THE POLLEN ANALYSIS OF DOLNÍ VĚSTONICE II, SECTION NO. 1

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During salvage excavations at the western slope, the section No. 1 has been sampled for palynological investigation (for stratigraphic correlation see Tab. 1).

The minerogenic sediment was treated by the method of mineral separation (Girard - Renault-Miskovsky 1969). Pollen spectra were usually observed on 10 slides (20 x 20 mm). The total sum includes all grains of arboreal (AP) and non-arboreal pollen (NAP). The numbers of sporomorphes are indicated in Tab. 10.

Description of the analysed samples

Sample No. 1. The pollen spectrum is composed by Pinus (34,5 %) and other arboreal species (Betula, Alnus, Picea, Juniperus, Corylus). Poaceae and Cyperaceae with approximatively equal percentages of pollen grains (17 %) dominate among the herbs, while Artemisia pollen reached 4 % of the total sum. The presence of Algae (Pediastrum sp.) is noted (4 % compared to the total sum). Among the spores of Pteridophyta, Botrychium was observed and divided into two types (Fig. 39:h,1). These sporomorphes were accompanied by redeposited sporomorphes of Tertiary and Upper Pleistocene origin and by number of objects with s-shaped opening, determined as water plancton by M. Konzalová.

Sample No. 2. In the pollen spectrum of this sample, Salix dominates by 13,5 % of the total sum. Pollen of Betula and Alnus are represented by equal percentages of 4 % of the total sum. The share of pollen of Artemisia and Asteraceae is higher compared to sample No. 1. An increase is observed in the number of Botrychium spores as well. Among Algae, the representants of Pediastrum integrum and Pediastrum boryanum var. boryanum are present. The spectrum of redeposited sporomorphes is enlarged by types such as Carya, Platycarya, Piceapollis sacculiferoides and others (Fig. 40).

Sample No. 3. The number of Picea and Juniperus grains is comparable with sample No. 2, while the number of Salix grains decreased. Heliophilous species of Asteraceae, Chenopodiaceae, Polygonaceae and Ranunculaceae dominated among herbaceous pollen. The water plancton and zygospores of Zygnemataceae were observed. Spores of Botrychium reached their maximum in this sample. Redeposited sporomorphes appeared in a high quantity as well (110 % compared to the total sum).

Sample No. 4. The pollen spectrum is relatively poor in species. The arboreal pollen are dominated by Pinus (70,7 % of total sum); share of Salix was higher compared to sample No. 3. Among the herbs the pollen of Cyperaceae and Artemisia prevailed.

Sample No. 5. This sample is important for its provenience from the cultural layer. In the arboreal pollen spectrum we

LITHOLOGY
SAMPLES
REDEPOSITED SPOROMORPHS
PINUS
OTHER AP
OTHER NAP
CYPERACEAE
AP:
Betula
Juniperus
Alnus
Picea
Salix
Thermophile trees
NAP:
Poaceae
Artemisia
Asteraceae-Liguliflorae
Asteraceae-Tubuliflorae
Chenopodiaceae
Ranunculaceae
Plantago major media
Other NAP
Hydrophyta
Indeterminata
Σ AP + NAP
86
581
223
587
215
110
74
99

