

## 2. DOROG TYPE (MIDDLE EOCENE) SPORE-POLLEN ASSEMBLAGE IN THE SOCKA BEDS OF SLOVENIA I.

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### Abstract

During our multidisciplinary studies of the problem of the Oligocene and Lower Miocene stratigraphy in Slovenia, we have established the following: 1. The Socka Beds are heterochronous. 2. The type locality is of Middle Eocene age. 3. The tropical coal forming vegetation was reconstructed on the basis of palynological data. 4. The dominance of the pollen grains associated with spores of tropical ferns (*Anemia*, *Lygodium*, *Gleicheniaceae*, etc.) is identical with the Dorog Basin type. This result changes the previous paleophytogeographical concepts on this subject.

*Key words:* Palynostratigraphy, Paleophytocology, Paleophytogeography, Middle Eocene, Slovenia.

### Introduction

The lithostratigraphic term Socka Beds (Sotzka-Schichten) was introduced by ROLLE in 1858.

The Socka Beds stratigraphic position has never been successfully solved. Namely, stratigraphers found themselves in persistent contradictions as they stated whether at different sites or all embracingly, the Latdorfian (Lower Oligocene), the Rupelian (Middle Oligocene), the Egerian, the Helvetian (Ottangian to Karpatian) age of the Socka Beds, or even vaguely supposed their Eocene age. If we carefully consider the existing literature, it becomes obvious that every work and in particular every rearrangement to accommodate the Socka Beds stratigraphic position to new developments in the chronostratigraphic scale, for example to the establishment of Oligocene or to the proposal of new Paratethian stages, only apparently moved the problem closer to the solution. But, in fact they only added to the confusion concerning the age and the correlation of the Socka Beds in their own way.

The aim of this paper is to present the most important sporomorphs from four localities: Socka, Dobrna, Velenje and Lepena in the Southern Karavanke, and of their comparison with the Transdanubian assemblages in Hungary.

## Results

### DINOPHYCEAE

*Cordosphaeridium* cf. *spinosum* var. *deflandrei* (LEJ.-CARPENTIER 1941) DE CON. 1965 (Plate 2.1., figs. 1,2), *C.* cf. *tiara centrocarpum* (DEFL. and COOKS. 1955) MORG. 1966 (Plate 2.1., figs. 3,4), *Glaphyrocysta* v. *Geridocysta* sp. 1 (Plate 2.1., figs. 5,6), *Glaphyrocysta* v. *Geridocysta* sp.2 (Plate 2.1., figs. 7,8).

### PTERIDOPHYTA

#### LYCOPSIDA

*Lycopodium* v. *Selaginella*. – *Zlivisporis dorogensis* (KDS. 1965) PACLT. and SICS. 1970 (Plate 2.2., fig. 3).

Selaginellaceae, *Selaginella*. – Cf. *Echinatisporis longechinus* W. KR. 1959 (Plate 2.1., fig. 18).

#### PTEROPSIDA

Osmundaceae. – *Baculatisporites ovalis* KDS. 1973 (Plate 2.2., fig. 2).

#### Schizaeaceae

Cf. *Lygodium*. – *Leiotriletes dorogensis* (KDS. 1960) KDS. 1961 fvar. *triplan* (Plate 2.1., fig. 9), *Leiotriletes adriennis* (R. POT. and GELL. 1933) W. KR. 1959 (Plate 2.1., fig. 10), *Leiotriletes microadriennis* W. KR. 1959 (Plate 2.1., fig. 11).

*Anemia*. – *Cicatricosisporites dorogensis* (R. POT. and GELL. 1933) subfsp. *dorogensis* (Plate 2.1., fig. 9, plate 2.2., figs. 4,5).

#### Gleicheniaceae

*Toroisporis* (*Toroisporis*) *teuplitzensis* W. KR. 1962 subfsp. *mediocris* W. KR. 1962 (Plate 2.1., figs. 13,14), *Toroisporis* (*Toroisporis*) *guineti* KDS. 1973 (Plate 2.1., fig. 15), *Concavisporites* (*Concavisporites*) *hungaricus* KDS. 1973 (Plate 2.1., figs. 16,17).

