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INVESTIGATION OF SPORES AND POLLEN GRAINS OF THE CARBONATE MANGANESE ORE BORE SAMPLES FROM ÚRKÚT

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INTRODUCTION

It is proved by our earlier publications [SIMONCSICS and KEDVES 1961, 1969, KEDVES and SIMONCSICS 1964 *a, b*] that the sedimentary manganese ore from Úrkút, particularly the carbonate ore, is rich in microfossils. We investigated and described the sporomorphs of two profiles. In the profile of Shaft III of Úrkút we have differentiated three layers on the basis of the quantitative occurrence of spores and pollen as well as of plankton remains (lower, *A* layer: *Classopollis* layer; middle, *B* layer: *Crassophaeridae* layer; upper, *C* layer: *Spheripollenites* layer). Overmore, we have tried to reconstruct the riverside zonation of vegetation.

The aim of the present investigations is:

a) To prove the flora components known hitherto, completing them with possible new ones from among the samples of the more than 100 m profile,

b) to ascertain the spore and pollen communities by means of a quantitative analysis of the new samples,

c) to class the company-complexes in layers and compare them to earlier results.

MATERIAL AND METHOD

The layer profile of boring 316 at Úrkút was at our disposal from 210,0 m till 106,2 m. The sampling is unfortunately not continuous. The object of our investigations was formed by twenty samples of the approximately 100 m thick layer, being 0.1, 0.2, 0.3, 0.8 and 1.0 m thick each.

We explored the single samples in averages, as well as — in case of samples suitable for that — disconnecting the single samples to more homogeneous strips. The strips were of light brown and greenish-brown colour according to the degree of oxidation of the manganese content.

In the course of the microscopic investigations we have striven for getting full details concerning the qualitative analysis, and endeavoured to take on a diagram the quantitative data summing them up according to facies-ecological, microstratigraphic purposes.

RESULTS

A) Data of the qualitative analysis:

Fgen.: *Leiotriletes* [NAUMOVA 1937] R. POT. and KR. 1954.

1. *L. manganicus* KDS. et SICS. 1964 a

2. *L. urkutensis* KDS. et SICS. 1964 a
3. *L. sphagnoides* KDS. et SICS. 1964 a
4. *L. transdanubicus* KDS. et SICS. 1964 a
5. *L. pflugi* SICS. et KDS. 1961
L. pflugi SICS. et KDS. 1961 fvar. *triplan* SICS. et KDS. 1961.

Fgen: *Punctatisporites* IBRAHIM 1933
1. *P. krutzschi* KDS. et SICS. 1964 a
2. *P. goczani* KDS. et SICS. 1964 a
3. *P. circulus* KDS. et SICS. 1964 a
4. *P. parvigranulatus* LESCHIK 1955

Fgen.: *Sphagnumsporites* RAATZ 1937.
1. *Sp. psilatus* [ROSS 1949] COUPER 1958
2. *Sp. clavus* [BALME 1957] DE JERSEY 1959

Fgen.: *Toroisporis* W. KR. 1959

Subfgen.: *Toroisporis (Toroisporis)*
1. *T. (Toroisporis) crassiexinus* KDS. et SICS. 1964 a
2. *T. (Toroisporis) crassitorus* KDS. et SICS. 1964 a
3. *T. (Toroisporis) toralis* [LESCHIK 1955] KDS. et SICS. 1964 a
4. *T. (Toroisporis) macrosinus* KDS. et SICS. 1964 a
5. *T. (Toroisporis) rectitorus* KDS. et SICS. 1964 a
6. *T. (Toroisporis) curvitorus* KDS. et SICS. 1964 a
7. *T. (Toroisporis) hungaricus* KDS. et SICS. 1964 a

Subfgen.: *Toroisporis (Toripunctisporis* W. KR. 1959)
1. *Toroisporis (Toripunctisporis) hungaricus* n. fsp.
(Table I, 1, 2, Fig. 1)

