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New Multi-disciplinary Data from the Neolithic in Serbia. The 2019 and 2021 Excavations at Svinjarička Čuka

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Abstract

The excavations at Svinjarička Čuka in the South Morava Valley in Serbia are presented with new primary data from the field and related material and scientific analyses. Newly recovered architectural remains from the classical Starčevo period revealed a variety of domestic features, so far belonging to an earlier and later occupation phase at the river terrace dating between 5700/5600 and 5500 BC. Details of the stratigraphy and certain materials are presented for selected domestic contexts, including one potential 'Starčevo house'. Archaeological and scientific analyses are discussed and contextualised within the Neolithisation process in the chapters on new radiocarbon data and their Bayesian modelling, pottery studies, chipped stones and their raw material analyses, grinding kits, animal remains, archaeobotanical results and charcoal analysis. The later occupation at the site is presented with new results for the Middle and Late Bronze Age and the Early Iron Age, including domestic contexts, radiocarbon data and materials.

Keywords

Starčevo, Serbia, Neolithic, Bronze Age, radiocarbon dating, subsistence, vegetation

Zusammenfassung – *Neue multidisziplinäre Daten aus dem Neolithikum Serbiens. Die Ausgrabungen der Jahre 2019 und 2021 von Svinjarička Čuka*

Der Text bietet einen Überblick zu neuen Ergebnissen der Ausgrabungen und naturwissenschaftlichen Untersuchungen an der Fundstelle Svinjarička Čuka im südlichen Morava-Tal in Serbien. Kürzlich gefundene Architekturreste der klassischen Starčevo Kultur belegen eine Reihe unterschiedlicher Siedlungsbefunde, die sich bislang einer früheren und einer späteren Besiedlungsphase auf der Flussterrasse zuordnen lassen, die absolut zwischen 5700/5600 und 5500 calBC datiert werden kann. Die Stratigraphie und Aspekte des Fundmaterials ausgewählter Kontexte werden vorgestellt, darunter ein potentielles „Starčevo Haus". Archäologische und naturwissenschaftliche Untersuchungen werden diskutiert und im Rahmen des Neolithisierungsprozesses kontextualisiert, mit Abschnitten zu neuen Radiokarbondatierungen und ihrer Bayesschen Modellierung, Keramikuntersuchungen, der geschlagenen Steinindustrie mit ihren Rohstoffquellen, Reibsteinen, den Faunenresten, den Ergebnissen von archäobotanischen und Holzkohleuntersuchungen. Die späteren Besiedlungsphasen des Fundplatzes werden mit neuen Ergebnissen zu Siedlungskontexten, Radiokarbondatierungen und Fundmaterial der mittleren und späten Bronzezeit und der frühen Eisenzeit vorgestellt.

Schlüsselbegriffe

Starčevo, Serbien, Neolithikum, Bronzezeit, Radiokarbondatierung, Subsistenz, Vegetation

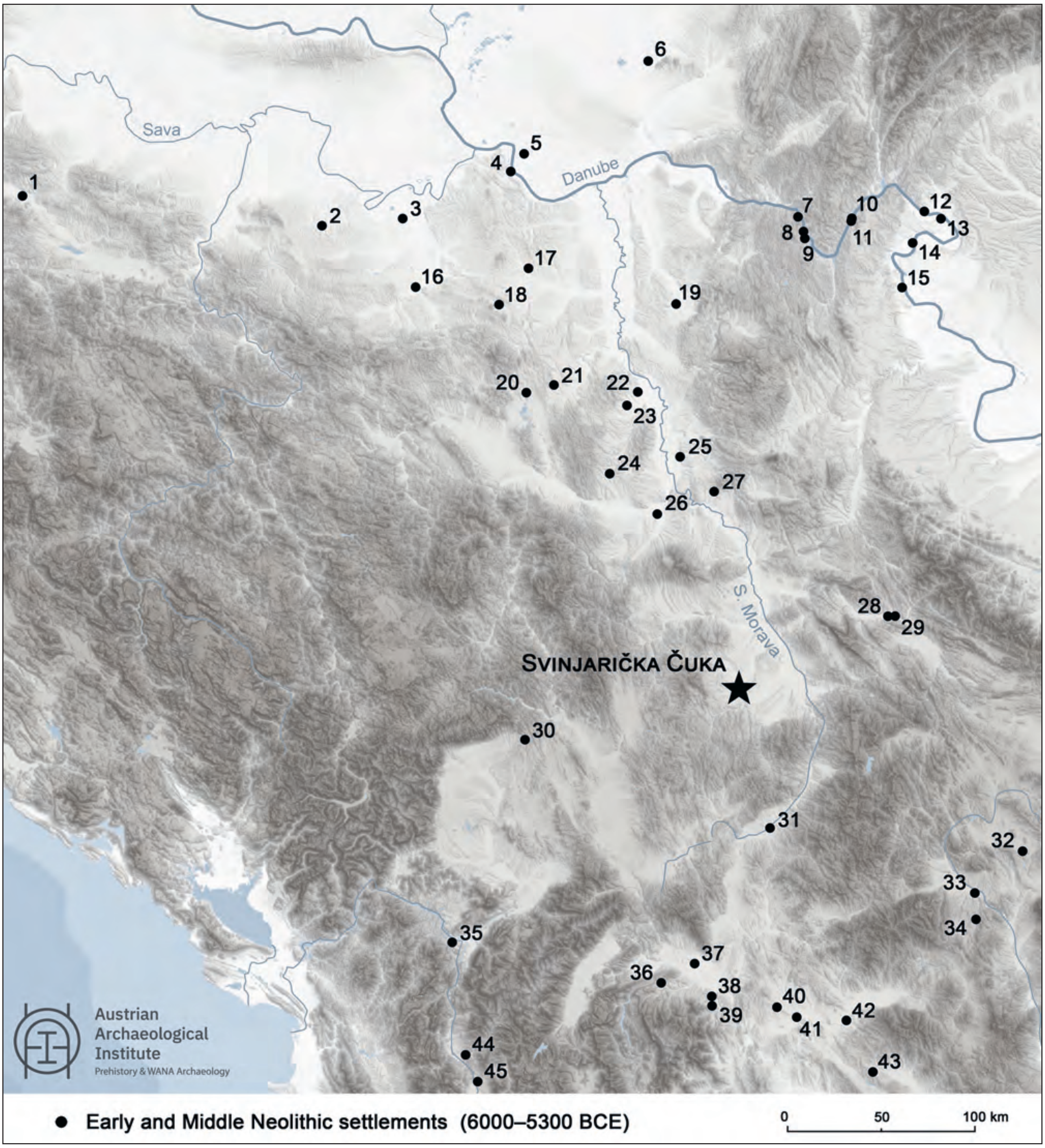


Fig. 1. Early and Middle Neolithic settlements in the central Balkans. – 1. Korića Han. – 2. Belotić. – 3. Grabovac-Đurića vinogradi. – 4. Vinča-Belo brdo. – 5. Starčevo Grad. – 6. At. – 7. Padina B. – 8. Lepenski Vir. – 9. Vlasac. – 10. Icoana. – 11. Cuina Turcului. – 12. Schela Cladovei. – 13. Ajmana-Mala Vrbica. – 14. Velesnica. – 15. Mihajlovac-Knjepište. – 16. Jaričište. – 17. Batačevo. – 18. Banja Aranđelovac. – 19. Belovode. – 20. Grivac. – 21. Divostin I. – 22. Bukovačka Česma. – 23. Međureč-Dunjički Šljivari. – 24. Blagotin. – 25. Drenovac. – 26. Lazarev grad. – 27. Crnokalačka Bara. – 28. Selište-Sinjac. – 29. Crnoklište. – 30. Rudnik Kosovski. – 31. Kovačke Njive. – 32. Gălăbnik. – 33. Nevestino. – 34. Vaksevo. – 35. Kolsh. – 36. Cerje-Govrlevo. – 37. Tumba Madžari. – 38. Zelenikovo. – 39. Grnčarica. – 40. Rug Bair. – 41. Anzabegovo. – 42. Vršnik. – 43. Damjan. – 44. Cetush. – 45. Burim (Map: M. Börner, B. Horejs, N. Schinnerl, D. Filipović).