#### Pteridaceae

*Polypodiaceoisporites bauxitus* KDS. and J. RÁK. 1965 (Plate 2.2., figs. 6,7), *Polypodiaceoisporites undulosculptatus* KDS. 1973 (Plate 2.2., fig. 8), *Polypodiaceoisporites marxheimensis* (MÜRR. and PF. 1952) W. KR. 1959 (Plate 2.2., figs. 19,20), *Segmentizonosporites palaeogenicus* KDS. and J. RÁK. 1965 (Plate 2.2., figs. 11,12).

#### Polypodiaceae

*Laevigatosporites haardti* (R. POT. and VEN. 1934) TH. and PF. 1953 subfsp. *haardti* (Plate 2.2., fig. 15), *Verrucatosporites favus* (R. POT. 1931) TH. and PF. 1953 subfsp. *favus* (Plate 2.2., figs. 16,17).

### INCERTAE

*Punctatisporites luteticus* W. KR. 1959 (Plate 2.1., fig. 12), *Trilites* fsp. (Plate 2.2., figs. 13,14), *Psophosphaera reissingeri* (KDS. 1961) KDS. 1974 (Plate 2.2., figs. 24,25).

### GYMNOSPERMATOPHYTA

Cycadopsida, Ginkgoaceae v. Cycadaceae. – *Cycadopites kyushuensis* (TAKAHASHI 1961) KDS. 1968 (Plate 2.3., figs. 1,2)

#### Coniferophytina

?Abietaceae, *Pseudotsuga* v. *Larix*. – Cf. *Psophosphaera* fsp. (Plate 2.2., figs. 22,23).

Taxodiaceae v. Cupressaceae. – *Inaperturopollenites concedipites* (WODEH. 1933) W. KR. 1971 (Plate 2.2., fig. 1).

## Araucariaceae

*Araucariacites balinkaense* KDS. 1974 (Plate 2.2., figs. 20,21).

## ? Coniferophytina

*Cupressacites dorogensis* (KDS. 1961) KDS. 1974 (Plate 2.2., figs. 26,27).

Reworked *gymnosperm* pollen grain. – *Alisporites* fsp. (Plate 2.2., figs. 18,19).

## ANGIOSPERMATOPHYTA

### DICOTYLEDONOPSIDA

Fagaceae. – *Fususpollenites fusus* (R. POT. 1934) KDS. 1978, *Fagaceae* (Plate 2.3., figs. 19,20).

Myricaceae. – *Plicapollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *turgidus* PF. 1953 (Plate 2.3., figs. 27,28).

Juglandaceae. – Cf. *Platycaryapollenites* fsp. (Plate 2.3., figs. 29,30), *Plicatopollis lunatus* KDS. 1974 (Plate 2.3., figs. 31,32), *Plicatopollis hungaricus* KDS. 1974 (Plate 2.3., figs. 33,34), *Plicatopollis krutzschii* KDS. 1974 (Plate 2.3., figs. 35,36).

Icacinaceae. – *Compositoipollenites rhizophorus* (R. POT. 1934) R. POT. 1960 subfsp. *rhizophorus* (Plate 2.3., figs. 39,40).

Elaeagnaceae v. Simarubaceae. – *Pentapollenites laevigatus* W. KR. 1962a subfsp. *laevigatoides* W. KR. 1962a (Plate 2.3., figs. 25,26).

Aquifoliaceae. – Cf. *Ilexpollenites erdtmani* KDS. 1978 (Plate 2.3., figs. 15,16).

Bombacaceae. – *Bombacacidites* fsp. (Plate 2.3., figs. 37,38).

Sapotaceae. – *Tetracolporopollenites urkuticus* KDS. 1978 (Plate 2.3., figs. 21,22).

Calyceraceae. – *Intragranulitricolporites tumescens* (KDS. 1964) KDS. 1978 (Plate 2.3., figs. 17,18).

Incertae. – *Eocaenipollis* fsp. (Plate 2.3., figs. 23,24).

### MONOCOTYLEDONOPSIDA

Palmae. – *Monocolpopollenites tranquillus* (R. POT. 1934) TH. and PF. 1953 subfsp. *tranquillus* (Plate 2.3., figs. 3–6).

*Nipa*. – *Spinizonocolpites* cf. *prominatus* (MCINTYRE 1965) KDS. 1974 (Plate 2.3., figs. 7,8), cf. *Nipa*. – *Spinizonocolpites* fsp. (Plate 2.3., figs. 9–12).