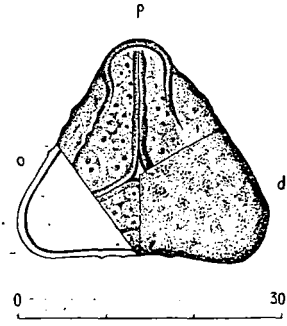
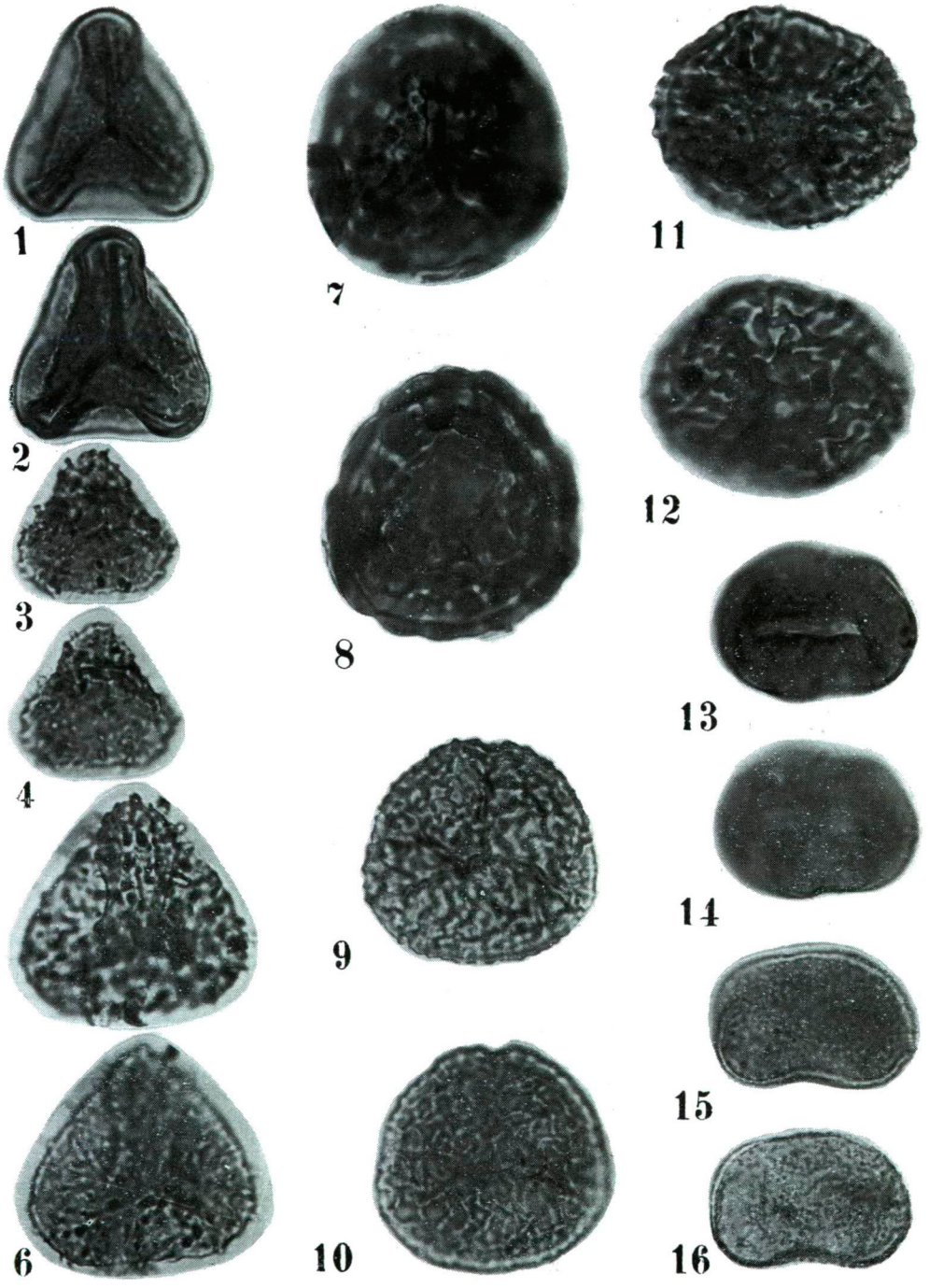


Fig. 1. Toroisporis (Toripunctisporis) hungaricus n. fsp.
o = optical cut, p = proximal surface, d = distal surface

