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TAXONOMICAL REVISION OF SELECTED POLLEN AND SPORES TAXA FROM NEOGENE DEPOSITS

Rewizja taksonomiczna wybranych taksonów spor i ziarn pyłku z osadów Neogenu

MARIA ZIEMBIŃSKA-TWORZYDŁO[1], IRENA GRABOWSKA[2], ALEKSANDRA KOHLMAN-ADAMSKA[3], KRYSTYNA SKAWIŃSKA[4], BARBARA SŁODKOWSKA[5], LEON STUCHLIK[4], ANNA SADOWSKA[6] and HANNA WAŻYŃSKA[5]

1 – Warsaw University, Institute of Geology, Żwirki i Wigury 93, 02–089 Warszawa
2 – 02–508 Warszawa, ul. Puławska 53B
3 – Museum of the Earth, Polish Academy of Sciences, Aleja Na Skarpie 20/26, 00–488 Warszawa
4 – W. Szafer Institute of Botany, Polish Academy of Sciences, Lubicz 46, 31–512 Kraków
5 – Polish Geological Institute, Rakowiecka 4, 00–975 Warszawa
6 – University of Wrocław, Institute of Geological Sciences, Paleobotany Department, Cybulskiego 30, 50–205 Wrocław

ABSTRACT. For unification the taxon determination of the most common pollen and spores from the Neogene of Central Europe a checklist of selected genera and species was elaborated. All taxons are illustrated and ordered in both morphological and botanical systems. For several taxons a systematical revision according to the rules of the International Code of Botanical Nomenclature was carried out. All enumerated taxons were classified to a proper group of geofloristic element.

KEY WORDS: Neogene, Paratethys, Polish Lowland, pollen, spores, taxonomy, botanical affinity, geofloristic element, palaeotropical, arctotertiary

INTRODUCTION

International co-operation on correlation of Neogenic deposits from Paratethys area and European Lowland basins, based on results of palynological investigations (Planderová et al. 1993), was prompted the authors of this paper to make an attempt to unify the taxonomy and to make revision of some scattered fossil taxa.

In the first stage of the mentioned co-operation a preliminary list of 108 taxa, based on the comparison of results of palynological analyses from various localities in Paratethys and European Lowland areas, was elaborated. It might serve as a basis for proper understanding of lists with percentage values, in which these species frequently occurred. The necessity of revision of many taxa has widened the scope of preliminary plans.

In the effect a list comprises 95 genera and 185 taxa of spores and pollen grains was elaborated. During the work 82 taxa were revised. Also, it became evident the necessity of establishing 15 new genera, 7 new species, 50 combinations and 6 new names. In spite of this, 1 new status was established and 3 diagnosis were emended. In such a way elaborated list, together with illustrations, can provide the basis for the univocal interpretation the results of palynological correlations. The next stage means the elaboration of common database for quantitative comparisons of spores and pollen grains of Neogene deposits in Poland and in neighbouring countries. The database was created on the basis of the list proposed by the authors of the present paper.

The lists of chosen sporomorph taxa from Neogene deposits were arranged according to two systems.

1. Morphological system: spores in triletemonolete arrangement and pollen grains of Gymnospermae with morphological types: inaperturate, saccate, polyplicate; of Angiospermae with morphological types: monoporate,

triporate, polyporate, monocolpate, tricolpate-tricolporate, polycolpate-polycolporate, syncolpate, tetrade. An order of taxa in the particular morphological groups is alphabetical.

2. Botanical system in genera and families arrangements follows: Tryon and Lugardon (1991 – for Pteridophyta); Szweykowska and Szweykowski (1993 – for Cycadophytina and Pinophytina); Takhtajan (1987 – for Magnoliophytina).

HISTORY OF INVESTIGATIONS

The differences in taxonomical approaches among various palynologists from different scientific centres have historical reasons. During the early stages of introducing the palynological methods for investigations of the Tertiary deposits Potonié (1931a–d, 1934) used generic names *Sporites* and *Pollenites*. The differentiation among morphological types of distinguished sporomorphs was only seen on the level of a fossil taxon (e.g. *Pollenites margaritatus* Potonié 1931a). In the next stage of development of the discipline Potonié (1934), Thiergart (1937), Raatz (1937) attempted to attribute species to botanical genera by the adding generic name before the epithet *Pollenites* and *Sporites,* e.g. *Ilex-pollenites margaritatus* Raatz 1937, Thiergart 1937. From that time a clear division among botanists is dated back: on those preferring the botanical systematics and those favouring only the morphological nomenclature.

When one was using the natural systematics, a morphological similarity of fossil spromorphs to present-day spores or pollen grains were frequently taken into consideration, what was reflected by adding to genera or botanical species names the epithet "type" (e.g. *Ilex* – type, *Pinus haploxylon* – type, etc.) This mode of classifying the pollen grains and spores would not have given the possibilities to showing the full morphological diversity at genera level, if one had not shown previously the species similarity. Mostly such pointing is not possible because present-day equivalents of fossil morphological types frequently do not exist. In such the case a fossil species name creation is necessary. Among advocates of pure botanical nomenclature an extreme tendency to giving the species names for fossil grains, classified to contemporary botanical genera, without showing the type of organ, is manifested (e.g. *Nelumbo europaea* Tarasevich 1983). This type of nomenclature was commonly used by palynologists, among others from former Soviet Union. This is not in conformity with recommendations by the International Code of Botanical Nomenclature (1961, art. 20, Rec. 20b), according to these in generic name the organ, being the base for the description, should be shown. The proper name for the fossil species of pollen of *Nelumbo* genus should be *Nelumbopollenites europaeus* (Tarasevich) comb. nov.

At the same time when Potonié, Thiergart and others in Europe used *Sporites* and *Pollenites* for genus names of spores and pollen grains, in the U.S.A. Wodehouse (1933) added the suffix "-pites" for root of the botanical generic name (e.g. *Caprifoliipites*), stressing in this way its organogenic source. Couper (1953) used in palynological taxonomy the suffix "-idites" for stressing the fossil origin of sporomorph kinds (e.g. *Haloragacidites*).

In older papers also the suffix "-idites" may be found, what in combination with contemporary genus or family names stresses fossil type of an organ and points to its morphological similarity {e.g. *Quercoidites* (Potonié, Thomson & Thiergart 1950), *Osmundacidites* (Couper 1953)}. Since the times of Potonié (1934) in the names of fossil genera of botanical origin the suffixes "-pollenites" and "-sporites" are often used. Pflug (1953a) introduced for genus names the suffixes "-pollis" and "-sporis" (e.g. *Classopollis*).

The other trend in nomenclature of the Tertiary sporomorphs was based solely on the morphological features. The most famous morphological systematics was worked out by Thomson and Pflug in 1953. According to it the generic names must contain the basic information on a sporomorph structure. The first part of the name informs about the quantity, type and arrangement of the germination apparatus (e.g. Triplano-; Tricolporo), and the second part of the generic name defines the type of an organ (-sporites or –pollenites). A clear formulation of principles of this systematics, the univocal genera diagnoses and very rich fossil material elaborated enabled the wide spreading of it, especially while older Tertiary deposits were under the work.

The morphological systematics proposed by Van der Hammen (1956) was close to that of Thomson and Pflug's (1953). The only dif-

ference was the stressing in the first part of generic name the character of a sporomorph superficial relief (e.g. *Clavatitricolporites*). In Europe this systematics did not find too many followers.

When Neogene palynological deposits are elaborated a precise using of the morphological taxonomy solely is insufficient. The possibility of relating of fossil taxa to contemporary families or genera led palynologists to idea of displaying this affiliation in generic name. The greatest contribution in the development of this systematics had Potonié (Synopsis 1956–1970) and Krutzsch (1959–1971). Both investigators attempted to set in order hitherto used divisions in all the systematics, taking into consideration the priorities in genus names described according to rules by the International Code of Botanical Nomenclature (1988). However, in spite of these efforts still exist several names of genera similarly sounding, often synonimical, based on the same type species (for example "*parmularius*" species was typical of three genera: *Cornoidites*, *Tricolpopollenites* and *Psilatricolporites*). Also, not all palynologists creating the new genus names used the same rules; so in the consequence a complete chaos arose. To help palynologists in this "jungle" of genera names Jansonius and Hills (1976 – with current supplements) took up an elaboration of a checklist of sporomorph genera from all the geological periods. In this work every genus have obtained a catalogue card with the successive number, diagnose, schematic drawing, references to literature and type species, and sometimes a short authors' comment, regarding the importance of a genus.

In the up to date palynological literature, following Potonié's instructions (Synopsis I–VI 1956–1970), the changes in genus names were observed by, among others, Nagy (1969; 1985) and Planderová (1990). At the moment there is a prevailing tendency to creating genera names, which indicate the botanical affinity. Also, there is the same trend in the present elaboration.

RULES ADOPTED FOR TAXA REVISIONS

1. The rules by the International Code of Botanical Nomenclature (ICBN) 1988 have acknowledged only formally existing important genera, retaining the rule of priority. The lack of proper recommendations of ICBN regarding the fossil remains forced in effect the necessity of using some rules by the International Code of Zoological Nomenclature (ICZN) 1961 (1963) elaborated for fossil fauna. According to the Code the concept of the type species is a criterion for a genus distinction. Thomson and Pflug (1953) and Potonié (1956) used the concept of "Genotypus" for evaluation of the basic species to a genus distinction. Nowadays, in the biological literature the concept of "genotype" is referred to as a complex of genetical features. ICZN 1961 (1963) in Art. 67, rec. 67a denied using the name "genotype" in relation to the type species.

2. The authors have adopted the rule that if it is a possibility to identify the morphological type of pollen grains and spores to a given botanical taxon of various rank (family, subfamily, genus, species) then will be also changed the morphological taxon, so in effect the botanical rank will be clearly visible: *Lycopodiaceaesporis* – affinity in the rank of family, *Castaneoideaepollis* – affinity in the rank of subfamily, *Selaginellisporis* - affinity in the rank of genus and *Selagosporis* – affinity in the rank of species.

3. While creating new genera the suffixes "-sporis", "-sporites", "-pollis" and "-pollenites" were used.

4. While creating a new name (nomen novum), to existing names of valid genera the suffix showing the type of organ is added, to which this name is relating. For example, the genus *Milfordia* Erdtman 1960 was complemented by suffix "-pollis" (*Milfordiapollis* Erdtman nom. nov.).

5. If there were changed the names improperly suggesting affinity to spores, e.g. *Sporotrapoidites* Klaus 1954 to *Trapapollis* gen. nov.

6. If it was created previously the genus of botanical etymology, then fossil species were incorporated into it, which had the same botanical affinity, and their features cover a genus diagnosis. For example to *Aesculidites* Elsik 1968 genus a new species *A. hippocastaneoides* sp. nov. was incorporated, corresponding morphologically to present-day species *Aesculus hippocastanum*.

7. If the morphological type of a fossil sporomorph represents the botanical genus, however no precisely comparable to the morpho-

logy of a given present-day species, then the organ name for the genus should be created and a fossil species incorporated into it. For example, from *Butomus* genus – *Butomuspollenites longicolpatus* (Doktorowicz-Hrebnicka 1964) comb. nov.

8. In the case, when the botanical division of a family into subfamilies is also visible in the morphology of sporomorphs, then morphological differences at the rank of a subfamily were taken into consideration. For the Castanoideae, a subfamily within the Fagaceae, the genus *Castaneoideaepollis* was established and it includes fossil pollen grains of the structural type found in all genera of that subfamily. The fossil pollen grains acknowledged to Quercoideae subfamily could not obtain generic name pointing at this subfamily because admitted genus *Quercoidites* Potonié, Thomson & Thiergart 1950 have existed. According to the priorite rule pollen grains of Quercoideae subfamily to this unit were acknowledged.

9. Sometimes changes in botanical nomenclature at the genus level recall for the necessity of fossil genera to be changed. For example, *Lycopodiumsporites* Thiergart 1937 genus, in spite of the botanical affinity, could not be retain because Holub (1983) and Ollgaard (1987) divided contemporary *Lycopodium* genus into new genera (*Huperzia, Lycopodiella, Lepidotis and Diphasiastrum*). According to this, for fossil sporomorphs, which morphological equivalents in Lycopodiaceae family may be found, but no in given genera, a new genus of *Lycopodiaceaesporis* was created.

10. The fossil genera of pollen grains or spores include in the name botanical affinity lost validity when their type species was improperly classified botanically. For example, *Juglanspollenites verus* Raatz 1937 cannot be included into *Juglans* genus because its morphological composition points to affinity to *Celtis* genus. In this case Potonié (1960) rule was obeyed (p. 135 – "if the type species of a genus is transferred to another genus the previous one lose his validity".

11. While a botanical affinity of a fossil species is designated to present-day species or genus the word "type" is added. It means that above all the morphological similarity of fossil spores or pollen grains to the taxon of the same rank occurs, what not always points to the botanical affinity. For example, the morphological type of pollen grains of "*Tilia* type" in Tiliaceae family presently occurs in two subfamilies in different genera (in Brownlowioideae the genera: *Berrya, Brownlowia*, and in Tilioideae: *Tilia*). In this case it was no possible to use the genera name of family origin because there are in Tiliaceae family also other morphological types of pollen grains.