1. Introduction

The Neolithisation process along the Axios-Vardar-Morava river corridor forms a key for understanding the complexity of the substantial transformation from hunter-gatherers into sedentary and farming communities on the Balkans starting around 6200–6000 BC. While the main routes of the Neolithic dispersal from West Asia into Europe are roughly identified based on archaeological, scientific and genetic data,[1] the complex process summarised as *Neolithisation* is only scarcely understood in both a socio-cultural and a chronological sense. Analysing the open questions, such as the timescale of adoption or adaptation of agriculture or its intensity, quality and impact for early Neolithic communities, requires well-contextualised data from state-of-the-art fieldwork. While the important and well-known Neolithic key sites in southeast Europe form the basis for our understanding of the cultural horizons known as Starčevo, Karanovo, Lepenski Vir or Anzabegovo, they left many blanks in a geographical and cultural sense (Fig. 1).[2]

Filling these gaps was the starting point of our research investigations in southern Serbia within the framework of a collaboration between the Archaeological Institute Belgrade and the Austrian Academy of Sciences with a focus on the region along the South Morava Valley and its tributaries (*Pusta Reka Research*). Extensive, intensive and geo-archaeological surveys allowed the identification of new prehistoric sites,[3] of which Svinjarička Čuka was to become the focus of our excavations since 2018 in collaboration with the National Museum of Leskovac.[4] The site is located on a flat river terrace within a hilly and fertile landscape west of the South Morava River floodlands. The environmental conditions appear very suitable for agricultural communities even until today in terms of soils, fresh water sources and climate.[5] Moreover, various and good-quality lithic raw material sources are available in this micro-region, as shown by Michael Brandl and Christoph Hauzenberger,[6] presumably representing an important factor in choosing this particular site for prehistoric communities.

The associated research project *Neolithic Technologies Trajectories of the Balkans* was designed to study the socio-cultural process along the southern Morava River region, in particular the built environment and the impact of new material technologies during the Starčevo Neolithic.[7] Both the excavations at Svinjarička Čuka and the NEOTECH project faced some delay during the Covid-19 pandemic, including a pause in fieldwork in 2020 as well as in material and scientific analyses until summer 2021. After a restart in the field in August 2021, the study campaign in April 2022 was also able to take place; both offer a new set of contextualised data and results. The research aspects related to the project aims, environmental conditions, excavation strategies and methodologies should not be repeated and will only be summarised when necessary as they follow the already published concept.[8] This contribution aims to offer new data and their interpretation in the context of the Neolithisation of the region with a special focus on stratigraphy and radiocarbon chronology, dwellings, faunal and floral remains including charcoal analysis as well as various materials, including the first presentation of grinding kits, which are important in understanding the food preparation process. The main excavation results are summarised below with a focus on one distinct context preliminarily defined as a potential 'Starčevo house', which is presented in more detail by means of stratigraphy and material analyses.

The Covid-related restrictions on working and travelling during the last two years complicated the post-excavation analyses and affected our original project schedule in many respects. Hence, not all materials from the 2019 and 2021 fieldwork have been analysed in detail yet, which affects the balance in this contribution. The younger occupation phase of the Metal Ages at the river terrace is studied by Aleksandar Bulatović and Ognjen Mladenović and is presented at the end of the paper.

2. Excavations 2019 and 2021

The fieldwork in the years 2019 and 2021 continued in the already opened trenches N1 and S1 (Fig. 2),[9] and was conducted for altogether eleven weeks in both years (19.8.–13.9.2019 and 2.8.–10.9.2021) with a Serbian-Austrian team of experts, students and workers.

The excavations directly continued the former ones from 2018 and followed the same methodological framework and documentation system with a focus on the 5 × 5 m squares R27–R28 in trench N1 and S22–T22 in trench S1.

1 Whittle et al. 2002. – Haak et al. 2015. – Hofmanová et al. 2016. – Krauss et al. 2017. – Borić et al. 2018. – Shennan 2018. – Brami, Horejs 2019. – Stefanović et al. 2020. – Gronenborn et al. 2021. – Marchi et al. 2022.

2 Cf. Porčić et al. 2020.

3 Horejs et al. 2018.

4 Horejs et al. 2019a.

5 Krauss et al. 2017. Cf. Obradović, Bajčev 2016 for the agricultural potential of soils in the Middle Morava Valley.

6 Brandl, Hauzenberger 2018.

7 FWF project no. P32096. Cf. Horejs et al. 2020.

8 Horejs et al. 2019a.

9 For the geophysical results, their interpretation and related location of the excavation trenches, see Horejs et al. 2019a, Fig. 2.

Fig. 2. View of the Svinjarička Čuka river terrace towards the south with the excavation trenches N1 (in front) and S1 (back) (Photo: M. Börner).

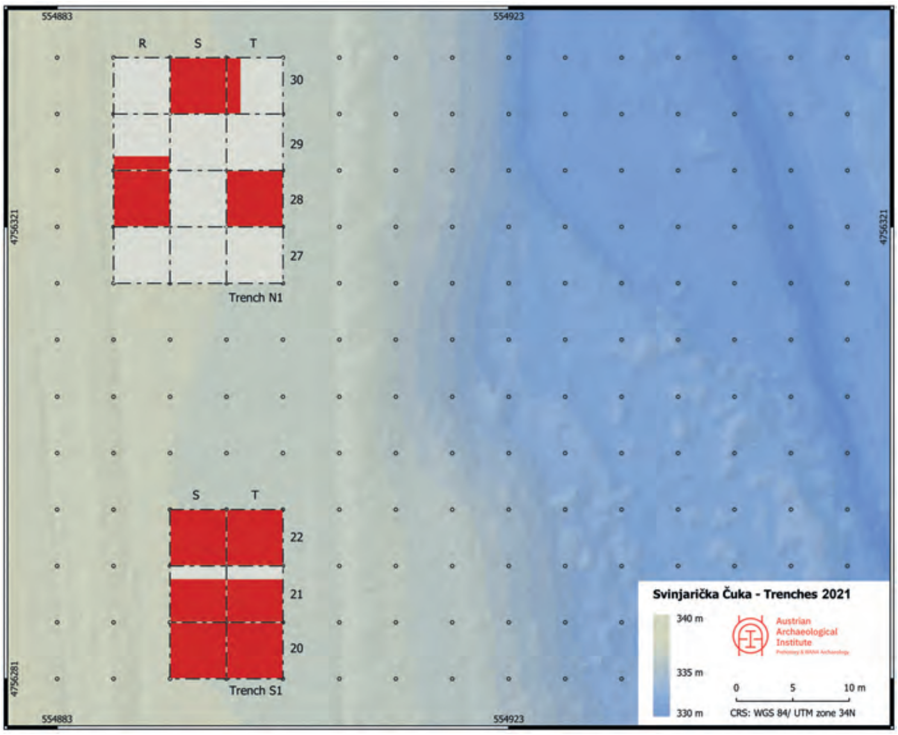


Fig. 3. Trenches N1 and S1 in the Svinjarička Čuka excavations 2019 and 2021 with opened and/or continued grids marked red (Map: M. Börner).

