



Contents lists available at ScienceDirect

Quaternary International

journal homepage: www.elsevier.com/locate/quaint

The character of the Atlantic oak woods of the Great Hungarian Plain

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ARTICLE INFO

Article history:

Received 15 June 2016

Received in revised form

30 January 2017

Accepted 16 February 2017

Available online xxx

Keywords:

Wooded steppe environments

Anthracology

Pollen analysis

Archaeobotany

Neolithic

Atlantic phase

Hungary

ABSTRACT

The aim of this paper is to compare the wood charcoal assemblages from several archaeological sites near Polgár (north-eastern Hungary) with the pollen records of the same area in order to infer the character of forest communities that developed between 7500 and 6500 cal. yr BP. One question of particular interest is the structure of the woodlands in the mid-Holocene, particularly during the Holocene Climatic Optimum, when summer mean temperatures were higher than today. Pollen studies in this period suggest the dominance of wooded steppe with significant, naturally open, steppe-covered habitats. Hazel (*Corylus avellana*) and oak (*Quercus* sp.) were the most important pollen components. On the other hand, the anthracological records suggest considerably less hazel, more oak admixed with several other woody taxa, particularly heliophilous *Cornus* sp. and Rosaceae trees or shrubs that still remain either invisible or are poorly represented in the pollen diagrams. The two types of data thus complement each other, and serve to better characterise this key time interval when Neolithic agriculture spread across the Great Hungarian Plain. Special attention is given to the joint occurrence of cornelian cherry (*Cornus* sp. cf. *C. mas*) and European smoke bush (*Cotinus coggygria*), as these commonly occur in the Sub-Mediterranean-subcontinental wooded steppe and thermophilous oak forest associations in SE Europe these days, under warmer summer conditions than those experienced in Hungary today. Their appearance and, in the case of cornelian cherry, abundance in the Atlantic wood charcoal assemblages suggest that, during the Atlantic phase, the wooded steppes of the north Great Hungarian Plain could have been of a Sub-Mediterranean character.

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1. Introduction

The environment of the eastern half of the Carpathian Basin was determined by the channel shifts of the ancient Tisza River at the end of the Pleistocene which resulted in the formation of complex palaeosurfaces (Tímár et al., 2005, Fig. 3). At the onset of the Holocene, there were major differences in groundwater levels, even over short distances, corresponding to the heterogeneous morphology and bedrock of the alluvial island, which in turn led to the formation of a hydrosere that determined the vegetation and

soil conditions of the alluvial island. The richly diverse mosaic patterning of the vegetation and the soils conforming to the different landforms determined the settlement of Neolithic communities, the extent of their farming activities and the availability of water (Sümegei et al., 2002, 2013).

In north-east Hungary, pollen analytical studies of Holocene lake sediments have demonstrated the impact of prehistoric cultures on the vegetation, but accessible pollen sites have usually been located away from important archaeological sites where agricultural activities over a long period of time have been documented (e.g. Willis et al., 1998; Magyari et al., 2001, 2008; Gardner, 2002), with the Ecsegfalva site in south-east Hungary being a notable exception (Willis, 2007). Palaeoecological investigations have been initiated in the Polgár area with the aim of characterizing changes in the Holocene vegetation cover and detect possible human impact on the environment during the development of

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Neolithic and Iron Age cultures (Chapman et al., 2009; Magyari et al., 2010, 2012). During the implementation of the Upper Tisza Project (Chapman et al., 2003; 2010), two pollen cores from the Holocene alluvial plain were investigated from the Sarló-hát meander (Magyari et al., 2010, 2012). The pollen data from Sarló-hát shed light on the extent of wooded steppe areas in the Great Hungarian Plain throughout the Holocene. The assessment of several Holocene pollen records together with Sarló-hát indicated that wooded steppe persisted in this region throughout the Holocene (Magyari et al., 2010, 2012). In addition, new palaeoenvironmental data from areas of east-central Europe has also indicated the continuous presence of open vegetation in the Holocene (Feurdean et al., 2015; Kunes et al., 2015; Pokorný et al., 2015).

Macroscopic plant remains from the Polgár area have been studied during the course of archaeological surveys. In 1957, charred oak and unidentified cereal grains were reported during an excavation conducted by I. Kutzián at the tell of Polgár-Csőszhalom (Gyulai, 2013). The beginning of the archaeological excavations in the 1990s and during the first decade of the 21st century coincided with more systematic archaeobotanical sampling spurred by increasing interest in former diets and different uses of plant resources. Plant materials were investigated from six Neolithic settlements near Polgár (Fairbairn, 1992, 1993; Gyulai, 2013; Nagy et al., 2014; Moskal-del Hoyo and Lityńska-Zajac, 2016), including materials from the above-mentioned tell site, while charcoal assemblages were studied from three archaeological sites (the Polgár-Csőszhalom tell and the horizontal settlement, Polgár-Ferenci hát) revealing great potential for the conducting of palaeoenvironmental studies and reconstruction of past forest communities (Moskal-del Hoyo, 2013).