12. Morphological name of a genera is retained if there is a morphological similarity of fossil sporomorphs to spores or pollen grains of more than one botanical taxon, e.g. the name *Tricolporopollenites megaexactus* is retained because there is no possibility to asses univocally the botanical affinity of this fossil species to a given botanical taxon; in this case in Cyrilaceae and Clethraceae families as similar morphological type occurs as in *Tricolporopollenites megaexactus.*

The symbols:
P – generally palaeotropical element
P1 – tropical
P2 – subtropical
A – generally arctotertiary element
A1 – warm-temperate
A2 – cool-temperate
Abbrevations "p.p." means pro parte

SYSTEMATIC PART

Cingulisporis Ważyńska **gen. nov.**

Polypodiaceoisporites Potonié 1951a ex Potonié 1956 p.p. *Cingulatisporites* Thomson 1953
Bifacialisporites Nagy 1963

Type species. ***Cingulisporis marxheimensis*** (Mürriger & Pflug 1952) **comb. nov.** (= *Triradiato – sporites marxheimensis* Mürriger & Pflug 1952, pl. 11, fig. 2; Marxheim, Upper Oligocene).

Derivation of name. Presence of a cingulum on the equator.

Diagnosis. Equatorial outline more or less triangular with rounded apices, sides straight or slightly concave or convex. On the equator a smooth cingulum, often more narrow on the apices. Trilete mark distinct, arms nearly reaching the equator. Surface on the distal face rugate with irregular distributed rugae, often fused together forming a pseudoreticulate pattern with irregular anastomosing muri. Sculp-

ture on the proximal face more or less similar to that of the distal face. Equatorial diameter 27–78 μm.

Botanical affinity. P.p. Schizaeaceae, p.p. Dicksoniaceae, p.p. Polypodiaceae, p.p. Cyatheaceae, p.p. Pteridaceae

Geofloristic element. Palaeotropical (P).

Remarks. A new genus based on the morphological features was created. It was used the names of spores of similar morphology: 1. *Cingulatisporites* Thomson 1953 – the genus lost validity because its type species *C. laevispeciosus* Pflug 1953 was transferred (with mistake in the species name *C. levis*) by Krutzsch (1963b) to *Leiotriletes* genus. 2. *Bifacialisporites* Nagy 1963 – according to Potonié (1966) it has not the typical cingulum. 3. *Polypodiaceoisporites* Potonié 1951a – it suggests family the botanical affinity to the Polypodiaceae improperly because this type of structure is found in other extant families fern, e.g. Pteridaceae, Schizaeaceae and Dicksoniaceae.

Cingulisporis marxheimensis (Mürriger & Pflug 1952) Ważyńska comb. nov.

Pl. 1, figs 2a, b; 3a, b

1952 *Triradiato – sporites marxheimensis* n. sp.; Mürriger & Pflug, p. 57, 61, 64, pl. 11, figs 2–4.
1953 *Cingulatisporites marxheimensis* (Mürriger & Pflug) n. comb.; Thomson & Pflug, p. 58, pl. 1, figs 13–15.
1959 *Polypodiaceoisporites marxheimensis* (Mürriger & Pflug) n. comb.; Krutzsch, p. 180.

Botanical affinity. P.p. Schizaeaceae, p.p. Dicksoniaceae

Geofloristic element. Palaeotropical (P1).

Occurrence. Oligocene – Lower Miocene.

Remarks. A new combination is a result of the genus change – see remarks in the diagnosis of genus. *Cingulisporis marxheimensis* was chosen as the type species taking into consideration the distinctive morphological features and relatively common, however not too abundant.

Cingulisporis corrutoratus (Nagy 1985) Ważyńska comb. nov.

Pl. 1, fig. 4a–c

1985 *Polypodiaceoisporites corrutoratus* n. sp.; Nagy, p. 96, pl. 27, figs 14–16, pl. 28, figs 1–6.

Botanical affinity. ? Polypodiaceae, ? Pteridaceae, p.p. *Pteris* type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Lower Miocene.

Remarks. A new combination is a result of the genus change – see remarks in the diagnosis of genus. The used combination *Polypodiaceoisporites corrutoratus* Nagy suggested the botanical affinity of this fossil species to the extant Polypodiaceae. In this family morphological variability of spores is very high and the morphological type *C. corrutoratus* is within this variability, however *C. corrutoratus* is comparable to spores of Pteridaceae family. Hence, the botanical affinity of fossil species is unknown and to the morphological type could be only classified.

Cingulisporis gracillimus (Nagy 1963) Ważyńska comb. nov.

Pl. 1, fig. 1a-c

1963 *Polypodiaceoisporites gracillimus* n. sp.; Nagy, p. 398–400, pl. 1, figs 3–6.

Botanical affinity. ? Polypodiaceae, ? Schizaeaceae (*Lygodium*), ? Pteridaceae, *Pteris* type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Lower Miocene.

Remarks. The new combination was introduced in the result of the genus change. The comparison of the *C. gracillimus* spores with present-day spores of Schizaeaeceae family (*Lygodium*) by Nagy (1963) and of Pteridaceae (*Pteris*) by Planderová (1990) validated the usage of the morphological generic name.

Cryptogrammasporis Skawińska **gen. nov.**

p.p. *Stereisporites* Krutzsch 1963b

Type species. ***Cryptogrammasporis magnoides*** (Krutzsch 1963b) **comb. nov.** {= *Stereisporites* (*Stereigranisporis*) *magnoides*; Krutzsch 1963b, p. 90, pl. 26, fig. 1–3, Rütterberg, Pliocene}.

Derivation of name. After the recent genus *Cryptogramma*.

Diagnosis. Spores trilete, equatorial outline triangular with rounded apices. Exospore 3 μm thick, two-layered with more or less undulated surface. Trilete mark with long laesura arms. Proximal face covered by small densely spaced verrucae, distal face covered by big verrucae,

3–4 µm in diameter, densely spaced. Equatorial diameter about 45 µm.

Botanical affinity. Pteridaceae, *Cryptogramma* type.

Geofloristic element. Arctotertiary (A). Genus *Cryptogramma* occurs at present in the temperate zone of northern hemisphere.

Remarks. Diagnosis of genus and new combination of species were for the first time given in the archival doctoral dissertation (K. Skawińska 1989). In species *Stereisporis* (*Stereigranisporis*) *magnoides* Krutzsch, the name of genus and subgenus has been changed into *Cryptogrammasporis*, because this morphological type of fossil spores is approximate to spores of the extant genus *Cryptogramma* (Pteropsida). The form of spore exine in this genus is different from the spores of genus *Stereisporites*, comparable to *Sphagnum* (Bryopsida).

Cryptogrammasporis magnoides (Krutzsch 1963) Skawińska comb. nov.

Pl. 2, fig. 1a-c

1963b *Stereisporites (Stereigranisporis) magnoides* n. sp.; Krutzsch, p. 90, pl. 26, figs 1–12.
1980 *Cryptogramma crispa* (Linne) Braun; Shatilova & Mtshedishvili, pl. 3, figs 5, 5a.
1993 *Cryptogramma* sp. 1; Kohlman-Adamska p. 107, pl. 6, fig. 5

Description. Spores trilete, equatorial outline triangular with rounded apices. Trilete mark with straight, 20–23 µm long arms. Exospore about 3 µm thick, two-layered, surface verrucate. Verrucae densely spaced on the distal face, 3–4 µm in diameter, on the proximal face smaller. Equatorial diameter of the spore about 46 µm.

Botanicalcal affinity. Pteridaceae, *Cryptogramma* type.

Geofloristic element. Arctotertiary (A1).

Occurrence. Miocene, Pliocene.

Remarks. Change of genus results from determination of the morphological similarity of fossil spores to extant spores of genus *Cryptogramma*, e.g. species: *C. crispa, C. stelleri, C. raddeana*.

Lycopodiaceaesporis Ważyńska **gen. nov.**

Lycopodiumsporites Thiergart 1937 ex Potonie 1956.
Camarozonosporites Pant 1954 ex Potonié 1956.
Retitriletes Hammen van der 1956 ex Pierce 1961 emend. Döring, Krutzsch, Mai & Schulz in Krutzsch 1963a.

Type species. ***Lycopodiaceaesporis*** (*Retitriletes* ex Krutzsch 1963a) ***pseudoclavatus*** (Krutzsch 1963a) **comb. nov.** (= *Retitriletes pseudoclavatus* Krutzsch; Krutzsch 1963a, p. 110, pl. 36, figs 1–5, Gerstungen/Werra, Upper Pliocene).

Derivation of name. After the Lycopodiaceae family.

Diagnosis. Spores trilete, equatorial outline rounded-triangular. Leasura arms reaching the equator. Exospore thick, two-layered, the outher layer thicker than the inner. On the distal face the sculpture is varying between irregular ridges formed by fusing together muri (*Camarozonosporites* and *Hamulatisporis* subgenera) to regular reticulate with polygonal lumina (*Retitriletes* subgenus). On the proximal face the sculpture is more or less similar to that of the distal face, totaly or sometimes partialy covering the surface. In the leasura arms area muri partialy free, anastomosing forming an irregular sculpture. Equatorial diameter 24–25 µm.

Botanical affinity. Lycopodiaceae.

Geofloristic element. Arctotertiary (A)/Palaeotropical (P), today to cosmopolitan family Lycopodiaceae belong 400, mainly tropical, species.

Remarks. The genus *Lycopodiumsporites* Thiergart 1937, cannot be maintained because of nomenclatural reasons (Krutzsch 1963). Holub (1983) and Ollgaard (1987) divided extant genus *Lycopodium* into several genera. In consequence, for fossil spores which morphological equivalents may be found in present-day family Lycopodiaceae, the new genus *Lycopodiaceaesporis* was created. This genus has three subgenera: two determined by Krutzsch 1963a (*Camarozonosporites* and *Hamulatisporis*) as subgenera within genus *Camarozonosporites*, and third, *Retitriletes*, described by Krutzsch (1963a) as a separate genus. The morphological features of all subgenera are within morphological variability of spores of Lycopodiaceae family. The genus *Selagosporis* Krutzsch 1963a was not included into newly formed genus. The spores of this taxon are morphologically very similar to spores of species *Huperzia selago* and have quite different morphology than other genera of Lycopodiaceae.

Lycopodiaceaesporis (*Retitriletes* ex Krutzsch 1963) *pseudoclavatus* (Krutzsch 1963) Ważyńska comb. nov.

Pl. 3, fig. 8a, b

1963a *Retitriletes pseudoclavatus* n. fsp.; Krutzsch, p. 110, pl. 36, figs 1–11.
1985 *Lycopodiumsporites pseudoclavatus* (Krutzsch) n. comb.; Nagy, p. 65, pl. 6, figs 12–15.

Botanical affinity. *Lycopodium* sect. *Lycopodium, L. clavatum* type.

Geofloristic element. Arctotertiary (A1), *Lycopodium clavatum* occurs in mixed forests of temperate zone and in montane forests of tropical zone.

Occurrence. Miocene – Pliocene.

Remarks. Change of genus results from the determination of botanical relations of fossil spores to extant family Lycopodiaceae and genus *Lycopodium* s.s. (*Lycopodium clavatum* type). In the specific name of new taxon the former genus *Retitriletes* Krutzsch 1963a, describing the sculpture of spore surface, was maintained as a subgenus.

Lycopodiaceaesporis (Camarozonosporites ex Krutzsch 1963) *decorus* (Wolf 1934) Ważyńska comb. nov.

Pl. 3, fig. 7a, b

1934 *Sporites decorus* n. sp.; Wolff, p. 67, pl. 5, fig. 12.
1959 *Camarozonosporites decorus* (Wolff) n. comb.; Krutzsch, p. 187.
1963a *Camarozonosporites (Camarozonosporites) decorus* (Wolff) Krutzsch; Krutzsch p. 126, pl. 44, figs 1–13.
1964 *Lycopodium* sp. 1 cf. *Camarozonosporites (Camarozonosporites) decorus* (Wolff) Krutzsch; Stuchlik, p. 13, pl. 2, fig. 4, 5.

Botanical affinity. *Lycopodiella* sect. *Campylostachys*, *Lycopodiella cernua* (= *Lycopodium cernuum*) type.

Geofloristic element. Palaeotropical (P1). *Lycopodiella cernua* occurs today in moist places in the tropical and subtropical zones.

Occurrence. Oligocene – Miocene.

Remarks. Change of genus results from the determination of botanical affinity of fossil spores to extant Lycopodiaceae and to genus *Lycopodiella* (*L. cernua* type). In the specific name of new taxon the genus *Camarozonosporites*, reflecting the relief of spore surface, was preserved.

Lycopodiaceaesporis (*Camarozonosporites* ex Krutzsch 1963a) *heskemensis* (Pflanzl 1955) Ważyńska comb. nov.

Pl. 3, fig. 9a, b

1955 *Cingulisporis heskemensis* n. sp.; Pflanzl in Mürriger & Pflanzl, p. 85, 87, pl. 5, figs 1–3.
1959 *Camarozonosporites heskemensis* (Pflanz) n. comb.; Krutzsch, p. 187–188, pl. 38, figs 413–421.
1961 *Lycopodium* forma *priva*; Doktorowicz-Hrebnicka, p. 192, pl. 3, fig. 26.
1963a *Camarozonosporites* (*Camarozonosporites*) *heskemensis* (Pflanzl) Krutzsch; Krutzsch, p. 122, pl. 42, figs 1–14.
1964 *Lycopodium cernuum* L. type; Stuchlik, p. 12, pl. 2, fig. 3.

Botanical affinity. *Lycopodiella* sect. *Campylostachys*, *Lycopodiella cernua* (=*Lycopodium cernuum*) type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Oligocene – Lower Miocene.

Remarks. As in the species mentioned previously.

Lycopodiaceaesporis (*Hamulatisporis* Krutzsch 1959) *helenensis* (Krutzsch 1963) Ważyńska comb. nov.

