Annales de la Société Géologique de Belgique. T. 110 - 1987, pp. 47-51 Mai 1987

LATE CRETACEOUS PALYNOMORPHS FROM THE BOREHOLES THERMAE 2002 (VALKENBURG A/D GEUL, THE NETHERLANDS) AND 's-GRAVENVOEREN (BELGIUM)

by

David J. BATTEN[1], Maurice STREEL[2], Michiel DUSAR[3] & Martin J.M. BLESS[4]

(1 figure and 1 plate)

1. INTRODUCTION

Late Cretaceous palynomorphs have been recognized in two samples from boreholes in the border area of northeastern Belgium (Herve-Voer area : 's-Gravenvoeren borehole) and the southeastern Netherlands (South-Limburg : Thermae 2002 borehole in Valkenburg a/d Geul). The palynoflora of both samples characterizes the same geological age (presumably Late Santonian) as shown below despite the fact that they come from quite different rock intervals (fig. 1).

The 's-Gravenvoeren sample is a core from a karst deposit (infill of an open fissure) within Visean limestones at 271 m bore depth. The Thermae 2002 sample comprises cuttings from a kaolinic mud-sand (bore depth 182-184 m) reworked a very short distance from the kaolinic paleosol underneath (Bless et al. 1986). This is considered to be the lithostratigraphic equivalent of the Hergenrath Clay, the lower member of the Upper Cretaceous Aachen Formation.

The findings clearly indicate that at the time of deposition of the Hergenrath Clay open karstic fissures deeply penetrated in the Dinantian limestones to at least 250 m below the present-day Dinantian surface in the 's-Gravenvoeren borehole.

2. PALYNOLOGY

The 's-Gravenvoeren core sample yielded very little organic matter and only a few palynomorphs of limited morphological diversity. The Thermae 2002 cutting sample by contrast proved to contain a comparatively large amount of plant detritus and a varied assemblage of miospores and some megaspores. A selection of specimens from both palynological preparations is illustrated on plate 1 (figures 1-9, 12 and 38 are from 's-Gravenvoeren, figures 10-11, and 13-37 are from Thermae 2002).

The confusing and largely unsatisfactory state of the taxonomy of Late Cretaceous miospores means that the names given to the majority of the species indentified are somewhat arbitrary, pending systematic revision. Author attributions are given below if specimens are not illustrated.

The two assemblages contain a number of taxa in common, notably species of *Trudopollis* and *Oculopollis.* The vast majority of the pollen grains recorded are referable to these and other genera of the Normapolles group. Also important is the occurrence of the triradiate spore *Trilobozonosporites rotalis* (Plate 1, fig. 26). Other taxa which have been encountered in both cores include *Camarozonosporites* spp. (*C. insignis* on Plate 1, fig. 33). *Gleicheniidites senonicus* (Plate 1, fig. 36), *Patellasporites distaverrucosus* (Brenner) Kemp and *Stereisporites* spp.

Forms similar to, and including *Trudopollis hemiperfectus* (Plate 1, figures 1, 2) are comparatively numerous in the preparation of the karst deposit, whereas the Thermae 2002 assemblage contains generally more robust species of *Trudopollis* (Plate 1, figures 11, 13, 14). Other differences in miospore composition include the presence of *Vacuopollis s. l.* (*i.e.* including *Pseudovacuopollis* ; Plate 1, figures 7-9, 12) in the former and the occurrence of pollen referable to *Clavatipollenites* sp., *Complexiopollis* spp. (Plate 1, fig. 25), *Interporopollenites* (including *I. aliciae* ; Plate 1, fig. 29) and *Cristaepollis multiporatus* (cf. *Erdtmanipollis*, Plate 1, figures 17, 18, 30, 31) in the latter. The Thermae 2002 assemblage also contains a large number of spores, among which are *Ceratosporites* sp. cf. *C. parvus* (Plate 1, fig. 34), *Concavisporites* sp. (Plate 1, fig. 27), *Densoisporites velatus* Weyland and Krieger, *Gabonisporis* sp. cf. *G. bacaricumulus* (Plate 1, fig. 28), *Kraeuselisporites* sp. cf. *K. reissingeri* (Harris), *Matonisporites phlebopteroides* Couper, *Patellasporites tavaredensis* (Plate 1, fig. 34), the megaspore *Tenellisporites tenellus* (Dijkstra) Potonié and *Uvaesporites* sp. (Plate 1, figures 32, 37).