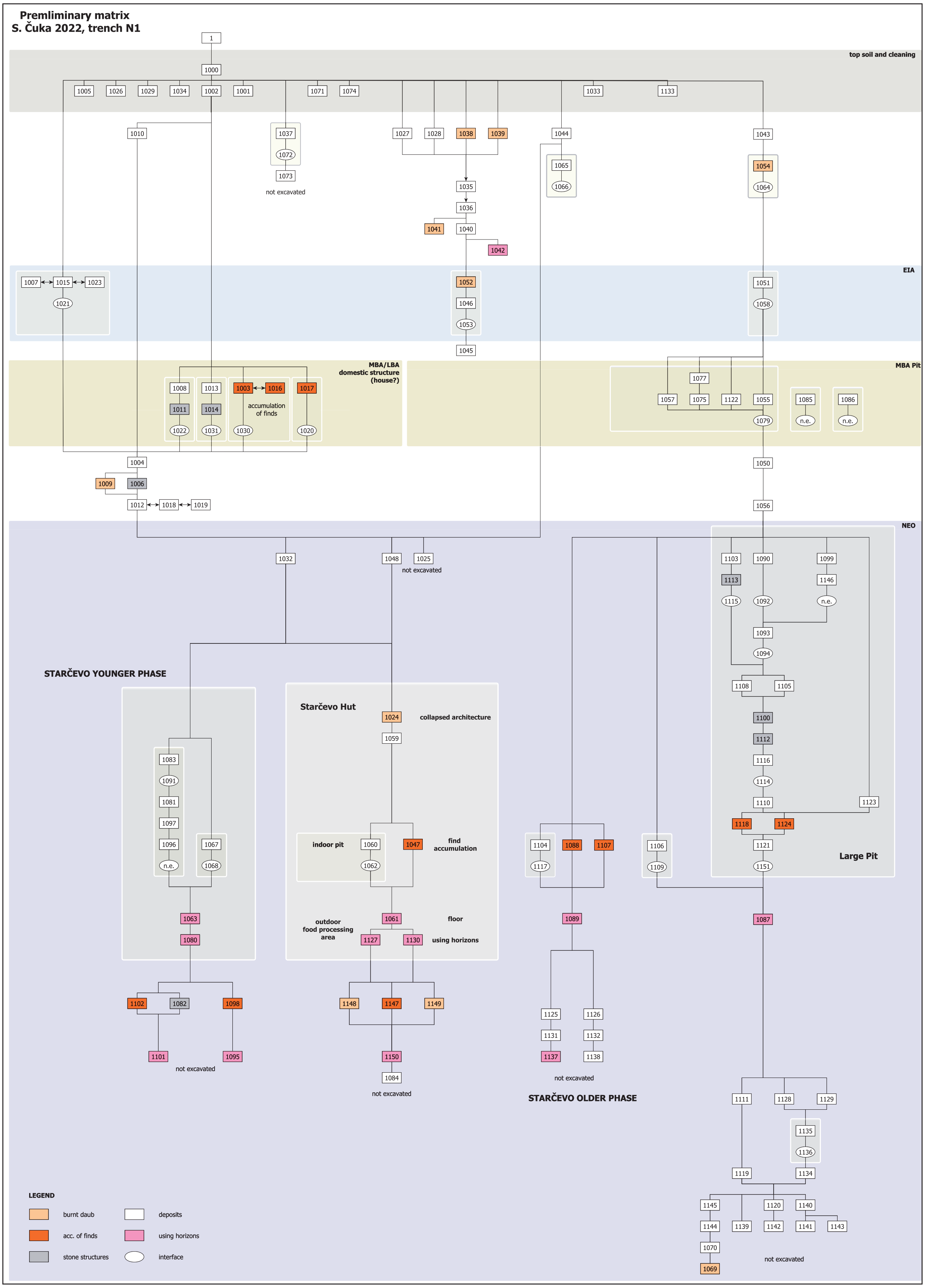


Fig. 4. Matrix of the stratigraphical units (SUs) excavated in trench N1 at Svinjarička Čuka
(Graphics: M. Börner, O. Mladenović, F. Ostmann, B. Horejs).

Fig. 5. Overview of a collapsed wattle-and-daub structure within a use horizon designated as 'Starčevo hut' excavated in trench N1 (Photo: F. Ostmann).

The additional squares S30–T30 and T28 were opened in N1 and S–T/20–21 in trench S1 (Fig. 3), doubling the area of investigation to altogether 225 m².

The main anthropogenic phases at the river terrace are so far evident for the Early and Middle Neolithic, the Eneolithic, the Middle and Late Bronze Age and the Early Iron Age. Aside from many detailed questions, the main aims of both seasons were the recovering of pure Starčevo Neolithic contexts, the definition and clarification of the younger occupation phases during the Metal Ages at the river terrace and gaining more insights into the vertical and horizontal stratigraphy of its occupation history. The main results of the excavations can be summarised as follows, starting with the Neolithic: two different phases of Starčevo domestic occupation have been recovered so far, which can be divided into an older and a younger phase. Both revealed various features (Figs. 4–5). The radiocarbon modelling outlined by Lyndelle Webster below supports our stratigraphical assumption of an earlier and later occupation recovered so far. The bedrock has not yet been reached, and this allows us to expect another, earlier Starčevo phase(s) below, as evident in the ^{14}C data from a drilling core (6087–6021 BC, 68.3 %).

2.1. Later Starčevo Features

The younger domestic Starčevo phase can be defined in the northern trench N1 in the squares S–T30 and R28–29, and although they are not physically related yet, their stratigraphical position, height and characterisation allow us to assume that they are roughly contemporaneous, radiocarbon dated to c. 5500 BC (Fig. 4 and below Figs. 10–14).

