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A MECSEK HEGYSÉG MIOCÉN RÉTEGEINEK PALYNOLÓGIAI VIZSGÁLATA

ÍRTA: NAGY LÁSZLÓNÉ

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PALYNOLOGICAL ELABORATIONS THE MIOCENE LAYERS OF THE MECSEK MOUNTAINS

by
ESTHER NAGY

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Lektorálta:
† DR. ANDREÁNSZKY GÁBOR
a biológiai tudományok kandidátusa

DR. GREGUSS PÁL
a biológiai tudományok doktora

DR. SOÓ REZSŐ
akadémikus

Szakszerkesztő:
SZABÓNÉ DRUBINA MAGDA

Technikailag szerkesztette:
GERGELYFFY LÁSZLÓNÉ

Fordító:
BALKAY BÁLINT

Nyelvi lektor:
KECSKÉS BÉLA

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TARTALOM — CONTENTS

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I. BEVEZETÉS

A mecseki neogén rétegek palynológiai vizsgálatának indító okai és körülményei

Az 1956. év folyamán a mecseki, Magyaregregy környéki miocénkori makroflóra-lelőhelyek palynológiai vizsgálatával bízott meg a M. Áll. Földtani Intézet akkori vezetője. A lelőhelyek anyagának értékelése kiegészítette a makroflorisztikai kutatásokat. Egészen új eredményeket adott a Mecsek hegység egykori területének vegetációjára, nem utolsósorban a lágyszárú növényekre, valamint az üledék fáciesjellegére vonatkozóan.

Az első tájékozódó jellegű vizsgálatok során a Magyaregregy környéki lelőhelyek palynológiai adatait a keleti Mecsek néhány makroflóra-lelőhely (Nagymányok, Zobák, Mecseknádasd) mintáinak palynológiai adataival vetettem össze. A vizsgálati eredmények alapján kísérletet tettem a lelőhelyek időben egymásután következő rétegeinek palynológiai értékelésére.*

A Magyaregregy határában levő almáspataki makroflórás lelőhelyek két rétegsorát értékeltük (NAGY E. et PÁLFALVY I. 1958, 1960). A lelőhelyek mintánkénti százalékos adataiból készült diagramok szerint a rétegsor alján főleg a makroflorisztikai, a rétegsor felső részén inkább a palynológiai adatok voltak értékelhetők. Megállapítottuk, hogy a kiemelt fajok esetében a makro- és mikropaleobotanikai adatok egymást szerencsésen egészítik ki (l. c.).

1957. év nyarán a Mecsek hegységbeli részletes térképezési munkálatokkal kapcsolatosan a mecseki fúrások miocén kőzetanyagának palynológiai vizsgálatába kezdtem. A vizsgálatok célkitűzése az volt, hogy felderítse a Mecsek hegység paleozóos—mezozóos tömbje körül elhelyezkedő neogén kifejlődési területek ősnövénytani képét és az ebből megállapítható ősföldrajzi, ősklimatológiai és üledékképződési körülményeket.

A vizsgálatok felhasználhatósága érdekében először az alapokat kellett megteremteni. A kutatás első előfeltétele az előkerülő számos új faj és genusz leírása volt. Csak ezután kerülhetett sor a fenti, célkitűzésül jelölt ősnövénytani értékelésre.

A morfológiai leíró, nomenklatúrai, taxonómiai munkálatok mellett az átvizsgált nagy anyagmennyiség már előzetesen lehetővé tett bizonyos, az

* „Beszámoló az észak-mecseki miocén palynológiai vizsgálatok eddigi eredményeiről." — Magy. Biol. Társ. Bot. Szakoszt. ülésén 1958. III. 25-én elhangzott előadás.

anyag értékelésére vonatkozó, módszertani kísérleteket (Nagy E. 1958, 1960), sőt a területen dolgozó geológusok és paleontológusok számára is szolgáltathattunk bizonyos adatokat (Nagy E. 1962).

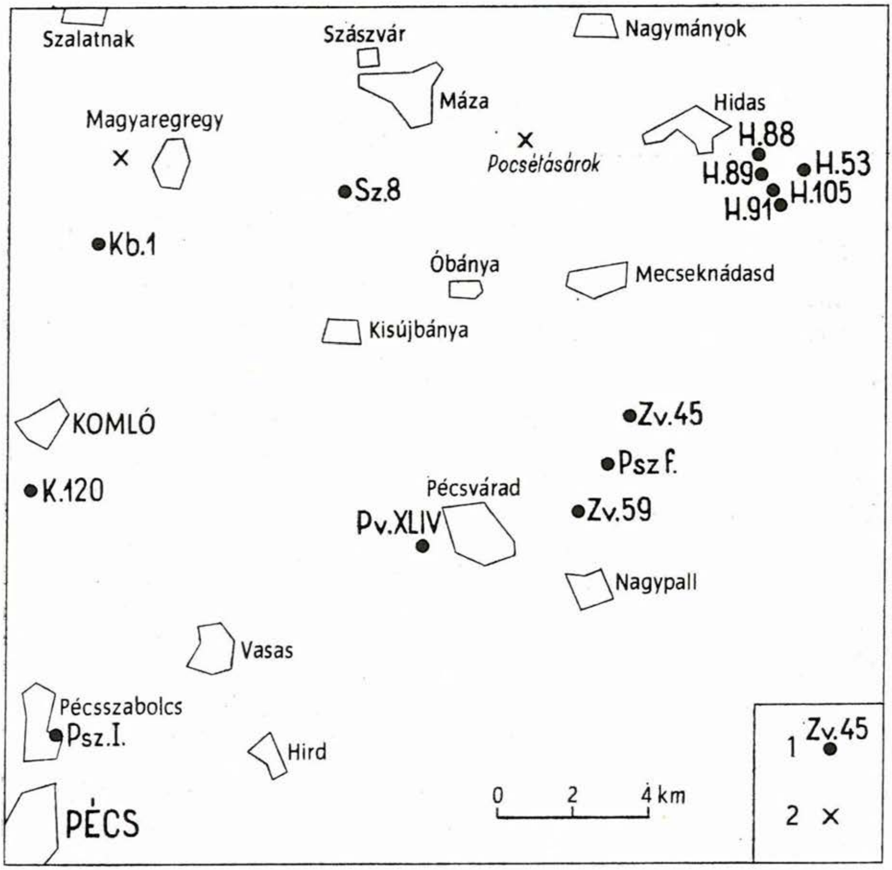
Köszönetemet kell kifejeznem dr. Fülöp József akad. lev. tagnak, a MÁFI igazgatójának a téma kidolgozásának és a monográfia megjelentetésének lehetővé tételéért, dr. Hámor Géza főosztályvezetőnek a Mecsekben gyűjtött alapszelvények anyagának átengedéséért, dr. Grossz Ádám egyetemi adjunktusnak a rendelkezésemre bocsátott mintákért, valamint dr. Soó Rezső akadémikusnak, néhai dr. Andreánszky Gábor kandidátus és dr. Greguss Pál biol. tud. doktora, professzoroknak szakmai irányításukért.

II. A MEGVIZSGÁLT MINTÁK RÉTEGTANI HELYZETE

A palynológiai kutatómunkát a mecseki neogén rétegsorát harántoló fúrások vizsgálatával kezdtem, megállapítva az idő függvényében történt flóraváltozásokat, majd a vizsgálatokat horizontális irányban is kiterjesztettem.

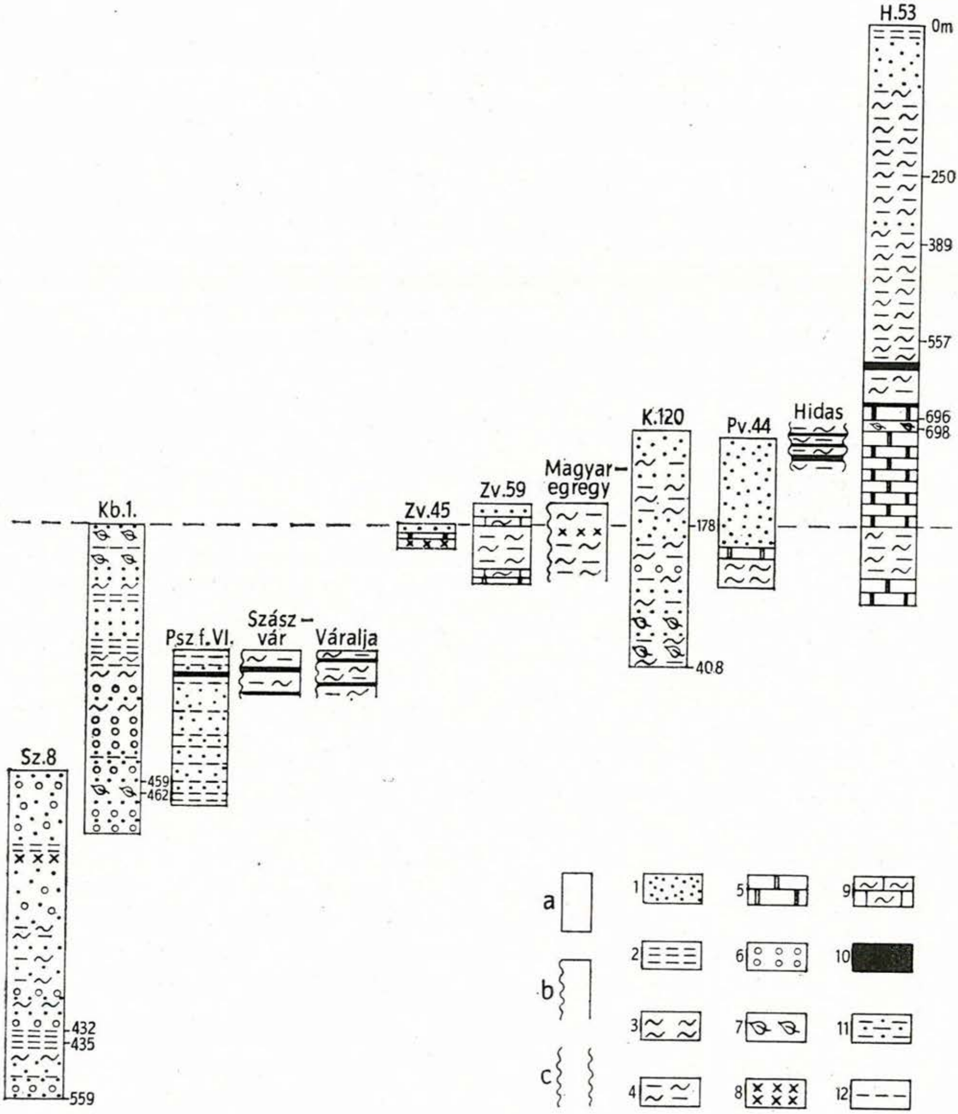
A kiindulási alap a Hidas 53. sz. 1126 m-es mélyfúrás volt. A fúrás rétegsora a mezozóikumra települő felsőhelvéti, torton, szarmata és pannon rétegeket tárta fel, ezért alkalmas volt a mecseki neogén jelentős időegységében a flóraváltozások megállapítására.

Az alsóhelvéti képződmények vizsgálatához más fúrások mintáit használtam fel. A Szászvár 8. sz. fúrásban a terresztrikus összletet, a Pusztakis-



1. ábra. A K-i Mecsek területén megvizsgált fúrások és feltárások vázlatos helyszínrajza HÁMOR G. 1964. után. — *1.* Fúrás jele és száma, *2.* felszíni feltárás

Fig. 1. Sketch map of the localities at which the samples discussed in this volume were collected (after G. HÁMOR, 1964). — *1.* Sign and number of borehole, *2.* outcrop



2. ábra. A megvizsgált rétegsorok feltételezett sztratigráfiai összefüggései. — *a*=fúrás, *b*=felszíni feltárás, *c*=bánya; *1.* homok, homokkő, *2.* agyag, *3.* márga, *4.* agyagmárga, *5.* mészkő, *6.* konglomerátum, *7.* szenesedett növényi maradvány, *8.* vulkáni eredésű kőzetek, *9.* mészmárga, *10.* kőszén, *11.* homokos agyag, *12.* a halpikkelyes összlet határa

Fig. 2. Hypothetical stratigraphical correlations of the examined sedimentary sequence. — *a*=borehole, *b*=outcrop, *c*=mine; *1.* sand, sandstone, *2.* clay, *3.* marl, *4.* clay-marl, *5.* limestone, *6.* conglomerate, *7.* carbonized plant remains, *8.* igneous rocks, 9. calcareous marl, *10.* coal, *11.* sandy clay, *12.* boundary of the fish-scale-bearing sequence

falu VI. sz. és a Zengővárkony 45. sz. fúrások a limnikus összletet tárták fel. Időrendi sorrendben a Komló 120. sz., majd a Zengővárkony 59. sz. fúrások vizsgálata következett, amelyek a felsőhelvéti halpikkelyes összletet és a slír rétegsorát foglalták magukba. Ezzel a Mecsek neogénjének vertikális szelvénye teljessé vált.

A vizsgálatok horizontális kiterjesztése érdekében a már említett fúrások, felszíni feltárások anyagainak vizsgálatát jó néhány fúrás, feltárás anyagvizsgálatával egészítettem ki (lásd 1. ábrát).

A megvizsgált fúrások és felszíni feltárások területi eloszlása a következő: a Mecsek hegység É-i részén Szászvár 8. sz. fúrás, Kisbattyán 1. sz. f., a szászvárbányai Kórházvölgy és a váraljai Pocsétásárok képviselte az alsóhelvéti szárazföldi és limnikus összlet felszíni feltárásait. Az ÉK-i részen a Hidas 53. sz. fúrás, a Hidas-bányabeli 2., 4., 5., 6. barnakőszéntelepek mintái, a Hidas 105. sz., H. 91. sz., H. 89. sz. és H. 88. sz. fúrások barnakőszéntelepes összletének mintái, a Mecseknádasd körüli felszíni feltárásokban a halpikkelyes agyagmárga makroflórás lelőhelyei; DK-en a Zengővárkony 45. és 59. sz. fúrások, a Pusztakisfalu VI. sz. fúrás; a D-i előtérben a Pécsvárad XLIV. sz. fúrás; a Ny-i részen a Komló 120. sz. fúrás és a Magyaregregy környéki felszíni feltárások vizsgálatát végeztem el (2. ábra).

A Magyaregregy környéki növénymaradványos lelőhelyek részint az alsóhelvéti limnikus összletből, halpikkelyes agyagmárga és tufitrétegek (Kisréti-árok, Almáspatak), részint a felsőhelvéti tufitból és a halpikkelyes agyagmárga rétegekből (Farkasordító, Leánykő) kerültek ki. A terület földtani vizsgálatát és térképezését vezető Hámor G. rétegtani beosztását vettem általában alapul. Koreczné Laky I. (1968) *Foraminifera*-vizsgálatai néhány speciális szakaszon, főleg faciológiai kérdésekben adtak biztos támpontot, amikor ismeretlen ökológiai igényű planktonszervezetek kerültek elő. A Hidas 53. sz. fúrás pannon rétegsorában az alemeletek elhatárolását Bartha F.-nek (1964), a *Mollusca* faunára vonatkozó biosztratigráfiai értékelése tette pontosabbá.

A kelet-mecseki vizsgálati eredményeket egy teljes nyugat-mecseki neogén szelvénnyel hasonlítottam össze. Ez az adatmennyiség alkalmas volt palynológiai adataival a mecseki neogén flóra jellemzésére.

III. A TERÜLETRE VONATKOZÓ EDDIGI PALEOBOTANIKAI EREDMÉNYEK

A mecseki miocén paleoflórájának feldolgozása a múlt századra nyúlik vissza.

STAUB M. határozta meg (1878, 1882) BÖCKH J. és HOFMANN K. gyűjtési anyagát az alsómediterrán összletből és tufából. A fosszíliák Ófalu, Mecseknádasd, Hidas, Váralja, Zobák-puszta, Komló, Abaliget, Tekeres és Mecsekrákos lelőhelyeiről származtak. 36 fajból álló flóra került elő, amelyből 2 *Fungi*, 4 *Gymnospermae*, 26 *Dicotyledones* és 4 *Monocotyledones*. 14 faj volt alkalmas a kor megállapítására. STAUB szerint a flóra az idősebb mediterránba sorolható, de a legidősebb miocén, „sőt ennél régibb rétegekben fellépő fajok túlnyomó számban kimutathatók" (1882. p. 27). Négy új fajt ír le (*Quercus Böckhii*, *Ficus Haynaldiana*, *Physolobium Ettingshauseni* és *Pterocarpus Hofmannii*). A flóra legtöbb faja a pillangósvirágúakhoz sorolható, mennyiségi sorrendben ezek után a *Laurus*-félék következnek (1878. p. 135). STAUB e flóra segítségével rekonstruálja a Mecsek harmadkori tájképét. Sűrű, nagy csapadékigényű, partmenti, szubtrópusi erdőt tételez fel és 18—20 °C hőmérsékleti átlaggal jellemzett „insularjellemű éghajlat"-ot (p. 139). Édesvíz (folyók, tavak) jelenlétét tételezi fel a flóra alapján. A flórarokonság szerinte szubtrópusi, kelet-ázsiai, kelet-indiai, észak-amerikai, mediterrán és a mai Kaukázusra utaló. Olyan fajokat is említ, amelyek a Karolina-szigetekre, az Antillákra és a trópusi Ázsiára utalnak (éppen a pillangósok, p. 141). Az akkori nagyon kevés irodalmi adat alapján és ETTINGSHAUSEN személyes segítségével összeállított dolgozat sok megállapítása ma is alapvető a mecseki flóra értékelésében.

ANDREÁNSZKY G. (in ANDREÁNSZKY et KOVÁCS 1955. p. 8) STAUB e munkáját értékelve kifejti, hogy a flóralista nem teljes, nem szabatos és az összeállított flóraegyüttes sem felel meg a flóra képének. Bár ellenvetései indokoltak, mégis örvendetes, hogy már a múlt században valaki elkezdte a mecseki flóra feldolgozását a rendelkezésre álló anyag alapján. STAUB flóralistáját összevetettem ANDREÁNSZKY 1965-ös munkájában levővel (p. 122—129). A STAUB által közölt 26 fajból 7-et említ ANDREÁNSZKY Magyaregregyről és 7-et más hazai harmadkori lelőhelyekről, ez 50%-nál több. PÁLFALVY 1964-es flóralistájával összehasonlítva (pp. 186—188) még nagyobb a megegyezés, mert két faj kivételével STAUB valamennyi említett faját megtalálta a Mecsekben.

A flóraképet illetően STAUB eléggé rávilágít a kelet-ázsiai flórarokonságra. Tárgyilagosságára vall, amikor azt írja: „tudományos tények alapján megkísértjük a Mecsek hegység volt harmadkorbeli tájképét phantasiánkban visszavázolni" (1878. p. 137). Kellő óvatosságot tanúsít a fajok értékelésében is (p. 140), amikor éppen a pillangósok flórarokonságát említve, azzal zárja sorait: „melyekről egyelőre többet nem mondok".

ANDREÁNSZKY G. 1949-től kezdődően tanítványaival végezte a Mecsek hegységi miocén makroflóra feldolgozását. Számos részletadaton kívül (1951a, 1954, 1955 stb.) a magyarországi harmadidőszaki flóra- és vegetációtörténeti, paleoklimatológiai képek értékelésénél mindig messzemenően figyelembe vette a mecseki, s különösképpen a magyaregregyi makroflóra maradványegyüttest (1954, pp. 263, 268; 1955. in ANDREÁNSZKY et KOVÁCS pp. 14, 81, 87, 90—91, 109—139; 1959. pp. 281—282).

PÁLFALVY I. részt vett a fent említett gyűjtésekben is, majd további gyűjtések eredményeképpen dolgozta fel Magyaregregy környéke (1953) majd a Mecsek hegység helvét—torton flóráját (1964). Ez utóbbiban a HAJÓS M. által feldolgozott *Diatomákkal* együtt 280 faj szerepel. Az együttesben a zárvatermők uralkodnak. A flórát összehasonlítja a hazai és a külföldi harmadkori flórákkal. ANDREÁNSZKY-val egyetértésben a flórarokonságot a távolkeleti, szubtrópusi vegetációra utalónak tartja. Következtet az egykori növénytársulásokra, paleoklimatológiai változásokat állapít meg. A vegetációtípusokat és a HÁMOR G. által felállított (1964) ideális szelvénnyel összevetett vegetációtípus-változásokat is közli.

HARASZTY Á. (1957) vizsgálta a hidasi barnakőszénbányából származó famaradványokat (xyliteket). Megállapította, hogy a maradványok fenyőfélék, a *Taxodiaceae* családból. Három típusuk van: *1.* a mai *Sequoia sempervirens* ENDL. fosszilis megfelelője a *Taxodioxylon gypsaceum* KRÄUSEL, *2.* a *Glyptostrobus pensilis* KOCH fosszilis formája a *Glyptostroboxylon tenerum* CONVENTZ és *3.* a *Taxodium distichum* RICH. fosszilis fajnak megfelelő a *Taxodioxylon taxodii* GOTHAN.

HAJÓS M. et PÁLFALVY I. (1963) a magyaregregyi Farkasordító-árok diatómás üledékeinek vizsgálata során 3 új *Diatoma* fajt, 2 új varietást, 3 új formát és 2 új *Chrysostomum* fajt írtak le, s a rétegsort paleoökológiailag is értékelik. BÁLDINÉ BEKE M. (1964) mecseki felszíni lelőhelyek és mélyfúrások miocén *Coccolithophoridáit* vizsgálta. A helvétiből és a szarmatából eléggé szegényes flóra került elő, a torton rétegek egységes vegetációképet mutatnak, a nyíltabb tengeri képződmények *Coccolithophoridákban* gazdagabbak.

BÓNA J. (1964) dolgozata felsorolja a Mecsekből előkerült *Coccolithophoridákat* és új fajokat ír le. A vizsgált anyagot lelőhelyenként, illetve fúrásonként rétegtani táblázatba foglalta. Megemlíti paleogén alakok felsőpannonba történt áthalmozódását is.

IV. VIZSGÁLATI MÓDSZER

1. Anyaggyűjtés

A jelen dolgozatban ismertetésre kerülő palynológiai mintaanyag gyűjtésénél a következőképpen jártunk el:

A Magyaregregy környéki felszíni feltárásokból 20 cm-enként, s ezen kívül anyagváltozásonként vettünk mintát. Előfordult az is, hogy egyes helyekről (pl. Mecseknádasd, Zobák stb.) összehasonlítás céljából csak egy-egy mintát vettünk.

A fúrások anyagának gyűjtése anyagváltozásonként, illetve a palynológiai kutatásra alkalmasabb rétegekből sűrűbb, a pollenszegény összletekből (pl. mészkő, kavicsrétegek) ritkább mintavétellel történt. A gyűjtött anyag zömét a M. Áll. Földtani Intézet által mélyített alapfúrások mintái adták, ily módon alapszelvények álltak rendelkezésemre, bőséges mintaanyaggal.

2. Feltárás

A feltárás módszere a minta minőségéhez alkalmazkodott. A megvizsgált anyagok zöme agyagmárga, márga volt, ezek feltárása a szokásos sósavas, ecetsavas, szükség esetén fluorsavas módszerrel, a lignitminták feltárása salétromsavas módszerrel történt. A feltárási munkákat DR. NAGYLAKI MIKLÓSNÉ végezte.

3. Mikroszkópi vizsgálat

A glicerinzselatinos, tartós preparátumok vizsgálatát *Zeiss* Nfpk binokuláris, biológiai kutató mikroszkóppal végeztem; 1,30 apertúrájú 90×-es objektív és mikrotár lencsékkel fényképeztem. A fényképek általában 1000×-es nagyítással, a részletfelvételek 2000×-es nagyítással készültek.

4. A palynológiai határozás

Miután a magyarországi miocén pollenflóra tudományos vizsgálata még nem tekint nagy múltra vissza, a feladatok nagyon sokrétűek.

A botanikai vonatkozások felkutatását elsőrendű feladatomnak tekintettem. Az összehasonlító recens spóra-pollen anyag jó részét a Nemzeti Múzeum herbáriumából, más részét hazai és külföldi arborétumokból személyesen gyűjtöttem.

A lehetőség mértéke szerint megkíséreltem a fosszilis együttesekbe ökológiailag is beilleszthető formák recens megfelelőinek áttekintését. Ha azok — döntő morfológiai érvek mellett — a vegetációképbe is beilleszthetők, akkor az azonosítás jogosnak tekinthető. Ha csak a morfológiai adottságok voltak megfelelőek, az ökológiaiak nem, akkor két eset állhat fenn: 1. vagy allochton, távoli eredettel kell számolnunk, 2. vagy a faj ökológiai adottságainak megváltozását kell feltételeznünk.

A közel egyidejű rétegekből való bemosás és az idősebb rétegekből való áthalmozódás lehetősége szükségessé teszi az idősebb rétegek spóra-pollen anyagának ismeretét is.

5. *A fajok leírása*

Teljességre törekedve, figyelembe vettem az egyetlen példányban, vagy igen kis számban előkerült fossziliákat is. Ismerve az egyes növényfajok nagyon eltérő spóra-pollenhozamát s a változó fosszilizációs körülményeket, az a véleményem, hogy egy-egy példány is jellemző lehet egy együttesre, vagy egy adott időegységre.

Az ismert és az új formák leírása és elnevezése, rendszertani besorolása vezet el a morfológiai és taxonómiai, nomenklatúrai kérdéscsoporthoz. Az egyes példányok leírásánál THOMSON et PFLUG (1953) és ERDTMAN, G. (1952) által alkalmazott morfológiai terminológiát alkalmaztam, szükségszerűen figyelembe véve a legújabb irodalmat is.

Az új fajok leírásánál a *Nemzetközi Botanikai Nevezéktani Szabályzat* előírásait messzemenően figyelembe vettem (1961. p. 15: "The Rules and Recommendations apply throughout the plant kingdom, recent and fossil."). A paleobotanikai értékelés érdekében mindenkor — a lehetőséghez képest — az egykor élt növényre próbáltam következtetni. Figyelembe vettem a leírt makrofossziliákat is.

Sporae dispersae-ről lévén szó, a fajok leírása a holotypushoz kötött, s ezért a holotypust fényképen — részleteiben is felismerhetően — próbáltam ábrázolni, ha szükséges, rajzokkal is alátámasztani.

6. *A nomenklatúra*

A fajok elnevezésénél is egyedüli alap a *Botanikai Szabályzat*. A morfológiai terminológiából alkotott mesterséges nomenklatúrát csak átmenetnek tekintem és alkalmazom, a fosszilis spórák és pollenek botanikai vonatkozásainak kiderítéséig. A prioritás szabályát alkalmazom. Ha a kutatások egy spóra vagy pollen recens megfelelőjét ismertté teszik, ekkor helyesnek tartom — az ismeretek mértéke szerint — a fosszilis faj nevében is kifejezésre juttatni a botanikai vonatkozásokat.

A spórák és pollenek elnevezésénél, a *Code*-dal egyezően (Art. 9. 2 és Recom. 20 B), általában a „*sporites*", „*pollenites*" végződést alkalmaztam. Ennek értelmében a PFLUG által 1953-ban kezdeményezett (*-sporis, -pollis:* in Palaeontographica 95. B, p. 86) rövidítéseket a szerzők nevének és érvényes közlési idejének változtatása nélkül, kijavítottam.

7. *A rendszerezés*

A legrégibb felfogások között szerepel a spórák, pollenek mesterséges [MOHL H. 1834 (in BERTSCH K. 1942 p. 1); REINSCH P. F. 1884; BENNIE J. és KIDSTON, R. 1886; BALÁZS I. 1896 stb.) rendszerezése mind fosszilis, mind recens pollenekre vonatkozóan. Idősebb geológiai korok spóráinak, illetve pollenjeinek mesterséges, ill. morfológiai rendszerbe való besorolása hiányos ismereteinkből következik. Legtöbb esetben a spóra-pollen és a makroflóra-leletek összefüggéseiről is kevés fogalmunk van.

A felsőkréta, alsótercier *Angiospermae* tömegei, annak ellenére, hogy mai feltételezéseink szerint sok rendszertani egységük kipusztult, közelebb hozhatók a recens taxonokhoz — a trópusok, szubtrópusok flórájának jobb megismerésével. Időben a mához közeledve, a fosszilis maradványoknak a mai növényvilághoz való kapcsolata mind több.

A palynológiában kialakult az a vélemény (THOMSON, P. et PFLUG, H. 1953, p. 6; NAGY E. 1958, p. 12; POTONIÉ, R. 1960, p. 24), hogy a quarterben, a fiatal tercierben általában besorolhatók a pollenek-spórák a mai növényrendszerbe.

WODEHOUSE, R. P. (1933, 1935), POTONIÉ, R. és munkatársai (1934, RAATZ, G. V. 1937; THIERGART, F. 1938; R. POT., THOMS. et THIERG. 1950) a tercierben — recens összehasonlító anyag alapján — a lehetőség szerint a természetes növényrendszerbe osztották be a spórákat és polleneket. Jelezték a bizonytalanságokat is és az ismeretlen rendszertani helyzetű spórákat, polleneket is leírták.

THOMSON et PFLUG (1953) teljesen új morfológiai rendszert állítottak fel, sok esetben figyelmen kívül hagyva a prioritási szabályokat.

R. POTONIÉ — a „Synopsis" három kötetében (1956, 1958, 1960) a species és genus rendszertani kategóriákat megtartva — a magasabb kategóriák számára — mesterséges rendszert alkalmaz.

TRAVERSE A. (1955) a természetes rendszerbe osztja be a spórákat, polleneket, az ismeretlenek számára új rendszertani egységeket alkotva.

A fosszíliák besorolására vonatkozóan SOÓ R. „Fejlődéstörténeti növényrendszertan"-át (1953, 1963) vettem alapul és igyekeztem fajaimat az ismereteim foka szerinti helyre besorolni.

8. Az értékelés

Az értékelés két fő irányban történhet, a kutatás foka szerinti sorrendben:

1. a megtalált maradványt sztratigráfiai tényezőnek tekintve, csak rétegazonosítás céljára használni fel;
2. a maradványokat botanikai objektumoknak is tekintve, az ebből levonható következtetéseket is értékelni.

1. Sztratigrafiai tényezőként felfogott maradványok jelenlétét a következőképp értékeljük: megjelenését a rétegsorban, dominanciáját, csökkenését és eltűnését. Jelenlétükből, illetve hiányukból is következtethetünk bizonyos — főleg paleogeográfiai — tényekre, pl. partközelre, parttávolra. Megállapíthatjuk, hogy a spóra vagy pollenfaj, illetve együttes bizonyos emeletre, szintre jellemző. Az üledék oxidációnak kitett, vagy ki nem tett voltára is következtethetünk a spóra-pollenanyag mennyiségéből, illetve megtartási állapotából (NAGY E. 1958).

2. Paleoökológiai, paleocönológiai, paleoklimatológiai, faciológiai adatszolgáltatásokhoz már jelentős botanikai ismeretek szükségesek. Idősebb geológiai korok vizsgálatánál a paleobotanikai ismeretek kevesebb, fiatalabb geológiai korok esetében több következtetés megtételére alkalmasak.

A mecseki anyaggal kapcsolatosan kísérletet tettem JEKHOWSKY, B. és munkatársai által a francia olajiparban alkalmazott gyors kiértékelési módszernek, némi módosítással való alkalmazására, vagyis bizonyos spórák, pollenek morfológiai alapon való összevonására. A módosításra az anyaggyűjtés eltérő módja, a fiatalabb geológiai kor és a vegetáció más jellegű összetétele miatt volt szükség. Ennek eredményeképpen palynológiai zónák felállítása vált lehetségessé (NAGY 1960, 1962).

V. RENDSZERTANI LEÍRÓ RÉSZ

A fajok leírását lásd az angol szövegben.

VI. A SPÓRA-POLLENSPEKTRUMOK ÉRTÉKELÉSE

1. Vegetációképek

Az egyes fúrások és feltárások pollenspektrumaiban a következő vegetáció-típusokat különböztettem meg: 1. láp-, ill. mocsárerdő, 2. vízparti ligeterdő, 3. parttól távolabb eső kevert lomberdő, 4. hegylábi, hegyoldali tűlevelű és lomberdő.

1. A *láp-*, ill. *mocsárerdő* vegetáció-típusba a következő fajokat soroltam: légzacskó nélküli *Coniferae* s. str. *(Taxodiaceae, Cupressaceae)*, *Alnipollenites verus*, *Betulaepollenites* sp.-ek, *Nyssapollenites* sp., *Myricipites*, *Jussiaeapollenites*, *Cyrillaceaepollenites* speciesek. Édesvizet jelölnek még az *Ovoidites ligneolus* R. POT. és *Utriculariaepollenites*, *Sparganium*, *Nymphaeaceae*, *Trapa* genusok speciesei is.

2. A *vízparti ligeterdő* tagjai a *Caryapollenites*, *Pterocarya* sp.-ek, *Platycarya*, *Tricolporopollenites cingulum*, *Salix*, *Liquidambar*, *Pityosporites labdacus* (*Pinus palustris*-nak feltételezett része), páfrányfélék, *Lygodium*-félék, *Polypodiaceoisporites*, *Verrucingulatisporites*, *Osmunda*-félék, *Leiotriletes*, *Monoleiotriletes*, a *Polypodiaceae* család (*Laevigatosporites haardti*, *Polypodiidites* stb. fajai), mohaspórák.

3. A parttól távolabb eső *kevert lomberdő* a ligeterdő vegetáció-típus termőhelyétől a hegylábig húzódó lehetett. Természetesen — az expositiótól függően — esetleg arra is felkapaszkodott. Mindezekből következik, hogy igen különböző ökológiájú fajokat foglal magában. Ide sorolhatók: az *Ulmus*, *Zelkova*-félék, a *Fagaceae* család legnagyobb része, *Tiliaceae*, *Sapotaceae*, néhány *Palmae*, *Podocarpus*, *Ginkgo*, *Flacourtiaceae*, *Acer*, *Araliaceae*, *Lauraceae*, *Ericaceae*, *Cornaceae*, *Caprifoliaceae*, *Ephedra*-félék, *Corylus*, *Malvaceae*, *Artemisia*, *Heliotropium*, *Ilex*, *Rhus*-félék, *Engelhardtia* fajok.

4. A *hegyoldali tűlevelű*, ill. *lomblevelűvel kevert erdő* hidegigényű, *Carpinus*, kevés *Fagus* és a különböző *Pinus* fajokból, *Dacrydium*, *Sciadopitys*, *Cedrus*, *Abies*, *Picea*, *Keteleeria* speciesekből állt.

A pollenspektrumokból megállapított paleocönológiai diagramokat összevetettük a minták kőzetanyagával. A kőzetanyag — mint ismeretes — a spóra-pollenanyag megmaradását igen nagy mértékben megszabja. Más szempontból is figyelemreméltóak az egy-egy mintából megszámolt pollenek, spórák mennyiségi adatai és ezek helyes értékelése is. Helyes értelmezéssel magyarázható meg, hogy pl. a hegyoldali erdőállomány pollenjeinek feldúsulása nem minden esetben jelzi a vegetáció feldúsulását. Jelezheti a beágyazó medencerésztől a szárazföldi partvonal eltávolodását, illetve a vegetáció eltűnését pl. transzgresszió által. Ilyen esetben a hegyoldalon levő távolabbi növényállomány pollenje mutatkozik a spektrumban.

A *Szászvár 8. sz. fúrás* 533 m-ig tartó szakaszából (48. ábra) 311 db minta került vizsgálat alá. A fúrás konglomerátum, homokkő, homok mintái nem voltak alkalmasak palynológiai értékelésre. A kevés pollen-spektrum a durva törmelék közé települt agyagmárgából, mészmárgából való.

A fúrás alsó része 533 m-től 442 m-ig igen kevés, erősen korrodált spórát-pollent és egyéb növénymaradványt tartalmaz, amely ősnövénytani kép megrajzolásához nem elegendő. A spóra-pollenanyag korrodáltsága arra enged következtetni, hogy a terület nagyon kevéssé volt vízzel borítva, s így az esetlegesen beágyazott pollenek a szárazföldi oxidáció hatására korrodálódtak. Áthalmozódásra utal a kevés mikroforaminifera-töredék és néhány, mezozóikumból származó spóra jelenléte.

A 435 m-től 432 m-ig terjedő szakaszon van néhány kiértékelhető pollenspektrum, de itt is váltakoznak a jó megtartású spórákból—pollenekből álló spektrumokat tartalmazó rétegek, a korrodált anyagot tartalmazó rétegekkel. Az értékelhető mintákban a nedves ökológiai igényű együttesek csak kevés esetben lépik túl az 50%-ot.

Aránylag kisebb szerepet játszott a szubtrópusi kevert lomberdő, a mintákban uralkodó a hegyvidékre jellemző *Coniferae* állomány (49. ábra). A folyóvízi—édesvízi összlet vegetációképe szubtrópusi kevert lomberdőre utal, nagyon sok *légzacskós Coniferae*-vel, amelynek egy része a szubtrópusi lomberdővel keveredett, főleg annak hegyoldali állományát alkotva.

Szárazabb térszínen aljnövényként tételezhetők fel az *Ephedripites hungaricus, Malvacearumpollenites rotundus, Ericipites* sp., *Heliotropioidearumpollenites gracilis, Pteracanthopollenites discordatus, Ilexpollenites* fajok, *Rhoipites* sp. anyanövényei. A trópusi, szubtrópusi flóra kiegészítője a kevés páfrányfaj: *Polypodiaceoisporites* sp.-ek, valamint *Osmundacidites gemmatus, Leiotriletes* sp., *Monoleiotriletes gracilis.*

Nedvesebb térszínre, láp-, ill. mocsárerdőre utal a *Taxodiaceae* pollen (kb. 14%), *Alnipollenites verus, Betulaepollenites betuloides, B. prominens, Myricipites myricoides* és a *Jussiaeapollenites champlainensis.* Az édesvizet jelzi az *Ovoidites ligneolus* és az *Utriculariaepollenites elegans.*

Az ún. terresztrikus összlet felfelé durva konglomerátum, homokkő, riolittufa rétegekből áll, amelyek úgyszólván pollenmentesek. A riolittufába zárt márgaközbetelepülésekben néhány pollen és kevés növényi szövetmaradvány található. A fúrás legfelső vizsgált mintájában (26—27 m között) érdekes maradványegyüttes van. A rendkívül szegényes *Angiospermae (Myrica, Ulmus, Tricolporopollenites microhenrici)* és ugyancsak kevés *Gymnospermae* mellett, kizárólag spórák találhatók. A fajokban rendkívül gazdag spóraanyag egy része — feltételezhetően — a folyópartról származó páfrányos maradványa. Az anyag jó megtartású és fajokban gazdag volta miatt nehezen elképzelhető, hogy valamennyi idősebb összletből mosódott volna át annak ellenére, hogy elég sok a régies forma, pl. a *Gleicheniaceae.* Ez utóbbiak mérete jóval kisebb a Bolchovitina által leírt alsókréta formákénál.

Ez utóbbi minta spektruma, a sok spóraanyaggal, teljesen azonos a *Kisbattyán 1. sz. fúrás* néhány megvizsgált mintájával. (A terresztrikus összletbe tartoznak a Kisbattyán 1. sz. fúrás 462 és 459 m közötti mintái.) Ezek szintén jóformán csak spórákat tartalmaznak, mégpedig az előzőkben említett kis alakú spórákat.

A limnikus összlet leginkább a *Pusztakisfalu VI. sz.* 126,2 m-es *fúrásban* tanulmányozható. A Pusztakisfalu VI. sz. fúrásból 18 db mintát vizsgáltam meg (50., 51. ábra). A fúrás helvéti rétegsora fás barnakőszén betelepülésekkel váltakozó kavics, homokos agyag, ritkábban bentonitképződményekből áll. Mindezekben aránylag kevés a spóra-pollenanyag. A barnakőszéntelepek sok növényi szövetmaradványt tartalmaznak. Az értékelhető minták kifejezetten édesvízi, partmenti, sűrű vegetációt tárnak elénk. A fúrás 25—27 métere közötti minta legjellemzőbb formái egy partmenti fűzfaerdőre utalnak, a hozzá csatlakozó myricás láppal. Jelentős spóramennyiség (14%) jelzi az aljnövényzetet, jórészt *Polypodiaceae*-vel (*Laevigatosporites haardti*). Emellett a *Caryapollenites simplex, Ophioglossisporites rotundus*, valamint a *Polypodiaceoisporites* sp. előfordulása is említésre méltó.

A partközelben szubtrópusi elegyes erdő lehetett, képviselői a *Tricolporopollenites microhenrici, Tricolporopollenites cingulum* ssp. *oviformis, T. cingulum* ssp. *pusillus, Sapotaceoidaepollenites microrhombus* ssp. *miocaenicus, Carpinuspollenites carpinoides, Caprifoliipites gracilis, Intratriporopollenites instructus, I. microreticulatus.* Aljnövényzetként a *Polygalacearumpollenites miocaenicus*-t, *Ilexpollenites margaritatus*-t, *Artemisiaepollenites sellularis*-t értékelhetjük.

22,5—25 m között még változatosabb a flóra. A páfrányspórák százaléka magas (32%): *Laevigatosporites haardti, Polypodiaceoisporites miocaenicus, Leiotriletes seydewitzensis, Neogenisporis* sp., *Verrucatosporites saalensis* találhatók a mintában. A partmenti kis *Taxodiaceae* állományhoz szubtrópusi lomberdő kapcsolódhatott. Édesvízi üledékre vall az *Ovoidites ligneolus* mellett az *Utriculariaepollenites elegans.*

A barnakőszéntelepek meddő képződményei (17,0—22,5 m) nem tartalmaznak pollent, fedőjük 15,0—17,0 m között édesvízi homok, amelynek jellemzője az *Ovoidites ligneolus, Utriculariaepollenites gracilis* mellett a *Salixipollenites* sp. (10,5%) és a *Taxodiaceae*-állomány. A szubtrópusi lomberdő gazdag spórájú aljnövényzetét jelzi, hogy a *Polypodiaceae* család mellett *Lygodium* specieszek is jelentkeztek (16% spóra).

12,5—15,0 m-ig a páfrányspórák lépnek előtérbe, kb. 60%-át alkotva a spektrumnak. Uralkodó a *Polypodiaceae* család (*Laevigatosporites haardti:* 32%), *Polypodiisporites favus, P. secundus, P. maximus, P. multiverrucosus, Verrucatosporites saalensis, V. histiopteroides* f. *major* mellett a *Lygodium* fajokra utaló *Polypodiaceoisporites gracillimus, P. mecsekensis, P. miocaenicus, Verrucingulatisporites miocaenicus, V. trifoliiformis.*

A szubtrópusi erdőt a kevés, *Fagaceae*-re utaló pollen, elég sok *Sapotaceoidaepollenites* sp. (6,5%), *Engelhardtioidites microcoryphaeus, Arecipites* sp., *Ilexpollenites margaritatus, Ginkgoretectina neogenica* alkotják. A nedves partszegélyre a *Taxodiaceae* mellett a *Cyrillaceaepollenites excelsus* jelenléte utal. A *Salixipollenites* sp.-ek már alig találhatók meg benne.

A 10,5—12,5 m-ig terjedő minta kevés *Angisopermae* pollent tartalmaz, az aljnövényzetre utaló egyszikűekkel együtt, és csak nagyon kevés *Coniferae*-t, amelyek esetleg hegyvidékre utalnak. A spektrum 86%-át páfrányspórák teszik (*Laevigatosporites haardti:* 22%). A 7,8—9,5 m-ből származó mintában (homokos mészmárga) az igen kevés *Coniferae* mellett az előzőekben említett páfrányspórák találhatók. Az e felett (6—6,3 m) elhelyezkedő fás barnakőszenet szövetmaradvány-törmelék jellemzi, a fedőből vett mintában is volt szövettörmelék.

Ugyancsak a limnikus összletet képviselik a *Szászvárbánya környékéről* származó minták (6 db) (52. ábra). A Fővölgyből származó mintákban kevés *Angiospermae* pollen (*Intratriporopollenites instructus, Tricolporopollenites cingulum* ssp. *oviformis, Alnipollenites verus*) mellett, az aljnövényzetet egy-két páfrányspóra jellemzi (*Bifacialisporites* sp.). Sok szövetmaradványt is tartalmaz, ez barnakőszenes képződményre utal. A Kórházvölgyből származó szenes agyagmárga minta ugyancsak sok szövetmaradványt és gombaspórát, egy-két *Angiospermae* pollent tartalmaz (*Carpinuspollenites carpinoides, Alnipollenites verus, Abietinaepollenites* sp.). Édesvizet jelez az *Ovoidites ligneolus*.

A *váraljai Pocsétás-árok* szelvényéből, a limnikus összletből gyűjtött egyetlen minta az eddigiekben leírt szubtrópusi lomberdőhöz hasonló pollenspektrummal rendelkezik: *Intratriporopollenites instructus, Zelkovaepollenites* sp., *Ulmipollenites* sp., *Tricolporopollenites microhenrici, Caryapollenites simplex, Pterocaryapollenites* sp., *Tricolporopollenites cingulum* ssp. *oviformis, T. cingulum* ssp. *fallax, Myricipites myricoides, Ilexpollenites margaritatus*, nagyon kevés *Coniferae* és *Lygodiumra* utaló spóra.

A *Zengővárkony 45. sz.* 36,5 m-es *fúrásból* 7 db mintát vizsgáltam meg (53., 54. ábra). A mezozóos trachidoleritre a limnikus összletbe tartozó durvább, majd finomabb agyagos homok, agyag települ, s csak a 17,2—17,8 m-ig terjedő agyagos aleuritban jelentkezik először értékelhető pollenspektrum. Az egykor itt élt szubtrópusi lomberdő összetétele még a Pusztakisfalu VI. sz. fúrás anyagából feltárt együttesre emlékeztet, azonban a *Salixipollenites* sp. jóval kevesebb és hozzá *Alnipollenites verus* csatlakozik. A partmenti erdőben aljnövényzetként értékelhető páfrányok a spektrum több mint 20%-át adják. A kevés fenyőpollen egy része légzacskó nélküli *Coniferae* s.str. Megtalálhatók a — valószínűleg hegyoldalon élt — fenyők pollenjei is: a *Cedripites szászvárensis* és a *Pityosporites labdacus*. Aljnövényként *Triporopollenites urticoides* jelentkezik.

A 16,4—17,2 m mélységközben szenes agyag található, lignitzsinórokkal, ami mocsár-, ill. láperdőre utal. A szubtrópusi ligniterdőre utaló *Salixipollenites* sp.-hez ökológiai igény szempontjából a *Nyssapollenites kruschi* ssp. *analepticus* csatlakozik. Az előző mintában is gazdagnak mutatkozó spóraállomány — még újabb fajokkal kiegészülve — itt a spektrum 76%-át adja. A szárazabb jellegű együttesre mutat a *Tricolporopollonites microhenrici, Tricolporopollenites cingulum* ssp. *oviformis, T. cingulum* ssp. *pusillus, Zelkovaepollenites thiergarti, Sapotaceoidaepollenites obscurus, Momipites punctatus, Aceripollenites rotundus, Caryapollenites simplex, Engelhardtioidites microcoryphaeus* és az *Ilexpollenites* sp.-ek.

A 14,0—14,5 m-ig terjedő congeriás agyag pollenmentes, a felette következő halpikkelyes agyagmárga összlethez tartozó minta (13,2—13,7 m) már az előbbiektől eltérő flóraképet tár elénk. A gazdag *Angiospermae* állományból hiányzik a *Salixipollenites* sp., ebből arra következtethetünk, hogy part menti, szárazabb jellegű szubtrópusi erdő alakult ki. Az *Ilexpollenites propinquus, Polygalacearumpollenites miocaenicus, Caprifoliipites gracilis, Graminidites media* pollenek utalnak e szárazabb erdő aljnövényzetére, s csak kevés pollen jelez nedvesebb területet (*Polypodiaceoisporites gracillimus* és egyéb *Polypodiaceoisporites* sp.-ek). Édesvíz jelenlétére mutat az *Utriculariaepollenites elegans*. Az édesvíz melletti, mocsarasabb részekre a *Cyrillaceaepollenites exactus*, *C. megaexactus* és a kevés *Taxodiaceae* pollenből következtethetünk. Igen kevés *Coniferae*, moha, gombaspóra egészíti ki a spektrumot.

A *nagymányoki Melegoldalban* a halpikkelyes agyagmárga összletből gyűjtöttük azt a mintát, mely közel 55%-os *Coniferae* pollenjével a magyaregregyi Kisréti-árok 48% *Coniferae*-t tartalmazó halpikkelyes agyagmárgájához közelálló. Lombosfa-állománya a Magyaregregy környéki lelőhelyekéhez hasonló összetételű, itt azonban egyik faj sem ér el pl. a *Caryapollenites simplex*-éhez hasonló jelentős mennyiséget (lásd Kisrét, Farkasordító). A kevés páfrányspóra is a Magyaregregy környéki lelőhelyekéhez hasonló fajokra utal (*Laevigatosporites haardti*, *Polypodiisporites favus*, *Leiotriletes* sp.-ek).

A halpikkelyes agyagmárga összlet számos *Magyaregregy környéki* feltárásból is ismert. A feltárásokból egy-egy minta került vizsgálatra, tájékozódó jelleggel, amelyekből kialakítható volt az általános vegetációkép.

A Magyaregregy környéki külszíni feltárások (55. ábra) alsó mintáiban, a Kisréti-árok 1. sz. lelőhelyéről származó mintában, a diófélék uralkodtak. 20%-át alkotják pollenspektrumának, ebből a *Caryapollenites simplex* 16%. E kevert ligeterdőben a hársfélék 4%-ban fordulnak elő, viszont a quercoid formák aránya kicsi (*Tricolpopollenites liblarensis*, *Tricolporopollenites cingulum* ssp. *oviformis*, *Faguspollenites tenuis* együttesen: 6%).

A szubtrópusi lomboserdő további képviselői a *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Sapotaceoidaepollenites obscurus*, *Carpinuspollenites carpinoides*, *Engelhardtioidites microcoryphaeus*, *Ostryapollenites rhenanus*, *Triporopollenites coryloides*. A *Coniferae* aránya is jelentős: 48%, ebből a *Pityosporites labdacus* 21%, az *Abietinaepollenites microalatus* 7%, ennek egy része keveredett a lombos állománnyal. A kevert erdő valószínűleg a hegylábon, hegyoldalon húzódhatott, amire a mikroterm lombos elemek mellett a *Piceapollenites neogenicus* (5%) és a *Keteleeriaepollenites komlóensis* (0,7%) utal.

A láp jellemzői a légzacskó nélküli *Coniferae* s.str., a *Myricipites myricoides*, *Betulaepollenites betuloides*, *Salixipollenites* sp. anyanövényei lehettek. Az édesvízre a *Myriophyllumpollenites quadratus*, ill. a félsósvízre a *Cooksonella circularis* plankton forma fellépése mutat.

A Kisréti-árok 3. sz. lelőhelyének mintája gazdag vegetációképet tár elénk 37% *Coniferae*-vel. A part menti édesvízi láp-, ill. mocsárerdőre utalók a *Taxodiaceae* fajok pollenjei (10%) és a *Myricipites myricoides* (19,4%), *Nyssapollenites* sp., *Salixipollenites* sp., *Betulaepollenites betuloides*. A *Caryapollenites simplex* aránya a spektrumban kisebb (8,4%), mint a Kisréti-árok 1. sz. lelőhelyén. A *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Aceripollenites reticulatus*, *Tricolporopollenites cingulum* ssp. *oviformis*, *T. cingulum* ssp. *pusillus*, *Tricolporopollenites microhenrici*, *Engelhardtioidites microcoryphaeus*, *Celtipollenites* sp., *Ostryapollenites rhenanus*, *Caprifoliipites sambucoides*, *Rhoipites* sp. fajok képviselői társulnak erdővé.

Az Almáspatak melletti I—II. lelőhelyekről 31 minta anyagát vizsgáltuk meg. Ezek közül a dácittufa- és tufitrétegekből nagyon kevés pollenanyag került elő (NAGY-PÁLFALVY, 1958, 1960). A felső, limonitos homokkő és halpikkelyes, tufás agyagmárga minták voltak értékelhetők palynológiai szempontból. Az értékelhető mintákban a *Coniferae* pollenek mennyisége eléri a 30—35%-ot. Lombosfa-állománya — a fajokat illetően — a többi Magyaregregy környéki flóráéhoz hasonló. Édesvízre az *Ovoidites ligneolus* és *Carex* gyökérzet maradványok jelenléte mutat. Viszont a felső mintában található néhány *Hystrichosphaeridae* maradvány tengerelöntésről tanúskodik.

A *Farkasordítói-árok* feltárásainak egy-egy mintája az előzőkhöz hasonló pollenspektrumú, de fajokban és egyedszámban sokkal gazdagabb. A legváltozatosabb növénytársulások éltek egymás mellett: az édesvízi (*Sparganiaceaepollenites* sp., *Myriophyllumpollenites quadratus*), a láp- és mocsárerdei (*Taxodiaceae, Myricipites myricoides, Salixipollenites* sp., *Betuloidaepollenites betuloides, Alnipollenites verus*, a *Cyrillaceaepollenites exactus*-szal). A partmenti erdőben élhetett a *Caryapollenites simplex* anyanövénye, amely 20%-kal lép fel. Ehhez társul a *Pterocaryapollenites stellatus*, majd a parttól távolabb a *Carpinuspollenites carpinoides, Tricolporopollenites microhenrici, Quercopollenites* fajai mellett a *Faguspollenites* sp., *Intratriporopollenites* sp., *Aceripollenites* sp., *Ulmipollenites* sp., *Zelkovaepollenites* sp., *Sapotaceoidaepollenites* sp.-ek és feltehetően a *Lauraceae* pollenek anyanövényei,* *Flacourtiaceae* sp., *Liquidambarpollenites formosanaeformis* és *Triporopollenites coryloides* egészítik ki a spektrumot. A *Coniferae* pollenek 28%-ot érnek el. Aljnövényekre a *Monocotyledones* fajok, páfrányspórák és a *Graminidites media* utalnak.

A *Leánykői-árokból*, általunk „főtelep"-ként jelölt „slír" lelőhelyről, a rétegsor 2. és 27. mintáját értékeltem. A 27. minta fajokban és egyedszámban is nagyon gazdag. A pollenspektrum nagy részét (35%) *Coniferae* teszi ki, e jelleg hasonló a többi Magyaregregy környéki lelőhely mintáiból származó spektrumokéhoz. A lombos fajok közül csökken a *Juglandaceae*, illetőleg a *Caryapollenites simplex* szerepe (6%). A *Fagaceae* és az *Ulmaceae* mintegy 18%-át adja a spektrumnak. Jelentősebb fajok: *Tricolporopollenites microhenrici, Quercopollenites robur* typus, *Tricolporopollenites cingulum* ssp. *pusillus* és egyéb *Tricolporopollenites* fajok, *Liquidambarpollenites orientaliformis, Aceripollenites rotundus, Carpinuspollenites carpinoides, Zelkovaepollenites* sp., *Ulmipollenites* sp., *Inaperturopollenites* sp., *Araliaceoipollenites euphorii, Cyrillaceaepollenites megaexactus, Myricipites myricoides* stb.

A feltárt rétegsor tetején elhelyezhető 2. sz. minta pollenspektruma valamivel szegényesebb. A *Coniferae* aránya csökken (kb. 20%). A lombosfák között, a 27. sz. mintáéhoz hasonlóan, uralkodó a *Fagaceae* (35%). Az egyéb lombosok aránya 17%. A *Juglandaceae* még jobban visszahúzódik (4%).

Magyaregregytől DNY-ra *Komló—Zobák-pusztánál* a rétegtanilag azonos helyzetű halpikkelyes agyagmárgából származó minta is gazdag *Coniferae*-állományra utal (72%), amely lombosfa típusokkal keveredhetett. Ilyenek: a *Tricolporopollenites cingulum* ssp. *fusus, T. cingulum* ssp. *oviformis, Faguspollenites* sp., *Zelkovaepollenites* sp., *Aceripollenites* sp., *Sapotaceoidaepollenites* sp., *Caryapollenites simplex, Pterocaryapollenites stellatus, Engelhardtioidites microcoryphaeus, Alnipollenites verus, Ilexpollenites margari-*

* PÁLFALVY I. (1964) cikke és szóbeli közlése alapján a *Lauraceae* fajok jelentős részét képezik a makroflóra maradványegyüttesének. Pollenjeik — ahogy erre már korábban (irodalmi adatokra is támaszkodva) utaltam (1958, p. 124) — nem maradnak fenn, vagy csak igen bizonytalan adatok utalnak jelenlétükre.

tatus. A kevés spóra sem tér el jelentősen a halpikkelyes agyagmárga összlet többi mintáiban levőktől.

A *Mecseknádasd* környékén ismert makroflóra-maradványos, halpikkelyes agyagmárgából gyűjtött mintát a *Coniferae* uralma jellemzi (74%); ez közel áll a Komló—Zobák-pusztai minta spektrumának értékéhez. E hasonlóság nyilvánvalóan a közellevő mezozóos tömb alkotta hegyoldal erdővegetációjának egyezéséből adódik. *Angiospermae*-állományuk összetétele is hasonló. A mecseknádasdi mintában található 4,8% *Myricipites* pollen helyi mocsárra utal.

A Magyaregeregy környéki halpikkelyes agyagmárga összlet felső részével vethető össze a *Hidas 53. sz. mélyfúrás* alsó szakaszának mintaanyaga. A fúrásból 62 db minta került vizsgálatra (56., 57. ábra). 1017—1019 m mélységközben a pollenanyag erősen korrodált, sok a felismerhetetlen töredék. Lombosfák jelenléte a következő fajokból állapítható meg: *Liquidambarpollenites* sp., *Cyrillaceaepollenites megaexactus, Sapotaceoidaepollenites* sp., *Ulmipollenites* sp., *Faguspollenites tenuis, Tricolporopollenites microhenrici, Caryapollenites simplex, Myricipites myricoides, Momipites punctatus.* Ezek mellett *Pityosporites labdacus* és páfrányspórák: *Polypodiisporites favus* és néhány *Polypodiaceoisporites* faj különíthető el.

A 971—983 m-ből származó minták pollentartalma csekély, %-osan nem értékelhető.

A 837,9—839 m közötti minta pollenspektrumában a *Coniferae* 20%, a szubtrópusi kevert erdőre utaló formák 37%, a parti ligeterdő társulása 27%, a láp- és mocsárerdő alakjai 16%-ot érnek el.

837,9—839,0 m-től megjelennek, majd a 738 m-től állandóan megtalálhatók a mikroforaminiferák, amelyek a torton barnakőszenes összlet feküjéig előfordulnak. Néhány mintából *Hystrichosphaeridae* is előkerült (755—757 m, 735—738 m, 688—690 m). Ezekben a mintákban — meglehetősen következetesen — jelentkezik a *Chenopodiaceae* pollenje is, amely forma — Averdieck (1958) szerint — tengerparti jellegre utal.

775—776 m-ben erősen korrodált pollenanyagot találunk, sok *Coniferae* és *Angiospermae* maradvánnyal. 763—764 m között valamivel gazdagabb ugyan a pollenspektrum, de szintén rossz megtartású, *Myrica*-láp jelenlétére utal. A 761,0—763,3 m-ből vett minta 17% hegyoldali *Coniferae*-t tartalmaz. *Taxodiaceae-Myricaceae* mocsár- és láperdő 10%-át teszi ki a spektrumnak, *Nyssapollenites kruschi* ssp. *analepticus*-szal. Gazdag kevert lomberdő (39%) csatlakozik ehhez sok tricolporat formával (30%); végül ligeterdőre utal 25%. Aljnövényként *Tubulifloridites ambrosiinae* és *Chenopodipollenites multiplex* méltó említésre.

A következő, 759—761 m-ből származó, csaknem teljesen mészhéjakból álló minta csupán 4 db pollent tartalmazott. A 757—759 m-ből származó minta pollenspektruma a mocsár-, ill. láperdő előretörésén kívül (28%) nagyjából azonos cönológiai együttesekre utal. Aljnövényként *Graminidites* sp., *Ericipites* sp., *Lygodioisporites* sp., *Stereisporites granulatus* mutatkozik. 755—757 m-ben a *Coniferae* kissé visszahúzódik (27%), a lombosállomány felszaporodik. 735—738 m-ben a *Coniferae* rendkívüli előretörése (72%), *Foraminifera* és *Hystrichosphaeridae* maradványok megjelenésével együtt, a tenger előnyomulására utal. (Ekkor a part menti lomboserdő nyilvánvaló visszahúzódásával kell számolnunk.) A szubtrópusi erdőben a melegebb éghajlatot a pálmapollenek mellett a *Dipterocarpacearumpollenites hidasensis*, *Tetracentracearumpollenites komlóensis*, *Sapotaceoidaepollenites obscurus*, *Rhoipites pseudocingulum* pollenek jelzik.

A 711—713 m-ből vett minta anyaga homokos, kavicsos mészkő, amelyben *Foraminiferák* és *plankton* maradványok mellett csak igen kevés *Coniferae*, s egy-két *Angiospermae*, *Cyrillaceaepollenites megaexactus*, *Tubulifloridites grandis*, és kevés spóra jelentkezik.

A 708,5—711,0 m mélységköz mintáinak meszes homokkő anyagában csekély számú spóra-pollenanyagot találunk, az eddigi spektrumok töredékeként. A 694,4; a 690—691,2, ill. 688,5—690 m-ben levő minták nem alkalmasak palynológiai értékelésre, a bennük levő mikroforaminifera és planktonanyag tengeri eredetű. 688,0—688,5 m-ből — a lithothamniumos összletnek lazább, márgásabb részéből származó minta — fenyő- és *Angiospermae*-állományt jelez. A 686,5—688; 680—683; 676—680, ill. 672,5—676 m-ből származó minták főleg tengeri eredetű maradványokat tartalmaznak (*Foraminifera*, *Botryococcus* és egyéb *plankton*). A kevés pollen szubtrópusi erdőre utal.

A barnakőszenes összletbe tartozó, 670,3—672,5 m mélységből származó két minta meddő, csupán kevés növényi szövetmaradványt tartalmaz. A 669,8—670,3 m-ben levő lignites, fényes barnakőszénsávos agyagban már több a szövetmaradvány. A kevés *Taxodiaceae—Myricaceae* pollen mocsár- és láperdőre utal.

A 669,0—669,8 m-ből gyűjtött agyagmárga minta értékelhető pollenspektrumot tartalmaz: 10% *Gymnospermae* pollen, s gazdag *Angiospermae* flóra jellemzi (56. ábra). Aljnövényzet pollenjeként fogható fel a *Caprifoliipites gracilis*, *Ilexpollenites margaritatus*, *Rhoipites pseudocingulum*, *Chloranthacearumpollenites dubius*, valamint a kevés spóra is: *Laevigatosporites haardti* és az *Echinatisporites variabilis*. Nedvesebb térszínt jelez a *Taxodiaceae* sp., a kevés *Myricipites myricoides*, *Betulaepollenites betuloides*. Tengerparti jellegre mutat a *Chenopodipollenites maximus* és *Ch. minimus* előfordulása.

A 667,2—669,0 m közötti agyagmárgából az előzőkhöz hasonló vegetációképű együttes kerül ki. A *Coniferae* majdnem azonos mennyiségű (14%). A lombosállomány fajokban gazdagodik (56. ábra). Mocsár-, ill. láperdőre utal a *Taxodiaceae* pollenek mellett a *Myricipites rurensis*, *M. myricoides*, *Cyrillaceaepollenites megaexactus*, *Nyssapollenites kruschi* ssp. *analepticus*, *Utriculariaepollenites elegans*. Tengerpartot jelez a *Chenopodipollenites minimus* a *Botryococcus* alga mellett.

A 666,8—667,2 m-ig és a 666,3 m-ből gyűjtött, molluszkahéj-törmelékes agyagmárga minta csaknem teljesen pollenmentes.

665,1—666,8 és 659,5—659,8 m között a fúrás barnakőszéntelepet harántolt. Kevés, láp-, ill. mocsárerdőre utaló *Taxodiaceae—Myricaceae* pollent, néhány *Angiospermae* pollent, valamint a barnakőszénre jellemző sok szövet- és gombamaradványt és kevés planktonformát tartalmaz.

A 630,8—632 m mélységközből vett hydrobiás agyagmárga minta pollenspektrumából levezethető a *Taxodiaceae—Myricaceae* (*Myricipites rurensis*)-láp, ill. -mocsár jelenléte, *Alnipollenites verus*, *Betulaepollenites betuloides*-szel. Emellett gazdag szubtrópusi erdővegetációra utaló pollenek találhatók e mintában; ezek egy része magasabb térszínre, hegyvidékre utal.

A 600,5—602,3 m-ig terjedő szakaszból vett minta agyagmárga. A pollenspektrum a *Coniferae* visszahúzódását mutatja (28%) nagy fajszám mellett. A *Coniferae* nagy része *Taxodiaceae* sp., amely *Myricipites rurensis*, *Cyrillaceaepollenites megaexactus* és *Betulaepollenites betuloides* anyanövényeivel társult. A lomboserdőre utaló alakok között a torton aljáról ismert *Dipterocarpacearumpollenites hidasensis* és a *Flacourtiacea* sp.-k is jelentkeznek. Aljnövényzetre utaló formái az előzőhöz hasonlók: *Lobeliaepollenites erdtmani*, *Ericipites hidasensis*, *Rhoipites* sp. pollenek és *Echinatisporites* sp., *Osmundacidites* sp., *Leiotriletes* sp. páfrányspórák.

592,3—599,7 és 592,7—593,1 m-ből, a torton barnakőszenes összlet mintáiban is láperdőre utaló *Taxodiaceae* és kevés *Myricipites* pollen van. Édesvizet jelez az *Ovoidites ligneolus*. A lignitre jellemzően sok a szövetmaradvány. Az 590,2—590,7 m-ből származó édesvízi csigákat és barnakőszenes agyagzsinórokat tartalmazó agyagmárga minta kevés légzacskó nélküli *Coniferae*-t, egy-két spórát és pollentöredékeket tartalmaz. Ez a minta képviseli a barnakőszenes összlet legfelső részét.

Az 572—575 m-ből, a turritellás—corbulás agyagmárga összletből származó minta a kőszéntelepes összletet követő tengerelöntés csökkent sósvízi képződménye. Pollenspektruma még *Taxodiaceae* állomány jelenlétére utal (13% *Taxodiaceae*), kevés *Myricipites rurensis* (3,5%), *Cyrillaceaepollenites megaexactus*, *Nyssapollenites kruschi* ssp. *analepticus* és *Betulaepollenites betuloides*-szel. A kevert lomberdő a hegylábra húzódhatott.

558—561 m mélységközből gyűjtött molluszkás agyagmárga — faunája alapján — a szarmatába tartozik. A mintában a fenyők mennyisége feltűnően nagy (41,5%), ebből az *Abietinaepollenites microalatus* 14%, a *Pityosporites labdacus* 19%, a *Piceapollenites neogenicus* 3%, a *Tsugaepollenites igniculus* és az *Abiespollenites absolutus* 0,6—0,6%. A kevert lomberdőben a *Tricolporopollenites henrici* lép előtérbe (11%) a szubtrópusi erdő anyanövényeivel társulva. Kevés spóra és *Chenopodipollenites maximus* egészítik ki az aljnövényzetet. A *Myricipites rurensis* (5%), a néhány *Taxodiaceae* sp., *Cyrillaceaepollenites megaexactus* és *Hydrosporites miocaenicus* láp jelenlétére utal.

Az 554—554,3 m-ből származó pollenspektrumban a *Coniferae* pollenek visszahúzódnak (25%), s a lombosfák pollenjei — különösen a *Fagaceae*-ra utalók száma — megnövekszik. A parti láp- és mocsárerdő pollenjei a spektrum 26%-át alkotják.

Az 553,1—554 m-ből származó minta újból a fenyőfélék előretörését mutatja (44%), ebből azonban 16%-ot a *Taxodiaceae* pollen tesz ki, ami a 10% *Myricipites* pollennel együtt bizonyítja a láp-, illetve mocsárerdő jelenlétét. A lomboserdei elemek közt uralkodó a *Fagaceae* családra utaló *Tricolporopollenites microhenrici* (30%).

Az 545,4—546,5 m közötti minta pollenspektruma hasonló az előzőéhez. Kevesebb a fenyőpollen (34%), de fajokban gazdagabb. A lomboserdőre itt a *Fagaceae* mellett a szárazabb elemek — *Ilexpollenites iliacus*, *I. margaritatus* — előretörése jellemző. Egyidejűleg a *Taxodiaceae* láp- és mocsárerdő elemei is megtalálhatók.

Az 534—537 m-nél a *Coniferae* állomány még jobban visszahúzódik (9%), a lombosfa állomány változatos fajokban, az előző mintákhoz hasonló összetételű. A szárazabb térszínre, ill. klímára utaló *Ilexpollenites iliacus*, *I. margaritatus*, valamint az *Ephedripites* sp. is megtalálható. Az erdő aljnövényzetére enged következtetni a *Chlorantacearumpollenites dubius*, *Tubulifloridites anthemidearum* és néhány spóra, pl. az *Echinatisporites hidasensis* is. A jellegzetes *Taxodiaceae—Myricaceae* láp elemei is megtalálhatók. A tengerpart közelségét a *Chenopodiaceae* pollenek jelzik. Tengeri üledékképződést bizonyít a néhány *Hystrichosphaeridae* és a *Thalassiphora pelagica*.

Az 521,5—524 és az 510,3 m-ből származó meszes homok, ill. homokkőminták csak néhány légzacskós fenyőpollent tartalmaztak.

A 494,8—496 m mélységben települő agyagmárgaminta kevés tengerpart menti erdőre utaló pollent tartalmaz, ugyanekkor a spektrumban a hegyoldalak erdővegetációjából eredő pollenek %-aránya jelentős (75%) és nagy a fajgazdagság is.

479,1—482 m-ben a *Gymnospermae* 23%-kal szerepel, a lomboserdő *Fagaceae* állományát főleg a *Quercopollenites* sp. képviseli (12%). A szárazabb térszínre utaló aljnövényzet az *Ephedripites (Ephedripites) mecsekensis*, *Caprifoliipites andreánszkyi*, *Ilexpollenites margaritatus*, *I. propinquus*, *Artemisiaepollenites sellularis*. Nedvesebb térszínt jelez a kevés *Taxodiaceae*, *Myricipites* sp., *Utriculariaepollenites elegans*, *Cyrillaceaepollenites megaexactus*, *Alnipollenites verus*, *Betulaepollenites betuloides*.

A 444,0 m mélységből vett minta pollenspektrumát a fenyőfélék a p a n n o n r a jellemző magas számmal uralják (71,5%). Ebből *Pityosporites labdacus* 22%, jelentős az *Abietinaepollenites microalatus*, *Piceapollenites* sp., *Cedripites deodaraeformis*, *Podocarpidites* sp., *Inaperturopollenites* sp. is. A légzacskó nélküli *Coniferae* pollenek között *Chamaecyparidipollenites flexuosus* határozható meg. A lombosfák között a *Quercopollenites* sp. az uralkodó (9%). A 427—432,6 m-ből származó minta spektrumában hasonlóan jelentős a *Coniferae* (55%), ehhez lombosfák csatlakoznak. Aljnövényként kevés *páfrányspóra* és *Graminidites*, valamint *Ericipites* sp. pollen mutatkozik, 417—420 m között a *Coniferae* 42%, amelyben — nyilvánvalóan helyi feldúsulás eredményeképpen — a *Ginkgo* 17%-kal jelentkezik. A kevert lomboserdő kiterjedése lecsökkenhetett; a lombosállományra utaló fajok fele a *Fagaceae*-hez tartozik (10%). Nedvesebb térszínre utalnak a *Sparganiaceaepollenites polygonalis*, a *Taxodiaceae* és a *Nymphaeaceae* pollenek.

364,2—367 m pannon összletben a *Coniferae* 64%-kal jelentkezik. Különösen sok a *Pityosporites labdacus* (30%) és az *Abietinaepollenites microalatus* (14%); az *Abiespollenites absolutus*, a *Piceapollenites* sp. (3—3%), és a *Keteleeriaepollenites komlóensis* (2%). A kevert lomberdei elemek mennyisége csak 10%, de fajokban gazdag. A ligeterdő és mocsárerdő visszahúzódott. A mintában levő néhány *Hystrichosphaeridae* valószínűleg áthalmozott, erre utal néhány spóra is (pl. a *Trilobosporites bernissartensis*).

298—299,1 m-ből vett mintában nedves élőhelyre utal a kevés *Taxodiaceae* sp., *Myricipites rurensis* és a *Nupharopollenites kedvesii*. A ligeterdő ismét kiterjedtebb, 32,5%-át teszi a spektrumnak; a kevert lomberdő aránya a többi pannon spektrumokhoz hasonlóan kicsi (6,3%), a hegyvidéki fenyőfélék aránya nagy (57%).

A 258,1–258,5 m-ből származó szenes agyagmárga minta kevés *Taxodiaceae* és *Angiospermae* pollent tartalmaz. A gazdag spóraanyag nagy része idősebb üledékből áthalmozódott. A helyi flórához tartozhatott a *Leiotriletes hidasensis, L. microlepioidites* és a *Laevigatosporites haardti*.

A 147,5–148,5 m-ben települő kőzetlisztes agyagmárga mintában ismét gazdag pollenanyag található. A mocsár-, ill. láperdőre utaló fajok mennyisége 15,2%. Édesvízre utal a *Myriophyllumpollenites quadratus, Ovoidites ligneolus* is. A ligeterdő 30,4%, amelyben a *Caryapollenites simplex* aránya 6%. A ligeterdő aránya valamivel nagyobb (28,2%), a tűlevelűek viszont visszahúzódtak (26,2%). Valószínűleg áthalmozódott a *Polypodiaceoisporites speciosus, Spongiosporites* cf. *spongiosus*. Jellegzetessége a mintának a *Dinoflagellaták* jelenléte is.

A 135,5–137; 134,8–135,5 és a 132,5–134,8 m-ig terjedő szakaszból vett mintákban a jelentős hegyvidéki erdőállomány mellett csak igen alárendelt szerepet játszanak a kevert lomberdő, a ligeterdő és a mocsárerdő elemei. Édes- vagy alig sós vízre utal a néhány *Dinoflagellata* és az *Ovoidites ligneolus*.

A 126,6–132,5 m közötti iszapos homokrétegben, szenesedett növényi szövetmaradványok mellett, csak kevés a spóra és a pollen. A *Coniferae* e kis példányszám mellett is elég sok fajt foglal magában. A nagyon kevés *Angiospermae* közül kiemelkedő a *Plantaginacearumpollenites hidasensis* jelenléte. Az aljnövényzetre utaló spórák közül az *Ophioglossisporites grandis, Polypodiaceoisporites mecsekensis* és *P. acutus* jelenléte említésre méltó.

A 118–126,6 m pollenspektruma néhány, hegyvidéket jelző fenyőtípuson kívül néhány *Taxodiaceae* pollent is tartalmaz. Ez utóbbiakból, a néhány szövetmaradványból és a *Myricipites* sp., *Nyssapollenites* sp., *Betulaepollenites* sp. jelenlétéből lápterületre következtethetünk. A szárazabb lomboserdőre a *Tricolporopollenites densus, T. microhenrici, T. cingulum* ssp. *pusillus, Ulmipollenites undulosus, Ilexpollenites margaritatus* és *Compositae* pollen enged következtetni. A spórák között a *Cicatricosisporites mecsekensis* valószínűleg áthalmozódással került az anyagba. Néhány plankton, különösen a *Dinoflagellaták* jelenléte, édesvízre utal.

A 73,3–89,5 m-ből származó minta flóraanyaga rendkívül gazdag. A mocsárerdő, liget- és kevert lomberdő együttes aránya 51%, a hegyvidékre utaló erdő 49%. A *Sparganiaceaepollenites polygonalis, Nymphaeaepollenites pannonicus, Myriophyllumpollenites quadratus,* valamint az *Ovoidites ligneolus* és a *Dinoflagellaták* édesvizet jeleznek.

A fúrás 11,8–12,68 m-e között gyűjtött pleisztocén löszminta teljesen pollenmentes, csak néhány szövetmaradvány található benne.

A *hidasi barnakőszénbánya* területén általában 8 telepet különítenek el. A 2. sz. telepből 9 db saját gyűjtésű mintát vizsgáltam meg.

Az 1. sz. minta (a telep feküje) finomhomokos agyag. A láp-, ill. mocsárerdőre jellemző a *Coniferae* 18%, és a *Nyssapollenites* sp., igen sok a *Myricipites* pollen (53,44%), az *Alnipollenites verus* és a *Cyperacearumpollenites* sp. szintén lápi környezetre vall. Édesvízben élhetett a *Tetraporina quadrata*, valamint a *Nymphaeaepollenites* anyanövénye. Parti ligeterdőre utal a *Zelkovaepollenites potoniéi, Caryapollenites simplex*, kevert lomberdőre a *Tricolporopollenites microhenrici, T. henrici, Quercopollenites* sp., *Tricolporopolle-*

nites cingulum ssp. *fusus* (a *Fagaceae* összesen kb. 8%), *Engelhardtioidites microcoryphaeus, Magnoliaepollenites simplex,* valamint az *Arecipites* sp. Aljnövényként *Triporopollenites coryloides, Ericipites* sp. és néhány spóra jelentkezik.

Az összlet 2. telepéből az 1. mintának megfelelő szintben gyűjtött 53. sz. agyagos homok minta pollenspektruma kevés *Myricipites* és *Taxodiaceae* pollent, s emellett egyéb édesvízi lápra utaló pollent is tartalmaz, ezek: *Cyperacearumpollenites* sp., *Sparganiaceaepollenites* sp., *Graminidites* pollen, valamint *Jussiaeapollenites champlainensis*. Kevés *Magnoliaceae* sp., valamint *Tricolporopollenites henrici* és a *Tricolporopollenites cingulum* ssp. *pusillus* található benne. A minta jellegzetessége a *Heliotropioidearumpollenites rotundus* nagyszámú előfordulása is, valamint szövetmaradványok jelenléte.

A 2. telep 2. számmal jelzett barnakőszén mintájában a *Taxodiaceae* pollenek és kevés spóra mellett a szövetmaradványok a *Taxodiaceae* mellett kétszikűekre és pálmákra utalnak. A *Savitrinia miocaenica* — édesvízi planktonforma — jelentős mennyiségű.

A 3. sz. fás barnakőszén mintában néhány *Taxodiaceae* pollenen, kevés spórán kívül sok szövet- és gombamaradvány található. A tömegesen jelenlevő *Coniferae* szövetmaradványok mellett szerepel egy — feltételezhetően — *Ulmus* sp. bélsugár keresztmetszete (LVI. tábla, 2.) is.

A 4. sz. fás barnakőszén mintában a *Taxodiaceae pollenek* mellett néhány *Zelkovaepollenites potoniéi, Caryapollenites simplex, Caprifoliipites andreánszkyi, Faguspollenites* sp., *Ulmipollenites* sp. és *Myricipites* sp. is található. Az anyag korrodált, rossz megtartású.

Az 5. sz. minta barnakőszén, tufitos betelepülésekkel. A mintában sok a szövet- és gombamaradvány, emellett kevés *Coniferae* töredék és néhány spóra van *(Leiotriletes maxoides minor)*. Az *Angiospermae*-t a *Tricolporopollenites microhenrici, T. cingulum* ssp. *pusillus, T. pseudocingulum, Zelkovaepollenites potoniéi, Quercopollenites robur* typus, *Tetracentracearumpollenites komlóensis, Heliotropioidearumpollenites rotundus, Sapotaceoidaepollenites* sp., *Momipites punctatus, Myricipites bituitus, M. myricoides, Caryapollenites simplex, Engelhardtioidites microcoryphaeus* pollenek képviselik.

A 6. sz. minta a széntelepet fedő agyagból való, anyaga szintén tufitos. A mocsár-, ill. láperdőre a *Taxodiaceae* pollenek, *Myricipites* sp., *Jussiaeapollenites champlainensis, Nymphaeaceae, Cyrillaceaepollenites megaexactus* és *Alnipollenites verus* utal. A part menti erdőben *Tricolporopollenites microhenrici, T. cingulum* ssp. *pusillus, Tricolpopollenites liblarensis* ssp. *fallax, Quercopollenites* sp., *Porocolpopollenites stereoformis, Ulmipollenites miocaenicus, Zelkovaepollenites potoniéi* anyanövényei éltek. Aljnövényként néhány páfrányspóra mutatkozik. Hegyoldali erdőre a *Ginkgoretectina neogenica* és néhány légzacskós *Coniferae* pollentöredék utal. A 7. sz. minta (homokos agyag) csak kevés pollent, néhány *Taxodiaceae, Sapotaceae* és *Nymphaeaceae* pollent tartalmaz. A 8. sz. minta mészmárga, amelynek pollenspektruma szintén a *Taxodiaceae—Myricaceae* láp jelenlétére utal.

Grossz Á. gyűjtéséből származó mintákat is vizsgáltam (59 db). Ezek részint a 4., 5., 6. sz. telepből, részint a *Hidas 105., H. 91., H. 89.* és *H. 88.* sz. fúrások barnakőszenes összletéből valók. A kőszén minták legtöbbje sok növényi szövetmaradványt és szerves törmeléket, a márga minták gazdag — a Hidas 53. sz. fúrásban harántolt barnakőszenes összlettel megegyező — *Taxodiaceae* mocsár- és láperdőre utaló pollenspektrumot szolgáltattak. A gazdag planktonanyag alapján megkülönböztethetők az édesvízi és csökkent sósvízi rétegek.

A *Komló 120. sz. fúrás* a Pécsszabolcs—Mánfa—Komló NY-i kifejlődési terület fontos alapszelvénye. Az 554,6 m mélységű fúrásból 36 minta került vizsgálatra (58—59. ábra).

A 492. m-től kezdődően vizsgáltam mintákat. 400,5—416,1 m közötti mintában csak liász formák voltak a spektrumban. 374,7 m-ig uralkodóan liászanyag található, egy-egy miocén formával.

A 374,7 m-ből vett minta a halpikkelyes összletből származik, pollenspektruma már harmadkori flóraegyüttest tükröz. A paleocönológiai egységek aránya erősen emlékeztet a Hidas 53. sz. fúrás halpikkelyes összletében mutatkozó képre, valamivel több a kevert lomberdőt jelző forma: a szóban forgó mintában 46%. Ez — felfelé haladva — eleinte emelkedik: 374,7—374,4 m-ben 52%, majd csökken: 374,4—372 m-ben 31%. Utóbbi mintában a *Coniferae* ad jelentős értéket (44%).

A 367 m-ből származó mintában a *Taxodiaceae* fajok (8,4%), ez és a kevés *Myricipites* sp. nedvesebb állományra utal. A vízparti erdő formái közt számottevő a *Caryapollenites simplex* (17%); egy kevés *Pterocaryapollenites* sp. is található. A kevert lomberdő fajai maximális mennyiségűek (55%).

A 178,0—178,8 m-ből, a halpikkelyes összlet felső részéből származó minta fajban gazdag pollenspektrumot tárt elénk (58. ábra).

89—95,6 m között a kissé homokos agyagmárga a „slír”-összlethez tartozik. Vegetációképe fajokban gazdag, pollenanyagának 54%-a hegyvidéki *Coniferae*. A láperdőre utalnak a *Taxodiaceae* pollenek, a *Cyrillaceaepollenites megaexactus*, az *Alnipollenites verus*, a *Betulaepollenites betuloides* és a *Carexpollenites* sp. A kevert lomberdő társulása fajokban gazdag, de számaránya kisebb az előzőkénél. Aljnövényeit a *Rhoipites pseudocingulum*, *Ilexpollenites margaritatus*, *Cistacearumpollenites* sp., *Triporopollenites urticoides*, *Plantaginacearumpollenites soói*, *Stereisporites* sp., *Leiotriletes microlepidoidites* anyanövényei alkothatták.

10—89 m-ig a rétegsor felső részéből vett minták pollenmentesek.

A *Zengővárkony 59. sz.* 105 m mélységű *fúrásból* 23 mintát vizsgáltam meg (60. ábra). A fúrás alján levő helvéti congériás összlet homokos mészkő és mészmárga képződményei 94,7—105 m között pollenmentesek.

A halpikkelyes agyagmárga összletben (73—83 m) a minták pollenspektruma gazdag vegetációról tanúskodik (60. ábra). A paleocönológiai együttesek egymás közötti aránya feltűnően hasonló a Hidas 53. sz. fúrás halpikkelyes összletében tapasztalthoz (61. ábra).

A 73—73,5 m-ben levő dácittufa-réteg mintája pollenmentes.

A 71,4—73 m-ből vett mintától kezdődően a halpikkelyes összletben 60,9 m-ig is igen gazdag a vegetáció. Megoszlása az előző, a dácittufa alatti mintákéhoz hasonló, a hegyvidéki fenyőerdő kisebb mérvű előretörésével. Felfelé haladva (56—60,9 m) a páfrányspórák feldúsulásából a parti ligeterdő terjeszkedésére következtethetünk, ez arányos az eddig túlnyomó hegyi *Coniferae* állomány kisebb mértékű visszahúzódásával. Az 56. m-től felfelé 48,5 m-ig ismét a hegyvidéki *Coniferae* állomány mutatkozik erőteljesebben, ami összefügghet a parti állomány víz alá kerülésével (61. ábra), ahol a mocsár- vagy láperdő csak 2%, a ligeterdő 7%, és a kevert lomberdő 13%.

A 46,8—48,5 m-ig terjedő kőzetlisztes agyagmárga-minta nem tartalmaz értékelhető mennyiségű spóra-, ill. pollenanyagot. Érdekessége a *Cycadopites miocaenica* fajra vonatkoztatható szövetmaradvány jelentkezése (l. XXVIII. tábla, 4., és XXIX. tábla 1—2.).

A 44,7—46,8 m-ben levő minta teljesen pollenmentes.

A 44,4—44,7 m „slír"-összletének szegényes pollenspektrumában még mindig kicsi a mocsár- és láperdőt jelző alakok száma (4%), a ligeterdő valamivel kiterjedtebb (17%), a kevert lomberdő állománya a spektrumban 31%-kal jelentkezik.

A 41,8—44,4 m-ben levő minta hasonló az előzőhöz, csak még szegényesebb.

A 39,8—41,8 m-ből származó mintában tengerelöntésről tanúskodik az *Angiospermae* teljes hiánya, néhány spóra és a hegyi területről bekerült *Coniferae* pollen.

A 37,5—39,8 m kevés *Botryococcus* telepen kívül teljesen meddő, a 34—37,5 m gyér spóra- és pollenanyaga mellett a planktonszervezetek a tenger kimélyülésére utalnak, *Crassosphaera concinna*, *Thytthodiscus mecsekensis* és más fajokkal.

A 30,9—34 m-ig terjedő minta gazdag tengeri planktonanyagával (*Crassosphaera*, *Emslandia*, *Cystidiopsis* stb.) a tenger további előretörését, ill. mélyülését jelzi. Erre utal a hegyvidéki fenyők magas százalékaránya (42%), és a parti lomboserdő egyedszám szerinti csökkenése is, valamint a kevés páfrányspóra.

A 28,8—30,9 m-ig terjedő homokkő, homoklisztes agyagmárga minták pollenmentesek.

A 28,6—28,8 m-ből vett minta tengerelöntésről tanúskodik planktonanyagán túlmenően is, mert csaknem kizárólag hegyvidéki fenyőpollenek mutathatók ki a spektrumában.

A 27,4—28,6, valamint a 24,8—27,4 m-ből származó homoklisztes mészmárga minták teljesen pollenmentesek.

A *Pécsvárad XLIV. sz.* 242,6—27,4 m-es *fúrásból* tájékozódó jelleggel 9 db mintát néztem át. A 231—236,1 m-ig terjedő szakasz mikrorétegzett agyagmárga-anyagából a halpikkelyes agyagmárga összletre jellemző flóraképet ismerhetünk meg. A parti nedves vegetáció fáciesre *Taxodiaceae* sp.-ből, *Nymphaeaceae* sp.-ből, *Myriophyllumpollenites* sp.-ből következtethetünk. A part menti ligeterdőre a *Pterocaryapollenites stellatus*, *Caryapollenites simplex* (8%), *Alnipollenites verus* (7%) pollenek utalnak. A kevert erdőre a *Liquidambarpollenites* sp., *Carpinuspollenites carpinoides*, *Tricolporopollenites microhenrici*, *Sapotaceoidaepollenites* sp., *Intratriporopollenites instructus*, *Tricolporopollenites cingulum* ssp. *oviformis*, *Porocolpopollenites rotundiformis*, *Ulmipollenites maculosus*, *Juglandaceae* sp., *Pityosporites* és *Dacrydiumites* fajokból, valamint az aljnövényzetre néhány spórából (*Laevigatosporites haardti*, *Verrucatosporites alienus*, *Neogenisporis* sp., *Gleicheniidites* sp. és *mohaspórák*) következtethetünk. A csökkent sósvizet a *Baltisphaeridium* sp. jelzi, a széndarabkák és egyéb növényi maradványok a vegetáció vízzel való elárasztására mutatnak. Hegyvidékre utaló a *Keteleeriaepollenites*, valamint az *Abietinaepollenites microalatus* magas értéke (34%).

A következő minták, a „slír”-összletbe tartozó homokos fácies miatt, csak kevés pollenanyagot tartalmaznak: a 173,7—175,8 m-ből való minta kevés pollenanyaga nem értékelhető ki, de a megtalált formák megfelelnek az eddigi spektrumnak. Szén és szövetmaradványok is előfordulnak a mintában, mint pl. a 154,5—160,1 m-ben levő mintában is. A 150—152,8 m, a 134,8—135,5 m és a 110—115 m spóra-pollenspektruma is kis egyedszámú és vegetációképe az előzőkhöz hasonló. E két utóbbi minta planktonanyaga tengervízre utal.

A torton barnakőszéntelepes összletben a 49,6—49,9 m homokkőmintája meddő, a 39,7—42,8 m-ig terjedő minta kevés, szenesedett szövetmaradványon kívül majdnem teljesen meddő. A 9,8—11 m közötti heterosteginás homokkő — néhány fenyőpollenen kívül — csak planktonmaradványt tartalmaz.

2. Flóraképek

A megvizsgált rétegsorok mintáit áttekintve, több flóraváltozás figyelhető meg. E változások természetesen nem egyenértékűek a nagyobb geológiai időegységek — korok, korszakok — határán mutatkozó változásokkal. Gyakran a geológiai fácies változásától függetlenek e flóraváltozások; előbbiekre általában csak közvetve utal a spóra-pollenspektrum. Fáciesváltozást többnyire az előforduló planktonszervezetek, valamint az áthalmozódott növényi szervezetek jelenléte jelez. Az üledékföldtani és a mikropaleontológiai adatokat figyelembe véve az eredményeket „flóraképekbe” sűrítettem össze.

A „szászvári kép” néven összefoglalt flóraegyüttest a Szászvár 8. sz. fúrás általam vizsgált alsó, kiértékelhető mintái képviselik. Ezeknek a spóra-pollenspektrumából néhány olyan növényfajra következtethetünk, amelyek az egész Mecsekben másutt elő nem kerültek. A *Pteridophyták* között ilyenek a *Verrucingulatisporites murireticulatus*, *Lycopodium* faj spórája, az *Echinatisporites szászvárensis*, *Selaginella* faj, a *Cicatricosisporites minimus*, *Schizaeaceae* faj, a *Gleicheniidites (T.) umbonatus* f. *minor* spórák a *Gleicheniaceae* család képviselői, valamint a *Polypodiaceoisporites rectolatus* faj, ismeretlen eredettel.

A már ismert spórafajok közül az *Osmundacidites gemmatus* W. Kr., *Monoleiotriletes gracilis* találhatók ez idáig kizárólag a szászvári képet alkotó együttesben. Míg a *Polypodiaceoisporites minutiosus*, *P. szászvárensis* a Kisbattyán 1. sz. fúrás 462. méteréből is előkerült. A *P. miocaenicus* n. sp.-t is itt találtam meg, de a helvét rétegsorban feljebb is előfordul (Kisbattyán 1. sz. f. 462. m-ben, valamint a Pszf. VI. sz. f., a Zengővárkony 45. és 59. sz. fúrásokban). A *Gymnospermae* közül a *Podocarpidites acmopyleformis* n. sp., a *Pityosporites labdacus* „D” typus és az *Ephedripites (E.) hungaricus* n. sp. csak ebben a flóraképben található. A *Cedripites szászvárensis* a szászvári képen kívül a pusztakisfalui képben is előfordult.

Néhány új *Angiospermae* faj pollenje is jellemző a képre: a *Pteracanthuspollenites discordatus*, *Malvacearumpollenites rotundus* kizárólag ebben a képben, a *Zelkovaepollenites thiergarti*, a *Heliotropioidearumpollenites gracilis* a helvét magasabb szintjeiben is mutatkozik. Az *Ulmipollenites stillatus* pedig elszórtan még a tortonai rétegekben is megtalálható.

A már ismert fajok közül az *Intratriporopollenites instructus* ssp. *macroreticulatus*, a *Betulaepollenites prominens*, néhány *Sapotaceoidaepollenites* sp. és kevés *pálmafaj*, valamint Krutzsch által alsómiocén rétegekből leírt *Persicariapollenites lusaticus* szerepel, amelyek még a helvét halpikkelyes rétegösszletben is előfordulnak.

A szászvári képre jellemző egy gazdag szubtrópusi vegetáció, amelyben kevés trópusi elem található. A trópusi elemek egy része aljnövényzetként fogható fel: pl. a *Lycopodium*, *Selaginella* és *Schizaeaceae* fajok. A trópusi hegyvidékre utaló a *Podocarpidites acmopyleformis*. A *Sapotaceoidaepollenites* fajai kevés példányszámmal, de következetesen megtalálhatók ezekben a mintákban. A Szászvár 8. sz. fúrás 26—27 m-éből előkerült sajátos, aprótermetű spórákkal jellemzett együttes jól elkülönül a fent említettektől, s a Kisbattyán 1. sz. fúrással egybevetve, rétegtanilag is felhasználhatónak bizonyult.

A „pusztakisfalui kép" a Pusztakisfalu VI. sz. fúrás mintáinak pollenspektrumaiból adódik, és a helvéti limnikus összletet jellemzi. E fúrás szelvényéből hiányoznak azok a fajok, amelyek megjelenése — mint fentebb említettem — kizárólag a szászvári képre szorítkozik. Néhány megegyező forma is van: *Polypodiaceoisporites miocaenicus*, *Monoleiotriletes gracilis*, *Cedripites szászvárensis*, *Utriculariaepollenites elegans*, *Platycaryapollenites miocaenicus* stb. Itt lép fel először a *Tetracentracearumpollenites minimus*. A *Polygalacearumpollenites miocaenicus* is csak itt és a Zengővárkony 45. sz. fúrás limnikus összletében fordult elő, míg a *Faguspollenites minor*, a *Tubuliloridites grandis* és a *Cistacearumpollenites rotundus* innen en és a halpikkelyes agyagmárga összletből vált ismertté. A pusztakisfalui flórakép jellemzője szubtrópusi kevert lomberdő, elég sok trópusi elemmel (*Sapotaceae*, *Engelhardtioidites* sp. és néhány *pálma*), határozottan édesvíz partjára utaló *Polypodiaceae* páfrányos (ez utóbbiak spórái 16—32%-os értékekkel). A spórák mennyisége néhol a spektrum 77%-át is eléri. Jellemző spórafajok: *Leiotriletes seydewitzensis*, *Neogenisporis* sp., *Verrucatosporites histiopteroides* f. *major*, *Polypodiaceoisporites gracillimus*, *P. mecsekensis*, *Verrucingulatisporites miocaenicus* (50. ábra). Elsősorban a part menti ligeterdőre utaló formák mutatkoznak. Egyes flóraelemek alapján hegylábra húzódó szárazabb kevert erdőt tételezhetünk fel. Itt jelentkezik először a *Carpinuspollenites carpinoides*, az *Intratriporopollenites instructus*, az *I. microreticulatus* és a *Pterocaryapollenites stellatus*, tehát mérsékeltebb övi, ill. szubtrópusi erdő hűvösebb szakaszára utaló fajok pollenjei. Kevés *Coniferae* egészíti ki a képet.

A „magyaregregyi kép" flóratársasága a helvéti halpikkelyes agyagmárga összlet több lelőhelyéről is előkerült. Legjellemzőbb a Kisrétiés a Farkasordítói-árokból származó minták pollenspektruma, de ez a kép jellemzi a Zengővárkony 45. és 59. sz. fúrással, valamint a Hidas 53. sz. fúrással feltárt halpikkelyes agyagmárga összletet is. Kizárólag ebben az együttesben található meg: *Abiespollenites crassus* és *Podocarpidites macrophylliformis* (*Gymnospermae*); *Plantaginacearumpollenites soói*, *Cichoriaearumpollenites gracilis*, *Scabiosaepollenites magnus*, *Triporopollenites urticoides*, *Liliacidites ellipticus* (*Angiospermae*).

Az egyéb flóratársulásokból is ismert fajok közül a *Dacrydiumites guillauminii*, az *Intratriporopollenites instructus macroreticulatus* és a *Heliotropioidea*-

rumpollenites gracilis a szászvári képben is előfordulnak. A *Persicarioipollenites lusaticus* a szászvári képben és halpikkelyes agyagmárgaösszletben, ezenkívül még a szarmata összletben is megtalálható.

A *Tubulifloridites grandis* a Pusztakisfalu VI. sz. fúrásban (limnikus összlet); a Zengővárkony 59. sz. fúrásban (halpikkelyes agyagmárga összlet, 51,3—56,0 m, 81,0—83,0 m); a Hidas 53. sz. fúrásban (alsótorton lajta- és barnakőszenes összlet, 711—713 m, 688—690 m, 630,8—632,0 m) egyaránt előfordult. A *Cistacearumpollenites rotundus* mind a pusztakisfalui képben, mind a magyaregregyi képben (Zgv. 59. sz. fúrás 51,3—60,9 m, Magyaregregy—Almáspatak I. sz. lelőhely, halpikkelyes agyagmárga összlet) megtalálható. A *Cistacearumpollenites macrodurensis* a magyaregregyi és a pusztakisfalui képben (Zgv. 45. sz. fúrás 13,2—13,7 m) egyaránt előfordul. A *Tricolporopollenites cletraceiformis* a limnikus összletben (Pszf. VI. sz. fúrás 12,5—15,0 m), a halpikkelyes agyagmárga összletben (Zgv. 59. sz. fúrás 67,5—70,5 m) és a barnakőszenes összletben (H. 53. sz. fúrás 667,8—669,2 m) is fellép.

A *Lonicerapollenites gallwitzi* (Zgv. 59. sz. fúrás 71,4—73 m) és *Ericipites discretus* (Zgv. 59. sz. fúrás 60,9—63 m) Németországból hasonló korú rétegekből került elő. Az *Ericipites baculatus* a Zgv. 59. sz. fúrás halpikkelyes agyagmárga összletében 56,0—60,9 m és 63—65 m között, illetve a Mecseknádasdnál levő felszíni feltárásban fordult elő. A *Sapotaceoidaepollenites turgidus* a halpikkelyes agyagmárga összletben (Zgv. 59. sz. fúrás 71,4—73,0 m és 67,5—70,5 m), a *S. kirchheimeri* a halpikkelyes összletben (Zgv. 59. sz. fúrás 67,5—70,5 m, 65,0—67,5 m, 56,0—60,9 m) s ezenkívül a „slírösszletben" (30,9—34,0 m) is megtalálható. A *Porocolpopollenites latiporis* a Zgv. 59. sz. fúrás 65,0—67,0 m közötti halpikkelyes agyagmárga rétegéből került ki. Az *Ulmipollenites maculosus* és a *Juglanspollenites verus*, valamint a *Liquidambarpollenites* genusz fajai *(L. formosanaeformis, L. styracifluaeformis, L. orientaliformis)* és a *Fagus* genus is több fajjal szerepel: *Faguspollenites subtilis* (Zgv. 59. sz. fúrás 71,4—73,0 m; 63,0—65,0 m; 65,0—67,5 m; Komló 120. sz. fúrás 178,0—178,8 m; Mecseknádasd felszíni feltárás), *F. minor* (Zgv. 59. sz. fúrás 67,5—70,5 m, 78,0—81,0 m), *F. vivus* (Zgv. 59. sz. fúrás 65,0—67,5 m; 51,3—56,0 m; Komló 120. sz. fúrás 178,0—178,8 m) (utóbbi áthúzódik a lagenidás képződményekbe, sőt feljebb is megtalálható), *F. gemmatus* (K. 120. sz. fúrás 374,4—374,7 m).

Az *Aceripollenites* genusznak szintén több faja található ebben a képben: *A. reticulatus* (Zgv. 59. sz. fúrás 65,0—67,5 m, H. 53. sz. f. 755—757 m), *A. rotundus* (Zgv. 59. sz. f. 51,3—56,0 m, Zgv. 45. sz. fúrásban, Mecseknádasd felszíni feltárás, magyaregregyi Leánykő 27. sz. minta, hidasi barnakőszénbánya 2. telep 1. minta).

Az áttekintésből is látható, hogy a magyaregregyi kép gazdag flóratársaságát jellemzi a lombhullató típusú fák előtérbe kerülése a szubtrópusi elemeken belül.

A következő, „zengővárkonyi kép" flóraegyüttese a globigeriás—lagenidás és az amphisteginás képződményekre jellemző. Legjobb szelvényeit a Zengővárkony 59. sz. fúrás 17,0—44,4 m-ig tartó szakaszából és a Hidas 53. sz. fúrás 672,0—766,8 m közötti rétegsorából ismertük meg. A zengővárkonyi flórakép szegényességének fő oka az, hogy az amphisteginás mészkőkifejlődés a pollenanyag megmaradására nem alkalmas, tehát a fajok számához viszonyítva aránylag kevés a pollen-spóraanyag mennyisége.

A trópusi flóraelemek (*Sapotaceae, Palmae*) mellett a fenyők és a lombosfák pollenanyaga található.

A Hidas 53. sz. fúrás amphisteginás—heterosteginás rétegsorára a *Faguspollenites crassus, F. tenuis, F. gemmatus, Ulmipollenites miocaenicus, U. maculosus, Zelkovaepollenites thiergarti, Z. potoniéi, Tricolporopollenites microreticulatus, Flacourtiaceae* sp., *Pterocaryapollenites mecsekensis* és *Caprifoliipites* fajok (*C. sambucoides, C. andreánszkyi*) jellemzők.

A Komló 120. sz. fúrás 367 m-étől fellép a *Tetracentracearumpollenites komlóensis* és a *Dipterocarpacearumpollenites hidasensis*, melyek a *Porocolpopollenites triangulus*-szal és a *Caryophyllidites hidasensis*-szel társulnak.

A Zengővárkony 59. sz. fúrás mintáiban tenger menti, melegebb éghajlatra utaló flóraelemek mutatkoznak. A páfrányok közül az *Ophioglossisporites* jelentkezik. A fenyők közül a *Pityosporites thunbergiiformis* és a *P. zaklinskaiana*, az *Angiospermae* közül a *Sapotaceoidaepollenites rotundus, Porocolpopollenites vestibulum* és a *Caryophyllidites microreticulatus* az említésre méltó.

A „h i d a s i k é p" a torton barnakőszéntelepes összletet képviseli, amely részint a Hidas 53. sz. fúrás 575—665 m-éből, továbbá a Hidas 88., 89., 91., 105. sz. fúrások barnakőszéntelepes mintáiból, részint a hidasi bányából gyűjtött mintákból vált ismertté. Jellegzetes láp-, illetve mocsárerdőre utaló növénytársulása van, édesvízi növényekkel és a parti ligeterdő — előző képből ismert — fajaival. A halpikkelyes összletben induló fajok közül a *Caprifoliipites andreánszkyi*, és az *Ulmipollenites miocaenicus* még itt is megtalálható.

A lágyszárú növények közül a *Heliotropioidearumpollenites rotundus, Lobeliaepollenites erdtmani, Ericipites hidasensis*, a *Chenopodipollenites* és az *Artemisiaepollenites* sp. jellemző.

A kőszénfedőben már jelentkezik a *Tsugaepollenites igniculus* is, bár egyébként a fedőrétegek pollenspektruma nagyon hasonló a hidasi kép flóraegyütteséhez.

A „s z a r m a t a k é p e t" csak a H. 53. sz. fúrás 389,0—557,0 m-ig terjedő szakasza képviseli a vizsgálati anyagban. A lombosfák közül az *Ulmipollenites miocaenicus* és a *Celtipollenites hidasensis* mellett a *Zelkovaepollenites thiergarti* és az *Ulmipollenites stillatus* néhány példánya mutatkozik. A partmenti mocsarakat jelző formákon kívül előtérbe kerülnek a *Fagaceae* család eddigi képekben is jelenlevő elemei. Eltűnnek a *Sapotaceae, Symplocaceae* családokra utaló formák. Néhány szárazabb termőhelyre utaló faj is kimutatható: *Ephedripites mecsekensis, Artemisiaepollenites sellularis.*

Ez a flórakép már nehezen különíthető el a „p a n n o n k é p"-től, ahol a *Coniferae* a pannonra másutt is igen jellemző mennyiségben és azonos morfológiai típusokkal jelentkezik. Molluscum-vizsgálatok alapján a H. 53. sz. fúrás 389 m feletti szakasza részben még a szarmatához sorolható, flóraösszetétel szerint azonban e rétegek már a pannonhoz kapcsolódnak. Elég nagy számmal jelentkeznek recens fajokkal közvetlenül összevethető formák (pl. 444 m-ben *Quercopollenites*, 9%). Emellett uralkodóan a mai szubtrópus északi övezetére, illetve a mediterránra jellemző lombhullató fafajokra lehet következtetni. MAI, D. szerint (1961. p. 66) — az anyagunkban is előforduló —

Intratriporopollenites polonicus a fiatalabb pliocénre jellemző. A mecseki pannonban jelentős mennyiségben található *Ulmipollenites undulosus* WOLFF fajt a németországi pliocénre tartják jellemzőnek. Ebben az összletben néhány forma a *Larix* genus jelenlétére utal (*Inaperturopollenites* cf. *magnus*). A lágyszárú növények közül a *Scabiosaepollenites minimospinuosus*, *Chenopodipollenites multiplex*, *Artemisiaepollenites sellularis*, *Graminipites media*, valamint — az itt *Litorella* sp.-hez tartozónak feltételezhető — *Plantaginacearumpollenites* sp. tengerparti területre mutat. A láp- és mocsárerdőt jelző fajok a Petőfibánya-i pannon barnakőszenes összlet vegetációjával hozhatók kapcsolatba, bár %-os mennyiségük jóval kisebb, és barnakőszénképződés a rétegsorban nem mutatkozik (NAGY 1958).

Az ismertetett flóraképek között lassú flóraváltozás észlelhető, amely legfeltűnőbben a trópusi fajok meglétében, majd eltűnésében mutatkozik meg. A változás másrészt abban nyilvánul meg, hogy a melegebb szubtrópusi, örökzöld jellegű flórát a szubtrópusi, lombhullató kevert erdő elemei váltják fel. Az ősföldrajzi helyzet változásai leginkább a fáciesváltozásokban tükröződnek, illetve a szárazföldi jelleg uralkodóvá válásában, majd a tengerelöntés fokozatos kiterjedésében, mely természetesen maga után vonja a vegetáció változását is.

A flóraképekben végbemenő változás a lassú filogenetikai fejlődésen kívül — amely egyes fajok eltűnésében és újak fellépésében mutatkozik — elsősorban a klímaváltozás függvénye. Ez, mai szemléletünk szerint — a konzervatív pollenek és spórák alapján — főleg a nagyobb melegigényű trópusi, szubtrópusi fajok fokozatos eltűnésében, elvándorlásában és a mérsékeltövi, ma is helyben élő fajok fellépésében, majd urakodóvá válásában nyilvánult meg.

A szárazföldi flóra- és vegetációkép-változásokat, amelyek a földfelszín kialakulásának, változásának is függvényei, nem minden esetben lehet a klasszikus rétegtan kategóriáival egybevetni, a faunazónák kereteibe szorítani.

3. A maradványegyüttes flórarokonsági kapcsolatai

A mecseki neogénből ismertté vált spóra-pollenfajok rokonsági körének megállapítására minden esetben kísérletet tettünk. Ez azonban nem mindenkor járt eredménnyel, elsősorban azért nem, mert a recens spóra- és pollenfajok még nincsenek kellőképpen feldolgozva, továbbá, mert maguk a szubtrópusi, trópusi flóraelemek sem eléggé ismertek. Ha a maradványegyüttesekben levő fosszilis spórákat, polleneket — legalább nemzetségig — azonosítani tudtuk a ma élő növényi taxonokkal, máris körvonalazhattunk bizonyos flórarokonsági kapcsolatokat. Tekintsük át az e téren elért eredményeket.

A „szászvári flóraképben" több a Dél-Kínára, Himalájára, tehát paleotrópusra utaló elem, mint az ennél fiatalabb összletekben. Kelet-ázsiai kapcsolatúak a *Gymnospermae* közül a *Ginkgo*, a *Keteleeria*, a *Sciadopitys* genus képviselői; paleotrópusi az *Acmopyle*, *Podocarpus*, *Dacrydium*. A zárvatermő arktotercier elemek közül Kelet-Ázsiában, különösképpen Kínában élő a *Pteracanthus*, a *Platycarya*, részben a *Carya*, az *Engelhardtia* és *Zelkova* genus. A többi genus képviselői vagy ma is helyben élők, vagy olyan széles az aerájuk (*Picea, Pinus*, a *Fagaceae* különféle fajai, *Betulaceae, Alnus* stb.), hogy csak nagy általánosságban használhatók fel flórarokonsági kapcsolatok megállapítására. A szászvári kép esetében a *Taxodiaceae* láp- és mocsárerdő társulás a *Jussiaeapollenites*-szel észak-atlanti rokonságra enged következtetni. A fajok többsége északi félgömbi flórarokonságú.

A „pusztakisfalui kép" világosan mutatja, hogy amikor uralkodó módon jelentkezik egy bizonyos fáciesjelleg, a vegetációképet kozmopolita növények uralják. E flóraképben túlnyomóan a *Polypodiaceae* család fajai az uralkodók, emellett az *Ophioglossum, Polygala, Ilex, Salix* és *Myrica* genuszok mutatkoznak nagyobb mennyiségben. Ebben a képben jelentkezik először a *Carpinus* és a *Pterocarya* genus is. Előbbi szélesebb areájú, mint az utóbbi, de mindkettő arktotercier elem. Az egyéb flóraelemek mennyisége elenyésző. A pollenspektrum tehát kelet-ázsiai (*Ginkgo, Tetracentrum, Engelhardtia*), mediterrán (*Cistus*) és észak-atlanti elemeket (*Taxodium, Cyrilla*) egyaránt tartalmaz.

A „magyaregregyi kép" pollenspektruma rendkívül gazdag. A flórarokonság jórésze arktotercier elemekből vezethető le, ekkor tehát a mai holarktikus flórabirodalom képviselői uralkodtak (pl. a jelentős %-os értékkel képviselt *Carya*, valamint a *Celtis, Castanopsis* genus). A *Keteleeria, Sciadopitys* már ma a dél-kínai flóraterületre korlátozódik. A mocsárerdei *Taxodium* és *Nyssa* esetében észak-atlanti kapcsolatra gondolhatunk. A *Zelkova*, valamint az *Engelhardtia* a mediterrántól a dél-kínai flóraterületig egyaránt megtalálható. ANDREÁNSZKY G. (in ANDREÁNSZKY et KOVÁCS 1955. p. 112), HARASZTY Á. (1957) és PÁLFALVY I. (1964. p. 186, 189—190) ezzel a társulással kapcsolatosan a *makroflórában* kelet-ázsiai elemek fellépését is említik [*Glyptostrobus europaeus* (BRONGT.) HEER, *Glyptostroboxylon tenerum* CONVENTZ].

A lombhullató fafajokra utaló pollenek legtöbbje (*Fagaceae, Ulmaceae, Betulaceae*) — az eddigi kutatások alapján — nem alkalmas a pontosabb flórarokonság elhatárolására. Ezek a családok ma a holarktikus flórabirodalomban élnek. A recensekhez közel álló *Liquidambar* fajok között is kimutathatók kelet-ázsiai, észak-amerikai és kisázsiai flórarokonságú fajok.

A flóratársulás lágyszárú növényekre, illetve egyéb aljnövényre utaló pollent gazdagon tartalmaz. Ezek egy része kozmopolita (*Polygonaceae, Plantaginaceae, Compositae, Liliaceae*). Mediterrán flóraelem a *Scabiosa* és a részben vagy egészen fás szárú *Cistaceae, Heliotropioidae*. A *Cletra* fajok ma a holarktikus flórabirodalom atlanti, észak-amerikai és a dél-kínai, valamint a neotrópus közép-amerikai, orinocói, dél-braziliái, illetőleg a paleotrópus hátsó-indiai, indomaláji flóraterületén is élnek. Jelentkeznek itt a trópuson, szubtrópuson élő, széles areájú *Symplocos* genus képviselői is, míg a *Lonicera* fajok ma az északi félgömbre jellemzők (KRÜSSMAN, 1962, II. p. 66.).

A „zengővárkonyi képben" a széles areájú mérsékeltövi lombhullató elemek (*Fagaceae, Fagus, Ulmus, Zelkova* és sok *Caprifoliaceae*) előretörése mellett — tengeri hatásként — melegebb éghajlati igényű (szubtrópusi, trópusi) taxonokat találunk. Így pl. dél-kínai flóraterületre a *Tetracentron*, indomaláji flóraterületre a *Dipterocarpus* utal, sőt még *Cycadaceae* is mutatkozik. A *Gleicheniaceae, Lygodium* és *Ophioglossum* fajok részben a holarktikus flórabirodalomhoz, részben a neo- és paleotrópusi flórabirodalomhoz tartoznak. Vannak a spektrumban a mérsékelt és a szubtrópusi flóraterületen egyaránt élő, kozmopolita páfrányok is, ezek azonban — a flóra összetétele miatt — inkább a melegebb klímaigényű páfrányfajokkal hozhatók vonatkozásba. Erre utal a *Sapotaceae* és *Symplocaceae* családba tartozó fajok jelenléte is.

A „hidasi képet" — a fáciesjelző elemeken kívül (*Taxodiaceae, Nyssa, Cyrilla* és egyéb vízinövények) — főleg a holarktikus flórabirodalomhoz tartozó, lombhullató elemek alkotják, melyek közül néhány a dél-kínai flóraterületen honos *(Tetracentron, Platycarya, Engelhardtia, Carya)*. Erre utal a fenyőfélék között a *Keteleeria, Sciadopytis* is. Ennek ellenére a barnakőszénminták pollenspektrumaiban olyan trópusi elemek is találhatók, amelyeknek megfelelői ma az indomaláji területen élnek (pl. *Dipterocarpus*).

A „szarmata képben" a ma élő lombosfák közül a holarktikus flórabirodalomra utaló elemek lépnek előtérbe, s mint már említettem, ezeket ritkán hozhatjuk kapcsolatba a ma élő fajokkal.

A „pannon képben" a mai holarktikus elemek szubtrópusi, mediterrán fajokkal, dél-kínai és észak-atlanti rokonsági körű alakokkal egyaránt jelentkeznek. A pannon flórakép e kapcsolatai jól összevethetők a mátraaljai (Petőfibányai) vizsgálatok során levezetett flórarokonsággal (Nagy, 1958. pp. 124—125).

Mecseki maradvány-flóráinkat összehasonlítva más, hazai neogén rétegekből származó pollenflórákkal, arra a következtetésre jutunk (Simoncsics 1959a, b, 1960; Kedves 1959; Nagy 1962a), hogy összetételük hasonló. Simoncsics (1959a, p. 81) a nógrádi Katalinbánya flóraegyüttesének jelentős részét atlanti észak-amerikai rokonságúnak tartja. A klíma értékelésénél nedves szubtrópusi klímát tételez fel, ehhez azonban hozzáfűzi: „Figyelemreméltó, hogy hasonló klímaviszonyok uralkodnak a *Glyptostrobus* hazájában, Kelet-Ázsiában is".

Pálfalvy I. (1964) a Keleti-Mecsek középsőmiocén makroflórájának vizsgálata során 24 olyan családot határozott meg, amelynek megfelelő pollenleletek ez ideig nem kerültek elő. E családok egy részének nem tartósak a pollenjei (pl. *Lauraceae*); illetve zárt virágzatuk nem alkalmas a pollenek szétszóródására *(Papilionaceae, Ficus)*, így pollenjeik hiánya indokolt.

A makroflórában szereplő családok között elég sok utal a trópusra és déli félgömbi elterjedésre. A csak spórákkal, ill. pollenekkel képviselt családok között (összesen 35 család), több a kevésbé exotikus család, amelyeknek egyes képviselői azonban szintén paleotrópusiak (*Acmopyle, Podocarpus, Araliaceae, Dipterocarpaceae* stb.).

A mecseki neogén flórát — a geológiai kifejlődés hasonlósága miatt — elsősorban a Kárpát-medence és a közvetlenül ehhez kapcsolódó medencerendszerek neogén flóráival kell összehasonlítani. A Mecsekhez földrajzilag leginkább közelesők *Jugoszlávia* miocén kifejlődési területei, ott azonban a palynológiai kutatás csak most indul. A makroflóra leletek alapján Pantič, N. 8 flóratípust különböztet meg, amelyek jellege a Mecsekéhez hasonló, de — földrajzi szélességük különbözőségének megfelelően — valamivel melegebb jellegű (Pantič 1956).

Jugoszláviából és *Görögországból* származó neogén pollen flórát vizsgált Pflug, Weyland és Pantič (1958). A flóralista (l. c., pp. 92—94) igen nagy egyezést mutat a mecsekivel. E munkájukban ezt írják: ... „die von uns auch vorausgesehene Tatsache, dass die sporenstratigraphische Gliederung Mitteleuropas offensichtlich nicht auf das untersuchte Gebiet passt. Wie es dem hier wärmeren Klima entspricht, verschwingen viele tertiäre Formen wesentlich später. En seien nur genannt: *Lygodium*, *Palmae*, *Engelhardtia*, *Symplocaceae*, *Sapotaceae*, *Rhus* und andere ..." (l. c., p. 94).

WEYLAND és PFLUG (1957. p. 107) a Ptolemais melletti pliocén flóra feldolgozásakor is utaltak arra, hogy melegebb volt a klíma, mint Közép-Európában, annak ellenére, hogy sok hasonló faj található itt. Feltételezik, hogy: „... der Klimaabfall von Süden nach Norden war weniger steil". WEYLAND és PFLUG (1961. p. 107.) a peloponnészoszi Megalopollis pliocén barnakőszénrétegeinek flóráját is az előzőkben említett jugoszláviai és görögországi flóraanyagon keresztül (WEYLAND et PFLUG 1957 és WEYLAND, PFLUG et PANTIČ 1958) kapcsolják össze a mátraalji flórával (NAGY 1958) és elkülönítik az egyéb közép-európai flóráktól.

Ausztriában, KLAUS, W. kéziratos disszertációjában ismertetett neufeldi flóra áll legközelebb a magyar felsőpannon flórához. A szintén általa feldolgozott Wolkersdorf-i alsószarmata pollenflóra is megegyező a mecseki szarmatáéval (1955). Az a megállapítása, hogy a szarmata lelőhelyen *Lygodium* és *Sapotaceae* előfordul, megegyezik a magyarországi adatokkal. KLAUS szerint ezek az adatok cáfolják POTONIÉ, THOMSON és THIERGART (1950, p. 44) arra vonatkozó megállapítását, hogy a szóban forgó spórák, ill. pollenek az alsómiocénre jellemzőek. Véleményem szerint a két megállapítás közti ellentmondás feloldható, ha számba vesszük azt, hogy míg a 2—3 szélességi fokkal északabbra fekvő rajnai barnakőszénterület a középsőmiocénben az Északi-tenger öble volt, addig a pannonban a magyar és osztrák területek a Paratethys részmedencéi voltak, s így valószínű, hogy ez utóbbi tengerrész környékén a melegkedvelő fajok tovább éltek.

BERGER, W. osztrák paleobotanikus a Brunn-Vösendorf-i lelőhely makroflóráját vizsgálta (1952). E flórát összehasonlítási alapul használtuk vizsgálataink során, mert jó egyezést mutatott a magyarországi fiatal tercier flórákkal.