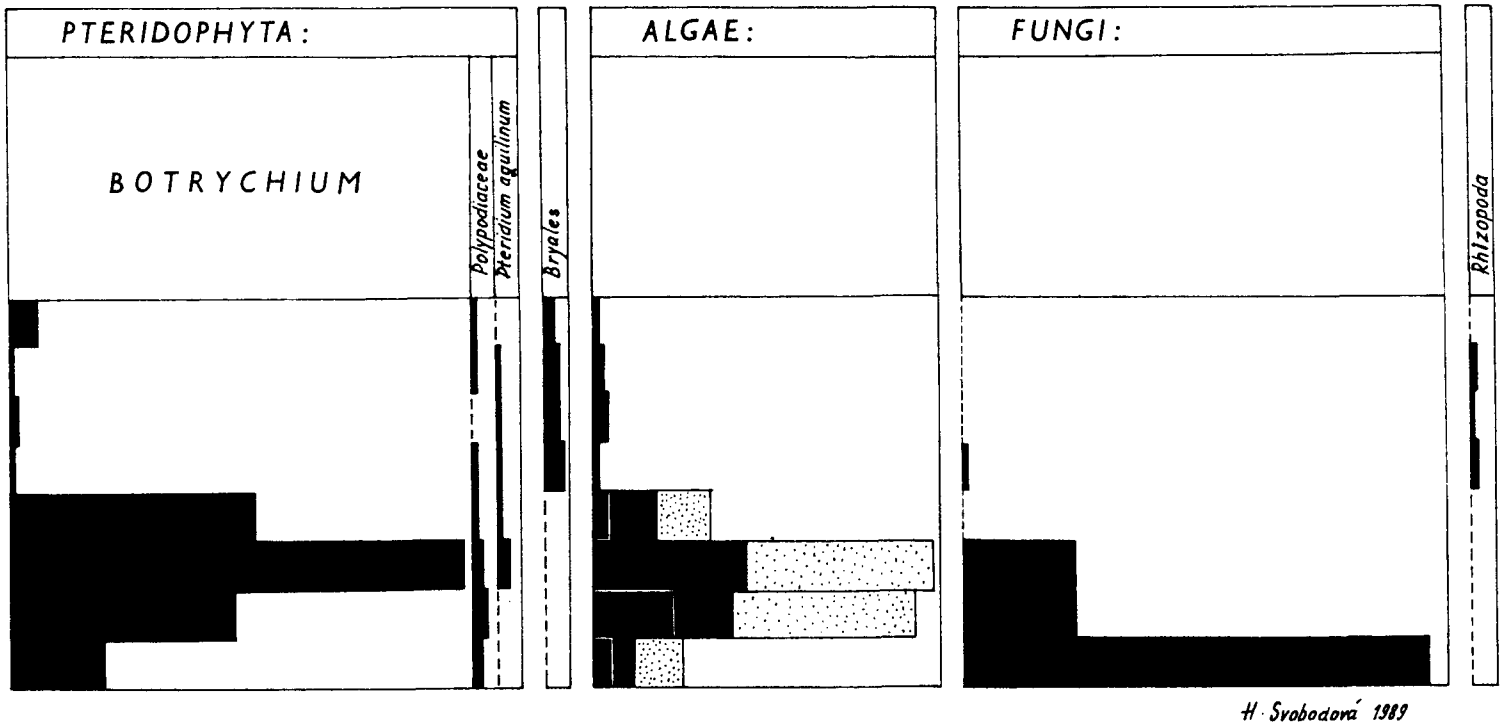

Fig. 38. Pollen diagram of Dolní Věstonice II, section 1.

Tab. 10. Dolní Věstonice - section 1. The sporomorphs table.

Sample No	1	2	3	4	5	6	7	8
AP:								
Alnus	3	3	-	-	3	-	7	1
Betula	5	3	1	-	6	3	2	1
Carpinus	-	-	-	-	1	-	-	-
Corylus	1	-	-	-	1	-	-	-
Juniperus	2	-	3	-	11	5	14	-
Larix (?)	-	-	-	-	-	-	-	1
Picea	4	-	5	1	5	6	4	-
Pinus	35	22	46	152	419	135	402	56
Tilia	-	-	-	-	1	-	-	-
Salix	-	10	1	4	-	-	5	-
Σ AP	50	38	56	157	447	149	434	59

Tab. 10. - cont.

NAP:								
Artemisia	4	4	1	5	4	1	8	-
t.Achillea	-	-	2	-	-	-	2	-
t.Cirsium	-	-	-	-	1	-	-	-
Asteraceae Liguliflorae	1	2	3	-	7	6	3	6
Asteraceae Tubiflorae undif.	1	1	-	-	4	3	-	1
Brassicaceae t.Barbarea	1	-	-	-	-	-	-	1
Chenopodiaceae	1	-	2	1	4	-	4	-
Cyperaceae	15	6	13	28	46	10	26	3
Daucaceae	-	1	-	1	-	-	-	-
Filipendula	-	1	-	1	-	-	-	-
Gentianella	-	-	1	-	-	-	-	-
Lamiaceae	-	-	-	-	-	2	-	-
t.Lythrum	-	-	-	-	-	1	-	-
Plantago major-media	-	-	-	-	1	1	4	-
Poaceae	17	12	18	11	54	38	66	13
Poaceae t.Glyceria	-	-	-	-	2	1	-	-
t.Ranunculus	-	-	2	-	2	-	3	-
Rumex acetosella	1	-	1	-	-	-	-	-
Silenaceae	1	-	-	-	-	-	-	-
Succisa	-	-	-	-	-	-	1	-
Valeriana	-	-	-	-	1	-	1	-
Indeterminata	7	8	7	11	15	10	27	3
Σ NAP+Hydrophyta	49	36	54	58	142	74	147	27
Σ AP + NAP	99	74	110	215	589	223	581	86

Tab. 10. - cont.