1 *Geology and Mineralogy, University of Aberdeen, Marischal College, Aberdeen AB9 1AS, Scotland.*

2 *Paleontologie, Université de Liège, 7, place du Vingt-Août, B-4000 Liège, Belgium.*

3 *Belgische Geologische Dienst, Jennerstraat, 13 B-1040 Brussel, Belgium.*

4 *Natuurhistorisch Museum Maastricht, Bosquetplein 6-7, NL-6211 KJ Maastricht, the Netherlands.*

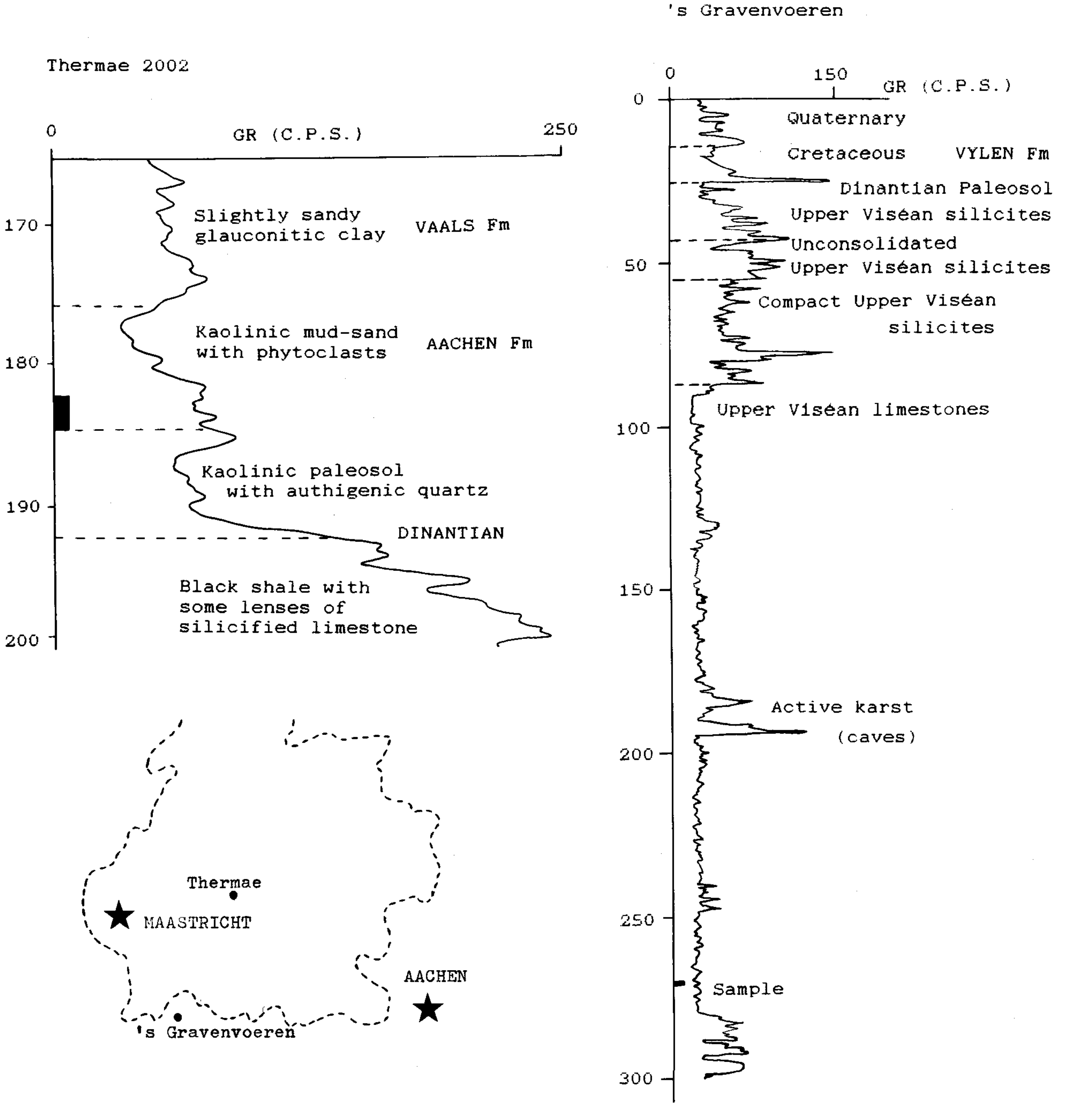


Figure 1 - Position of palynological sample in lithostratigraphic sequence of Thermae 2002 at base of Aachen Formation (Hergenrath Clay equivalent) and in 's-Gravenvoeren in karstic fissure in Dinantian limestone.
Sample 271.46 m (s'-Gravenvoeren) provided by the Belgian Geological Survey from one if its reconnaissance coreholes, was found in a paleokarst environment within compact limestones of Upper Visean age, 250 m below the top of the Paleozoic. It was macerated from a black carbonaceous clay along a closed thin calcite vein inclined 55° oblique to the sedimentary dip of 37° WNW. The encompassing strata consist of grey-coloured brachiopod-rich bioclastic peloidal packstones deposited as shallow water sediments. The Upper Visean limestone displays many open fisures and even indications of active karst down to 285 m which are interpreted as a rejuvenated paleokarst. Paleokarst features of undefined age exist intermittently down to the final depth of the corehole (865 m). Unfortunately other clay infillings did not yield palynomorphs.

These differences cannot be interpreted to have much stratigraphic significance. The taxonomically restricted karst assemblage may reflect a species impoverished local vegetation. The association of the majority of miospores encountered in the two assemblages is consistent with a Santonian, or at the latest, an Early Campanian age. The scarcity of Postnormapolles-type pollen, the lack of marine phytoplankton, the presence of the presumed freshwater algae *Schizosporis parvus* Cookson and Dettmann and (in the karst deposit) *Schizocystia laevigata* (Plate 1, fig. 38), and the occurrence of *Clavatipollenites* sp. in the Thermae 2002 sample indicate that sedimentation probably took place before the Campanian. Younger strata in the vicinity have a marine origin.

A likely lower age limit of Middle Santonian is indicated by the occurrence of *Trilobozonosporites rotalis, Trudopollis hemiperfectus, Vacuopollis proconcavus* and *V. semiconcavus*. Dating can be further refined to probable Late Santonian for the Thermae 2002 sample by the presence of *Cristaepollis multiporatus*.