A *szlovákiai medencék* miocén—pliocén rétegösszletének palynológiai spektrumai — fáciesbeli eltéréseken kívül — nem különböznek lényegesen a hazai, különösen az észak-magyarországi flóráétól (PALCTOVÁ, B. 1958; PLANDEROVÁ, É. és SNOPKOVÁ, P. 1960; PLANDEROVÁ, É. 1961, 1962, 1963). A Kisalföld és a Vágvölgye neogén rétegeinek vizsgálatánál SNOPKOVÁ, P. (1961, p. 230) ugyanazon szubtrópusi, trópusi elemek jelenlétét igazolta, amelyek nálunk is kimutathatók. A tortonban Szlovákia területén lehűlés mutatható ki (PLANDEROVÁ, É., SNOPKOVÁ, P. 1960), ami a Mecsekben is jelentkezik, ha a torton pollenspektrumokból a kőszénképző mocsárerdő elemeit elhagyjuk. PALCTOVÁ, B. (1960) a *dél-csehországi* felsőoligocén—középsőmiocén rétegekből származó flórát vizsgált. Noha lelőhelyei már a Kárpátokon kívüli területen vannak, a flóraváltozások hasonlók: jellemző a trópusi, szubtrópusi elemek visszavonulása, majd teljes eltűnése a tercier középső részének végén.

4. Paleoklimatológiai következtetések

Az egykori éghajlatra ugyan elsősorban a növényi maradványok alapján következtethetünk (ANDREÁNSZKY in ANDREÁNSZKY et KOVÁCS 1955, p. 88.), de a fosszilis elemeknek csak meglehetős bizonytalansággal megítélhető klímaigénye e téren nehézségeket okoz. A miocénben már sokkal távolabb állunk az *aktualizmus elvének* közvetlen alkalmazásától, mint a pliocénben, ahol a recens fajok klímaigénye alapján módunk volt merészebb következtetésekre is (NAGY 1958. pp. 126—130). Az értékelés alapját adó spóra-pollen együttes tagjai a legritkább esetben hozhatók kapcsolatba vagy azonosíthatók pontosan a ma élő fajok valamelyikével. Sikeres határozásnak könyvelhetjük el, ha legalább a recens genuszig eljutunk, mert ebben az esetben már bizonyos határok közé szoríthatjuk az értékeléshez szükséges adatokat. Kivételesen előadódhat az is, hogy a család megállapítása már lehetővé tesz éghajlati következtetéseket.

A ma élő növények esetében az elterjedési területükön levő meteorológiai állomások adatai támpontot adnak az éghajlatigény megítélésére, bár még ezek is sok hibalehetőséget rejthetnek magukban. A klíma értékelésénél ugyanis feltétlenül figyelembe kell vennünk a különböző expozíciójú hegyoldalakon, vízpartokon és egyéb területen élő növényegyüttesekre ható tényezőket, tehát a helyi- és a mikroklímát is.

A mecseki fosszilis fajok feltételezett flórarokonsági kapcsolatai sokszor Kelet-Ázsiába, különösen Délkelet-Kínába vezetnek, ahol azonban a mai növényzet pontos, részletező felmérése még nem történt meg, a flóra csak nagy vonásokban ismert.

Óvatosan kell eljárnunk a fosszilis flóraértékelésénél azért is, mert maradványegyütteseink csak töredékflórák, amelyekből hiányozhatnak az együttes jellegét megszabó rendszertani egységek (esetünkben pl. a makrofossziliák között gyakori *Lauraceae*), illetőleg a vegetációképre jellemző mennyiségi megoszlás igen nagy mértékben eltérhet az eredetitől (NAGY, 1958. pp. 13—14).

A Mecsek miocénjének flóraösszetétele kifejezett trópusi klímára nem utal, a trópusi fajok száma kicsiny, tehát palynológiai eredményeink megegyeznek a Mecsek hegység miocén klímájával foglalkozó kutatók korábbi adataival (STAUB 1878. p. 138; ANDREÁNSZKY 1955. I. táblázat; PÁLFALVY 1964).

Az éghajlati értékelésnél trópusi elemnek tekintettük a *Sapotaceae* család pollenjeit, az *Acmopyle* rokonsági körére utaló pollent, az *Arecipites*, *Jussiaeapollenites*, *Dipterocarpacearumpollenites*, az *Araliaceae* családhoz sorolt néhány fajt (az *A. edmundi* és *euphorii typust*), valamint az *Echinatisporites*, *Polypodiaceoisporites* néhány képviselőjét, *Cicatricosisporites*-t, *Gleicheniidites* sp.-t.

A Szászvár 8. sz. fúrás alsó mintái 432,5—434,5 méterek között *szubtrópusi* jellegű flórát magukba foglaló vegetációra utalnak, ahol mintánként csak alacsony %-ban (0,6—5,4%-ig) találunk trópusi fajokat (l. 49. ábra, alsó szakasz). Uralkodóak a szubtrópusi erdő elemei (a 45,1—42,5%-t kitevő, *Zelkova* speciesekkel összevethető polleneket szubtrópusi elemeknek tartom, mert a mecseki neogén szelvény felső részében már nem fordulnak elő). Ugyancsak szubtrópusi elemek a *Fagaceae* családba tartozó *Tricolporopollenites microhenrici* alakkörbe sorolt, és a palynológiai irodalomban idősebb harmadkori rétegekből említett, e családra utaló fajok is. A *Castanea* fajokkal összevethető *T. cingulum* ssp. *oviformis*-t viszont meleg—mérsékeltövi elemnek tartom, míg a ssp. *fusus*-t és ssp. *pusillus*-t már inkább a *Castanopsis* genusszal vetem egybe, s a szárazabb térszínű erdő alkotójának gondolom (v. ö. KRÜSSMANN, I. 1930. p. 254). S valóban, ahol a rétegsorban a legtöbb a *cingulum* typusú pollen, ott fordul elő *Ephedripites* pollen is.

A Szászvár 8. sz. fúrás anyagában talált, még mérsékelt égövinek feltételezett fajok pollenjei lényegében a területhez kapcsolódó hegyvidék jellemzői: *Keteleeriaepollenites*, *Abiespollenites*, *Piceapollenites* és néhány *Polypodiaceae* családba tartozó spóra.

Az éghajlat kiegyenlítetlenebb voltára utal a spórák alacsony aránya (2,5—4,2%).

A 26—27 m mélységből származó, terresztrikus összletre utaló mintában a trópusi jellegű páfrányok uralkodnak.

A pusztakisfalui flóraképben — egyes mintákban — uralkodnak a páfrányok (11,8—74,4% közötti értékben). Ha ezekhez kapcsoljuk a *Salixipollenites* néhol jelentős mennyiségét, akkor még erőteljesebben mutatkozik a vízpartra utaló, kiegyenlített helyi klíma. Uralkodóak a szubtrópusi elemek (48,5—97,9% között), a rétegsorban felfelé növekvő tendenciát mutatva.

A Pusztakisfalu VI. sz. fúrás 25,0—27,1 m-ből vett minta tartalmazta a legkevesebb szubtrópusi fajt. Ugyanitt aránylag sok trópusi elem volt található (8,6%). A trópusi flóramaradványok mennyisége a rétegsorban felfelé csökken (bár maximuma a barnakőszén feletti, 7. sz. mintában volt 13,7%-kal, minimuma az 5. sz. mintában 1,4%-kal).

A pusztakisfalui képben a mérsékelt égövre, ill. hegyi klímára utaló fajok arányszáma általában kicsiny, kivéve a fentemlített mintát, ahol maximumot mutatott (42%).

A magyaregregyi kép gazdag szubtrópusi erdővegetációra, meleg szubtrópusi éghajlatra utal (80% körüli átlag). A trópusi elemek aránya a Komló 120. sz. fúrásban 2,7%, a Hidas 53. sz. fúrásban 3%, a Zengővárkony 59. sz. fúrás ugyanezen szakaszában 2,6%, tehát közel azonos értékű. Ez az éghajlat talán legjobban a Jangce folyamtól délre levő lombhullató és örökzöld, széleslevelű erdőtípus éghajlatigényével (HOU, CHEN, WANG 1959, p. 6—8) vethető össze. A mérsékelt övi flóraelemek aránya — az előző képhez viszonyítva — valamivel kisebb. Ez utóbbi jelenség a transzgredáló tenger kiegyensúlyozó hatásának tulajdonítható (62. ábra).

A zengővárkonyi kép jellemző vonása mindenütt a transzgresszió, amit a mintákban található tengeri planktonszervezetek jeleznek. Közös vonás az is, hogy valamennyi, ide tartozó mintában kimutatható a hegyoldalra felhúzódó elegyes erdő, hűvösebb helyi flóraelemeivel (a lombosfák közül pl. a *Fagus*, a tűlevelűek: *Abies*, *Picea*). A Hidas 53. sz. fúrás mintáiban a kőzetkifejlődés miatt szegényesebb a flóra, de mind itt, mind a Zengővárkony 59. sz. és a Komló 120. sz. fúrásban egyes trópusi elemek jelzik a klíma melegebb voltát (*Dipterocarpaceae*, *Sapotaceae*, *Cycadopites*).

A hidasi képből levezethető páradús, helyi klímát a trópusi flóraelemek nagy száma bizonyítja (átlag 7%). Viszonylag jelentős a mérsékelt övi lombhullató elemek mennyisége is, a szubtrópusi elemek háttérbe szorulása mellett (ANDREÁNSZKY 1959, p. 285). E jelleg a láp- és mocsárerdőn kívüli területek és a hegyvidékek flóraelemeiből adódik (62. ábra).

A hidasi barnakőszén-telepes összletet fedő képződmények pollenspektrumában a tengerelöntést — néhány planktonszervezeten kívül — a láp-, ill. mocsárerdei elemek visszahúzódása jelzi. Az éghajlat lehűlését a távolabbi területeknél a lápba hullott allochton pollenek, a hegylábi lombos- és a hegyvidéki fenyveserdő fajai mutatják. A kőszéntelep fedő (rotaliás szint), pollenspektruma alapján, nem különíthető el a szarmata összlet alsó részének mintáitól.

A szarmata képben az összlet közepetájáról vett mintákban jelentkeznek utoljára jelentősebb százalékarányban a trópusi elemek (pl. H. 53. sz. fúrás 554—554,3 m: 7%); (57. és 62. ábra). A szarmata középső és felső szakasza között éghajlatváltozás állapítható meg. A H. 53. sz. fúrásban, 496 m-től felfelé — annak ellenére, hogy egy-két trópusi elem még megtalálható — a vegetációkép már teljesen a pannonhoz csatlakozik. Az itt levő mérsékelt övi és szubtrópusi elemek mai megfelelői a mediterrán, ill. a dél-kínai flóraterületen találhatók (SOÓ 1962. p. 92. flóratérkép I. 10. jelzésű dél-kínai flóraterület).

A Hidas 53. sz. fúrás 432,6 m-étől felfelé már csak elvétve kerül elő trópusi faj. A pollenspektrum szubtrópusi és mérsékelt égövre jellemző fajokból, uralkodóan fenyőkből áll. Ebből következően a rétegek lerakódásakor uralkodó éghajlat a mai mediterrán területek éghajlatához lehetett hasonló. Az említett nagy mennyiségű fenyőpollen a mainál magasabb hegység jelenlétére enged következtetni (62. ábra).

A mecseki neogén fejlődéstörténete folyamán állandóan ható tényezőként kell számításba vennünk a mezozóos-paleozóos hegységtömeget, és a túlnyomórészt tengeri környezetet, ill. a pannonban a csökkentsósvízű tavat. Mindkettő éghajlati tényezőként is jelentkezik. A hegyekhez kapcsolódó szárazföldi területek — a földtani irodalom alapján is — szigetekként helyezkedtek el a neogén tengerben (SZENTES in: VADÁSZ, p. 516). A tenger és a szigetek között kialakult napi széljárás az uralkodó széliránytól függetlenül is az ülepítő medencébe vitte a pollenanyagot. Ezzel magyarázható a hegyvidékre jellemző fenyőfélék csaknem állandó jelenléte a spektrumokban. Ez a levegőmozgás — hegyi-völgyi szél formájában — még az édesvízi szakaszokban is betölthette ugyanezt a szerepet.

A neogénben a tenger közelsége *kiegyenlített klímát* biztosított a vegetáció számára. Száraz klímára jellemző növényfaj pollenje (pl. *Ephedra*) aránylag kevés fordul elő anyagunkban.

A neogén folyamán a Mecsek szubtrópusi övbe eső szigetvilágának növénytakarójában végbemenő változás részint a lassú filogenetikai változásból, részint a fokozatos lehűlésből adódott, mely azonban nem volt egyenletes (WOLDSTEDT 1955, SCHWARZBACH 1961. p. 189). Mind ez, mind az egyes lelőhelyek egykori helyzetéből fakadó mikroklíma és helyi klímaváltozások bélyegei kifejeződtek az egykori vegetáció összetételében.

5. A spektrumok szerepe a faciológiai értékelésben

A vizsgálati anyagban előforduló planktonszervezetek elsősorban az üledék faciológiai értékelésére, másodsorban az üledék eredetére vonatkozóan szolgáltatnak adatokat. A fáciesjelleg megítélésénél az ismert ökológiai igényű planktonszervezetekből indultam ki. A planktonszervezetek egy része édesvízi (*Ovoidites ligneolus* R. POT., *Tetraporina quadrata* BOLCH., *Pediastrum* sp.), más részük félsósvízi (*Actynocyclus octonarius* EHRENBERG, *Thalassiphora pelagica* EIS. et GOCHT); végül tengervízre jellemző alakok is vannak (*Emslandia australiense*, *Crassosphaera concinna*, *Cystidiopsis certus*, *Tytthodiscus* genus, valamint a *Foraminiferák*). Támpontul felhasználtam az ökológiailag értékelhető vízinövények pollenjeit is (*Nymphaeaceae*, *Sparganiaceae*). Az új fajok közül néhánynál az ökológiai adatok megállapíthatók voltak. Édesvízi üledékben fordult elő a *Savitrinia miocaenica*, a *S. magna* és a *Geiseloidinium miocaenicum*. Csökkentsósvízi képződményből vált ismertté a *Peridinium lambdoideum*, *Cymatiosphaera hungarica*, *Cooksonella circularis*. Normál sótartalmú tengervízben élőnek bizonyult a *Tytthodiscus mecsekensis*, *Margosphaera velata* és a *Hidasia* genus fajai.

Vannak pontosan még meg nem állapítható ökológiájú és sótűrésű fajok a már ismert és az új formák között is. A *Botryococcus braunii* KÜTZING pl. az irodalom szerint (TRAVERSE, 1955. p. 344) sósvíztől az édesvízig mindenütt megtalálható. Vizsgálati anyagunkban is elég széles skálájú sótűrésűnek mutatkozott, valódi édesvízi üledékben azonban nálunk eddig nem fordult elő. Normál és csökkent sótartalmú vízben keletkezett üledékekben azonban egyaránt megtaláltuk, különösen a Hidas 53. sz. és a Zengővárkony 59. sz. fúrás csökkentsósvízi szakaszaiban ért el néhol jelentős mennyiséget.

A *Foraminifera* vizsgálatok eredményei is felhasználhatók voltak adataim alátámasztására, pl. a Zengővárkony 59. sz. fúrás 13. sz. (30,9—34 m) mintájában, ahol a *Foraminifera* maradványok és *Crassosphaera concinna* tengeri planktonforma együtt volt az *Emslandia australiense*, a *Cystidiopsis certus* és a *Margosphaera velata* fajjal, így az új fajok ökológiai igényét az ismert maradványokéval egyezőnek vehettük. Fenti minta a lagenidás „slír"-összletből való, a 14. sz. (34—37,5 m), azonos anyagú mintához hasonlóan, amelyben szintén szerepelt a *Crassosphaera concinna*, s ez a vele együtt található *Tytthodiscus mecsekensis* faj tengeri voltára utalt. A *Thalassiphora pelagica* faj jelenlétéből viszont a *Cymatiosphaera microreticulata*, *Hidasia velata* és a *flexibile* fajok ökológiai igényére (tengeri környezet) következtethettünk.

Az *Actynocyclus octonarius* EHRENBERG diatomafaj csökkentsósvízi, part menti fáciest jelez, s így a vele együtt található *Cooksonella circularis*-t is csökkentsósvízinek tételeztem fel, s az utóbbi jelenléte alapján minősítettem csökkentsósvízinek a Magyaregregy—Kisréti-árokból vizsgált, a halpikkelyes agyagmárga összletbe tartozó mintát.

A barnakőszén-telepes összlet 2. telepének 1. sz. mintájában levő *Savitrinia miocaenica*, a *Tetraporina quadrata* és *Ovoidites ligneolus* társaságában került elő, s így édesvizet jelez.

Kevés számú adat esetében természetesen nagyobb a bizonytalanság, de ez csökkenthető, ha figyelembe vesszük a geológiai üledékképződésre vonatkozó adatokat, a paleozóológiai eredményeket és együttesen értékeljük valamennyit.

A mecseki ideális rétegsor szerinti szelvény sorrendjében a flóratársulásokból a következő fáciesekre lehet következtetni:

A terresztrikus összletben (Szászvár 8. sz. fúrás) előforduló néhány *Ovoidites ligneolus* R. Pot. édesvízi eredetre utal.

A limnikus összletbe tartozó Pusztakisfalu VI. sz. fúrás rétegsorában nem fordulnak elő olyan jellemző planktonszervezetek, amelyek alkalmasak lennének faciológiai kérdések eldöntésére. A geológiai értékelés szerint az üledéksor édesvízi. A fúrás 15—17 m-éből leírt *Heliospermopsis hungaricus* faj faciológiailag nem értékelhető, mert vele együtt más, fáciest jelző őslénytani lelet nem került elő.

A Zengővárkony 45. sz. fúrásban a limnikus rétegek (16,4—21,2 m) és a congeriás mészkő (13,2—14,5 m) mintái — mikropaleontológiai adatokkal igazoltan — édesvízi eredetűek. A fúrás 21,2 m alatti szakaszában levő, *Radiolaria* maradványokat és szivacstűket tartalmazó minták tengeri eredetre, a halmaradványokat és *Ostracoda* héjmaradványokat tartalmazó minták pedig csökkent sótartalmú vízre utalnak (Koreczné Laky I. szerint). A mintákban előforduló planktonszervezetek közül a *Fülöpia fimbriata* fajt ezért csökkentsósvízinek tartjuk.

A Magyaregregy környéki lelőhelyek mintáiban aránylag kevés a meghatározható planktonanyag. A Kisréti-árok anyagában félsósvízre utal a *Cooksonella circularis*. Az Almáspatak II. sz. lelőhely felső, sávos agyagmintájában a *Cymatiosphaera elliptica* és a *Micrhystridium* sp. — a rokon fajok analógiája alapján — tengeri eredetű.

A Hidas 53. sz. fúrás rétegsora 983—984,5 m-ben a *Tytthodiscus* sp. tengeri eredetre mutat, amit Koreczné Laky I. (1968. p. 12.) *Foraminifera* vizsgálatai is igazolnak, ő ugyanis a fauna alapján 941—942,5 m közötti tengeri ingressziót állapított meg. Ugyancsak tengeri üledékre utal a 837,9—839 m-ból származó minta is. Az összletet tengeri eredetűnek tartjuk *Foraminifera*, *Hystrichosphaeridae* maradványok és *Chenopodiaceae* pollenek alapján (Nagy 1962. p. 325—326). A „slírösszlet" aljától — 763—764,6 m-től felfelé — a mikroforaminiferák és a planktonszervezetek szintén tengeri üledékre utalnak: a 755—757 m-nél *Cystidiopsis certus*, *Micrhystridium microreticulatum*, 735—738 m között *Hidasia duigana*, *H. flexibile* és *Foraminiferák* jelzik a tengeri üledék jelenlétét. A 685,5—688 m közötti minták *Foraminifera*, *Cymatiosphaera microreticulata*, *Hidasia duigana* maradványok alapján a tenger mélyülését vagy nyíltabbá válását jelzik.

A torton mintái csökkent sósvizet, majd 630,8—632 m-ben a *Tetraporina quadrata*, 592,7—593,1 m és 590,2—590,7 m-ben az *Ovoidites ligneolus* édesvizet jeleznek. Tengerelöntésről tanúskodik a kőszénfedőben a *Micrhystridium microreticulatum* és néhány egyéb plankton is.

A szarmata összletben a tengeri üledéket a *Thalassiphora pelagica*, *Cymatiosphaera microreticulata* és néhány *Hidasia* sp. jelzik.

A pannonban elég gyakori az *Ovoidites ligneolus* sima változata, amelynél feltételezhető, hogy aligsós vízű üledékben fordul elő. Ugyancsak édesvízre, illetve aligsós vízre utal, recens anyagból való következtetések alapján, néhány *Dinoflagellata* faj is.

A Zengővárkony 59. sz. fúrás teljes rétegsora aránylag gazdag planktonszervezetekben, mindenekelőtt a *Botryococcus braunii* telepekben. Planktonszervezetek alapján a rétegsor alsó része csökkent sósvízi rétegekkel kezdődik, majd felfelé kiédesedik (73,5—76 m között). 73 m-től felfelé ismét csökkent sósvízi üledéket jelez az *Actinocyclus octonarius* és a *Cooksonella circularis*. A rétegsorban felfelé haladva kb. 35 m-ig tart a fáciesek váltakozása, majd mindinkább sósabb vízre mutatnak a planktonmaradványok. Erre utalnak a KORECZNÉ LAKY I. (1968. p. 17) által ebből a szintből meghatározott *Foraminiferák*: a *Rotalia papillosa* BRADY, *R. beccarii* (L.), *Orbulina triloba* D'ORB., *Globigerina bulloides* D'ORB. stb., valamint az *Ostracoda* héjak és *Echinodermata* tüskemaradványok. Ugyanezen összletben 34—34,9 m-ből származó minta plankton szervezetei: a *Crassosphaera concinna*, *Tytthodiscus mecsekensis*. A 30,9—34 m-ből származó mintában a *Crassosphaera* és *Botryococcus* példányai mellett *Emslandia australiense*, *Margosphaera velata*, *Cystidiopsis certus* és chitinvázú mikroforaminifera maradványok találhatók. A további minták szintén tengeri üledékre jellemző mikroszervezeteket tartalmaznak: a 28,8—29,2 m-ben *Coccolithophorida* leletek (BÁLDINÉ BEKE M. 1964, p. 162), a 28,6—28,8 m-ben ismét *Crassosphaera concinna* COOKS. et MAN. és *Botryococcus braunii* KÜTZG. fordulnak elő.

A planktonszervezetek más része másodlagosan helyezkedett el az üledékben: idősebb geológiai korokból halmozódott át. Az áthalmozódott anyag fontos adatokat szolgáltat az anyagszállítás körülményeire vonatkozóan.

A vizsgált mecseki neogén rétegsorokból különböző geológiai időszakokból származó szervezetek kerültek elő. Az áthalmozódás leginkább a mezozóikumból — főleg a júrából eredt. Nemegyszer azonban a palaeozóikumból való áthalmozódásra is rá kell mutatnunk. Elég nagymértékű az eocén eredetű áthalmozódás is.

A planktonszervezetek megtartási állapota, nagy szennyezettsége néha megakadályozta pontosabb meghatározásukat. Sok esetben az *áthalmozódást* spóra-pollen leletek is alátámasztották.

A Szászvár 8. sz. fúrásban sok adat utal az áthalmozódásra. A 434,5—435 m-ben a *Baltisphaeridium brevispinosum* (EIS. 1931) EIS. 1958 a paleozóikumból, a 433,8—434 m-ben a *Callialasporites devi* n. sp., a 432,7—433,5 m-ben a *C. dampieri* (BALME) DEV a júrából, a *Micrhystridium* cf. *inconspicuum* DEFL. a krétából leírt fajok. Ugyancsak mezozóos, júra áthalmozódásra mutat 156,9—157,3 m-ben a *Micrhystridium* cf. *fragile* DEFL. is.

A Pusztakisfalu VI. sz. fúrás 5. mintájában (10,5—12,5 m) a *Classopollis* sp. áthalmozódásra utal.

A Zengővárkony 45. sz. fúrás 17,2—17,8 m-ében a *Baltisphaeridium* cf. *brevispinosum*, 16,4—17,2 m-ében a felsőkréta *Angiospermae* pollen halmozódott át.

A Komló 120. sz. fúrás alsó szakaszában liász áthalmozódás állapítható meg. 400,5—406,1 m-ben *Eucommiidites* sp., 398,5—400,5 m-ben liász spóra található. 372—374,4 m-ben a paleozóos *Baltisphaeridium brevispinosum* (EIS.), a paleocén-eocén *Sapotaceoidaepollenites biconus*, majd a 178—178,8 m-ből származó mintában ugyancsak a *Baltisphaeridium brevispinosum*, egy másik *Baltisphaeridium* sp.-szel és a mezozóos *Callialasporites dampieri* (BALME) DEV, valamint az eocén *Porocolpopollenites stereoformis* PF. utal áthalmozásra.

A barnakőszéntelepes összlet agyagos meddőjében (53. sz. minta) a kréta cf. *Hexagonifera chlamydata* Cooks. et Eis., az eocén *Porocolpopollenites stereoformis* és a paleocén—eocén *Sapotaceoidaepollenites biconus* formák áthalmozásra utalnak.

A Zengővárkony 59. sz. fúrás halpikkelyes összletében 71—73 m-ben paleozóos eredetű *Angulisporites*, 67,5—70,5 m-ben paleocén—alsóeocén *Tricolporopollenites satzveyensis*, 41,8—44,4 m-ben kréta eredetű *Trudopollis* sp. és *Anemiidites echinatus* Ross fordul elő. A 30,9—34 m-ben paleocén—eocénre utaló *Sapotaceoidaepollenites biconus* mutatkozik. A tenger még kiterjedtebb voltára utal (18,5—20,2 m-ből) a liász eredetű *Concavisporites (Obtusisporites)* sp. spóra.

A Hidas 53. sz. fúrásban mind planktonszervezetek, mind spóra-pollenanyag alapján következtethetünk áthalmozásra. 1017—1019 és 837,9—839 m-ben alsókréta *Duplexisporites toratus* található. A 755—757 m-ben *Baltisphaeridium* cf. *trifurcatum* (Eis.) Downie et Sarj. a paleozóikumból, a 735—738 m-ben levő *B. heteracanthum* (Defl. et Cooks.) Downie et Sarjeant kréta—alsótercierből leírt. A 711—713 m-ben levő *Kalyptea* sp. júrából, a 688,5—690 m-ben levő *Micrhystridium* cf. *operosum* Defl. krétából ismert. Emellett *Hystrichosphaeridium* sp. töredék is található az utóbbi mintában. A 688—688,5 m anyagában *Hystrichosphaeridium* sp., a csatlakozó 686,5—688 m-ből származó mintában az előző tengeri planktonszervezet mellett előforduló *Scolecodonta* maradvány a francia krétában előforduló maradványra hasonlít (Verdier, 1962. p. 15). A 665,1—666,8 m-ben a krétából leírt *Micrhystridium* cf. *operosum* Defl., az 534—537 m-ben a júrából közölt *M.* cf. *deflandrei* Valensi és néhány *Hystrichosphaeridae* maradvány alapján, valamint a kréta *Duplexisporites toratus* jelenlétéből következtethetünk az áthalmozásra.

A fúrás felsőpannon szakaszában a paleocén, eocén áthalmozást a *Baltisphaeridium oligacanthum* ssp. *stella* W. Wetzel, *Crassosphaera* sp. mellett néhány eocénből leírt spóraforma is alátámasztja, mint pl. a *Polypodiispor tes tenellis*, *Reticuloidosporites dentatus*. Bóna J. *Coccolithophorida* vizsgálatai is eocén áthalmozódást mutattak ki a fúrás pannon összletében (1964, p. 126). Mindamellett mezozóos rétegekből való áthalmozódás is van a fúrás ugyanezen szakaszában (258—258,5 m), mert az *Ornatisporites reticulatus* és *O. dentatus* mezozóos eredetűek. Kedves M. és Simoncsics P. a genuszt megtalálták a liász rétegek vizsgálata során. Még további mezozóos, krétából ismert *Pteridophyta* és *Angiospermae* is található a pannon szakaszban.

6. Rétegazonosítás

A neogénben a vizsgálati anyagok közötti kisebb geológiai időkülönbségek miatt alapos, körültekintő elemzések szükségesek a rétegtani kérdések megoldásához. Rendkívül kevés, jellegtelen vagy perzisztens maradványokat tartalmazó minták esetében a leletek nem alkalmasak a vitás kérdések eldöntésére. Ilyenkor további — az előzőkkel összefüggő — esetleg heteropikus fáciesű anyag vizsgálatára van szükségünk.

Megnehezítette a rétegsorok értékelését a palynológiai alapszelvények hiánya, illetve a kutatás hazai viszonylatban úttörő jellege.

Éppen a neogén az, ahol — az előző geológiai korokhoz viszonyítva — aránylag kis flóraváltozással kell számolnunk. Az időegység aránylag rövid, a flóra változása aránylag kicsi, ezért már eléggé kialakult vegetációtípusokkal számolhatunk.

A mecseki anyagban is előfordultak rétegsorok, amelyek palynológiai szempontból nem értékelhetők. Ilyenek a Szászvár 8. sz. fúrás terresztrikus összletének konglomerátumai.

A Szászvár 8. sz. fúrás terresztrikus összletének 26—27 m közötti mintájában levő sajátos, apró spóraelemekkel jellemzett spektruma, a rétegazonosítás céljából megvizsgált Kisbattyán 1. sz. fúrás terresztrikus összletének 459—462 m közötti mintáival egyeztethető össze (2. ábra).

Az édesvízi eredetű barnakőszén-telepeket is magában foglaló limnikus összletet tárja fel a Pusztakisfalu VI. sz. fúrás. Az édesvizet jelző planktonszervezetek, valamint a nedves páfrányos, parti erdei vegetációra utaló pollenspektrum alátámasztják az üledékképződés körülményeit. Ezekhez csatlakozóak a szászvárbányai Fővölgy és Kórházvölgy limnikus összletéből, és a váraljai Pocsétás-árokból gyűjtött minták pollenspektrumai (52. ábra).

A nagymányoki Meleg-oldalból származó minta pollenspektruma közelebb áll a Magyaregregy környéki limnikus összletből származó minták anyagához (56. ábra).

A Magyaregregy környéki lelőhelyekről Pálfalvy I.-nal történt gyűjtések anyaga alapján — véleményére is támaszkodva — az almáspataki lelőhely a limnikus összletbe, az összes többi a halpikkelyes agyagmárga összletbe sorolható.

A Zengővárkony 45. sz. fúrás alsó mintái — a Pusztakisfalu VI. sz. fúrás spóra-pollenspektrumaival való összevetés alapján — a limnikus összletbe tartoznak. A 17,8—18,1 m-től felfelé jelentkező *Radiolaria*, szivacstű és halmaradványok, a kevés áthalmozott pollen- és planktonanyaggal, tengeri hatásra utalnak és a congeriás és halpikkelyes agyagmárga-összletbe tartoznak.

A Zengővárkony 59. sz. fúrás 44,4—95,1 m-ig megvizsgált mintái planktonanyaguk alapján (l.: „A spektrumok szerepe a faciológiai értékelésben" c. fejezetet), csökkent sósvízi és édesvízi üledékek váltakozásával, a halpikkelyes agyagmárga-összletre utalnak. Spóra- és pollenspektruma — nagy fajgazdagságával — eléggé egyedi képet ad ahhoz, hogy a többi fúrás vele egyidejűnek tartott szakaszát összevethessük vele. Az a megállapításom a flóraelemek alapján, hogy a Magyaregregy környéki vegetációképhez hasonló, összevethető a Komló 120. sz. fúrás 178—374,7 m-ig terjedő mintáival, a Zengővárkony 45. sz. fúrás felső mintáival, a Hidas 53. sz. fúrás 837,9—984,5 m-ig terjedő szakaszának megvizsgált mintáival, valamint a Pécsvárad XLIV. sz. fúrás alsó 161,1 m-től lefelé levő mintáinak pollenspektrumával.

A Zengővárkony 59. sz. fúrás felső részében a planktonszervezetek fellépése és az áthalmozódás ténye (l.: „A spektrumok szerepe a faciológiai értékelésben" c. fejezetet), a vegetáció jellegének változása (l.: „Vegetációképek" c. fejezetet) a tenger nyíltabbá és mélyebbé válását jelzi (24,8—44,4 m-ig). A planktonszervezetek közül a *Cystidiopsis certus* a Zgv. 59. sz. fúrás 30,9—34 m-éből, és a H. 53. sz. fúrás 755—757 m-éből került elő, ami a globigerinás szintet jelzi („slírösszlet").

A Komló 120. sz. fúrás harmadkori üledékei is 374,7 m-től a fent említett jellegzetes vegetációképet adják. Rétegtani érdekessége a 374,7 m-ből származó mintának, hogy néhány jellegzetes pollenfajta — a *Tetracentracearumpollenites komlóensis*, *T. minimus*, a *Tricolporopollenites serratus*, a *Flacourtiaceae* sp. és a *Faguspollenites tenuis* — a Hidas 53. sz. fúrás 667,2—759 m közötti szakaszának pollenspektrumaira emlékeztet.

Ehhez a rétegtani szinthez csatlakoznak a Pécsvárad XLIV. sz. fúrás felső, az ún. „slírösszletbe" tartozó, nagyon kevés pollenanyaggal rendelkező mintái, amelyek messzemenő következtetésekre nem jogosítanak fel (l.: „Vegetációképek" c. fejezetet). Mind a 134,8—135,5 m-ből, mind a 110—115 m-ből származó minták tengervízre utalnak. 9,8—11,0 m-ben a heterosteginás homokkő biztosan mutatja a torton tengeri fáciesét, amit a mintában jelentkező néhány planktonszervezet is alátámaszt.

A legteljesebb rétegsort a halpikkelyes összlettől felfelé a pleisztocénig a Hidas 53. sz. fúrás foglalja magába. Éppen a halpikkelyes összlethez tartozó minták közül sok ki nem értékelhető, korrodált pollenanyagot tartalmaz (l.: „Vegetációképek" c. fejezetet). Az értékelhető mintákat mind a flóra, mind a kimutatható klíma alapján, a magyaregregyi képhez tartozónak kell tekinteni.

A tengerelöntést *Foraminifera* és *planktonmaradványok* is jelzik (l.: „A spektrumok szerepe a faciológiai értékelésben" c. fejezetet), ami a halpikkelyes rétegösszletben ingresszióra mutat (837,9—984,5 m közötti szakasz). 766,8 m-től felfelé Koreczné Laky I. a „slírösszlet" globigerinás szintjét mutatta ki, erre utal a *Cystidiopsis certus* (l. p. 44) mellett a *Micrhystridium microreticulatum* és az áthalmozás is.

Felfelé a kőzetfácies változása (759—761 m-től) pregnánsan jelzi a torton lajtaösszletet. Itt a parti vegetáció víz alá kerülésén kívül a beágyazó kőzet, a mészkő is előidézője a pollenspektrum elszegényedésének.

A lajtaösszlet fedője a torton barnakőszenes összlet. Ebben az összletben — a hidasi bányából származó mintákhoz hasonlóan — a meddők pollenspektruma gazdag, de a barnakőszenes minták csak nagy mennyiségű szövetmaradványt tartalmaznak.

A hidasbányai 5. telepre a *Deflandridium stellatum* faj jellemző, valamennyi bányabeli 5. telepi mintában megtalálható.

A Hidas 53. sz. fúrás barnakőszén-telepes összlete felett, 572—575 m-ben, tengeri plankton jelzi a turritellás—corbulás agyagmárga-összletet, 556—561 m-ben eocén; majd feljebb júra áthalmozás is található. A tenger kiterjedését jelzi a parti erdő csökkenése, illetve a hegyi *Coniferae* állomány növekedése. A tengerelöntést mutatja a gazdag planktonanyag a 479,1—482 m-ből, amely már szarmata minta. A 496 méterben levő, ugyancsak szarmata mintában már a pannonra jellemző vegetációkép mutatkozik. A pannonban két részre való tagolódás mutatható ki, ugyanis a 258,1—258,5 méterben transzgresszió jelensége állapítható meg a sok, mezozóos jellegű, áthalmozott spórából. Ezt tekinthetjük a felsőpannon alsó határának. A pannonra jellemző sok hegyvidékre utaló *Coniferae* a hegyperemek kiemelkedésével kapcsolatos (Bartha, 1964. p. 180).

Az elmondottakból kitűnik, hogy az üledékföldtanilag, paleozóológiailag vizsgált rétegösszletekből származó, lehetőleg összefüggő rétegsorokat lehetett biztosabban egyeztetni, miután palaeobotanikailag, s főleg palynológiailag fel nem dolgozott rétegsorokról van szó.

VII. ÖSSZEFOGLALÁS

A palynológia mai helyzete hazánkban elsősorban *alapflórák* leírását teszi szükségessé, s ezért a mecseki neogén palynológiai vizsgálatának legfontosabb célkitűzése a spóra—pollen alapflóra leírása volt. Az alapflóra megismerése után vált lehetségessé a vegetációs képek megalkotása, valamint a paleogeográfiai, paleoklimatológiai és faciológiai körülmények vázolása. Az eredmények alapot adnak további kutatásoknak, s adatokat szolgáltatnak a Mecsek hegység részletes földtani térképezéséhez és a rétegazonosításhoz.

A mecseki neogén spóra-pollen alapflóra a következő rendszertani egységeket foglalja magában:

Phylum: **PYRRHOPHYTA:** *Geiselodinium miocaenicum* NAGY 1965, *Peridinium lambdoideum* NAGY 1966, *Palaeoperidinium nudum* n. sp., *Palaeoperidinium mecsekense* n. sp., *Gonyaulax pannonicus* NAGY 1965, *Gonyaulax reticulatus* n. sp., *Deflandridium stellatum* n. g. n. sp., *Emslandia australiense* DEFL. et COOKS. 1955 em. NAGY 1965, cf. *Dinoflagellata* sp., cf. *Hystrichosphaeridium* sp., *Micrhystridium* cf. *inconspicuum* (DEFL. 1935) *Deflandre* 1937, *Micrhystridium* cf. *operosum* DEFLANDRE 1937, *Micrhystridium* cf. *fragile* DEFLANDRE 1947, *Micrhystridium* cf. *deflandrei* VALENSI 1958, *Micrhystridium* sp., *Baltisphaeridium brevispinosum* (EISENACK 1931) EISENACK 1958, *Baltisphaeridium* cf. *trifurcatum* (EISENACK 1931) DOWNIE et SARJEANT 1963, *Baltisphaeridium oligacanthum* (W. Wetzel 1952) DOWNIE et SARJEANT 1963 ssp. *stella* (W. WETZEL 1952) DOWNIE et SARJEANT 1963, *Baltisphaeridium heteracanthum* (DEFL. et COOKSON 1955) DOWNIE et SARJEANT 1963, *Baltisphaeridium multispinosum* NAGY 1965, *Baltisphaeridium ciliatum* n. sp., *Baltisphaeridium* sp. 1, *Baltisphaeridium* sp. 2, *Cymatiosphaera microreticulata* NAGY 1965, *Cymatiosphaera hungarica* n. sp., *Cymatiosphaera elliptica* n. sp., Hyalin szemölcsös gömb (Hyaline Warzenkugel), *Leiosphaeridia* sp. 1, *Leiosphaeridia* sp. 2, cf. *Leiofusa* sp., *Pyxidiella* sp., *Tytthodiscus mecsekensis* NAGY 1965, *Tytthodiscus* sp., *Crassosphaera concinna* COOKSON et MANUM 1960, *Cooksonella circularis* NAGY 1965, *Margosphaera velata* NAGY 1965, ? *Ceratocystidiopsis* sp., *Cystidiopsis certus* NAGY 1965, *Thalassiphora pelagica* (EIS. 1954) EIS. et GOCHT 1960, *Heliospermopsis hungaricus* NAGY 1965, *Kalyptea* sp., cf. *Hexagonifera chlamydata* COOKS. et EIS. 1962, *Hidasia duigana* NAGY 1965, *Hidasia duigana* NAGY 1965 f. *magna* n. f., *Hidasia flexibilis* n. sp., *Hidasia velata* n. sp., *Savitrinia miocaenica* NAGY 1966, *Savitrinia magna* NAGY 1966, *Fülöpia fimbriata* NAGY 1965, *Ovoidites ligneolus* (R. POT. 1931) R. POT. 1951, cf. *Ovoidites ligneolus* R. POT. 1931, sima forma, *Tetraporina quadrata* BOLCHOVITINA 1953, Forma A., Forma B.

Összesen 29 genus, 52 species, ebből 1 n. g., 9. n. sp. A szerző összesen 9 új genuszt és 25 specieszt írt le a mecseki anyagból.

Phylum: **CHRYSOPHYTA**: *Actinocyclus octonarius* EHRENBERG 1838.

1 genus, 1 species.

Phylum: **CHLOROPHYTA:** *Botryococcus braunii* KÜTZG., *Pediastrum* sp.

Összesen 2 genus, 2 species.

Phylum: **MYCOPHYTA:** *Notothyrites setiferus* COOKSON 1947 és **Ascomycetes** (Tömlős gombák), **Basidiomycetes** (Basidiumos gombák), **Adelomycetes** (Fungi imperfecti, Konidiumos gombák).

Phylum: **BRYOPHYTA:** *Saxosporites hidasensis* NAGY 1968, *Rudolphisporites rudolphi* W. KR. et PACLTOVÁ 1963, *Rudolphisporites* cf. *rudolphi* W. KR. et PACL. 1963, *Rudolphisporites mecsekensis* NAGY 1968, *Bohemiasporites vaclavensis* (W. KR. et PACLT. 1963) W. KR. 1967, *Phaeocerosporites baranyaensis* NAGY 1968, *Phaeocerosporites transversus* NAGY 1968, *Ricciaesporites hungaricus* NAGY 1968, *R. transdanubicus* NAGY 1968, *Stereisporites* sg., *Stereisporites cyclus* W. Kr. 1963 ssp. *microcyclus* W. KR. 1963, *Stereisporites* sg. *Stereigranisporites granulus* W. KR. et SONTAG 1963, *Encalyptasporites pliocaenicus* NAGY 1968.

Összesen 7 genus, 12 species, ebből 3 genuszt és 7 specieszt írt le a szerző.

Phylum: **PTERIDOPHYTA:** *Verrucingulatisporites murireticulatus* NAGY 1963, *Echinatisporites cycloides* W. KR. 1963., *E. szászvárensis* n. sp., *E. hidasensis* n. sp., *E. mecsekensis* n. sp., *E. variabilis* n. sp., *Ophioglossisporites rotundus* n. g. n. sp., *O. grandis* (COOKSON 1947) n. c., *Osmundacidites gemmatus* (W. KR. 1959) n. c., *Cicatricosisporites mecsekensis* NAGY 1963, *Cicatricosisporites minimus* NAGY 1963, *Cicatricosisporites pannonicus* n. sp. asp. *triplanus*, *Gleicheniidites subgenus Triremisporites umbonatus* (BOLCH. 1953) n. c. f. *minor* n. f., *G.* sg. *Triremisporites zengőensis* n. sp., *G.* sg. *Triplexisporites triplex* W. KR. 1959 f. *minor* n. f., *Semigleicheniidites duplex* NAGY 1968, *Concavisporites minimodivisus* NAGY 1963, *Concavisporites* sp., *C.* sg. *Obtusisporites svatopluki* (PACLTOVÁ 1960) W. KR. 1962, *Leiotriletes maxoides* W. Kr. 1962 ssp. *maximus* (PF. 1953) W. KR. 1959 b, *L. regularis* (PF. 1953) W. KR. 1959, *L. maxoides* W. KR. 1962 ssp. *minoris* W. KR. 1962, *L. microlepioidites* W. KR. 1962, *L.* cf. *microadriennis* W. KR. 1959, *L. wolffi* W. KR. 1962 ssp. *wolffi*, *L. wolffi* W. KR. 1962 ssp. *brevis* W. KR. 1962, *L. seidewitzensis* W. KR. 1962, *L. miocaenicus* n. sp., *L. hidasensis* n. sp., *Leiotriletes* sp. asp. *triplan*, *Monoleiotriletes gracilis* W. KR. 1959, *Divisisporites* sp., *Undulatisporites curvatus* n. sp., *Spongiosisporites* cf. *semispongiosus* W. KR. 1959, *Anemiidites echinatus* ROSS 1949, *Baculatisporites semibaculatus* n. sp., *Verrucatisporites inaequalis* n. g. n. sp., *Lygodioisporites solidus* (R. POT. 1934) R. POT. 1951., *L. paucivallatus* (PFLUG 1953) n. c., *L. multivallatus* (PFLUG 1953) n. c., *Trilites* sp., *Duplexisporites toratus* (WEYLAND et GREIFELD 1953) PLAYFORD et DETTMANN 1965, *Leptolepidites baranyaensis* NAGY 1963, *L. magnipolatus* NAGY 1963, *L. parvus* n. sp., *Macroleptolepidites krutzschi* NAGY 1963, *Foveotriletes maculatus* n. sp., *Angulisporites multiangulus* n. sp., *Soóisporites elegans*

Nagy 1968, *Polypodiaceoisporites* cf. *speciosus* (R. Pot. 1934) R. Pot. 1951, *P.* cf. *microspeciosus* W. Kr. 1959, *P. gracillimus* Nagy 1963 var. *emarginatus* n. var., *P. rectolatus* Nagy 1963, *P. medius* Nagy 1963, *P. zólyomii* Nagy 1963, *P. acutus* n. sp., *P. mecsekensis* n. sp., *P. verrucosus* n. sp., *P. simplex* n. sp., *P. helveticus* n. sp., *P. muricinguliformis* n. sp., *P. zengővárkonyensis* n. sp., *P. miocaenicus* n. sp., *P. minutiosus* n. sp., *P. szászvárensis* n. sp., *P. magdalenae* n. sp., *P. hidasensis* n. sp., *P. hamulatus* n. sp., *P. minutus* n. sp., *P. torosus* n. sp., *P. longus* n. sp., *Polypodiaceoisporites* sp., *Verrucingulatisporites gregussi* Nagy 1963, *V. mecsekensis* n. sp., *V. miocaenicus* n. sp., *V. trifoliiformis* n. sp., *Bifacialisporites murensis* Nagy 1963, *B. murensis* f. *minor* n. f., *B. magnus* n. sp., *B. mecsekensis* n. sp., *B. medius* n. sp., *Callialasporites devi* n. sp. *C. dampieri* (Balme 1957) S. Dev 1961, *Ornatisporites reticulatus* Nagy 1963, *O. dentatus* Nagy 1963, *Neogenisporis* sp., *Trilobosporites* cf. *bernissartensis* (Delcourt et Sprumont 1955) R. Pot. 1956, *Mecsekisporites miocaenicus* Nagy 1968, *M. aequus* Nagy 1968, *M. zengővárkonyensis* Nagy 1968, *M. cerebralis* Nagy 1968, *Laevigatosporites haardti* (R. Pot. et Venitz 1934) Th. et Pf. 1953, *L. minor* (Cookson 1947) W. Kr. 1959, *L. major* (Cookson 1947) W. Kr. 1959, *Polypodiisporites favus* (R. Pot. 1931) R. Pot. 1933, *P. secundus* (R. Pot. 1934) R. Pot. 1956, *P.* cf. *tenellis* W. Kr. 1959b, *P. acutus* n. sp., *P. cellarius* W. Kr. 1959, *P. potoniéi* n. sp., *P. clatriformis* (Th. et Pf. 1953) n. c., *Polypodiidites multiverrucosus* Nagy 1963, *P. maximus* n. sp., *Verrucatosporites alienus* (R. Pot. 1931) Th. et Pf. 1953, *V. saalensis* W. Kr. 1959, *V. histiopteroides* W. Kr. 1962 f. *major* n. f., *V. gemmatus* Nagy 1963, *Reticuloidosporites dentatus* Pflug 1953, cf. *Reticuloidosporites* subgen. *Acussporites poriacus* W. Kr. 1959., *Hydrosporites miocaenicus* n. sp.

Összesen 37 genus, 110 species, 5 n. g., 47 n. sp. A szerző összesen 8 genuszt és 64 specieszt írt le ebből a törzsből.

Phylum: **GYMNOSPERMAE:** *Cycadopites miocaenica* n. sp., *Ginkgoretectina neogenica* n. sp., *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 „A" typus, *P. labdacus* (R. Pot. 1931) Th. et Pf. 1953 „B" typus, *P. labdacus* (R. Pot. 1931) Th. et Pf. 1953 „C" typus, *P. labdacus* (R. Pot. 1931) Th. et Pf. 1953 „D" typus, *P. thunbergiiformis* n. sp., *P. zaklinskaiana* n. sp., *Abietinaepollenites microalatus* (R. Pot. 1931) R. Pot. 1951, *A. microalatus* (R. Pot. 1931) R. Pot. 1951 ssp. *microalatus*, *A. microalatus* (R. Pot. 1931) R. Pot. 1951 ssp. *major* R. Pot. 1951, *A. neogenicus* n. sp., *Tsugaepollenites igniculus* (R. Pot. 1931) R. Pot. et Ven. 1934, *T. igniculus* (R. Pot. 1931) R. Pot. et Ven. 1934 f. *maximus* Raatz 1937, *T. viridifluminipites* (Wodehouse 1933) R. Pot. 1958, *Piceapollenites neogenicus* n. sp., *Pseudotsugoidites mecsekensis* n. sp., *Abiespollenites absolutus* Thiergart 1938, *A. crassus* n. sp., *Keteleeriaepollenites komlóensis* n. g. n. sp., *Inaperturopollenites* cf. *magnus* (R. Pot. 1934) Th. et Pf. 1953, *Cedripites szászvárensis* n. sp., *C. deodaraeformis* n. sp., *C. crassus* n. sp., *Taxodiaceaepollenites* Kremp 1949, *Sequoiapollenites polymorphosus* Thierg. 1938, *Cunninghamiaepollenites lignitus* n. g. n. sp., *Sciadopityspollenites serratus* (R. Pot. et Venitz 1934) Raatz

1937., *Chamaecyparidipollenites flexuosus* n. g. n. sp., *Araucariacites komlóensis* n. sp., *A. hidasensis* n. sp., *Podocarpidites microreticuloidata* COOKSON 1947, *P. papilionis* n. sp., *P. acmopyleformis* n. sp., *P. macrophylliformis* n. sp., *Dacrycarpites hungaricus* NAGY 1962, *Dacrydiumites balanseformis* n. sp., *D. taxoidiformis* n. sp., *D. guillauminii* n. sp., *D. inclinatus* n. sp., *Phyllocladipollenites grandis* n. sp., *Illinites* cf. *tectus* (LESCHIK 1956) CLARKE 1965, *Ephedripites* s. gen. *Ephedripites hungaricus* NAGY 1963, *Ephedripites* s. gen. *Ephedripites mecsekensis* NAGY 1963, *Ephedripites* s. gen. *Distachyapites bernheidensis* W. KR. 1961, *Ephedripites* s. gen. *Distachyapites bicostatus* n. sp., *Ephedripites* s. gen. *Distachyapites miocaenicus* n. sp., *Ephedripites* s. gen. *Distachyapites ellipticus* n. sp., *Ephedripites* s. gen. *Distachyapites minimus* n. sp.

Összesen 23 genus, 50 species, 3 n. g., 28 n. sp.

Phylum: **ANGIOSPERMAE:** *Magnoliaepollenites simplex* n. g. n. sp., *Tetracentracearumpollenites minimus* n. g. n. sp., *T. komlóensis* n. g. n. sp., *Nupharipollenites kedvesii* n. g. n. sp., *Nymphaeaepollenites pannonicus* n. g. n. sp., *Chloranthacearumpollenites dubius* n. g. n. sp., *Liquidambarpollenites orientaliformis* n. sp., *L. styracifluaeformis* n. sp., *L. formosanaeformis* n. sp., *Tricolporopollenites caesalpiniaceaeformis* n. sp., *Slowakipollenites neogenicus* n. sp., *S. mecsekensis* n. sp., *Alangiopollenites barghoornianum* (TRAVERSE 1955) W. KR. 1962, *A. simplex* n. sp., *Nyssapollenites kruschi* (R. POT. 1934) ssp. *analepticus* (R. POT. 1934) n. c., *N. kruschi* (R. POT. 1934) ssp. *contortus* (PF. et TH. 1953) n. c., *Jussiaeapollenites champlainensis* (TRAVERSE 1955) n. c., *Sporotrapoidites hungaricus* n. sp., *Myriophyllumpollenites quadratus* n. g. n. sp., *Rutacearumpollenites komlóensis* n. g. n. sp., *Polygalacearumpollenites miocaenicus* n. g. n. sp., *Rhoipites pseudocingulum* (R. POT. 1934) R. POT. 1960, *Aceripollenites reticulatus* n. g. n. sp., *A. rotundus* n. g. n. sp., *Ilexpollenites iliacus* (R. POT. 1931) R. POT. 1960, *I. margaritatus* (R. POT. 1931) R. POT. 1960, *I. propinquus* (R. POT. 1934) R. POT. 1960, *Siphonodontipollenites hungaricus* n. g. n. sp., *Spinuliferoidaepollenites zólyomii* n. g. n. sp., *Cyrillaceaepollenites megaexactus* (R. POT. 1931) R. POT. 1960, *C. exactus* (R. POT. 1931) R. POT. 1960, *Araliaceoipollenites euphorii* (R. POT. 1931) R. POT. 1951. I., *A. euphorii* (R. POT. 1931) R. POT. 1951. III., *A. euphorii* (R. POT. 1931) R. POT. 1951. IV., *A. edmundi* (R. POT. 1931) R. POT. 1960, *A. edmundi* (R. POT. 1931) R. POT. 1960 f. *reticulatus* n. f., *Tricolporopollenites hedwigae* PFLANZL 1956, *T. satzveyensis* PF. 1953, *T. edmundi* (R. POT. 1931) TH. et PF. 1953 f. *major* n. f., *Rubiaceae* sp., *Caprifoliipites sambucoides* n. sp., *C. andreánszkyi* n. sp., *C. gracilis* n. sp., *Lonicerapollenites* cf. *gallwitzi* W. KR. 1962, *Lonicerapollenites* sp., *Scabiosaepollenites magnus* n. g. n. sp., *S. minimospinuosus* n. g. n. sp., *Intratriporopollenites* cf. *microreticulatus* MAI 1961, *I. insculptus* MAI 1961, *I. instructus* (R. POT. 1931) PF. et TH. 1953 ssp. *instructus*, *I. instructus* (R. POT. 1931) PF. et TH. 1953 ssp. *macroreticulatus* MAI 1961, *I. polonicus* MAI 1961, *Malvacearumpollenites rotundus* n. sp., cf. *Malvacearumpollenites* sp., *Oleoidearumpollenites reticulatus* n. g. n. sp., *O. chinensis* n. g. n. sp., *Heliotropioidearumpollenites gracilis* n. g. n. sp., *H. rotundus* n. g.

n. sp., *Utriculariaepollenites elegans* n. g. n. sp., *Pteracanthopollenites discordatus* n. g. n. sp., *Plantaginacearumpollenites miocaenicus* NAGY 1963, *P. soói* NAGY 1963, *Plantaginacearumpollenites* sp., *Cistacearumpollenites rotundus* n. g. n. sp., *C. macrodurensis* (PF. et TH. 1953) n. c., *Flacourtiaceae* pollenek, *Dipterocarpacearumpollenites hidasensis* n. g. n. sp., *D. spinosus* n. g. n. sp., *Lobeliaepollenites erdtmani* n. g. n. sp., *Tubulifloridites grandis* n. sp., *T. granulosus* n. sp., *T. ambrosiinae* n. sp., *T. anthemidearum* n. sp., *Artemisiaepollenites sellularis* n. g. n. sp., *Cichoriaearumpollenites gracilis* n. g. n. sp., *Compositoipollenites rizophorus* (R. POT. 1934) R. POT. 1951, *Tricolporopollenites clethraceiformis* n. sp., *Ericipites discretus* (R. POT. 1934) n. c., *E. baculatus* n. sp., *E. hidasensis* n. sp., *Ericipites* sp., *Spinulaepollenites arceuthobioides* W. KR. 1962, *Caryophyllidites hidasensis* n. sp., *C. microreticulatus* n. sp., *Chenopodipollenites maximus* n. sp., *C. neogenicus* n. sp., *C. multiplex* (WEYL. et PF. 1957) W. KR. 1966, *Sapotaceoidaepollenites obscurus* (PF. et TH. 1953) n. c., *S.* cf. *abditus* (PF. 1953) n. c., *S. biconus* (PF. 1953) n. c., *S. microrhombus* (PF 1953) n. c. f. *miocaenica* n. f., *S. kirchheimeri* (TH. et PF. 1953) n. c., *S.* cf. *sapotoides* (PF. et TH. 1953) R. POT. 1960, *S. turgidus* n. sp., *S. rotundus* n. sp., *Porocolpopollenites vestibulum* (R. POT. 1931) TH. et PF. 1953, *P. triangulus* (R. POT. 1931) TH. et PF. 1953, *P. latiporis* PF. et TH. 1953, *P. stereoformis* PF. 1953, *P. hidasensis* NAGY 1963, *Persicarioipollenites lusaticus* W. KR. 1962, *Triporopollenites urticoides* n. sp., *Ulmipollenites undulosus* WOLFF 1934, *U. miocaenicus* n. sp., *U. maculosus* n. sp., *U. stillatus* n. sp., *Celtipollenites komlóensis* n. g. n. sp., *Zelkovaepollenites potoniéi* n. g. n. sp., *Z. thiergarti* n. g. n. sp., *Carpinuspollenites carpinoides* PF. 1953, *Ostryapollenites rhenanus* (THOMS. 1950) n. c., *Triporopollenites coryloides* PF. 1953, *Betulaepollenites prominens* (PF. 1953) n. c., *B. betuloides* (PF. 1953) n. c., *Alnipollenites verus* R. POT. 1934, *Triporopollenites cf. robustus* PF. 1953, *Faguspollenites subtilis* n. sp., *F. vivus* n. sp., *F. gemmatus* n. sp., *F. crassus* n. sp., *F. minor* n. sp., *F. tenuis* n. sp., *Quercopollenites granulatus* n. g. n. sp., Q. *robur* typus, Q. *petraea* typus, *Tricolporopollenites henrici* (R. POT. 1931) W. KR. 1961, *T. asper* (TH. et PF. 1953) W. KR. 1961, *T. densus* (PF. 1953) W. KR. 1961, *T. microhenrici* (R. POT. 1931) W. KR. 1961 ssp. *intragranulatus* PF. 1953, *T. microhenrici* (R. POT. 1931) W. KR. 1961 ssp. *intrabaculatus* PF. 1953, *Tricolporopollenites porasper* PF. 1953, *T. villensis* (THOMS. 1950) TH. et PF. 1953, *T. minimus* n. sp., *T.* cf. *genuinus* (R. POT. 1934) TH. et PF. 1953, *T. cingulum* (R. POT. 1931) ssp. *fusus* TH. et PF. 1953, *T. cingulum* (R. POT. 1931) ssp. *pusillus* (R. POT. 1934) TH. et PF. 1953, *T. cingulum* (R. POT. 1931) ssp. *oviformis* (R. POT. 1931) TH. et PF. 1953, *Tricolpopollenites liblarensis* (THOMSON 1950) TH. et PF. 1953 ssp. *liblarensis*, *T. liblarensis* (THOMSON 1950) TH. et PF. 1953 ssp. *fallax* (R. POT. 1934) TH. et PF. 1953, *Juglanspollenites verus* RAATZ 1937, *Juglanspollenites* sp., *Pterocaryapollenites stellatus* (R. POT. et VENITZ 1934) THIERGART 1938, *P. mecsekensis* n. sp., *P. rotundiformis* n. sp., *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960, *Engelhardtioidites microcoryphaeus* (R. POT. 1931) R. POT. 1960, *Platycaryapollenites miocaenicus* n. g. n. sp., *Subtriporopollenites* sp., *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962, *Polyporopollenites hidasensis* n. sp., *Triporopollenites megagranifer* (R. POT. 1931) PF. et TH. 1953, *Myricipites rurensis* (PF. et TH. 1953) n. c., *M. myricoides* (KREMP 1949) n. c., *M. bituitus* (R.

POT. 1931) n. c., *Momipites punctatus* (R. POT. 1931) n. c., *Salixipollenites helveticus* n. sp., *S. densibaculatus* n. sp., *Tricolpopollenites parmularius* (R. POT. 1934) TH. et PF. 1953, *T. granulatus* n. sp., *T. steinensis* PF. 1953, *Liliacidites ellipticus* n. sp., *Cyperacearumpollenites* sp., *Graminidites media* (COOKSON 1947) R. POT. 1960, *Arecipites tranquillus* (R. POT. 1934) n. c., *A. zievelensis* (PF. 1953) n. c., *A. trachycarpoides* n. sp., *A. chamaedoriformis* n. sp., *Sabalpollenites retareolatus* (PF. 1953) n. c., *S. papillosus* (MÜRR. et PF. 1953) n. c., *Monocolpopollenites observatus* PF. 1953, *Sparganiaceaepollenites polygonalis* THIERGART 1938.

Leírásra került 84 Angiospermae genus és 170 species, ebből 35 n. g., 78 n. sp. A szerző leírt a már előzőkben publikáltakkal együtt 36 Angiospermae genuszt és 81 specieszt.

A mecseki neogén anyagból *összesen** leírásra került 184 genus, 398 species, amiből 45 új genus és 162 új species. A mecseki anyagból összesen — az előző cikkekben megjelentekkel együtt — 60 új genuszt és 208 specieszt a szerző írt le.

A spóra-pollenegyüttesekből — ökológiai egységekbe osztottan — palaeovegetációképek felállítása vált lehetségessé. Ezekből a vegetációképekből az egymáshoz összetételben és geológiai időegységben, fáciesjellegben közelállókat képekbe lehetett összevonni. Valamennyi kép szubtrópusi jellegű vegetáció maradványegyüttes és egy középhegység jelenlétét bizonyítja.

A flóra- és fáciesváltozások a következő képeket alakították ki: a *szászvár kép* meleg szubtrópusi vegyeserdőt foglal magában, száraz elemekkel és édesvízi planktonszervezetekkel.

A *pusztakisfalui kép* nedves, páfrányos, édesvízparti sűrű vegetációt tár elénk, sok kozmopolita elemmel.

A *magyaregregyi kép* egyike a legelterjedtebbeknek, leggazdagabb vegetációjú kevert örökzöld és lombhullató erdőre enged következtetni. A felső mintákban kimutatható a tenger behatolása.

A *zengővárkonyi kép* a nyílt tenger melletti, kiegyenlített, óceáni éghajlatú, szubtrópus vegetációképe. A nyílt tengeri agyag, agyagmárga minták melegebb klímaigényű vegetációra utalnak. A mészkőkifejlődésű rétegsorok partközelibb, több hegylábi, hűvösebb flóraelemet tartalmaznak.

A *hidasi kép* a tortonai barnakőszénképződés láp-, ill. mocsárerdejének párás fáciesű, sok trópusi elemet magában rejtő flóraegyüttesét foglalja magában.

Az erre következő, tengerelöntést jelző minták után a *szarmata kép* már több lombhullató elemet tartalmaz, amelyekben még jelentkeznek trópusi elemek.

A *pannon vegetációkép* már a szarmata összlet felső mintáiban kimutatható, sok hegyvidékre jellemző fenyőpollennel (*Abies, Tsuga* stb.) s a trópusi elemek teljes eltűnésével. A pannont egy erős áthalmozódási szakasz két részre, alsó- és felsőpannonra tagolja.

A vegetáció flórarokonsági kapcsolata általában holarktikus. Az alsó

* Függelékként ismertetjük a zoogén maradványokat: Phylum: **RHIZOFLAGELLATA:** *Foraminifera* maradványok; **INCERTAE SEDIS:** *Scolecodonta*.

szászvári képben nagyobb arányban kelet-ázsiai, részben paleotrópusi, s csak kisebb mértékben közel-keleti, illetve észak-amarikai fajok éltek. A nedvesebb, édesvízi szakasz uralkodóan kozmopolita jellegű.

A *magyaregregyi kép* — az általános holarktikus jelleg mellett — több kelet-ázsiai, s kevesebb észak-amerikai elemet foglal magában. Az aljnövényzetben több mediterrán elem található, mint az előző képekben. A *zengővárkonyi kép* pollenspektruma — a kőzet típusából következően és a tengerelöntés hatására — szegényesebb.

A barnakőszenes összlet pollenspektruma — a fáciesjellegű vegetációkép mellett — kelet-ázsiai, északi-félgömbi lombhullató elemeket tartalmazó együttesre enged következtetni. A torton felső és a *szarmata* alsó része — tengeri hatásra, kevés trópusi elem mellett — inkább hegyi, északi-félgömbi lombosokat tartalmaz. A *pannonhoz* közeli szakasza — mediterrán és mérsékeltövi rokonságú flóraelemek keverékét mutatja, a kiemelkedő hegyvidéket jelző *Coniferae*-vel.

A vegetációegyüttes a Kárpát-medencében és ehhez kapcsolódó medencékben előforduló neogén együttesekkel vethető egybe, amelyekre jellemző, hogy egyes trópusi flóraelemek a szarmata—pannon emeletig húzódnak fel. A mecseki maradványegyüttesből levonható p a l a e o k l i m a t o l ó g i a i adatok fő irányvonalakban a melegebb jellegű szubtrópustól a meleg mérsékeltövig terjedő változásokat mutatják. A lehűlés nem volt egyenletes, különösen a speciális, helyi kifejlődésű klímaszakaszok mutatnak elütő jelleget.

A pollenspektrumokból az egykori élő helyek szárazföldi, édesvízi és tengeri jellegének elkülönítésére is következtettem a xerophyton, édesvízi és tengerparti növények pollenjeinek segítségével. Az egykori ülepítő medence f á c i e s j e l l e g é r e közvetlen adatokat a planktonszervezetekből állapítottam meg. Az üledékek fáciesjellegén kívül az eredetére is következtettem az áthalmozódásból. A meghatározott flóraelemek és a megállapított vegetációképek az ideális geológiai szelvényt támasztják alá.

A standardul felhasználható vegetációkép sorozatból összefüggés állapítható meg a fosszilis mikrofaunával történt megállapításokkal. A flóraváltozás nem szükségképpeni függvénye a mindenkori palaeofaunisztikai, illetve geológiai változásoknak, s nem mindig esik egybe a geológusok által megállapított, geológiai időegységeket elválasztó határvonalakkal.

Palynological elaborations the Miocene layers of the Mecsek Mountains

I. INTRODUCTION

Reasons for and circumstances of palynological investigation of the Mecsek Mountains Neogene

In 1956, the author undertook the palynological investigation of those localities around Magyaregregy (Mecsek Mountains, Southern Hungary) that have yielded Miocene macroflorae. Besides constituting a complement to macrofloral research, the palynology of these localities opened up some new insights into the Miocene vegetation of the Mecsek region, particularly as regards the herbaceous flora and the facies of the deposits containing the pollen.

As a first preliminary investigation, the author has collated palaeontological evidence from Magyaregregy with palynological material from other macrofloral localities of the Eastern Mecsek (Nagymányok, Zobák, Mecseknádasd) and has attempted at a stratigraphico-palynological evaluation of these localities.

Two profiles of the macrofloral locality of Almáspatak near Magyaregregy were evaluated (E. NAGY et PÁLFALVY, 1958, 1960). The percentages of fossils in the sediment layers of the profiles have shown that in the lower part of the stratigraphic succession it is the macroflora that provides a better for a stratigraphic subdivision, whereas in the upper part the palynological material is to be preferred for the purpose. In the case of certain species both macro- and microfossil evidence has been found to be in good agreement.

In 1957, in connection with the detailed mapping and research drilling then under way in the Mecsek Mountains, the author undertook the palynological examination of the Miocene sections of the drillholes in question, in order to round out the phytopaleontological image of the Neogene areas of deposition surrounding the central Palaeozoic–Mesozoic mass of the mountains, as well as to draw palaeogeographic, palaeoclimatological and lithological inferences therefrom.

The purpose of gaining useful results required, first of all, the laying of a suitable fundation, i.e. the describing of the numerous new species and genera encountered during this work. Only thereafter could an evaluation according to the above points of view be attempted.

The huge volume of the material in hand made it possible to make, simultaneously with the work of description, morphological, nomenclatural and taxonomic ordering, also some methodological experiments into the procedures of evaluation (E. NAGY, 1958, 1960) and the preliminary stating of some information for the benefit of the geologists and palaeontologists working in the field (E. NAGY, 1962).

II. GEOLOGICAL POSITION OF THE MATERIAL INVESTIGATED

Work was first begun on drill cores of boreholes that had traversed the Mecsek Mountains Neogene. Floral changes as a function of time were recognized, and the horizontal range of the vertical successions thus found, was then established.

The basis of this activity was the 1126 m deep borehole No 53 of Hidas. Having traversed the entire succession of the Upper Helvetian, Tortonian, Sarmatian and Pannonian strata overlying the Mesozoic, it proved suitable for establishing the sequence of floral changes that had during the Neogene taken place in the Mecsek region.

For the Lower Helvetian, other boreholes had to be chosen: Szászvár No 8, which had disclosed the lower and upper members of the Lower Helvetian terrestrial sequence; Pusztakisfalu No VI and Zengővárkony No 45, that had traversed the limnic sequence, as well as Komló No 120, and Zengővárkony No 59, that had traversed the Upper Helvetian "fish-scale sequence" and the Tortonian "schlier". In this way, the vertical profile of the Mecsek Mountains Neogene had been completed.

In order to extend the results horizontally, the author investigated numerous other outcrops and boreholes (see the layout map, Fig. 1, and Fig. 2 for borehole profiles on pages 7 and 8). The distribution of these was as follows:

in the Northern Mecsek: Boreholes Szászvár No 8, Kisbattyán No 1; exposures of the Kórház valley at Szászvárbánya and of the Pocsétás gully at Váralja;

in the Northeastern Mecsek: Borehole Hidas No 53 (samples of the lignite seams 2., 4., 5. and 6. of Hidas), drill cores of the lignitic sequence from boreholes Hidas Nos. 105, 91, 89, and 88; macrofloral localities near Mecseknádasd;

in the Southeastern Mecsek: Boreholes Zengővárkony Nos. 45 and 59; Pusztakisfalu No VI;

in the southern foreland: Borehole Pécsvárad No 44,

in the Western Mecsek: Borehole Komló No 120 and outcrops near Magyaregregy.

Palynological results from the Eastern Mecsek were collated with a complete palynological profile of the Western Mecsek Neogene. This inventory of evidence was deemed sufficient for a thorough characterization of Neogene plant life in the Mecsek Mountains region.

III. PROCEDURES

Sampling for the purposes of the present monograph was performed as follows.

In surface exposures, *samples were taken* at vertical intervals of 20 centimeters or at changes in lithology, whichever came first. For purposes of comparison, a few isolated samples were taken from outside the staked-out profiles. From the drill cores, samples were generally taken at the rate of one per change of lithology. However, sediments suitable for palynological study were sampled more densely than unsuitable ones (limestones, gravels).

Maceration was performed in the usual way, with hydrochloric or acetic acid in dependence on the nature of the sediment, with fluoric acid if the need arose (clays, clay marls) or with the nitric acid procedure in the case of lignites.

The stabilized preparates mounted in glycerine jelly were studied under a *Zeiss* Nfpk binocular biological microscope; photos were made through an objective lens of 1/30 aperture and 90× magnification and a *Microtar* lens.

The photos were made with 1000× enlargement mostly, the enlargement of some important parts was 2000 ×.

For the purpose of exploring possible *botanical affinities*, confrontation with living plants was complemented with ecologic and cenologic considerations. I examined the spores and pollen grains of recent species similar to the fossile ones.

For the sake of the paleontological conclusions I sonsidered as my leading mission the searching for the botanical relations. With the help of these.

I could *determine biocenosis* in many cases. In some cases it was not possible to integrate some specimens with the ecologycal type. In this cases two variations are possible:

1. this forms are allochtonous or

2. their oekotype were changed meanwhile.

I took into consideration the redeposition from the elder layers too, which gives informations about the circumstances of the formations of sediment.

I took fossils found single or few exemplares into consideration too. The spore and pollen production of plants is very different. The differences in the circumstances of fossilisation are also considerable, so every single exemplar can be characteristic of an association or facies or geological period.

As to *terminology*, the morphological names proposed by Thomson and Pflug, on the one hand, and by Erdtman, on the other, have been used. I took the new literature into account too.

As regards *nomenclature*, the rules laid down in the *International Code of Botanical Nomenclature* have been adhered to as closely as practicable.

I treat the morfological nomenclature temporary, untill we can bring to light the connections of the fossil spores and pollen grains with the vegetable kingdom.

I took into consideration also the described macrofossils at the paleobotanical valuation of the spores and pollen grains.

Agreeing with the *Code* (Art. 9, Rec., 20 B) I applied the names "sporites" and "pollenites".

IV. TAXONOMIC AND DESCRIPTIVE PART

As basis of the classification of the material examined, the second 1963 edition of the treatise *"Plant systematics on the basis of evolution history"* by R. Soó has been adapted. For the zoofossils cropping up in the microplankton, the systems of GRASSÉ (1952), PIVETEAU (1952) and EISENACK (1954) have been adapted.

The taxa that in the present state of our knowledge cannot yet be placed with certainty in the natural system have been introduced in an approximative way.

All the species to be mentioned below are preserved in various slides kept at *the Palynological Laboratory of the Hungarian Geological Institute.*

Phylum: **PYRRHOPHYTA**
Classis: **Dinophyceae (Peridineae)**
Subclassis: **Dinoflagellatae**
Ordo: *Gymnodiniales*
Familia: Deflandreidae EISENACK 1954
Genus: *Geiselodinium* W. KR. 1962

Geiselodinium miocaenicum NAGY 1965

1965. *Geiselodinium miocenicum* n. sp. NAGY, in Acta Bot. XI. p. 201, fig. 3, Plate I. 3, II. 11, Holotype and diagnosis.

A single specimen of a fresh-water plankton organism from borehole Zengővárkony No 45; depth 13.2 to 13.7 m; Lower Helvetian medium- to coarsegrained sand, with an intercalated layer of carbonaceous clay.

Ordo: *Peridiniales*
Familia: Peridiniaceae
Genus: *Peridinium* EHRENBERG 1832

Tests belonging to this genus are fairly frequent in a succession of cores (135.5 to 137, 134.8 to 135.5, 132.5 to 134.8 meters) in the Upper Pannonian of borehole Hidas 53. Most forms exhibit some sort of tabulation, although some do not justify any far-reaching inferences owing to poor preservation and contamination. Relatively smooth, unornamented tests are considered in literature as indices of a freshwater habitat. A statement concerning the comparison of freshwater and marine forms in the *Traité de Zoologie* (I., p.

350) reads as follows: "SCHILLER (1935) note que les premières sont en général de forme pleine et lisse, tandis que les secondes ont des profils anfractueux, à relief prononcé".

Peridinium lambdoideum NAGY 1966

1966. *Peridinium lambdoideum* n. sp. NAGY, in The Palaeobotanist 1966. Vol. 15, Nos. 1–2, pp. 38–40. Holotype and diagnosis.

A few specimens in the Upper Pannonian of borehole Hidas No 53 (134.8 to 135.5 m, silty clay marl).

Genus: *Palaeoperidinium* DEFLANDRE 1934 emend. SARJEANT 1967

Palaeoperidinium nudum n. sp.

Plate I, Fig. 1

Holotype: Borehole H. 53, sample No 4, slide No 1, 33.7×169.1.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, silty clay-marl, borehole H. 53, depth 132.5 to 134.8 m.

Diagnosis: A spheroidal theca of 65 by 54 μ size. The transverse band is about 5 μ wide, slightly helicoidal. There are a few meridional ridges, presumably vestiges of a tabulation. The apex bears a crack indicative of a large pylome. In the side view, the fossil is finely baculate. The bacula, 1 to 1.5 μ long, lend the test a reticulate relief. The surface bears spines about 2 μ big, spaced 10 to 12 μ apart. There are a few verruca-like prominences, some of which form the rudiments of one peak at the apex, two at the antapex. In the zone corresponding to the helicoidal ring there are two small verruca-like prominences.

Differential diagnosis: The fossil resembles DEFLANDRE's *Palaeoperidinium nuciforme* (1938, Pl. VIII, Figs. 5, 6). However, *P. nuciforme* is covered with spines that are longer than the bacula of the new species. The transversal ring of *P. nuciforme* is more pronounced, and the prominence at the apex is longer.

Remarks: Our material from the Pannonian of the Mecsek Mountains has yielded just a few specimens. Placing them into the genus established by DEFLANDRE in 1934 is justified on the grounds that the thecae bear morphological features indicative of *Peridinium*, and that tabulation can at most be surmised on our fossils. As the sediment that has yielded these fossils is relatively recent and contains peridinia of better preservation, too, W. WETZEL's attribution of the lack of tabulation to the digestive processes of plankton-eating organisms (1952, p. 407) seems plausible. However, lack of tabulation may be due-to inorganic corrosion, too.

Palaeoperidinium mecsekense n. sp.

Plate I, Fig. 6, 8

Holotype: Borehole H. 53, sample No. 5, slide No. 3, 42.8×105.6.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, silty clay-marl, borehole H. 53, depth 134,8 to 135,5 m.

Diagnosis: An ellipsoidal theca of 60 and 56 μ size. Epi- and hypotheca are of equal size. Wall 1 to 1.5 μ thick. On one side, the following tabulation is observed: 1', 3'', transversal furrow 5 to 6 μ wide, 3''', ? 1''''. The other side of the test is entirely devoid of tabulation; the edges of the existing tabulation are strongly developed. The apices of the tabulae and the ends of the zone are tapering (Textfig. 3).

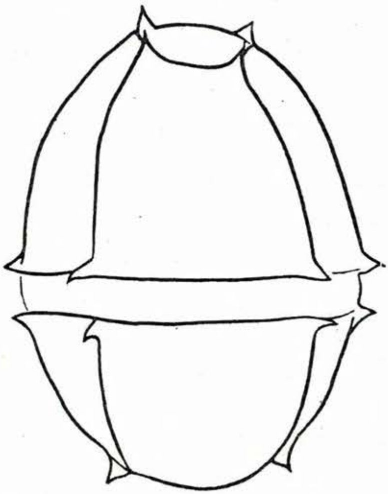


Fig. — ábra 3. Palaeoperidinium mecsekense NAGY

A few specimens were found in the Pliocene of borehole H. 53.

Differential diagnosis: The species resembles *Palaeoperidinium castanea* described by DEFLANDRE from the Cretaceous (DEFLANDRE 1936, Ann. Paléont. 25, p. 177, Pl. 6, Fig. 1). However, the shape is less rounded, the horizontal furrow is invisible and the epitheeal prominence, present on DEFLANDRE's species, cannot be observed owing to the way the specimen lies in the slide. The surface of our specimen is strongly contaminated.

There is some morphological resemblance to *Peridinites rossicus* DEFL. (Tr. de Paléont. I., 122, and DEFLANDRE 1940). The new species is, however, meridionally elongated, and no longitudinal zone can be observed in it. *Peridinites rossicus* is an Eocene form, anyway.

Familia: G o n y a u l a c i d a e LINDEMANN
Genus: *Gonyaulax* DIESING

Gonyaulax pannonicus NAGY 1965

1965. *Gonyaulax pannonicus* n. sp. NAGY in Acta Botanica XI. pp. 200–201. I. 1–2. II. 10. Holotype and diagnosis.

Two specimens from the Upper Pannonian of borehole Hidas 53, occurring together with all the other forms of *Peridiniales.*

Gonyaulax reticulatus n. sp.

Plate I, Fig. 7, 10

Holotype: Borehole H. 53, sample No 5, slide No 2, 42×104.3.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, silty clay-marl, borehole H. 53, depth 134,8 to 135,5 m.

Diagnosis: Biconical form of 63 by 52 μ size, epitheca rounded; tabulation approximately 3', 1a, 6'', 6g, 6''', 1''''. The base of the hypotheca is nearly straight. Surface coarsely reticulate. Zone subequatorial (See Fig. 4).

Differential diagnosis: The new form differs from *G. pannonicus* with longer shape and reticulat surface. Our specimen is fairly similar to the ventral part of Jurassic *Gonyaulax amabilis* Defl. 1939, but the Jurassic specimen is 38 μ only and has not a reticulat surface.

Remarks: The theca faces the viewer with its dorsal side; it is hard to observe its ventral side.

A single specimen occurred in our material.

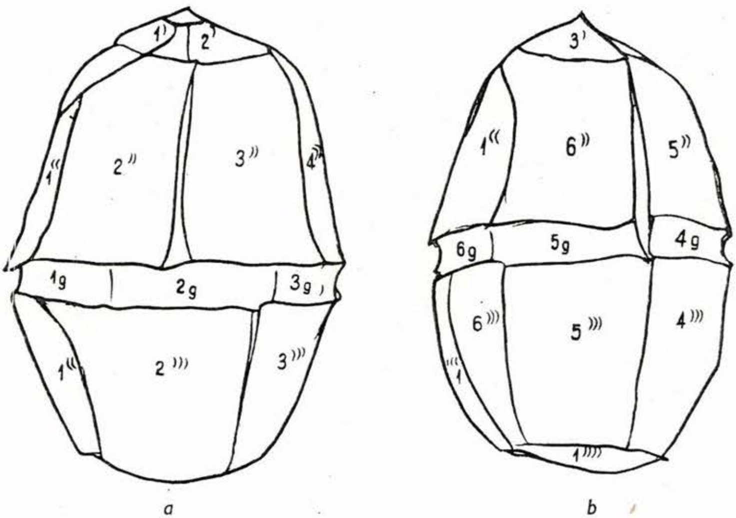


Fig. — ábra 4. Gonyaulax reticulatus n. sp.

Ordo: *D i n o c o c c a l e s*
Familia: D i n o c o c c a c e a e
Genus: *Deflandridium* n. g.

Derivatio nominis: In honour of Professor G. DEFLANDRE, France
Generotype: Deflandridium stellatum n. g. n. sp.

Diagnosis: A rounded polyhedral, multiapical planktonic form.

Remarks: There are similar forms in the extant order *Dinococcales* but they differ from all known fossil genera. Our specimen most resembles *Palaeostomocystis sinuosa* COOKSON et EISENACK 1960 (COOKSON et EISENACK 1960, p. 258, Pl. 38, Fig. 16–17), which, unlike our specimen, the has fewer and more rounded prominences and thinner wall. The aperture cf. *Palaeostomocystis sinuosus* from which the name has been derived is in our opinion a morphological variety connected with a physiological function.

Deflandridium stellatum n. g. n. sp.
Plate II, Fig. 1, 3, 4, 6

Holotype: Seam No. V. of Hidas lignite, sample No 34, slide No 3. 33,6×114,9.
Locus typicus: Hidas, lignite mine.
Stratum typicum: Tortonian lignite sequence, seam No 5.

Diagnosis: Polyhedral planktonic form of 78 by 68 μ size. Apices spaced 24 to 37 μ apart, 6 to 10 μ high, broad-based. Wall 2 to 3.5 μ thick, smooth-surfaced.

Differential diagnosis: Resembles *Hystrichosphaeridium striatoconus* described by DEFLANDRE et COOKSON (1954, p. 1235), but the prominences on their species are not swellings of the test proper, in addition the new species is much bigger.

Remarks: The specimens of this fairly abundant planktonic fossil (up to 100 have so far been recognized) deviate little from the holotype; in some of them, the prominences are less pronounced. The species is restricted to the rich planktonic assemblage of brackish facies of seam No V of the Hidas lignite mine. Concerning *Thaurilens denticulata* PAV. (1952, p. 361, Fig. 274 D), GRASSÉ states: "Enveloppe polyédrique, comprimée, à angles prolongés en courtes cornes. Marin." — On the fossil species, the prominences do not end like a horn. The dimensions are also widely different: The diameter of *Thaurilens denticulata* is 14 μ (TRÉGOUBOFF et ROSE 1957, p. 125). The now-living species belongs to the order *Dinococcales* which is (l. c., p. 96) an "ordre provisoire à cause de la confusion taxonomique possible de certaines espéces... ils ne représentent, peut-être, en réalité que des stades évolutifs de divers *Gymnodiniens*."

Differences in morphology and in size notwithstanding, the points of morphological similarity and the uncertainty of the order have prompted me to relegate the new genus to the place reserved within the taxonomic system for the order *Dinococcales*.

Familia: I n c e r t a
Genus: *Emslandia* GERLACH 1957

Emslandia australiense (DEFL. et COOKS. 1955) em. NAGY 1965

1965. *Emslandia australiense* (DEFL. et COOKS. 1955) NAGY em. 1965 in Acta Botanica XI. p. 202, Pl. I. 6., II. 7.

A species described from the Australian Middle Miocene. A single specimen at 30.9 to 34 m depth in the "schlier" sequence cut by borehole Zengővárkony No 59.

cf. *Dinoflagellata* sp.

Plate III, Fig. 2

Test 119 μ long, 78 μ wide, of a roughly parallelogrammatic outline. Surface smooth, wall about 1.5 μ thick. On both sides of the test, a double prominence reminding of the transversal zone of the *Dinoflagellates* can be surmised. The fossil might be a membrane that had lost its cysts. The poor preservation of the test (fractures, strong crumpling and contamination) precludes a more profund evaluation.

A single specimen at 658.8 to 659.1 m depth in borehole Hidas 53.

Ordo: *H y s t r i c h o s p h a e r i d e a* EISENACK 1938
Familia: H y s t r i c h o s p h a e r i d a e O. WETZEL 1933 em. DEFLANDRE 1937.

EISENACK has repeatedly affirmed (e. g. in his papers from 1938 and 1954) the resemblance between the order *Hystrichosphaeridea* and the peridinids. EVITT is of the firm opinion that hystrichosphaerids are nothing but cystas of dinoflagellates (1961, 1963) and has proposed—on the basis of his investigations—to subsume them under the Rules of Botanical Nomenclature. For the time being, EISENACK's system (1954, p. 68) has been taken as a basis.

Genus: *Hystrichosphaeridium* DEFLANDRE 1937

cf. *Hystrichosphaeridium* sp.
Plate I, Fig. 5

A test fragment with two projections, of 60 μ size altogether, encountered in the unconsolidated marly portion of the Tortonian Leitha kalk, depth 668.0 to 668.5 m, of borehole Hidas 53. Probably related to *Hystrichosphaeridium tubiferum* (EHRENBERG 1838) DEFLANDRE 1937 occuring in the Belgian Eocene (PASTIELS 1948, p. 38) and also in Cretaceous cherts (O. WETZEL, 1933, p. 40). Presumably redeposited.

Genus: *Micrhystridium* DEFLANDRE 1937 emend. DOWNIE et SARJ. 1963

Micrhystridium cf. *inconspicuum* (DEFL. 1935) DEFLANDRE 1937
Plate I, Fig. 4

A specimen suggestive of this form group has been encountered in Lower Helvetian light grey clays at a depth of 432.7 to 433.5 m in borehole Szászvár 8. On the basis of specimens from Cretaceous cherts, DEFLANDRE (1937, Ann. Paléont. XXVI, p. 80) specifies the diameter of the test as being 9 μ at most, with projections from 9 to 14 μ long; hence, in the rare case of very long projections the full size of the fossil can attain 20 or 22 μ. Our form coincides with the representations (1937, Pl. XII, Figs. 11, 12) of the holotype and paratype.

According to A. SARJEANT (1959, p. 341), the diameter of the test is less than 10 μ; it is 11 μ in our specimen. SARJEANT's Fig. 7b shows a specimen with spiny projections up to 4 μ length which closely corresponds to our fossil.

Our specimen has presumably been redeposited from the Mesozoic into the terrestrial Helvetian.

Micrhystridium cf. *operosum* DEFLANDRE 1937
Plate V, Fig. 4–5

Roundish tests of 8 to 8.5 μ diameter with slight prominences of about 0.5 μ size, uniformly scattered all over the surface. Wall transparent, colourless. Described by DEFLANDRE (1937, Ann. Paléont. p. 34) as a form abundant in Cretaceous cherts. This minute planktonic form, frequent also in the Mecsek Mountains Miocene, particularly on the Helvetian—Tortonian border (depth 665.1 to 666.8, 688.5 to 690 m) of borehole Hidas 53, has presumably been redeposited from the Mesozoic.

Micrhystridium cf. *fragile* Deflandre 1947
Plate I, Fig. 11

Roundish test of 20 μ diameter with simple straight or slightly curved projections of about 10 to 11 μ length, slightly tapering, closed at their ends. There are about 15 to 18 projections of this kind, somewhat more than the number given by Deflandre (10 to 15). The surface structure of the test cannot be observed owing to contamination. Encountered in a single specimen in clayey siltstone, at 430.0 to 431.1 m depth in borehole Szászvár 8. Originally described from the Jurassic by Deflandre (1947, p. 8), and encountered also in the Jurassic by Sarjeant (1959, p. 340), it seems to be, in our material too, a fossil redeposited from the Jurassic.

Micrhystridium cf. *deflandrei* Valensi 1958
Plate I, Fig. 2–3

Spheroidal test of 10 μ diameter with hairy projections about 1 μ long. The surface exhibits a sort of lineation due to a quasiregular arrangement of hair bases. On the embedded specimen it would be hard to tell apart the upper and lower surface for studying the rows of points described and figured by Valensi (1953, p. 51, Pl. VII, Figs. 19, 21, 22). With a view to the above-enumerated features I have called it cf. *deflandrei* on the assumption that it has been redeposited from the Jurassic.

A single specimen in the Sarmatian (depth 534 to 537 m) of borehole Hidas 53.

Micrhystridium sp.

Roundish test of 20 μ diameter with a fairly large number of simple, thin, closely packed projections of 6 to 8 μ length. The full diameter including the projections is 38 μ. Strong contamination of the surface precludes a more profound examination.

Encountered in Sample 1 of locality Almáspatak II, Magyaregregy, in Helvetian tuffaceous clays and calcareous marls (0.10 to 0.20 m interval).

Genus: *Baltisphaeridium* (Eisenack 1958) Downie et Sarjeant 1963

Baltisphaeridium brevispinosum (Eisenack 1931) Eisenack 1958
Plate I, Fig. 9

A few specimens, with test diameters in the 30 to 40μ range, correspond to the original description of Eisenack (1931, p. 11). As the form has been encountered also in the Belgian Eocene (Pastiels 1948, p. 43), it is not pronouncedly out of place in our material, either. Encountered in greenish-grey marl (depth 434.5 to 435 m, borehole Szászvár 8), in the Helvetian "fish-scale" sequence (depth 372.0 to 374.4 m, borehole Komló 120); and in light grey argillaceous-calcareous fine sand (depth 178.0 to 178.8 m, same borehole). Test diameters respectively 40, 30 and 32 μ, in the above order.

Baltisphaeridium cf. *trifurcatum* (EISENACK 1931) DOWNIE et SARJEANT 1963
Plate III, Fig. 1

About the form described by EISENACK in 1931, p. 112 under the name *Ovum hispidum trifurcatum* and redescribed, also by him, from the Palaeozoic in 1937 as *Hystrichosphaeridium trifurcatum*, EISENACK (1938, pp. 16–19) states: "Auch bei dieser Art is die Variationsbreite erheblich grösser, als es ursprünglich beurteilt werden konnte". PASTIELS (1948, p. 39) mentions it from the Belgian Eocene. Our specimen presumably belongs to this form group. It was encountered in the Tortonian "schlier" (depth 755 to 757 m), of borehole Hidas 53. The specimen is one half of a test, 93 μ long, 63 μ in diameter, with bi- and trifurcating projections 15 to 18 μ long and a finely punctate surface. It most closely resembles Plate 2, Fig. 13 and p. 17 of EISENACK 1938. Its state of preservation suggests redeposition from a more ancient sediment.

Baltisphaeridium oligacanthum (W. WETZEL 1952) DOWNIE et SARJEANT 1963 subsp. *stella* (W. WETZEL 1952), DOWNIE et SARJEANT 1963
Plate V, Fig. 6

Roundish test of 60 by 55 μ size, wall 1 to 2 μ thick, with clusters of bifurcating projections 15 to 20 μ long, spaced 15 to 25 μ apart. Full major axis, including projections, is 83 μ.

Our specimen is comfortable to the diagnosis by W. WETZEL (1952, pp. 402—403) of *Hystrichosphaeridium oligacanthum* from the North German–Danish Cretaceous chert nodules. The subspecies described (l. c.) is smaller, but the species proper has a wide range of variability probably paralleled also by the subspecies.

A single specimen in Lower Pannonian calcareous marl (depth 298.0 to 299.1 m), borehole Hidas 53. Presumably reworked from an older deposit.

Baltisphaeridium heteracanthum (DEFL. et COOKSON 1955) DOWNIE et SARJEANT 1963
Plate IV, Fig. 1

Roundish test of 85 μ diameter (120 μ with projections). The surface bears projections of highly varied shape, 12 to 25 μ long, 1 to 4 μ thick. Test torn open and apparently compressed. Surface contaminated. A single specimen in grey, slightly calcareous sandstone of the "schlier" sequence (depth 735.0 to 738.0 m) of borehole Hidas 53.

In Australia, it occurs from the Upper Cretaceous onwards (DEFLANDRE et COOKSON 1955, p. 276, COOKSON et EISENACK 1961, p. 73).

Baltisphaeridium multispinosum NAGY 1965

1965. *Baltisphaeridium multispinosum* n. sp. NAGY — in Acta Bot. XI. p. 203. II. 8–9. Holotype and diagnosis.

A single specimen encountered in a brackish bed of the Helvetian "fisch-scale" sequence, depth 56 to 60.9 m, borehole Zengővárkony 59.

Baltisphaeridium ciliatum n. sp.

Plate IV, Fig. 2–3

Holotype: Borehole H. 53, sample No 21, slide No 1a, 39.4×104.5.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignitic sequence, borehole H. 53, depth 590.7 to 592,3 m.

Diagnosis: Oval test of 33 by 25 μ size, bearing sparsely and randomly scattered non-tapering projections of 3 to 5 μ length and of the uniform thickness of 1 μ.

Differential diagnosis: Of the same order of magnitude as *Micrhystridium duvernayensis*, described by STAPLIN (1961, p. 3.) from the Devonian of Canada; shape also similar; the random scattering of the projections is another common feature. Our specimen differs from *M. duvernayensis* by its non-tapering and shorter projections.

A single specimen, presumably redeposited.

Baltisphaeridium sp. *1.*

Plate IV, Fig. 5

Irregularly elliptical, squat test of 50 by 35 μ size, with tapering projections of 8 to 10 μ length, about 1.5 to 2 μ diameter.

In connection with *Hystrichosphaeridium isocalamus*, DEFLANDRE and COOKSON (1955, p. 272) state that elongate ellipsoidal forms are scarce in the hystrichosphaerid form group. As regards its shape, our form is closest to *H. capitatum* figured by COOKSON and EISENACK (1960, Paleontology, Pl. 36, Fig. 9) from the Oxfordian or Kimeridgian. Their species is, however, slenderer and its projections have endings of different shape. A more precise taxonomic definition and differentiation is impossible owing to strong contamination.

In this episode of marine ingression, redeposition from a more ancient formation (Mesozoic) is not at all excluded.

A single specimen in clayey marl, Tortonian "schlier", depth 672.5 to 676 m, borehole Hidas 53.

Baltisphaeridium sp. 2.

Plate VI, Fig. 2

Test of 35 μ length with a simple, somewhat thicker base of 15 to 20 μ diameter; obtuse, closed apex, with a few broken projections. Full size including projections is 52 μ. Surface strongly contaminated.

A single specimen in light gray clayey marls, Helvetian "fish-scale" sequence, depth 178.0 to 178.8 m, borehole Komló 120.

Familia: Pterospermopsidae EISENACK 1954
Genus: *Cymatiosphaera* (O. WETZEL 1933) DEFLANDRE 1954

Cymatiosphaera microreticulata NAGY 1965

Plate V, Fig. 9–10

1965. *Cymatiosphaera microreticulata* n. sp. NAGY — in Acta Bot. XI. pp. 203–204, I. 4–5. Holotype and diagnosis.

A few specimens of this planktonic form have been encountered in Helvetian and Tortonian marine deposits. Similar forms have been mentioned from the Middle Miocene of Germany (RAUKOPF 1959, Pl. 5, Fig. 3).

Cymatiosphaera hungarica n. sp.

Plate IV, Fig. 4, 7–8

Holotype: Borehole H. 53, sample 22, slide 2/1, 32.1×11.0.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignitic sequence, borehole H. 53, depth 558 to 561 m.

Diagnosis: Test roundish, of 30 μ diameter, wall thin (about 1 μ), divided into a few polygonal fields by a low perpendicular membrane. The surface bears spines of 1.5 μ.

Differential diagnosis: Affine to *Cymatiosphaera* cf. *wetzeli* DEFLANDRE 1954 (DEFL. et COOKSON 1955, p. 289), our specimen is closer in size to the forms classed as Lower Eocene of the Princeton member of the Dilwyn Clay, Victoria, Australia (33 to 38 μ). The forms from Miocene (or older) samples of borehole Birregurra 1 (Victoria) are somewhat larger (up to 44 μ in diameter). Our species differs in surface ornament from the granulate Australian specimens.

In shape and in the presence of a low membrane, the new species resembles *C. pachytheca* Eisenack, described (1957, p. 244, Pl. 19, Fig. 4) from the Swabien Liassic. In Fig. 4b, l. c., even some spines are seen on the outline of the test. The Hungarian specimen is much smaller, thinner-walled, with lower spines; in its wall, no pores could be observed.

Remarks: Only one specimen has been encountered so far.

A similar fossil of 37 μ size has cropped up in an Upper Pannonian sample (No 4, depth 147.5 to 148.5 m, borehole Hidas 53).

Cymatiosphaera elliptica n. sp.

Plate IV, Fig. 6, 9

Holotype: Magyaregregy, Locality Almáspatak II, sample No 1, slide 2, 32.5×110.2.
Locus typicus: Magyaregregy.
Stratum typicum Helvetian; tuffaceous clay, clay-marl, fish-scale sequence, 0.10 to 0,20 m.

Diagnosis: Body of 26 μ size; surface split up by a low membrane into about 25 polygonal fields. The wall, 1 μ thick, is slightly swollen in the middle of the fields. Minute spines 1.5 μ tall rise at the intersections of the membranes. Besides the holotype, a few specimens have been encountered in various samples from Mecsek Mountains localities.

Differential diagnosis: As to size and morphology, the new species recalls *C. punctifera* described by Deflandre et Cookson (1955, p. 289) from the Australian Lower Eocene, *C. eupeplos* (Valensi 1948) Defl. 1954 (l. c.), occurring in Australia from the Lower Eocene to the Middle Miocene, and *C. parva*, described by Sarjeant (1959, pp. 342–343) from the Jurassic of England. It differs from all these by its elliptical shape. The fields on its surface are smaller and denser than those of *C. parva* and *C. punctifera*; from the latter it also differs by the presence of the minute spines. *C. eupeplos* is distinguished from the new species by its thicker wall and its spines.

Hyaline warty sphere („Hyaline Warzenkugel")

One specimen of 37 μ diameter in the Upper Pannonian of borehole Hidas 53 (197.5 to 198.5 m depth). Under the name *"hyaline Warzenkugel"*, similar forms were mentioned and figured from the Wallensen lignite of Reuver age by Altenhenger (1959, p. 51, Pl. 7., Figs. 1–7) who held them for remains of hystrichosphaerids, redeposited from the Mesozoic. The present paragraph is merely to indicate their presence in our material. In my opinion, they are planktonic organisms.

Familia: Leiosphaeridae EISENACK 1954
Genus: *Leiosphaeridia* EISENACK 1958

Leiosphaeridia sp. *1.*
Plate VI, Fig. 1, 5

Body elliptic, of 53 μ diameter; wall thin, strongly warped, finely granulate. It fully agrees with both the description and the photo of *Protoleiosphaeridium diaphaneum* described from the Canadian Upper Devonian by STAPLIN (1961, Pl. 48, fig. 8). Owing to the enormous distance both in space and time, one cannot do better than just mention the coincidence. Still, the redeposition of our fossil from the Mesozoic is most likely. It was encountered in the Tortonian lignitic sequence of borehole Hidas 53 (630.8 to 632.0 m depth).

Leiosphaeridia sp. *2.*
Plate V, Fig. I

Body 86 μ long, 50 μ wide, elliptic; wall smooth, thin, warped.

One specimen in light grey clay-marl, in the Helvetian "fish-scale sequence" of borehole Komló 120 (depth 178.0 to 178.8 m).

Familia: Leiofusidae EISENACK 1938
Genus: *Leiofusa* EISENACK 1938

cf. *Leiofusa* sp.
Plate VII, Fig. 2

Body 119 μ long and 45 μ wide. The figured specimen is taperingly rounded at both ends; wall 2 μ thick, warped. Morphologically, the form agrees with the genus *Leiofusa*, established by EISENACK 1938, p. 28 for forms occurring in the Silurian. The form has probably been redeposited from the Palaeozoic. According to J. ORAVECZ (private communication), the Szalatnak borehole drilled in the northern foreland of the Mecsek Mountains has traversed some Silurian deposits, in which ORAVECZ has found remains of some planktonic organisms. However, owing to the highly carbonified, metanthracitic preservation of these, it is unlikely that the form in my material should have derived from the Silurian. The limestone and calcareous phyllite overlying the Silurian in the Szalatnak borehole is Devonian: according to ORAVECZ, these may have constituted the most rock from which our fossil has been redeposited.

A few specimens of similar morphology were encountered in the Pannonian of borehole Hidas 53. The figured form has come from a Upper Pannonian light grey clayey marl at 147.5 to 148.5 m depth.

Genus: *Pyxidiella* Cookson et Eisenack 1958

Pyxidiella sp.

Plate VI, Fig. 6

Bodies 40 to 44 μ long, 33 to 36 μ wide, ellipsoidal. Wall 3 to 4 μ thick, uneven owing to dense verruca-like prominences that appear 2 μ tall on the wall rim. The bodies bear no aperture, only some warpings of peculiar form.

They resemble *Leiosphaera scrobiculata*, described by Deflandre and Cookson (1955, p. 291) from Upper Cretaceous and Lower Eocene localities of S and SW Australia. Later on, Cookson and Eisenack (1958, p. 52) referred the form to their newly established *Pyxidiella* genus. Gerlach (1961, p. 210) mentions the presence of the species in his material too. Because of the above-outlined circumstances, we do not identify our finds with the species. Their redeposition from more ancient strate is probable. Two specimens, encountered in the Pannonian of borehole Hidas 53 (at 73.3 to 89.5 and 298.0 to 299.1 m depth, respectively), disappeared during the fixation of the slides, so that they cannot be submitted to a closer scrutiny.

Genus: *Tytthodiscus* Norem 1955

Tytthodiscus mecsekensis Nagy 1965

Plate VIII, Fig. 3

1965. *Tytthodiscus mecsekensis* n. sp. — Nagy in Acta Bot. XI. p. 206. III. 12–14. Holotype and diagnosis.*

Borehole Zengővárkony 59: "Schlier" sequence 34.0 to 37.5 m depth.

Tytthodiscus sp.

Body 25 μ in diameter; wall about 2 μ thick, made up of an aggregate of minute tubules whose apertures go clean through the entire wall. The inside diameter of the tubules is about 0.5 μ. Wall thickness is about one-twelfth of the diameter.

One specimen is the Helvetian fish-scale sequence of borehole Hidas 53 (983.0 to 984.5 m depth).

* There is a misprint in the diagnosis: in the 11th row from the top, the relation of wall thickness to diameter is 1:21 rather than 2:1.

Genus: *Crassosphaera* Cookson et Manum 1960

Crassosphaera concinna Cookson et Manum 1960

Plate VII, Fig. 1

Description: Roundish bodies of 70 to 100 μ diameter, often warped or torn open after the death of the organism. Wall 3 to 4 μ thick; i. e. the forms are not thick-walled, not even relatively. On the surface, the subcircular and hexagonal projections have minute axial tubules at their centers. One of the specimens in sample No 13 of borehole Zengővárkony 59 (Plate VII, Fig. 1) is of 81 μ diameter, with a wall 3 to 4 μ thick: the projections are 1.5 μ wide at their bases and about 0.5 μ tall. In this specimen, the projections are arch-connected. In another specimen of 70 μ diameter, both the wall thickness and the projections are smaller, in line with the smaller diameter. This species, indicating a marine facies, was encountered in some samples from 28.6 to 37.5 m depth in the "schlier" sequence of borehole Zengővárkony 59.

Remarks: The wall thickness of *Crassosphaera* is, undoubtedly, a function of body size to some extent. In *Crassosphaera*, "The wall is ornamented with prominences or projections" (l. c., p. 5). Some authors are inclined to relegate even forms exhibiting some morphological differences into the same species: e. g. "The prominences ... in profile appear as low arches or short, straight-sided papillae" (l. c., p. 6). Also in our material (see above), specimens of such morphology have been encountered. The Upper Pannonian of borehole Hidas 53 (73.3 to 89.5 m depth) has also yielded smaller specimens of 33 to 51 μ size, but the slide got ruined and the photos themselves do not permit the establishment of a new species.

Genus: *Cooksonella* Nagy 1965

Cooksonella circularis Nagy 1965

1965. *Cooksonella circularis* n. g. n. sp. — Nagy 1965 — in Acta Bot. XI. pp. 206–208; IV. 16–19. Generotype and diagnosis.

Occurrence: In the fish-scale sequence of borehole Zengővárkony 59 (67.5 to 70.5 m depth); in the fish-scale-bearing clayey marls of the Kisrét ravine Magyaregregy; also in brackwater deposits of the Pannonian.

Genus: *Margosphaera* NAGY 1965

Margosphaera velata NAGY 1965
Plate VII, Fig. 4

1965. *Margosphaera velata* n. g. n. sp. NAGY — in Acta Bot. XI. pp. 208–209. V. 23–25. Generotype and diagnosis.

In the "schlier" sequence of borehole Zengővárkony 59 (30.9 to 34.0 m depth).

Genus: *Ceratocystidiopsis* DEFLANDRE 1937

? *Ceratocystidiopsis* sp.
Plate V, Fig. 7

Gossamer-like triangular membrane; diagonal dimension 107 μ. It has three tapering apices, one recurved. It exhibits warpings and gashes of considerable size, through which a central body could have found egress. Supposing this, our specimen would fit even as to size into e. g. *Ceratocystidiopsis* DEFLANDRE 1937 (Mircofossiles des silex crétacés, II., Ann. Paléont. XXVI. pp. 41–42). One specimen in the Tortonian lignitic sequence of borehole Hidas 53 (590.7 to 592.3 m depth).

Genus: *Cystidiopsis* NAGY 1965

Cystidiopsis certus NAGY 1965
Plate III, Fig. 4–5

1965. *Cystidiopsis certus* n. g. n. sp. NAGY — in Acta Bot. XI. pp. 209–210, V. 27–30. Generotype and diagnosis.

This organism, considered a "*Dinoflagellata* cysta" by KUPRIANOVA, was encountered in the "schlier" sequence of borehole Zengővárkony 59 (30.9 to 34.0 m depth), and likewise in the "schlier" sequence of borehole Hidas 53 (755 to 757 m depth).

Genus: *Thalassiphora* EIS. et GOCHT 1960

Thalassiphora pelagica (EIS. 1954) EIS. et GOCHT 1960

Plate IX, Fig. I

Full size 120 by 83 μ; that of the central body, 58 by 39 μ. The central body beare pronounced longitudinal thickenings of the wall, up to 3 and even 6 μ. Some of these are wavy, and some continue also on the membrane, up to the margin of the latter. There are branchings, described as root-like ("würzelartig") by some authors, both in the transversal direction and in intermediate directions. The membrane is much more transparent than the body; it is double-walled with a slightly wavy rim. It exhibits neither a pylome, nor projections. The absence of the latter might be due to the fact that the portion, perpendicular to the median ridge, shown in EISENACK and GOCHT, 1960, Fig. on p. 513 is missing from the membrane. The specimens described by EISENACK 1954 (p. 71) are bigger: their full diameter varies from 144 to 196 μ.

Two specimens from grey Sarmatian clay, borehole Hidas-53, 534 to 537 m depth.

EISENACK et GOCHT (1960, p. 515) state *Thalassiphora pelagica* to be typical of the European Tertiary.

Genus: *Heliospermopsis* NAGY 1965

Heliospermopsis hungaricus NAGY 1965

Plate VIII, Fig. 4–5

1965. *Heliospermopsis hungaricus* n. g. n. sp. NAGY — in Acta Bot. XI. pp. 204–205, V. 20–22. Generotype and diagnosis.

One specimen in a grey sand of the Lower Helvetian limnic sequence of borehole Pusztakisfalu VI. (15.0 to 17.0 m depth*).

It is hard to say anything specific about the ecologic requirements of a form of which only one specimen is known. The possibility of redeposition has also to be envisaged, particularly so as, despite its freshwater origin, the deposit contains some foraminifera, too.

* In Acta Botanica, p. 205, 10th line from the top, the erroneous figure 17.0 to 17.5 m is to be corrected.

Genus: *Kalyptea* COOKSON et EISENACK 1960

Kalyptea sp.
Plate VI, Fig. 4

Description: Body 88 by 78 μ, oval; wall finely rugulate, appearing granulate on the margin, with a pointed projection of 15 μ length. The body is encircled by a thin gossamer-like membrane. The full size of the specimen is 104 μ. The body is broken and the membrane fairly crumpled, so that its original position relative to the body is hard to establish.

One specimen in sample No 49, slide No 2, 38.9×103, in a calcareous sandstone of the Leitha limestone sequence of borehole Hidas-53 (711 to 713 m depth).

Owing to the poor preservation of the specimen, it would not be justified to give a more detailed diagnosis. By the description and figure, our specimen is fairly similar to *Kalyptea monoceras* COOKS. et EIS. (1960, p. 257) from the Australian Jurassic. If this similarity should reflect an affinity, then the specimen in our material would suggest redeposition from the Jurassic.

Genus: *Hexagonifera* COOKS. et EIS. 1961 em. COOKS. et EIS. 1962

cf. *Hexagonifera chlamydata* COOKS. et EIS. 1962
Plate VI, Fig. 3

Full size 91 by 70 μ; size of the internal shell 85 by 65 μ. Our specimen fits the description by COOKSON et EISENACK (1962, Micropaleont. 8, 4, p. 496) except that it is slightly smaller. Half of the body is broken up, so that the hexagonal cover is invisible.

One specimen in sample No 53 from Seam II, Hidas mine. Since the species has originally been described from the Cretaceous, I have identified it as a "cf." Redeposition is possible.

Genus: *Hidasia* NAGY 1965

Hidasia duigana NAGY 1965

1965. *Hidasia duigana* n. g. n. sp. — NAGY — in Acta Bot. XI. p. 212. V. 26, VI. 32–33. Generotype and diagnosis.

A few specimens in the marine Miocene of borehole Hidas-53.

Hidasia duigana Nagy f. *magna* n. f.

Plate III, Fig. 3

Form type: Borehole Hidas 53, sample No 13, slide No 2, 41.6×112.1.
Locus typicus: Hidas.
Stratum typicum: Greenish-grey clay-marl, Sarmatian, 444,0 m depth, borehole Hidas 53.

Diagnosis: Body 53 by 43 μ; wall very thin, strongly warped, intensely refractive. The minute wrinkles sometimes run out in small zigzags. Also in this form, the pentagonal shape due to warping is typical.

Differential diagnosis: Highly similar to *Hidasia duigana* Nagy, but much larger.

A few specimens have been encountered.

Hidasia flexibilis n. sp.

Plate V, Fig. 2–3

Holotype: Borehole H.-53, sample No 11, slide No 4, 30×120.2.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, dark grey clay-marl, depth 479.1–482.0 m, borehole H.-53.

Diagnosis: Body 42 by 32 μ, roundish; wall highly refractive, less than 1 μ thick, finely granulate. Crumpling presumably secondary.

Differential diagnosis: Distinguished from *Hidasia duigana* Nagy by a somewhat thicker wall, larger size and granulation.

Remarks: Organisms with similar wall structure, in the 30 to 40 μ size range, variously warped and crumpled, occur in marine deposits throughout the Middle Miocene. Further observations may lead to a more detailed knowledge and possible subdivision of these fossils.

Hidasia velata n. sp.

Plate V, Fig. 8

Holotype: Borehole H.-53, sample No 11, slide No 4, 36.3×115.8.
Locus typicus: Hidas.
Stratum typicum: Dark grey clay-marl, Sarmatian, 479.1 to 482.0 m depth, borehole H.-53.

Diagnosis: Body roundish, of 25 by 21 μ size, wall strongly refractive, colourless, very thin with very fine wrinkling.

Differential diagnosis: The size would correspond to bladderless coniferous pollen, *Taxodiaceae-Cupressaceae* in particular (25 to 30 μ), but the wall of the new species is thinner and its optical refractivity much stronger.

Remarks: Moderately abundant but quite persistent throughout the Middle Miocene.

Genus: *Savitrinia* Nagy 1966

Savitrinia miocaenica Nagy 1966
Plate II, Fig. 2

1966. *Savitrinia miocenica* n. g. n. sp. — Nagy — in The Palaeobotanist 1966. Vol. 15, Nos. 1–2, p. 40. Pl. 2. Figs. 1–8. Generotype and diagnosis.

About 5 specimens of a planktonic organism; fossils consisting of a central body and a membrane. From a fine-sandy clay next to Seam II of Hidas mine.

Savitrinia magna Nagy 1966
Plate VII, Fig. 3

1966. *Savitrinia magna* n. sp. — Nagy — in the Palaeobotanist 1966. Vol. 15, Nos. 1–2. p. 40. Pl. 1. Figs. 4–5. Holotype and diagnosis.

One specimen in a clay-marl from the lignitbearing sequence of borehole Hidas 53 (630.8 to 632 m depth).

Genus: *Fülöpia* Nagy 1965

Fülöpia fimbriata Nagy 1965

1965. *Fülöpia fimbriata* n. g. n. sp. — Nagy — in Acta Bot. XI. pp. 210–211. Generotype and diagnosis.

One specimen from a clay-marl in the fish-scale bearing sequence of borehole Zengővárkony-45 (16.4 to 17.2 m depth). Presumably a marine planktonic organism.

Genus: *Ovoidites* R. Pot. 1951

Ovoidites ligneolus (R. Pot. 1931) R. Pot. 1951

For a list of synonyms see Nagy 1958, pp. 103–104.

Since 1931, this form has in numerous instances been recorded either as a pollen or as a spore.

It was R. POTONIÉ who in 1951 gave the name *Ovoidites ligneolus*, without any justification. It has been considered a zoofossil by THOMSON et PFLUG (1953, p. 113). A fairly comprehensive review covering also the various opinions concerning the origin of this fossil was given by KRUTZSCH (1959, pp. 249–254).

The few specimen encountered so far cropped up in fresh-water deposits. Morphologically, a smooth (perhaps more intensely corroded) variant and another, ornamented one with a positive reticulum, can be distinguished. The thickness of the outer wall is also different, 3 to 4 μ in the thicker and about 1 μ in the thinner variant.

cf. *Ovoidites ligneolus* R. POT., *smooth form*

Largely elliptic forms 54 to 107 μ long, 30 to 48 μ wide. Wall 1 to 2 μ thick. Some are split open, others exhibit secondary warping. Presumably planktonic organisms, present throughout the Mecsek Mountains Miocene. Most abundant in the Pannonian. (As to occurrence and range see KRUTZSCH 1959, pp. 249–254). Their abundance in Pannonian deposits was stated by WEYLAND, PFLUG et MUELLER (1960, pp. 81–82) who placed these forms into the genus *Monocolpopollenites*.

Genus: *Tetraporina* NAUMOVA 1937

Tetraporina quadrata BOLCHOVITINA 1953
Plate II, Fig. 5

1953. *Tetraporina quadrata* BOLCHOVITINA — in Trudy Inst. Geol. Nauk. 145. Geol. Ser. (No 61) p. 102, XVI. 43.
1958. *Tetraporina quadrata* BOLCHOVITINA — in NAGY, MÁFI Évkönyv, XLVII, 1. p. 102 and 230.* Pl. II. Fig. 2.

In our material the form has been encountered in the size range of 35 to 43 μ, in full agreement with the diagnosis by BOLCHOVITINA ("Length equal to width—40—45—48 μ. Yellow colour. Outline of the pollen quadrangular, with slightly concave sides and truncated apices, in which latter there are simple pores. Exine thin, surface slightly punctate, sometimes with warping."). In this diagnosis, I consider it necessary to substitute only two words, "pollen" for "body", and "pores" for "pore-like features".

This change of diagnosis is justified by the planktonic nature of the organism, proved also by the wide stratigraphic range of the genus. NAUMOVA has recorded it from the Lower Carboniferous, BOLCHOVITINA from the

* At both places, the size is erroneously given as 4 μ the correct size is 40 μ.

Cretaceous; I have encountered it in the Middle Miocene borehole Hidas-53, 630.8 to 632 m depth, and sample 1 of sem II of Hidas mine. In Hungary, it has further been encountered in the Pliocene (NAGY 1958, l. c.). I consider it a freshwater planktonic organism; so does KRUTZSCH (1961 d, p. 330).

Form A

Plate VIII, Fig. 2

Oval body, 210 μ long, 115 μ wide. Wall thin, smooth, 2 μ thick, torn open at the middle.

A single specimen in a clay marl of the brackish fish-scale-bearing sequence of borehole Zengővárkony-59 (67.5 to 70.5 m depth).

Form B

Plate VIII, Fig. 1

Oval body, 190 μ long, 122 μ wide where it is widest. Wall 2 μ thick, irregularly wavy, finely granulate. Warping is observed parallel to the long sides of the body, but also farther inwards.

One specimen from the fish-scale-bearing sequence of borehole Komló-120 (374.7 m depth).

Phylum: **CHRYSOPHYTA**
Classis: **Bacillariophyceae (Diatomae)**
Subclessis: **Centricae**
Familia: Eupodiscaceae
Genus: *Actinocyclus* EHRENBERG 1838

Actinocyclus octonarius EHRENBERG 1838

Several specimens ranging from 55 to 73 μ in diameter in some samples, but particularly in the fish-scale-bearing sequence of borehole Zengővárkony-59 (67.5 to 70.5 m depth).

According to M. HAJÓS the species occurs in near-shore brackwater deposits.

Phylum: **CHLOROPHYTA**
Classis: **Chlorococcales (Protococcales)**
Familia: Botryococcaceae
Genus: *Botryococcus* KÜTZING 1849

Botryococcus braunii KÜTZG.
Plate III, Fig. 6

Colonies of 20 to 100 μ size, consisting of individual cells of roundish shape and 5 to 15 μ size. Fairly frequent in our material at large, it is rather abundant in some samples, e. g. in almost all samples of borehole Zengővárkony-59 and in numerous samples of borehole Hidas-53. The copious literature on *Botryococcus* (COOKSON 1953, pp. 108–110; TRAVERSE 1955, Pollen analysis of the Brandon Lignite . . ., pp. 79–80; and 1955, Micropaleontology 1, 4, pp. 343–350) deals in such detail with the spread of this genus from America to Australia and with its morphology that it is superfluous to enlarge upon it any further. FRÉMY and L. DANGEARD (1938, pp. 115–130) studied fossil *Botryococcus* from the French Tertiary; comparing it with living *B. braunii* KÜTZING they drew the conclusion (l. c. p. 120), that "Ces organismes avaient été précédemment décrits par l'un de nous sous le nom de *Botryococcus elegans* L. DANG. L'étude détaillée de l'espèce actuelle, *Botryococcus Braunii* KÜTZ., montre qu'en réalité l'algue tertiaire ne peut être séparée." These authors have established polymorphism both in the living and in the fossil species: "Les *Botryococcus* de THUIT-HÉBERT présentent, eux aussi, un certain polymorphisme. À côté de colonies assez volumineus et à grandes cupules il en existe d'assez nombreuses qui sont très petites et sur lesquelles les cupules sont étroites, serrées et difficilement discernables, comme dans plusieurs des échantillons actuels que nous avons étudiés" (l. c. p. 132).

The study of living *Botryococcus braunii* KÜTZ. (l. c. p. 131) has raised the problem whether polymorphism represents stages of evolution or whether it is due to ecologic factors such as temperature, light intensity, water composition, pH etc. I had the occasion go make some observations concerning the ecological side of the variability of *Botryococcus*. In the marine sediment of sample 13 of borehole Zengővárkony-59, the cells constituting the *Botryococcus* colony are smaller, their margins jagged. The colonies in the brackwater sediment of sample No 27 consist of larger, smoother-walled cells. The settling of this question will require further research, however.

Familia: H y d r o d i c t y a c e a e
Genus: *Pediastrum* MEYEN 1829

cf. *Pediastrum* sp.

One fragmentary specimen in sample 22 of borehole Zengővárkony-59.

Phylum: **MYCOPHYTA (FUNGI)**

Fungal remains are rather widespread and locally abundant in the Mecsek Mountains Miocene. A small percentage of these belongs to the **Ascomycetes** and an even smaller one to the **Basidiomycetes:** the majority belongs, however, to the **Adelomycetes** *(Fungi imperfecti)*.

