THE POLLEN GRAINS OF THE CARBONATE MANGANESE ORE OF THE SHAFT III. IN ÚRKÚT

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INTRODUCTION

We have previously published in papers the plant microfossils found in oxide manganese ore [SIMONCSICS & KEDVES 1961] and the *Pteridophyta* spores of carbonate manganese ore in Úrkút [KEDVES & SIMONCSICS 1964 *a, b*]. In our works we have put forward the idea that the oxide and carbonate ore could be formed sooner than the black coal of Liassic in Mecsek and even sooner than the age of Upper Liassic. On the basis of the main spore- and pollen-types being present in the carbonate manganese ores we have made attempts to reconstruct the vegetation of the sedimental recess and the surrounding area and according to the microfossils we have divided the carbonate ore deposit into level A *(Classopollis)*, level B *(Crassosphaeridae)* and level C *(Spheripollenites)*.

In the present paper we are going to demonstrate the pollen-types of the carbonate manganese ore deposit in Úrkút together with their botanical and stratigraphical consequences.

SYSTEMATIC PALYNOLOGY

Although the descent of the Jurassic disperse pollen-types is uncertain, we are not going to set up an artificial pollen-system, but we are trying to enlist the pollen-types on the basis of a natural relationship instead. In our systematization we are following Soó's work [1963] to an extent where the degree of relationship is certain, probable or possible.

Phylum: **Gymnospermatophyta**
Subphylum: **Pteridospermophytina**
Classis: **Pteridospermopsida**
Ordo: **Caytoniales**

Vitreisporites pallidus [REISSINGER, 1938] NILSSON 1958 (Plate II. *27, 28*).

The pollen-type is rare in the manganese ore of Úrkút and can be found only in the level A of the carbonate deposit. Its stratigraphy is given from Jurassic to Lower Cretaceous by COUPER [1958]. There is no recent equivalent to this pollen-form. From the fossil disperse pollen-types the type *V. signatus* LESCHIK 1955 from Keuper, the type *V. bjuvensis* NILSSON 1958 from Rhaetic, the type *Caytonipollenites contectus* DE JERSEY 1959 and *C. subtilis* DE JERSEY 1959 from Lower Jurassic (?) and the type

Caytoniales-Pollenites diaphanus PAUTSCH 1958 and *Caytoniales? Pollenites fuscocorpus* PAUTSCH 1958 from Keuper show similarity to the type of Úrkút.

The similarity of the *Vitreisporites pallidus* to the *Caytonianthus arberi* [THOMAS] HARRIS and *C. oncodes* HARRIS pollens of associated type was shown by COUPER [1958]. Its similarity to the *Sagenopteris nilssoniana* [BRONGN.] WARD pollen is also worth mentioning [HARRIS 1926, 1932].

According to the above-mentioned facts the descent of this pollen-form is given in the *Caytoniales*.

It is revealed in SOÓ's system [1963] that the *Caytoniales* — beside the *Pteridospermales* — is an order of the *Pteridospermophytina* and of the class *Pteridospermopsida*. According to ENGLER's Syllabus [1954] the *Caytoniales* which is the second order to the *Cycadopsida (Cycadophyta)* — descending from the *Pteridospermae* — occured from Upper Triassic to Upper Jurassic.

Classis: **Cycadopsida**
Ordo: **Cycadales**

Cf. *Cycadopites* [WODEHOUSE, 1933] ex WILSON & WEBSTER 1946 fsp. (Plate II. *21, 22*).

The plicated pollen-form found in the only sample does not make possible a diagnosis. The sample possibly belongs to the *Cycadopites* fgen.

Description: It is a monocolpate pollen. Its contour is ellipsoid, but one of the two poles is somewhat blunter. Its colpus extends from pole to pole and near the poles it widens out. The wall is thick, double-layered, about 5μ. The ectexine-endexine rate is 4:1. The exine is smooth-chagrenate, here and there corroded. Its length is 60μ, its width is 42μ. The pollen-grain is plicated, and because of the fold running along the colpus there is some similarity to the genera *Eucommiidites* ERDTMAN 1948 and *Bennettitaepollenites* [THIERGART, 1949] R. POT. 1958.