Pl. 4, fig. 1

1963a *Camarozonosporites* (*Hamulatisporis*) *helenensis* n. fsp.; Krutzsch, p. 128, pl. 45, figs 1–7.
1964 *Lycopodium* sp. 2; *Camarozonosporites* (*Hamulatisporis*) *helenensis* Krutzsch; Stuchlik, p. 13, pl. 2, fig. 9.

Botanical affinity: *Lycopodiella* sect. *caroliniana*: p.p. *L. caroliniana* (=*Lycopodium carolinianum*) type.

Geofloristic element. Palaeotropical (P2)/Arctotertiary (A).

Occurrence. Miocene.

Remarks. As in the species mentioned previously.

Lycopodiaceaesporis (Hamulatisporis Krutzsch 1959) *rarus* (Doktorowicz-Hrebnicka 1960) Ważyńska comb. nov.

Pl. 4, fig. 2

1960 *Lycopodium* forma *rara*; Doktorowicz-Hrebnicka, p. 74, pl. 16, figs 15, 16.
1963a *Camarozonosporites (Hamulatisporis) rarus* (Doktorowicz-Hrebnicka) emend. et nov. comb.; Krutzsch, p. 130, pl. 46, figs 1–16.

Botanical affinity. *Lycopodiella* sect. *caroliniana*, p.p. *L. caroliniana* (= *Lycopodium carolinianum*) type.

Geofloristic element. Palaeotropical (P2), *Lycopodiella caroliniana* occurs today in temperate and tropical climate along the Eeast and South shores of the U.S.A., in South America – Guyana, Brasilia, and in South Africa (absent in West America, Europe and temperate West Asia).

Occurrence. Oligocene – Miocene.

Remarks. Change of genus results from determination of the botanical affinity of fossil spores to genus *Lycopodiella* (*L. caroliniana* type) from the family Lycopodiaceae. In the specific name of new taxon subgenus *Hamulatisporis*, reflecting the relief of spore surface, was preserved.

Lycopodiaceaesporis (Retitriletes ex Krutzsch 1963) *lusaticus* (Krutzsch 1963) Ziembińska-Tworzydło comb. nov.

Pl. 3, fig. 11a–c

1963a *Retitriletes lusaticus* Krutzsch; Krutzsch, p. 96, pl. 29, fig. 1–5.

Botanical affinity. *Lycopodium clavatum* type.

Geofloristic element. Arctotertiary (A1).

Occurrence. Oligocene – Miocene.

Remarks. As in the species mentioned previously.

Osmundacidites Couper 1953

Type species. *Osmundacidites wellmanii* Couper 1953

Osmundacidites primarius major (Raatz 1937) Ziembińska-Tworzydło comb. nov.

Pl. 4, fig. 10a, b

1937 *Sporites primarius* Wolff f. major n. f.; Raatz, p. 13, pl. 1, fig. 14.
1960 *Osmunda – Sporites primarius* Wolff forma *pilosa major*; Doktorowicz-Hrebnicka, p. 74, pl. 15, figs 11, 12.
1967 *Baculatisporites primarius major* Raatz; Krutzsch, p. 56, pl. 10, figs 1–6.
1985 *Osmundacidites primarius* (Wolff) n. comb.; Nagy, p. 74, pl. 12, figs 5–6.

Botanical affinity. Osmundaceae, *Osmunda* type.

Geofloristic element. Arctotertiary (A1). Genus *Osmunda* with 14 species occurs today from temperate to tropical zones of northern hemisphere.

Occurrence. Miocene.

Remarks. Introduction of new combination of subspecies *Osmundacidites primarius* results from frequent occurrence of especially large spores of this species.

Selaginellisporis Ważyńska **gen. nov.**

Echinatisporis Krutzsch 1959

Type species. ***Selaginellisporis*** *(Echinatisporis* Krutzsch 1959) ***miocenicus*** (Krutzsch & Sontag 1963) **comb. nov.** (= *Echinatisporis miocenicus* Krutzsch & Sontag; Krutzsch, 1963b, p. 110, pl. 36, figs 6–9, II Lusatian Seam).

Derivation of name. After the recent genus *Selaginella*.

Diagnosis. Spores trilete, equatorial outline rounded to triangular with rounded apices. Tetrade mark with long arms nearly reaching the equator. Exospore thick, two-layered. Distal face covered by varied shape and size processes, loosely or densely spaced. Proximal face smooth or with some processes. Equatorial diameter without ridges 19–70 μm.

Botanical affinity. Selaginellaceae, *Selaginella* type.

Geofloristic element. Arctotertiary (A)/Palaeotropical (P). Today the species of genus *Selaginella* (more than 700) occur mainly in tropical and subtropical regions except for *S. selaginoides*, a boreal species.

Remarks. The new genus *Selaginellisporis* was formed for hitherto described fossil spores morphologically similar to spores of extant genus *Selaginella*. The genus *Echinatisporis*, described by Krutzsch (1959), reflecting the relief of spore surface was preserved as a subgenus.

Selaginellisporis (*Echinatisporis* Krutzsch 1959) *miocenicus* (Krutzsch & Sontag 1963) Ważyńska comb. nov.

Pl. 5, fig. 4

1963b *Echinatisporis miocenicus* n. fsp. (Krutzsch & Sontag); Krutzsch, p. 110, pl. 36, figs 6–13.

Botanical affinity. Selaginellaceae, *Selaginella* type.

Geofloristic element. Palaeotropical (P2)/Arctotertiary (A1).

Occurrence. Miocene.

Remarks. *Selaginellisporis* (*Echinatisporis*) *miocaenicus* has been chosen as the type

species of genus *Selaginellisporis* because is morphologically most resembling the spores of present-day genus *Selaginella*. It occurs in Neogene layers more frequently than other species of this genus.

Selaginellisporis (Echinatisporis Krutzsch 1959 *echinoides* (Krutzsch & Pacltová 1963) Ważyńska comb. nov.

Pl. 5, fig. 5a, b

1963b *Echinatisporis echinoides* n. fsp. (Krutzsch & Pacltová); Krutzsch, p. 114, pl. 38, figs 1–5.

Botanical affinity. Selaginellaceae, *Selaginella* type.

Geofloristic element. Arctotertiary (A1)/Palaeotropical (P2).

Occurrence. Miocene.

Remarks. As in the species mentioned previously.

Selaginellisporis (Echinatisporis Krutzsch 1959) *longechinus* (Krutzsch 1959) Ważyńska comb. nov.

Pl. 5, fig. 3

1959 *Echinatisporis longechinus* n. fsp.; Krutzsch, p. 133, pl. 20, figs 217, 218.; pl. 21, fig. 219; pl. 22, figs 229–233.

Botanical affinity. Selaginellaceae, *Selaginella* type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Eocene – Lower Miocene.

Remarks. As in the species mentioned previously.

Tsugaepollenites Potonie & Venitz 1934 ex Potonié 1958

Type species. *Tsugaepollenites igniculus* (Potonié 1931) Potonie & Venitz 1934 ex Potonié 1958

Botanical affinity. Pinaceae, *Tsuga* type

Geofloristic element. Arctotertiary (A1). The genus Tsuga with 14 species occurs on northern hemisphere in the Himalayas, Japan and North America.

Remarks. Because of similar morphology of fossil pollen grains to the grains of extant genus *Tsuga* the taxon *Tsugaepollenites* Potonié et Venitz 1934 have been restored replacing later morphological genus (younger synonym) *Zonalapollenites* Pflug 1953.

Tsugaepollenites spectabilis (Doktorowicz-Hrebnicka 1964) Słodkowska comb. nov.

Pl. 6, fig. 16

1964 *Tsuga* typ *diversifolia* Rudolph forma *spectabilis*; Doktorowicz-Hrebnicka, p. 38, pl. 6, fig. 17, 17a.

1971 *Zonalapollenites reuterbergensis* n. sp. (= *Tsuga reuterbergensis* n. sp.); Krutzsch, p. 156, pl. 45, figs 1–4.

1974 *Zonalapollenites spectabilis* (Doktorowicz-Hrebnicka) n. comb.; Ziembińska-Tworzydło, p. 354, pl. 12, fig. 3.

Botanical affinity. *Tsuga diversifolia* type.

Geofloristic element. Arctotertiary (A1).

Occurrence. Miocene – Pliocene.

Remarks. The change of genus results from determination of the morphological similarity of fossil pollen grains to the grains of extant genus *Tsuga* (*T. diversifolia* type), which is connected with restoration of taxon *Tsugaepollenites* and underlines the priority of the nomenclator of the species. Two species known from the literature *Zonalapollenites spectabilis* (Doktorowicz- Hrebnicka) Ziembińska-Tworzydło and *Z. reuterbergensis* Krutzsch do not manifest any differences in the morphological structure.

Tsugaepollenites spinosus (Doktorowicz-Hrebnicka 1964) Słodkowska comb. nov.

Pl. 6, fig. 12

1964 *Tsuga* typ *diversifolia* Rudolph forma *spinosa*; Doktorowicz-Hrebnicka, p. 38, pl. 9, fig. 39.

1971 *Zonalapollenites spinulosus* n. sp. (=*Tsuga spinulosa* n. sp.); Krutzsch, p. 148, pl. 41, figs 1–10.

1974 *Zonalapollenites spinosus* (Doktorowicz-Hrebnicka) n. comb.; Ziembińska-Tworzydło, p. 353, pl. 12, fig. 1a, b.

1985 *Tsugaepollenites spinulosus* (Krutzsch) n. comb.; Nagy, p. 136, pl. 47, fig. 2.

Botanical affinity. *Tsuga diversifolia* type.

Geofloristic element. Arctotertiary (A1). Today *Tsuga diversifolia* occurs in montane forests of Japan.

Occurrence. Miocene – Pliocene.

Remarks. The change of genus results from the determination of morphological similarity of fossil pollen grains to pollen grains of extant genus *Tsuga* (*T. diversifolia* type) which is connected with restoration of taxon *Tsugaepollenites* and underlines the priority of the author of the species. Two species known from the literature *Zonalapollenites spinosus* (Doktorowicz-Hrebnicka 1964) Ziembińska-Tworzydło

1974 and *Z. spinulosus* Krutzsch 1971 do not manifest distinct differences in morphological structure.

Keteleeriapollenites Nagy 1969

Type species. *Keteleeriapollenites komlonsis* Nagy 1969

Keteleeriapollenites dubius (Chlonova 1960) Słodkowska comb. nov.

Pl. 7, fig. 6

1960 *Keteleeria dubia* n. sp.; Chlonova, p. 59, pl. 9, fig. 5.
1971 *Abiespollenites dubius* (Chlonova) n. comb. (= ? *Keteleeria dubia* Chlonova 1960); Krutzsch, p. 98, pl. 21, figs 1–10.

Botanical affinity. Pinaceae, *Keteleeria* type.

Geofloristic element. Arctotertiary (A1). The genus *Keteleeria* (4 species) occurs today in mixed forests of SE China.

Occurrence. Miocene.

Remarks. The change of genus results from determination of the botanical affinities of fossil pollen grains to pollen grains of genus *Keteleeria*. They are very large (> 100 μm), the corpus is round and of relatively thin exine, a reticulum of the same type both on the corpus and on the sacs (but on sacs with much larger lumina) and there is no crest on the corpus, so typical of the pollen grains of *Abies*.

Aglaoreidiapollis Grabowska **nom. nov.**

Aglaoreidia Erdtman 1960

Type species. ***Aglaoreidiapollis cyclops*** (Erdtman 1960) **nom. nov.** (= *Aglaoreidia cyclops* Erdtman 1960)

Botanical affinity. Unknown.

Geofloristic element. Palaeotropical (P).

Remarks. Nomen novum has been formed by addition to the name of taxon *Aglaoreidia* an suffix -pollis, in order to show the character of organ. Both the diagnosis of genus according to Erdtman 1960, supplemented by Krutzsch 1970a, and the type species are left without changes.

Aglaoreidiapollis cyclops (Erdtman 1960) Grabowska nom. nov.

Pl. 8, fig. 7

1960 *Aglaoreidia cyclops* n. sp.; Erdtman, p. 47, pl. 1, figs b, c.
1970a *Aglaoreidia cyclops* Erdtman; Krutzsch, p. 88, pl. 15, figs 1–20.

Botanical affinity. Unknown, ? Ruppiaceae, ? Amarylidaceae, ? Liliaceae.

Geofloristic element. Palaeotropical (P1).

Occurrence. Lower Eocene – Lower Oligocene.

Remarks. Nomen novum in the name of species is the result of changes in genus by addition of the suffix -pollis to the name *Aglaoreidia*.

Graminidites Cookson 1947 ex Potonié 1960

Type species. *Graminidites media* Cookson 1947

Graminidites bambusoides Stuchlik sp. nov.

Pl. 8, figs 4, 5

1964 *Gramineae "Bambusa"* type; Stuchlik, p. 76, pl. 24, figs 1, 2.
1970a *Graminidites* sp. A (*Bambusa* – typus); Krutzsch, p. 51, pl. 1, fig. 1.
1990 *Graminidites* cf. sp. A *Bambusa* type (Stuchlik) n. comb.; Planderová, p. 54, pl. 24, figs 1, 2.

Holotype. Pl. 8, fig. 5 (= *Gramineae "Bambusa"* type; 1964 Stuchlik, pl. 24, fig. 1)

Locus typicus. Borehole Rypin

Stratum typicum. Middle Miocene

Derivation of name. After the recent genus *Bambusa*.

Diagnosis. Pollen grains oval to spheroidal, polar axis 50–60 μm. On the distal pol a pore about 4 μm in diameter with an annulus about 4 μm broad. Exine very thin (less than 1 μm with secondary falts, surface psilate to finely granulate.