I have performed the classification of fungal remains in consultation with mycologist S. TÓTH.

The forms encountered in the Mecsek Mountains material have largely been compared with those recorded in papers on the Hungarian Tertiary (SIMONCSICS 1959 to 1964, KEDVES 1959 to 1964, NAGY 1958).

Classis: **Ascomycetes**

In the opinion of S. TÓTH, a few ascospores can be classed here (e. g. from sample No 2, Seam II, Hidas mine: 26 μ size, borehole Hidas-53, 444.0 m depth: 23 μ size) (Plate IX, Fig. 7, 9). A few ascospores of *X y l a r i a l e s* also belong here (e. g. Magyaregregy Almáspatak, Locality II, Sample 1, 30 and 33 μ size) (Plate IX, Fig. 6).

Also the rather striking forms of the order *M i c r o t h y r i a l e s* are represented in our material:

Ordo: *H e m i s p a e r i a l e s (M i c r o t h y r i a l e s)*
Familia: M i c r o t h y r i a c e a e SACC.
Subfamilia: M i c r o t h y r e a e
Genus: *Notothyrites* COOKSON 1947

Notothyrites setiferus COOKSON 1947
Plate IX, Fig. 11

Flattish hemispherical isolated bodies of wavy rim, 112 to 135 μ diameter, consisting of radial hyphae connected throughout their length. The individual cells making up the hyphae are 4 to 10 μ long and 2 to 4 μ wide. Cell-walls are thin; outer walls are somewhat thicker (2 μ). The dark, ring-shaped pore at the middle is slightly excentric, 10 to 18 μ in diameter. Around the ring there are 3 "setae". According to COOKSON (1947, p. 209), this type bears 8 setae, but fossilization or maceration might change their number. She described this form from the Upper Oligocene of the Kerguelen Islands. I have encountered a few specimens in a clay marl in the 2- to 70-m interval of the main haulage tunnel of Szászvár mine. According to S. TÓTH (personal communication), the species is more frequent today on tropical evergreen plants than at our latitudes.

Classis: **Basidiomycetes**

A spore 22 μ long together with its appendage presumably belongs to the series *Ustilaginales* (in the depth 71.4–73.0 m of borehole Zengővárkony-59, 22 μ size, Plate IX, Fig. 10). A repeatedly encountered small elliptic form might also belong here (borehole Szászvár 8, 26–27 m, 13 μ size, Plate IX, Fig. 5).

Appendix: **Adelomycetes (Fungi imperfecti)**

In the opinion of S. TÓTH, most of our fungal remains belong to this little-known taxonomic unit. Conidia belonging to the *Hyphomycetes* group are fairly numerous. Conidia suggesting *Alternaria* are often encountered e. g. in the 534 to 537 m and 298 to 299.1-m depth intervals of borehole Hidas 53 (Plate IX, Fig. 2) whereas forms of 38 to 72 μ size; abundant enough in the first meter of locality Almáspatak II, resemble *Bacterodesmium*. Conidia of *Hyphomycetes* that cannot be classified with more accuracy (Plate IX, Fig. 12), are numerous. Fungal spores of 27 to 37 μ size in the Miocene sequence of borehole Hidas 53. (Plate IX, Fig. 3–4), also belong to *Hyphomycetes*. Fungal spores belonging to *Fungi imperfecti* have been encountered in all boreholes and all outcrops, too. So have various other remains of fungi, hypha threads etc. (Plate IX, Fig. 8), part of which could be identified as fungal fossils on the basis of the literature.

Owing to the considerable difficulty of identifying fossil fungi, and to poor delimitation of fossil fungi from the living, I prefer not to give any evaluation of the remains in our material.

Phylum: **BRYOPHYTA**

Scarce but fairly persistent, small, roundish spores of 7 to 20 μ size, presumably of bryophytes. ERDTMAN (1957) figured some spores of living species: They were of a similar order of magnitude. The exospore of some of the spores placed here is simple, smooth or very sparsely ornamented like those of the genera *Schistostega*, *Splachnum* and *Voitia* (ERDTMAN 1957, pp. 121–122).

Small spores of similar size but with better developed structural elements occurring in our material include forms with verrucate, reticulate and, seldom, foveolate exine. Similar forms are figured in ERDTMAN 1957 [in connection with the genus *Buxbaumia*, with *Diphysicum foliosum* = *D. fossile* LINDEBERG (p. 102, Fig. 200), with *Hookeria albicans* = *H. albicans lutens* (L.) S. M. (p. 111), with *Polytrichum juniperinum* WILLD. (p. 116, Fig. 235), and with a number of other genera].

Our material has yielded also a few larger moss spores whose structural elements permitted a more precise determination. There were the following.

Classis: **Anthocerotinae**
Familia: Anthocerotaceae

On the four form groups placed by KRUTZSCH (1963, Atlas II, p. 2) to the family *Anthocerotaceae*, *Saxosporites (Saxosporis)* is represented in our material by one species, *Rudolphisporites (Rudolphisporis)* by two, and *Bohemiasporites (Bohemiasporis)* by one (see also KRUTZSCH 1967, Atlas IV–V, p. 16).

Genus: *Saxosporites* W. KR. 1963

1963. *Saxosporis* n. fgen. in KRUTZSCH, Atlas II. p. 4.

Saxosporites hidasensis NAGY 1968
Plate X, Fig. 3, 8

1968. *Saxosporites hidasensis* n. sp. NAGY in Acta Botanica 14, 1–2, p. 113, Plate I, Fig. 1, 3, 5. Holotype and diagnosis.

One specimen in an Upper Pannonian silty clay-marl, 132.5 to 134.8 m depth, in borehole Hidas 53.

Genus: *Rudolphisporites* W. KR. 1963

1963. *Rudolphisporis* n. fgen. in KRUTZSCH, Atlas II. p. 4.

Rudolphisporites rudolphi W. KR. et PACL. 1963

1935. *Anthoceros* cf. *punctatus* – RUDOLPH in B.B.C. p. 328, Pl. 5, Fig. 28.
1959. *Microreticulatisporites rudolphi* n. fsp. W. KRUTZSCH – in Geologie, Beiheft 21–22/1959 p. 159, nomen nudum.
1963. *Rudolphisporis rudolphi* W. KR. et PACLTOVÁ, Atlas II. p. 56. 9.

One specimen of 58 μ size from the Pliocene. RUDOLPH (l. c.) regards as Pliocene the deposit in which he encountered the specimen he described as *Anthoceros* cf. *punctatus*, it is dated as Miocene by KRUTZSCH (1963, Atlas II, p. 56). STUCHLICH (in KRUTZSCH l. c.) recorded the form from Upper Miocene limnic deposits.

Rudolphisporites cf. *rudolphi* W. KR. et PACL. 1963

Plate X, Fig. 9

Roundish spores of 47 to 50 μ size, with spines on their distal side. The spines, occasionally curved, may exceptionally exceed a length of 5 μ. On the proximal side there is a reticulum of foveae of 2 to 4 μ size. The thickness of the exine is 1.5 to 2.5 μ; on larger specimens it tends to be thicker. The line of dehiscence is marked; r = 5. Our forms possess a smaller number of projections more widely spaced than those described by KRUTZSCH. A few specimens in the Helvetian fish-scale-bearing sequence (56 to 60.9 m and 63 to 65 m depths in borehole Zengővárkony-59 and 763.3 to 764.6 m depth in borehole Hidas-53). Presumably, a transition between *R. rudolphi* W. KR. et PACL. and *R. mecsekensis* NAGY.

Rudolphisporites mecsekensis NAGY 1968

Plate X, Fig. 1, 4

1968. *Rudolphisporites mecsekensis* n. sp. NAGY in Acta Bot. 14, 1–2, p. 114, Plate I, Fig. 2, 4, 6. Holotype and diagnosis.

A few specimens in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59.

Genus: *Bohemiasporites* W. KR. 1967

1967. *Bohemiasporis* n. fgen. in KRUTZSCH, Atlas IV–V, p. 16.

Bohemiasporites vaclavensis (W. KR. et PALCL. 1963) W. KR. 1967

1967. *Bohemiasporis vaclavensis* (W. KR. et PACLTOVÁ 1963) n. comb. in Atlas IV–V, p. 96, Pl. 30, 1–6.

Trilete spore of 48 μ diameter, with a low reticulum on the distal side, and low verrucalike prominences at the intersections of the reticular lines. The wall of the reticulum is of uneven thickness. Adjacent to the thin line of dehiscence that reaches down to the equator and splits up near it, there is a torus-like formation. Wall thickness without spines 1 to 1.5 μ.

Two specimens in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59.

Besides the genera described by Krutzsch, the following can be classed on a morphological basis with the family *Anthocerotaceae:*

Genus: *Phaeocerosporites* Nagy 1968

Phaeocerosporites baranyaensis Nagy 1968

Plate X, Fig. 5–6, 12, Plate XI, Fig. 3

1968. *Phaeocerosporites baranyaensis* n. g. n. sp. Nagy, in Acta Bot. 14, 1–2, p. 117, Plate I, Fig. 7–8. Generotype and diagnosis.

A few specimens in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59, and in the "schlier" and fish-scale-bearing sequences of borehole Hidas-53.

Phaeocerosporites transversus Nagy 1968

Plate XI, Fig. 1–2, 4

1968. *Phaeocerosporites transversus* n. sp. Nagy in Acta Bot. 14, 1–2, p. 118, Plate II, Fig. 1–2. Holotype and diagnosis.

Three specimens in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59.

Classis: **Hepaticae**
Ordo: *Marchantiales*
Familia: Ricciaceae
Genus: *Ricciaesporites* Nagy 1968*

Ricciaesporites hungaricus Nagy 1968

Plate XII, Fig. 1

1968. *Ricciaesporites hungaricus* n. g. n. sp. Nagy in Acta Botanica 14, 1–2,* p. 120, Plate III, Fig. 1–3 and Plate IV, Fig. 1. Generotype and diagnosis.

Three specimens in a clay marl of the fish-scale-bearing sequence of borehole Zengővárkony-59 (51.3 to 65 m depth).

*The "trilet" word must be corrected to "triangular" in the original description. The new genus differs from Rouseisporites genus (Pocock 1962) in some morfological speciality and mostly in its bigger dimensions, perhaps they are different points of a development.

Ricciaesporites transdanubicus NAGY 1968
Plate XII, Fig. 2

1968. *Ricciaesporites transdanubicus* n. sp. NAGY in Acta Botanica 14, 1–2, p. 124, Plate IV, Fig. 2 and Plate V, Fig. 1. Holotype and diagnosis.

Two specimen in a clay marl of the fish-scale-bearing sequence of borehole Zengővárkony-59 (56 to 65 m depth).

Classis: **Musci**
Subclassis: **Sphagnidae**
Familia: S p h a g n a c e a e
Genus: *Stereisporites* THOMSON et PFLUG 1953

In 1934 (5, p. 11) R. POTONIÉ described a small spore by the name *Sphagnaceae ? Sporites stereoides,* which he compared with a living *Sphagnum* sp. The valid genus belonging to this name was established in 1953 by THOMSON et PFLUG.

Stereisporites subgenus *Stereisporites cyclus* W. KR. 1963
ssp. *microcyclus* W. KR. 1963
Plate X, Fig. 2, 7

A rounded triangular spore of 23 μ size. Its light-coloured exine is thin (about 1.5 μ). Equatorial outline smooth; surface intragranulate. Line of dehiscence thin, slightly wavy, reaching down to the equator. Its junction of the equator is marked by a slight thickening.

One specimen in the terrestrial Lower Helvetian of borehole Szászvár-8 (26 to 27 m depth).

Botanically, this species is presumably a *Sphagnum.*

KRUTZSCH established in 1963 (Atlas III, p. 40) the subspecies *Stereisporites (Stereisporites) cyclus microcyclus* for forms found in the Pliocene of Rüterberg.

Stereisporites subgenus Stereigranisporites granulus W. KR. et SONTAG 1963

1963. *Stereisporites (Stereigranisporis) granulus* n. fsp. W. KR. et SONTAG in KRUTZSCH, Atlas III. p. 86. 16.

Spore trilete, of 22 μ size; wall thin (1 μ). On the somewhat tilted spore, the observable apical thickening is very slight. Outline somewhat wavy. The margin of the exine exhibits lobelike constrictions, perhaps the traces of injuries. Line of dehiscence is very short. The ornament consists of small non-uniform granula.

One specimen in a clay of the Tortonian "schlier" of borehole Hidas-53 (757 to 759 m depth).

The species has been described by KRUTZSCH et SONTAG (1963, Atlas III, p. 86) from a sample of the Middle Miocene lignite sequence of Lausitz; it has cropped up in samples of the same age from several other German localities.

Subclassis: **Bryidae**
Ordo: *P o t t i a l e s*
Familia: E n c a l y p t a c e a e
Genus: *Encalyptasporites* NAGY 1968

Encalyptasporites pliocaenicus NAGY 1968
Plate XIII, Fig. 2

1968. *Encalyptasporites pliocenicus* n. g. n. sp. NAGY, in Acta Botanica, 14, 1–2, p. 126, Plate VIII, Fig. 1–3. Generotype and diagnosis.

One specimen from the Upper Pannonian of borehole Hidas-53 (132.5 to 134.8 m depth).

Phylum: **PTERIDOPHYTA**

Also in classifying pteridophyte spores, I have primarily taken into consideration the phylogenetic system of plants. The frequent revisions of the system, the extent of the order *Filicales* and the meagre knowledge of their spores did not make this task an easy one.

Difficulties are enhanced when studying a fossil material by the suspicion of extinct taxonomic units and by the almost lacking knowledge of tropical and subtropical florae.

Within the broad outlines of the natural system, I have had recourse to the artificial ones set up by R. POTONIÉ and KREMP (1954), R. POTONIÉ (1956, 1958, 1960) and W. KRUTZSCH (1959b, 1962, 1963), changing them here and there in favour of the natural system. I have thoroughout referred to known and supposed botanical affinities, if any.

Some spores have been revealed by a closer scrutiny as redeposited from older sediments, just as has been the case with the algae. This uncertainty is enhanced whenever the genus is represented by a species unknown characterizing a more ancient epoch (Palaeozoic, Mesozoic), but hitherto. A definite standpoint as to the redeposition of these will be possible only when the species in question will be encountered in pre-Miocene deposits, either in Hungary or abroad.

Classis: **Lycopsida** or **Lycopodineae**
Ordo: *L y c o p o d i a l e s*
Familia: L y c o p o d i a c e a e
Genus: *Verrucingulatisporites* KEDVES 1961

Verrucingulatisporites murireticulatus NAGY 1963

1963. *Verrucingulatisporites murireticulatus* n. sp. NAGY — in Acta Botanica IX. 3–4, p. 394. Type specimen and diagnosis.

One specimen in 26 to 27 m depth in borehole Szászvár-8; the reticulum on its distal side suggests the family *Lycopodiaceae* (Fig. 5).

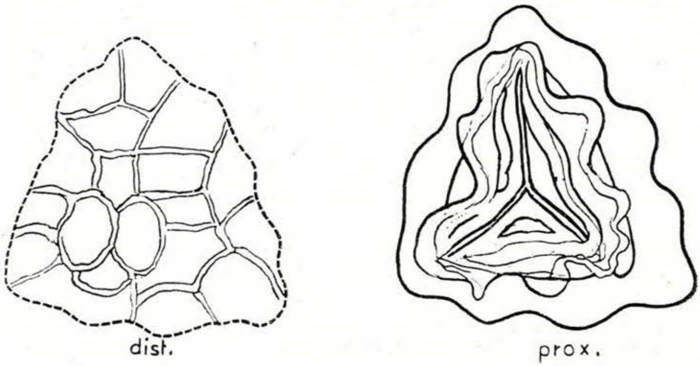


Fig. — ábra 5. Verrucingulatisporites murireticulatus NAGY

Ordo: *S e l a g i n e l l a l e s*
Familia: S e l a g i n e l l a c e a e

The species belonging to the genus *Echinatisporites* of the morphological nomenclature are generally held for belonging to this family.

Concerning some of the species, there is some incertitude as to botanical affinity. Enumerating species by species all relevant information available I have retained the unity of this morphological category.

Genus: *Echinatisporites* W. KR. 1959

1959. *Echinatisporis* n. fgen. W. KRUTZSCH in Geologie Beiheft 21/22, 1959. p. 132.

Echinatisporites cycloides W. KR. 1963

1963. *Echinatisporis cycloides* n. fsp. W. KRUTZSCH in Atlas III. p. 108. Pl. 35.

A spore of 66 μ diameter, densely strewn with spines of 3 to 5 μ length. Equatorial outline roundish. Wall thin (about 1 μ). Line of dehiscence thin, straight; length about 4/5 of the radius.

One specimen in a sample taken at Zobákpuszta from the Helvetian fish-scale-bearing sequence. KRUTZSCH (1963, Atlas III, p. 108) considers it a Chattian form. According to KRUTZSCH most of the German specimens are larger than 45 μ.

Echinatisporites szászvárensis n. sp.

Plate XIII, Fig. 6, 9

Holotype: Borehole Sz. 8, sample No 227, slide No 2, 45.3×115.5.
Locus typicus: Szászvár.
Stratum typicum: Helvetian, dark grey clay-marl from the terrestrial sequence, depth 437.8 to 438.5 m, borehole Sz. 8, secondary.

Diagnosis: Roundish spore of 37 μ diameter, densely covered with spines. These are 5 to 6 μ wide at their base and 4 to 5 μ long, tapering to obtuse points, although some are acute. Line of dehiscence short.

Differential diagnosis: Echinatisporites verruechinus resembles our form in size, shape and in the squatness of its spines, but in KRUTZSCH's species the spines stand less dense and are interspersed with other ornamental elements. Our form resembles in size and shape *Echinatisporis ? chattensis* W. KR. described in 1963 (Atlas III, p. 104) but its spines are different.

One specimen has so far been encountered in our material: even that is presumably redeposited.

Affinity to the family *Selaginellaceae* is presumable.

Echinatisporites hidasensis n. sp.

Plate XIII, Fig. 1, 3, 15–16

Holotype: Borehole H. 53, sample No 18, slide No 1, 41.5×108.8.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, grey clay-marl borehole H. 53, depth 534,0 to 537,0 m.

Diagnosis: Roundish spore of 37 μ diameter, with loosely scattered verrucae and spines on its surface. The rounded verrucae are more numerous than the pointed spines. The exosporium is 1.5 μ thick. Line of dehiscence about one third of the diameter: it is flanked on either side by a torus about 1.5 μ thick.

Differential diagnosis: The specific difference is in the ornament and in the distribution of the ornamental elements. KRUTZSCH's *Echinatisporis* fsp. A (1959, p. 136) also has two sets of ornamental elements, but its spines are longer, more acute and broader-based; also the ornamental elements are more sparse.

Three specimens have been found thus far; besides the holotype, there was one of 39 μ size in the depth interval 763.3 to 764.6 m of borehole Hidas-53, and one of 35 μ size in sample 104 of borehole Komló-120.

Botanical affinity to the *Selaginellaceae* is possible.

Echinatisporites mecsekensis n. sp.

Plate XIII, Fig. 7–8

Holotype: Borehole Zgv. 45, sample No 4, slide No 1, 36.1–115.0.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, limnic sequence, dark grey silty clay, borehole Zgv. 45, depth 16,0 to 16,4 m.

Diagnosis: Trilete spore of 31 μ size, of echinate sculpture. Dense stand of small spines, 1.5 to 2 μ long, acute. Line of dehiscence 5/5. Exosporium about 1 μ.

Differential diagnosis: The new species most resembles *Echinatisporites echinoides grausteinensis* W. KR. (Atlas III, 1963, p. 114). Sizes are equal, but the spines of the new species are smaller, narrowerbased, and of a more delicate structure. Living *Selaginella radiata* (AUBL.) AL. BR. (ERDTMAN 1957, p. 93, Fig. 180) also resembles the new species.

One specimen has so far been found.

The spore presumably represents the family *Selaginellaceae*.

Echinatisporites variabilis n. sp.

Plate XIII, Fig. 4–5

Holotype: Borehole H. 53, sample No 34, slide No 1, 30.1×115.1.
Locus typicus: Hidas.
Stracum typicum: Tortonian, greenish-grey clay-marl, 669.2 to 669.8 m depth, borehole H. 53.

Diagnosis: Spherical trilete spore of 53 μ diameter, covered with a dense stand of spines. Some of these are up to 12 μ long, tapering, 3 μ wide at the base; others are 3 to 4 μ long, acute. Exosporium 1.5 μ thick. The line of dehiscence is about 1/3 of the diameter; it is accompanied on either side by a tapering torus of about 1 μ.

Differential diagnosis: In none of the *Echinatisporites* species thus far described have spines so different in size been observed.

Remarks: Only one specimen in our material; presumably a representative of the family *Selaginellaceae*. The spores of *Selaginella unciata* (DESV.) SPRING. and *S. kraussiana* (KUNZ) A. BR. (ERDTMAN, 1957, pp. 93–94) also have projections of dissimilar morphology, but, otherwise, they differ rather widely from the fossil species.

Classis: **Pteropsida (Filicinae)**
Subclassis: **Eusporangiatae**
Ordo: *O p h i o g l o s s a l e s*
Familia: O p h i o g l o s s a c e a e
Genus: *Ophioglossisporites* n. g.

Generotype: Ophioglossisporites rotundus n. g. n. sp.

Diagnosis: Thick-walled, roundish, trilete spores, whose exine is ornamented with verrucae and foveoles that influence also the outline of the body. Proximal side is smooth or poorly ornamented.

Differential diagnosis: The new genus differs from *Foveotriletes* VAN DER HAMMEN 1954 ex R. POTONIÉ 1956 in that its exine is not densely reticulate with minute pores. From *Microfoveolatisporis* KRUTZSCH 1962, it differs by its thicker wall and larger foveoles.

Remarks: Having studied the spores of living *Ophioglossum lusitanicum* L., *Ophioglossum vulgatum* L., and *O. engelmanni* PRANTL, I am of the opinion that the morphological features of these justify the assumption of a botanical affinity between the genus *Ophioglossum* and the new genus.

Ophioglossisporites rotundus n. g. n. sp.

Plate XV, Fig. 1, 4

Holotype: Borehole Zgv. 59, sample No 14, slide No 2, 38.4×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Tortonian, grey clay-marl from the "schlier", borehole Zgv. 59, depth 34.0 to 37.5 m.

Diagnosis: Roundish, trilete spore of 42 μ diameter. The line of dehiscence does not reach to the equator (it is about 2/3 of the radius). Proximal side smooth, with minute grains of about 1 μ size spaced 5 to 12 μ apart. The distal side bears an ornament, consisting of small foveoles, that looks like a reticulum and lends a wavy outline to the wall of about 3 μ thickness. The wall consists of a thick exosporium (about 2 μ) and an endosporium of about 1 μ.

Remarks: Ophioglossum coriaceum A. CUNN. as figured by ERDTMAN (1957, p 83, Fig. 153) much resembles our species in shape and structural features, but not in size (it is significantly larger). Living *O. falcatum* (PRESL)

FOWLER as described morphologically by SELLING (1946, p. 27, pp. 26–27.), is also highly similar to the new species, but it is less roundish. Of the spores studied by me, that of living *Ophioglossum lusitanicum* L. is closest to, but not identical with, the fossil species.

Besides the holotype, a second specimen of 35 μ diameter has been encountered in the Helvetian limnic sequence of borehole Pusztakisfalu-VI (10.5 to 12.5 m depth).

Ophioglossisporites grandis (COOKSON 1947) n. c.

1947. *Triletes grandis* n. sp. COOKSON — Plant Microfossils from the Lignites of Kerguelen Archipelago p. 137. XVI. 66. 67.

Roundish trilete spores in the 60 to 66 μ size range. Surface unevenly pitted, corrugate, verrucate. Exosporium 1.5 to 3 μ thick, in dependence on the ornamental elements; endosporium less than 1 μ, smooth. Line of dehiscence simple, short, equalling about half the radius in length. A few specimens have been encountered in the Upper Pannonian, 126.6 to 132.5 m depth, of borehole Hidas 53, and in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (51.3 to 56.0 m depth).

Trilites grandis has been described by I. C. COOKSON (l. c.) from the Tertiary of the Kerguelen Islands and referred botanically to *Ophioglossum lusoafricanum* WELW.

Subclassis: **Leptosporangiatae**
Ordo: *Osmundales*
Familia: Osmundaceae
Genus: *Osmundacidites* COUPER 1953

Osmundacidites gemmatus (W. KR. 1959) n. c.

1959. *Baculatisporites gemmatus* n. fsp. KRUTZSCH — in Geologie Beiheft 21/22 1959, p. 142. XXV. 270–271.

According to KRUTZSCH, this form is persistent throughout the Palaeogene.

A few specimens have been encountered in the deeper portions of the Mecsek Mountains Helvetian. The figured specimen is of 50 μ size and has come from depth interval 433.8 to 434.1 m of borehole Szászvár 8.

COUPER (1953, p. 20), discussing the botanical affinities of the genus, suggests the *Osmundaceae* as a probable combination; so does KRUTZSCH (1959b, p. 143). In the course of my studies into the palynology of the Hungarian Pliocene, I had the opportunity to examine a very large number of osmundaceous spores (1958, pp. 32–33); on the basis of this and of the relevant literature I also hold this species to belong to the family *Osmundaceae*.

Ordo: *Filicales*
Subordo: *Simplices*
Familia: Schizaeaceae
Genus: *Cicatricosisporites* R. POT. et GELL. 1933

Cicatricosisporites mecsekensis NAGY 1963

1963. *Cicatricosisporites mecsekensis* NAGY — in Acta Botanica IX. 3–4. pp. 391–392. Holotype and diagnosis.

Two specimens: one in the Upper Pannonian, 118 to 126.8 m depth, of borehole Hidas-53, the other in the Helvetian limnic sequence of borehole Zengővárkony-45 (16.0 to 16.4 m depth). These forms might conceivably indicate a redeposition from the Cretaceous.

Cicatricosisporites minimus NAGY 1963

Plate XIV, Fig. 3, 6

1963. *Cicatricosisporites minimus* n. sp. NAGY — in Acta Botanica IX. 3–4. p. 301. Holotype and diagnosis.

Two specimens, both from depth interval 26.0 to 27.0 m of borehole Szászvár-8.

Cicatricosisporites pannonicus n. sp. asp. *triplanus*

Plate XIII, Fig. 10, 14

Holotype: Borehole Sz.-8, sample No 2, slide No 2, cross table number 34.8×104.9.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, greenish-bluish-grey silty clay, depth 26.0 to 27.0 m, borehole Sz.-8.

Diagnosis: Trilete spore of 34 μ size, in the triplane position. The laesurae of the tetrade mark cannot be observed. Sculpture cicatricose or canaliculate, with four isolated striae; muri spaced 2 μ apart; exosporium 1 to 1.5 μ thick.

Differential diagnosis: The four isolated striae and the density and size of the muri suffice to distinguish the new species from the *Cicatricosisporites* described thus far: *C. australiensis* COOKSON, *C. dorogensis* R. POT. et GELL., and *C. mecsekensis* NAGY are much larger, whereas *C. minimus* is much smaller.

Botanical affinity: perhaps *Schizaeaceae*.

Familia: G l e i c h e n i a c e a e
Genus: *Gleicheniidites* (Ross 1949) W. Kr. 1959

The generic name derives from a monotype species described in 1949 by Ross (pp. 31–32). I agree with Krutzsch (1959b, pp. 109 and subsequent pages) who states that the figured specimens bear tori or krytomes. The morphological subgenera established by Krutzsch (l. c.) are suitable for classifying known forms. I do not, however, refer to *Neogenisporites* Krutzsch 1962 the forms that can be placed into the above genus. In the (Atlas II, 1962, p. 12) Krutzsch states, that the small forms might belong to *Gleicheniidites*.

Gleicheniidites subgenus *Triremisporites* (Delcourt et Sprumont 1957) Dőring 1965

1957. *Triremisporites* n. g. in Delcourt et Sprumont Bull. Soc. Belg. Geol. LXVI. (1957. 1. pp. 61–63.)
1959. *Gleicheniidites (Laticrassisporis)* n. subgen. in Krutzsch, Geologie, Jhg. 8, Beiheft 21/22, p. 113.
1965. *Gleicheniidites (Triremisporites)* Delcourt et Sprumont 1957 in Dőring Geologie, Jhg. 14. Beiheft 47. p. 28.

Gleicheniidites subgenus *Triremisporites umbonatus* (Bolch. 1953) n. c., f. *minor* n. f.

Plate X, Fig. 10, 11

Form type: Borehole Sz.-8, sample No 2, slide No 1, 44.7×104.1.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26.0 to 27.0 m.

Description: This small trilete spore of 17 μ size agrees with the figures and description of Bolchovitina (1953, Plate 7, Figs. 4–7), except that it is much smaller (the mean size of Bolchovitina's specimens is 35 μ). This is the justification for distinguishing a f. *minor*. The form of Bolchovitina is an index fossil of the Aptian in the Soviet Union and also in Hungary. The small form occurred in the Helvetian of Szászvár, in an assemblage of small spores.

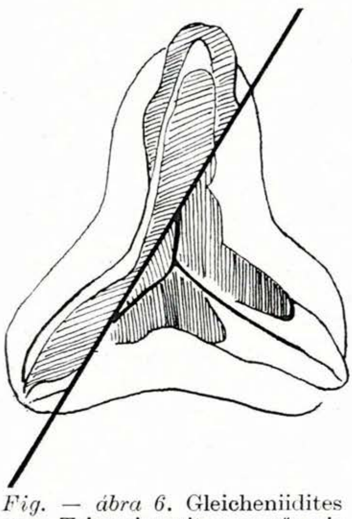


Fig. — ábra 6. Gleicheniidites sgen. Triremisporites zengőensis n. sp.

Gleicheniidites sgen. *Triremisporites zengőensis* n. sp.

Plate XV, Fig. 5–6

Holotype: Borehole Zgv. 59, sample No 23, slide No 1, 45.6×111.4.
Locus typicus: Helvetian fish-scale-bearing sequence, grey silty clay-marl, depth 56.0 to 60.9 m, borehole Zgv.-59.

Diagnosis: Trilete, gleichenioid spore of 28 μ size. Sides concave; at the corners the exine tapers to less than 0.5 μ, whole the thickening is about 4 μ at the middle of the sides. On the proximal side at the corners the straight and thin Y line reaches the equator. On the proximal side, at the contact of the exosporium and the central body there runs a wavy fold. On the distal side there are fused flat verrucae, the proximal side is ornamented by a similar, but more distinct fold (Textfig. 6).

Differential diagnosis: As to size, the new species resembles *Gleichenia nigra* BOLCH., *G. umbonata* BOLCH. and *G. rasilis* BOLCH. (1953, pp. 53–54). Of these, *G. umbonata* and *G. nigra* have spores of concave outline. The new species differs from both by its low verrucae on the distal side.

Only one specimen has so far been encountered.

Subgenus: *Gleicheniidites Triplexisporites* W. KR. 1959

1959. *Gleicheniidites (Triplexisporis)* KRUTZSCH in Geologie, Beiheft 21–22. p. 111. Abb. 24. "E".

Gleicheniidites sgen. *Triplexisporites triplex* (BOLCH. 1953) W. KR. 1959 f. *minor* n. f.

Plate XIV, Fig. 7–9

Form type: Borehole Sz.-8, sample No 7, slide No 1, cross table number 45.7×104.0.

Locus typicus: Szászvár.

Stratum typicum: Lower Helvetian, fine- and mediumgrained sandstone, borehole Sz.-8, depth 83.0 to 83.6 m.

Description: The spore of 20 μ size is much smaller than the mean size of 48 μ given by BOLCHOVITINA. Also the cingulum is proportinally narrower, 3 to 4 μ, as against the 5 to 6 μ indicated by BOLCHOVITINA. As in all other respects the form agrees with that of BOLCHOVITINA (1953, p. 54, Plate 8, Figs. 10–13), I have termed it (Textfig. 7) f. *minor*.

Botanical affinity: probably *Gleichenia*.

A few specimens in the Mecsek Mountains material.

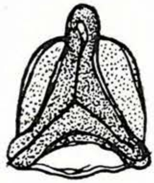


Fig. — ábra 7. Gleicheniidites sgen. Triplexisporites triplex f. minor n. f.

Genus: *Semigleicheniidites* NAGY 1968

Semigleicheniidites duplex NAGY 1968
Plate XIII, Fig. 13, 17

1968. *Semigleicheniidites duplex* n. g. n. sp. — in Acta Botanica 14 (3–4) p. 357. Generotype and diagnosis.

Two specimes in borehole Zengővárkony No-59 in Upper Helvetian fish-scale-bearing sequence, probably redeposited (Textfig. 8).

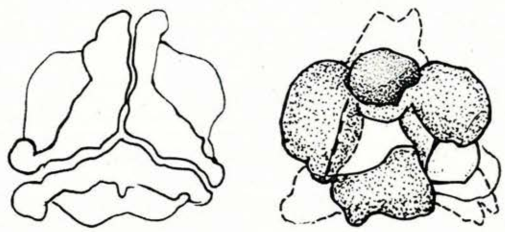


Fig. — ábra 8. Semigleicheniidites duplex NAGY

Genus: *Concavisporites* PFLUG 1953 emend. DELCOURT et SPRUMONT 1955*

The name *Concavisporites* is mentioned by PFLUG (list of legends to Plates, 1952, Pal. Zeitschr. 26, p. 135) and by THOMSON et PFLUG (1952, pp. 14, 16). In 1953, PFLUG (p. 49) classed in this genus the spores that are "meist glatte, seltener strukturierte Sporen, die meist beide, seltener eines folgender Merkmale aufweisen:

a) Torus
b) konkave Äquator-Kontur".

PFLUG stated the entire group to be similar to forms encountered in the *Gleicheniaceae*. DELCOURT et SPRUMONT emended (1955, p. 22) PFLUG's diagnosis as follows: " . . . les *Concavisporites* ont, comme le génotype, et le bourrelet arrondi et le contour concave". I have adopted this latter view, as a concave outline in itself is very little to go on when discriminating a genus.

* POTONIÉ (1956, Synopsis I, p. 15) indicates 1952 as the year of origin of the genus *Concavisporites*, but evidence in literature shows 1953 to be the correct date. PFLUG himself (1953, TH. et PF. p. 49) marked the name "n. g." in 1953, as in 1952 it was only a nomen nudum.

Concavisporites minimodivisus NAGY 1963

1963. *Concavisporites minimodivisus* n. sp. NAGY – in Acta Botanica IX. 3–4, pp. 387–388. Holotype and diagnosis.

One specimen from 398.3 m depth in borehole Komló-120. On a morphological basis, an affinity to the family *Gleicheniaceae* is possible.

The *Concavisporites* species to be described below cannot be referred to the family *Gleicheniaceae:* still, on grounds of morphological similarity, we shall keep them together in want of a better solution.

Concavisporites sp.

Plate XV, Fig. 2–3

Representatives of this form were encountered in the Upper Pannonian (147.5 to 148.5 m depth) and Sarmatian (510.3 m depth) of borehole Hidas-53.

A form group of similar size range was described by KRUTZSCH (1962, Atlas I, p. 102) from the German Pliocene. The forms in the Mecsek material are of similar shape and 27 μ mean size, but bear a torus, which KRUTZSCH's forms do not. As to affinities with living plants, they most resemble *Adiantum tetraphyllum* H. B. WILLD.

Subgenus: *Concavisporites* s. g. *Obtusisporites* W. KR. 1959

1953. *Concavisporites* n. g. PFLUG in Palaeontogr. 94. B. p. 49.
1959. *Concavisporites* (*Obtusisporis* n. subfgen.) W. KR. in Geologie, Bh. 21–22. p. 121.

Concavisporites s. g. *Obtusisporites svatopluki* (PACLT. 1960) W. KR. 1962

1960. *Cingulatisporites svatopluki* n. sp. PALCTOVÁ in Sbornik Ust. Ust. Geol. XXV. 1958. p. 164. II. 6–8.
1962. *Concavisporites (? Obtusisporis) svatopluki* (PACLTOVÁ 1960) n. comb. KRUTZSCH in Atlas I. p. 104. Pl. 45. Fig. 18–20.

One specimen of a trilete spore of 31 μ size in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (depth interval 63 to 65 m, slide No 1, cross table number 35.8×99.6).

I do not agree with the classification of KRUTZSCH; the establishing of a new combination merely on the basis of the concavity of the inner body seems somewhat forced. It would be preferable to separate the spores with "Obtusi-Verfaltung" (KRUTZSCH 1962, Atlas I, p. 12) from the genus *Concavisporites* which is defined on the basis of even more general morphological properties.* But as just one specimen of this genus has been encountered in the Mecsek Mountains material, I think I am justified in not attacking this problem.

The genotype species was described by PACLTOVÁ from a South Bohemian Oligo-Miocene lignite, but in the Hungarian Lias this genus is represented by several species, being redeposition in our material, too.

Familia: Incertae

I have subsumed under this heading those species belonging to the *Filicales* whose closer taxonomic affinities would be hard to establish.

Genus: *Leiotriletes* (NAUMOVA 1939) R. POT. et KR. 1954

Leiotriletes maxoides W. KR. 1962 ssp. *maximus* (PF. 1953) W. KR. 1959b

Plate XVII, Fig. 1, 4

Trilete spores of 75 to 90 μ size. Wall thickness 2.5 to 3 μ on the sides, 4 to 5 μ at the apices. Sclerine two-layered: endosporium twice as thick on the sides and three times as thick at the apices as the endosporium. KRUTZSCH reserves this subspecies for forms larger than 80 μ. Except for a slight difference in size, the specimens in our material fully agree morphologically with those described by KRUTZSCH; it is consequently unjustified to place them elsewhere in the system. A few specimens were encountered in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (60.9 to 65 m depth); some others in sample No 27 of the Leánykő-Főtelep of Magyaregregy.

As to botanical affinities, these forms are usually regarded as species of *Lygodium*. For references see KRUTZSCH (1962, Atlas I, pp. 19–20).

Leiotriletes regularis (PF. 1953) W. KR. 1959

1952 b. *Laevigatisporites neddeni* R. POT. in TH. et PF. 21, 25. Pl. 1, 8, 10–11, Antweil, Palaeocene.

1953. *Laevigatisporites neddeni* R. POT. subsp. *regularis* PFLUG, Pl. 1. Fig. 85–88. (Wehmingen, Palaeocen).

1959. *Leiotriletes regularis* (PF. 1953) W. KR. in Geol. Bh. 21–22. p. 57.

* This idea is due to R. POTONIÉ (1934. 4, p. 36, VI. 1.).

The species was encountered in the lower Helvetian terrestrial sequence of borehole Szászvár-8. The acute apices of the spore of 33 μ size are the results of compression in the direction of the line of dehiscence (as an initial stage of the triplane state).

Leiotriletes maxoides W. KR. 1962 subsp. *minoris* W. KR. 1962

A roundish, trilete spore of 48 μ size. Exine about 1.5 μ thick, slightly thicker at the apices. Line of dehiscence rather short, about 2/3 of the radius.

Occurrence: In sample No 5 of seam II, Hidas mine. Reported by KRUTZSCH from a dubious Lower Miocene or Upper Oligocene, and other Miocene deposits, by PACLTOVÁ from the Oligo-Miocene of Southern Bohemia (KRUTZSCH, Atlas I, p. 16).

Leiotriletes microlepioidites W. KR. 1962
Plate XIV, Fig. 13–14

Slightly concave spores of 26 to 29 μ diameter, some of which exhibit a secondary folding: the sides of these latter may be convex. The exine, 1 μ thick, is double-layered. The thin line of dehiscence sometimes reaches up to the equator. Our specimens are Pannonian (from borehole Hidas-53), as are those from the locus typicus.

Leiotriletes cf. *microadriennis* W. KR. 1959
Plate XV, Fig. 7, 10, 13

Specimens of 53 μ size, crumpled, with a thin exine, resembling the species described by KRUTZSCH from the Geiseltal. Presumably redeposited in the Upper Pannonian of borehole Hidas-53 (73.3 to 89.5 m depth); possibly also in the "schlier" of borehole Zengővárkony-59 (34.0 to 37.5 m).

Leiotriletes wolffi W. KR. 1962 ssp. *wolffi*
Plate XV, Fig. 11–12

Trilete, slightly convex spore of 37 μ size. The line of dehiscence is 4/5 of the radius. Exosporium 1 μ thick, two-layered.

A few specimens in Middle Miocene beds, e. g. in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (56 to 60.9 m depth). KRUTZSCH recorded it from the Oligocene, Miocene and Pliocene, and indicated the Lower Miocene as the stratum typicum. The species is inclined to form sinuous, transitional forms.

Leiotriletes wolffi W. Kr. 1962 ssp. *brevis* W. Kr. 1962

Trilete spores of 32 to 34 μ diameter, with rounded apices. The line of dehiscence is 4/5 of the radius. Exosporium 1 μ thick. On the surface of the spores, near the atrium, a fine granulation is clearly visible, just as on the specimens figured by Krutzsch (1962, Atlas I, p. 29, Plate 7, Figs. 5 etc.). A few specimens have been encountered at 56 to 60.9 m depth in borehole Zengővárkony-59.

I have grouped with these fossils a few forms in the triplane state and a few transitional ones of identical exine structure and size.

Leiotriletes seidewitzensis W. Kr. 1962

A small smooth spore of 24 μ size and slightly convex outline. Wall about 1 μ thick, two-layered. Line of dehiscence about 4/5 of the radius.

One specimen was found in the 6.3 to 7.8 m depth interval of borehole Pusztakisfalu VI; a few other specimens were encountered in the Helvetian fresh-water sequence. The species was described by Krutzsch (1962, Atlas I, p. 30) from the Lower Miocene of Seidewitz.

Leiotriletes miocaenicus n. sp.
Plate XVI, Fig. 4–5

Holotype: Borehole Zgv.-59, sample No 23, slide No 1, 30.5×117.6.
Locus typicus: Zengővárkony.
Stratum typicum: Upper Helvetian fish-scale-bearing sequence grey silty clay-marl, borehole Zgv.-59, depth 56.0 to 60.9 m.

Diagnosis: Trigonal spore of 53 μ size, with rounded apices. Sides straight, slightly convex. Exine about 1.5 μ thick, two-layered, smooth with secondary warping. Line of dehiscence thin, 3/4 of radius, vaguely branching at the end.

Differential diagnosis: Recalls the form described by the name *Toroisporis ? pliocaenicus* (Thg. 1940) W. Kr. 1962 (Atlas I. 1962, p. 86, particularly figures 7, 8, 9). The difference is that the exine of the new species does not thicken at the apices; its line of dehiscence is shorter, and the proximal tori, vague even on Krutzsch's specimens, is completely absent.

Only one specimen has so far been found.

Leiotriletes hidasensis n. sp.
Plate XVI, Fig. 1

Holotype: Borehole H.-53, sample No 8, slide No 2, 29.3×110.3.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, dark grey carbonaceous clay-marl, borehole H.-53, depth 258.1 to 258.5 m.

Diagnosis: Trilete spore, of rounded triangular shape and 60 μ size. Sides straight, slightly concave, or occasionally convex on crumpled specimens. Exine three-layered, smooth about 2 μ thick on the sides, about 3 μ thick at the apices. Line of dehiscence marked, short, about 2/3 of the radius.

Differential diagnosis: As to size, it resembles *Leiotriletes maxoides* W. KR. 1962 ssp. *maxoides* W. KR. 1962 (Atlas I. p. 18), but it is not so rounded, nor does its line of dehiscence resemble that figured by KRUTZSCH (l. c., Plate 2).

A few specimens of 53 to 60 μ size were encountered in our Pannonian material.

Leiotriletes sp. *triplane*

A few triplane forms have been encountered in the samples containing *Leiotriletes* sp. Presumably owing to their position, these could not be identified with any of the known forms.

Genus: *Monoleiotriletes* W. KR. 1959

Monoleiotriletes gracilis W. KR. 1959

Plate XVII, Fig. 2, 5

Smooth trilete spores of 34 to 41 μ size, with rounded apices; their lines of dehiscence do not reach the equator (r about 2/3), their ends may be branching. Some spores are split open along the line of dehiscence, and appear slightly darker about the apex. This is presumably the sign of some ornament. According to KRUTZSCH (1959b, p. 36), "Apexfeld schwach punctat (bzw. intrapunctat)". In 1962 he re-diagnosed this form (Atlas I, p. 44), stating "in Apexnähe mit schwacher Mikrostruktur versehen."

A few specimens in the terrestrial and limnic Lower Helvetian of boreholes Szászvár-8, Zengővárkony-45, and Pusztakisfalu-VI, some of them intensely crumpled. KRUTZSCH described the form from the Eocene of the Geiseltal, but encountered it (l. c.) also in the Miocene of Seidewitz and Muscau.

Botanical affinities: unknown.

Genus: *Divisisporites* PFLUG 1953

Divisisporites sp.
Plate XIV, Fig. 11–12

Small spore of 17 μ size; exine thin (less than 0.5 μ), line of dehiscence reaching to and branching at the equator. Shape truncated at the apices, consequently polygonal. A similar spore was figured by KRUTZSCH (Atlas I, 1962, p. 74) by the name *Divisisporites (Divisisporites)* fsp. A. His spore of 33 μ size turned up in the lower Chattian of Kottbus. Our small spore from 26 to 27 depth, borehole Szászvár 8, was unfortunately destroyed during examination.

Genus: *Undulatisporites* PFLUG 1953

Undulatisporites curvatus n. sp.
Plate XVI, Fig. 6–7

Holotype: Borehole Zgv.-59, sample No 17, slide No 1, 32.2×100.8.
Locus typicus: Zengővárkony.
Stratum typicum: Upper Helvetian fish-scale-bearing sequence, grey clay-marl, borehole Zgv.-59, 41.8 to 44.4 m depth.

Diagnosis: Trilete spore of 52 μ size, strongly rounded. Line of dehiscence thick, threadlike, reaching to the equator, wavy, bifurcating at the end. Exine two-layered, about 1.5 μ thick.

Differential diagnosis: Undulatisporites microcutis described by PFLUG (1953, p. 52) is somewhat smaller (30 to 50 μ) and its Y line does not reach to the equator.

Occurrence: Beside the holotype, one specimen of 60 μ size in the Leánykő sequence, Magyaregregy (sample II of main seam).

Genus: *Spongiosisporites* W. KR. 1959

1959. *Spongiosisporis* n. fgen. W. KR. — in Geologie, Beiheft 21/22. 1959. p. 124.

Spongiosisporites cf. *semispongiosus* W. KR. 1959

1959. *Spongiosisporis semispongiosus* n. fsp. W. KR. l. c., p. 126, XVI., 170–173.

An elongate oval spore of 83 μ size, resembling KRUTZSCH's species. The line of dehiscence is obscured by a fold across the middle of the body. The species was described by KRUTZSCH (1959, p. 126) from the Lutetian of the Geiseltal. It is presumably redeposited in our Pannonian material (147.5 to 148.5 m depth, borehole Hidas 53).

Genus: *Anemiidites* ROSS 1949

Anemiidites echinatus ROSS 1949

Plate XIV, Fig 10

A rounded, triangular trilete spore of 32 μ size, covered with spines. Larger by a few microns than, but otherwise agreeing with, the form described by ROSS.

Encountered in the "schlier" sequence, 44.4 to 44.7 m depth, of borehole Zengővárkony-59, where an Upper Cretaceous *Trudopollis* sp. has already been found. *Anemiidites echinatus* ROSS derives (1949, p. 32) from the Upper Santonian or Lower Campanian of Scania.

Genus: *Baculatisporites* TH. et PF. 1953

Baculatisporites semibaculatus n. sp.

Plate XVII, Fig. 3, 6

Holotype: Borehole Zgv.-59, sample No 23, slide No 2, 35.8×112.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, grey silty clay-marl from the fish-scale-bearing sequence borehole Zgv.-59, depth 56.0 to 60.9 m.

Diagnosis: Roundish trilete spore of 61 μ size. Exosporium thick (about 5 μ). Small bacula, less than 1 μ thick, emerge on the margin of the ectexosporium. On the distal side there are similar bacula sparsely scattered at intervals of 2 to 8 μ. The proximal surface is smooth. The line of dehiscence is 4/5 of the radius, thin, slightly sinuous bifurcating at its very end.

Differential diagnosis: Our spore most resembles *Baculatisporites primarius* (WOLFF 1934) TH. et PF. 1953, which is, however (l. c., p. 66, Pl. 5. Fig 8) much smaller and has a much thicker exine. Also, its bacula are longer and restricted to the distal side.

Besides the holotype is a corroded specimen of 76 μ size from 755 to 757 m depth, borehole Hidas-53 that probably belongs here and, possibly, also a smaller specimen of 43 μ size from 757 to 759 m depth, same borehole.

There is a certain morphological resemblance to *Lycopodium densum* LABILL. whose spores are, however, smaller and less round with projections more spine-like and closer-spaced; also, their line of dehiscence reaches up to the equator.

Genus: *Verrucatisporites* n. g.

Generotype: Verrucatisporites inaequalis n. g. n. sp.

Diagnosis: Azonotrilete microspore, triangular in equatorial outline, ornamented with isolated verrucae and spines.

Differential diagnosis: The genus *Osmundacidites* COUPER differs from the new genus by its round equatorial outline; *Verrucosisporites* differs from it by its coalescing ornamental elements and its lack of spines.

Verrucatisporites inaequalis n. g. n. sp.
Plate XXV, Fig. 7–8

Derivatio nominis: By the ornamental elements, randomly scattered and of unequal size.
Holotype: Borehole Zgv.-45, sample No 5, slide No 1, 35.0×103.9.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian limnic sequence borehole Zgv.-45, depth 17.2 to 17.8 m.

Diagnosis: Azonotrilete spore of 30 to 31 μ size, ornamented with verrucae of non-uniform size and with spines (the diameter of the elements varies from 0.5 to 3 μ). Larger elements, mingled with smaller ones, are grouped along the equatorial outline; there are smaller elements without larger ones about the middle of the equatorial plane. Proximal side smooth. The line of dehiscence is accompanied on either side by two of small verrucae. The inner row is finer and closer-spaced than the outer one.

Only one specimen has so far been encountered.

Botanical affinities: unknown.

Genus: *Lygodioisporites* R. POTONIÉ 1956

A form described in 1934 by R. POTONIÉ as *Sporites solidus* was re-named in 1950 *Lygodium flexuosoides—Typ.—Lygodium ? sporites solidus* (R. POT., TH., THIERG., p. 45). Whereas in this latter paper the name is written with a question mark in the text *(Lygodium ? sporites)*, there is no question mark in the legends to the figures 5. and 6. of Plate "A"; reference is made to R.

POTONIÉ's 1934 paper, in which the species is validly established. However, in 1951 R. POTONIÉ (pp. 138–139) mentioned the basic species from the Eocene of the Geiseltal and also THOMSON's Liblar specimens by the name *Lygodioisporites solidus*. In this same paper, he applied the same generic name to a smooth "*adriennis*" form: consequently, validity should be dated from 1956 only, when POTONIÉ re-diagnosed the genus *Lygodioisporites* and applied the generic name *Lygodiumsporites* to the form "*adriennis*" (POTONIÉ 1956, pp. 20 and 40). In 1953, PFLUG relegated the basic species into the genus *Corrugatisporites* established by IBRAHIM in 1933 (TH. et PF. 1953, pp. 55–56) and distinguished two subspecies: *multivallatus* and *paucivallatus*. KRUTZSCH (1959, pp. 150–151) placed the entire form group into the genus *Trilites*. However, R. POTONIÉ distinguished this latter from both *Lygodioisporites* and *Corrugatisporites* (Synopsis I, pp. 26, 40–41). In the following the species of the genus will be distinguished with PFLUG's two subspecies advanced to specific rank.

Lygodioisporites solidus (R. POT. 1934) R. POT. 1951
Plate XVIII, Fig. 5

1934. *Sporites solidus* n. sp. — POTONIÉ in Arb. Inst. Paläob. 4. p. 42. I. 35.
1950. *Lygodium*? — *spor. solidus* R. POT. — in R. POT., THOMS. et THIERG., Geol. Jb. 65. p. 45. A. 5–6.
1951. *Lygodioisporites solidus* R. POT. in Palaeontogr. 91. B. XX. 12, 13.

The specimen described and figured by R. POTONIÉ as *Sporites solidus* (1934, 4. p. 42, Pl. 1, Fig. 35) is of 36 μ size, smaller than the Hungarian specimen figured here, whose size is 54 μ. POTONIÉ (l. c.) states the proximal side to be fairly smooth and ornament to be restricted almost entirely to the distal side.

The Hungarian specimen agrees also with the form described by KRUTZSCH as *Trilites solidus*, except for a size difference of 10 μ. This size difference apart, I fail to see any distinctive features: nor can I perceive any between the figures of KRUTZSCH's *Trilites* cf. *solidus* and *Trilites asolidus*.

KRUTZSCH states the range of the form (1959, p. 151) to extend from the Lower Eocene to the border of the Oligocene. In the Mecsek Mountains material, a few specimens encountered in the Pannonian are presumably redeposited.

Botanical affinity: presumably *Lygodium*.

Lygodioisporites paucivallatus (PFLUG 1953) n. c.
Plate XVIII, Fig. 6–7

1953. *Corrugatisporites solidus* R. POT. subsp. *paucivallatus* n. subsp. PF. in Palaeontogr. 94. B. p. 56. II. 41–43.

Spore of 35 to 50 μ size, triangular in equatorial outline. The line of dehiscence does not attain the equator; the ornamental elements on its both sides are somewhat coalesced. Otherwise, the ornamental elements are smaller than 2 μ and arranged radially, perpendicularly to the line of dehiscence.

A few specimens in the limnic sequence 6.3 to 7.8 m and 10.5 to 12.5 m depth, of borehole Pusztakisfalu-VI and in 34 to 37.5 m depth in the "schlier" of borehole Zengővárkony-59.

PFLUG considers this form to be Early Tertiary.

Lygodioisporites multivallatus (PFLUG 1953) n. c.

Plate XVIII, Fig. 1, 4

1953. *Corrugatisporites solidus* R. POT. subsp. *multivallatus* n. subsp. PF. in Palaeontgr. 94. B. p. 56. II. 27. 40.

Trilete spore of 33 to 51 μ size, with rounded apices. The verrucae form a fairly dense stand, coalescing particularly along the Y line. The ornamental elements occasionally exceed the height of 2 μ at the apices and coalesce almost lobe-fashion.

Frequent particularly in the Helvetian limnic sequence of borehole Zengővárkony-45 (16.4 to 17.8 m depth and in 6.3 to 7.8 m depth in borehole Pusztakisfalu-VI).

PFLUG considers the form to range from the Rhine Valley lignites to the Reuver.

Genus: *Trilites* ERDTMAN 1947, COOKSON 1947 ex COUPER 1953

Trilites sp.

Plate XXV, Fig. 2–4

A fragment of 22 μ size of a small roundish azonotrilete spore found in greenish-bluish grey Helvetian silty clay in borehole Szászvár-8 (26 to 27 m depth). Wall thickness 1 μ, almost impossible to measure owing to the heavy sculpture. The ornamental elements—broad-based spines—are rather randomly scattered on both hemispheres, locally coalescing palisade-fashion. The height of the spines is uneven but less than 3 μ. The line of dehiscence is obscured by the ornament.

Genus: *Duplexisporites* (Deák 1962) Playford et Dettmann 1965

Duplexisporites toratus (Weyland et Greifeld 1953) Playford et Dettmann 1965

Plate XVIII, Fig. 8, Plate XIX, Fig. 1, 6

Trilete spores of 40 to 50 μ size, and rounded triangular shape; surface corrugate, with a cingulum. In the beds directly overlying the Cretaceous in borehole Hidas-53, but also in beds higher up (in the depth intervals 1,017 to 1,019, 837.9 to 839, 534 to 537, and 134.8 to 135.5 m) redeposited.

Genus: *Leptolepidites* Couper 1953

Leptolepidites baranyaensis Nagy 1963

1963. *Leptolepidites baranyaensis* n. sp. Nagy in Acta Botanica, IX. 3–4, pp. 388–389. Holotype and diagnosis.

One specimen in the Helvetian limnic sequence of borehole Zengővárkony-45 (16.4 to 17.2 m depth). Morphologically similar to the genus *Leptolepia*.

Leptolepidites magnipolatus Nagy 1963

1963. *Leptolepidites magnipolatus* n. sp. Nagy in Acta Botanica IX. 3–4, p. 389. Holotype and diagnosis.

In a lignitic sample from the limnic sequence of borehole Zengővárkony-45 (16.0 to 16.4 m depth). Presumably closely related to the preceding species, morphologically as well as ecologically, as the appeared in two adjacent samples, both lignitic (Textfig. 9).

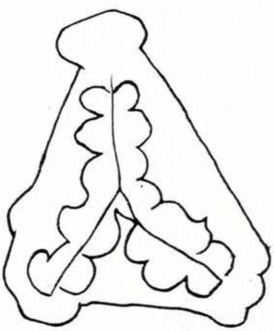


Fig. — ábra 9. Leptolepidites magnipolatus Nagy

Leptolepidites parvus n. sp.

Plate XVIII, Fig. 11–12

Holotype: Borehole Zgv.-59, sample No 24, slide No 1, 31.2×109.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence gray silty clay-marl, borehole Zgv.-59, 60.9 to 63.0 m depth.

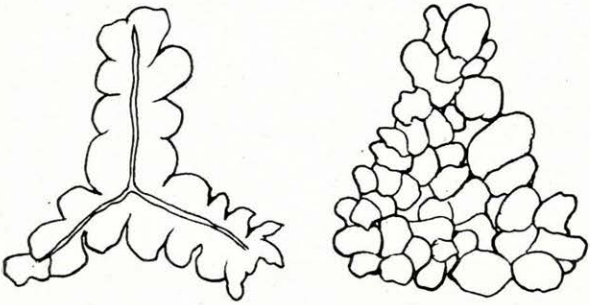


Fig. — ábra 10. Leptolepidites parvus n. sp.

Diagnosis: Trilete spore of 35 μ size, densely covered with uneven verrucae. Line of dehiscence thin, slightly wavy, reaching up to the equator, accompained on either side by a close-spaced row of roundish verrucae of 5 to 8 μ size. Some of these have coalesced to form a torus-like configuration along the line of dehiscence. On the distal side, the verrucae are smaller, up to 4 μ high around the equator, to become taller again about the middle of the distal side (Fig. 10).

Differential diagnosis: From the species established so far of the genus *Leptolepia*, this species differs by its very dense stand of verrucae. The entire spore makes the impression of bristling with verrucae.

There were two specimens in the same sample. Botanical affinities unknown. On a morphological basis, the affinity suggested by the generic name given by COUPER, is possible.

Genus: *Macroleptolepidites* NAGY 1963

Macroleptolepidites krutzschi NAGY 1963

Plate XI, Fig. 6

1963. *Macroleptolepidites krutzschi* n. g. n. sp. NAGY — in Acta Botanica IX. 3–4, pp. 389–390. Holotype and diagnosis.

A few specimens in the Upper Pannonian of borehole Hidas-53 (258.1 to 258.5 m depth). I consider the sample as a whole, and also this fossil in it, as redeposited. The generic name, chosen on a morphological basis, was suggested by the ornament similar to, but larger than, that of the genus *Leptolepidites*. Thus far, no botanical affinity is known.

Genus: *Foveotriletes* VAN DER HAMMEN 1954 ex R. POT. 1956

Foveotriletes maculatus n. sp.

Plate XIX, Fig. 11, 15

Holotype: Borehole Zgv.-59, sample No 14, slide No 2, 39.0×111.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian "schlier", grey clay-marl, borehole Zgv-59, 34.0 to 37.5 m depth.

Diagnosis: Trilete spore of 39 μ size with rounded apices. Line of dehiscence straight, reaching almost up to the equator covered with a few occasional foveola that influence its course. The distal side carries scattered groups of coalesced ornamental elements.

Differential diagnosis: Foveotriletes crassifovaris W. KR. 1962 resembles, in its habit, the Mecsek Mountains species, but is smaller than the latter, has denser foveola and its distal side is differently ornamented.

Remarks: The single specimen found thus far is in the sinuosoidal state. Botanical affinities unknown.

Genus: *Angulisporites* BHARDWAJ 1954

Angulisporites multiangulus n. sp.

Plate XVIII, Fig. 9, 10

Holotype: Borehole Zgv.-59, sample No 29, slide No 1, 31.9×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence light grey clay-marl, borehole Zgv.-59, depth 71.4 to 73.0 m, secondary.

Diagnosis: Roundish trilete spore of 50 μ diameter, isometrically polygonal in equatorial outline. Cingulum about 2.5 μ wide, two-layered. At the middle of the distal side of the spore there is an area-like rounded internal triangle of about 30 μ size. The line of dehiscence is slightly wavy, gaping, reaching to the cingulum. The surface is locally granulate (perhaps corroded) (Textfig. 11).

Differential diagnosis: Angulisporites splendidus BHARDWAJ 1954 (p. 616, Fig. 4) is larger, less roundish; its cingulum is not so even, but exhibits some breaks; and its line of dehiscence does not reach, up to the cingulum.

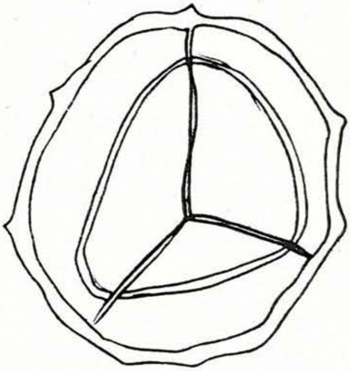


Fig. — ábra 11. Angulisporites multiangulus n. sp.

Remarks: Angulisporites splendidus BHARDWAJ occurs in the Stephanian C of the Palatinate (BHARDWAJ, l. c., and POTONIÉ et KREMP II, 1956, p. 105). Redeposition from the Palaeozoic is likely.

Genus: *Soóisporites* NAGY 1968

Soóisporites elegans NAGY 1968

1968. *Soóisporites elegans* n. g. n. sp. – in Acta Botanica 14 (3–4) pp. 358–359. Generotype and diagnosis.

One specimen in borehole Zgv. 59. in the "schlier" secondary (Textfig. 12).

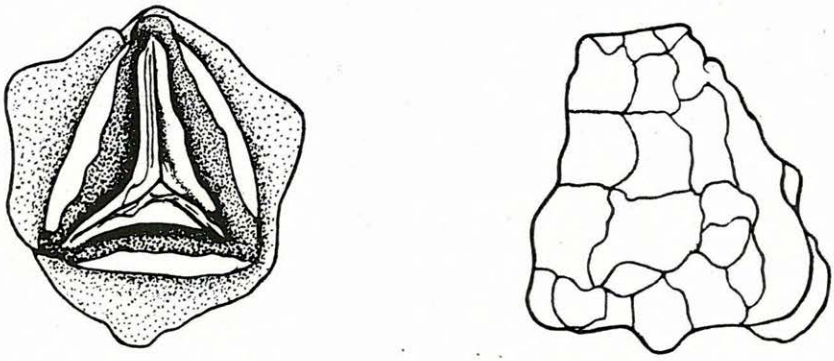


Fig. — ábra 12. Soóisporites elegans NAGY

Genus: *Polypodiaceoisporites* R. POT. 1956

Polypodiaceoisporites speciosus (R. POT. 1934) R. POT. 1951*

1934. *Sporites speciosus* n. sp. R. POT. in Arb. Inst. Paläobot. B. 4. p. 44. Tf. 1. Fig. 32
1951. *Polypodiaceoisporites speciosus* (R. POT.) – in Palaeontogr. B. 91. p. 144. Tf. 20. Fig. 8.
1956. *Polypodiaceoisporites* (al. *Sporites*) *speciosus* (R. POT. 1934) R. POT. 1951. – in Synopsis I. p. 63.

* Although there is a name *Sporites speciosus,* on pp. 136–137 of the paper of POTONIÉ 1951, the name *Polypodiaceoisporites speciosus* figures on pp. 138, 144 and on the cited plate, wherefore I prefer to use this name with 1951 as its date.

A trilete spore of 44 μ size, with a smooth cingulum of about 4 μ width on its proximal side, and with a straight line of dehiscence reaching to the equator, as far as this can be established. The ornamental elements cluster along the line of dehiscence; there are just a few grains farther afield. On the distal side, the coalesced ornamental elements constitute a reticulum.

Remarks: Our form agrees with the description and figure in R. POTONIÉ (1934, 4, p. 44, Pl. 1, Fig. 32), but the form figured by him in 1956 (Synopsis I, 9, p. 84) has an area cluttered up with ornamental elements and it is only along the cingulum that there is no ornament; moreover, it differs only in size from *P. marxheimensis* (MÜRR. et PF.) W. KR. I assume that POTONIÉ wished to show the ornament of both sides in the same drawing.

A few specimens, presumably redeposited in the Upper Pannonian of borehole Hidas-53 (147.5 to 148.5 m depth).

Polypodiaceoisporites cf. *microspeciosus* W. KR. 1959

Plate XVI, Fig. 2–3

Spores ranging from 30 to 39 μ in size, corresponding by and large to the species described by KRUTZSCH from the Eocene of the Geiseltal. Some of the specimens were encountered in the Upper Pannonian (134.8 to 135.5 and 135.5 to 137 m depth), the rest in the Helvetian (761 to 763.3 and 757 to 759 m depth) of borehole Hidas-53. The ones from the Pannonian are contaminated and corroded, presumably redeposited.

Polypodiaceoisporites gracillimus NAGY 1963 var. *emarginatus* n. var.

Plate XIX, Fig. 10, 14

Variety type: Borehole Zgv.-45, sample No 1, slide No 1, 34.8×117.5.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian, limnic sequence yellow, medium- to coarse-grained, poorly sorted sand, carbonaceous portion, borehole Zgv.-45, depth 8.6 to 13.2 m.

Description: In size (40 μ) and in the arrangement of the ornamental elements it resembles *P. gracillimus* NAGY described (1953 pp. 398–399) from the Lower Miocene of the Brickyard "Wind", Eger. The new variety differs from this latter by that its cingulum exhibits reentrants at 3 or 4 points, its line of dehiscence is thin and the ornamental elements along it are not coalesced.

A few specimens have been encountered.

It is presumably the spore of some species of *Lygodium*.

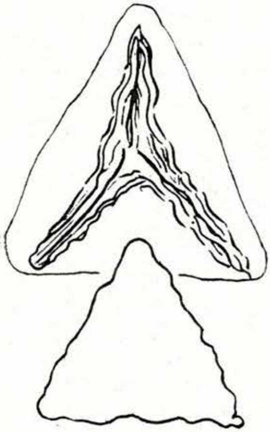


Fig. — ábra 13. Polypodiaceoisporites rectolatus NAGY

Polypodiaceoisporites rectolatus NAGY 1963

1963. *Polypodiaceoisporites rectolatus* n. sp. NAGY — in Acta Botanica IX. 3–4, pp. 393–394. Holotype and diagnosis.

One specimen in borehole Szászvár-8 (433.8 to 434.1 m depth). Presumably, a spore of *Lygodium* (Textfig. 13).

Polypodiaceoisporites medius NAGY 1963

1963. *Polypodiaceoisporites medius* n. sp. NAGY — in Acta Botanica IX. 3–4, pp. 392–393. Holotype and diagnosis.

One specimen of unknown taxonomic position in the Lower Helvetian of borehole Szászvár-8 (26 to 27 m depth).

Polypodiaceoisporites zólyomii NAGY 1963

1963. *Polypodiaceoisporites zólyomii* n. sp. NAGY — in Acta Botanica IX. 3–4, p. 393. Holotype and diagnosis.

One specimen in borehole Szászvár-8 (26 to 27 m depth); botanical affinity unknown.

Polypodiaceoisporites acutus n. sp.
Plate XIX, Fig. 9

Holotype: Borehole H.-53, sample No 3, slide No 1, 30.1×112.0.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, grey muddy sand, borehole H.-53, depth 126.6 to 132.5 m.

Diagnosis: Trilete spore of 50 μ size, with straight or slightly concave sides. Its smooth cingulum is 5 to 8 μ wide, narrower at the apices than on the sides. The thin line of dehiscence reaches up to the equator. The proximal side bears randomly scattered, small verrucae of 1 to 1.5 μ size. On the distal surface there are randomly scattered, cylindrical projections 5 to 10 μ tall, 4.5 μ in diameter, rounded on tip, irregularly interspersed with minute grains (Textfig. 14).

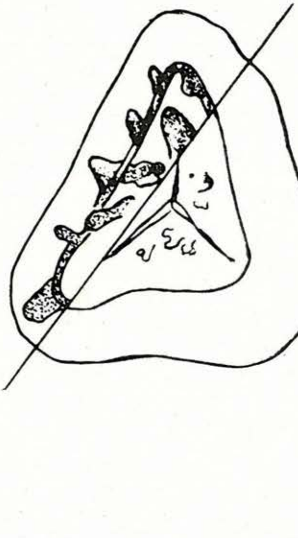


Fig. — ábra 14. Polypodiaceoisporites acutus n. sp.

Differential diagnosis: Distinguished by its peculiar large ornamental elements from all species of the genus *Polypodiaceoisporites*.

A few specimens have so far been found.

Polypodiaceoisporites mecsekensis n. sp.

Plate XIX, Fig. 7–8

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 30.0×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 63 to 65 m.

Diagnosis: Spore of 51 μ size; equatorial outline triangular with rounded apices, with a cingulum 4 to 7 μ wide. Line of dehiscence thin, reaching up to the cingulum as far as discernible. The proximal side bears isolated verrucae of widely different size, some acute, others coalesced, forming a string on the margin of the area. The verrucae on the distal side are more uniform, lower, arranged almost reticulum-fashion (Textfig. 15).

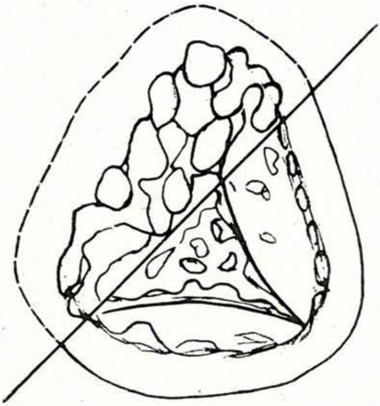


Fig. – ábra 15.
Polypodiaceoisporites mecsekensis n. sp.

Differential diagnosis: The present species differs from *Polypodiaceoisporites speciosus* (R. Pot. 1934) R. Pot. 1951 by that its ornament does not form a regular reticulum; from *P. marxheimensis* (Mürr. et Pf. 1952) W. Kr. 1959 by its smaller size, from *P. gracillimus* Nagy 1963 by its less regular ornament.

Remarks: I have subsumed under this heading the *Polypodiaceoisporites* spores in the size range of 39 to 58 μ, which may eventually be classified in more detail. Such spores are fairly numerous in boreholes Hidas-53, Zengővárkony-45, and-59, Pusztakisfalu VI, and also in the outcrops.

Polypodiaceoisporites verrucosus n. sp.

Plate XIX, Fig. 12–13

Holotype: Borehole Sz.-8, sample No 2. slide No 2, 41.7×97.8.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, terrestrial sequence, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26 to 27 m.

Diagnosis: Spore of 31 μ size, equatorial outline triangular, with a cingulum of 3 to 6 μ width. The central triangle of the distal side is heavily ornamented (verrucate). The elements are 3 to 4 μ high, most of them coalesced into muri, but separate grains can also be observed. The line of dehiscence is thin and reaches up to the cingulum. The proximal side is less heavily ornamented. The line of contact between cingulum and central portion is straight.

Differential diagnosis: The spore agrees in size to *Verrucingulatisporites undulatus* NAGY 1963 (p. 400). Also in ornament, there is a marked similarity. Still, the smooth cingulum of the new species relegates it to this genus.

Occurrence: A few specimens of about 30 μ size in the Miocene material of boreholes Szászvár-8, Zengővárkony-59, and Hidas-53.

Botanical affinity: Presumably *Lygodium*.

Polypodiaceoisporites simplex n. sp.

Plate XX, Fig. 1

Holotype: Borehole H.-53, sample No 2, slide No 4, 41.3×117.8.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, grey muddy clay, borehole H.-53, depth 118 to 126.8 m.

Diagnosis: Spore of 44 to 47 μ size, equatorial outline triangular, rounded, with a smooth cingulum of 6 to 8 μ width. Sides slightly concave or convex, depending on the position of the spore. Line of dehiscence straight, thin, reaching up to the equator: accompanied by low ornamental elements coalesced in a width of 4 to 5 μ. This ornament does not run down to the equator. On the distal side, the ornament consists of sparse verrucate elements.

Differential diagnosis: Ornament sparse as compared to the other species of *Polypodiaceoisporites*.

Scarce in our material. Botanical affinities unknown.

Polypodiaceoisporites helveticus n. sp.

Plate XX, Fig. 14, 17

Holotype: Borehole Pszf.-VI, sample No 3, slide No 1, 34.9×114.4.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian limnic sequence, grey, slightly silty clay, borehole Pszf.-VI, depth 6.3 to 7.8 m.

Diagnosis: Trilete spore of 36 μ size, equatorial outline triangular with rounded apices and almost straight sides. Cingulum smooth, 4 to 5 μ wide. Line of dehiscence thin; reaches up to the cingulum, with ornamental elements of 1 to 1.5 μ width, parallel to the line, both close to it and farther afield. On the distal side, there are sharply defined, rather tall ornamental elements coalesced into muri, but some isolated elements also occur (Textfig. 16).

Differential diagnosis: The present species differs from *P. mecsekensis*

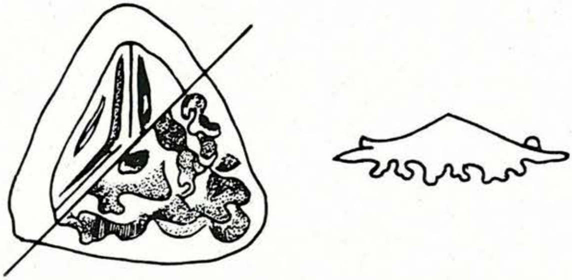


Fig. — ábra 16. Polypodiaceoisporites helveticus n. sp.

n. sp. by its smaller size and by the prominent ornament of the proximal side. *P. muricinguliformis* n. sp. is also larger, and the ornamental elements of its distal side are more widely spaced, more linear.

Remarks: A few specimens of 36 to 42 μ size in the Lower Helvetian.

Polypodiaceoisporites muricinguliformis n. sp.

Plate XX, Fig. 7, 8

Holotype: Borehole Zgv.-59, sample No 16, slide No 1, 37.6×104.5.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence, grey clay-marl, borehole Zgv.-59, depth 39.8 to 41.8 m.

Diagnosis: Trilete spore of 42 μ diameter, equatorial outline rounded triangular. Cingulum about 5 μ wide, fairly straight. On its proximal side, the area is surrounded by coalesced ornamental elements forming an arcuate wall of about 1 μ thickness. Line of dehiscence thin, wavy, with small grains arranged on either side. The distal side is ornamented by uneven, zigzagging, loosely arranged muri (Textfig. 17).

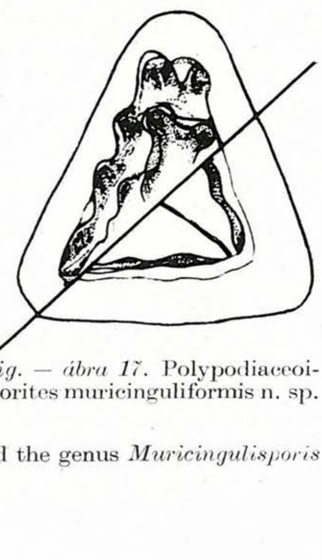


Fig. — ábra 17. Polypodiaceoisporites muricinguliformis n. sp.

Differential diagnosis: The present species recalls the proximal ornament of *Muricingulisporis muricingulis** W. Kr. (1959, pp. 177–178), but the arrangement of the muri is different. Also the distal ornament are fairly different; the shape of the spore and the width of the cingulum do not agree, either. A few specimens of 42 to 48 μ diameter in the beds traversed by borehole Zengővárkony-59.

* Krutzsch (personal communication) has transferred the genus *Muricingulisporis* into the genus *Polypodiaceoisporites*.

Polypodiaceoisporites zengővárkonyensis n. sp.

Plate XX, Fig. 15–16

Holotype: Borehole Zgv.-59, sample No 14, slide No 1, 38.8–100.6.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence grey clay-marl, borehole Zgv.-59, depth 34.0 to 37.5 m.

Diagnosis: Trilete cingulate spore of 35 μ diameter. Cingulum about 4.5 μ wide on the sides, suddenly tapering at the apices. Y-line thin, slightly wavy, reaches almost up to the inner border of the cingulum. Ornament of proximal side non-uniform, linear. On the border of the area there is a fine frill-like ornament thickening to 2 μ near the apices. The distal side is ornamented by verrucae arranged in the fashion of epidermal cells and forming a reticulum (Textfig. 18).

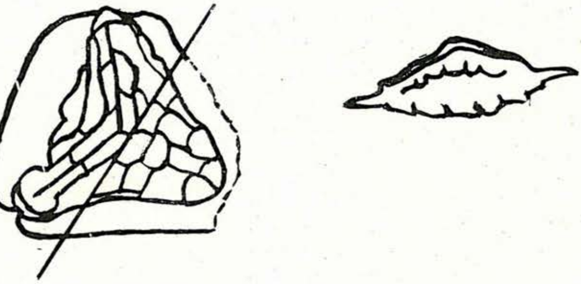


Fig. — ábra 18. Polypodiaceoisporites zengővárkonyensis n. sp.

Differential diagnosis: Distinguished from the other species by the low verrucate ornament.

Only one specimen has so far been encountered.

Polypodiaceoisporites miocaenicus n. sp.

Plate XXI, Fig. 2, 4

Holotype: Borehole Pszf.-VI, sample No 5, slide No 2, 28.9×110.4.
Locus typicus: Pusztakisfalu.
Stratum typicum: Helvetian fresh-water sequence, borehole Pszf.-VI. depth 10.5 to 12.5 m.

Diagnosis: A trilete cingulate spore of 28 μ size. The cingulum is narrower at the apices (1 to 1.5 μ) than on the sides (2 to 3 μ). Y-line thin, slightly sinuous it reaches up to the equator. Both sides verrucate; ornament consisting of both isolated and coalesced elements, locally arranged reticulum-like on the distal side (Textfig. 19). On the proximal side, the ornament is denser along the line of dehiscence, but isolated grains also occur.

Differential diagnosis: KRUTZSCH (1959, p. 193) gives 30 μ as an exclusive figure for the size of *P. verruspeciosus*. The holotype of the new species is 28 μ in diameter, the other specimens range from 17 to 33 μ. The Y line of *P. verruspeciosus* is 4/5 of the radius; that of the new species reaches up to the internal border of the cingulum. The sides of the new species may be straight, concave or convex, depending on the position of the spore. The sides of KRUTZSCH's species are straight or slightly concave.

Fig. — ábra 19. Polypodiaceoisporites miocaenicus n. sp.

Remarks: Specimens with the cingulum loosened off are fairly frequent.

Numerous specimens in boreholes Szászvár-8, Pusztakisfalu-VI, Zengővárkony-45, -59, and Kisbattyán-1.

Polypodiaceoisporites minutiosus n. sp.

Plate XVIII, Fig. 2–3, 13–14

Holotype: Borehole Sz.-8, sample No 2, slide No 1, 45.8×113.2.
Locus typicus: Szászvár
Stratum typicum: Lower Helvetian, terrestrial sequence, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26 to 27 m.

Diagnosis: Trilete spore of 20 μ diameter. Equatorial outline straight or slightly concave, apices gently rounded. Cingulum 1.5 to 2 μ wide on the sides, 0.5 μ wide at the apices. Line of dehiscence thin, reaching the equator. The ornament of the proximal side consists of small pointed grains and elements formed by the coalescing of such. The distal side largely carries coalesced elements (Textfig. 20).

Fig. — ábra 20. Polypodiaceoisporites minutiosus n. sp.

Differential diagnosis: Distinguished from all the species of this genus by its small size, the features of its cingulum and the delicacy of its ornament.

Beside the holotype, one specimen also of 20 μ size, was found at a depth of 462 m in borehole Kisbattyán-1.

Polypodiaceoisporites szászvárensis n. sp.

Plate XX, Fig. 3–6

Holotype: Borehole Sz.-8, sample No 2, slide No 1, 32.5×107.2.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian terrestrial sequence, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26 to 27 m.

Diagnosis: Zonotrilete microspore of 25 μ size. Outline straight or slightly concave. The zone surrounding the spore is of uneven thickness, tapering at the poles, attaining a width of 3.5 μ on the sides. The line of dehiscence can clearly be seen to reach up to the equator (r = 5/5). The sculptural elements of the proximal side are coalesced in the neighbourhood of the tetrade mark, but there are also some isolated grains. The distal side is finely corrugate.

Differential diagnosis: The *P. szászvárensis* n. sp. may be compared with *P. minutiosus* n. sp. and *P. magdalenae* n. sp. in consideration of size and structure. It differs from both the thickness of the middle of the side of the cingulum and by the coarser ornamentation.

A few specimens in the stratum typicum and at 462 m depth in borehole Kisbattyán-1, likewise in the terrestrial sequence; size range 20 to 25 μ.

Polypodiaceoisporites magdalenae n. sp.

Plate XX, Fig. 2, 10

Derivatio nominis: After my co-worker MAGDOLNA ESZTERGÁLYOS.
Holotype: Borehole Sz.-8, sample No 2, slide No 1, 34.9×108.7.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, terrestrial sequence, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26 to 27 m.

Diagnosis: Cingulate triangular spore of 27 μ size, with slightly concave sides. The cingulum, 2 to 3 μ wide on the sides, tapers almost to a line at the apices. The thin line of dehiscence almost attains the equator. Densely verrucate on both the proximal and the distal side, with elements of 1 μ size forming a reticulate pattern. The ornament along the line of dehiscence is coalesced to form thin linear prominences.

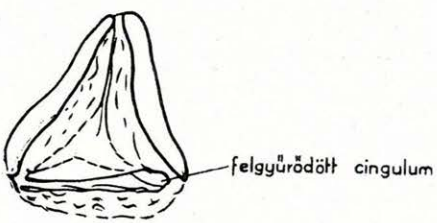


Fig. — ábra 21. Polypodiaceoisporites magdalenae n. sp.

Differential diagnosis: Closest to *P. verruspeciosus* described by KRUTZSCH (1959b, p. 187) and stated by him be of exactly 30 μ size. The Mecsek Mountains form is smaller, with less concave sides and less rounded poles: the cingulum is developed differently. From *P. miocaenicus* n. sp., the present species differs by its more delicate structure and by the line formed by the coalescence of ornamental elements along its line of dehiscence (Textfig: 21).

Remarks: A few specimens in borehole Szászvár-8. Botanical affinities unknown.

Polypodiaceoisporites hidasensis n. sp.

Plate XX, Fig. 12–13

Holotype: Borehole H.-53, sample No 24, slide No 1, 52.5×115.8.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignitic sequence, lignite, borehole H.-53, depth 600.5 to 602.3 m.

Diagnosis: Zonotrilete spore of 37 μ size, with rounded apices and convex sides. The cingulum is smooth, broad (6 μ) at the middle of the sides, tapering to 0.5 μ near the poles. The Y line is thin and reaches up to the equator. The proximal side of the spore is almost smooth; the ornamental elements form a thin band along the Y line; besides these, there are a few grains farther afield. The ornament of the distal side is a low reticulum composed of grains 3 to 5 μ tall. Some verrucae emarge like a little head next to the polar tapering portion of the cingulum.

Differential diagnosis: It resembles *P. mecsekensis* n. sp. but its narrower cingulum is more definitely tapering at the apices.

Rather scarce.

Polypodiaceoisporites hamulatus n. sp.

Plate XXI, Fig. 9–10

Holotype: Borehole Zgv.-59, sample No 23, slide No 1, 36.4×106.6.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 56.0 to 60.9 m.

Diagnosis: Trilete cingulate spore of 26 μ size, with rounded apices. Cingulum 3 μ wide on the sides, suddenly narrowing at the apices. Line of dehiscence thin, reaching up to the internal border of the cingulum. The central portion is ornamented by small granules. The low, close-spaced verrucae of the distal side constitute a hamulate reticule (Textfig. 22).

Fig. — ábra 22. Polypodiaceoisporites hamulatus n. sp.

Differential diagnosis: No such small spore with so peculiar structural elements has so far been encountered in the genus *Polypodiaceoisporites*.

A few specimens of 26 to 33 μ size also in borehole Szászvár-8, depth 26 to 27 m.

Polypodiaceoisporites minutus n. sp.

Plate XIX, Fig. 2–5

Holotype: Borehole Sz.-8, sample No 2, slide No 3, 29.1×100.8.
Locus typicus: Szászvár.
Stratum typicum: Helvetian, terrestrial sequence, greenish-bluish-grey silty clay, borehole Sz.-8, depth 26 to 27 m.

Diagnosis: Trilete cingulate spore of 32 μ diameter. The cingulum is about 3 to 4 μ wide, smoothly bordered, straight or locally concave, inclined to sinuosity. Line of dehiscence thin, reaching almost up to the border of the cingulum. The ornamental elements are somewhat coalesced along the line of dehiscence. The proximal side is less densely ornamented than the distal side

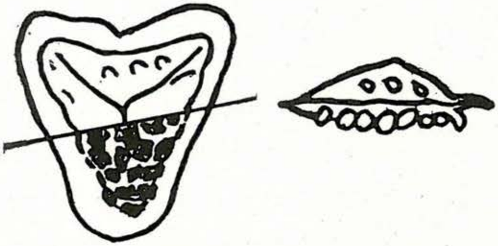


Fig. — ábra 23. Polypodiaceoisporites minutus n. sp.

which bears verrucae 3 to 4 μ tall, mostly isolated (Textfig. 23).

Differential diagnosis: The slightly sinuous border and the marked ornament on the distal side are features that distinguish the new species from the other species of the genus *Polypodiaceoisporites*. *P. acutus* somewhat resembles the new species, but is much smaller and has a narrower cingulum and smaller verrucae.

Remarks: There were quite a few specimens from 24 to 37 μ size in borehole Szászvár-8. In a specimen of 37 μ diameter from 432.5 to 432.7 m depth of this same borehole, the ornamental element are somewhat coalesced. The species has been encountered also in the bottom samples of borehole Hidas-53. Botanical affinites unknown.

Polypodiaceoisporites torosus n. sp.

Plate XX, Fig. 9, 11

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 28.3 × 113.0.
Locus typicus: Zengővárkony.
Stratum typicum: Upper Helvetian fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59 depth 51.3 to 56.0 m.

Diagnosis: Trilete cingulate spore with rounded apices, of 42 μ size. The cingulum is accompanied by a second thickening farther inwards; the cingulum is about 1 to 1.5 μ, the inner thickening about 2 μ in width. The thin line of dehiscence reaches up to about the inner thickening, as far as this can be perceived. Along it there is a loose string of separate and coalesced verrucae. On the distal side there is a dark torus about 5 μ wide on the sides, 3 μ wide at the apices. Within it, there are just a few verrucae (Textfig. 24).

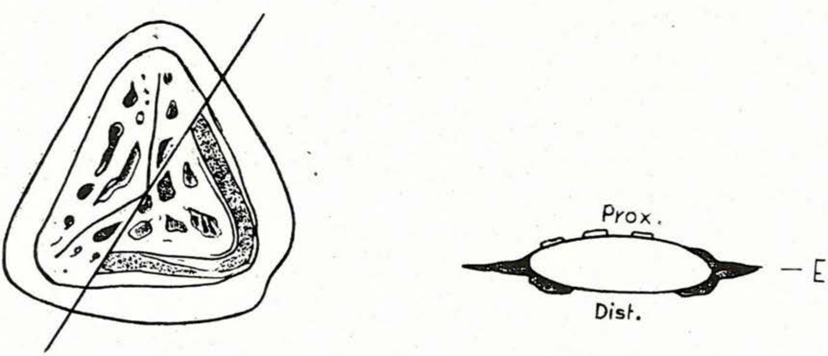


Fig. — ábra 24. Polypodiaceoisporites torosus n. sp.

Differential diagnosis: It is the torus structure that distinguishes this species from the rest of the genus *Polypodiaceoisporites.*

Rermarks: A few specimens ranging in size from 42 to 50 μ at 51.3 to 60.9 m depth in borehole Zengővárkony-59, at 432.5 to 432.7 m depth in borehole Szászvár-8 and at 757 to 759 m depth in borehole Hidas-53.

Polypodiaceoisporites longus n. sp.

Plate XIV, Fig. 2, 4

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 39.6×114.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 63 to 65 m.

Diagnosis: Trilete cingulate spore of 41 by 38 μ size. On the proximal side, the line of dehiscence runs, accompanied by a few separate and coalesced verrucae, to the border of the narrow area. The cingulum is of even thickness on the sides (about 4 μ) and concave, suddenly narrowing at the apices. On the distal side there is a narrow wavy cingulum running parallel to the equator, and ending in projections of 2 to 4 μ size at the apices. On the distal side there is a triangular torus of 5 μ maximum width, arcuste in outline: within and parallel to it there is a narrow ridge composed of coalesced verrucae.

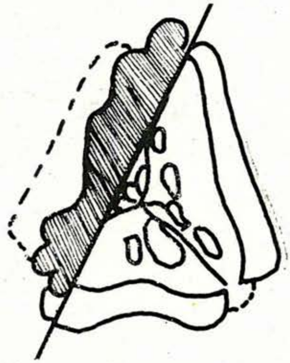


Fig. — ábra 25. Polypodiaceoisporites longus n. sp.

Differential diagnosis: It is the peculiar proximal and distal cingula that distinguish the present species from the other species of *Polypodiaceoisporites* (Textfig. 25).

Only one injured specimen has so far been encountered.

Polypodiaceoisporites sp.

Spore fragment of 63 μ size, encountered in borehole Szászvár-8, at 433.6 to 433.8 m depth.

Genus: *Verrucingulatisporites* KEDVES 1961

Verrucingulatisporites gregussi NAGY 1963

1963. *Verrucingulatisporites gregussi* n. sp. NAGY – in Acta Botanica IX. 3–4., p. 395. Holotype and diagnosis

A few specimens in the lignitic samples Nos. 3.4 of borehole Zengővárkony45. No botanical affinity could so far be established. (Textfig. 26).

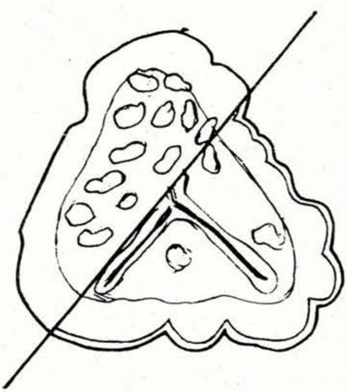


Fig. — ábra 26. Verrucingulatisporites gregussi NAGY

Verrucingulatisporites mecsekensis n. sp.
Plate XXI, Fig. 5–6

Holotype: Borehole Zgv.-45, sample No 3, slide No 1, 36.8×109.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fresh-water sequence, dark grey silty clay, borehole Zgv.-45, depth 16 to 16.4 m.

Diagnosis: Trilete cingulate spore of 36 by 37 μ size and rounded triangular shape. On the proximal side, the area is surrounded in a zigzag line by a wavy cingulum of 4 to 5 μ width. Line of dehiscence thin, straight, reaching almost up to the border of the area. Along it, there are insularly coalesced ornamental elements tapering towards the apices. Besides these there are a few isolated verrucae 4 to 5 μ tall, 3 to 4 μ wide. On the distal side there is another, distinct cingulum, more pronouncedly zigzagging than the proximal one. The ornament of the distal side is low, muri-like.

Differential diagnosis: It is in its peculiar cingula that the new species differs from the species hitherto described. From *V. gregussi* NAGY, it can be distinguished by the coalesced ornamental elements on its distal side.

Outside the locus classicus, a few specimens have been encountered in the Helvetian limnic sequence of boreholes Pusztakisfalu-VI and Zengővárkony-59, in the size range of 36 to 57 μ.

Verrucingulatisporites miocaenicus n. sp.
Plate XXI, Fig. 1, 3

Holotype: Borehole Zgv.-45, sample No 3, slide No 1, 45.9×114.9.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, limnic sequence, dark grey silty clay, borehole Zgv.-45, depth 16.0 to 16.4 m.

Diagnosis: Trilete cingulate spore of 47 μ size with rounded apices. Width of cingulum 1.5 to 4 μ, outer border wavy or zigzagging. Inward of the cingulum there is a thin curtain-like inner shell. The Y-line is straight and does not reach the cingulum. The ornamental elements along the line of dehiscence are somewhat coalesced. Both sides of the spore bear verrucae, some of which have coalesced. Coalescence is more frequent on the distal side.

Differential diagnosis: This species differs from the rest of the genus *Verrucingulatisporites* in the peculiar inner membrane on its proximal side.

A few specimens in the Helvetian.

Verrucingulatisporites trifoliiformis n. sp.

Plate XXI, Fig. 12–13

Holotype: Borehole Pszf.-VI, sample No 7, slide No 1, 31.2×100.8.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian limnic sequence, in grey unconsolidated medium-grained sand, borehole Pszf.-VI, depth 15 to 17 m.

Diagnosis: Trilete spore of 32 μ diameter, with a peculiar cingulum recalling a clover leaf. The width of the cingulum is 5 to 8 μ; it is wavy, zigzagging, vanishing completely on the lower side of the spore. Line of dehiscence thin, short. Along it there is a torus-like configuration of coalesced ornamental elements. The entire area is ornamented with verrucae, some of which lean over the cingulum. The distal side is close-packed with verrucae of 2 to 4 μ size, interpersed with some separate grains. The verrucae are coalesced locally (Textfig. 27).

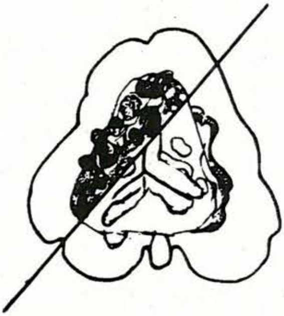


Fig. — ábra 27. Verrucingulatisporites trifoliiformis n. sp.

Differential diagnosis: It is by its peculiar cingulum that the species can be distinguished from the other species of the genus.

Only one specimen so far.

Genus: *Bifacialisporites* Nagy 1963

Bifacialisporites murensis Nagy 1963

Plate XXI, Fig. 11

1963. *Bifacialisporites murensis* n. sp. Nagy — in Pollen et Spores, V. 1. p. 144. Holotype and diagnosis.

A spore fairly frequent in the Mecsek Mountains drill cores, particularly in the Pannonian of Hidas-53, and in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (Textfig. 28). The size range is from 50 to 80 μ. The spore presumably belongs to a species of *Lygodium*.

Bifacialisporites murensis f. *minor* n. f.

Plate XXI, Fig. 7–8

Form type: Borehole Zgv.-45, sample No 3, slide No 2, 35.5×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian, limnic sequence, dark grey clay, borehole Zgv.-45, depth 16.0 to 16.4 m.

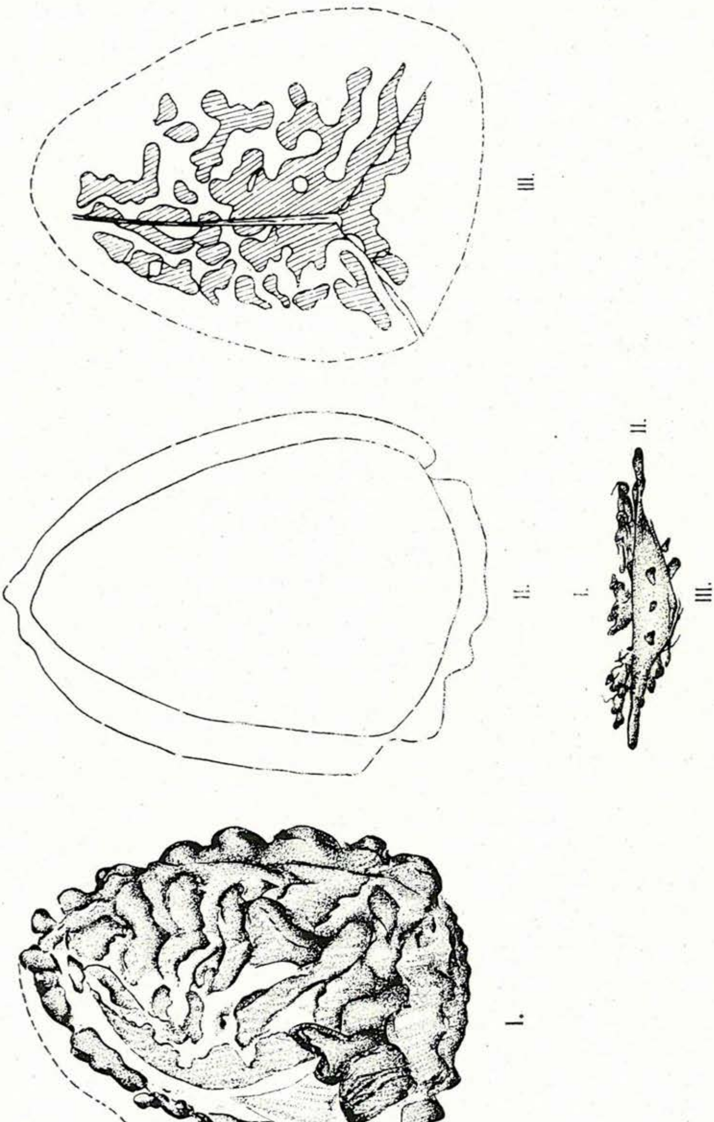


Fig. — *ábra 28.* Bifacialisporites murensis NAGY

Description: Trilete cingulate spore of 33 μ size which, apart from the size difference, agrees with *Bifacialisporites murensis* NAGY. The new form has been introduced on the grounds that no forms transitional in size between it and the basic species have been encountered so far.

Fairly frequent in the Helvetian material of the Mecsek Mountains.

Bifacialisporites magnus n. sp.

Plate XXII, Fig. 1

Holotype: Borehole H.-53, sample No 8, slide No 1, 40.5×107.5.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, dark grey carbonaceous marl, borehole H.-53, depth 258.1 to 258.5 m.

Diagnosis: Trilete cingulate spore of 72 by 72 μ size. On its proximal side, the cingulum is wavy, of varying width (up to 9 μ). The thin, thread-like line of dehiscence reaches up to the cingula. Along it, coalesced ornamental elements from rows whose width varies from 7 to 1 μ, tapering towards the apices. On the proximal side, the cingulum is not separated from the body of the spore, but on the distal side it has a small rim. On the distal side, the ornamental elements constitute loose muri and form—on the distal margin of the spore—a zigzagging cingulum of 2 to 5 μ width, that seldom reaches beyond the outline of the proximal cingulum.

Differential diagnosis: The difference against *B. murensis* NAGY 1963 consists in the large size, and in the torus-like ornamental elements around the line of dehiscence of the proximal side.

A few more specimens were found in this same sample.

Bifacialisporites mecsekensis n. sp.

Plate XXII, Fig. 3, 5, 6

Holotype: Borehole Zgv.-59, sample No 14, slide No 1, 31.8×101.9.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence, grey clay marl, borehole Zgv.-59, depth 34.0 to 37.5 m.

Diagnosis: Trilete cingulate spore of 70 by 55 μ size, rounded at the apices. The elements of the structure are grouped on three levels. On the proximal side, the ornament is arranged in a triangular field. The thin line of dehiscence reaches up to the border of this area. On either side of it, the ornamental elements are coalesced torus-fashion, in about 3 μ width. The outer side of this torus is wavy, it tapers slighly towards the apices. Also over the rest of the proximal side, there are low, coalesced ornamental elements and a few isolated ones (Textfig. 29). The second level is represented by a somewhat wavy cingulum of smooth outline and of 5 to 6 μ width. The distal side of the spore is convered with low ornamental elements coalesced into muri

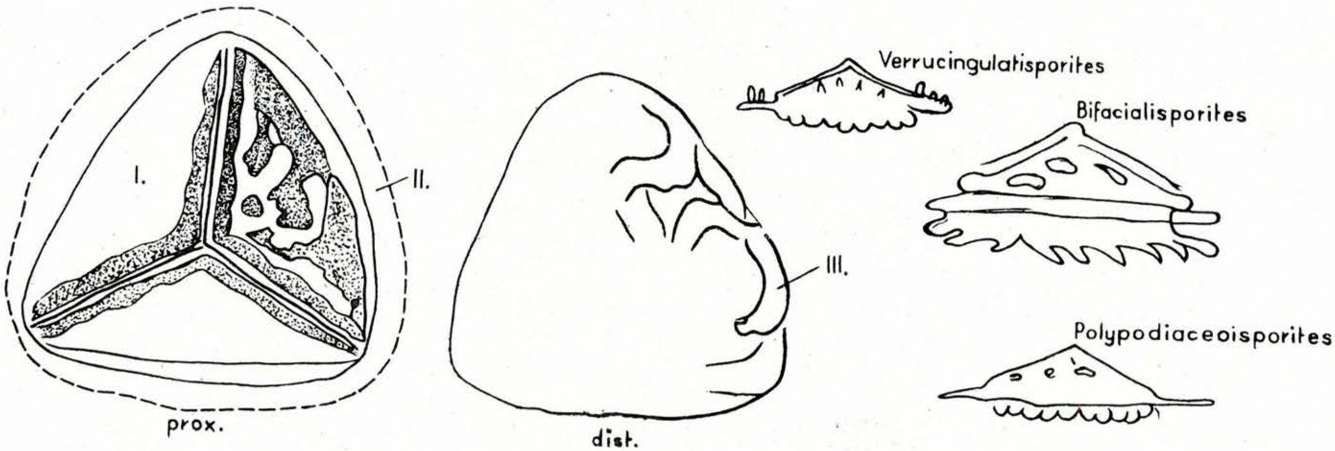


Fig. — ábra 29. Bifacialisporites mecsekensis n. sp.

which are arranged like a closely spaced reticulum; most of the lateral elements are of smooth contours what influences also the outline of the spore.

Differential diagnosis: Much resembling *Bifacialisporites murensis* NAGY 1963 in ornament and size. The distinctive features of the new species are the torus-like element on the proximal side and the arrangement of most ornamental elements into muri on the proximal as well as on the distal side. The arrangement of the elements on the distal side is also specific.

The three levels of the spore are readily visible in lateral view on another specimen found in the fish-scale-bearing sequence of this same borehole (56 to 60.9 m depth). Rather scarce in the Miocene.

This multi-level arrangement of the spore structure is encountered among living plants in the *Cibotinae (Cyatheaceae)*.

Bifacialisporites medius n. sp.

Plate XXII, Fig. 2, 4; Plate XXIII, Fig. 1–3

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 43.2×113.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence grey silty clay-marl, borehole Zgv.-59, depth 63 to 65 m.

Diagnosis: Zonotrilete spore of 52 by 44 μ size, with rounded apices. On the proximal side, a triangular area is filled up mosaic-fashion by verrucae of 1.5 to 4 μ size with the thin line of dehiscence treading its way among them. The ornament is slightly coalesced along the line of dehiscence. Cingulum smooth, 4 to 5 μ wide, locally with small reentrants that make it wavy, and with distinct reentrants or interruptions at the apices. The dense distal ornament is similar to the proximal one, but more intensely coalesced muri-fashion, so that it influences also the outline of the spore (Textfig. 30).

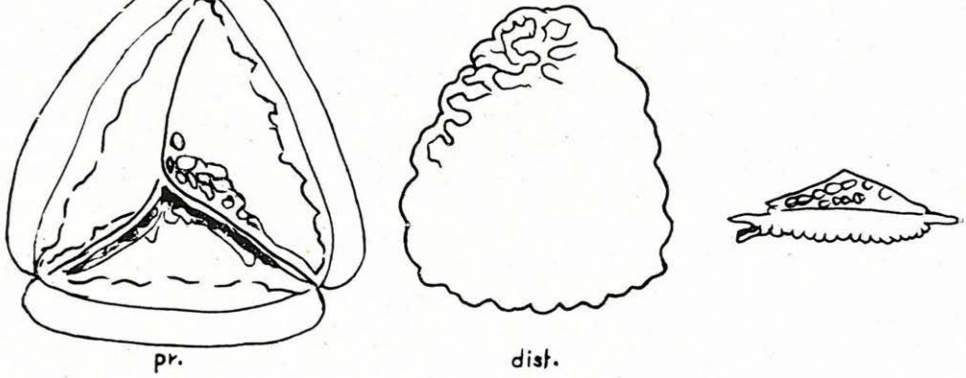


Fig. — ábra 30. Bifacialisporites medius n. sp.

Differential diagnosis: Differs from *Bifacialisporites mecsekensis* by its smaller size, closerpacked and smaller ornamental elements.

Remarks: Encountered in a few samples of the Mecsek Mountains Middle Miocene. The specimens have a size range from 40 to 57 μ, concave, convex or straight sides, and reentrants of varying depth. The ornament of the distal side has been slightly pushed off-center by fossilization, as is the case with most of the *Bifacialisporites* fossils.

Genus: *Callialasporites* Sukh Dev 1961

Callialasporites devi n. sp.

Plate XXIII, Fig. 5

Derivatio nominis: In honour of S. Dev palynologist, Lucknow.
Holotype: Borehole Sz. 8, No 219, slide No 2, 38.8–112.3.
Locus typicus: Szászvár.
Stratum typicum: Helvetian, dark grey clay marl from the terrestrial sequence borehole Sz. 8, secondary.

Description: Full diameter is 57 μ, the massive spore body of rounded triangular outline is 31 μ in diameter. Line of dehiscence gaping, not reaching to the inner border of the zone. The outer membrane is 10 to 15 μ wide, finely granulate, somewhat wavy, adherent to the spore body.

Differential diagnosis: The species differs from cf. *Callialasporites* sp. described by S. Dev (1961, p. 49) in its smaller sizes and it has not three bladders.

The only specimen encountered thus far indicates redeposition from the Jurassic or Cretaceous, as the species cf. *Callialasporites* it was described from the Upper Gondwana (Dev 1961, p. 54).

Callialasporites dampieri (Balme 1957) S. Dev 1961

Plate XXIII, Fig. 6

Full size 63 μ; central body of 50 by 40 μ size, locally ornamented with spines. The exine of the central body is 1.5 to 2.5 μ thick; the gaping line of dehiscence reaches to the internal exine. The width of the warped, torn outer membrane varies from 5 to 12 μ.

Two specimen, likewise in borehole Szászvár-8, at 432,7 to 433,5 m depth, and likewise redeposited from the Jurassic.

Genus: *Ornatisporites* NAGY 1963

Ornatisporites reticulatus NAGY 1963

Plate XXIV, Fig. 1, 3

1963. *Ornatisporites reticulatus* n. g. n. sp. NAGY — in Pollen et Spores V. 1. p. 146. Generotype and diagnosis.

Two species of the genus *Ornatisporites* have been encountered in the Pannonian of borehole Hidas-53 (258.1 to 258.5 m depth). *O. reticulatus* is represented by a single specimen redeposited from the Mesozoic.

Species of unknown botanical affinity.

Ornatisporites dentatus NAGY 1963

Plate XI, Fig. 5

1963. *Ornatisporites dentatus* n. sp. NAGY — in Pollen et Spores V. 1. pp. 146–147. Holotype and diagnosis.

A few specimens from the interval 258.1 to 258.5 m of the same borehole H.-53. The species is assumed to have been redeposited from older strata, This is confirmed by the fact that in the course of investigations into the Liassic manganiferous complex, M. KEDVES and P. SIMONCSICS (1964, p. 608) found a spore resembling the genus *Ornatisporites* in morphology.

Genus: *Neogenisporis* W. KR. 1962a

Neogenisporis sp.

Plate XXIV, Fig. 2, 4

Laticingulate spore of 33 to 37 μ size. Width of cingulum 2 to 2.5 μ on the sides, 1 μ at the apices. Line of dehiscence thin, reaching to the equator, branching at the end. There is a vague torus on the proximal and a better developed one the apex. The specimens are crushed, their line of dehiscence displaced off-center, even torn open in some. Hence, a more accurate determination is precluded until a better-preserved material turns up.

Scarce but persistent in the Mecsek Mountains material, particularly in the Lower Helvetian.

Genus: *Trilobosporites* (PANT 1954) ex POTONIÉ 1956

Trilobosporites cf. *bernissartensis* (DELCOURT et SPRUMONT 1955) R. POT. 1956

Plate XXIII, Fig. 4

A trilete spore of 62 μ size, encountered in the Lower Pannonian of borehole Hidas-53 (364.2 to 367.0 m depth), can be placed in this species which is said to be highly variable. The figures in literature do not permit a close morphological comparison. The line of dehiscence of the Mecsek Mountains specimen is not torn open. It is thin, straight, reaching up to the cingulum. On either side of it, there is a row of ornamental elements 2 to 5 μ wide, tapering towards the suddenly thickening valva-like portions of the poles.

One specimen, redeposited from the Lower Cretaceous, corroded.

Botanical affinity: presumably *Lygodium.*

Genus: *Mecsekisporites* NAGY 1968

Mecsekisporites miocaenicus NAGY 1968

Plate XXIV, Fig. 5–8

1968. *Mecsekisporites miocaenicus* n. g. n. sp. — in Acta Botanica 14 (3–4) p. 360. Generotype and diagnosis.

One specimen in borehole Zengővárkony No 59, depth 34.0 to 37.5 m, "schlier" sequence (Textfig. 31).

Mecsekisporites aequus NAGY 1968

Plate XXV, Fig. 1

1968. *Mecsekisporites aequus* n. g. n. sp. — in Acta Botanica 14 (3–4) p. 361. Holotype and diagnosis.

Four exemplares: In borehole Zgv. No 59, in depth 56.0 to 60.9 m, in depth 63 to 65 m, in Kisrét ravine, Magyaregregy, and in borehole Hidas 53, depth 757 to 759 m.

Mecsekisporites zengővárkonyensis NAGY 1968

Plate XXV, Fig. 5, 6, 9

1968. *Mecsekisporites zengővárkonyensis* n. g. n. sp. — in Acta Botanica 14 (3–4) p. 361. Holotype and diagnosis.

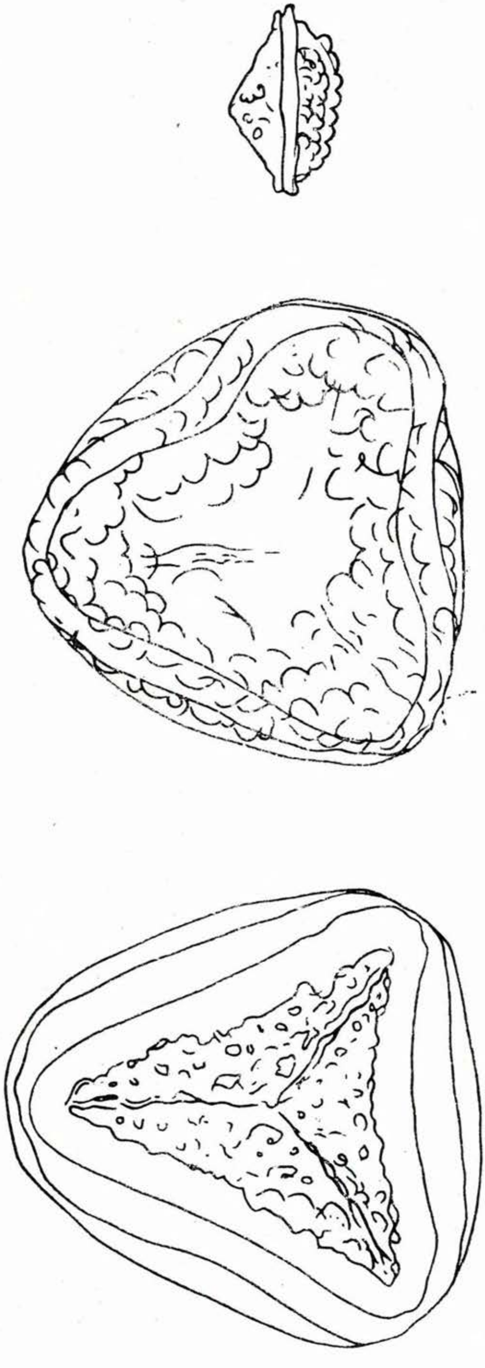


Fig. — ábra 31. Mecsekisporites miocaenicus NAGY

Two specimens besides the holotype in borehole Zengővárkony-59, depth 56.0 to 60.9 m, and in the depth 71.4 to 73 m, Helvetian, fish-scale-marl.

Mecsekisporites cerebralis NAGY 1968

Plate XXVI, Fig. 1, 4, 5

1968. *Mecsekisporites cerebralis* n. g. n. sp. — in Acta Botanica 14 (3–4) p. 362. Holotype and diagnosis.

Three exemplares in borehole Zengővárkony No-59. The holotype is in depth 56 to 60.9 m and two specimens in depth 51.3 to 56 m, Helvetian fish-scale-bearing sequence.

Genus: *Laevigatosporites* IBRAHIM 1933

The priority of the generic name given by IBRAHIM (1933, p. 39) is beyond doubt (see also KRUTZSCH 1959b, pp. 192–194). However, the name gained popularity thanks to THOMSON et PFLUG (1953, p. 59). For Tertiary forms, R. POTONIÉ and his pupil VENITZ (KRUTZSCH, l. c.) introduced the name *Sporites haardti*. THIERGART (1938, p. 297) mentioned and described the form by the name *Polypodiaceae-sporites haardti*. In the description by R. POTONIÉ and VENITZ, length is given as 28 to 34 μ; THIERGART raised it to 42 μ and defined a f. *minor* for the smaller specimens (from 27 to 36 μ); he spoke of an "unregelmässig" rather than bean-like shape (l. c.). POTONIÉ (1956, Synopsis I, p. 76) held the name given by THIERGART to be correct and stated the type of the forms to be of 34 μ size. When monographing the Tertiary of the Kerguelen Islands, COOKSON (1947, p. 135) described forms from 55.5 to 77 μ size by the name *Monolites major* and forms of 34.5 to 50 μ as *Monolites minor*. She emphasized the smoothness of both and the lack of "ridges" along the line of dehiscence. THOMSON and PFLUG (1953, p. 59) recorded two related forms: the outline of bean-shaped *Laevigatosporites haardti* of 25 to 70 μ size is at the line of dehiscence "konkav bis geradlinig"; it is "wulstig" about the long line of dehiscence (l. c.). The other form is *Laevigatosporites discordatus*, of 50 to 90 μ size, ellipsoidal with a short line of dehiscence and without "wulsten". Of the figured specimens, KRUTZSCH (1959b, l. c.) regards only one as "*haardti*".

Starting with R. POTONIÉ, authors have on the basis of spore studies on living species indicated the family *Polypodiaceae* as the living relatives of the form. However, this family includes (WILLIS, 1957, p. 530) 3,000 species in 130 genera, and no comprehensive study of its spores has so far been made. Moreover, bean-shaped smooth spores occur in numerous other families such as the *Schizaeaceae* and *Dennstaedtiaceae* (HARRIS, 1955).

These spores may exhibit morphological differences owing to the presence or absence of the perisporium, which might be destroyed during fossilization or maceration; or, once the spore is fossilized, further differences may be due to embedding and fossilization in the lateral or polar position: the former is likely to result in bean-shaped, the latter in elliptical forms.

For these reasons, I prefer not to ascribe any stratigraphic significance to these fossil taxonomic units. In our material, three types could be distinguished:

Laevigatosporites haardti (R. Pot. et Venitz 1934) Th. et Pf. 1953

I have classed here the forms resembling Potonié's holotype (1934, Pl. 1, Fig. 13). These are bean-shaped spores of about 50 μ size; their length-to-width ratio is between 1.5 and 2 (1.7 for the holotype). Their exine is smooth, 1.5 to 2.2 μ thick: this is why these forms are not easily deformed. Their line of dehiscence is long and accompanied by a ridge on either side. Frequent in the Pliocene and Helvetian of boreholes Zengővárkony-45 and Pusztakisfalu-VI.

Laevigatosporites minor (Cookson 1947) W. Kr. 1959

Forms of 34 to 53 μ size, largely restricted to the Tortonian lignitic sequence. The length-to-width ratio is 1.3 to 1.5, i. e. they are wider than the preceding group. The exine is smooth, thinner and easier to crush than in the preceding group. The line of dehiscence is shorter, gash-like, not accompanied by ridges.

Laevigatosporites major (Cookson 1947) W. Kr. 1959

A specimen of 59 μ size in the Helvetian fish-scale-bearing sequence of borehole Zengővárkony-59 (30.9 to 34.0 m depth). Exine thin, secondary crumpling likely. It resembles in size and length-to-width ratio the spores described from the Tertiary of the Kerguelen Islands.

Genus: *Polypodiisporites* R. Pot. 1934

These forms with ornamented exosporia, held to be spores of polypodiaceous plants, have been variously classified by various authors.

The preservation of the artificial generic names, all sounding similar and referring, in one way or another, to the family *Polypodiaceae*, is necessary until further notice because even these are almost insufficient to classify the numerous species of this family. In our material, there occur forms that can be assigned to the following genera:

(1) The genus *Polypodiisporites* described by R. POTONIÉ, valid with the date 1934; it includes bean-shaped spores with negative reticulum covered with relatively uniform verrucae.

(2) The genus *Polypodiidites* established by ROSS in 1949, also valid; its type and generic diagnosis was given by *Couper* in 1953. The forms belonging here are more robust, with ornaments in a variety of sizes; their verrucae exhibit a tendency to grow smaller towards the proximal side (ROSS 1949, p. 33).

(3) According to the diagnosis of *Verrucatosporites* by THOMSON et PFLUG 1953, the verrucae do not form a negative reticulum in the forms of this genus.

Polypodiisporites favus (R. POT. 1931) R. POT. 1933

Bean-shaped monolete spores of 51 to 70 μ size with low verrucae and a negative reticulum. Fairly frequent in the Helvetian and Tortonian terrestrial and fresh-water deposits, but also in other Middle Miocene layers. Particularly abundant at 6.3 to 7.8 m depth in borehole Pusztakisfalu-VI, in sample No 3. (6.3–7.8 m) of borehole Zengővárkony-45 and at 60.9 to 63 m depth in borehole Zengővárkony-59.

Polypodiisporites secundus (R. POT. 1934) R. POT. 1956

Plate XXVII, Fig. 2, 7

Bean-shaped spores of 46 to 55 μ size, with low verrucae that lend but a very slight sinuosity to the outline of the spores. In top view, an ornament consisting of polygonal fields of 3 to 5 μ size can be discerned. Exine about 2.5 μ thick; exosporium about 1 μ thick, wavy; endosporium about 1.5 μ thick, two-layered, smooth. Line of dehiscence longer than half the diameter.

Fairly frequent in the Helvetian of the Mecsek Mountains (boreholes Pusztakisfalu-VI, Zengővárkony-45, and Hidas-53; also in the Pannonian of the latter). A form smaller than ours was described by POTONIÉ (1934, 4, p. 39) from the Eocene of the Geiseltal and one of similar size by POTONIÉ et VENITZ (1934, 5, p. 13) from the Lower Rhine Valley Miocene and referred to the genus *Blechnum* of the *Polypodiaceae*.

Polypodiisporites cf. *tenellis* W. KR. 1959

Spores of 49 to 51 μ size, oval in equatorial outline; exine thin with secondary crumpling. A very fine reticulate structure is visible: the minute low verrucate elements form a very delicate sinuosity on the outline of the spore. The line of dehiscence is not quite straight; its length is about half the length of the spore; it is not accompanied by any ridge.

Our specimens are larger than those described from the Geiseltal. They occurred in the depth interval of 298.0 to 299.1 m of borehole Hidas-53 and in Seam II of Hidas mine. Possibly redeposited.

Polypodiisporites cellarius W. Kr. 1959 n. c.

1959. *Reticuloidosporites (Polypodiisporites) cellarius* n. fsp. — in Krutzsch Geologie, Bhf. 42, T. 471, 472, fig. p. 216.

Described by Krutzsch (1959b) from the Lutetian of the Geiseltal. A specimen of 66 μ size has turned up in the Pannonian of borehole Hidas-53; it presumably indicates redeposition from the Eocene. Our specimen is slightly more rounded than the figured holotype, being presumably less compressed than suggested by the diagnosis.

Polypodiisporites acutus n. sp.

Plate XXVII, Fig. 3, 4

Holotype: Borehole Zgv.-45, sample No 5, slide No 1, 30.1×103.9.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian, limnic sequence, dark grey clayey silt, borehole Zgv.-45, depth 17.2 to 17.8 m.