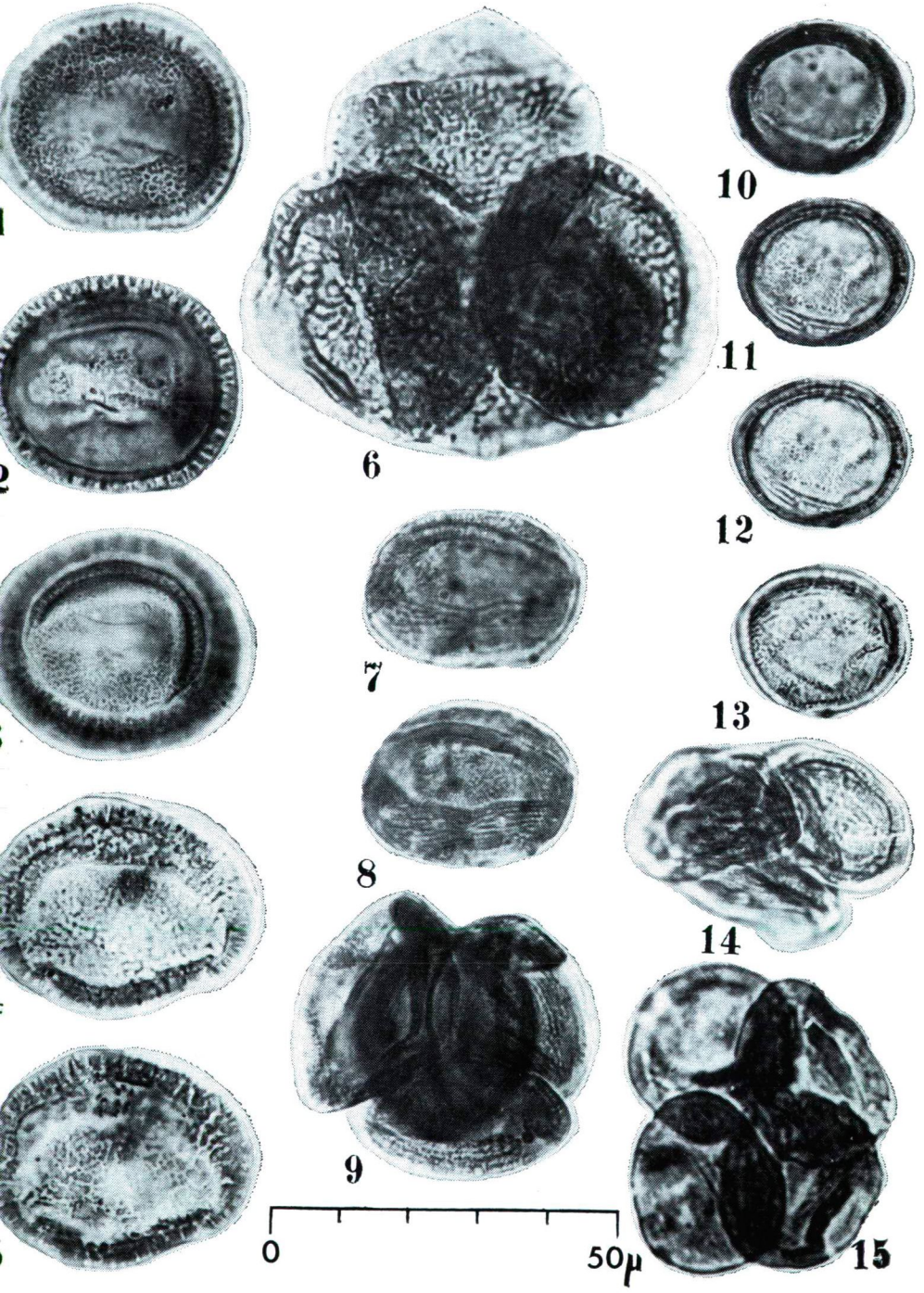
The holotype of the *Cycadopites* [*C. follicularis* WILS. & WEBST., 1946] descends from Tertiary deposits. Not neglecting the fact that the *Cycadales* occurs from Traissic on and its maximum of development can be dated in Jurassic and Lower Cretaceous, the descent of this pollentype from *Cycadales* is probable. The *Pentoxylales* — classed as *Cycadopsida* by SOÓ [1963] — cannot be considered as a pollen-producing taxon, because it was found only in India, whereas, on the other hand, the *Nilssoniales* — classed as belonging to the same order — can be regarded as a pollen-producing taxon, because it was at its height in Jurassic. But we do not know the pollen-type of *Nilssoniales*, because it has died out and we have no knowledge of its associated pollen, either.