North African Upper Cretaceous reworking: *Proxapertites africanus* KDS. nom. nud. (Plate 2.3., figs. 13,14).

## Conclusions

1. The presented spore-pollen assemblage is identical with the Middle Eocene “Dorog type” of Hungary.

2. So far the Middle Eocene age is restricted to the coal bearing strata at Socka, Dobrna, Velenje and Lepena (near Jesenice) at Slovenia–Austria–Italy border. All these localities belong to the Southern Karavanka Mountains.

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## References

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Plate 2.1.

- 1,2. *Cordosphaeridium* cf. *spinosum* var. *deflandrei* (LEJ.-CARPENTIER 1941) DE CON. 1965, slide: Lepena-6-1, cross-table number: 11.9/144.6.
- 3,4. *Cordosphaeridium* cf. *tiara centrocarpum* (DEFL. and COOKS. 1955) MORG. 1966, slide: Lepena-6-1, cross-table number: 9.2/145.8.
- 5,6. *Glaphyrocysta* v. *Geridocysta* sp.1, slide: Lepena-6-1, cross-table number: 9.1/140.1.
- 7,8. *Glaphyrocysta* v. *Geridocysta* sp.2, slide: Lepena-6-1, cross-table number: 19.9/139.9.
9. *Leioiriletes dorogensis* (KDS. 1960) KDS. 1961 fvar. *triplan*, *Schizaeaceae*, cf. *Lygodium*, and *Cicatricosisporites dorogensis* R. POT. and GELL. 1933. subfsp. *dorogensis*, *Schizaeaceae*, *Anemia*; slide: Velenje Sv. Bric-3-1, cross table number: 5.4/133.5.
10. *Leioiriletes adriennis* (R. POT. and GELL. 1933) W. KR. 1959, *Schizaeaceae* cf. *Lygodium*; slide: Dobrna-2-1, 9.3/130.9.
11. *Leioiriletes microadriennis* W. KR. 1959, *Schizaeaceae* cf. *Lygodium*; slide: Dobrna-2-1, cross-table number: 5.6/144.1.
12. *Punctatisporites luteticus* W. KR. 1959; slide: Velenje Sv. Bric-4-2, cross-table number: 6.9/137.1.
- 13,14. *Toroisporis* (*Toroisporis*) *teuplizenensis* W. KR. 1962 subfsp. *mediocris* W. KR. 1962. cf. *Gleicheniaceae*, slide: Dobrna-2-1, cross-table number: 23.2/147.2.
15. *Toroisporis* (*Toroisporis*) *guineti* KDS. 1973, cf. *Gleicheniaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 18.2/132.4.
- 16,17. *Concavisporites* (*Concavisporites*) *hungaricus* KDS. 1973, *Gleicheniaceae*, slide: Velenje Sv. Bric-4-2, cross-table number: 17.2/135.2.
18. Cf. *Echinatisporis longechinus* W. KR. 1959, *Selaginellaceae*, *Selaginella*, slide: Lepena-3-1, cross-table number: 13.5/135.6.

Plate 2.2.

1. *Punctatisporites luteticus* W. KR. 1959, with *Inaperturopollenites concedipites* (WODEH. 1933) W. KR. 1971, *Taxodiaceae-Cupressaceae*, slide: Velenje Sv. Bric-6-1, cross-table number: 11.4/129.6.
2. *Baculatisporites ovalis* KDS. 1973, *Osmundaceae*, slide: Dobrna-2-1, cross-table number: 24.8/134.3.
3. *Zlivisporis dorogensis* (KDS. 1965) PACLT. and SICS. 1970, *Lycopodiaceae*, *Lycopodium* v. *Selaginella*, Velenje Sv. Bric-4-2, cross-table number 22.3/129.6.
- 4,5. *Cicatricosisporites dorogensis* R. POT. and GELL. 1933 subfsp. *dorogensis*, *Schizaeaceae*, *Anemia*, slide: Dobrna-2-1, cross-table number: 10.2/142.3.
- 6,7. *Polypodiaceoisporites bauxitus* KDS. and J. RÁK. 1965, slide: Lepena-3-1, cross-table number: 20.8/146.7.
8. *Polypodiaceoisporites undulosculptatus* KDS 1973, *Pteridaceae*, slide: Velenje Sv. Bric-4-2, cross-table number: 6.5/147.9.
- 9,10. *Polypodiaceoisporites marxheimensis* (MÜRR. and PF. 1952) W. KR. 1959, *Pteridaceae*, slide: Velenje Sv. Bric-6-1, cross-table number: 9.5/137.2.