Hydrophyta:								
Myriophyllum spicatum	-	-	2	-	-	-	-	-
Nuphar	-	-	-	-	-	1	2	-
Sparganium-Typha angustifolia	-	1	2	-	-	-	-	-
Utricularia	-	-	-	-	1	-	-	-
Σ Hydrophyta	-	1	4	-	1	1	2	-
Pteridophyta:								
Botrychium type a	16	18	67	35	-	-	-	-
Botrychium type b	2	16	37	72	8	6	6	5
Equisetum	-	-	-	-	3	-	1	-
Lycopodium annotinum	-	3	-	6	-	-	-	-
Polypodiaceae	2	2	2	3	1	-	1	1
Pteridium aquilinum	-	-	3	1	2	1	1	-
Selaginella selaginoides	-	-	-	-	-	-	7	-
Σ Pteridophyta	20	39	109	117	14	7	16	6

Tab. 10. - cont.

Bryales	-	-	-	-	21	7	5	2
Algae:								
Desmidiaceae	-	-	-	12	-	-	1	1
Pediastrum boryanum var. boryanum	-	3	-	-	-	1	1	-
Pediastrum duplex	-	-	-	-	2	-	-	-
Pediastrum integrum	-	2	-	-	2	6	8	-
Pediastrum sp.	5	6	-	4	-	-	-	-
Zygnemataceae	3	10	35	11	-	-	-	-
Σ Algae	8	21	35	27	4	7	10	1
Plancton	10	27	44	24	-	present	-	-
Fungí:								
Microthyrium	-	-	-	-	2	-	2	-
Fungí	95	17	25	-	1	-	-	-
Rhizopoda	-	-	-	-	8	1	4	-

Tab. 10. - cont.

Redeposited sporomorphes:								
Carya	1	1	1	1	-	-	1	-
Engelhartia	-	-	-	-	-	-	2	-
Piceapollis sacculiferoides	-	2	3	1	-	-	1	-
Pinus	8	16	93	133	23	49	383	31
Pityopollenites	-	-	1	-	-	-	-	-
Platycarya	1	7	1	5	-	-	-	-
Pterocarya	-	-	-	-	1	-	-	-
Sciadopitys	-	-	-	-	-	-	2	-
Tilia	-	-	-	-	-	-	1	-
Indeterminata	-	3	-	2	4	5	13	-
Tertiary sporomorphes	-	-	-	1	1	7	16	-
Hystridospherideae	-	-	-	6	-	-	-	-

observed, apart from usual species such as Pinus, Picea, Betula, Alnus and Juniperus, certain termophilous deciduous trees (Tilia, Carpinus and Corylus). Herbaceous pollen spectrum was abundant and contained the heliophilous species of Asteraceae Tubiflorae, Asteraceae Liguliflorae, Chenopodiaceae and pollen types such as Artemisia, Cirsium, Ranunculus, Valeriana and Plantago major-media. Pollen grains of Poaceae and Cyperaceae were in aproximatively equal proportions (9 % of total sum). Spores of Botrychium appeared less frequently (about 2 % compared to the total sum); Rhizopoda and Algae were scarcely noticed. Evidence of redeposited sporomorphes, including types of Mesozoicum age (according to M. Konzalová), was rather scarce, about 5 % compared to the total sum.

Sample No. 6. Arboreal pollen are dominated by Pinus (60,6 %), accompanied by pollen grains of Picea, Betula and Juniperus. Herbaceous pollen spectrum was similar to sample No. 5. Pollen of Poaceae reaches 17 % of the total sum, pollen of Cyperaceae make only about 4 % and pollen of Asteraceae 6 %. The presence of pollen grains of Artemisia, Lamiaceae and Plantago major-media was noted. Spores of Pteridophyta, Bryophyta and Algae occured scarcely.

Sample No. 7. The arboreal pollen spectrum is characterized by continual presence of Pinus and re-appearence of Salix and Alnus. The herbaceous pollen spectrum is dominated by Poaceae, accompanied by a reduced number of Asteraceae, Ranunculaceae and Plantago major-media pollen and by a standard number of Chenopodiaceae pollen. Spores of Pteridophyta (Botrychium, Selaginella selaginoides, Equisetum) and Algae (Pediastrum sp.) are scarse.

