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Vinča tell in southeast Europe: Multi-proxy palaeobotanical evidence from Late Neolithic levels and the implications for the environment and economy

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ABSTRACT

Results of the initial analysis of wood charcoal and on-site pollen from the large, long-used Neolithic Vinča tell are combined with the data from wild-gathered seed/fruit assemblage towards the reconstruction of the vegetation composition around the Neolithic settlement in its final phases of occupation (around 4500 cal BC). The ecology of the identified vegetation forms, in conjunction with the published geological and botanical information, is used to infer the distribution of plant resources in the vicinity of the site. Further, the potential roles of different vegetation types in the economy of the settlement are explored, and possible responses of palaeovegetation to the anthropogenic disturbance assessed. The evidence from Vinča suggests the presence of a range of vegetation formations and the limited human impact on their availability. The abundance and careful management of the natural resources may have been the key to the longevity of this site.

1. Introduction

Despite the long history of research at the Belo Brdo site in Vinča, as yet no studies have focused on the environmental context of this large, long-lasting site. Previous investigations (Vasić, 1932, 1936; Čolić, 1984; Srejović and Tasić, 1990) largely focused on the discovery and consideration of artefactual remains, though faunal material was also collected and analysed (Bökönyi, 1990). Virtually no data on the natural environment of the settlement were produced and so information was lacking on aspects such as the past vegetation composition and distribution; geology, pedology, and hydrology in the area of the site; the nature, extent and stability of natural resources available to and potentially exploited by the Neolithic community. Consequently, there was little understanding of how important the natural setting and land use opportunities were for the site's longevity and resilience.

The renewed/current excavations of the site (Tasić, 2005) have included systematic recovery of bioarchaeological remains. Macroplant (seed/fruit) remains and animal bones have been examined and interpreted as evidence of food and food-related practices (Filipović, 2004; Dimitrijević, 2006; Tasić and Filipović, 2011; Filipović and Tasić, 2012; Borojević et al., in preparation.). The analyses have provided useful insight into the range and abundance of domesticated and wild plants and animals present/used at the site, as well as into specific food-related activities such as procurement, production, processing and storage. It has been suggested that the subsistence economy of the settlement relied on a combination of crop and animal husbandry, supported by wild plant gathering and hunting/fishing.

We present and discuss previous and newly available palaeobotanical evidence from the last Neolithic occupation of the site, and provide the first information on the natural landscapes and ancient vegetation of the Vinča tell. We combine results from the analysis of different botanical datasets – remains of edible seed/fruit of wild (collected) plants, wood charcoal, and pollen from archaeological deposits – and use them as a basis for the reconstruction of the vegetation composition and for making inferences on land use practices and potential indicators of human impact on the natural environment.

2. Present-day environment of the site and the surrounding area

The Vinča site is located in the north-central Balkans, directly south of the territory of modern-day province of Vojvodina in

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Serbia. Its position is in the southernmost part of the Great Pannonian plain, in the area where the Carpathian basin in the north meets the outskirts of the Dinaric Alps and the Carpathian Bend in the south/southeast. The site sits on the right bank of the Danube, about 100 m above sea level, ~14 km to the east from the confluence of the Danube and the Sava, in the small geographical zone known as Višnjička Kosa (Fig. 1). Two other large watercourses in the wider area flow into the Danube – the Tisa/Tisza and the Great Morava. A small Danube tributary runs directly to the east of the site – the ~12 km-long river Boleč ica that originates from the mountains of Avala (511 m) and Kosmaj (626 m) in the south. The Boleč ica river valley represents a natural route of communication between the Danube and the areas to the south. Archaeological evidence suggests that the Boleč ica may have served as a major Neolithic 'road' leading from Vinča to now identified sources of raw materials in the hinterland (stone, ochre, cinnabar, and copper minerals were likely obtained from the mountains of Avala and Kosmaj, around the Boleč ica spring). It could also have been utilised for trade/contact with some of the contemporary settlements in the region (e.g. Antonović, 1992; Mioč et al., 2004; Antonović et al., 2005).

2.1. Present-day climate

The climate of the central and northern Balkans is temperate-continental with a strong influence of sub-Mediterranean conditions reaching from the south. Due to great variability in the terrain and landscape forms, ranging from plains in the north to high mountains in the south of the region, as well as the presence of large river systems and vegetation diversity, there are numerous local climatic variations. The lowlands north of the Sava-Danube line (Vojvodina, north Serbia) are more or less cut off from the impact of the Mediterranean and are entirely open to the continental climate of the Central-Eastern Europe, with cold, dry winters including heavy snowfall, and very warm summers, while they also come under influence of humid Atlantic air masses (Reed et al., 2004; Stošić and Lazarević, 2009). Although the position of Vinča is, generally, within the Panonnian plain, the hills of Višnjička Kosa (up to 279 m asl) to some extent protect it from the cold air masses coming in from the north while it also receives mild conditions from the south extending through the large valley of the Great Morava river which meets the Danube some 50 km to the east. The data from the nearest weather station (in Belgrade, ~15 km to the west) show a mean annual temperature of 13 °C and a mean annual precipitation of 713 mm for the period between 1996 and 2004, both of which are characteristic of temperate climate (Jakovljević et al., 2008).

