Geological Quarterly, Vol. 40, No. 2, 1996, p. 169–184

Paweł FILIPIAK

The miospore horizons from the Devonian-Carboniferous boundary beds in the Bolechowice IG 1 borehole (Holy Cross Mts.)

Among fifteen samples from the Bolechowice IG 1 borehole eight samples yielded numerous palynomorphs. Four standard palynological zones CVa, VF, PC and CM were established. Two new species *Raistrickia baculata* sp.n. and *Reticulatisporites bolechowicensis* sp.n. are described from the depth range of 152.40–153.40 m. Palynological investigations confirmed the occurrence of the Devonian-Carboniferous boundary between samples 152.40–153.40 and 141.70–141.95 m, what confirms the results of the former authors.

INTRODUCTION

The new palynological investigations have been done on the basis of samples from the borehole Bolechowice IG 1 as advised by Prof. H. Żakowa. The borehole was drilled in 1961 in SW part of the Holy Cross Mts., in the south-east part of the Gałęzice–Bolechowice–Borków Syncline (Fig. 1). The previous works concerning microflora from the borehole have been made by A. Jachowicz (*fide* H. Żakowa, 1967), together with detailed elaboration of lithofacies and biofacies. The above-mentioned borehole was described in detail taking into account stratigraphical (H. Żakowa, 1963), petrographical (W. Ryka, H. Żakowa, 1964) and microfaunistical (G. Freyer, H. Żakowa, 1967) aspects. The palynological biostratigraphy of the Devonian-Carboniferous transition from the western part of the Holy Cross Mts. was elaborated by A. Jachowicz (1961, 1962, 1967), A. Jachowicz, H. Żakowa (1969), E. Turnau (1985, 1990) and P. Filipiak (in press).

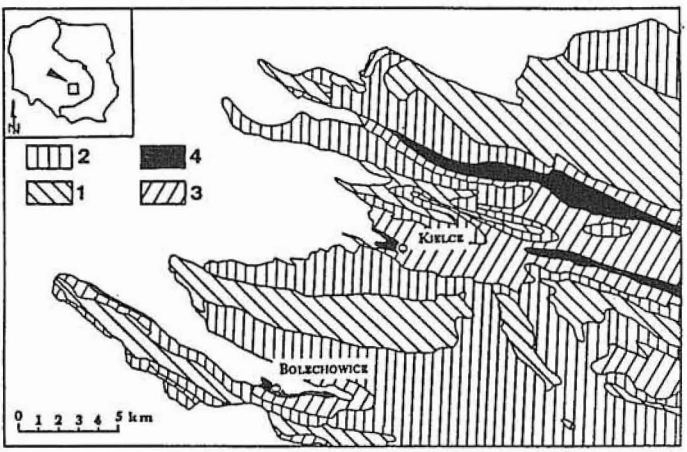


Fig. 1. Geological sketch of the western part of the Holy Cross Mts. (after J. Czarnocki, 1938)
1 — Cambrian-Silurian, 2 — Lower-Middle Devonian, 3 — Upper Devonian, 4 — Lower Carboniferous
Szkic geologiczny zachodniej części Gór Świętokrzyskich (według J. Czarnockiego, 1938)
1 — kambr-sylur, 2 — dewon dolny i środkowy, 3 — dewon górny, 4 — karbon dolny

METHODS OF WORK AND STATE OF PRESERVATION OF PALYNOMORPHS

Fifteen samples of the Bolechowice IG 1 borehole were collected to resume the palynological investigation. Samples studied represent carbonate rocks (limestone, marls) and siliceous-argillaceous shales. Detailed lithological characteristics and profile are presented in H. Żakowa (1967). 30 g portion of each sample was macerated using standard laboratory methods. Very fine screens (10, 20, 53 μm) were used in order to separate the miospores from the residue in the last stage of laboratory work. It permitted, through disposal of tiny organic particles for creating clean, rich in palynomorphs slides (four per each sample). All works were done using unrecurring vessels.

Eight samples out of fifteen delivered useful palynological material rather rich in miospores. The miospore state of preservation is generally good. Especially well preserved are miospores with thin and thick exine from the lower part of the section, on the other hand worse preserved are the miospores from the higher samples. They show traces of corrosion and mineralization inside what led to obliteration of the characteristic features of individual miospores or to their complete destruction. The frequency of recognizable miospores was several hundred specimens per sample.

SYSTEMATIC PALAEONTOLOGY

In total 60 species, among them two new species (Pl. I and II), have been recognized during palynological research of the material from the following depth ranges 157.50–

158.50, 152.40–153.40, 151.40–152.40, 141.75–141.95, 135.00–137.00, 129.40–133.40, 123.45–125.30, and 118.50–119.70 m (Tab. 1). All specimens including, holotypes are deposited at the University of Silesia, Department of Earth Sciences in Sosnowiec.