Classis: **Cycadopsida or Ginkgopsida**

Monosulcites minimus COOKSON 1947 ex COUPER 1958 (Plate II. 9—11).

The pollen-type consistently occurs everywhere in the carbonate deposit and in the basis of the deposit (the lower part of the level A) it is the dominant form of the spore-pollen complex.

1—3. — *Classopollis grandis* n. fsp.
4—6. — *Classopollis grandis* n. fsp.
7—9. — *Classopollis classoides* [PFLUG, 1953] POCOCK & JANSONIUS 1961.
10—14. — *Classopollis minor* POCOCK & JANSONIUS 1961.
15. — *Classopollis classoides* [PFLUG, 1953] POCOCK & JANSONIUS 1961.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The origin of the exines is uncertain. From the recent classes — beside the *Ginkgopsida* — the *Cycadopsida* produces similar pollen-types. Concerning this problem literary data were published previously [SIMONCSICS & KEDVES, 1961].

From the associated spores COUPER [1968] records the *Andostrobus manis* HARRIS and *A. wonnacotti* HARRIS prepared pollen-grains which correspond to the formerly examined *M. minimus* COOKSON. On the other hand the above-mentioned two associated *Androstrobus* pollens are compared with the Permian disperse *Gynkgaletes* LUBER 1955 fgen. by POTONIÉ [1958]. Regarding the habit the *Androstrobus* corresponds to the *Cycadales*. According to THOMAS & HARRIS [in GOTHAN & WEYLAND, 1964] the male flowers of the *A. manis*, the *Nilssonia compacta* and the *Beania gracilis* on one hand, and on the other the *A. wonnacotti*, the *N. tenuinervis* and the *B. mamayi* belong together and are to be classed as *Nilssoniales*. The *Nilssoniales* is an order of the *Cycadopsida*.

Classis: Cf. **Cycadopsida**

Monosulcites urkutiensis SICS. & KDS. 1961 em.

The species was recorded by the authors from the oxide manganese ore deposit. Instead of the holotype of the species only the holotypes of two subfsp. found in the manganese ore deposit were given and the naming of the first subfsp. was not correct, either, so the species is to be emended.

Diagnosis: see SIMONCSICS & KEDVES [1961].
Holotype: SIMONCSICS & KEDVES [1961] Pl. II. *24, 25.*
Locus typicus: Úrkút.
Stratum typicum: oxide manganese ore, Middle Jurassic.

Note: The relationship of the pollen-grain can be named as *Cycadopsida*. Though monocolpate character occurs both in the *Ginkgopsida* and in the *Monocotyledonopsida*, it cannot be *Monocotyledonopsida* because of its age and cannot be *Ginkgopsida*, either, first of all because of its shape. The pollen of the *Ginkgopsida* is more spindle-shaped very often with sharp apices. Whereas one or both apices of the *M. urkutiensis* are blunted, sometimes even circular.

The subspecies together with the form found in the carbonate manganese ore deposit are as follows:

a) subfsp. *urkutiensis* nov. nom.
Syn.: subfsp. *hyalinoides* SICS. & KDS. 1961.
This subfsp. has not occured in our present material.

b) subfsp. *scabratus* SICS. & KDS. 1961 (Pl. II. *8, 7*). There were only a few samples in the basis of the deposit.

c) subfsp. *circulus* n. subfsp. (Pl. II, *1, 2, 5, 6*).
Diagnosis: The contour is approximately circular. The colpus is short, not longer than the 2/3 part of the pollen-diameter. There are plications of exine on both sides of the colpus which are bifurcating at one end of the colpus and are not or, at least, in a lesser degree are at the other.