The uppermost Starčevo-related layer SU 1050 (S–T30 in trench N1) cannot be defined as a use horizon, but appears to represent a layer of possibly relocated Neolithic deposits that contains pure Starčevo materials in large amounts without any younger intrusions. The next following horizontal layers underneath (SUs 1087, 1089) represent a use horizon in an *in situ* position. The accumulation of finds defined as SU 1088 (sherds, small finds) and an accumulation of animal bones are scattered above a stamped clay floor (SU 1089) preserved in large parts of the area. The yellowish-beige clay floor shows a very comparable character to floor SU 1061 in the neighbouring squares R28–29 and appears at the same height level. This youngest identified floor (SUs 1087, 1089) is evident in most parts of the squares S–T30 and allows the definition of the uppermost and youngest Starčevo pure use horizon in this area. A large pit feature (IF 1151) is associated with this youngest floor SU 1087, but can only roughly be defined in its borders due to the later Middle Bronze Age pit (IF 1079) cutting into it (Fig. 36). This large Starčevo pit contains several domestic features, including smaller pits (IF 1092, 1094, 1114) with in-filings, a stone installation (SU 1110) and floor-like limy layers with find accumulations in a horizontal position, including one large Barbotine storage vessel and a bunch of small finds and artefacts (SU 1118). The next layers underneath the 'Large Pit' have been partially recovered (Fig. 4: SUs 1111, 1128, 1129 until 1069), but not finally excavated yet and presumably belong to the next older Starčevo horizon of this area. Another domestic structure related to the younger Starčevo phase at Svinjarička Čuka has been recovered in the squares R28–29, composed of massive stamped clay floors with renewals (SUs 1127, 1150, 1061), a pit feature (IF 1962) and a massive deposition of artefacts and vessels (SU 1047), which represent the horizon of a collapsed 'Starčevo hut' (Fig. 5). This domestic space covers around 2 × 3 m, as indicated by the floors and associated layers. The massive deposition of burnt daub (SU 1024) derives from a collapsed vertical wattle-and-daub structure, which can be interpreted as the remains of a light building or hut.

Two other large features in these squares can be assigned as roughly contemporaneous in stratigraphic terms. A stone installation composed of at least three stones in a horizontal position (SU 1082) is associated with a horizontal brown clay layer and the scattered remains of a vessel. The other large feature of roughly the same date appears as a large pit with brown to dark-brown in-fillings (SU 1096) that presumably continues into the neighbouring squares R27–28 and S28. The recovered levels of the upper fillings contain accumulations of finds (SU 1097), artefacts and implements, medium-sized and small inclusions of burnt daub fragments and small to medium-sized stones, altogether indicating the remains of another domestic feature, which requires further excavation. Overall, three Starčevo features can be associated with the younger phase of the Neolithic site so far: the collapsed remains of a wattle-and-daub hut ('Starčevo hut'), a stone installation in a horizontal position associated with an *in situ* vessel, and finally, a large pit with pure Starčevo material as in-filling and burnt daub fragments indicating the third set of potential architectural remains.

2.2. A Potential 'Starčevo House' of the Earlier Phase

The so far older Starčevo phase has been located in the southern trench S1 as well as in the northern trench N1 in square S30. It remains unclear if these older layers in the two trenches are related to each other or if they represent different chronological horizons at the site. In any case, the extensively excavated features in the squares S–T22 (50 m^2) in trench S1 point towards a large domestic feature, preliminary interpreted as the remains of a 'Starčevo house' (Figs. 6–8).[10] The remains in these squares belong to at least one particular large built structure with several levels of use and presumably also repair subphases, which demonstrates the creation of a domestic space used at least multi-seasonally. The Bayesian models of the radiocarbon dates support our assumption by revealing earlier and later activities during the 57th and 56th centuries BC for the house-related structures (see below with Figs. 10–14). A number of large to very large schist-stone slabs are placed in a horizontal position and frame the outline of the architectural structure, which cannot be securely defined in its borders yet, but measures at least around 7.50 × 4.30 m (Fig. 8).

Altogether five stone slabs or clusters of slabs have been recovered (Fig. 6: SUs 24, 33, 99, 100, 101, 110, 122), which can presumably be reconstructed into a rectangular-shaped ground plan with a potential southeast corner (?) and a limiting north-south-oriented structure preserved to a length of 3.80 m, potentially representing the small side wall in the east (Fig. 7). This eastern row consists of the large stone installations SUs 101 and 100, accompanied by a series of three pits (IF 106, 105, 102) within a north-south line (Fig. 8). These small to medium-sized shallow pits (diameter 0.7–1 m and depth 5–10 cm) contained a small quantity of old, fragmented and small material, such as sherds, stones and pieces of daub, in their in-fillings (Fig. 7). The connected features of the massive flat stones with associated pits point towards wooden (and therefore not preserved) post installations, originally positioned within the pits and/or upon the stabilising plates (Fig. 8).

This technical concept is also evident in the presumably inner part of the structure in the stabilising installations for a wooden post composed of a shallow pit and a cluster of the same kind of flat massive stones in a circular arrangement (SU 122). The addition of further stabilising stones (SU 24) in younger and above-laying floors allows us to assume repair activities (Figs. 6, 9). The presumable inner part of the structure contains a sequence of at least five floors and use horizons, one on top of the other, characterised by particular layers of scattered materials and artefacts in horizontal deposition. The so far oldest recovered floor (SUs 103, 120) was identified in the area west of the north-south-oriented post installation row within an area of c. 4.20 × 4.30 m. The floor is composed of hard stamped clayish soil with lots of

10 The stratigraphical units lying above the building and the covering younger layers have been presented in Horejs et al. 2019a, 182–185.

