavia* Ung. Trzeba jednak zwrócić uwagę na fakt, że liściom tego typu towarzyszą we florze Ruzowa aż 4 taksony kopalnych owoców dębów z sekcji *Cerris* Oersted (Hummel 1983), a we florze Sośnicy 2 taksony miseczek *Quercus* z tej sekcji. Przy dużej zmienności morfologicznej liści dębów tego typu, obserwowanej także współcześnie, trzeba się pogodzić z faktem, że taksonomia oparta na kopalnych szczytkach liści nie będzie nigdy równie precyzyjna jak taksonomia oparta na kopalnych owocach.

Jako współczesne gatunki porównawcze wchodzi w grę gatunki sekcji *Cerris* Oersted, zwłaszcza gatunki wschodniopacyficzne (por. Hummel 1983).

Drugim kopalnym gatunkiem jest *Quercus pseudocastanea* Goepf., opisany z Malczyc (Goepfert 1852a), wyróżniony w materiałach ze Sośnicy tylko przez Reichenbacha (1919). Badania typowego okazu tego taksonu z Malczyc pozwoliły na uzupełnienie diagnozy o cechy budowy epidermy.

Q. pseudocastanea Goepf. występował we florach kopalnych Europy od środkowego miocenu po górny pliocen. Najważniejszą cechą morfologiczną tego gatunku jest odwrotnie jajowaty kształt ca-

tych liści oraz kształt ząbków na ich brzegach. Nie wiadomo które współczesne gatunki są najbardziej zbliżone do kopalnego (Mai & Walther 1988). Według Schwarza (1936–1939) jest to prymitywna forma pokrewna dębom roburoidalnym, zdaniem Kołakowskiego (1974) gatunek ten nawiązuje do współczesnych przedstawicieli sekcji *Cerris* Oersted. Badania anatomiczne *Q. pseudocastanea* Goepp. nie mogą jednak definitywnie rozstrzygnąć przynależności do sekcji.

Oprócz liści dębów we florze Sośnicy znaleziono także odciski kopalnych owoców tego rodzaju, które oznaczyła i opisała M. Łańcucka-Środoniowa. Są to miseczki dwóch gatunków dębów z sekcji *Cerris* Oersted: *Quercus sapperi* (Menzel) Mai ex Hummel i *Q. microcerrisaecarpa* Kolakovsky, opatrzone charakterystycznymi, promieniście ułożonymi łuskami górnymi. Dość liczne odciski samych żołędzi dębów (*Quercus* sp. div.), różnego kształtu i wielkości, były także ilustrowane przez Goepperta (1855) i Kräusla (1921). Przypuszczalnie należą one do dębów z sekcji *Cerris* Oersted, podobnie jak znalezione miseczki. Żołędzie niedużych rozmiarów można by łączyć z *Q. microcerrisaecarpa* Kolakovsky, który odznacza się bardzo małymi wymiarami miseczek.