Maximal size: 16 μ (15—22 μ)
Holotype: Pl. II. *5, 6;* prep. U—III—28—95—3.
Locus typicus: Úrkút.
Stratum typicum: carbonate manganese ore, Middle Jurassic.

Note: This subfsp. can be differentiated from the *M. urkutiensis scabratus* by its shape, from the *M. urkutiensis urkutiensis* by its ornamentation. References to its relationship, see above. For the sake of exactitude on the basis of the colpus and the plications we have to mention the similarity with the associated spores of the genus *Androstrobus* and, on the other hand, we have to consider its relationship to the *Ginkgopsida* to be improbable for the reason of its shape.

Classis: **Chlamydospermophytina**
Ordo: **Bennettitales**

Bennettitaceaeacuminella cf. *simplex* MALYAVKINA 1953. (Pl. II. *23—25*).

The only sample found in our material — according to descriptions, drawings and reproductions available — on the whole corresponds to the species recorded from Rhaetic sediments of Saghiz with the possible difference that our sample is not intragranulate, but granulate. POTONIÉ [1958] refers to the fact in Synopsis II, that the *B. simplex* is similar to the associated pollen of the *Wielandiella punctata* NATHORS. This pollen-type offers newer data to the abundant *Bennettitales* flora in our area.

Beside the Rhaetic period this type occured in former Liassic coals, too, recorded by ROGALSKA [1954]. So the stratigraphy of this form can be given in the Rhaetic-Liassic—Middle Jurassic.

Classis: ? **Chlamydospermophytina**
Ordo: ? **Bennettitales**

Eucommiidites ERDTMAN 1948.

On the basis of COUPER'S profound analysis [1958] and the corresponding parts of POTONIÉ'S Synopsis II the genus is not typically tricolpate, but praecolpate. If it is so, the former hypothesis that the producers of the abovementioned pollen-genus were angiospermal, must be dropped. This statement is in accordance with many recent opinions.

There is neither equivalent, nor — at least — similar pollen among the recent *Gymnospermae*. But we find pollengrains with similar structure among the associated pollentypes of the extinxt *Gymnospermae*, namely in the *Pteridospermales* and the *Bennettitales*. We are forced to drop the *Pteriospermales* as a producing taxon, because — according to our recent knowledge — it died out already in Triassic and its microspores were of enormous size (200—500 μ). The most probable order is the *Bennettitales*. The probability is increased by the fact that its heyday was in Jurassic, when it flourished in great number according to WIELAND [1916].

The known pollen-types of the *Bennettitales* — with the acceptance of the trilete microspores of the genus *Cycadocephalus* NATHORST — are monocolpate with a touch of praecolpate. It means that two or more plications with or without furrow run parallel with the main colpus. In case of two additional furrows the pollen seems to be tricolpate and types similar to *Eucommiidites* arise.

Eucommiidites troedssonii ERDTMAN 1948 ex COUPER 1958. (Plate II. *12—14, 15, 16, 26*)

This pollen-form can be found in all three levels with a few samples. In one case (Plate II. *26*) a major heap of pollens occurs in the preparation. The praecolpate character can be well seen even in the case of these presumably immature grains.

Eucommiidites rugulatus n. fsp.
(Plate II. *17, 18, 19, 20*)

Diagnosis: The contour of equator is oval with somewhat angular poles. In the longitudinalis axis of the aquator a thin colpus runs. The rate of the longer diameter equatorial and the colpus is 4:3. The colpus is not opened at the ends. A 2 μ wide plication goes along with the colpus in the sample of the type. In the opposite side two plications — growing narrow at the poles while they reach the equator — run parallel with the equator and its longitudinal axis. The wall is two-layered tectate-rugulate-baculate. It is thin (under 1 μ). Maximal size: 23×14—28×18 μ.

Holotype: Plate II. *17*, *18*; prep. U—III—8—116.
Locus typicus: Úrkút.
Stratum typicum: carbonate manganese ore, Middle Jurassic.

