PREHISTORIC LANDSCAPES OF THE PUSTA REKA REGION (LESKOVAC). NEW INVESTIGATIONS ALONG THE SOUTHERN MORAVA RIVER

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Abstract: *A new Austrian-Serbian cooperation has been initiated to investigate the Leskovac Basin at the Southern Morava that will focus on the identification of potential early farming communities in the region. Additional analyses of the later prehistoric sites, dating to the Copper and Bronze Ages, seek to provide an insight into the long-term landscape use by prehistoric communities in the area. The first systematic survey campaign of the new Pusta Reka Project in 2017 provided new data regarding the prehistory in the region and a first insight into the landscape and the environmental conditions. The Leskovac Basin and its low elevations between the tributary rivers to the Southern Morava River, forms a settlement area presumably attractive to prehistoric communities. Extensive and intensive archaeological surveys formed the basis for geophysical surveys and corings in the selected areas. GIS analyses, material studies and radiocarbon dating of core samples have been conducted to gain a broad spectrum of new primary data about the prehistory in the region. The first results of the site Svinjarička Čuka situated east of Caričin Grad are presented and discussed in details regarding location, environment, chronological as well as cultural relations.*

Key words: *Leskovac Basin, Neolithisation, Starčevo, Brnjca group, Survey, GIS*

Introduction

The fundamental change from mobile hunter-gatherers to farming and herding societies marks one of the crucial and sustainable steps in humankind. These changes in all aspects of human life during the Neolithisation process have been a hot topic in archaeology ever since V. G. Childes' crucial work (Childe 1957) and have never lost their appeal in our scientific field, not least because the study of these early societies and their changes offers the possibility of attaining some fundamental advancement in our understanding of the human mind. Therefore, the great publication outcome regarding the Neolithisation process is not surprising, especially within a global perspective. The evidence of differing complex pathways of the Neolithisation requires detailed analyses for each area on a local/regional level as well as embedded in a broader cultural and theoretical framework. The central Balkans are of particular interest in this perspective and offers a new insight into the Neolithisation process regarding the adoption and transformation of new technologies and practices, such as pottery production, lithic technologies and living structures. The Neolithic dispersal into the Balkans is most probably related with migrations from Anatolia and the Aegean as currently debated (Hofmanová et al. 2016).

However, although connectivity between the Balkans and the Aegean-Anatolian world is widely accepted for the beginning of the Neolithic, the amount and quality of archaeological data belonging to these trajectories are scarce in many aspects. In contrast to this lack of archaeological data, the recent outcome of aDNA analyses points to the relations in human genomes of Anatolian, Aegean and south-eastern Europe ancestors (e.g. Mathieson et al. 2018) but frequently underestimates the very complex and multifaceted process that would have led to the obvious diversity of early farming societies between the Near East and Europe. The recent publications in this field have brought attention back to the potential role of the main river valleys of southeast Europe (Srejović 1969; Perić 2001; Orton et al. 2016). Within this framework, we will focus on the Axios-Vardar-Morava route between the Aegean and the Danube region, especially the Starčevo horizon for the earliest Neolithic in the central Balkans, and the role of this route and cultural horizon for our understanding of societal change during this time.

The new Pusta Reka Project aims to fill current gaps in our understanding outlined above, focusing on one particular region in south Serbia located along the Southern Morava River and its tributaries. A few prehistoric sites had been registered within the Leskovac territory so far, mainly known through surface finds and suggest that prehistoric sites were scattered in the river valleys and

mountainous areas. The earliest occupation in the region is attested from the Neolithic period (Bulatović and Jović 2009), however, only occasional and accidental finds suggest the presence of the Starčevo culture in the Leskovac region, as such, the understanding of the occupation during the Early Neolithic period remains unclear.

Within a broad cooperation between the Institute for Oriental and European Archaeology (OREA) of the Austrian Academy of Sciences (B. Horejs), the Institute of Archaeology in Belgrade (A. Bulatović) and the Archaeological Museum in Leskovac (V. Stevanović), the physical, social and cultural landscapes in prehistory will be studied using an interdisciplinary approach. The main goal of the project is to investigate the use of the Leskovac basin located between river streams by focusing on the identification of potential early farming communities in the region. Additional documentation and analyses of the later prehistoric sites coinciding with Copper and Bronze Ages seeks to provide an insight into the long-term landscape use by prehistoric communities in the area. The results of the first fieldwork conducted between 28.8.2017 and 20.9.2017 are presented and discussed in this contribution. The interdisciplinary approach of archaeological surveys, geophysics, geoarchaeological corings, GIS analyses, radiocarbon dating and material studies provides the foundation for further archaeological investigations, including excavations, in the future.

Survey Methods

Archaeological Surveys and Landscapes

The Leskovac Basin was chosen due to its location as the first broad basin after passing the Serbian-Macedonian Massive Mountains along the southern Morava River (Fig. 1). Following the concept of the Axios-Vardar-Morava route as one of the main ways for Neolithic trajectories from the Aegean to the Danube, this basin seemed highly attractive for our project.[1] The connection along the Nišava Valley crosses immediately north of the basin and provides one of the very few west-east-routes in the Balkans. Whilst the role of these communication routes are well-known for later prehistory, as well as in antiquity and later historical times, these routes, especially along the southern Morava, are only scarcely attested by archaeological data from older prehistoric periods.

The Leskovac Basin is limited in the east by the western extension of the Balkan Mountains, with the Suva Planina Mountain being the highest peak (1810 m). The mountains of the Serbian-Macedonian Massive form the southern and

[1] We warmly thank M. Gavranović for the discussions and his input in searching the best-fitting zone.

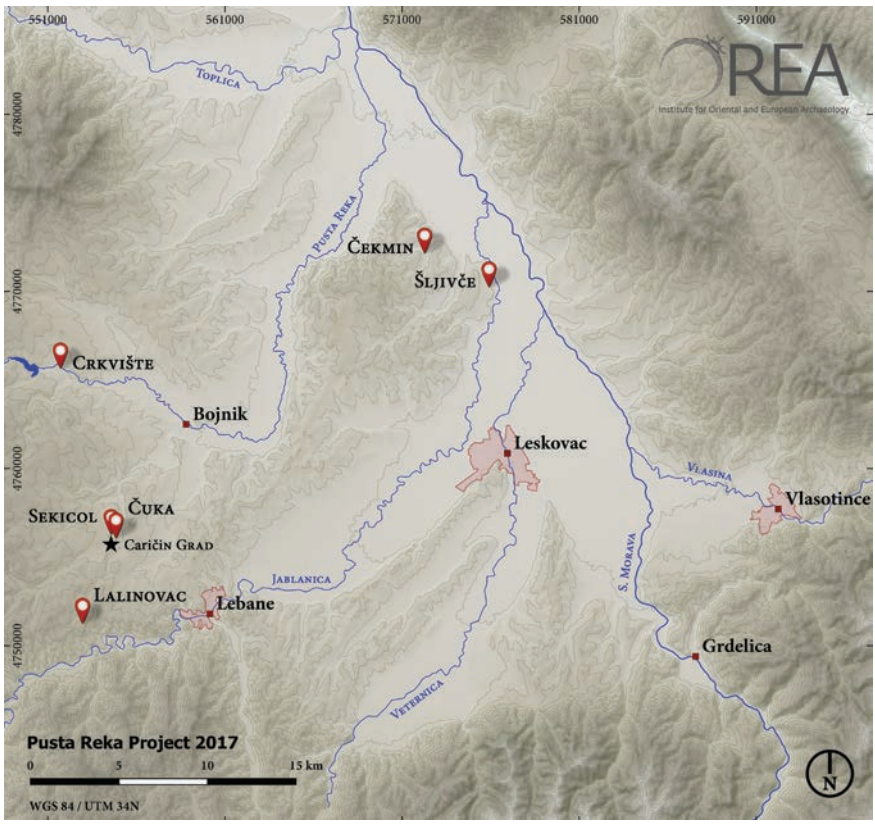

Fig. 1. Six main sites of the surveys 2017 and their location in the river system (Southern Morava, Jablanica, Pusta Reka) (map: M. Börner/OREA)
Сл. 1. Шест најзначајнијих локалитета са рекогносцирања и њихова позиција у сливовима Јужне Мораве, Јабланице и Пусте реке (мапа: M. Börner/OREA)

western limitations, with the Kukavica Mountain being the highest peak in the south (1442 m). The basin is characterized by several small rivers (the Toplica, Pusta Reka, Jablanica and Veternica Rivers) draining into the primary Southern Morava River, located at the eastern edge of the basin. Within an area of c. 1.600 km^2 there are smooth elevations between 250 and 450 m in height providing an ideal environment for agriculture, most likely from prehistoric times until the present day. The plains along the Southern Morava are regularly flooded, scarcely settled and likely to be silted up with alluvium. Nevertheless, prehistoric sites were attested during rescue excavations in 2010 along the Southern Morava River further south, and via scattered surface finds in the zone of the Leskovac Basin (Garašanin and Ivanović 1958; Ercegović-Pavlović and Kostić 1988; Bulatović and Jović 2009).