Diagnosis: Bean—shaped spore of 25 by 10 μ size. Proximal side straight or slightly concave. Line of dehiscence about 1/2 of full length. Surface evenly covered with pointed spines 1 to 2 μ high. Exine 1 μ thick; endosporium less than 1/2 μ thick (Textfig. 32).

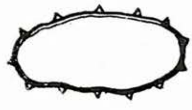


Fig. — ábra 32. Polypodiisporites acutus n. sp.

Differential diagnosis: The species differs by its small size and its ornament from the species of this genus.

Remarks: A few specimens in the 23 to 25 μ size range in Helvetian samples.

Botanical affinity: Presumably *Polypodiaceae*.

Polypodiisporites potoniéi n. sp.

Plate XXVI, Fig. 2, 3

Derivatio nominis: In honour of Prof. R. Potonié, Krefeld.
Holotype: Borehole Zgv.-59, sample No 24, slide No 1, 35.7×114.4.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zengővárkony-59, depth 60.9 to 63.0 m.

Diagnosis: Bean-shaped spore of 61 by 43 μ size; proximal side straight or slightly convex. Line of dehiscence (30 μ) about half the length of the fossil. Surface covered with a dense stand of tapering verrucae, 2 to 3 μ high. Between the verrucae, a negative reticulum consisting of depressions 1 to 1.5 μ wide is visible. The thickness of the exosporium is 2.5 μ to 3.5 μ, depending on the height of the verrucae; the endosporium is smooth, 1 to 1.5 μ thick.

A few specimens so far.

Differential diagnosis: It most resembles *Polypodiisporites favus* R. Potonié, but the verrucae are smaller and the exine thinner.

Botanical affinity: Presumably *Polypodiaceae.*

Polypodiisporites clatriformis (Th. et Pf. 1953) n. c.

Bean-shaped spores of 70 to 80 μ size; proximal sides straight or convex. Surfaces covered with relatively low verrucae, smaller towards the proximal side, with a negative reticulum visible between them. Their line of dehiscence is about 3/4 the full length. A few specimens in the Middle Miocene deposits. In Germany it occurs in the Middle Eocene and Middle Miocene.

Genus: *Polypodiidites* Ross 1949 ex Couper 1953

Polypodiidites multiverrucosus Nagy 1963

This form, described from the Brickyard "Wind", Eger, Hungary (Nagy 1963, p. 404), occurs also in the Helvetian and Tortonian of the Mecsek Mountains, but in larger sizes (from 55 to 40 μ) and with verrucae higher by 1 to 2 μ; at 6.3 to 17 m depth in borehole Pusztakisfalu-VI, at 56.0 to 60.9 m depth in borehole Zengővárkony-59; at 558 to 561 m depth in borehole Hidas-53, and at the surface locality Farkasordító at Magyaregregy.

Presumably related to the family *Polypodiaceae.*

Polypodiidites maximus n. sp.

Plate XXVII, Fig. 1, 5

Holotype: Borehole Pszf.-VI, sample No 5, slide No 20, 31.1×120.6.
Locus typicus: Pusztakisfalu.
Stratum typicum: Helvetian, limnic sequence, light grey, clayey silt, borehole Pszf.-VI, depth 10.5 to 12.5 m.

Diagnosis: Bean-shaped spore of 66 by 50 μ size, covered by uneven verrucae 20 to 3 μ wide, 2 to 5 μ tall. Furrows of changing width between the verrucae form an uneven but distinct reticulum. The exine, 1.5 to 2 μ thick, is essentially an endosporium. The ornamental elements diminish in size towards the proximal side.

Differential diagnosis: Ornamental elements of so large size are unknown among the forms of the genus.

Remarks: Rather scarce.

Botanical affinity: Presumably *Polypodiaceae.*

Genus: *Verrucatosporites* THOMSON et PFLUG 1953

Verrucatosporites alienus (R. POT. 1931) TH. et PF. 1953

A form of 40 to 60 μ size, usually occurring in the deposits containing *Polypodiisporites favus* R. POT. 1934, but represented by a smaller population. Characterized by sparse verrucae and the consequent absence of a reticulum. It represents the family *Polypodiaceae.*

Verrucatosporites saalensis W. KR. 1959

Bean-shaped spores of 32 to 46 μ size, with various pointed, obtuse, isolated and coalesced ornamental elements lacking a reticulate structure. Line of dehiscence straight, fairly long, with a narrow swelling on either side of it. Size in the 32 to 46 μ range: the upper limit exceeds the size of the largest specimen observed by KRUTZSCH. The form was described by KRUTZSCH (1959b, p. 209) from the Eocene of the Geiseltal: a similar form was mentioned by ZAKLINSKAIA (l. c.) from the Miocene of the Caucasus. In our material it turned up fairly often in samples of the Lower Helvetian limnic sequence (in cores of boreholes Pusztakisfalu-VI, Zengővárkony-45).

Verrucatosporites histiopteroides W. KR. 1962 f. *major* n. f.

Plate XXVII, Fig. 6, 9

Spores of 56 to 74 μ size, somewhat larger than the size (45 to 65 μ) given by KRUTZSCH. Among the sculpture elements, fewer are broad and flat and more are conical. Ours might be a transitional form towards to *Verrucatosporites alienus*. It was encountered in the "schlier" sequence of borehole Zengővárkony-59, and in the brackwater and limnic deposits of boreholes Zengővárkony-45 and Pusztakisfalu-VI. The botanical affinities of the form are discussed by KRUTZSCH (1962, Geol. 11/3, p. 269); it is remarkably similar to *Histioptera incisa* (THUNB.) AG. which belongs to the family *Polypodiaceae* (ERDTMAN, 1957, p. 63, fig. 115). This living species occurs in tropical regions (South America, West Africa, Madagascar, the Himalayas and New South Wales). A few specimens have been found in our material. Form type: Borehole Zengővárkony-59, sample No 13, slide No 1, 45.5 × 111.3 size 75 by 54 μ.

Verrucatosporites gemmatus Nagy 1963

1963. *Verrucatosporites gemmanus* n. sp. Nagy – in Acta Botanica IX. 3–4, pp. 395–396. Holotype and diagnosis.

A few specimens in the Pannonian material of borehole Hidas-53; presumably polypodiaceous.

Genus: *Reticuloidosporites* Pflug 1953

Reticuloidosporites dentatus Pf. 1953

Bean-shaped spore of 62 μ size, with echinate ornamental elements, 1 μ tall, constituting a fairly dense reticulum. One specimen in the Pannonian of borehole H. No 53 (Sample No 9, depth 298.0 to 299.1 m). Pflug described it from the upper seam of the Helmstedt deposit; it is probably indicative of redeposition in our material.

Subgenus: *Reticuloidosporites* sg. *Acussporites* W. Kr. 1959.

1959. Subfgen.: *Reticuloidosporites* (*Acussporis* n. subfgen.) Krutzsch in Geologie Jhg. 8. Beiheft 21–22. p. 219.

cf. *Reticuloidosporites* subgen. *Acussporites poriacus* W. Kr. 1959

1959. *Reticuloidosporites (Acussporis) poriacus* n. fsp. Krutzsch in Geologie Beih. 21–22/1959. p. 219.

Roundish form of 50 μ size; perhaps, the polar variant of the form described by Krutzsch. Its wavy, two-layered wall is about 2 μ thick. On the surface one could surmise the presence of "minute pinhole-like pores" of which Krutzsch (1959b, p. 20) states that "Sie ist . . . reticulat angeordnet". In our form, a reticulate pattern is very vague, structural element are even smaller and less regularly arranged than in Krutzsch's form.

According to Krutzsch (l. c.), the form occurs in the German Eocene and Middle Miocene. In our material it cropped up in the Pliocene (Borehole Hidas 53, depth 135.5 to 137.0 m, one specimen), presumably as a result of redeposition.

Krutzsch (l. c. p. 219) did not even definitely decide whether his form is a spore or pollen, as its line of dehiscence cannot be observed (nor can that of our form).

Subclassis: **Hydropterides**
Ordo: *Salviniales*
Familia: Salviniaceae
Genus: *Hydrosporites* W. KR. 1962

1962. *Hydrosporis* n. fgen. KRUTZSCH – in Atlas I. p. 11.

KRUTZSCH placed into this genus small, round, sculptured and smooth spores. He indicated for the smooth forms, possible affinities with the genera *Azolla* and *Salvinia*, too; indeed, he did not exclude their belonging to any of several other genera of water ferns.

A single specimen has so far been encountered in our material.

Hydrosporites miocaenicus n. sp.
Plate XXVII, Fig. 8

Holotype: Borehole H.-53, sample No 19, slide No 2/1, 34.7×116.
Locus typicus: Hidas.
Stratum typicum: Tortonian, grey clay-marl, borehole H.-53, depth 558 to 561 m.

Diagnosis: A roundish microspore of 27 μ size. Its smooth exosporium is about 2 μ thick. Line of dehiscence thin, about 2/3 of the radius. Along it there is a darker line of about 2 μ width.

Differential diagnosis: It most resembles the species described by KRUTZSCH in 1962 (Atlas I, p. 66) by the name *Hydrosporis levis*, but it is larger with a thicker exosporium.

Remarks: Remains of *Azolla* were reported by PACLTOVÁ from the Oligocene of Ceské Budejovice (1960*, pp. 55–57), and by KRUTZSCH (1962, Atlas I, pp. 70–72) from the German Tertiary by the name *Azolla bohemica* PACLTOVÁ 1960.

Remains and microspores of *Azolla filiculoides* L. were reported by DUIGAN from the Australian Quaternary (1956, pp. 1–13, Pl. 2). Her figures and also ERDTMAN's living *Azolla filiculoides* (1957, p. 50) much resemble the new species.

* For more data and literature about the occurrence of *Azolla*, see the cited papers by PACLTOVÁ and DUIGAN.

Phylum: **GYMNOSPERMAE**
Subphylum: **PTERIDOSPERMOPHYTINA**
Classis: **Cycadopsida**
Ordo: *C y c a d a l e s*
Familia: Z a m i a c e a e
Genus: *Cycadopites* WODEHOUSE 1933 ex WILSON et WEBSTER **1946**

WODEHOUSE's genus *Cycadopites* (1933, p. 494) is a nomen nudum. The genotype, established by WILSON and WEBSTER (1946, p. 274) by the name *Cycadopites follicularis*, came from the Tertiary of Montana.

Cycadopites miocaenica n. sp.
Plate XXVIII, Fig. 1, 3

Holotype: Borehole Zgv.-59, sample No 13, slide No 2, 29.7×115.5.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence grey clayey silt, borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Spindle-shaped pollen, of 34 by 18 μ size; on its ventral side between the two poles there is a furrow with a prominent rim on either side. The surface of the exine is completely smooth.

Differential diagnosis: The Mecsek Mountains specimen does not resemble unequivocally *Cycadopites follicularis* WILSON and WEBSTER 1946, apart from the small difference in size, the new species is less elongate and the rim of the furrow does not turn so smoothly at the poles. Therefore, it seemd to be indicated to establish a new species for the Mecsek Mountains form. Having studied five living American species of the genus *Zamia* (WODEHOUSE 1935, p. 238) stated: "The grains are exactly alike in all observable respects." A photo by M. KEDVES of the pollen of living *Zamia obidensis* DUCKE much resembles our new species, both in size and morphology (see Plate XXVIII, Fig. 2).

Scarce in our material.

Sample No 20 (46.8 to 48.5 m depth) of this same borehole yielded an *epidermal fragment* of 315 by 130 μ size (Plate XXVIII, Fig. 4, Plate XXIX, Figs. 1–2). The remainder (slide 1, cross table number 36.1×106.8) is cycadaceous in the opinion of Prof. P. GREGUSS, with countersunk stomata surrounded by guard cells. The epidermal cells are relatively elongate. Prof. GREGUSS was kind enough to put at my disposal original photos of the epiderms of *Zamia recurvata* DUCKE (Plate XXVIII, Fig. 5) and *Macrozamia miqueli* A. DC., which correspond in stomatal structure with the epidermis in my material. These two data (the pollen and the epidermis) suggest the presence of some species of *Zamia* in our material.

Subphylum: **CONIFEROPHYTINA**
Classis: **Ginkgopsida**
Ordo: *Ginkgoales*
Familia: Ginkgoaceae
Genus: *Ginkgoretectina* MALJAVKINA 1953

Ginkgoretectina neogenica n. sp.

Plate XXX, Fig. 2, 3

Holotype: Borehole H.-53, sample No 11, slide No 1, 41.1×115.3.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, dark grey clay-marl, borehole H.-53, depth 479.1 to 482 m.

Diagnosis: Spindle-shaped pollen of 30 by 12 μ size. The colpus on its ventral side tapers to more or less acute points at the two poles. Exine thin (about 1 μ) easily crumpled.

Differential diagnosis: There are a number of genera whose names refer to *Ginkgo* and partly to some definite species of *Ginkgo*. Some of these were described from the Palaeozoic (*Ginkgocycadophytus* SAMOILOVITZ 1953, Permian, in. R. POT., Synopsis II, 1958, p. 93 and *Ginkgaletes* LUBER 1955, Permian, l. c. p. 94). Even apart from the difference in age, both differ also morphologically from our form; in the case of this genus, a morphological difference is not so significat, though. MALJAVKINA's form (1959, l. c.), which morphologically resembles the Mecsek Mountains form, is much larger, wherefore I prefered to establish a new species. In THOMSON and PFLUG's genus *Monocolpopollenites*, *M. zievelensis* PFLUG might be a *Ginkgo*, too (1953, p. 62), but neither this form, nor *M. ingens* PFLUG (l. c.) is identical with our form. Also on the basis of the pollen of living *Ginkgo* figured in ERDTMAN 1957, p. 21 and in KEDVES 1961, the affinity of our form to some species of *Ginkgo* seems probable.

Remarks: The occurrence of macrofossil *Ginkgo* in the Mecsek Mountains Miocene is recorded by PÁLFALVY (1964, p. 186; *Ginkgo adiantoides* UNG.). The pollen is not abundant but persistent in our Miocene and Pliocene material, with a size range of 21 to 43 μ.

Classis: **Coniferopsida**
Ordo: *Pinales (Coniferales)*

The lack of comprehensive studies on living coniferous pollen renders the indentification of fossil coniferous pollen one of the most difficult palynological tasks. The few well-known Central European species are readily distinguished in the Pleistocene; in the Pliocene, it is usual to distinguish, besides the types *Cedrus* and *Dacrydium*, a *Pinus silvestris type* RUDOLPH, a *Pinus haploxylon type* RUDOLPH, *Picea*, *Abies*; two types of *Tsuga*, *Sciado-*

pitys, bladderless coniferous pollen (partly on the basis of KLAUS manuscript thesis), and *Laricoidites*. According to WILLIS (1957, p. 169), there are 380 living species of conifers. In the Tertiary, this figure was presumably much larger and the distinction of the forms is substantially hampered by the lack of an adequate knowledge of various aspects of the problem.

The attempt at systematizing the coniferous pollen in our material is based on the literature available, particularly ERDTMAN (1957), ZAKLINSKAIA (1953, 1957), THOMSON and PFLUG (1953). R. POTONIÉ (1956, 1958, 1960: Synopsis I, II, III) and partly on studies of living material.

Familia: Abietaceae — Pinaceae
Subfamilia: Pinoideae
Genus: *Pityosporites* SEWARD 1914

Pityosporites labdacus (R. POT. 1931) TH. et PF. 1953

This species is to be treated as a collective category that includes the representatives of numerous species. It cannot be considered sinonymous with RUDOLPH's *Pinus sylvestris type*, although even that type was intended by RUDOLPH (1935, p. 259) to accommodate several species; I divided it on a morphological basis in two groups in a Pliocene material (NAGY 1958, pp. 38–40). Also in the present instance, I have carried out a morphological classification, although without the aim of identifying the fossil *Pinus* species of my material either with the figures of ERDTMAN (1943, 1957) or of other authors.

Pityosporites labdacus (R. POT. 1931) TH. et PF. 1953 *Type "A"*

Plate XXIX, Fig. 7

Pollen of 47 to 80 μ length, 30 to 45 μ height, with bladders more than hemispherical. The pollen bodies themselves are about twice as big as the bladders. The bodies bear no marked exine ridge, the surfaces are relatively delicately sculptured and also the reticulum of the bladder is rather delicate. Pollen of this type is not abundant but persistent from the Lower Helvetian to the Pliocene. The type presumably includes numerous species.

Pityosporites labdacus (R. POT. 1931) TH. et PF. 1953 *Type "B"*

Plate XXIX, Fig. 3, Plate XXX, Fig. 6

Forms 60 to 90 μ long, 35 to 45 μ high in the lateral position, up to and over 50 μ high in the dorso-ventral position. Both the body and the bladder are irregular of shape, frequently crumpled. Most grains bear narrow ridges of exine.

Also this form is persistent over the entire Mecsek Mountains Neogene, but most abundant in the Helvetian. The type presumably includes numerous species.

Pityosporites labdacus (R. Pot. 1931) Th. et Pf. 1953 *Type "C"*
Plate XXIX, Fig. 4

Elongate pollen of 50 to 73 μ size. The body is 40 to 58 μ long, 20 to 38 μ high. The bladders, relatively small (between 25 and 35 μ), are of the "*silvestroid*" type, with a rather delicate reticulum. The body is delicately granulate, less so on the ventral side.

In our material the type occurs from the bottom of the Helvetian to the bottom of the Sarmatian.

Pityosporites labdacus (R. Pot. 1931) Th. et Pf. 1953 *Type "D"*
Plate XXIX, Fig. 6

Pollen of 40 to 73 μ size and "*labdacus*" type. Body 25 to 40 μ in diameter, usually round, massive, or at least massive on the margin; surface less ornamented, at most granulate. The margin of the body exine is either entirely smooth or wavy. Bladder 15 to 30 μ (according to the size of the body), roundish, delicately reticulate. Exclusively in the terrestrial Helvetian (borehole Szászvár-8).

It might represent the *Podocarpaceae:* the establishing of its affinity will require further research.

Pityosporites thunbergiiformis n. sp.
Plate XXX, Fig. 1, 4

Holotype: Borehole Zgv.-59, sample No 13, slide No 1, 34.6×117.5.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence grey clayey silt. Borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Silvestris-type pollen of 85 μ full length. Body 60 by 50 μ, covered with granulae of various size. In the dorsoventral direction, the exine is about 3 μ thick, wavy, densely baculate; ectexine about 2, endexine about 1 μ thick. In the direction of the bladders, the exine thickens to about 6 or 7 μ and its sinuosity becomes broader. In the dorsoventral position, the bladders are seen to be of 50 by 30 μ size. They are more than hemispherical, with smooth borders. At the point of adhesion, on the outer side of the bladder, the grains of the exine's reticulum are smaller, whereas at the middle of the bladder they attain 5 μ.

Differential diagnosis: From the species thus far described of *Pityosporites*, it differs in the exine structure of the body and in the large grains about the middle of the bladder.

Remarks: Fairly frequent up to the Pliocene. Of ERDTMAN's figures (1957, p. 36) it most resembles in size and morphology the pollen of *Pinus thunbergii* PARL. IKUSE's (1956, Pl. 45, 32–34) figures of *P. thunbergii* also much resemble our fossil species.

Pityosporites zaklinskaiana n. sp.

Plate XXXI, Fig. 1, 2

Derivatio nominis: In honour of Palynologist E. D. ZAKLINSKAIA, Moscow.
Holotype: Borehole Zgv.-59, sample No 13, slide No 1, 33.4×101.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey clayey silt. Borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: "Silvestroid" pollen of 80 μ full diameter. Body large, 70 by 45 μ, finely reticulate, with a ridge about 2.5 or 3 μ tall on its proximal side. Bladders small, 30 by 23 μ, strewn with a reticulum of about 2 to 3 μ grain size, denser on the borders.

Differential diagnosis: Distinguished from the other species of the genus by its peculiar large body and small bladders.

Remarks: Similar forms (as far as can be recognized on her small figures) were reported by ZAKLINSKAIA (1954, Plate I, Figs. 11 to 12) from the Palaeogene of Kazachstan by the name "*Pinus sectio Banksiana*".

Genus: *Abietinaepollenites* R. POT. 1951.

Abietinaepollenites microalatus (R. POT. 1931) R. POT. 1951

The holotype was figured in 1931 from the Miocene and described in 1934 by the name *Pollenites microalatus* by R. POTONIÉ (Arb. Inst. 4, p. 49). On the basis of Pliocene material (Miocene according to KRUTZSCH, 1963, Atlas II, p. 56), RUDOLPH established the so-called *Pinus haploxylon type*. On the basis of studies on living material, he stated (1935, pp. 253–254) that, except for *Pinus strobus* L., the members of the *haploxylon* section of the *Pinus* genus exhibit pollen forms of identical type. He presented the two types (*silvestris* and *haploxylon*) as examples to be followed, and although we cannot use them nomenclaturally, we practically use his morphological finding as a basis.

In our material, this species occurs in there forms: one large, one smaller and one rather modern (cf. NAGY 1958. pp. 41–43: a list of synonyms is also given there).

Abietinaepollenites microalatus (R. Pot. 1931) R. Pot. 1951 ssp. *microalatus*

Plate XXXI, Fig. 4

Pollen of 50 to 66 μ size, with bladders as high as the pollen body. The ornament is a reticulum, more delicate on the body than on the bladders. Ridge very vague, exine 1.5 μ thick.

This form agrees with the so-called ancient form of *Pinus haploxylon* (the type which I described from the Mátra Foreland Pliocene: 1958, pp. 41–42). In the Mecsek Mountains material it extends into the Pliocene, but is less abundant than in the Miocene.

Delcourt and Sprumont (1955, pp. 51–52) mention its occurence in the Wealden and the Cenomanian; R. Potonié recorded it in the Miocene lignite of the Lausitz (1958, p. 61).

Abietinaepollenites microalatus (R. Pot. 1931) R. Pot. 1951 ssp. *major* R. Pot. 1951

Plate XXX, Fig. 5

Haploxylon type pollen of 66 to 103 μ size, in which the structure elements of the body differ widely in size range from those of the bladder; consequently, this cannot be a *picea*-type pollen. The bladders are wide-spaced. There is no exine ridge.

This form presumably also includes representatives of several species. Frequent in the bottom part of the Helvetian, it extends into the Pliocene: the Pliocene specimens are slightly larger.

Concerning type *major*, Delcourt and Sprumont (l. c., p. 52) cite Ross (1953, p. 34) who reported pollen whose size relegates it rather to the subspecies *Abietinaepollenites microalatus microalatus* (they mention forms of 40 μ size; l. c.).

Abietinaepollenites neogenicus n. sp.

Plate XXXII, Fig. 3, 4

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 42.7×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, silty clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: Haploxylon type pollen of 79 μ full diameter. Body size about 45 by 45 μ, finely reticulate with a small exine ridge about 2 to 2.5 μ tall. Bladders hemispherical, with reticulum, with meshes of about 3 to 4 μ. The bladders spaced about 10 μ apart, adhere to the dorsal side.

Differential diagnosis: It differs from the other *haploxylon*-type pollen mainly in the wider spacing of the bladders, wherefore in the dorsoventral position the pollen is not so smoothly elliptic as *A. microalatus microalatus*, but smoother than the ancient type of *A. microalatus major*. In size, it ranges between these two, with diameters from 65 to 79 μ.

Not too frequent in the Middle Miocene and the Pliocene.

Subfamilia: Abietoideae

Genus: *Tsugaepollenites* R. POT. et VENITZ 1934.

1933. *Tsuga* WODEHOUSE in Tertiary Pollen II. p. 491.
1934. *Tsugaepollenites* R. POT. et VENITZ in Arb. Inst. Paläob. 5. p.17.
1937. *Tsuga-pollenites* R. POT. RAATZ in Abh. Preuss. Geol. L. A. 183. p. 15.
1953. *Zonalapollenites* n. g. PFLUG in Palaeontogr. 94. B. p. 66.

Tsugaepollenites igniculus (R. POT. 1931) R. POT. et VENITZ 1934

1931. *Sporonites igniculus* R. POT. in Braunkohle H. 27. p. 556, Abb. 2.
1934. *Tsugae-pollenites igniculus* R. POT. et VENITZ in Arb. Inst. Paläob. 5. p. 17. 1. T. 8. fig.

I have classed a few pollen grains of about 50 μ size with POTONIÉ's original form. Compared to the preceding one, this form is much scarcer.

Tsugaepollenites igniculus (R. POT. 1931) R. POT. et VENITZ 1934, forma *maximus* RAATZ 1937

Plate XXXI, Fig. 5

The from described by R. POTONIÉ from the German Miocene is of 35 μ size (1934, 5., p. 17). RAATZ (1937, p. 15) mentioned a variety of 72 μ size; by the name *forma major:* R. POTONIÉ (1951) applied this same name to a specimen of 71 μ size. NAGY (1958, pp. 50–51) recorded as f. *major* some grains in the 60 to 110 μ range. In the Miocene and Pliocene, the present form is most abundant among the pollen of this form group.

Tsugaepollenites viridifluminipites (WODEHOUSE 1933) R. POT. 1958

1933. *Tsuga viridi — fluminipites* n. sp. WODEHOUSE in Tertiary Pollen II. p. 491, 14.
1953. *Zonalapollenites viridifluminipites* (WODEH.) n. c. THOMS. et PF. Palaeontogr. 94. B. p. 67.
1958. *Tsugaepollenites* (al. *Tsuga*) *viridifluminipites* (WODEHOUSE sp.) in THOMSON et PFLUG — R. POT. in Synopsis II. p. 48.

Pollen corresponding to living *Tsuga canadensis* CARR. occurred in just two specimens in the Pliocene of borehole Hidas-53.

Genus: *Piceapollenites* THIERGART 1938

R. POTONIÉ described this form in 1931* by the name *Piceapollenites alatus*. In 1934 (Arb. Inst. Paläobot. 5. p. 18) he raised the diagnosis of *Picea ? pollenites alatus*, described by POTONIÉ et VENITZ from a Miocene lignite, to the rank of a generic diagnosis (Synopsis II. p. 64). In 1934 (l. c.), POTONIÉ stated: "Exine an ihrer dicksten Stelle zwischen den Luftsäcken bis etwa 5 μ, also dicker als bei meisten *Pinus*-Arten." In 1958, he restated this same morphological feature (l. c.) as follows: " 'Kamm', d. h. optischer Querschnitt der proximalen Kalotte, kräftiger als bei *Abiespollenites*". This statement is not corroborated by the fossil evidence at my disposal. A survey of literature (see for details NAGY 1958, pp. 43–45) and a study of pollen from living plants convinced me that it is preferable to rely primarily on THIERGART's rather incomplete diagnosis from 1938, in which he does not mention the ridge at all, and uses, as a basis of comparison, the pollen of living *Picea abies* (L.) KARST. Also in THIERGART's figure (l. c. Pl. 24, Fig. 5) it is hard to establish the size of the ridge.

THOMSON and PFLUG (1953, p. 68) apply in full the diagnosis of living *Picea* species to the pollen of the "*alatus*" type, which is also a contradiction. I propose to describe, for the time being, the "*piceoid*" form, present in our material, as a new species.

Piceapollenites neogenicus n. sp.
Plate XXXII, Fig. 1

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 29.6×109.9.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, silty clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: A pollen of 112 μ full length. Body about 90 μ long, 60 μ wide. Exine finely reticulate, about 3 μ thick at the ridge. Air bladders 40 μ long, 60 μ wide, about hemispherical in shape, reticulum of their exine slightly rougher: the structure passes gradually into that of the body.

Differential diagnosis: Includes morphologically the pollen corresponding to the diagnosis of *Pityosporites alatus* (R. POT. 1931) THOMSON et PFLUG 1953 (l. c.), but only those in the 60 to 120 μ size range.

Remarks: Some smaller specimens presumably corresponding to *Picea omorica* PURKYNE might be separated from the new species. However, the problem is not so simple as it seemed on the basis of my Pliocene material of 1958 (l. c.), because distinction is to be made on the basis of morphological differences, which suggest the presence of more than just two species. This collective form of *Picea* pollen occurs from the bottom of the Helvetian to, and including, the Pliocene. The common features of the forms subsumed here include a more delicate structure and differences in the position of the bladders.

* For a list of synonyms see NAGY 1958, p. 43.

Genus: *Pseudotsugoidites* (R. Pot., Thoms. et Thierg. 1950) emend.

1950. *Pseudotsugoidites* R. Pot., Thoms. et Thierg. in Geol. Jb. 65. p. 48.

The authors gave this name as a nomen nudum, as stated by R. Potonié in 1958 (Synopsis II. p. 78). The generotype below refers to a form recalling Erdtman's figure (1957, p. 40) of living *Pseudotsuga*.

Generotype: Pseudotsugoidites mecsekensis n. sp.

Diagnosis: Spheroidal, bladderless pollen with thin, smooth exine, which locally thickens into minute peaks and thins out on the distal side.

Differential diagnosis: Inaperturopollenites magnus (R. Pot. 1934) Th. et Pf. 1953—referred to the living genus *Larix*—is finely granulate or verrucate.

Pseudotsugoidites mecsekensis n. sp.

Plate XXIX, Fig. 5

Holotype: Mecseknádasd, slide No 1.
Locus typicus: Mecseknádasd.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl.

Diagnosis: Spheroidal pollen of 80 μ size. Exine about 1.5 μ thick, locally thickened at 4 or 5 points into prominences 2 μ tall; smooth otherwise.

Remarks: One specimen in the material of the macrofloral locality above the village of Mecseknádasd. Macrofossils of *Pseudotsuga* are known from the European Tertiary (Andreánszky 1954, p. 148).

Genus: *Abiespollenites* Thiergart 1938

Abiespollenites absolutus Thiergart 1938

Pollen in the 70 to 170 μ size range. Body minutely reticulate, less ornamented on the ventral side, with an exine ridge 5 to 10 μ tall (partly in dependence on the size of the pollen grain). Bladders, usually more than hemispherical, resemble in the lateral position those of the *Pinus silvestris type*. The bladders bear a coarse-grained reticulum. Some of the pollen grains are intensely crumpled, corroded, difficult to study (for description and literature see R. Potonié 1958 p. 63 and Nagy 1958 pp. 45–46). Persistent in the Mecsek Mountains material even more frequent in the Pliocene. The species is to be regarded as a collective category. Rather than giving a specific description, THIERGART compared the species with living *Abies* (1938, p. 306). RAATZ only gave dimensions (1937, p. 16). The species should by all means be subdivided further as soon as more knowledge concerning living conifers will be available.

Abiespollenites crassus n. sp.

Plate XXXIV, Fig. 2

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, cross table number 32.1×114.9.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey, silty clay-marl, borehole Zgv.-59, depth 63.0 to 65.0 m.

Diagnosis: Pollen of 99 μ full length. Body about 50 by 62 μ. Surface of exine wavy, 3 to 4 μ thick. Ectexine "a" densely baculate; ectexine "b" consists of wider-spaced bacula. Bladders about 50 by 50 μ, more than hemispherical. The surface is reticulate, coarser (3 to 5 μ) at the middle, finer near the borders.

Differential diagnosis: It is the large bladders, and the relatively thinner exine of peculiar structure that distinguish the new species from *A. absolutus* THIERG.

A few specimens of 88 to 116 μ size in the deep cores (Nos. 24, 25, 27) of borehole Zengővárkony-59.

Genus: *Keteleeriaepollenites* n. g.

Generotype: *Keteleeriaepollenites komlóensis* n. g. n. sp.

Diagnosis: Disaccate pollen of relatively delicately reticulate exine; body without ridge; bladders more the hemispherical and more coarsely reticulate.

Differential diagnosis: The genus most resembling the new one is *Abiespollenites* THIERGART, which differs, however, from the new one by its heavier exine structure and marked ridge.

Remarks: Pollen grains of 70 to 135 μ full diameter, scarce but persistent in the entire Mecsek Mountains Neogene. The decision, whether the small differences in morphology or possibly in size justify the distinguishing of species would, require the study of living *Keteleeria*. So far, the pollen of living *Keteleeria davidiana* (BETRAND) BEISSN. is known. The genus *Keteleeria* has four living species in China (WILLIS 1957, p. 353.). For more detaile about the fossil genus *Keteleeria*, see NAGY 1958, pp. 46–47.

Keteleeriaepollenites komlóensis n. g. n. sp.
Plate XXXIV, Fig. 1

Holotype: Borehole K.-120, sample No 18, slide No 1, 29.3×117.2.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish-scale-bearing sequence, light grey clay-marl, borehole K.-120, depth 178.0 to 178.8.

Diagnosis: Disaccate pollen of 110 μ full diameter. Body 90 by 58 μ, finely reticulate, exine about 1.5 μ thick. Bladders 53 by 40 μ, more than hemispherical, covered by a reticulum consisting of grains of 2 to 5 μ size.
Differential diagnosis: see the generic description.

Genus: *Inaperturopollenites* TH. et PF. 1953

Inaperturopollenites cf. *magnus* (R. POT. 1934) TH. et PF. 1953
Plate XXXII, Fig. 2

Our large, elliptic pollen grain of 137 μ size cannot be placed here with all certainty. Its exine is thick, about 5 μ, granulate, or perhaps finely verrucate. Few specimens in the Pliocene of borehole Hidas-53 (the figured specimen was found at 147.5 to 148.5 m depth). The genus *Larix* might be mentioned in this connection with a very great deal of caution. PRAGLOWSKI (1962, p. 63) states the maximum size of *Larix decidua* MILL. to be 90 μ, whereas ERDTMAN (1954, p. 132) admits 102 μ.*

Genus: *Cedripites* WODEHOUSE 1933

In 1958, COUPER (p. 154, Pl. 29, Figs. 5–6) established the genus *Parvisaccites* as a complement to WODEHOUSE's valid genus. I feel this is superfluous, because the differences can be taken care of on the specific level.

Cedripites szászvárensis n. sp.
Plate XXXIII, Fig. 2

Holotype: Borehole Sz.-8, sample No 218, slide No 1, 45.8×114.5.
Locus typicus: Szászvár.
Stratum typicum: Helvetian, terrestrial sequence, grey clay-marl, borehole Sz.-8, depth 433.6 to 433.8 m.

* See further MANUM (1962, pp. 38–40).

Diagnosis: Pollen of 66 by 45 μ size, provided with a roundish bladder. Body very delicately reticuloid, exine thin (ridge about 1 to 1.5 μ tall). In the dorsoventral position, the two bladders pass gradually into the body, except that their surfaces are slightly more reticulate. Bladder diameter 15 to 20 μ.

A specimen in the lateral position was encountered in this same sample (Slide No 1, 41.8×115.6), (Plate XXXV, Fig. 6). I have designated this lateral specimen as isotype (according to the *Code*, 1961, p. 7).

Differential diagnosis: The new species differs from *Cedripites eocenicus* WODEHOUSE (1933, pp. 490–491) by shape and by the body-size-to-bladder-size ratio.

Remarks: Besides the Szászvár borehole, this form has occurred in rather subordinate numbers in boreholes Komló-120 and Zengővárkony-45. It has not been encountered in cores younger than these.

Cedripites deodaraeformis n. sp.
Plate XXXV, Fig. 2

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 37.5×110.0.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: "*Cedroid*" pollen of 91 μ full diameter. Body 60 by 60 μ, heavily reticulate; the slightly wavy ridge of 3.5 to 4 μ passes over to the bladders, and flares out on them. Bladders about 43 by 50 μ, even more coarsely reticulate.

Differential diagnosis: The new species differs from the two preceding ones by the peculiar development of the ridge.

Highly similar to the pollen or living *Cedrus deodara* LOND. A form scarce but persistent from the Middle Miocene to the Pliocene, in the size range 53 to 120 μ.

Remarks: PÁLFALVY (1964, p. 186) reported a macrofossil of *Cedrus miocenica* LAUBY from the Helvetian-Tortonian flora of the Mecsek Mountains.

Cedripites crassus n. sp.
Plate XXXV, Fig. 1

Holotype: Borehole H.-53, sample No 1, slide No 2, 19.5×87.5.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian clay-marl, borehole H.-53, depth 73.3 to 89.5 m.

Diagnosis: "*Cedroid*" pollen of 114 μ full length. The body of about 90 by 50 μ size can hardly be distinguished from the bladder. The heavily reticulate exine passes gradually into the bladder of about 45 by 55 μ size which is broad-based and recurved cloak-like. The body is spanned by a ridge 4 to 5 μ tall on the average but up to 12 μ locally.

Differential diagnosis: C. deodaraeformis n. sp. differs by its size and ornament from *C. crassus* n. sp. A few specimens in the Pliocene material of borehole Hidas-53.

Familia: Taxodiaceae — Cupressaceae

Studies on the pollen of the living plants have revealed that, except for the rather conspicuous genus *Sciadopitys*, pollen grains of the two families are very difficult to distinguish (cf. NAGY 1958, pp. 53–61, and 130–135, with a copious literature). The Mecsek Mountains material studied so far (including also the Hidas Mine samples) has revealed this form group to be much less abundant than was suggested in reference cited above. The group termed "*bladderless Coniferae* s. str." by KLAUS* was most abundant with 35 percent in sample 6, seam 1, Hidas mine.

I agree with MANUM (1960, pp. 40–42) in considering the papillate forms as distinguishable in the fossil material. As far as I had the occasion to find out, taxodiaceous pollen is characterized by a thicker exine than cupressaceous pollen. As suggested by MANUM (l. c.), some taxonomically far-way specimens are liable to be placed here time and again. The wear and tear due to corrosion and fossilization is not adequetaly known, either, although it may affect just the main difference between *Taxodiaceae* and *Cupressaceae*, viz. the thickness of the exine. Nor does the separation of the "*hiatus*" forms bring the problem nearer to a solution. Any spherical pollen assumes this form when split open. I have divided into three groups the pollen grains belonging here of the Mecsek Mountains material. In addition, I have discriminated some species. The three morphological groups are as follows:

1. Smooth forms with thicker exine
2. Smooth forms with thinner exine
3. Forms with finely granulate exine

Genus: *Taxodiaceaepollenites* KREMP 1949

Taxodiaceaepollenites sp.
Plate XXXIV, Fig. 3–5

1. Forms with thicker exine: grains in the 14 to 33 μ size range, with an exine about 1 μ thick, which have more or less preserved their roundish shape. In some specimens, the papilla is at the middle of the equatorial plane. Exine smooth or intragranulate. I suppose this group to be taxodiaceous.

* See the unpublished dissertation of KLAUS (1950).

2. Forms with thinner exine: grains in the 17 to 40 μ size range, exine about 0.5 μ thick, smooth, occasionally intrapunctate. More often crumpled, owing to the thinness of the exine. The exine morphology of the few split-open specimens in our material suggests the family *Cupressaceae* (NAGY, 1958, p. 61).

3. Forms of granulate surface: this group presumably includes cupressaceous and cephalotaxaceous pollen. Roundish grains of 23 μ size, with finely granulate surface. As to size and morphology, the genera *Callitris* and *Diselma* (ERDTMAN, 1957, p. 10, 18) enter into consideration. Occurrence in borehole Hidas-53 particularly in the Helvetian section, and in borehole Zengővárkony-45 at large.

The species I have placed into various taxonomic units are the following.

Familia: T a x o d i a c e a e
Genus: *Sequoiapollenites* THIERGART 1938

Sequoiapollenites polymorphosus THIERG. 1938
Plate XXXV, Fig. 4–5

Specimens with papillae of 27 to 33 μ size: the length of the papilla could actually be measured on one specimen only (10 μ): I consider it to belong to the group of *Sequoia*, together with the rest of the specimen which exhibit papillae. The specimens were found in the Helvetian, Tortonian and Sarmatian samples of borehole Hidas-53.

Genus: *Cunninghamiaepollenites* (WODEHOUSE 1933) n. c.

1933. *Cunninghamia* WODEHOUSE Tertiary Pollen II. p. 495, 17. fig.

In 1958 SZAFER (p. 11) described—from the Tortonian of Stare Glivice—a plant macrofossil by the name *Cunninghamia europaea*. From the same material, J. OSZAST (l. c., p. 9) reported pollen grains of *Cunninghamia* (l. c., Pl. 2, Fig. 17). PÁLFALVY reported a remain of *Cunninghamia* sp. from the Helvetian and Tortonian of the Mecsek Mountains (1964, p. 186).

Cunninghamiaepollenites lignitus n. sp.
Plate XXXIV, Fig. 6

Holotype: Hidas mine, seam II, sample No 6, slide No 2, 34.2×112.8.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignitic sequence.

Diagnosis: Roundish pollen grain of 36 μ size, with a minute pore aperture in its intragranulate exine. Radial, fold-like lines issue from the pore towards the border of the grain. The ectexine surrounds the body as a delicate, finely intrapunctate veil. One specimen so far. Possibly another specimen of 19 μ size from the same sample can also placed here.

Differential diagnosis: There is only one contour drawing of the generotype. It is peculiarly crumpled, torn open and granulate. The Mecsek Mountains species is smooth and untorn. This difference precludes any identification with the generotype and makes it preferable to establish a new taxon.

Genus: *Sciadopityspollenites* RAATZ 1937

Sciadopityspollenites serratus (R. POT. et VENITZ 1934) RAATZ 1937

Plate XXXIII, Fig. 5

For a list of synonyms, see NAGY, 1958, pp. 52–53. Furthermore:
1958. *Sciadopityspollenites serratus* (R. POT. et VEN.) RAATZ — in R. POT. Synopsis II. p. 81.

Sciadopityspollenites serratus is scarce in our material: it occurs in the 35 to 54 μ size range. In this respect, it best fits the specimens recorded by MANUM (1962, p. 42). The specimens described by RAATZ (1937 p. 13) are larger (41 to 60 μ). The few specimens I found in my Mátraalja material (NAGY 1958, p. 53) are smaller (30 to 40 μ). Its European stratigraphic range has been determined as Eocene to Pliocene (THIERGART 1949, KIRCHHEIMER 1950, KRUTZSCH 1957, NAGY 1958).

Most authors refer this species to the living Japanese species *Sciadopitys verticillata* SIEB. et ZUCC., but there is no statisfactory evidence for a specific identification (see KIRCHHEIMER 1950, MANUM 1962).

Familia: C u p r e s s a c e a e
Genus: *Chamaecyparidipollenites* n. g.

Generotype: Chamaecyparidipollenites flexuosus n. g. n. sp.

Diagnosis: Roundish pollen grains of small size. The ectexine, loosely separated from the endexine, lends an irregular outline to the grain. Surface unevenly intragranulate.

Differential diagnosis: The loose ectexine suggests the genus *Cunninghamia* but the ectexine of *Cunninghamiaepollenites* is even more definitely separate; also, the pollen grains of this genus possess pores.

Remarks: I have established the fossil genus on the basis of its morphological similarity to ERDTMAN's (1957, p. 26) figure of the pollen of *Chamaecyparis pisifera* ENDL. The genus *Chamaecyparis* occurs in East Asia (Taiwan, Japan), on the Pacific coast of North America and in Florida (KRÜSSMANN 1960, p. 48). The living species exhibit a wide variety of ecologic requirements. *Chamaecyparis pisifera* thrives on wet valley floors in Japan (l. c. p. 103), *Ch. thyoides* (L.) B. I. P. in North American swamps.

Chamaecyparidipollenites flexuosus n. g. n. sp.
Plate XXXV, Fig. 3

Holotype: Borehole H.-53, sample No 13, slide No 2, 32.6×113.5.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, greyish green clay-marl, borehole H.-53, depth 444 m.

Diagnosis: Roundish pollen of 27 μ size; exine 1.5 μ thick. Ectexine perhaps slightly thinner than endexine: the two are separated locally.

Differential diagnosis: see generic diagnosis.

A few specimens in our material.

Familia: A r a u c a r i a c e a e
Genus: *Araucariacites* COOKSON 1951

1947. *Granulonapites (Araucariacites)* COOKSON Plant Microfossils p. 130.
1951. *Araucariacites* COOKSON — in COOKSON et DUIGAN, Tertiary Araucariaceae from South-Eastern Australia, Biol. Sci. 4. 4. p. 442.
1953. *Araucariacites* genus COOKSON ex COUPER — Upper Mesozoic and Cainozoic etc. p. 39.

The generic name *Araucariacites* was applied in brackets by COOKSON (1947, p. 130), in the sense of ERDTMAN's (1947) "*nomen typicum concretum*". However, in 1951 she dropped the "*nomen typicum abstractum*" (see above).

The holotype of the genus *Araucariacites* was defined in 1953 by COOPER (l. c.).

Araucariacites komlóensis n. sp.
Plate XXXVI, Fig. 1

Holotype: Borehole K.-120, sample No 105, slide No 2, 46.1×104.0.
Locus typicus: Komló.
Stratum typicum: Helvetian fish-scale-bearing sequence dark grey sandy marl, borehole K.-120 depth 372.0 to 374.4 m, presumably secondary.

Diagnosis: Inaperturate spheroidal pollen grain of 85 μ diameter. Exine structure: ectexine (sexine) granulate or baculate (pilate), about 1 to 1.5 μ thick, endexine (nexine) thick, locally up to 2 μ, thinner elsewhere; beneath it the endexine "b" is thin, line-like. This endexine structure gives the impression of a delicate reticulum in surface view. The wall bears secondary folds.

Differential diagnosis: The new species agrees with the diagnosis of *Araucariacites hungaricus* described by M. DEÁK (1964, pp. 112–113) from the Upper Aptian of the Bakony Mountains: "Pollen á contour rond ou ovale, exine finement granulée" (l. c. p. 112); except that the new species is much larger, with a much finer granulation. COOKSON (1947, Kerguelen Arch. p. 131), refering to ERDTMAN and to her own observations, also states the pollen to be granulate. Whereas the figure in ERDTMAN 1957 (p. 9, Fig. 7) refers only to the exine structure, his painstaking description and figures in 1965 (pp. 17–20) confirm the necessity of placing our form into this genus. Our form is closely related to the figures of in situ specimens in ERDTMAN 1951 (Pl. 2, Figs. 14–15). Considering the figures, and also the considerable geographical distance, it seemed more reasonable to describe the form as a new species.

Remarks: The size of our form coincides with the maximum size of pollen grains of the living genus *Araucaria* as stated by COOKSON and DUIGAN (1951, l. c., Pl. 2, Figs. 14–15).

One specimen in my material, in a sample is derived from a hypothetical brackwater deposit which yielded, also *Baltisphaeridium brevispinosum* (EIS.) EIS. This latter form suggests redeposition; hence, the new form is presumably redeposited, too. This is confirmed by TSCHUDY's figure (1965, Fig. 1) of an *Araucariacites* from the Upper Cretaceous of the Appalachian Ranges, which strikingly resembles the new species.

According to G. ANDREÁNSZKY (1954, p. 147), the family *Araucariaceae*, now restricted to the southern hemisphere, thrived also on the northern hemisphere in earlier times, but not—as stated by ANDREÁNSZKY in a personal communication—in the Neogene. A scale of a strobile was described as *Araucaria hungarica* by K. RÁSKY (1943, pp. 524–525) from the Oligocene of Csillaghegy.

Araucariacites hidasensis n. sp.

Plate XXXVI, Fig. 6

Holotype: Borehole H.-53, sample No 1, slide No 2, 20.2×88.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, grey clay-marl, borehole H.-53, depth 73.3 to 89.5 m.

Diagnosis: Spheroidal, inaperturate pollen of 73 μ size, with an exine about 2 μ thick. Spines, about 1 to 1.5 μ tall project from the surface of the ectexine: beneath them a concentric, wavy endexine is seen. In top view, the exine shows a reticulum of uneven grain size. The pollen grain is secondarily crumpled.

Differential diagnosis: It differs from *Araucariacites komlóensis* n. sp. by its small spines, uneven reticulation and smaller size.

Remarks: It is more similar to the exine drawings of some *Agathis* species figured by ERDTMAN (1957, p. 8, fig. 5) than to the exine drawing of the *Araucaria* species. It is larger by 13 μ than the pollen of living *Agathis*, as stated by COOKSON and DUIGAN (1951, Table 5) and by 11 μ than the maximus pollen grain size of *Agathis yallournensis* COOKSON et DUIGAN.

Familia: P o d o c a r p a c e a e
Genus: *Podocarpidites* (COOKSON 1947) ex COUPER 1953

I agree with COUPER (1953, p. 53) in that it would be unjustified to restrict the diagnosis to disaccate pollen forms and I do not join R. POTONIÉ's (1958, p. 68) objection.

Several species that can be classed with this genus have been encountered in our material.

Podocarpidites microreticuloidata COOKSON 1947
Plate XXXVI, Fig. 4–5

Our specimens are of 63 to 90 μ length and 32 to 60 μ body size. COOKSON mentions forms of 53 to 64 μ size. As there is an overlap in size range, I consider it superfluous to establish a new species. The form is scarce in the Helvetian limnic sequence and in the Middle Miocene. Trisaccate specimens have also occurred (borehole Zengővárkony-59, sample No 22).

Podocarpidites papilionis n. sp.
Plate XXXVII, Fig. 1–2

Holotype: Borehole Zgv.-59, sample No 14, slide No 1, 42.1×107.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence, grey clay-marl, borehole Zgv.-59, depth 34.0 to 37.5 m.

Diagnosis: Disaccate pollen grains of 81 μ full length. Body about 30 by 40 μ, with a thick (2 to 3 μ), massive exine. Bladders of about equal size (50 by 38 μ), in characteristic butterfly-wing position, with a relatively coarse-grained reticulum on the distal side. The reticula converge towards the point of adherence of the tapering bladder.

Differential diagnosis: The position and reticulum of the bladder differs from the forms described till now.

One specimen so far.

Podocarpidites acmopyleformis n. sp.
Plate XXXVIII, Fig. 3–4

Holotype: Borehole Sz.-8, sample No 219, slide No 2, 30.7×104.9.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, terrestrial sequence, grey calcareous marl, borehole Sz.-8, depth 433.8 to 434.1 m.

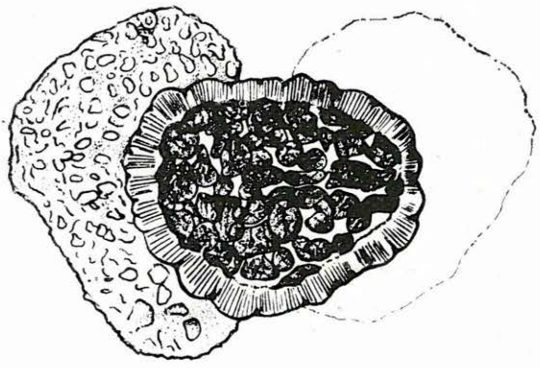


Fig. — ábra 33. Podocarpidites acmopyleformis n. sp.

Diagnosis: Disaccate pollen of 73 μ full size. Body 40 by 32 μ, wavy in outline. Exine composed of a massive ectexine, 3.5 to 4 μ thick, and a baculate endexine less than about 1 μ thick. Surface of body uneven, covered with low verrucae paralleling the wavy outline of the exine. Bladders about 45 by 30 μ in size, with a thin exine and fine-grained reticulum, in the wing-and-wing position of podocarpaceous pollen. Secondarily crumpled (Textfig. 33).

Differential diagnosis: The exine structure differs from those of the similar pollen types of *Podocarpus* and *Dacrydium*. The structure as figured and described by Erdtman (1957, p. 7 and 1965, p. 14) of the body of *Acmopyle pancheri* Pilger is similar to that of the Mecsek Mountains species.

In the dorsoventral view, the bladder of the living species is smaller than that of the fossil one, its reticulum is of a broader lumen, but the outline of its exine is just as delicate. All this raises the problem of affinity to the genus *Acmopyle*.

One specimen thus far.

Podocarpidites macrophylliformis n. sp.

Plate XXXIII, Fig. 3; Plate XXXVI, Fig. 7

Holotype: Borehole K.-120, sample No 18, slide No 2, 36.2×115.2.

Locus typicus: Komló.

Stratum typicum: Helvetian fish-scale-bearing sequence light grey calcareous clay-marl, borehole K.-120, 178.0 to 178.8 m.

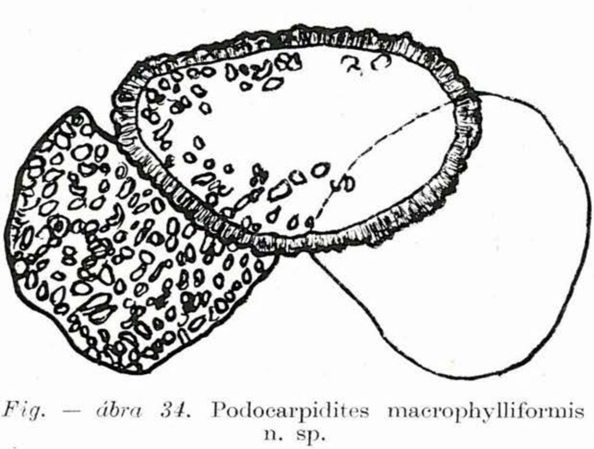


Fig. — ábra 34. Podocarpidites macrophylliformis n. sp.

Diagnosis: Disaccate pollen of 80 μ full length. In the lateral position, the body appears of 50 to 30 μ size; exine about 3 μ thick with an outline relief of 2 to 3 μ, and a correspondingly heavy ornament. Bladders about 35 by 35 μ size, heavily outlined, minutely reticulate (Textfig. 34).

Differential diagnosis: Seems to be affine to the form group of living *Podocarpus macrophyllus* var. *mahi* BUD. on the basis of a figure in the Chinese pollen book (1960, Pl. IV. Fig. 1).

Besides the holotype, a few specimens were encountered in Middle Miocene deposits.

Genus: *Dacrycarpites* COOKSON et PIKE 1953

Dacrycarpites hungaricus NAGY 1962

This form described from the Lower Miocene of Várpalota (1962, pp. 154–156) occurs in the size range 100 to 120 μ; bladder structure typically "podocarpoid" *(Podocarpus)*, sectio *Dacrycarpus* (COOKSON and PIKE, p. 7).

In the fish-scale-bearing sequence (178.0 to 178.8 m depth) of borehole Komló-120; in the lignite-bearing (667.2 to 669.7 m depth) of borehole Hidas-53; presumably redeposited in the Upper Pannonian (135.5 to 137.0 m depth) of the latter borehole.

Genus: *Dacrydiumites* COOKSON 1953 emend.

1947. *Disaccites (Phyllocladidites)* n. sp. COOKSON — in Plant Microfossils from the lignites of Kerguelen Archipelago. B.A.N.Z.A.R.E.; A. II. 8. pp. 132–133.
1953. *Phyllocladidites* COOKSON ex COUPER in COUPER N.Z.G.I. Pal. Bul. 22. p. 38.
1953. *Dacrydiumites* COOKSON — in Austr. Journ. of Botany Vol. 1. No 1. p. 66.

Generotype: Dacrydiumites mawsonii (COOKSON 1947) COOKSON 1953, l. c.

In 1947, COOKSON designated no generotype. In 1953, COOPER designated *Phyllocladidites mawsonii* as generotype. COOKSON emphasized, both in 1947 and 1953 (Aust. Journal of Botany 1. 1. p. 64.) when giving the name *Phyllocladidites* that she supposed the fossil species to represent the living genus *Phyllocladus*. However, in her 1953 paper she ascertained the two species described by her to be markedly similar to *Dacrydium franklini* HOOK. F. and changed the name of the genus to *Dacrydiumites* (1953 p. 66.). Now according to the *Code*, "The only proper reasons for changing a name are either a more profound knowledge of the facts resulting from adequate taxonomic study or necessity of giving up a nomenclature that is contrary to the rules." Studies on material from living plants appear to me a sufficient reason for changing this generic name. However, the species subsequently described by COOKSON, *Dacrydiumites florinii* (COOKSON et PIKE 1953, p. 479) and *D. balmei* (COOKSON 1956, pp. 46–47), do not fit the original generic diagnosis any more.

My material includes fairly numerous species of the genus. On the basis of these and of the above considerations, I give the following emendation:

Diagnosis: Medium-sized pollen grains of bilateral or radial symmetry, bladders either 2 or 3 or surrounding the pollen body, which when expanded, do not extend far beyond the equator of the grain; body of grain ellipsoidal with a wide clearly defined furrow. The exine is firm, granular, with well-developed mesoexinic formations.

Remarks: The morphological similarity between the genus *Phyllocladus* and *Dacrydium franklini* HOOK raises the possibility of a closer botanical affinity (see the remarks concerning these families in ERDTMAN 1965).

Dacrydiumites balansaeformis n. sp.

Plate XXXIX, Fig. 3–4

Holotype: Borehole Zgv.-59, sample No 1, slide No 14, 42.1×109.3.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence, grey clay-marl, borehole Zgv.-59, depth 34.0 to 37.5 m.

Diagnosis: Disaccate pollen of 74 μ full diameter. Body about 65 by 25 μ, hard to distinguish from the bladders. Baculate ridge about 5 to 6 μ thick, underlain by a sparsely baculate layer of about 1 μ thickness. The bladder of about 25 by 15 μ size bears a reticulum that is the continuation of that of the body. Its ornament is arranged fish-scale fashion and continues in long baculate elements. The bladders are arranged radially about the aperture of the exine.

Differential diagnosis: As for size, *Dacrydiumites florinii* COOKSON 1953 agrees with the Mecsek Mountains species; the description of its disaccate variety appears to be almost completely identical with the new species. There is a slight difference in the thickness of the ridge (that of *D. florinii* is slightly thinner).

Remarks: On the basis of Table 3 of the paper by COOKSON and PIKE, the Mecsek Mountains species is closer to the photo (l. c. Plate 3, Figs. 36–37) of living *Dacrydium balansae* BRONG. et GRIS. than to *Dacrydiumites florinii* COOKSON et PIKE 1953 which is rather intensely variable. According to the description, however, the pollen grains of the living species are much smaller.

One specimen thus far.

Dacrydiumites taxoidiformis n. sp.

Plate XXXVII, Fig. 3–4

Holotype: Borehole Zgv.-59, sample No 13, slide No 1, 37.2×113.2.
Locus typicus: Zengővárkony.
Stratum typicum: "Schlier" sequence, grey clayey silt, borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Pollen of 75 μ full diameter. Body about 50 by 46 μ, heavily outlined and minutely reticulate. The exine ridge, 5 to 6 μ thick, is slightly wavy. Bladders about 35 by 30 μ in size, slightly more than hemispherical, adhering close to each other on the periphery, as in the pollen of haploxylon type. Bladders divided into long scale-like units resembling bacula. Bladders covered with a sparse coarsegrained reticulum on their distal sides.

Differential diagnosis: It is the peculiar twofold ornament that distinguishes this species from the rest of the genus.

The fossil species much resembles *Dacrydium taxoides* BRONG. et GRIS. as figured by ERDTMAN (1957, p. 18).

A few specimens besides the holotype.

Dacrydiumites guillauminii n. sp.

Plate XXXIII, Fig. 4

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 31.1×100.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing-sequence, grey silty clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: Spherical pollen of 52 μ diameter. Body of about 42 μ diameter, minutely but markedly reticulate. The bladder is represented by a ridge about 4 to 7 μ tall, constituted by minute parallel bacula arranged fish-scale fashion.

Differential diagnosis: Differs in its nearly or fully radially symmetric bladders from the other species of the genus. Profoundly resembles living *Dacrydium guillauminii* BUCHHOLZ (ERDTMAN, 1957. p. 17). From *Dacrydium araucarioides* BRONG. et GRIS. (l. c. p. 14), it differs mostly in size; the structure is rather similar. A few specimens in the 52 to 85 μ size range in the lower portions of boreholes Szászvár-8 and Zengővárkony-59.

Dacrydiumites inclinatus n. sp.

Plate XXXVIII, Fig. 1–2

Holotype: Borehole Zgv.-59, sample No 24, slide No 1, 29.5×102.6.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 60.9 to 63 m.

Diagnosis: Pollen of 88 μ full diameter. Body 57 by 57 μ, exine about 2 μ thick, outline wavy with a relief of 2 to 4 μ, ornament frosted-looking. Bladder about 35 by 20 μ, densely reticulate, bending out in a flat arc beside the body. On the distal side, in the area bounded by the bladders and in a position rotated for 90° with respect to these, a formation of 22 μ size and another of 14 μ size is visible.

Differential diagnosis: It is the peculiar bladder structure and the small tubercles, not identical to there of *Dacrydium franklinii* HOOK. (ERDTMAN, 1957, p. 16), that distinguish this species from the rest of the genus.

Two specimens in all, both in the same borehole, the other specimen is of 63 μ size (in sample No 22 51.3–56 m).

Genus: *Phyllocladipollenites* n. g.

Generotype: Phyllocladipollenites grandis n. g. n. sp.

Diagnosis: Pollen grains of bilateral symmetry, with a small bladder. Body elongate, spheroidal, with two peculiar projections, surface structurate.

Differential diagnosis: Widely different, both in size and morphology from COOKSON's et PIKE's *Phyllocladus palaeogenicus* (Austr. Journ. Bot. 1954, Plate 2, Figs. 1–6).

Remarks: In 1947, when establishing the genus *Phyllocladidites*, COOKSON believed to be writing about representatives of the genus *Phyllocladus*. Subsequent research revealed the fossil species to be related to living *Dacrydium franklinii* (COOKSON 1953, p. 64) and a new generic name had to be given (see also under the genus *Dacrydiumites* l. c. p. 66).

The species I have found is larger, but in morphology it resembles living *Phyllocladus protractus* PILGER (ERDTMAN 1957, p. 31, Fig. 51). This suggested the establishing of a new genus. The problem as to whether the morphological similarity between *Dacrydium franklinii* HOOK. and the representatives of *Phyllocladus* that prompted the misnomer is the result of a botanical affinity, is another interesting point (see also ERDTMAN 1965, p. 54).

Phyllocladipollenites grandis n. sp.
Plate XXXIX, Fig. 1–2

Holotype: Borehole Zgv.-59, sample No 26, slide No 1, 42.2×115.0.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence grey silty clay-marl, borehole Zgv.-59, depth 65.0 to 67.0 m.

Diagnosis: A pollen grain of 88 μ full length, body size about 75 by 45 μ. Exine coarsely reticulate, with a ridge about 5 μ tall on the proximal side. The ridge flares out and forms a point laterally. On the outline, the dense parallel bacula form slightly wavy warpings. It is from these that the bladder of 7 to 10 μ width issues laterally and proximally in ERDTMAN's sense.

Differential diagnosis: See generic description.

One specimen thus far.

Familia: I n c e r t a
Genus: *Illinites* KOSANKE 1950 em. R. POT. et KLAUS 1954

Illinites cf. *tectus* (LESCHIK 1956) CLARKE 1965
Plate XXXVI, Fig 2–3

One specimen — a bladdered pollen of 47 μ full diameter. Body roundish, 30 by 30 μ in dorsoventral view, fairly massive. Thickness of exine 2 to 4 μ in outline. There is a short trilete mark at the middle. The bladder exhibits a smooth transition; it stands out 8 to 9 μ in the direction of the major axis, 1 to 1.5 μ in the direction of the minor axis of the body. The bladder consists, particularly on the distal side, of coarse, parallel fibers which constitute a fine-grained reticulum on the proximal side. Redeposited from Permian in the borehole Komló-120, depth 178.0 to 178.8 m.

Genus: *Ephedripites* BOLCH. 1953 ex R. POT. 1958.
Subgenus: *Ephedripites* R. POT. s. g. *Ephedripites* W. KR. 1961

Ephedripites sgen. *Ephedripites hungaricus* NAGY 1963
Plate XL, Fig. 3–4

1963. *Ephedripites (Ephedripites) hungaricus* n. sp. NAGY in Grana Palynologica 4:2, pp. 277–278 and 4:3, p. 208 a, b, c. Holotype and description.

One specimen of 47 by 19 μ size in sample No 214 (432.5 to 432.7 m depth) of borehole Szászvár-8.

Ephedripites sgen. *Ephedripites mecsekensis* NAGY 1963
Plate XL, Fig. 1–2

1963. *Ephedripites (Ephedripites) mecsekensis* n. sp. — NAGY in Grana Palynologica 4:2, pp. 278–279, figure and photo 4:3, p. 280, a. Holotype and description.

A few specimens in the Sarmatian and Tortonian cores (479.1 to 482.0 and 590.7 to 592.3 m depth, respectively) of borehole Hidas-53.

Subgenus: *Ephedripites* R. POT. sgen. *Distachyapites* W. KR. 1961

Ephedripites sgen. *Distachyapites bernheidensis* W. Kr. 1961
Plate XL, Fig. 10

Elliptic pollen grain of 55 by 24 μ size. Exine about 1 μ thick. There are some 8 ribs about 2 μ wide, running into the pole. In the furrows between them there is a somewhat zigzagging Z-line reaching to the poles. This form, described by KRUTZSCH (1961, Geol. Beih., 32., pp. 25–26) from the Upper Oligocene of Germany, occurs in a somewhat younger setting in the Mecsek Mountains (in the Helvetian fish-scale-bearing sequence, sample No 32, depth 76 to 78 m, borehole Zengővárkony-59).

A more crumpled specimen of 50 μ size from the Tortonian lignitic-bearing sequence (590.7 to 592.3 m depth) of borehole Hidas-53 may also belong here. The marbly texture recorded by KRUTZSCH is absent both in the specimens given by KRUTZSCH (l. c., II. Plate, 22–32 Figs.) and those in my material.

Ephedripites sgen. *Distachyapites bicostatus* n. sp.
Plate XL, Fig. 7–9

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 35×114.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, grey silty clay-marl with fish scales, borehole Zgv.-59, depth 51.3 to 56 m.

Diagnosis: Elliptic pollen grain of 64 by 28 μ size; its 6 or 7 ribs of about 2 μ width, converging towards the poles, look in optical section, first like a black band, then like two bands farther below. The furrows between the ribs are about 3 μ wide. The ribs are arranged in pairs along the furrows. On the furrow bottom there is a shallow depression looking like a light band with a more or less wavy Z-line in it (Textfig. 35).

Differential diagnosis: Ephedripites sgen. *Distachyapites bicostatus* stands close to *E.* sgen. *D. bernheidensis* W. KR. (1961, Geologie, Beiheft 32, pp. 25–26). The former differs from the latter, first of all, by its larger size, by its broader ribs and furrows, more pronounced Z-line and smaller number of ribs.

One specimen.

Fig. — ábra 35. Ephedripites sgen. Distachyapites bicostatus n. sp.

Ephedripites sgen. *Distachyapites miocaenicus* n. sp.
Plate XL, Fig. 11–12

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 31.1×116.0.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: Elliptic, "*ephedroid*" pollen grain of 53 by 27 μ size, with 4 or 5 broad ribs (3 μ) running into the pole, separated by depressions 8 to 9 μ wide. It is in these latter that the pronouncedly sinuous, shortly branching Z-line is situated. Exine very thin (about 0.5 μ).

Differential diagnosis: The new species undoubtedly belongs to the form group of *Ephedra eocenipites* WODEHOUSE (1933, pp. 495–496) = *Ephedripites (Distachyapites) eocenipites* (WODEHOUSE 1933) W. KR. (1961, pp. 22–31). It stands close to the Upper Oligocene and Lower and Middle Miocene forms W. KRUTZSCH (l. c., Plate V, 96–105, and 110–113, respectively). The new species differs from *E. (D.) bernheidensis* W. KR., first of all, by the smaller number of its ribs. Beside the remarkably thin exine (which, according to KRUTZSCH, is a feature dependent on preservation), it differs both from WODEHOUSE's basic species, and from those of KRUTZSCH by the less pronounced ramification of its Z-line.

Our specimen is secondarily crumpled and split open on the side: this is also due to the thinness of the exine. One specimen so far.

Ephedripites sgen. *Distachyapites ellipticus* n. sp.
Plate XL, Fig. 13–14

Holotype: Borehole Zgv.-59, sample No 21, slide No 1, 43.6×110.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl with fish-scales, borehole Zgv.-59, depth 48.5 to 51.3 m.

Diagnosis: Elliptical form of 50 by 22 μ size, tapering to a point at both ends. There are 9 or 10 ribs 1 to 1.5 μ wide, slightly wavy, convergent towards the poles. The furrow between the ribs is 2 to 3 μ wide, with an irregularly branching Z-line in it. It exhibits the marbly texture perpendicular to its long axis (Textfig. 36) just as was observed by KRUTZSCH's on his *E. eocenipites* specimens (l. c., Pl. VI. Figs. 106–109).

Differential diagnosis: The new species most resembles *E. (D.) bernheidensis* KRUTZSCH, but differs from it by its greater number of ribs. The holotype is pointed at both ends, which is worth some emphasis even if one supposes it to be a feature of preservation.

One specimen.

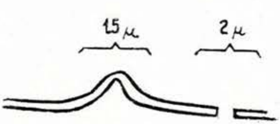


Fig. — ábra 36. Ephedripites sgen. Distachyapites ellipticus n. sp.

Ephedripites sgen. *Distachyapites minimus* n. sp.
Plate XL, Fig. 5–6

Holotype: Borehole Pszf.-VI, sample No 11, slide No 1, 43.4×114.2.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian, limnic sequence, lignite with intercalated carbonaceous clay, borehole Pszf.-VI, depth 22.5 to 25.0 m.

Diagnosis: Elliptic pollen grain of 35 by 10 μ size, tapering to a point at the poles. Number of ribs 4 or 5. Ribs 1 μ wide, with a black band along their middle. The furrow between them is 2 to 2.5 μ wide. In it, there is a sinuous Z-line.

Differential diagnosis: COOKSON's *Ephedra notensis* from the Australian Lower Eocene (1956, p. 45 and Pl. IX. Figs. 6–10) would agree, as to size range, with the new species, but it belongs to the form group *Ephedripites* sgen. *Ephedripites*. *E.* sg. *Distachyapites lusaticus* W. KR. et SONTAG 1961 is similar in size, too, but the number of ribs does not tally, nor does the course of the Z-line; nor, indeed, does the "starke Schlängelung des Talbodens" (KRUTZSCH 1961, p. 26).

One specimen so far.

Phylum: **ANGIOSPERMAE, ANGIOSPERMATOPHYTA**
Classis: **Dicotyledonopsida**
Subseries: **Polycarpicae — Rubiales**
Ordo: *Magnoliales*
Subordo: *Magnoliinae*
Familia: Magnoliaceae
Genus: *Magnoliaepollenites* n. g.

Generotype: Magnoliaepollenites simplex n. g. n. sp.

Diagnosis: Heteropolar, monocolpate pollen; sexine thicker than nexine.

Remarks: The pollen of *Magnolia* is so simple in structure that it is easily mistaken—especially when viewed without oil immersion—for planktonic organisms. The pollen of *Magnolia* has been encountered in deposits as old as the Jurassic (R. SOÓ, 1963, p. 252). ANDREÁNSZKY stated the macrofossils of *Magnolia* to cover the time span from the Cretaceous to the Pliocene in Europe (1954, pp. 164, 245, 247) and described six macrofossil species from the Sarmatian of Hungary (1959, pp. 57–60). PÁLFALVY recorded one macrofossil species from the Mecsek Mountains Helvetian (1964, p. 187).

Magnoliaepollenites simplex n. g. n. sp.
Plate XLI, Fig. 1, 4

Holotype: Borehole H. 53, sample No 31, slide No 2, 48×107.5.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence. Borehole H. 53, depth 665.1–666.8.

Diagnosis: Monocolpate pollen grains of 50 μ size. Exine 1 μ thick, intragranulate.

Differential diagnosis: Sometimes mistake for planktonic organisms *(smooth Ovoidites)*, but the refractivity of these latter is stronger and their exine is not structured, *Magnolia hamori* HOWARD, as figured by ERDTMAN (1952, p. 256, Fig. 148 E), resembles our form, except that it is larger, more elongate and more delicately ornamented.

A few specimens in the Middle Miocene cores (590.7 to 592 and 665.1 to 666.8 m) of borehole Hidas-53.

Familia: T e t r a c e n t r a c e a e A. C. SMITH 1945
Genus: *Tetracentracearumpollenites* n. g.

Generotype: Tetracentracearumpollenites minimus n. g. n. sp.

Diagnosis: Small roundish (prolate spheroidal) tricolporate pollen grains of about 20 μ size; exine pilate, colpus narrow, surface reticulate.

Differential diagnosis: Differs from the genus *Caprifoliipites* WODEHOUSE 1933 by its pore structure and larger size.

Remarks: G. ANDREÁNSZKY (1959, pp. 61, 62) described a leaf remain from the Sarmatian flora of Balaton by the name *Tetracentron hungaricum*; P. GREGUSS (1963, pp. 277–281) described a homoxylic wood fragment from the Sarmatian deposits of the Tokaj Mountains by the name *Tetracentronites hungaricum*. Both data support my classification of the pollen finds as belonging to the genus *Tetracentron*.

Tetracentracearumpollenites minimus n. g. n. sp.
Plate XL, Fig. 15–17

Holotype: Borehole Pszf. VI, sample No 5, slide No 2, 27.4×104.2.
Locus typicus: Pusztakisfalu.
Stratum ypicum: Lower Helvetian, limnic sequence, light grey clayey silt, borehole Pszf.-VI, depth 10.5 to 12.5 m.

Diagnosis: Roundish tricolporate pollen grain of 18 μ size; exine about 1.5 μ thick; ectexine (sexine) composed of pila 1 μ long; endexine 0.5 μ thick, smooth. Surface reticulate. Colpus thin, not reaching to the pole; exopore slightly elongate towards the poles, endopore a slit perpendicular to, and slightly overreaching, the colpus.

Differential diagnosis: Differs from *Tetracentracearumpollenites komlóensis* n. g. n. sp. by its thinner exine and narrower colpus and by its pore structure. It further resembles *Caprifoliipites andreánszkyi* n. sp., except that it is not simplibaculate and is considerably smaller. The grain size of the reticulum is the same, however.

Remarks: Tetracentron sinense OLIV. is a monotypic genus living in China. Morphologically, its pollen much resembles our fossil species.

A few specimens of 14 to 18 μ size are in Middle Miocene samples.

Tetracentracearumpollenites komlóensis n. g. n. sp.

Plate XL, Fig. 18–20

Holotype: Borehole K.-120, sample No 104, slide No 1, 37.3×110.2.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish scale-bearing sequence, clay-marl, borehole K.-120, depth 367 m.

Diagnosis: Rounded tricolporate pollen grains of 18 μ size. Exine 2 μ thick; extexine pilate, about 1.5 μ thick; endexine smooth. Surface reticulate, mean grain size 1 μ. Colpi wide-spaced, straight, 1 μ wide at the equator, tapering towards the poles. Endopore round, outlined by the caverna; exopore meridionally elongate.

Differential diagnosis: This species resembles *Tetracentracearumpollenites minimus* n. g. n. sp. except for the caverna, colpus and pore structure. The representatives of *Caprifoliipites* WODEHOUSE 1933 differ from it by their larger size and thicker exine.

Remarks: Fairly frequent in the Mecsek Mountains Middle Miocene. Size range 14 to 18 μ.

Ordo: *N y m p h a e a l e s*
Familia: N y m p h a e a c e a e
Genus: *Nupharipollenites* n. g.

Derivatio nominis: On the basis of the resemblance to pollen belonging to the genus *Nuphar*.

Generotype: Nupharipollenites kedvesii n. g. n. sp.

Diagnosis: Monocolpate, elliptic pollen grain. Exine ornamented with rather heavy spines.

Differential diagnosis: Differs from the genus *Nymphaeaepollenites* by its oval shape, greater size, and heavier ornament.

Nupharipollenites kedvesii n. g. n. sp.
Plate XLI, Fig. 2, 3, 8

Derivatio nominis: In honour of Palynologist DR. MIKLÓS KEDVES, Szeged.
Holotype: Borehole Zgv.-59, sample No 24, slide No 2, 30.2×109.2.
Locus typicus: Zengővárkony.
Stratum typicum: Upper Helvetian, fish-scale-bearing sequence, grey silty clay-marl, borehole Zgv.-59, depth 60.9 to 63.0 m.

Diagnosis: Elliptic pollen grain of 56 by 30 μ size, ornamented with spines 3 to 5 μ wide at the base, 4 to 6 μ long. Exine thick (5 to 6 μ together with the spines). The spines are embedded in the ectexine. Endexine smooth, 1 μ thick. Germinal aperture monosulcate.

Remarks: A few specimens in the Mecsek Mountains material, from the Helvetian to the Pannonian. Some specimens are fossilized in a contracted, boat-shaped state (Pl. XLI., Fig. 8), recalling one of the possible forms of the pollen of living *Nuphar luteum* (L.) SM. (ERDTMAN 1954, p. 110, Pl. XV, Fig. 257; see further BERTSCH 1942, Pl. 20, 2). The dumbbell-shaped sulcus is clearly visible: cf. living *Nuphar advena* AIT. (ERDTMAN, l. c. Fig. 256). Specimens identified with living *Nuphar macrophyllum* L. were recorded by MACKO (1957, p. 94) from the Lower Miocene of Upper Silesia. I am unable to identify my forms on the basis of his figures M. KEDVES (1960, p. 108, Pl. 7, Fig. 9) identified the forms he had found with MACKO's forms and called them *Monocolpopollenites nupharoides*. In his comprehensive diagramme he entered them as *Nuphar* sp. The form figured by KEDVES is almost twice as large as my holotype. Expressing doubts as to the botanical affinity of his specimens, KEDVES mentioned the palm *Nipa*. However, the presence of a tropical mangrove palm in my material is well-nigh inconceivable, my specimens are pollen grains of the genus *Nuphar*.

Genus: *Nymphaeaepollenites* n. g.*

Generotype: Nymphaeaepollenites pannonicus n. g. n. sp.

Diagnosis: Roundish zonisulcate pollen grains covered with spiny projections.

Differential diagnosis: The new genus differs from the genus *Nupharipollenites* by its more roundish shape, smaller size and more delicate ornament.

Remarks: ERDTMAN's figures of *Nymphaea* (1954, p. 110 and Plate XV) much resemble the fossil specimens.

*The legitimate denomination of the *Nymphaeacidites* genus, described by S. C. D. SAH (1967) come to my knowledge only at the time of the page—proof reading of my own work (1969), ready for publication even in 1964.

Nymphaeaepollenites pannonicus n. g. n. sp.

Plate XLI, Fig. 5, 10, 11

Holotype: Hidas Mine, Seam II, sample No 1, slide No 1, 36.3×109.6.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence.

Diagnosis: Roundish pollen grain of 36 μ size. Exine 1.5 μ thick, with thin and pointed spines 1 to 2 μ tall.

Differential diagnosis: See generic description.

Remarks: The distribution of the spines is as in living *Nymphaea alba* L. (ERDTMAN 1954, Pl. XV, Figs. 259–260), but the spines are more delicate, curved. The fossil material includes some specimens split open like the pollen of the living species. Several specimens in the 25 to 36 μ size range, in samples of Seam II, Hidas Mine, of the Middler Miocene of borehole Hidas-53, and of outcrops at Mecseknádasd. In a specimen from this latter sample, the spines are of dissimilar height, occasionally attaining even 7 μ.

Ordo: *P i p e r a l e s*
Familia: C h l o r a n t h a c e a e
Genus: *Chloranthacearumpollenites* n. g.

Generotype: Chloranthaceaerumpollenites dubius n. g. n. sp.

Diagnosis: Five- or six-lobed, polycolpoidate pollen of about 20 μ size; exine baculate.

Differential diagnosis: In *Stephanoporopollenites hexaradiatus* (THIERG.) TH. et PF., described from the lowermost Tertiary of Germany, the sides are constricted at the middle and the surface is smooth.

Chloranthacearumpollenites dubius n. g. n. sp.

Plate XLI, Fig. 6, 7, 12

Holotype: Borehole H.-53, sample No 34, slide No 1, 44.8×109.5.
Locus typicus: Hidas.
Stratum typicum: Tortonian lignite-bearing sequence, greenish grey clay-marl, borehole H.-53, depth 669.2 to 669.8 m.

Diagnosis: 5-lobate pollen grain of 23 μ diameter, with 5 colpi. Ectexine composed of bacula (pila) of about 0.5 μ length; endexine of about the same thickness, smooth. Surface finely reticulate.

Remarks: Three injured specimens in the Middle Miocene cores of borehole Hidas-53.

As regards botanical affinity on a morphological basis, the genus *Chlo-*

ranthus of the family *Chloranthaceae* seems likely, on the basis of pollen of *Chloranthus inconspicuus* Sw. as figured and described by Erdtman (1952, p. 111, Fig. 57). The genus *Chloranthus* is wide-spread in East India.

Ordo: *Hamamelidales*
Familia: Hamamelidaceae
Genus: *Liquidambarpollenites* Raatz 1937

1938. *Liquidambarpollenites* Thiergart, Jb. Preuss. Geol. L. A. 58. p. 319, Pl. 25. fig. 23.
1953. *Periporopollenites* Thomson et Pflug, p. 111, pro parte.
For a list of additional synonymus, see Nagy 1958, p. 63.

In 1934, R. Potonié (5, p. 33) included in the comparative material of the form *Pollenites stigmosus* R. Pot. also *Liquidambar styraciflua* L. In 1935 (p. 260), Rudolph gave a description and a figure of the *Liquidambar type*. He had found his pollen grains in the Miocene of Schosnitz, where macrofossils of *Liquidambar europaeus* A. Br. had also been encountered. The generic name was first used by Thiergart (1938, l. c.). A paper on this subject by Thiergart's pupil Raatz was published in 1937, sooner than Thiergart's own. In it, Raatz stated that „Ihre Zugehörigkeit zu den *Hamamelidaceen* ist nicht mehr fraglich.“ In the literature on fossil pollen (see above), this form was indentified and named as *Liquidambar* pollen by all workers from 1937 to 1953. On this latter date, however, Thomson and Pflug set up the form genus *Periporopollenites* and designated *Periporopollenites stigmosus* R. Pot. as its generotype stating that „Hierher gehört der 'vorläufige Gattungshinweis' (R. Pot., Thoms. et Thierg. 1950) '*Liquidambarpollenites*'.“ The diagnosis of the genus *Periporopollenites* is too loose: „Mehr als drei Poren. Diese sind auf den ganzen Exinekörper verteilt. Symmetrie entsprechend der Porenzahl und -anordnung verschieden. Keine Colpen.“ Pollen belonging to widely different botanical categories have been placed into this form genus: according to the authors. It even includes *Buxus*, the *Caryophyllaceae*, *Liquidambar*, the valid genus *Smilacipites* established in 1933 by Wodehouse, and also a form suggestive of the genus *Extratriporopollenites*. Today, thanks largely to the results of Chang King-tan (1958, 1959), and Kuprianova (1960), the genus *Liquidambar* is known thoroughly enough to permit the identification of well enough preserved Late Tertiary pollen with the pollen of living genera. Andreánszky was also able to identify his macrofossil species from Sarmatian localities of Hungary with living species (1959, p. 69).

In Miocene material from the Mecsek Mountains, the following forms could be identified:

Liquidambarpollenites orientaliformis n. sp.
Plate XLII, Fig. 1–2

Holotype: borehole Zgv.-59, sample No 29, slide No 1, 41.2×110.5.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, light grey marl with fish scales. Zgv.-59, 71.4–73 m.

Diagnosis: Roundish pollen grain of 41 μ size, with about 15 oval pores of 8 to 9 μ length, 4 to 5 μ width. The pore membranes bear relatively large granula. Exine about 2 μ thick; the upper parts of the sparse bacula of the ectexine are coalesced into a tegillum; the endexine is smooth. The surface of the ectexine is sparsely, roughly granulate.

Differential diagnosis: The oval pores, the large granula of the pore membranes, the tegillum and the sparse bacula of the ectexine, are features distinguishing this species from the two others.

Remarks: The form was encountered in sample No 27 of the Leánykő Main Seam, Magyaregregy, in cores from 56 to 73 m depth of borehole Zengővárkony-59, in cores from 178 to 178.8 m depth of borehole Komló-120 and in the Pannonian of borehole Hidas-53. It fully agrees with the pollen of *Liquidambar orientalis* MILL. In the macrofossil material, this is borne out by the fossil leaf *Liquidambar ternata* ANDREÁNSZKY et NOVÁK (1957, p. 43 Ann. Hist. Nat. Mus., ser. 8).

Liquidambarpollenites styracifluaeformis n. sp.

Plate XLI, Fig. 13, 20

Holotype: Borehole Zgv. 59, sample No 29, slide No 1, 30.3×108.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, light grey clay-marl with fish scales. Borehole Zgv.-59, 71.4–73 m.

Diagnosis: Roundish pollen grain of 44 μ size; multiporate with 14 or 15 pores. Pores round, of 4 to 6 μ diameter, with fine cracks at the rims. The granula of the pore membrane are relatively small. Exine 1 μ thick, baculate, its surface densely and finely granulate, looking almost like a delicate reticulum.

Several specimens from the Mecsek Mountains Middle Miocene (in the core that yielded the holotype and in the strata of the Magyaregregy–Almáspatak locality).

In literature, macrofossil *Liquidambar europaea* A. BR. is identified with living *L. styraciflua* L.

Differential diagnosis: Differs from the other two species by its round pores with minute cracks at their rims, by the relatively small granula of the pore membrane and by the densely and finely granulate exine surface.

Liquidambarpollenites formosanaeformis n. sp.

Plate XLI, Fig. 9, 14

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 35.8×109.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, grey silty clay-marl with fish scales, borehole Zgv.-59, depth 51.3 to 56 m.

Diagnosis: Roundish pollen grain of 48 μ size; multiporate with 10 to 13 pores evenly distributed on the surface; roundish, of 6 to 8 μ diameter, with large enough granula. Exine relatively thin, about 1 μ. Surface sparsely and roughly granulate.

Differential diagnosis: Differs from the preceding two species in that its pores are more sparse, roundish, with large granula in them, and also in its coarsely granulate surface.

Remarks: A few specimens in the Mecsek Mountains Middle Miocene (sample No 22 of borehole Zengővárkony-59, sample No 28 of borehole Komló-120, and also in the strata of the Locality Magyaregregy–Farkasordító). The new species can be identified with the pollen of living *Liquidambar formosana* HENCE. Of the leaf fossils, *Liquidambar pseudoprotensa* ANDREÁNSZKY (1959, p. 71) best fits the new species.

Ordo: *Fabales*
Familia: cf. Caesalpiniaceae
Genus: *Tricolporopollenites* TH. et PF. 1953

Angiospermous pollen is mostly tricolporate (THOMSON et PFLUG 1953, p. 11). Botanically this is no more informative of the plant than the plain name *Dicotyledones.* Although POTONIÉ (1960, Synopsis III, p. 101) suppressed the genus on the grounds that its type, *T. dolium,* stands close to *Rhoipites,* but I find it necessary to retain it. The importance of the fossil form genus consists in that it will hold the forms which we cannot identify, distinguish, or assign botanical affinities to, in more detail. With the evolution of palynology, more or less extensive units will be split off, from time to time, and incorporated into the natural system. Hence, it will be possible to suppress the genus only when all pollen species included in it will be satisfactorily placed in the natural system.

Tricolporopollenites caesalpiniaceaeformis n. sp.

Plate XLII, Fig. 6–7

Holotype: Borehole Zgv.-45, sample No 2, slide No 1, 42.7×106.7.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian, limnic sequence, greenish-grey congerian clay, borehole Zgv.-45, depth 14.0 to 14.5 m.

Diagnosis: Prolate, tricolporate pollen grain of 35 by 21 μ size. Exine about 2 μ thick, pilate, with clavi sitting on relatively thin bacula forming a fine-grained reticulum in top view. Colpus about 1 μ wide, broken at the equator, convergent towards the pole. Endopore lolongate, about 5 μ (Text-fig. 37).

Differential diagnosis: Resembles *Tricolpopollenites henrici* (R. POT.)

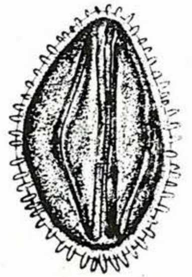


Fig. — ábra 37. Tricolporopollenites caesalpiniaceaeformis n. sp.

TH. et PF. Differs from it by its pilate (clavate) exine structure, by its narrower colpus and lolongate endopore.

Remarks: The order *Fabales* is rather extensive, including, as it does, three large families undoubtedly represented also in the Neogene flora of the Mecsek Mountains. Polyads characteristic of *Mimosaceae* have not been encountered thus far in the Mecsek Mountains material. The flower structure, phytogeographical range and ecological requirements of the family *Caesalpiniaceae* make its presence highly likely. The pollen of *Gleditschia heterophylla* EGE. and *Lysidice rhodostegia* HCE. (Chinese Pollen Book, Pl. LVII, Figs. 5–6) much resembles the new species.

Ordo: *M y r t a l e s*
Subordo: *T h y m e l a e i n e a e*
Familia: E l a e a g n a c e a e
Genus: *Slowakipollenites* W. KR. 1962

1962. *Slowakipollis* n. fgen. KRUTZSCH: in Geologie 11. 3. p. 272.

Slowakipollenites neogenicus n. sp.

Plate XLII. Fig. 3–4

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 29.5×113.6.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, silty clay marl, borehole Zgv.-59, depth 63.0 to 65.0 m.

Diagnosis: Roundish tricolporate pollen grain of 24 μ diameter. Exine about 1.5 μ thick. Ectexine 0.5 to 1 μ thick, endexine about 0.5 μ thick, both finely baculate. Surface of exine finely granulate. Exocolpus long (about 14 μ). Exopapilla projecting; pore diameter about 4 μ; the endopore forms an atrium (Textfig. 38).

Differential diagnosis: Differs from *Slowakipollenites hippophaëoides* W. KR. (1962, p. 273) by its densely baculate exine structure (KRUTZSCH' form is "punctat verrucat" according to his description). Also, the pore of KRUTZSCH's form is more protruding.

Fig. — ábra 38. Slowakipollenites neogenicus n. sp.

Remarks: Both specimens encountered so far are in the lateral position. The core from 837.9 to 839 m depth of borehole Hidas-53 has yielded a fourpored variant. On a morphological basis, botanical affinity to the family

Elaeagnaceae can be surmised; the species might even be a fossil *Hippophaë*. Both in Germany (KRUTZSCH 1962, p. 274) and in the Mecsek Mountains, the mother plant presumably lived in a habitat near the seashore. ERDTMAN (1954, p. 88) mentions the occurrence on the seashore of living *Hippophaë rhamnoides* L. It is a "pioneer plant": "It disappears under increasing competition from other scrubs and trees." The presence of *Alnus, Salix, Carya* and chenopodiaceous pollen in my material tends to corroborate this statement. ERDTMAN (l. c.) considers *Hippophaë* to be climatically indifferent. KRUTZSCH stated *Slowakipollenites hippophaëoides* to occur in the German Chattian. Its presence at a higher level (Middle Miocene) in my material might be due to the difference in latitude.

Slowakipollenites mecsekensis n. sp.

Plate XLI, Fig. 15–17

Holotype: Borehole Zgv.-59, sample No 27, slide 1, 35.6×114.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, silty clay-marl, borehole Zgv.-59, depth 67.5 to 70.5 m.

Diagnosis: Tricolporate pollen grain of 28 by 25 μ size. Oval in the lateral view. Exine thick, about 2 μ at the poles, multi-layered (two layers of smooth ectexine, both about 0.5 μ thick, and a finely baculate endexine likewise about 0.5 μ thick). This structure results in an intrapunctate exine. At the pores, the exine attains a thickness of about 3 μ. In front of the colpus there is a short exocolpium (4 to 4.5 μ). The pores begin with translucent exopapillae, protruding about 2.5 μ, which look transparent in lateral view and can be seen to protrude from the outer layer ("a") of the ectexine. Beneath this latter, the inner layer of the ectexine forms a germinalia includding several atria, bordered inwards by the atrium of the endexine. In the top view, the pore is seen to be elongate in the direction of the equator. The endopore is about 3 μ wide and 2 μ high in the inner layer of the ectexine ("b") and about 3 μ wide and 1 μ high in the endexine.

Differential diagnosis: Differs from both *Slowakipollenites čechowici* (PACLTOVÁ) W. KR. and *S. elaeagnoides* W. KR. first of all in size, and also in its thicker exine of peculiar structure. A morphologically similar form from the Lower Miocene of the Sikhote-Alyn Mountains, SW Siberia, was identified as rhamnaceous in the Atlas of POKROVSKAIA et AL. (1956, p. 350, Pl. XXI, Fig. 12).

I consider this species to represent the family *Elaeagnaceae*. Only one specimen has so far been encountered.

Subordo: *M y r t i n e a e*
Familia: A l a n g i a c e a e
Genus: *Alangiopollenites* (TRAVERSE 1955) W. KR. 1962

1955. Genus: *Alangium* TRAVERSE – in Pollen Analysis of the Brandon Lignite p. 64.
1962. *Alangiopollis* n. fg. W. KR. – in Geologie 11, 3. p. 279.

Alangiopollenites barghoornianum (TRAVERSE 1955) W. KR. 1962

Plate XLII, Fig. 5

1955. *Alangium barghoornianum* n. sp. TRAVERSE, l. c. 12 (102).
1962. *Alangiopollis barghoornianum* (TRAVERSE 1955) n. comb. KRUTZSCH in Geologie 11, 3. p. 280. VII. 1–9.

The species was described from the late Oligocene Brandon Lignite of Vermont by TRAVERSE (l. c.). KRUTZSCH (1962) reported it as a rare fossil in the German Lower Miocene to Oligocene. A few specimens have been found in the Mecsek Mountains material. The photo shows a specimen of 66 μ size from a Tortonian core, 667.2 to 669.2 m depth, of borehole Hidas-53. Further Hungarian occurrences include the Lower Miocene of the Bakony Mountains (NAGY, 1962a), and the vicinity of Abaújszántó in the Tokaj Mountains (personal communication by L. RÁKOSI). A macrofossil was described by ANDREÁNSZKY (1963, p. 37–38) from the environs of Dédestapolcsány, by the name *Alangium hungaricum*.

Alangiopollenites simplex n. sp.

Plate XLII, Fig. 9

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 41.2×109.7.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, grey clay-marl, borehole Zgv.-59, depth 63 to 65 m.

Diagnosis: Roundish tricolporate pollen grain of 77 μ diameter; colpi extending over half the distance from the pore to the pole. Pore of about 5 μ diameter, covered by embracing lobes. Ectexine about 3 μ thick. Both exolamellae are striate, "a" more coarsely so than "b". The endolamella, about 1 μ thick, consists of three parts: there is a dark, less refracting endolamella, „b", between the smooth, strongly refracting endolamellae "a" and "c". As a consequence, a fine elongate uniform reticulum consisting of ornamental elements of about 0.5 μ size is visible on the surface of the pollen. The individual grains of the reticulum are 2 to 3 μ long and 1 μ wide. The outline of the pollen is rendered slightly irregular by the endings of the inferior striate ornamental elements.

Differential diagnosis: A. barghoornianum (TRAVERSE) has a coarser structure, the grains of the reticulum on its exine are larger. The ornamental elements are 1 μ thick and fairly randomly scattered over the surface.

Remarks: Stands close morphologically to *A. barghoornianum* (TRAVERSE); a botanical affinity is possible. One specimen so far.

Familia: Nyssaceae
Genus: *Nyssapollenites* THIERGART 1938

Nyssapollenites kruschi (R. POT. 1934) ssp. *analepticus* (R. POT. 1934) n. c.

1934. *Pollenites kruschi* f. *analepticus* R. POT. in Arb. Inst. Paläob. 4. p. 65.

Prolate, spheroidal, tricolporate pollen of 18 to 30 μ size. Exine about 1 μ thick, two-layered, smooth or finely intrarugulate. Scarce from the Lower Miocene fresh-water sequence to the Middle Miocene. From the North Hungarian Sarmatian, L. IGALI-ZELLER (1955, pp. 18–19) reported a *Nyssa* fruit; ANDREÁNSZKY (1959, p. 148) reported a *Nyssa* leaf.

Nyssapollenites kruschi (R. POT. 1934) ssp. *contortus* (PF. et TH. 1953) n. c.

1953. *Tricolporopollenites kruschi* (R. POT.) ssp. *contortus* n. ssp. PF. et THOMS. in Palaeontogr. 94. B. p. 104, XIII. 34–38.

Prolate, tricolporate pollen of 40 μ size. Exine about 2 μ thick, two-layered, intrarugulate (?). Cavernas about 3 to 4 μ wide at the equator, convergent and tapering towards the pole. Exopore round, surrounded by a caverna, endopore lolongate (?). Found in sample 1. of Seam II, Hidas mine.

Familia: Onagraceae
Genus: *Jussiaeapollenites* (TRAVERSE 1955) n. c.

Jussiaeapollenites champlainensis (TRAVERSE 1955) n. c.

Plate XLII, Fig. 8

1940. *Pollenites oculus noctis* THIERG. in Brennstoff-Geologie 13. p. 47. VII. 1.
1955. *Jussiaea champlainensis* n. sp. TRAVERSE, Pollen Analysis of the Brandon Lignite etc. p. 66, 12 (104).

Pollen grains of 54 to 63 μ size from Seam II of Hidas Mine and from the core of 433.6 to 433.8 m depth of borehole Szászvár-8. Morphologically, these grains fully agree with TRAVERSE's description and figure (l. c.). Both TRAVERSE and THIERGART consider the form to be Oligocene. In our material, it occurred in Middle Miocene deposits (a total of 3 specimens).

Familia: T r a p a c e a e
Genus: *Sporotrapoidites* Klaus 1954

Sporotrapoidites hungaricus n. sp.
Plate XLIII, Fig. 1–2

Holotype: Borehole Zgv.-59, sample No 23, slide No 1, 36.7×115.5.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, silty clay-marl, borehole Zgv.-59, depth 56.0 to 60.9 m.

Diagnosis: Roundish pollen grain of 35 μ diameter. Its ridge-shaped ectexine configurations converge from three directions to the pole. The ridges, 4 to 5 μ wide and of uneven course, overreach the outline of the pollen by about 1.5 μ. Above the ridge there is a thin, straight configuration recalling a line of dehiscence. Exine 1 to 1.5 μ thick, two-layered, unevenly covered with minute spine-like formations.

Differential diagnosis: The new species is about half the size of *Sporotrapoidites illingensis* KLAUS (1954, p. 122, Pl. 1, Figs. 1–3). The ridge does not overreach the outline of the pollen so pronouncedly as observable on KLAUS' form.

Remarks: One specimen so far. One side is slightly warped. I consider it a form belonging to the genus *Trapa* (cf. ERDTMAN 1954, p. 104, Pl. XIII, Figs. 221–223, ERDTMAN–BERGLUND–PRAGLOWSKI, 1961, p. 58, Pl. 62, Figs. 1–2, and the Soviet Miocene Atlas by POKROVSKAIA et al., 1956. Pl. IV, Figs. 13–14, Pl. VI. Fig. 17–19, Pl. XIV, Fig. 1, and Pl. XXI, Fig. 14).

Familia: H a l o r a g a c e a e
Genus: *Myriophyllumpollenites* n. g.

Generotype: Myriophyllumpollenites quadratus n. g. n. sp.

Diagnosis: Roundish, suboblate, aspidate pollen with a broad margin and 3 or 4 pores.

Myriophyllumpollenites quadratus n. g. n. sp.

Plate XLII, Fig. 10

Holotype: Borehole Hidas 53, sample No 4, slide No 2, 34.0×107.5.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian clay-marl, borehole Hidas-53, depth 147.5 to 148.5 m.

Diagnosis: Roundish pollen grain of 39 μ diameter, all four sides slightly concave. Exine definitely two-layered, intragranulate. The four pores are markedly protruding, aspidate. Pore diameter about 6 to 7 μ. Anule ring about 2 μ thick. In size and morphology, it stands closest to *Myriophyllum verticillatum* L.

A few specimens in the Mecsek Mountains Neogenes. Sample No 1 of borehole Hidas-53 yielded a typically quadrangular, smaller specimen of 27 μ size, obviously belonging to a different species which could not, however, be described because the preparate it was found in got ruined.

Ordo: *T e r e b i n t h a l e s*
Subordo: *R u t i n e a e*
Familia: R u t a c e a e
Genus: *Rutacearumpollenites* n. g.

Generotype: Rutacearumpollenites komlóensis n. g. n. sp.

Diagnosis: Tri- or polycolporate, suboblate-perprolate pollen grains of baculate surface.

Differential diagnosis: In ornament and size, it resembles the genus *Caprifoliipites* Wodehouse 1933. It differs from that genus in being polycolporate and having bacula of smaller size.

Rutacearumpollenites komlóensis n. g. n. sp.

Plate XLIII, Fig. 15–16

Holotype: Borehole K.-120, sample No 18, slide No 2, 29.0×113.2.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl, borehole K-120, depth 178.0 to 178.8 m.

Diagnosis: Tetracolporate pollen grain of 24 μ size; exine 1.5 μ thick. Ectexine and endexine of about equal thickness; ectexine baculate, endexine smooth. Surface finely reticulate (Textfig. 39).

Remarks: One specimen beside the holotype, from the depth interval 78 to 81 m of borehole Zengővár-

Fig. — ábra 39. Rutacearumpollenites komlóensis n. g. n. sp.

kony-59. The rutaceous genera *Aegle* and *Feronia*, reported by GUINET (1962, Plates 43, 44) are tetracolporate: the new species stands between the two in size.

Familia: Polygalaceae
Genus: *Polygalacearumpollenites* n. g.*

Generotype: Polygalacearumpollenites miocaenicus n. g. n. sp.

Diagnosis: Polycolporate, suboblate, subprolate pollen.

Differential diagnosis: Stands closest to the genus *Sapotaceoidaepollenites*, but is sharply distinguished from that genus by its polycolporateness.

Polygalacearumpollenites miocaenicus n. g. n. sp.
Plate XLIII, Fig. 14

Holotype: Borehole Pszf.-VI, sample No 12, slide No 1, 32.0×106.4.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian, limnic sequence, greenish-grey plastic clay, borehole Pszf.-VI, depth 25 to 27.1 m.

Diagnosis: Subprolate, polycolporate pollen grain of 26 by 22 μ size with about 17 colpi (Textfig. 40) which run from pole to pole. At the equator they are about 2 μ wide, to narrow sharply at the poles, where they form caverns. The colpi bear an angular exopore and a lalongate endopore of about 4 μ diameter. Exine about 2 to 2.5 μ thick at the poles, slightly thinner on the sides. Endexine about 1.5 μ thick, two-layered, slightly wavy, endexine about 1 μ thick, smooth. The surface is somewhat rugulate, as far as can be seen among the numerous colpi.

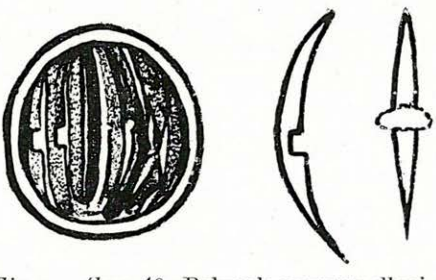


Fig. — ábra 40. Polygalacearumpollenites miocaenicus n. g. n. sp.

Remarks: Polygala erioptera DC., as figured by VAN CAMPO (1958, II, Pl. 39), stands very close to the new species, in its size of 26.5 μ as well as in the number of its colpi and in the structure of its pores. Among the forms figured in the Chinese pollen book (1960, LXXV, 10), it is *P. japonica* HOUTT. that best corresponds in size to the new specimen.

Fairly frequent in the highest few Helvetian cores of borehole Zengővárkony-45, size range of 22 to 28 μ.

* The legitimate denomination of this genus is *Polygalacidites* (SAH 1967, see p. 169 too).

Genus: *Rhoipites* WODEHOUSE 1933

Rhoipites pseudocingulum (R. POT. 1934) R. POT. 1960

Plate XLIII, Fig. 20–21

Subprolate, prolate, spheroidal or rhomboidal pollen grains of 27 to 48 μ size. Exine about 2 to 3 μ thick, two-layered; sexine pilate, with short baculae, clavi coalesced. Outline of grain slightly wavy. Surface more or less granulate, occasionally reticulate. Agrees with MAMCZAR's specimens from the Konin lignite.

Fairly abundant, particulary in the Middle Miocene section of borehole Hidas-53.

Familia: Aceraceae
Genus: *Aceripollenites* n. g.

Generotype: Aceripollenites reticulatus n. g. n. sp.

Diagnosis: Tricolpate pollen with baculate exine, occasionally arranged into striae.

Remarks: ANDREÁNSZKY and his pupils have described numerous macrofossil species of *Acer* from the Hungarian Tertiary, but the palynological evidence for the presence of *Acer* is rather scarce.

Aceripollenites reticulatus n. g. n. sp.

Plate XLIII, Fig. 5–6

Holotype: Borehole Zgv.-59, sample No 26, slide No 1, 35.5×115.4.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, clay-marl, borehole Zgv.-59, depth 65 to 67 m.

Diagnosis: Tricolpate pollen grain of 37 μ diameter. Colpi wide open in polar view. Exine about 1.5 μ thick; ectexine 1 μ, baculate, endexine 0.5 μ, smooth. On the surface, the baculate exine constitutes a fine reticulum which is striate locally.

Remarks: A few specimens besides the Zengővárkony borehole.

Botanical affinity: presumably *Aceraceae.*

Aceripollenites rotundus n. g. n. sp.

Plate XLIII, Fig. 10–11

Holotype: Borehole Zgv.-49, sample No 22, slide No 1, 37.8×115.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, clay-marl, borehole Zgv.-59, depth 51.3 to 56 m.

Diagnosis: Tricolpate pollen of 40 μ size, colpi about 1 μ thick, open in polar view. Ectexine 0.5 μ thick, granulate. Endexine of similar thickness, smooth. In polar view, broad roundish lobes are visible. Encountered in several Mecsek Mountains localities, but sparse everywhere (sample 1 of Seam II, Hidas Mine, sample 27 of the Leánykő, Main Seam, outcrop of Mecseknádasd, borehole Zengővárkony 45; size range 27 to 52 μ). Botanically, this pollen belongs to the *Aceraceae*.

Ordo: *Celastrales*
Familia: Aquifoliaceae
Genus: *Ilexpollenites* (Thiergart 1938) R. Pot. 1960

The forms described and figured as *Pollenites iliacus, P. margaritatus, P. propinquus* by R. Potonié (1931 and 1934), and as *Ilicipollenites margaritatus* and *I.* cf. *margaritatus* by Wolff (1934), are placed by today's workers into the family *Aquifoliaceae.* Thiergart assigned in 1938 (p. 321) the name *Ilexpollenites* to the above forms: the name was first used by Raatz in 1937 (after Thiergart according to the Synopsis III, 1960, p. 99). Thiergart mentioned *I. propinquus* with a question mark. It was in 1960 that R. Potonié referred it into the genus established by Thiergart, on the basis of the recovered holotype (l. c. p. 100). Thiergart's description is invalid — the form is not monotypical and was not given a generic diagnosis. It was validated by Potonié.

Ilexpollenites iliacus (R. Pot. 1931) R. Potonié 1960

Plate XLIII, Fig. 17–19

For a list of synonyms, see Nagy 1958, p. 71 (first part of the list), and
1931. *Pollenites iliacus* R. Pot. — in Braunkohle p. 556, fig. 5.

According to the relevant literature, the form occurs from the Eocene to the Pliocene. Our form fully agrees with R. Potonié's description (1934, Arb. Inst. Paläobot. 4, p. 72). It is this form group that includes the spheroidal pollen grains of 29 to 39 μ size, covered with clavate elements of 2 to 3 μ size. The clavi of the ornamental elements are big, about twice as large as the stem, up to 3 μ wide, pear-, blackjack- or button-shape. The intraornamental fields, somewhat wider than the clavi, form something like a reticulum. The projections are of varied size and might be absent from the meridional area (as is particulary distinct in polar view).

Ilexpollenites margaritatus (R. Pot. 1931) R. Pot. 1960

Plate XLIII, Fig. 12–13

For a list of synonyms, see Nagy 1958, p. 71 (second part of the list of synonyms), and 1960. *Ilexpollenites margaritatus* R. Pot. in R. Pot. Synopsis III. p. 99.

Tricolporate pollen grains of elliptical or round outline, 24 to 35 μ size, with a clavate exine 2 to 3 μ thick, clavi mostly 1 to 2 μ thick. Ornamental elements of various length, usually longest at the poles, occasionally scarce in the meridional area.

According to the relevant literature, the form occurs from the Eocene to the Pliocene in slightly greater abundance than *I. iliacus* (R. Pot.) R. Pot. does.

Ilexpollenites propinquus (R. Pot. 1934) R. Pot. 1960

Plate XLIII, Fig. 9

1934. *Pollenites propinquus* R. Pot. — Arb. Inst. Paläobot. 4. p. 74. Pl. 3. Fig. 33.
1934. *Pollenites propinquus* R. Pot. — Arb. Inst. Paläobot. 5. p. 35.
1938. *Ilex?* — *pollenites propinquus* R. Pot. — Thiergart, Jb. Preuss. Geol. L. A. 58. p. 322. Pl. 25. Fig. 31.
1953. *Tricolporopollenites margaritatus* (R. Pot.) Pf et Th. f. *minor*, p. 107. Pl. 14. fig. 74–80.

As early as 1934, Potonié referred the form *Pollenites propiquus* R. Pot. to the family *Aquifoliaceae*, namely to living *Ilex opaca* (*Ilex quercifolia* Meerb.). A small form (in the 15 to 25 μ size range) is mentioned by the name *Tricolporopollenites margaritatus* f. *minor* by Thomson et Pflug (1953, l. c.). However, since according to R. Potonié's original descriptions (Arb. Inst. 4. p. 74) the forms can be distinguished on the basis of certain features connected with size, and since the 1953 paper by Thomson and Pflug did not emend Potonié's description (indeed, it cites R. Potonié as the author), I do not consider justified the suppression of the specific name *propinquus*. In view of the numerous species of the family *Aquifoliaceae* (300 according to Willis 1957, p. 48), the few forms established so far presumably include numerous species and will have to be subdivided at a later stage. *Ilexpollenites propinquus* (R. Pot.) is highly abundant in the Mecsek Mountains Miocene (in the entire material of borehole Hidas-53, and in several cores of borehole Zengővárkony-45 and 59, Komló-120, and Szászvár-8).

In keeping with R. Potonié's diagnosis (l. c.), I have placed here small roundish tricolporate pollen grains of 17 to 23 μ size whose small clavi are of about 1 μ size.

Familia: S i p h o n o d o n t a c e a e

The family figures among the members of *Celastraceae* (WILLIS 1957, p. 609), although ERDTMAN (1952, pp. 105 and 409) has shown it to constitute a separate family, as its pollen structure is different. The living genus *Siphonodon* is represented by two species living in Malaya and Australia.

Genus: *Siphonodontipollenites* n. g.

Generotype: Siphonodontipollenites hungaricus n. g. n. sp.

Diagnosis: Triporate, oblate pollen; in polar view, it exhibits a rounded triangular shape, convex sides and large pores; the exine thickens towards the pores.

Differential diagnosis: It is distinguished from other triporate pollen by its peculiar large, rigid pores.

Siphonodontipollenites hungaricus n. g. n. sp.
Plate XLII, Fig. 11–12

Holotype: Borehole H-53, sample No 52, slide No 1, 39.0×103.6.
Locus typicus: Hidas.
Stratum typicum: Tortonian, "Schlier", light grey clay-marl, borehole H-53, depth 757 to 759 m, presumably secondary.

Diagnosis: Pollen grain of 17 μ equatorial diameter in polar view. Rounded triangular, with convex sides. Its three large pores, complete with atrium and ectopore, are of 4 μ diameter. Exine twolayered. The ectexine, thickening towards the pores, bears minute granula which constitute a delicate reticulum in top view.

Remarks: One specimen so far: the exine is injured at one of the pores. The new species is smaller than *Siphonodon celastrineus* GRIFF. as figured by ERDTMAN (1952, p. 105). Might be redeposited.

Familia: I n c e r t a
Genus: *Spinuliferoidaepollenites* n. g.

Generotype: Spinuliferoidaepollenites zólyomii n. g. n. sp.

Diagnosis: Roundish, small pollen, covered with a dense stand of spines; ectexine thinner than endexine.

Differential diagnosis: The new genus is the same in size as the fossil *Malvacipollis* HARRIS 1965, but the spines of the new genus are longer and, for the later reason, the presence of foramina cannot be observed on it.

Spinuliferoidaepollenites zólyomii n. g. n. sp.

Plate XLIV, Fig. 2–3

Derivatio nominis: Honour DR. B. ZÓLYOMI, Budapest, corresponding member of the Hungarian Academy of Sciences.
Holotype: Borehole Pszf.-VI, sample No 5, slide No 1, 44.8×100.5.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian limnic sequence, light grey clayey silt, borehole Pszf.-VI, depth 10.5 to 12.5 m.

Diagnosis: Roundish pollen grain of 26 μ diameter, densely covered with spines of 4 to 5 μ height. The spines start from bases 1 to 1.5 μ wide and taper to points. Ectexine 0.5 μ thick, endexine vague, presumably 1 μ thick.

Remarks: As to botanical affinities, one genus each of two different families, *Micrantheum (Euphorbiaceae)* and *Stachyanthus (Icacinaceae)* enter into consideration according to ERDTMAN's figures (1952). In size, it stands close to *Micrantheum ericoides* DESF., but the new species does not possess the remarkably thick exine and the foramina of the living one, and cannot be identified with it. *Stachyanthus zenkeri* (l. c. p. 212) agrees in size with the new species, but its spines are shorter and less close-spaced. Also according to ERDTMAN (l. c.), the pollen of the *Icacinaceae* and *Euphorbiaceae* are affine. The problem requires further careful study. For the time being, I have classed the new species with the family *Icacinaceae,* as it is to that family that it stands closer morphologically.

One specimen thus far.

Familia: Cyrillaceae
Genus: *Cyrillaceaepollenites* (MÜRR. et PF. 1951) R. POT. 1960

Cyrillaceaepollenites megaexactus (R. POT. 1931) R. POT. 1960

Plate XLIII, Fig. 4

The form was first figured (1931, Sitzber. Ges. Fr. I., Pl. V, Fig. 42b) and described by the name *Pollenites exactus* (1931, 4. p. 61) by R. POTONIÉ who compared it with *Castanea sativa* MILL. In 1950 (R. POT., THOMS. et THIERG.), THOMSON figured a species by the name *Poll. cingulum brühlensis* (l. c. p. 56, Plate B, 31–33). In 1951, MÜRRIGER et PFLUG (p. 91) called this form *Cyrillaceae — poll. cingulum brühlensis* THOMSON with reference to THOMSON. In 1953, THOMSON et PFLUG mentioned *exactus* and *brühlensis* as two subspecies of *Tricolporopollenites megaexactus.* In the Synopsis (III, 1960, p. 102) POTONIÉ emended *Cyrillaceaepollenites* (MÜRR. et PF. 1951) and suppressed *brühlensis* as a late homonym of *megaexactus.* The form occurs in my material from the Lower Helvetian limnic sequence to the Pliocene, with oblate spheroidal pollen grains of 17 to 29 μ size having a smooth or hyaline-smooth exine. The caverna is provided with long rugae which occasionally broaden at the equator. Specimens in the polar aspect are fairly frequent. It is considered a representative of the family *Cyrillaceae*.

Cyrillaceaepollenites exactus (R. Pot. 1931) R. Pot. 1960

Plate XLIII, Fig. 22

Tricolporate, prolate, spheroidal pollen grains of 9 to 15 μ size; exine smooth, colpus narrow, rugae small. Scarce enough in the Lower Helvetian limnic sequence and in the Helvetian section of borehole Hidas-53.

Ordo: *Cornales*
Familia: Araliaceae
Genus: *Araliaceoipollenites* R. Potonié 1951

Araliaceoipollenites euphorii (R. Pot. 1931) R. Pot. 1951. 1*

Plate XLIII, Fig. 8

1931. *Pollenites euphorii R.* Pot. — in Zeitsch. Braunk. p. 328, Pl. 1, Fig. 12.
1934. *Pollenites euphorii* R. Pot. — in Arb. Inst. 4. p. 64, Pl. 2, Fig 33, 39, Pl. 3, Fig. 19.
1951. *Araliaceoipollenites euphorii* R. Pot. 1934 in R. Pot. 1951, Pl. 21, Fig. 139–141.
1953. *Tricolporopollenites euphorii* (R. Pot.) Thoms. et Pf. p. 102, Pl. 12, Fig. 137–139.

The form was first figured by R. Potonié in 1931 by the name *Pollenites euphorii* (Pl. 1, Fig. 12)**. It has lately been considered a representative of the family *Araliaceae*. This rare form is distinguished by several authors only as to size from *Tricolporopollenites edmundi* (R. Pot.). Mamczar (1962, pp. 118–121) distinguished on a morphological basis four form groups, all within the family *Araliaceae*.

A pollen grain of 24 μ size from borehole Zengővárkony-59, depth 41.8 to 44.4 m, and possibly another one of 23 μ size from 67.5 to 70.5 m depth, same borehole, are to be placed in Mamczar's group I. These are of rhomboidal shape, with colpi flexed at the equator. Exine about 2 μ thick at the poles, ectexine baculate and 1.5 μ thick, endexine smooth and about 0.5 μ thick. At the equator, the ectexine thins to about 0.5 μ. As compared to living *Heteropanax fragrans* Seem. (Mamczar 1962, Pl. XXV, Fig. 66), its colpi seem somewhat more pronounced.

* Mamczar's group.
** For a detailed list of synonyms and considerations as to botanical affinities, see Mamczar (1962, pp. 117–118).

Araliaceoipollenites euphorii (R. POT. 1931) R. POT. 1951. III*

Plate XLIV, Fig. 4

Of the pollen grains in our material, one specimen of 28 μ size from sample No 53 of seam II, Hidas Mine can be classed here. It is oval (very slightly rhomboidal), with a slightly rounish pole. Colpus about 3 μ at the equator, pore lalongate. Exine baculate, about 1.5 μ thick at the poles, only 0.5 μ thick at the equator, densely covered by verrucae of 1 μ size. Surface finely reticulate. According to MAMCZAR's comprehensive review (l. c. p. 121), it has so far been largely encountered in Tertiary lignites.

MAMCZAR gives the botanical affinity of this form as cf. *Aralia* L. genus (MAMCZAR, 1962, p. 120).

Araliaceoipollenites euphorii (R. POT. 1931) R. POT. 1951. IV**

Plate XLIV, Fig. 5

A specimen of 37 μ size, slightly tilted towards the polar position; 178.0 to 178.8 m depth, borehole Komló-120. Shape broadened at the equator; colpus, too (4μ at the equator). The pore is stated to be small by MAMCZAR. The Komló specimen is distended owing to its position and other circumstances of fossilisation, so that its original condition is hard to reconstruct. The pore occupies about half the width of the colpus. Exine thick at the poles (about 3 μ), thinner at the equator, two-layered; ectexine consisting of coalesced bacula; endexine thin, smooth. Surface reticulate. MAMCZAR considered also *Group IV.* to belong to the *Araliaceae*, but could not refer it to any of the genera he had studied (1962. p. 120).

Araliaceoipollenites edmundi (R. POT. 1931) R. POT. 1960

The form was first figured (1931, Sitzg. Ber. Pl. 1, V 52b and V 53a) and described (1934, Arb. Inst. 4. p. 66) by R. POTONIÉ who gave it the name *Pollenites edmundi*. He stated it to be a pollen of 27 to 36 μ size, scarce in Miocene lignites, and related to the *Fagaceae* or possibly to the *Nyssaceae*. In 1951, he re-figured it (Pl. 21, Figs. 135–137) by the name *Araliaceoipollenites edmundi*. He referred to Arb. Inst. 5. p. 29, 1934 and mentioned pollen grains of 40 to 47 μ size. THOMSON et PFLUG included the form (1953, p. 101, Pl. 12, Figs. 125–132) in the collective morphological genus *Tricolporopollenites*, stating R. POTONIÉ as the author (1931, l. c.) and relegated to it specimens of 40 to 60 μ size. R. POTONIÉ gave the generic diagnosis of *Araliaceoipollenites* in 1960 (Synopsis III, p. 97) and subsumed under this heading the species described until then by the names *Pollenites*, *Tricolpopollenites euphorii* and *edmundi*. MAMCZAR (1962) studied, among others, also *Pollenites edmundi*

* MAMCZAR's group III. (MAMCZAR 1962).
** MAMCZAR's group IV. (l. c.)

R. Pot. and came—on the basis of comparisons with the pollen of living plants—to the conclusion that the larger Miocene grains are 38 to 53 μ in size and of reticulate surface. He referred this *Group I.* to the genus *Cornus* L. Group II, includes grains of 35 to 40.5 μ size and granulate surface and is referred to the genus *Aralia* L. Mamczar had studied palynologically 24 species of the 15 genera of the family *Araliaceae* and 21 species of the three genera of the family *Cornaceae*. According to Willis, however (1957, p. 51) the family *Araliaceae* includes 700 species in 55 genera, most of them tropical, of Indo-Malayen preferences; the family *Cornaceae* has 100 species in 15 genera. Hence, the decision of the botanical affinities of the pollen on this form group will have to be preceded by some thorough studies of these two closely related families. The forms I have distinguished within this group in my material are as follows.

