



Palaeotopography related plant succession stages in a coal forming deltaic succession in early Jurassic in Hungary



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ABSTRACT

An integrated palaeoecological study was performed regarding the Early Jurassic coal bearing succession (Mecsek Coal Formation) of the Mecsek Basin (S Hungary) focusing on boreholes from Máza-South and Rükker areas representing the periphery and the central part of the coastal plain of a delta respectively. Comparative investigations were based on a previous palaeobotanical ecogroup model and on the integrated interpretation of sedimentological and palaeobotanical data from Máza-South.

Sedimentary isopach and coal seam ash content data were applied to reconstruct palaeotopography and coal seam thickness data to detect plant growing intensity at Máza-South (10 km²). Plant fossils identified from the corresponding strata were used as sources for the identification of four topography-related plant succession stages determined by sequential facies changes. Channel banks and small islands are characterised by underdeveloped associations composed of colonist elements. Exposed slopes or levees, or local elevations in overbank conditions are covered with assemblages of small herbaceous plants. Crevasse splay complexes are characterised by more developed plant cover and swamps in floodplain depressions are characterised by typical swampy successions. Based on these succession stages, plant remains from Rükker were also interpreted, however, mainly swampy and elevated overbank habitats alternated at Rükker reflecting continuous floods.

According to the results, Máza-South was a small area located very close to the bayline between the alluvial plain and the coastal plain of a delta, less favourable for intensive plant growing where dry land was restricted to levees and crevasse splays. This resulted in more dynamic plant changes, typical for deltaic peripheral territories. In contrast, Rükker represents the central part of the delta plain environment dominated by woody forms of large growth. In the uppermost sequence plant composition at Máza-South became similar to that of Rükker indicating that, with transgression, the central delta plain environment, permanent at Rükker, advanced towards the peripheral zone represented by Máza-South.

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1. Introduction

In the last decades peat-forming environments were generally reinterpreted focusing on spatio-temporal changes of accommodation determined by high-frequency, small-scale changes of base level (e.g. Marchioni and Kalkreuth, 1991; Diessel, 1992, 1998, 2007; Holdgate,

1992, 1995, 1997; Standke et al., 1993; Boyd and Diessel, 1994; Banerjee et al., 1996; Bohacs and Suter, 1997; Diessel and Gammidge, 1998; Diessel et al., 2000; Staub, 2002; Wadsworth et al., 2002, 2003, 2010; Shao et al., 2003; Davies et al., 2006; Ambrose and Ayers, 2007; de Oliveira and Kalkreuth, 2010).

At the same time, palaeoecological reconstruction of localities based on micro- and macroflora remains received increasing attention (Batten, 1974; Phillips and Peppers, 1984; Phillips et al., 1985; Thomas and Cleal, 1993; DiMichele and Phillips, 1994; Van Konijnenburg-van Cittert and van der Burgh, 1996; Abbink, 1998; Nguyen Tu et al., 1999; Thorn, 2001; Hesselbo et al., 2003; Shao et al., 2003; Abbink et al., 2004; DiMichele et al., 2006; McElwain et al., 2007; DiMichele and Gastaldo, 2008; Francis et al., 2008; Gordenko, 2008; Jansson et al.,

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2008; Sun et al., 2008; Bercovici et al., 2009; Libertin et al., 2009; Kustatscher et al., 2010; Scanu et al., 2015). However, the best results of such reconstructions can be attained by not only the careful interpretation of enclosed fossil assemblages, but the integrative interpretation of palaeontological, lithological and mineralogical data.

The palaeoecology of the Early Jurassic ecosystem in the Mecsek Mts. (S Hungary, Fig. 1) has become the subject of extensive studies recently based on the rich collection of plants, on which taxonomical analyses have been carried out since 1989 (Barbacka, 1991, 1992, 1994a, 1994b, 1997, 2000, 2001, 2002, 2009, 2011; Barbacka and Bodor, 2008; Bodor and Barbacka, 2008; Thévenard and Barbacka, 2000). The flora from Mecsek is seed fern–fern–conifer dominated, with cycads and ginkgophytes highly represented as well. The seed fern *Komlopteris nordenskiöldii* is the most common species, and the second most numerous is the conifer, *Elatocladus* sp. Bennettitaleans are rather sporadic. Although sphenophytes are not very abundant, they occasionally form bigger accumulations in one large slab. The size of the remains and good state of preservation of even fragile and delicate compound leaves, fronds or reproductive structures suggest an autochthonous or para-autochthonous origin for the fossils (see also Barbacka, 2011).

Ecogroups based on the co-occurrence of taxa on the same stone slab proved that tendencies in plant associations during their lifetime can be confirmed using statistical methods, especially the Detrended Correspondence Analysis (DCA) method (Barbacka, 2011). It was shown on

the basis of fossil remains of autochthonous origin that plants formed ecogroups dependent on minor local environmental changes within the locality. Thus, the plant accommodation concept provides an ideal basis for the palaeoecological interpretation of the identified ecogroups.

More than 5000 rock slabs were recovered from the Mecsek Coal Formation. Each identifiable plant fragment on the slabs has been counted for statistical analysis of the macroflora. The abundances and co-occurrences were studied and the plants were associated with environments based on their morphology, cuticle and literature data. Five ecogroups could be identified within the delta plain of the Jurassic Mecsek area (Barbacka, 2011). Plants, corresponding with given niches, can be used as indicators of environmental changes. According to the interpretation of the DCA plot, the main factors determining this differentiation were moisture and degree of habitat disturbance. Along with these factors the following five plant assemblages were attributed to five putative types of environment: (1) The *Sagenopteris* ecogroup was interpreted as related to moderately disturbed (not exposed for damage or quick erosion), relatively dry (non-flooded) inland areas. This is a shrubby cycadophyte–fern assemblage with numerous Caytoniales. Species belonging to this unit include *Cladophlebis denticulata*, *Marattiopsis hoerensis*, *Sagenopteris* sp., *Nilssonia obtusa*, *Nilssonia revoluta*, *Anomozamites marginatus*. (2) The *Thamatopteris* ecogroup was related to highly disturbed short-lived, moderately wet territories formed by alluvial deposits (islands, peninsulas, forelands),



Fig. 1. Location of the study area near Pécs, SW Hungary. The enlarged rectangle is presented on Fig. 2.

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