- 11,12. *Segmentizonosporites palaeogenicus* KDS. and J. RÁK. 1965, slide: Velenje Sv. Bric-4-1, cross-table number: 11.3/140.8.
- 13,14. *Trilites* fsp., slide: Velenje Sv. Bric-4-2, cross-table number: 12.7/146.2.
15. *Laevigatosporites haardtii* (R. POT. and VEN. 1934) TH. and PF. 1953 subfsp. *haardtii*, *Polypodiaceae*, slide: Dobrna-1-1, cross-table number: 8.6/132.1.
- 16,17. *Verrucatosporites favus* (R. POT. 1931) TH. and PF. 1953 subfsp. *favus*, *Polypodiaceae*, slide: Velenje Sv. Bric-6-1, cross-table number: 9.5/129.6.
- 18,19. *Alisporites* fsp. – reworked, slide: Socka-1-1, cross-table number: 7.7/144.8.
- 20,21. *Araucariacites balinkaense* KDS. 1974, *Araucariaceae*, slide: Dobrna-1-1, cross-table number: 8.9/130.8.
- 22,23. Cf. *Psophosphaera* fsp., ?*Abietaceae*, *Pseudotsuga* v. *Larix*, slide: Dobrna-1-1, cross-table number: 4.8/140.3.
- 24,25. *Psophosphaera reissingeri* (KDS. 1961) KDS. 1974, slide: Velenje Sv. Bric-6-1, cross-table number: 5.2/142.6.
- 26,27. *Cupressacites dorogensis* (KDS. 1961) KDS. 1974, cf. *Coniferae*, slide: Lepena-8-1, cross-table number: 7.8/141.8.

Plate 2.3.

- 1,2. *Cycadopites kyushuensis* (TAKAHASHI 1961) KDS. 1968, *Ginkgoaceae*, v. *Cycadaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 7.8/130.6.
- 3,4. *Monocolpopollenites tranquillus* (R. POT. 1934) TH. and PF. 1953. subfsp. *tranquillus*, *Palmae*, slide: Velenje Sv. Bric-6-1, cross-table number: 17.2/151.3.
- 5,6. *Monocolpopollenites tranquillus* (R. POT. 1934) TH. PF. 1953 subfsp. *tranquillus*, *Palmae*, slide: Velenje Sv. Bric-6-1, cross-table number: 5.2/151.2.
- 7,8. *Spinizonocolpites* cf. *prominatus* (MCINTYRE 1965) KDS. 1974, *Palmae*, *Nipa*, slide: Lepena-3-1, cross-table number: 9.2/145.2.
- 9,10. *Spinizonocolpites* fsp., *Palmae*, cf. *Nipa*, slide: Lepena-2-1, cross-table number: 17.2/143.2.
- 11,12. *Spinizonocolpites* fsp., *Palmae*, cf. *Nipa*, slide: Lepena-3-1, cross-table number: 5.8/144.2.
- 13,14. "*Proxapertites africanus* KDS. nom. nud.", slide: Velenje Sv. Bric-3-1, cross-table number: 5.9/131.9.
- 15,16. Cf. *Ilexpollenites erdtmani* KDS. 1978, *Aquifoliaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 15.2/142.3.
- 17,18. *Intragranulitricolporites tumescens* (KDS. 1964) KDS. 1978, *Calyceaceae*, slide: Dobrna-1-1, cross-table number: 10.1/135.8.
- 19,20. *Fususpollenites fusus* (R. POT. 1934) KDS. 1978, *Fagaceae*, *Castanopsis*, slide: Dobrna-1-1, cross-table number: 8.9/139.8.
- 21,22. *Tetracolporopollenites urkauticus* KDS. 1978, *Sapotaceae*, slide: Dobrna-1-1, cross-table number: 8.1/140.1.
- 23,24. *Eocaenipollis* fsp., slide: Dobrna-1-1, cross-table number: 15.6/135.1.
- 25,26. *Pentapollenites laevigatus* W. KR. 1962 subfsp. *laevigatoides* W. KR. 1962, *Elaeagnaceae* v. *Simarubaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 16.3/144.4.
- 27,28. *Plicatopollis pseudoexcelsus* (W. KR. 1958) W. KR. 1961 subfsp. *nurgidus* PF. 1953, cf. *Myricaceae*, slide: Dobrna-1-1, cross-table number: 8.9/127.6.
- 29,30. Cf. *Platycaryapollenites* fsp., *Juglandaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 7.2/135.9.
- 31,32. *Plicatopollis lunatus* KDS. 1974, *Juglandaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 8.6/130.1.
- 33,34. *Plicatopollis hungaricus* KDS. 1974, *Juglandaceae*, slide: Dobrna-1-1, cross-table number: 8.9/131.2.
- 35,36. *Plicatopollis krutzschii* KDS. 1974, *Juglandaceae*, slide: Velenje Sv. Bric-3-1, cross-table number: 9.3/143.8.
- 37,38. *Bombacacidites* fsp., *Bombacaceae*, slide: Lepena-3-1, cross-table number: 10.6/136.1.
- 39,40. *Compositoipollenites rhizophorus* (R. POT. 1934) R. POT. 1960 subfsp. *rhizophorus*, *Icacinaceae*, slide: Lepena-8-1, cross-table number: 10.2/133.1.