Note: In its structure this pollenform is similar to the species of *Schopfipollenites* POTONIÉ & KREMP 1954, but without "umbo". From the other species of the *Eucommiidites* form-genus it can be distinguished by its closed colpus, shape and ornamentation of the wall. In level A it occured only in a few samples together with the *E. troedssonni*.

Classis: ? **Coniferopsida**
Ordo: ? **Taxales**

Spheripollenites subgranulatus COUPER 1958 (Plate II. *3*, *4*)

Beside the *Classopollis* the pollen-type *Spheripollenites* occurs en masse, the spectra are dominated by them especially in the upper level C. The probability of its connection with the *Taxales* — beside morphological similarities — is backed by the fact that the macrofossils of the order appear in greater number from the Jurassic period. There are similar samples to the *Spheripollenites* among the *Taxodiaceae* pollen-types, too, but positive representatives of the family are hardly known before Cretaceous exception: a *Sciadopitys* leaf from Lower Cretaceous. The *Cupressaceae* can also be regarded as a pollen-producer to the family, but its microfossils are known only from Upper Jurassic.

The stratigraphy of the pollen-form is given by COUPER [1958] from Middle Jurassic. to Upper Cretaceous.

Gymnospermatophyta incertae sedis

Classopollis [PFLUG, 1953] POCOCK & JANS. 1961.

After some imperfect description of the morphology of the pollen-genus [PFLUG, 1953, BALME, 1957, COUPER, 1958, ZAUER & MTCHEDLISHVILI, 1954 and others] this problem was cleared by POCOCK & JANSONIUS 1961. They named the *C. classoides* [PFLUG, 1953] POCOCK & JANSONIUS 1961 as genus type. COUPER [1958] emended the