Anteturma SPORITES Potonié, 1893
Turma **Triletes** (Reinsch) Dettman, 1963
Subturma **Azonotriletes** (Luber) Dettman, 1963
Infraturma **Apiculati** (Bennie et Kidston) Potonié, 1954
Genus *Raistrickia* Schopf, Wilson et Bentall emend. Potonié et Kremp, 1954
Raistrickia baculata sp.n.
(Pl. I, Figs. 1, 2, 4 and 5)

H o l o t y p e : Slide: 2 Bol. 53 µm II, GIUS 4-837 Bol/1.
T y p e h o r i z o n : LV Zone.
T y p e l o c a l i t y : Bolechowice IG 1 borehole, depth 152.40–153.40 m.
D e r i v a t i o n o f t h e n a m e : [Lat.] *baculum* = stick, staff; in reference to baculashaped terminations processes.
D i a g n o s i s : Trilete acamerate miospore, amb subcircular to convexly triangular. Suture distinct, simple, often gaping almost to the end the miospore. Ornamentation exist on both sides of miospore and consists of prominent bacula. The shape differs from discrete, straight long truncated processes to short often fused with each other forming muri 5–15 µm in length. Some bacula have mushroom-like shape, with broader free end. The shape and measurement of processes are very well seen on densely ornamented margin of miospore, 3–8 µm in height and 2–7 µm in width.
D i m e n s i o n s : 74–(81)–95 µm (based on 4 specimens).

R e m a r k s . — The new species differs from *Raistrickia clavata* (Hacquebard) Playford 1964 possesing not so dense ornamentation which is sometimes fused in long muri. From other form the species differs by its characteristic ornamentations.

Infraturma **Cingulati** (Potonié et Klaus) Dettman, 1963
Genus *Reticulatisporites* (Ibrahim) Neves, 1964
Reticulatisporites bolechowicensis sp.n.
(Pl. II, Figs. 8–10)

H o l o t y p e : Slide: 2 Bol. 53 µm I, GIUS 4-838 Bol/2.
T y p e h o r i z o n : LV Zone.
T y p e l o c a l i t y : Bolechowice IG 1 borehole, depth 152.40 –153.40 m.
D e r i v a t i o n o f t h e n a m e : Bolechowice — the name of the village where the borehole was localised.
D i a g n o s i s : Trilete camerate miospores; amb subcircular to convexly triangular. Suture distinct, often gaping with strong labra ornamented with reticulum of muri, extending almost to central body margin. Distal and proximal surface bear dense reticule sculpture often projecting beyond the equatorial outline. Intexine distinct, laevigate, outline convexly triangular. Separation between the intexine and exoexine is better seen on distal surface; on proximal surface two layers are connected especially on the area of the trilete mark.
D i m e n s i o n s : Amb — 45–(76)–82 µm (based on 20 specimens); central body — 30–(37)–54 µm (based on 20 specimens).

Table 1

Stratigraphic distribution of palynomorphs in the Bolechowice IG 1 borehole

Miospores	Miospore zones							
	CVa	VF	?	?	PC	?	CM	CM
	depth							
	157.50–158.50	152.40–153.40	151.40–152.40	141.75–141.95	135.00–137.00	129.40–133.40	123.45–125.30	118.50–119.70
Retusotriletes communis Naumova 1953								
Corbulispora sp.								
Diaphanospora rugosa (Naumova) Byvsheva 1985								
Geminospora sp.								
Lophozonotriletes lebedianensis Naumova 1953								
Punctatisporites sp.								
Convolutispora cancellothyris (Waltz) Avhimovitch et Nekriata in Avhimovitch *et al.*, 1993								
Spelaeotriletes papulosus (Sennova) Avhimovitch in Avhimovitch *et al.*,1993								
Stenozonotriletes laevigatus Naumova 1953								
Grandispora famenensis (Naumova) Streel 1974								
Grandispora famenensis (Naumova) Streel var. *minutus* Nekriata 1979								
Knoxisporites dedaleus (Naumova) Moreau-Benoit 1980								
Retusotriletes incochatus Sullivan 1964								
Apiculiretusispora verrucosa (Caro-Moniez) Streel 1974								
Auroraspora asparella (Kedo) Van der Zwan 1980								
Auroraspora macra Sullivan 1968								
Cyrtospora cristifer (Luber) emend. Van der Zwan 1979								
Knoxisporites cf. *triradiatus* Hoffmeister, Staplin et Malloy *sensu* Sullivan 1964								
Discernisporites micromanifestus (Hacquebard) Sabry et Neves 1971								
Pustulatisporites dolbii Higgs, Clayton et Keegan 1988								
Auroraspora evanida (Kedo) Avhimovitch emend. Avhimovitch, Byvsheva, Higgs, Streel et Umnova 1988								
Densosporites devonicus Richardson 1960								
Diducites mucronatus (Kedo) Van Veen 1981								
Grandispora lupata Turnau 1975								