1, 2 — *Toroisporis (Toripunctisporis) hungaricus* n. fsp., holotype.
3, 4 — *Conbaculatisporites* fsp. A.
5, 6 — *Conbaculatisporites* fsp. B.
7, 8 — *Taurocusporites* fsp.
9, 10 — *Camarozonaosporites (Hamulatisporis)* fsp. A.
11, 12 — *Camarozonosporites (Hamulatisporis)* fsp. B.
13, 14 — *Laevigatosporites* cf. *ovatus* WILS. et WEBST. 1946.
15, 16 — *Marattisporites scabratus* COUPER, 1958.
×1000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Diagnosis

From polar visual angle, the contour is triangular with mildly concave side lines. The proximal surface is granular, with grains of about 3 μ wide bases and ending in fine small points and being 1 μ high. The torus is 7 μ wide at the middle line, 4 wide at about the middle of laesures, and widens out at he corners. The ornamentation of torus is identical with that of the proximal surface. The laesures are long, reach the equator and are of finely wavy course. Along the laesures, the thickness of wall is expressed by the form of the collateral line. On the distal side, the ornamental elements are rather flat and of more blurred pattern than on the proximal side. The surface is stained by the thicker and thinner wall parts.

The maximum size is: 30 μ.

Holotype: Table I, 1, 2, prep. U-316—II—9—1/3, No. of cross table: 38,0—103,4.

Locus typicus: Úrkút, Jurassic.

Stratum typicum: Light carbonate manganese ore.

Derivatio nominis: By its occurrence in Hungary.

Differential diagnosis: It is separated from the form species described by KRUTZSCH [1959] first of all by its smaller size.

Fgen.: *Concavisporites* PF. 1953

Subfgen.: *Concavisporites (Concavisporites)*

1. *C. (Concavisporites) polygonalis* KDS. et SICS. 1964 a
2. *C. (Concavisporites) mortoni* [DE JERSEY 1959] DE JERSEY 1962

Subfgen.: *Concavisporites (Obtusisporis* W. KR. 1959)

1. *C. (Obtusisiporis) undulus* KDS. et SICS. 1964 a
2. *C. (Obtusisporis) hexagonalis* KDS. et SICS. 1964 a

Fgen.: *Verrucosisporites* IBRAHIM 1933

1. *V.* cf. *rarus* KDS. et SICS. 1964 a

Fgen.: *Baculatisporites* TH. et PF. 1953

1. *B. spinifer* [THIERG. 1949] KDS. et SICS. 1964 a

Fgen.: *Conbaculatisporites* KLAUS 1960

1. *C.* fsp. A (Table I, 3,4)
2. *C.* fsp. B (Table, I, 5,6)

Fgen.: *Trilites* COOKSON 1947 ex COUPER 1953

1. *T.* cf. *pulcher* KDS. et SICS. 1964 a
2. *T. couperi* KDS. et SICS. 1964 a

Fgen.: *Clavatisporites* KDS. et SICS. 1964 a

1. *Cl. clarus* KDS. et SICS. 1964 a
2. *Cl. pulcher* KDS. et SICS. 1964 a
3. *Cl.* fsp.

Fgen.: *Dictyotriletes* [NAUMOVA 1937] R. POT. et KR. 1954

Subfgen.: *Dictyotriletes* (*Kluisporites* COUPER 1958) POCOCK 1962

1. *D. (Klukisporites) deaki* KDS. et SICS. 1964 a
2. *D. (Klukisporites) variegatus* [COUPER 1958] KDS. et SICS. 1964 a

Fgen.: *Taurocusporites* STOVER 1962

1. Cf. *T.* fsp. (Table I, 7,8)

Fgen.: *Camarozonosporites* PANT 1954 ex R. POT. 1956

Subfgen.: *Camarozonosporites* (*Hamulatisporis* W. KR. 1959)

1. *C. (Hamulatisporis)* fsp. A (Table I, 9, 10)
2. *C. (Hamulatisporis)* fsp. B (Table I, 11, 12)