PLATES

Plate 1

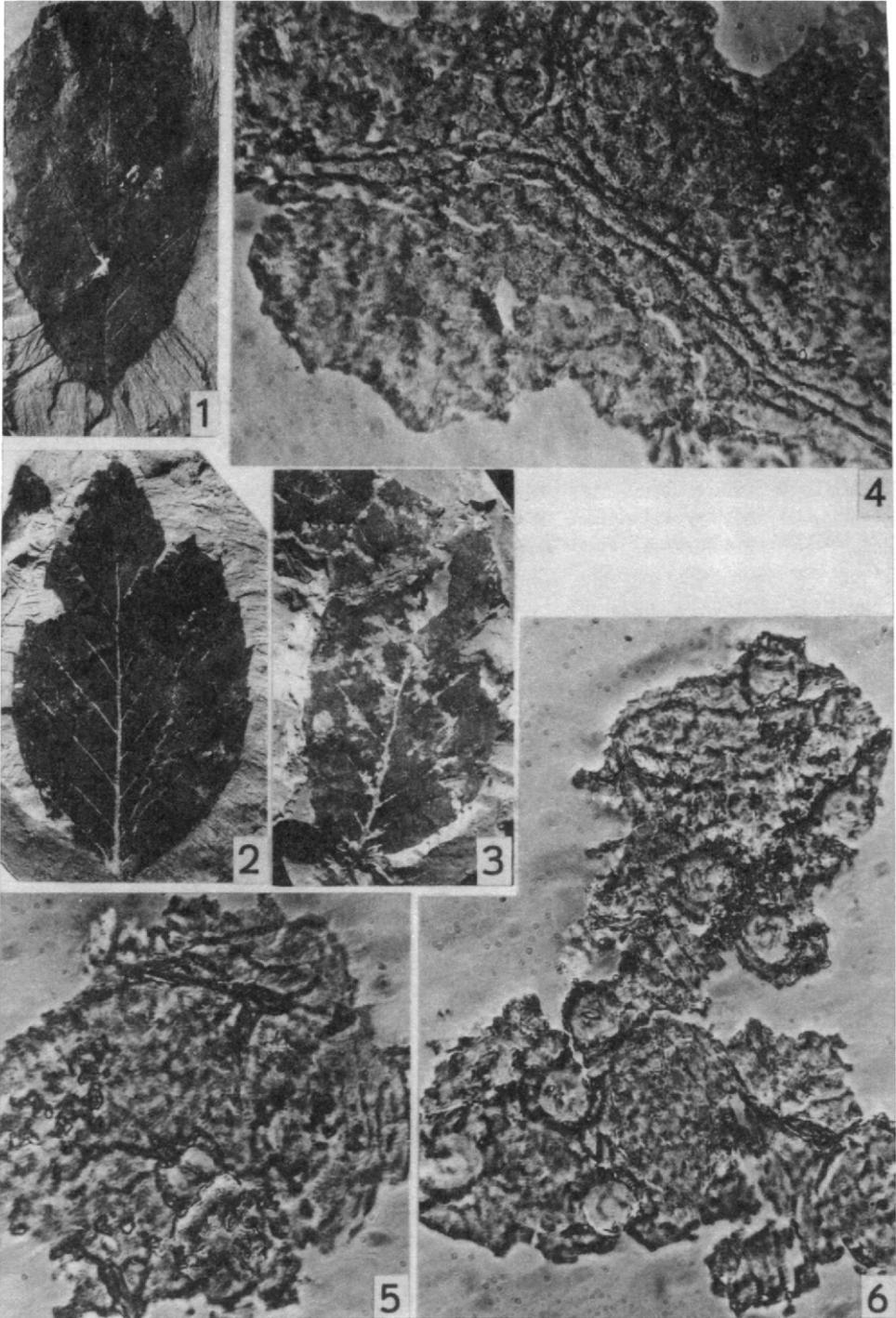
Fagus silesiaca Walther et Zastawniak

1. Holotype, No MZ. VII/53/239, Sośnica
2. Topotype, No 820p/2 MGUWr, Sośnica
3. Topotype, No 1825p MGUWr, Sośnica
4. Upper epidermis, cells with undulate anticlines, x 400; No MZ. VII/53/239, prep. MMG So 2/79, Sośnica
5. Lower epidermis with cyclocytic stomata and uniseriate glands, x 400, No MZ. VII/53/239, prep. MMG So 2/79, Sośnica
6. Lower epidermis with imperfect cyclocytic stomata, x 400, No MZ. VII/53/239, prep. MMG So 2/79, Sośnica

1, 3 – phot. M. Małachowska-Kleiber

2 – phot A. Pachoński

4–6 – phot. H. Walther



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Plate 2

Fagus silesiaca Walther et Zastawniak

1. No 54/396 IB, Sośnica

Quercus pseudocastanea Goep. emend. Walther et Zastawniak

2. No 824p MGUWr, Sośnica

3. No 902p MGUWr, Sośnica (Reichenbach 1919, pl. 11, fig. 10)

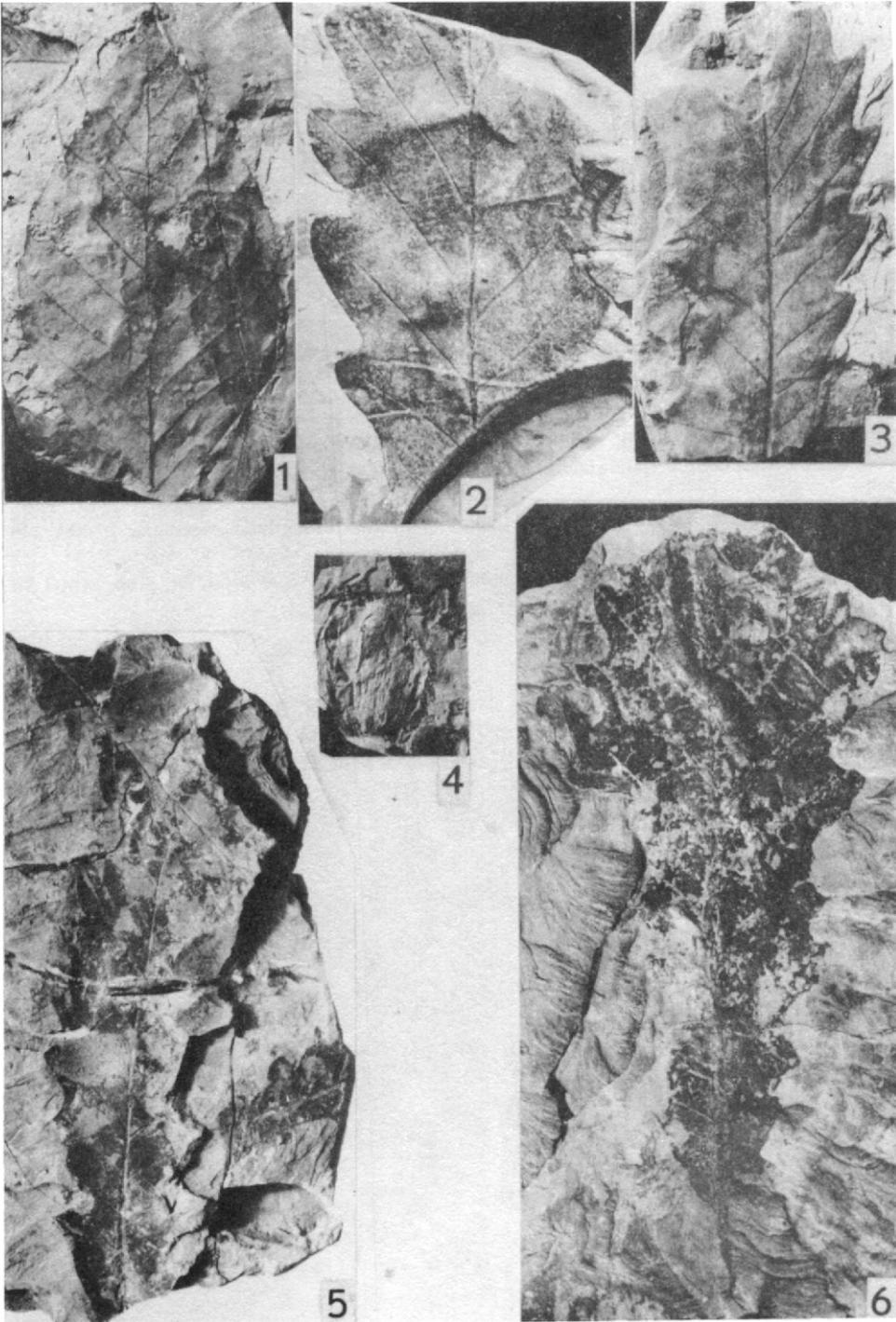
5. No 2838p MGUWr, Malczyce. Original: Goepfert 1852a, pl. 35, fig. 2