Hymenospora intertextus (Nekriata et Sergeeva) Avhimovitch et Loboziak 1993		—						
Raistrickia baculata sp.n.		—						
Reticulatisporites bolechowicensis sp.n.		—						
Retispora macroreticulata (Kedo) Byvsheva 1985		—						
Cymbosporites acutus (Kedo) Byvsheva 1985				—				
Spelaeotriletes obtusus Higgs 1975				—				
Plicatispora scolecophora (Neves et Ioannides) Higgs, Clayton et Keegan 1988				—	—	—		
Convolutispora major (Kedo) Turnau 1971				—	—	—	—	
Convolutispora mellita Hoffmeister, Staplin et Malloy 1955					—			
Endoculeospora setacea (Kedo) Avhimovitch et Higgs 1988					—			
Krauselisporites mitriatus Higgs 1971					—			
Umbonatisporites abstrusus (Playford) Clayton 1971					—			
Verrucosisporites opressus (Higgs) Higgs, Clayton et Keegan 1988					—			
Crassispora trychera Neves et Ioannides 1974					—		—	
Bascaudaspora submarginata (Playford) Higgs, Clayton et Keegan 1988					—		—	
Colatisporites decorus (Bharadwaj et Venkatachala) Williams 1973					—		—	
Pustulatisporites gibberosus (Hacquebard) Playford 1964					—		—	
Schopfites delicatus Higgs emend. Higgs, Clayton et Keegan 1988					—		—	
Umbonatisporites distinctus Clayton 1971					—		—	
Verrucosisporites nitidus (Naumova) Playford 1964					—		—	
Endoculeospora gradzinskii Turnau 1975					—		—	—
Anaplanisporites bacatus (Hoffmeister, Staplin et Malloy) Smith et Butterworth 1967							—	
Colatisporites denticulatus Neville 1973							—	
Convolutispora circumvallata Clayton 1971							—	
Convolutispora vermiformis Huges et Playford 1961							—	
Foveosporites oppositus Playford 1971							—	
Knoxisporites literatus (Waltz) Playford 1963							—	
Knoxisporites triangularis Higgs, Clayton et Keegan 1988							—	
Lycospora sp.							—	
Prolycospora claytonii Turnau 1978							—	
Raistrickia clavata Hacquebard emend. Playford 1964							—	
Raistrickia corynoges Sullivan 1968							—	
Raistrickia variabilis Dolby et Neves 1970							—	
Velamisporites perinatus (Hughes et Playford) Playford 1971							—	
Schopfites claviger Sullivan emend. Higgs, Clayton et Keegan 1988							—	—
Corbulispora cancellata (Waltz) Bharadwaj et Venkatachala 1961							—	—

R e m a r k s . — The new species differs from other forms from the genus *Reticulatisporites* possesing very dense network of muri especially on trilete mark labra.

THE RESULTS OF PALYNOLOGICAL INVESTIGATION

Planimetric analyses of 15 samples deliver miospores which may belong to two assemblages: the Devonian and the Carboniferous one (Fig. 2). The Devonian assemblage is represented by samples from the depth ranges of 157.50–158.50 and 152.40–153.40 m, while the Carboniferous assemblage is represented by samples from the depth ranges of 141.75–141.95, 135.00–137.00, 129.40–133.40, 123.45–125.30 and 118.50–119.70 m. Because the miospores from the interval of 151.40–152.40 m were poorly preserved and not numerous, their univocal classification to one of the two above-mentioned assemblages is not possible (Tab. 1).

In spite of the fact that the material belongs to the uppermost Devonian and lowermost Carboniferous not all the standard zones could be recognized here. Unrecognized were the topmost assemblages of the Famennian and lowermost assemblages of the Tournaisian.

The assemblage from 157.50–158.50 m can be classified to the Devonian miospore zone CVa (*Cornispora varicornata*). Despite of the lack of an index taxon the following miospore testify this: *Grandispora famenensis* (Naumova) Streel, *Lophozonotriletes lebedianensis* Naumova, *Spelaeotriletes papulosus* (Sennova) Avhimovitch, *Auroraspora macra* Sullivan, *Retusotriletes incochatus* Sullivan, *Cyrtospora cristifer* (Luber) emend. Van der Zwan, *Knoxisporites dedaleus* (Naumova) Moreau-Benoit and *Apiculiretusispora verrucosa* (Caro-Moniez) Streel.

Acritarchs are not so common and not so diversified.

The next sample (152.40–153.40 m) delivers very taxonomically diversified material, which was classified to the VF (*Diducites versabilis-Grandispora famenensis*) Zone. One of the index taxons, *Diducites versabilis* is absent here. Main components of that assemblage are miospores with thick exine of the following genera: *Grandispora, Hymenospora* and *Densosporites*. The important elements of the assemblage are as follows: *Retispora macroreticulata* (Kedo) Byvsheva, *Diducites mucronatus* (Kedo) Van Veen, *Grandispora famenensis* (Naumova) Streel, *G. lupata* Turnau, *Hymenospora intertextus* (Nekriata et Sergeeva) Avhimovitch et Loboziak, *Knoxisporites dedaleus* (Naumova) Moreau-Benoit, *Densosporites devonicus* Richardson and *Cyrtospora cristifer* (Luber) emend. Van der Zwan. Appearance of *G. lupata* Turnau in the assemblage indicates the presence of the upper part of the VF Zone in the SP (*Spelaeotriletes papulosus*) Subzone.

Acritarchs are very numerous and very diversified at this level.

The sample from 135.00–137.00 m delivers very diversified and numerically rich material. The Lower Carboniferous miospores dominate here; the miospore assemblage indicates the PC (*Spelaeotriletes pretiosus-Raistrickia clavata*) Zone. Very common are: *Schopfites delicatus* Higgs emend. Higgs, Clayton et Keegan, *Umbonatisporites distinctus* Clayton, *Krauselisporites mitriatus* Higgs, *Convolutispora major* (Kedo) Turnau and *Colatisporites decorus* (Bharadwaj et Venkatachala) Williams. Some older species were also recognized: *Cyrtospora cristifer* (Luber) emend. Van der Zwan, *Pustulatisporites gibberosus* (Hacquebard) Playford, *Apiculiretusispora verrucosa* (Caro-Moniez) Streel,