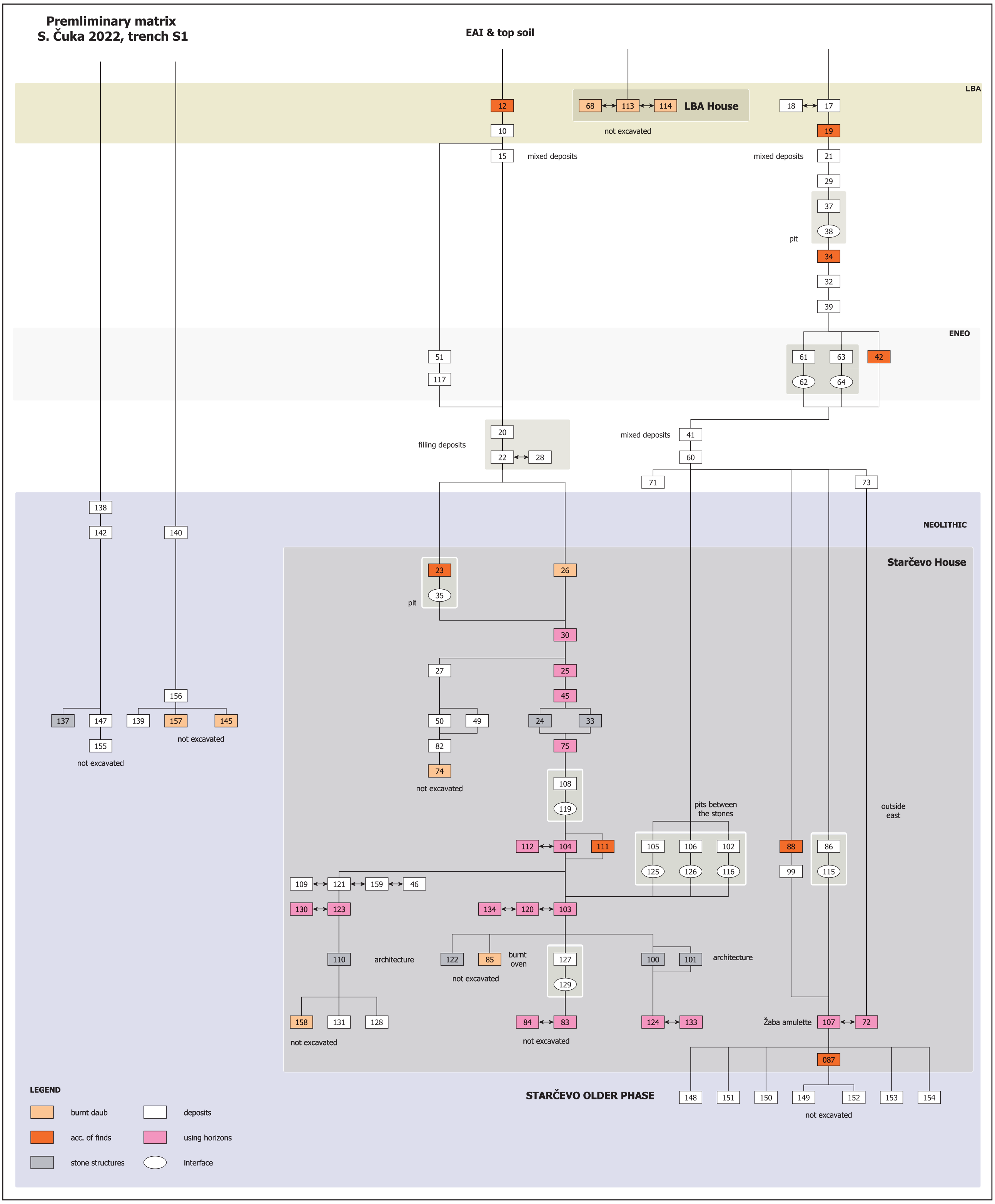


Fig. 6. Matrix of the stratigraphical units (SUs) excavated in trench S1 at Svinjarička Čuka (Graphics: M. Börner, N. Schinnerl, F. Ostmann, B. Horejs).

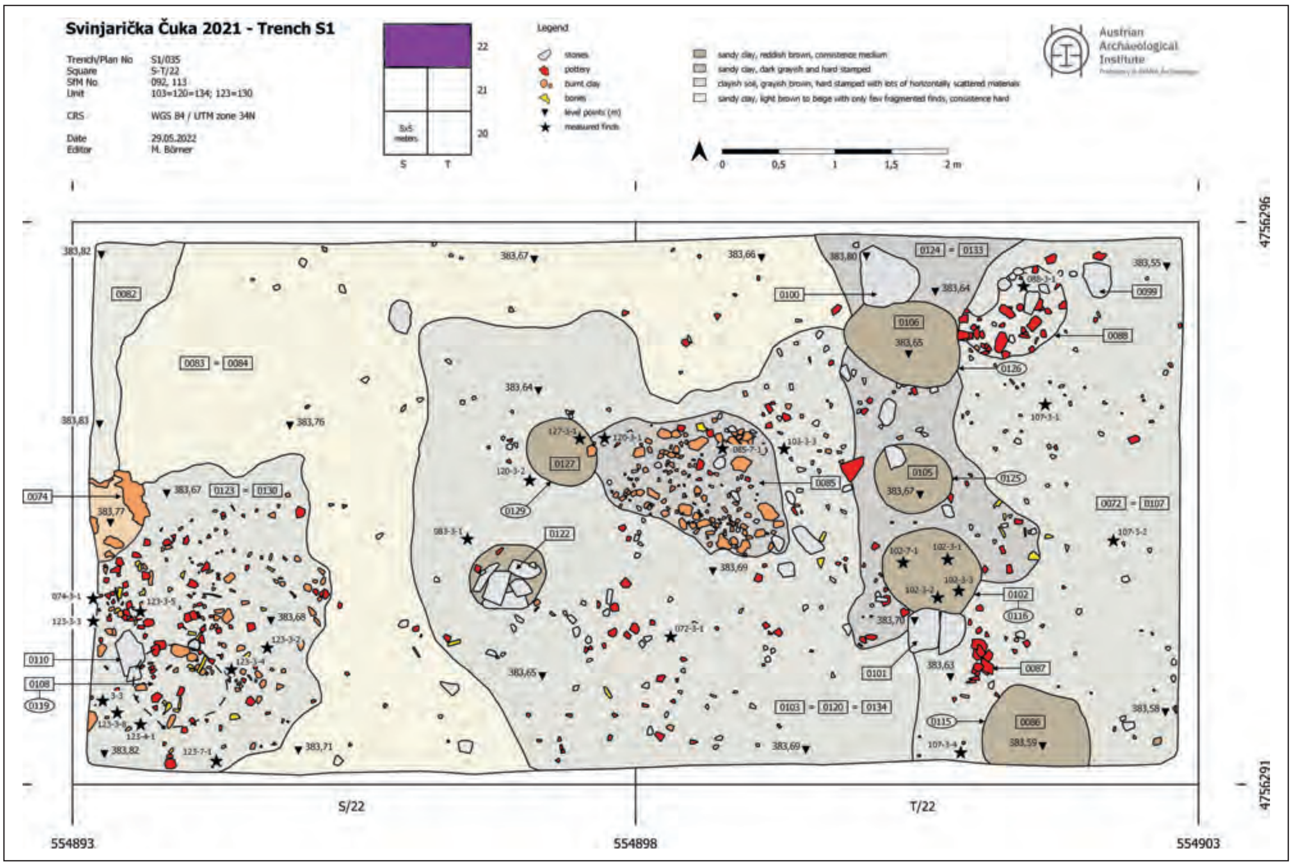


Fig. 7. Detailed mapping of the layers in trench S1, squares S–T/22 of the earlier phase in the 'Starčevo house' with floors (SUs 103, 120, 134), a pyrotechnical installation (SU 85), the architectural remains of pits and wooden-post beddings (SUs 100, 102; IF 116, 105, 106) (Graphics: M. Börner, B. Horejs).

horizontally scattered materials (sherds, bones, artefacts) (Fig. 7). The next layers underneath (SUs 83, 84) differ markedly as light-brown to beige sediments with only a few fragmented finds. The remains of a pyrotechnical installation (SU 85) built with daub and stones (Figs. 7–8) are probably associated with this use horizon. Detailed analyses of this installation have not been accomplished yet. The preliminary assessment of its remains (partially with flattened, white to grey burnt sides) allows us to assume a hearth. The next following younger floor (SU 104) shows the same characteristics of a very hard clayish soil with abundant sherds, artefacts, tools, bones and other implements above it. The floor covers a larger area towards the west, within a total space of 6.50 × 4.30 m. The succeeding floor horizon (SU 75) covers c. 5.60 × 4.30 m and contains larger fragments of pottery (Fig. 9), perhaps indicating some *in situ* depositions, but mostly in-fillings (see below chapter 4). Associated with this use horizon is the renewal of the post installation facility (SU 122) with additional stones (SUs 24, 33).