Araliaceoipollenites edmundi (R. Pot. 1931) R. Pot. 1960

Plate XLIV, Fig. 20–21

Tricolporate pollen of 35 by 23 μ size, ectexine composed of bacula of 2 μ size, endexine 0.5 μ, smooth. The surface appears coarsely granulate. The caverna along the three colpi is thick, 5 μ in the equatorial region, tapering to 2.5 μ at the poles. The pore, situated at the equator, is of 2 μ size; the endopore and exopore fully penetrate the caverna.

A few specimens in the 33 to 37 μ size range in cores of boreholes Pusztakisfalu-VI, Zengővárkony-59, Komló-120 and Hidas-53 (in this last et 126.6–132.5, 600.5–602.5, 761.0 to 763.3 m depth).

It is this type that corresponds to Mamczar's group II (1962, p. 114) whose botanical affinity he indicated as cf. *Aralia* L. I identify it with the *Pollenites edmundi* figured and described in the greatest detail by Potonié (1934, Potonié et Venitz, p. 29, Pl. 3, Figs. 71–74).

Araliaceoipollenites edmundi (R. Pot. 1931) R. Pot. 1960. f. *reticulatus* n. f.

Plate XLIV, Fig. 6–8

Form type: Borehole Zengővárkony-59, sample No 27, depth 67.5–70.5 m, Helvetian, fish-scale-bearing sequence, slide No 1, 44.4×115.4.

Description: Tricolporate pollen grain of 36 by 21 μ size, densely covered with baculae of 2 μ size, which consitute a reticulum consisting of meshes of 0.5 to 1 μ diameter on its surface. The three colpi are 3 μ wide in the equatorial region and taper to 1 μ at the poles. Diameter of pores 3 μ.

A few specimens have so far been found.

Differs from *Araliaceoipollenites edmundi* R. Pot. by its narrower cavern and by the reticulum constituted by its structural elements.

Botanically, the form presumably belongs to the family *Araliaceae*.

It is a transitional form towards *Tricolporopollenites hedwigae* Pflanzl

Tricolporopollenites hedwigae Pflanzl 1956

1934. *Pollenites* cf. *edmundi* R. Pot., Arb. Inst. Paläobot. B. 5. in Potonié et Venitz: Zur Mikrobotanik des Miozänen Humodils der niederrheinischen Bucht. Pl. 3, Fig. 75.
1956. *Tricolporopollenites hedwigae* Pflanzl — Notizbl. Hess. L. A. Bodenforschung 84, Pl. 16, Fig. 15. p. 243.

The two specimens reported in literature agree in size and structure with the Hungarian specimen. In 1934, Potonié held it to be a state of preservation of *P. edmundi.* It was described by the name *Tricolporopollenites hedwigae* from a Middle Miocene clay near Meissner.

Tricolporopollenites satzveyensis Pflug 1953

Plate XLIV, Fig. 15, 23

Tricolporate pollen in the 42 to 38 μ size range. It agrees with the form described by Pflug (Thomson et Pflug, 1953, p. 103, Pl. 13, Figs. 10–13). Its width-to-length ratio varies from 0.6 to 0.9. Structure intrabaculate. Pore elongate in the meridional direction. Often crumpled secondarily.

Nothing is known about the botanical affinities of the species. It is presumably related to the family *Araliaceae,* but other families are also possible.

Stratigraphically, it occurs in the lower Eocene (Antweiler Bild) according to Pflug (l. c.). In our material it was found at 433.6 to 433.8 m depth in borehole Szászvár-8, at 67.5 to 70.5 m depth in borehole Zengővárkony-59 and in samples from the Hidas mine.

Familia: Cornaceae

Tricolporopollenites edmundi (R. Pot. 1931) Th. et Pf. 1953 f. *major* n. f.

Plate XLIV, Fig. 10, 13

Form type: Borehole Zengővárkony-59, sample No 26, slide No 1, 32.2×107.8.

More or less rhomboidal pollen in the 47 to 52 μ size range. Its bacula are 2 μ tall on the sides, up to 4 μ tall at the poles. The clavi of the bacula stand so dense as to be almost coalescent. Endexine about 1 μ, smooth. Surface reticulate. Exopore round; the endopore overreaches the narrow colpus. Caverna well-developed, up to 4 μ at the equator, tapering towards the poles.

Remarks: A few specimens in Middle Miocene cores (65 to 67 m, borehole Zengővárkony-59; 630.8 to 632.0 m, borehole Hidas-53).

Ordo: *Rubiales*
Familia: Rubiaceae

Rubiaceae sp.
Plate XLIV, Fig. 1

Pollen fragment of 30 μ diameter, with 6 apparent lobes and with pores between the lobes. Exine smooth, 1 μ thick at the middle of the lobes, about 2 μ thick at the pores where it constitutes a small labrum. Besides an injury, the pollen grain exhibits a strong secondary warping.

Thomson et Pflug (1953, Pl. 10, figs. 42–43) described unidentified pollen grains of similar morphology: they did not place them into the slightly similar genus *Stephanoporopollenites* (op. cit., explanations to the plates, p. 126) but referred them to the *Labiatae* or *Rubiales*. According to the available literature about the pollen of living plants (Bertsch 1942, Pl. 27–28; Erdtman 1952; *Labiatae* pp. 217–220, *Rubiaceae*, pp. 383–387; Guinet 1962, Pl. 23), the family *Rubiaceae* is the only to enter into consideration, because the figured species of the *Labiatae* all possess a reticulate exine. Of the families of the order *Rubiales*, only the *Rubiaceae* and *Dipsacaceae* have polycolpate pollen. Even disregarding its other incongruent features, dipsacaceous pollen is to be left out of consideration owing to its large size. The polycolpate representatives of the other families studied by Bertsch (l. c.) have to be dropped owing to their reticulate structure or the extremely great number of their colpi. However, even focussing our attention on the family *Rubiaceae*, it is hard to be more specific, since according to Willis (1957, p. 573), this is one of the biggest families with 5500 species in 450 genera. They range from the tropics to the arctic regions. Moreover, beside referring it to this family, we cannot profit much more by our fossil, as it is just a single specimen and fragmentary at that. Van Campo (personal communication) considers it a *Gallium* type.

It was found in the Tortonian lignite-bearing sequence, depth 600.5 to 602.3 m, borehole Hidas-53.

Familia: Caprifoliaceae
Genus: *Caprifoliipites* Wodehouse 1933

Caprifoliipites sambucoides n. sp.
Plate XLIV, Fig. 9, 14

Holotype: Borehole H.-53, sample No 33, slide No 3, 35.8×118.4.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Tricolporate, clavate pollen grain of 24 by 20 μ size. Exine about 2 μ thick, ectexine composed of pila of about 1.5 μ size. The pila are not entirely uniform in size. Endexine about 0.5 μ thick, smooth. Arrangement of pila retipilate. The diameter of the reticular grains thus formed varies from 2 to 4 μ. The narrow colpi are slightly broken at the equator and convergent towards the poles. Pores of about 1.5 μ diameter.

Differential diagnosis: The exine of *Caprifoliipites andreánszkyi* n. sp. is thicker; its pila are more uniform, and so are those of *C. gracilis* n. sp. Also, the colpi of *gracilis* are shorter: both are prolate spheroidal in shape.

As a botanical affinity, I prefer to suggest the genus *Sambucus*; it is particularly the morphology of the pollen of *S. obulus* L. that shows a great deal of similarity to the new species.

Remarks: WODEHOUSE (1933, p. 518) mentioned an even smaller specimen (16.5 by 22.8 μ size) in connection with the setting up of the genus *Caprifoliipites:* this specimen recalled the genus *Viburnum* in morphology, the genus *Sambucus* is size. His find derived from the Miocene flora of Florissant (l. c.) rather than from the Eocene. *C. viridi-fluminis* WODEHOUSE is, besides its small size, tricolpate according to the description. Owing to these differences some of which may be due to the now outdated techniques used by WODEHOUSE, I would not be justified in identifying my species with his.

A few specimens in Middle Miocene deposits.

Caprifoliipites andreánszkyi n. sp.

Plate XLIV, Fig. 16–19, 22

Derivatio nominis: In honour of the late Professor DR. G. ANDREÁNSZKY, Budapest.
Holotype: Borehole Zgv.-59, sample 13, slide No 2, 36.6×116.3.
Locus typicus: Zengővárkony.
Stratum typicum: Tortonian, "Schlier" sequence, grey clayey silt, borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Tricolporate pollen grain of about 20 μ size; shape round (oblate spheroidal with a length-to-width ratio nearly 1). Exine pilate, about 2.5 to 3 μ thick; sexine (ectexine) about 2 μ thick, composed of uniformly developed pila; nexine (endexine) about 1 μ thick, smooth. As a result of this exine structure, the surface exhibits a simplibaculate, retipilate (?) reticulum of 1 to 2 μ meshes. The diameter of the reticular elements decrease somewhat near the colpi. These latter are about 1.5 μ thick, slightly tapering towards the poles. Exopore (?) — a small round depression not so wide as the colpus. Endopore elongate, perpendicular to the colpus.

Remarks: In order to establish the botanical affinity of the species, I have studied numerous species of extant pollen such as *Bucklandia populnea* R. BR. *(Hamamelidaceae)*, the *Celastrum* species, and the genus *Viburnum* of the family *Caprifoliaceae*. It is the pollen of this last one (*V. rhytidophyllum* HEMSL.) that most resembles the new species.

Beside the type locality, the new species was found to be highly abundant in borehole Hidas-53 and Komló-120 and in the Hidas mine.

Caprifoliipites gracilis n. sp.
Plate XLIV, Fig. 11–12

Holotype: Borehole Zgv.-45, sample No 3, slide No 1, 43.5×115.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, limnic sequence, silty clay, borehole Zgv.-45, depth 16.4 to 17.2 m.

Diagnosis: Tricolporate pollen grain of 19 μ size; round (oblate spheroidal); exine 2 μ thick, clavate. Ectexine composed of pila of about 1.5 μ height; endexine smooth, 0.5 μ thick. On the surface, the ornamental elements constitute a reticulum of 1.5 to 2 μ spacing (retipilate). Colpus short, about 1 μ thick at the equator, suddenly narrowing towards, but not reaching up to the poles, with a small roundish pore.

Differential diagnosis: The new species resembles *C. andreánszkyi*, but its exine is thicker, the heads ot the pila are smaller and the pore structure is also different.

Remarks: Occurs in fairly large numbers in the Middle Miocene of the Mecsek Mountains. I suggest, as its botanical relationship, the family *Caprifoliaceae*, in view of the slight morphological difference from the preceding species and to the extent of the family *Caprifoliaceae*.

Genus: *Lonicerapollenites* W. Kr. 1962a

1962. *Lonicerapollis* n. fgen. W. Krutzsch — in Geologie 11, 3. p. 274.

Lonicerapollenites cf. *gallwitzi* W. Kr. 1962
Plate XLV, Fig. 2–3

Roundish spore of 35 μ size, of triangular equatorial outline, with germinalia at the three apices. Wall multilayered, with sparse spines of about 1.5 μ on the outside, a baculate ectexine, and a thin but more compact endexine underlain by a finely baculate layer. There is a plica-like fold, apparently secondary, from pole to pole. The poles are as large as the colpi are wide. Ectexine protruding labrum fashion; there is a vestibulum.

One specimen in the core from 48.5 to 51.3 m depth of borehole Zengővárkony-59 (slide No 1, 45.0×105.7). Krutzsch mentions it as a sparse element of Lower and Middle Miocene assemblages.

With respect to botanical affinity, beside the genus *Lonicera* one might mention some further genera of the *Caprifoliaceae: Abelia, Leycesteria, Dipelta* (on the basis of the Chinese pollen book, 1960), *Triosteum, Linnaea* (according to Erdtman 1952, 1954) too.

Lonicerapollenites sp.

I have provisorily placed here a pollen grain of 47 μ diameter from the 60.9 to 63 m depth interval of borehole Zengővárkony-59. Its surface is covered with spines about 1.5 μ high, 1 μ wide at the base, spaced 3.5 to 4 μ apart. The wall consists of two super imposed layers of bacula, each about 1.5 μ thick, the internal one denser. Triporate, but the grain is so crumpled that little is seen of the pore structure.

Familia: Dipsacaceae
Genus: *Scabiosaepollenites* n. g.

Generotype: Scabiosaepollenites magnus n. g. n. sp.

Diagnosis: Large, prolate spheroidal pollen; thick, spiny exine provided with pores and colpi.

Differential diagnosis: Easy to distinguish from the genera described on the basis of its large size, the peculiar ornament of its exine and its germinal structure.

Scabiosaepollenites magnus n. g. n. sp.

Plate XLVI, Fig. 1

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 31.2×116.1.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl, borehole Zgv.-59, depth 51.3 to 56.0 m.

Diagnosis: Large roundish pollen grain of 98 by 83 μ size. Exine thick, 5 to 8 μ, even 10 to 11 μ when taken with its spines spaced 10 to 12 μ apart. The spines are of two kinds: the larger ones are 2 to 3 μ tall, 1.5 to 2 μ wide at the base, tapering to points. Among them there are small spines 0.5 μ high. Ectexine 5 to 6 μ thick, coarsely baculate; endexine 2 μ thick, smooth, compact. There are two pores of 35 μ diameter, surrounded by thick exine margins (4 to 5 μ).

Differential diagnosis: Differs from *S. minimospinuosus* n. sp. by the uneven surface of its exine, by the presence of two sorts of spines and by its large pores. Morphologically, it is related to the genus *Scabiosa*.

Scabiosaepollenites minimospinuosus n. g. n. sp.

Plate XLV, Fig. 1; Plate XLVI, Fig. 8

Holotype: Borehole H.-53, sample No 4, slide No 2, 40.3×104.0.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, silty clay-marl, borehole H.-53, depth 147.5 to 148.5 m.

Diagnosis: Roundish pollen grain of 120 by 90 μ size. Exine thick (about 10 μ). Ectexine of fairly uniform thickness (4 to 5 μ), composed of strong bacula. The margin of the ectexine bears small spines about 0.5 μ high. Endexine about 4 μ thick. The exine exhibits two roundish pores of about 28 μ diameter, with an exine margin 3 μ thick.

Differential diagnosis: Differs from *Scabiosaepollenites magnus* n. g. n. sp. first of all by the even surface of the exine—a result of the uniform size of the spines—and by its pores of smaller size whose margins are also narrower.

Remarks: A single specimen, strongly crushed, in my material.

Affinity to the genus *Scabiosa* likely.

Subseries: **Malvales — Solanales**
Ordo: *M a l v a l e s*
Familia: T i l i a c e a e
Genus: *Intratriporopollenites* TH. et PF. 1953

The morphological features and botanical affinities of fossil tiliaceous pollen were treated in great detail by D. H. MAI (1961, pp. 54–93), who established the family connexion on the basis of a fossil flower find with in situ pollen.He identified the pollen with fossil *I. instructus* (R. POT.) TH. et PF. of the *Sporae dispersae*. The extinct tiliaceous genus in question belonged in his opinion to the subfamily *Brownlowioidae*, and within it to the group whose representatives now thrive in East Asia and Indomalaya. He described the fossil by the name *Burretia instructa* (R. POT.) MAI. According to the *Code* (1961), Art. 59: "The author who first describes a perfect state may adopt the specific epithet applied to the corresponding imperfect state, but his binomial for the perfect state is to be attributed to him alone, and is not to be regarded as a new combination." In MAI's interpretation, it is only the pollen found in the anthera that should be called by the new name, whereas those found as sporae dispersae should be given the name of the form genus established by THOMSON et PFLUG. Article 11 of the *Code*, referring to priorities, states the exceptions concerning the only correct name and admits certain alternatives also with respect to fossil plants. Applying this article, one could give the generic name *Burretia* to tiliaceous pollen which can be identified with *Burretia* beyond any doubt by careful analysis. For forms to which this does not apply or whose morphological features cannot be observed owing to advanced corrosion, it would be right to keep up the form genus *Intratriporopollenites*, but with the restriction, proposed by MAI (l. c. p. 64), that it should be applied to "*tilioid*" forms only.

In agreement with MAI (p. 59)—who pointed out some deficientics of the *Code*—I would on my part, also welcome it if the *Code* regulated the ways and means of making changes in fossil plant names. The general trend should of course be—under preservation of the principle of priorities—from the morphological systems towards the natural system of plants.

In my material I could, with reference to MAI's morphological findings (l. c. pp. 59–63), distinguish the following species:

Intratriporopollenites cf. *microreticulatus* MAI 1961
Plate XLV, Fig. 5, 8

"*Tilioid*" pollen grain of 37 μ equatorial diameter, borehole Hidas-53, depth 298.0 to 299.1 m. Highly corroded and crumpled, it defies accurate identification. It is in the polar position, and only its convex triangular, relatively smooth outline and its thin exine suggest the species. The only visible anulus is oval. MAI states it to be an Eocene form, and it presumably indicates redeposition from the Eocene also in our material.

It is perhaps to this species that three corroded and crumpled specimens (one of 31 μ size from borehole Zengővárkony-45, depth 16.4 to 17.2 m, and two from borehole Hidas-53, depth 672.5 to 676.0 and 534.0 to 537.0 m respectively), should be referred.

Intratriporopollenites insculptus MAI 1961
Plate XLV, Fig. 4

A large specimen of 52 μ size and a small one of 37 μ size, in the polar position, belong to this species. Their outline is convex triangular; there is a strongly developed anulus following the colpus. Muri duplibaculate. A four-pore form of 63 μ size is also classed here.

The representatives of the species were encountered in the Helvetian–Tortonian cores of boreholes Zengővárkony-59 (65 to 67 m depth), and Hidas-53 (667.2 to 669.0 and 683.0 to 686.5 m depth).

Intratriporopollenites instructus (R. POT. 1931) PF. et TH. 1953. subsp. *instructus*

Pollen grains of 41 to 47 μ equatorial diameter, with hemispherical anuli. Ectexine continued above the pore. Reticulum composed of grains of about 1 μ size. Exine about 2 μ thick. A few specimens in the Sarmatian and Tortonian cores of borehole Hidas-53, among others in the one from 667.2 to 669.0 m depth, in which the preceding species was encountered, and also in the depth interval 73.5 to 76.0 m of borehole Zengővárkony-59 and in the Middle Miocene of Mecseknádasd. According to MAI, it is the group of *I. instructus* that represents the pollen of the genus *Burretia*. In my opinion, the name *Burretiaepollenites* should be preferred.

Intratriporopollenites instructus (R. POT. 1931) PF. et TH. 1953. ssp. *macroreticulatus* MAI 1961
Plate XLV, Fig. 6–7

Pollen grains of 43 to 44 μ equatorial diameter; one specimen four-pored. Their features agree with those of the preceding ones, except perhaps for a slightly thinner exine. Reticulum 2 μ or coarser.

Occurrence: Borehole Szászvár-8 (depth 433.8 to 434.1 m) and Zengővárkony-59 (60,9 to 63 m).

Intratriporopollenites polonicus Mai 1961
Plate XLVI, Fig. 2–3

Specimens of 30 to 33 μ diameter in the polar position. Shape rounded triangular. Anuli small. Exine thin, about 1 μ (scrobiculi ?). Two specimens in Tortonian–Sarmatian cores of borehole Hidas-53 (depth: 572 to 575 and 444 m, respectively). Both specimens crumpled.

Familia: M a l v a c e a e
Genus: *Malvacearumpollenites* Nagy 1962

1962. *Malvacearumpollis* n. g. Nagy in Acta Bot. VIII. 1–2. p. 159.

Malvacearumpollenites rotundus n. sp.
Plate XLVII, Fig. 1, 5

Holotype: Borehole Sz.-8, sample No 219, slide No 2, 29.0×103.2.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian grey clay-marl, borehole Sz.-8, depth 433.8 to 434.1 m.

Diagnosis: Roundish, echinate pollen grain of 73 by 67 μ size, with three pores. Exine finely baculate; bacula of about 0.5 μ size make the surface of the exine look finely granulate in the top view. There are massive spines 3 to 6 μ tall, spaced 4 to 7 μ apart, ending in blunt points; bases of these spines 1.5 to 4 μ wide, not rising above the exine. The three pores are of 7 μ diameter each, surrounded by an exine margin 2 to 3 μ thick.

Remarks: According to Saad's key to the *Malvaceae* (1960, p. 34), this form belongs to group II. No more accurate indentification can be given. On the basis of our present day knowledge.

Only one specimen in our material.

cf. *Malvacearumpollenites* sp.
Plate XLVII, Fig. 6

Roundish pollen of 67 μ diameter. Exine thick (3 to 5 μ together with the short massive projections that cover it in a dense stand).

One specimen in a grey silty clay marl, 56.0 to 60.9 m depth, borehole Zengővárkony-59. The surface is strongly contaminated, which precludes any more detailed identification.

Ordo: *L i g u s t r a l e s*
Familia: O l e a c e a e
Genus: *Oleoidearumpollenites* n. g.

Generotype: Oleoidearumpollenites reticulatus n. g. n. sp.

Diagnosis: Elliptical, prolate, oblate, tricolporate, tricolporoidate, tricolpate pollen. Exine reticulate, simplibaculate with bacula 2 to 4 μ long. Ectopore angular, endopore rounded.

Differential diagnosis: Differs from the genus *Caprifoliipites* WODEHOUSE by its smaller bacula and small clavi, from the genus *Ilexpollenites* by shape and the uniform reticulum, and likewise by the small clavi.

Oleoidearumpollenites reticulatus n. g. n. sp.
Plate XLVII, Fig. 2–3

Holotype: Borehole K.-120, sample No 18, slide No 2, 35.3 to 113.8.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl, borehole K.-120, depth 178.0 to 178.8 m.

Diagnosis: Pollen grain of 30 μ diameter, in polar position, with three lobes. Its surface forms a very marked simplibaculate reticulum. The bacula are 3 to 4 μ high, with heads hardly thicker than the stems.

Differential diagnosis: The new species differs from the *Oleoidearumpollenites chinensis* n. sp. by the stronger reticulum.

Remarks: Size and morphology of the new genus suggest the genus *Ligustrum* or *Jasminum* (Chinese pollen book, Pl. LXXI, Fig. 2, 4). *L. perrotetti* DC. figured by PH. GUINET (1962, I., Pl. 34) resemble our species, but the abundance of the unknown pollen grains of the family *Oleaceae* (including 400 species of 21 genera according to WILLIS 1957, p. 442) and the 40 species of the genus *Ligustrum* (ibid., p. 383) bid caution.

Besides the holotype, one secimen of 24 μ size at 374.4 to 374.7 m depth in borehole Komló-120.

Oleoidearumpollenites chinensis n. g. n. sp.
Plate XLVII, Fig. 7–8

Holotype: Locality Almáspatak II, sample No 1, slide No 1, 39.4×103.5.
Locus typicus: Magyaregregy.
Stratum typicum: Helvetian, fish-scale-bearing sequence, tuffaceous clay, calcareous marl.

Diagnosis: Spheroidal tricolporate pollen grain of 28 μ size; exine two-layered; ectexine composed of baculate ornamental elements of about 3 μ size diminishing towards the colpi; endexine smooth, about 0.5 μ thick.

Colpi wide-spaced, slightly convergent towards the poles. The baculate elements constitute a reticulum of about 2 μ spacing.

Differential diagnosis: Differs from the *Oleoidearumpollenites reticulatus* n. sp. by the finer reticulum.

Remarks: Scarce in Middle Miocene deposits. The fossil species resembles the pollen of living *Ligustrum delavayanum* HARIOT, *L. sinense* LOUR. and *Syringa amurensis* RUPR. as to form (cf. the Chinese pollen book, 1960, Pl. LXXI, Figs. 3, 4, 9), and also as to size (ibid., pp. 187–188) but not so closely as to permit identification.

Ordo: *B o r a g i n a l e s (T u b i f l o r a e)*
Familia: B o r a g i n a c e a e
Subfamilia: H e l i o t r o p i o i d e a e

Genus: *Heliotropioidearumpollenites* n. g.

Generotype: Heliotropioidearumpollenites gracilis n. g. n. sp.

Diagnosis: Tricolporate or tetracolporate, prolate pollen grains bearing so-called pseudocolpi which make them look polycolpate.

Differential diagnosis: It is the presence of the pseudocolpi that distinguishes this genus from the other genera described thus far of fossil tricolporate pollen grains.

Heliotropioidearumpollenites gracilis n. g. n. sp.
Plate XLVII, Fig. 4

Holotype: Borehole Zgv.-59, sample No 27, slide No 1, 40.6×115.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian grey silty clay-marl with fish scales, borehole Zgv.-59, depth 67.5 to 70.5 m.

Diagnosis: Roundish tricolporate pollen of 30×25 μ size in the polar position. It has three pores with small atria. The so-called pseudocolpus is situated between two pores: in the polar aspect it appears as a slight depression. Exine about 1 μ thick, tegillate, delicately intragranulate (Textfig. 41).

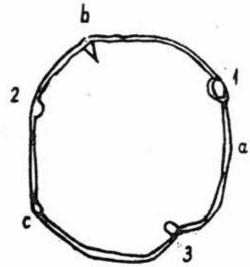


Fig. – ábra 41. Heliotropioidearumpollenites gracilis n. g. n. sp.

Differential diagnosis: The new species differs from *Heliotropioidearumpollenites rotundus* by its smooth exine, stronger structure of pori.

Remarks: Beside the holotype, one specimen of 23 μ size from the 432.5 to 432.7 m core of borehole Szászvár-8. ERDTMAN (1952, p. 79) reported similar pollen forms in the subfamily *Heliotropioideae* of the family

Boraginaceae (Heliotropium, Tournefortia). However, in the new species the pores and pseudocolpi are not as regularly placed as in ERDTMAN's figure. *Heliotropium seruschanicum* M. POP., figured in the Chinese pollen book (Plate 20, fig. 3) also much resembles the new species.

Heliotropioidearumpollenites rotundus n. g. n. sp.

Plate XLVI, Fig. 4

Holotype: Hidas Mine, Seam II, sample No 53, slide No 2, 33.8×112.4.
Locus typicus: Hidas Mine.
Stratum typicum: Tortonian lignite-bearing sequence.

Diagnosis: Pollen grain of 30 by 25 μ size, subprolate, with 4 (?) colpi having small round exopores and large endopores surrounded by round anuli of about 4 μ diameter. The colpi alternate with pseudocolpi slightly shorter than the ones provided with pores. The colpi converge and taper towards the poles. In the polar position, the pollen is spherical, with the four pores protruding. Exine about 1 μ thick, smooth.

Differential diagnosis: The new species differs from *H. gracilis* n. sp. by its more roundish shape, and more marked pores. The holotype is tetracolporate, but tricolporate forms have also been encountered.

Remarks: Particularly abundant in samples Nos 5 and 53 of Seam II, Hidas Mine, in the 20 to 30 μ size range.

The new species resembles the pollen of *Heliotropium strigosum* WILLD. var. *stellulatum* (MAIRE) MON. as figured by VAN CAMPO (1957, Pl. 6). The pollen of the living species is slightly larger, prolate in polar position, not as rounded, with lolongate pores. Of the two species described by *Selling* from Hawaii (1947, pp. 272–273), *Heliotropium curassavicum* L. is a herbaceous seashore plant. Its pollen is smaller than, but similar in shape, to the new species.

Ordo: *S o l a n a l e s*
Familia: L e n t i b u l a r i a c e a e
Genus: *Utriculariaepollenites* n. g.

Generotype: Utriculariaepollenites elegans n. g. n. sp.

Diagnosis: Polycolporate, polyporoidate, suboblate, prolate pollen. Ectexine thicker than endexine, finely reticulate.

Differential diagnosis: Differs from the fossil representatives of the genus *Polygalaceae* by its smaller size, by its less regularly arranged colpi and by its pore structure.

Utriculariaepollenites elegans n. g. n. sp.
Plate XLVIII, Fig. 12

Holotype: Borehole K.-120, sample No 105, slide No 1, 30.2×111.5.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, clay-marl, borehole K.-120, depth 37.2 to 374.4 m.

Diagnosis: Subprolate, polycolporoidate pollen grain of 24 by 15 μ size. Ectexine slightly thicker than endexine, intragranulate. 6 or 7 colpi. Caverns adjacent to the colpi 2 μ wide, slightly tapering towards the poles. Colpi somewhat constricted at the equator, at the place of the germinal aperture.

Remarks: The grains of the new species range from 17 to 31 μ in size. Some grains are, so to speak, in a rolled-up state. The thin colpi might have been displaced, by some mechanical influence prior to fossilization.

Ubiquitous in the Mecsek Mountains Neogene, the new species might correspond to several plant species.

Familia: Acanthaceae
Genus: *Pteracanthopollenites* n. g.

Generotype: Pteracanthopollenites discordatus n. g. n. sp.

Diagnosis: Elongate elliptical, tricolporate pollen, ribbed, with an exine exhibiting a peculiar grid-like structure.

Differential diagnosis: The new genus recalls the pollen of *Ephedra*, but differs from it strikingly by that it is provided with pores and by the grid pattern of the exine.

Pteracanthopollenites discordatus n. g. n. sp.
Plate XLVIII, Fig. 1–2

Holotype: Borehole Sz.-8, sample No 219, slide No 2, 33.2×102.6.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian, grey calcareous marl, borehole Sz.-8, depth 433.8 to 434.1 m.

Diagnosis: Elongate elliptical pollen grain of 53 by 20 μ size. Between the two poles there are 5 or 6 ribs of 2 μ size, on three ribs there are lalongate pores of 5 μ diameter at the middle. The exine is intrabaculate; as a result, the surface exhibits an uneven grid pattern.

Remarks: The surface of the grain is corroded, and it is difficult to give any more detailed analysis of the exine structure. According to the Chinese pollen book (1960, p. 45), the pollen of *Pteracanthus angustifrons* (C. B. CLARKE)

BREM. has 12 to 15 ribs and 3 pores. However, the pollen grains of the living species are almost twice as large. On the basis of the morphological similarity, it is to this genus that I have referred the new species.

One specimen thus far.

Familia: Plantaginaceae
Genus: *Plantaginacearumpollenites* NAGY 1963

1963. *Plantaginacearumpollis* n. g. in Acta Botanica IX. 3–4, p. 396, with two species.

Plantaginacearumpollenites miocaenicus NAGY 1963
Plate XLVI, Fig. 6–7

1963. *Plantaginacearumpollis miocenicus* n. g. n. sp. — in Acta Botanica IX. 3–4, pp. 396–397. Diagnosis and generotype.

One specimen of 27 by 25 μ size in sample No 23 (erroneously given as sample No 20 in Acta Botanica) of borehole Hidas-53 (a Sarmatian core of 572 to 575 m depth).

Plantaginacearumpollenites soói NAGY 1963

1963. *Plantaginacearumpollis soói* n. sp. — in Acta Bot. IX. 3–4, p. 397. Diagnosis and holotype.

One specimen from the Helvetian fish-scale-bearing sequence, 65 to 67.6 m depth, of borehole Zengővárkony-59.

Plantaginacearumpollenites sp.
Plate XLVIII, Fig. 5–6

One specimen of 35 μ size; 4 or 5 pores; exine multi-layered, about 3 μ thick, recalling the genus Litorella (ERDTMAN 1954, p. 115, Pl. XVII, Fig. 28). The specimen disappeared during the fixation of the slide, so that I cannot describe it as a new species, and can do no better than to indicate its presence in the material (in the Pannonian, 126.6 to 132.5 m depth, of borehole Hidas-53). *Litorella americana* BERG and *L. lacustris* L. are weeds of the seashore and the lake shore, respectively (ERDTMAN, l. c., and WILLIS 1957, p. 390).

Ordo: *Cistales (Parietales)*
Familia: Cistaceae
Genus: *Cistacearumpollenites* n. g.

Generotype: Cistacearumpollenites rotundus n. g. n. sp.

Diagnosis: Tricolporate pollen, prolate to oblate, with round endospore. Colpi uniform. Surface reticulate, rugulate, striate, depending on the arrangement of the pilate (clavate) exine structure.

Differential diagnosis: Differs from the genus *Ilexpollenites* by size and pore structure, and by the uniformity of the ornamental elements.

Cistacearumpollenites rotundus n. g. n. sp.
Plate XLVIII, Fig. 3–4

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 33.3×112.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, clay-marl, borehole Zgv.-59, depth 51.3 to 56.0.

Diagnosis: Prolate, tricolporate pollen grain of 40 by 34 μ size; colpi narrow, slightly convergent towards the poles. Endopore round, outlined by an anulus of about 4 μ diameter. Exine pilate, about 3 μ thick: ectexine (sexine) 2 μ, endexine (nexine) thin, 1 μ. Surface finely reticulate.

Remarks: A few specimens of 40 to 44 μ size in Middle Miocene layers (borehole Zengővárkony-59; borehole Pusztakisfalu-VI, depth 12.5 to 15 m; locality Almáspatak-I, clay-marl with fish scales).

The holotype is tilted into a lateral position. As a botanical affinity, the family *Cistacea* (HEYDACKER 1963 and ERDTMAN 1952) may be put forward on a morphological basis.

Cistacearumpollenites macrodurensis (PF. et THOMS. 1953) n. c.
Plate XLVIII, Fig. 15, 18

1953. *Tricolporopollenites macrodurensis* n. sp. PF. et THOMS. in Palaeontogr. 94. B. XIII. 5–9.

Prolate, tricolporate pollen grain of 41 μ size. Its germinal structure belongs to HEYDACKER's type 2 (1963, pp. 42–43). The colpi reach to the poles. Pores outlined by the colpi exine baculate, thicker at the poles. It corresponds to the Upper Oligocene-Lower Miocene form described by THOMSON et PFLUG in the Eschweiler lignite and referred to the genus *Parthenocissus* or possibly *Cissus* (1953, p. 103). It also resembles *Hudsonia ericioides* L. as described and figured by HEYDACKER, except that it is smaller in size.

Encountered in borehole Zengővárkony-45 (13.2 to 13.7 m depth).

Familia: Flacourtiaceae

Flacourtiaceous pollen

This is a fairly abundant group of pollen, of 15 to 30 μ size, tricolporate (colporoidate), subprolate to prolate, with a finely reticulate, intrarugulate exine structure.

For the time being, and until further classification, I have subsumed these forms under a comprehensive name. The species *Tricolporopollenites ráskyi* established and referred to the family *Flacourtiaceae* by M. Kedves (1963b, pp. 37–38) is also comprehensive, both as to size and ornament. The family *Flacourtiaceae* comprises 500 species in 70 genera (Willis 1957, p. 271). Soó (1963, p. 391) ascribed some 900 species to the family. It includes tropical and subtropical trees and scrubs. A number of these could have occurred in the floral association that yielded our material. I prefer to present only. diagrammatically the specimens relegated to this family on a morphological basis (Chinese pollen book, Plate XLVI) and to postpone further subdivision until some sort of monographic treatment of the family on takes place.

Ordo: *Dilleniales*
Familia: Dipterocarpaceae
Genus: *Dipterocarpacearumpollenites* n. g.

Generotype: Dipterocarpacearumpollenites hidasensis n. g. n. sp.

Diagnosis: Oblate-subprolate, spheroidal, tricolpate, tricolporoidate, tricolporate pollen, with a characteristic reticuloid exine recalling coniferous pollen.

Differential diagnosis: It is the peculiar exine structure that distinguishes the new genus from all other angiospermous genera.

I have so far distinguished two species:

Dipterocarpacearumpollenites hidasensis n. g. n. sp.
Plate XLVIII, Fig. 7

Holotype: Borehole H.-53, sample No 33, slide No 1, 32.0×118.1.
Locus typicus: Hidas.
Stratum typicum: Tortonian lignite-bearing sequence, greenish-grey clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Spheroidal, subprolate, tricolporate pollen grain of 50 by 43 μ size. The caverna, about 5 μ wide at the equator, tapers to about 3 μ towards—out does not reach to—the poles. The round pore does not overreach the caverna. Ectexine baculate in about 4 to 6 μ width, which results in a finely reticulate surface recalling the bladder structure of coniferous pollen. Nexine thin, 0.5 μ.

Remarks: On the basis of the exine structure one would be inclined, at a first glance, to assign it to a conifer, e. g. to a *Dacrydium* sp. The colpi and pores prive it, however, to be angispermous beyond any doubt. The pollen of living *Dipterocarpus crinitus* DYER varies from 50 to 61 μ in size; its exine is 3 to 3.5 μ thick. Most specimens are so crumpled that the course of the colpi is difficult to trace. The fossil species differs from the living one in being tricolporate rather than colpate and prolate rather than oblate. However, since the genus *Dipterocarpus* GAERTN. Has 70 species and the family *Dipterocarpaceae* has 350 (WILLIS 1957, p. 222), no weighty conclusions can be based on the knowledge of just one species. Still, the remarkable exine structure seems to be unique among angiosperms (ERDTMAN 1952 p. 153); this is the argument justifying the assumption of an affinity.

Our material has included quite a few specimens in the size range of 37 to 52 μ (11 there of have been photographed), largely in the Middle Miocene material of boreholes Hidas-53 and Zengővárkony-59; a few specimens cropped up also in the Pannonian where they had presumably been redeposited.

Dipterocarpacearumpollenites spinosus n. g. n. sp.

Plate XLVIII, Fig. 16–17

Holotype: Borehole H.-53, sample No 33, slide No 1, 31.9×102.2.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, greenish-grey clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Subprolate spheroidal, tricolporate pollen grain of 52 by 40 μ size. Exine intrabaculate, 2 μ thick, strewn with spines about 2 μ tall spaced about 4 μ apart.

Differential diagnosis: Resembles *D. hidasensis* n. g. n. sp. in shape and structural elements. Differs from it by the more pronounced colpi and pores, by the even more conifer-like traits of its structure, by the thinner bacular layer and by possessing spines.

Three specimens are in the Middle Miocene of borehole H.-53.

Ordo: *Campanulales*
Familia: Lobeliaceae
Genus: *Lobeliaepollenites* n. g.

Generotype: Lobeliaepollenites erdtmani n. g. n. sp.

Diagnosis: 3–4-colporoidate prolate pollen of lolongate pore aperture. Exine structure pilate (baculate).

Differential diagnosis: The new genus may be tetracolporat, like the *Sapotaceoidaepollenites* genus, but the shape of this last-mentioned genus is more roundish and the structure of the pori are lolongat.

Remarks: The pollen exhibits morphological features identical with those of the genus *Lobelia*, subfamily *Lobelioideae*, family *Campanulaceae*, *L. wollastonii* E. C. BAK., as figured by OLOV HEDBERG (1956, Pl. 5, Figs. a–c), is larger, although strikingly similar morphologically. The morphological characterization by ERDTMAN (1952, p. 93) of the subfamily *Lobelioidea* confirms my standpoint.

Lobeliaepollenites erdtmani n. g. n. sp.
Plate XLVIII, Fig. 8–10

Derivatio nominis: In honour of Professor DR. G. ERDTMAN, Stockholm.
Holotype: Borehole H.-53, sample No 28, slide No 21, 39.1×110.8.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, clay-marl, borehole H.-53, depth 630.8 to 632.0 m.

Diagnosis: Prolate, tetracolporoidate pollen grain of 24 by 18 μ size. Exine about 1 μ thick; ectexine sympilate, endexine about 0.5 μ thick, smooth; surface intragranulate. Colpi about 2 μ wide, tapering and slightly convergent towards the poles. Pores elongate meridionally, about 3 μ in diameter, angular.

Remarks: A few specimens of 22 to 25 μ size in the Middle Miocene (borehole Hidas-53, depth 600.3 to 602.3 and 572 to 575 m).

Ordo: *Asterales*
Familia: Compositae
Subfamilia: Tubuliflorae
Genus: *Tubulifloridites* (COOKSON 1947) R. POT. 1960

1947. *Tricolpites (Tubulifloridites)* COOKSON in Plant Microfossils from the Lignites of Kerguelen Archipelago p. 134, Pl. XV, fig. 46.
1960. *Tubulifloridites* COOKSON — in R. POT. Synopsis III. p. 106.

COOKSON introduced in 1947 the name as a subgeneric term. She validly described and figured the monotypical subgenus with the species *Tricolpites (Tubulifloridites) antipodica* (COOKSON 1947, p. 134, XV. 44).

When applying the term as a generic name, R. POTONIÉ (Synopsis III, 1960, p. 106) does not indicate the change and states it to be inseparable from the genus *Compositoipollenites* which he validated in 1960: "Ein klarer Unterschied zu *Compositoipollenites* ist bisher nicht genannt worden". On the basis of the descriptions and figures published, the two forms can readily be distinguished, as COOKSON'form is decidedly tricolpate, POTONIÉ's form is roundish with uncertain colpi (indicated with a question mark or in parentheses). According to POTONIÉ's original description (1934, Arb. Inst. 4. p. 94) the exine is 2 μ thick; this is borne out also by the figures (1934, 4, Pl. 6, fig. 32 and 1960, Pl. 6., Fig. 123) whereas in the genus *Tubulifloridites* no strong exine is visible according to either description (COOKSON, l. c. and R. POT. 1960, Pl. 6, Fig. 126).

Tubulifloridites grandis n. sp.

Plate XLIX, Fig. 1–2

Holotype: Borehole Zgv.-59, sample No 22, slide No 1, 33.8×113.8.
Locus typicus: Zengővárkony.
Stratum typicum: Upper Helvetian, grey silty clay-marl with fish scales, borehole Zgv.-59, depth 51.3 to 56 m.

Diagnosis: Spheroidal, tricolpate pollen grain of 44 μ diameter, covered with a dense stand of spines, 4 to 9 μ wide at the base, 3 to 5 μ tall. There are 4 to 6 spines per lobe. The ends of the spines are pointed, with a small vacuole in the interior of each. The exolamella is double: exolamella "a" is smooth, very thin, exolamella "b" is baculate (intrabaculate) (Textfig. 42), apparently somewhat thickened at its margin, obviously owing to the coalescence of some of the clavi.

Fig. — ábra 42. Tubulifloridites grandis n. sp.

Differential diagnosis: The form described in 1947 by COOKSON (l. c., p. 134, Pl. XV, fig. 44) is smaller, the spines are narrower-based and appear more pointed. The figure does not lend itself to the comparison of other details.

Remarks: Several specimens in the 27 to 44 μ size range in some cores of boreholes Zengővárkony-59, Hidas-53. On a morphological basis, a botanical affinity to the genera *Carduus, Atractylis* ets. can be supposed. A form of similar size (38.4 μ) and morphology was described from the Miocene of the Sikhote-Alyn Mountains in the Miocene pollen atlas by POKROVSKAIA et al. (1956, p. 428–429, Pl. XXX, Figs. 13).

Tubulifloridites granulosus n. sp.

Plate XLIX, Fig. 3–4

Holotype: Borehole Zgv.-59, sample No 14, slide No 1, 37.8×103.3.
Locus typicus: Zengővárkony.
Stratum typicum: Tortonian, "Schlier" sequence, grey clay-marl, borehole Zgv.-59, depth 34.0 to 37.5 m.

Diagnosis: Roundish tricolpate pollen grains of about 20 μ size, with 7 or 8 spines (2 μ wide and 2 μ tall) per lobe. Exine thin (1 μ), intragranulate.

Differential diagnosis: Differs by its exine structure and pointed spines from *Tubulifloridites antipodica* COOKSON.

A few specimens in the cores of boreholes Zengővárkony-59 and Pusztakisfalu-VI.

Tubulifloridites ambrosiinae n. sp.

Plate XLIX, Fig. 5–6

Holotype: Borehole H.-53, sample No 54, slide No 1, 37.1×117.3.
Locus typicus: Hidas.
Stratum typicum: Tortonian, "Schlier" sequence, grey clay-marl, borehole H.-53, depth 761.0 to 763.3 m.

Diagnosis: Roundish tricolpate pollen of 23 μ diameter. Exine 3 μ thick; ectexine a baculate layer 2 μ thick (Textfig. 43); there are small, not too pointed spines about 0.5 μ tall; endexine about 0.5 μ thick, smooth. Spines spaced about 3 μ apart. Among the spines, the exine surface is finely granulate. In polar position the grain reminds of a pollen tetrade.

Fig. — ábra 43. Tubulifloridites ambrosiinae n. sp.

Differential diagnosis: Differs from the other species of the *Tubulifloridites* genus by the relatively small spines and by the peculiar shape of its polar view.

Remarks: The holotype is in the polar position. ERDTMAN (1954, p. 84) writes: "The ectexine is flattened at the poles more than the endexine. In polar view, a single grain resembles somewhat a tetrad with the endexine apparently occupying the position of the top pollen in a tetrahedral tetrad". About the exine structure of *Ambrosia maritima* L., ERDTMAN (1952, p. 122) states: "Textum distinctly stratified, provided with spinules".

One specimen thus far.

On the basis of morphological features, affinity to the genus *Ambrosia* is probable.

Tubulifloridites anthemidearum n. sp.

Plate XLIX, Fig. 9–11

Holotype: Borehole H.-53, sample No 18, slide No 1, 28.1×116.4.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, clay-marl, borehole H.-53, depth 534.0 to 537.0 m.

Diagnosis: Roundish tricolporate pollen grain of 30 μ size, covered with a dense stand of spines 2 to 3 μ tall, very pointed, each provided with a smal vacuole. Exine tegillate; the bacula constituting the tegillum are centripetally thickened and their top portions are coalesced. The infrategillar bacula are about 3 to 4 μ tall at the middle of the sides, decreasing to 1 μ near the poles. There are some branching ones among the infrategillate bacula. The surface is reticulate as a result. Nexine 1 μ thick (Textfig. 44).

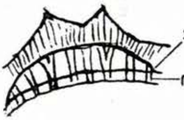


Fig. — ábra 44. Tubulifloridites anthemidearum n. sp.

Differential diagnosis: Differs from the other fossil species of the genus by the infrategillat baculi.

Remarks: Exine structure highly similar to that of the "*Anthemis type*" figured by E. Stix (1960, p. 76). Botanical affinity to the tribus *Anthemideae* is probable.

A few specimens in the Tortonian and Sarmatian cores of borehole Hidas-53.

Genus: *Artemisiaepollenites* n. g.

Generotype: Artemisiaepollenites sellularis n. g. n. sp.

Diagnosis: Small tricolporate pollen with small spines on the tegillum; intrabaculate with reticulate surface.

Differential diagnosis: Distinguished by from the rest of compositaceous pollen by an exine structure resembling the living genus *Artemisia*.

Artemisiaepollenites sellularis n. g. n. sp.

Plate XLIX, Fig. 16–17; Plate XLI, Fig. 18–19

Holotype: Borehole H.-53, sample No 23, slide No 2, 34.1 × 119.4.
Locus typicus: Hidas.
Stratum typicum: Tortonian, turritellaceous—corbulaceous clay-marl sequence, dark grey clay. Borehole H.-53, depth 572 to 575 m.

Diagnosis: Tricolporate pollen grain of 16 μ diameter. Exine about 2 μ thick, baculate. The tegillum bears very small spines spaced about 2 μ apart. The sexine (ectexine) beneath the tegillum is densely baculate, about 1 μ thick. Nexine (endexine) about 0.5 thick, smooth. Surface very finely reticulate. At the junction of the lobes of the polarly positioned pollen grain, a bight in the pore is observed.

Remarks: The holotype is in the polar position, wherefore the course of its colpi cannot be traced.

A specimen of 14 μ size found in the 26 to 27 m core of borehole Szászvár-8 is slightly tilted from the polar towards the lateral position, and shows colpi that narrow towards the poles and bear small genicule-like pores.

Morphologically, our specimens resemble the genus *Artemisia*. The structural elements figured in the Chinese pollen book (1960, Pl. XXVI, Figs. 9–10, Plate XVII, Figs 1–3) as well as the illustrations of Erdtman (1954, p. 84, Pl. VII, 125–128, Pl. VIII. Figs. 129–133, and 1952, p. 123, Fig. 65) and E. Stix (1960 p. 76), confirm this view.

A few specimens have so far been encountered.

Genus: *Cichoriaearumpollenites* n. g.*

Generotype: Cichoriaearumpollenites gracilis n. g. n. sp.

Derivatio nominis: On the basis of morphological similarity to some species of the tribe *Cichorieae.*

Diagnosis: Roundish tricolporate pollen with small spines. The exine exhibits a hexagonal arrangement of cristae.

Differential diagnosis: It is the crista structure of the sexine that distinguishes this genus from the rest of compositaceous pollen.

Cichoriaearumpollenites gracilis n. g. n. sp.

Plate XLVIII, Fig. 13–14

Holotype: Borehole Zgv.-59, sample No 22, slide No 2, 36.2×113.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, grey silty clay-marl with fish-scales, borehole Zgv.-59, depth 51.3 to 56 m.

Diagnosis: Roundish tricolporate pollen grain of 26 μ diameter. Owing to the arrangement of the ornamental elements (cristae) of the sexine, the outline of the pollen grain is a rounded irregular hexagon in the polar view. The cristae bear small spines, with depressions (lacunae) between them. On the margin of the exine, there are spines 2 to 3 μ tall, numbering 10 to 14 on every other side (the long sides) and 3 or 4 on the short sides in between (Textfig. 45).

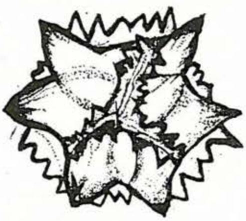


Fig. — ábra 45. Cichoriaearumpollenites gracilis n. g. n. sp.

Remarks: The pollen grain is rather compressed. In both size and morphology, it resembles the pollen of certain genera (*Taraxacum* and *Crepis*) of the subfamily *Liguliflorae.*

Research into the living genera of the family *Compositae* is not by far complete (see Wodehouse 1935, Erdtman 1943, 1952, E. Stix 1960). It has been found that the presence of cristae is not resticted to the tribe *Cichorieae.* The pollen of the genera *Vernonia, Berkheya* and *Barnadesia,* belonging, in the actual taxonomic system, to the *Tubuliflorae,* also exhibit cristae. The results published so far by E. Stix suggest that the subdivision of the family *Compositae* should be changed: that author has, indeed, already pointed out some taxonomical ambiguities (E. Stix 1960, p. 99). A full palynological treatment of the family *Compositae* (more than 13,000 species in about 900 genera, according to Willis 1957, p. 164) and the definite settling of taxonomical problems is certainly not my task. Morphological similarities suggest two genera of the tribe *Cichorieae.*

A few specimens in cores of borehole Zengővárkony-59.

* The legitimate denomination of this genus is *Cichoreacidites* (Sah 1967, see p. 167 too).

Genus: *Compositoipollenites* R. POT. 1951

Compositoipollenites rizophorus (R. POT. 1934) R. POT. 1951

Round pollen grains of 24 to 30 μ size and thick exine (about 2 μ). Surface studded with massive spines 3 to 4 μ tall: this is why the large round pores are difficult to observe in full detail (?). Two specimens at 688.0 to 688.5 and 479.1 to 482.0 m depth, respectively, in borehole Hidas-53. First described in 1934 by R. POTONIÉ in the Geiseltal Eocene, by the name *Pollenites rizophorus* (1934, 4, p. 94), with the statement "Exitus meist nicht zu sehen (wahrscheinlich drei)". In the way of botanical affinites, POTONIÉ mentioned compositaceous, caprifoliaceous, nymphaceous and leguminosaceous pollen. In 1951, he called it *Compositoipollenites* (Palaeontogr., explanation to Plate XXI, fig. 183). THOMSON et PFLUG (1953, p. 88) describe the form as *Intratriporopollenites rizophorus* (R. POT.) subsp. *geiseltalensis*, with a diagnosis similar to the preceding ones. In 1960, R. POTONIÉ (Synops. III. pp. 105–106) gave it the name established in 1951, but he attached to it a modified diagnosis. He corroborated the hitherto uncertain three pores and as mentioned („und colpi?") a negative reticulum. In agreement with D. MAI, I restrict, for the time being, THOMSON's and PFLUG's genus *Intratriporopollenites* to „*tilioid*" pollen (cf. the remarks concerning the genus *Tubulifloridites*). The form is mentioned here for stratigraphic rather than botanical reasons. German literature states the Lower Oligocene as the youngest occurrence: the few specimens in our material cropped up in marine deposits of the Middle Miocene.

Ordo: *Ericales*
Familia: Clethraceae
Genus: *Tricolporopollenites* TH. et PF. 1953

Tricolporopollenites clethraceiformis n. sp.
Plate XLIX, Fig. 7–8

Holotype: Borehole Zgv.-59, sample No 27, slide No 2, 41.9×114.4.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, borehole Zgv.-59, depth 67.5 to 70.5 m.

Diagnosis: Oblate spheroidal, tricolporate pollen grain of 23 μ size. Exine about 2 μ ectexine about 1 μ thick, smooth; endexine granulate. Germinal elements: one narrow colpus that does not completely reach up to the pole. Caverna about 2 to 2.5 μ wide, scarcely narrowing towards the pole both colpus and caverna break sharply at the pore, followed also by the protruding exopore. The round endopore reaches up to the perimeter of the caverna.

Differential diagnosis: Resembles, in the polar view, *Cyrillaceaepollenites megaexactus* (R. Pot.) R. Pot. but is easily distinguished therefrom by its typical narrow exopore. In the lateral view, distinction is not so simple but feasible if the thin pore region can be recognized. The exine of the new species is ornamented.

According to Willis (1957, p. 149), the family *Clethraceae* includes the genus *Clethra* with 30 tropical and subtropical species. Traverse (1955, p. 67) mentioned the genus *Clethra* with a question mark from the Brandon lignite of Vermont. In Hungary, it was mentioned by Simoncsics (1959, p. 67) and Kedves (1959, p. 170, 1961, p. 27, 1962, p. 160).

Familia: Ericaceae
Genus: *Ericipites* Wodehouse 1933

Ericipites discretus (R. Pot. 1934) n. comb.

Plate XLIX, Fig. 12–13

1934. *Pollenites discretus* R. Pot. — in Arb. Inst. Paläobot. 4. p. 86, Pl. 6, Fig. 23.
1953. *Tetradopollenites discretus* (R. Pot.) Pf. et Th. Palaeontgr. 94. p. 113, Pl. 15, Fig. 74–78.

The form was first described by R. Potonié from the Eocene of the Geiseltal. It was further mentioned by Thomson et Pflug from the Upper Eocene and Lower Oligocene, and also from the Middle and Upper Pliocene of Germany. A fairly rare form.

In the Mecsek Mountains material, it was found in cores from the Helvetian fish-scale-bearing sequence (60.9 to 63.0 m depth) of borehole Zengővárkony-59, in the Sarmatian (545.4 to 546.5 m depth) of borehole Hidas-53; and one specimen in each of several cores in the Pannonian of the last-cited borehole.

Exine strong, double-layered; ectexine 1 μ thick, baculate; endexine 3 μ thick. The germinal aperture connecting the tetrades is bordered on either side by a thick (3 μ) exine lath.

Botanical affinity: family *Ericaceae.*

Ericipites baculatus n. sp.

Plate XLIX, Fig. 18–19

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 45.6×109.7.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, grey silty clay-marl with fish scales, borehole Zgv.-59, depth 63 to 65 m.

Diagnosis: Tricolpate pollen grains arranged in tetrads of 36 μ diameter. The individual grains forming the tetrad have a diameter of 20 μ. Ectexine baculate, 1 to 1.5 μ thick, endexine about 0.5 μ thick. The ectexine looks finely reticulate in top view, owing to its surface structure. Colpi of adjacent grains opposed, narrow (about 0.5 μ), 10 to 12 μ long.

Differential diagnosis: Differs from *Ericipites* discretus (R. Pot. 1934) n. c. by the thickness of the exine.

Remarks: A few specimens of about 30 μ size in borehole Zengővárkony-59, and in the Middle Helvetian exposures of Mecseknádasd. Presumably an ericaceous pollen species. Couper (1953, p. 53) established the artificial genus *Dicotetradites* for tetrads of various ornament and placed it into *Incertae sedis*. The figure of *D. clavatis* Couper (Plate 8, Fig. 125) shows a roundish form not exhibiting the typical shape of the ericaceous tetrad. Also, it is bigger than the new species (45 to 62 μ). The form photographed by Couper (1960, p. 62, Pl. 10, Fig. 2) is more similar morphologically to the new species. Still, in the diagnosis of the genus *Dicotetradites*, Couper (1953, l. c.) states "Exine very variable in nature of sculpture". This diagnosis fits practically any pollen tetrade of any sculpture. With respect to Couper's diagnosis, I agree with Potonié (1960, Synopsis III, p. 139) who stated that "Die Diagnose Couper's gestattet bisher nicht, das Genus von ähnlichen älteren Genera zu unterscheiden". Couper's type would agree with the species *Tetradopollenites discretus* described by Thomson et Pflug (1953, p. 113). Erdtman (1952, p. 161) mentioned species with more or less baculate exine in connexion with certain pollen forms of the family *Ericaceae:* e. g. the exine of *Rhododendron arborescens* Torr. "is slightly uneven and distinctly baculate" (l. c.).

Ericipites hidasensis n. sp.

Plate L, Fig. 1–2

Holotype: Borehole H.-53, sample No 27, slide No 1, 33.0×96.4.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, microstratified clay-marl, borehole H.-53, depth 600.5 to 602.3 m.

Diagnosis: Pollen tetrade of 39 μ diameter; the individual pollen grains are about 25 μ diameter. Exine composed of a finely intrabaculate ectexine and a smooth endexine about 0.5 μ thick. The surface appears finely granulate. Colpi 1 μ thick and about 12 μ long.

Differential diagnosis: Differs from *Ericipites discretus* (R. Pot.) n. c. by its thinner exine and its exine structure, from *E. baculatus* n. sp. by its exine structure. *E. ericius* (R. Pot. 1931) R. Pot. 1960 and *E. callidus* (R. Pot.) n. c. differ from it in having a smooth exine.

Remarks: A few specimens in the Mecsek Mountains Helvetian.

Botanical affinity to the family *Ericaceae* probable.

Ericipites sp.

These forms disappeared in the course of the secondary treatment of the slide, so that I can only indicate their presence in the core from 364.2 to 367 m depth of borehole Hidas-53. I am of the opinion that they represent the family *Ericaceae.* Smooth pollen grains with exines 1 μ thick, in the 29 to 41 μ size range.

Subseries: **CARYOPHYLLALES — MONOCHLAMYDAE**
Ordo: *Santalales*
Subordo: *Loranthineae*
Familia: Loranthaceae
Genus: *Spinulaepollenites* KRUTZSCH 1962

1962. *Spinulaepollis* W. KRUTZSCH in Geologie Jhg. 11. H. 3. p. 278.

Spinulaepollenites arceuthobioides W. KR. 1962
Plate XLIX, Fig. 14–15

Roughly hexagonal pollen grains, tricolporate (?), of 20 to 22 μ size, with convex sides, more precisely, with a concave depression at the middle of each side. Exine about 1.5 μ thick, with irregularly distributed spines, of 1 μ size or even smaller, on its surface.

KRUTZSCH states this species to range from the Middle Eocene to the Pliocene and indicates the Upper Eocene and Miocene as periods of greatest abundance in Germany (1962a, p. 278). As a botanical affinity, he suggests the species *Arceuthobium oxycedri* BIEB. of the family *Loranthaceae,* which corresponds in size to the present species, but its spines are much taller and more uniformly distributed (ERDTMAN 1952, p. 250). At any rate, the present finds represent the first occurrence of the species in Hungary. There were four specimens in all, in boreholes Komló-120 (367.0 to 374.7 m depth), Zengővárkony-45 (13.2 to 13.7 m depth) and Szászvár-8 (432.5 to 432.7 m depth).

Ordo: *Caryophyllales*
Subordo: *Caryophyllineae*
Familia: Caryophyllaceae
Genus: *Caryophyllidites* COUPER 1960

Caryophyllidites hidasensis n. sp.
Plate L, Fig. 3, 8

Holotype: Borehole H.-53, sample No 43, slide No 1, 39.9×103.5.
Locus typicus: Hidas.
Stratum typicum: Tortonian, Leitha limestone sequence, depth 688 to 688.5 m.

Diagnosis: Roundish pollen grain of 37 μ diameter, with about 14 or 15 round pores of 5 to 6 μ diameter. The pores are situated in the ectexine "b". Their outlines are sharply defined; the pore membrane bears granula of about 1 μ diameter. Exine thick (3 to 4 μ). Ectexine "a" smooth (tegillum). Ectexine "b" 2 to 3 μ thick, coarsely baculate. Endexine about 1 μ thick, smooth. Owing to this structure, the surface of the pollen is coarsely granulate.

Differential diagnosis: Agrees, in size, with *Caryophyllidites polyoratus* COUPER 1960, but the pores of the new species are larger and scarcer; also, there are spines on the surface of the exine.

Remarks: Among the representatives of the family *Caryophyllaceae*, there are many species similar in morphology and size to our fossil species, particularly in the genus *Melandrium* (S. CHANDRA 1962). At the present stage of research, I prefer not to identify it with any species of this widespread cosmopolite family (1,300 species in 80 genera according to WILLIS, 1957, p. 122). Only one specimen in our material.

Caryophyllidites microreticulatus n. sp.

Plate XLIX, Fig. 20–21

Holotype: Borehole Zgv.-59, sample No 13, slide No 1, 36.5×116.0.
Locus typicus: Zengővárkony.
Stratum typicum: Tortonian, "Schlier" sequence, grey silt, borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Roundish pollen grain of 26 μ diameter, with round pores of 2 to 2.5 μ diameter, spaced 7 to 8 μ apart. Ectexine baculate, about 1.5 μ thick, slightly thickened centripetally. This structure lends the surface a delicately reticulate look. Endexine smooth, about 0.5 μ thick. The pores are situated in the endexine.

Differential diagnosis: Differs from *Caryophyllidites hidasensis* n. sp. by size, exine, and pore structure. KRUTZSCH's *C. ruetebergensis* (1966, pp. 40–41) stands close to the new species also in size, but the pores of the new species are smaller and more widely spaced.

Remarks: Among the species in SUNIRMAL CHANDA's 1962 paper, our form most resembles *Viscaria alpina* var. *serpentinicola* (Pl. 16, figs. 9–12).

Subordo: *Chenopodineae*
Familia: Chenopodiaceae
Genus: *Chenopodipollenites* W. KR. 1966

1966. *Chenopodipollis* n. fgen. KRUTZSCH in Geologie Jhg. 15. Beiheft 55, p. 35.

Chenopodipollenites maximus n. sp.

Plate L, Fig. 4–5

Holotype: Borehole H.-53, sample No 22, slide No 1, 31.4×112.2.
Locus typicus: Hidas.
Stratum typicum: Tortonian, turritellian clay-marl sequence, borehole H.-53, depth 558 to 561 m.

Diagnosis: Spheroidal, polyforate pollen of 38 μ size. Pores about 3 to 4 μ long, about 50 in number, distorted to oval shapes in the course of fossilization. Exine rim wavy. Tegillum 1.5 μ thick, underlain by a baculate layer likewise 1.5 μ thick, which lends the surface a delicately granulate look. Endexine vague, possibly thinner than 0.5 μ. The pores look like apertures.

Differential diagnosis: Differs from WEYLAND et PFLUG's species *Periporopollenites multiplex* (1957, p. 103) by its larger size and more wavy exine margin, from MAMCZAR's *Pollenites stellatus* (cf. *Stellaria* ?) (1960, p. 219, Pl. XIV, Figs. 199a, b) by its larger size and thicker exine. HARRIS' *Polyporina fragilis* (1960, p. 95, Pl. 29, Figs. 20–21) agrees as to size, but the new species has a thicker exine and a larger number of pores. It differs also from the rest of the species encountered in the Mecsek Mountains by its large size, large and numerous pores.

A few rather crumpled specimens in the Middle Miocene of borehole Hidas-53.

Chenopodipollenites neogenicus n. sp.

Plate L, Fig. 9–10

Holotype: Borehole H.-53, sample No 7, slide No 2, 40.9×111.3.
Locus typicus: Hidas.
Stratum typicum: Upper Pannonian, grey clay-marl, borehole H.-53, depth 147.5 to 148.5 m.

Diagnosis: Roundish polyporate pollen grain of 31 by 28 μ size. Pores of 1.5 to 2 μ diameter, spaced 2 to 2.5 μ apart, exceeding 40 in number. There are small granula at the middle of each pore. Exine about 3.5 μ thick, of wavy outline. Smooth tegillum about 1 μ thick, ectexine baculate (about 2 μ), endexine smooth, about 0.5 μ.

Differential diagnosis: The medium size member of the three Miocene species of the Mecsek Mountains differs from the *Chenopodipollis maximus* n. sp. by the smaller number and size of its pores, from the *Chenopodipollis multiplex* by the thicker exine and wider-spaced pores.

A few specimens in our material.

Chenopodipollenites multiplex (WEYL. et PF. 1957) W. KR. 1966

Plate L, Fig. 6–7

1957. *Periporopollenites multiplex* WEYLAND et PFLUG in Palaeontogr. 102. p. 103, Pl. 22, Figs. 18–19.

Small polyporate pollen grains of 22 to 27 μ size; margin of exine slightly wavy; tegillum 0.5 μ; ectexine baculate, 1 μ; endexine smooth, 0.5 μ. Pores round, of about 2 μ diameter, distinctly outlined, about 50 in number. Scarce but persistent in the Middle Miocene and Pannonian cores of borehole Hidas-53 and in the samples from Hidas Mine. I have interpreted this pollen as belonging to a seashore plant (NAGY, 1962).

Ordo: *E b e n a l e s (D i o s p y r a l e s)*
Familia: S a p o t a c e a e
Genus: *Sapotaceoidaepollenites* R. POT., TH. et THIERG. 1950

1950. *Sapotaceoidae – poll.* R. POT., THOMS. et THIERG. in Geol. Jb. 58. p. 62.
1953. *Tetracolporopollenites* n. g. PF. et THOMS. – in Palaeontogr. 94. B. p. 108.
1960. *Sapotaceoidaepollenites* R. POT., THOMS. et THIERG. in Synopsis III. p. 109.

R. POTONIÉ referred to the family *Sapotaceae* some pollen from the Eocene and Miocene deposits, first figured by him (1931, 3. Mitt. p. 3, fig. 30) and described (POTONIÉ et VENITZ 1934, 5. p. 1, Pl. 4, Fig. 117) by the name *Pollenites manifestus*. POTONIÉ, THOMSON et THIERGART used the name *Sapotaceoidaepollenites* for the forms belonging to this form group (1950, p. 62). In 1953, THOMSON et PFLUG (p. 108) set up the morphological genus *Tetracolporopollenites* for these forms. What they stated about the number of germinalia in the diagnosis reads as follows: "Normalerweise vier Germinalien (im selteneren Falle auch drei)". Furthermore, "Polachse ist vierzählige (im selteneren Falle dreizählige) Symmetrieachse". About the botanical affinity: "Die Abteilung gehört wohl grössteinteils zu den *Sapotaceae*. Die dreiporigen Formen finden sich neben vierporigen in einer Anthere, wie rezente Beispiele zeigen". They recall the preliminary generic name given by POTONIÉ, THOMSON et PFLUG (1950; see above). Whereas THOMSON et PFLUG extended the botanical affinity with the *Sapotaceae* to all species described on the subsequent pages (108 to 111) of the cited paper, they did not indicate it in the name because—as they expounded it in the chapter on nomenclature—they preferred not to give botanical names (1953, p. 10). Since, however, the given generic name is *Tetracolporopollenites* and the forms placed in it include also tricolporate ones, the morphological name is somewhat of a misnomer, wherefore I accept for the genus the name *Sapotaceoidaepollenites* first applied in 1950 (l. c.) and redescribed by R. POTONIÉ in 1960.

Sapotaceoidaepollenites obscurus (PF. et THOMS. 1953) n. c.
Plate L, Fig. 15

1953. *Tetracolporopollenites obscurus* n. sp. PF. et THOMS. in Palaeontogr. 94. B. XIV. pp. 86–99, 102–108.

Tetracolporate pollen grains of 25 to 44 μ size. Pairs of adjacent caverns converge at the pole. Endopore wide, overreaching the colpus. Encountered in cores of boreholes Pusztakisfalu-VI, Zengővárkony-59, -45, Komló-120, Hidas-53 and in samples from the Middle Miocene exposure at Zobák.

Sapotaceoidaepollenites cf. *abditus* (Pf. 1953) n. c.

Plate L, Fig. 14, 22, 23

1953. *Tetracolporopollenites abditus* n. sp. Pf. in Palaeontogr. 94. B. p. 108. XIV. pp. 100–101.

Ellipsoidal pollen of 17 μ size; caverna parallel to the outline. Exine constricted near the pole; the pairs of cavernas constitute a cavium there. Pore developed in the form of rugae, exine smooth. The caverna is—as opposed to the description by Pflug (1953, Thomson et Pflug p. 108)—not uniformly thick but thinning towards the pole; this is why I give the name with a "cf". A single specimen at 630.8 to 632.0 m depth in borehole Hidas-53.

The species has been described from the German Middle Eocene.

Sapotaceoidaepollenites biconus (Pflug 1953) n. c.

Plate L, Fig. 18, 25

1953. *Tetracolporopollenites biconus* Pflug in Th. et Pflug, Palaeontogr. 94. p. 109, Pl. 15, Figs. 1–3.

The form figured and described by Pflug (l. c.) from the German Palaeocene and Eocene fully agrees as to size and morphology with the Mecsek Mountains specimens which was found in a total number of five in sample No 5 of Seam II, Hidas Mine, in boreholes Komló-120 (372.0 to 374.4 m), Zengővárkony-45 (13.2 to 13.7 m) and -59 (30.9 to 34.0 m). They all are presumably redeposited.

Sapotaceoidaepollenites microrhombus (Pflug 1953) n. c. f. *miocaenica* n. f.

Plate L, Fig. 11

1953. *Tetracolporopollenites microrhombus* n. sp. Pf. in Palaeontogr. 94. B. p. 109. XV. 22–25.

Form type: Borehole Pusztakisfalu VI, sample No 10, slide No 1, 46.5–114.6.

The species described by Pflug occurred in our material in the 24 to 30 μ size range, in the Middle Miocene sequence.

Differential diagnosis: Agrees in size with the form described by Pflug from the German Eocene, except that the breadth-to-length index is smaller

(0.6 to 0.7). The diameter of the exopore is smaller (2 μ). The diameter of the endopore is about the same as in the original species. A few specimens have so far been encountered in the Mecsek Mountains Miocene (borehole Pusztakisfalu-VI and Hidas-53; at 667.2 to 669.0 and 757.0 to 759.0 m depth in the latter).

Sapotaceoidaepollenites kirchheimeri (TH. et PF. 1953) n. c.

Plate L, Fig. 20

1953. *Tetracolporopollenites kirchheimeri* (REISS.) n. c. TH. et PF. in Palaeontogr. 94. B. p. 109. XV. 13–21.

REISSINGER gave under the name *Pollenites kirchheimeri* a poor enough figure (1950, Pl. XVIII, Fig. 62). THOMSON et PFLUG described it latter (1953, p. 100, Pl. 15, Figs. 13–31) by the name *Tetracolporopollenites kirchheimeri*, identifying their form with REISSINGER's figure. They considered the species to extend from the Lower Eocene to the Middle Miocene. I have found a few pollen grains agreeing morphologically with this species in borehole Zengővárkony-59, but only one of them (found at 67.5 to 70.5 m depth in borehole Zengővárkony-59) is of the size specified by THOMSON et PFLUG (35 by 19 μ). The other specimens (from 30.9 to 34.0, 56.0 to 60.9 and 65.0 to 67.0 m depth, respectively, in borehole Zengővárkony-59) are somewhat smaller (of 34, 31 and 29 μ diameter, respectively).

Sapotaceoidaepollenites cf. *sapotoides* (PF. et THOMS. 1953) R. POT. 1960

Plate L, Fig. 21

1953. *Tetracolporopollenites sapotoides* n. sp. PF. et THOMS. in Palaeontogr. 94. B. XV. 6–12.

Conformable to the form described by THOMSON et PFLUG (1953, Pl. 15, Fig. 11) from the Eocene, Oligocene and Lower Miocene. At 63 to 65 m depth in borehole Zengővárkony-59 was found (35 μ). An other exemplar slightly smaller than the original species (30 μ) was in borehole Hidas-53 from 479,1 to 482 m.

Sapotaceoidaepollenites turgidus n. sp.

Plate L, Fig. 12–13

Holotype: Borehole Zgv.-59, sample No 29, slide No 1, 34.3×109.8.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl, borehole Zgv.-59, depth 71.4 to 73 m.

Diagnosis: Elliptical tricolporate pollen grain of 35 by 19 μ size, secondarily crumpled to a pear shape. Exine 2 μ thick. Ectexine "a" thin, ectexine "b" finely intrabaculate, endexine similar in structure to ectexine "a". Surface of exine very delicately intragranulate. Colpus and caverna 2 μ wide in the equatorial region, tapering to 1 μ towards the poles, straight. The pore is surrounded by a caverna, which it overreaches. The pollen looks swollen around the equator.

Differential diagnosis: Resembles the specimen reported by THOMSON and PFLUG (1953, Pl. 15, Fig. 32) as an undetermined form from the Middle Miocene (l. c. p. 129). Comparison with the rather small figure reveals, however, that the new species has broader cavernas and looks invariably as if it were crushed to a pear shape.

Remarks: A few specimens from Middle Miocene layers.

Botanical affinity to the family *Sapotaceae* probable.

Sapotaceoidaepollenites rotundus n. sp.

Plate L, Fig. 16–17, 24

Holotype: Borehole Zgv.-59, sample No 13, slide No 1, cross table number 35.8×105.6.
Locus typicus: Zengővárkony.
Stratum typicum: Tortonian, "Schlier" sequence, grey, clayey silt, borehole Zgv.-59, depth 30.9 to 34.0 m.

Diagnosis: Spherical, tetracolporate pollen grain of 25 by 24 μ size. Exine 1.5 μ thick, two-layered, smooth, at most chagrinate. Caverna about 2 to 2.5 μ wide, straight, suddenly narrowing into points at the poles. Exopore round, of about 2 μ diameter, outlined by the caverna, endopore about 5 μ wide, equatorially elongate, about 3 μ high.

Differential diagnosis: Corresponds in its spherical shape to *Tetracolporopollenites folliformis* PFLUG (1953, p. 109, Pl. 15, Figs. 26 to 29), but the latter is less regular. Our species is slightly larger and its breadth-to-length index is lower.

Remarks: A few specimens in the upper section of borehole Zengővárkony-59. Botanical affinity: *Sapotaceae.*

Familia: Symplocaceae
Genus: *Porocolpopollenites* PFLUG 1953

1950. Symplocospollenites R. POT., THOMSON et THIERG. in Geol. Jb. 1949. Bd. 65. p. 61.
1951. *Symplocoipollenites* R. POT. Palaeontogr. Bd. 94. Abt. B. p. 147.

The names above are not connected to any monotypic species description: PFLUG's name, first provided with a diagnosis and a genotype, is valid.

Porocolpopollenites vestibulum (R. Pot. 1931) Th. et Pf. 1953
Plate LI, Fig. 9–10

1931. *Pollenites vestibulum* R. Pot. in Braunkohle p. 329, Pl. 2, Fig. 23.
1951. *Symplocoipollenites vestibulum* R. Pot. in Palaeontogr. Bd. 94. B. p. 147. XXI. 158–159.

Triporate pollen of 39 μ diameter and straight sides, with a finely rugulate ornament. Width of pore, 3 to 4 μ; postvestibulum 12 μ wide, elongate in the equatorial direction. Colpus short (8 μ). Exine 2 μ thick.

A single specimen in the "Schlier" material of borehole Zengővárkony-59. According to Thomson et Pflug (l. c.), the form ranges from the Lower Tertiary to the early Upper Tertiary.

Porocolpopollenites triangulus (R. Pot. 1931) Th. et Pf. 1953
Plate LI, Figs. 3–4

A corroded specimen of about 30 μ size in a Tortonian core (667.2 to 669.2 m depth) of borehole H.-53. According to Thomson et Pflug (1953, p. 94), the stratigraphic range of the form covers the Middle and early Upper Tertiary.

Porocolpopollenites latiporis Pf. et Th. 1953
Plate LI, Fig. 5–6

Tricolporate pollen of 31 μ diameter; outline straight or concave, colpus short, scarcely visible. Exolamellae "a" and "b" slightly separate at the pore. The postvestibulum of 10 μ size is somewhat elongate in the equatorial direction. Surface finely gemmate. Scarce in the Helvetian cores of borehole Zengővárkony-59. Described from the Rhine Valley Miocene by Thomson et Pflug (l. c. p. 93, Pl. 10, figs. 123–124).

Porocolpopollenites stereoformis Pflug 1953
Plate LI, Fig. 7–8

Roundish, tricolporate pollen of 28 μ size; two specimens, one at 178.0 to 178.8 m depth in borehole Komló-120, the other in sample No 6 of Seam II, Hidas mine. Described by Pflug from the upper seam of Helmstedt (Middle Eocene). Rare. Referred by Pflug to the family *Symplocaceae*.

Porocolpopollenites hidasensis Nagy 1963
Plate LI, Fig. 1–2

1963. *Porocolpopollenites hidasensis* n. sp. — in Acta Bot. IX. 3–4. pp. 397–398, Pl. V, Fig. 39–41. Holotype and diagnosis.

One specimen of 31 μ size in the Tortonian turritellian clay-marl sequence at 572 to 575 m depth in borehole Hidas-53. Botanical affinity to the family *Symplocaceae* probable.

Ordo: *Polygonales*
Familia: Polygonaceae
Genus: *Persicarioipollenites* W. KR. 1962

1962. *Persicarioipollis* n. fgen. KRUTZSCH in Geologie 11. 3. p. 282.

Persicarioipollenites lusaticus W. KR. 1962
Plate L, Fig. 19

1962. *Persicarioipollis lusaticus* n. fsp. W. KR. l. c. p. 284.

Pollen grains of 30 to 36 μ size, in full morphological agreement with KRUTZSCH's figures (1962a, p. 284, Pl. IX, Figs. 10–17). KRUTZSCH considers it a form of *Polygonum persicaria* type.

Encountered in the Miocene of the Oberlausitz and in the Pliocene of Hodonín (Czechoslovakia).

In our material it cropped up at 65 to 67 m depth in borehole Zengővárkony-59 and at 433.8 to 434.1 m depth in borehole Szászvár-8.

Ordo: *Urticales*
Familia: Urticaceae
Genus: *Triporopollenites* PF. et TH. 1953

Triporopollenites urticoides n. sp.
Plate LI, Fig. 11–12

Holotype: Borehole Zgv.-45, sample No 5, slide No 1, 29.8×115.3.
Locus typicus: Zengővárkony.
Stratum typicum: Lower Helvetian, limnic sequence, dark grey clayey silt, borehole Zgv.-45, depth 17.2 to 17.8.

Diagnosis: Suboblate, triporate pollen grain of 15 μ size. Exine less than 1 μ thick; surface appears intragranulate. The three simple round pores are subequatorial, without any thickening.

Differential diagnosis: Stands closest to the genus *Corylus*, but differs from it by the simple pore structure and smaller size.

Remarks: On the basis of ERDTMAN's figures (1952, p. 446), it might be a representative of the family *Urticaceae*. This family (480 species in 41 genera according to WILLIS p. 672) includes plants ranging from the tropics to the temperate zones. Rare form.

Familia: U l m a c e a e
Subfamilia: U l m o i d e a e
Genus: *Ulmipollenites* WOLFF 1934

WOLFF's monotypical species *Ulmipollenites undulosus*, described in 1934, has five pores. This feature is to be interpreted as a property of the holotype. The author states the outline of the pollen grain to be smooth (1934, p. 75), which must be due to the use of a microscope of much lower resolution than the ones being used today. This interpretation has throughout been taken into consideration while classifying the species. In our opinion, these forms are representatives of the genus *Ulmus*.

Ulmipollenites undulosus WOLFF 1934

Plate LII, Fig. 5

Roundish pollen grains of rugulate surface, 27 to 34 μ diameter, with 4 or 5 pores. Exine 0.5 thick at the middle of the sides, about 1 μ thick at the pores. Surface finely rugulate, which renders the exine rim slightly wavy. Endexine smooth, quite thin (less then 0.5 μ). On its surface, the structural elements constitute a reticulum with grains of less than 1.5 μ size. Pores of about 2.5 μ diameter, sunk into the endexine. There is a slight anulus about the pores.

Remarks: Differs from *Ulmipollenites miocaenicus* n. sp. in its thinner exine and more delicate surface structure, from *U. stillatus* n. sp. in the absence of a raindrop-shaped thickening beside the pore.

Encountered in the Mecsek Mountains Pannonian, in the material of borehole of Hidas-53.

Ulmipollenites miocaenicus n. sp.

Plate LII, Fig. 3–4

Holotype: Borehole H.-53, sample No 33, slide No 1, 33.1×109.0.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Roundish pollen grain of 33 by 28 μ size; exine rugulate; five pores of 3 μ diameter. Pores embedded in the subequatorial exine. Ectexine about 1 to 1.5 μ thick; margin of exine wavy. Endexine thin and smooth.

The rugulate elements are seen to constitute a reticulum of 2 to 2.5 μ diameter in top view.

Differential diagnosis: Resembles Wolff's *U. undulosus* but has pores of broad aperture and exhibits no arci.

Remarks: Besides the holotype, it was encountered in 29 to 34 μ size in several Middle Miocene samples (borehole Komló-120 and Seam II, Hidas Mine).

Ulmipollenites maculosus n. sp.

Plate LII, Fig. 1–2

Holotype: Borehole H.-53, sample No 33, slide No 2, 33.0×108.1.
Locus typicus: Hidas.
Stratum typicum: Tortonian lignite-bearing sequence, clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Roundish pollen grain of rugulate surface and 30 μ diameter. The rugulate elements are of 4 to 7 μ diameter, elongate, constituting a pattern of wavy streaks. Exine about 1.5 μ thick, wavy. Ectexine about 1 μ; endexine smooth, about 0.5 μ. Pores subequatorial, provided with anuli. The arci connecting the pores do not agree with those described by Thomson and Pflug (1953, p. 21 and Fig. 12); they rather look like folds in the exine.

Differential diagnosis: Differs by its more coarsely rugulate structure consisting of elongate elements from the rest of the *Ulmipollenites* species.

Remarks: Besides the holotype, a five-pored variety of 37 μ size was encountered at 51.3 to 56.0 m depth in borehole Zengővárkony-59, and a specimen of 41 μ size at 71.4 to 73 m depth, same borehole.

Ulmipollenites stillatus n. sp.

Plate LI, Fig. 13, 16

Holotype: Borehole H.-53, sample No 11, slide No 4, 40.8×117.0.
Locus typicus: Hidas.
Stratum typicum: Sarmatian clay-marl. Borehole H.-53, depth 479.1 to 482.0 m.

Diagnosis: Roundish pollen grain of rugulate surface and 29 μ size, with four round subequatorial pores of 1.5 μ diameter embedded in the endexine. Exine about 0.5 μ thick midway between two pores. Beseide the pores, the anulus is thickened in a raindrop shape to about 1.5 μ. Surface slightly rugulate; as a result, the rim of the exine is but slightly wavy. The mesh size of the reticulum constituted by the ornamental elements is 1.5 μ.

Differential diagnosis: Stands closest to *U. miocaenicus* n. sp., but the exine of the latter is thick and its pore structure is also different.

Remarks: Encountered in the 29 to 39 μ size range, in several samples of the Mecsek Mountains Middle Miocene (boreholes Hidas-53, 688.0 to 688.5 m, 600.5 to 602.3 m and 479.1 to 482.0 m depth; Szászvár-8, 431.8 to 432.2 m depth; Komló-120, 178.0 to 178.8 m depth; Mecseknádasd, Zobák).

Subfamilia: Celtoideae
Genus: *Celtipollenites* n. g.

Generotype: Celtipollenites komlóensis n. g. n. sp.

Diagnosis: Medium-size pollen grains, mostly polyaperturate. Ectexine tegillate, baculate, endexine smooth. Apertures provided with anuli.

Differential diagnosis: The germinalia recall the apertures of the genus *Liquidambarpollenites* but the apertures of the latter are more numerous and differ also by shape and exine structure.

Celtipollenites komlóensis n. g. n. sp.
Plate XLIII, Fig. 3, 7

Holotype: Borehole K.-120, sample No 18, slide No 2, 38.4×111.9.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole K.-120, depth 178.0 to 178.8 m.

Diagnosis: Spheroidal pollen grain of 36 μ size, with about 6 lolongate apertures of 6 μ size, outlined by thin anuli about 1 μ wide. Exine about 2.5 μ thick, tegillum wavy, underlain by two layers: ectexine baculate, about 1.5 μ thick, of minutely reticulate surface; endexine smooth.

Differential diagnosis: see generic description.

Remarks: One specimen thus far. Among the living species of *Celtis,* the pollen of *Celtis occidentalis* L. stands close to our species in size and number of apertures: also, its shape may be elliptic as that of the fossil species. PÁLFALVY (1964. p. 188) mentioned the macrofossils *Celtis hungaricus* and *C. miocenicus* from the Mecsek Mountains Miocene.

Genus: *Zelkovaepollenites* n. g.

Generotype: Zelkovaepollenites potoniéi n. g. n. sp.

Diagnosis: Oblate, polyangulate pollen grains of rugulate surface. 4 to 6 pores, equatorial or subequatorial, depending on the position of the pollen grain. The pores are usually accompanied by marked anuli. Ectexine wavy.

Differential diagnosis: The pollen forms of rugulate exine resembling the new genus belong to the family *Ulmaceae.* The exine of the genus *Ulmipollenites* WOLFF is slightly thinner, less coarsely rugulate and smoother.

Remarks: THOMSON et PFLUG remarked that the angular forms of *Polyporopollenites undulosus* (1953, p. 91) might belong to *Zelkova.* In the Mecsek Mountains material, we could thus far distinguish two types:

Zelkovaepollenites potoniéi n. g. n. sp.

Plate LI, Fig. 17, 20

Derivatio nominis: In honour of Professor Dr. R. POTONIÉ, Klefeld
Holotype: Borehole H.-53, sample No 34, slide No 2, 44.9×103.4.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, borehole H.-53, depth 669.2 to 669.8 m.

Diagnosis: Roundish-quadrangular pollen grain of 33 μ diameter, with almost straight sides. Surface rugulate, resulting in a wavy outline. Exine about 1.5 μ thick at the crests and 1 μ in the troughs of the waves. Situated at the four apices of the grain, the pores of narrow aperture are made conspicuous by anuli about 3 μ thick.

Remarks: Encountered in the 30 to 40 μ size range: most specimens posses four, some posses five pores. Thickness of exine occasionally attains 2 μ on the sides. Many specimens are folded, presumably with arci-like configurations.

Relatively abundant in the Middle Miocene; a few specimens have also been encountered in the Pannonian.

Zelkovaepollenites thiergarti n. g. n. sp.

Plate LI, Fig. 14, 15

Derivatio nominis: In honour of Professor Dr. F. THIERGART, Berlin
Holotype: Borehole Sz.-8, sample No 214, slide No 1, 35.4×112.3.
Locus typicus: Szászvár.
Stratum typicum: Lower Helvetian clay shale, borehole Sz.-8, depth 432.5 to 432.7 m.

Diagnosis: Roundish polyangulate pollen grain of 27 μ diameter, surface rugulate, looking like a reticulum through a slightly elevated microscope tube. Outline of grain wavy, ectexine about 1 μ thick.

Embedded in the endexine, the four pores possess relatively wide apertures (about 2 μ) and small anuli. They are often subequatorial and connected by arci-like bands.

Differential diagnosis: Only four-pored specimens have so far been encountered in our metarial. It is usually smaller in size than *Z. potoniéi* n. g. n. sp. from which it differs also by its more finely rugulate exine structure and by its pore structure.

Remarks: In the Mecsek Mountains material, this form has been encountered from the Lower Helvetian to the Sarmatian, in rather lower abundance than the preceding form.

Familia: B e t u l a c e a e
Genus: *Carpinuspollenites* THIERGART 1938

1933. *Carpinus* WODEHOUSE Tertiary Pollens II. p. 510, fig. 42.
1938. *Carpinus?—pollenites* THIERGART in Geol. Jb. 58. p. 315.
1953. *Polyporopollenites* n. g.—PFLUG in TH. et PF. Palaeontogr. 94. B. p. 92.
1966. *Carpinipites* n. g.—STRIVASTAVA in Pollen et Spores VII. 3. p. 530.

The name *Carpinus* was first applied to the fossil genus by WODEHOUSE (1933, pp. 510–511). In 1938, THIERGART used, with a question mark, the name *Carpinuspollenites* in connection with POTONIÉ's species *Poll. granifer megagranifer* (1938, p. 315). In 1934, POTONIÉ mentioned, as possible relations of this species (Arb. Inst. 5. p. 24), various species of the genus *Carpinus*. (For a list of synonyms see also NAGY 1958, p. 84.) In 1953, PFLUG subsumed the species considered as *Carpinus* under the artificial genus *Polyporopollenites* and set up *Ulmipollenites undulosus* WOLFF as generotype. Our forms agree with his description (1953, p. 92, Pl. 10, Figs. 79 to 84) and can be identified with his species. The fossil genus may be identified with the living *Carpinus* genus, in spite of the note of interrogation (?) in THIERGART's original description we must name it *Carpinuspollenites*.

I don't use the name *Carpinipites* initiated by STRIVASTAVA (1966, p. 530) as a name concerning about fossil *Carpinus* was written down in the literature already earlier.

Carpinuspollenites carpinoides (PF. 1953) n. c.
Plate LII, Fig. 8

1953. *Polyporopollenites carpinoides* n. sp. PF. in Palaeontogr. 94.—l. c.

Three- and four-pored roundish pollen grains of 30 to 50 μ size. Exine about 1 μ thick, or slightly thicker or thinner, in dependence on grain size. There are labri at the pores. Exine finely granulate. Scarce but persistent in the Miocene and Pannonian (boreholes Hidas-53, Zengővárkony-59, exposures of Mecseknádasd, Magyaregregy, Leánykő Main Deposit, Almáspatak, etc.).

Genus: *Ostryapollenites* THOMSON 1950

Ostryapollenites rhenanus (THOMS. 1950) n. c.
Plate LII, Fig. 10

1934. *Pollenites* cf. *granifer bituitus* R. POT. et VENITZ in Arb. Inst. Paläobot. etc. 5. p. 24. II. 46.
1950. *Ostrya? — Poll. granifer rhenanus* n. sp. THOMS. in Geol. Jb. 65. p. 52. B. 9–10.
1953. *Triporopollenites rhenanus* (THOMS.) n. c. THOMS. et Pf., Palaeontogr. 94. B. VIII. 150–152.

Triporate pollen grain of 27 μ size; sides convex, labrum and vestibulum small. Surface finely granulate. Corresponds morphologically to the living genus *Ostrya*. The form was described by the name *Ostrya?-Poll. granifer rhenanus* by THOMSON (1950. in R. POT., THOMS. et THIERG. p. 52). Distinguished from the complex group "*granifer*" under the name *Triporopollenites rhenanus* by THOMSON et PFLUG (1953, p. 84).

Scarce in our material. The figured specimen has come from a Upper Helvetian core (178 to 178.8 m depth) of borehole Komló-120.

Genus: *Triporopollenites* PFLUG et THOMS. 1953

Triporopollenites coryloides PFLUG 1953

Plate LII, Fig. 6, 9

Triangular pollen grain of slightly concave sides, 20 μ size. Exine 1 μ thick, finely rugulate.

Scarce in our material. The figured specimen has come from 15 to 17 m depth in borehole Pusztakisfalu-VI. Botanical affinity: presumably a *Corylus* sp.

Genus: *Betulaepollenites* R. POT. 1934

A pollen with the above generic name, *B. microexcelsus*, was described by R. POTONIÉ (1934, Arb. Inst. 4. p. 58) who stated it to stand close to the genus *Betula*. For this reason, I regard as superfluous the genus *Betulaceoipollenites* established by R. POTONIÉ, and also the form genus *Trivestibulopollenites* by PFLUG for species considered to belong to the *Betulaceae* or, indeed, to some *Betula* sp.

In my material, I could distinguish the following species.

Betulaepollenites prominens (PF. 1953) n. c.

Plate LII, Fig. 13

1953. *Trivestibulopollenites prominens* n. sp. PFLUG Palaeontogr. 94. B. p. 85. IX. 35–38.

Triporate pollen of 26 to 30 μ size, with anuli and vestibula. It is its "infrafoveolate" structure that distinguishes it from the other betuloid forms. However, this structure might be due to corrosion. Cropped up at 433.6 to 433.8 m depth in borehole Szászvár-8, and in the Pannonian (147.5 to 148.5 m depth) of borehole Hidas-53. PFLUG (1953, p. 85) described it in Eocene deposits. Its presence in my material, particularly in the Upper Pannonian, is presumably due to redeposition.

Betulaepollenites betuloides (PF. 1953) n. c.
Plate LII, Fig. 12

1953. *Trivestibulopollenites betuloides* n. sp. PFLUG, Palaeontogr. 94. B. p. 85. IX. 39–41.

Triporate pollen of 20 to 30 μ size and roundish shape, with vestibula, labra and small anuli. Exine two-layered, endexine slightly thinner than ectexine. Thickness of exine varies as grain size, from 1 to 2 μ. Most grains exhibit some secondary folding. Scarce but persistent throughout the Mecsek Mountains Miocene.

Genus: *Alnipollenites* R. POT. 1934

Alnipollenites verus R. POT. 1934
Plate LIV, Fig. 12, 16

1934. *Alnipollenites verus* R. POTONIÉ in Arb. Inst. Paläobot. 4. p. 58, Pl. 2, Fig. 13, 17.
1953. *Polyvestibulopollenites verus* TH. et PF. Palaeontographica 94. B. p. 90, Pl. 10, Figs. 62–76.
1960. *Alnipollenites verus* R. POT. 1934. Synops. III. p. 129.

Pollen grains of 17 to 30 μ size, both four- and five-pored varieties, agreeing with the description by THOMSON et PFLUG, rather scarce in various boreholes and exposures. (For a list of synonyms and further details, see NAGY 1958, p. 87.)

Genus: *Triporopollenites* PF. et THOMSON 1953

Triporopollenites cf. *robustus* PFLUG 1953
Plate LII, Fig. 11

Triporate pollen of 28 to 31 μ size; sides convex, anuli marked, exine about 1.5 μ thick, structurate.

A few spec'mens not quite fitting the original description in borehole Zengővárkony-59. The anulus is less marked, for instance. According to the description, the form occurs in the Lower Tertiary including the Lower Oligocene: some representatives might conceivably mount to our Middle Miocene.

Botanical affinity uncertain; possibly betulaceous according to PFLUG (TH. et PF. 1953, p. 82).

Familia: Fagaceae
Genus: *Faguspollenites* RAATZ 1937

R. POTONIÉ's figure in Jb. Preuss. Geol. L. A. 1931 (p. 31, Fig. 23) shows a form placed into the family *Nyssaceae* by the name *Pollenites pulvinus*. The pore is surrounded by the caverna. In the figure from Braunkohle (1931 p. 328, Pl. 1, Fig. 10) the pore apparently overreaches the caverna. This form was given the name *Pollenites pseudocruciatus* by POTONIÉ: the figure was republished in 1934 (4, Pl. 2, Fig. 30). The other figures are either pronouncedly nyssaceous (Pl. 6, Figs. 13, 15) or do not enter into consideration for reasons of scale and poor printing. In their remarks to *Pollenites pulvinus*, POTONIÉ et VENITZ (1934, 5. pp. 27–28) state it to stand close to *Pollenites pseudocruciatus*. The figures and drawings (Pl. 3, Figs. 64–66) also exhibit a pore structure typically nyssaceous. They designate this form as "*Fagaceae* ?" and compare it with *Fagus silvatica* L. In the same volume, WOLFF compares *P. pulvinus* with *Fagus silvatica* L. However, his figures (Pl. 5, Figs 5, 21, 23) also rather resemble the *Nyssaceae*, or the *Symplocaceae* in the polar view. In 1937, RAATZ (p. 23, Pl. 1, Fig. 1) compares *Faguspollenites verus* with *Fagus ferruginea* AIT. and *Fagus silvatica* L. and another variety of coarser exine structure with *Fagus orientalis* LIPSKY. In 1940, THIERGART mentions fagaceous forms from the Oligocene to the Pliocene. Those of his figures which permit the recognition of details can indeed be referred to *Fagus* (Pl. e. g. V. Fig. 9). In their 1950 paper, POTONIÉ, THOMSON et THIERGART distinguished a "*Fagus ferrugineoide Typ*" and a "*Fagus silvaticoide Typ*" (p. 54). There is no description, only figures and a statement of size differences (Pl. B, Figs 19–20).

In 1951, POTONIÉ republished the two figures of the 1950 paper, now by the name *Fagoipollenites pseudocruciatus* R. POT. (the larger form was compared to *F. silvatica* L.), and *F. pulvinus* R. POT. (the smaller one was compared with *F. ferruginea* AIT.). He mentioned a third, smaller, form by the name *Fagiopollenites pseudofagus* R. POT. (For a critical analysis see R. POTONIÉ, Synops. III. 1960, pp. 103–104).

In our material there occur pollen in the sporae dispersae state which definitely possess the morphological features of living *Fagus* species. Among the living species, I have had the opportunity to study *F. silvatica* L., *F. orientalis* LIPSKY and *F. ferruginea* AIT. A thorough study of all living species of *Fagus* and a comparative evaluation of the results would be most desirable.

In the following, I shall emend the diagnosis of the genus *Faguspollenites*, on the grounds of its being too narrow as it is (cf. POTONIÉ, Synopsis III, pp. 102–103).

Diagnosis: Roundish, tricolporate pollen of 30 to 58 μ size: exine intrabaculate, baculate or granulate, resulting in a more or less coarse granulation of the surface. Exocolpi of various length, splitting open in some instances. The round or oval endopore invariably overreaches the colpus.

Remarks: Species are to be distinguished by the thickness and ornament of the exine, the length of the colpi, the shape and size of the pores, and the size of the pollen grains. ERDTMAN states (1932, p. 177) the pollen of *Fagus silvatica* L. to be "*? tegillate*" I have found it tegillate myself. Among the fossil grains, however, I have found a tegillum only in a single specimen of *Faguspollenites minor* n. sp., a thick-exined form. The tearing open of the tegillum may be the result of fossilization in the thinner-exined species. All species of *Faguspollenites* are provided with exocolpi and endopores: hence, this feature will not be stated separately for each species. Colpus invariably thin, occasionally splitting open, but this is a feature connected with the physiological role or with fossilization (simple tearing open), and is due to the relative thinnes of the exine, and so is the frequent secondary folding.

In my material, I could distinguish the following types:

Faguspollenites subtilis n. sp.

Plate LII, Fig. 14

Holotype: Borehole Zgv.-59, sample No 29, slide No 1, 36.8×114.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian fish-scale-bearing sequence, borehole Zgv.-59, depth 71.4 to 73.0 m.

Diagnosis: Roundish tricolporate pollen grain of 57 μ diameter. Exine thin (less than 1 μ), densely baculate; ectexine granulate, endexine less than 0.5 μ, smooth. Near the pores, the exine thickens to 1.5 μ, even 2 μ. It is finely granulate in the view. Colpus long (25 μ); pore oval, about 7 μ wide.

Differential diagnosis: This is the form closest to RAATZ's description of *Faguspollenites verus*, as regards the thinness and ornament of its exine. In polar view it is, however, oval rather than round and may even be triangular. Also its pore is oval rather than round. Moreover, the Mecsek Mountains species is larger. A few specimens of 50 to 57 μ size have cropped up in cores of boreholes Zengővárkony-59 and Komló-120, and in the Mecseknádasd exposure. Tetrads have also been encountered.

Stands closest to the pollen of living *Fagus silvatica* L.

Faguspollenites vivus n. sp.

Plate LII, Fig. 16

Holotype: Borehole Zgv.-59, sample No 26, slide No 1, 41.7×113.1.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole Zgv.-59, depth 65.0 to 67.5 m.

Diagnosis: Roundish tricolporate pollen grain of 47 μ size. Exine about 2.5 μ thick, densely clavate, ectexine 2 μ thick, clavi closepacked, almost coalescent. Surface of exine rather coarsely granulate. Colpi short, not reaching to the poles (only about 2/3 of the radius). Pores about 5 to 6 μ in diameter.

Differential diagnosis: Of smaller and thicker exine and more coarsely granulate than *F. subtilis* n. sp. Colpi shorter, outline more roundish.

Remarks: In the size range of 34 to 48 μ, in boreholes Zengővárkony-59, Komló-120, and in the Pannonian section of borehole Hidas-53.

Faguspollenites gemmatus n. sp.

Plate LI, Fig. 18–19

Holotype: Borehole H.-53, sample No 27, slide No 1, 28.8×110.8.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, grey clay-marl, borehole H.-53, depth 600.2 to 602.3 m.

Diagnosis: Roundish tricolporate pollen grain of 47 μ size. Exine about 2 μ thick, ectexine about 2 μ, densely baculate or gemmate, endexine 0.5 μ, smooth. Surface coarsely granulate. Colpi fairly short, not reaching up to the pole, pore diameter about 4 to 5 μ.

Differential diagnosis: Of about the same size as *F. vivus* n. sp., but different in exine structure and surface ornament.

Remarks: The coarser ornament of the exine recalls *Fagus orientalis* LIPSKY.

A few specimens in the Tortonian cores of borehole H.-53, and in the Helvetian ones of borehole Komló-120.

Faguspollenites crassus n. sp.

Plate LII, Fig. 20

Holotype: Borehole H.-53, sample No 52, slide No 2, 43.5×114.8.
Locus typicus: Hidas.
Stratum typicum: Tortonian, "Schlier" sequence, light grey clay-marl, borehole H.-53, depth 669.0 to 669.8 m.

Diagnosis: Roundish tricolporate pollen grain of 44 μ size. Exine 1.5 to 2 μ thick; ectexine intrabaculate, about 1 μ thick; the two endexine layers are 0.5 μ thick in all, and smooth. In the polar position, the colpus is about half as long as the radius of the pollen. At the pores, the endexine is thickened anulus fashion to about 4 μ. The pore diameter is, consequently, about 10 μ.

Differential diagnosis: As opposed to the rest of the *Faguspollenites* species, the pore structure is strongly developed.

Remarks: In spite of the marked pore structure, I consider it to belong to this genus, as it possesses an endospore.

Two specimens in borehole H.-53. I have selected the injured one for holotype it exhibits the typical features more clearly than the other one.

Faguspollenites minor n. sp.

Plate LIII, Fig. 4–5

Holotype: Borehole Zgv.-59, sample No 27, slide No 1, 33.5×114.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole Zgv.-59, depth 67.5 to 70.5 m.

Diagnosis: Roundish tricolporate pollen grain of 37 μ size. Exine about 2 μ thick. There in a tegillum underlain by a densely baculate sexine about 1 μ thick and by another layer, 0.5 μ thick, consisting of bacula. Nexine (endexine) 0.5 μ thick, smooth. Surface of exine finely granulate. Colpus short, pore about 5 μ wide.

Differential diagnosis: Of the *Faguspollenites* specimens I have encountered thus far, this is the only one to bear a tegillum.

Remarks: Several specimens in sample of borehole Zengővárkony-59; a few further ones of 35 to 39 μ size, also in borehole Hidas-53 (e. g. 558.0 to 561.0 m) and borehole Pusztakisfalu-VI (42.5–106.2 m). In exine structure, surface ornament and size, it is comparable with *Fagus ferruginea* AIT.

Faguspollenites tenuis n. sp.

Plate LIII, Fig. 6

Holotype: Borehole K.-120, sample No 107, slide No 1, 34.6×101.9.
Locus typicus: Komló.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole K.-120, depth 374.7 m.

Diagnosis: Roundish tricolporate pollen grain of 42 μ size. Exine about 1 μ thick; ectexine about 0.5 μ, granulate; endexine also about 0.5 μ, smooth. Colpus short, pore round, about 5 μ in diameter.

Differential diagnosis: Resembles *Faguspollenites subtilis* n. sp. in exine structure, but is much smaller; its colpus is shorter even relatively speaking.

Remarks: Further research may reveal transitional forms between the two. Remarkably enough, the two species did not occur together, except for a cf. *F. subtilis* specimen in sample No 18 of borehole Komló-120. *F. tenuis* was encountered in samples N^{os} 106 and 107 of borehole Komló-120 and in cores from the Helvetian–Tortonian boundary in borehole Hidas-53. Sizes range from 33 to 42 μ.

Quercopollenites n. g.

Generotype: Quercopollenites granulatus n. g. n. sp.

Diagnosis: Prolate, subprolate spheroidal, tricolporate, tricolporoidate (tricolpate) pollen. Surface usually ornamented.

Remarks: A more profound scrutiny of tricolpate pollen has revealed it to be tricolporoidate, i. e. to posses some sort of germinalia, if only in the form of a thinning of the exine.

In 1958, I distinguished three types of *Quercus* pollen in an Upper Pannonian material (pp. 91–93). In connection with the Mecsek Mountains material, I persist in separating the first two types but place the third one into the so-called "*microhenrici*" form group. I have not called the forms *Quercus* sp., but have added—as directed by the *Code*—the ending "*pollenites*". According to ANDREÁNSZKY (1955. p. 79), "most of the ones found in the Middle Miocene exhibit Mediterranean affinities. In the Sarmatian, the oak species represented by the leaves reveal rather varied affinities [Mediterranean, Near Eastern and local (*Q. robur* L.)]." ANDREÁNSZKY stated the problem to be unsolved at that date (l.c.).

In the Mecsek Mountains material I have distinguished the following pollen forms of "*quercoid*" type:

Quercopollenites granulatus n. g. n. sp.

Plate LII, Fig. 21

Holotype: Borehole H.-53, sample No 7, slide No 1, 17.9×80.0.
Locus typicus: Hidas.
Stratum typicum: Pannonian, silty clay-marl, borehole H.-53, depth 147.5 to 148.5 m.

Diagnosis: Prolate, tricolporoidate pollen of 31 μ size, in lateral position. Exine about 1.5 μ thick. Ectexine coarsely granulate, endexine smooth. Colpi straight, parallel, but slightly tapering towards the poles.

Remarks: A few specimens of 26 to 37 μ size in the Pannonian cores of borehole H.-53. Some specimens in the polar position have been placed here on grounds of similarity in size and exine structure.

Quercopollenites robur type

Plate LIII, Fig. 10

Pollen grains of 20 to 29 μ size, tricolpate, tricolporoidate in lateral position. Shape prolate spheroidal or subprolate (with a ratio of about 0.8). Colpi about 1.5 to 2 μ wide at the equator, convergent and slightly tapering towards the poles. Exine 1 μ thick, granulate.

Scarce but fairly persistent from the Sarmatian down to, and including the Helvetian (e. g. in the fish-scale-bearing sequence of the exposures Almáspatak I and Mecseknádasd).

With particular regard to their occurrence also in the Miocene, I refrain from identifying them with *Q. robur* L.

Quercopollenites petraea type

Plate LIII, Fig. 18

Prolate, subprolate, tricolpate, tricolporoidate pollen grains of 28 to 39 μ size; exine about 1.5 μ thick. Colpi slightly wider (3 to 4 μ), tapering towards, but not reaching to, the polles. Exine slightly more delicately granulate than in the preceding type.

A few specimens in the Pannonian cores of borehole Hidas-53.

Genus: *Tricolporopollenites* Pf. et Thoms. 1953

Henceforth, those forms have been referred to this genus which are supposed to be related to the living representatives of the genus *Quercus* or of the family *Fagaceae.*

Tricolporopollenites henrici (R. Pot. 1931) W. Kr. 1961

Plate LII, Fig. 17

More or less spindle-shaped, prolate-subprolate pollen grains of 30 to 44 μ size, usually tapering to points at the poles. Caverna 3 to 5 μ wide, tapering towards the poles. Exine two-layered, ectexine baculate, clavi often coalescent (tegillate). Endexine smooth, surface finely reticulate. None too abundant but persistent throughout the Mecsek Mountains Neogene. It is held for a representative of the genus *Quercus* (Th. et Pf. 1953, p. 95).

Tricolporopollenites asper (Th. et Pf. 1953) W. Kr. 1961

Plate LIII, Fig. 2–3

Tricolpate (colporate), chagrinate pollen grains of 26 to 24 μ size, spheroidal, slightly elongate in the direction of the polar axis. This is a collective species for pollen of quercoid type. Most specimens have come from the Helvetian. Thomson et Pflug (1963, p. 96) state it to occur in the German Eocene and Oligocene: I presume the finds from the Pliocene (Reuwer etc.) mentioned by them to be due to redeposition.

Tricolporopollenites densus (PF. 1953) W. KR. 1961
Plate LIII, Fig. 11–12

Spheroidal tricolpate, tricolporate pollen grain of 33 μ size. Exine about 1.5 μ thick, unevenly intrabaculate. PFLUG indicates no botanical affinity. It occurs in the Eocene of Germany. Its occurrence in the Pannonian, 118.0 to 126.8 m depth, of borehole Hidas-53 is possibly due to redeposition. One specimen has so far been encountered in our material.

Tricolporopollenites microhenrici (R. POT. 1931) W. KR. 1961

This is a collective species as indicated by POTONIÉ (1934, 5. p. 27, Pl. 2, fig. 61), who connected it with *Pollenites microhenrici*, and also by PFLUG (1953, see also the discussion concerning the genus *Tricolpopollenites*). It includes tricolpate and tricolpororate pollen forms of 20 to 30 μ size (1953, Pl. 11, Figs. 92, 95, 96, 103, 118, 124 etc.), and also tricolporate pollen grains. PFLUG's two subspecies are the following:

Tricolporopollenites microhenrici (R. POT. 1931) W. KR. 1961 ssp. *intragranulatus* PF. 1953
Plate LIII, Fig. 9

The forms of 21 to 30 μ size are persistent throughout the Mecsek Mountains material, from the bottom of the Lower Helvetian through the Pannonian.

Tricolporopollenites microhenrici (R. POT. 1931) W. KR. 1961 ssp. *intrabaculatus* PF. 1953
Plate LIII, Fig. 13

Intrabaculate pollen of 21 to 30 μ size. Absent from the terrestrial section of the Mecsek Mountains Helvetian, bur fairly numerous farther up, particularly in the Tortonian and Sarmatian.

Tricolporopollenites porasper PFLUG 1953
Plate LIII, Fig. 14

Subprolate, tricolporate pollen grains, of 39 to 60 μ size. Cavernas converging towards the poles, constituting a cavium. Endopores elongate in the meridional direction. Exine about 1 μ thick, intrabaculate.

It occurs form the lowermost Helvetian up to the Sarmatian in the Mecsek Mountains material. PFLUG (1953, THOMSON et PFLUG, p. 105) considers it a *Quercus* species.

Tricolporopollenites villensis (Thoms. 1950) Thoms. et Pf. 1953

Plate LIII, Fig. 7–8

Thomson originally described it by the name *Pollenites cingulum villensis* (1950, R. Pot., Thoms., Thierg.). In 1953, Thomson et Pflug described it as an independent species, referred it to the *Cupuliferoidae* and stated it to be a characteristic fossil of the Middle Tertiary (1953, p. 99), a plant of the extrapalustrine forest.

In our material it is represented by prolate pollen grains of 24 to 31 μ size and baculate exine. The caverns, marked at the pores, form a cavium at each pole. There is a marked, elliptical endopore.

In the lowermost cores of borehole Zengővárkony-59, and in the Helvetian of borehole Hidas-53.

Tricolporopollenites minimus n. sp.

Plate LII, Fig. 22–24

Holotype: Borehole Zgv.-59, sample No 34, slide No 1, 45.4×111.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole Zgv.-59, depth 81.0 to 83.0 m.

Diagnosis: Tricolporate pollen of 17 μ size; shape broadly elliptical, width-to-length index 0.8. Cavernas bending at a slight angle at the equator, slightly convergent and tapering towards the poles. Exopore lalongate, endopore small and round. Exine thick (2 μ), compared to the size of the grain, and finely intrabaculate.

Differential diagnosis: Differs from *T. cingulum* (R. Pot. 1931) Th. et Pf. 1953 besides its shape, also by being intrabaculate, although both are of about the same size. *Cyrillaceaepollenites megaexactus* (R. Pot. 1931) R. Pot. 1960 is of a similar shape, but hyaline-smooth and larger.

A few specimens besides the holotype in the fish-scale-bearing beds of boreholes Zengővárkony-59 and Komló-120 and in the Helvetian, Tortonian and Sarmatian cores of borehole Hidas-53.

Tricolporopollenites cf. *genuinus* (R. Pot. 1934) Th. et Pf. 1953

A few perprolate, reticulate pollen grains of 37 to 42 μ size in the Mecsek Mountains Helvetian. They are conformable to the original description by R. Potonié (1934, 4, pp. 95–96) but deformed in shape, presumably owing to a strong secondary crumpling. They are smaller than the size given in the original description, and correspond to the lower limit of the range given by Thomson et Pflug. Presumable affinity: some *Quercus* species.

Tricolporopollenites cingulum (R. POT. 1931) TH. et PF. 1953

This is a form group established in 1931, some of whose subspecies were already named by R. POTONIÉ himself. He stated *"fusus"* (1934, 4, p. 82) to be a subspecies of *Pollenites cingulum*, *"pusillus"* (l.c. p. 71) to be a subspecies of *P. quisqualis*. R. POTONIÉ first figured *Pollenites oviformis* in 1931 (Braunkohle, p. 328, Pl. 1, fig. 20) and described it in 1934 (4. p. 95). In 1953, THOMSON et PFLUG condensed the form group *"cingulum"* on a morphological basis and considered *"pusillus"* and *"oviformis"* to be castaneaceous. The two latter were subsumed under the name *Cupuliferoipollenites* by POTONIÉ (Synopsis III, p. 98, with reference to 1951). Until a detailed morphological analysis, I prefer to keep THOMSON's and PFLUG's name.

Tricolporopollenites cingulum (R. POT. 1931) THOMS. et PF. 1953 ssp. *fusus* TH. et PF. 1953

Plate LIII, Fig. 15–16

Spindle-shaped or cylindrical pollen grains of 22 to 30 μ size; exine intrarugulate, cavernas parallel, swollen at the equator.

Not too abundant but persistent from the middle of the Helvetian up to the Pannonian in Mecsek Mountains material. The botanical affinities are unknown as yet, nevertheless, it is better to keep together the *"cingulum"* forms.

Tricolporopollenites cingulum (R. POT. 1931) TH. et PF. 1953 ssp. *pusillus* (R. POT. 1934) TH. et PF. 1953

Plate LIII, Fig. 19

Prolate tricolporate pollen grains of 18 to 20 μ size. Exine smooth, chagrinate. Possibly castaneaceous. In the lower portions of the Mecsek Mountains Middle Miocene (in boreholes Szászvár-8, Pusztakisfalu-VI, Zengővárkony-45, and -59).

Tricolporopollenites cingulum (R. POT. 1931) TH. et PF. 1953 ssp. *oviformis* (R. POT. 1931) TH. et PF. 1953

Plate LIII, Fig. 20–21

Oval, tricolporate pollen grains of 11 to 18 μ size. Colpi thickened in the equatorial section, convergent. On the basis of comparative material from living plants, it is considered to represent some *Castanea* sp. The form occurs from the Lower Helvetian up to the Pliocene. It presumably represents several species.

It was also found in the form of a massule (in a core from 81 to 83 m depth, borehole Zengővárkony-59; Pl. LIII, Fig. 17).

Genus: *Tricolpopollenites* PFLUG et THOMSON 1953

This is a collective form genus. R. POTONIÉ, THOMSON et THIERGART (1950) gave names like *Cupuliferoidaepollenites*, *Quercoidites* etc. to the forms which constitute the majority of this pollen type. Most of these KRUTZSCH (1961b p. 322) referred to the genus *Tricolporopollenites* PF. et TH. 1953, he stated not only to posses colpi, but also to be tricolporate or tricolpororate (as I suggested in 1963, Évi Jel. 1960. p. 232).

Tricolpopollenites liblarensis (THOMSON 1950) TH. et PF. 1953

In 1950, THOMSON (in R. POT., THOMS. et THIERG.) described a form of 18 to 20 μ size by the name *Pollenites liblarensis* (l.c. p. 55). THOMSON et PFLUG transferred it to the form genus *Tricolpopollenites*, but gave no holotype, either. On 1960, POTONIÉ, establishing the genus *Cupuliferoidaepollenites* for this species, stated it to be of 20 μ size and, confronting it with "*quisqualis*", stated it to be "mehr walzenförmig", whereas "*quisqualis*" was "mehr spindelförmig" (R. POT. Syn. II. p. 92). An up-to-date treatment of the group is obviously both lacking and desirable. I find the name *Cupuliferoidaepollenites* somewhat unfortunate because, according to literature (THOMSON et PFLUG 1953, p. 97), it may also represent leguminosaecous pollen. Such minute thin-exined pollen grains are easily deformed by mechanical action and thus the above slight difference does not seem to be a distinctive criterion on the specific level. For the time being, I have adopted THOMSON's and PFLUG's classification as to size.

Tricolpopollenites liblarensis (THOMSON 1950) TH. et PF. 1953
ssp. *liblarensis*
Plate LIII, Fig. 1

Forms of 19 to 26 μ size, most of them slightly intrarugulate: none too abundant in my material form the Helvetian to Pannonian.

Tricolpopollenites liblarensis (THOMSON 1950) TH. et PF. 1953
ssp. *fallax* (R. POT. 1934) TH. et PF. 1953
Plate LII, Fig. 15

Tricolpate (tricolporate) pollen grains of 10 to 18 μ size; exine smooth. A few specimens in the Mecsek Mountains Helvetian.

Ordo: *J u g l a n d a l e s*
Familia: J u g l a n d a c e a e
Genus: *Juglanspollenites* RAATZ 1937

Juglanspollenites verus RAATZ 1937
Plate LIV, Fig. 1

The figured specimen is of 46 μ size; its exine is thin, easily crumpled. There are 8 or 9 round pores of 2 to 4 μ diameter, all on one hemisphere.

Very rare in the Mecsek Mountains Miocene (size range, 32 to 46 μ). Originally described by RAATZ from the Miocene of the Oberlausitz (1937, p. 18).

Juglanspollenites sp.
Plate LIV, Fig. 3

A few uncertain, corroded specimens of 32 to 33 μ size in my material can be referred to the genus *Juglanspollenites*. Their poor preservation precludes any further conclusions.

Genus: *Pterocaryapollenites* THIERGART 1938

Pterocaryapollenites stellatus (R. POT. et VENITZ 1934) THIERGART 1938
Plate LIV, Fig. 4–5

List of synonyms (pro parte) NAGY 1958, p. 95. Furthermore:
1960. *Pterocaryapollenites stellatus* THIERG. in R. POT. Synopsis III. p. 132.

Polyhedral pollen grains of 33 to 39 μ size: there are six more or less uniformly distributed small atria. The pores are slightly subequatorial. Exine finely intrapunctate. A few specimens in the Mecsek Mountains Middle Miocene (Mecseknádasd; boreholes Pusztakisfalu-VI, Hidas-53; at 667.2 to 669.2 m depth in the latter).

Remarks: These specimens resemble those found in the Oligocene of the Dorog Basin, but differ, in spite of the agreement in size, from those of Petőfibánya (NAGY 1958, Pl. XXIII, Figs. 8–9), which have much less-developed labra and anuli. Botanical affinity to the genus *Pterocarya* is likely.

Pterocaryapollenites mecsekensis n. sp.

Plate LIV, Fig. 7–8

Holotype: Borehole H.-53, sample No 33, slide No 1, 32.2×108.4.
Locus typicus: Hidas.
Stratum typicum: Sarmatian, green-grey clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Pollen grain of 53 by 39 μ size, elliptically rounded hexagonal shape, with straight or slightly concave marginal laths of various length (14 to 22 μ). The laths are 1.5 to 2 μ wide at the middle, 2 to 3 μ wide at the pores. The outer layer of the ectexine, exolamella "a", forms a small labrum at the pores: exolamella "b" is broadly dissolved; exolamella "c" is smooth. There is a praevestibulum between exolamellae "b" and "c". The endexine constitutes an atrium. The pores are somewhat subequatorial, oval or round, about 1.5 to 2 μ wide. Number of pores six. Exine finely intragranulate.

Differential diagnosis: Differs *Pterocaryapollenites stellatus* (R. Pot. et Venitz 1934) Thiergart 1938 by its larger size, by the characteristic laths on the margin of the exine and by its intragranulate structure.

A form resembling the new species was published by the name *Pterocaryapollenites* aff. *stellatus* by Raatz (1937, p. 19, Pl. 1, Fig. 7). However, that form is round rather than hexagonal like the Mecsek Mountains species. As the shape, the number of sides and the intensity of warping are different, I do not identify Raatz's form with mine. Raatz's description does not mention lath-like thickenings and his figure does not lend itself to the settling of the point. Raatz (l. c.) states his form to be a large one, but the specimens from the Mecsek Mountains are even larger. In his description of a fossil *Pterocarya* species, Kremp (1950, p. 64) did mention the presence of laths.