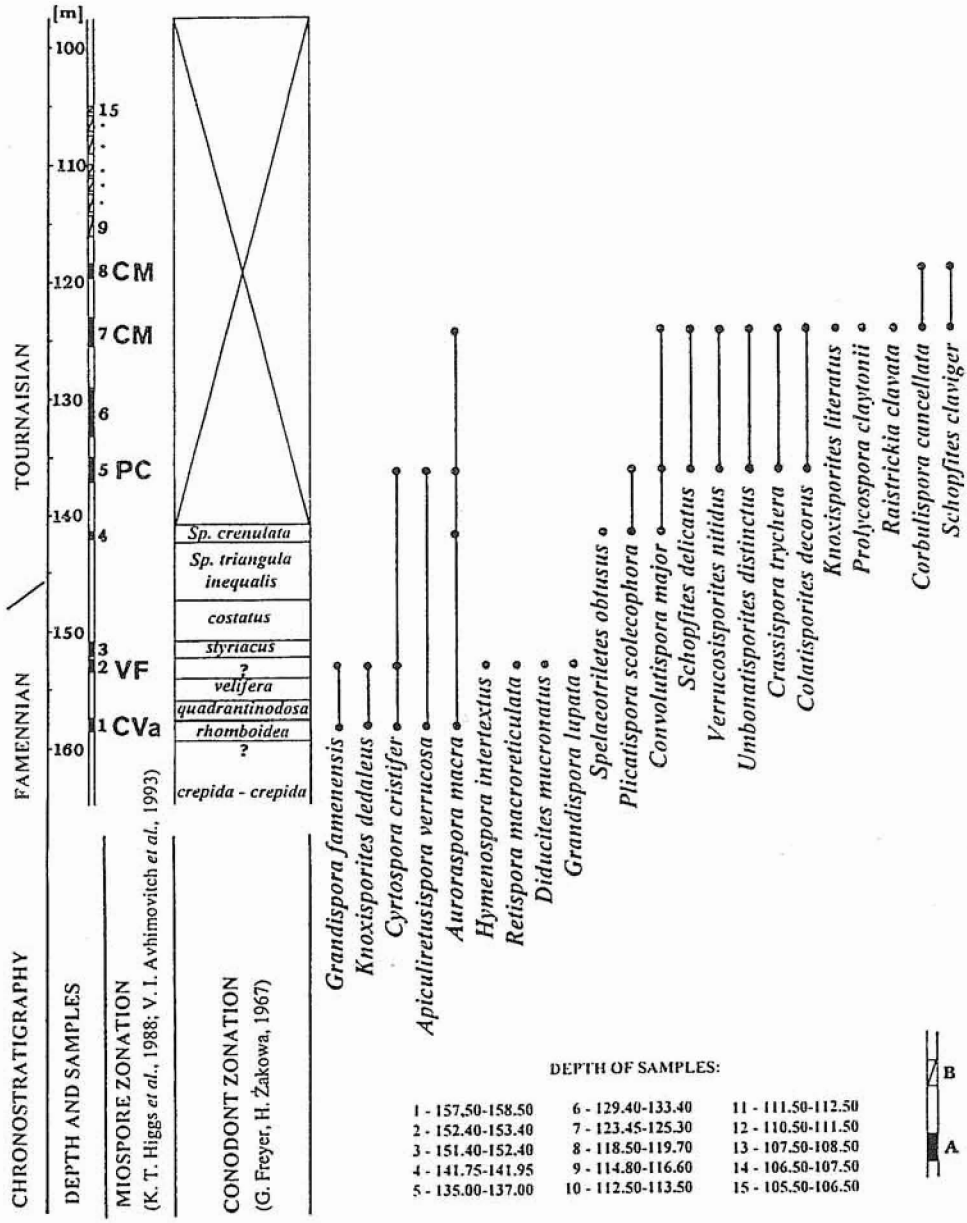


Fig. 2. Stratigraphic distribution of the index and characteristic miospores in the Bolechowice IG 1 borehole; miospore and conodont zonation

A — positive samples, B — negative samples

Stratygraficzne rozprzestrzenienie miospor wskaźnikowych i charakterystycznych w otworze wiertniczym Bolechowice IG 1; poziomy miosporowe i konodontowe

A — próbki pozytywne, B — próbki negatywne

Plicatispora scolecophora (Neves et Ioannides) Higgs, Clayton et Keegan, *Umbonatisporites abstrusus* (Playford) Clayton, *Crassispora trychera* Neves et Ioannides, *Endoculeospora gradzinskii* Turnau, *Discernisporites micromanifestus* (Hacquebard) Sabry et Neves, *Auroraspora macra* Sullivan and *Verrucosisporites nitidus* (Naumova) Playford.

Acritarchs are present but not very common.

In the sample from the depth range of 123.45–125.30 m *Schopfites claviger* Sullivan emend. Higgs, Clayton et Keegan appears for the first time and this allows the assemblage to be classified to the CM (*Schopfites claviger-Auroraspora macra*) Zone. Besides the index species following important forms were recognized: *Auroraspora macra* Sullivan, *Schopfites delicatus* Higgs emend. Higgs, Clayton et Keegan, *Umbonatisporites distinctus* Clayton, *Endoculeospora gradzinskii* Turnau, *Raistrickia clavata* Hacquebard emend. Playford, *Pustulatisporites gibberosus* (Hacquebard) Playford, *Knoxisporites literatus* (Waltz) Playford, *Verrucosisporites nitidus* (Naumova) Playford, *Colatisporites decorus* (Bharadwaj et Venkatachala) Williams, *Prolycospora claytonii* Turnau, *Convolutispora major* (Kedo) Turnau, *Crassispora trychera* Neves et Ioannides and *Lycospora* sp.

Acritarchs appear in restricted amount.