Botanical affinity. Poaceae, *Bambusa* type.

Geofloristic element. Palaeotropical (P2). Today the genus *Bambusa* (75 species) occurs in tropical and subtropical Asia and America.

Occurrence. Miocene.

Remarks. The name given by Stuchlik (1964) and other authors was not valid in the light of regulations of ICBN. Now the present-day name *Bambusa* has been replaced by adjective form in the name of fossil species *bambusoides*. Similar pollen grains have also been observed in other extant grass genera, e.g. *Oryza, Clidonia* and *Dendrocalamus*.

Milfordiapollis Grabowska **nom. nov.**

p.p. *Inaperturopollenites* Pflug & Thomson 1953
p.p. *Monoporopollenites* Meyer 1956 ex Potonie 1960
Milfordia Erdtman 1960
Restionidites Elsik 1968
Centrolepidacites Wu Zuo-ji & Yu Jin-feng 1981

Type species. ***Milfordiapollis incertus*** (Pflug & Thomson 1953) Krutzsch 1961 **nom. nov.** (=*Inaperturopollenites incertus* Pflug & Thomson 1953 p. 66, pl. 5, fig. 34)

Derivation of name. After a locality in England (Erdtman 1960) suffix pollis indicates the plant organ.

Botanical affinity. P.p. Restionaceae, p.p. Centrolepidaceae, p.p. Flagellariaceae.

Geofloristic element. Palaeotropical (P). Families Restionaceae, Flagellariaceae and the majority of genera of Centrolepidaceae occur in tropical part of southern hemisphere (Africa, Australia, New Zealand, Chile). Some genera of Centroleidaceae grow in SE China and Malesia.

Remarks. Nomen novum has been formed by addition of the suffix -pollis to the name *Milfordia*, in order to show the character of organ. The morphological genera, to which the type species *M. incertus* was included, have been rejected: 1. *Inaperturopollenites* Pflug & Thomson because its morphological structure did not correspond with morphology of the type species; 2. *Monoporopollenites* Meyer because this is collective genus; 3. Genera *Restioniidites* Elsik and *Centrolepidacites* Wu Zuo-ji & Yu Jin-feng, connected with extant families, have not been accepted because the pollen morphology in both families is very similar. Pores are both of "centrolepidoid" and "graminoid" type (Chanda 1966, Ladd 1977), while in related family Flagellariaceae only "graminoid". Exine has always tectum perforatum. All these features occur in species of genus *Milfordiapollis*. Hence, this taxon cannot be included into particular family.

Diagnosis of the genus (Erdtman 1960) with later supplement (Krutzsch 1970a) and the type species *M. incerta*, chose and described by Krutzsch 1961, have been left without changes.

Milfordiapollis incertus (Pflug & Thomson 1953) Krutzsch 1961 Grabowska nom. nov.
Pl. 8, figs 8, 9

1953 *Inaperturopollenites incertus* n. sp. (Pflug & Thomson); Thomson & Pflug, p. 66, pl. 5, figs 31–36.
1960 *Milfordia hypolaenoides* n. sp.; Erdtman, p. 46, pl. 1, fig. a.
1961 *Milfordia incerta* (Thomson & Pflug) n. comb.; Krutzsch, p. 325
1970a *Milfordia incerta* (Thomson & Pflug) Krutzsch; Krutzsch, p. 72, pl. 9, figs 1–26.

Botanical affinity. P.p. Restionaceae, p.p. Centolepidaceae.

Geofloristic element. Palaeotropical (P1).

Occurrence. Lower Eocene – Middle Miocene.

Remarks. Nomen novum for this species with pores of "centrolepidoid" type is connected with the genus which does not show proper botanical affinities because this morphological type of pollen grains occurs in the families Restionaceae and Centrolepidaceae.

Milfordiapollis hungaricus (Kedves 1965) Krutzsch & Vanhoorne in Krutzsch 1970 Grabowska comb. nov.
Pl. 8, fig. 11

1965 *Monoporopollenites hungaricus* n. fsp.; Kedves, p. 50, 51, figs 1–6.
1968 *Restioniidites hungaricus* (Kedves) n. comb.; Elsik, p. 313, pl. 15, fig. 13.
1970a *Milfordia hungarica* (Kedves) Krutzsch & Vanhoorn; Krutzsch, p. 74, 75, pl. 10, figs 1–3.

Botanical affinity. P.p. Restionaceae, p.p. Centrolepidaceae, p.p. Flagellariaceae

Geofloristic element. Palaeotropical (P1).

Occurrence. Lower Eocene – Lower Oligocene.

Remarks. Nomen novum for this species with pores of "graminoid" type is connected with new name of genus which does not show a proper botanical affinity. This morphological type of pollen grains occur in three extant families: Restionaceae, Centrolepidaceae and Flagellariaceae.

Milfordiapollis minimus Krutzsch 1970 Grabowska comb. nov.
Pl. 8, fig. 10a, b

1970a *Milfordia minima* n. sp.; Krutzsch, p. 76, pl. 10, figs 1–34.
1974 *Restioniidites minimus* (Krutzsch) n. comb.; Kedves, p. 26, pl. 11, figs. 1–3.

Botanical affinity. P.p. Restionaceae, p.p. Centrolepidaceae, p.p. Flagelariaceae.

Geofloristic element. Palaeotropical (P1).

Occurrence. Eocene – Oligocene, Lower Miocene.

Remarks. As for the former species.

Corylopollis Ziembińska-Tworzydło **gen. nov.**

non *Coryli?-pollenites* Potonié 1934
non *Corylus-pollenites* Raatz 1937
non *Corylus-pollenites* Thiergart 1937 (nomen nudum)
Coryloidites Potonié, Thomson & Thiergart 1950
p.p. *Triporopollenites* Pflug & Thomson 1953

Type species. ***Corylopollis coryloides*** (Pflug 1953b) **comb. nov.** (= *Triporopollenites coryloides* Pflug 1953b; Thomson & Pflug 1953, p. 84, pl. 9, fig. 20, Wallensen, Middle Pliocene).

Derivation of name. After the extant genus *Corylus*.

Diagnosis. Pollen grains triporate, equatorial outline triangular, apertures on the apices circular or slightly lolongate. Equatorial diameter 23–35 µm, polar axis about 10 µm long. Exine tectate, tectum smooth to provided with very fine irregular spaced processes. Endexine forming a small annulus around the pore.

Botanical affinity. Betulaceae, *Corylus* type.

Geofloristic element. Arctotertiary (A). Today *Corylus* (15 species) occurs in temperate and warm-temperate zones of Europe, North America and Asia.

Remarks. *Triporopollenites coryloides* Pflug 1953b possessing features similar to pollen grains of *Corylus* has been taken as type species. From very similar morphologically genus *Myricipites* it differs in the structure of germinal apparatures. Described hitherto genera *Coryli*?*-pollenites* Potonié 1934 and *Corylus-pollenites* Raatz 1937 have been admitted by Potonié (1960) as younger synonyms of genus *Myricipites* Wodehouse 1933. *Coryli*?*-pollenites corypheus* Potonié, later transferred to genus *Myriciptes*, was the type species for both genera. To the genus *Coryloidites* its authors Potonié, Thomson & Thiergart (1950) did not included any species.

Corylopollis coryloides (Pflug 1953) Ziembińska-Tworzydło comb. nov.

Pl. 8, figs 17, 18

1953b *Triporopollenites coryloides* n. sp. (Pflug); Thomson & Pflug, p. 84, pl. 9, figs 20–24.
1960 *Triporopollenites coryloides* Pflug emend. Potonié; Potonié, p. 116, 117.

Botanical affinity. *Corylus avellana* type.

Geofloristic element. Arctotertiary (A2).

Occurrence. Oligocene – Pliocene.

Remarks. The change of genus results from determination of the botanical affinities of fossil pollen grains to the grains of extant genus *Corylus*.

Myricipites Wodehouse 1933

Type species. *Myricipites dubius* Wodehouse 1933

Myricipites microcoryphaeus (Potonié 1931) Słodkowska comb. nov.

Pl. 8, figs 23, 24

1931a *Pollenites microcoryphaeus* n. sp.; Potonié, p. 332, pl. 2, fig. 13.
1950 *Engelhardtioidites microcoryphaeus* Potonié; Potonié & al., p. 51, pl. B, fig. 8; pl. C, fig.16.
1953 *Triatriopollenites coryphaeus* (Potonié) subsp. *microcoryphaeus* (Potonié); Thomson & Pflug, p. 80, 81, pl. 8, figs 38–63.
1990 non *Engelhardtioidites microcoryphaeus* (Potonié) Potonié; Planderová, p. 214, pl. 61, figs 1–19

Botanical affinity. *Myrica* type.

Geofloristic element. Palaeotropical (P2). Presently *Myrica* genus (54 species) occurs mostly in subtropical zone, few species in temperate zone and moderately warm-temperate zone of northern hemisphere.

Occurrence. Eocene – Middle Miocene.

Remarks. *Myrcipites microcoryphaeus* has a morphological composition pointing at greater similarity to pollen grain of *Myrica* genus (clearly visible atrium, the thick exine), than to *Engelhardtia*. In the light microscope, in specimens determined as *Myricipites microcoryphaeus*, the punctate tectum is not visible, so characteristic of Juglandaceae family. There is a feature, which served as the base for transferring the species from *Engelhardtioidites* genus to *Myrcipites* one.

Celtipollenites Nagy 1969

Type species. *Celtipollenites komlonsis* Nagy 1969

Celtipollenites verus (Raatz 1937) Ziembińska-Tworzydło comb. nov.

Pl. 9, figs 11, 12

1937 *Juglans-pollenites verus* n. sp.; Raatz, p. 18, pl. 1, fig. 9. 1961 *Carpinus* forma *naturalis*; Doktorowicz-Hrebnicka, p. 226, pl. 11, fig. 143.

1973 *Celtis vera* (Raatz) n. comb.; Lubomirova & Timoshkina, p. 14, pl. 1, figs 6–8.

Botanical affinity. Ulmaceae, *Celtis* type.

Geofloristic element. Arctotertiary (A1), the genus *Celtis* (80 species) occurs presently in subtropical zone, and only one species in temperate zone.

Occurrence. Miocene – Pliocene.

Remarks. The common features of fossil pollen graines of *Juglanspollenites verus* and the grains of *Celtis* genus (Lubmirova & Timoshkina 1973) enable the species to the *Celtipollenites* Nagy genus be incorporated. Because the type species for the *Juglanspollenites* genus was *J. verus*, when transferred to other ones, the genus *Juglanspollenites* was no longer valid.

Haloragacidites Couper 1953

Type species. *Haloragacidites trioratus* Couper 1953

Haloragacidites stephanoporatus (Stuchlik 1964) Stuchlik comb. nov.

Pl. 9, fig. 16

1964 *Halorrhagoidites stephanoporatus* n. sp.; Stuchlik, p. 52–53, pl. 16, figs 7, 8.

Description. Pollen grains 6-porate, equatorial outline hexagonal. Pores in the equator are on apices with an annulus about 5 μm broad. Exine about 3 μm thick, two layered, verrucate. Verrucae on their tops flatty truncate, densely and irregularly spaced. Equatorial diameter 25 μm.

Botanical affinity. Haloragaceae, *Haloragis* type.

Geofloristic element. Palaeotropical (P2).

Occurrence. Middle Miocene.

Remarks. The genus *Halorrhagoidites* Stuchlik 1964 is no longer valid because it was not definied, however species features of *H. stephanopratus* Stuchlik 1964 cover the diagnosis of the genus *Haloragacidites* Couper 1953.

Haloragacidites triporatus (Stuchlik 1964) Stuchlik comb. nov.

Pl. 9, fig. 17a, b

1964 *Halorrhagoidites triporatus* n. sp.; Stuchlik, p. 52, pl. 16, fig. 6.

Description. Pollen grains triporate with very short polar axis. Equatorial outline triangular with slightly thickened pore area. Exine less than 2 μm thick, verrucate, verrucae about 3 μm in diameter. Equatorial diameter of pollen grain about 30 μm.

Botanical affinity. Haloragaceae, *Haloragis* (=*Hallorrhagis*) type.

Geofloristic element. Palaeotropical (P2). Presently *Haloragis* (60 species) occurs mainly on southern hemisphere and on northern in S-E Asia.

Occurrence. Middle Miocene.

Remarks. The genus *Halorrhagoidites* Stuchlik 1964 is no longer valid because it was not definied, however species features of *H. triporatus* Stuchlik 1964 cover the diagnosis of the genus *Haloragacidites* Couper 1953.

Juglandipollis Kohlman-Adamska **gen. nov.**

p.p. *Juglanspollenites* Raatz 1937
p.p. *Multiporopollenites* Pflug 1953b
non *Juglandipites* Simpson 1961

Type species. ***Juglandipollis juglandoides* sp. nov.**

Derivation of name. After the recent genus *Juglans*

Diagnosis. Pollen grains polyporate spheroidal to oval. Pores circular to oval distributed in the equator area and on one hemisphere of the pollen grain. Exine two-layered, ectexine thicker than endexine, in the pore area somewhat swollen, forming more or less distinct annulus. Surface tectate, tectum provided with spinulae. Equatorial diameter 30–50 μm.

Botanical affinity. Juglandaceae, *Juglans* type.

Geofloristic element. Arctotertiary (A), presently the *Juglans* genus (15 species) occurs from southern Europe to eastern Asia and in the South and North America.