6. No 2859p MGUWr, Malczyce. Original: Goepfert 1852a, pl. 35, fig. 1

Quercus sp.

4. Acorn, No 1882p MGUWr, Sośnica

1-4, 6 - phot. M. Małachowska-Kleiber
5 - phot. A. Pachoński



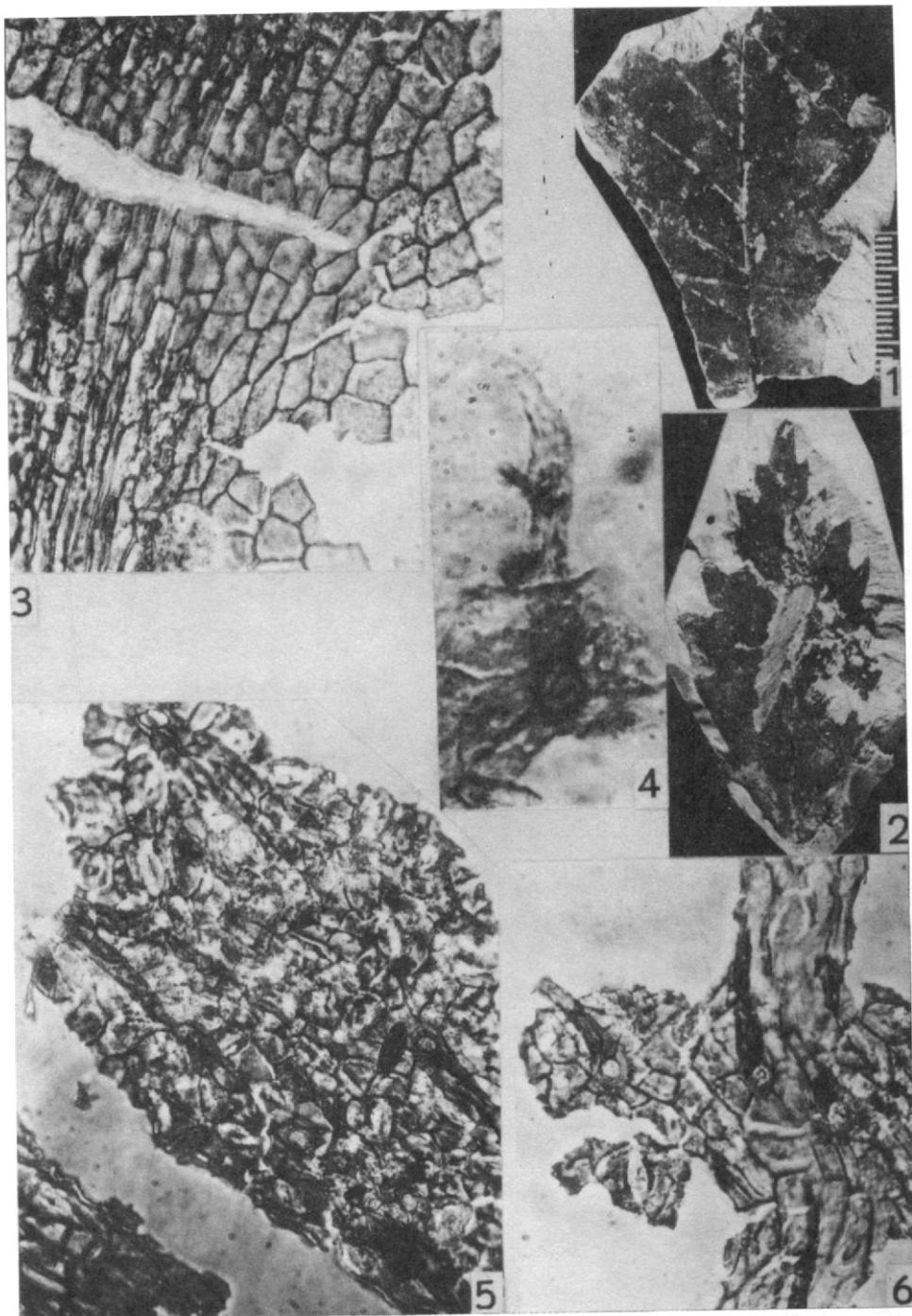
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Plate 3

Quercus pseudocastanea Goep. emend. Walther et Zastawniak

1. No 1095p MGUWr, Sońnica
2. No 1037p/4 MGUWr, Sońnica
3. Upper epidermis, near leaf margin, x 400, No 1037p/4 MGUWr, prep. MMG So 7/79
4. Lower epidermis, simple uniseriate glandular trichome, x 1000, No 1037p/4 MGUWr, prep. MMG So 60/79
5. Lower epidermis, fasciculate to stellate trichomes with two unicellular elements, x 400, No 1037p/4 MGUWr, prep. MMG So 7/79
6. Lower epidermis with solitary unicellular trichomes, x 400, No 1037p/4 MGUWr, prep. MMG So 7/79