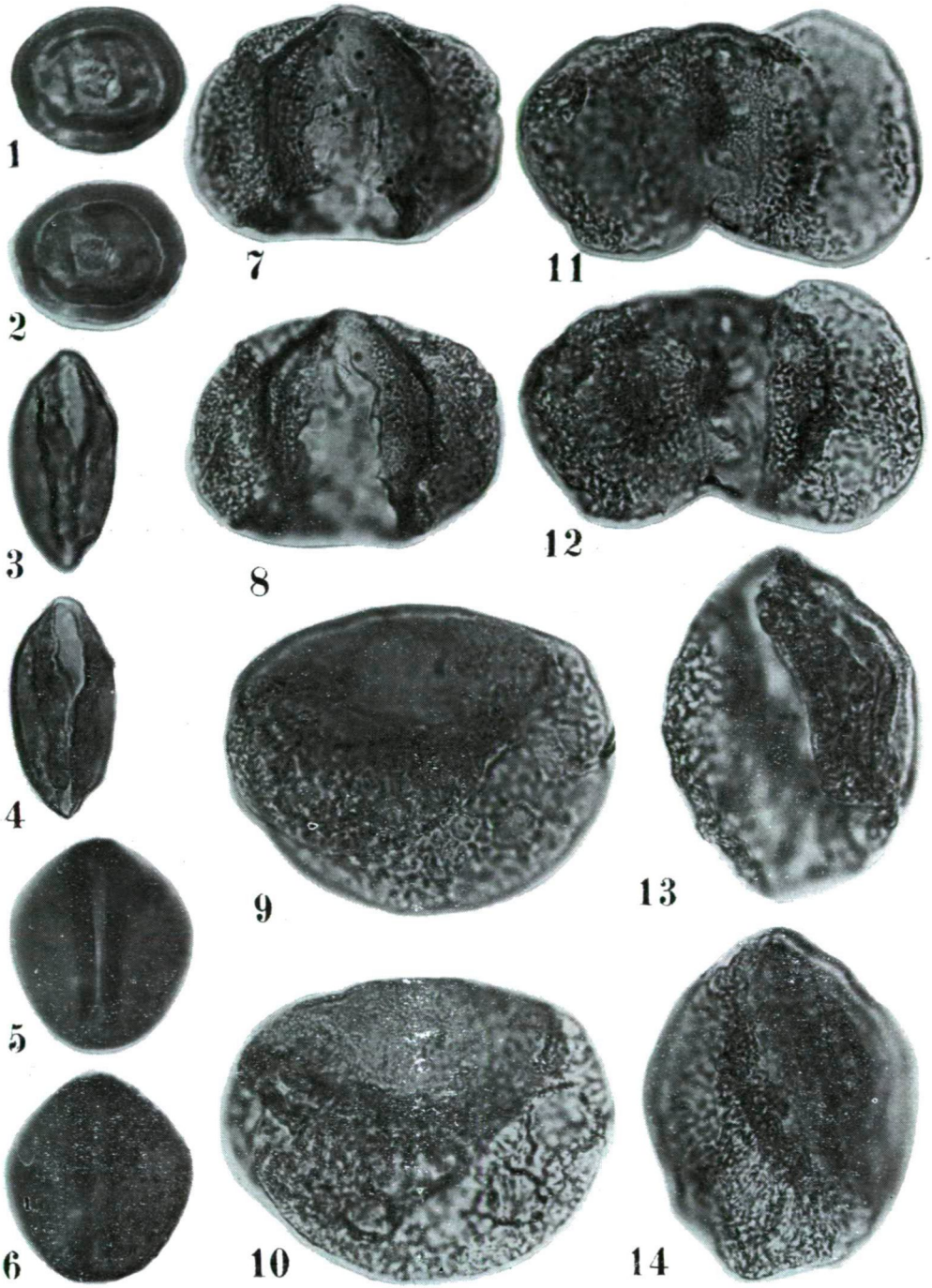
Fgen.: *Laevigatosporites* IBRAHIM 1933

1. *L.* cf. *ovatus* WILS. et WEBST. 1946 (Table I, 13, 14)
Fgen.: *Marattisporites* COUPER 1958
1. *M. scabratus* COUPER 1958 (Table I, 15, 16)
Fgen.: *Spheripollenites* COUPER 1958
1. *S. scabratus* COUPER 1958
2. *S. subgranulatus* COUPER 1958
Fgen.: *Classopollis* [PFLUG 1953] POCOCK et JANS. 1961
1. *C. classoides* [PF. 1953] POCOCK et JANS. 1961
2. *C. minor* POCOCK et JANS. 1961
3. *C. grandis* SICS. et KDS. 1969
Fgen.: *Corollina* [MALYAVKINA 1949] VENK. et GÓCZÁN 1964
1. *C. meyeriana* [KLAUS 1960] VENK. et GÓCZÁN 1964
Fgen.: *Bennettitaceaeacuminella* MALYAVKINA 1953
1. *B.* cf. *simplex* MALYAVKINA 1953
Fgen.: *Ginkgoretectina* MALYAVKINA 1953
1. *G. punctata* MALYAVKINA 1953 (Table II, 3, 4)
2. *G. ferrei* POCOCK 1970 (Table II, 5, 6)
3. *G. fsp.*
Fgen.: *Monosulcites* ERDTMAN 1947, COOKSON 1947 ex COUPER 1953
1. *M. minimus* COOKSON 1947
2. *M. urkutiensis* [SICS. et KDS. 1961] SICS. et KDS. 1969 subfsp. *urkutiensis*
Fgen.: *Eucommiidites* ERDTMAN 1948
1. *E. troedssonii* ERDTMAN 1948 ex COUPER 1958
2. *E. rugulatus* SICS. et KDS. 1969
Fgen.: *Alisporites* DAUGHERTY 1941
1. *A. similis* [BALME 1957] DETTMANN 1963 (Table II, 7, 8)
2. *A. thomasii* [COUPER 1958] POCOCK 1962 (Table II, 9, 10)
3. *A.* fsp. (Table II, 11, 12)
Fgen.: *Parvisaccites* COUPER 1958
1. Cf. *P. enigmatus* COUPER 1958 (Table II, 13, 14)
Fgen.: *Platysaccus* NAUMOVA 1937 ex R. POT. et KLAUS 1954
1. *P.* fsp. (Table III, 1, 2)
Fgen.: *Vitreisporites* LESCHIK 1955
1. *V. pallidus* [REISSINGER, 1938] NILSSON, 1958
2. *V.* cf. *cragii* POCOCK 1970 (Table III, 3, 4)
Fgen.: *Cerebropollenites* NILSSON 1958
1. *C. macroverrucosus* [THIERG. 1949] POCOCK 1970 (Table III, 5, 6).