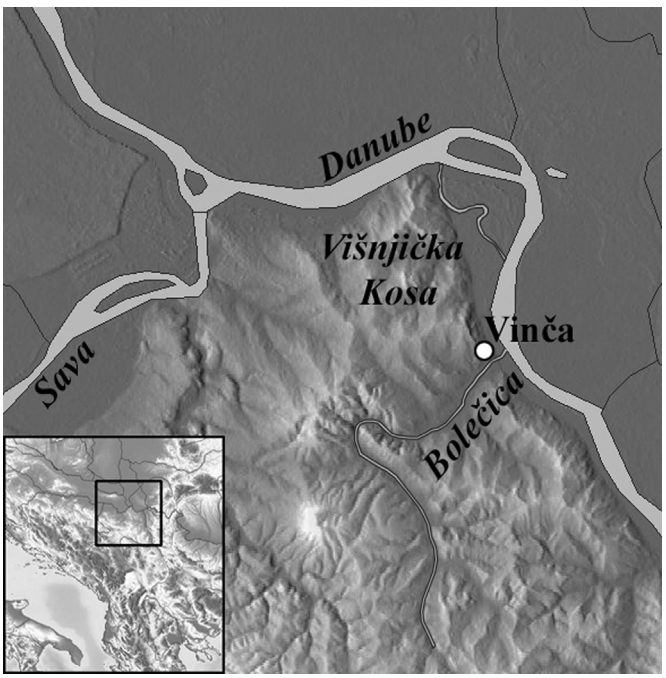

Fig. 1. Map showing the location of the Vinča site and the surrounding area.

2.2. Soils

The landscape across the Danube from Vinča and further to the north/northwest, in Vojvodina, is predominantly flat and consists of extensive loessic and sandy plateaus, loess terraces/dunes, meandering rivers and streams, numerous oxbow lakes and bogs, and salt marshes. The area has a remarkable pedological variability seen in the mosaic of soils of diverse physical structure and chemical content (e.g. chernozem, alluvial sediments, sands, loess, saline soils). The major soil type is organically rich, heavy, black earth (chernozem), which is likely to have developed under the continental climate and forest-steppe of the Early-Mid Holocene (cf. Eckmeier et al., 2007; Zech et al., 2009; Marković et al., 2014); it is, in modern times, most-valued for agricultural purposes (Stojanović et al., 1987; Kojić et al., 2001, p. 495). Fluvial sandy, silty and clayey soils (gleys, cambisols, podzolic soils) present near large rivers are also highly suitable for field and garden crops, whereas adjacent hydromorphic vertisols (such as heavy clayey 'smonitsa') normally have a high groundwater table which makes them unsuitable for cultivation without drainage. Lithomorphic soils (e.g. shallow rendzinas) occur in the upland regions (Živković et al., 1972; Stošić and Lazarević, 2009).

A similar spectrum of soils extends southwards, to the right bank of the Danube. The Višnjička Kosa is made up of Middle Miocene sediments which differ in their lithological structure and deposition; they include clayey deposits found along and within the Danube riverbed and limestone on slopes and hilltops, in some areas covered with calcareous Lower Sarmatian deposits of marine (i.e. Pannonian Sea) origin (Bogojević, 1968; Jakovljević et al., 2008; Rundić et al., 2012). Across the whole area, Miocene deposits are overlain by Pleistocene loess sediments, 2–15 m thick and composed of silt, sand and clay loosely cemented by calcium carbonate ($CaCO_3$) deriving from the limestone substrate. Deposits of river gravel of *c.* 1 m thickness ('carbonate alluvium') are registered in some places and are considered remnants of the Danube terraces. On top of loess, or directly above the carbonate alluvium, a $CaCO_3$-rich chernozem layer of variable thickness and chemical composition (i.e. with different levels of nitrogen, potassium and phosphates) was formed in the Early-Mid Holocene (Bogojević, 1968; Jakovljević et al., 2008; Zech et al., 2009). The groundwater table is generally low and does not affect the surface soils. The homogeneous grain structure and high porosity of loess permits good aeration. A number of vegetation forms with deep-penetrating and elaborate root systems ensure circulation of minerals and replenishment of soil nutrients (Bogojević, 1968; Jakovljević et al., 2008). The structure and chemistry of the soil, the high carbonate content in particular, are favourable for the growth of diverse vegetation.

2.3. Modern vegetation composition

The area to the north of the Sava-Danube line belongs to the Central European phytogeographical region, but the flora shares characteristics of the Pontic-central Asian (steppic) and the Euro-Siberian (boreal) subregions. However, vast areas under

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