

PALYNOLOGICAL INVESTIGATION OF THE MIOSPORE IN COAL FORMATIONS OF THE DOBRUDZHA BASIN, LATE WESTPHALIAN

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Abstract: This article reports about the microflora of the Late Westphalian coal sediments of the Dobrudzha Coal Basin, NE Bulgaria. The correlation of the miospore assemblages presented here and the majority of species identified also occur in the Western European subdivision Ts and TO (Clayton et al., 1977). The miospore from coals of the two boreholes (172 and 177), of the part of Makedonka, all Krupen and Gurkovo Formations are described in this report. The coals from this formation are economically the most important of the Dobrudzha Basin.

Key words: Late Westphalian, palynology, miospore, borehole, Coal formation, Dobrudzha Basin, NE Bulgaria.

The Dobrudzha Coal Deposits are located within the same-named coal basin in Northeastern Bulgaria, Fig.1. Three deposits are located within the basin: Dobrudzha, Kaliakra and Nanevo. The larger western part of the basin is onshore, while the smaller eastern part is in the Black Sea shelf aquatory. The miospore of Late Westphalian sediments, from coals of the two boreholes (172 and 177, Fig.2), of the part of Makedonka, all Krupen and Gurkovo formations are described in this report. The coals from these formations are economically the most important of the Dobrudzha Basin.

Geological and Lithostratigraphic Setting

The report of thickness of the formations within a lithostratigraphic setting presented in this study is based on the studies published by Tenchov and Kulaksazov in 1972. Part of the formations is characterised with specific conditions of the coalfield. The distribution of the marsh-lake and fluviate sedimentation is considered to be subaerial delta conditions (Tenchov, Y., 1993).

The miospore investigation of Carboniferous boreholes in NE Bulgaria were united by Dimitrova (Dimitrova in Tenchov, Dimitrova, 1995, Dimitrova in Nikolov et al, 1988; Lacheva, Dimitrova, 1984; Dimitrova, 1988, 1992, 1993, 1997). The analysis of the spore assemblages from part of the Westphalian in the above mentioned regions permits the palynostratigraphic subdivision of this regional type. Three miospore zones are established by Dimitrova in Nikolov et al.(1989) for Late Westphalian in the Dobrudzha deposit and two assemblages for the Upper part of Nanevo borehole.

Palynological Investigation

Borehole 177

Makedonka Formation

The Makedonka Coal Formation contains from 10 to 12 coal seams ranging in thickness from 2 to 3 meters.

The interval coal m5-m9 is characterised by the relatively high frequency of *Vestispora magna* (Butt. & Will.) Wills. & Venk. (8-12%). The miospore spectra reported include the following species and genera: *Torispora securis* (Balme) Alp., Doub, & Horst, *Punctatosporites granifer* Pot. & Kr., *P. minutus* (Ibr.) Alp. & Doub. *Laevigatosporites vulgaris* (Ibr.) Alp. & Doub.; *Lycospora*, *Densosporites*, *Lophotriletes*, *Punctatisporites*, *Granulatisporites*, *Verrucosisporites*, *Calamospora*, *Crassispora*, *Cirratiradites*, *Apiculatisporites*, *Vestispora*, *Triquitrites*, *Torispora*, *Laevigatosporites*, *Endosporites*, *Florinites* and *Wilsonia*.

Coal seam m5 (samples: 1954,30 m, 1952,70 m, 1951, 60 m) contain abundant Monoletes spores from genera *Torispora*, *Punctatosporites* and *Laevigatosporites*, and also the first appearance of the species *Torispora securis*; *Endosporites globiformis* present to 4%.

The samples: 1323,00 m, 1921,30 m, 1920,75 m, 1920,20 m, 1919,50 m, 1919,30 m are between coal seams m5 and m9. It is characterised with maximum percentage of the genus *Lycospora* (55%), high presence of genera *Laevigatosporites* (25%), *Crassispora* (37%), *Vestispora* (11%), and low *Torispora securis*.

The miospore assemblage from the coal seams m9-m12 recorded in this study is broadly similar in composition to the first assemblage described. The range is marked by the appearance of species *Vestispora fenestrata* (Kos. & Brok.) Wils. & Venk. and genus *Speciososporites* and the full disappearance of the species *Vestispora magna* up to m9

coal seam. The species *Westphalensisporites irregularis* Alp. and *Endosporites ornatus* Wils. & Coe, and genera *Triquitrites* and *Leiotriletes* become a little more fragmented.

The coal seam m9 (samples: 1822,00 m, 1881,75 m,1880,70 m) is indicated with new genera such as *Westphalensisporites irregularis*, *Speciososporites* sp., *Laevigatosporites minor* and *Vestispora velensis*.