Apart from sporomorphs, we have found the following more important microfossils: *Tytthodiscus* fsp., *Crassosphaera concinna* COOKSON et MANUM 1960, *Crassosphaera* sp., *Hystrichosphaeridae* div. gen. et sp., *Foraminiferae;* chitin-skeletal remains (Table III, 7, 10).

B) Quantitative results (Fig. 2)

On the basis of the percentage distribution of the spore-pollen data of boring profile there may be separated locally two main layers. From 106.2 until 161.6 m the *Spheripollenites* pollen grains are dominant and besides them, there occur also *Monosulcites minimus* in a considerable percentage. Below them, till 209.3 m, the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quantity of the mentioned pollen grains strongly decreases, the *Classopollis* occurring in a dominant quantity. Inside the two main layers, takint into consideration the finer details, there may be separated from each orther further communities that are important from a facies ecological point of view.

(a) From 209.3 till 204.0 m, that is basis and substratum of the main layer, the composition of sporomorphs is rather mixed. A prominent dominance cannot be observed at either of the groups separated. The high *Pteridophytic* percentage is referring to that a profile part close to the fernery of the vegetation lining the sunk basin. The quantity of pollen grains referring to *Cycadaceae* is high, as well. That is verifying the *Pteridophytic, Cycadaceae* zone, ascertained earlier [KEDVES and SIMONCSICS 1964 a]. Apart from the mentioned sporomorphs, also pollen types *Eucommiidites* are considerable components of the spore-pollen communities. That is referring to that the *Gymnospermatophyte* producing these pollen grains took part in the riverside vegetation, too. In this way, the gymnospermous zone *(Cycadinae — Cheirolepis-Brachyphyllum-Pagiophyllum)* that follows the *Pteridophyte* community is richer than it is in the profile of shaft III in Úrkút. *Crassosphaeridae* occur in a considerable quantity only in that part.