The archaeological survey teams for the new project presented here (B. Horejs, A. Bulatović, M. Börner, B. Milić, F. Ostmann, D. Bochatz, L. Burkhardt, D. Blattner, V. Stevanović) investigated Crkvište in Brestovac next to the Pusta Reka River, Lalinovac and Šljivče close to the Jablanica River and Čekmin, Čuka as well as Sekicol located between both river systems (Fig. 1). Besides these six main sites, 38 archaeological spots have been defined based on surface collections, of which 20 can be dated to prehistoric times. Most of the sites detected indicate a diachronic use, mainly dating to the Metal Ages (Copper and Bronze Age) and historical times (Byzantine, Ottoman). Several chipped stone artefacts from Sekicol and one potential tool collected next to Lalinovac indicate human activities in older prehistory, presumably dating to Paleolithic. At least five sites provided materials most likely dating to the Neolithic (Brestovac, Svinjarička Čuka, Šljivče, Čekmin and Selište), including several findspots within the broader area.

All archaeological find spots were defined in their physical location via GIS and described, with all collected material being cleaned, documented and entered into a database. Ceramics and lithics were dominant find categories and were additionally documented statistically and differentiated in diagnostic and non-diagnostic pieces. The chronological definition of the prehistoric ceramics was defined as Neolithic (Starčevo, Vinča if possible), early/late Copper Age, early Bronze Age, late Bronze Age, Iron Age, or simply prehistoric if a clearer distinction was not possible. Selected diagnostic pieces were described in detail, drawn and/or photographed. Altogether 6.710 ceramics (1.353 significant and 5.357 body sherds) and 523 chipped stone artefacts, as well as 63 small finds form the basis for the sites' chronological and functional definition; all the survey finds are stored in the Archaeological Museum of Leskovac. Based on the outcome of the extensively surveyed areas, the two main sites of Čekmin and Svinjarička Čuka, as well as a find spot next to the modern village of Sekicol (Štu08), have been additionally investigated on a more intensive scale. Topographical maps were created via Leica Rover DGPS and intensive archaeological survey - by means of collecting all objects within defined squares - were conducted in several areas of these sites and their find spots. At Čekmin the two selected spots of Kućište (Ček01) and Ček03 were investigated intensively in squares of 3 by 3 meters in areas of 850 m^2 (Ček01) and 594 m^2 (Ček03), with a total coverage of 1.444 m^2. A potential "lithic knapping spot" next to Sekicol (Štu08) was investigated in an area of 144 m^2 also in squares of 3 by 3 meters. At S. Čuka (Štu01) altogether 3 different areas with 171 squares (A, B, C) of 5 by 5 meters and 3 by 3 meters respectively have been investigated, totalling 2.307 m^2. Altogether 3.895 m^2 were investigated intensively by archaeological survey followed by GIS analyses. Whilst the detailed GIS stud-

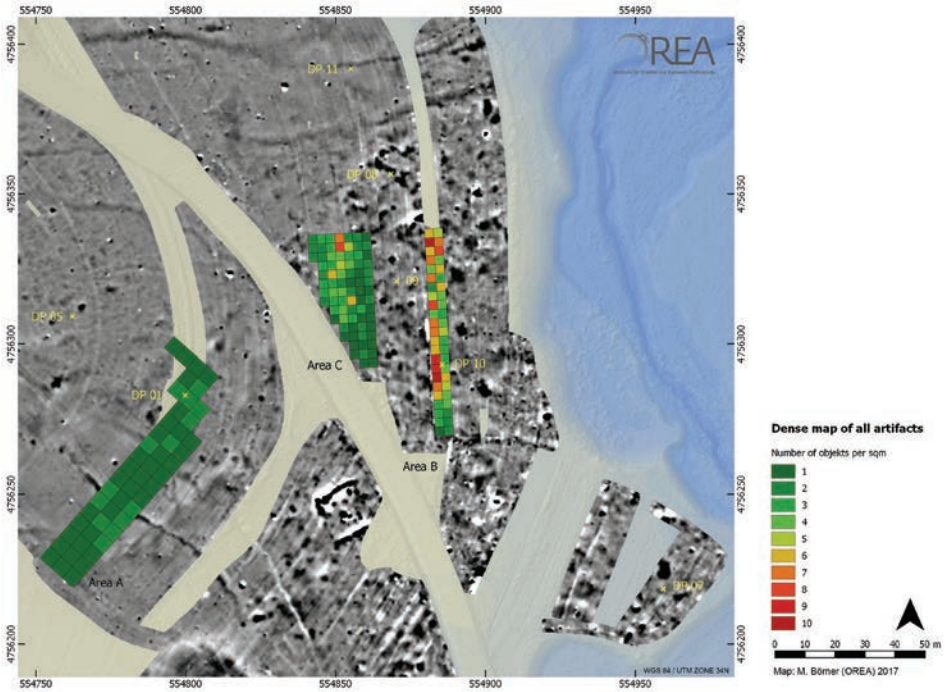

Fig. 2. GIS analyses illustrating the density of finds based on intensive surveys at Svinjarička Čuka (map: M. Börner/OREA)

Сл. 2. GIS анализе које илуструју густину налаза на основу интензивних рекогносцирања на Свињаричкој чуки (мапа: M. Börner/OREA)

ies by M. Börner are still ongoing, first results can be summarised, for example, the results of Svinjarička Čuka provide important information illustrated in the spatial analyses of the heat map (Fig. 2).

Finds and Materials from Svinjarička Čuka

Pottery and Small finds

Generally, all areas provided prehistoric surface finds, but their density increased from west to east with the highest amount per m^2 in area B, located at the lowest part of the terrace next to the Svinjarička River. The chronological analyses show a differentiated pattern in their distribution: Starčevo related ceramics and small finds were distributed in almost all squares of areas A, B and C, and form the majority of finds, aside from the category dated as "prehistoric" without further refinement (Fig. 3). This Early to Middle Neolithic horizon can easily be distinguished due to its characteristic surface treatments present on coarse wares, such as Barbotine and Impresso wares (Fig. 3, 1–6).

Fig. 3. Selected pottery fragments of Starčevo horizon collected in the areas A-C at Svinjarička Čuka (Štu01) (photos: F. Ostmann/OREA)
Сл. 3. Изабрани фрагменти старчевачке керамике сакупљени у зонама A-C на Свињаричкој чуки (Štu01) (фотографије: F. Ostmann/OREA)

Moreover,fragments with plain surfaces, burnished or red-slipped are evident in the assemblage, also probably dating to the Starčevo horizon (Fig. 3, 8-13). Although detailed diachronic petrographic analyses of fabrics have not been undertaken so far, our preliminary macroscopic examination allows identification of distinct features in Early to Middle Neolithic ceramics in comparison to Copper Age and Bronze Age wares. This macroscopic classification of wares is based on hardness, porosity, break, inclusions, colour and surface treatment following practices already conducted on other prehistoric sites (e.g. Horejs 2010). The macroscopic grouping of pottery to form 'Ware Groups', offers not only a useful information about pottery production such as technology like firing, but also style, and forms an important foundation for further work at a higher resolutions such as thin section petrography or chemistry (e.g. contributions in Alram-Stern and Horejs 2018). The Starčevo wares already classified from Svinjarička Čuka appear to primarily be tempered with organic materials (e.g. straw) and therefore lightweight. We have also found the less frequent presence of macroscopic Ware Groups with mineral and rock inclusions either with or without organic temper (Fig. 3). The organic tempered Ware Groups are primarily found in pale colours (beige, bright orange or light brown). Others occur also with brown to dark brown and grey-brown surfaces. Bodies with complete red surfaces are seldom, which is probably related to the preservation of slipped surfaces (Fig. 3, 8.13). Comparable ceramics are known from various sites with Early to Middle Neolithic layers, such as