- 1 - phot. B. Bastian
2 - phot. M. Małachowska-Kleiber
3-6 - phot. H. Walther



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Plate 4

Quercus gigas Goep. emend. Walther et Zastawniak

1. No 2839p MGUWr, Malczyce. Original: as *Fagus dentata* Goepert 1852a. pl. 34, fig. 3
2. Sine numero, MP, as *Castanea atavia* Ung., Sośnica
3. No 2362p MGUWr, Sośnica

Quercus sp. – acorns

4. No 698p/2 MGUWr
5. No 2242p MGUWr
6. No 2094p MGUWr
7. No 2244p MGUWr
8. No 2509p MGUWr

phot. A. Pachoński

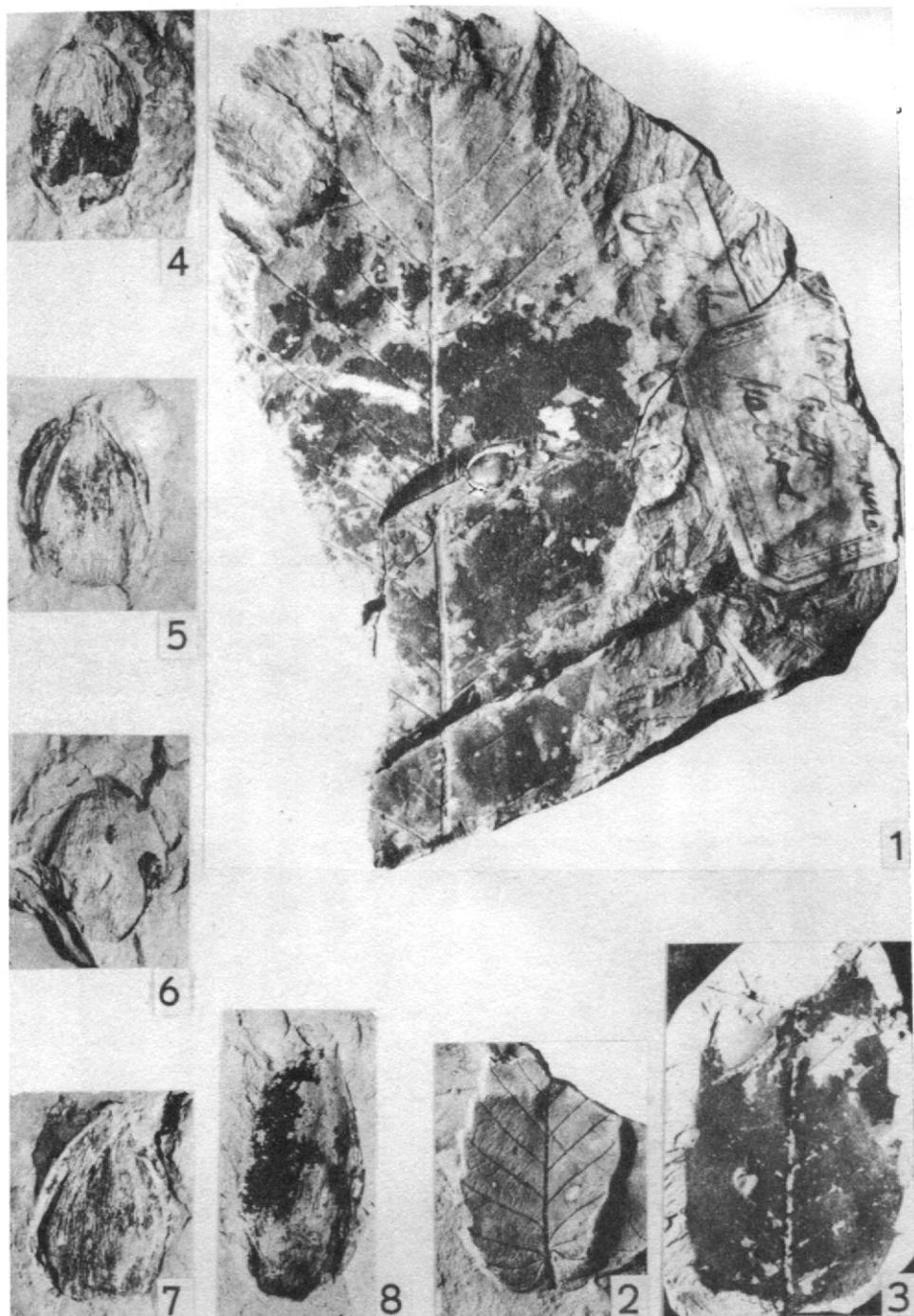


Plate 5

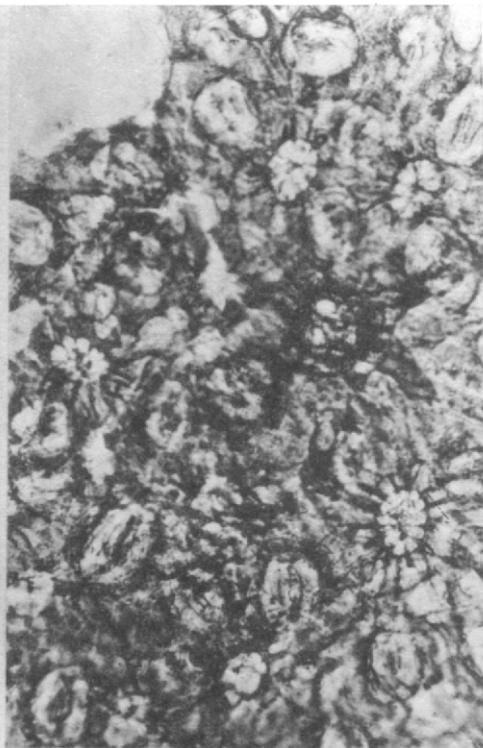
Quercus gigas Goep. emend. Walther et Zastawniak