The next following younger floor (SU 45) stretched over an area of 5.90 × 4.80 m. Later intrusions dating to the Metal Ages are evident, especially in square S22, but the Starčevo materials dominate the assemblage. The succeeding floors SUs 25 and 30 above presumably belong to one use horizon. They are again composed of hard to very hard clayish soil with abundant finds and can be linked with a contemporaneous small platform (SU 26) of burnt daub and a small pit (IF 35); all features of the youngest horizon have been presented already.[11]

While the potential inner part of this 'Starčevo house' with its five use horizons shows abundant materials in fragmented, scattered, dense and horizontal position, the layers east of the north-south post installation line are different (Figs. 8–9). The darker (and partially not so hard) soil of these layers (SUs 72, 107) contains only very small and highly fragmented finds. The remains of one storage vessel (SU 87) can be associated with this horizon and indicate the trampling/floor level. Although further detailed analyses

11 See also Horejs et al. 2019a, 184, 187 and Fig. 9; 190, 192–193 and Figs. 14–15.

Fig. 8. Overview of the 'Starčevo house' in trench S1/T22 with post installation structures in a row composed of massive stone plates (left: SU 101. – right: SU 100) associated with pits (from left to right: IF 116, 125, 126). The remains of a storage vessel (SU 87) and a pyrotechnical installation (SU 85) inside the building belong to the same use horizon (Photo and graphics: F. Ostmann).

are required, our preliminary interpretation suggests another spatial function compared to the floors further west, perhaps an outdoor area associated with the 'house'. Radiocarbon dating supports this interpretation and shows a contemporaneous use of this space with the potential hearth (SU 85) and the earlier floors (SUs 124, 123, 120, 103) of the house (Figs. 6, 11).

Overall, the Starčevo remains in trench S1/S–T22 show intensive domestic activities in this area that can be linked to a built structure preliminarily interpreted as a 'Starčevo house'. Within the dimensions of at least 7.50 × 4.30 m, large stone slabs indicate wooden post footings or beddings, of which one in the inner part has been renewed. So far, it has been possible to identify five floors associated with various installations (platform, hearth, pits, storage), supporting the reconstruction of a domestic space in use during the 57th and 56th centuries BC.

2.3. Metal Ages and Post-Prehistory

The new excavated features from the Metal Ages are presented in detail below (see chapter 11) and will be summarised only roughly. Additional pure contexts of the Eneolithic, as previously recovered in trench S1, are not attested yet, although pottery of the 4th millennium BC is evident as a few later intrusions in some Starčevo layers. Presumable pits or dug-ins of this period were hardly visible in the soil so far. The already indicated potential Middle Bronze Age occupation of the river terrace is supported by a large pit feature recovered in trench N1 dug into the Starčevo Neolithic layers (SU 1050) described above. The domestic use of the terrace during the Late Bronze Age is evident due to the newly recovered remains of a house in trench S1. The Early Iron Age (c. 1000 BC) evidence already attested by pits in trench S1 is supplemented with further domestic features of comparable dating in the same area (squares S–T/20–21) as well as in trench N1. Some later materials at the site indicate short-term activities after the prehistory. One shallow pit feature in trench N1, square T28 (IF 1072, SU 1037) was excavated and defined by Ivan Bugarski, an expert from the Caričin Grad team. Thanks to this team's engagement, these remains are dated to the 15th–16th centuries AD.

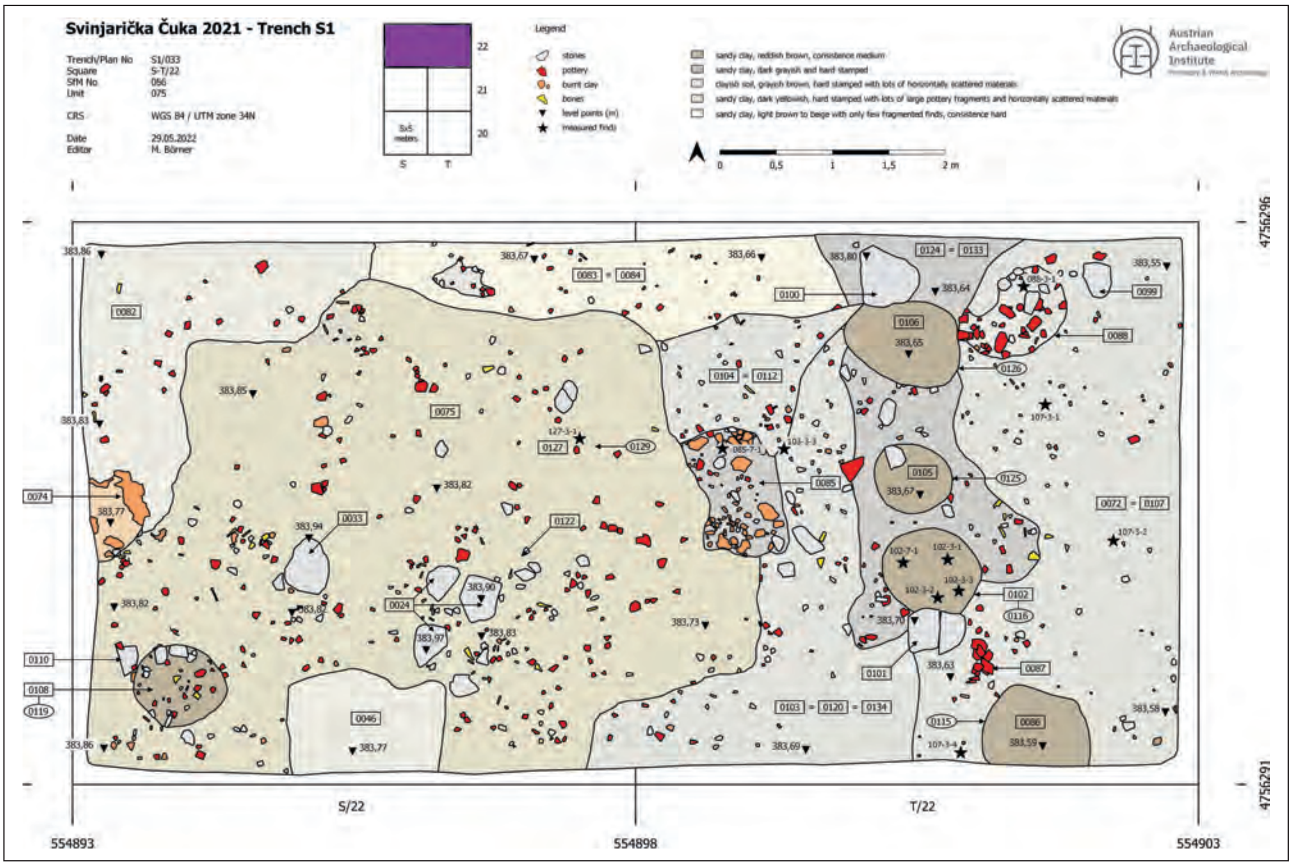


Fig. 9. Detailed mapping of the layers in trench S1, squares S–T/22 of the later phase in the 'Starčevo house' with floors (SU 75) and the architectural remains of pits and wooden-post beddings in the east (SUs 100, 102; IF 116, 105, 106) and the west (central?) part (SUs 102, 24, 33) (Graphics: M. Börner, B. Horejs).