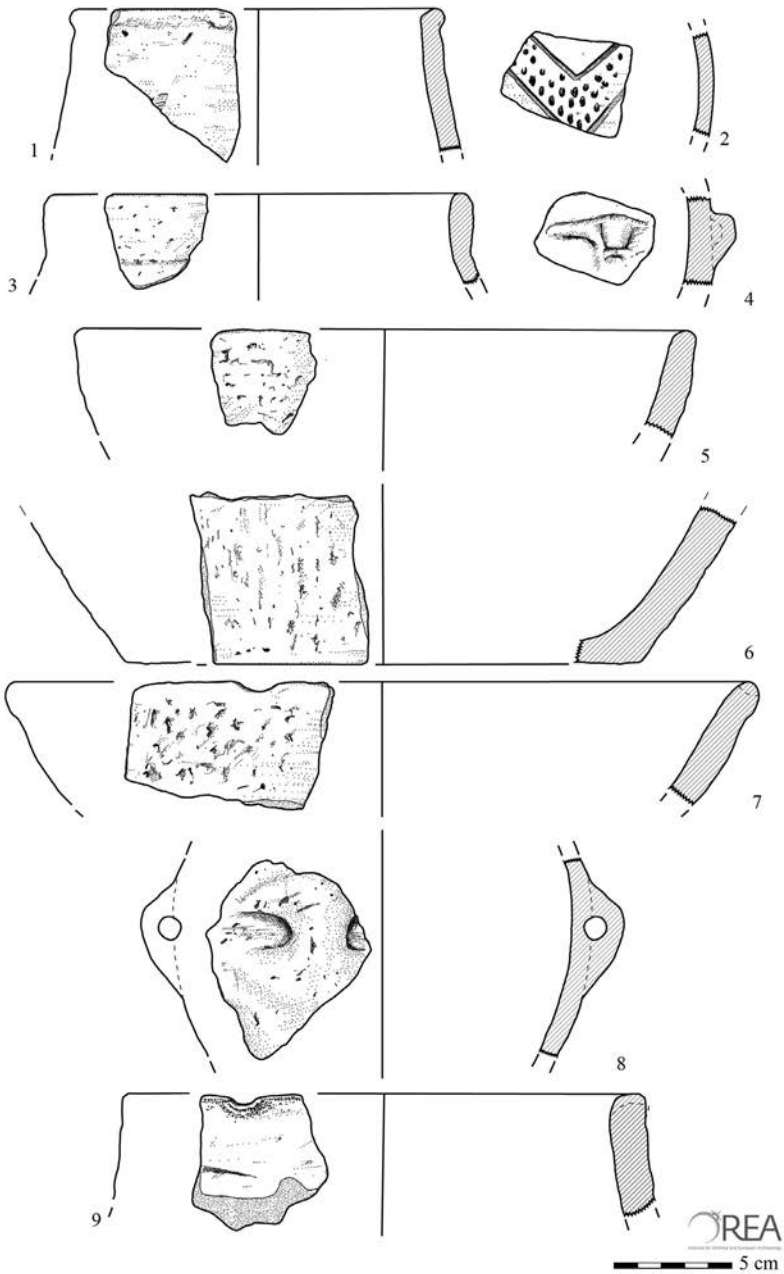

Fig. 4. Fragments of Starčevo vessels from the areas A–C at Svinjarička Čuka (Štu01) (drawings/graph: L. Burkhardt, D. Blattner/OREA)
Сл. 4. Фрагменти старчевачких посуда из зона A–C на Свињаричкој чуки (Štu01) (цртежи: L. Burkhardt, D. Blattner/OREA)

Drenovac (Perić 2009, Pl. V), Lepenski Vir (Perić and Nikolić 2004, Pl. XI), Blagotin (Vuković 2011) Vinča (Perić and Nikolić 2008, Pl. I) or Tumba Madžari (Naumov et al. 2009, Pl. 60).

The variety of vessel shapes and types include jars with slightly conical or cylindrical necks (Fig. 4, 1.3), sometimes with thickened and slightly everted lip as known in the Starčevo layers of Lepenski Vir (Perić and Nikolić 2004, Pl. XI, 1.3.5.6), Drenovac (Perić 2009, Pl. III, 1.6-9) or Mramor Čaška (Naumov et al. 2009, Pl. 57, 2-3). Deep bowls of conical shape with regular rounded lip produced within the characteristic Starčevo ware are also evident (Fig. 4, 5) known for example in the early Neolithic sites of Radin Dol (Naumov et al. 2009, Pl. 37.) and Drenovac (Perić 2009, Pl. I, 1.5). Shallow flat bowls, partially with finger impressions directly on the mouth also occur (Fig. 4, 7), comparable to pottery from the Starčevo layers of Lepenski Vir (Perić and Nikolić 2004, Pl. III; Perić and Nikolić 2016, Pl. 208), Vinča (Perić and Nikolić 2008, Pl. I, 1) and Drenovac (Perić 2009, Pl. I, 2). Bases occur as flat, disc-shaped or pedestalled feet (Fig. 3, 4; 4, 6) as appears common during Early to Middle Neolithic times in the central Balkans (Pavúk 2016). Handles of horizontal lugs or massive *Grifflappen* were also recovered (Fig. 4, 8). In summary, the Neolithic ceramics from all three areas of Svinjarička Čuka are consistent with a domestic assemblage, which can be related to the Starčevo horizon without offering a formal chronological context so far. The combination of wares, decoration and types of vessels at Svinjarička Čuka are reminiscent in many ways to the material from early Neolithic pit fillings of Drenovac, the nearest Starčevo site (Perić 2009).

In addition, to the high amount of Starčevo pottery collected in all three areas, prehistoric tools and small finds were also recovered, including a polished stone axe, hammer and grinding stones, ceramic discs (in Starčevo ware) as well as fragments of figurines and so-called cult tables (Fig. 5). Linear decorated cult tables with parallel grooved lines covering the exterior are well-known in Early to Middle Neolithic, such as in Zelenikovo, Gorobinci or Anzabegovo (Naumov et al. 2009, Pl. 88). The fragment of a figurine-head (Fig. 5, 4) reminds of the Neolithic figurines of the central Balkans as discussed broadly by S. Hansen and D. Bailey (Hansen 2007, Bailey 2017).

Interestingly, Late Neolithic finds did not occur on the surface, which suggests the absence of the Vinča period. In addition to the Neolithic, the areas B and C at Svinjarička Čuka show traces of Copper and Bronze Ages evidence albeit in small amounts. According to stylistic and typological characteristics of pottery finds, the site was populated both during the Late Copper Age, namely the Coţofeni-Kostolac culture period and in the Late Bronze Age when bearers

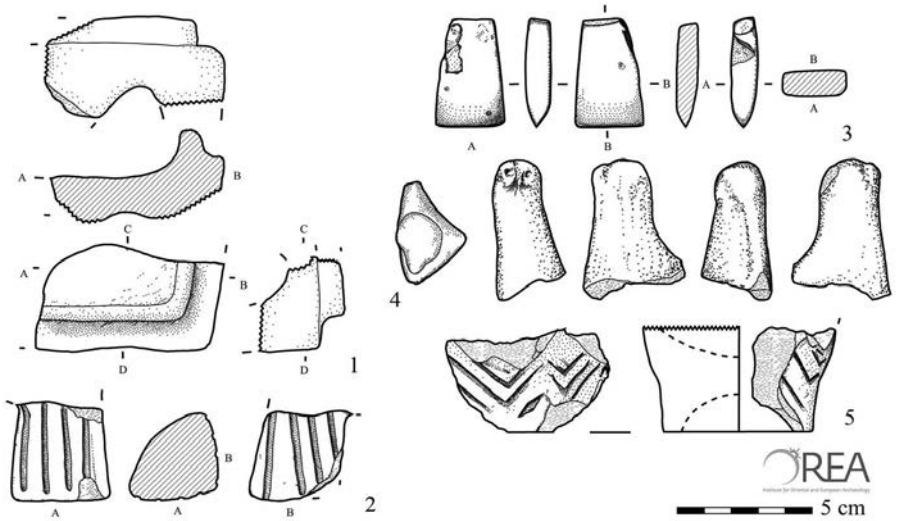

Fig. 5. Fragments of cult tables (1.2.5), stone axe (3) and figurine (4) from the areas A–C at Svinjarička Čuka (Štu01) (drawings/graph: L. Burkhardt, D. Blattner/OREA)
Сл. 5. Фрагменти жртвеника (1.2.5), камена секира (3) и фигурина (4) из зона A–C на Свињаричкој чуки (Štu01) (цртежи: L. Burkhardt, D. Blattner/OREA)