A few specimens in our material.

Possessing grains of 36 to 48 μ major diameter, the pollen of *Pterocarya stenoptera* DC., living in Japan, much resembles the new species morphologically.

Pterocaryapollenites rotundiformis n. sp.

Plate LIV, Fig. 15

Holotype: Borehole H.-53, sample No 33, slide No 2, 41.3×107.6.
Locus typicus: Hidas.
Stratum typicum: Tortonian, lignite-bearing sequence, greenish-grey clay-marl, borehole H.-53, depth 667.2 to 669.2 m.

Diagnosis: Elliptical pollen grain of 53 by 42 μ size, with eight round subequatorial pores of 2 to 3 μ diameter. Surface very delicately granulate. The ridge from pore to pore is of uniform width, slightly wavy, convex or straight. Exolamella "a" of the ectexine is thin, exolamella "b" is up to 1.5 μ thick and dissolved in the pore region. Exolamella "c" is thickened in the neighbourhood of the pore, in a way faintly resembling an anulus. The endexine

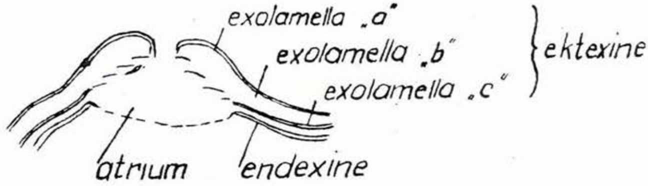


Fig. — ábra 46. Pterocaryapollenites rotundiformis n. sp.

constitutes a very short, small atrium. The body exhibits some secondary crumpling (Textfig. 46).

Differential diagnosis: Differs from *P. mecsekensis* n. sp., beside its more rounded shape, also by its narrower laths of different structure and by the presence of a small atrium. From *P. stellatus* (R. Pot. et Ven.) Thierg., it differs by size and shape, by the absence of a labrum and by the presence of a small anulus.

Two specimens in our material.

Botanical affinity to the genus *Pterocarya* is possible.

Genus: *Caryapollenites* Raatz 1937

Caryapollenites simplex (R. Pot. 1931) R. Potonié 1960
Plate LIV, Fig. 2

For a list of synonyms, see Nagy 1958, p. 96. Also:
1960. *Caryapollenites simplex* (R. Pot. 1931) Raatz 1937 in. R. Potonié: Synopsis III. p. 123.

Locally enriched in the Mecsek Mountains Neogene, in the 32 to 50 μ size range. For instance, the pollen assemblage of the core from 67.5 to 70.5 m depth of borehole Zengővárkony-59 has yielded 12 percent of *Caryapollenites*.

Genus: *Engelhardtioidites* (R. Pot., Thoms. et Thierg. 1950) R. Pot. 1960

Pollenites microcoryphaeus designated as the holotype was first figured in 1931 by R. Potonié (1. Mitt. p. 329, Pl. 2, Fig. 13) who stated it to be of 19 μ size. In 1950, it was mentioned by R. Potonié, Thomson et Thiergart (p. 51) as *Engelhardtioides microcoryphaeus* R. Pot. = *E. forma minor* Thomson; this should make rather doubtful the validity of the name which is, however, valid all right according to Art 11 of the *Code*. I have placed one of the figures

(Plate C, Fig. 16) into the genus *Momipites punctatus* (see under that heading). It is the other figure (Plate B, Fig. 8) that serves as the type of this species (cf. also the drawings by POTONIÉ, Synopsis III, 1960, Pl. 7, Figs. 148, 149).

Engelhardtioidites microcoryphaeus (R. POT. 1931) R. POT. 1960

Plate LIII, Fig. 22–23

Triporate pollen, of 17 to 22 μ equatorial diameter, provided with atria. Sides slightly concave. Exine two-layered, chagrinate. Fairly abundant in the core from 432.5 to 434.1 m depth of borehole Szászvár-8, in the Helvetian of borehole Hidas-53, in the exposures of Mecseknádasd and Almáspatak, and in the Tortonian of Hidas Mine.

Genus: *Platycaryapollenites* n. g.

Generotype: Platycaryapollenites miocaenicus n. g. n. sp.

Diagnosis: Small triporate pollen grains; exine provided with an arcoid band.

Differential diagnosis: It is the characteristic crossed bands that distinguish the genus from the pollen of similar size of *Engelhardtia*.

Remarks: The possibility of the occurrence of *Pterocarya* was raised in 1940 by THIERGART (p. 38), in connection with the Tertiary *Juglandaceae*; the point was raised also by KREMP (1950, p. 64). In the Miocene pollen atlas of the Soviet Union, POKROVSKAIA et al. (1956, p. 336) mentioned a grain of 17.7 μ diameter of *Platycarya* cf. *strobilacea* SIEB. et ZUCC. from the Lower Miocene of the Sikhote-Alyn Mountains.

Platycaryapollenites miocaenicus n. g. n. sp.

Plate LIII, Fig. 25–26

Holotype: Borehole Pszf.-VI, sample No 10, slide No 1, 33.1×120.1.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian, limnic sequence, clayey sand, borehole Pszf.-VI, depth 22.5 to 25.0 m.

Diagnosis: Triporate pollen of 18 μ size, in the polar position: on the surface of the exine there are 2 or 3 interwoven arcoid bands. Exine thin (about 1 μ), ectexine chagrinate, thicker than the endexine.

Remarks: Encountered also in the Helvetian cores of borehole Zengővárkony-59, Szászvár-8, Komló-120 and Hidas-53, in 18 to 20 μ size. Besides the arch, which are structural features, some of the grains exhibit also some secondary folding.

Genus: *Subtriporopollenites* PFLUG et THOMSON 1953

This form genus was established for the *Juglandaceae* and forms of uncertain taxonomic position (1953, p. 85). I have placed the forms of plausible enough botanical affinities in the respective genera (see preceding pages). There is one form of uncertain affinity which I shall report here.

Subtriporopollenites sp.
Plate LIV, Fig. 6

Roundish pollen grains of 23 to 27 μ size each with three round pores of subequatorial position; exine thinner than 1 μ. Surface chagrinate, intragranulate. The pores, their shape and embedding in the exine recall the "*caryoid*" elements of the family *Juglandaceae*. Except for *S. simplex*—which corresponds to *Carya*—all were described from the Eocene by THOMSON et PFLUG (1953, pp. 85–87).

The form occurs in our material from the Lower Helvetian up to the Pannonian.

Genus: *Plicatopollis* W. KR. 1962

Plicatopollis plicatus (R. POT. 1934) W. KR. 1962
Plate LIII, Fig. 24

1934. *Pollenites plicatus* n. sp. in R. POTONIÉ Arb. Inst. Pal. 4, p. 55, Pl. 2, Fig. 19.

Pollen grains of 19 to 21 μ size, and rounded triangular shape with convex sides. Exopore round, exine three-layered; there are anuli and atria. At the middle of each side, there are small mounds showing the original wall thickness. The fields of dissolution are in some instances as obvious as on KRUTZSCH's drawing (l.c.), whereas in other instances they are hidden by secondary folds looking like arch issuing from the pore. KRUTZSCH supposes the form to be a late juglandaceous one, a Poltavian element (l.c.). This is why I have provisorily placed it next to the *Juglandaceae*.

A few strongly crumpled specimens in boreholes Zengővárkony-45 (13.2 to 13.7 m depth), Hidas-53 (667.2 to 669.2 m depth) and Szászvár-8 (434.5 to 435.0 m depth).

Triatriopollenites levis (R. POT.) TH. et PF. (1953, p. 81, Pl. 8, Figs. 78, 79) much resembles this form.

Genus: *Polyporopollenites* Pflug 1953

I have distributed all the forms placed by Pflug into this genus among the units of the natural system. I am using it at present only for one pollen grain of unknown botanical affinity, which possesses five pores, polyporate. In so far as botanical relationships are concerned, the pollen grain seems to derive from a juglandaceous plant, as suggested by exine and pore structure.

Polyporopollenites hidasensis n. sp.

Plate LV, Fig. 10

Holotype: Borehole H.-53, sample No 1, slide No 2, 42.5×103.0.
Locus typicus: Hidas.
Stratum typicum: Pannonian, clay marl, borehole H.-53, depth 73.3 to 89.5 m.

Fig. — ábra 47. Polyporopollenites hidasensis n. sp.

Diagnosis: Roundish pore of 37 μ diameter, with five pores. Exine thick, up to 3 μ. Ectexine "a" about 0.5 μ thick, slightly wavy, granulate. Ectexine "b" composed of loosely fibrous layers about 1.5 μ wide, provided with atrium. Endexine about 0.5 μ thick, slightly wavy. Pore diameter about 2 μ slightly subequatorial (Textfig. 47).

One specimen in our material.

Genus: *Triporopollenites* Pflug et Thomson 1953

Triporopollenites megagranifer (R. Pot. 1931) Pf. et Th. 1953

Triporate pollen of 26 to 30 μ diameter roundish of triangular shape, with convex sides and round pores. Pores subequatorial. Exine about 2 μ thick, slightly thicker near the pores. Surface granulate. This form, described by R. Potonié from the German Eocene, occurs according to that author also in the Miocene (1934. 4, p. 55). We have encountered a few specimens in the Lower Helvetian of the Mecsek Mountains (borehole Hidas-53, Pusztakisfalu-VI, Zengővárkony-59). It is presumably redeposited in the Pannonian (118.0 to 126.8 m) of borehole Hidas-53.

Botanical affinities uncertain. The families *Juglandaceae* and *Betulaceae* have been mentioned (Thomson et Pflug 1953, p. 83). In 1951 and again in 1960, R. Potonié suggested *Myrica*.

Ordo: *M y r i c a l e s*
Familia: M y r i c a c e a e
Genus: *Myricipites* WODEHOUSE 1933

Myricipites rurensis (PF. et TH. 1953) n. c.

Plate LIII, Fig. 27

1953. *Triatriopollenites rurensis* n. sp. PFLUG et THOMS. Palaeontogr. B. 94, p. 79, VII. 81–109.

Triatrio-pollen of convex shape, 27 to 38 μ size. Exine about 2 μ thick at the pores, only about 1 μ at the middle of the sides. Small labra and atria visible. Exine chagrinate or intrapunctate. Secondary folding quite frequent. Four-pore variants have also been encountered.

Scarce but persistent in the Middle Miocene and Pannonian of the Mecsek Mountains (borehole Zengővárkony-45 and -59, Komló-120, lignite-bearing sequence of Hidas Mine, exposures of Almáspatak and Mecseknádasd).

Comparison with material from living plants (*Myrica rubra* SIEB. et ZUCC., *M. xalapensis* H. B. et K., *M. reticulata* FEYSM. et BINN., *M. longifolia* FEYSM. et BINN. etc.) has proved, in agreement with opinions stated in literature, that the form represents one or several species of *Myrica*.

Myricipites myricoides (KREMP 1949) n. c.

Plate LIV, Fig. 11, 13, 14

1949. *Pollenites myricoides* n. sp. in KREMP Palaeontogr. 90, p. 64, VI. 63.

Convex triangular triporate pollen grains of 22 to 32 μ size, provided with atria. Exine relatively thin (1 μ), smooth, somewhat chagrinate, easily crumpled; secondary folding frequent. Four-pored variants have also been encountered.

KREMP (1950, pp. 64–65) stated *Poll. myricoides* to be of about 22 μ size. In our material it occurs from the Lower Helvetian up to the Sarmatian, getting scarcer upwards (boreholes Szászvár-8, Pusztakisfalu-VI, Zengővárkony-45, Komló-120, Hidas-53, exposure Almáspatak). This is a myricaceous pollen.

Myricipites bituitus (R. POT. 1931) n. c.

Plate LV, Fig. 1

1931. *Pollenites bituitus* n. sp. in R. POTONIÉ Braunkohle p. 329, Pl. II, Fig. 17.

Triporate pollen of 19 to 25 μ size, with convex sides; exine thinner than 1 μ, chagrinate; labrum small, atrium present. Scarce in the Middle Miocene (at 393.8 to 496.0 m depth in borehole Hidas-53; Seam II of Hidas Mine).

The form should be revised. POTONIÉ (1934, 4, p. 57) attributed to it specimens of 13 to 21 μ size, THOMSON et PFLUG (1953, p. 79), specimens of

18 to 30 μ size. In 1960 (Syn. III., p. 114) POTONIÉ designated a form of 24 μ size as holotype.

As to botanical affinities, POTONIÉ suggested the *Betulaceae*, THOMSON and PFLUG the *Myricaceae*.

Genus: *Momipites* WODEHOUSE 1933

Momipites punctatus (R. POT. 1931) n. c.

Plate LIV, Fig. 9–10

1931. *Pollenites coryphaeus punctatus* n. f. R. POTONIÉ in Braunkohle 30, 16, p. 329, Pl. II, Fig. 7.
1934. *Coryli? pollenites coryphaeus* R. POT. pro parte in Arb. Inst. 4, Pl. 2, Fig. 10.
1953. *Triatriopollenites coryphaeus* (R. POT.) ssp. *punctatus* (R. POT.) TH. et PF. in Palaeontogr. 94, B, Pl. 8, Fig. 15–37.
1960. *Engelhardtioipollenites punctatus* (al. *coryphaeus punctatus* R. POT. 1931, 1. Mitt. S. 329, Pl. 2, Fig. 7, 26 μ) R. POT. 1951.

Triporate pollen of 17 to 30 μ size. Sides straight or very slightly concave. Exine about 1 μ thick, ectexine thicker than endexine. Surface chagrinate. Atria small, pore apertures lolongate. Secondary crumpling rare.

Most frequent in the Helvetian, the form is still present in the Tortonian. The Sarmatian has yielded some specimens that could be identified with a "cf.". The few specimens encountered in the Pannonian I regard as the result of redeposition. I could establish no botanical affinity for this form.

Ordo: *Salicales*
Familia: Salicaceae
Genus: *Salixipollenites* SRIVASTAVA 1966

The diagnose given by SRIVASTAVA (1966, p. 529) has to be completed in the following manner: instead of "without germ pores"—"with tricolporoidate or vague germinalia" is needed.

Salixipollenites helveticus n. sp.

Plate LV, Fig. 24–25

Holotype: Borehole Pszf.-VI, sample No 7, slide No 1, 35.6×112.9.
Locus typicus: Pusztakisfalu.
Stratum typicum: Lower Helvetian, limnic sequence, grey medium-grained sand, borehole Pszf.-VI, depth 15 to 17 m.

Diagnosis: Subprolate pollen grain of 16 by 10.5 μ size. Ectexine about 0.5 μ thick, consisting of small bacula; endexine somewhat thinner, smooth. Surface structure—a delicate reticulum. Colpi about 0.5 μ wide at the equator, narrowing towards the poles, slightly convergent. Germinal structure very vague, possibly poroidate (?).

Differential diagnosis: It differs from *Salixipollenites trochuensis* SRIVASTAVA species in its smaller measurements and more inequaler bacula. Differs from *S. densibaculatus* n. sp. by its smaller size, and by the smaller and more uneven elements of the exine structure.

Remarks: The specimens in our material cover the 14 to 21 μ size range. The small delicate grains exhibit a resemblance to the figures of *Salix* pollen in the Chinese pollen book (1960, Pl. LXXXVI, Figs. 11–16). According to WILLIS (1957, p. 582), the genus *Salix* comprises 160 cosmopolitic species. Its presence in our material is probable enough.

Most of our specimens have been found up in cores of boreholes Pusztakisfalu-VI and Zengővárkony-45.

Salixipollenites densibaculatus n. sp.

Plate LV, Fig. 3–5

Holotype: Borehole Zgv.-59, sample No 25, slide No 1, 38.4×113.3.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, clay-marl, borehole Zengővárkony-59, depth 63.0 to 65.0 m.

Diagnosis: Subprolate, tricolporoidate pollen grain of 22 by 15 μ size. Ectexine densely baculate; bacula about 1.5 long, 1 μ wide. Endexine about 0.5 μ thick, smooth. Colpus difficult to study; so is the poroid aperture.

Differential diagnosis: It differs from *Salixipollenites trochuensis* SRIVASTAVA in smaller size and in bigger bacula then those of the holotype. Differs from *S. helveticus* n. sp. by its proportions, its thicker exine and densely baculate structure.

Remarks: The specimens in the polar position are trilobate. They occur in 18 to 32 μ size, besides borehole Zengővárkony 59, also in the Helvetian and Lower Tortonian cores of boreholes Zengővárkony-45, Pusztakisfalu-VI and Hidas-53. However, forms identified as "cf.", have cropped up also in the Pannonian. The latter might belong to a different species.

Genus: *Tricolpopollenites* TH. et PF. 1953

Tricolpopollenites parmularius (R. POT. 1934) TH. et PF. 1953

Plate LV, Fig. 8–9

Tricolpate (tricolporate) pollen grains, of 31 to 35 μ size and subprolate shape, in the lateral position. Exine about 1.5 μ thick, ectexine and endexine of about equal thickness (?), smooth or chagrinate. Colpus narrow, not reaching up to the poles; cavern about 3 to 5 μ wide at the equator.

When describing the species (1934. 4, p. 52) from the Eocene of the Geisteltal, R. Potonié used pollen from *Salix* and *Populus* as comparative material. In 1951, he called the form *Cornaceoipollenites* (Palaeontogr. 91, Pl. B. XXI, Fig. 145), and added in 1960 (Synopsis III, p. 93) that the name was merely of a taxonomic significance (?), because cornaceous pollen is tricolporate. It seems proper to leave this form in the form genus *Tricolpopollenites* as long as the knowledge concerning it is rather poor. Thomson et Pflug (1953, p. 97) distinguished two forms — f. *cylindrior* and f. *rotundior*. Both have cropped up also in our material. According to Thomson and Pflug (l.c.), the form is abundant in the lower but sparse in the Middle Tertiary.

A few specimens in the Middle Miocene cores of borehole Zengővárkony-59.

Genus: *Tricolporopollenites* Th. et Pf. 1953.

Tricolporopollenites granulatus n. sp.

Plate LV, Fig. 13–14

Holotype: Borehole H.-53, sample No 34, slide No 1, 35.5×103.5.
Locus typicus: Hidas.
Stratum typicum: Tortonian, "Schlier" sequence, borehole H.-53, depth 757 to 759 m.

Diagnosis: Roundish pollen grain of 31 μ size, with three tapering exocolpi of 6 μ width at the equator, and three lolongate exopores of about the same width. The area of the colpus is covered with sparse granules of about 0.5 μ diameter. Exine about 2 μ thick; in the densely clavate (baculate) ectexine of about 1.5 μ thickness, the clavi appear entirely coalesced (tegillate structure). Endexine about 0.5 μ thick, likewise baculate. Exine finely rugulate, reticulate, even more delicate near the colpi.

Differential diagnosis: Differs from all other tricolporate forms by the structure of the germinal aperture and of the exine.

One specimen in our material. Nothing is known so far about botanical affinities.

Tricolporopollenites steinensis Pf. 1953

Plate LV, Fig. 6–7

Small tricolpate pollen of 16 μ size; exine covered with bacula of 0.5 μ size. Wide caverns, convergent at the poles; broad rugae.

One specimen at 118 to 126.8 m depth in borehole H.-53. It possibly indicates redeposition, having originally been described by Pflug from the Lower Eocene.

Classis: **Monocotyledonopsida (Monocotyledones)**
Subseries: **Alismatales — Poales**
Ordo: *Liliales*
Subordo: *Lilicineae*
Familia: Liliaceae
Genus: *Liliacidites* COOPER 1953

Liliacidites ellipticus n. sp.
Plate LV, Fig. 22–23

Holotype: Borehole Zgv.-59, sample No 23, slide No 2, 32.0×108.2.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, silty clay-marl, borehole Zgv.-59, depth 56.0 to 60.9 m.

Diagnosis: Anisopolar, egg-shaped, monosulcate pollen grain of 51×35 μ size. In top view, the ectexine is seen to constitute a reticulum composed of penta- or hexagonal grain of 1 to 2.5 μ diameter. The wall thickness of the reticulum is 0.5 to 0.75 μ. On the margin of the grain, the ectexine is manifests itself in the form of bacula 1.5 to 2 μ wide; endexine about 0.5 μ thick, smooth.

Differential diagnosis: Although of the same width, *Liliacidites kaitangataensis* COUP. (1953, p. 56, Pl. 7, fig. 97), described from the Upper Cretaceous, is less long and is of a different shape at large. Also, the grains constituting the reticulum of the new species are more uniform. *L. variegatus* COUPER (1953, p. 56, Pl. 7, Figs. 98–99) is smaller, with a thinner exine; the grains of the reticulum are smaller and disposed much like in the other species of COUPER. I have chosen as holotype the right-hand one of two closely adjacent specimens.

Botanically, its morphological similarity to pollen from living plants places the new species into the family *Liliaceae*.

Of the figures in the Chinese pollen book, those of *Hemerocallis fulva* L. (Pl. IX, Fig. 9) and *Lilium tenuifolium* FISCH. (Pl. LXI, Fig. 4) are similar, both in shape and structure, to the new species, and so are SCHULZE's figures (1964) of the genus *Iris*.

Ordo: *Cyperales*
Familia: Cyperaceae

Cyperacearumpollenites sp.

Encountered in samples from Almáspatak (locality I, clay with fish scales exposed above the rhyolite tuffite); also in some cores of borehole Hidas-53; scarce in sample 1 of Seam II, Hidas Mine. The specimens are rather untypical and ill-preserved, so that their description would be little justified, but since the presence of the family is highly probable ecologically, it was deemed necessary to report this pollen.

Ordo: *Poales (Graminales, Glumiflorae)*
Familia: Gramineae
Genus: *Graminidites* (COOKSON 1947) R. POTONIÉ 1960

1947. *Monoporites (Graminidites)* COOKSON—B.A.N.Z.A.R.E. Reports p. 134, XV. 41.

Applying the above generic name, R. POTONIÉ does not indicate his own combination (1960 Synopsis III, p. 111).

Graminidites media (COOKSON 1947) R. POT. 1960

1947. *Monoporites (Graminidites) media* COOKSON l. c.
1956. *Monoporopollenites graminoides* MEYER p. 111, Pl. 4, Fig. 29.

Pollen of 28 to 45 μ size; exine 1 μ or less, often secondarily folded. Under a high-resolution microscope, the exine in seen to be finely baculate and the surface more or less finely granulate in consequence. The single pore is of 5 to 6 μ diameter, with an anulus of 2 μ average width.

Remarks: In my opinion, the figure and brief statement by MEYER (1956, p. 111, Pl. 4, Fig. 29: " . . . werden alle Pollenformen zusammengefasst, die nur eine deutliche Keimpore besitzen. Zur neuen Art *M. gramineoides* werden alle glatten einporigen *Sporomorphen* gestellt.") are insufficient to reject the earlier description by COOKSON, which can be considered monotypical. It was justified to change the double name given by COOKSON after ERDTMAN (1947) (which can not be used any more anyway, according to the *Code*, 1961, Art. 34, P. 150). R. POTONIÉ's combination is all the more justified since the earlier names applied to pollen of similar morphology refer, all, to the family *Gramineae* (see also the list of synonyms in NAGY 1958, p. 100). ERDTMAN (1952, p. 193) mentioned some species of the families *Restionaceae* and *Flagellariaceae* to have a "*graminoid*" pore structure. TACHTAJAN (1959, p. 274) derives the series *Poales (Graminales)* from the series *Restionales*. He supposes an extinct flagellariaceous plant to have been their common ancestor. This may explain why some species of the two families have pollen of similar morphology and structure. However, the genera of both families are much less numerous than those of the *Gramineae* (*Restionaceae* include 19, *Flagellariaceae* 10 genera, according to WILLIS 1957). Even in these, the genera of "*graminoid*" structure consist of but a few species. The relevant genera of the family *Restionaceae* live in Southern and Southwestern Africa and Australia, those of the family *Flagellariaceae* in the Malay Archipelago and New Caledonia. The *Gramineae* count 4,500 species in 450 genera (WILLIS 1957) and thus, even supposing a sudden acme in the Neogene, the existence of a few species already in the Middle Miocene is most likely.

These forms are rather unpopulous and scant in our material.

Subseries: **Spadiciflorae — Pandanales**
Ordo: *Spadiciflorae (Arales = Arecales + Arales)*
Familia: Palmae
Genus: *Arecipites* WODEHOUSE 1933

WODEHOUSE connected the name with the palm family *Arecaceae* and compared his species with the pollen of *Phoenix dactylifera* L.

The keeping up of POTONIÉ's genus *Palmaepollenites* merely on the grounds of the minute difference mentioned by POTONIÉ (Synopsis II, 1958, p. 97) is unjustified: "Es ist zu überlegen, ob *Palmaepollenites* zu *Arecipites* zu stellen wäre. Es geschieht nicht, weil dort mehr länglich-elliptische Körner gemeint sind, deren Spalte sich terminal nicht weitet." WODEHOUSE's diagnosis (1933, p. 497): "Ellipsoidal, 23–25 μ long, with a single longitudinal furrow, which may close tightly throughout its entire length, not gaping at its ends." In the next paragraph he expounds the final part of this sentence, discussing the taxonomic incertitudes connected with monocolpate pollen, mentioning the similar pollen of the *Magnoliaceae*, *Cycas*, *Ginkgo*, and the *Bennettitales*. He is of the opinion that it is the tapering of the colpus which may serve as a distinctive criterion against the forms possessing colpi with broad, rounded ends (*Cycas*, *Ginkgo*, the *Bennettitales*). His position is also reflected by his figure (p. 500, Fig. 22) where the end of the colpus is slightly open (which it is not the case in POTONIÉ's figure, Synopsis II, 1958, Pl. 11, Fig. 137). In 1934 (Arb. Inst. 4, p. 51) R. POTONIÉ described a pollen grain of about 24 μ size by the name *Pollenites tranquillus* n. sp., which he compared with pollen from living *Acorus calamus* L. *(Araceae)*, and *Typha angustifolia* L. *(Typhaceae)*. He gave two figures (Pl. 2, Figs 3 and 8) without designating a holotype: he spelled the name as "*Araceae*?", and did not, consequently, regard it as a palm. In 1951 (Pl. XX, Figs. 31 and 31a) he gave two figures of the same specimens, labelled, "*Palmaepoll. tranquillus* R. POT. (4, 51) ± 24 Geiseltal" in the explanation to the plate. In 1953, THOMSON et PFLUG established the artifical form genus *Monocolpopollenites* and designated POTONIÉ's species as its genotype. Also, they changed the diagnosis to inclide pollen grains of from 20 to 45 μ size, and, in consequence, changed also the thickness of exine (POTONIÉ admitted a thickness of 0.3 μ, THOMSON et PFLUG up to 2 μ). They cited R. POTONIÉ as author (l.c. p. 62–63) who later quoted this form as "glatter *Palmenpollen*". They stated themselves that " . . . ist die Zugehörigkeit zu den *Palmae* sehr wahrscheinlich (cf. *Phönix*)." They chose a type from the lignite of the Antweiler Graben rather than from the original locus (the Geiseltal Eocene).

I am using here the generic name *Arecipites* WODEHOUSE 1933, validly described and provided with a generic diagnosis.

Arecipites tranquillus (R. Pot. 1934) n. c.

Plate LV, Fig. 19

1934. *Pollenites tranquillus* n. sp. R. Pot. Arb. Inst. Paläob. 4. p. 51, II. 3, 8.
1953. *Monocolpopollenites tranquillus* (R. Pot.) n. c. Pflug et Thomson, Palaeontogr. 94, p. 62.
1958. *Palmaepollenites tranquillus* R. Pot. 1951. Synopsis II. p. 97. XI. 138.

Ellipsoidal, prolate pollen of 30 by 16 μ size. Accompanied on either side by a cavern 2 to 3 μ wide and tapering towards the poles, the colpus covers the full length of the grain. Width of colpus about 2 μ; exine thinner than 1 μ. Surface finely granulate.

A few specimens in the lower section of borehole Szászvár-8 (the figured specimen derives from 433.6 to 433.8 m depth). I have also placed here, with a "cf.", a specimen of even larger size (42 μ) from 48.5 to 51.3 m depth in borehole Zengővárkony-59.

Arecipites zievelensis (Pf. 1953) n. c.

Plate LV, Fig. 11

1953. *Monocolpopollenites zievelensis* n. sp. Pflug — Palaeontogr. 94, p. 62, Pl. 4, Figs. 18–23.

Elliptic, monocolpate pollen of 34 by 24 μ size. Exine less than 1 μ thick, two-layered, ectexine thicker than endexine, smooth, chagrinate. The thin exine is highly liable to crumple. The tapering colpus hardly reaches the two poles. The caverna, up to 2 μ wide at the equator, is also tapering. The junction of colpus and equator is missing and so is the extension of the colpus into an apex. As there has been just one specimen in my material and as I failed to detect these features in some of the specimens figured by Thomson and Pflug (1953, Pl. 4, Figs. 20, 22), either this form is no *A. zievelensis* (Pf.), or the specimens just cited ones are not.

Described by Pflug in Thomson et Pflug (1953) from the Eocene. I regard it as a palm pollen, but they cited also *Ginkgophytes* as possible relations.

Arecipites trachycarpoides n. sp.

Plate LV, Fig. 12

Holotype: Borehole Zgv.-59, sample No 34, slide No 1, 42.7×102.0.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole Zgv.-59, depth 81 to 83 m.

Diagnosis: Subprolate, monocolpate pollen grain of 23 by 22 μ size. Shape slightly asymmetric, with an apex slightly off center. These apices are connected by a colpus of about 3 μ width that has a colpal labium of about

1 μ on either side. Exine about 1 μ thick, very delicately baculate; surface finely granulate in consequence.

Differential diagnosis: Resembles the form group of *A. tranquillus* (R. POT.) n. c., but whereas R. POTONIÉ (1934. 4, p. 51) speaks of a thin-exined pollen (0.3 μ), WODEHOUSE states the exine to be smooth or more finely pitted than that of *A. punctatus* (1933, p. 497). Our species differs from both. Its remarkable similarity to the pollen of the East Asian genus *Trachycarpus* (see the figure of *T. fortunei* H. WENDL. Pl. LV, Fig. 16) made me attribute it to that genus. According to J. RANIECZKA-BOBROWSKA (1963, p. 177), *Trachycarpus rhapifolia* (STERNB.) TACHT. is an Eocene-to-Lower-Miocene palm in Poland.

Arecipites chamaedoriformis n. sp.

Plate LV, Fig. 2

Holotype: Borehole Zgv.-59, sample No 32, slide No 1, 33.9×112.6.
Locus typicus: Zengővárkony.
Stratum typicum: Helvetian, fish-scale-bearing sequence, borehole Zgv.-59, depth 76 to 78 m.

Diagnosis: Roundish pollen grain of 25 by 20 μ size, with one colpus along which there is a marginal lath less than 1 μ wide. Exine 2 μ thick. Ectexine finely clavate (pilate); the pila locally appear coalesced. Endexine thin (less than 0.5 μ) and smooth. The surface appears finely reticulate as a result of this structure. Near the colpus, this structure becomes even more delicate (just finely granulate), and close to the colpus the surface is entirely smooth.

Differential diagnosis: Differs from *Sabalpollenites papillosus* (MÜRR. et PFLUG) PF. mainly by the marginal lath adjacent to the colpus and by that its reticulum is finer-grained.

Botanically, it is related to some species of the genus *Chamaedorea* WILLD. (*Ch. speciosa* H. WENDL. and *Ch. schiedeana* MART.).

Genus: *Sabalpollenites* (THIERG. 1938) R. POT. 1968

It is THIERGART (1938, pp. 308–309) who described *Sabalpollenites convexus*, but without designating a holotype, and labelling "cf. *Ginkgo* or *Palma*" his Fig. 14. and "cf. *Sabal*" his Fig. 15. of Pl. 24. This latter was designated lectogenotype by POTONIÉ in 1958 (Synopsis II, p. 98).

PFLUG indicates the genus *Sabal* as the botanical relation of *Monocolpopollenites retareolatus* (1953, p. 63). It is into this genus that I am placing PFLUG's and MÜRRIGER et PFLUG's species with the following complement to the diagnosis: "all palm pollen whose ornament indicates the genus *Sabal* is to be placed here".

Sabalpollenites retareolatus (PF. 1953) n. c.

Plate LV, Fig. 17

1953. *Monocolpopollenites retareolatus* PFLUG, in THOMS. et PFLUG, Palaeontogr. 94, B. p. 63.

Ellipsoidal monocolpate pollen of 24 to 30 μ size. Surface reticulate, owing to a dense stand of clavate elements of about 1 μ size. Colpus reaching to the poles, narrow with a narrow caverna.

A few specimens in Middle Miocene deposits (at 63.0 to 70.5 m depth in borehole Zengővárkony-59 and at 572 to 575 m depth in borehole Hidas-53).

Sabalpollenites papillosus (MÜRR. et PFLUG 1953) n. c.

Plate LV, Fig. 21

1953. *Monocolpopollenites papillosus* (MÜRR. et PF.) in TH. et PF. Palaeontogr. 94, B. p. 63.

Pollen of 19 to 27 μ size, none too abundant in our Middle Miocene material: boreholes Hidas-53 (534 to 537 m and 600.5 to 602.3 m depth), Zengővárkony-45 (16.0 to 16.4 m depth). They represent plants belonging to the *Palmae*.

Genus: *Monocolpopollenites* THOMSON et PFLUG 1953

Monocolpopollenites observatus PF. 1953

Plate LV, Fig. 20

A few specimens of 33 to 43 μ size and a few fragments in deep cores of borehole Hidas-53 (667.2 to 669.2 m, 683.5 to 686.5 m, 757 to 759 m, 837.9 to 839.0 m, and 1,071 m).

According to THOMSON et PFLUG, the size range of the species is 40 to 50 μ; its age is Palaeocene and Lower Eocene. Indicating also other possibilites, they hold it to belong most probably to a palm or to be some spore (1953, p. 62). As in spores the line of dehiscence is rarely visible at the middle of the sides, the assumption of monocolpate palmaceous pollen has more merit.

Ordo: *P a n d a n a l e s*
Familia: S p a r g a n i a c e a e
Genus: *Sparganiaceaepollenites* THIERGART 1938

Sparganiaceaepollenites polygonalis THIERGART 1938
Plate LV, Fig. 15, 18

1950. *Sparganioidites* R. POTONIÉ, THOMSON et PFLUG, Geol. Jbuch 1949. B. 65, p. 50, Taf. C, Fig. 11.

THIERGART (1938, p. 307) mentions this name as a monotypical generic term from the Niederlausitz lignite. MEYER (1956) also reported the form from a Miocene material. He gave no generic diagnosis. His laconic specific diagnosis (l.c. p. 111) and very bad figure do not justify the use of the name given by him (*Monoporopollenites sparganioides* in Geol. Bavarica p. 111, Pl. 4, Fig. 28). The fossil forms exhibit considerable resemblance to ERDTMAN's figures (1954. p. 64, Pl. III, Figs. 30–31a) of living *Sparganium*. According to ERDTMAN's figures (ibid., Pl. II, Figs. 20–21 and Pl. III, Figs. 32, 33), the pollen of *Typha* and *Potamogeton* is of a more delicate structure than the figured species of the genus *Sparganium*.

Sparse in my material, it cropped up in boreholes Hidas-53, Komló-120, and Zengővárkony-59 and in the Hidas Mine sequence, even as a tetrade in one instance (Pl. LV, Fig. 15). The surface of the pollen bears bacula of 1.5 μ size, forming a reticulum in the top view. Pore diameter is 3 to 4 μ; grain size is 25 to 31 μ.

Plant tissue fragments
Plate LVI, Fig. 1–8

Some scarce tissue fragments have also cropped up in our material. Necessarily of minute size, and lacking most characteristic features, they preclude any detailed determination.

At my request, L. RÁKOSI examined the tissue fragments in question and expressed his opinion of them, for which I am sincerely grateful.

Most of these remains derive from the Hidas lignite, partly from samples collected in the mine proper and partly from cores of borehole H.-53 (depths 665.1 to 666.8 m, 592.7 to 593.1 m, 590.7 to 592.7 m).

It is the following tissue fragments that could be more or less accurately identified:

Remnant of a *fern trachea*, borehole Hidas-53, depth 665.1 to 666.8 m lignite-bearing sequence, Pl. LVI, Fig. 3.

Taxodiaceous tissue remnant (as revealed by its bars of SANIO). Sample 55 from Seam II, Hidas Mine. Pl. LVI, Fig. 6.

Tangential section of a pith ray, sample 3 from Seam II, Hidas mine; either *Ulmus* or *Quercus* in the opinion of L. RÁKOSI. Pl. LVI, Fig. 2.

Epidermal fragment of a dicotyledonous plant, with haplohelistomae, sample 2 from Seam II, Hidas Mine. Pl. LVI, Fig. 7.

Vessel bundle of a palm, Pl. LVI, Fig. 4. Sample 2 from Seam II of Hidas Mine has yielded a xylem bundle indicative of some palm species.

Root epidermal cells of *Carex* sp. from locality Almáspatak II, sample 1, Pl. LVI, Fig. 5. Tissue remnant, presumably epidermal, Pl. LVI, Fig. 1.

The xylites determined by Á. Haraszty (1953) in samples from Hidas Mine gave only the family *Taxodiceae* as the closest possible identification. The tissue fragments of a few μ size are more informative than that; also, the lignite samples contain some material that, although unsuitable for identification on the specific level, permits some taxonomic classification within the *Taxodiaceae*.

Leaf cell

Plate LVI, Fig. 8

A leaf cell highly similar morphologically was described by Thiergart (1940, Pl. XIV, Fig. 23.) from a tropical low moor of East Sumatra. However, the size of Thiergart's cell is 60 μ, whereas the one from sample 53 of Seam II, Hidas Mine is only of 26 μ diameter.

APPENDIX

Animal remains

The spores and pollen were decompanied by various animal remains. Where autochtonous, these may contribute to the ecologic evaluations of the one time biotope. Their profound study does not enter into my field of research.

Foraminiferal remains

Their taxonomic position is given by Deflandre (Chapter "Généralités", pp. 90–93 in Piveteau, Traité de Paléontologie, Vol. I) as:

Phylum: **RHIZOFLAGELLATA**
Subphylum: **RHIZOPODA**
Classis: **Granuloreticulosa**
Ordo: *Foraminifera*

In marine and brackwater deposits, remnants of foraminifera have cropped up fairly often together with other microfossils. In agreement with A. Eisenack (1954, pp. 72–74), I consider these fragments to be "die hellgelben und dunkelrotbraunen Innentapeten kalkschaliger Arten". The remnants in our material are either isolated chambers or ones that bear also the germinal chamber. The fragments found thus far are all within the size range of spores and pollen.

Foraminiferal remains have been treated in some detail by EISENACK (l.c.). The topic of their role as facies indicators in the Mecsek Mountains deposits was taken up in an earlier publication (E. NAGY 1962b).

INCERTAE SEDIS I

Scolecodonta

Plate IX, Fig. 13

Remain of 93 μ length, characterized—as opposed to the scolecodonts figured thus far—by a longest median dentition rather than by a long lateral one. Some of the species figured from the Lower Cretaceous of France (VERDIER, 1962, Pl. 15, unnumbered figures) are of comparable size. Also, the dentition of one is rather similar to that of our form. It is not inconceivable that there should be two specimens in parallel but opposite positions adhered to one another, giving rise to the dentition in two directions. Specimens (four?) thus connected are visible in a figure of O. WETZEL's Cretaceous material (1961, p. 344, Pl. 3, Fig. 10).

V. EVALUATION OF THE SPORE AND POLLEN SPECTRA

1. Floral assemblages

Beyond a mere taxonomic classification, an evaluation of broader outlook of the spores and pollen found in the samples studied.

During the monographic treatment of the living flora of a phytogeographical unit, botanists survey and record natural plant associations. The classification of these units is based on ecological features in the first place. According to RÜBEL (1930, p. 48), such a classification is " . . .bald mehr klimatökologisch, bald mehr edaphökologisch, meist mit dem Versuch, durch die Physiognomie die Gesamtökologie zu erfassen."

The reconstruction of fossil plant associations is based on the fossil assemblage (the *thanatocenosis*), which is sometimes very scanty. Whereas plant cenologists can consult pedologist, meteorologists etc., the palaeoecology, palaeoclimatology and possibly, palaeopedology of a region will be inferred, as far as possible, from the plant fossil assemblage. The evidence provided by this latter is, of course, complemented with information gleaned from the embedding medium, zoofossils, etc.

The pollen spectra established for the Mecsek Mountains Miocene were evaluated according to ecologic principles*, Reconstruction of the one-time palaeocenoses was done on the basis of the principle of actualism. Pollen spectra enabled us to distinguish palaeocenological units controlled by palaeoecological factors, mainly edaphic ones. Of course, fine distinctions comparable with those relying on recent spores and pollen grains are out of question. I have classed the pollen spectra of the individual drill cores into the following types of vegetation: *(1)* swamp-and-marsh forest, *(2)* seashore-and-riparian forests, *(3)* mixed deciduous forests farther inland, *(4)* deciduous and coniferous forests of the piedmont areas and hillsides.

(1) Into the vegetation type of the swamp-and-marsh forest; I have placed the following types: bladderless coniferous pollen s. str. *(Taxodiaceae, Cupressaceae)*, *Alnipollenites verus*, *Betulaepollenites* (several species), *Nyssapollenites* sp., species of *Myricipites*, *Jussiaeapollenites*, *Cyrillaceaepollenites*.

Further types indicating a fresh-water habitat are *Ovoidites ligneolus* R. POT., and species of the genera *Utriculariaepollenites*, *Sparganium*, *Nymphaea*, *Trapa*.

(2) The seashore-and-riparian forest assemblage includes *Caryapollenites*, species of *Pterocarya*, *Platycarya*, *Tricolporopollenites cingulum*, *Salix*, *Liquidambar*, *Pityosporites labdacus* (elements presumably representing *Pinus palustris*), ferns, *Lygodium* species, *Polypodiaceoisporites*, *Verrucingulatisporites*, types of *Osmunda*, *Leiotriletes*, *Monoleiotriletes*, the family *Polypodiaceae* (*Laevigatosporites haardti*, species of *Polypodiidites* etc.), moss spores.

(3) The mixed-deciduous-forest assemblage presumably covered the belt from the seashore forest to the piedmont zone. Of course, favourable exposition could result in its climbing up the slopes of foothills, too. Hence, it includes species covering a fairly wide range of ecologic requirements: *Ulmus*, *Zelkova*,

* For an example of such an evaluation, see NAGY 1962b.

most of the *Fagaceae*, *Tiliaceae*, *Sapotaceae*, some palms, *Podocarpus*, *Ginkgo*, *Flacourtiaceae*, *Acer*, *Araliaceae*, *Lauraceae*, *Ericaceae*, *Cornaceae*, *Caprifoliaceae*, some species of *Ephedra*, *Corylus*, *Malvaceae*, *Artemisia*, *Heliotropium*, *Ilex*, some species of *Rhus* and *Engelhardtia*.

(4) The coniferous and mixed deciduous-coniferous forest of the hillside included thermophobic *Carpinus*, a few species of *Fagus*, various species of *Pinus*, *Dacrydium*, *Sciadopitys*, *Cedrus*, *Abies*, *Picea*, and *Keteleeria*.

I have collated the palaeocenologic diagrams derived from the pollen spectra with the lithology of the embedding rock, and the distance from the seashore as derived from the pollen spectra and from the planktonic fossils in the samples, and as expressed also by the sequence of palaeocenologic units shown in the diagram. The frequency data of the pollen and spore species counted in the individual samples also offer remarkable information. It is these data that make one realize why the enrichment of the pollen of the hillside forest does not invariably indicate a lush vegetation, as it may, of course, indicate also the recession of the seashore from the locality of deposition under study, or the suppression of the nearshore vegetation by a transgression, resulting in a relative enrichment of the hillside forms, a phenomenon readily reflected by the spectrum.

Of the full depth of 533 m of *borehole Szászvár-8* (see diagram Fig. 48), we studied 311 samples. The frequent layers of conglomerate, sandstone and sand yielded little palynological information. The few pollen spectra were derived from the clay marls and calcareous marls interbedded with layers of coarse detritic sediment.

From 533 to 442 m, it contains scarce spores and pollen, intensely corroded and inadequate at large for the outlining of a palaeophytologycal image. The strong corrosion of the spores and pollen grains suggests the area to have but seldom been covered with water; even the palynomorphs embedded in some sediment have been corroded due to attack by atmospheric oxidation in those parts of the region, from where the water withdrew.

Fragments of microforaminifera and a few Mesozoic spores constitute an argument in favour of redeposition.

In the section from 435 to 432 m, there are a few pollen spectra suitable for evaluation, but even here layers containing well-preserved palynomorphs alternate with ones containing corroded material. In the samples suitable for evaluation, the assemblages requiring a humid habitat seldom exceed 50 percent. The subtropical mixed deciduous forest played a somewhat subordinate role; the hills were overgrown with conifers (see the palaeocenologic diagram of borehole Szászvár-8 Fig. 49).

Rich in bladderless coniferous pollen, the assemblage of the fresh-water and fluviatile sequence indicates subtropic mixed deciduous forest; some of the conifers were interspersed with the subtropical deciduous forest, particularly with its hillside portions.

In the undergrowth of dry-ground habitats, one may suppose the presence of the mother plants of *Ephedripites hungaricus*, *Malvacearumpollenites rotundus*, *Ericipites* sp., *Heliotropidearumpollenites gracilis*, *Pteracanthopollenites discordatus*, species of *Ilexpollenites*, *Rhoipites* sp. can be supposed. The tropical, subtropical flora is complemented with some representatives of ferns:

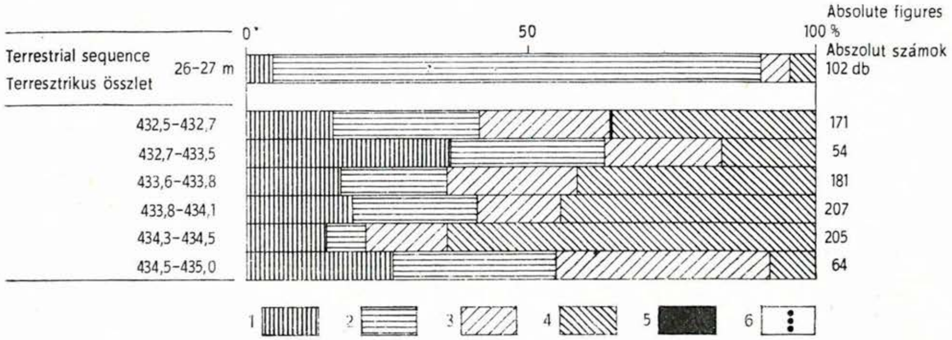


Fig. 49. Paleoecological diagram of Borehole Szászvár-8. — *1.* Swamps-and-marsh forests, *2.* riparian forests, *3.* mixed deciduous forests, *4.* deciduous and coniferous forests of the piedmont areas and hillsides, *5.* Botryococcus, *6.* Ephedra

49. ábra. A Szászvár 8. sz. fúrás paleoökológiai diagramja. — *1.* Mocsárerdő, *2.* ligeterdő, *3.* kevert lomberdő, *4.* hegyoldali erdő (lombhullató, tűlevelű), *5.* Botryococcus, *6.* Ephedra

species of *Polypodiaceoisporites, Osmundacidites gemmatus, Leiotriletes* sp., *Monoleiotriletes gracilis.*

A wet-ground or a swamp or marsh forest is indicated by the presence of taxodiaceous pollen (about 14 percent) — *Alnipollenites verus, Betulaepollenites betuloides, B. prominens, Myricipites myricoides* and *Jussiaeapollenites champlainensis.* Open surfaces of fresh-water are indicated by *Ovoidites ligneolus* and *Utriculariaepollenites elegans.*

Farther upwards, the so-called terrestrical sequence consists of layers of coarse conglomerate, sandstone, rhyolite tuff, which are practically devoid of palynomorphs. In the marls intercalated in the rhyolite tuff there are a few grains of pollen and sparse remnants of plant tissue. In the uppermost investigated sample of the borehole (between 26 and 27 m of depth) there is an interesting assemblage. Both angiosperms *(Myrica, Ulmus, Tricolporopollenites microhenrici)* and scarce *Gymnosperms* are quite scarce; *spores* abound. Reflecting a vegetation of numerous species, the spore assemblage is presumably due, in part at least, to a riparian glade of ferns. The abundance and good preservation of the material renders the idea of an entirely assemblage is redeposited somewhat difficult to accept, although there are fairly numerous ancient forms such as *Gleicheniaceae.* These latter are, however, much smaller than the Lower Cretaceous forms described by BOLCHOVITINA.

The spectrum of this sample with the numerous spores is almost fully identical with those of the few investigated samples of *borehole Kisbattyán 1* (samples from the interval of 462 and 459 m of the terrestrial sequence). These, too, consist almost exclusively of spores, and, to be more specific, of the small spores mentioned above.

The limnic sequence can most readily be studied in the *borehole Pusztakisfalu-VI,* of 126.2 depth, of which I have investigated 18 samples (see diagram Fig. 50 and palaeoecologic table Fig. 51). The Helvetian succession of the borehole consists of alternating gravel and sandy clay with seams of lignite and rare layers of bentonite. All these are relatively poor in pollen.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN THE SAMPLES FROM AROUND SZÁSZVÁR MINE

A SZÁSZVÁR-BÁNYA KÖRNYÉKI MINTÁK SPÓRA-POLLENÉRTÉKEINEK %-os DIAGRAMJA

Locality-Lelőhely	Sample-Mintaszám	OVOIDITES LIGNEOLUS	FUNGI	MUSCI	LEIOTRILETES MAXOIDES ssp. MAXIMUS	BIFACIALISPORITES sp.	LAEVIGATOSPORITES HAARDTI	POLYPODIISPORITES FAVUS	EGYÉB SPÓRÁK	PITYOSPORITES LABDACUS	ABIETINAEPOLL. MICROALATUS	PICEAPOLL. NEOGENICUS	ABIESPOLL. ABSOLUTUS	KETELEERIAPOLL. KOMLÓENSIS	LÉGZACSKÓNÉLKÜLI CONIFERAE	EGYÉB GYMNOSPERMAE	RHOIPITES PSEUDOCINGULUM	ILEXPOLL. MARGARITATUS	ILEXPOLL. PROPINQUUS	INTRATRIPOROPOLL. INSTRUCTUS	FLACOURTIACEAE sp.	ERICIPITES sp.	ULMIPOLL. MIOCAENICUS	ULMIPOLL. MACULOSUS	ZELKOVAEPOLL. POTONIEI	CARPINUSPOLL. CARPINOIDES	TRIPOROPOLL. CORYLOIDES	ALNIPOLL. VERUS	FAGUSPOLL. MINOR	QUERCOPOLL. sp.	TRICOLPOROPOLL. MICROHENRICI	TRICOLPOROPOLL. CING. ssp. OVIFORMIS	TRICOLPOROPOLL. CING. ssp. FUSUS	TRICOLPOPOLL. LIBL. ssp. FALLAX	PTEROCARYAPOLL. STELLATUS	CARYAPOLL. SIMPLEX	ENGELHARDTIOIDITES MICROCORYPHAEUS	MYRICIPITES MYRICOIDES	SALIXIPOLL. HELVETICUS	GRAMINIDITES MEDIA	PALMAE	EGYÉB ANGIOSPERMAE
Fővölgy	2-70		+	1		1			11											1								2				1										2
Kórházvölgy	17-18	+	+						1				1													1		1													1	
Felsőárok	695. pont																																									
Felsőárok	697. pont																																									
Kórházvölgy	743. pont		+						2																																	1
Váralja					2					1		3			1	5		4		1				1	1			4		2	5	1	1	1	1	1		4				2
Nagymányok			+																																							

1mm=1%

Fig.-ábra 52.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN BOREHOLE ZENGŐVÁRKONY 45

A ZENGŐVÁRKONY 45.sz. FÚRÁS SPÓRA-POLLENÉRTÉKEINEK %-os DIAGRAMJA

Fig.-ábra 53.

The lignite seams contain numerous remnants of plant tissue. The samples suitable for an evaluation indicate a lush, prononcedly fresh-water vegetation of riparian habitat. The most typical forms of the sample from 25 to 27 m suggest a riparian willow wood with an adjacent myricaceous swamp. The undergrowth is reflected by a considerable abundance of spores (14 percent), largely polypodiaceous *(Laevigatosporites haardti)*. Besides these, *Caryapollenites simplex*, *Ophioglossisporites rotundus* and *Polypodiaceoisporites* are also worth mentioning.

Near the shore there probably was a zone of subtropical mixed forest, represented by *Tricolporopollenites microhenrici*, *Tricolporopollenites cingulum* ssp. *oviformis*, *T. cingulum* ssp. *pusillus*, *Sapotaceoidaepollenites microrhombus* ssp. *miocaenicus*, *Carpinuspollenites carpinoides*, *Caprifoliipites gracilis*, *Intratriporopollenites instructus*, *I. reticulatus*. The undergrowth is indicated by *Polygalacearumpollenites miocaenicus*, *Ilexpollenites margaritatus*, *Artemisiaepollenites sellularis*.

Between 22.5 and 25 m the flora is even more colourful. Fern spores make up 32 percent *(Laevigatosporites haardti*, *Polypodiaceoisporites miocaenicus*, *Leiotriletes seydewitzensis*, *Neogenisporis* sp., *Verrucatosporites saalensis)*. A small stand of *Taxodiaceae* near the shore is backed up by a subtropical deciduous forest.

A fresh-water vegetation is suggested, besides *Ovoidites ligneolus*, also by *Utriculariaepollenites elegans*.

The barren interlayers between the lignite seams are devoid of pollen (17.0 to 22.5 m): they are overlain, between 15.0 and 17.0 m, by fresh-water with sands with *Ovoidites ligneolus*, *Utriculariaepollenites gracilis* besides *Salixipollenites* sp. (10.5 percent) and taxodiaceous pollen. The subtropical deciduous forest had a dense undergrowth of ferns, including the family *Polypodiaceae* and also some species of *Lygodium* (16 percent of the spores).

Between 12.5 and 15.0 m, fern spores dominate the spectrum, in a proportion of 60 percent: the most abundant family is the *Polypodiaceae* (*Laevigatosporites haardti*, 32 percent). Beside *Polypodiisporites favus*, *P. secundus*, *Polypodiidites maximus*, *P. multiverrucosus*, *Verrucatosporites saalensis*, *V.*

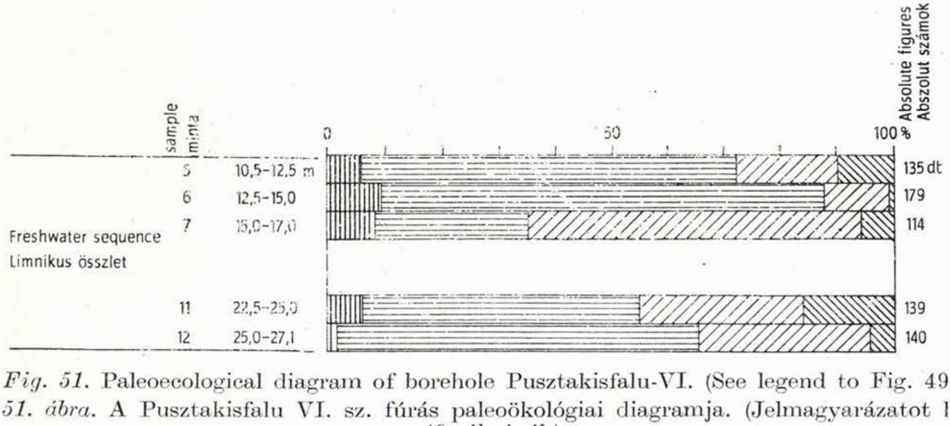


Fig. 51. Paleoecological diagram of borehole Pusztakisfalu-VI. (See legend to Fig. 49)
51. ábra. A Pusztakisfalu VI. sz. fúrás paleoökológiai diagramja. (Jelmagyarázatot l. a 49. ábránál.)

histiopteroides f. *major*, species of *Lygodium* are represented by *Polypodiaceoisporites gracillimus*, *P. mecsekensis*, *P. miocaenicus*, *Verrucingulatisporites miocaenicus*, *V. trifoliiformis*.

The subtropical forest is represented by sparse fagaceous pollen, fairly abundant *Sapotaceoidaepollenites* (6.5 percent), *Engelhardtioidites microcoryphaeus*, *Arecipites* sp., *Ilexpollenites margaritatus*, *Ginkgoretectina neogenica*. A wet longshore zone is indicated besides the taxodiaceous pollen also by the presence of *Cyrillaceaepollenites excelsus*. *Salixipollenites* sp. had by this time become fairly rare.

The sample from 10.5 to 12.5 m contains little angiospermous pollen even including the monocotyledons of the undergrowth. *Conifers* that might indicate a hilly hinterland are also very scarce. 86 percent of the spectrum consists of fern spores (of which 22 percent are *Laevigatosporites haardti*). The sandy, calcareous marl from 7.8 to 9.5 m depth—an interlayer between lignite seams—has yielded some very scarce coniferous pollen the abovementioned fern spores. The lignite seam above it (6 to 6.3 m) contains a debris of plant tissue remnants and so does the layer immediately above it.

The six samples from *the vicinity of Szászvár Mine* (see Fig. 52) likewise represent the limnic sequence (from 2 to 70 m of depth). In the samples from the Main Valley (Fővölgy) there are just a few fern spores of the undergrowth (*Bifacialisporites* sp.) besides the angiospermous pollen (*Intratriporopollenites instructus*, *Tricolporopollenites cingulum* ssp. *oviformis*, *Alnipollenites verus*). The abundance of tissue remnants indicates a lignitic enviroment. The carbonaceous clay marl from the Kórházvölgy (Hospital Valley) also contains numerous tissue fragments and mycospores and a few grains of angiospermous pollen (*Carpinuspollenites carpinoides*, *Alnipollenites verus*, *Abietinaepollenites* sp.). A fresh-water habitat is indicated by *Ovoidites ligneolus*.

A sample from the limnic sequence exposed in the Pocsétásárok at *Váralja* gave a pollen spectrum much resembling the subtropical deciduous-forest assemblages mentioned above: *Intratriporopollenites instructus*, *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Tricolporopollenites microhenrici*, *Caryapollenites simplex*, *Pterocaryapollenites* sp., *Tricolporopollenites cingulum* ssp. *oviformis*, *T. cingulum* ssp. *fallax*, *Myricipites myricoides*, *Ilexpollenites margaritatus*, very few grains of coniferous pollen and spores of *Lygodium*.

Of the cores of *borehole Zengővárkony*-45, of 36.5 m depth, I have examined seven samples (see pollen diagram Fig. 53 and paleoecological table Fig. 54). Mesozoic trachydolerite is overlain here by coarse clayey sands, becoming finer-grained upwards, and clays of the limnic sequence. It is in the clayey silt from 17.2 to 17.8 m that a pollen spectrum permitting an evaluation is first found. The composition of subtropical deciduous forest of this region still resembled that reflected by the pollen assemblages of borehole Pusztakisfalu-VI, except that *Salixipollenites* (much scarcer) is accompanied by *Alnipollenites verus*. Ferns, interpreted as belonging to the undergrowth of this riparian forest, make up more than 20 percent of the assemblage. Part of the scarce coniferous assemblage consists of bladderless coniferous pollen s. str. There is also the pollen of spruce trees, presumably from the hillside forest (*Cedripites szászvárensis* and *Pityosporites labdacus*). *Triporopollenites urticoides* suggests a plant of the undergrowth.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN BOREHOLE SZÁSZVÁR 8.

A SZÁSZVÁR 8.sz. FÚRÁS SPÓRA-POLLENÉRTÉKEINEK %-os DIAGRAMJA

Fig.-ábra 48.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN BOREHOLE PUSZTAKISFALU VI.

A PUSZTAKISFALU VI.sz. FÚRÁS SPÓRA-POLLENÉRTÉKEINEK %-os DIAGRAMJA

Fig.-ábra 50.

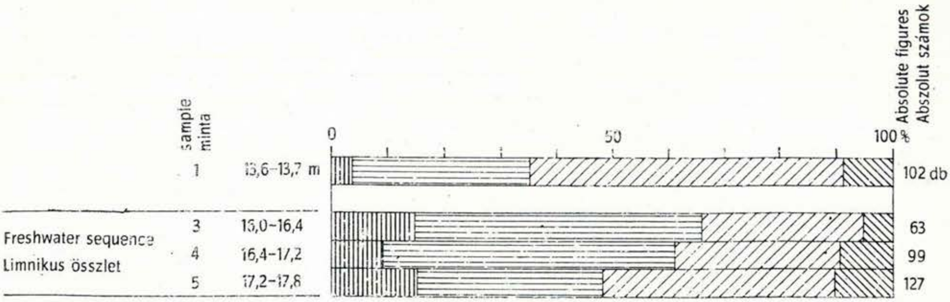


Fig. 54. Paleoecological diagram of borehole Zengővárkony-45. (See legend to Fig. 49)
54. ábra. Zengővárkony 45. sz. fúrás paleoökológiai diagramja. (Jelmagyarázatot l. a 49. ábránál.)

At 16.4 to 17.2 m, there is a carbonaceous clay with stringers of lignite, indicating a swamp of marsh forest. The spore assemblage, rich enough even in the previous samples, is enriched here to 76 percent. It is accompanied by *Salixipollenites* and paralleled, in respect of ecologic requirements, by *Nyssapollenites kruschi* ssp. *analepticus* indicative of a subtropical riparian forest. An assemblage of plants growing on drier ground is reflected by *Tricolporopollenites microhenrici*, *Tricolporopollenites cingulum* ssp. *oviformis*, *T. cingulum* ssp. *pusillus*, *Zelkovaepollenites thiergarti*, *Sapotaceoidaepollenites obscurus*, *Momipites punctatus*, *Aceripollenites rotundus*, *Caryapollenites simplex*, *Engelhardtioidites microcoryphaeus*, and species of *Ilexpollenites*.

The congerian clay between 14.0 to 14.5 m is barren; the sample above (13.2–13.7 m) it indicates a different vegetation. The rich angiospermous assemblage lacks *Salixipollenites* sp.: this was a riparian forest under a drier subtropical climate. *Ilexpollenites propinquus*, *Polygalacearumpollenites miocaenicus*, *Caprifoliipites gracilis*, and *Graminidites media* reflect the undergrowth of this drier forest: the palynomorphs indicating a wetter habitat (*Polypodiaceoisporites gracillimus* and other *Polypodiaceoisporites* species) are rather scarce. Open freshwater surfaces are indicated by *Utriculariaepollenites elegans*. Swampy habitats adjacent to the open water are suggested by *Cyrillaceaepollenites exactus*, *C. megaexactus*, and a few grains of taxodiaceous pollen. The spectrum is completed by scarce coniferous pollen, moss spores and mycospores.

A sample collected from the fish-scale-bearing sequence on *Melegoldal* Hill at *Nagymányok* yielded almost 55 percent of coniferous pollen; a clay marl from the fish-scale-bearing sequence in the *Kisrét* ravine at *Magyaregregy* gave 48 percent. The deciduous trees represented by the assemblage of the Melegoldal sample are similar to those in the other samples from the localities around Magyaregregy (Farkasordító, Kisrét), but no single species is as abundant in it as e. g. *Caryapollenites simplex* is in those. The scarce fern spores are similar to those encountered in the other localities near Magyaregregy (*Laevigatosporites haardti*, *Polypodiisporites favus*, some species of *Leiotriletes*).

The fish-scale-bearing sequence is known in numerous exposures about *Magyaregregy*. For the sake of a general orientation and of outlining a broad image of the flora, one sample from each exposure has been studied.

In the samples from the lower reaches of the surface exposures near Magyaregregy (see Fig. 55), juglandaceous pollen is most abundant, making up 20 percent of the spectrum in the sample from Locality I of the Kisrét ravine; *Caryapollenites simplex* alone gives 16 percent. In this mixed riparian forest; tiliaceous pollen amounts to 4 percent, whereas quercoid forms are relatively scarce (a total of 6 percent for *Tricolpopollenites liblarensis*, *Tricolporopollenites cingulum* ssp. *oviformis*, *Faguspollenites tenuis*). Further representatives of the subtropical deciduous forest are *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Sapotaceoidaepollenites obscurus*, *Carpinuspollenites carpinoides*, *Engelhardtioidites microcoryphaeus*, *Ostryapollenites rhenanus*, *Triporopollenites coryloides*. *Conifers* are abundant (48 percent): some of them such as *Pityosporites labdacus* (21 percent), and *Abietinaepollenites microalatus* (7 percent) indicate a mixed deciduous-coniferous forest. This mixed forest presumably climbed up the piedmonts and hillsides, as proved by the microthermous deciduous elements also by *Piceapollenites neogenicus* (5 percent), *Keteleeriaepollenites komlóensis* (0.7 percent).

The swamp is represented by bladderless coniferous pollen s. str., *Myricipites myricoides*, *Betulaepollenites betuloides*, *Salixipollenites* sp. An open fresh-water environment is indicated by *Myriophyllumpollenites quadratus*, brackish water by the planktonic form *Cooksonella circularis*.

Locality No. 3 of the Kisrét ravine reflects a lush vegetation with 37 percent of conifers. *Taxodiaceous* pollen (10 percent) as well as *Myricipites myricoides* (19.4 percent), *Nyssapollenites* sp., *Salixipollenites* sp., and *Betulaepollenites betuloides* suggest a nearshore fresh-water swamp-or-marsh forest. *Caryapollenites simplex* is less abundant in this spectrum than in that of locality I of the Kisrét ravine (8.4 percent). The forest is composed of the mother plants of *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Aceripollenites reticulatus*, *Tricolporopollenites cingulum* ssp. *oviformis*, *T. cingulum* ssp. *pusillus*, *Tricolporopollenites microhenrici*, *Engelhardtioidites microcoryphaeus*, *Celtipollenites* sp., *Ostryapollenites rhenanus*, *Caprifoliipites sambucoides*, *Rhoipites* sp.

From Localities I and II at Almáspatak I have examined 31 samples. The beds of d a c i t e t u f f and tuffite yielded very little pollen (see NAGY et PÁLFALVY 1958, 1960). It is the upper limonitic sandstone and the tuffaceous clay marl with fish-scales that could be evaluated from a palynological point of view. In these, conifers make up 30 to 35 percent of the assemblage. The deciduous assemblage is much similar in specific composition to those of the other localities around Magyaregregy. An open fresh-water environment, is indicated by *Ovoidites ligneolus* and by remnants of *Carex* roots. On the other hand, *hystrichosphaerids* in the uppermost sample indicate an advance of the sea.

The samples from the exposure in the *Farkasordító* ravine gave spectra similar to the preceding ones, but much richer in both species and specimens. These were highly variegated florae living in a quite narrow space. Open fresh-water is indicated by *Sparganiaceaepollenites* sp., *Myriophyllumpollenites quadratus*; the swamp-and-marsh forest is represented by taxodiaceous pollen,

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN SAMPLES FROM AROUND MAGYAREGREGY

A MAGYAREGREGY KÖRNYÉKI MINTÁK SPÓRA–POLLENÉRTÉKEINEK %-os DIAGRAMJA

Fig.-ábra 55.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN BOREHOLE KOMLÓ 120

A KOMLÓ 120.sz. FÚRÁS SPÓRA–POLLENÉRTÉKEINEK %-os DIAGRAMJA

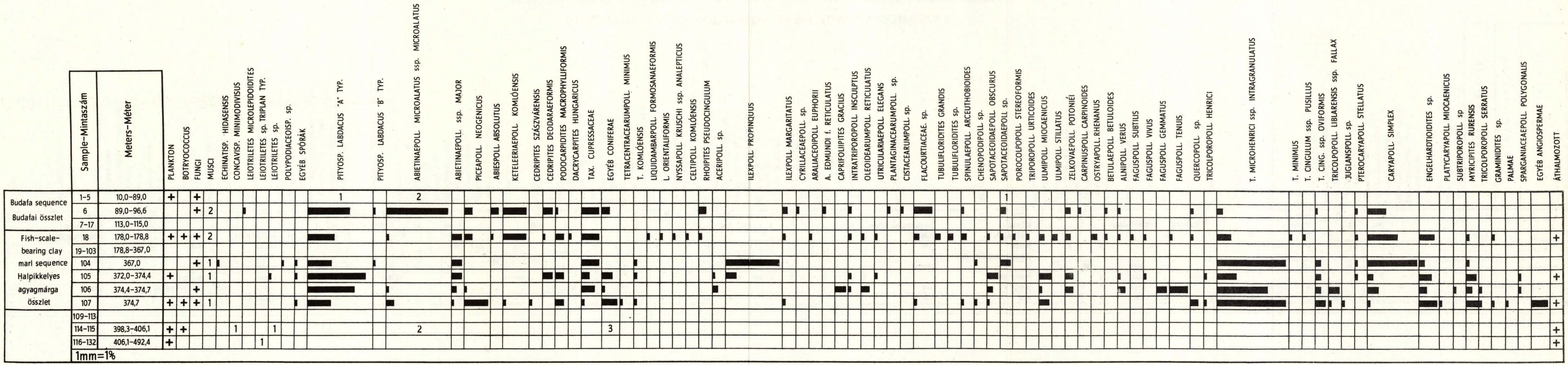


Fig.–ábra 58.

Myricipites myricoides, *Salixipollenites* sp., *Betuloidaepollenites betuloides*, *Alnipollenites verus*, and *Cyrillaceaepollenites exactus*. The seashore forest was presumably rich in the mother plant of *Cyrillaceaepollenites exactus*, which makes up 20 percent of the spectrum. It is accompanied by *Pterocaryapollenites stellatus*, and out of plants thriving farther inland, by *Carpinuspollenites carpinoides*, *Tricolporopollenites microhenrici*, species of *Quercopollenites* besides *Faguspollenites* sp., *Intratriporopollenites* sp., *Aceripollenites* sp., *Ulmipollenites* sp., *Zelkovaepollenites* sp., *Sapotaceoidaepollenites* sp. and, presumably, lauraceous pollen.* The spectrum is completed by *flacourtiaceous pollen*, *Liquidambarpollenites formosanaeformis*, and *Triporopollenites coryloides*. Coniferous pollen makes up 28 percent of the assemblage. The undergrowth is suggested by monocotyledonous pollen, fern spores and *Graminidites media*.

I have evaluated samples Nos. 2 and 27. from the "s c h l i e r" locality in the *Leánykő* ravine (near Magyaregregy) which we have referred to as "main deposit". Sample No. 27 is very rich both in species and specimens. A substantial portion of the spectrum (35 percent), like the other spectra from the vicinity of Magyaregregy, is coniferous. Of the deciduous trees, the *Juglandaceae* (to be more exact, *Caryapollenites simplex*) are on the decrease, with 6 percent. Fagaceous and ulmaceous pollen make up 18 percent of the spectrum (*Tricolporopollenites microhenrici*, *Quercopollenites robur type*, *Tricolporopollenites cingulum* ssp. *pusillus* and other species, *Liquidambarpollenites orientaliformis*, *Aceripollenites rotundus*, *Carpinuspollenites carpinoides*, *Zelkovaepollenites* sp., *Ulmipollenites* sp., *Inaperturopollenites* sp., *Araliaceoipollenites euphorii*, *Cyrillaceaepollenites megaexactus*, *Myricipites myricoides*, etc. are the most important forms).

The spectrum of sample No. 2 from the top portion of the exposure is somewhat less colourful. The conifers are less abundant (20 percent); the deciduous portion is dominated by the *Fagaceae* (35 percent). This implies a floral assemblage much like that of sample No. 27. Other deciduous trees make up 17 percent of the spectrum. The *Juglandaceae* are even more repressed at only 4 percent.

A sample of identical stratigraphic position is a c l a y - m a r l w i t h f i s h s c a l e s from *Komló—Zobák-puszta* southwest of Magyaregregy. It has yielded 72 percent of coniferous pollen, from a stand presumably mixed with deciduous trees as implied by *Tricolporopollenites cingulum* ssp. *fusus*, *T. cingulum* ssp. *oviformis*, *Faguspollenites* sp., *Zelkovaepollenites* sp., *Aceripollenites* sp., *Sapotaceoidaepollenites* sp., *Caryapollenites simplex*, *Pterocaryapollenites stellatus*, *Engelhardtioidites microcoryphaeus*, *Alnipollenites verus*, *Ilexpollenites margaritatus*. Nor do the scarce spores difference from the ones encountered in other samples from the fish-scale-bearing sequence.

A clay-marl with plant macrofossils from the f i s h - s c a l e - b e a r i n g s e q u e n c e near *Mecseknádasd* with a 74 percent ratio of conifers in the pollen spectrum, much resembles the above sample. This similarity is probably

* According to I. PÁLFALVY (1964. and personal communication) species of *Lauraceae* constitute a substantial percentage of the macrofossil assemblage. Their pollen, as I have already pointed out, in agreement with several statements in literature (1958, p. 124), either disappears completely in the course of sedimentation or there is at best just the vaguest evidence of its presence.

due to pollen from the hillsides of the nearby Mesozoic block. The angiospermous part of the spectrum is also similar. 4.8 percent of *Myricipites* pollen in the Mecseknádasd sample indicates a local marsh.

The upper part of the fish-scale-bearing sequence exposed around Magyaregregy compares with the deeper cores of *borehole Hidas*-53. I have examined a total of 62 samples from this borehole (see diagram Fig. 56 and palaeoecologic table Fig. 57). At 1017 to 1019 m the pollen grains are intensely corroded, including numerous unrecognizable fragments. The deciduous portion of the spectrum includes *Liquidambarpollenites* sp., *Cyrillaceaepollenites megaexactus*, *Sapotaceoidaepollenites* sp., *Ulmipollenites* sp., *Faguspollenites tenuis*, *Tricolporopollenites microhenrici*, *Caryapollenites simplex*, *Myricipites myricoides*, *Momipites punctatus*. These forms are accompanied by *Pityosporites labdacus* and fern spores such as *Polypodiisporites favus*, and a few species of *Polypodiaceoisporites*.

The scarce pollen grains of the interval of 983 to 971 m are insufficient for an evaluation.

It is in the core from 837.9 to 839.0 m that the first *microforaminifera* crop up, to become persistent from 738 m depth to the footwall of the Tortonian lignite-bearing-sequence. A few samples yielded some hystrichosphaerids (775 to 757 m, 735 to 738 m, 688 to 690 m). Chenopodiaceous pollen is fairly persistent in all these samples: according to Averdieck (1958), this form indicates the proximity of a seashore.

In the spectrum of the sample from 837.9 to 839.0 m, there are 20 percent coniferous pollen; 37 percent indicative of the subtropical mixed forest; 27 percent—of seashore forest; 16 percent—swamp-and-marsh forest.

The core from 776 to 775 m has yielded a highly corroded pollen assemblage dominated by coniferous and angiospermous pollen.

The core from 763 to 764 m gave a somewhat more colourful spectrum, likewise of poor perservation. The proximity of a myricaceous swamp is implied.

The core from 763.3 to 761.0 m contains 17 percent of hillside conifers, and 10 percent is derived from a taxodiaceous-myricaceous swamp-and-marsh forest with *Nyssapollenites kruschi* ssp. *analepticus*. Next to it there is a lush mixed deciduous forest accountiny for 39 percent of the spectrum; 30 percent of the 39 are tricolporate forms. The riparian forest has contributed 25 percent. From the undergrowth, *Tubulifloridites ambrosiinae* and *Chenopodipollenites multiplex* are worth mentioning.

Consisting almost entirely of calcareous shells, the next core (759 to 761 m) yielded a total of four of pollen grains.

The core from 757 to 759 m has given a highly similar spectrum, apart from an advance of the swamp-and-marsh forest (28 percent). The undergrowth contributed among others *Graminidites* sp., *Ericipites* sp., *Lygodioisporites* sp., and *Stereisporites granulus*.

The core from 755 to 757 m reflects a slight retreat of conifers (27 percent) and a corresponding advance of deciduous trees.

In the core from 735 to 738 m, the abundance of conifers (72 percent) and the presence of foraminifera and hystrichosphaerids implies a marine transgression, obviously accompanied by a retreat of the seashore forest.

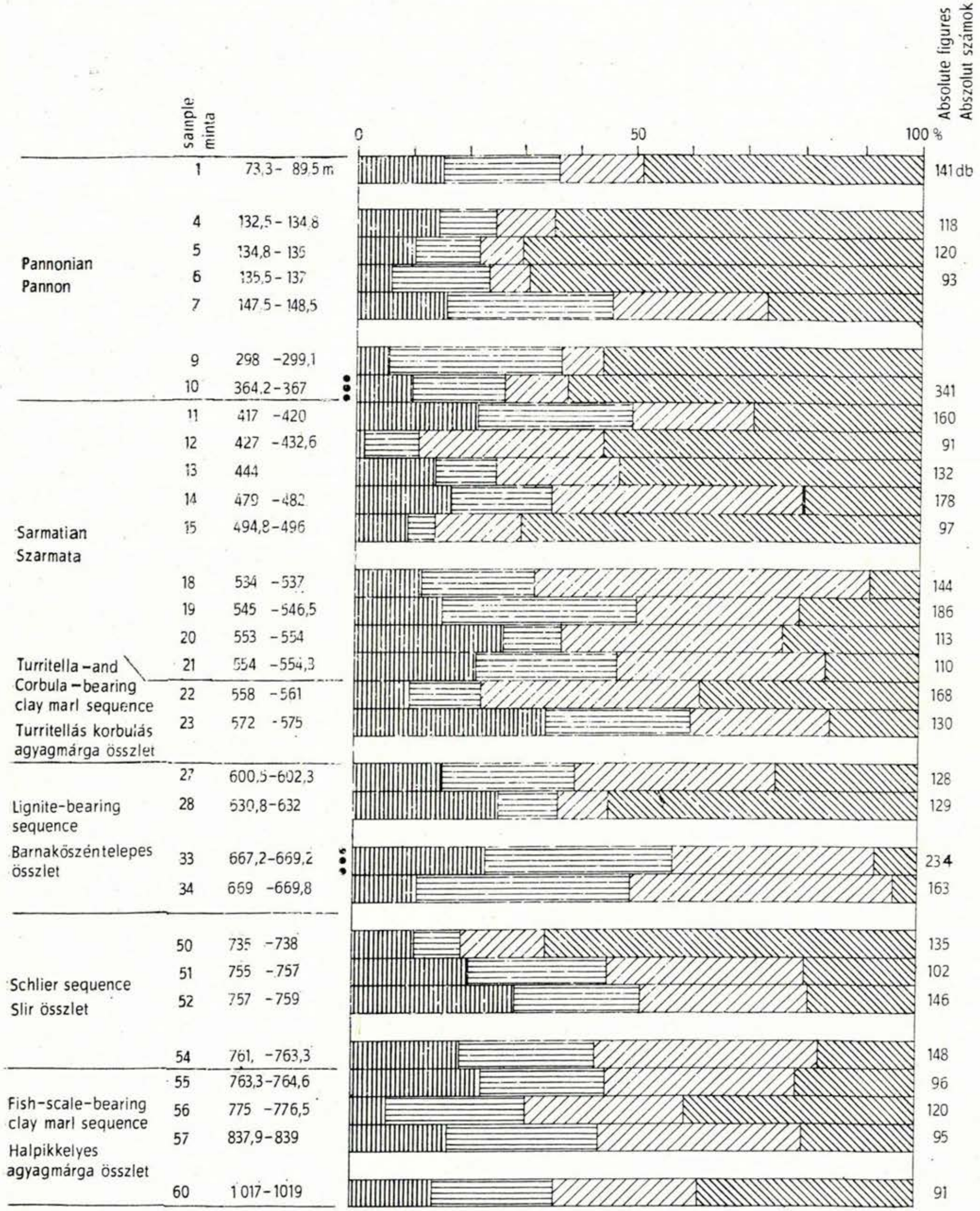


Fig. 57. Paleoecological diagram of borehole Hidas-53. (See legend to Fig. 49)

57. ábra. Hidas 53. sz. fúrás paleoökológiai diagramja. (Jelmagyarázatot l. a 49. ábránál.)

In the subtropical forest, the termophilic element is represented, besides the palms, also by the mother plants of *Dipterocarpacearumpollenites hidasensis, Tetracentracearumpollenites komlóensis, Sapotaceoidaepollenites obscurus, Rhoipites pseudocingulum.*

The core from 711 to 713 m is a sandy, pebbly limestone which yielded besides foraminifera and planktonic remains some scarce coniferous pollen and just a few grains of angiospermous pollen *(Cyrillaceaepollenites megaexactus, Tubulifloridites grandis)* and a few spores.

In the calcareous sandstone of the cores from 708.5 to 711.0 m there is a sparse assemblage of pollen and spores, a small fraction of those in the previous samples. The samples from 688.5 to 694.4 m do not lend themselves to an evaluation; their microfossils are planktonic foraminifera. A sample from 688.0 to 688.5 m, a relatively ill-consolidated marl of the l i t h o t h a m n i a n s e q u e n c e, yielded a fragmentary coniferous and angiospermous assemblage. The cores from 686.5 to 688.0, 683.0 to 672.5 m contained a marine microplankton (foraminifera, *Botryococcus* and others). The scarce palynomorph assemblage indicates a subtropical forest.

The two samples from 670.3 to 672.5 m (from the l i g n i t i c c o m p l e x) are almost sterile, with a few tissue remnants. The lignitic material from 669.8 to 670.3 m with stringers of gleaming brown coal is already richer in tissue fragments. The scarce taxodiaceous-myricaceous pollen assemblage is indicative of a swamp-and-marsh forest.

A clay-marl from 669.0 to 669.8 m yielded a pollen spectrum rich enough for evaluation, with 10 percent of gymnospermous pollen and a colourful assemblage of angiospermous pollen (see diagram Fig. 56). The undergrowth is reflected by *Caprifoliipites gracilis, Ilexpollenites margaritatus, Rhoipites pseudocingulum, Chloranthacearumpollenites dubius,* and a few spores such as *Laevigatosporites haardti* and *Echinatisporites variabilis.* Wet ground is indicated by taxodiaceous pollen, *Myricipites myricoides, Betulaepollenites betuloides.* A seashore assemblage is represented by *Chenopodipollenites maximus* and *Ch. minimus.*

The clay-marl from 667.2 to 669.0 m exhibits a floral assemblage much resembling the above one. Conifers are approximately as abundant (14 percent). The deciduous assemblage is even more varied (see pollen diagram of borehole Hidas-53). Besides taxodiaceous pollen, the swamp-or-marsh forest is indicated by *Myricipites rurensis, M. myricoides, Cyrillaceaepollenites megaexactus, Nyssapollenites kruschi* ssp. *analepticus, Utriculariaepollenites elegans.* Besides some algal remains *(Botryococcus)*, the seashore is indicated also by *Chenopodipollenites minimus.*

The samples from 666.8 to 667.2 and from 666.3 m are clay marls with much debris of gastropods interbedded in the lignitic succession. They are almost pollenless.

Between 665.1 and 666.8 m and between 659.5 and 659.8 m the bit traversed seams of lignite. The sparse pollen in the samples is taxodiaceous, myricaceous, indicative of the swamp-and-marsh forest. There are a few grains of angiospermous pollen, abundant fungal remains and tissue fragments as usual in lignites, and sparse plankton remains.

The pollen spectrum of the h y d r o b i a n c l a y - m a r l from 630.8

to 632.0 m reflects a taxodiaceous-myricaceous swamp and marsh with *Myricipites rurensis*, *Alnipollenites verus* and *Betulaepollenites betuloides*. Furthermore, the sample yielded a spectrum indicative of a lush subtropical forest, partly growing on elevated grounds or in the hills.

The core from 600.5 to 602.3 m is a clay marl. The pollen spectrum indicates a regression of conifers (28 percent), although the number of coniferous species is still substantial: some of them are taxodiaceous, accompanied by *Myricipites rurensis*, *Cyrillaceaepollenites megaexactus*, and *Betulaepollenites betuloides*. The deciduous forest assemblage includes *Dipterocarpacearumpollenites hidasensis*, known from the bottom of the Tortonian, and also some species of *Flacourtiaceae*. The undergrowth has included as in the above assemblage the mother plants of *Lobeliaepollenites erdtmani*, *Ericipites hidasensis*, *Rhoipites* sp. and ferns (*Echinatisporites* sp., *Osmundacidites* sp., *Leiotriletes* sp.).

In the samples from 599.7 to 592.3 and 592.7 to 593.1 (from the Tortonian lignitic complex), there are also some taxodiaceous pollen grains and scarce *Myricipites*. An open fresh-water surface is indicated by *Ovoidites ligneolus*. The lignite is rich in tissue remnants. A clay-marl from 590.2 to 590.7 m with fresh-water gastropods and stringers of carbonaceous clay contains scarce bladderless coniferous pollen, a few spores, and some pollen fragments. This core is considered to represent the top of the lignite-bearing sequence.

The turritellian-corbulacean clay-marl sequence (sample from 572 to 575 m) is post-lignite brackwater deposit. Its pollen spectrum still indicates a stand of *Taxodium* (13 percent) with *Myricipites rurensis* sparse enough (3.5 percent), *Cyrillaceaepollenites megaexactus*, *Nyssapollenites kruschi* ssp. *analepticus* and *Betulaepollenites betuloides*. The mixed deciduous forest presumably receded to the foothills.

The molluscan clay-marl from 558 to 561 m is proved to be Sarmatian by its zoofossils. The abundance of pines is remarkable (41.5 percent, including 14 percent of *Abietinaepollenites microalatus*, 19 percent of *Pityosporites labdacus*, 3 percent of *Piceapollenites neogenicus*; also *Tsugaepollenites igniculus* and *Abiespollenites absolutus*, both at 0.6 percent). In the mixed deciduous forest, *Tricolporopollenites henrici* is predominant (11 percent); its mother plant was accompanied by trees of the subtropical forest. The undergrowth is reflected by some spores and *Chenopodipollenites maximus*. A swamp is indicated by *Myricipites rurensis* (5 percent), some grains of taxodiaceous pollen, *Cyrillaceaepollenites megaexactus* and *Hydrosporites miocaenicus*.

In the spectrum from 554.0 to 554.0 to 554.3 m deciduous elements, the fagaceous pollen grains show an advance at the expense of the conifers. The pollen of the seashore swamp-and-marsh forest constitutes 26 percent of the spectrum.

The sample from 553.1 to 554.0 m reflects a comeback of conifers (44 percent, of which 16 percent is due, however, to taxodiaceous pollen). This and the 10 percent of *Myricipites* proves the continued presence of the swamp-and-marsh forest. The deciduous forest is largely represented by *Tricolporopollenites microhenrici*, indicative of the family *Fagaceae* (30 percent).

The pollen spectrum of the sample from 545.4 to 546.5 m is much similar to the preceding ones. The coniferous assemblage is sparser (34 percent) but more colourful. The deciduous forest is characterized, besides the *Fagaceae*, by an advance of more xerophilic elements (*Ilexpollenites iliacus, I. margaritatus*). Elements of the taxodiaceous swamp-and-marsh forest are also present.

At 9 percent, conifers are even more subordinate in the sample from 534 to 537 m. There are many species of deciduous trees but the general composition is much the same as in the preceding samples. *Ilexpollenites iliacus, I. margaritatus* and *Ephedripites* sp., indicative of a drier ground and climate, are also represented. The undergrowth is reflected by *Chloranthacearumpollenites dubius, Tubulifloridites anthemidearum* and some spores (*Echinatisporites hidasensis*). The seashore is reflected by chenopodiaceous pollen; marine deposition is proved by a few hystrichosphaerids and *Thalassiphora pelagica*. The elements of the characteristic taxodiaceous-myricaceous swamp are present also in this sample.

The calcareous sand and sandstone from 521.5 to 524.0 m and 510.3 m contains a few grains of bladderless coniferous pollen only.

The seashore forest whose pollen was found in the clay marl from 494.8 to 496.0 m presumably was a sparse one, whereas the hillside forest has yielded an abundant (75 percent) and colourful assemblage.

In the sample from 479.1 to 482.0 m, gymnosperms make up 23 percent; *Quercopollenites* in the fagaceous portion of the deciduous forest amounts to 12 percent of the spectrum. A dry-ground undergrowth is reflected by *Ephedripites (E.) mecsekensis. Caprifoliipites andreánszkyi, Ilexpollenites margaritatus, I. propinquus, Artemisiaepollenites sellularis*, a wet-ground flora by a few taxodiaceous species *Myricipites* sp., *Utriculariaepollenites elegans, Cyrillaceaepollenites megaexactus, Alnipollenites verus*, and *Betulaepollenites betuloides*.

The spectrum of the sample from 444.0 m is dominated by conifera in the high proportion (71.5 percent) characteristic of the Pannonian (*Pityosporites labdacus* 22 percent, *Abietinaepollenites microalatus, Piceapollenites* sp., *Cedripites deodaraeformis, Podocarpidites* sp., *Inaperturopollenites* sp.). Of the bladderless conifers s. str., only *Chamaecyparidipollenites flexuosus* could be identified. Among the deciduous trees, *Quercopollenites* sp., is predominant at 9 percent.

Also in the spectrum from 427.0 to 432.6 m, conifers are abundant (55 percent); they are accompanied by deciduous trees. The undergrowth is represented by scarce fern spores, *Graminidites* and *Ericipites* sp.

From 417 to 420 m there is 42 percent of conifers, of which *Ginkgo* makes up 17 percent, presumably as a result of some local enrichment. Half of the 20 percent mixed deciduous forest is represented by fagaceous pollen. A wet-ground assemblage includes taxodiaceous elements, *Sparganiaceaepollenites polygonalis*, and nymphaeaceous pollen.

In the core from 364.2 to 367.0 m there is 64 percent of coniferous pollen. *Pityosporites labdacus* is particularly abundant (30 percent); there is 14 percent of *Abietinaepollenites microalatus*, 3 percent each of *Abiespollenites absolutus* and *Piceapollenites* sp., and 2 percent of *Keteleeriaepollenites komlóensis*. The mixed deciduous forest reflects, at only 10 percent, quite a colourful assemblage. The riparian and swamp forest had also receded. A few hystrichosphaerids in the sample are presumably redeposited, and so are some spores (e. g. *Trilobosporites bernissartensis*).

In the core form 288.0 to 299.1 m, a wet-ground habitat is indicated by somewhat scarce taxodiaceous pollen, *Myricipites rurensis* and *Nupharopollenites kedvesii*. The riparian forest is more extensive, making up 32.5 percent of the spectrum; the mixed deciduous forest is as sparse as usual in Pannonian spectra (6.3 percent): hillside conifers are abundant (57 percent).

The carbonaceous clay-marl from 258.1 to 258.5 m contains scarce taxodiaceous and angiospermous pollengrains. Most of the colourful spore assemblage is redeposited. Local flora may have included *Leiotriletes hidasensis, L. microlepioidites* and *Laevigatosporites haardti*.

In the silty clay-marl from 147.5 to 148.5 m, there is again a rich pollen assemblage. The swamp-and-marsh forest makes up 15.2 percent of the spectrum. Open fresh water is indicated by *Myriophyllumpollenites quadratus* and *Ovoidites ligneolus*. The riparian forest contributed 30.4 percent, 6 percent of which is *Caryapollenites simplex*. The share of the riparian forest is somewhat greater than before (28.2 percent), but the conifers have receded (26.2 percent). Forms presumably redeposited include *Polypodiaceoisporites speciosus*, *Spongiosisporites* cf. *spongiosus*. A remarkable feature is the presence of dinoflagellates.

In the samples from 137.0 to 132.5 m, the mixed deciduous forest, riparian and swamp forest are subordinate compared to the mountain forest. Deposition in fresh or very slightly saline water is indicated by some *dinoflagellates* and *Ovoidites ligneolus*.

The sample from 126.6 to 132.5 m is a muddy clay with carbonized plant tissue remnants, poor in pollen and spores. Despite the small number of specimens, the coniferous assemblage is colourful enough. Of the very scarce angiosperms, the presence of *Plantaginacearumpollenites hidasensis* is remarkable. Of the spores representing the undergrowth, *Ophioglossisporites grandis, Polypodiaceoisporites mecsekensis* and *P. acutus* are worth mentioning.

The spectrum of the sample from 118.0 to 126.6 m includes besides some mountain conifers and also a few taxodiaceous pollen grains. These latter, with a few tissue remnants, *Myricipites* sp., *Nyssapollenites* sp., and *Betulaepollenites* sp. indicate the proximity of a swamp. A dry-terrain deciduous forest is reflected by *Tricolporopollenites densus*, *T. microhenrici*, *Tricolporopollenites cingulum* ssp. *pusillus*, *Ulmipollenites undulosus*, *Ilexpollenites margaritatus* and compositaceous pollen. Of the spores, *Cicatricosisporites mecsekensis* is presumably due to redeposition into this assemblage. A few planktonic fossils including dinoflagellates indicate deposition a fresh-water.

The sample from 73.3 to 89.5 m has yielded a particularly rich assemblage. The swamp forest, riparian forest, and mixed deciduous forest make up a total of 51 percent, the rest having been contributed by the hillside forest. *Sparganiaceaepollenites polygonalis*, *Nymphaeaepollenites* sp., *Myriophyllumpollenites quadratus*, *Ovoidites ligneolus*, and dinoflagellates indicate a fresh-water habitat.

The Pleistocene loess sample from 11.8 to 12.68 m is entirely devoid of pollen; it contains but a few tissue remnants.

In the *Hidas Mine*, 8 seams of lignite are distinguished. I have studied 9 samples of my own collection from seam II.

Sample 1 from the footwall of the seam is a clay with fine sand. The one-time lignite swamp-and-marsh are represented by 18 percent of coniferous pollen, *Nyssapollenites* sp., and very abundant *Myricipites* 53 percent; *Alnipollenites verus* and *Cyperacearumpollenites* can be relegated to the swamp assemblage. In a fresh-water habitat, the mother plants of *Tetraporina quadrata* and *Nymphaeaepollenites* were thriving. The seashore forest is indicated by *Zelkovaepollenites potoniéi*, *Caryapollenites simplex*, the mixed deciduous forest by *Tricolporopollenites microhenrici*, *T. henrici*, *Quercopollenites* sp., *Tricolporopollenites cingulum* ssp. *fusus* (*Fagaceae* at about 8 percent), *Engelhardtioidites microcoryphaeus*, *Magnoliaepollenites simplex*, and *Arecipites* sp. The undergrowth is represented by *Triporopollenites coryloides*, *Ericipites* sp. and a few spores.

On the occasion of a second sampling of seam II, sample 53, a tuffaceous material collected at the same level as sample 1, gave a spectrum composed of scarce taxodiaceous and myricaceous pollen, and some other fresh-water plants (*Cyperaceaepollenites* sp., *Sparganiaceaepollenites* sp., *Graminidites*, *Jussiaeapollenites champlainensis*). There are a few grains of magnoliaceous pollen, *Tricolporopollenites henrici*, and *Tricolporopollenites cingulum* ssp. *pusillus*. A remarkable feature is the abundance of *Heliotropioidearumpollenites rotundus* and the presence of tissue fragments.

The tissue fragments in the lignite sample denoted No 2. indicate dicotyledons and palms. There are also taxodiaceous pollen and some spores. The fresh-water plankton organism *Savitrina miocaenica* is fairly abundant.

Sample No 3, a woody lignite, contains abundant tissue fragments and fungal remains, beside a few grains of taxodiaceous pollen and a few spores. Besides masses of coniferous tissue fragments, a cross section of a pith ray, possibly of *Ulmus*, has also cropped up (Pl. LVI, Fig. 2).

In sample No 4, likewise a woody lignite, there are besides the taxodiaceous pollen also some grains of *Zelkovaepollenites potoniéi*, *Caryapollenites simplex*, *Caprifoliipites andreánszkyi*, *Faguspollenites* sp., *Ulmipollenites* sp., and *Myricipites* sp. The material is corroded and poorly preserved.

Sample No 5. is a lignite with tuffaceous stringers. Beside abundant tissue fragments and fungal remains, this sample contains, too, some fragments of coniferous pollen grains and a few spores (*Leiotriletes maxoides minoris*). The angiosperms are represented by *Tricolporopollenites microhenrici*, *Zelkovaepollenites potoniéi*, *Quercopollenites robur type*, *Tricolporopollenites cingulum* ssp. *pusillus*, *T. pseudocingulum*, *Tetracentracearumpollenites komlóensis*, *Heliotropioidearumpollenites rotundus*, *Sapotaceoidaepollenites* sp., *Momipites punctatus*, *Myricipites bituitus*, *M. myricoides*, *Caryapollenites simplex* and *Engelhardtioides microcoryphaeus*.

Sample No 6 is a clay, likewise tuffaceous, from the seam roof. The swamp-and-marsh forest is indicated by taxodiaceous pollen, *Myricipites* sp., *Jussiaeapollenites champlainensis*, nymphaceous pollen, *Cyrillaceaepollenites megaexactus*, and *Alnipollenites verus*. The seashore forest included mother plants of *Tricolporopollenites cingulum* ssp. *pusillus*, *Tricolpopollenites liblarensis* ssp. *fallax*, *Quercopollenites* sp., *Porocolpopollenites stereoformis*, *Ulmipollenites miocaenicus*, *Zelkovaepollenites potoniéi*. The few fern spores may be interpreted as representing the undergrowth. The hillside forest is reflected by

Ginkgoretectina neogenica and a few fragments of bladderless coniferous pollen.

The sandy clay of sample No 7 includes just a few pollen grains of *Taxodiaceae*, *Sapotaceae* and *Nymphaeaceae*.

In the calcareous marl of sample No 8., the proximity of the taxodiaceous-myricaceous swamp can also be demonstrated.

The 59 samples collected by Ádám Grossz were taken from seams 4, 5, and 6, and from the lignite-bearing sequences of *borehole Hidas-88, -89*, -91, and 105. Most of the lignite samples yielded abundant plant tissue and vegetal debris; the marl samples gave rich spectra of the taxodiaceous swamp type encountered also in the lignite-bearing sequence of borehole Hidas-53. The abundant plankton assemblages permit to distinguish layers of sediment deposited in fresh and brackish water.

Borehole Komló 120 constitutes an important key section of the western region of Pécsszabolcs–Mánfa–Komló. 36 samples from this borehole of 554.6 m depth examined (Textfig. 58).

The first sample examined had come from 492 m depth. In the sample from 400.5 to 416.1 m a rather rich material was found, but the spectrum consists entirely of Liassic forms. Up to 374.7 m depth, the palynomorphs are largely Liassic with only an occasional Miocene form.

The spectrum of sample from 374.7 m (from the fish-scale complex) is already a decidedly Tertiary one. The percentage ratios of the paleoecologic units (see Fig. 59) much resemble those in the fishscale-bearing sequence of borehole Hidas-53, except for a slightly higher abundance of the mixed deciduous forest: 46 percent in the sample just mentioned, 52 percent in the one from 374.4 to 374.7 m, and somewhat less (31 percent) in the one from 372.0 to 374.4. In this latter sample, coniferous pollen is abundant (44 percent).

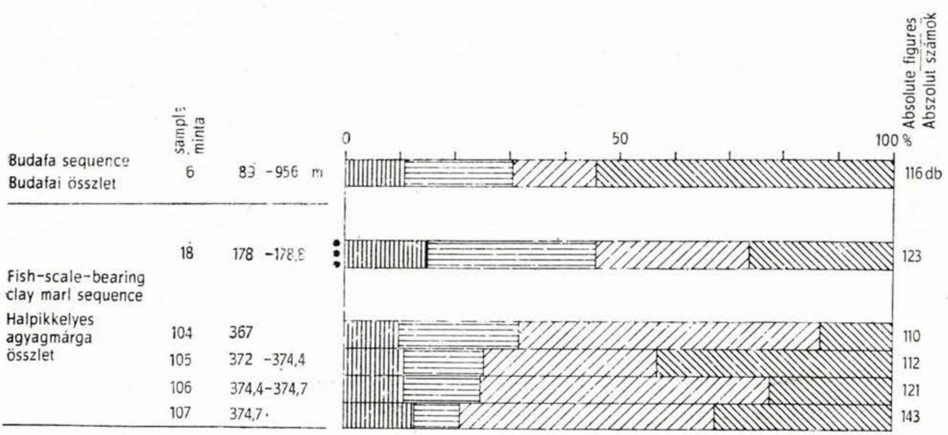


Fig. 59. Paleoecological diagram of borehole Komló-120. (See legend to Fig. 49)
59. ábra. Komló 120. sz. fúrás paleoökológiai diagramja. (Jelmagyarázatot l. a 49. ábránál.)

In the sample from 367 m depth, 8.4 percent of taxodiaceous pollen and some scarce grains of *Myricipites* indicate a wet habitat. In the seashore forest, *Caryapollenites simplex* is enriched up to 17 percent; some grains of *Pterocaryapollenites* have also been encountered. It is here that the abundance of the mixed forest is the greatest (55 percent).

A sample from the top part of the fish-scale-bearing sequence (178.0 to 178.8 m) has yielded a spectrum of numerous species (see the diagramme of borehole Komló-120).

The slightly sandy clay-marl from 89.0 to 95.6 m is from the ''schlier'' sequence. Its palynomorph spectrum is largely varied, with 54 percent of mountain conifers. The swamp forest is represented by *Taxodiaceae, Cyrillaceaepollenites megaexactus, Alnipollenites verus, Betulaepollenites betuloides* and *Carexpollenites* sp. The mixed deciduous forest has yielded many species but a smaller population compared to the preceding type. The undergrowth is reflected by *Rhoipites pseudocingulum, Ilexpollenites margaritatus, Cistacearumpollenites* sp., *Triporopollenites urticoides, Plantaginacearumpollenites soói, Stereisporites* sp., *Leiotriletes microlepioidites*.

The samples between 89 and 10 metres are devoid of palynomorphs.

From *borehole Zengővárkony*-59, of 105 m depth. I have examined 23 samples (see Fig. 60) The bottom of the well from 94.7 to 105 m, is in the Helvetian congerian sequence; its limestones and calcareous marls are palynologically sterils.

In the fish-scale-bearing sequence, clay-marls from 73 to 83 m have given pollen spectra revealing a colourful vegetation (cf. the pollen diagramme of borehole Zengővárkony 59). The percentages of the palaeocenologic units are much the same as in the fish-scale complex of borehole Hidas 53 (see the palaeoecological diagrams Fig. 61).

A dacite tuff intercalated at 73.0 to 73.5 m is devoid of pollen.

The upper portion of the fish-scale-bearing sequence from 73 m up to 60.9 m reveals a not less colourful vegetation, with a similar distribution over cenologic units, except for a slight advance of the coniferous forest from the mountains. Farther up, in the 56.0 to 60.9 m interval, the enrichment of spores reflects the extension of the riparian forest, at the expense of the hillside stands of conifers which latter had been more abundant formerly. Between 48.5 m and 56.0 m, the mountain conifers become more abundant once more, as a result of the drowning of the nearshore vegetation by the advancing sea. (Note that in diagram Fig. 61, the swamp or marsh forest is represented by only 2 percent, the riparian forest by 7 percent and the mixed deciduous forest by 13 percent of the spectrum).

The silty clay-marl from 46.8 to 48.5 m does not contain palynomorphs in an abundance sufficient for an evaluation. Its point of interest is a tissue fragment presumably belonging to the species *Cycadopites miocaenica* (Pl. XXVIII, Fig. 4 and Pl. XXIX, Fig. 1–2).

The sample from 44.7 to 46.8 m is entirely devoid of palynomorphs.

In the scanty pollen spectrum of the ''schlier''-sequence sample from 44.4 to 44.7 m, the percentage of the swamp-and-marsh forest is still low (4 percent), the riparian forest is somewhat more extensive (17 percent), whereas the mixed deciduous forest makes up 31 percent of the spectrum.

PERCENTUAL DISTRIBUTION OF PALYNOMORPHS IN BOREHOLE ZENGŐVÁRKONY 59

A ZENGŐVÁRKONY 59.sz. FÚRÁS SPÓRA-POLLENÉRTÉKEINEK %-os DIAGRAMJA

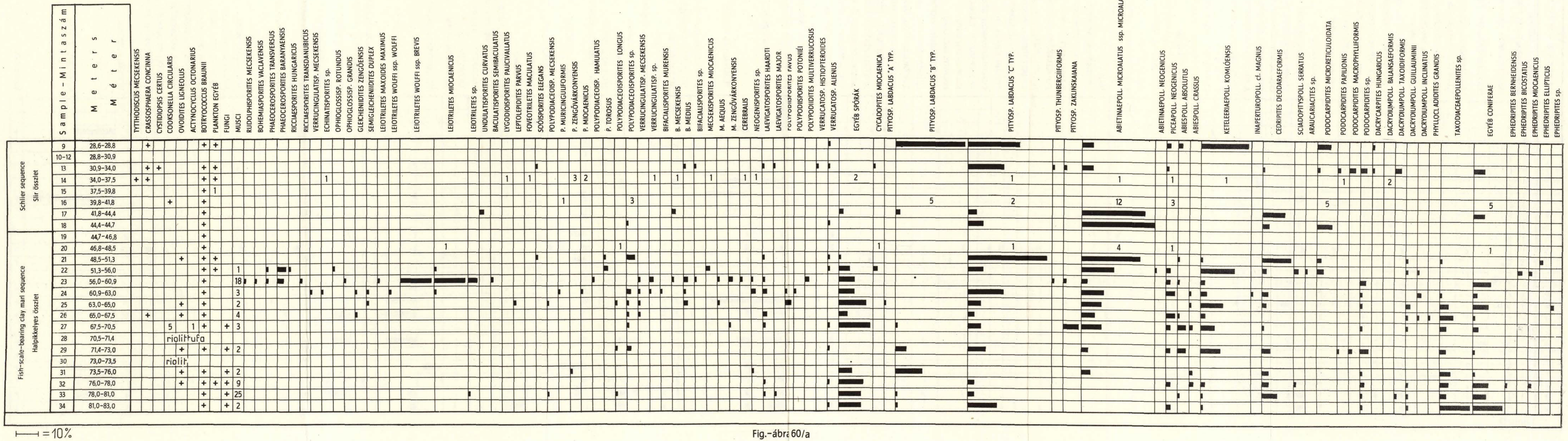
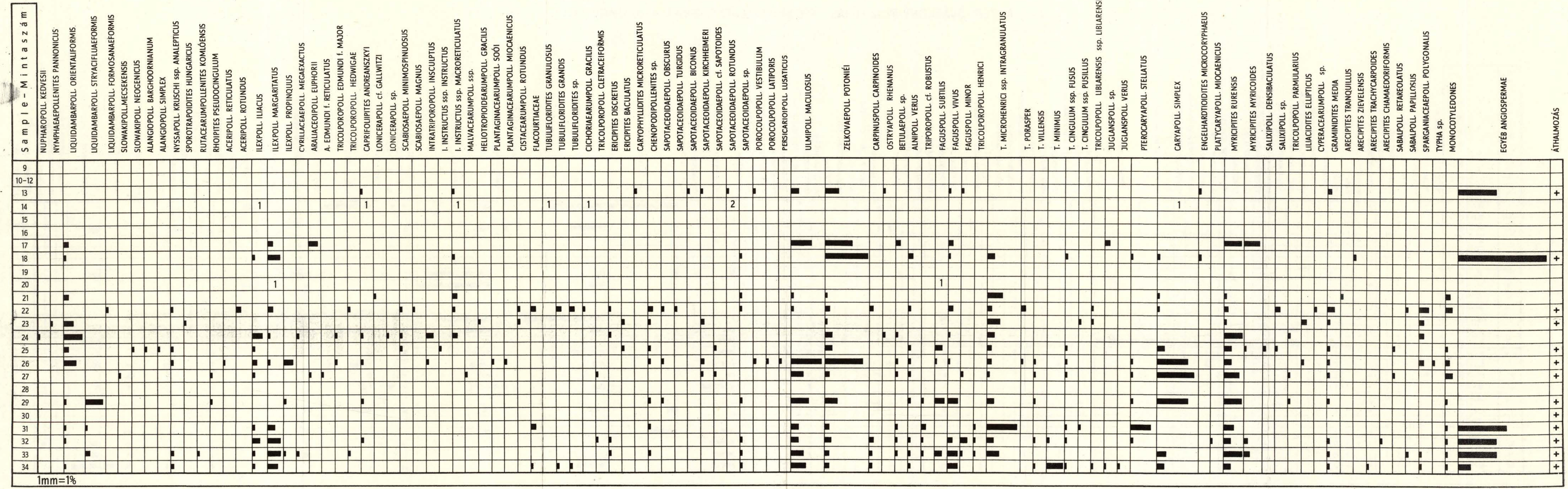


Fig.-ábra 60/a


Sample – Mintaszám
NUPHAROPOLL. KEDVESII
NYMPHAEAEPOLLENITES PANNONICUS
LIQUIDAMBARPOLL. ORIENTALIFORMIS
LIQUIDAMBARPOLL. STRYACIFLUAEFORMIS
LIQUIDAMBARPOLL. FORMOSANAEFORMIS
SLOWAKIPOLL. MECSEKENSIS
SLOWAKIPOLL. NEOGENICUS
ALANGIOPOLL. BARGHOORNIANUM
ALANGIOPOLL. SIMPLEX
NYSSAPOLL. KRUSCHI ssp. ANALEPTICUS
SPOROTRAPOIDITES HUNGARICUS
RUTACEARUMPOLLENITES KOMLÓENSIS
RHOIPITES PSEUDOCINGULUM
ACERIPOLL. RETICULATUS
ACERIPOLL. ROTUNDUS
ILEXPOLL. ILIACUS
ILEXPOLL. MARGARITATUS
ILEXPOLL. PROPINQUUS
CYRILLACEAEPOLL. MEGAEXACTUS
ARALIACEOIPOLL. EUPHORII
A. EDMUNDI f. RETICULATUS
TRICOLPOROPOLL. EDMUNDI f. MAJOR
TRICOLPOROPOLL. HEDWIGAE
CAPRIFOLIIPITES ANDREANSZKYI
LONICERAPOLL. cf. GALLWITZI
LONICERAPOLL. sp.
SCABIOSAEPOLL. MINIMOSPINUOSUS
SCABIOSAEPOLL. MAGNUS
INTRATRIPOROPOLL. INSCULPTUS
I. INSTRUCTUS ssp. INSTRUCTUS
I. INSTRUCTUS ssp. MACRORETICULATUS
MALVACEARUMPOLL. ssp.
HELIOTROPIOIDEARUMPOLL. GRACILIS
PLANTAGINACEARUMPOLL. SOÓI
PLANTAGINACEARUMPOLL. MIOCAENICUS
CISTACEARUMPOLL. ROTUNDUS
FLACOURTIACEAE
TUBULIFLORIDITES GRANULOSUS
TUBULIFLORIDITES GRANDIS
TUBULIFLORIDITES sp.
CICHORIAEARUMPOLL. GRACILIS
TRICOLPOROPOLL. CLETRACEIFORMIS
ERICIPITES DISCRETUS
ERICIPITES BACULATUS
CARYOPHYLLIDITES MICRORETICULATUS
CHENOPODIPOLLENITES sp.
SAPOTACEOIDAEPOLL. OBSCURUS
SAPOTACEOIDAEPOLL. TURGIDUS
SAPOTACEOIDAEPOLL. BICONUS
SAPOTACEOIDAEPOLL. KIRCHHEIMERI
SAPOTACEOIDAEPOLL. cf. SAPOTOIDES
SAPOTACEOIDAEPOLL. ROTUNDUS
SAPOTACEOIDAEPOLL. sp.
POROCOLPOPOLL. VESTIBULUM
POROCOLPOPOLL. LATIPORIS
PERSICARIOIPOLL. LUSATICUS
ULMIPOLL. MACULOSUS
ZELKOVAEPOLL. POTONIÉI
CARPINUSPOLL. CARPINOIDES
OSTRYAPOLL. RHENANUS
BETULAEPOLL. sp.
ALNIPOLL. VERUS
TRIPOROPOLL. cf. ROBUSTUS
FAGUSPOLL. SUBTILIS
FAGUSPOLL. VIVUS
FAGUSPOLL. MINOR
TRICOLPOROPOLL. HENRICI
T. MICROHENRICI ssp. INTRAGRANULATUS
T. PORASPER
T. VILLENSIS
T. MINIMUS
T. CINGULUM ssp. FUSUS
T. CINGULUM ssp. PUSILLUS
TRICOLPOPOLL. LIBLARENSIS ssp. LIBLARENSIS
JUGLANSPOLL. sp.
JUGLANSPOLL. VERUS
PTEROCARYAPOLL. STELLATUS
CARYAPOLL. SIMPLEX
ENGELHARDTIOIDITES MICROCORYPHAEUS
PLATYCARYAPOLL. MIOCAENICUS
MYRICIPITES RURENSIS
MYRICIPITES MYRICOIDES
SALIXIPOLL. DENSIBACULATUS
SALIXIPOLL. sp.
TRICOLPOPOLL. PARMULARIUS
LILIACIDITES ELLIPTICUS
CYPERACEARUMPOLL. sp.
GRAMINIDITES MEDIA
ARECIPITES TRANQUILLUS
ARECIPITES ZIEVELENSIS
ARECIPITES TRACHYCARPOIDES
ARECIPITES CHAMAEDORIFORMIS
SABALPOLL. RETAREOLATUS
SABALPOLL. PAPILLOSUS
SPARGANIACEAEPOLL. POLYGONALIS
TYPHA sp.
MONOCOTYLEDONES
EGYÉB ANGIOSPERMAE
ÁTHALMOZÁS
9
10–12
13
14
15
16
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32
33
34
1mm=1%

Fig.-ára 60/b.

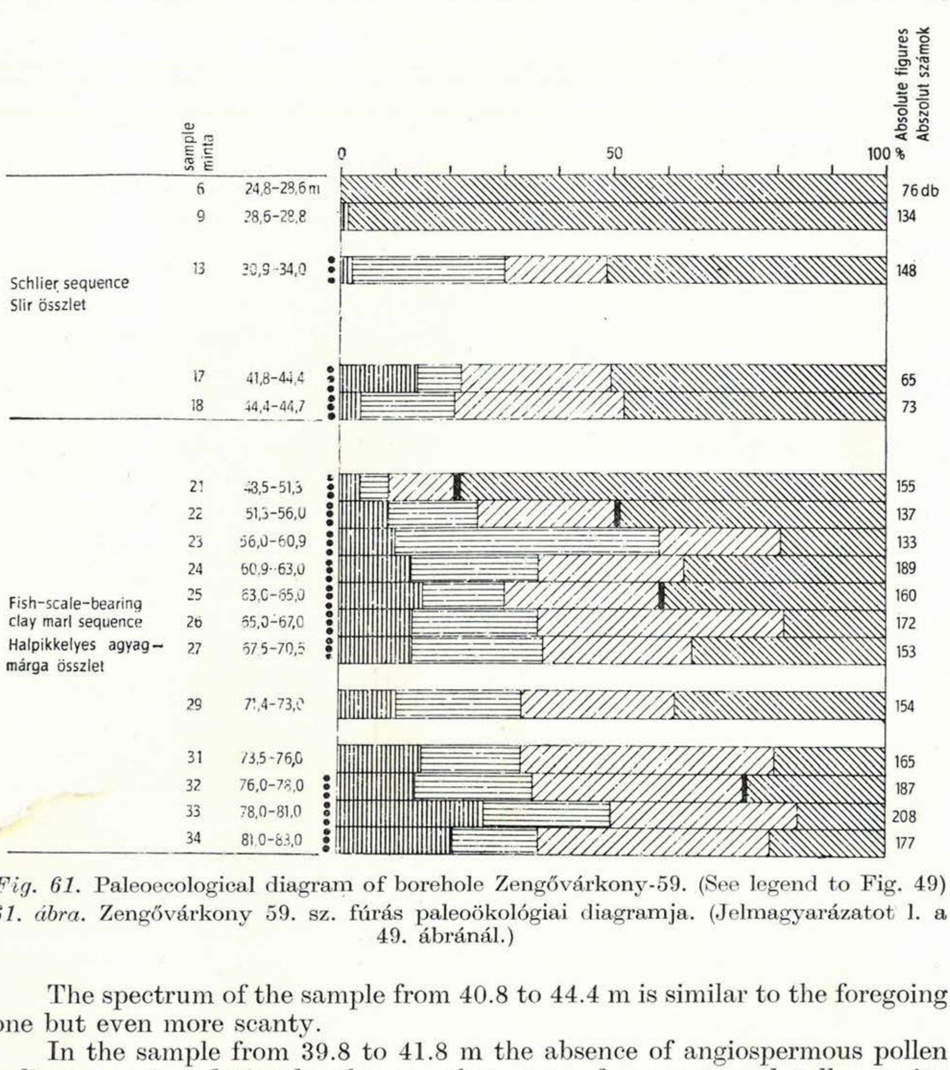

Fig. 61. Paleoecological diagram of borehole Zengővárkony-59. (See legend to Fig. 49)
61. ábra. Zengővárkony 59. sz. fúrás paleoökológiai diagramja. (Jelmagyarázatot l. a 49. ábránál.)

The spectrum of the sample from 40.8 to 44.4 m is similar to the foregoing one but even more scanty.

In the sample from 39.8 to 41.8 m the absence of angiospermous pollen indicates an inundation by the sea; there are a few spores and pollen grains from hillside conifers.

The sample from 37.5 to 39.8 m is completely sterile except for a few colonies of *Botryococcus*; in the sample from 34.0 to 37.5 m, the planktonic organisms (*Crassosphaera concinna, Tytthodiscus mecsekensis* and other species) associated with a scanty assemblage of palynomorphs indicate the deepening of the sea.

The sample from 30.9 to 34.0 m reveals a further advance and deepening of the sea by its rich assemblage of marine plankton (*Crassosphaera, Emslandia, Cystidiopsis* etc.). This is borne out also by the high percentage (42) of mountain conifers and the scarcity of palynomorphs from the deciduous seashore forest.

Beyond its planktonic assemblage, the sample from 28.6 to 28.8 m proves a further advance of the sea, by the fact that its palynomorph spectrum consists almost exclusively of the pollen of mountain conifers.

The silty calcareous marls from 28.6 to 24.8 m are devoid of palynomorphs.

From *borehole Pécsvárad-XLIV* of 242.6 m depth, I have examined nine samples for purposes of orientation. The sample from 231.0 to 236.1 m is a finely banded clay-marl with a palynomorph assemblage characteristic of the f i s h - s c a l e - b e a r i n g s e q u e n c e. The wet-ground seashore association is reflected by taxodiaceous and nymphaeaceous pollen and species of *Myriophyllumpollenites*. The riparian forest is indicated by *Pterocaryapollenites stellatus*, *Caryapollenites simplex* (8 percent), *Alnipollenites verus* (7 percent). The mixed deciduous forest is represented by *Liquidambarpollenites* sp., *Carpinuspollenites carpinoides*, *Tricolporopollenites microhenrici*, *Sapotaceoidaepollenites* sp., *Intratriporopollenites instructus*, *Tricolporopollenites cingulum* ssp. *oviformis*, *Porocolpopollenites rotundiformis*, *Ulmipollenites maculosus*, species of *Juglandaceae*, *Pityosporites* and *Dacrydiumites* and a few spores from the undergrowth (*Laevigatosporites haardti*, *Verrucatosporites alienus*, *Neogenisporis* sp., *Gleicheniidites* sp., and moss spores).

Brackish water is indicated by *Baltisphaeridium:* bits of coal and other vegetal debris may represent the flotsam. The mountains have left their mark in the form of *Keteleeriaepollenites* and *Abientinaepollenites microalatus*, the latter in the considerable 34 percent abundance.

The samples below, belonging to the Tortonian "s c h l i e r" sequence are of sandy lithology and, as a result, scarce in palynomorphs.

The scanty spectrum of the sample from 173.7 to 175.8 m is insufficient for an evaluation, but the forms included in it agree with the spectra determined thus far. There are bits of coal and tissue remnants both in this sample and in the one from 154.5 to 160.1 m.

The spectra of the samples from 150.0 to 152.8 m, 134.8 to 135.5 m and 110.0 to 115.0 m also include but a few specimens which indicate, notwithstanding, a vegetation much like the previous ones. The planktonic organisms in the two latter samples indicate deposition in a marine medium.

In the Tortonian l i g n i t e - b e a r i n g - s e q u e n c e, the sandstone sample from 49.6 to 49.9 m is devoid of palynomorphs; the sample from 39.7 to 42.8 m is very nearly so, except for some carbonized tissue fragments.

The h e t e r o s t e g i n i a n s a n d s t o n e from 9.8 to 11.0 m contains only planktonic forms, except for a few grains of coniferous pollen.

2. Paleoclimate

The investigation of the palaeoclimate is faced with many difficulties, becouse the research of the basic spore-and-pollen flora could not meet all requirementy concerning the botanical relationship.