The last positive sample from the depth range of 118.50–119.70 m is poorer in miospores and does not bring any new palynological information. Among many species occurring already below the most common are: *Schopfites claviger* Sullivan emend. Higgs, Clayton et Keegan, *Endoculeospora gradzinskii* Turnau, *Discernisporites micromanifestus* (Hacquebard) Sabry et Neves, *Corbulispora cancellata* (Waltz) Bharadwaj et Venkatachala and *Pustulatisporites dolbii* Higgs, Clayton et Keegan. This assemblage and lack of typical Visean species (as e.g. *Lycospora pusilla*) seem to indicate still the CM Zone.

Acritarchs are very numerous but not diversified.

Besides the above-mentioned samples, with strictly established miospore zonation, several samples yielded only general stratigraphical informations. The main content of the sample from the depth range of 151.40–152.40 m are large, thick-walled Prasinophyte (*Tasmanites* and *Leiosphaeridia*) and other acritarchs. Miospores are generally absent except for some not precisely recognized specimens from the following genera *Diducites* and *Discernisporites*.

Miospores from the depth range of 141.75–141.95 m are not common. The following species were recognized: *Auroraspora macra* Sullivan, *Convolutispora major* (Kedo) Turnau, *Retusotriletes incochatus* Sullivan, *Spelaotriletes obtusus* Higgs, *Cymbosporites acutus* (Kedo) Byvsheva and *Plicatispora scolecophora* (Neves et Ioannides) Higgs, Clayton et Keegan. The rest of miospores were classified to genera: *Grandispora*, *Rugospora* and *Punctatisporites*. *Convolutispora major* (Kedo) Turnau and *Spelaotriletes obtusus* Higgs appear for the first time at this depth and they indicate that in the Bolechowice IG 1 profile this is the first positive sample from the Carboniferous. The assemblage is too poor to allow for more precise classification.

Acritarchs appear in restricted amount.

The scarce palynological material was found at the depth of 129.40–133.40 m. The material is poorly diversified and badly preserved. Only a few genera were recognized: *Auroraspora*, *Velamisporites*, *Punctatisporites*, *Grandispora* and *Corbulispora*.

CONCLUSIONS

The new palynological research permitted to introduce the exact miospore zonation scheme corresponding to the Upper Devonian and the Lower Carboniferous (M. Streel *et al.*, 1987; K. T. Higgs *et al.*, 1988; V. I. Avhimovitch *et al.*, 1993). It gave possibility to correlate strict miospore zonation scheme with the previously elaborated conodont zonation (G. Freyer, H. Żakowa, 1967). According to geographical position of the Holy Cross Mts. it was necessary to compile palynological zonation both for European part of Russia, Belarus, Ukraine with that for Western Europe. This is caused by diachronic appearance of some important species in relation to the Western Europe area but isochronic — in the area to the east from Poland and *vice versa*. The results achieved by the study of the palynological material from the Bolechowice IG 1 borehole have confirmed the occurrence of the Devonian/Carboniferous boundary between samples 152.40–153.40 and 141.70–141.95 m (Fig. 2). The exact indication of the boundary horizon is impossible because of scarcity of positive material found in the critical part of the section and lack of samples in the interval between 151.40–152.40 and 141.75–141.95 m. Devonian zones CVa and VF can be correlated with earlier established conodont zones (G. Freyer, H. Żakowa, 1967) as follows: the miospore zone CVa — the conodont zone *rhomboidea*, and the miospore zone VF — the conodont zone *styriacus*. There is a lack of equivalents among miospore zones for conodont zones from Carboniferous here, namely for *Siphonodella triangulata inaequalis* and *Siphonodella crenulata*. The last recognized conodont zone *S. crenulata* has not been strictly correlated with miospore material from the depth of 141.75–141.95 m. The main reason is the lack of sufficient positive material from this depth. The conodont zone *crenulata* corresponds in standard miospore zonation scheme to the uppermost part of the VI Zone and the HD Zone. These zones were not recognized in the section. The composition and state of preservation of miospores from 141.75–141.95 m do not permit the unequivocal classification of investigated material to the concrete zone. The recognized miospores could belong to the VI or HD zones. Less diversified species and lack of index species for the next HD Zone testify for attachment to the VI Zone. On the other hand lack of species typical for the HD Zone like e.g. *Umbonatisporites distinctus* Clayton, which appears numerously in higher parts, does not permit to ascribe the above-mentioned material to this zone. Anyway, there could be no doubt for occurrence at the depth range of 135.00–137.00 m the miospore zone PC (following directly after HD in standard miospore zonation scheme). Unfortunately there is the lack of the conodont data from this part of the section which would confirm the miospore data. The same refers to younger samples from the depth ranges of 123.45–123.30 and 118.50–119.70 m.

Acknowledgements. The author gratefully acknowledges Prof. E. Turnau (Polish Academy of Science in Kraków) and Prof. S. Dybova-Jachowicz (University of Silesia) for very helpful critical remarks. Prof. H. Żakowa (Polish Geological Institute in Kielce) is thanked for providing samples. Thanks are also due to Dr. M. Jachowicz (Polish Geological

Institute in Sosnowiec) for help and advice during maceration. Dr. A. Gawęda and Dr. T. Wrzołek (University of Silesia) are thanked for help in translation.

Wydział Nauk o Ziemi
Uniwersytetu Śląskiego
Sosnowiec, ul. Będzińska 60
Received: 7.02.1996

REFERENCES

AVHIMOVITCH V. I., TCHIBRIKOVA E. V., OBUKHOVSKAYA T. G. *et al.* (1993) — Middle and upper Devonian miospore zonation of eastern Europe. Bull. Centres Rech. Explor.-Prod. Elf Aquitaine, **17**, p. 79–147.