Remarks. There are known three fossil pollen genera, which botanical names are connected with *Juglans* genus. 1. *Juglanspollenites* is no longer valid because the type species *Juglanspollenites verus* Raatz 1937 considered as the *Celtis* (Lubmirova & Timoshkina 1973) was transferred to the genus *Celtipollenites* Nagy 1969. 2. *Juglandipites* with the type species *J. magniforamina* Simpson 1961 was created on the basis of a single spe-

cimen and according to Potonié (1970) is a synonym of *Juglanspollenites* genus. 3. There is no longer valid morphological genus *Multiporopollenites* Pflug 1953 because its type species *M. maculosus* morphologically resembles to pollen grains of present-day *Juglans* genus, and it was transferred to a new ones of *Juglandipollis*.

Juglandipollis juglandoides Kohlman-Adamska sp. nov.

Pl. 9, figs 18, 19

1993 *Juglans* Linné – type 1; Kohlman-Adamska, p. 133, pl. 17, fig. 11.

Holotype. Pl. 9, fig. 19.

Locus typicus. Borehole Kosztowo.

Type horizon. Middle Miocene (Ścinawa Formation).

Derivation of name. After the recent genus *Juglans*.

Diagnosis. Pollen grains polyporate, oval to spheroidal, diameter 30–40 µm. Pores circular 2–4 µm in diameter, distributed in the equator area and on one hemisphere. Exine two-layered about 2 µm thick, ectexine thicker than endexine, tectate, in the pore are somewhat swollen, up to 2.5 µm forming a distinct annulus.

Botanical affinity. *Juglans* type (*J. cinerea, J. nigra*).

Geofloristic element. Arctotertiary (A1). Extant species *Juglans cinerea* and *J. nigra* occur in warm-temperate zone of the North America.

Occurrence. Miocene – Pliocene.

Remarks. *Juglandipollis juglandoides* differs from *J. maculosus* having less number of pores and more clearly visible the ring surrounding them.

Juglandipollis maculosus (Potonié 1931) Kohlman-Adamska comb. nov.

Pl. 9, fig. 20

1931b *Pollenites maculosus* n. sp.; Potonié, p. 27, pl. 2, fig. V19d.
1953 *Multiporopollenites maculosus* (Potonié) n. comb.; Thomson & Pflug, p. 94, pl. 10, fig. 95.
1985 *Juglanspollenites maculosus* (Potonié) n. comb.; Nagy, p. 204 pl. 115, fig. 15.

Botanical affinity. *Juglans* type (*J. regia, J. sigillata*).

Geofloristic element. Arctotertiary (A1). Presently *Juglans regia* occurs from the mediterranean areas of Europe to Eastern Asia, and *J. sigillata* in China (the Yunnan Province).

Occurrence. Oligocene – Miocene.

Remarks. Change of genus results from the determination of morphological similarity of fossil grains of *Multiporopollenites* to pollen of *Juglans* genus. Transferring the type species *Multiporopollenites maculosus* to *Juglanspollenites* genus (presently *Juglandipollis*) by Nagy (1985) makes the morphological genus of *Multiporopollenites* no longer valid.

Butomuspollenites (Doktorowicz-Hrebnicka 1957) Ziembińska-Tworzydło emend.

p.p. *Monocolpopollenites* Pflug & Thomson 1953
p.p. *Arecipites* Krutzsch 1970a

Type species. ***Butomuspollenites monocolpatus*** Doktorowicz-Hrebnicka 1957 **emend.** (= *Butomus – Pollenites monocolpatus* f. nov.; Doktorowicz-Hrebnicka, 1957 p. 111, pl. 22, figs 11, 12, Orłowo, Poznań Clay, Upper Miocene).

Derivation of name. After the recent genus *Butomus*.

Diagnosis. Pollen grains monocolpate, usually asymetric. Equatorial outline in polar view irregular ellipsoidal. Colpus on the distal side (anacolpate) narrow, sharpened at the endings. Exine two-layered, ectexine semitectate, reticulate, lumina polygonal to more or less circular, muri distinctly simplibaculate. Lumina diameter bigger on the proximal side, decreasing on the distal side in the colpus area. Equatorial diameter 25–45 µm.

Botanical affinity. Butomaceae, *Butomus* type.

Geofloristic element. Arctotertiary (A). Presently a monotype family Butomaceae with the species *Butomus umbellatus* occurs in wetlands and watersides in Europe and Asia.

Remarks. The generic name established by Doktorowicz-Hrebnicka (1957) clearly points to the botanical affinity of fossil pollen grains of this type to pollen of *Butomus* genus. The generic name *Arecipites* Wodehouse 1933 proposed by Krutzsch (1970a) for species *A. butomoides, A. monocolpatus* and *A. longicolpatus* suggests a botanical affinity to palms (Arecaceae). Nichols et al. (1973) transferred *A. buto-*

moides to the *Monocolpopollenites* genus. Taking into consideration the morphological similarity of fossil grains to the grains of present-day *Butomus* genus, these species were finally included into the *Butomuspollenites* genus. The features differing certain species each of other are structure of the reticulum, size of the lumina and size of the specimens.

Butomuspollenites monocolpatus (Doktorowicz-Hrebnicka 1957) Ziembińska-Tworzydło emend.

Pl. 10, fig. 13a, b

1957 *Butomus – Pollenites monocolpatus* f. nov.; Doktorowicz-Hrebnicka, p. 111, pl. 22, figs 11, 12.
1970a *Arecipites monocolpatus* (Doktorowicz-Hrebnicka) n. comb.; Krutzsch, p. 118, pl. 25, figs 14, 15.

Diagnosis emended. Pollen grains monocolpate, equatorial outline irregular, 35–45 µm in diameter. Colpus long, overlapping the outline forming a characteristic appendix-like outgrowth. Exine two-layered, ectexine semitectate, reticulate. Reticulum with irregular circular lumina. On the proximal side lumina diameter biger decreasing towards the colpus.

Botanical affinity. *Butomus* type.

Geofloristic element. Arctotertiary (A2).

Occurence. Upper Miocene – Pliocene.

Remarks. The species established by Doktorowicz-Hrebnicka (1957) has the morphological features resemble pollen grains of *Butomus* genus, and it is distinguished as the type species of *Butomuspollenites* genus. Krutzsch (1970a) reserved about too large size of pollen grains of this species relating to pollen of extant *Butomus* genus.

Butomuspollenites butomoides (Krutzsch 1970) Ziembińska-Tworzydło comb. nov.

Pl. 10, fig. 12a, b

1970a *Arecipites butomoides* subsp. *butomoides*; Krutzsch, p. 112, pl. 24, figs 12–29.
1973 *Monocolpopollenites butomoides* (Krutzsch 1970) n. comb.; Nichols & al., p. 252.

Botanical affinity. *Butomus* type.

Geofloristic element. Arctotertiary (A2).

Occurrence. Miocene – Pliocene.

Remarks. Change of generic name results from the determination of botanical affinity of fossil pollen grains to *Butomus* genus.

Butomuspollenites longicolpatus (Krutzsch 1970) Ziembińska-Tworzydło comb. nov.

Pl. 10, fig. 14a, b

1970a *Arecipites longicolpatus* n. sp.; Krutzsch, p. 112, pl. 25, figs 1–13.

Botanical affinity. *Butomus* type.

Geofloristic element. Arctotertiary (A2).

Occurrence. Miocene – Pliocene.

Remarks. Change of generic name results from the determination of botanical affinity of fossil pollen grains to *Butomus* genus.

Aceripollenites Nagy 1969

Type species. *Aceripollenites reticulatus* Nagy 1969

Aceripollenites palmatoides Skawińska sp. nov.

Pl. 11, fig. 8a–c

1985 *Acer palmatum* type; Skawińska p. 108–109, pl. 1, figs 1–10.

Holotype. Pl. 11, fig. 8a–c.

Locus typicus. Borehole Ostrzeszów GEO3.

Stratum typicum. Middle Miocene (Poznań Formation).

Derivation of name: After the recent species *Acer palmatum*.

Diagnosis. Pollen grains tricolporate, prolate-spheroidal with long colpi nearly meeting each on the pole. Pores lolongate 8 x 3 µm. Exine two-layered about 1.5 µm thick, ectexine twice thick as endexine, semitectate striato-reticulate. Striae distinct, narrow, running parallel to each other, anastomosing, forming finereticulate pattern polar axis 31–33 µm, equatorial diameter 20–30 µm.

Botanical affinity. Aceraceae, *Acer palmatum* type.

Geofloristic element. Arctotertiary (A1), recently *Acer palmatum* occurs in warm-temperate zone of Japan.

Occurrence. Middle Miocene

Remarks. The species name was introduced for the first time and the species described in the archival doctoral dissertation (Skawińska 1989).

Aesculidites Elsik 1968

Type species. *Aesculidites circumcristatus* (Fairchild 1966) Elsik 1968

Aesculidites hippocastaneoides Sadowska sp. nov.

Pl. 11, figs 6, 7

1984 *Aesculus*; Jahn & al., pl. 9, figs 16–26.

Holotype. Pl. 11, fig. 7.

Locus typicus. Outcrop Kłodzko.

Stratum typicum. Pliocene.

Derivation of name. After the recent species *Aesculus hippocastanum*

Diagnosis. Pollen grains tricolporate, isopolar, in equatorial view oval with narrow rounded pole fields. Polar axis 20–30 μm long. Colpi long, narrow with circular pores in the equator area. Along the colpi ectexine provided with small spinules. Between the colpi exine psilate or finely granulate.

Botanical affinity. Hippocastaneaceae, *Aesculus hipocastanum* type.

Geofloristic element. Arctotertiary (A1), presently *Aesculus hippocastanum* occurs in montane areas of the Balkan Peninsula.

Occurrence. Miocene – Pliocene

Remarks. The fossil pollen grains are morphologically related to pollen of extant species *Aesculus hippocastanum*. This is relatively often element of Pliocene floras of Europe.

Caprifoliipites Wodehouse 1933

Type species. *Caprifoliipites viridiflumi-nipites* Wodehouse 1933

Caprifoliipites viburnoides (Gruas – Cavagnetto 1978) Kohlman-Adamska comb. nov.

Pl. 12, figs 12a, b; 13a, b.

1978 *Tricolporopollenites viburnoides* n. fsp. Gruas – Cavagnetto, p. 36, pl. 14, figs 16–19.

1993 *Viburnum* L. – typ; Kohlman-Adamska, p. 154, pl. 33, figs 7a,b; 8a,b.

Botanical affinity. Caprifoliaceae, *Viburnum* type.

Geofloristic element. Arctotertiary (A1). Presently the genus *Viburnum* (200 species) occurs in the temperate and subtropical zones of northern hemisphere, mainly in Asia and North America.

Occurrence. Eocene – Pliocene.

Remarks. *Tricolporopollenites viburnoides* Gruas-Cavagnetto is included to the *Caprifoliipites* genus considering its great similarity to present-day pollen grains of *Viburnum* of the Caprifoliaceae family. *C. viburnoides* is the species sensu lato covers fossil pollen grains resembling several extant species of *Viburnum*, e.g. *V. odoratissimum, V. carlesi, V. lentago.*

Castaneoideaepollis Grabowska **gen. nov.**

Castanea-pollenites Raatz 1937
Castanopsis?-pollenites Thiergart 1937
Castaneoidites Potonié, Thomson, Thiergart 1950
Castaneoipollenites Potonié 1951b
Cupuliferoipollenites Potonié 1951 ex Potonié 1960
p.p. *Tricolporopollenites* Pflug & Thomson 1953

Type species. ***Castaneoideaepollis oviformis*** (Potonié 1934) **comb. nov.** (= *Pollenites oviformis* Potonié 1934, p. 95, pl. 5, fig. 27, Geiseltal, Eocene)

Derivation of name. After the recent subfamily Castaneoideae (Fagaceae).

Diagnosis. Pollen grains tricolporate prolate (polar axis to 25 μm, equatorial diameter to 12 μm). Outline in equatorial view oval to broadly oval. Colpi narrow nearly parallel not meeting in the pole, with pores in the equator. Pores more or less circular to slightly lolongate. Exine two-layered rather thin, ectexine as thick as endexine, tectate, tectum psilate or so.

Botanical affinity. Fagaceae, Castaneoideae (*Castanea, Castanopsis, Passania, Lithocarpus* types)

Geofloristic element. Palaeotropical (P). Recently members of the Castaneoideae subfamily occur mainly in subtropical and tropical zones of Asia and less often in North America.

Remarks. The genera which names were connected with the botanical affinity were refused: 1. *Castaneapollenites* Raatz 1937 and *Castaneoidites* Potonié, Thomson & Thiergart 1950 because for both taxa the type species was *Pollenites exactus* Potonié 1931d. 2. The *Castaneoipollenites* Potonié 1934 is nomen nudum and synonym for *Castaneoidites* Potonié, Thomson & Thiergart. 3. *Castanopsis*? - *pollenites* Thiergart 1937 was no validated by Potonié 1960. 4. *Cupuliferoipollenites* Potonié 1951 originates from the old name Cupuliferae used for Fagaceae family. This family comprises three subfamilies: Castaneoideae, Fagoideae, and Quercoideae, and each of them is characterized by different morphology of pollen grains. 5. For fossil grains with structure similar to pollen of Castaneoideae subfamily a new genus *Castaneoideaepollis* was created. As the type species *C. oviformis* (Potonié 1934) was chosen.

Castaneoideaepollis oviformis (Potonié 1934) Grabowska comb. nov.

Pl. 12, fig. 8

1934 *Pollenites oviformis* n. sp.; Potonié, p. 95, pl. 5, fig. 27.
1951a *Cupuliferoipollenites oviformis* Potonié; Potonié, pl. 20, fig. 70.
1953 *Tricolporopollenites cingulum* (Potonié) n. comb. subsp. *oviformis* (Potonié) n. comb.; Thomson & Pflug, p. 100, pl. 12, figs 42–49.