3. POSSIBLE AGE OF KARSTIFICATION

The uppermost portion of the Dinantian rocks in 's-Gravenvoeren and Thermae 2002, and also in other boreholes in South-Limburg (e.g. Heugem and Kastanjelann ; Bless et al. 1981) has been exposed to a deep weathering causing deeply penetrating karstification of the carbonates followed by their silicification (e.g. Gökdag 1982). Shales of Middle Visean age in the Heugem borehole and of presumed latest Visean age in the Thermae and 's-Gravenvoeren boreholes have been affected by lateritic weathering that resulted in a kaolinic paleosol with abundant authigenic quartz crystals (frequently containing a nucleus of carbonate) and with bleached fragments of silicified Dinantian shales and carbonates.

Karstification, silicification and lateritic weathering must have occurred prior to the deposition of the overlying mud-sand of the Aachen formation (Hergenrath clay) in the Thermae boreholes. This mud-sand lithologically resembles the underlying kaolinic paleosol in Thermae 2000 and Thermae 2002 (Bless et al. 1986), but it is distinguished by the presence of abundant plant remains (wood fragments, seeds, cuticles, megaspores and small palynomorphs).

Lateritic weathering was a widespread phenomenon at this latitude in Western Europe during the Jurassic and Early Cretaceous. It indicates that warm, wet conditions prevailed during much of the period (Higgs & Beese 1986). The main karstification of the Dinantian limestones in South-Limburg and vicinity is more likely to be of the same age. Presumably it followed a period of weathering and erosion of the former Upper Carboniferous overburden in this area which took place during the Permo-Triassic.

The karst landscape must have been still in existence during at least the early stages of deposition of the Late Santonian Aachen Formation as indicated by the presence of coeval palynomorphs in the karstic fissures of 's-Gravenvoeren.

It should be noted that the Dinantian rocks in the 's-Gravenvoeren borehole are overlain by the Upper Maastrichtian Vijlen Chalk. Sediments of the Late Santonian Aachen Formation to Early Maastrichtian Beutenaken Chalk are absent. This is in contrast to the situation a few kilometers to the North and may indicate that the 's-Gravenvoeren region remained a karst landscape until the beginning of the Upper Maastrichtian, when the Cretaceous sea finally drowned the whole area.