The sample (1854,20 m) between coal seams m9 and m12 contain abundant *Lycospora* (36%), *Triquitrites* (18%), *Crassispora* (11%), and low *Vestispora*.

The coal seam m12 - sample 1812,10 m is indicated by very rare *Vestispora fenestrata*.

Borehole 177

Krupen Formation

All four coal seams (n1 to n4) were subjected to palynological analysis in the section. This miospore assemblage is characterised by the predominance of the genus *Vestispora*: *Vestispora cancellata*, *V. laevigata* Wils. & Venk., *V. cancellata*, *V. pseudoreticulata* Spode, *V. tortuosa* (Balme) Bhard., *V. velensis* (Bhard.) Wils. & Venk. and *V. fenestrata*, with many taxons characteristic of the uppermost to Late Westphalian genera, such as *Westphalensisporites*, *Triquitrites*, *Crassispora*, *Speciososporites*, *Torispora*, *Laevigatosporites*, *Punctatosporites*, *Florinites*, *Endosporites*, *Guthorlisporites*, *Wilsonia*.

The coal seam n1 (1725,25 m 1724,60 m, 1722,70 m) contains *Alatisporites pustulatus*, *Reticulatisporites reticulatus* and *Laevigatosporites minor* (16% in 27%, 23% in 34%). The species are usually present in trace amounts. Monosaccate (*Wilsonites* and *Guthorlisporites*) are generally rare, with appearance of the species *Vestispora laevigata* and few *Torispora* and *Punctatosporites* in sample 1722,70m.

The coal seams n2 - below n4 (1696,25 m, 1695,80m, 1626,35 m) are present with the high *Lycospora* (30%), *Laevigatosporites* very rare in all samples with low *Torispora*. The miospore assemblage of the seam n4 is some distance above the base of this level and present with more or less constant number of *Punctatosporites* spp. and the appearance of *P. rotundus* Bhard.

Borehole 172

Gurkovo Formation

The level of the seam p1 of this formation is defined by the first regular occurrence of the selected species *Thymospora thissenii* ((Kos.)Wils. & Venc. and *Th. obscura* (Kos.) Wils. & Venc., *Speciososporites laevigatus* Alp., *Laevigatosporites perminutus* Alp. & Doub.

The section above coal seam p3 is considered to be characteristic with the *Th. pseudothissenii* (Kos.) Wils. & Venc., *Punctatosporites*, *Lycospora*, *Triquitrites*, *Florinites* and disappearance of *V. laevigata*.

The samples of depth 1479,15 m and 1506, 30 m are present with similar assemblages, which contain the species *Th. Pseudothiessenii*, the genus *Laevigatosporites* (18-21%) and the genus *Cadiospora* (2% in this samples).

In the sample of 1479,15 m is the first appearance of the genera *Candidispora* and *Spinospores*. The Pollenites Group is presented with genera: *Illinites*, *Latensina*, other Monosaccate and Bisaccate pollen.

Conclusion

The coal seams are extremely good markers for the more swamped and drier areas during coal sedimentation of the microfossil assemblages. The three very important palynological correlation ranges in the Late Westphalian are coal seams m5, p1 and p3, which mark the change of the palynoflora.

The age of the studied formations was determined by selected miospore of the palynological assemblages such as the following taxa: *Torispora securis*, *Thymospora* spp., *Triquitrites sculptilis*, *Punctatosporites rotundus*, *Vestispora fenestrata*, *V. laevigata*, *Spinospores spinosus*, *Cadiospora magna*, *Candidispora candida*.

The coal seams subject of this investigation of the two boreholes are very richly presented, with common occurrence of the miospore taxa and the index genera typical for Late Westphalian age *Torispora* and *Thymospora*. The results of the studies on miospores from the Doubrudzha region in Bulgaria made it possible to compile local miospore assemblages as well as to give palynologically selected index taxa of the scheme of the Westphalian deposits of Northwest Europe (Clayton et al. 1977) and the Donetz Basin of the U.S.S.R. (Owens et al., 1988, Inosova et al., 1976); Sudetic Basin (Gorecka, Gorecka-Nowak, 1990); Silesia (Jachowicz, 1972). The miospore assemblages from boreholes 177 and 172 led to an abrupt decrease in the decrease in the species composition in other limnic basins.

The appearance of the ebiol of species *Punctatosporites rotundus* and in the coal seam n4 and the appearance of genera *Cadiospora* and *Candidispora* above the coal seam p3 are still subject to further investigations to determine the boundary Westphalian C and D in the stratigraphic schemes published for Dobrudzha Basin to date.

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