of Brnjica culture settled this region as well as the entire south-eastern Serbia. Characteristic types of the Coţofeni-Kostolac culture pottery recovered were amphorae with long funnelled neck and herringbone ornaments along with the typical element of Brnjica culture - the wide rims of amphorae or pots with ring modelled inner edge. These finds of the Cotofeni-Kostolac culture, so far to the south-east might confirm recent arguments of some authors regarding the distribution of this culture toward the south (Kapuran and Bulatović 2012; Bulatović and Milanović forthcoming). According to recently published dates from the site of Bubanj in Niš, Cotofeni-Kostolac culture existed in the last third of the 4th millennium calBC, while Brnjica culture bearers lived in this area between the 14th and 12th century calBC, based on absolute dates from Svinjište near Preševo and Medijana site in Niš (Bulatović and Vander Linden 2017; Bulatović et al. forthcoming). Two absolute dates from Svinjarička Čuka site referred in Fig. 7 fit well into the date ranges for these cultures.

Lithics

Due to the abundance of nodules and pebbles of raw materials suitable for knapping in direct vicinity of the site of Svinjarička Čuka, a relatively high number of lithics were collected from the surface. In addition, there was a variety of evidently knapped artefacts, ranging from flakes (being most numerous),

cores, blades, and debris. The material often demonstrated the preservation of a natural surface (i.e. cortex) on blanks, which are rarely modified, particularly in the flake assemblage. There are a number of specimens which provide information about testing of raw materials, recognised by nodules with one or two removals, and so-called opening flakes, which are completely covered with cortex and abandoned without further use. Lithic raw materials from the site's surrounding are being investigated in the scope of another project aiming to define primary sources and secondary deposits in South Serbia (for first results see Brandl 2018), in order to help reconstruction of the production on a local scale, and the possible introduction and use of exotic materials for knapping at the site during prehistory.

Preliminary results of technological analysis suggest that there existed a reduction of multi- and unidirectional cores for production of flakes and blades, most likely referring to the opportunistic exploitation of local raw materials, often without the initial preparation of the platform and knapping face. Additionally, there is an evidence for the use of anvil technique, due to the presence of bipolar cores, or pièces esquillées. In contrast to the flake assemblage, a relatively small group of blade(let)s speaks in favour of a selection of clean, non-cortical blanks for further use, which are mainly available in form of sickle inserts and laterally retouched blades (Fig. 6).

Fig. 6. A selection of chipped stone artefacts from Svinjarička Čuka (Štu01) (photos: F. Ostmann/OREA)
Сл. 6. Избор налаза од окресаног камена са Свињаричке чуке (Štu01) (фотографија: F. Ostmann/OREA)

The vast majority of chipped stone artefacts show traces of percussion by soft (bone and antler) and hard (stone) hammer, while only rare pieces could attest to production by a metal hammer, possibly relating to the metal ages and even later. So far, only a few pieces showed evidence for the use of pressure technique for the production of regular blades, most likely concerning the Neolithic and Copper Age in the wider region. In contrast to the pottery assemblage, the lithics from the site and its surrounding are less chronologically sensitive. However, this material in the correlation to other finds, provides clear evidence for Early Neolithic production that fits with the record from other published sites located further north (Šarić 2014, Bogosavljević-Petrović and Starović 2016). This allows for the examination of themes on a broader scale including the beginning of farming and its further developments.

Due to the site's close vicinity to the famous Caričin Grad, traces found of the late Antiquity and the Byzantine period are not surprising. The amount of finds from these later periods is nevertheless very low in relation to the Starčevo horizon and prehistory in general. Many burnt daub fragments appeared on the surface, especially of the areas B and C, which cannot be definitively dated. The extensive and intensive archaeological surveys indicate multi-layered settlement(s) at Svinjarička Čuka dating from early Neolithic, late Copper Age, Early and Late Bronze Age, and perhaps Early Iron Age as well. Geophysical surveys and core drillings provided additional data for the archaeological and environmental definition of the site discussed next.

Geophysical Surveys

With the aim of better defining prehistoric settlement sites and identifying previously unknown sites, geophysical prospection was planned as part of the research project. In light of the conditions found in the region of Leskovac and Lebane, magnetic prospection was the best suited method for our purposes. Typical structures at prehistoric sites are in-filled ditches and pits. In the fill, the common accumulation of organic matter, burnt daub and fragments of pottery, guarantee a sufficiently high contrast in terms of magnetic susceptibility in order to localise and characterise these features. In the organic remains, a higher concentration of magnetite, a ferromagnetic iron oxide, can be observed. The magnetite is a metabolic product of magnetotactic soil bacteria (Fassbinder et al., 1990). Furthermore, the thermoremantently magnetised material found both, on the surface and in pit fillings, results in an increased magnetic field, detectable by means of magnetic measurements (Schmidt, 2009).

For the magnetic measurements, the convertible LEA MAX system was used. This includes an array of seven Förster fluxgate gradiometer probes mounted on a light and foldable cart and the 10-channel digitiser LEA D2 for data registration. The Förster FEREX CON650 fluxgate gradiometer probes register the vertical gradient of the vertical component of the Earth's magnetic field with an accuracy of 0.1 nT (nanotesla). The measured gradient (the difference between two vertically arranged sensors in the gradiometer probe) is insensitive to the typically large fluctuations of the Earth's magnetic field and is determined only by the magnetisation of local subsurface objects. The vertical sensor separation was 0.65 m. The measurements were carried out with a lateral profile distance of 50 cm and a measuring point distance between 5 and 10 cm depending on the cart's velocity.

The data positioning for the magnetic survey was decided by means of differential GPS, using two GNSS receivers ReAct (Førsberg) in RTK mode (Real-Time Kinematic), to achieve a relative accuracy of 2 cm. The coordinate system used during the magnetic measurements was the WGS84 UTM Zone 34N (EPSG: 32634). The coordinates of fixed points, determined in advance, were used to correct the exact location of the base position. Given the precision of these coordinates, in the range of centimetres, the absolute accuracy of the data positioning is between 2 and 10 cm. As a result, the magnetic data and their interpretation are presented in the coordinate system WGS84 UTM Zone 34N (EPSG: 32634). The data processing firstly included a decoding of magnetic and position data and secondly, an offset and drift correction resulting in georeferenced raster images (full-dynamic GeoTiff) of the magnetic data.

Magnetic measurements were carried out at the sites of Čuka (Štu01) and Čekmin (Ček01 and Ček03). The third site, Lalinovac, was chosen because of the surface finds, which suggested the presence of a prehistoric lithic working place. The largest area was covered at Čuka (5 ha), while areas at Čekmin totalled 1.4 ha. At Lalinovac, an area of 1.6 ha was prospected. In general, the magnetic data successfully reflects both the archaeological situation and the surface conditions in the investigated areas. Some parts of these areas could not be covered by the magnetic measurements due to the presence of crops, ploughed fields, trees and other constraints. In order to present the genuine magnetic data, we abstained from a rough data extrapolation or interpolation to fill such gaps, thus avoiding misinterpretation.