3. Radiocarbon Dating

Twenty-six samples from Neolithic horizons at Svinjarička Čuka have thus far been radiocarbon dated: 19 from trench S1 and seven from trench N1 (Tab. 1). Each represents short-lived material (charred seeds) retrieved by flotation from the series of use horizons. Here we also consider one result (MAMS-34883) from a survey core, since the sample (charcoal) represents a deposit underlying all excavated strata in trench S1. All measurements except one were carried out in the AMS radiocarbon laboratory of the Curt-Engelhorn-Centre for Archaeometry in Mannheim. One measurement was made at the Leibniz AMS laboratory at Kiel University. The radiocarbon ages (^{14}C years before present, BP) and individual calibrated dates (BC; 68.3 % and 95.4 % probability ranges) are reported in Tab. 1. Calibration was undertaken using OxCal v4.4.2 and the IntCal20 curve interpolated to yearly intervals (Resolution = 1).[12]

The dates from all horizons consistently place Neolithic activity at Svinjarička Čuka between c. 5800 BC and 5400 BC (Fig. 10). The survey core date falls markedly earlier, in the late 7th millennium, and may hint at earlier horizons not yet exposed in the excavation. One date from trench N1 and four from trench S1 are obviously outliers (not shown in Fig. 10); four point to late 2nd-millennium BC activity, while one date in trench S1 belongs to the mid-4th millennium BC. Notably, these obvious outliers come from the upper portion of the Neolithic sequences in both trenches, where the risk of intrusive material is higher. Since the samples represent a series of overlying use horizons (shown schematically in Fig. 11), using a Bayesian approach, we can take advantage of this *a priori* relative chronological information to help constrain the radiocarbon results.

Separate models generated in OxCal are presented for trench S1 (Fig. 12) and trench N1 (Fig. 13). These include all data from the excavation trenches except for the five clear outliers. The survey core date is simply plotted below the trench S1 sequence; since there is a substantial time gap (c. 400 years)

12 Bronk Ramsey 2009a. – Reimer et al. 2020.

Period	Lab #	Material	SU		%C	$\delta^{13}C$ (‰)†	^{14}C Age ± 1σ (years BP)	Unmodelled Calibrated Age Range (BC) 68.3 % prob.	Unmodelled Calibrated Age Range (BC) 95.4 % prob.
TRENCH S1									
EARLY NEOLITHIC / STARČEVO	MAMS-40139	emmer grain	20	deposit incl. some burnt clay	42.2	-20.5	3857 ± 21	2434–2236	2456–2208
	MAMS-40138	emmer grain	22	deposit incl. finds, burnt clay and patches of charcoal	56.5	-23.2	6597 ± 24	5610–5483	5616–5480
	MAMS-40137	emmer grain	22	deposit incl. finds, burnt clay and patches of charcoal	59.6	-22.0	6611 ± 24	5612–5486	5619–5482
	MAMS-54201	barley grain	140	deposit with find accumulation	51.4	-19.8	3814 ± 23	2289–2204	2343–2146
	MAMS-54200	Prunus fruit stone	138	deposit with find accumulation	64.6	-15.1	6512 ± 24	5520–5409	5532–5380
STARČEVO	MAMS-40136	emmer grain	26	remains of daub structure	30.6	-23.0	6734 ± 25	5667–5623	5714–5569
	MAMS-40135	emmer grain	26	remains of daub structure	27.1	-23.6	4822 ± 24	3643–3536	3648–3528
	MAMS-46944	emmer grain	26	remains of daub structure	44.3	-21.4	6842 ± 25	5742–5671	5786–5662
	MAMS-46941	emmer grain	30	use horizon incl. finds and burnt clay	43.2	-21.8	6617 ± 25	5615–5486	5621–5482
	MAMS-46943	einkorn grain	45	use horizon incl. finds and burnt clay	42.8	-20.2	6579 ± 25	5552–5480	5611–5478
	MAMS-46942	einkorn grain	45	use horizon incl. finds and burnt clay	53.9	-26.6	3785 ± 22	2281–2146	2289–2141
	KIA-56229	Timopheev's wheat grain	50	deposit with burnt clay	62.0	-21.0	6625 ± 35	5618–5486	5623–5482
	MAMS-54194	barley grain	104	use horizon with find accumulation, incl. occasional charcoal	58.8	-24.1	6613 ± 29	5615–5485	5620–5481
	MAMS-54193	barley grain	103	use horizon with find accumulation	55.8	-29.2	6791 ± 31	5718–5661	5728–5632
	MAMS-54197	emmer grain	120	use horizon with find accumulation, incl. few charcoal fragments	58.0	-19.6	6642 ± 30	5622–5540	5627–5484
	MAMS-54198	hulled barley grain	123	use horizon with find accumulation	47.2	-26.5	6612 ± 31	5615–5485	5620–5480
	MAMS-54192	hazelnut shell	85	accumulation of daub	63.8	-24.4	6606 ± 29	5612–5484	5618–5481
	MAMS-54195	einkorn grain	107	use horizon incl. plentiful daub	59.3	-22.7	6579 ± 30	5553–5480	5613–5478
	MAMS-54199	barley grain	124	use horizon with find accumulation	51.2	-23.7	6846 ± 30	5750–5669	5801–5656
TRENCH N1									
NEOLITHIC	MAMS-46945	emmer grain	1024	remains of daub structure	55.9	-22.8	3770 ± 22	2275–2141	2287–2062
	MAMS-46948	emmer grain	1060	deposit within pit	57.3	-20.7	6585 ± 26	5555–5481	5612–5479
	MAMS-54204	Cornelian cherry fruit stone	1104	use horizon with dense concentration of finds	62.9	-20.5	6762 ± 25	5709–5632	5718–5627
	MAMS-54202	barley grain	1061	use horizon, incl. plentiful daub	59.6	-21.1	6465 ± 25	5473–5386	5479–5374
	MAMS-54203	barley grain	1089	use horizon	57.3	-17.4	6533 ± 24	5525–5474	5608–5411
	MAMS-54205	barley grain	1129	use horizon and clay floor, with small charcoal pieces and burnt clay	48.5	-19.9	6528 ± 25	5527–5473	5557–5388
	MAMS-54206	pea seed	1134	use horizon with scattered charcoal	61.7	-58.6	6488 ± 34	5479–5385	5521–5371
SURVEY CORE SAMPLE									
	MAMS-34883	charcoal	§68	core PR07 220 cm depth	0.5	-32.9	7221 ± 31	6087–6021	6220–6011

Tab. 1. Radiocarbon dates from Neolithic levels of Svinjarička Čuka († $\delta^{13}C$ error is 2 ‰).

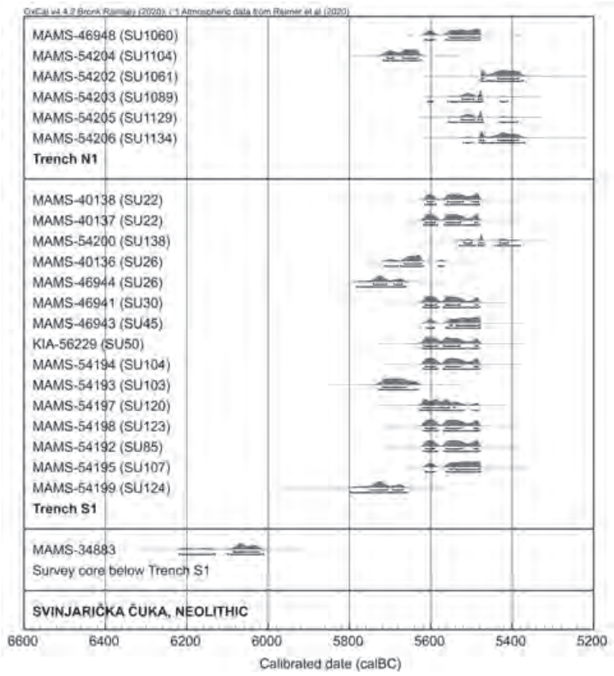


Fig. 10. Independently calibrated dates from Neolithic levels. Bars indicate 68.3 % and 95.4 % probability ranges (Graphics: L. Webster).