Botanical affinity. Castaneoideae, *Castanea, Castanopsis, Passania* and *Lithocarpus* types.

Geofloristic element. Palaeotropical (P2).

Occurrence. Paleocene – Miocene.

Remarks. Change of genus results from the determination of morphological similarity of pollen grains to the grains of extant subfamily Castaneoideae.

Castaneoideaepollis pusillus (Potonié 1934) Grabowska comb. nov.

Pl. 12, figs 6, 7

1934 *Pollenites quisqualis pusillus* n. f.; Potonié, p. 71, pl. 3, fig. 21.
1951b *Cupuliferoipollenites pusillus* Potonié; Potonié, p. 227, pl. 1, fig. 21.
1953 *Tricolporopollenites cingulum* (Potonié) n. comb. subsp. *pusillus* (Potonié) n. comb.; Thomson & Pflug, p. 100, pl. 12, figs 28–41.

Botanical affinity. Castaneoideae, *Castanea, Castanopsis, Lithocarpus, Passania* types.

Geofloristic element. Palaeotropical (P2).

Occurrence. Paleocene – Miocene.

Remarks. Change of genus results from the determination of morphological similarity of fossil pollen grains to grains of extant Castaneoideae subfamily. Transfering *Cupuliferoipollenites pusillus* to a new genus cancels the name *Cupuliferoipollenites* as *C. pusillus* had been the type species of the genus *Cupuliferoipollenites*.

Cercidiphyllites Mtshedishvili 1961

Type species. *Cercidiphyllites brevicolpatus* Mtshedishvili 1961

Cercidiphyllites minimireticulatus (Trevisan 1967) Ziembińska-Tworzydło comb. nov.

Pl. 13, fig. 1a, b; 2

1967 *Tricolpopollenites minimireticulatus* n. fsp.; Trevisan, p. 38, pl. 24, figs 10–12.
1985 *Cercidiphyllum* sp.; Skawińska, p. 109, pl. 2, figs 1–3.

Botanical affinity. Cercidiphyllaceae, *Cercidiphyllum* type.

Geofloristic element. Arctotertiary (A1). *Cercidiphyllum* (2 species) occurs in warm-temperate zone of Eastern Asia.

Occurrence. Miocene.

Remarks. *Tricolpollenites minimireticulatus* Trevisan according to the suggestion of Skawińska has been included into *Cercidiphyllum* genus of Cercidiphyllaceae family. Trevisan (1967) improperly established the botanical affinity to Dioscoreaceae, the Monocotyledone class, which do not posses tricolpate pollen type.

Clerodendrumpollenites Skawińska **gen. nov.**

Type species. ***Clerodendrumpollenites microechinatus* sp. nov.**

Derivation of name. After the recent genus *Clerodendrum*.

Diagnosis. Pollen grains tricolporate, in equatorial view oval to broadly oval, polar axis 65–68 μm long. Colpi narrow nearly parallel or somewhat arcuated. Exine two-layered, ectexine thicker than endexine, tectate. Tectum supported by distinct columellae, provided with regularly spaced small spines (microechinate). Tectum between the spines scabrate to granulate.

Botanical affinity. Verbenaceae, *Clerodendrum* type.

Geofloristic element. Palaeotropical (P). Present-day genus *Clerodendrum* (about 150 species) occurs in tropical and subtropical areas on both hemispheres.

Remarks. For the first time the genus *Clerodendrumpollenites* with the typical species *C. microechinatus* has been described in the archival doctoral dissertation (Skawińska 1989).

Clerodendrumpollenites microechinatus Skawińska sp. nov.

Pl. 12, fig. 14a–c

1985 *Clerodendrum* sp.; Skawińska, p. 110, pl. 3, figs 1, 2.

Holotype. Pl. 12, fig. 14a–c.

Locus typicus. Borehole Ostrzeszów GEO3.

Stratum typicum. Middle Miocene (Poznań Formation).

Derivation of name. After the sculpture of surface.

Diagnosis. Pollen grains tricolporate, prolate amb oval with broadly oval poles (68x44 µm). Exine two-layered about 2 µm thick, ectexine thicker than endexine, tectate. Tectum supported by indistinct columelle about 1 µm, high. Surface of tectum provided with loosely spaced, up to 1.5 µm long spines. Between them surface scabrate to granulate.

Botanical affinity. *Clerodendrum* type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Middle Miocene.

Cornaceaepollis Stuchlik **gen. nov.**

non *Cornoidites* Thiergart 1951
p.p. *Tricolpopollenites* Pflug & Thomson 1953
non *Cornaceoipollenites* Potonié 1951a ex Potonié 1960
Cornoidites Stuchlik 1964

Type species. ***Cornaceaepollis major*** (Stuchlik 1964) **comb. nov**. (= *Cornoidites major* Stuchlik 1964, p. 62, pl. 19, figs 1–4)

Derivation of name. After the recent family Cornaceae.

Diagnosis. Pollen grains tricolporate, in polar view rounded-triangular to triangular, in equatorial view broadly oval. Polar axis 23–60 µm long. Colpi rather long, running from one pole to the other nearly meeting in the poles. Apocolpium diameter 5–15 µm. Pores in the middle of the colpi, set transversally to them. Exine rather thick 2–5 µm, tectate. Surface reticulate or granulate.

Botanical affinity. Cornaceae, Cornoideae, Mastixioideae.

Geofloristic element. Palaeotropical (P). Present day representatives of Cornaceae family (12 genera) occur from tropical to temperate zone of N. America and in temperate zone of Asia.

Remarks. Stuchlik (1964) described two species: *Cornoidites major* and *C. minor* but he did not describe genus formally. Thiergart 1951 established genus *Cornoidites* without description and illustration in connection with species *C.* cf. *parmularius*. It is the reason of cancellation of genus *Cornoidites* because the species *Cornoidites parmularius* has been transferred to genus *Eucommioipollis*. So the genus *Cornoidites* Stuchlik 1964 is a homonym of genus *Cornoidites* Thiergart 1951, which according to Potonié 1960 and Jansonius et Hills 1976 (card no. 603) is nomen nudum. The genus *Cornaceoipollenites*, which also has *C. parmularius* as the type species lost its validation because of reasons mentioned. To new genus *Cornaceaepollis* the fossil pollen grains of morphology similar to pollen of today family Cornaceae (subfamilies Cornoideae and Mastixioideae) have been included.

Cornaceaepollis major (Stuchlik 1964) Stuchlik comb. nov.

Pl. 13, fig. 11a–c

1964 *Cornoidites major* n.sp.; Stuchlik, p. 62, pl. 19, figs 1–4.

Botanical affinity. Cornoideae, *Cornus* type.

Geofloristic element. Palaeotropical (P2). Today genus *Cornus* (45 species) occurs in warm temperate zone of northern hemisphere, mainly in Asia and America.

Occurrence. Middle Miocene.

Remarks. New combination results from establishing the new generic name for fossil pollen grains of morphology similar to pollen of extant family Cornaceae.

Cornaceaepollis minor (Stuchlik 1964) Stuchlik comb. nov.

Pl. 13, figs 12a, b; 13

1964 *Cornoidites minor* n. sp.; Stuchlik, p. 62, pl. 19, figs 1–7.

Botanical afiinity. Cornoideae, *Cornus* type.

Geofloristic element. Palaeotropical (P2).

Occurrence. Middle Miocene.

Remarks. As in previous species.

Cornaceaepollis satzveyensis (Pflug 1953) Ziembińska-Tworzydło comb. nov.

Pl. 13, figs 8–10a, b

1953b *Tricolporopollenites satzveyensis* n. sp. (Pflug); Thomson & Pflug, p. 103, pl. 13, figs 10–13.

Botanical affinity. Mastixioideae.

Geofloristic element. Palaeotropical (P1). Today the subfamily Mastixioideae with one genus *Mastixia* (25 species) occurs in Indomalayan region in palaeotropical zone.

Occurrence. Paleocene – Miocene.

Remarks. Because of the similarity of pollen grain structure of this species to pollen of Cornaceae family, and especially to those from subfamily Mastixioideae, the species has been excluded from the collective morphological genus *Tricolporopollenites* and transferred to genus *Cornaceaepollis*, pointing at its botanical relations.

Diospyrospollenites Skawińska **gen. nov.**

Type species. ***Diospyrospollenites ovalis*** (Tarasevich 1980) **comb. nov.** (= *Diospyros ovalis* Tarasevich 1980); Tarasevich, p. 381–382, pl. 1, fig. 4, Plain Oksko – Don, Middle Miocene.

Derivation of name. After the recent genus *Diospyros*.

Diagnosis. Pollen grains tricolporate, prolate (45x40 µm). Colpi long, not always parallel reaching the poles. Pores lalongate. Exine tectate, surface of the tectum psilate to scabrate.

Botanical affinity. Ebenaceae, *Diospyros* type.

Geofloristic element. Palaeotropical (P). Today genus *Diospyros* (c. 500 species) occurs in tropical and subtropical zones of both hemispheres.

Remarks. For the first time a diagnosis of genus, its description and a new combination of species were given in the archival doctoral dissertation (Skawińska 1989).

Diospyrospollenites ovalis (Tarasevich 1980) Skawińska comb. nov.

Pl. 13, figs 3a, b; 4

1980 *Diospyros ovalis* n. sp.; Tarasevich, p. 381, 382, pl. 1, figs 4, 6–8.
1985 *Diospyros* sp.; Skawińska, p. 111, 112, pl. 4, figs 4–9; pl. 5, figs 1, 2.

Botanical affinity. *Diospyros* type.

Geofloristic element. Palaeotropical (P1).

Occurrence. Middle Miocene.

Remarks. New combination of the species results from establishing the new genus *Diospyrospollenites*. Fossil pollen grains of *D. ovalis* morphologically are the most similar to grains of *Diospyros lotus* and *D. kaki*.

Eucommioipollis Ziembińska-Tworzydło **gen. nov.**

Cornaceoipollenites Potonié 1951a
p.p. *Tricolpopollenites* Pflug & Thomson 1953
p.p. *Tricolporopollenites* Pflug & Thomson 1953
p.p. *Psilatricolporites* Hammen van der 1956
non *Eucommiapollis* Menke 1976

Type species. ***Eucommioipollis eucommius*** (Planderová 1990) **comb. nov.** (=*Tricolporopollenites eucommi* Planderová 1990, p. 70, 71, pl. 69, figs 22–24, Hontianske Nemce, Lower Sarmatian)

Derivation of name. After the recent genus *Eucommia*.

Diagnosis. Pollen grains tricolporate in equatorial view outline oval with broadly rounded to flatted poles. Colpi short not of the same length, more or less paralle, considerably deeply cut into the poles. Pores lolongate often indistinct. Exine two- layered 3 µm thick, ectexine tectate. Tectum psilate. Polar axis 26–48 µm long, equatorial diameter 22–36 µm.

Botanical affinity. Eucommiaceae, *Eucommia* type.

Geofloristic element. Arctotertiary (A). In the present days the monotypic genus *Eucommia* occurs in mesophytic mountain forests of Central China.

Remarks. To the genus *Eucommiapollis* beside type species *E. eucommius* the species *E. parmularius* has been included which was previously recognized as a typical of the following genera: *Tricolpopollenites*, *Cornaceoipollenites*, *Cornoidites* (cf. *parmularius*), *Psilatricolporites*. Because of that according to the International Code of Botanical Nomenclature the genera mentioned are loosing their validity. The genus *Eucommiapollis* Menke has completely different morphological features (especially in the structure of colpi) than pollen grains of the only living species *Eucommia ulmoides*.

Eucommioipollis eucommius (Planderová 1990) Ziembińska-Tworzydło comb. nov.

Pl. 13, figs 5, 6

1960 *Eucommia* af. *ulmoides* n. sp.; Oszast, p. 22, pl. 7, figs 17–19, 21; pl. 8, figs 1, 3.
1974 *Tricolporopollenites parmularius* (Potonié) Krutzsch; Ziembińska-Tworzydło, p. 399, pl. 24, fig. 12.
1977 *Tricolporopollenites parmularius* (Potonié) Krutzsch; Krutzsch & Vanhoorne, p. 69, pl. 29, figs 1–8.

1990 *Tricolporopollenites eucommii* n. sp.; Planderová, p. 70, 71, pl. 69, figs 22–24.

Botanical affinity. *Eucommia* type.

Geofloritic element. Arctotertiary (A1).

Occurrence. Miocene.

Remarks. Morphological features are consistent with the diagnosis by Planderová (1990). To this species large pollen grains of polar axis exceeding 40 µm and equatorial diameter 30–34 µm have been included. The species has been recognized as typical of new genus because morphological structure of fossil grains here included is the most similar to that of today species *Eucommia ulmoides*.

Eucommioipollis parmularius (Potonié 1934) Ziembińska-Tworzydło comb. nov.

Pl. 13, fig. 7a, b

1934 *Pollenites parmularius* n. sp.; Potonié, p. 52, pl. 2, fig. 7.
1953 *Tricolpopollenites parmularius* (Potonié) n. comb.; Thomson & Pflug, p. 97, pl. 11, figs 152–162.
1954 *Pollenites* cf. *parmularius* Potonié; Doktorowicz-Hrebnicka, p. 68, fig. 136.
1960 *Tricolporopollenites parmularius* (Potonié) n. comb. (Krutzsch); Krutzsch & al., fig. 94.
1977 *Tricolporopollenites* cf. *parmularius* (Potonié) Krutzsch; Krutzsch & Vanhoorne, p. 69, pl. 26, figs 9–11.
1978 *Psilatricolporites parmularius* (Potonié) n. comb.; Kedves, p. 32, pl. 5, figs 1–9.