After data processing, the magnetic data images were thoroughly examined for detection of anomalies that might indicate archaeological features. Interpretation and discussion concerning the results are concisely postulated be-

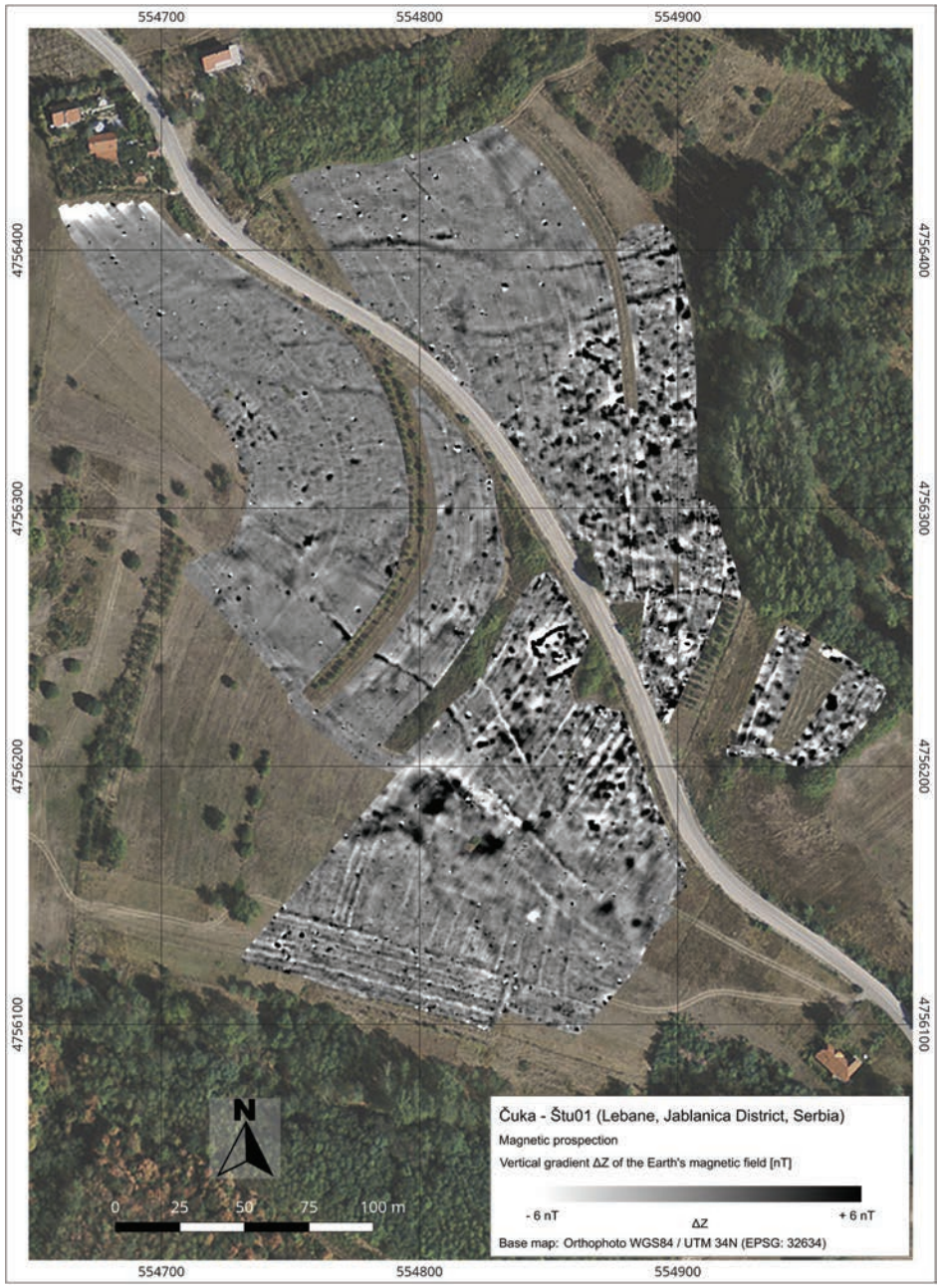

Fig. 7. Svinjarička Čuka (Štu01): Magnetic data, greyscale dynamics ±6 nT (Eastern Atlas)

Сл. 7. Свињаричка чука (Štu01): Подаци геомагнетног снимања, скала контраста ±6 nT (Eastern Atlas)

low, as the suggested visual interpretation mostly speaks for itself. The general approach to classify the magnetic anomalies is to distinguish them by means of their amplitudes, polarisation and shape. Anomalies of unambiguously modern human origin were initially separated and marked in blue colour. Secondly, other anomalies, which were assumed to have an archaeological or geomorphological background, were sorted out in classes that reflect the causes of their physical structures. A colour scheme was used to distinguish the magnetic signals with respect to their physical causes. The depicted and described interpretation is the outcome of a subjective approach that takes both the general archaeological context and the environmental conditions under consideration, and that by no means aims to claim exhaustiveness. It is rather a cautious proposition, which aims to serve as a basis for further archaeological research.

Svinjarička Čuka

The geological base is characterised by low-metamorphic schists and gneiss with amphibole and quartz veins (Pavlović et al. 2012). The predominant soil types are cambisols, while the lower parts of the site are covered by sandy lake deposits. Significant sources of magnetic disturbances were found along the modern street crossing the area and close to modern farm houses.

The objective of the magnetic survey at Čuka (Štu01) was to ascertain the existence of settlement structures in the perimeter where the surface findings were detected. An overview of the results of the magnetic survey at Čuka is shown in Figure 7. The magnetic data show a very clear division of the area into two distinct parts. The elevated ground to the west and to the north is mainly free of distinct magnetic indications that can be associated with any settlement structures. However, the lower sector to the east manifests a high density of magnetic anomalies that can be related to the zones with human activity. The density of magnetic anomalies also decreases rapidly towards the south, on the alluvial terrace along the Svinjarička River, a tributary to the south-north running Caričina River.

The main non-modern features in the northern, western and southern parts of the investigated area are the traces of refilled erosion gullies and the outcrops or rises of magnetised bedrock formations. High concentrations of positive, circular and irregularly shaped, magnetic anomalies, indicating the existence of pits, are found in the east, along the river, on a surface of approximately 2 hectares. This area is displayed in Figure 8 as a yellow-shaded semi-circle. Inside this circle, a great number of complex anomalies, with diameters varying between 4 and 7 m, suggest multi-layered (settlement?) deposits. Relatively high

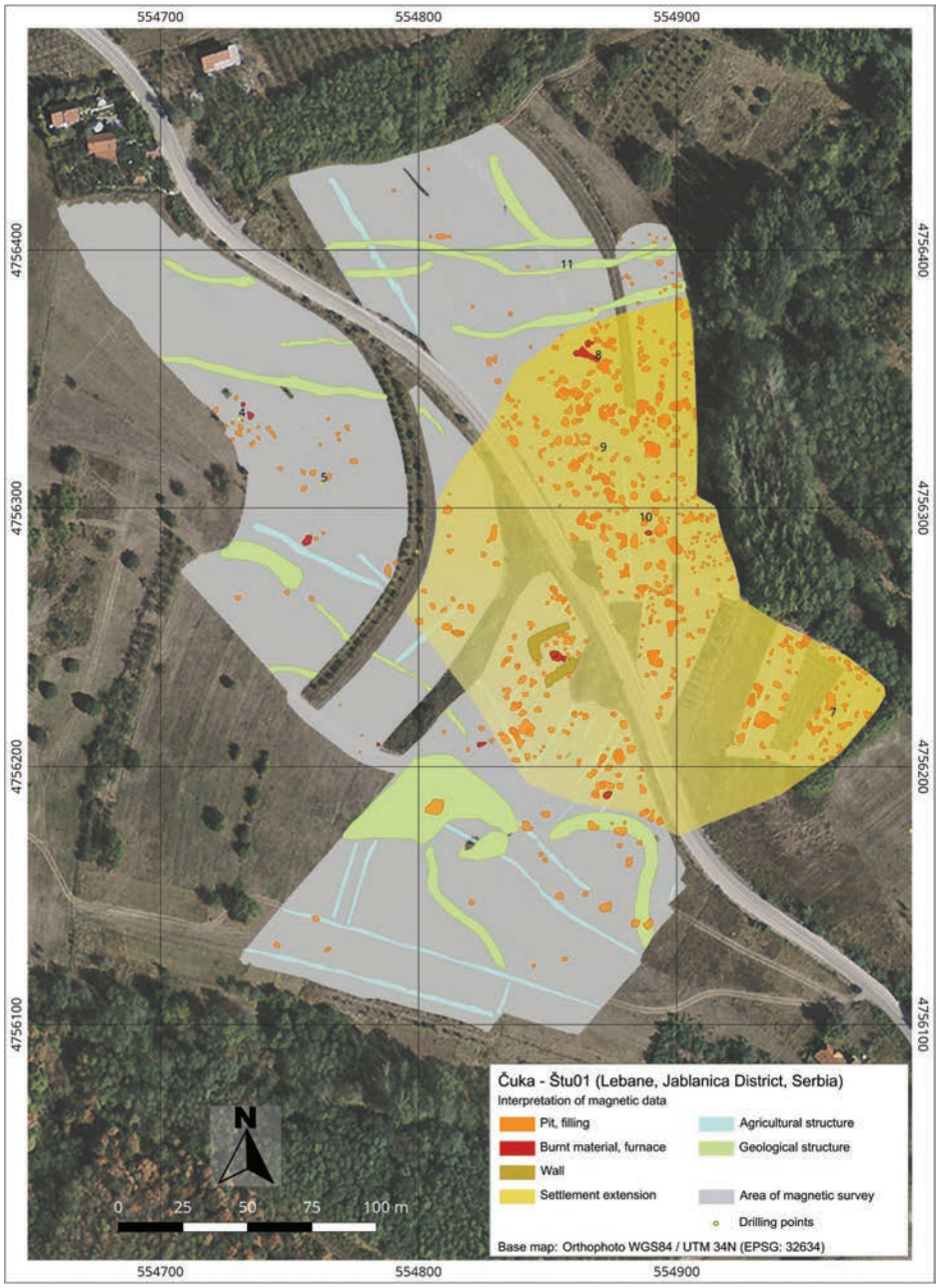

Fig. 8. Svinjarička Čuka (Štu01): Interpretation of the magnetic data (Eastern Atlas)
Сл. 8. Свињаричка чука (Štu01): Интерпретација података геомагнетног снимања (Eastern Atlas)