(b) From 204.0 till 178.0 m, in the lower part of the proper main layer, the typical *Classopollis* dominance is representing the zone lying farther from the bank. The fern-spores, beginning from the lower samples of this part, are decreasing with minor fluctuations. In addition to *Spheripollenites,* also the increasing amount of *Monosulcites minimus* is to be mentioned. *Monosulcites urkutiensis* appeared only on the bottom and on top of the region.

(c) Till 161.5 m a gymnospermous zone of transitory character can be established, by a decreasing *Classopollis* quantity that of *Spheripollenites* increases. In the transitional part, also the amount of *Monosulcites urkutiensis* increases somewhat. That is the upper part of the main layer.

(d) From 160.0 till 110.7 m there is a *Spheripollenites* dominance that corresponds to the radiolarian clay marl, accompanied by a considerable, about 20 per cent, amount of *Monosulcites minimus.*

(e) In the upper part of the profile, in the carbonate manganese ore above the main layer (samples 1—3), the sporomorphic composition again changes, referring again to a riverside vegetation, however not of a size like that on the bottom of the profile. The quantity of *Monosulcites minimus* referring to *Cycadaceae* is high or dominant or it is identical with *Spheripollenites.* The quantity of fern-spores has augmented a little, as well.

The organisms indicating the ecology of salt- or brackwater are represented in every sample of the profile at least by one of the three groups *(Hystrichosphaeridae, Crassosphaeridae, Foraminiferae),* they are, however, quantitatively not considerable

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1, 2 — *Corollina meyeriana* [KLAUS 1960] VENK. et GÓCZÁN 1964.
3, 4 — *Ginkgoretectina punctata* MALYAVKINA 1953.
5, 6 — *Ginkgoretectina ferrei* POCOCK 1970.
7, 8 — *Alisporites similis* [BALME 1957] DETTMANN 1963.
9, 10 — *Alisporites thomasii* [COUPER 1958] POCOCK 1962.
11, 12 — *Alisporites* fsp.
13, 14 — *Parvisaccites* cf. *enigmatus* COUPER 1958.
×1000