4. REFERENCES

BLESS, M.J.M., P. BOONEN, J. BOUCKAERT, C. BRAUCKMANN, R. CONIL, M. DUSAR, P.J. FELDER, W.M. FELDER, H. GÖKDAG, F. KOCKEL, M. LALOUX, H.R. LANGGUTH, C.G. VAN DER MEER MOHR, J.P.M.Th. MEESSEN, F. OP HET VELD, E. PAPROTH, H. PIETZNER, J. PLUM, E. POTY, A. SCHERP, R. SCHULZ, M. STREEL, J. THOREZ, P. VAN ROOIJEN, M. VANGUESTAINE, J.L. VIESLET, D.J. WIERSMA, C.F. WINKLER PRINS & M. WOLF, 1981 : Preliminary report on Lower Tertiary-Upper Cretaceous and Dinantian-Fammennian rocks in the boreholes Heugem-1/1a and Kastanjelaan-2 (Maastricht, The Netherlands). Med. Rijks Geol. Dienst. Vol. 35/15 : 333-415.

BLESS, M.J.M., J. BOUCKAERT, P.J. FELDER, H.R. LANGGUTH & J.P.M.Th. MEESSEN, 1986. Gesteenten, fossielen en water van de proefboring Thermae 2000 te Valkenburg aan de Geul. Valkdruk, Valkenburg a/d Geul i.s.m. Natuurhistorisch Museum Maastricht : 1-40. ISBN 90-6190-025-6.

GÖKDAG, H., 1982. Some diagenetic aspects and origin of porosity in the Dinantian (Early Carboniferous) carbonates in the wells Heugem-1a and Kastanjelaan-2 (Maastricht, the Netherlands). Public. Natuurhist. Gen. Limburg, 32 : 50-53.

HIGGS, K. & A.P. BEESE, 1986. A Jurassic microflora from the Colbond Clay of Cloyne, County Cork. Ir. J. Earth Sci., 7 : 99-109.

PLATE 1

Palynomorphs of presumed Late Santonian age. Figures 1-9, 12 and 38 are from 's-Gravenvoeren, 271 m. Figures 10-11 and 13-37 are from Thermae 2002, 182-184 m. Magnifications are c. X1000 except where indicated.

1 *Trudopollis hemiperfectus* (Pflug) Pflug.

2 *Trudopollis* sp.

3 *Oculopollis brevioculus* Góczán.

4 Incompletely formed *Oculopollis*.

5 *Oculopollis cardinalis* Weyland and Krieger.

6 *Oculopollis aestheticus* Weyland and Krieger (= *Extratriporopollenites triceps* Skarby).

7 *Vacuopollis semiconcavus* Pflug (= *Extratriporopollenites sinuatus* Skarby).

8 *Vacuopollis proconcavus* Weyland and Krieger.

9 *Vacuopollis* group (cf. *Pseudovacuopollis involutus* Tschudy).

10-11 *Trudopollis* spp.

12 *Vacuopollis proconcavus* Weyland and Krieger.

13-14 *Trudopollis* spp.

15 *Oculopollis* sp.

16 *Pseudoculopollis* sp.

17-18 *Cristaepollis multiporatus* Krutzsch (*ex gr. Erdtmanipollis pachysandroides* Krutzsch).

19-20 *Oculopollis orbicularis* Góczán.

21 *Oculopollis concentricoides* Weyland and Krieger.

22 *Oculopollis* sp. (*Extratriporopollenites parmatus* Skarby).

23 *Trudopollis protrudens* (Erdtman in Ross) Pflug (= *Extratriporopollenites firmus* Skarby).

24 *Ceratosporites* sp. cf. *C. parvus* Brenner.

25 *Complexiopollis* sp.

26 *Trilobozonosporites rotalis* (Weyland and Krieger) Potonié.

27 *Concavisporites* sp.

28 Part of *Gabonisporis* sp. cf. *G. bacaricumulus* Srivastava, X900.

29 *Interporopollenites aliciae* Vazquez Reyero.

30-31 *Cristaepollis multiporatus* Krutzsch (see 17, 18 above).