Sample No. 8. Pollen spectrum was relatively poor in species. Pollen grains of Pinus, Betula and Alnus are observed. Herbs are represented by pollen of Poaceae, Asteraceae Liguliflorae and Brassicaceae. Spores of Botrychium make 6 % and redeposited sporomorphes reach 36 % related to the total sum.

Interpretation

Pollen analysis of minerogenic sediment have been subject of discussions for some years. At the beginning of 60´ies, B. Frenzel (1964) iniciated the method of their preparation, investigated the process of sedimentation of pollen grains in minerogenic sediments and cleared the possibilities of interpretation. Pollen analyses of Upper Pleistocene sediments from Dolní Věstonice I were presented by R. Schütrumpf (Brandtner 1956), M. Puchmajerová (1950) and H. Svobodová (Svobodová-Svoboda 1988; Svobodová 1991). Several years ago, B. Urban (1984) analysed the part of the section at Dolní Věstonice II - brickyard, including soil horizons of PK III and PK II. Together with R. Schütrumpf´s results, her investigations became starting point for interpretation of redeposited sporomorphes by later studies.

The redeposited Tertiary and Upper Pleistocene sporomorphes appeared throughout the sampled section (Fig. 38). The pollen of Platycarya, Carya, Engelhartia and Sciadopitys do not belong

to the Würm period. The Pinus grains, if corroded and dark yellow or brown (Fig. 40:d,f) and of smaller dimension (e.g. Pinus minutus - Fig. 40:b) origin from earlier strata as well. If the Pinus grains were redeposited from younger PK III and PK II horizons, the differentiating criteria are missing. These phenomena should be taken in account in interpretation of the Pinus presence throughout the section.

In the sample No. 1 termophilous trees are represented only by Corylus, while Alnus and Betula represent humid environment. Among the herbs dominate rather steppe species such as Artemisia, Poaceae, Polygonaceae, Chenopodiaceae and Brassicaceae. Spores of heliophilous fern Botrychium accompanied the steppe vegetation. Algae suggest the presence of possible water basins.

In the sample No. 2, the species Alnus and Betula prevail in arboreal pollen spectrum and the heliophilous species of Poaceae, Artemisia and Asteraceae dominate among the herbs. Botrychium witness an arid steppe vegetation. Pollen of Sparganium-Typha angustifolia, Algae, Zygnemataceae and water plancton suggest presence of water.

The dominance of spores of Botrychium and steppe species in the sample No. 3 indicate an arid steppe as well (without presence of termophilous deciduous trees). The same is true for sample No. 4.

High share of Pinus (71 % of the total sum) is striking in pollen spectrum of the cultural layer (sample No. 5). This sample may be compared to previous results concerning the same layer, from excavations 1985-86 (Svobodová 1991), where arboreal pollen sum range between 30 % and 50 % of the total sum. Another comparable evidence yielded the nearby section at Bulhary, dated to 25 675+2 750-2 045 B.P., where the total sum of arboreal pollen did not overpass 30 % as well (Rybníčková-Rybníček 1989). Pedological analysis documents the presence of earlier soils particles (Stillfried A: PK III and PK II, contribution by L. Smolíková), usually rich in Pinus (Urban 1984), in this level. Thus we are sceptical to the observed abundance of Pinus pollen in this sample. Furthermore, the intensity of Pinus pollen production in open steppe environment should be taken in account. For all these reasons, the high amount of Pinus pollen grains does not prove presence of a pine forest in the vicinity.

Samples from the archaeological excavations 1985-86 provide further evidence of termophilous deciduous trees (Quercus and Fagus) and coniferous trees (Larix). Among steppe species we observed pollen grain of Ephedra distachya. Spores of Botrychium reached 60 % compared to total sum and Algae (Pediastrum sp.) reached higher percentages as well.

Pollen spectra of all samples from the Pavlovian cultural layer of Dolní Věstonice II document steppe environment with heliophilous vegetation, with islands of termophilous deciduous (Quercus, Tilia, Carpinus, Fagus, Corylus) and coniferous (Pinus, Picea, Larix) trees. Juniperus appears as species of rather tundra - like landscape. Alnus, Salix, Populus and Betula indicate humid environment.