amplitudes of the vertical magnetic gradient (up to 10 and 15 nT), rectangular to circular outlines and an internal structuring insinuate the possible existence of deeper, and thus older, settlement layers. The drilling data from the core no. 10 in the centre of the postulated site (s. below) show cultural layers that clearly reveal increased magnetic susceptibility at a depth of 2.3 metres. At drilling no. 7, in the south-eastern part, the deepest cultural layer is reached at a similar depth.

Given that the most distinctive positive magnetic anomalies correspond to cultural layers deeper than 2 metres, approximately (the thickness of the plough horizon has to be subtracted), these anomalies were distinctively marked (Fig. 9). The distribution of these features show one cluster in the northern part of approximately 1.200 m², another one in the central part of approximately 700 m², and three rather isolated spots in the southern part. Assuming a radial expansion of the settlement, there is a high probability that the expected oldest layers can be found in the central group. In addition, other archaeological features were identified in the magnetic data.

Remarkable, although less interesting for the analysis of the prehistoric stages of the site, are some large-scale magnetic anomalies in the south-western part of the settlement's core (fig. 7-9). Here, immediately to the west of the road, a pattern of linear dipole anomalies of high amplitudes (>25 nT) roughly form a square with a side length of 15 m. Inside this square further dipole anomalies suggest the existence of thermoremanent material in the ground. Its large dimensions and high amplitudes most likely reveal the presence of building remains associated with the nearby Late Antiquity complex of Iustiniana Prima. The characteristics of the magnetic anomalies are indicative of highly-magnetised construction materials like fired bricks or opus caementicium.

The site of Čekmin and its surroundings were already known as the findspot of Neolithic items, including Starčevo ones, both noted on the surface and at the erosion edges along the small stream that crosses the site. In this site, the magnetic measurements are affected by the clay mining in the northern part of the area, and by the existence of several deep trenches and pits, probably dug out by looters. The goal of the magnetic prospection was to delimit the still existing remains of the expected prehistoric settlement. For that reason, the areas on the northern bank of the stream (Ček01 and Ček02) and on the more elevated zones to the south of the stream (Ček03) were investigated. At Čekmin, the magnetic data revealed the existence of prehistoric settlement structures over the whole area, but without showing a clear centre of the settlement. However, the most promising spots were located in the northern part of the investigated area (Ček01). The cores drilled in the site show cultural layers with a thickness of more than 3 me-

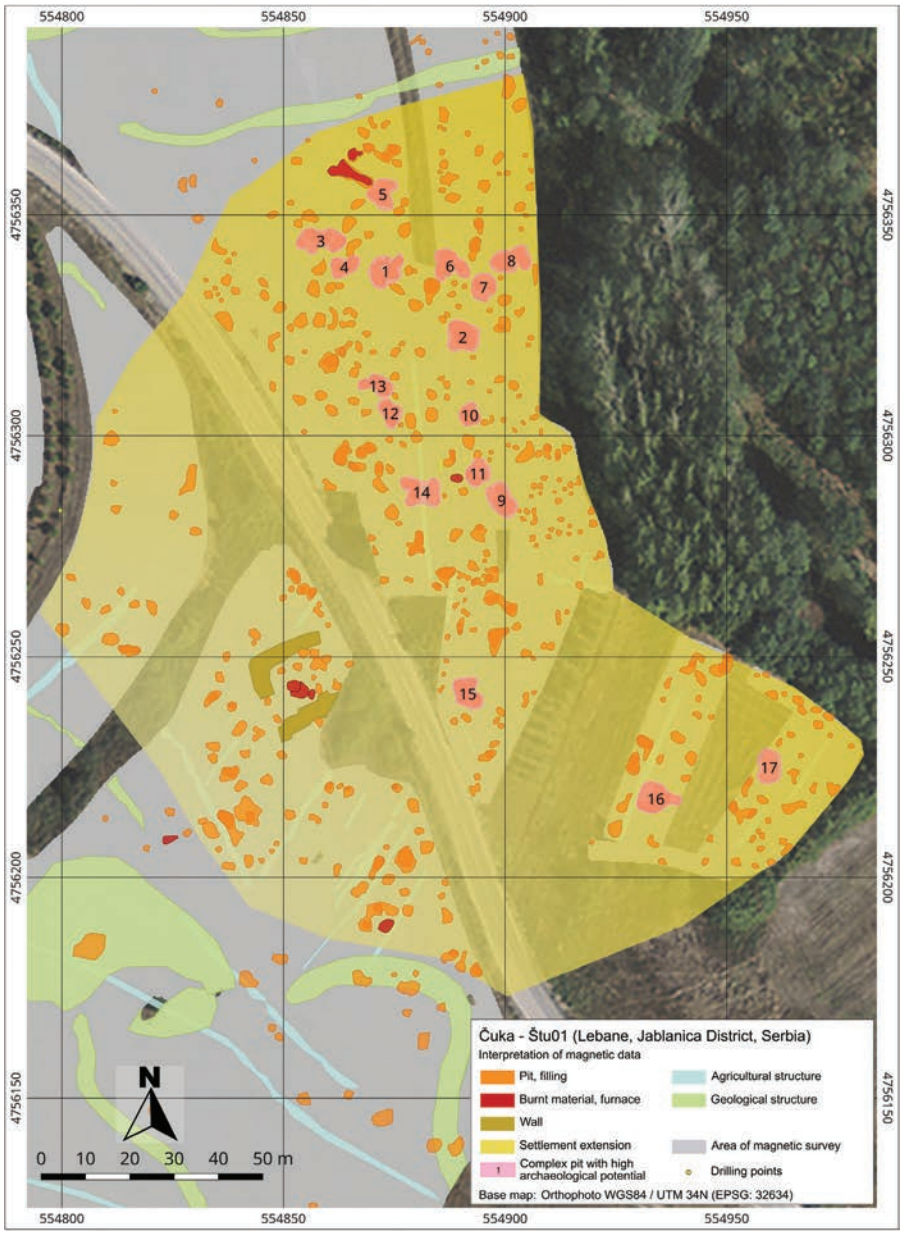

Fig. 9. Svinjarička Čuka (Štu01), central part: Interpretation of the magnetic data, with marked spots of the most distinctive magnetic anomalies suggesting multi-phase pits of prehistoric origin (Eastern Atlas)

Сл. 9. Свињаричка чука (Štu01), централни део: интерпретација података геомагнетног снимања, са маркираним зонама најиндикативнијих аномалија, које указују на јаме из различитих праисторијских периода (Eastern Atlas)

tres and with high magnetic susceptibility values. Further promising spots were located at the south-eastern terraces, where drilling results, archaeological survey and magnetic data confirm prehistoric human activity.

Close to the track leading to the village of Lalinovac from the south, a potential Paleolithic tool was found during archaeological survey. The origin of this artefact is not clear, and so a magnetic prospection of the find spot was executed. The place itself and the accessible parts of the surrounding agricultural fields, both to the west and to the east, were investigated. However, the magnetic data of Lalinovac did not provide any suggestion for the existence of archaeological structures in the ground. The data only reflects some contamination with scrap metal near the surface, caused by recent agricultural activity. The large-scale increases of the measured magnetic gradient solely reveal the geological base.