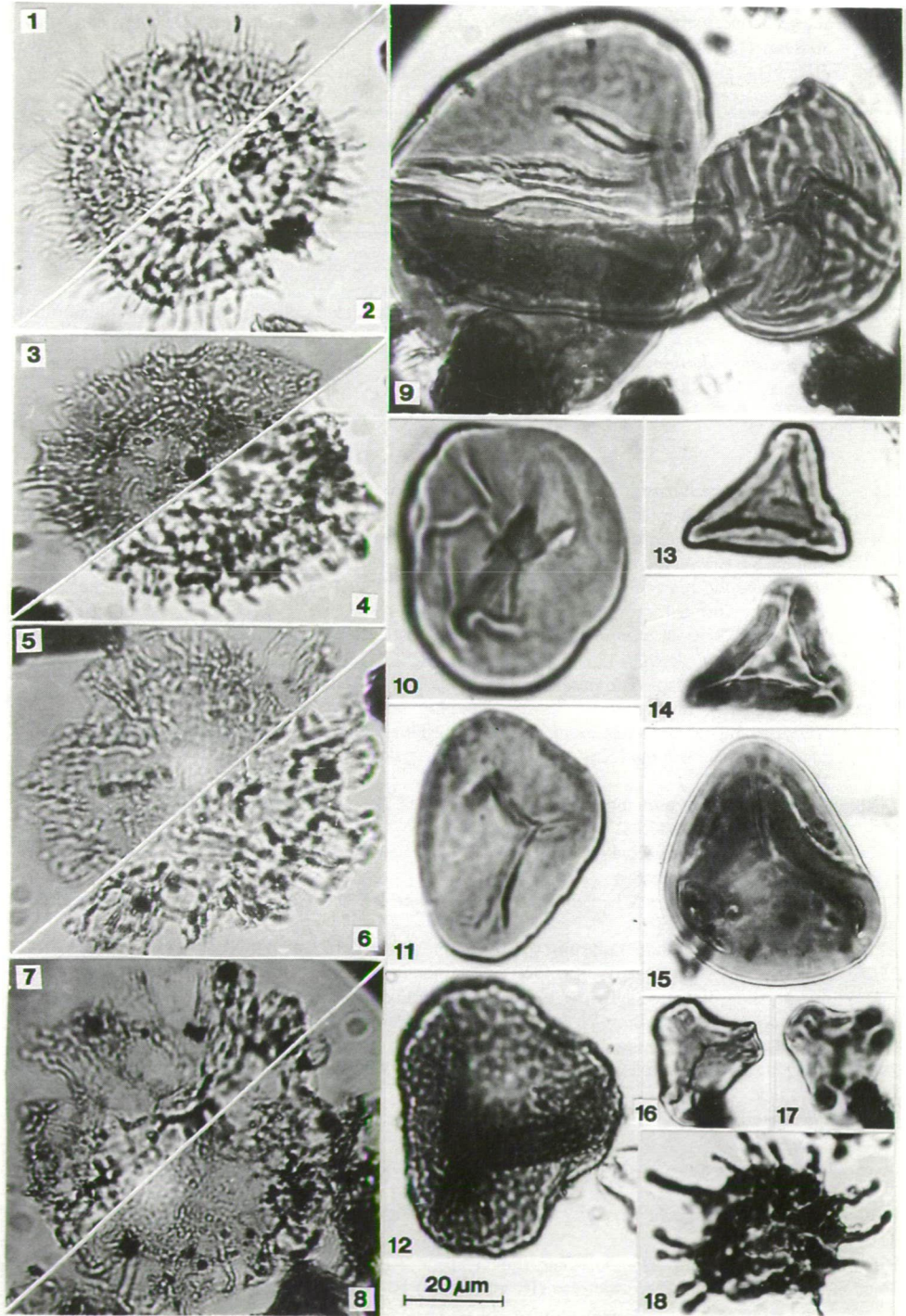


Plate 2.1.