The taxons used for paleoclimatological evaluations based on present-day spores and pollens can be seldom identified. Because our evaluations are limited, the determination is considered successful, if the genus is identified. However, by the aid of some recent families, certain climatic conclusions can be drawn (e. g. *Palmae*, *Sapotaceae*, *Symplocaceae*, etc.). There exist some cosmopolitan genera which do not support a more precise estimation, in spite of the fact that, in the first place, we use the plant remains in the evaluation of the one-time climate.

In the Mecsek Mountains in the Neogene a large-scale decrease in temperature can be found as compared to other parts of Europe. The temperature curve however, cannot be held for regular, as it shows variations much influenced by different factors.

Conclusions as to the climate of the region being considered have been inferred from the pollen spectra reflecting the contemporaneous vegetation which, however, was highly influenced by the microclimate. Our present-day knowledge, however, is not enough for the evaluation of such details.

Changes in temperature can be the result of hypsometric elevation which should also be taken into consideration. Very often we can give a realistic evaluation only on this basis. My investigations together with geological record, have contributed to paleogeographic reconstructions, according to which we can suppose that there was a mountain on the inset relief, near the one-time sedimentation basin. In such a way, the elements indicating a colder climate can be evaluated as common highland elements of the subtropical climate.

The exposition of the slopes played an important role in the estimation of the temperature.

There was hardly any possibility for estimating the precipitation conditions in relation to climatic factors, on the basis of my palynological studies. At the same time, the *Ephedra* species and *Compositae* forms were taken for representatives of a drier climate.

Starting from the principle of actualism, we can suppose, that the direction played a marked role in pollen-transport, could be the cycle of winds in the sea-and-shore and mountain-and-valley relatives, winds that brought the pollen material independently from the dominant wind directions, into the sedimentation basin. Of course, if the daily wind directions coincided with the dominant one, pollen grains could be brought here very great distances. This air movement was responsible for pollen transport even in the lacustrine phases. The hypothesis is justified by the fact that in the spectra the pollen products of highland vegetation can be constantly found.

The researched areas were of a littoral position. Representing, as believed an extensive inner lake shore, they could provide a balanced climate for the vegetation in the latest Neogene time. In the whole Neogene I studied, the general type of the steady climate was *subtropical*, a confirmation for the opinion of Staub (1878, p. 138), Andreánszky (1955, Plate I) and Pálfalvy (1964).

Tropical floral elements are relatively rare so a tropical climate is not manifested anywhere by the vegetation. Tropical floral elements can occur in subtropical areas as undergrowth (Rübel, 1930, p. 69–70), which means that the presence of some tropical species do not absolutely indicate a tropical climate. Some bryophytes *(Anthocerotaceae)*, the representatives of *Echinatisporites*, *Polypodiaceoisporites*, *Cicatricosisporites* and the *Gleicheniidites* spores, were evaluated as tropical elements, representing *Cycadaceae* and

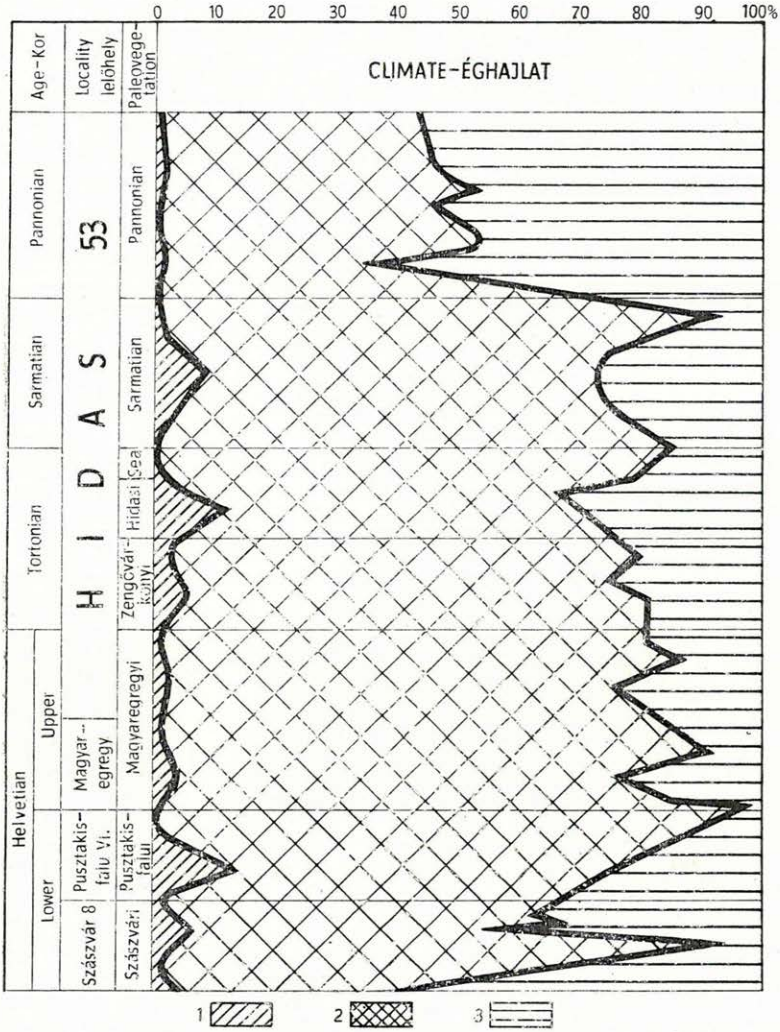

Fig. 62. Percentual distribution of the elements of the Mecsek Mountains Neogene flora according to temperature preferences. — *1.* Tropic, *2.* subtropic, *3.* temperata

62. ábra. A mecseki neogén flóra elemeinek hőmérsékletigény szerinti %-os megoszlása. — *1.* Trópusi, *2.* szubtrópusi, *3.* mérsékeltövi

Acmopyle pollen grains, *Sapotaceae* family, *Jussiaeapollenites*, *Dipterocarpacearumpollenites* species, some species (*edmundi*, *euphorii* types) of the *Araliaceae* family and *Arecipites* species.

The oldest Neogene sequence is Helvetian (see Fig. 62). The samples from the lower—terrestrial—part of borehole Szászvár-8 (434.5 to 432.5 m) indicate a subtropical climate (*Szászvár pattern*). Tropical elements are represented in a relatively low percent (0.6 to 5.4%). In the spectrum the subtropical elements are predominant (47.7 to 93%). Although I referred, in conformity with the principle of actualism, the species of the genus *Zelkova*, occurring in the younger complexes of the series, to the warmer temperate-zone elements; the *Zelkova* species from the Szászvár series, were taken for subtropical elements. The results of the research show that the species discovered here in the younger sequences are rare and I suppose that their heat demand in greater.

In my opinion the *Tricolporopollenites microhenrici* type, which is affine with the family *Fagaceae*, is a subtropical element like some other species of this family, which in palynological literature are mentioned to be of Earlier Tertiaty age. The *Tricolporopollenites cingulum* ssp. *oviformis* of the *Castanea* genera seems to be the representative of a warmer temperate zone *T. cingulum* ssp. *pusillus*, like the representatives of the genus *Castanopsis* may have derived from a drier forest (see KRÜSSMANN 1960, p. 284). This is proved by the fact, that wherever in the pollen spectra we find a lot of "*cingulum*"-type pollens, there the *Ephedripites* pollen grains are also represented.

The species whose pollens occur in the material of the borehole Szászvár-8 and which are assumed to have come from a temperate zone, could live mainly on the higher stretches of the hillsides, as indicated by the *Keteleeriaepollenites*, *Piceapollenites* species and by some other *Coniferae* pollen grains. A stronger temperature fluctuation (between 2.5 and 4.2%) is shown by the low proportion of spores.

In the P u s z t a k i s f a l u p a t t e r n I summarized all records of the freshwater, lacustrine phase I could identify in several boreholes (Pusztakisfalu No-VI, Zengővárkony No-45) and also in some samples of the northern part of the Mecsek Mountains. All the samples contain a lot of ferns (between 11.8 and 74.4%). These together with the pollens of *Salix*, represent a well-balanced climate and riparian vegetation. Upward in the profile of the above boreholes, subtropical elements tend to increase (48.5 to 97.9%). Though the tropical elements generally decrease upward, this fact is not quite regular.

In the Pusztakisfalu pattern, representing a dense stand of riparian vegetation, the elements of the temperate zone, originating from a faroff hillside, have been less populous and their ratio is consequently rather low. An exception in this regard is the sample from borehole Pusztakisfalu No-VI (between 25 and 27.1 m), where the spectrum is shared with 42 percent temperate-zone elements. Most likely here we must reckon with the thinning of the typical riparian vegetation and with the appearance of hillside vegetation. Therefore, the proportion of tropical elements may have been relatively high (8.9%) which can be explained by a southerly exposure.

In the *M a g y a r e g r e g y p a t t e r n* the pollen spectra of the Helvetian section shows a subtropical climate. Subtropical species average up to 80 percent. The proportion of the tropical elements, originating from the same level of different boreholes is similar (in borehole Komló-120: 2.7%, in borehole Hidas-53: 3%, in borehole Zengővárkony-59: 2.6%). The climate demand of the assemblage can be easily compared with that of the deciduous and evergreen broadleaves forest south of the Yang Tze (HOU, CHEN, WANG 1956, p. 6–8); with that mentioned by RÜBEL (1930, p. 61) or ANDREÁNSZKY (1959, p. 232) as *Laurisilvae* and with the vegetation type of *Laurilignosa* of Soó (1962, p. 69). Comparing the geological and paleontological data, we have to suppose a subtropical archipelago, whose paleogeographical position recalls the position of the southern islands of Japan and Taiwan.

The *Zengővárkony pattern*, representing the Lower Tortonian includes two facies: both the amphistegina-bearing limestone (borehole Hidas-53) and the "schlier" samples (borehole Zengővárkony-59) give evidence for a transgression. The amount of tropical elements (*Sapotaceae, Symplocaceae*, tropical ferns and the pollen of *Cycadaceae* species) are presumably due to the balancing effect and the expansion of the sea. Beside the evidence of subtropical mixed forest in both of the boreholes, in the borehole Hidas-No 53 there are also traces of frondiferous species (e. g. *Fagus*) which represent the somewhat colder local climate of the pediment.

The *Hidas pattern* has been yielded by the Middle Tortonian lignite-bearing sequence. The pollen assemblages give evidence mainly of a humid regional climate, presumably with a relatively high air moisture. In this subtropical swamp-and-marsh forest, the percentage of tropical elements is comparatively high (an average of 7%). But, the proportion of deciduous elements of the temperate zone (7.4%) is also significant. The same results were reported by ANDREÁNSZKY (1959, p. 285) as to the contemporaneous macroflora which seems to have included highland floral elements admixed to the swamp vegetation.

In *Upper Tortonian* time, the transgression of rotalia-bearing seawater inundated the Hidas area and drowned the peat bog. At the same time, on the basis of the increasing proportion of the colder-highland floral elements (10.6%) in the pollen-spectrum, we can conclude on a cooling of climate. The Upper Tortonian deposits pass over into the Sarmatian without any change in the pollen spectrum. It is impossible to draw a boundary on a paleofloristic basis here.

Conversely in the centre of the *Sarmatian* sequence of the Mecsek Mountains, change in climate can be detected, as in the younger samples the share of the tropical elements is rather low. (At the base of the Sarmatian, borehole Hidas-53, 554 and 554.3 m, their quantity is 7%). In borehole Hidas-53, from 496 m upward, despite the scarce tropical pollen grains occuring in the Sarmatian samples, the vegetation is like that of the Pannonian. The pollen representing subtropical and temperate zone elements can be correlated with pollen species of the Mediterranean or South-Chinese floral realms (Soó 1962, p. 92 and HOU, CHEN, WANG 1956, p. 7).

In borehole Hidas-53, from 432.6 m upward, the *Pannonian* sequence contains subtropical and temperate-zone species and conifers represented in a high percentage. Consequently at the deposition of these strata, something like the present-day Mediterranean climate was predominant. The great quantity of conifer pollen grains suggests and emergence and a resultant orography higher than the present-day Mecsek Mountains.

VI. GENERAL EVALUATION

The present state of palynology in Hungary requires first of all the description of basic flora: this is why the main goal of the palynological study of the Mecsek Mountains Neogene was just the *description of the basic spore-and-pollen flora*. This done, it became possible to outline *patterns of vegetation* and to sketch up the *paleogeographical*, *paleoclimatical* and lithofacial conditions. The results serve as a basis for further research and contribute to the detailed geological mapping of the mountains and to the correlation of the deposits.

The *basic spore-and-pollen flora* of the Mecsek Mountains Neogene includes the following taxonomic units (see Hungarian text, pp. 46—51):

Phylum: **PYRRHOPHYTA:** genera 29, species 52, from these n. g. 1, n. sp. 9. The author described altogether genera 9, species 25 from the Mecsek Mountains.

Phylum: **CHRYSOPHYTA:** genera 1, species 1.

Phylum: **CHLOROPHYTA:** genera 2, species 2.

Phylum: **BRYOPHYTA:** genera 7, species 12; genera 3, species 7 **Nagy.**

Phylum: **PTERIDOPHYTA:** genera 37, species 110, n. g. 5, n. sp. 46. The author described a total of 8 genera and 64 species.

Phylum: **GYMNOSPERMAE:** genera 23, species 50, from there 3. n. g., 28 n. sp., the author has described altogether 4 genera, and 31 species.

Phylum: **ANGIOSPERMAE:** The reported angiospermous forms belong to 84 genera and 170 species, of which 35 genera and 78 species have first been described here. Of the angiosperms, the author has described a total of 36 genera and 81 species from the Mecsek Mountains.

In an appendix, I have reported zoofossils from the phylum **RHIZOFLAGELLATA:** *Foraminifera*; **INCERTAE SEDIS:** *Scolecodonta*.

The genera and species reported from the Mecsek Mountains Neogene number 184 and 398, respectively, of which 45 genera and 162 species have first been described here. So these latter—taken together with the new taxa published earlier from the Mecsek Mountains—make up a total of 60 genera and 208 species described by the author herself.

The spore-and-pollen assemblages could be classed into *ecologic units*. Units similar in composition, facies and geological age could be labelled as *floral patterns*. All floral patterns represent florae of subtropical nature, with medium-tall hills nearby.

The changes of the flora and of the facies resulted in the development of the following aspects: The *Szászvár pattern* is the warm subtropical mixed forest of the Helvetian terrestrial sequence, with xerophilic forms and freshwater planktonic organisms.

The *Pusztakisfalu pattern* is the reflection of a lush riparian or lakeshore flora with ferns on a wet-ground, with numerous cosmopolitan elements in the limnic sequence of the Helvetian. *The Magyaregregy aspect* represents the Helvetian fish-scale-bearing sequence it is one of the most widespread, ones, with a mixed evergreen and deciduous forest of particularly colourful composition. The uppermost samples indicate a marine transgression.

The *Zengővárkony pattern* reflects the flora of the "schlier" sequence, a subtropical vegetation under an equable oceanic climate on the shore of the open sea, with two subdivisions. The calcareous deposits contain a riparian vegetation with a greater abundance of cooler foothill or hillside forms: the clays and clay-marls deposited farther offshore gave more thermophilic forms.

The *Hidas pattern* is the humid flora, including numerous tropical elements, of the swamp-and-marsh forest of the Tortonian lignite formation.

The *Sarmatian pattern* following the marine ingression above the lignitic sequence is already richer in deciduous elements, some of which are still tropical, however.

The *Pannonian pattern* had already developed in the uppermost Sarmatian samples, with abundant pollen grains of mountain conifers (*Abies, Tsuga* etc.) and a complete lack of tropical elements. The Pannonian is subdivided into an upper and a lower unit by a phase of intense reworking.

In a general way, the flora is of *holarctic affinities*. The Helvetian *Szászvár pattern* includes a greater proportion of East Asiatic-partly paleotropical-elements than of Near Eastern or North American ones. In the *Pusztakisfalu pattern* the wet and fresh-water elements are largely cosmopolitan. The *Magyaregregy pattern* with its overall holarctic character includes more East Asiatic than North American elements. In the undergrowth, Mediterranean elements are more numerous than in that of the foregoing pattern. The palynomorph spectrum of the *Zengővárkony pattern* is less colourful, owing to lithology and the marine transgression. The spectrum of the *Tortonian lignite-bearing sequence* suggests, within the composition determined by the lignitic lithofacies, an assemblage consisting largely of East Asian deciduous elements of the Northern Hemisphere. The *upper part* of the *Tortonian* and the *lower part* of the *Sarmatian* have yielded—besides a few tropical elements due to the influence of an oceanic climate—largely deciduous Northern Hemisphere forms of mountainous preferences. The late part of the Sarmatian exhibits a mixture of elements of Mediterranean and temperate affinities, with conifers indicating the uplifting of the mountains.

The entire *flora is comparable* to the *other Neogene florae* of the Carpathian Basin and adjacent basin areas which possess the common trait that some of their tropical elements persist into the Sarmatian and Pannonian.

The *paleoclimatic information* that can be gleaned from the fossil assemblage of the Mecsek Mountains indicates in its main line a cooling from a warm subtropical to a warm temperate climate (Fig. 62). The cooling rate was not by far uniform: it is particularly the special local climatic episodes which deviate from this main line. The climate of the Pusztakisfalu pattern is *warmer* and *more humid* than that of the *drier* Szászvár pattern. The Magyaregregy facies represents a *more steady climate,* but the variegated ecological types represented in it suggest an unsteady microclimate. At the end of the period characterized by the Magyaregregy pattern, the climate was uniformized by the marine transgression.

Also the lower Tortonian exhibits a *steady oceanic, warm subtropical climate.* Even during the *local humid warm subtropical episode* of the lignitic facies, the pollen of xerophytic plants, present also in the preceding fish-scale-bearing sequence and in the subsequent Sarmatian, indicate *drier* regions nearby. The Sarmatian spectra already indicate a *cooler subtropical climate.*

In the Lower Sarmatian there are still some tropical elements in the undergrowth. Farther on in the Sarmatian, and in the Pannonian, there is a flora indicating a more steady, *Mediterranean*, or *warm temperate climate*. The change in the flora is most intimately connected with the gradual cooling. The rate of cooling is not uniform: superimposed on it are fluctuations, dependent upon the climatic rhythm on the one hand, and on local and microclimatic phenomena influenced by geological and geomorphological changes, on the other.

Pollen spectra have enabled me to distinguish dry-land, fresh-water and marine habitats, by evaluating the pollen of xerophytic, fresh-water and seashore plants. Immediate inferences as to the *facies of deposition* in the sedimentary basin could be drawn from the planktonic organisms (cf. also NAGY, 1965a, b; 1966; 1967). Beside the lithofacies, also the origin of the detritus could be determined from the presence of redeposited forms.

The floral elements thus inferred and the floral determined confirm the geological profile established beforehand. The sequence of floral facies that can be set up as a standard can be correlated with the inferences drawn from the zoomicrofossils (Fig. 2). The floral changes are not necessarily functions of the palaeofaunistical or geological changes in any period, and floral limits do not necessarily coincide with the geological boundaries drawn by the geologists on the basis of the latter.

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TÁRGYMUTATÓ

SUBJECTS INDEX

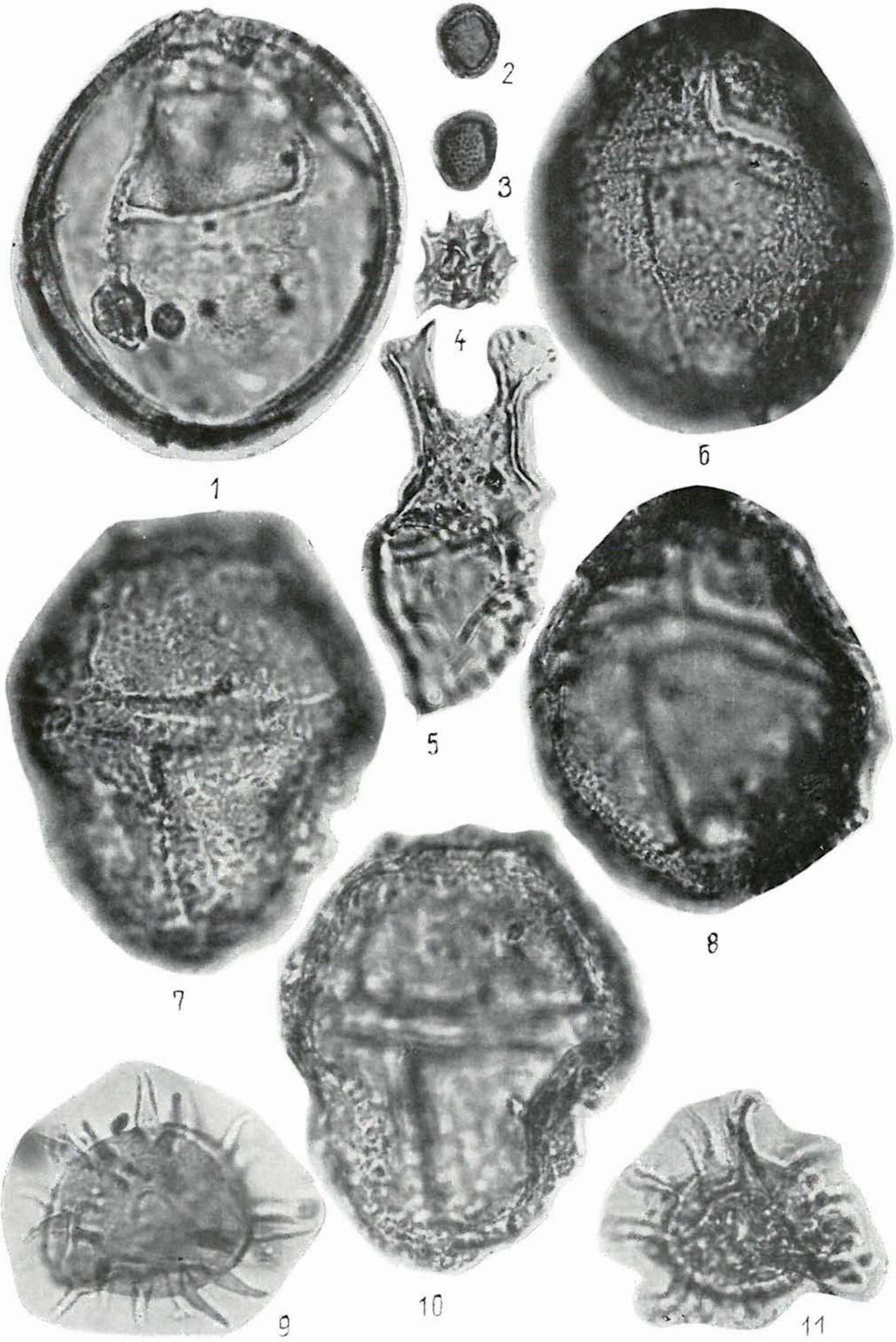
TÁBLÁK

PLATES

I. Table — Plate I

1. *Palaeoperidinium nudum* n. sp. — Holotype
2., 3. *Micrhystridium* cf. *deflandrei* VALENSI 1958 — Redeposited
4. *Micrhystridium* cf. *inconspicuum* (DEFL. 1935) DEFLANDRE 1937 — Redeposited
5. cf. *Hystrichosphaeridium* sp. — Redeposited
6., 8. *Palaeoperidinium mecsekense* n. sp. — Holotype
7., 10. *Gonyaulax reticulatus* n. sp. — Holotype
9. *Baltisphaeridium brevispinosum* (EISENACK 1931) EISENACK 1958 — Redeposited
11. *Micrhystridium fragile* DEFL. 1947 — Redeposited

1. Hidas 53. sz. f. 132,5—134,8 m
2., 3. Hidas 53. sz. f. 534—537 m
4. Szászvár 8. sz. f. 432,7—433,5 m
5. Hidas 53. sz. f. 668—668,5 m
6., 7., 8., 10. Hidas 53. sz. f. 134,8—135,5 m
9. Komló 120. sz. f. 178,0—178,8 m
11. Szászvár 8. sz. f. 430—431,1 m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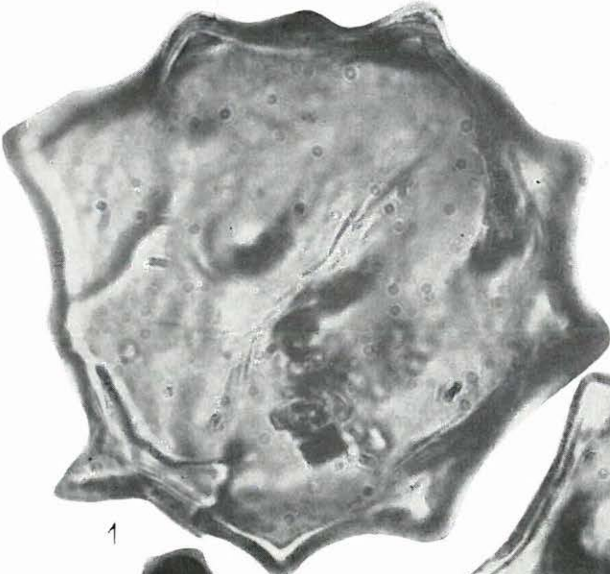
II. Tábla — Plate II

1. *Deflandridium stellatum* n. g. n. sp.
2. *Savitrinia miocaenica* NAGY 1966
3., 4., 6. *Deflandridium stellatum* n. g. n. sp. — Generotype
5. *Tetraporina quadrata* BOLCHOVITINA 1953

1., 3., 4., 6. Hidasbánya V. telep 34. minta
2., 5. Hidas II. telep 1. minta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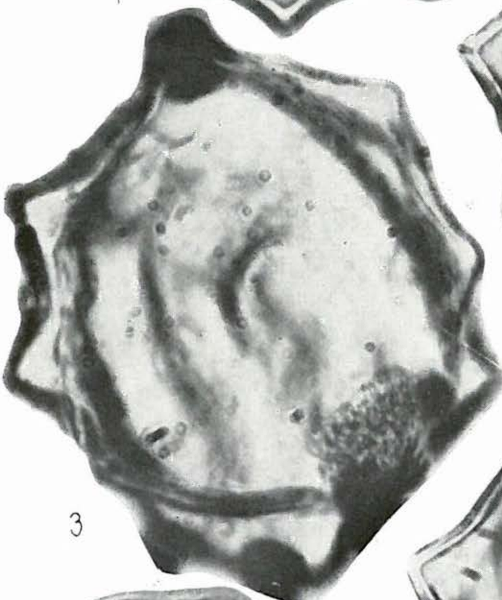
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III. Tábla — Plate III

1. *Baltisphaeridium cf. trifurcatum* (EISENACK 1931) DOWNIE et SARJEANT 1963 — Redeposited
2. cf. *Dinoflagellata* sp.
3. *Hidasia duigana* NAGY 1965 f. *magna* n. f. — Formatype

4., 5. *Cystidiopsis certus* NAGY 1965

6. *Botryococcus braunii* KÜTZG. 1849

1. Hidas 53. sz. f. 755—757 m
2. Hidas 53. sz. f. 658,8—659,1 m
3. Hidas 53. sz. f. 686,5—688 m

4., 5., 6. Zengővárkony 59. sz. f. 30,9—34 m


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IV. Tábla — Plate IV

1. *Baltisphaeridium heteracanthum* (DEFL. et COOKSON 1955) DOWNIE et SARJEANT 1963 — Redeposited

2., 3. *Baltisphaeridium ciliatum* n. sp. — Holotype — Redeposited

4., 7., 8. *Cymatiosphaera hungarica* n. sp. — Holotype

5. *Baltisphaeridium* sp. 1. — Redeposited

6., 9. *Cymatiosphaera elliptica* n. sp. — Holotype

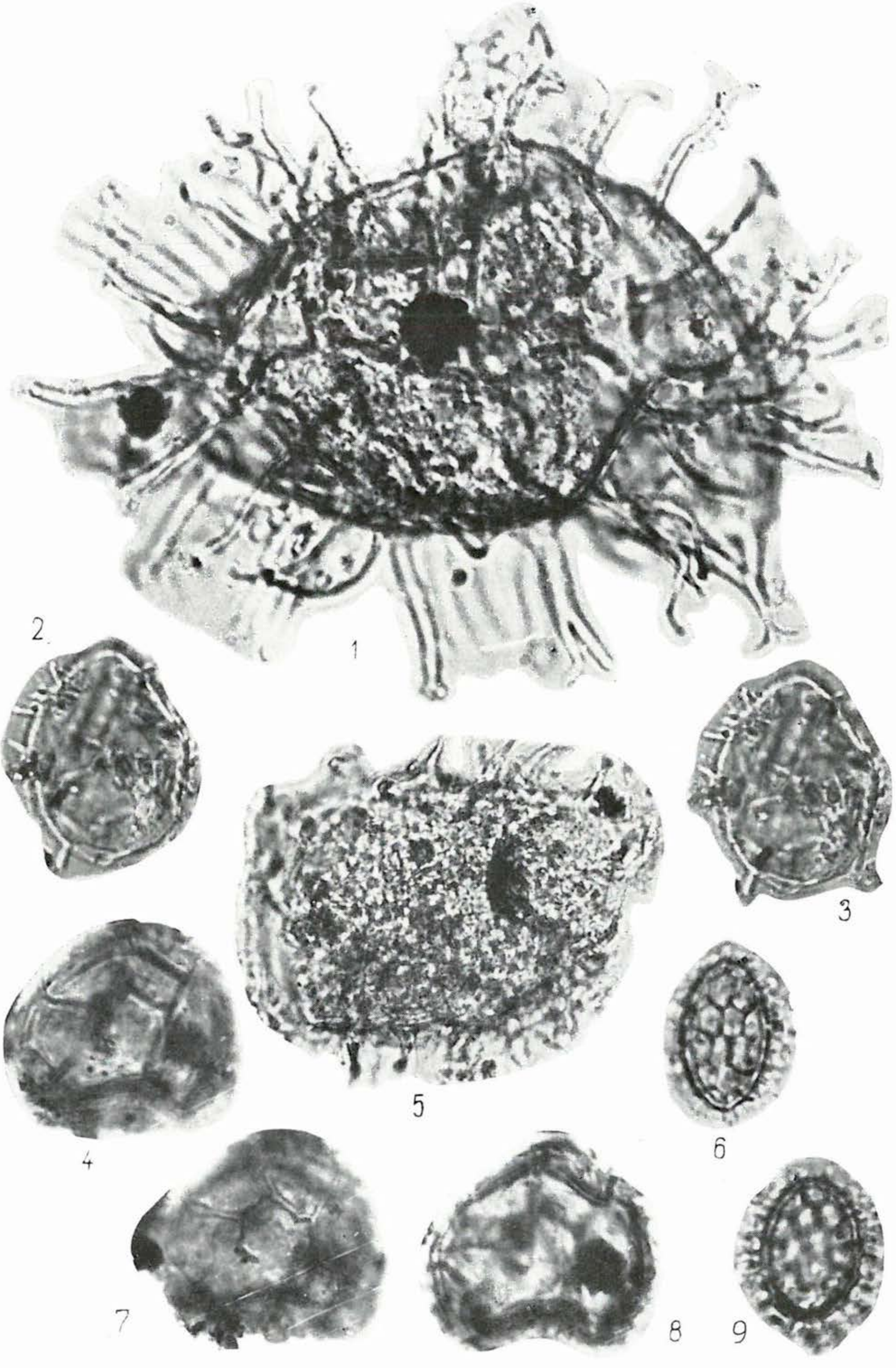
1. Hidas 53. sz. f. 735—738 m

2., 3. Hidas 53. sz. f. 590,7—592,3 m

4., 7., 8. Hidas 53. sz. f. 558–561 m

5. Hidas 53. sz. f. 672,5—676 m

6., 9. Almáspatak II. 0,10—0,20 m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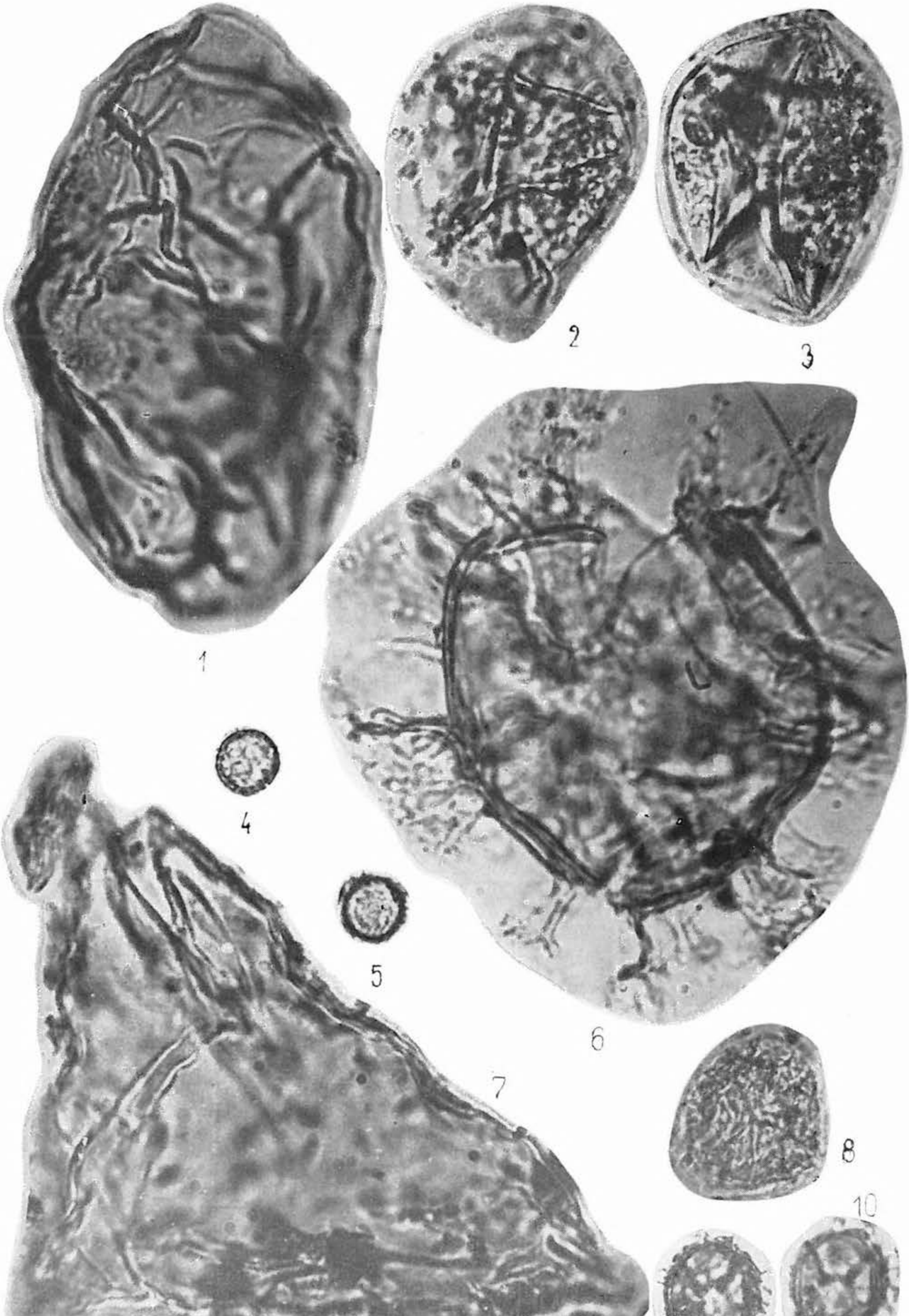
V. Tábla — Plate V

1. *Leiosphaeridia* sp. 2.
2., 3. *Hidasia flexibilis* n. sp. Holotype
4., 5. *Micrhystridium cf. operosum* DEFL. 1937; Redeposited
6. *Baltisphaeridium oligacanthum* n. sp. — Holotype — Redeposited
7. ? *Ceratocystidiopsis* sp. — Redeposited
8. *Hidasia velata* n. sp. — Holotype
9., 10. *Cymatiosphaera microreticulata* NAGY 1965

1. Komló 120. sz. f. 178—178,8 m
2., 3., 8. Hidas 53. sz. f. 479,1—482 m
4., 5. Hidas 53. sz. f. 688,5—690 m
6. Hidas 53. sz. f. 298—299,1 m
7. Hidas 53. sz. f. 590,7—592,3 m
9., 10. Hidas 53. sz. f. 686,5—688 m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VI. Tábla — Plate VI

1., 5. *Leiosphaeridia* sp. 1. — Redeposited
2. *Baltisphaeridium* sp. 2.
3. cf. *Hexagonifera chlamydata* Cooks. et Eis. 1962 — Redeposited
4. *Kalyptea* sp. — Redeposited
6. *Pyxidiella* sp. — Redeposited

1., 5. Hidas 53. sz. f. 630,8—632 m
2. Komló 120. sz. f. 178—178,8 m
3. Hidas II. 53. minta
4. Hidas 53. sz. f. 711—713 m
6. Hidas 53. sz. f. 73,3—89,5 m


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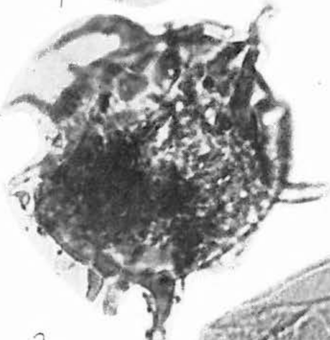
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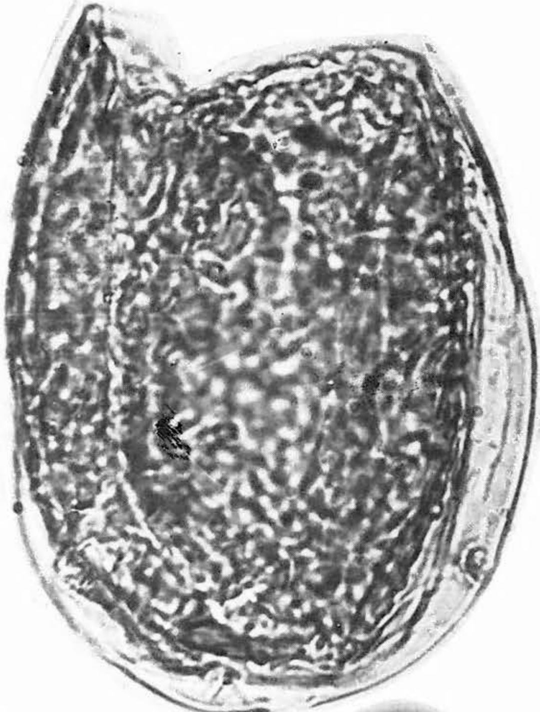
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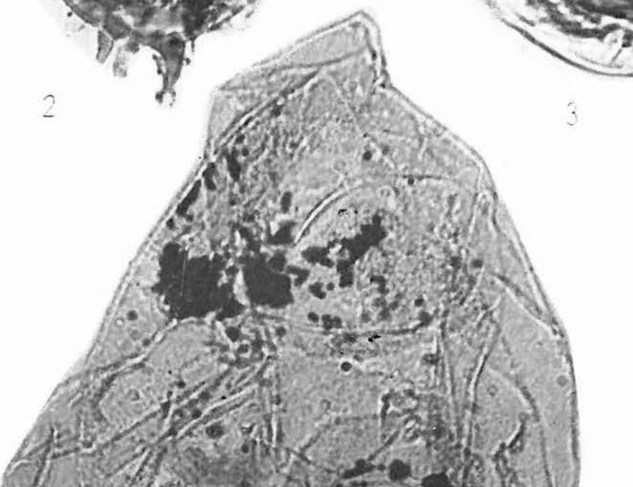
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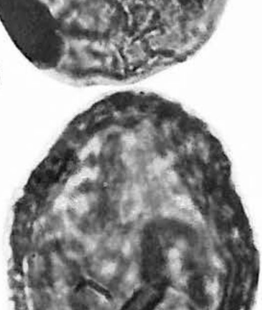
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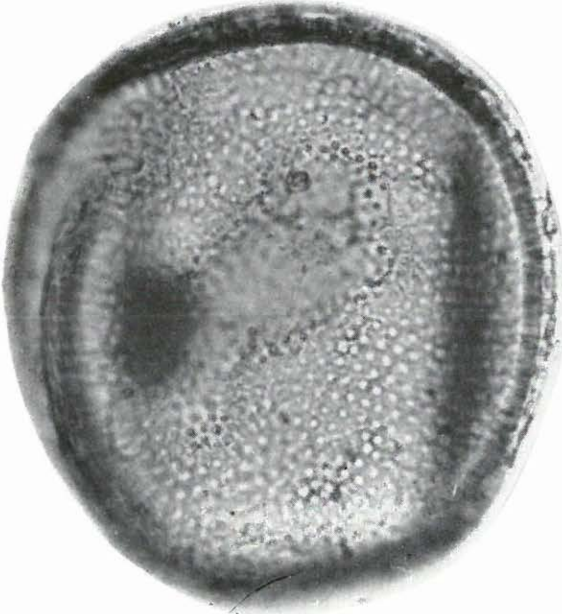
VII. Tábla — Plate VII

1. *Crassosphaera concinna* Cookson et Manum 1960
2. cf. *Leiofusa* sp. — Redeposited
3. *Savitrinia magna* Nagy 1966
4. *Margosphaera velata* Nagy 1965

1., 4. Zengővárkony 59. sz. f. 30,9—34 m
2. Hidas 53. sz. f. 147,5—148,5 m
3. Hidas 53. sz. f. 630,8—632 m



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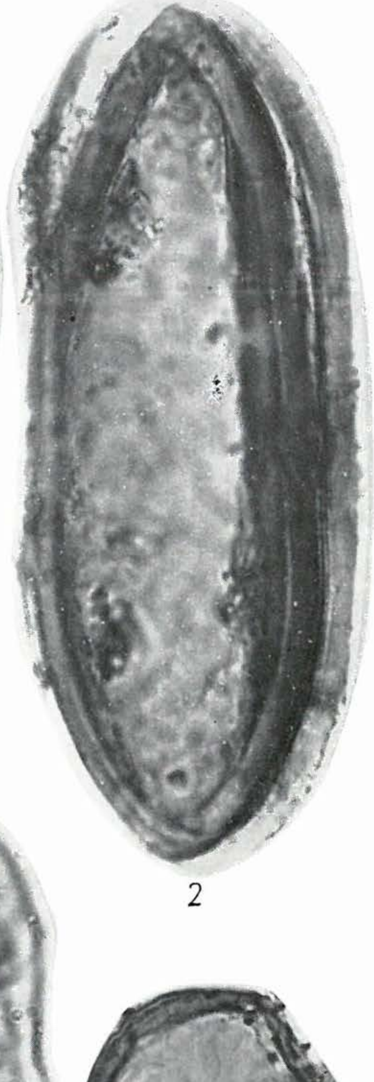

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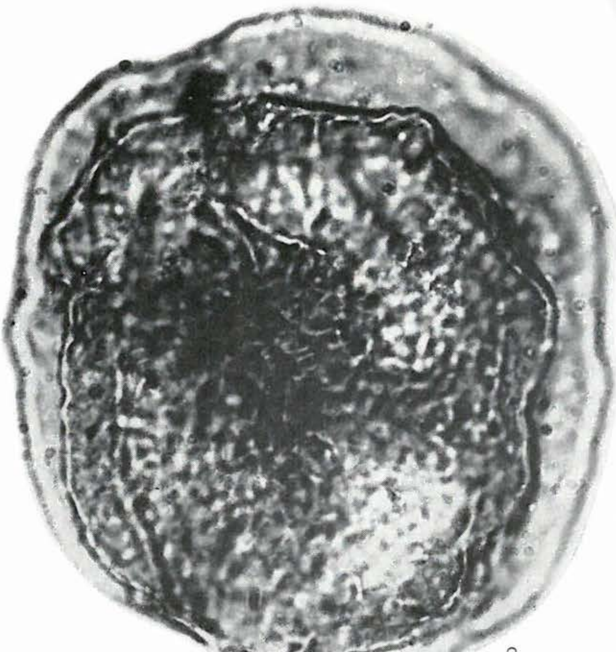

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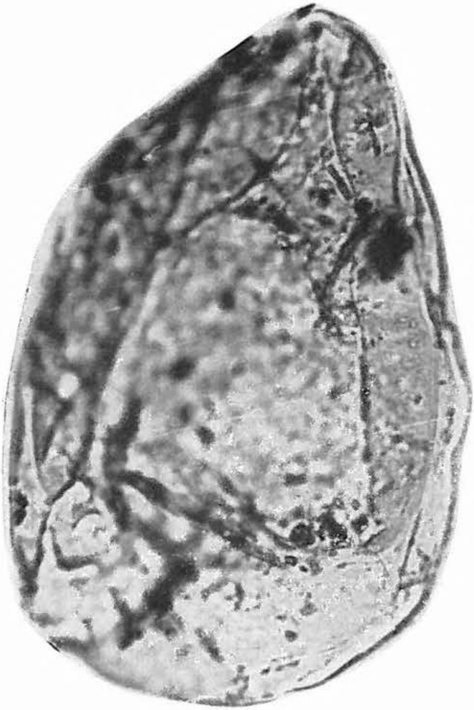
VIII. Tábla — Plate VIII

1. *Form B* — 500 x
2. *Form A* — 500 x
3. *Tytthodiscus mecsekensis* NAGY 1965
4., 5. *Heliospermopsis hungaricus* NAGY 1965

1. Komló 120. sz. f. 374,7 m
2. Zengővárkony 59. sz. f. 67,5—70,5 m
3. Zengővárkony 59. sz. f. 34—37,5 m
4., 5. Pusztakisfalu VI. sz. f. 15—17 m



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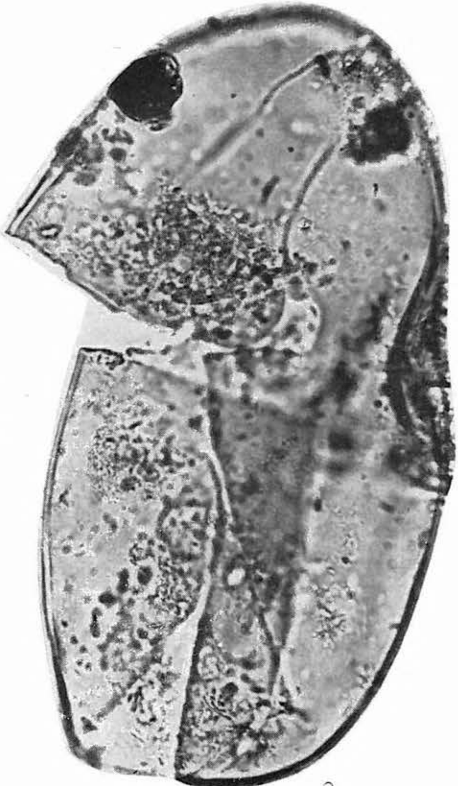

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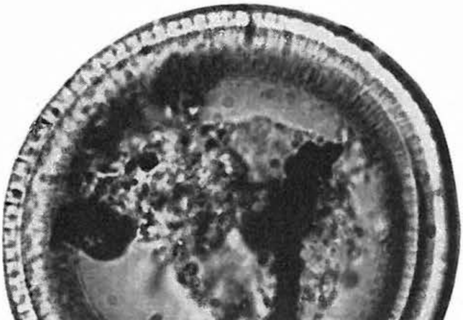

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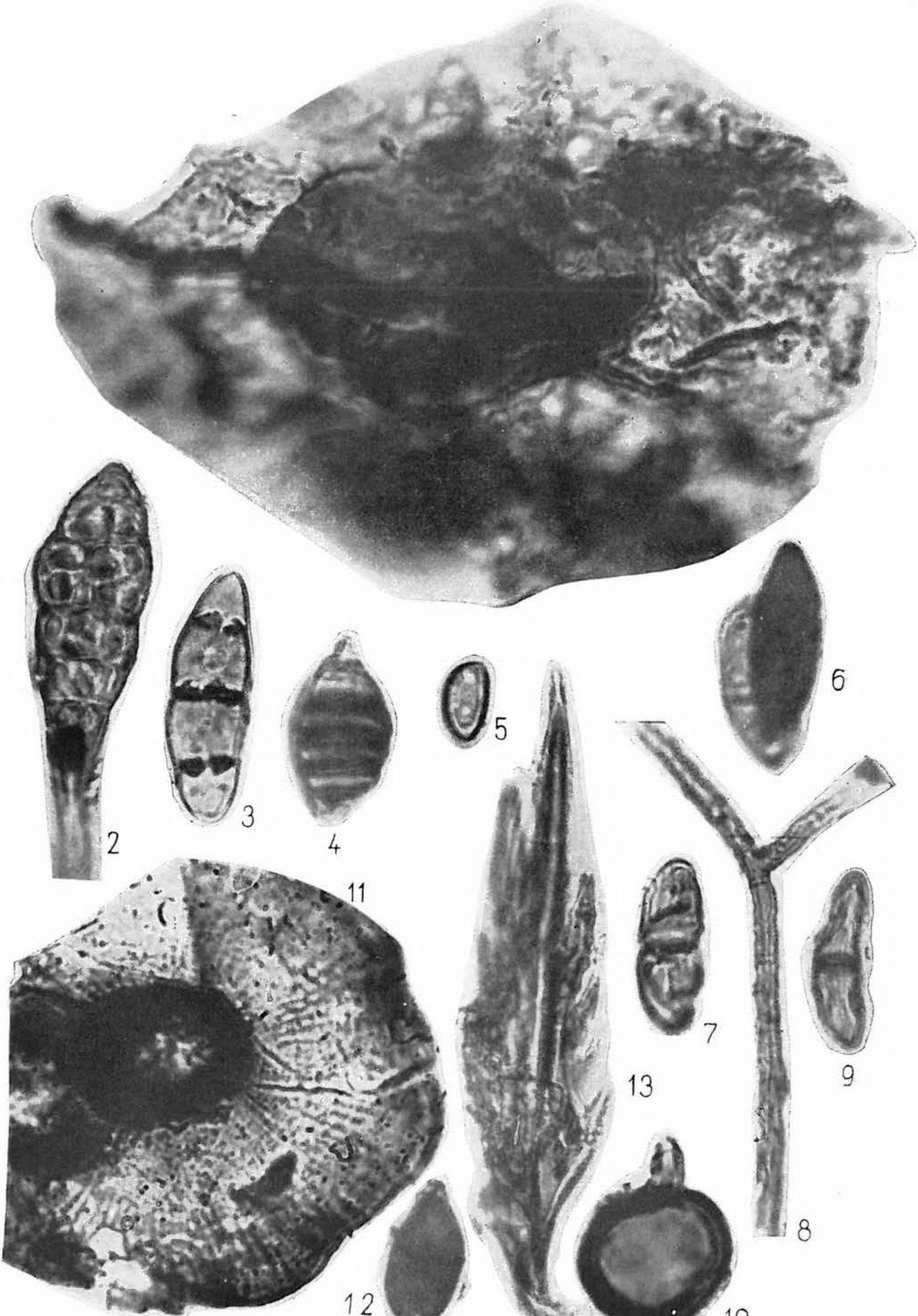
IX. Tábla — Plate IX

1. *Thalassiphora pelagica* (EIS. 1954) EIS. et GOCHT. 1960
2. Gombaspóra *(Adelomycetes)*
3. Gombaspóra *(Hyphomycetes)*
4. Gombaspóra *(Hyphomycetes conidium)*
5. Gombaspóra (cf. *Basidiomycetes*)
6. Gombaspóra *(Ascomycetes, Xylariales ascospora)*
7. Gombaspóra (cf. *Ascomycetes: ascospora*)
8. *Hypha* fonal (500 x)
9. Gombaspóra (cf. *Ascomycetes: ascospora*)
10. Gombaspóra (cf. *Ustilaginales*)
11. *Notothyrites setiferus* COOKS. 1947 (500 x)
12. Gombaspóra *(Adelomycetes) Hyphomycetes conidium*
13. *Scolecodonta* — Redeposited

1., 2., 8. Hidas 53. sz. f. 534—537 m
3., 4., 9. Hidas 53. sz. f. 444 m
5. Szászvár 8. sz. f. 26—27 m
6. Hidas 53. sz. f. 364,2—367 m
7. Hidas 2. telep
10. Zengővárkony 59. sz. f. 71,4—73 m
11. Szászvárbánya fő bányavágat 2—70 m
12. Hidas 53. sz. f. 258,1—258,5 m
13. Hidas 53. sz. f. 686,5—688 m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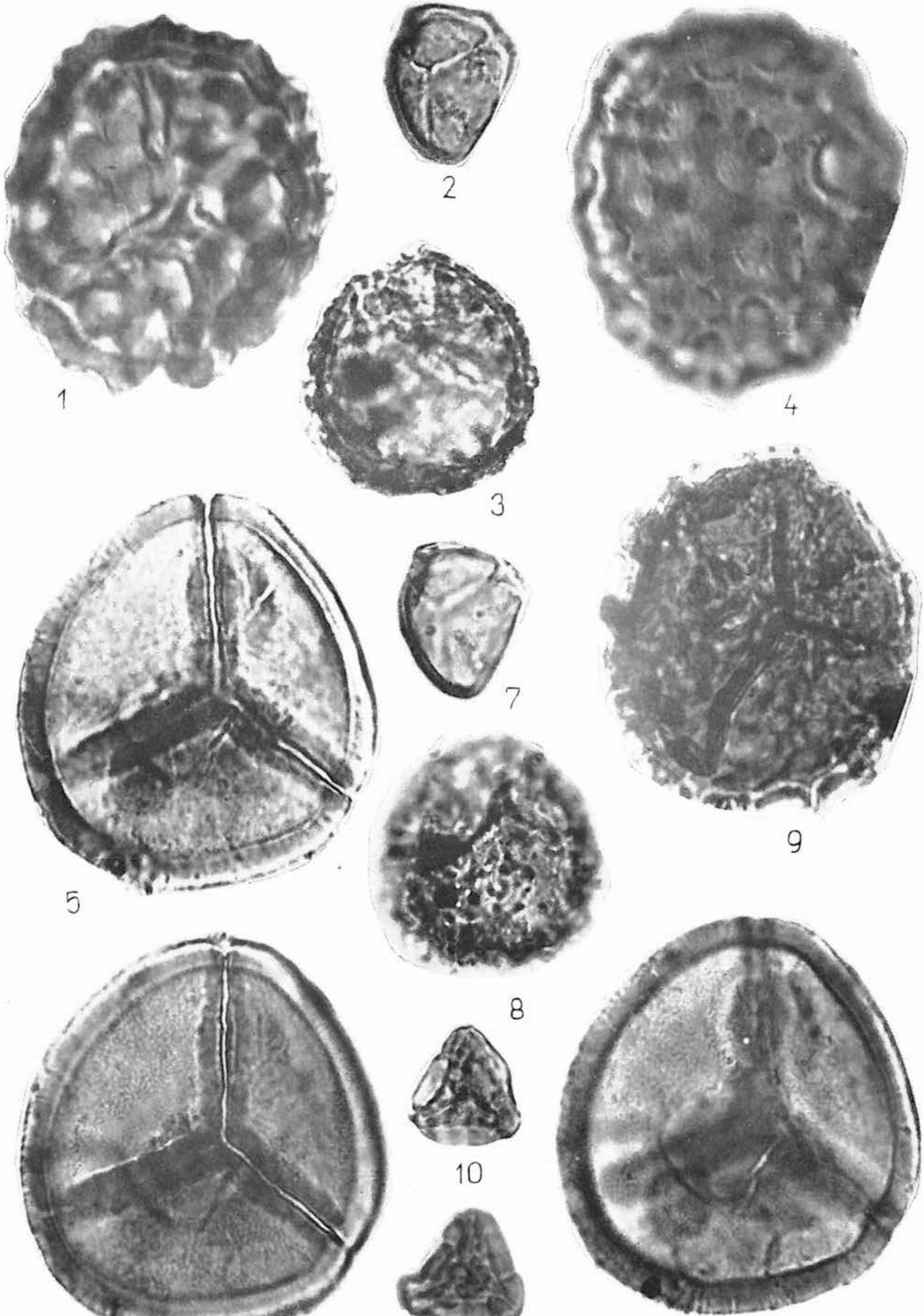
X. Tábla — Plate X

1., 4. *Rudolphisporites mecsekensis* NAGY 1968
2., 7. *Stereisporites* sg. *Stereisporites cyclus* W. KR. 1963 *microcyclus* W. KR. 1963
3., 8. *Saxosporites hidasensis* NAGY 1968
5., 6., 12. *Phaeocerosporites baranyaensis* NAGY 1968
9. *Rudolphisporites* cf. *rudolphi* W. KR. et PACL. 1963
10., 11. *Gleicheniidites* sg. *Triremisporites umbonatus* (BOLCH. 1953) n. c., f. *minor* n. f.

1., 4. Zengővárkony 59. sz. f. 56,0—60,9 m
2., 7., 10., 11. Szászvár 8. sz. f. 26—27 m
3., 8. Hidas 53. sz. f. 132,5—134,8 m
5., 6., 12. Zengővárkony 59. sz. f. 51,3—56 m
9. Hidas 53. sz. f. 763,3—764,6 m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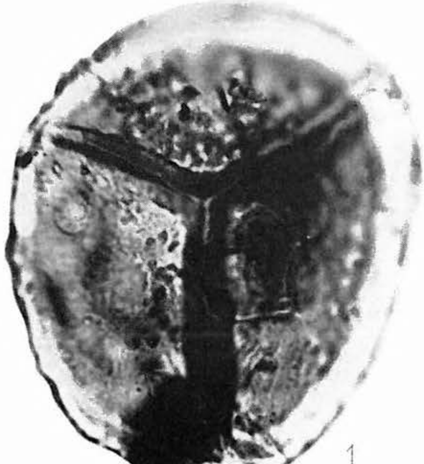
XI. Tábla — Plate XI

1., 2., 4. *Phaeocerosporites transversus* NAGY 1968
3. *Phaeocerosporites baranyaensis* NAGY 1968
5. *Ornatisporites dentatus* NAGY 1963 — Redeposited
6. *Macroleptolepidites krutzschi* NAGY 1963 — Redeposited

1., 2., 3., 4. Zengővárkony 59. sz. f. 51,3—56 m
5., 6. Hidas 53. sz. f. 258,1—258,5 m



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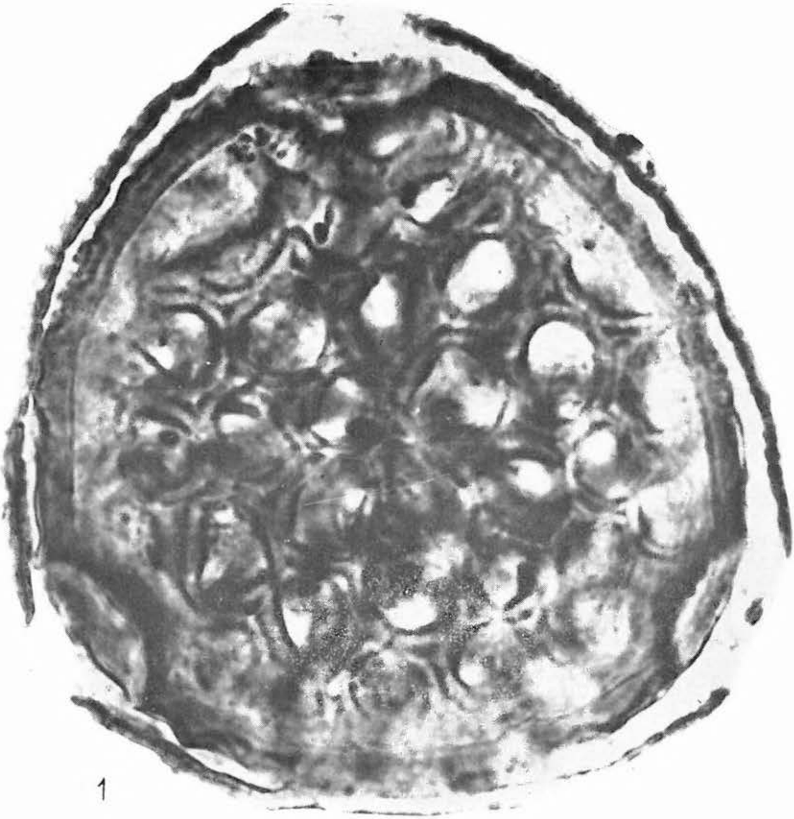
XII. Tábla — Plate XII

1. *Ricciaesporites hungaricus* Nagy 1968
2. *Ricciaesporites transdanubicus* Nagy 1968

1. Zengővárkony 59. sz. f. 51,3—56 m
2. Zengővárkony 59. sz. f. 56—60,9 m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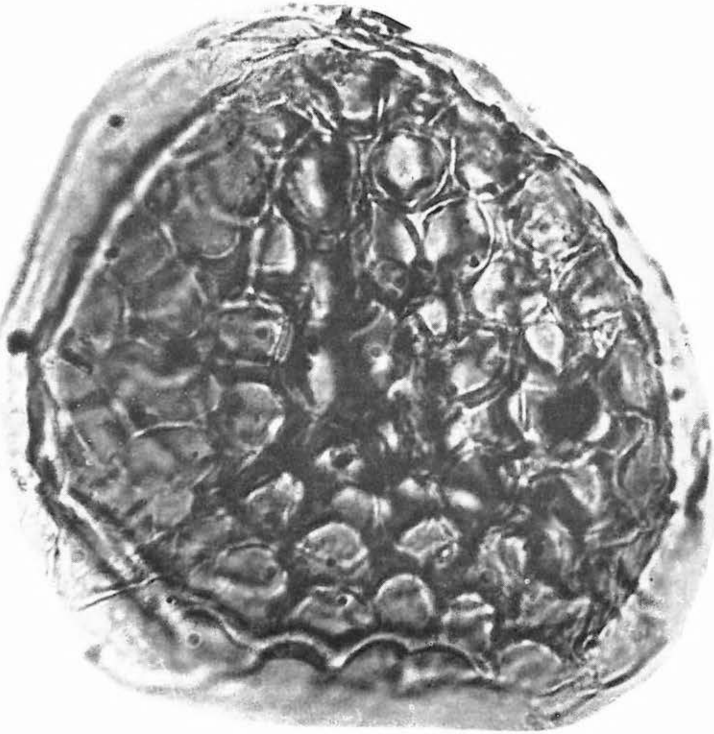
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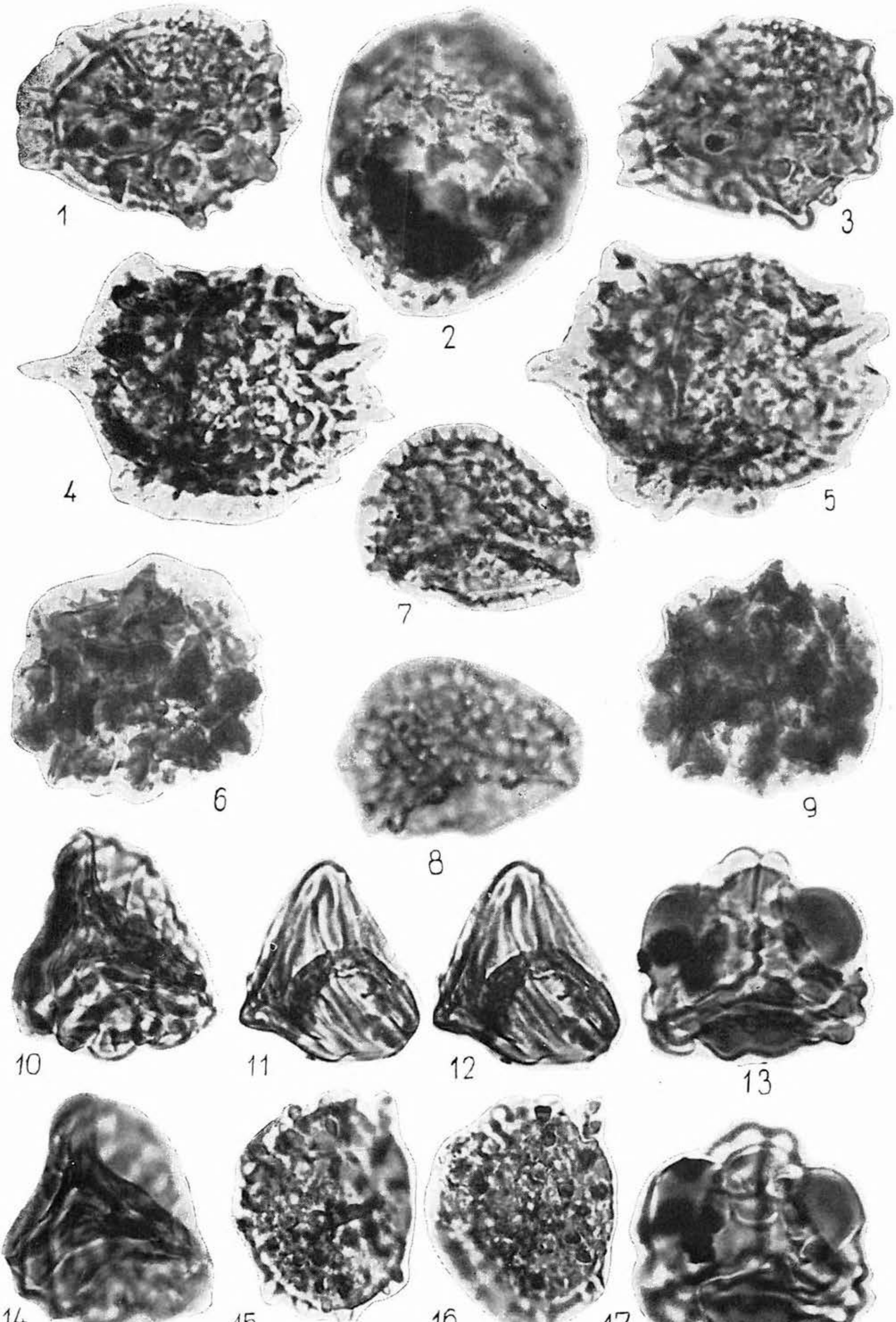
XIII. Tábla — Plate XIII

1., 3. *Echinatisporites hidasensis* n. sp. — Holotype
2. *Encalytasporites pliocaenicus* Nagy 1968
4., 5. *Echinatisporites variabilis* n. sp. — Holotype
6., 9. *Echinatisporites szászvárensis* n. sp. Holotype — Redeposited
7., 8. *Echinatisporites mecsekensis* n. sp. Holotype — Redeposited
10., 14. *Cicatricosisporites pannonicus* n. sp. asp. *triplanus* — Holotype
11., 12. *Neogenisporis* sp.
13., 17. *Semigleicheniidites duplex* Nagy 1968 Generotype — Redeposited
15., 16. *Echinatisporites hidasensis* n. sp.

1., 3., 15., 16. Hidas 53. sz. f. 534—537 m; 763,3—764,6 m
2. Hidas 53. sz. f. 132,5—134,8 m
4., 5. Hidas 53. sz. f. 669,2—669,8 m
6., 9. Szászvár 8. sz. f. 437,8—438,5 m
7., 8. Zengővárkony 45. sz. f. 16,0—16,4 m
10., 11., 12., 14. Szászvár 8. sz. f. 26,0—27,0 m
13., 17. Zengővárkony 59. sz. f. 65,0 - 67,5 m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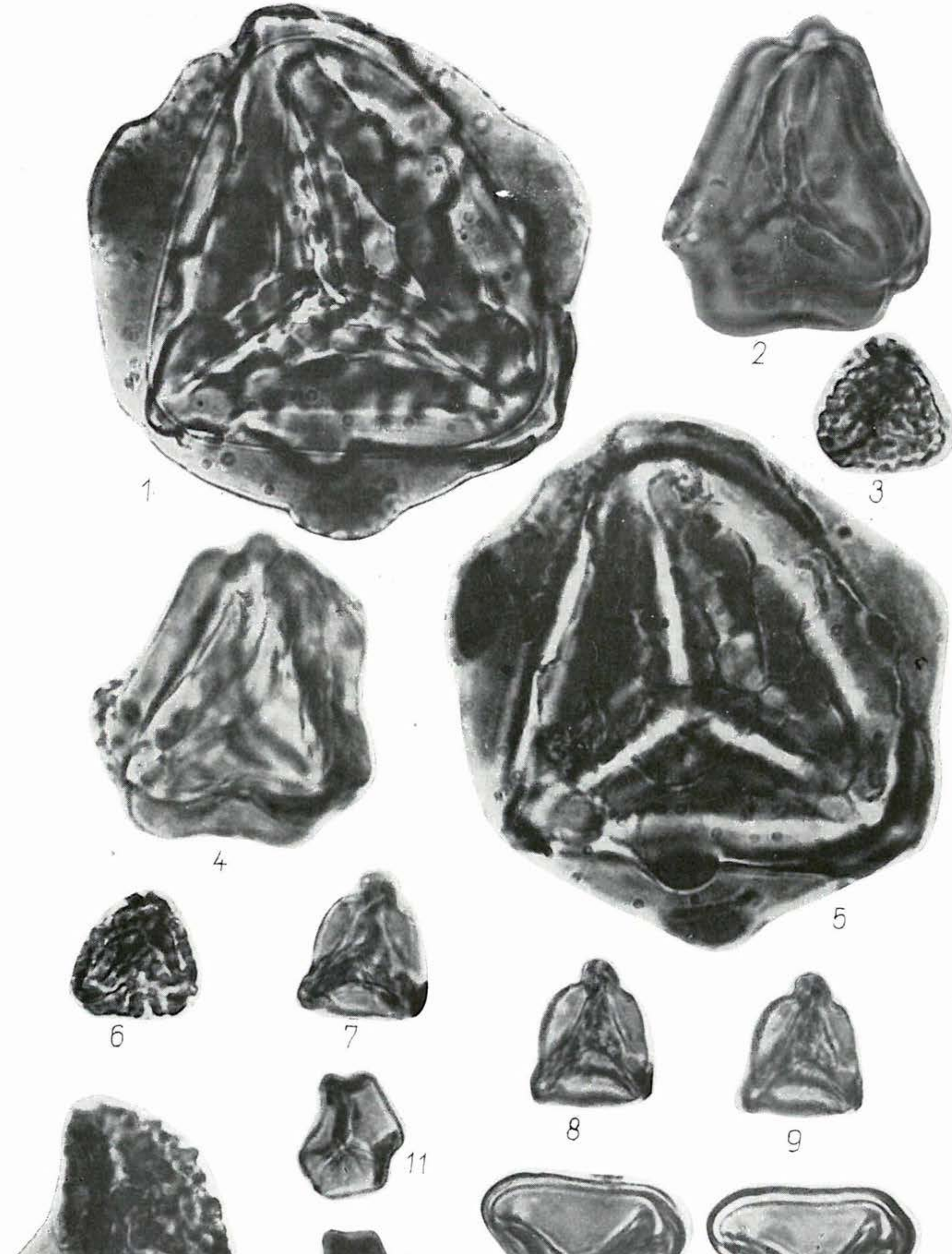
XIV. Tábla — Plate XIV

1., 5. *Soósisporites elegans* NAGY 1968 — Generotype
2., 4. *Polypodiaceoisporites longus* n. sp. — Holotype
3., 6. *Cicatricosisporites minimus* NAGY 1963
7., 8., 9. *Gleicheniidites* sg. *Triplexisporites triplex* (BOLCH. 1953) W. KR. 1959 f. *minor* n. f.
10. *Anemiidites echinatus* ROSS 1949
11., 12. *Divisisporites* sp.
13., 14. *Leiotriletes microlepioidites* W. KR. 1962

1., 5. Zengővárkony 59. sz. f. 30,9—34 m
2., 4. Zengővárkony 59. sz. f. 63—65 m
3., 6., 8., 9., 11., 12. Szászvár 8. sz. f. 26—27 m
7. Szászvár 8. sz. f. 83—83,6 m
10. Zengővárkony 59. sz. f. 44,4—44,7 m
13., 14. Hidas 53. sz. f. 298,0—299,1 m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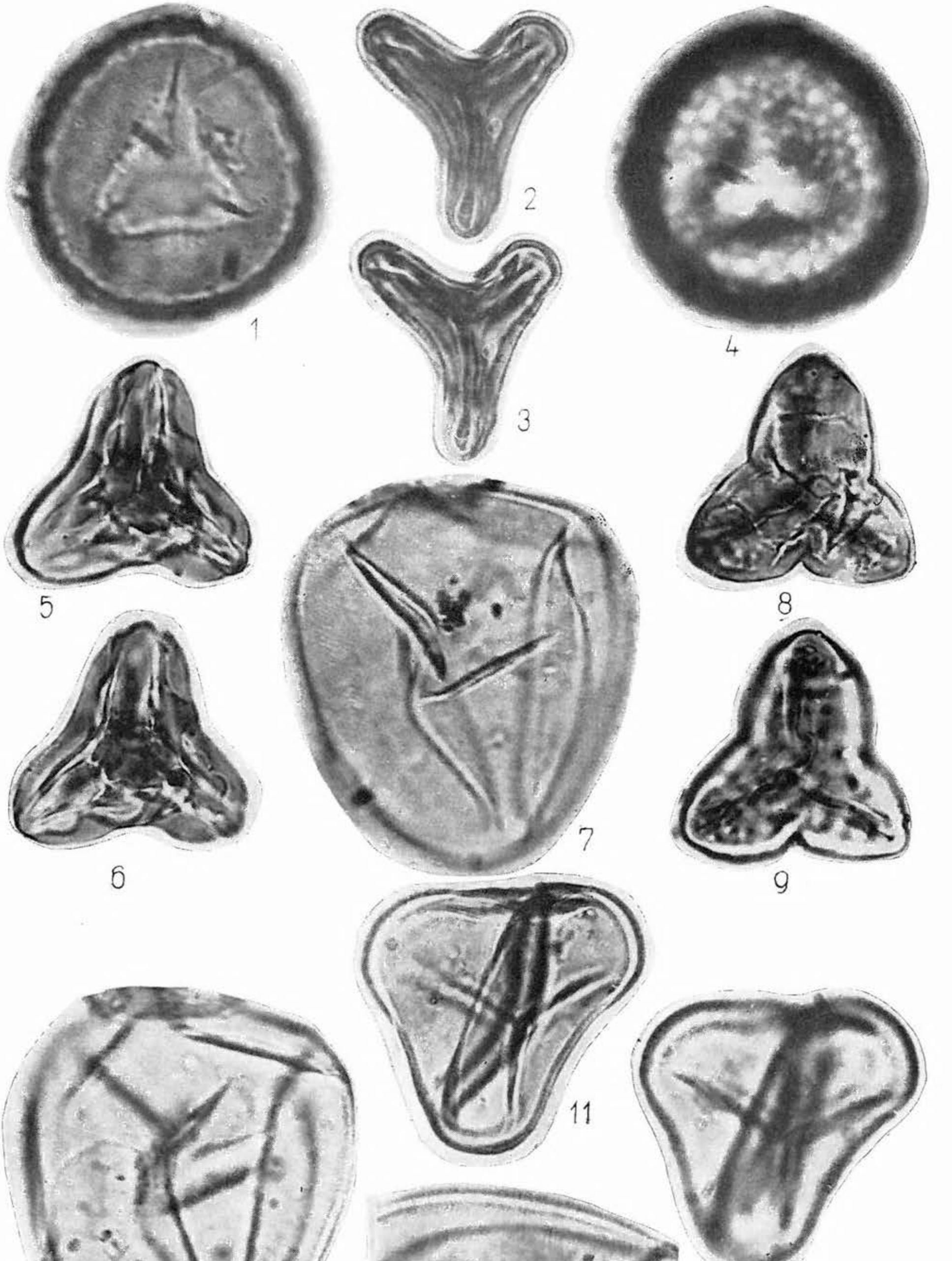
XV. Tábla — Plate XV

1., 4. *Ophioglossisporites rotundus* n. g. n. sp.
2., 3. *Concavisporites* sp.
5., 6. *Gleicheniidites* sg. *Triremisporites zengőensis* n. sp.
7., 10., 13. *Leiotriletes* cf. *microadriennis* W. Kr. 1959 — Redeposited
8., 9. *Tripartina* sp. — Redeposited
11., 12. *Leiotriletes wolffi* W. Kr. 1962 ssp. *wolffi*

1., 4., 7., 10., 13. Zengővárkony 59. sz. f. 34—37,5 m
2., 3. Hidas 53. sz. f. 510,3 m
5., 6., 11., 12. Zengővárkony 59. sz. f. 56—60,9 m
8., 9. Zengővárkony 59. sz. f. 18,5—20,2 m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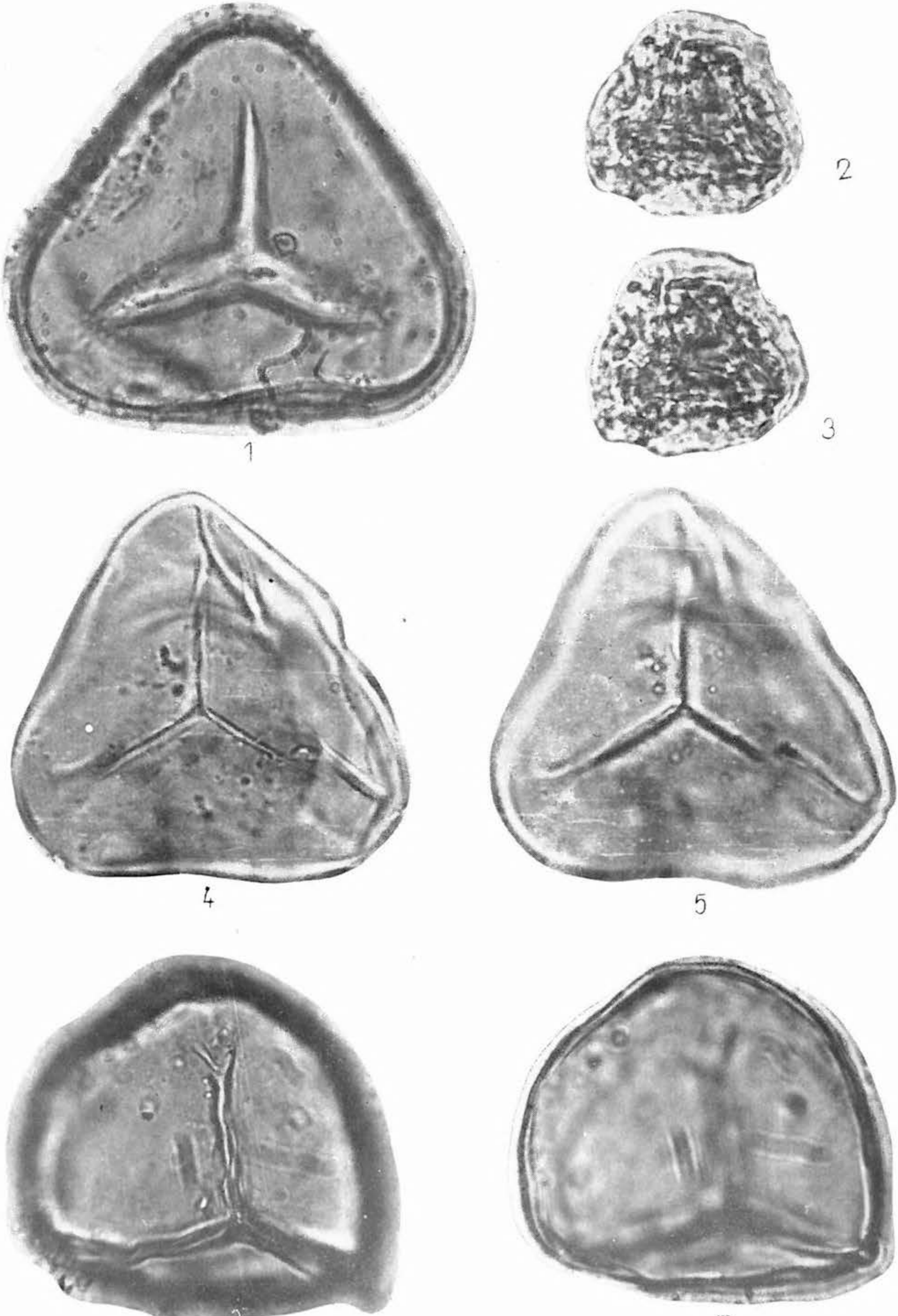
XVI. Tábla — Plate XVI

1\. *Leiotriletes hidasensis* n. sp. — Holotype
2., 3. *Polypodiaceoisporites* cf. *microspeciosus* W. Kr. 1959
4., 5. *Leiotriletes miocaenicus* n. sp. — Holotype
6., 7. *Undulatisporites curvatus* n. sp. — Holotype

1\. Hidas 53. sz. f. 258,1—258,5 m
2., 3. Hidas 53. sz. f. 135,5—137 m
4., 5. Zengővárkony 59. sz. f. 56—60,9 m
6., 7. Zengővárkony 59. sz. f. 41,8—44,4 m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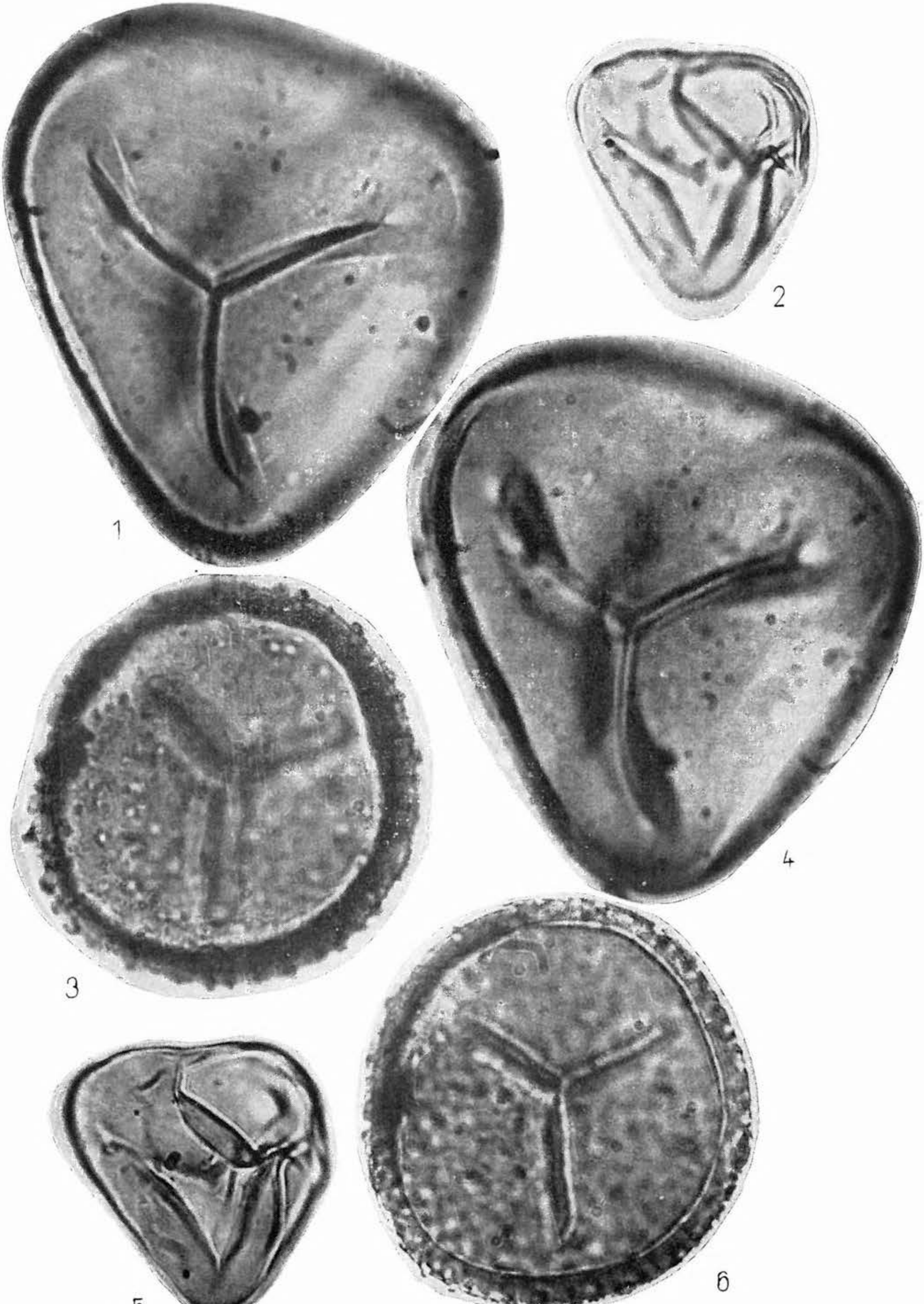
XVII. Tábla — Plate XVII

1., 4. *Leiotriletes maxoides* W. KR. 1962 ssp. *maximus* (PF. 1953) W. KR. 1959b
2., 5. *Monoleiotriletes gracilis* W. KR. 1959
3., 6. *Baculatisporites semibaculatus* n. sp. — Holotype

1., 4. Zengővárkony 59. sz. f. 63—65 m
2., 5. Szászvár 8. sz. f. 433,8—434,1 m
3., 6. Zengővárkony 59. sz. f. 56—60,9 m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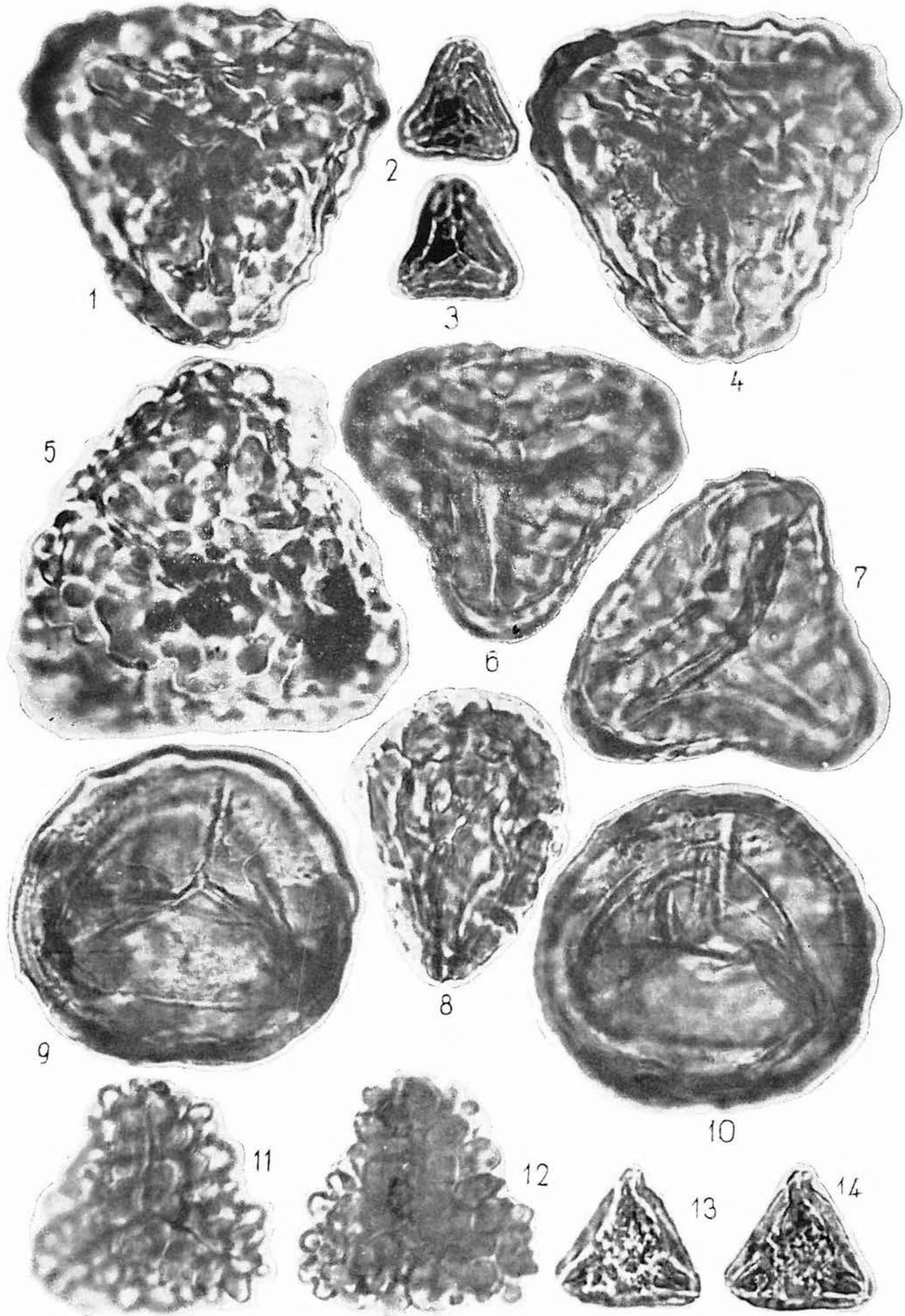
XVIII. Tábla — Plate XVIII

1., 4. *Lygodioisporites multivallatus* (PFLUG 1953) n. c.
2., 3. *Polypodiaceoisporites minutiosus* n. sp.
5. *Lygodioisporites solidus* (R. POT. 1934) R. POT. 1951 — Redeposited
6., 7. *Lygodioisporites paucivallatus* (PFLUG 1953) n. c.
8. *Duplexisporites toratus* (WEYLAND et GREIFELD 1953) PLAYFORD et DETTMANN 1965 — Redeposited
9., 10. *Angulisporites multiangulus* n. sp. — Holotype — Redeposited
11., 12. *Leptolepidites parvus* n. sp. — Holotype
13., 14. *Polypodiaceoisporites minutiosus* n. sp. — Holotype

1., 4. Zengővárkony 45. sz. f. 17,2—17,8 m
2., 3. Kisbattyán 1. sz. f. 462 m
5. Hidas 53. sz. f. 126,8—135,5 m
6., 7. Pusztakisfalu VI. sz. f. 10,5—12,5 m
8. Hidas 53. sz. f. 534—537 m
9., 10. Zengővárkony 59. sz. f. 71,4—73 m
11., 12. Zengővárkony 59. sz. f. 60,9—63 m
13., 14. Szászvár 8. sz. f. 26—27 m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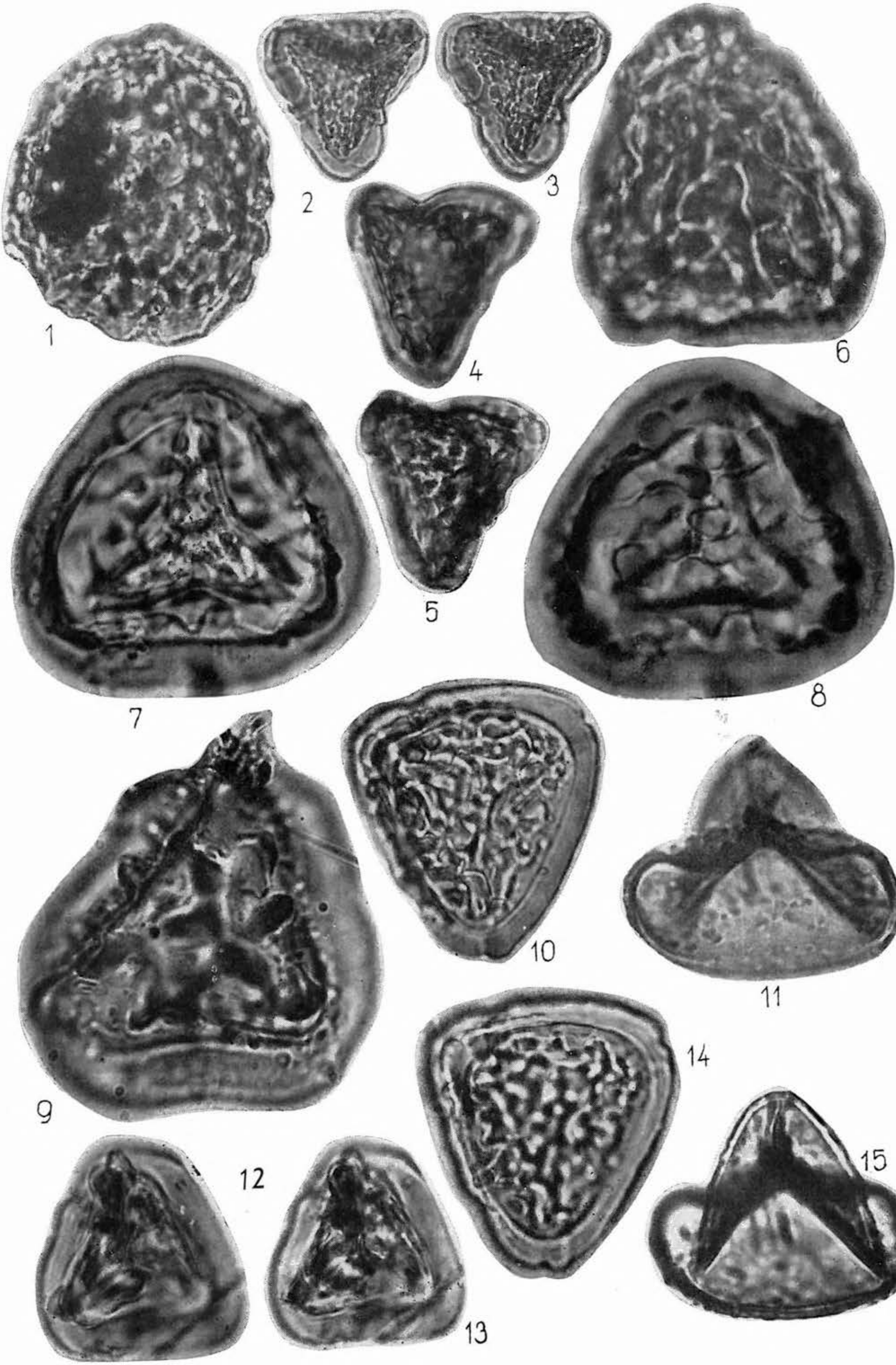
XIX. Tábla — Plate XIX

1., 6. *Duplexisporites toratus* (WEYLAND et GREIFELD 1953) PLAYFORD et DETTMANN 1965
2., 3. *Polypodiaceoisporites minutus* n. sp.
4., 5. *Polypodiaceoisporites minutus* n. sp. — Holotype
7., 8. *Polypodiaceoisporites mecsekensis* n. sp. — Holotype
9. *Polypodiaceoisporites acutus* n. sp. — Holotype
10., 14. *Polypodiaceoisporites gracillimus* NAGY 1963 var. *emarginatus* n. var.
11., 15. *Foveotriletes maculatus* n. sp. — Holotype
12., 13. *Polypodiaceoisporites verrucosus* n. sp. — Holotype

1. Hidas 53. sz. f. 837,9—839 m
6. Hidas 53. sz. f. 1017—1019 m
2., 3. Hidas 53. sz. f. 118—126,8 m
4., 5., 12., 13. Szászvár 8. sz. f. 26—27 m
7., 8. Zengővárkony 59. sz. f. 63—65 m
9. Hidas 53. sz. f. 126,6—132,5 m
10., 14. Zengővárkony 45. sz. f. 8,6—13,2 m
11., 15. Zengővárkony 59. sz. f. 34—37,5 m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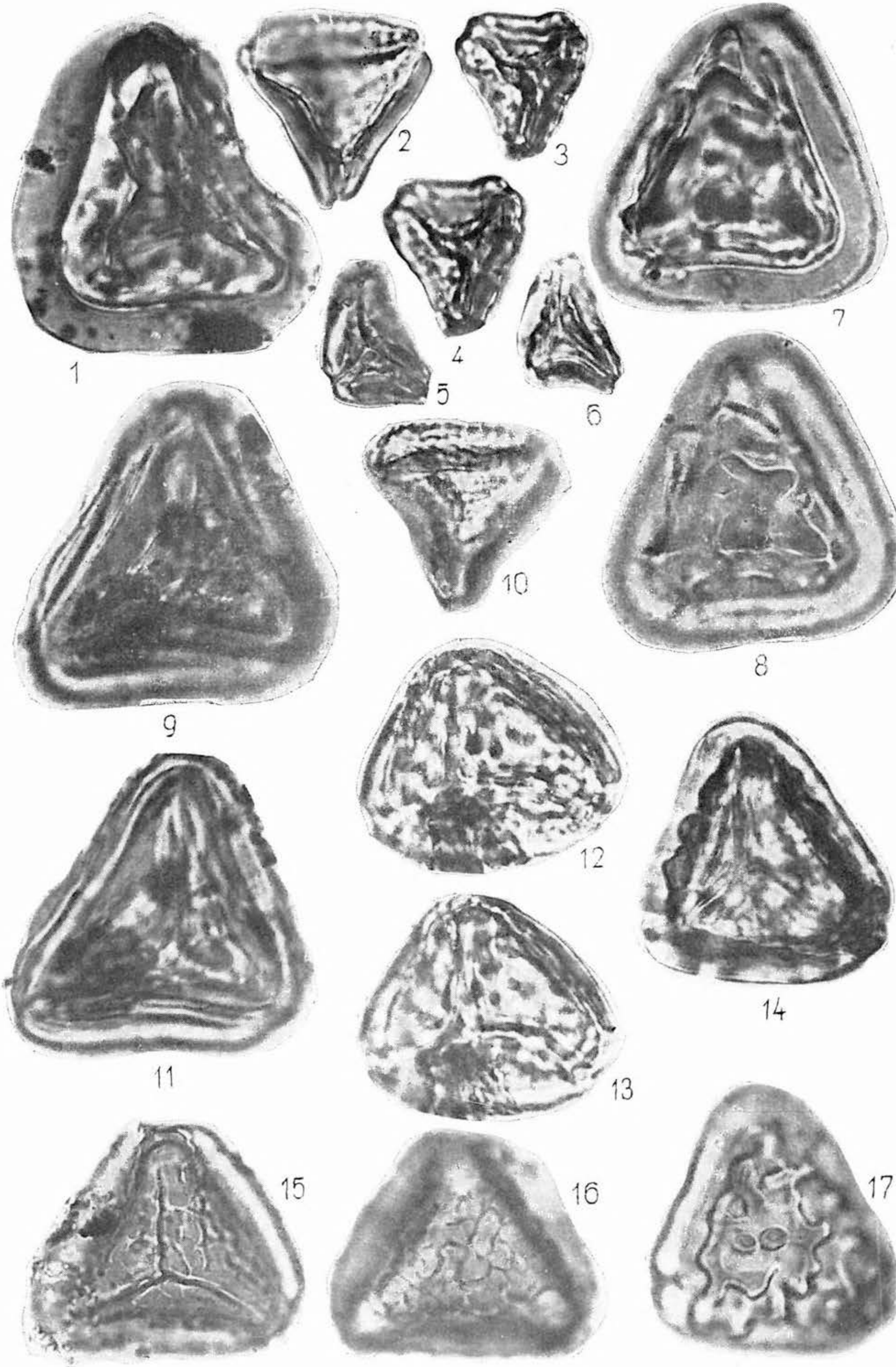
XX. Tábla — Plate XX

1. *Polypodiaceoisporites simplex* n. sp. — Holotype
3., 4. *Polypodiaceoisporites szászvárensis* n. sp.
5., 6. *Polypodiaceoisporites szászvárensis* n. sp. — Holotype
2., 10. *Polypodiaceoisporites magdalenae* n. sp. — Holotype
7., 8. *Polypodiaceoisporites muricinguliformis* n. sp. — Holotype
9., 11. *Polypodiaceoisporites torosus* n. sp. — Holotype
12., 13. *Polypodiaceoisporites hidasensis* n. sp. — Holotype
14., 17. *Polypodiaceoisporites helveticus* n. sp. — Holotype
15., 16. *Polypodiaceoisporites zengővárkonyensis* n. sp. — Holotype

1., 2., 3., 4. Hidas 53. sz. f. 118–126,8 m
5., 6., 10. Szászvár 8. sz. f. 26—27 m
7., 8. Zengővárkony 59. sz. f. 39,8—41,8 m
9., 11. Zengővárkony 59. sz. f. 51,3–56 m
12., 13. Hidas 53. sz. f. 600,5—602,3 m
14., 17. Pusztakisfalu VI. sz. f. 6,3–7,8 m
15., 16. Zengővárkony 59. sz. f. 34—37,5 m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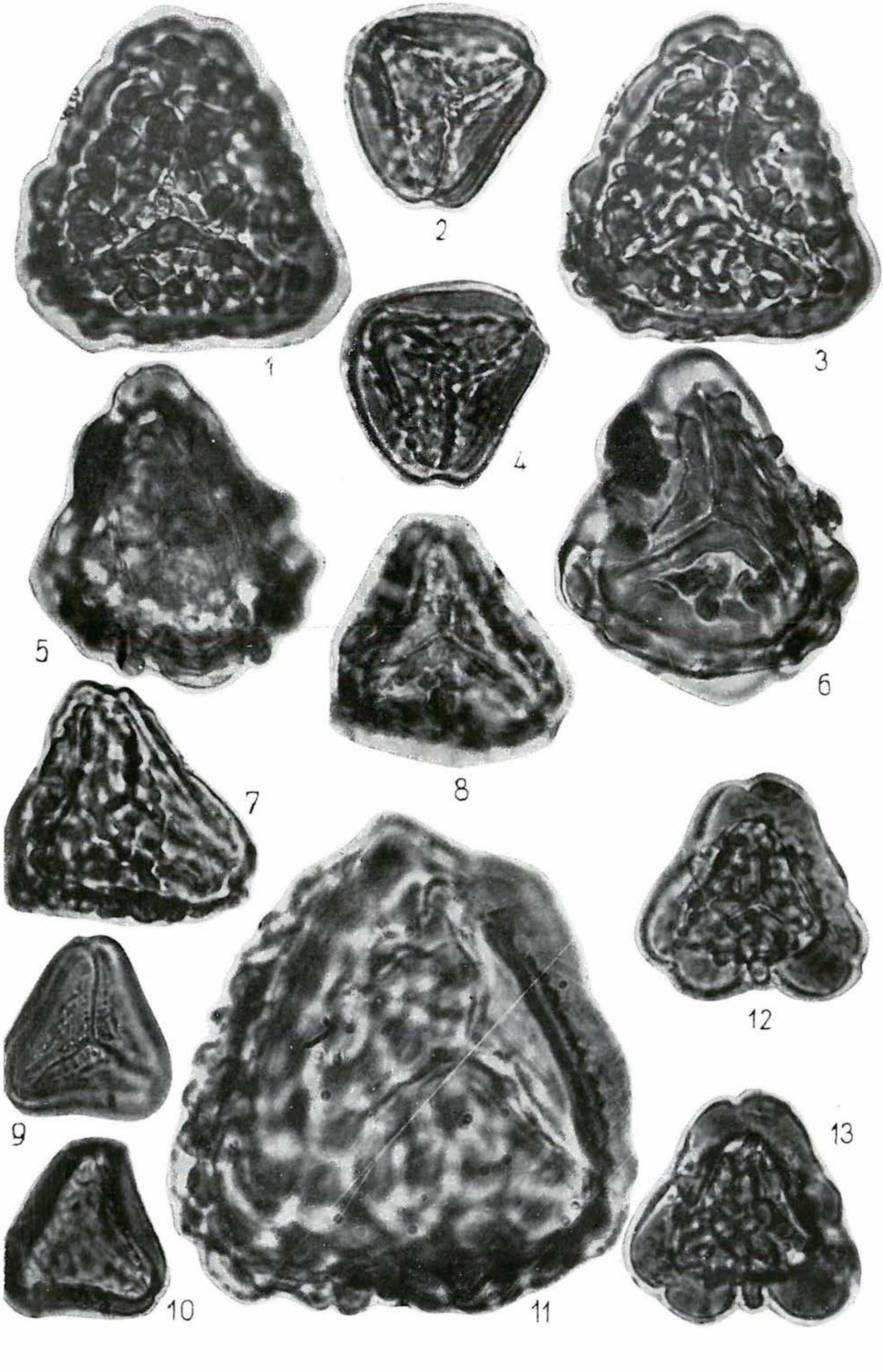
XXI. Tábla — Plate XXI

1., 3. *Verrucingulatisporites miocaenicus* n. sp — Holotype
2., 4. *Polypodiaceoisporites miocaenicus* n. sp. — Holotype
5., 6. *Verrucingulatisporites mecsekensis* n. sp. — Holotype
7., 8. *Bifacialisporites murensis* NAGY 1963 f. *minor* n. f. — Formatype
9., 10. *Polypodiaceoisporites hamulatus* n. sp. — Holotype
11. *Bifacialisporites murensis* NAGY 1963
12., 13. *Verrucingulatisporites trifoliiformis* n. sp. — Holotype

1., 3., 5., 6., 7., 8. Zengővárkony 45. sz. f. 16—16,4 m
2., 4. Pusztakisfalu VI. sz. f. 10,5—12,5 m
9., 10. Zengővárkony 59. sz. f. 56—60,9 m
11. Hidas 53. sz. f. 258,1—258,5 m
12., 13. Pusztakisfalu VI. sz. f. 15—17 m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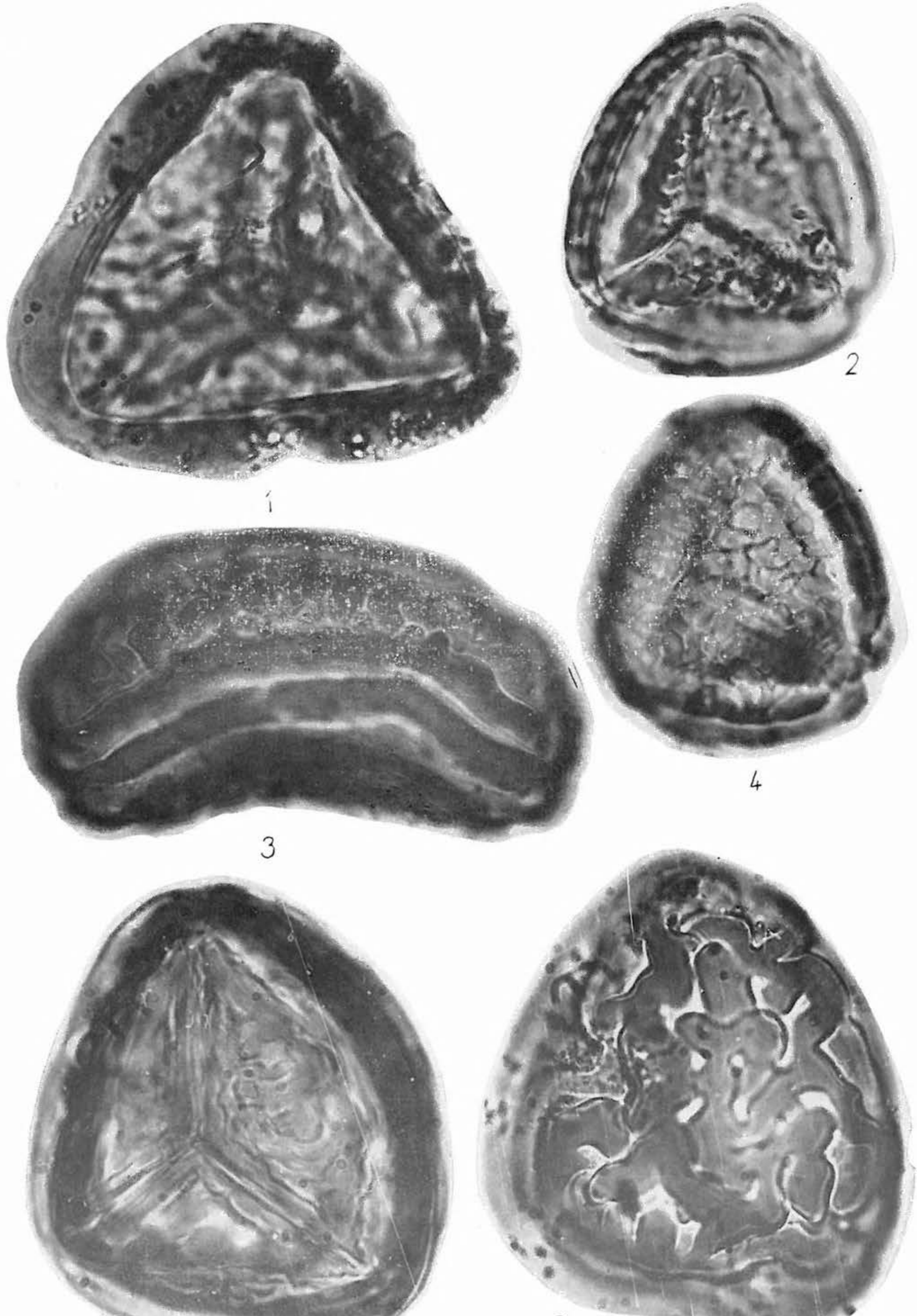
XXII. Tábla — Plate XXII

1\. *Bifacialisporites magnus* n. sp. — Holotype
2., 4. *Bifacialisporites medius* n. sp. — Holotype
3., 5., 6. *Bifacialisporites mecsekensis* n. sp. — Holotype

1\. Hidas 53. sz. f. 258,1—258,5 m
2., 4. Zengővárkony 59. sz. f. 56,0—60,9 m
3., 5., 6. Zengővárkony 59. sz. f. 34—37,5 m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XXIII. Tábla — Plate XXIII

1., 2., 3. *Bifacialisporites medius* n. sp. — Holotype
4. *Trilobosporites* cf. *bernissartensis* (DELCOURT et SPRUMONT 1955) R. POT. 1956 — Redeposited
5. *Callialasporites devi* n. sp. — Redeposited
6. *Callialasporites dampieri* (BALME 1957) SUKH DEV 1961 — Redeposited

1., 2., 3. Zengővárkony 59. sz. f. 34—37,5 m
4. Hidas 53. sz. f. 364,2—367 m
5. Szászvár 8. sz. f. 433,8—434,1 m
6. Szászvár 8. sz. f. 432,7—433,5 m

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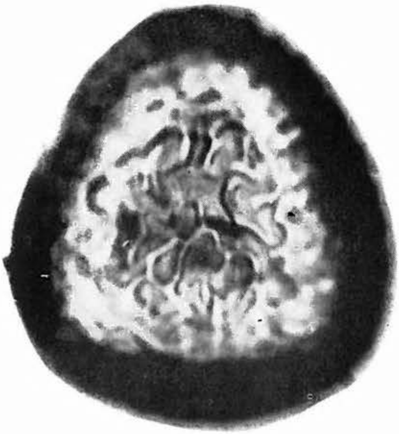

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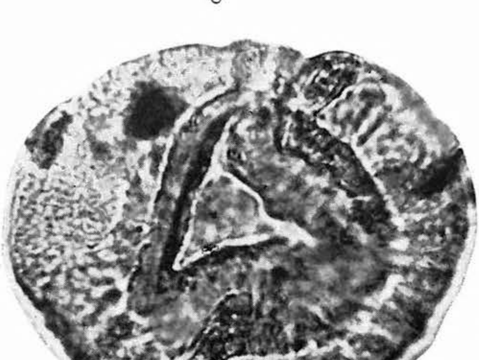

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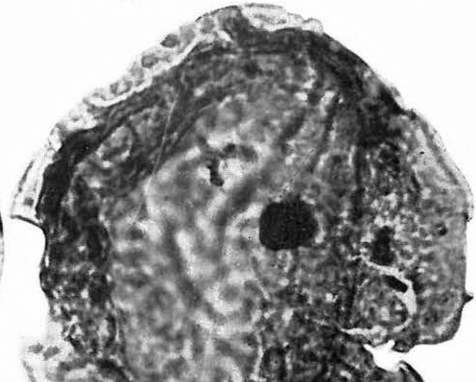

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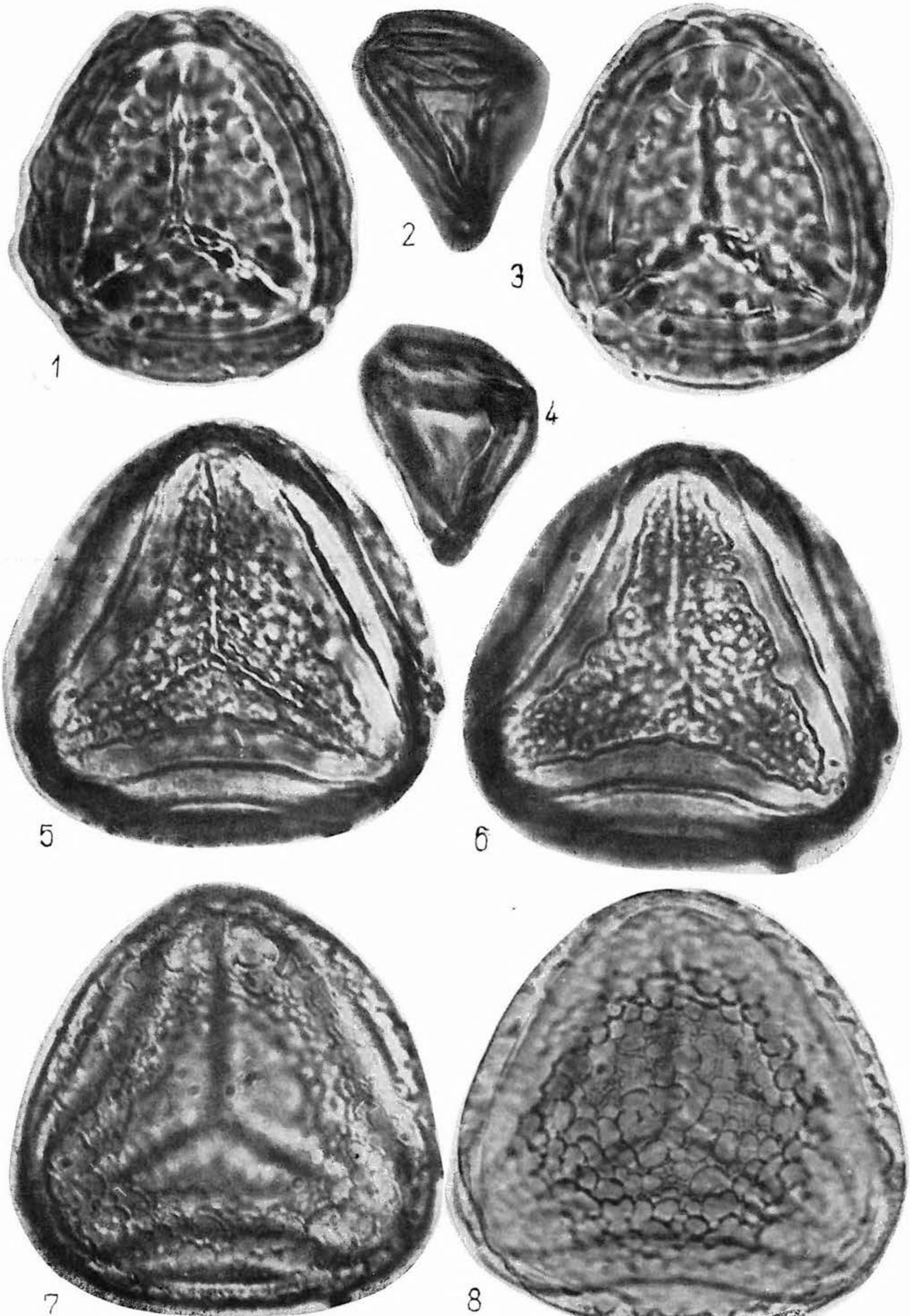
XXIV. Tábla — Plate XXIV

1., 3. *Ornatisporites reticulatus* Nagy 1963 — Redeposited
2., 4. *Neogenisporis* sp.
5—8. *Mecsekisporites miocaenicus* Nagy 1968 — Generotype

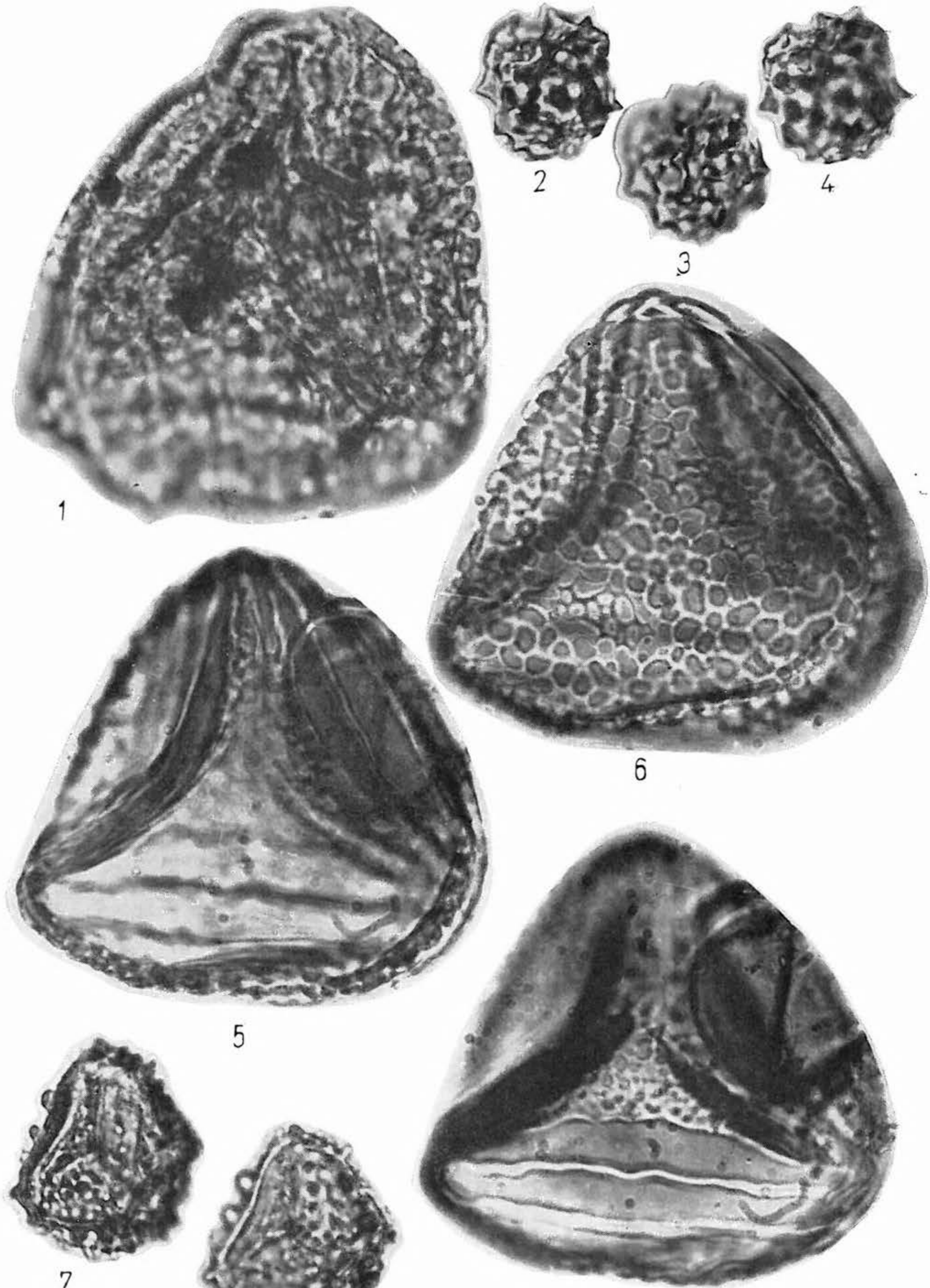
1., 3. Hidas 53. sz. f. 258,1—258,5 m
2., 4. Szászvár 8. sz. f. 26—27 m
5.—8. Zengővárkony 59. sz. f. 34—37,5 m



XXV. Tábla — Plate XXV

1\. *Mecsekisporites aequus* NAGY 1968 — Holotype
2—4. *Triletes* sp.
5., 6., 9. *Mecsekisporites zengővárkonyensis* NAGY 1968 — Holotype
7., 8. *Verrucatisporites inaequalis* n. g. n. sp. — Generotype