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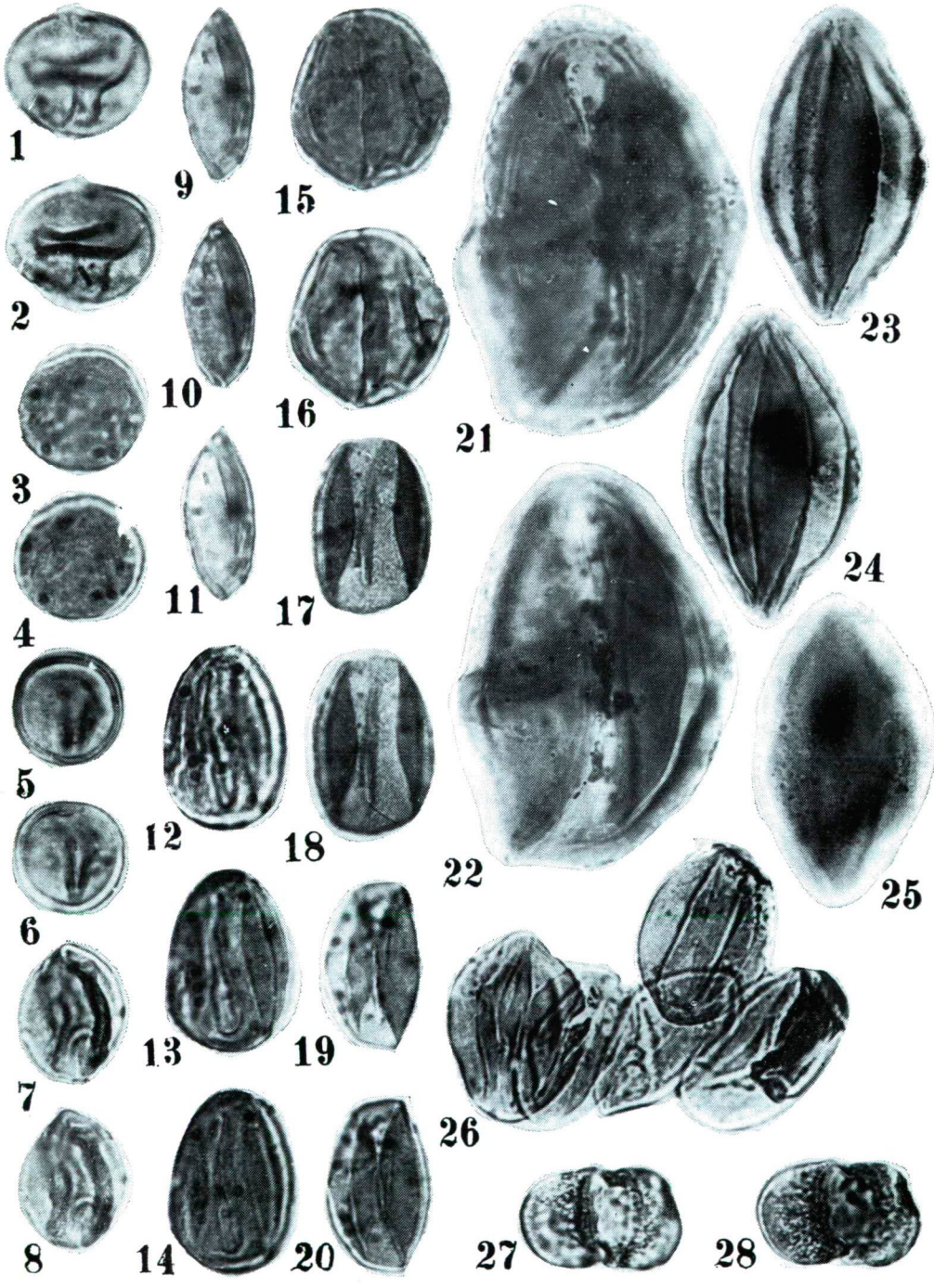
1—4. — *Spheripollenites subgranulatus* COUPER 1958.
5,6. — *Monosulcites urkutiensis* subfsp. *scabratus* SICS. & KDS. 1961.
7,8. — *Monosulcites urkutiensis* subfsp. *scabratus* SICS. & KDS. 1961.
9—11. — *Monosulcites minimus* COOKSON 1947 ex COUPER 1958.
12—16. — *Eucommiidites troedssonii* ERDTMAN 1948 ex COUPER 1958.
17—20. — *Eucommiidites rugulatus* n. fsp.
21,22 — Cf. *Cycadopites* fsp.
23—25. — *Bennettitaceaeacuminella* cf. *simplex* MALYAVKINA 1953.
26. — *Eucommiidites troedssonii* ERDTMAN 1948 ex COUPER 1958.
27,28. — *Vitreisporites pallidus* [REISSINGER, 1938] NILSSON 1958.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former *Pollenites torosus* REISSINGER 1950 by including every disperse *Classopollis* in the species *C. torosus*. POCOCK & JANSONIUS [1961] pointed out that the inclusion of several species in the *Classopollis* genus in highly reasonable, later BURGER [1965] emended the *C. torosus* [REISSINGER, 1950] COUPER fsp. beside other species belonging to the *Classopollis* and separated it from the *Classopollis classoides*. The present material contains several *Classopollis* form-species, which are partly described and partly newly discovered form-species.

The equivalent recent pollen-type of the *Classopollis* form-genus is not known. But on the basis of similarity of morphology and of certain elements of wall structure it might be in connection with *Gymnospermatophyta*. Identifications and similarities with pollen-grains clinged to cones or axis of cones and with grains not prepared from the pollen sac are not at all convincing. The connection of the *Classopollis* fgen. with the fossile genera *Cheirolepis*, *Brachyphyllum* and the *Pagiophyllum* is probable, but not certain.

The genus *Cheirolepis* SCHIMPER is *Coniferales* incertae sedis according to SEWARD [1964]. The genus *Brachyphyllum* BRONGN. can be found among the *Cupressaceae* at SEWARD [1964], in GOTHAN & WEYLAND'S book [1964] it is regarded as a *Coniferae* with questionable relationship and at ZIMMERMANN [1959] on account of the anatomy of epidermis it is placed into the *Araucuriaceae*. By the same author the genus *Pagiophyllum* HEER belongs to the *Araucariinae*, it is in relationship partly with the *Araucaria* and partly with the *Araucariaceae*. It is worth mentioning that the disperse pollen-grains of the *Classopollis* type are classed as genus *Brachyphyllum* or *Pagiophyllum* by several Soviet research-workers.