CZARNOCKI J. (1938) — Carte geologique generale de la Pologne, feuille 4 Kielce. Edition du Service Geologique de Pologne.

FILIPIAK P. (in press) — The Devonian-Carboniferous boundary in the Kowala trench (Holy Cross Mts, Poland), based on miospores. Pr. Państw. Inst. Geol.

FREYER G., ŻAKOWA H. (1967) — Famennian conodonts from borehole Bolechowice 1 (in the Holy Cross Mts). Acta Geol. Pol., **17**, p. 105–137, no. 1.

HIGGS K. T., CLAYTON G., KEEGAN J. B. (1988) — The stratigraphic and systematic palynology of the Tournaisian rocks of Irland. Geol. Surv. Irland, Spec. Pap., **7**, p. 1–93.

JACHOWICZ A. (1961) — Próba zastosowania mikroflory do podziału stratygraficznego osadów dolnego karbonu w profilu Górny Śląsk – Niecka Miechowska – Góry Świętokrzyskie. Kwart. Geol., **5**, p. 989–990, no. 4.

JACHOWICZ A. (1962) — Preliminary microfloral characteristic of the Lechówek and Zaręby beds (Święty Krzyż Mountains) (in Polish with English summary). Kwart. Geol., **6**, p. 403–415, no. 3.

JACHOWICZ A. (1967) — Microflora of the Zaręby beds from the Świętokrzyskie Mountains (in Polish with English summary). Pr. Inst. Geol., **49**.

JACHOWICZ A., ŻAKOWA H. (1969) — Microflora of the horizon *Goniatites granosus* in the Gałęzice Syncline (Świętokrzyskie Mts.) (in Polish with English summary). Kwart. Geol., **13**, p. 511–524, no. 3.

RYKA W., ŻAKOWA H. (1964) — Tufogene rocks of Tournaisian from Bolechowice (Holy Cross Mountains) (in Polish with English summary). Kwart. Geol., **8**, p. 721–763, no. 4.

STREEL M., HIGGS K., LOBOZIAK S., RIEGEL W., STEEMANS P. (1987) — Spore stratigraphy and correlation with faunas and floras in the marine Devonian of the Ardenne-Rhenish regions. Rev. Palaeobot. Palynol., **50**, p. 211–229, no. 1–2.

TURNAU E. (1985) — Devonian-Carboniferous boundary in the borehole Kowala 1 (Southern Holy Cross Mts, Poland); spores. Bull. Pol. Ac. Earth Sc., **33**, p. 1–5, no. 1–2.

TURNAU E. (1990) — Spore zones of Famennian and Tournaisian deposits from the Kowala 1 borehole (in Polish with English summary). Kwart. Geol., **34**, p. 291–304, no. 2.

ŻAKOWA H. (1963) — Karbon i dewon w wierceniu Bolechowice 1. Kwart. Geol., **7**, p. 732–733, no. 4.

ŻAKOWA H. (1967) — The Lower Carboniferous from the vicinity of Bolechowice (Holy Cross Mts.) (in Polish with English summary). Acta Geol. Pol., **17**, p. 51–103, no. 1.

Paweł FILIPIAK

POZIOMY MIOSPOROWE Z WARSTW GRANICZNYCH DEWONU Z KARBONEM W OTWORZE WIERTNICZYM BOLECHOWICE IG 1 (GÓRY ŚWIĘTOKRZYSKIE)

Streszczenie

Z otworu wiertniczego Bolechowice IG 1 do ponownego opracowania przekazano 15 próbek. Z 8 uzyskano materiał pozytywny palinologicznie. Dzięki zastosowaniu nowoczesnych metod laboratoryjnych uzyskane zespoły miospor są bogatsze w taksony od zespołów uzyskanych uprzednio przez A. Jachowicza (*fide* H. Żakowa, 1967) (tab. 1). Rozpoznano i udokumentowano występowanie na głębokości 152,40–153,40 m dwóch nowych gatunków: *Raistrickia baculata* sp.n. i *Reticulatisporites bolechowicensis* sp.n. Planimetryczna analiza palinologiczna próbek wykazała występowanie dwóch zespołów miospor: dewońskiego i karbońskiego. Zespół dewoński występuje na głębokości 157,50–158,50, 152,40–153,40 m, natomiast zespół karboński uzyskano z głębokości 141,75–141,95, 135,00–137,00, 129,40–133,40, 123,45–125,30 i 118,50–119,70 m. Zbadany materiał palinologiczny umożliwił wyróżnienie następujących poziomów miosporowych: poziom CVa — 157,50–158,50 m, poziom VF — 152,4–153,4 m, poziom PC — 135,00–137,00 m oraz poziom CM — 123,45–125,30 i 118,50–119,70 m (fig. 2).