1. Lower epidermis, stomatas, bases of one glandular trichom and one multicellular trichom, x 1000, No 2839p MGUWr, prep. MMG So 5/79, Malczyce
2. Lower epidermis, stomatas and multicellular trichomes, x 400, No 2839p MGUWr, prep. MMG So 39/79, Malczyce
3. Lower epidermis, arms of the multicellular trichomes, x 1000, No 2839p MGUWr, prep. MMG So 5/79, Malczyce

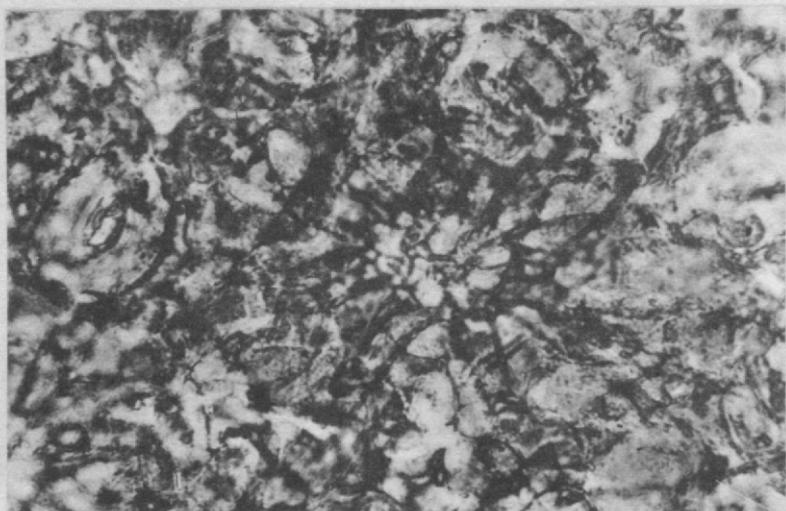
phot. H. Walther



1



2



3

Plate 6

Quercus gigas Goepp. emend. Walther et Zastawniak

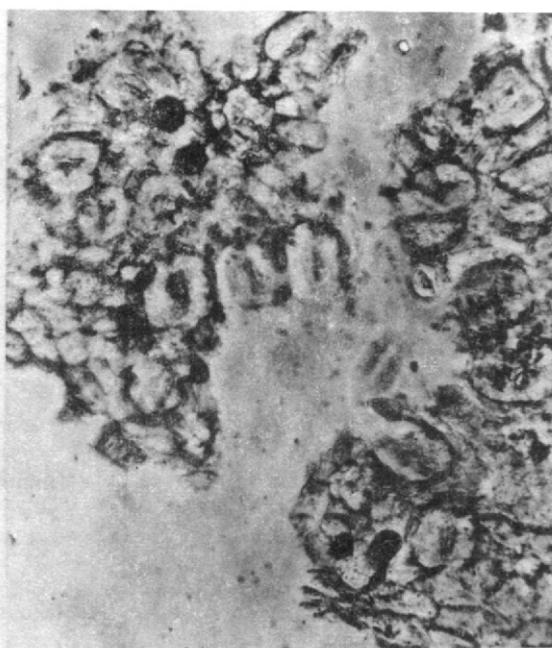
1. No 907p/1 MGUWr, Sośnica
2. No 1169p MGUWr, Sośnica
3. No 54/389 IB, Sośnica
4. Lower epidermis, x 400, No 907p MGUWr, prep. MMG So 35/79, Sośnica
5. Lower epidermis, stomatas surrounded by cutin walls, x 1000, No 907p MGUWr, prep. MMG So 35/79, Sośnica