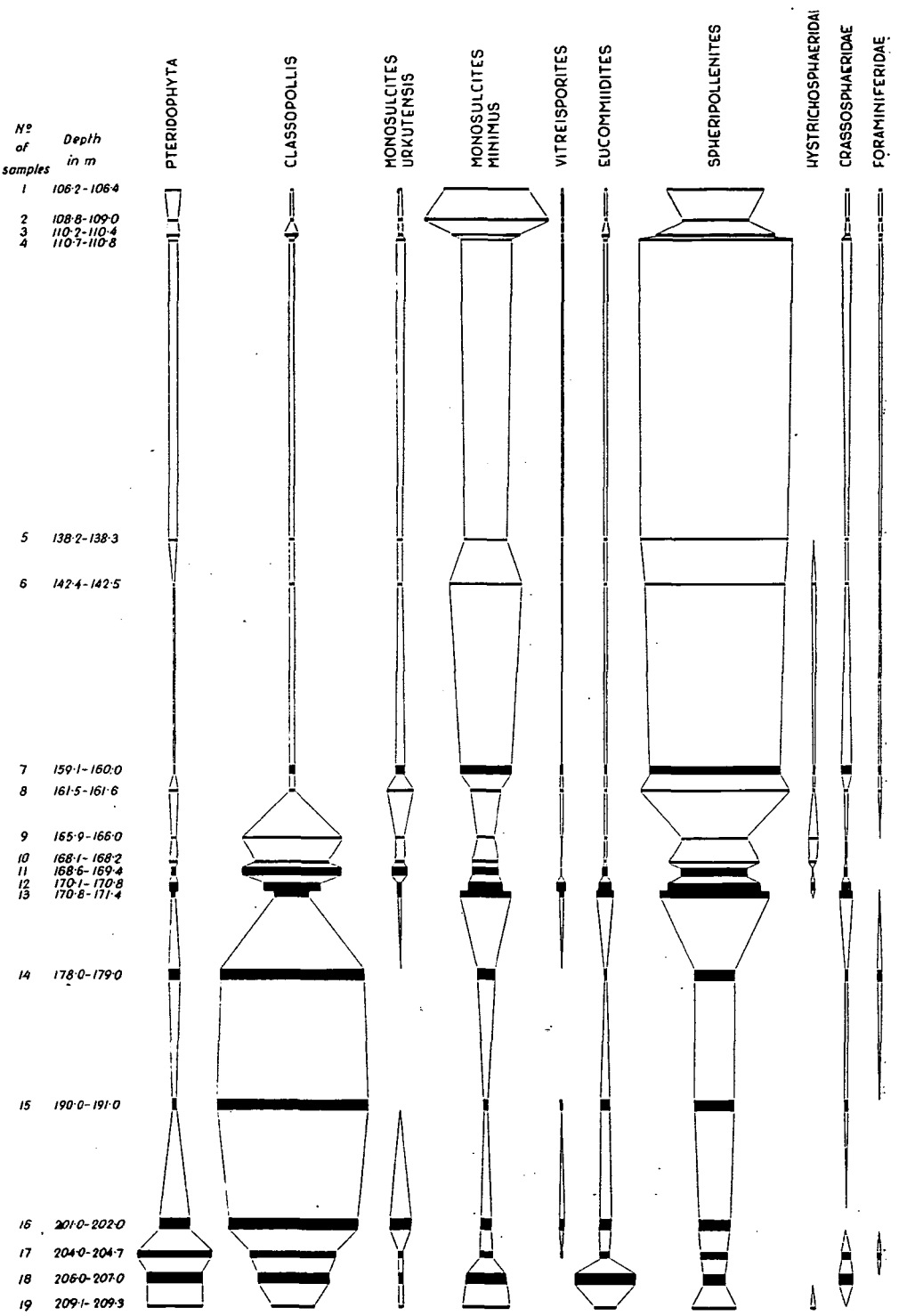

Fig. 2. Contracted diagram of the sporomorphs of the profile investigated

and cannot be factors of the synthesis. The approximately consequent although rare occurrence of the remains of *Foraminiferae* with chitin skeleton is referring to sediments of salt-water (half-salt-water) character along the whole profile.

DISCUSSION OF RESULTS

(1) A large part of the sporomorphs, earlier demonstrated or described in the course of microscope investigations have again occurred in our samples. From among the present matter of investigation only *Toroisporis (Toripunctisporis) hungaricus* n. fsp. has been described. Also the number of spore-pollen types that are new as compared to the above mentioned ones but already published in another place is not low (17). From among the pollen types the pneumatic forms are more frequent than in case of earlier investigations, and the chitin skeletal *Foraminiferae* remains take part first in the present work in the manganese ore at Urkut.

(2) Our earlier statements about the zonation of the vegetation bordering the basin for sediment collection [KEDVES et SIMONCSICS 1964 a] are essentially supported by newer data. In respect of the finer details, on the basis of the layer the larger participation of Coniferae producing the pollen types *Eucommiidites* in the community is worth mentioning. The smaller quantity of plankton organisms may have been also a result of the sporadical defectiveness of sampling or of the fact that every sample was rich in spores and pollen grains. For instance, *Crassosphaeridae* always occurred but in comparatively low quantity, as a separate layer it could not be demonstrated.

(3) Although the lighter and darker parts of several striped samples were separately explored and investigated, we could not establish an essential difference in the spore-pollen composition. We had, therefore, to reject our supposition that the strips may have depended upon the change of seasons.

SUMMARY

We have carried out spore-pollen investigations on sample 20 of the carbonate manganese ore layer group of boring No. 316 at Úrkút. In the course of the investigations we have demonstrated 61 kinds of sporomorphs. From among these one form species is completely new, and seventeen species are new only for the manganese ore in Urkut. Opposite to the aerlier finds, the occurrence of the *Foraminiferae* remains with chitin skeletons in new. Based on quantitative data, there can be separated two main palynologic layers and — in respect of finer details — further facies. The lighter and darker strips of the manganese ore-separated according to the degree of oxidation of the manganese ore — cannot be separated in respect of their spore-pollen material.