32 *Uvaesporites* sp., part of proximal face (for median focus, see 37).

33 *Camarozonosporites insignis* Norris.

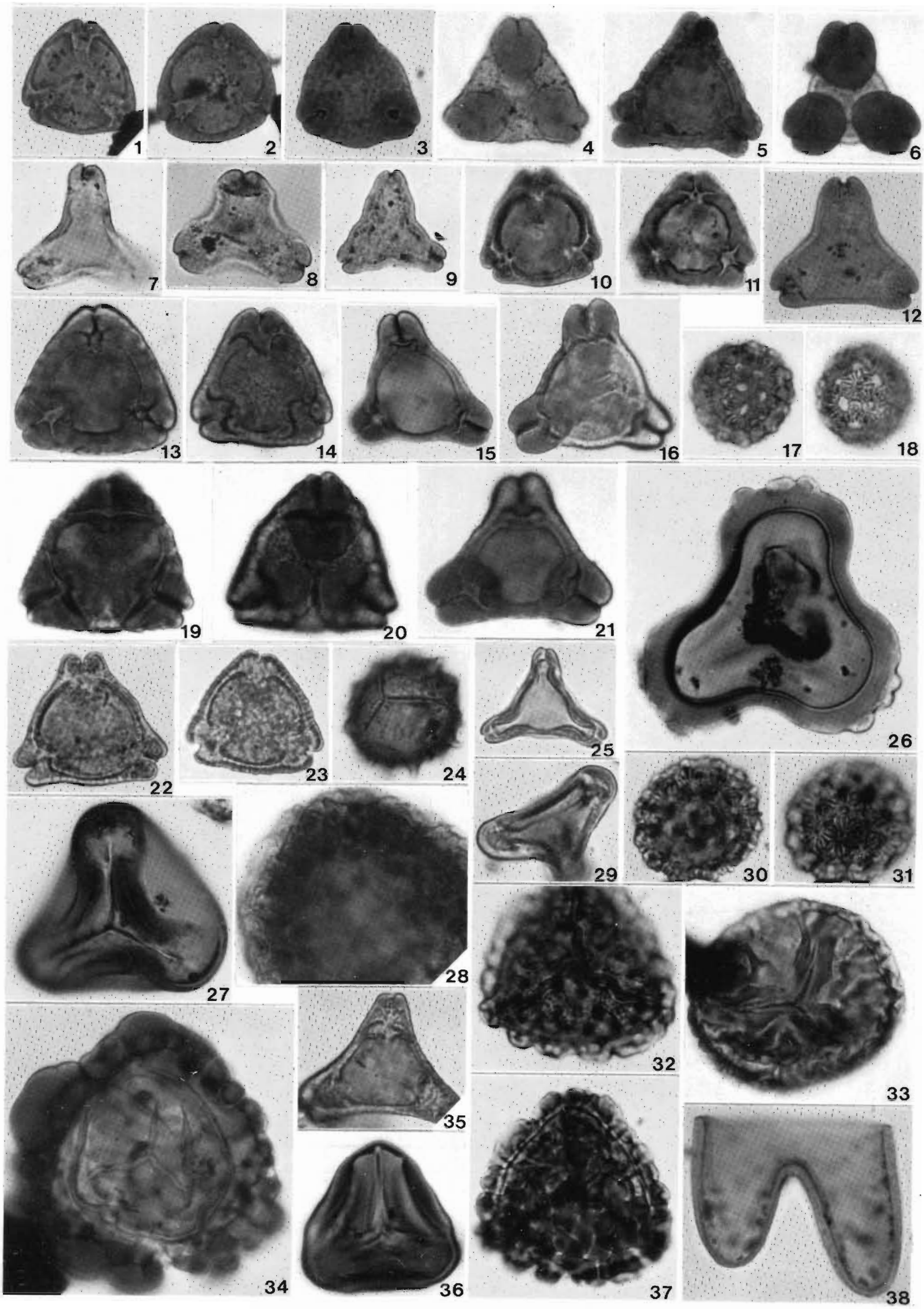
34 *Patellasporites tavaredensis* Groot and Groot.

35 *Osculapollis* sp.

36 *Gleicheniidites senonicus* Ross.

37 *Uvaesporites* sp., median focus (for proximal focus, see 32).

38 *Schizocystia laevigata* Cookson and Eisenack.


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38