Environmental and archaeological prospection by coring

The aims of environmental and archaeological prospection by drilling were to 1) explore the existence of viable geo-archives (soils and sediments) and their potential for environmental reconstructions in the surroundings of prehistoric sites, 2) the localisation and horizontal and vertical discrimination of cultural layers, and 3) the retrieval of datable material from the cultural layers for the establishment of a preliminary chronological model of the archaeological sites Čuka, Čekmin und Šljivče. In total, about 20 corings with an open tube or closed plastic tubes (diameter 5 cm) were conducted with an electric vibracoring device.

The documentation and interpretation of the cores followed pedological, sedimentological, and archaeological principles. Organic content, carbonate content, grain size, and further pedological characteristics were determined according to the guidelines of the German Manual of Soil Mapping (Ad-Hoc-AG Boden 2005). The colour of soils, sediments, and archaeological layers were determined using the Munsell soil colour chart. The magnetic susceptibility of the cores in plastic tubes was measured at 4-cm intervals using the Bartington MS3 Magnetic Susceptibility Meter and the MS2C Core Logging Sensor (Dearing 1994).

Svinjarička Čuka

From a geomorphological point of view, the archaeological site Svinjarička Čuka is located on the eastern slope of the NW-SE trending hill spur. In the northwest, the spur is connected to the elevated hinterland and on the other sides, it is bordered by woody river valleys. The eastern slope of the spur, according to the archaeological survey and the geophysical measurements of the area with the highest density of archaeological finds and remains, was explored by

Fig. 10. Coring spots at Svinjarička Čuka (base map: Esri, DigitalGlobe, GeoEYE) (St. Schneider)
Сл. 10. Места на којима је извршено бушење на Свињаричкој чуки (основа мапе: Esri, DigitalGlobe, GeoEYE) (St. Schneider)

nine corings. Preliminary analyses of the corings reveal pedological and geological changes on a small scale, forming a mosaic-like structure of the soils, sediments, and cultural layers (Fig. 10-11). The upper part of the hill spur is covered by thin and very compact clay soils with deep dry cracks. They have developed on pedogenetically altered loess (core PR 01), or on slope deposits overlying marl (cores PR 04 and PR 05). The upper layers of the cores PR 01 and PR 04 contain fragments of burnt daub. Whether these are in situ features and indicate (prehistoric) human activity, or were implemented in the layers by falling from the surface into the dry cracks (peloturbation) could not yet be determined.

The middle part of the hill spur is dominated by well-pronounced archaeological layers. They contain burnt levels and have a high content of fragments of ceramics, burnt daub, and charcoal. Magnetic susceptibility values of the archaeological layers are significantly higher than those of the underlying – and sometimes intertwined – slope deposits. The thickness of the archaeological lay-

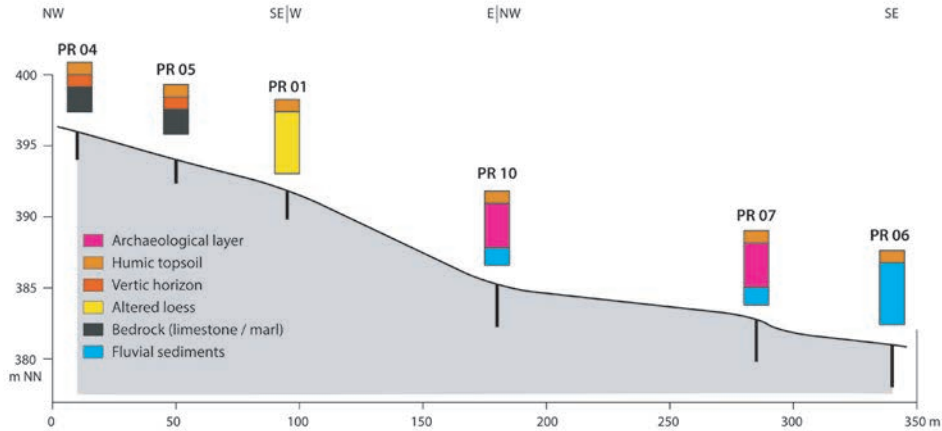

Fig. 11. Cross-section with the preliminary interpretation of the corings at Svinjarička Čuka (graph: St. Schneider)

Сл. 11. Пресек са прелиминарном интерпретацијом бушења на Свињаричкој чуки (графика: St. Schneider)

ers is the highest in the South (2.3 m in core PR 10) and thins out to the North, in the direction of core PR 11, which does not contain any archaeological remains.

Cores PR 06 and PR 07 document the stratigraphy of the hill spur's foot slope at the transition into the river valley. From the surface, up to a depth of three metres, PR 06 reveals well-sorted sandy fluvial sediments of a terrace of the river engulfing the spur. The same fluvial sediments build the base of core PR 07. However, up to three metres below the surface, PR 07 contains well-pronounced archaeological layers similar to those found in the middle part of the hill spur.

Summarizing the environmental information derived from the preliminary analysis of the corings, it may be stated that the environs of the archaeological site include several geo-archives, with a high potential for landscape reconstruction. The fluvial sediments of the river valley engulfing the hill-spur, and the slope deposits of the middle and foot slope in particular, which are intertwined with the cultural layers, show the potential to be valuable geo-archives that contain information on past landscape conditions. However, small-scale changes and a mosaic-like geologic and pedologic structure make a thorough exploration by a close-knit net of cores necessary in order to allow a detailed and profound reconstruction of the original geomorphological situation of the site. Summing up the information on the thickness and extent of cultural layers at Svinjarička Čuka, it may be concluded that the cultural layers at the site concentrate on the middle and the lower part of the eastern slope of the hill spur, on which the site is located. The

thickness of layers with archaeological content is the highest in the south-eastern areas close to the foot slope and the river, and it thins out to the north and west (Fig 11). A preliminary relative chronology based on the radiocarbon dating of two cores (Fig. 12) is discussed below. The top of the spur and higher slope areas have thin soil cover and are free from cultural layers. Whether this is the original situation, or soils and cultural layers were eroded, still has to be elucidated.

Čekmin and Šljivče

Besides Svinjarička Čuka, corings were performed at two further archaeological sites near Čekmin and Šljivče. At Čekmin, cores were retrieved from five geophysical anomalies supposedly pointing to archaeological features such as pits (see above). Two of the cores reveal well-pronounced archaeological layers up to a depth of 3.3 m below surface, including burnt levels, fragments of ceramics, burnt daub, and charcoal. Two further cores contain layers with burnt daub, pieces of charcoal, and ceramics fragments. However, the layers are significantly less thick, and the overall content of archaeological material is lower, possibly indicating more pits than extensive, continuous archaeological layers. Although the fifth core from a geophysical anomaly did not contain any remains of human activity, Čekmin needs to be regarded as an archaeological site with significant occurrence of buried archaeological layers. In contrast, the exploration of the near-surface subsoil at Šljivče (Fig. 1) did not lead to the discovery of human remains. Although five corings were conducted in the area, only natural soils could be detected.

Discussion of Svinjarička Čuka

The data provided by the archaeological, geophysical and geographical analyses let us suggest the presence of a new prehistoric site at Svinjarička Čuka with complex horizontal and vertical stratigraphies in an area of about minimum 10.000 m^2. The surface materials indicate a date range in the Early to Middle Neolithic (Starčevo), Late Copper Age, Late Bronze and perhaps Early Iron Age. This preliminary relative chronology is supported by radiocarbon data of samples from two drilling cores (Fig. 12).