1-3 - phot. M. Małachowska-Kleiber

4, 5 - phot. H. Walther



1



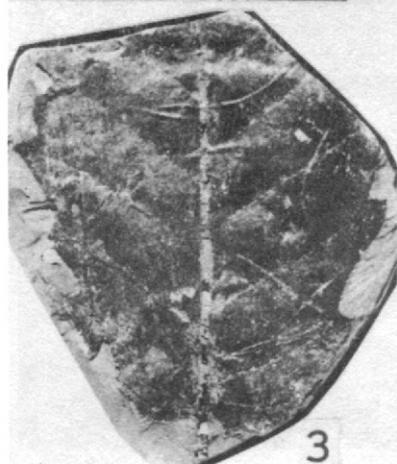
4



2



5



3

Plate 7

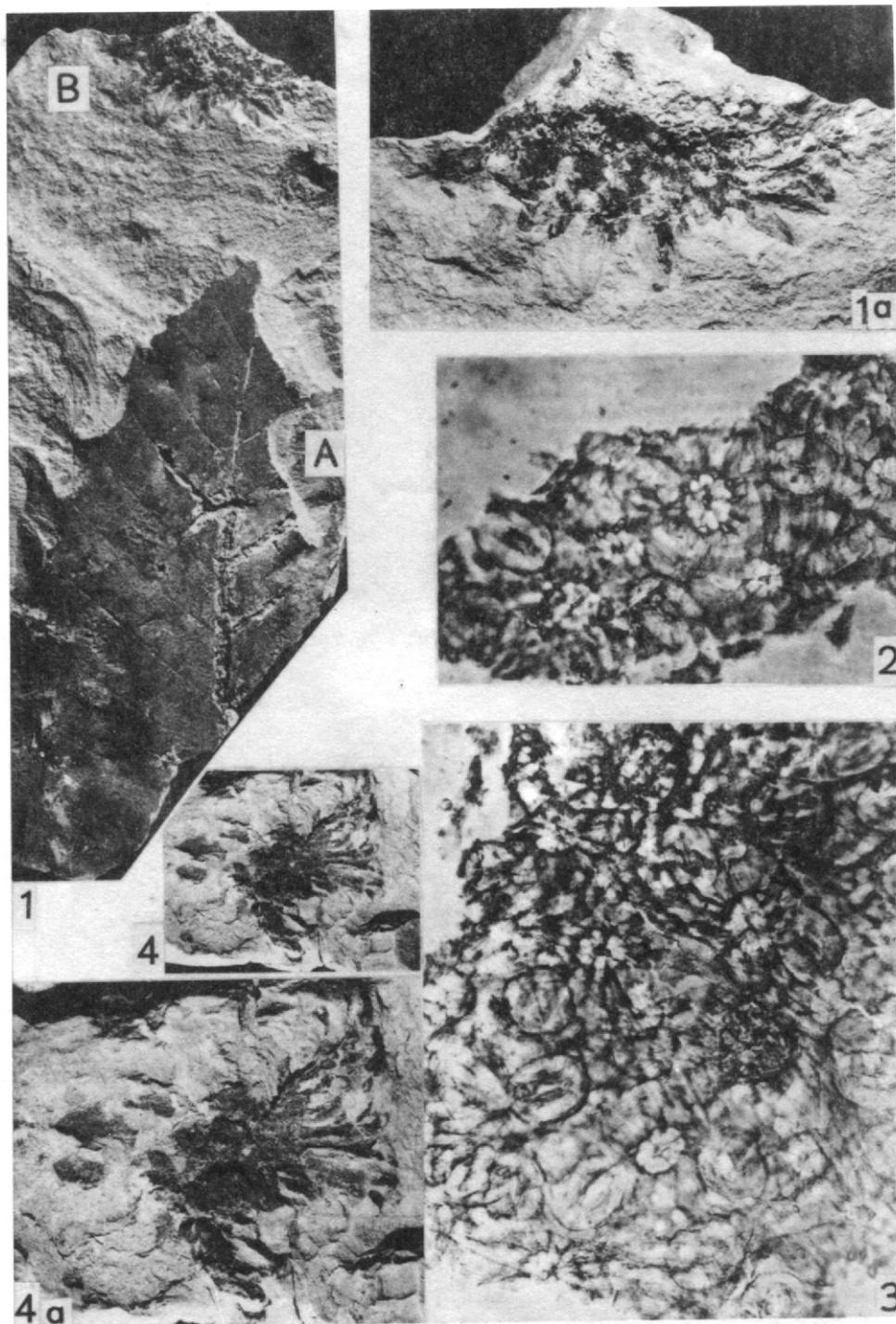
Quercus gigas Goep. emend. Walther et Zastawniak

1. No 551p MGUWr, Sośnica; A-leaf, B-cupule of *Quercus sapperi* (Menzel) Mai ex Hummel
- 1a. The same as 1 B, x 1.5
2. Lower epidermis, stomatas and different types of multicellular trichomes, x 400, No 551p MGUWr, prep. MMG So 14/79
3. Lower epidermis, stomatas and multicellular trichomes, x 400, No 551p MGUWr, prep. MMG So 14/79

Quercus microcerrisaecarpa Kolakovsky – cupule

4. No 981p/3, Sośnica
- 4a. The same, x 1.5

- | | |
|-----------|--------------------------------|
| 1 | - phot. M. Małachowska-Kleiber |
| 1a, 4, 4a | - phot. A. Pachoński |
| 2, 3 | - phot. H. Walther |