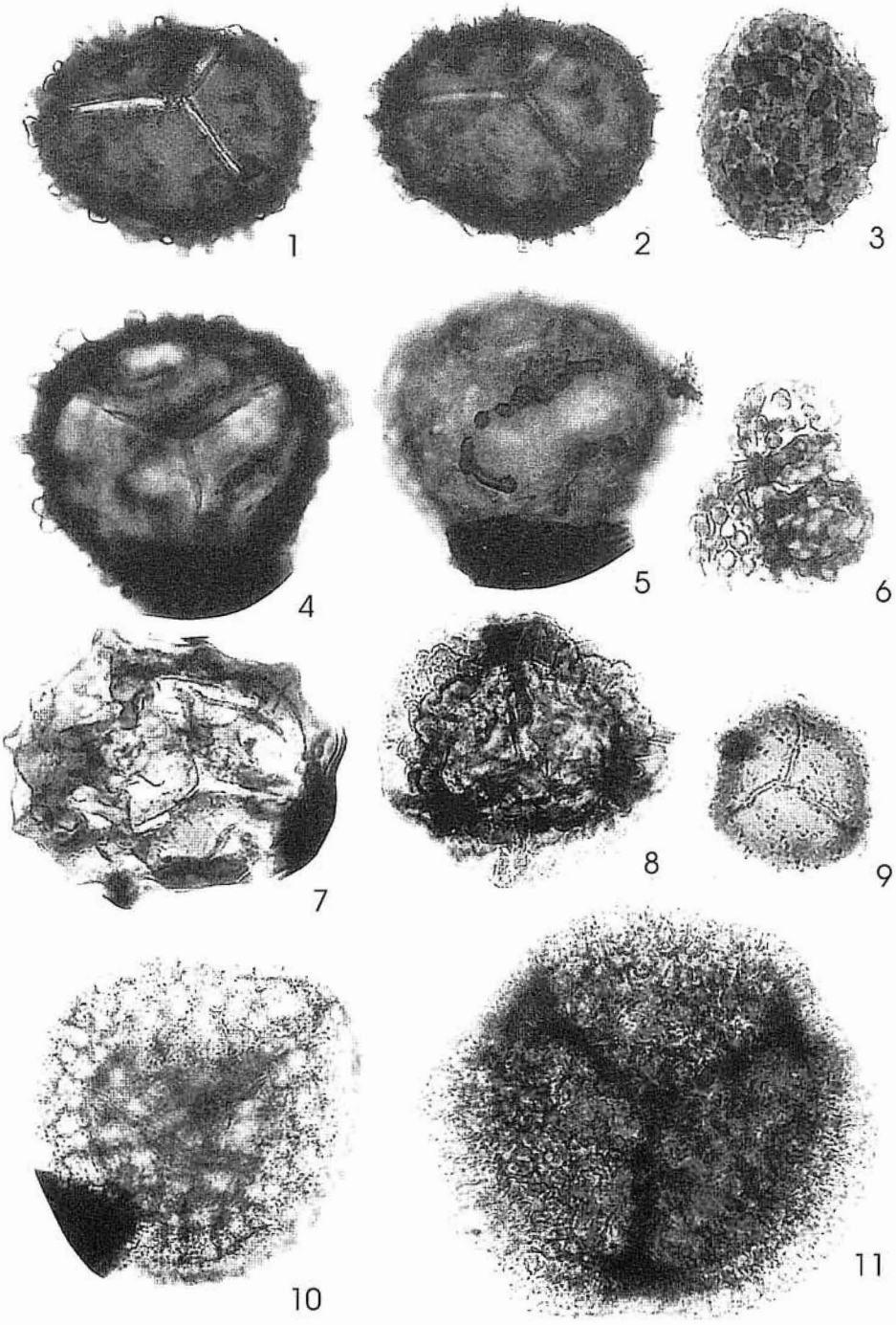
Otrzymane rezultaty potwierdziły wyniki badań A. Jachowicza (*fide* H. Żakowa, 1967), według których granicę dewon/karbon należy prowadzić między próbkami z głębokości 152,40–153,40 i 141,75–141,95 m (fig. 2). Dokładniejsze wskazanie horyzontu granicznego jest niemożliwe, ponieważ brak pozytywnych próbek palinologicznych z głębokości 151,40–152,40 i 141,75–141,95 m.

Wyznaczone poziomy miosporowe CVa i VF korelują się z wcześniej wyznaczonymi poziomami konodontowymi (G. Freyer, H. Żakowa, 1967) i odpowiadają kolejno: poziom miosporowy CVa — poziomowi konodontowemu *rhomboidea*, a poziom miosporowy VF — poziomowi konodontowemu *styriacus*. Brak odpowiednika poziomów miosporowych dla poziomów konodontowych karbonu *Siphonodella triangula inaequalis* z głębokości 145,50 m oraz dla *S. crenulata* z głębokości 141,40–141,75 m. W próbce tej brak także miospor *Krauselisporites hibernicus* i *Umbonatisporites distinctus* Clayton typowych dla poziomu HD. Nie budzi wątpliwości występowanie na głębokości 135,00–137,00 m poziomu miosporowego PC (następującego bezpośrednio po HD w zonacji miosporowej). Brak konodontów uniemożliwia potwierdzenie datowania miosporowego próbek z głębokości 135,00–137,00, 123,45–125,30 i 118,50–119,70 m.

PLATE I

Figs. 1, 2, 4, 5. *Raistrickia baculata* sp.n.
2 — other focus, 4 — proximal focus, 5 — distal focus
2 — w innej ostrości, 4 — ostrość na stronę proksymalną, 5 — ostrość na stronę dystalną
Fig. 3. *Raistrickia clavata* Hacquebard emend. Playford
Fig. 6. *Pustulatisporites gibberosus* (Hacquebard) Playford, tetrad (tetrada)
Fig. 7. *Corbulispora cancellata* (Waltz) Bharadwaj et Venkatachala
Fig. 8. *Hymenospora intertextus* (Nekriata et Sergeeva) Avhimovitch et Loboziak
Fig. 9. *Grandispora lupata* Turnau
Figs. 10, 11. *Retispora macroreticulata* (Kedo) Byvsheva
11 — tetrad (tetrada)