The genus *Classopollis* occurs in every sample of the carbonate manganese ore of Úrkút. It is the dominant pollentype of level A, greatly surpassed in level B, while it is going to be a common type again in level C, though its importance is subordinate to the *Spheripollenites* (and the *Monosulcites*). In the material of Úrkút several *Classopollis* form-species occur.

Classopollis classoides [PFLUG, 1953] POCOCK & JANSONIUS 1961 (Plate I. *7*, *8*, *9*)

There are numberless unharmed samples in our material. A part from the form-species *Classopollis torosus* [REISSINGER, 1950] COUPER 1958 published from the oxide manganese ore belongs to the species *Classopollis minor* POCOCK & JANSONIUS 1961 and the *Classopollis classoides*.

Classopollis minor POCOCK & JANSONIUS 1961
(Plate I. *10—13*, *14*)

The type *C. minor* is not common in the carbonate deposit, but types under the name of *C. torosus* [REISSINGER, 1950] COUPER 1958 (published in our former paper on oxide ore, see SIMONCSICS & KEDVES [1961] Plate II. *1—5*, *6*, *11*, *12*, *21—22*, *23*, *24*, *25*) can be mostly included in the above-mentioned species. The pollen-type — according to its authors — occurs from Lower Jurassic to Eocene.

Classopollis grandis n. fsp.
(Plate I. *1—3*, *4*, *5*, *6*)

Diagnosis: The shape of the pollen-grain is spherical with a thick equatorial ring. The proximal hemisphere is gently conical, the distal one is more convex. The exine of hemisphere is about 1 μ thick. The distal exine is tectate, finely granulate, of rugulate structure and its contour is not clear, with a pore of 5 μ diameter. The distal pole is separated from the equatorial thickening by a tenuous exine layer, the

PFLUG-"rimula". In the proximal side a triangular thin exinal field of unclear contour refers to tetradic juncture. The proximal hemisphere is also tectate with coarsely circular or irregular ornamentations, which fuse into equatorially lengthened elements toward the equator and take part of formation of the ring. The equatorial exine thickening is 3—5 μ. The thick wall is dissected by channels running roughly parallel with the equator. The channels by flanking sections of thick, circularly or equatorially lengthened wall make an impression of endostriae.

The diameter of the typical sample is 50×47 μ, the size of the other samples is in the range 36—50 μ, the length of the polediameters is in the range 32—40 μ.

Holotype: Plate I. *1—3;* prep. U—III—3—82.

Stratum typicum: green, grey, finely streaked carbonate manganese ore, Middle Jurassic.

Locus typicus: Úrkút.

Note: The new species differs from all the other *Classopollis* not only in size, but also in the structure of the equatorial thickening, i.e. the striate character of it is not so distinct as in other *Classopollis*. This pollen-type occurs rarely, mostly in the upper level of the deposit.

SUMMARY

1. On the basis of the above systematic palynological data we have pointed out 4 or 6 classes of the phylum *Gymnospermatophyta* in carbonate manganese ore of Úrkút. The orders *Caytoniales*, *Cycadales* and *Bennettitales* may be considered as undoubtedly existing ones.

2. The relationship between the two dominant pollenspecies is uncertain, but the descent of the former from the *Araucariaceae* and the descent of the latter from the *Taxales* is possible.

3. On the basis of macrofossils the flora of Middle Jurassic is characterized by the widespread range of the *Bennettites*. This is not reflected in the pollen-spectra of the samples even in case, if we suppose that the genera of the pollen-species *Eucommiidites* come from the *Bennettites*. The possible insect-pollination could cause the low number of the pollens, the one-sidedness of the oecological conditions could give an explanation to the poverty of genera.

4. The systematic analysis of the pollen-material did not change our former stratigraphical conclusions. The age of the carbonate deposit is to be dated in Middle Jurassic.

5. The picture of the Middle Jurassic flora surrounding the recess accumulated with manganese in Úrkút has remained unchanged and corresponds to the results published in our former paper [KEDVES & SIMONCSICS, 1964].

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