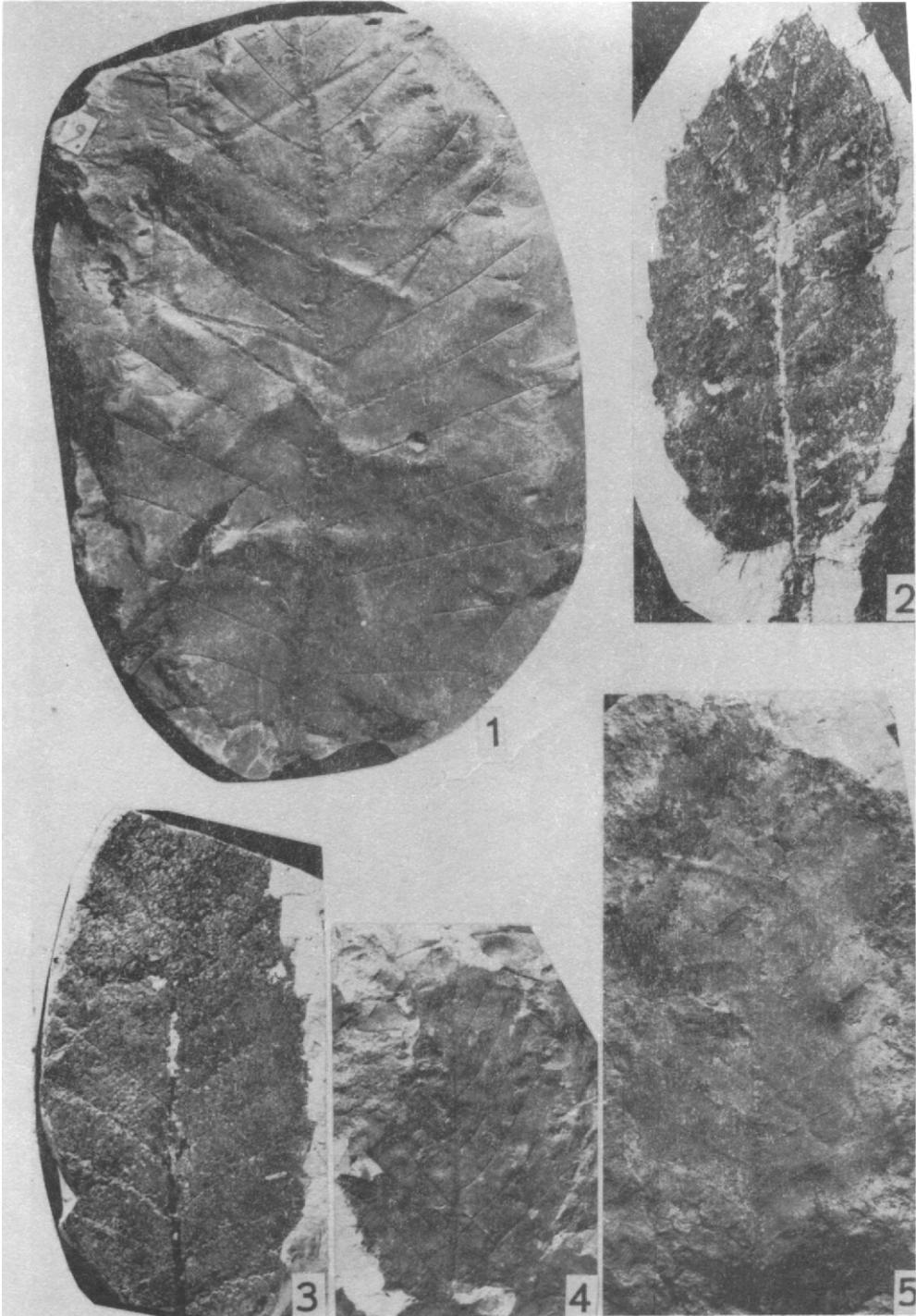
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Plate 8

Quercus gigas Goep. emend. Walther et Zastawniak

1. Isotype, No 742p MGUWr, Sośnica, twin impression of missing holotype from Goepfert 1855, pl. 8, fig. 2
2. No 1073p MGUWr, Sośnica
3. No 54/500 IB, Sośnica
4. No 552p MGUWr, Sośnica, Goepfert's original
5. No 911p MGUWr, Sośnica

phot. M. Małachowska-Kleiber



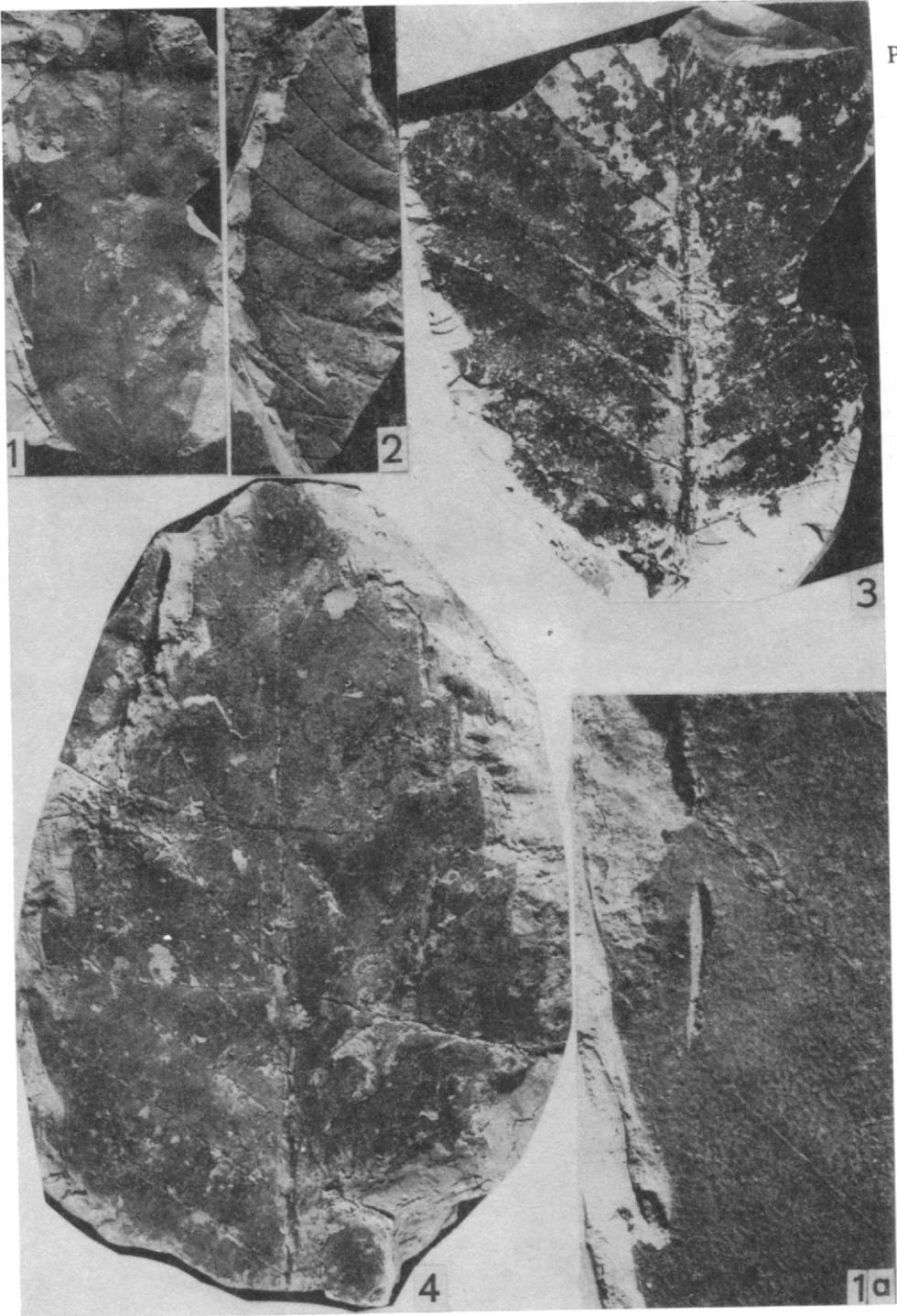
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Plate 9