1\. Hidas 53. sz. f. 757—759 m
2.—4. Szászvár 8. sz. f. 26—27 m
5., 6., 9. Zengővárkony 59. sz. f. 56,0—60,9 m
7., 8. Zengővárkony 45. sz. f. 17,2—17,8 m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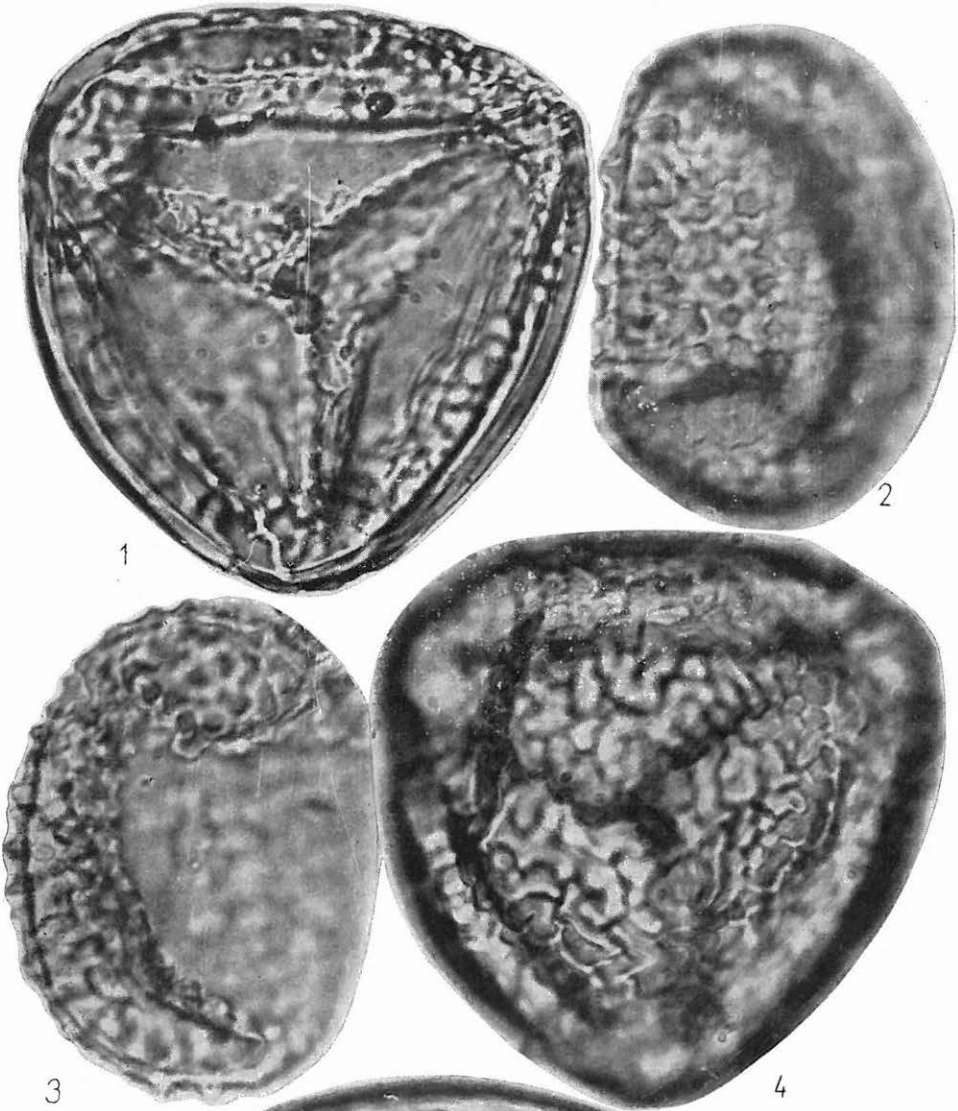
XXVI. Tábla — Plate XXVI

1., 4. *Mecsekisporites cerebralis* Nagy 1968 — Holotype
2., 3. *Polypodiisporites potoniéi* n. sp. — Holotype
5. *Mecsekisporites cerebralis* Nagy 1968 — Holotype (detail)

1., 4., 5. Zengővárkony 59. sz. f. 56—60,9 m
2., 3. Zengővárkony 59. sz. f. 60,9—63 m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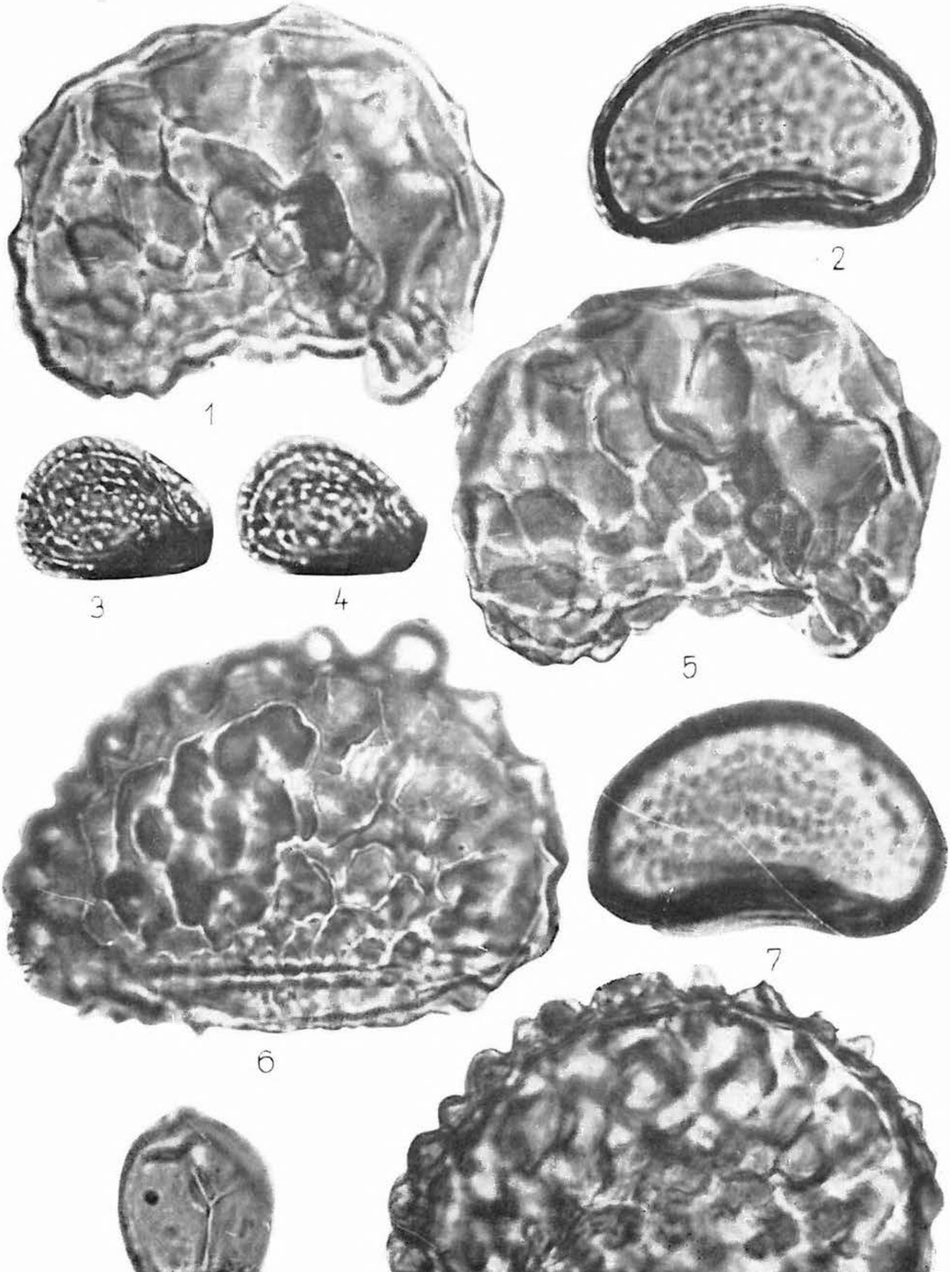
XXVII. Tábla — Plate XXVII

1., 5. *Polypodiidites maximus* n. sp. — Holotype
2., 7. *Polypodiisporites secundus* (R. Pot. 1934) R. Pot. 1956
3., 4. *Polypodiisporites acutus* n. sp. — Holotype
6., 9. *Verrucatosporites histiopteroides* W. Kr. 1962 f. *major* n. f.
8. *Hydrosporites miocaenicus* n. sp. — Holotype

1., 5. Pusztakisfalu VI. sz. f. 10,5—12.5 m
2., 7. Pusztakisfalu VI. sz. f. 6,3—7.8 m
3., 4. Zengővárkony 45. sz. f. 17,2—17,8 m
6., 9. Zengővárkony 59. sz. f. 30,9—31 m
8. Hidas 53. sz. f. 558—561 m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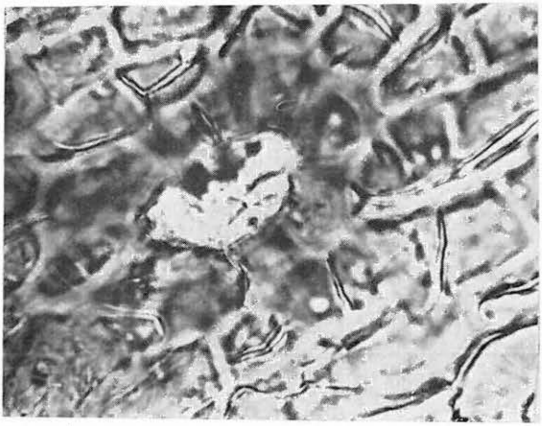
XXIX. Tábla — Plate XXIX

1., 2. *Cycadaceae* fosszilis epidermisz maradvány (stoma) — Fossil remnant of the epidermis of *Cycadaceae* (stoma)
3. *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 "*B*" *typus*
4. *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 "*C*" *typus*
5. *Pseudotsugoidites mecsekensis* n. sp.
6. *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 "*D*" *typus*
7. *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 "*A*" *typus*

1., 2. Zengővárkony 59. sz. f. 46,8—48,5 m
3. Zengővárkony 59. sz. f. 41,8—44,4 m
4. Szászvár 8. sz. f. 434,3—434,5 m
5. Mecseknádasd
6. Szászvár 8. sz. f. 433,6—433,8 m
7. Zengővárkony 59. sz. f. 73,5—76 m



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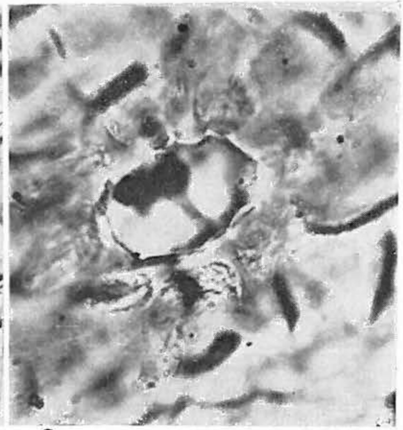

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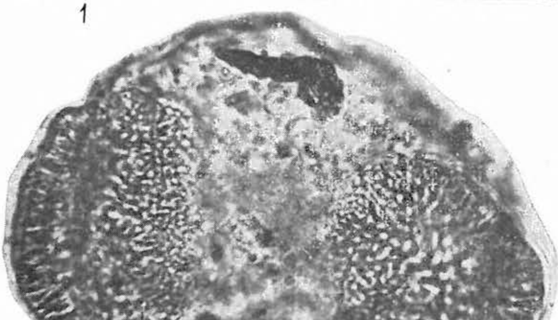

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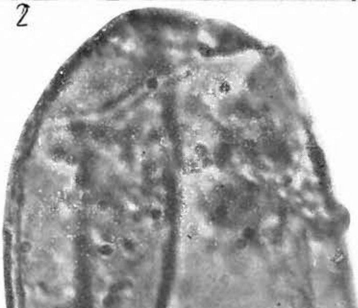

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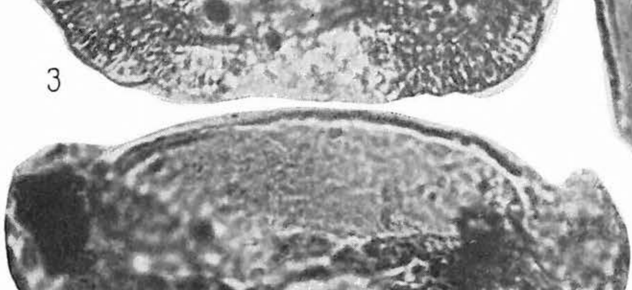

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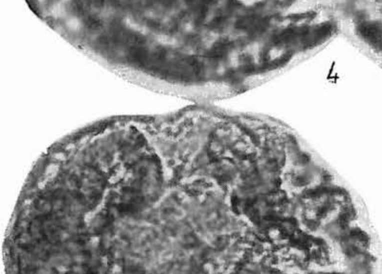

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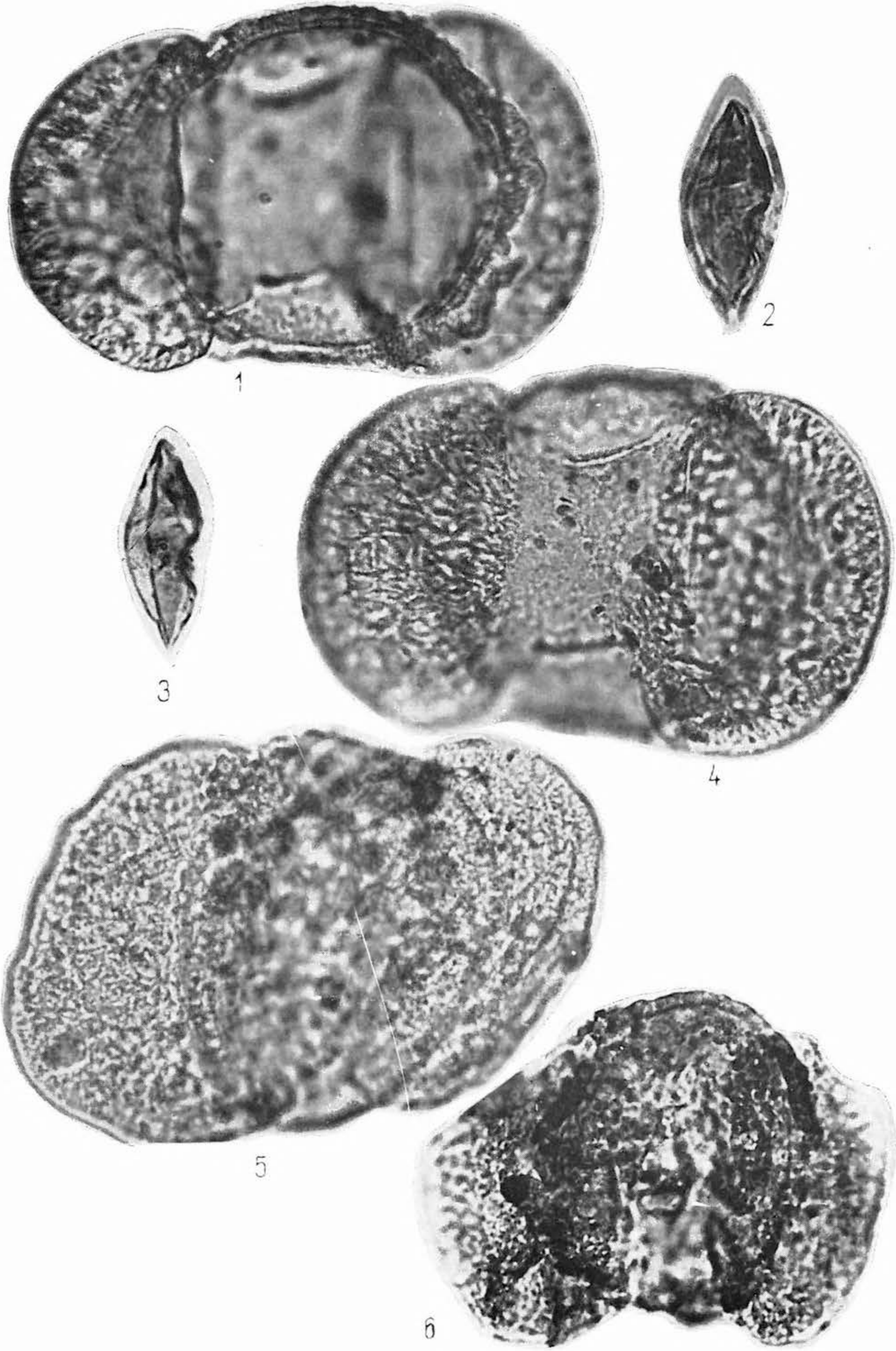
XXX. Tábla — Plate XXX

1., 4. *Pityosporites thunbergiiformis* n. sp.
2., 3. *Ginkgoretectina neogenica* n. sp.
5. *Abietinaepollenites microalatus* (R. Pot. 1931) R. Pot. 1951 ssp. *major* R. Pot. 1951
6. *Pityosporites labdacus* (R. Pot. 1931) Th. et Pf. 1953 "*B*" *typus*

1., 4. Zengővárkony 59. sz. f. 30,9—34 m
2., 3. Hidas 53. sz. f. 479,1—482 m
5. Hidas 53. sz. f. 134,8—135,5 m
6. Hidas 53. sz. f. 630,8—632 m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XXXI. Tábla — Plate XXXI

1., 2. *Pityosporites zaklinskaiana* n. sp.
3. *Cycadopites* sp. — Redeposited
4. *Abietinaepollenites microalatus* (R. POT. 1931) R. POT. 1951 ssp. *microalatus*
5. *Tsugaepollenites igniculus* (R. POT. 1931) R. POT. et VENITZ 1934, f. *maximus* RAATZ 1937

1., 2. Zengővárkony 59. sz. f. 30,9—34 m
3., 4. Szászvár 8. sz. f. 433,8—434,1 m
5. Hidas 53. sz. f. 572—575 m

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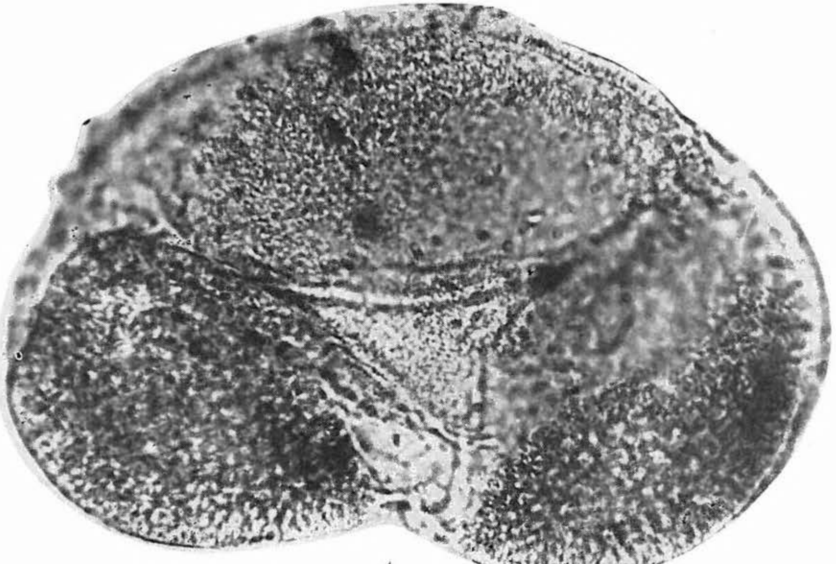
XXXII. Tábla — Plate XXXII

1. *Piceapollenites neogenicus* n. sp. — Holotype
2. *Inaperturopollenites* cf. *magnus* (R. Pot. 1934) Th. et Pf. 1953 - 500 ×
3., 4. *Abietinaepollenites neogenicus* n. sp.

1., 3., 4. Zengővárkony 59. sz. f. 51,3—56 m
2. Hidas 53. sz. f. 147,5—148,5 m



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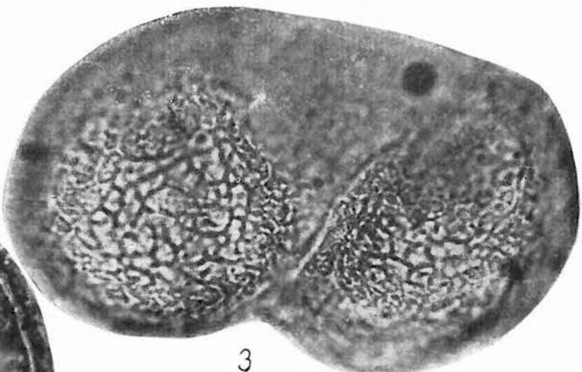

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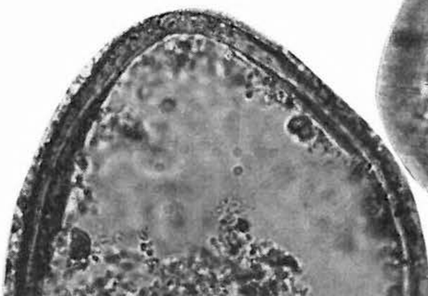

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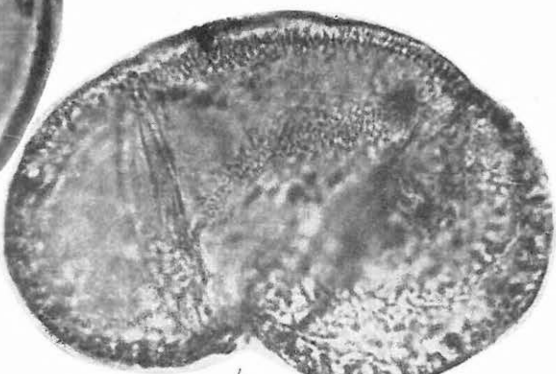

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XXXIII. Tábla — Plate XXXIII

1. *Piceapollenites neogenicus* n. sp.
2. *Cedripites szászvárensis* n. sp. — Holotype
3. *Podocarpidites macrophylliformis* n. sp. — Holotype
4. *Dacrydiumites guillauminii* n. sp. — Holotype
5. *Sciadopityspollenites serratus* (R. Pot. et Venitz 1934) Raatz 1937

1. Zengővárkony 59. sz. f. 56,0—60,9 m
2. Szászvár 8. sz. f. 433,6—433,8 m
3. Komló 120. sz. f. 178—178,8 m
4. Zengővárkony 59. sz. f. 51,3—56 m
5. Zengővárkony 59. sz. f. 76—78 m


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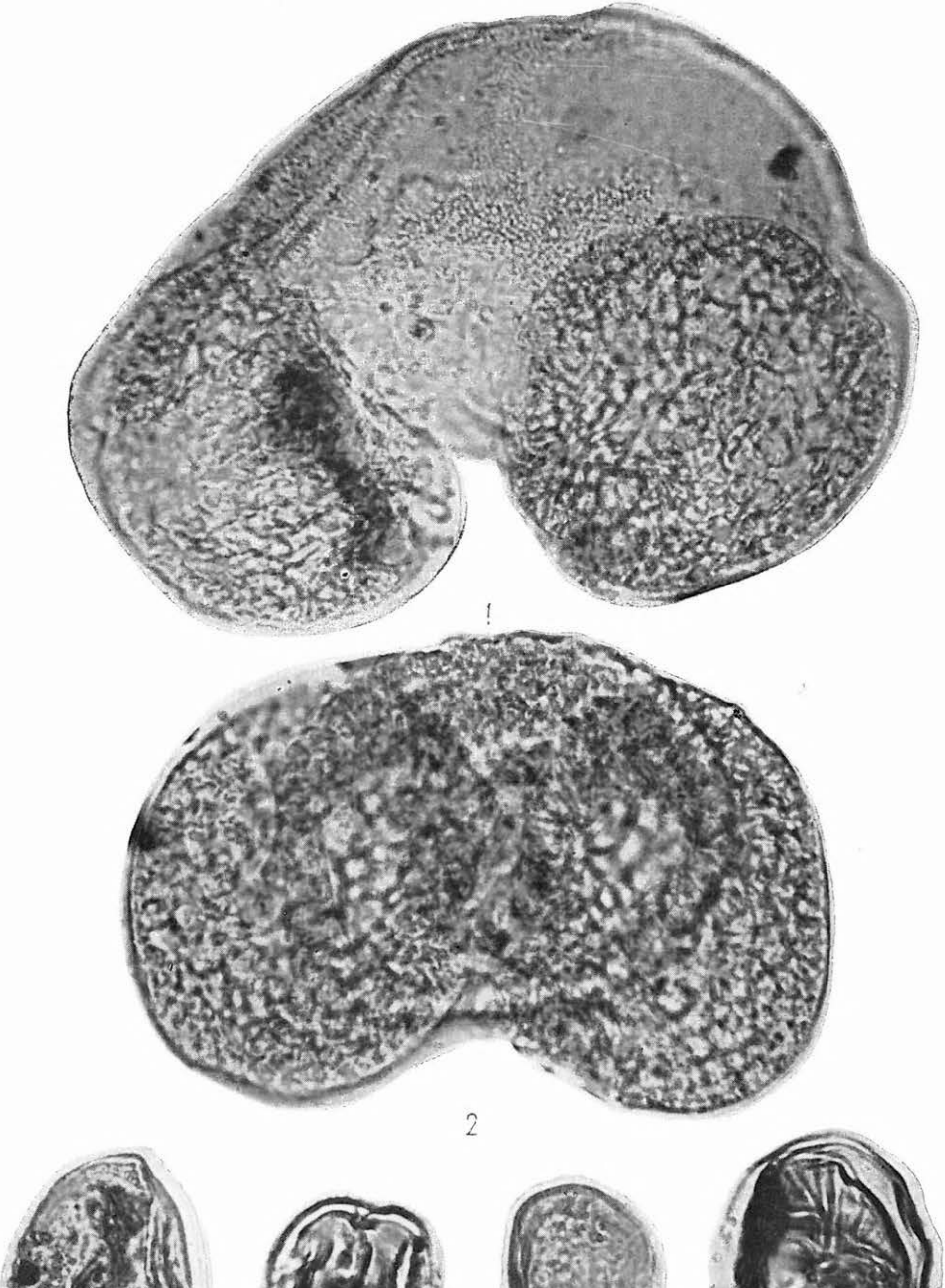
XXXIV. Tábla — Plate XXXIV

1. *Keteleeriaepollenites komlóensis* n. g. n. sp. — Generotype
2. *Abiespollenites crassus* n. sp. — Holotype

3—5. *Taxodiaceaepollenites* sp.

6. *Cunninghamiaepollenites lignitus* n. sp. — Generotype

1. Komló 120. sz. f. 178—178,8 m
2. Zengővárkony 59. sz. f. 63—65 m
3. Hidas 53. sz. f. 132,5—134,8 m
4. Hidas 53. sz. f. 667,2—669,2 m
5. Hidas 53. sz. f. 444 m
6. Hidas II. t. 6 m



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XXXV. Tábla — Plate XXXV

1. *Cedripites crassus* n. sp. — Holotype
2. *Cedripites deodaraeformis* n. sp. — Holotype
3. *Chamaecyparidipollenites flexuosus* n. g. n. sp. — Generotype

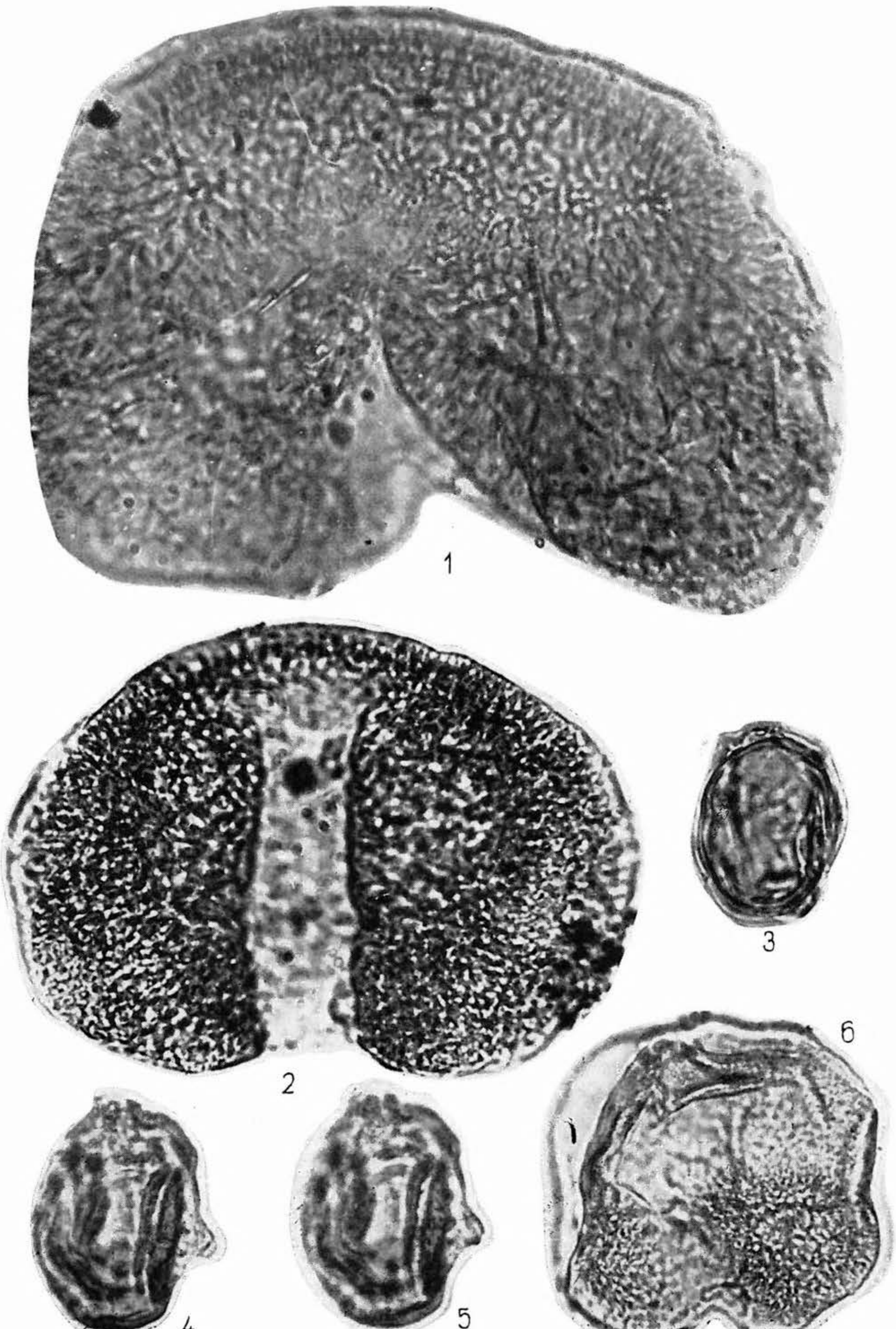
4., 5. *Sequoiapollenites polymorphosus* THIERG. 1938

6. *Cedripites szászvárensis* n. sp. — Izotype

1. Hidas 53. sz. f. 73,3—89,5 m
2. Zengővárkony 59. sz. f. 51,3—56 m
3. Hidas 53. sz. f. 444 m

4., 5. Hidas 53. sz. f. 667,2—669,2 m

6. Szászvár 8. sz. f. 433,6—433,8 m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XXXVI. Tábla — Plate XXXVI

1. *Araucariacites komlóensis* n. sp. — Holotype — Redeposited
2., 3. *Illinites* cf. *tectus* (LESCHIK 1956) CLARKE 1965 — Redeposited
4., 5. *Podocarpidites microreticuloidata* COOKSON 1947
6. *Araucariacites hidasensis* n. sp. — Holotype
7. *Podocarpidites macrophylliformis* n. sp. — Holotype

1. Komló 120. sz. f. 372,0—374,4 m
2., 3., 7. Komló 120. sz. f. 178—178,8 m
4., 5. Zengővárkony 59. sz. f. 28,6—28,8 m
6. Hidas 59. sz. f. 73,3—89,5 m


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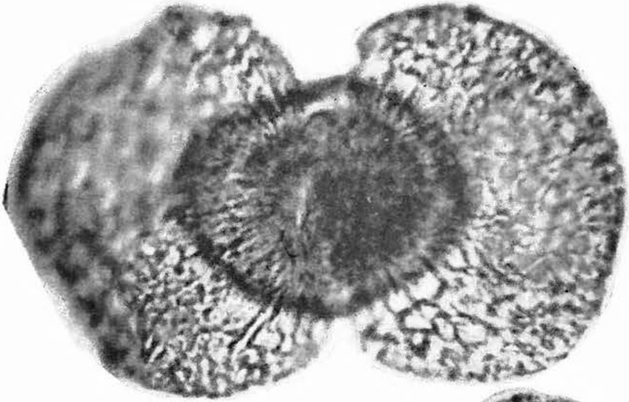
XXXVII. Tábla — Plate XXXVII

1., 2. *Podocarpidites papilionis* n. sp. — Holotype
3., 4. *Dacrydiumites taxoidiformis* n. sp. — Holotype

1., 2. Zengővárkony 59. sz. f. 34—37,5 m
3., 4. Zengővárkony 59. sz. f. 30,9—34 m



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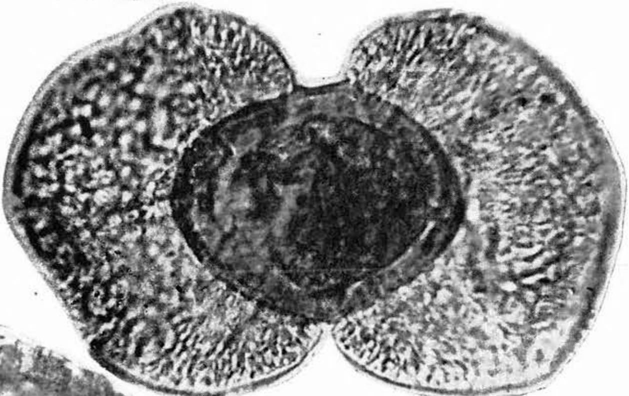

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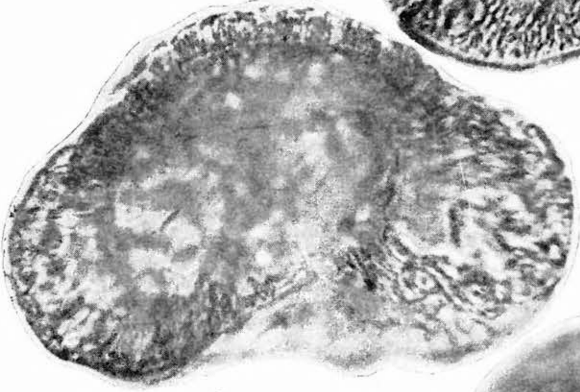

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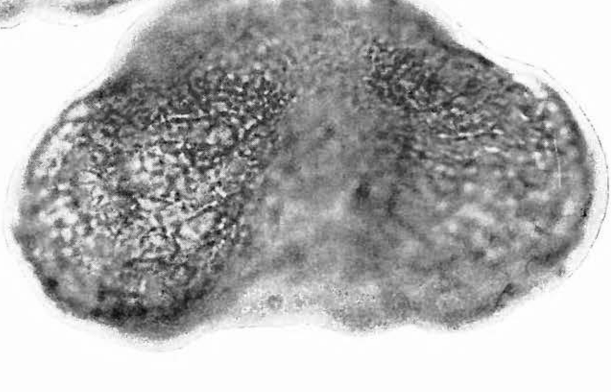

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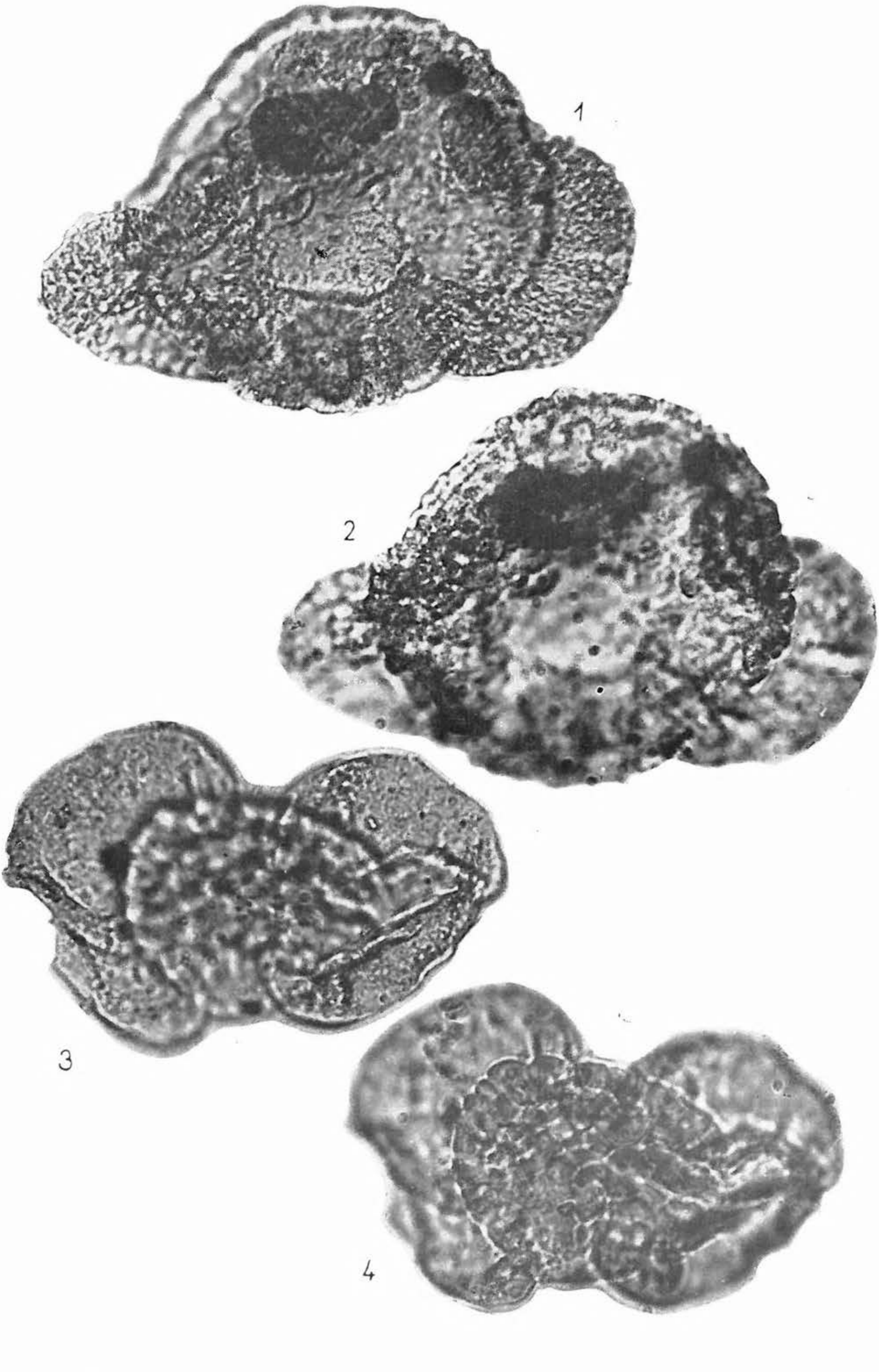
XXXVIII. Tábla — Plate XXXVIII

1., 2. *Dacrydiumites inclinatus* n. sp. — Holotype
3., 4. *Podocarpidites acmopyleformis* n. sp. — Holotype

1., 2. Zengővárkony 59. sz. f. 60,9–63 m
3., 4. Szászvár 8. sz. f. 433,8—434,1 m



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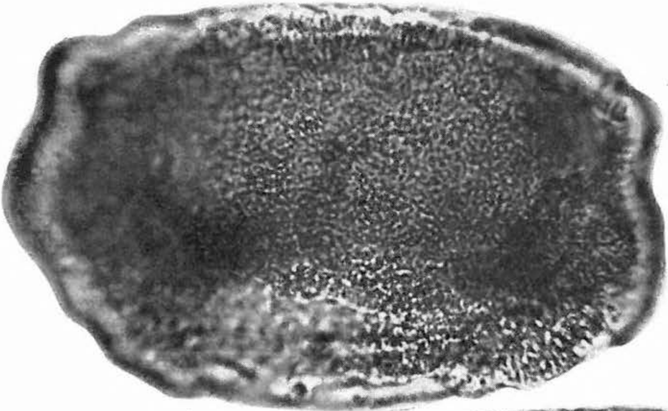
XXXIX. Tábla — Plate XXXIX

1., 2. *Phyllocladipollenites grandis* n. sp. — Holotype
3., 4. *Dacrydiumites balansaeformis* n. sp. — Holotype

1., 2. Zengővárkony 59. sz. f. 65—67 m
3., 4. Zengővárkony 59. sz. f. 34—37,5 m



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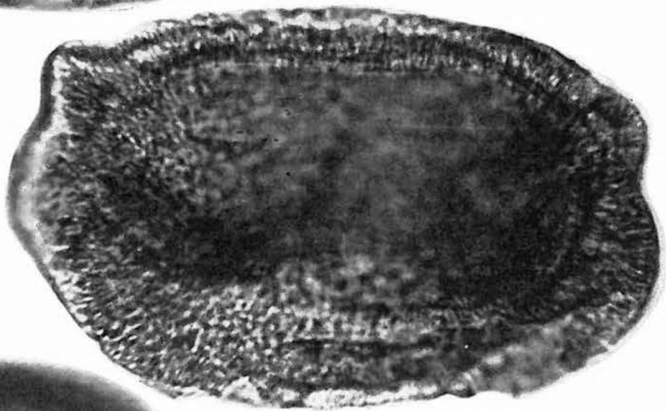

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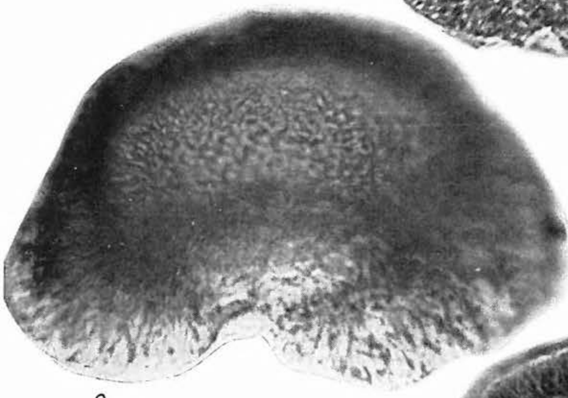

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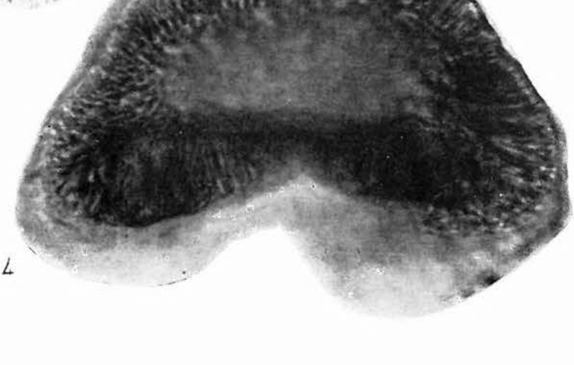

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XL. Tábla — Plate XL

1., 2. *Ephedripites* sg. *Ephedripites mecsekensis* NAGY 1963
3., 4. *Ephedripites* sg. *Ephedripites hungaricus* NAGY 1963
5., 6. *Ephedripites* sg. *Distachyapites minimus* n. sp. — Holotype
7—9. *Ephedripites* sg. *Distachyapites bicostatus* n. sp. — Holotype
10. *Ephedripites* sg. *Distachyapites bernheidensis* W. KR. 1961
11., 12. *Ephedripites* sg. *Distachyapites miocaenicus* n. sp. — Holotype
13., 14. *Ephedripites* sg. *Distachyapites ellipticus* n. sp. — Holotype
15—17. *Tetracentracearumpollenites minimus* n. g. n. sp. — Generotype
18—20. *Tetracentracearumpollenites komlóensis* n. g. n. sp. — Holotype

1., 2. Hidas 53. sz. f. 479,1—482,0 m
3., 4. Szászvár 8. sz. f. 432,5—432,7 m
5., 6. Pusztakisfalu VI. sz. f. 22,5—25 m
7—9., 11., 12. Zengővárkony 59. sz. f. 51,3—56 m
10. Zengővárkony 59. sz. f. 76—78 m
13., 14. Zengővárkony 59. sz. f. 48,5—51,3 m
15—17. Pusztakisfalu VI. sz. f. 10,5—12,5 m
18—20. Komló 120. sz. f. 367 m


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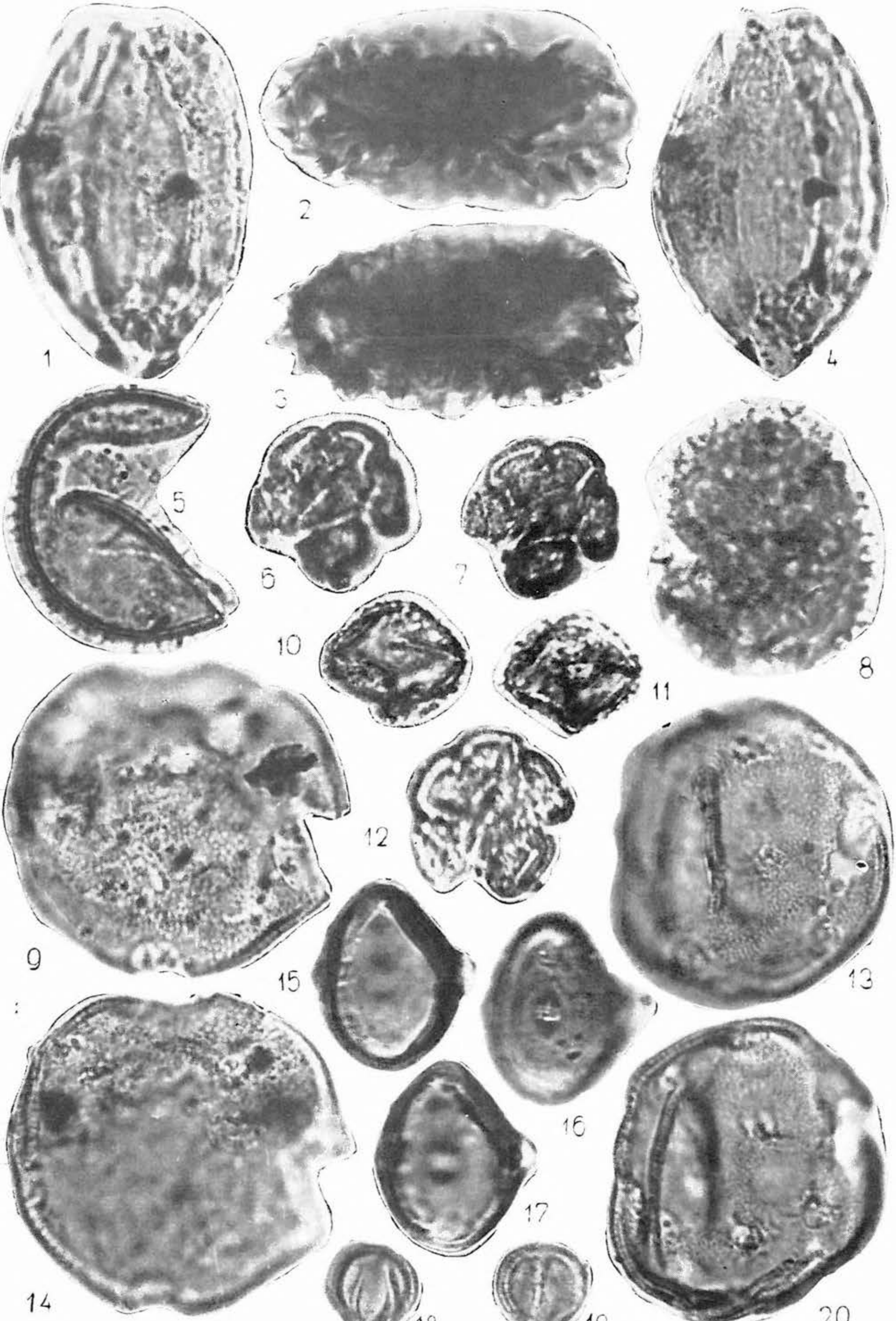
XLI. Tábla — Plate XLI.

1., 4. *Magnoliaepollenites simplex* n. g. n. sp. — Generotype
2., 3., 8. *Nupharipollenites kedvesii* n. g. n. sp. — Generotype
5. *Nymphaeaepollenites pannonicus* n. g. n. sp. — Generotype
6., 7., 12. *Chloranthacearumpollenites dubius* n. g. n. sp. — Generotype
9., 14. *Liquidambarpollenites formosanaeformis* n. sp. — Holotype
10., 11. *Nymphaeaepollenites pannonicus* n. g. n. sp.
13., 20. *Liquidambarpollenites styracifluaeformis* n. sp. — Holotype
15—17. *Slowakipollenites mecsekensis* n. sp. — Holotype
18., 19. *Artemisiaepollenites sellularis* n. g. n. sp. — Holotype

1., 4. Hidas 53. sz. f. 665,1—666,8 m
2., 3., 8., Zengővárkony 59. sz. f. 60,9—63,0 m
5. Hidas II. telep 1 m
10., 11. Hidas 53. sz. f. 479,1—482 m
6., 7., 12. Hidas 53. sz. f. 669,2—669,8 m
9., 14. Zengővárkony 59. sz. f. 51,3—56 m
13., 20. Zengővárkony 59. sz. f. 71,4—73,0 m
15—17. Zengővárkony 59 sz. f. 67,5—70,5 m
18., 19. Szászvár 8. sz. f. 26—27 m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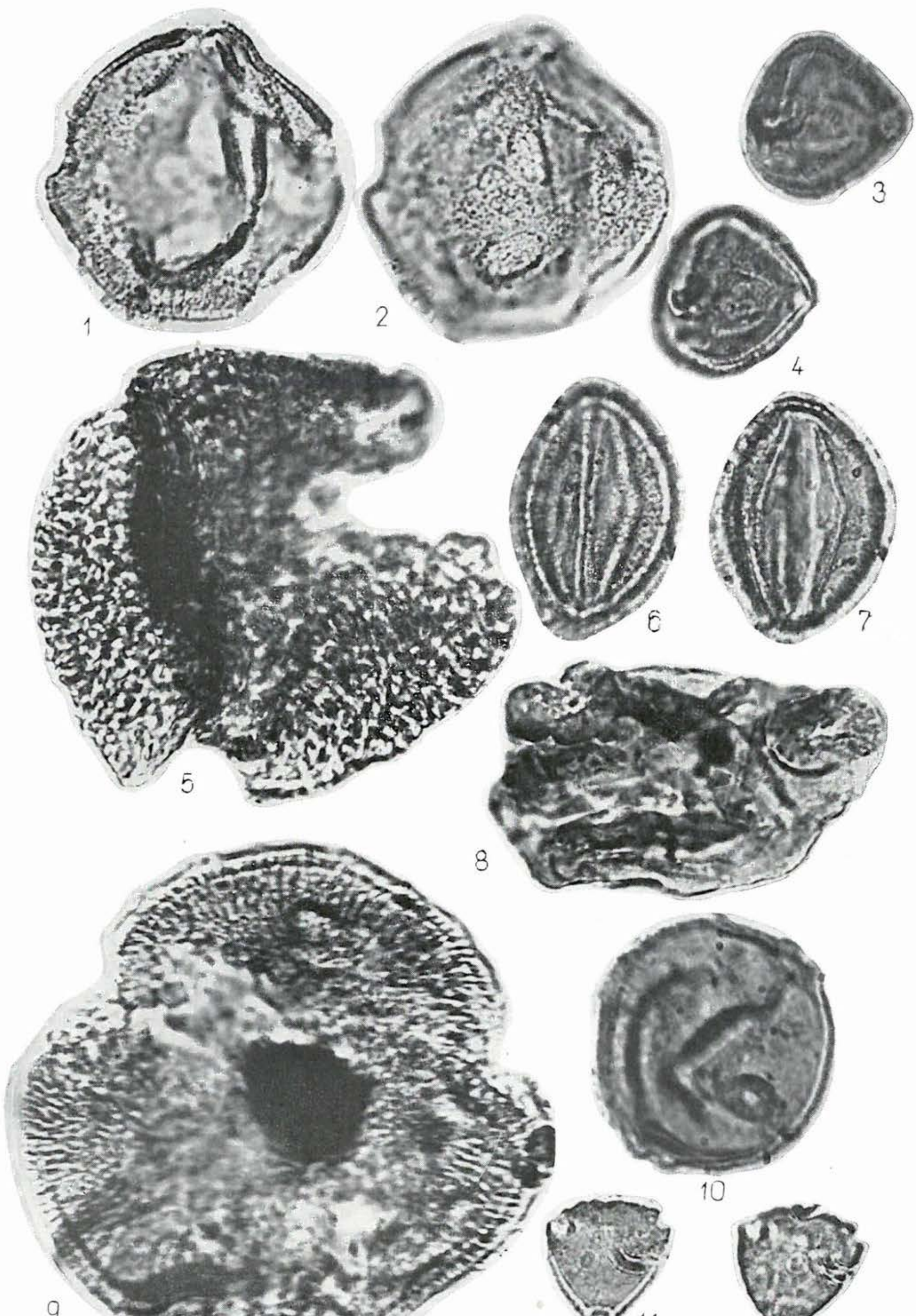
XLII. Tábla — Plate XLII

1., 2. *Liquidambarpollenites orientaliformis* n. sp. — Holotype
3., 4. *Slowakipollenites neogenicus* n. sp. — Holotype
5. *Alangiopollenites barghoornianum* (TRAVERSE 1955) W. KR. 1962
6., 7. *Tricolporopollenites caesalpiniaceaeformis* n. sp. — Holotype
8. *Jussiaeapollenites champlainensis* (TRAVERSE 1955) n. c.
9. *Alangiopollenites simplex* n. sp. — Holotype
10. *Myriophyllumpollenites quadratus* n. g. n. sp. — Generotype
11., 12. *Siphonodontipollenites hungaricus* n. g. n. sp. — Generotype — Redeposited

1., 2. Zengővárkony 59. sz. f. 71,4—73 m
3., 4., 5. Hidas 53. sz. f. 667,2—669,2 m
6., 7. Zengővárkony 45. sz. f. 14,0—14,5 m
8. Szászvár 8. sz. f. 433,6—433,8 m
9. Zengővárkony 59. sz. f. 63—65 m
10. Hidas 53. sz. f. 147,5—148,5 m
11., 12. Hidas 53. sz. f. 757- 759 m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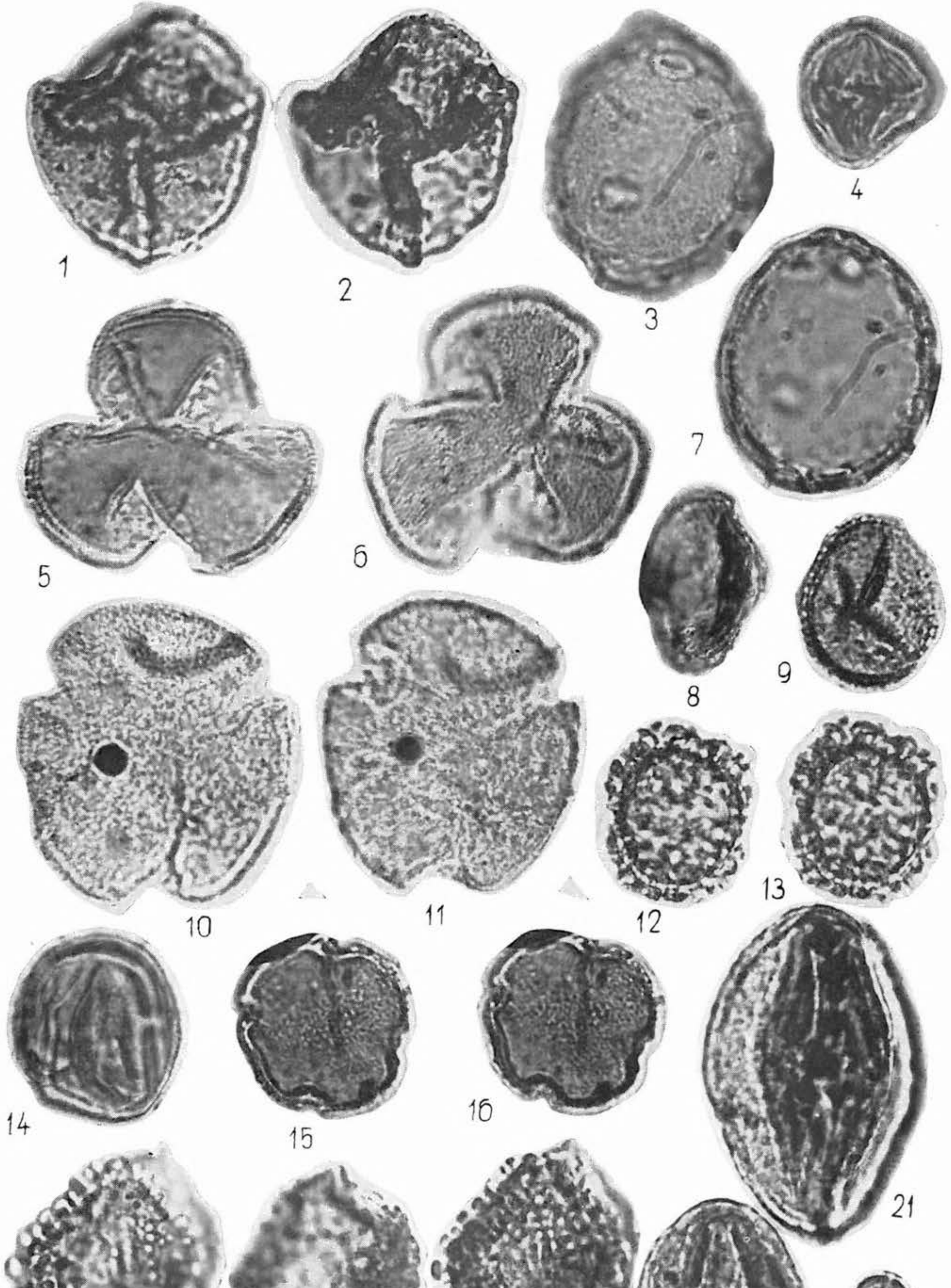
XLIII. Tábla — Plate XLIII

1., 2. *Sporotrapoidites hungaricus* n. sp. — Holotype
3., 7. *Celtipollenites komlóensis* n. g. n. sp. — Generotype
4. *Cyrillaceaepollenites megaexactus* (R. Pot. 1931) R. Pot. 1960
5., 6. *Aceripollenites reticulatus* n. g. n. sp. — Generotype
8. *Araliaceoipollenites euphorii* (R. Pot. 1931) R. Pot. 1951 I.
9. *Ilexpollenites propinquus* (R. Pot. 1934) R. Pot. 1960
10., 11. *Aceripollenites rotundus* n. g. n. sp. — Holotype
12., 13. *Ilexpollenites margaritatus* (R. Pot. 1931) R. Pot. 1960
14. *Polygalacearumpollenites miocaenicus* n. g. n. sp. — Generotype
15., 16. *Rutacearumpollenites komlóensis* n. g. n. sp. — Generotype
17—19. *Ilexpollenites iliacus* (R. Pot. 1931) R. Pot. 1960
20—21. *Rhoipites pseudocingulum* (R. Pot. 1934) R. Pot. 1960
22. *Cyrillaceaepollenites exactus* (R. Pot. 1931) R. Pot. 1960

1., 2. Zengővárkony 59. sz. f. 56—60,9 m
3., 7., 15., 16. Komló 120. sz. f. 178—178,8 m
4., 9. Hidas 53. sz. f. 667,2—669,2 m
5., 6. Zengővárkony 59. sz. f. 65—67 m
8. Zengővárkony 59. sz. f. 41,8—44,4 m
10., 11. Zengővárkony 59. sz. f. 51,3—56 m
12., 13. Hidas 53. sz. f. 118—126,8 m
14. Pusztakisfalu VI. sz. f. 25—27,1 m
17—19. Szászvár 8. sz. f. 433,6—433,8 m
20—21. Hidas 53. sz. f. 659,5—659,8 m
22. Hidas 53. sz. f. 658,8—659,1 m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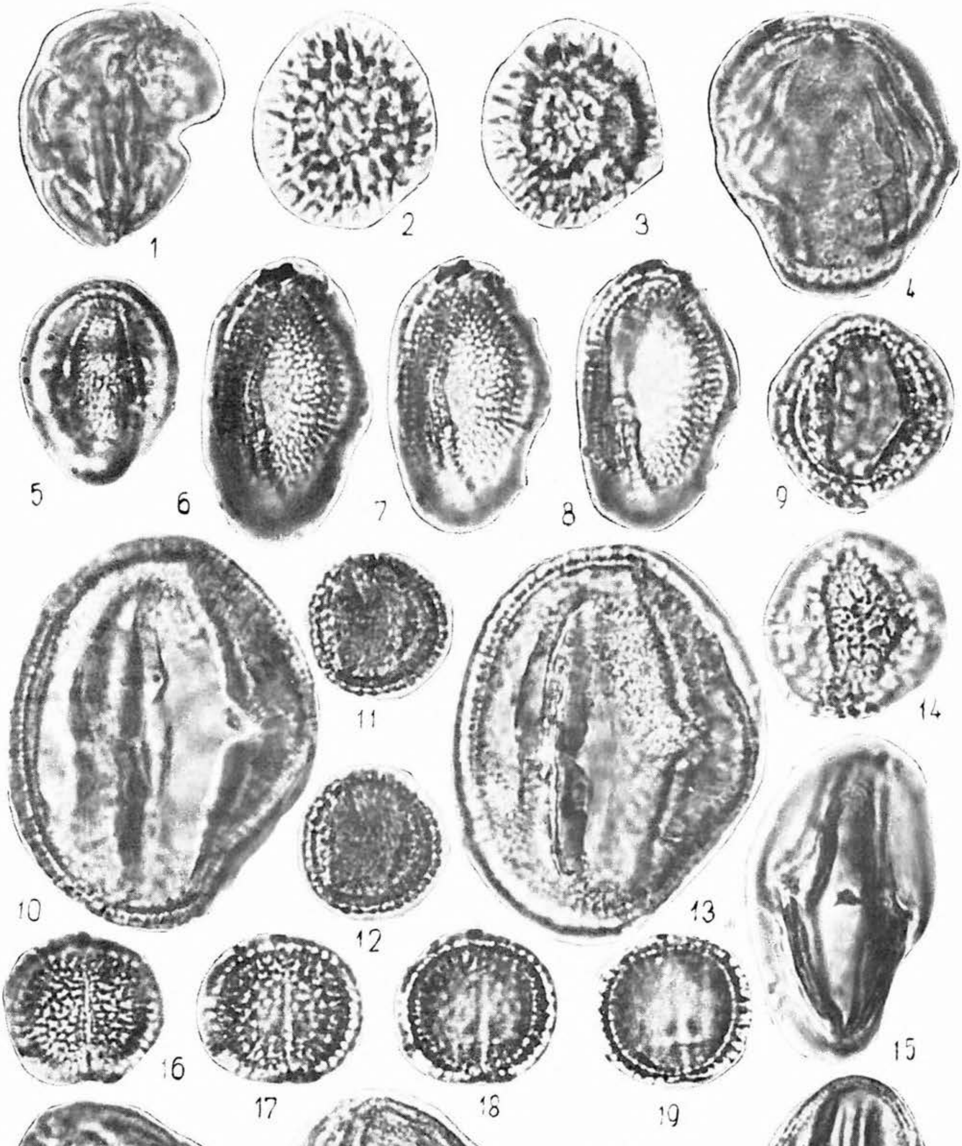
XLIV. Tábla — Plate XLIV

1. *Rubiaceae* sp.
2., 3. *Spinuliferoidaepollenites zólyomii* n. g. n. sp. — Generotype
4. *Araliaceoipollenites euphorii* (R. Pot. 1931) R. Pot. III
5. *Araliaceoipollenites euphorii* (R. Pot. 1931) R. Pot. IV
6—8. *Araliaceoipollenites edmundi* (R. Pot. 1931) R. Pot. 1960 f. *reticulatus* n. f.
9., 14. *Caprifoliipites sambucoides* n. sp. — Holotype
10., 13. *Tricolporopollenites edmundi* (R. Pot. 1931) R. Pot. 1960 f. *major* n. f.
11., 12. *Caprifoliipites gracilis* n. sp. — Holotype
15., 23. *Tricolporopollenites satzveyensis* Pf. 1953
16—19., 22. *Caprifoliipites andreánszkyi* n. sp. — Holotype
20—21. *Araliaceoipollenites edmundi* (R. Pot. 1931) R. Pot. 1960

1. Hidas 53. sz. f. 600,5—602,3 m
2., 3. Pusztakisfalu VI. sz. f. 10,5—12,5 m
4., 5. Komló 120. sz. f. 178—178,8 m
6—8. Zengővárkony 59. sz. f. 67,5—70,5 m
9., 14. Hidas 53. sz. f. 667,2—669,2 m
10., 13. Zengővárkony 59. sz. f. 56—60.9 m
11., 12., Zengővárkony 45. sz. f. 16,4—17,2 m
20., 21. Hidas 53. sz. f. 118—126,8 m
15., 23. Hidas 53. sz. f. 600,5—602,3 m
16—19., 22. Zengővárkony 59. sz. f. 51,3—56 m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XLV. Tábla — Plate XLV

1\. *Scabiosaepollenites minimospinuosus* n. g. n. sp. — Holotype
2., 3. *Lonicerapollenites* cf. *gallwitzi* W. Kr. 1962
4\. *Intratriporopollenites insculptus* Mai 1961
5., 8. *Intratriporopollenites* cf. *microreticulatus* Mai 1961
6., 7. *Intratriporopollenites instructus* (R. Pot. 1931) Pf. et Th. 1953 ssp. *macroreticulatus* Mai 1961

1\. Hidas 53. sz. f. 147,5–148,6 m
2., 3. Zengővárkony 59. sz. f. 48,5—51,3 m
4\. Hidas 53. sz. f. 683—686,5 m
5., 8. Zengővárkony 45. sz. f. 16,4—17,2 m
6., 7. Zengővárkony 59. sz. f. 60,9—63 m


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XLVI. Tábla — Plate XLVI

1. *Scabiosaepollenites magnus* n. g. n. sp. — Generotype
2., 3. *Intratriporopollenites polonicus* MAI 1961
4. *Heliotropioidearumpollenites rotundus* n. g. n. sp. — Holotype
5. *Heliotropioidearumpollenites gracilis* n. g. n. sp.
6., 7. *Plantaginacearumpollenites miocaenicus* NAGY 1963
8. *Scabiosaepollenites minimospinuosus* n. g. n. sp. — Holotype

1. Zengővárkony 59. sz. f. 51,3—56 m
2., 3., 6., 7. Hidas 53. sz. f. 572,0—575 m
4. Hidas II. No 53.
5. Szászvár 8. sz. f. 432,5—432,7 m
8. Hidas 53. sz. f. 147,5—148,6 m


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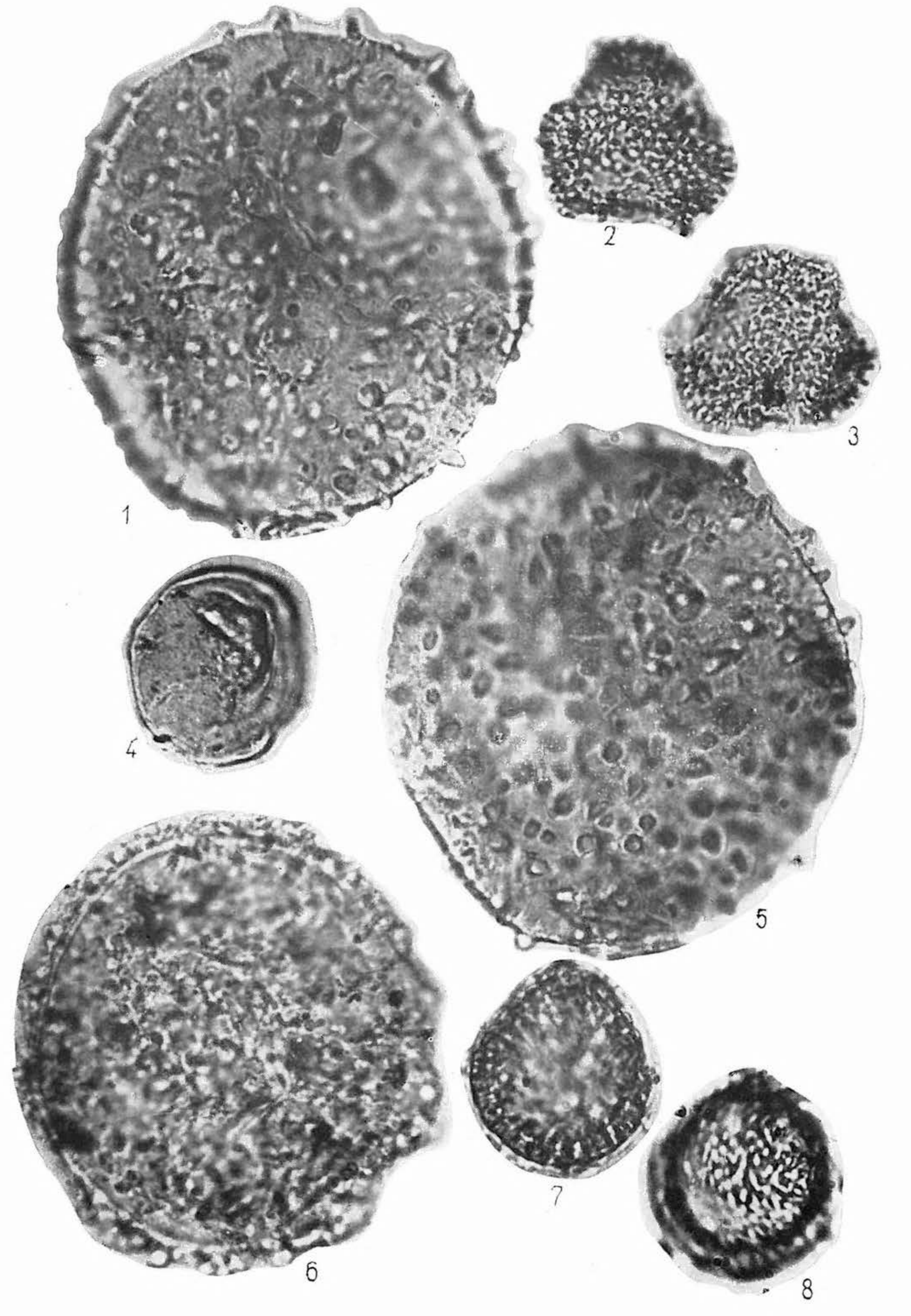
XLVII. Tábla — Plate XLVII

1., 5. *Malvacearumpollenites rotundus* n. sp. — Holotype
2., 3. *Oleoidearumpollenites reticulatus* n. g. n. sp. — Generotype
4. *Heliotropioidearumpollenites gracilis* n. g. n. sp. — Generotype
6. cf. *Malvacearumpollenites* sp.
7., 8. *Oleoidearumpollenites chinensis* n. g. n. sp. — Holotype

1., 5. Szászvár 8. sz. f. 433,8—434,1 m
2., 3. Komló 120. sz. f. 178—178,8 m
4. Zengővárkony 59. sz. f. 67,5—70,5 m
6. Zengővárkony 59. sz. f. 56—60,9 m
7., 8. II. Almáspatak 1. m. 0,1—0,4 m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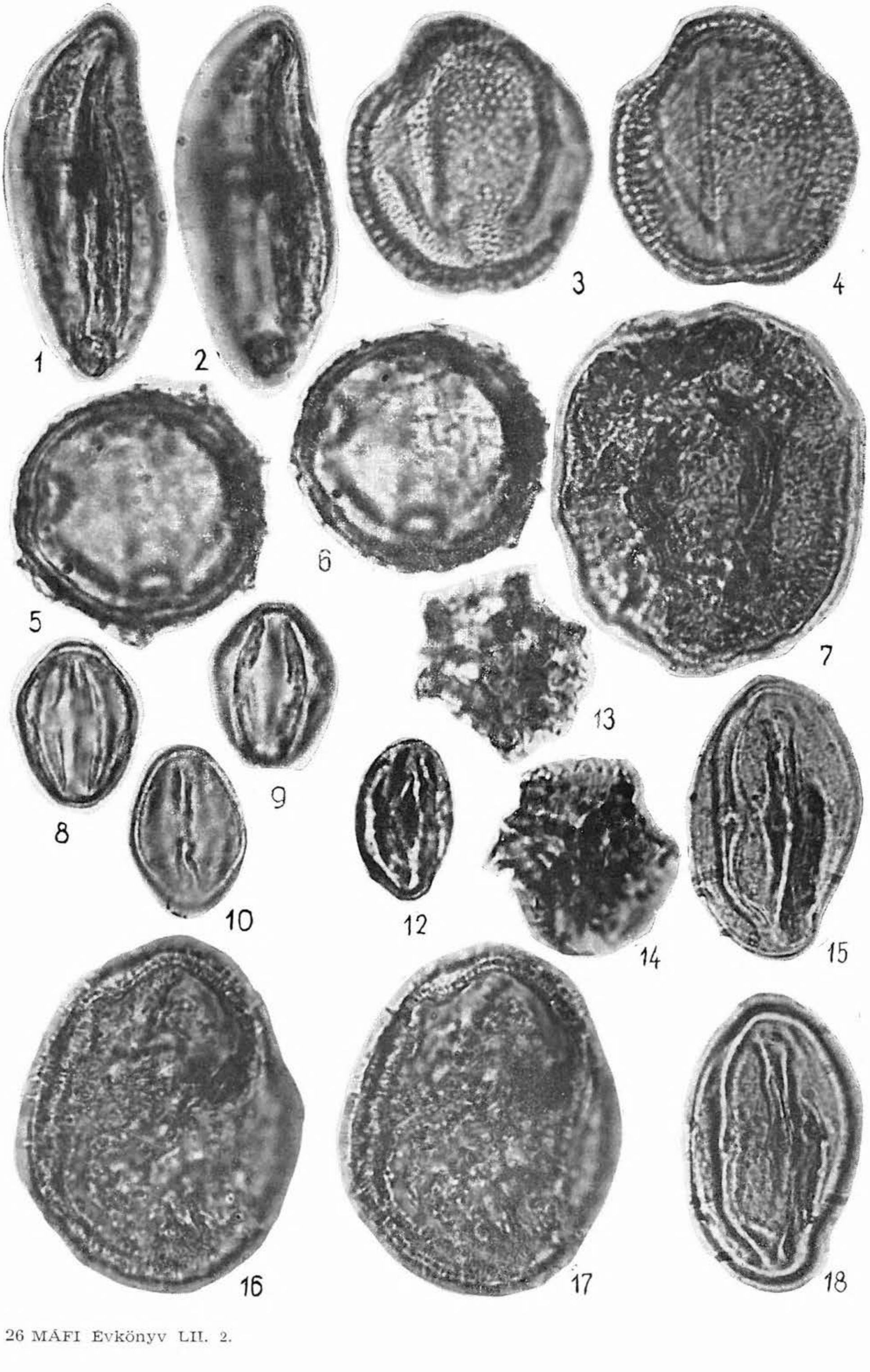
XLVIII. Tábla — Plate XLVIII

1., 2. *Pteracanthopollenites discordatus* n. g. n. sp. — Generotyep
3., 4. *Cistacearumpollenites rotundus* n. g. n. sp. — Generotype
5., 6. *Plantaginacearumpollenites* sp.
7. *Dipterocarpacearumpollenites hidasensis* n. g. n. sp. — Generotype
8—10. *Lobeliaepollenites erdtmani* n. g. n. sp. — Generotype
12. *Utriculariaepollenites elegans* n. g. n. sp. — Generotype
13., 14. *Cichoriaearumpollenites gracilis* n. g. n. sp. — Generotype
15., 18. *Cistacearumpollenites macrodurensis* (PF. et THOMS. 1953) n. comb.
16., 17. *Dipterocarpacearumpollenites spinosus* n. g. n. sp. — Holotype

1., 2. Szászvár 8. sz. f. 433,8—434,1 m
3., 4., 13., 14. Zengővárkony 59. sz. f. 51,3—56 m
5., 6. Hidas 53. sz. f. 126,6—132,5 m
7., 16., 17. Hidas 53. sz. f. 667,2—669,2 m
8—10. Hidas 53. sz. f. 572—575 m
12. Komló 120. sz. f. 372—374,4 m
15., 18. Zengővárkony 45. sz. f. 13,2—13,7 m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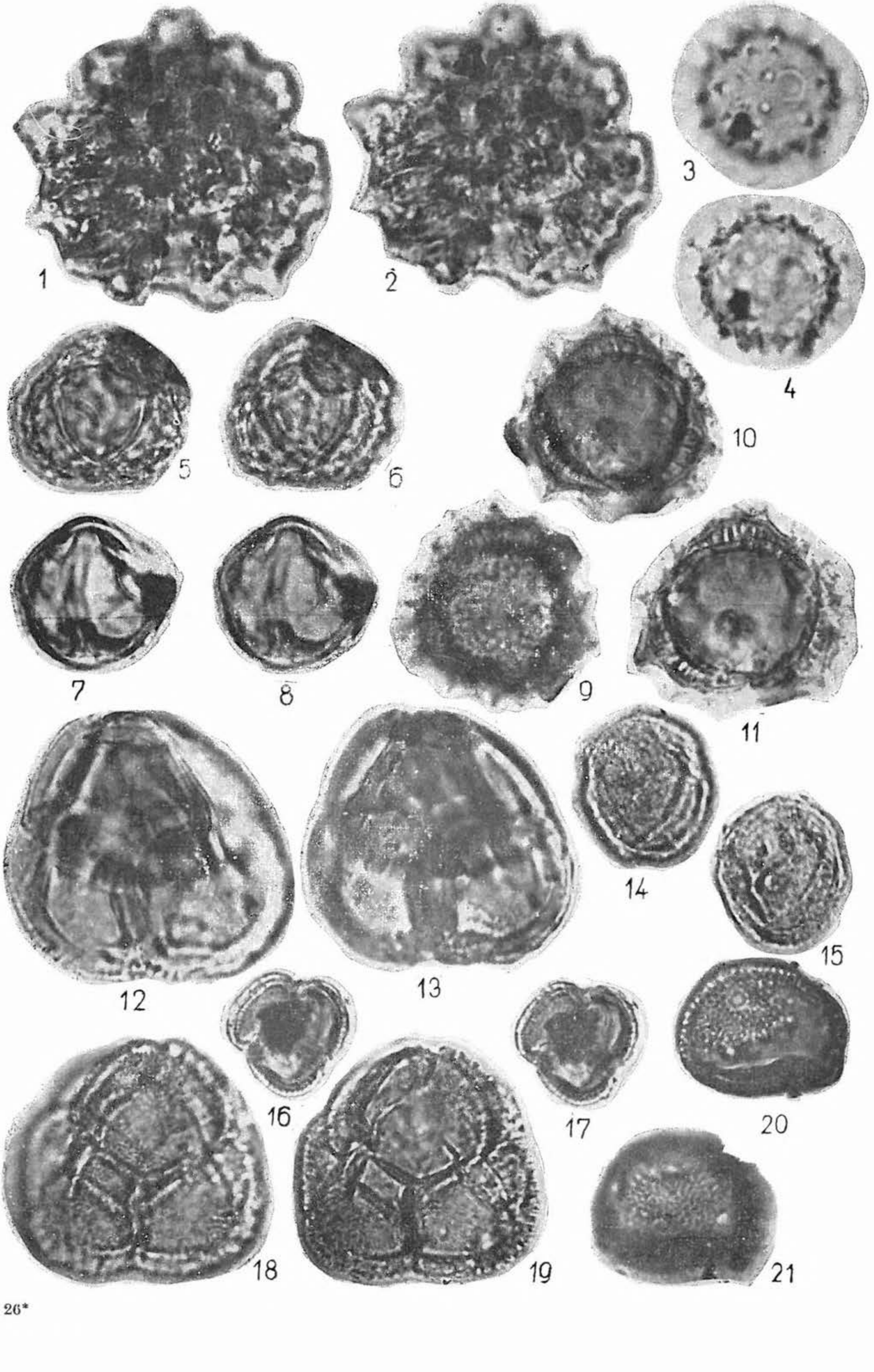
XLIX. Tábla — Plate XLIX

1., 2. *Tubulifloridites grandis* n. sp. — Holotype
3., 4. *Tubulifloridites granulosus* n. sp. — Holotype
5., 6. *Tubulifloridites ambrosiinae* n. sp. — Holotype
7., 8. *Tricolporopollenites clethraceiformis* n. sp. — Holotype
9—11. *Tubulifloridites anthemidearum* n. sp. — Holotype
12., 13. *Ericipites discretus* (R. Pot. 1934) n. comb.
14., 15. *Spinulaepollenites arceuthobioides* W. Kr. 1962
16., 17. *Artemisiaepollenites sellularis* n. g. n. sp. — Generotype
18., 19. *Ericipites baculatus* n. sp. — Holotype
20., 21. *Caryophyllidites microreticulatus* n. sp. — Holotype

1., 2. Zengővárkony 59. sz. f. 51,3—56 m
3., 4. Pusztakisfalu VI. sz. f. 10,5—12,5 m
5., 6. Hidas 53. sz. f. 761—763,3 m
7., 8. Zengővárkony 59. sz. f. 67,5—70,5 m
9—11. Hidas 53. sz. f. 534—537 m
12., 13. Zengővárkony 59. sz. f. 60,9—63 m
14., 15. Komló 120. sz. f. 367,0—374,7 m
16., 17. Hidas 53. sz. f. 572—575 m
18., 19. Zengővárkony 59. sz. f. 63—65 m
20., 21. Zengővárkony 59. sz. f. 30,9—34 m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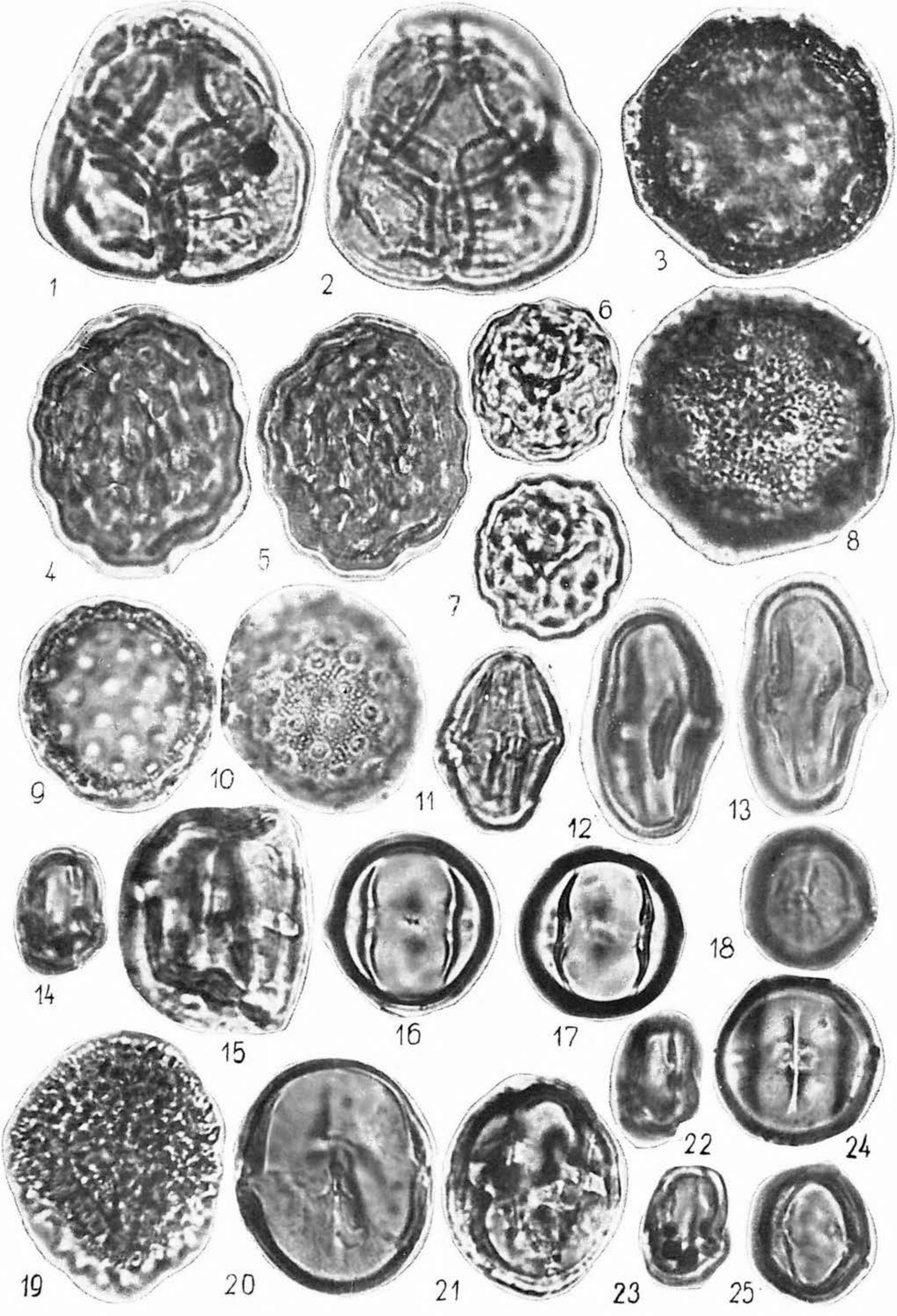
L. Tábla — Plate L

1., 2. *Ericipites hidasensis* n. sp. — Holotype
3., 8. *Caryophyllidites hidasensis* n. sp. — Holotype
4., 5. *Chenopodipollenites maximus* n. sp. — Holotype
6., 7. *Chenopodipollenites multiplex* (WEYL. et PF. 1957) W. KR. 1966
9., 10. *Chenopodipollenites neogenicus* n. sp. — Holotype
11. *Sapotaceoidaepollenites microrhombus* (PF. 1953) n. c. f. *miocaenica* n. f.
12., 13. *Sapotaceoidaepollenites turgidus* n. sp. — Holotype
15. *Sapotaceoidaepollenites obscurus* (PF. et THOMS. 1953) n. c.
14., 22., 23. *Sapotaceoidaepollenites* cf. *abditus* (PF. 1953) n. c.
16., 17., 24. *Sapotaceoidaepollenites rotundus* n. sp. — Holotype
18., 25. *Sapotaceoidaepollenites biconus* (PF. 1953) n. c. — Redeposited
19. *Persicarioipollenites lusaticus* W. KR. 1962
20. *Sapotaceoidaepollenites kirchheimeri* (TH. et PF. 1953) n. c.
21. *Sapotaceoidaepollenites* cf. *sapotoides* (PF. et TH. 1953) R. POT. 1960

1., 2. Hidas 53. sz. f. 600,5—602,3 m
3., 8. Hidas 53. sz. f. 688—688,5 m
4., 5. Hidas 53. sz. f. 558—561 m
6., 7. Hidas 53. sz. f. 134,8—135,5 m
9., 10. Hidas 53. sz. f. 147,5—148,5 m
11. Pusztakisfalu VI. sz. f. 22,5—25 m
12., 13. Zengővárkony 59. sz. f. 71,4—73 m
15. Pusztakisfalu VI. sz. f. 12,5—15 m
14., 22., 23. Hidas 53. sz. f. 572—575 m
16., 17., 24. Zengővárkony 59. sz. f. 35,8—105,6 m
18., 25. Zengővárkony 59. sz. f. 30,9—34 m
19., 20. Zengővárkony 59. sz. f. 65—67 m
21. Hidas 53. sz. f. 479,1—482 m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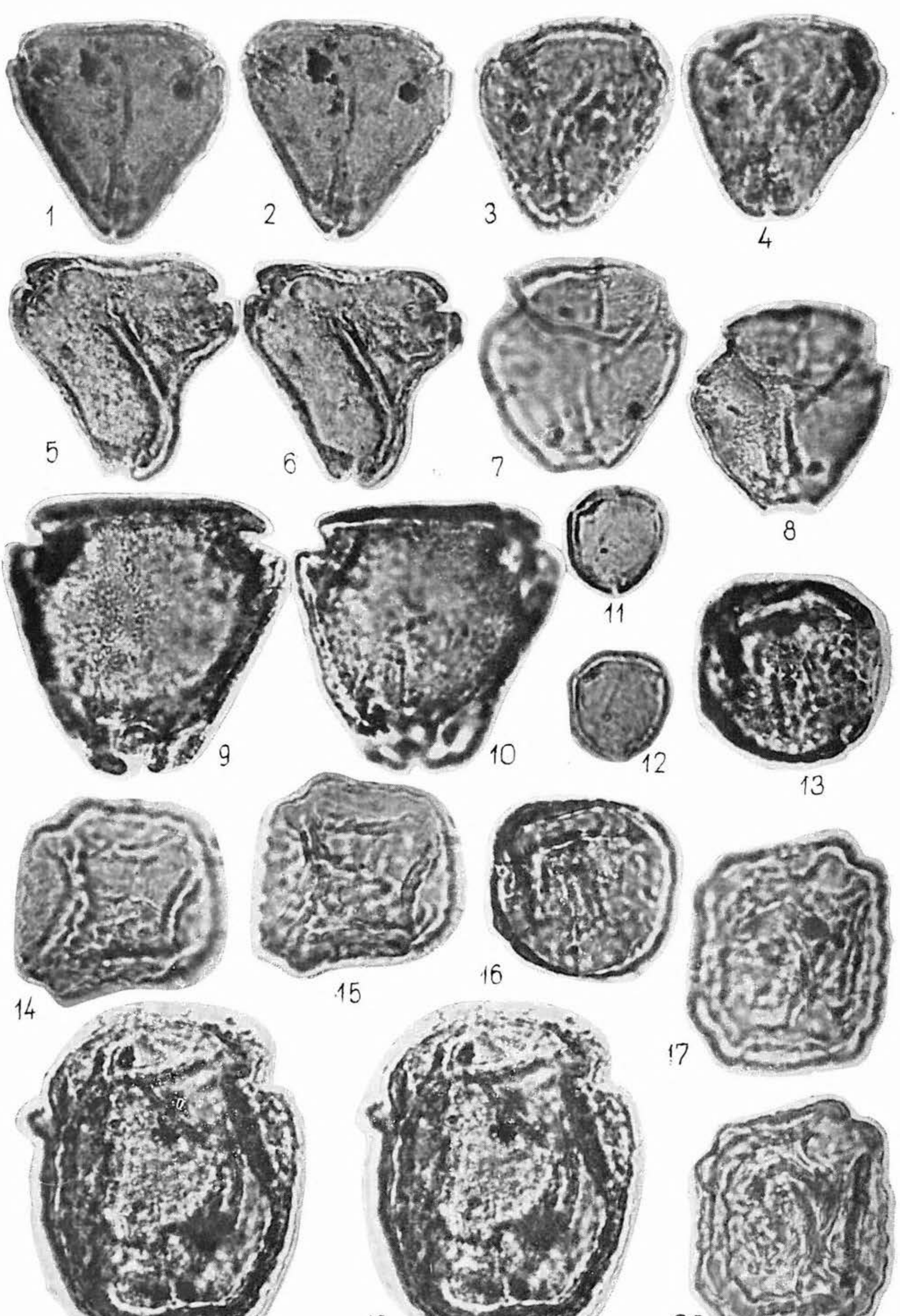
LI. Tábla — Plate LI

1., 2. *Porocolpopollenites hidasensis* NAGY 1963
3., 4. *Porocolpopollenites triangulus* (R. POT. 1931) TH. et PF. 1953
5., 6. *Porocolpopollenites latiporis* PF. et TH. 1953
7., 8. *Porocolpopollenites stereoformis* PFLUG 1953
9., 10. *Porocolpopollenites vestibulum* (R. POT. 1931) TH. et PF. 1953
11., 12. *Triporopollenites urticoides* n. sp. — Holotype
13., 16. *Ulmipollenites stillatus* n. sp. — Holotype
14., 15. *Zelkovaepollenites thiergarti* n. g. n. sp. — Holotype
17., 20. *Zelkovaepollenites potoniéi* n. g. n. sp. — Generotype
18., 19. *Faguspollenites gemmatus* n. sp. — Holotype

1., 2. Hidas 53. sz. f. 572—575 m
3., 4. Hidas 53. sz. f. 667,2—669,2 m
5., 6. Zengővárkony 59. sz. f. 65—67 m
7., 8. Komló 120. sz. f. 178—178,8 m
9., 10. Zengővárkony 59. sz. f. 30,9—34 m
11., 12. Zengővárkony 45. sz. f. 17,2—17,8 m
13., 16. Hidas 53. sz. f. 479,1—482,0 m
14., 15. Szászvár 8. sz. f. 432,5—432,7 m
17., 20. Hidas 53. sz. f. 669,2—669,8 m
18., 19. Hidas 53. sz. f. 600,5—602,3 m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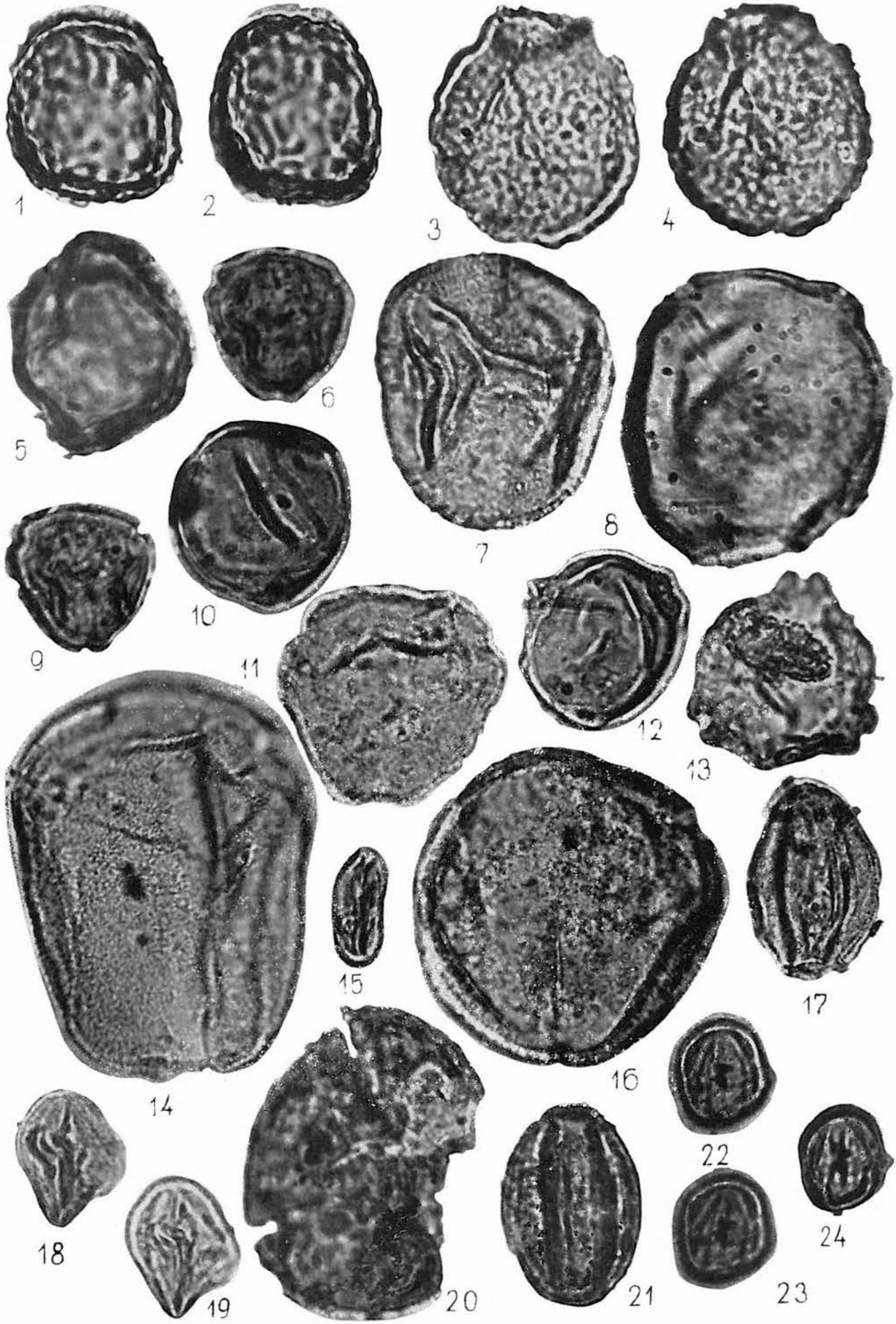
LII. Tábla — Plate LII

1., 2. *Ulmipollenites maculosus* n. sp. — Holotype
3., 4. *Ulmipollenites miocaenicus* n. sp. — Holotype
5. *Ulmipollenites undulosus* Wolff 1934
6., 9. *Triporopollenites coryloides* Pflug 1953
7. *Faguspollenites vivus* n. sp. — Holotype
8. *Carpinuspollenites carpinoides* (Pf. 1953) n. c.
10. *Ostryapollenites rhenanus* (Thoms. 1950) n. c.
11. *Triporopollenites* cf. *robustus* Pf. 1953
12. *Betulaepollenites betuloides* (Pf. 1953) n. c.
13. *Betulaepollenites prominens* (Pf. 1953) n. c. — Redeposited
14. *Faguspollenites subtilis* n. sp.
15. *Tricolpopollenites liblarensis* (Thoms. 1950) Th. et Pf. 1953 ssp. *fallax* (R. Pot. 1934) Th. et Pf. 1953
16. *Faguspollenites vivus* n. sp. — Holotype
17. *Tricolporopollenites henrici* (R. Pot. 1931) W. Kr. 1961
18., 19. *Tricolporopollenites microhenrici* (R. Pot. 1931) W. Kr. 1961 ssp. *intragranulatus* Pf. 1953
20. *Faguspollenites crassus* n. sp. — Holotype
21. *Quercopollenites granulatus* n. g. n. sp. — Generotype
22—24. *Tricolporopollenites minimus* n. sp. — Holotype

1., 2., 3., 4. Hidas 53. sz. f. 667,2—669,2 m
5. Hidas 53. sz. f. 135,5—137 m
6., 9. Pusztakisfalu VI. sz. f. 15—17 m
7., 10., 12. Komló 120. sz. f. 178—178,8 m
8. Hidas 53. sz. f. 73,3—89,5 m
11. Hidas 53. sz. f. 118—126,8 m
13. Szászvár 8. sz. f. 433,6—433,8 m
14. Zengővárkony 59. sz. f. 71,4—73 m
15. Szászvár 8. sz. f. 434,5—435 m
16. Zengővárkony 59. sz. f. 65—67,5 m
17. Hidas 53. sz. f. 600,5—602,3 m
18., 19. Zengővárkony 45. sz. f. 8,6—13,2 m
20. Hidas 53. sz. f. 669,0—669,8 m
21. Hidas 53. sz. f. 147,5—148,5 m
22—24. Zengővárkony 59. sz. f. 81—83 m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LIII. Tábla — Plate LIII

1\. *Tricolpopollenites liblarensis* (THOMSON 1950) TH. et PF. 1953 ssp. *liblarensis*

2., 3. *Tricolporopollenites asper* (TH. et PF. 1953) W. KR. 1961 — Redeposited

4., 5. *Faguspollenites minor* n. sp.

6\. *Faguspollenites tenuis* n. sp.

7., 8. *Tricolporopollenites villensis* (THOMSON 1950) THOMS. et PF. 1953

9\. *Tricolporopollenites microhenrici* (R. POT. 1931) W. KR. 1961 ssp. *intragranulatus* PF. 1953

10\. *Quercopollenites robur type*

11., 12. *Tricolporopollenites densus* (PF. 1953) W. KR. 1961 — Redeposited

13\. *Tricolporopollenites microhenrici* (R. POT. 1931) W. KR. 1961 ssp. *intrabaculatus* PF. 1953

14\. *Tricolporopollenites porasper* PFLUG 1953

15., 16. *Tricolporopollenites cingulum* (R. POT. 1931) TH. et PF. 1953 ssp. *fusus* THOMS. et PFLUG 1953

17\. *Tricolporopollenites cingulum* ssp. *oviformis*, massula

18\. *Quercopollenites petraea type*

19\. *Tricolporopollenites cingulum* (R. POT. 1931) TH. et PF. 1953 ssp. *pusillus* (R. POT. 1934) TH. et PF. 1953

20., 21. *Tricolporopollenites cingulum* (R. POT. 1931) TH. et PF. 1953 ssp. *oviformis* (R. POT. 1931) TH. et PF. 1953

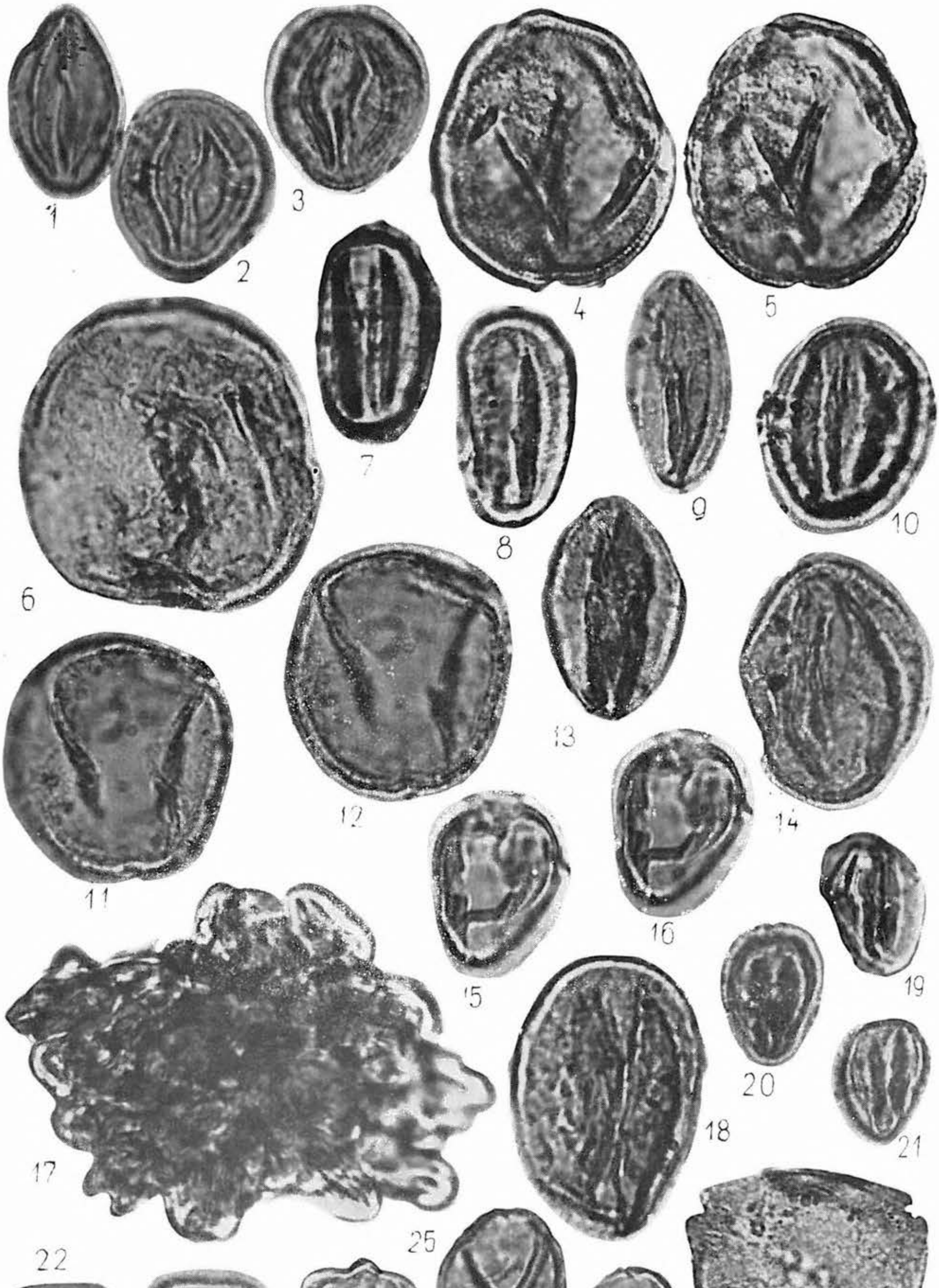
22., 23. *Engelhardtioidites microcoryphaeus* (R. POT. 1931) R. POT. 1960

24\. *Plicatopollis plicatus* (R. POT. 1934) W. KR. 1962

25., 26. *Platycaryapollenites miocaenicus* n. g. n. sp. — Generotype

27\. *Myricipites rurensis* (PF. et TH. 1953) n. c.

1. Zgv. 59. 56—60,9 m; *2—3*. H. 53. 757—759 m; *4—5*. Zgv. 59. 67,5—70,5 m; *6*. K. 120. 374,7 m; *7—8*. Zgv. 59. 65—67 m; *9*. Zgv. 45. 8,6—13,2 m; *10*. Almáspatak I.; *11—12*. H. 53. 118—126,8 m; *13*. H. 53. 630,8—632 m; *14*. Zgv. 59. 51,3—56 m; *15—16*., *27*. Zgv. 59. 63—65 m; *17*. Zgv. 59. 81—83 m; *18*. H. 53. 73,3—89,5 m; *19*. Zgv. 59. 73,5—76 m; *20—21*. H. 53. 837,9—839 m; *22*., *23*. Zgv. 45. 16,4—17.2 m; *24*. Zgv. 45. 13,2—13,7 m; *25—26*. Pkf. VI. 22,5—25 m.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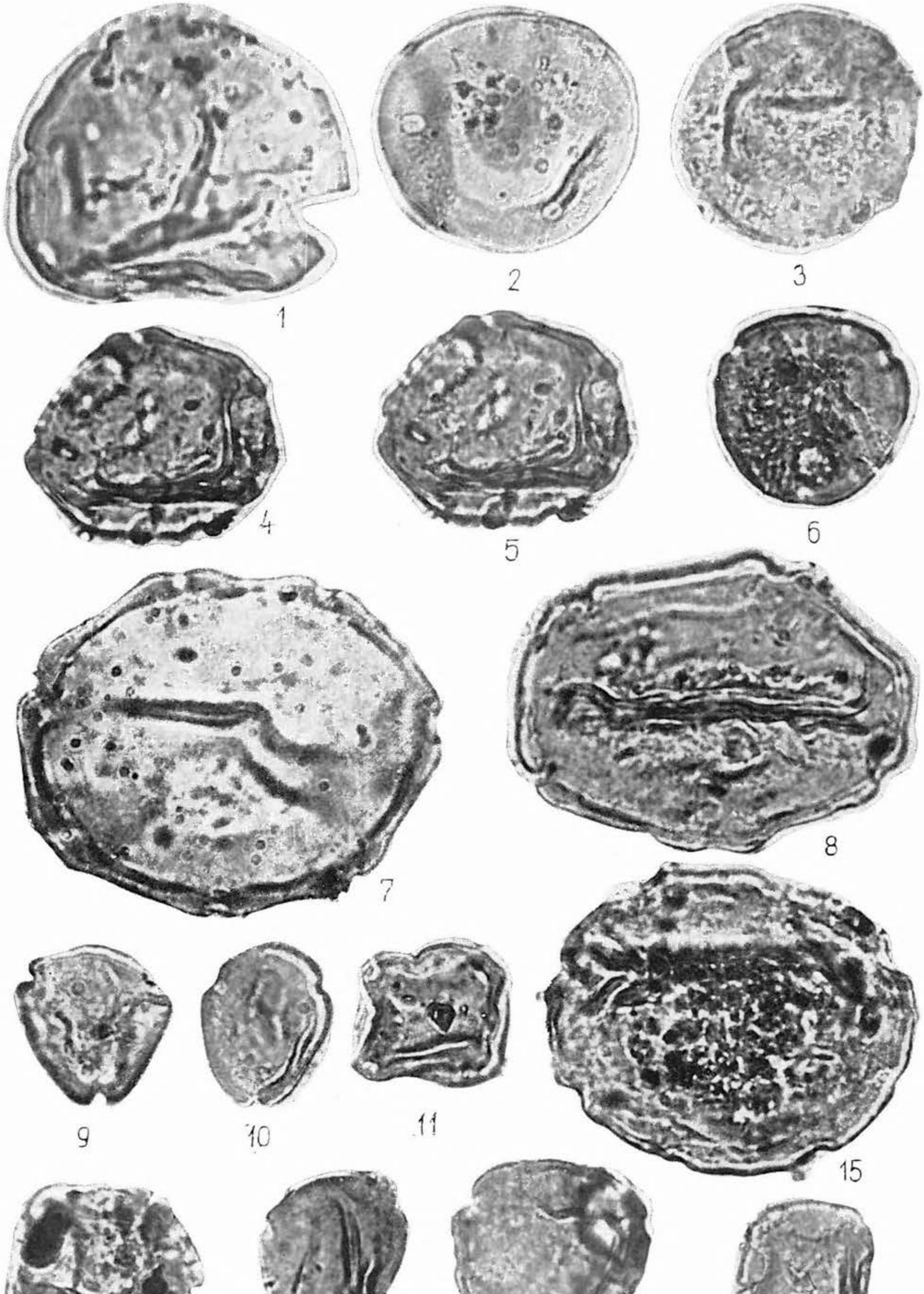
LIV. Tábla — Plate LIV

1. *Juglanspollenites verus* RAATZ 1937
2. *Caryapollenites simplex* (R. POT. 1931) R. POT. 1960
3. *Juglanspollenites* sp.
4., 5. *Pterocaryapollenites stellatus* (R. POT. et VENITZ 1934) THIERGART 1938
6. *Subtriporopollenites* sp.
7. *Pterocaryapollenites mecsekensis* n. sp.
8. *Pterocaryapollenites mecsekensis* n. sp. — Holotype
9., 10. *Momipites punctatus* (R. POT. 1931) n. c. — Redeposited
11., 13., 14. *Myricipites myricoides* (KREMP 1949) n. c.
12., 16. *Alnipollenites verus* R. POT. 1934
15. *Pterocaryapollenites rotundiformis* n. sp. — Holotype

1. Zengővárkony 59. sz. f. 81—83 m
2. Zengővárkony 45. sz. f. 13,2—13,7 m
3. Hidas 53. sz. f. 600,5—602,3 m
4., 5. Pusztakisfalu VI. sz. f. 25—27 m
6. Hidas 53. sz. f. 761—763,3 m
7. Hidas 53. sz. f. 147,5—148,5 m
8., 15. Hidas 53. sz. f. 667,2—669,2 m
9. Szászvár 8. sz. f. 434,3—434,5 m
10. Szászvár 8. sz. f. 433,6—433,8 m
11. Zengővárkony 45. sz. f. 16,4—17,2 m
12. Hidas 53. sz. f. 534—537 m
13. Szászvár 8. sz. f. 432,5—432,7 m
14. Hidas 53. sz. f. 630,8—632,0 m
16. Szászvár 8. sz. f. 433,6—433,8 m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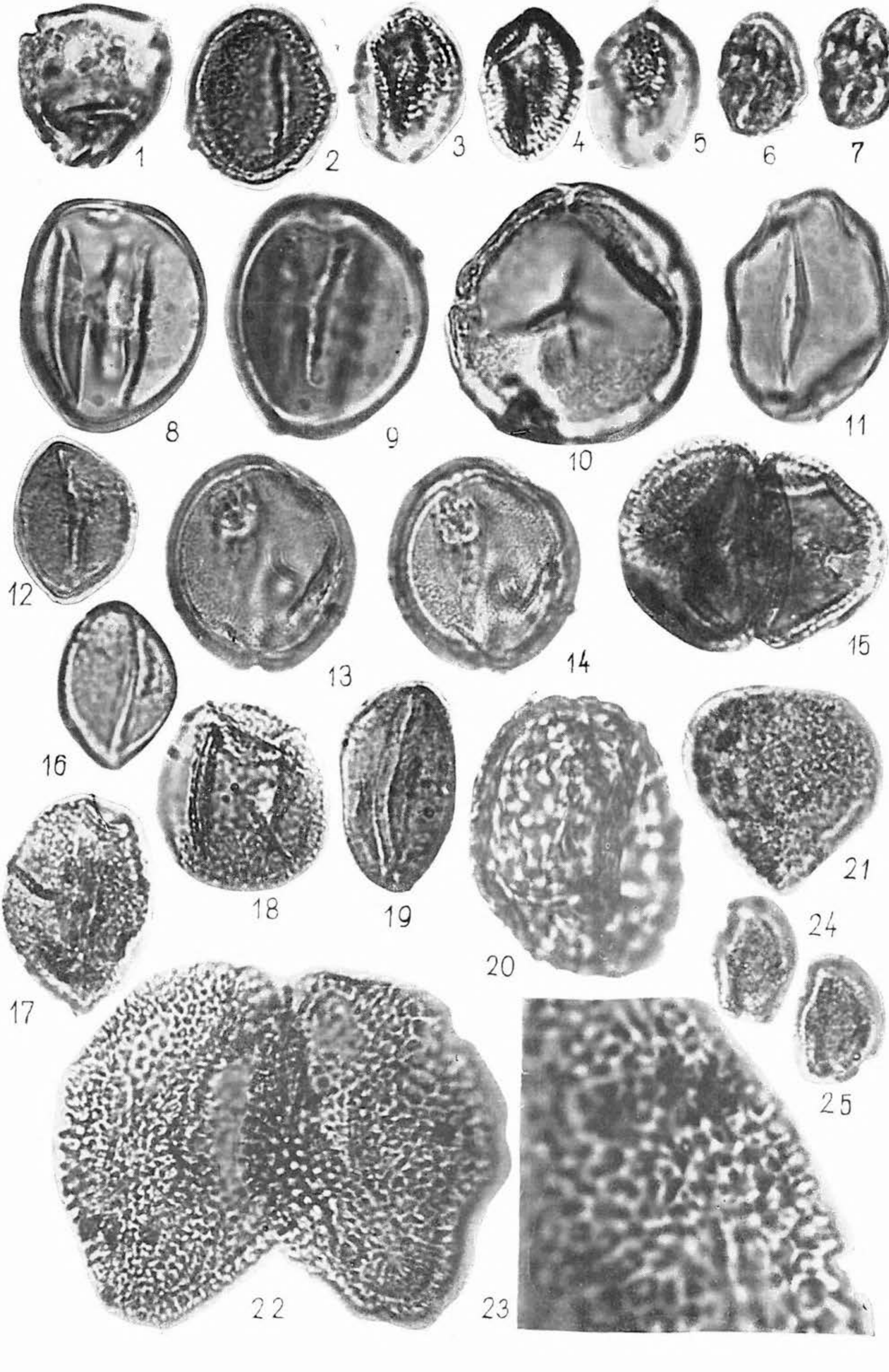
LV. Tábla — Plate LV

1. *Myricipites bituitus* (R. Pot. 1931) n. c.
2. *Arecipites chamaedoriformis* n. sp. — Holotype
3., 4., 5. *Salixipollenites densibaculatus* n. sp. — Holotype
6., 7. *Tricolporopollenites steinensis* Pf. 1953
8., 9. *Tricolpopollenites parmularius* (R. Pot. 1934) Th. et Pf. 1953
10. *Polyporopollenites hidasensis* n. sp. — Holotype
11. *Arecipites zievelensis* (Pf. 1953) n. c.
12. *Arecipites trachycarpoides* n. sp. — Holotype
13., 14. *Tricolporopollenites granulatus* n. sp. — Holotype
15., 18. *Sparganiaceaepollenites polygonalis* Thiergart 1938
16. *Trachycarpus fortunei* H. Wendl.
17. *Sabalpollenites retareolatus* (Pf. 1953) n. c.
19. *Arecipites tranquillus* (R. Pot. 1934) n. c.
20. *Monocolpopollenites observatus* Pf. 1953
21. *Sabalpollenites papillosus* (Mürr. et Pflug 1953) n. c.
22. *Liliacidites ellipticus* n. sp. — Holotype
23. *Liliacidites ellipticus* n. sp. — detail 2000 x
24., 25. *Salixipollenites helveticus* n. sp. — Generotype

1. Hidas 53. sz. f. 494,8—496 m
2. Zengővárkony 59. sz. f. 76—78 m
3., 4., 5. Zengővárkony 59. sz. f. 63—65 m
6., 7. Hidas 53. sz. f. 118—126,8 m
8., 9. Zengővárkony 59. sz. f. 67,5—70,5 m
10. Hidas 53. sz. f. 73,3—89,5 m
11. Zengővárkony 59. sz. f. 44,4—44,7 m
12. Zengővárkony 59. sz. f. 81—83 m
13., 14. Hidas 53. sz. f. 757—759 m
15. Zengővárkony 59. sz. f. 51,3—56 m
16. Recens
17. Hidas 53. sz. f. 572—575 m
18., 22., 23. Zengővárkony 59. sz. f. 56—60,9 m
19. Szászvár 8. sz. f. 433,6—433,8 m
20. Hidas 53. sz. f. 667,2—669,2 m
21. Hidas 53. sz. f. 600,5—602,3 m
24., 25. Pusztakisfalu VI. sz. f. 15—17 m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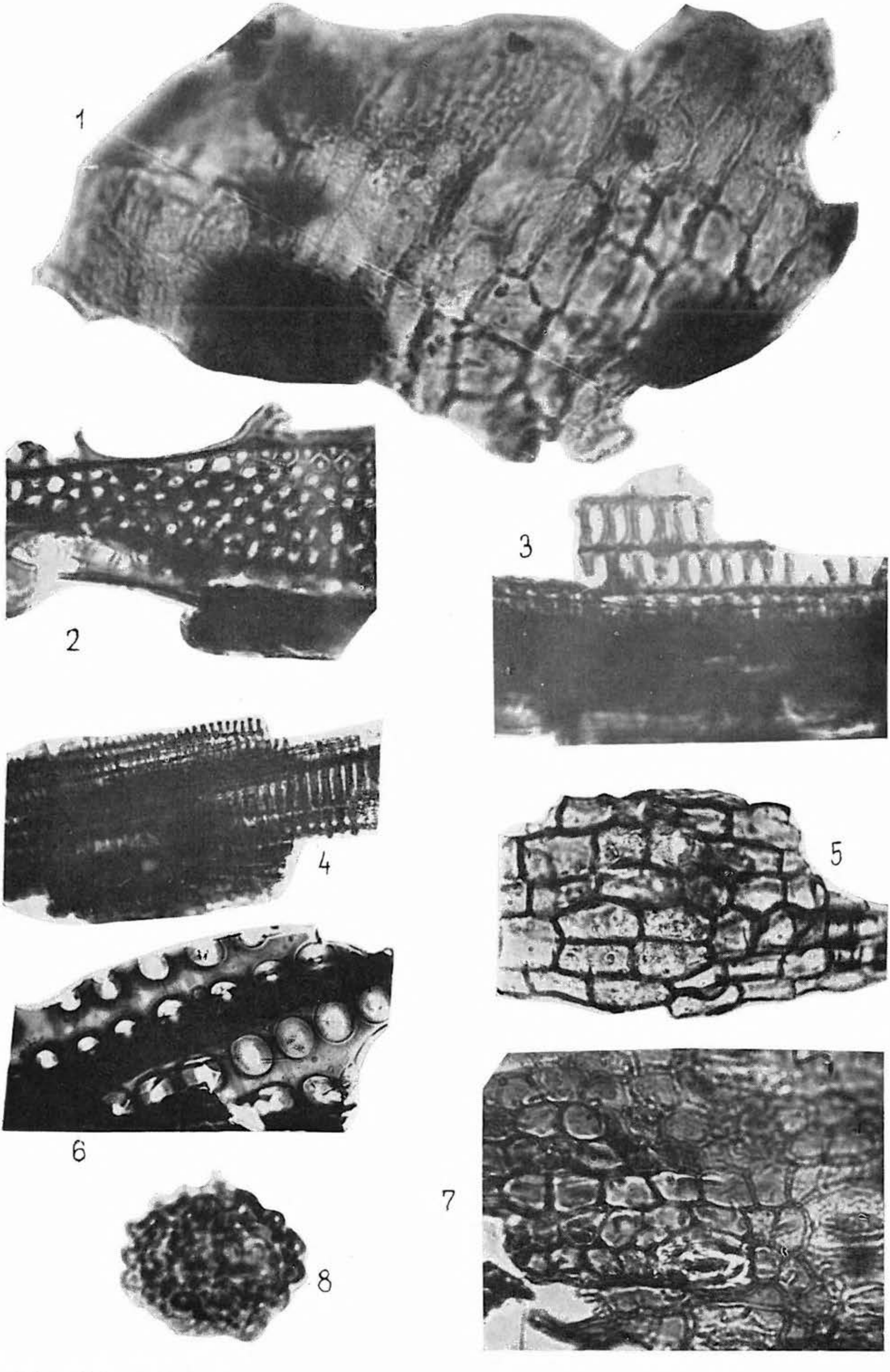
LVI. Tábla — Plate LVI

1., 7. Epidermisz — Epidermis
2. *Ulmus* bélsugár (tangencialis metszet) — Pith ray of *Ulmus* (tangential section)
3. Páfrány tracheamaradvány — Remnant of fern trachea
4. Pálma edény-nyaláb — Vessel bundle of a palm
5. *Carex* sp. gyökérepidermis sejtek — Cells of root epidermis of *Carex* sp.
6. *Taxodiaceae* szövetmaradvány *Taxodiaceous* tissue fragment
8. Levélsejt — Leaf cell

1. Hidas 53. sz. f. 592,7—593,1 m
2. Hidasbánya II. telep 3. minta
3. Hidas 53. sz. f. 665,1—666,8 m
4., 7. Hidasbánya II. telep 2. minta
5. Almáspatak II. 0,1—0,2 m
6., 8. Hidasbánya II. telep 53. minta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