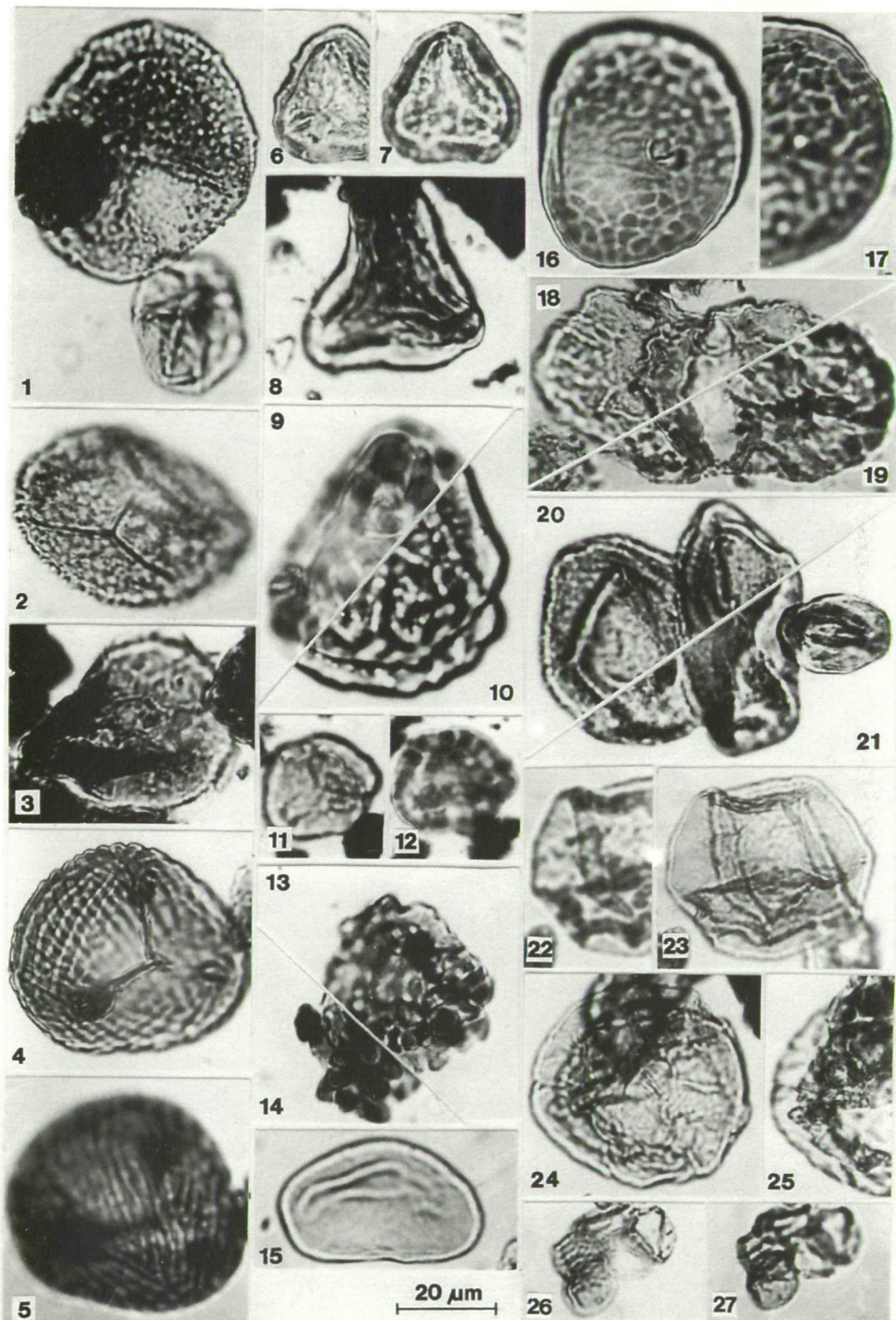


Plate 2.2.