Botanical affinity. *Eucommia* type.

Geofloritic element. Arctotertiary (A1).

Occurrence. Miocene – Pliocene.

Remarks. *Eucommioipollis parmularius* differs from typical species in smaller dimensions (polar axis 31–34 µm, equatorial diameter 26–28 µm), more rounded polar outline and narrow and convex polar field. Change of genus is the result of finding a striking similarity of fossil pollen grains to those of extant genus *Eucommia*.

Lythraceaepollenites Thiele-Pfeiffer 1980

Type species. *Lythraceaepollenites bavaricus* Thiele-Pfeiffer 1980

Lythraceaepollenites decodonensis Stuchlik sp. nov.

Pl. 14, figs 9, 10, 11

1964 *Decodon* cf. *globosus* (Reid) Nikitin; Stuchlik, p. 49, pl. 15, figs 6, 7.
1984 *Decodon*; Jahn & al., pl. 10, figs 20–30.

Holotype: Pl. 14, fig. 9.

Locus typicus. Borehole Rypin.

Stratum typicum: Middle Miocene.

Derivation of name. After the recent genus *Decodon*.

Diagnosis. Pollen grains tricolporate. In equatorial view longitudinal ovate (30 x 18 µm) with slightly sharpened pole fields, in polar view the outline triangular to rounded-triangular with deeply indented colpi. Colpi short and straight, running parallel one to the other along lateral sides. Pores rather big lalongate to circular. Exine two-layered, about 1.5 µm thick, ectexine as thick as endexine, tectate, tectum psilate to finely granulate.

Botanical affinity. Lythraceae, *Decodon* type.

Geofloristic element. Arctotertiary (A1). Today genus *Decodon* (1 species, *Decodon verticillata* = *Lythrum verticillatum*) occurs in swamp regions of eastern parts of USA.

Occurrence. Middle Miocene.

Remarks. It differs from *Lythraceaepollenites bavaricus* Thiele-Pfeiffer 1980 by more eloganted polar axis (P/E = 1.66), triangular equatorial outline, and psilate to finely reticulate surface of tectum.

Nelumbopollenites Skawińska **gen. nov.**

Type species. ***Nelumbopollenites europaeus*** (Tarasevich 1983) **comb. nov.** (= *Nelumbo europaea* Tarasevich 1983; Kuprianova, Tarasevich, p. 142, pl. 2, fig. 7, Tambowskaja Obłast, Middle Miocene).

Derivation of name. After the recent genus *Nelumbo*.

Diagnosis. Pollen grains tricolpate, prolate, in equatorial view oval in polar view circular. Polar axis 77 µm long, equatorial diameter about 56 µm. Colpi not deep, arcuately bended in the equator. Exine two-layered up to 3.5 µm thick, ectexine thicker than endexine, semitectate. Tectum supported by rather high columellae forming a reticulate – rugulate pattern.

Botanical affinity. Nelumbonaceae, *Nelumbo* type.

Geofloristic elemet – Palaeotropical (P). Genus *Nelumbo* (4 species) is distributed today in subtropical and tropical regions of SE Asia, SE part of N America and in northern part of S America.

Remarks. First description of genus and new combination for typical species *Nelumbopollenites europaeus* (Tarasevich) comb nov. is in the archival doctoral dissertation (Skawińska 1989).

Nelumbopollenites europaeus (Tarasevich 1983) Skawińska comb. nov.

Pl. 14, fig. 12a–d

1983 *Nelumbo europaea* n. sp. (Tarasevich); Kuprianova & Tarasevich, p. 142, pl. 2, fig. 27, pl. 5, figs 1–4
1985 *Nelumbo* sp.; Skawińska, p. 112, pl. 5, figs 3–5.

Botanical affinity. *Nelumbo* type.

Geofloristic element. Palaeotropical (P2).

Occurrence. Miocene – Pliocene.

Remarks. Morphology of pollen grains of *Nelumbopollenites europaeus* is similar to morphology of pollen grains of four extant species of *Nelumbo* (Zetter & Keri 1989) but differences in structure of the reticule on the surface of exine are not so distinct that the fossil species could be included into one of present day taxa. The establishing of new organ genus *Nelumbopollenites* results from principles of ICBN and point 7 of revision presented.

Oleoidearumpollenites Nagy 1969

Type species. *Oleoidearumpollenites reticulatus* Nagy 1969

Oleoidearumpollenites microreticulatus (Pflug & Thomson 1953) Ziembińska-Tworzydło comb. nov.

Pl. 14, fig. 18a–c

1949 cf. *Oleaceae*; Kremp, p. 76, pl. 9, fig. 131a–c.
1953 *Tricolporopollenites microreticulatus* n. sp. (Pflug & Thomson); Thomson & Pflug, p. 106, pl. 16, figs 35–39.
1960 *Oleaceae* forma *artificosa*; Mamczar, p. 53, pl. 13, figs 177–179.
1961 *Oleaceae;* Romanowicz, p. 354, pl. 21, figs 264–266.
1964 cf. *Fraxinus* sp.; Stuchlik, p. 70, pl. 21, figs 14–17.
1969 *Caprifoliipites gracilis* n. sp.; Nagy, p. 423–424, pl. 44, figs 11, 12.
1973 *Oleaceae;* Stachurska & al., pl. 14, figs 10–14.

Botanical affinity. Oleaceae.

Geofloristic element. Arctotertiary (A1). Present-day representatives of Oleaceae family (27 genera) are distributed from tropical to temperate zones.

Occurrence. Oligocene – Pliocene.

Remarks. New combination for species results from finding the morphological similarity of pollen grains of *O. microreticulatus* to the pollen of extant Oleaceae family without possibility of pointing at the close similarity to present-day genus.

Platanipollis Grabowska **gen. nov.**

non *Platanoidites* Potonié, Thomson & Thiergart 1950
non *Platanopollenites* Potonié 1951
p.p. *Tricolporopollenites* Pflug & Thomson 1953
Platanus L. Pacltová 1982

Type species. ***Platanipollis ipelensis*** (Pacltová 1966) comb. nov. {= *Tricolporopollenites ipelensis* Pacltová 1966, p. 61, pl. 19, figs 14–16, Oberckov (Ipel Basin), South Slovakia, Egerian}.

Derivation of name. After the recent genus *Platanus*.

Diagnosis. Pollen grains tricolporate, prolate (15–25 x 12–18um). In equatorial view outline oval to circular with rounded poles. Colpi not distinct deep, parallel or nearly parallel considerably broadly spaced, not meeting in the poles, covered by granulate membrane. Endaperture developed as pore-like endocolpi, transversaly ragged. Exine two-layered, tectate, tectum granulate to reticulate.

Botanical affinity. Platanaceae, *Platanus* type.

Geofloristic element. Palaeotropical (P). The family Platanaceae (1 genus *Platanus* with 7 species) occurs today in S Europe, E Asia and N America.

Remarks. The diagnosis of genus *Platanoidites* Potonié, Thomson & Thiergart 1950 and *Platanoipollenites* Potonié 1951a, b (as a synonym) does not match the morphology of pollen grains of present day genus *Platanus*, precisely presented by Pacltová (1982). The type species for both genera mentioned is *Pollenites gertrudae* Potonié 1931, which has only one pore in each of three colpi. Pacltová (1966) distinguished fossil species *Tricolporopollenites ipelensis* which she moved to the extant genus *Platanus* in 1982, emending simultanously the diagnosis of species. The botanical affinity to extant genus *Platanus* has been preserved while forming the new organ genus and the ending -pollis has been added. A widely distributed in Younger Palaeogene and Older Neogene *Platanipollis ipelensis* (Paclto-

vá) species has been chosen as the type species.

Platanipollis ipelensis (Pacltová 1966) Grabowska comb. nov.

Pl. 14, fig. 21a–c

1966 *Tricolporopollenites ipelensis* n. sp.; Pacltová, p. 25, pl. 19, fig. 14–19.
1982 *Platanus ipelensis* Pacltová n. emend; Pacltová, p. 61, 62, pl. 4, figs 1–7; pl. 5, figs 1–12; text fig. 7.
1990 *Tricolporopollenites* sp. type "*Platanus*"; Planderová, p. 70, pl. 69, figs 19, 20.

Botanical affinity. *Platanus* type.

Geofloristic element. Palaeotropical (P1)

Occurrence. Upper Paleocene – Lower Miocene.

Remarks. Chosen as the type species *Platanipollis ipelensis* was precisely described and ilustrated by Pacltová (1982). Its morphological features are very similar to those of extant pollen of genus *Platanus*.

Quercoidites (Potonié, Thomson & Thiergart 1950 ex Potonié 1960) Słodkowska emend.

p.p. *Tricolpopollenites* Pflug & Thomson 1953
p.p. *Tricolporopollenites* Pflug & Thomson 1953
Quercopollenites Nagy 1969

Type species. ***Quercoidites henrici*** (Potonié 1931a) Potonié, Thomson & Thiergart 1950

Emended diagnosis. Pollen grains tricolporate, equatorial outline oval, amb in polar view considerable small. Polar axis 20–60 μm long. Colpi running parallel and nearly meeting in the pole area. In the equator area along the colpi exine is divided formig a lolongate pore-like aperture. Exine two-layered, ectexine thicker than endexine, tectate. Surface of the tectum provided with various irregular granules or verrucae.

Botanical affinity. Fagaceae, Quercoideae.

Geofloristic element. Arctotertiary/Palaeotropical (A/P). The genus *Quercus* (600 species) occurs today in northern hemisphere in different climatic zones – from temperate to tropical.

Remarks. For all fossil pollen grains morphologically similar to pollen of subfamily Quercoideae the priority generic name *Quercoidites*, established in 1950, has been used. Emendation of diagnosis extends the use of this genus over all fossil pollen grains of "quercoidal" structure. The genus *Quercopollenites* Nagy 1969 is younger synonym.

Quercoidites asper (Pflug & Thomson 1953) Słodkowska comb. nov.

Pl. 15, fig. 1

1953 *Tricolpopollenites asper* n. sp. (Pflug & Thomson); Thomson & Pflug, p. 96, pl. 11, figs 43–47.
1961a *Tricolporopollenites asper* (Potonié) n. comb.; Krutzsch, p. 322.

Botanical affinity. *Quercus robur* type.

Geofloristic element. Arctotertiary (A1). Today *Quercus robur* occurs in Europe, N Africa and Asia Minor.

Occurrence. Neogene.

Remarks. The genus *Tricolpopollenites asper* has been included into genus *Quercoidites* in order to extending of this genus diagnosis.

Quercoidites granulatus (Nagy 1969) Słodkowska comb. nov.

Pl. 15, figs 10, 11

1969 *Quercopollenites granulatus* n. sp.; Nagy, p. 223, pl. 52, fig. 21.

Botanical affinity. *Quercus* type (with rough – granulate pollen grains).

Geofloristic element. Arctotertiary (A1).

Occurrence. Miocene.

Remarks. *Quercopollenites granulatus* was transferred to *Quercoidites* genus in accordance to the widening of its diagnosis. The genus *Quercopollenites* (Nagy 1969) lost validity because its type species *Q. granulatus* was transferred to the other genus.

Quercoidites pudicus (Potonié 1934) Słodkowska comb. nov.

Pl. 15 figs 3, 4

1934 *Pollenites confinis pudicus* n. f.; Potonié, p. 90, pl. 5, figs 12, 13.
1951b *Fraxinoipollenites pudicus* Potonié; Potonié, p. 277, pl. 1, fig. 49.
1953 *Tricolpopollenites pudicus* (Potonié) n. comb.; Thomson & Pflug, p. 95, pl. 11, figs 27–29.
1960 *Fraxinoipollenites pudicus* (Potonié) Potonié; Potonié p. 94
1961a *Tricolporopollenites pudicus* (Potonié) n. comb.; Krutzsch, p. 322.

Botanical affinity. *Quercus* type (with fine – granulate pollen grains).

Geofloristic element. Arctotertiaty (A1).

Occurence. Miocene.

Remarks. The transferring to *Quercoidites* genus the species *Fraxinoipollenites pudicus* (Potonié) Potonié, which was the type species for the genus *Fraxinoipollenites* (Potonié 1960), gives in the efect the lost of its validity.

Trapapollis Kohlman Adamska **gen. nov.**

Sporotrapoidites Klaus 1954

Type species. ***Trapapollis erdtmanii*** (Nagy 1979) **comb. nov.** (= *Goerboepollenites erdtmanii* Nagy 1979, p. 185, fig. 3 E – N, fig. 4 A – E, Nagygörbö, 1, 911,0 m, Karpatian).

Derivation of name. After the recent genus *Trapa*.

Diagnosis. Pollen grains tricolporate in equatorial view more or less spheroidal and triangular in polar view. The grains are provided with 3 meridional sexinous crests dividing along the short colpi and meeting at the poles. Exine rather thick, two – layered, tectate. Surface of the tectum smooth outside the crest and psilate to verrucate on the crest. Polar axis without the crest 40–75 μm long, equatorial diameter, crest not included 35–40 μm.

Botanical affinity. Trapaceae (= Hydrocaryaceae), *Trapa* type.

Geofloristic element. Arctotertiary (A). Present-day genus *Trapa* (3 species) occurrs in warm-temperate zone of Europe, Asia and northern Africa.

Remarks. Klaus (1954) forming the name of *Sporotrapoidites* genus based on the morphology of polar field, where three collars form sign similar to a tetrade mark, characteristic of spores. The transforming the *Sporotrapoidites* name into *Trapapollis* was in the effect of adopted by authors the rule of eliminating from the genus name the suggestion of its morphological affinity, i.e. that there is a spore.