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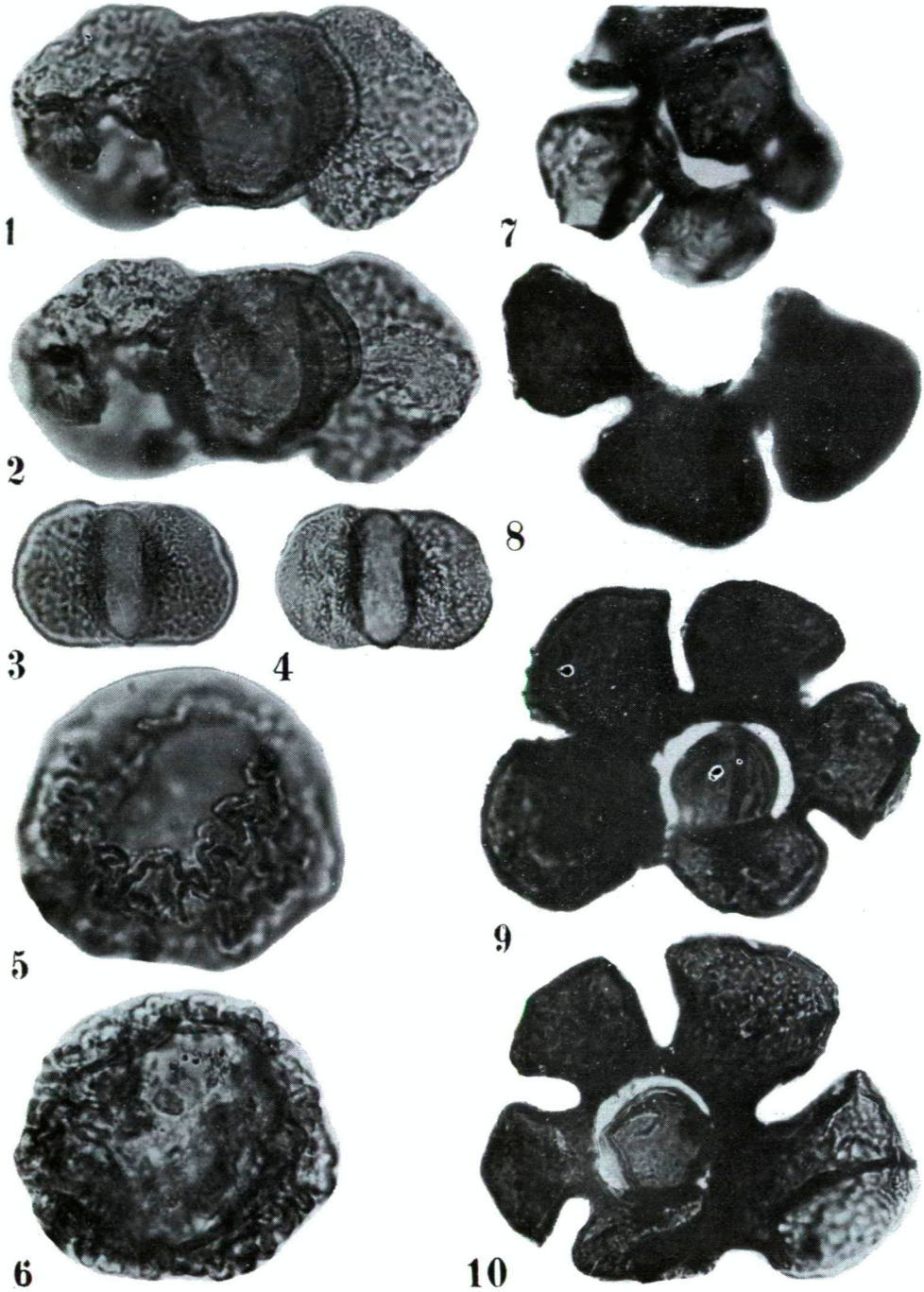
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1, 2 — *Platysaccus* fsp.
3, 4 — *Vitreisporites* cf. *cragii* POCOCK 1970.
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