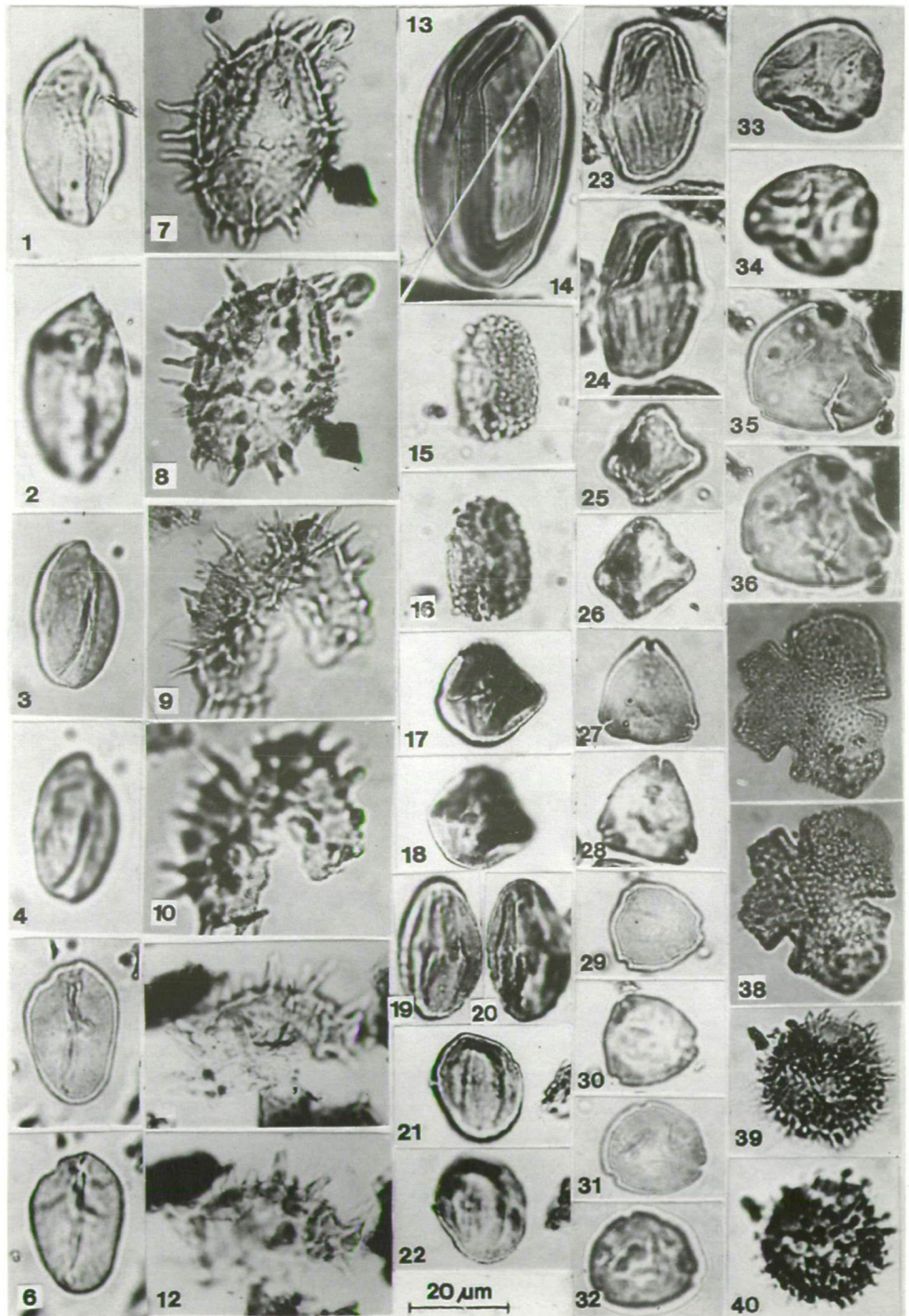


Plate 2.3.