This mid-Holocene stage is especially interesting since it is a key time interval when the first Neolithic communities spread across the Great Hungarian Plain. In addition, in this part of Central Europe, the summer climate became warmer and winters were milder than in the previous Early Holocene interval (Magyari et al., 2010; Feurdean et al., 2013). However, some periods of wetter conditions were also reported for the eastern part of the Great Hungarian Plain at the turn of the 5th millennium BC and in the middle of the same millennium (Gulyás and Sümegei, 2011a, b). We are particularly interested in the predicted similarity between these Atlantic wooded steppes, developed under a warmer-than-present summer climate, and the Sub-Mediterranean-subcontinental oak-wooded steppe (Varga et al., 2000; Járαι-Komlódi, 2003; Bohn et al., 2004; Illyés et al., 2007).

The aim of this study is to present the taxonomic composition and relative abundance distribution of the charcoal assemblages from several Neolithic sites of the Polgár region (Fig. 1), compare the wood assemblages with the woody component of the pollen assemblages derived from the Sarló-hát pollen record (Fig. 1), and provide a characterisation of the canopy composition of the forests in the Atlantic period that broadly corresponds with the Neolithic cultural periods in the Great Hungarian Plain. We also discuss characteristic steppic elements of the plant macrofossil assemblages in order to indicate the steppic plant associations of the Atlantic wooded steppes in the Polgár Island.

2. Material and methods

2.1. Study site

The study area geographically belongs to the Borsod Plain (Taktaköz microregion) in North Hungary (Marosi and Somogyi, 1990). Polgár Island, a loess-covered lag surface rising above a one-time floodplain, covers an area of some 60–70 km² and lies on

the outskirts of Polgár in north-eastern Hungary (Sümegei et al., 2005) (Fig. 1). This lag surface forms an island overlooking the modern alluvial plain and has an average height of 85–88 m. Its formation was completed ca. 15,000 years ago, parallel to the formation of the alluvium of the River Tisza. The surface geomorphology is dominated by Holocene and Late Pleistocene alluvial landforms. Neolithic settlements are usually located on the Pleistocene elevated levees (Sümegei et al., 2005, Fig. 1) where chernozem soils developed. Parts of the Pleistocene levee localities are covered by saline soils (Marosi and Somogyi, 1990). All the anthracological samples discussed in this study come from Neolithic sites on Polgár Island. On the other hand, the Sarló-hát meander, which is situated in the Tiszadob area, about 10 km north of Polgár Island (Fig. 1), lies in the Holocene alluvium, where several former channel generations and meanders of the Holocene Tisza river were formed (Tímár et al., 2005; Sümegei et al., 2005). These surfaces are covered by raw alluvial soils (Chapman et al., 2003, 2010). In the northern part of the area, mainly in the Sajó-Hernád interfluvium, brown earth developed in a few places.

The climate of the area is temperate-continental; the northern part of the alluvial plain is relatively humid (annual precipitation: 600 mm); however, towards the south (Újtikos, Polgár), rainfall decreases abruptly to 500 mm (Szász and Tókei, 1997). The mean annual temperature is between 9.7 and 9.9 °C, while the January mean temperature is 3.5 °C. The difference between the mean temperature of the coldest and warmest months is large, at 22–24 °C, which is typical for continental climatic regions.

The intensive topographic and archaeological investigation of Polgár Island started in the 1990s within the framework of various research projects and as part of the salvage excavations preceding the construction of the M3 Motorway (Chapman, 1994; Chapman et al., 2010; Raczky and Anders, 2009a; Raczky et al., 2014). The micro-region is outlined by the boundaries of one-time natural palaeogeographic conditions, and it was thus possible to reconstruct the sequence of human occupation and the changes in the micro-region's settlement patterns between 7450 and 6450 cal BP (5500 and 4500 BCE) based on the information gained from many different sources (field surveys, magnetometer surveys, palaeoenvironmental inquiries) (Raczky and Anders, 2009a; Raczky et al., 2014). Additionally, a series of intensive and multidisciplinary investigations were conducted on several key sites in the region, for example at Polgár-Ferenci-hát (Whittle et al., 2013), Polgár-Piócási-dűlő (Nagy et al., 2014), Polgár-Bosnyákdomb (Raczky and Anders, 2009b; Koziowski and Kaczanowska, 2009) and Polgár-Csőszhalom (Raczky et al., 2014).

The settlements of the Polgár region were occupied over roughly one thousand years spanning the Middle and Late Neolithic, and they reflect dynamic patterns of change. The first communities settling in the micro-region, groups representing the Alföld Linear Pottery Culture (ALBK, ca. (5500 and 5100 BCE) distinctive for the culture's earliest ceramic style, established their loosely structured settlements on the banks of prehistoric watercourses. In the next period (ALBK II–III), the habitation areas increased to 2–5 ha and also extended into areas lying somewhat farther from the watercourses. In the next and final phase of the ALBK development, the number of settlements declined from 20 to eight, but there was considerable growth in their extent, illustrating a process of settlement concentration. A 3.6-ha-large section of one of these larger settlements was excavated at Polgár-Ferenci-hát, where a central area ringed by a circular ditch was identified. The activities in the area within the enclosure led to the gradual vertical accumulation of occupation deposits, i.e. of the superimposition of horizontal occupation levels (Raczky and Anders, 2009a). This simultaneous process of nucleation and vertical superposition was expressed most emphatically in material terms after the ALBK period, during

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