The oldest layers indicate potential Mesolithic evidence with a date range of 6811-6612 calBC. The Early Neolithic period is evident by one sample dated in 6207-6017 calBC. The centuries of the Middle Neolithic (or beginning of the Late Neolithic?) are represented by two dates of 5748-5644 calBC and 5611-5481 calBC. The following 2000 years are not represented in these two cores, which continue with a dated sample of the Late Copper Age (3482-3110 calBC)

Core ID / Ознака бушотине	Laboratory no. / Бр. лабораторије	Depth of the sample in drill core / Дубина узорка у бушотини	^{14}C Alter (BP) / датум BP	±	δ13C AMS [‰]	Cal 1- sigma	Cal 2- sigma	C [%]
Štu23_0000_13_1	MAMS_34881	90 cm	4558	26	-26	3364-3136 calBC	3482-3110 calBC	53
Štu23_0000_13_1	MAMS_34882	185 cm	6824	31	-26,2	5729-5674 calBC	5748-5644 calBC	0,8
Štu23_0000_13_1	MAMS_34883	220 cm	7221	31	-32,9	6101-6024 calBC	6207-6017 calBC	0,5
Štu01_0000_13_08	MAMS_34886	87 cm	3140	25	-27,2	1444-1331 calBC	1494-1309 calBC	44,5
Štu01_0000_13_08	MAMS_34884	178 cm	6581	29	-26,8	5547-5488 calBC	5611-5481 calBC	43,9
Štu01_0000_13_08	MAMS_34885	233 cm	7857	32	-27,2	6743-6644 calBC	6811-6612 calBC	49,4

Fig. 12. Radiocarbon dates of charcoals of the drilling cores 7 and 10 at Svinjarička Čuka
Сл. 12. Радиокарбон датуми узорака гарежи из тачака бушења бр. 7 и 10 на Свињаричкој чуки

and finally one of the Late Bronze Age (1494-1309 calBC). Both dated cores demonstrate not only a consistent deposition of cultural layers with corresponding depths and composition, but also support the independently presumed relative chronology of the site based on the surface finds. The composition of archaeological layers in chronological order let us expect human remains until 2,30 meters depth in probable well-preserved conditions.

The clustering of structures within a northern, central and southern part as indicated by the geophysical data, suggest a broad dispersal of the settlement(s), perhaps with chronologically differentiated horizontal stratigraphy. Around 20 massive structures are expected to lay in c. 2 meters depth and therefore probably belong to the Neolithic. The large number of small-scale magnetic anomalies observed aside from the large structures, may suggest the presence of shallower and possibly younger post-holes, working pits, and near-surface concentrations of burnt material.

The construction of the modern street seems to cut through the prehistoric settlement zone with this recent destruction potentially eroding and re-depositing cultural layers due to secondary deposition of soils upon the fields next to the street. The ongoing collection of mainly Starčevo objects by a local farmer and his verbal accounts of finds support our main results - whilst the river terrace east of the modern street including the survey areas B and C appears to be densely used in prehistory, the western part towards Caričin Grad revealed a massive rectangular structure, most likely dating into Late Antique or Byzantine periods.

Results and Outlook

The first systematic survey campaign of the new Pusta Reka Project in 2017 revealed new results presented in this contribution. The focus of our envi-

ronmental and archaeological analyses was the Leskovac Basin in south Serbia and its low elevations between the tributary rivers to the Southern Morava River. Altogether 38 prehistoric find spots have been detected in this distinct settlement chamber including the 6 sites Crkvište, Lalinovac, Šljivče, Čekmin, Sekicol and Svinjarička Čuka. Except Lalinovac, which did not provide further prehistoric finds aside the single potential Paleolithic tool, the others revealed new primary data about the Neolithic period and the Metal Ages. The distribution of sites demonstrate that the elevations between the Pusta Reka and Jablanica Rivers, as well as the flood plains, were settled in prehistory, presumably from the (Early?) Neolithic onwards. While several analyses (GIS, cores, material studies) are still ongoing, the first results about the Svinjarička Čuka site are promising. The small terrace of the Svinjarička River appears to have been used at least since the Early Neolithic times, probably interrupted by a hiatus (?) and re-settled in late Copper Age about 2000 years later. An accumulation of cultural layers up to 2,50 meters is located on the terrace, which seem to be consistent and deposited in the right order (in situ?) after the radiocarbon dates. Around 20 circular-shaped pit like structures and various smaller anomalies, along with coring suggest a complex horizontal and vertical stratigraphy. The preliminary studies of the surface finds can be related with the cultural horizons of Starčevo, Coţofeni-Kostolac and Donja Brnjica. Traces of occupation of Vinča horizon could not have been identified at this site so far. The absolute dates from the corings of the site confirm this preliminary chronological determination, but require further investigation in the future. Later destruction seems to be limited according to the relatively small amounts of Antique, Byzantine or later ceramics.

The further plans for the Pusta Reka project are to intensify the environmental studies and focus on excavations of the Svinjarička Čuka site, defined in the course of the survey. The ongoing GIS analyses of the survey data, material studies as well as ongoing analyses of the drilling cores will form the basis for the first excavations. The excavations of a potential Starčevo site, with the focus on defining the Early Neolithic occupation in the region would enhance our view on the pre-Vinča horizon, previously limited only to accidental finds, and could significantly contribute to our understanding of the Neolithisation processes of the Central Balkans. The promising evidence of Copper and Bronze Ages on the site will offer the opportunity for a diachronic investigation and a broader view on the prehistoric development of human occupation and their impact on the landscape. The parallel lithic resources project by Michael Brandl from the OREA Raw Material Lab is focusing on the available stone sources of the region and the studies of raw material procurement strategies in prehistory. The first results of

his analyses and geoarchaeological surveys are already published (Brandl 2018). This pilot study is expected to be continued in the future to provide substantial new data about Neolithic resource management in the Leskovac Basin.

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ПРАИСТОРИЈСКИ ПЕЈЗАЖИ ОБЛАСТИ ПУСТА РЕКА (ЛЕСКОВАЦ). НОВА ИСТРАЖИВАЊА У ЗОНИ ЈУЖНЕ МОРАВЕ

Кључне речи: *Лесковачки басен, неолитизација, старчевачка култура, брњичка група, рекогносцирање, ГИС*

Прва систематска истраживачка кампања новог пројекта Пуста Река 2017. године открила је нове резултате који су представљени у овом чланку. Тежиште наше свеобухватне анализе јесте Лесковачки басен на југу Србије и област између Јужне Мораве и њених притока, са ниском надморском висином. У овој регији откривено је укупно 38 праисторијских налазишта, укључујући и локалитете у Брестовцу (Црквиште), Лалиновцу, Живкову (Шљивче), Чекмину (Кућиште), Секицолу и Штулцу (Свињаричка чука). Осим Лалиновца, у којем је откривен само један потенцијални палеолитски артефакт други локалитети су пружили више нових података о неолитском периоду и металном добу. Распоред локалитета указује да су области између Пусте реке и Јабланице, као и плавна зона, биле насељене у праисторији, вероватно већ од (раног?) неолита. Док су још увек у току неке анализе (ГИС, анализа материјала), први резултати у вези локалитета Свињаричка чука обећавају. Чини се да је живот на малој тераси Свињаричке реке, коришћене већ у време раног неолита, вероватно прекинут у једном тренутку, и поново успостављен у касном бакарном добу, више од два миленијума касније. Акумулација културних слојева до дубине од 2,5 м указује на континуира-

но насељавање, што потврђују и апсолутни датуми из узорака добијених палеогеографским бушењем. Око 20 кружних структура налик јамама откривених током геомагнетне проспекције и различите мање аномалије дуж зоне бушења указују на сложену хоризонталну и вертикалну стратиграфију. Прелиминарне анализе површинских налаза за сада се са сигурношћу могу повезати само са старчевачком, Коцофени–Костолац и брњичком групом. Трагови присуства винчанског хоризонта до сада нису идентификовани на овој локацији. Накнадно уништавање локалитета изгледа није било интензивно, према релативно малим количинама античке, византијске или позније керамике које су констатоване на површини.

Даљи планови пројекта Пуста река су интензивирање студија о животном окружењу и фокусирање на ископавања локалитета Свињаричка чука, дефинисаног током рекогносцирања. Текуће ГИС анализе података са рекогносцирања, студије материјала, као и текуће анализе узорака из бушотина чиниће основу за прва ископавања овог локалитета. Ископавање овог потенцијалног старчевачког локалитета, са фокусом на дефинисање раног неолитског насељавања у региону, проширило би наша сазнања о пре-Винчанском хоризонту, који је раније био ограничен само на случајне налазе. Ово би могло значајно допринијети нашем разумевању процеса неолитизације централног Балкана. Интензивни докази о бакарном и бронзаном добу на локалитету ће пружити могућност за дијахронично истраживање и шири поглед на праисторијски развој људског насељавања и њихов утицај на околину. Паралелни пројекат истраживања ресурса окресаног камена од стране М. Брандла (Michael Brandl) из OREA лабораторије за сировине фокусира се на доступне камене изворе у региону и студије стратегија набавке сировина у праисторији. Први резултати његових анализа и геоархеолошких истраживања су већ објављени (Brandl 2018). Очекује се да ће се ова пилот-студија наставити у будућности да би се обезбедили значајни нови подаци о располагању неолитским ресурсима у Лесковачком басену.