



## Palynological evidence for short-term vegetation and climate change in the Late Miocene of West Bulgaria

### Палинологични данни за краткосрочни растителни и климатични промени през Късния Миоцен в Западна България

*Dimiter Ivanov*

*Димитър Иванов*

Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, Acad. G. Bonchev Str., Bl. 23, 1113 Sofia, Bulgaria; E-mail: dimiter@bio.bas.bg

**Абстракт.** Обект на изследване са седиментните последователности от Гоцеделчевския и Станянския басейн, Западна България с помощта на поленов анализ. Анализирани са интервали с висока резолюция (опробвани през 0,05 m) от въглищните пластове на двата басейна.

Реконструкцията на растителността отразява нейната динамика по време на натрупването на седиментите и образуването на въглищата. През този период от време, мезофитните горски палеоценози са обитавали равнинните и хълмистите територии, обкръжаващи двата басейна. В крайбрежните територии и влажните местообитания е доминирала растителност съставена от пионерни видове тревисти растения и листопадни и вечнозелени храсти. Папратовидните растения, продуциращи спорите отнасяни към фосилния род *Laevigatosporites* (Thelypteridaceae?), са били важен компонент на торфообразуващата растителност. По време на „езерните“ фази са се развивали крайбрежни растителни съобщества на род *Osmunda*. Интервалите с висока резолюция показват добре изразена цикличност с продължителност в границите на прецесионните орбитални изменения (период от 21–23 ka).

**Ключови думи:** палинология, растителност, климат, Миоцен, България.

Recently, high resolution (HR) pollen analysis has been performed in some Neogene basins. The present report provides data obtained by HR palynological studies on the Late Miocene sediments from two basins (Gotse-Delchev and Staniantsi Basins) in West Bulgaria.

The Staniantsi Basin is situated in West Bulgaria (Fig. 1), at the state border with Serbia. It is located within an NW–SE trending intramountain depression. The lower part of the Neogene sequence is an alternation of autochthonous brown coal and marl, which displays small-scale sedimentary cycles. The upper part of the sequence is characterized by alternating dark to light grey clays and calcareous silts. According to the mammal fauna and palaeomagnetic data (Utescher et al., 2009), the age of the sediments corresponds to the Upper Maeotian to Pontian. For the purpose of HR pollen analysis 78 samples were collected from three cycles (HRI's) at a sample rate of 0.05 m.

The Gotse-Delchev Basin (Fig. 1) is situated in the valley of the Mesta River (Southwest Bulgaria). The bottom of the basin is lined by pre-Neogene rocks, and it is filled in by sediments of Neogene age. The materials under study originate from coal-bearing sediments of Baldevo Formation exposed in open pit mine Kanina. The exposed sequence comprises a basal unit with browncoal-clay cycles (app. 4.2 m) representing

a swamp facies, and clayey/siliciclastic cover layers partly representing a lacustrine facies. A total of 26 specimens sampled at 0.05 m were palynologically analysed from a high resolution interval (HRI) in the browncoal horizon. Fossil mammals and floristic remains indicate an Early to Middle Pontian age for the sediments of the Baldevo Formation (Vatsev, Petkova, 1996).

The Staniantsi high resolution sections display short-term cyclic pattern of vegetation and climate change. The cycles are expressed by alternations of brown coal and marl/shell beds and show cyclic change in peat-forming vegetation related to oscillations of the groundwater level. These changes are related to alternation of wetter/warmer and drier/cooler climate phases, and orbital precession is probable triggering mechanism of the cyclivity (Utescher et al., 2009).

High resolution pollen analysis of the coal seam in Kanina open cast displays similar pattern of vegetation and climate change. In the middle part of the profile a change in sedimentation is observed with reduced inflow of terrigenous materials, which corresponds to vegetation change. Increased proportion of microtherm elements in this part of the profile could reflect some cooling and decreasing of the temperatures. Changes in peat-forming vegetation showed relation to oscillations of the lake level and groundwater



Fig. 1. Map of Bulgaria with the location of floras 1, Staniantsi Basin; 2, Gotse-Delchev Basin

dynamics. The analyzed section shows the affinity of the *Polypodiaceae/Thelypteridaceae* communities to phases with peat forming, while *Osmunda* communities dominate the phases with clay sedimentation.

In both basins ferns were an important component of the peat-forming vegetation (Ivanov et al., 2010), while outside the mire, wetland vegetation consisting of pioneers and a mixed mesophytic forest with ev-

ergreen shrubs existed. The duration of the cycles is estimated as corresponding to the precession cyclicity (period of 21–23 ka).

*Acknowledgments:* This work is a contribution to the Projects 436 Bul. 113/139/0-1/AS 103/3-1 (DFG, Germany) and B-1525 (NSF, Bulgaria), and to the NECLIME network.

## References

- Ivanov, D., T. Utescher, A. R. Ashraf, V. Mosbrugger, V. Bozukov, N. Djorgova, E. Slavomirova. 2010. Late-Miocene palaeoclimate and ecosystem dynamics in southwestern Bulgaria – a study based on pollen data from the Gotse-Delchev Basin. – *Turkish J. Earth Sciences* (in press).
- Utescher, T., D. Ivanov, M. Harzhauser, V. Bozukov, A. R. Ashraf, C. Rolf, M. Urbat, V. Mosbrugger. 2009. Cyclic climate and vegetation change in the late Miocene of Western Bulgaria. – *Palaeogeogr., Palaeoclimat., Palaeoecol.*, 272, 99–114.
- Vatsev, M., A. Petkova. 1996. New data on the stratigraphy of the Neogene in the Gotse Delchev Basin (Southwest Bulgaria). – In: *Ann. of the University of Mining and Geology*, 41, 1–geol., 13–20 (in Bulgarian with English abstract).