Quercus gigas Goeppl. emend. Walther et Zastawniak

1. No 1403p MGUWr, Sośnica
- 1a. The same, x 4
2. No 510p MGUWr, Sośnica
3. No 1072p MGUWr, Sośnica
4. No 54/311 IB, Sośnica

phot. M. Małachowska-Kleiber



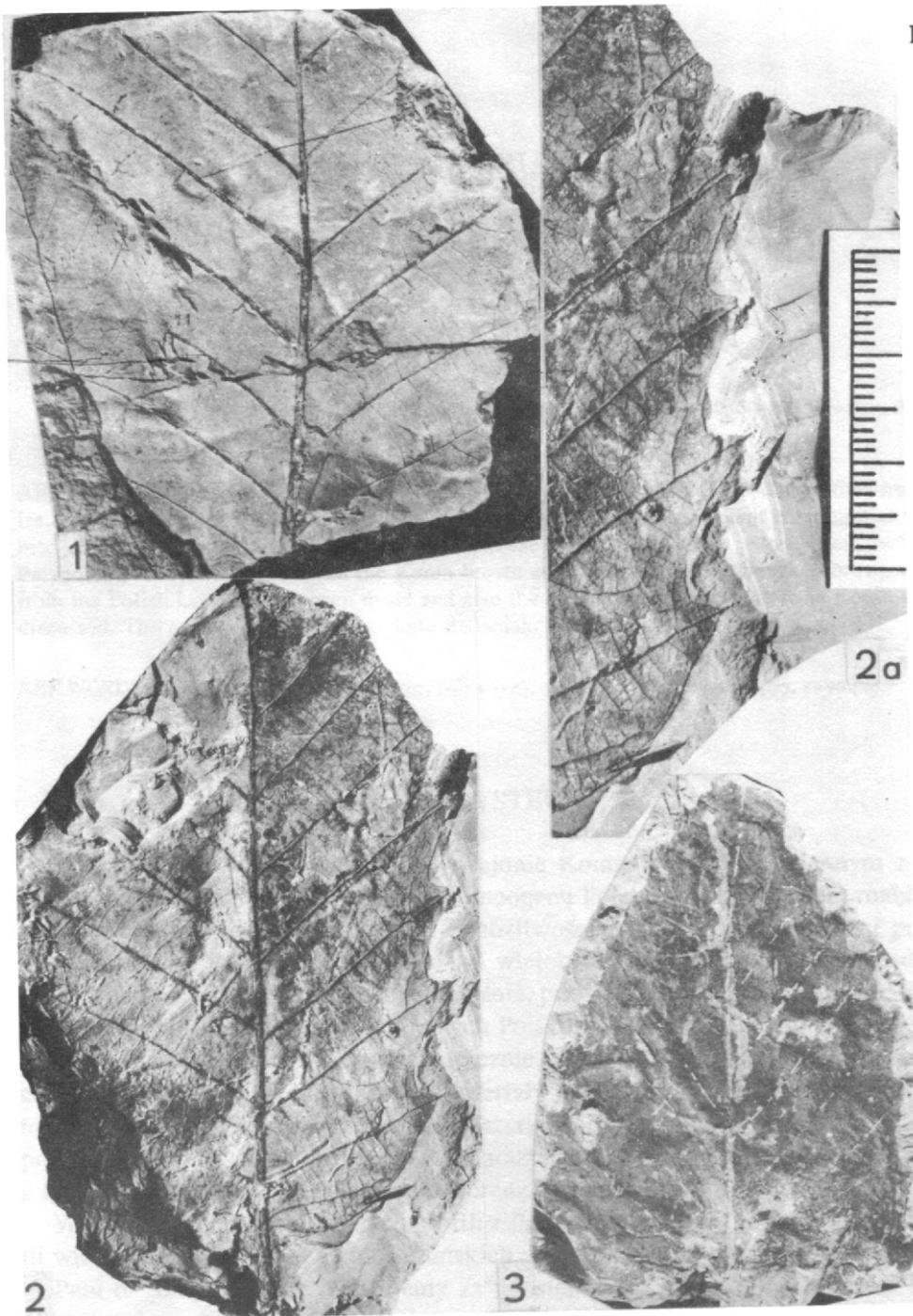
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Plate 10

Quercus gigas Goepp. emend. Walther et Zastawniak

1. No 1010p/7 MGUWr, Sośnica
2. Sine numero, MP, as *Castanea atavia* Ung., Sośnica
- 2a. The same, x 1.5
3. No 675p/8 MGUWr, Sosnica

1, 2 – phot. M. Małachowska-Kleiber
3 – phot. A. Pachorński



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