Figs. 1, 2, 4, 5, 8–11 — depth 152.40–153.40 m; Figs. 3, 6, 7 — depth 123.45–125.30 m; magn. x 500

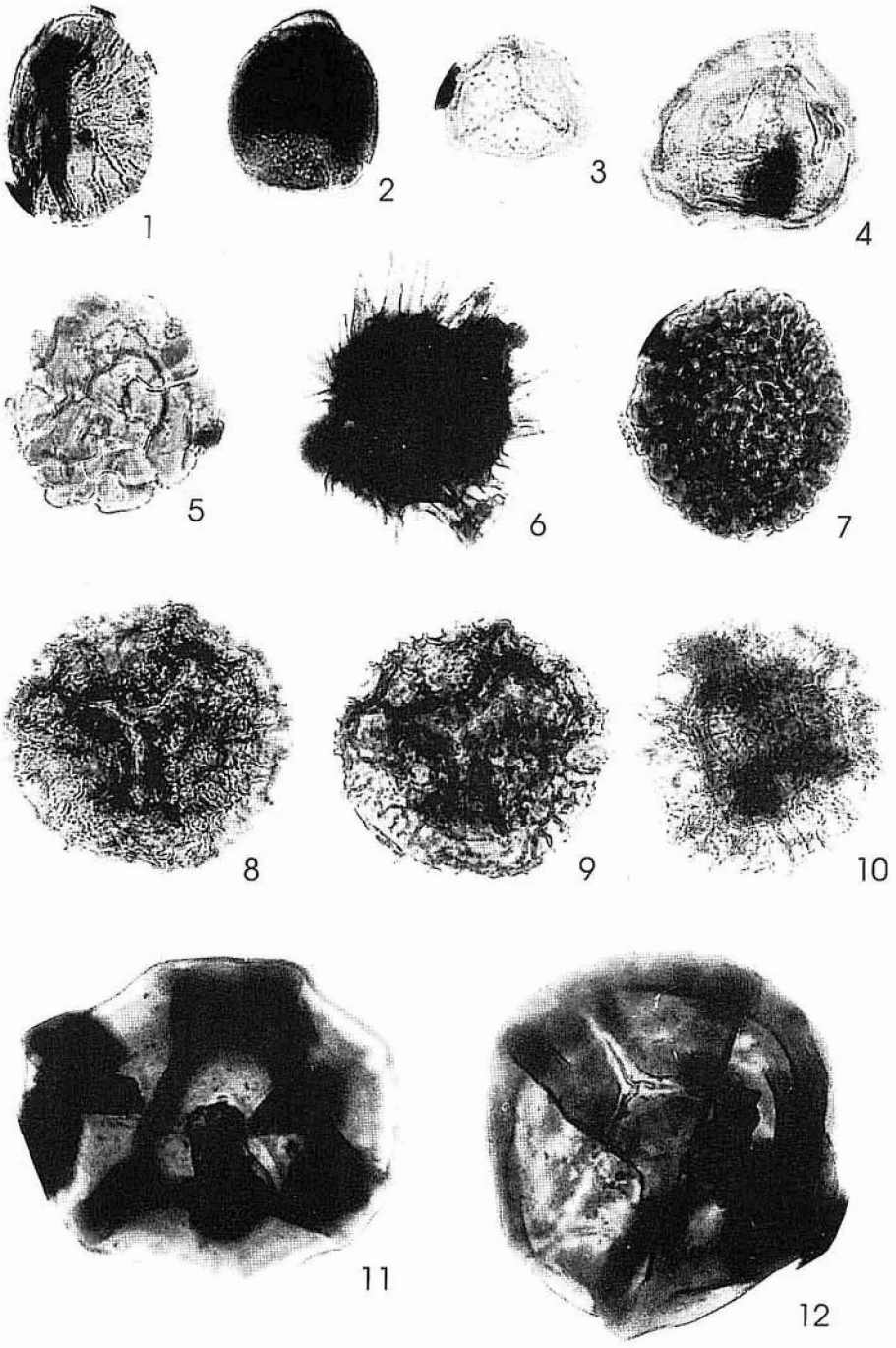


Paweł FILIPIAK — The miospore horizons from the Devonian-Carboniferous boundary beds in the Bolechowice IG 1 borehole (Holy Cross Mts.)

PLATE II

Fig. 1. *Umbonatisporites distinctus* Clayton
Fig. 2. *Cyrtospora cristifer* (Luber) emend. Van der Zwan
Fig. 3. *Grandispora famenensis* (Naumova) Streel var. *minutus* Nekriata
Fig. 4. *Grandispora famenensis* (Naumova) Streel
Fig. 5. *Corbulispora* sp.
Fig. 6. *Raistrickia corynoges* Sullivan
Fig. 7. *Convolutispora mellita* Hoffmeister, Staplin et Malloy
Figs. 8–10. *Reticulatisporites bolechowicensis* sp.n.
9 — other focus (w innej ostrości)
Fig. 11. *Knoxisporites triangularis* Higgs, Clayton et Keegan
Fig. 12. *Knoxisporites* cf. *triradiatus* Hoffmeister, Staplin et Malloy *sensu* Sullivan

Figs. 1, 2, 7 — depth 135.00–137.00 m; Figs. 3, 4, 8–10 — depth 152.40–153.40 m; Fig. 5 — depth 157.50–158.40; Figs. 6, 11, 12 — depth 123.45–125.30 m; magn. x 500



Paweł FILIPIAK — The miospore horizons from the Devonian-Carboniferous boundary beds in the Bolechowice IG 1 borehole (Holy Cross Mts.)