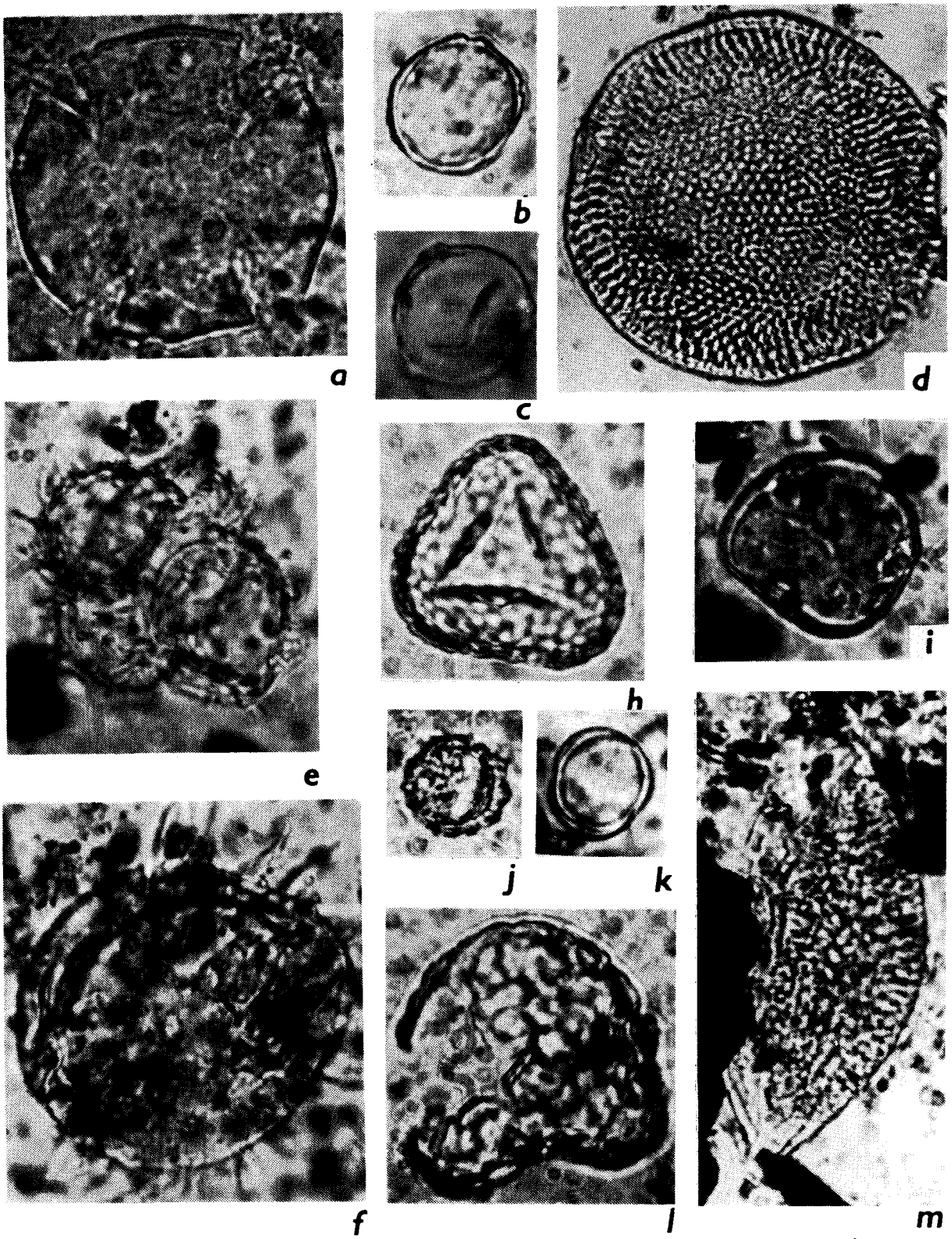

Fig. 39. Microphotographs of sporomorphs, a - Platycarya (layer 4), b - Plantago lanceolata (6), c - Betula (2), d - cf. Crassosphaera concinna (4), e - Selaginella selaginoides (3), f - Dinoflagellate cyst.? after van Geel et. al. (1989) t.-230 (1), h - Botrychium t.a (4), i - Tilia (2), j - Achillea t. (2), k - Artemisia (5), l - Botrychium t.b (4), m - Sciadopitys (3) x1 000.

The cool and dry type of vegetation prevailed in the overlying layer (sample No. 6). Pollen spectrum in the lower pseudogley (sample No. 7) suggests a tundra -forest vegetation with Juniperus, Salix and Pinus among the trees, and prevailing Poaceae and Cyperaceae representing the herbs. Among Pteridophyta we observed Selaginella selaginoides and Botrychium. The share of arboreal pollen is surprisingly high, about 74 % of the total sum.

