



Early angiosperm pollen from the Trambesh Formation, Lower Aptian, Central North Bulgaria

Полен на ранни покритосеменни от Тръмбешката свита, Долен Аптски подетаж, Централна Северна България

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Introduction

The appearance of flowering plants and their rapid radiation during the Early Cretaceous represents a marked turnover from gymnosperm to angiosperm dominated ecosystems within a time interval of about 30 Ma. Despite the importance of this significant ecological transformation many aspects regarding the timing, floral composition, spatial distribution and radiation are poorly documented. The Barremian–Aptian time interval appears as particular critical for understanding the first appearance of the major angiosperm lineages. At present, detailed and stratigraphically well constrained records documenting the morphological variability, diversity and abundance of early angiosperm pollen are relatively rare. For the northern hemisphere, the locations are mostly situated along the margins of the Tethyan ocean and the evolving North Atlantic and include the Potomac Group, United States (Doyle, Robbins, 1977), the Wealden Group, England (Hughes et al., 1979), the Lusitanian and Algarve basins, Portugal (Heimhofer et al., 2007). Most of these early angiosperm records lack independent stratigraphic control due to the absence of important ammonite or dinocyst markers in the fossil bearing strata. This fact hampers detailed comparison between the palynofloras and in addition, their correlation with major climatic and tectonic events during the Mid-Cretaceous, which had significant influence on the evolution and rapid diversification of the flowering plants (Heimhofer et al., 2007).

One of the main objectives of this study is to report and provide documentation of the first finds of early angiosperm like pollen from the Lower Aptian sediments in the Butovo section, Central North Bulgaria. The study also aims description of the whole palynological association thus indicating age assessment and

environmental conditions during Early Aptian in the studied area.

Material studied and geological background

The palynologically productive samples have been obtained from the Trambesh Formation especially from the Butovo section, Central North Bulgaria. The formation is built by clays, marls and rare, thin sandstone beds. Recent studies of Ivanov and Idakieva (2013) provided full description of this section and extensive biostratigraphical study of the ammonite successions. The authors recognized the *Deshayesites forbesi* ammonite Zone, indicating Early Aptian age for the succession.

Pollen grains of angiosperm – like morphology occur in three of the studied samples, although rare and in a limited stratigraphic interval. The morphological study is undertaken under transmitted light microscope and especially SEM and shows their similarities to early angiosperm pollen. The pollen types are left in open nomenclature until more specimens can be analyzed and more information becomes available on their morphological variability.

Palynological results

Besides an exceptionally well preserved ammonite fauna, the Lower Aptian strata in the Butovo section yielded a rich record of palynomorphs including pteridophyte spores, gymnosperm pollen and early angiosperms (Fig. 1). Gymnosperms predominate the assemblages. An overwhelming dominance of the *Classopollis* group is recorded throughout the section, up to 40% to 50% of the palynoflora. It often occurs in tetrads due to the exceptionally preservation conditions. *Araucariacites* spp. are also common. Pteridophyte spores account

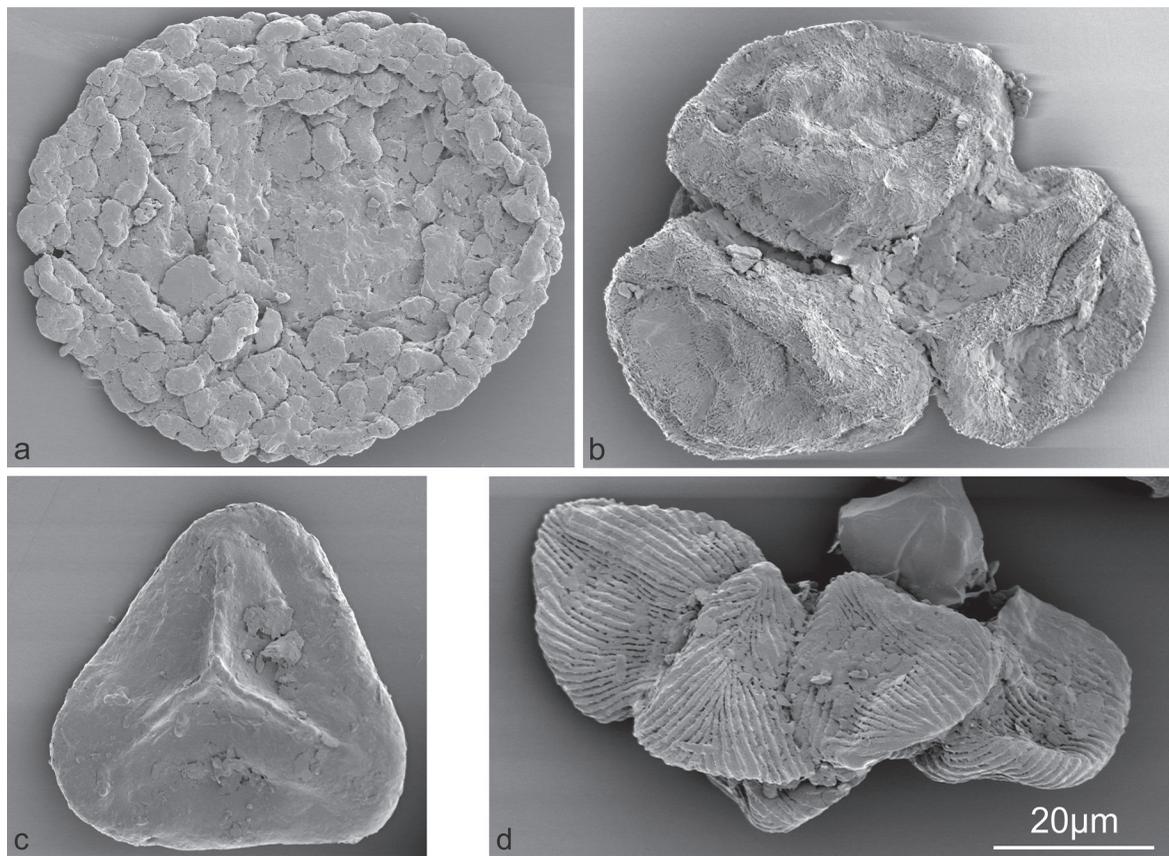


Fig. 1. Palynomorphs from the Trambesh Formation: *a*, *Stellatopollis* sp.; *b*, *Classopollis* sp.; *c*, *Gleichenidiites* sp.; *d*, *Cicatricosisporites* sp.

up to 30% in the assemblages being represented by *Cicatricosisporites* spp., *Appendicisporites* spp., *Bikolispores* spp., *Gleichenidiites* spp. Angiosperm pollen represents a minor constituent of the palynoflora and accounts for less than 2% in the samples. In terms of diversity it is represented by monocolpate crotonoid grains of probably magnoliid and monocotyledonous affinity attributed to the *Stellatopollis* genus. These forms are of particular interest for comparison with published records. Representatives of the *Stellatopollis* group are part of the earliest angiosperm pollen assemblages and have been documented from Upper Barremian–Lower Aptian interval in southern England, Portugal and Egypt.

The encountered climate sensitive sporomorphs have more palaeoecological significance, rather than stratigraphic value. Their association indicates for the first time that the studied area was part of the Southern Laurasian floral province which was characterized by warm temperate to subtropical humid climate. Comparison with published palynofloras from the other localities in the northern hemisphere show strong similarities with regard to floral composition and especially the timing of first appearances of particular angiosperm pollen forms. Based on the refined ammonite framework, the results imply that early an-

giosperms played subordinated role in Early Aptian Bulgarian floras.

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