Trapapollis erdtmanii (Nagy 1979) Kohlman-Adamska comb. nov.

Pl. 15, figs 23a, b; 24

1979 *Goerboepollenites erdtmanii* sp. n.; Nagy, p. 185, figs 2, 3 E- N, 4 A-D.
1985 *Sporotrapoidites erdtmani* (Nagy 1979) n. c.; Nagy, p. 163, pl. 93, figs 18–20; pl. 94, figs 1–8.

Botanical affinity. *Trapa* type.

Geofloristic element. Arctotertiary (A1).

Occurrence. Miocene – Pliocene.

Remarks. Selected as the type species *Trapapollis erdtmanii* was described in details and illustrated by Nagy (1979). Its morphological features are in concordance with the features of pollen of *Trapa* genus.

Trapapollis illingensis (Klaus 1954) Kohlman-Adamska comb. nov.

Pl. 15, fig. 25a, b

1954 *Sporotrapoidites illingensis* n. sp.; Klaus, p. 122, pl. 1, figs 1–3.

Botanical affinity. *Trapa* type.

Geofloristic element. Arctotertiary (A1).

Occurrence. Miocene – Pliocene.

Remarks. The new registration of species originates from the genus change.

Tricolporopollenites Pflug & Thomson 1953

Type species. *Tricolporopollenites dolium* (Potonié 1931b) Thomson & Pflug 1953

Tricolporopollenites brühlensis (Thomson 1950) Grabowska stat. nov.

Pl. 16, figs 1–5

1950 *Pollenites cingulum brühlensis* n. spm.; Potonié & al., p. 56, 63, pl. B, figs 31–33.
1953 *Tricolporopollenites megaexactus* (Potonié) n. comb. subsp. *brühlensis* (Thomson) n. comb.; Thomson & Pflug, p. 101, pl. 12, figs 51–57.
1960 *Cyrillaceaepollenites megaexactus* subsp. *brühlensis* (Thomson) n. comb.; Potonié, p. 102.
1966 *Tricolporopollenites* cf. *brühlensis* (Thomson) Thomson & Pflug; Sontag, p. 38, pl. 50, fig. 13a, b.

Botanical affinity. P.p. Clethraceae, p.p. Cyrillaceae, p.p. Rosaceae.

Geofloristic element. Palaeotropical (P2). Presently a monotype Clethraceae family (*Clethra* genus with 30 species) occurs in South and North America, SE Asia in subtropical zone and in the mountains in tropical areas; Cyrillaceae (3 genera and 14 species) – presently in tropical and subtropical America, especially in the Atlantic area, in south-eastern America.

Occurrence. Eocene – Pliocene.

Remarks. The rank of the taxon *T. brühlensis* was changed from a subspecies into a species. 1. In the first name *Pollenites cingulum brühlensis* the taxon "*cingulum*" is not confirmed in the pollen morphology of this type. 2. The replacement of the taxon *Tricolpo-*

ropollenites megaexactus brühlensis by the species *Cyrillaceaepollenites megaexactus* done by Potonié (1960) is not still valid because *T. brühlensis* differs from *T. megaexactus*, among other, by more protrounding the equatorial part of colpi with pore beyond the contour of a pollen. In equatorial view it is characterized by trefoil like callosity. 3. It cannot be maintained *Cyrillaceaepollenites* genus because the grains of similar structure are also found beyond Cyrillaceae family. 4. Sontag (1966) cannot be the nomeclator of the species because the taxon in the species rank is in brackets and has "cf."

Tricolporopollenites exactus (Potonié 1931) Grabowska comb. nov.

Pl. 16, figs 8–10

1931b *Pollenites exactus* n. sp.; Potonié, p. 26, pl. 1, fig. V49b.
1953 *Tricolporopollenites megaexactus* (Potonié) n. comb. subsp. *exactus* (Potonié) n. comb.; Thomson & Pflug, p. 101, pl. 12, figs 87–92.
1960 *Cyrillaceaepollenites exactus* (Potonié) n. comb.; Potonié, p. 102

Botanical affinity. P.p. Clethraceae, *Clethra* type; p.p. Cyrillaceae, *Cyrilla* type.

Geofloristic element. Palaeotropical (P2).

Occurrence. Eocene – Pliocene.

Remarks. The morphological genus *Tricolporopollenites* was maintained instead of the *Cyrillaceaepollenites* one (Potonié 1960), suggesting the botanical affinity to the Cyrillaceae family because the pollen of similar morphology in the Clethraceae family also occurs. It was mantained, according to the first identification of the species (Potonié 1931b) and later changing (Potonié 1960), the taxon "*exactus*" in the species rank.

Tricolporopollenites liblarensis (Thomson 1950) Grabowska comb. nov.

Pl. 16, figs 13, 14

1950 *Pollenites liblarensis* n. spm. (Thomson); Potonié et al., p. 55.
1950 *Cupuliferoidae-pollenites liblarensis* n. spm. (Thomson); Potonié & al., p. 66, pl. B, figs 26, 27.
1953 p.p. *Tricolpopollenites liblarensis* (Thomson) (= *quisqualis* Potonié) n. comb.; Thomson & Pflug, p. 97, pl. 11, figs 111–132.

Botanical affinity. P.p. Fabaceae (= Leguminosae), p.p. Fagaceae, p.p. Combretaceae, p.p. Verbenaceae.

Geofloristic element. Palaeotropical (P2).

Occurrence. Upper Paleocene – Miocene.

Remarks. Named by Thomson & Pflug (1953) the species *Tricolpopollenites liblarensis fallax* , *T. liblarensis* (=*quisqualis*) and *T. retiformis* were transferred (excluding *T. liblarensis*) to *Tricolporopollenites* genus by Krutzsch (1954, 1961), Krutzsch et al. (1960) and Krutzsch & Vanhoorne (1977), proved that in species of the former *Tricolpopollenites* genus more or less developed pores in colpi occur. In *T. liblarensis* species, from which was separated by Krutzsch (1954) *T. quisqualis*, the pores are not always visible, however in the equatorial part of colpi a loosening of exine or curving of a colpus are distinct. The name of *Cupuliferoidaepollenites* genus was not used, for which *T. liblarensis* was the type species, because it may suggest the botanical affinity only to Fagaceae family, while the similar pollen grains are known from various families.

Tricolporopollenites photinioides Skawińska sp. nov.

Pl. 16, figs 27a, b; 28

Holotype. Pl. 16, fig. 27a, b.

Locus typicus. Borehole Ostrzeszów GEO 3.

Stratum typicum. Middle Miocene, Poznań Formation.

Derivatio of name. After the recent genus *Photinia*.

Diagnosis. Pollen grains tricolporate, equatorial outline ovate, with slightly rounded poles. Colpi slightly arcuate not meeting one an other at the poles. Pores lolongate often not distinct. Exine two-layered 1–1.5 µm thick, ectexine thicker than endexine, surface finely striate. Polar axis about 30 µm long.

Botanical affinity. Rosaceae, *Photinia*, *Sorbus* types.

Geofloristic element. Arctotertiary (A1). Presently *Photinia* genus with 60 species occurs in tropical S-E Asia and Central America; *Sorbus* genus (more than 100 species) in temperate zone of northern hemisphere.

Occurence. Miocene.

Remarks. The fossil pollen graines are the most similar to those of extant *Photinia* genus, however similar ones may be also found in *Sorbus* genus.

Sapotaceoidaepollenites Potonié, Thomson & Thiergart 1950 ex Potonié 1960

Type species. *Sapotaceoidaepollenites manifestus* (Potonié 1931d) ex Potonié 1960

Sapotaceoidaepollenites oblongus (Pflug & Thomson 1953) Grabowska comb. nov.

Pl. 17, fig. 5

1953 *Tetracolporopollenites oblongus* n. sp. (Pflug & Thomson); Thomson & Pflug, p. 110, pl. 15, fig. 31.

Botanical affinity. Sapotaceae.

Geofloristic element. Palaeotropical (P1). Presently Sapotaceae family with 50 genera occurs mostly in tropical and subtropical zones, some of them in warm-temperate zone.

Occurrence. Upper Eocene – Miocene.

Remarks. Change in genus results from the similarity of structure of fossil pollen graines of *Sapotaceoidaepollenites oblongus* to those of extant Sapotaceae family.

Skimmiaepollenites Skawińska **gen. nov.**

Type species. ***Skimmiapollenites reticulatus*** Skawińska **sp. nov.**

Derivation of name. After the recent genus *Skimmia*.

Diagnosis. Pollen grains 4–5-colporate, prolate, polar outline ovate, equatorial outline circular to 4–5-lobate. Polar axis 35–42 µm long, equatorial diameter 23–28 µm. Ectexine semitectate, striato-reticulate.

Geofloristic element. Palaeotropical (P). Presently *Skimmia* genus (10 species) occurs in warm-temperate to subtropical zones of eastern Asia.

Botanical affinity. Rutaceae, *Skimmia* type.

Remarks. The diagnosis of the genus and species was given for the first time in the the archival doctoral dissertation (Skawińska 1989).

Skimmiaepollenites reticulatus Skawińska sp. nov.

Pl. 17, fig. 6a–c; 7a, b

1985 *Skimmia laureola* Hooker – typ; Skawińska, p. 113, pl. 6, figs 1–7.

Holotype. Pl. 17, fig. 6a–c.

Locus typicus. Borehole Ostrzeszów GEO 3.

Stratum typicum. Middle Miocene, Poznań Formation.

Derivatio of name. After the reticulate sculpture of pollen grains.

Diagnosis. Pollen grains 4–5-colporate, prolate, polar outline ovate, equatorial outline circular to 4–5-lobate. Polar axis 35–42 µm long, equatorial diameter 23–28 µm. Colpi more or less parallel, long and narrow, nearly meeting at the poles. Along the colpi endexine swollen. Pore lalongate. Exine two – layered 2.5 µm thick, ectexine thicker than endexine, semitectate. Columellae fused with their capita forming a reticulate pattern. Lumina irregular, smaller at the poles, arranged in a striato-reticulate pattern.

Botanical affinity. Rutaceae, *Skimmia* type (*Skimmia laureola)*

Geofloristic element. Palaeotropical (P2).

Occurrence. Miocene.

Remarks. As above.

Symplocoipollenites (Potonié 1951 ex Potonié 1960) Słodkowska **emend.**

Symplocospollenites Potonié, Thomson & Thiergart 1950 ex Potonié 1960
p.p. *Porocolpopollenites* Pflug 1953b

Type species. ***Symplocoipollenites vestibulum*** (Potonié 1931b) Potonié 1951a,b ex Potonié 1960

Emended diagnosis. Pollen grains 3–5-colporate, mostly 3-colporate oblate. Equatorial outline triangular, sometimes more circular, polar outline oval to rhomboidal. Colpi very short only slightly longer than pores diameter. Pores circular seldom oval with distinct vestibulum and small labrum. Ectexine tectate, tectum psilate, granulate to baculate.

Botanical affinity. Symplocaceae.

Geofloristic element. Palaeotropical (P). Present-day, a monotype Symplocaceae family with *Symplocos* genus (300–400 species) occurs in tropical and subtropical zones of S-E Asia, only one species in warm-temperate Atlantic zone of North America.

Remarks. Potonié (1960) globose forms included to *Symplocospollenites* genus, triangle to *Symplocoipollenites*. Pflug (1953) for both forms created morphological genus *Porocolpollenites*. For all species of this genus the botanical affinity Symplocaceae family is

given, and this is the reason the putting these species into one genus – *Symplocoipollenites*. This genus was chosen because most Neogene species were included by Potonié (1960) to it.

Symplocoipollenites latiporis (Pflug & Thomson 1953) Słodkowska comb. nov.

Pl. 18, figs 1a, b; 2

1953 *Porocolpopollenites latiporis* n. sp. (Pflug & Thomson); Thomson & Pflug, p. 93, pl. 10, figs 123–124.

Botanical affinity. *Symplocos* type.

Geofloristic element. Palaeotropical (P2).

Occurrence. Miocene.

Remarks. Change in genus results from the necessity of including the species into the genus pointing at the botanical origin.

Symplocoipollenites maturus (Doktorowicz-Hrebnicka 1960) Ziembińska-Tworzydło comb. nov.

Pl. 18, figs 3, 4

1960 *Symplocos-pollenites vestibulum* Potonié forma *matura*; Doktorowicz-Hrebnicka, p. 111, pl. 43, fig. 227.

1974 *Porocolpopollenites maturus* (Doktorowicz-Hrebnicka) n. comb.; Ziembińska-Tworzydło, p. 382–383, pl. 19, figs 5, 6.

Description. Pollen grains tricolporate, equatorial outline triangular with slightly convex sides, angulaperturate. Exine two-layered 1.5–3 μm thick, surface granulate.

Botanical affinity. Symplocaceae.

Geofloristic element. Palaeotropical (P2).

Occurrence. Miocene.

Remarks. As in the species metioned previously.

Symplocoipollenites orbis (Pflug & Thomson 1953) Słodkowska comb. nov.

Pl. 18, figs 5, 6

1953 *Porocolpopollenites orbis* n. sp. (Pflug & Thomson); Thomson & Pflug; p. 92, pl. 10, figs 109, 111.

1970b *Symplocospollenites orbis* (Thomson & Pflug) Potonié; Krutzsch, p. 336, pl. E 79.

Botanical affinity. Symplocaceae.

Geofloristic element. Palaeotropical (P1).

Occurrence. Paleocene.

Remarks. As above.