The uppermost sample completes the sequence by a dry vegetation, poor in species.

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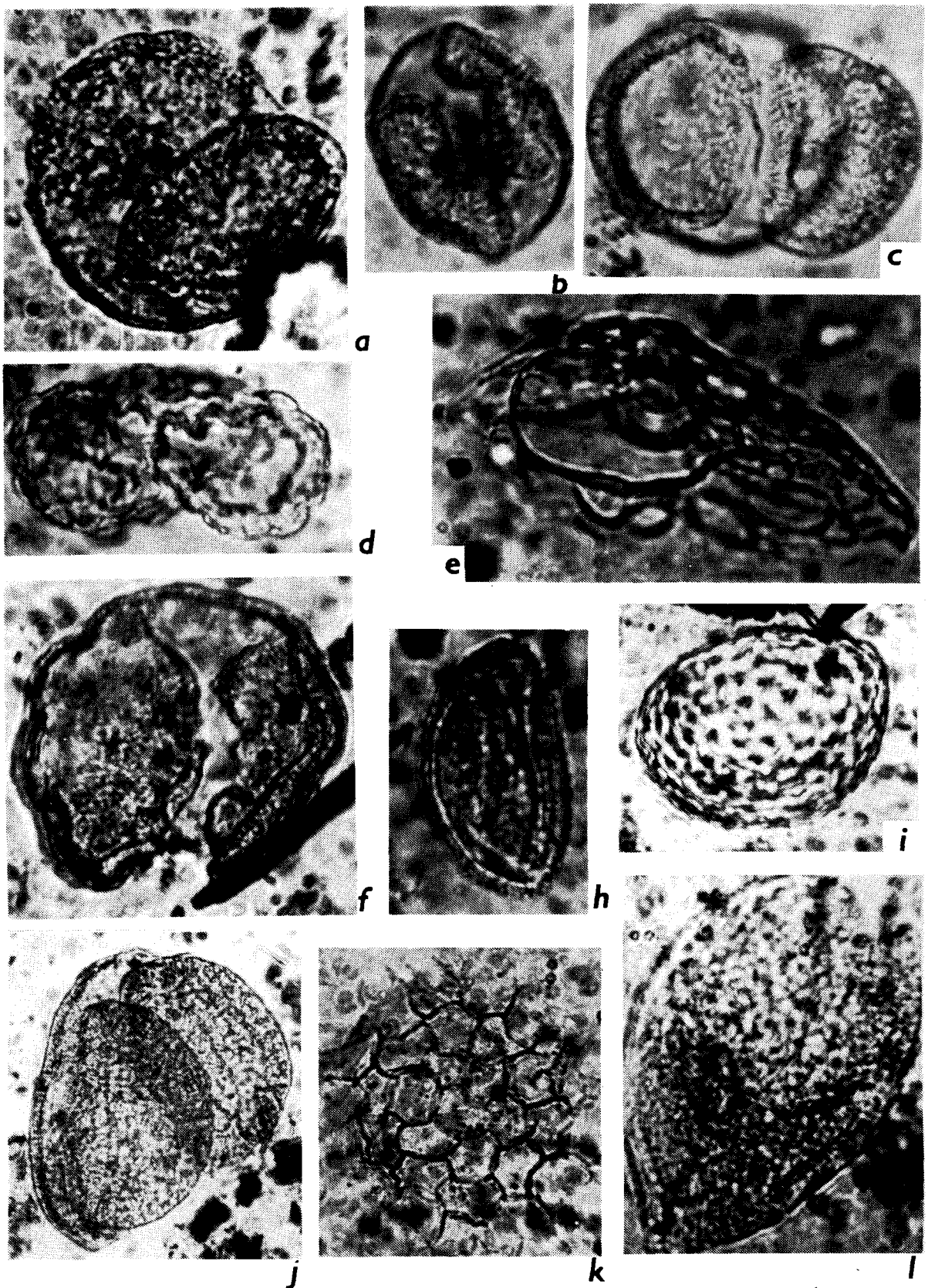

Fig. 40. Microphotographs of sporomorphs, a-d,f - Pinus (a: layer 4, b:5, c:3, d:4, f:3), e - Acari - Oribatei ? (5), h - Asteraceae Tub.undif. (1), i - Zygnemataceae after van Geel - van der Hammen (1978) t. 51 (3), j - Picea (1), k - Pediastrum boryanum (2), l - Piceapollis sacculiferoides (2). a-h,k x1000, i,j x500.

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