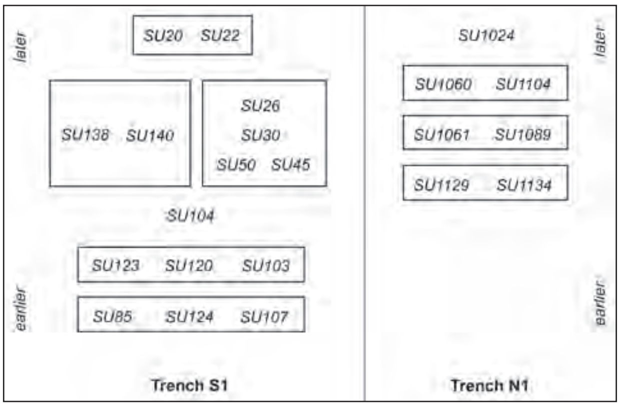


Fig. 11. Schematic of relative chronological order assumed for the Bayesian models, based on stratigraphy (Graphics: L. Webster).

between this date and the excavation sequence, including it in the model adds no useful constraint. OxCal's outlier functionality is applied in the models to help identify and downweigh poorly fitting data.[13] Dates are assigned an initial 5 % *prior* probability of being an outlier, and the model calculates a *posterior* outlier probability, assuming that outliers follow a Student's *t* distribution.[14]

The Bayesian models date the Neolithic activity exposed in trench N1 close to 5500 BC (5525–5470 BC, 68.3 %; 5560–5375 BC, 95.4 %). The upper Neolithic layers of trench S1 seem to reflect the same timeframe, though the multi-mode result caused by the shape of the calibration curve allows some probability (~16 %) close to 5600 BC. The lower part of the S1 sequence likely reflects activity between 5625 and 5525 BC (68.3 %).

4. Starčevo Pottery Analyses

All the Neolithic pottery from well-defined Starčevo stratigraphical units excavated to date has been processed, photographed and undergone basic statistical recording. In addition, nearly 4000 diagnostic Starčevo fragments (rims, bases, handles and decorated wall sherds, see Fig. 14) have been recorded in the project database in terms of dimensions, decoration, ware group and aspects of their production. The sherds recorded in the database form the basis of the proportional estimations of the different pottery types discussed below in order to provide a provisional overview of the assemblage to date whilst excavations, pottery recording and refitting work is ongoing. There is no discernible difference between the types of pottery found in the north and south trenches, with joins found for vessels between the trenches (SU 1054 joins with SU 51) which suggests movement of pottery across the site generally. As such, the pottery will be discussed together to give an overall impression of the repertoire of shapes in use at the site, followed by a more detailed discussion of the pottery associated with the possible 'Starčevo house' in the south trench.

To complement the typological work, 48 sherds from the site are currently undergoing raw material and technological analysis, the results of which will be published in a separate article focused on pottery production. In summary, the technological and raw materials analysis has confirmed macroscopic observations[15] that the pottery was made using a limited variety of silicate-rich sandy raw materials, geologically compatible to the area surrounding the site, and often with the addition of organic temper (Fig. 15). Additionally, the pottery was made and decorated using a range of different techniques and tools to achieve different finishes, such as the layering of wet clay onto a vessel to produce barbotine

13 Bronk Ramsey 2009b.

14 For example, with a 100 % posterior outlier probability, MAMS-46944 [O:100/5] is identified as a likely outlier and its influence accordingly downweighted; MAMS-46941 [O:2/5] is unlikely to be an outlier. Note that fully removing dates with a high posterior outlier probability from the trench N1 and S1 models does not substantially affect the outcome; it is preferable instead to allow the model to downweigh them.

15 Horejs et al 2019a, 194. – Burke 2022a, 73–74.

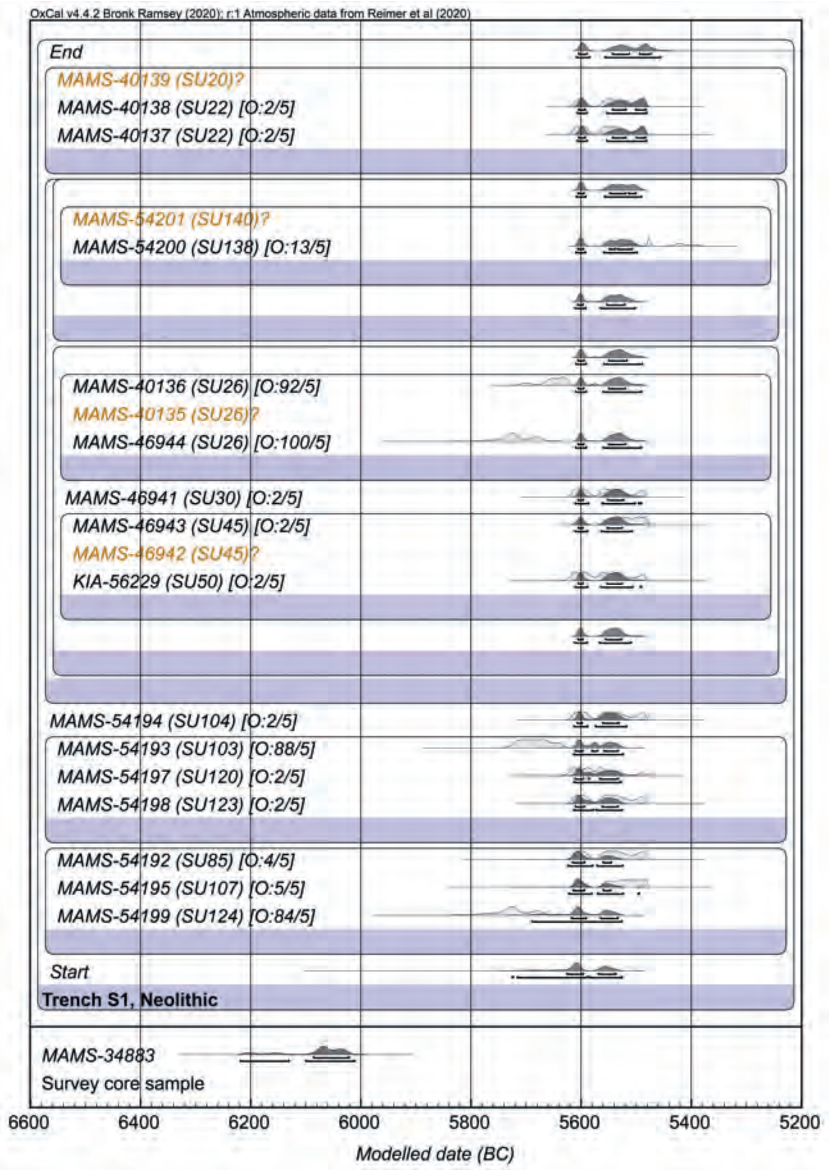


Fig. 12. Bayesian model for the Neolithic in trench S1. Independently calibrated dates before modelling appear in light grey; posterior probability distributions after modelling are shown in dark grey, with 68.3 % and 95.4 % probability ranges indicated. Dates coloured brown (followed by '?') indicate where obvious outliers (younger by millennia) have been excluded. MAMS-34883 (survey core sample) is not included in the model, but simply plotted below (Graphics: L. Webster).

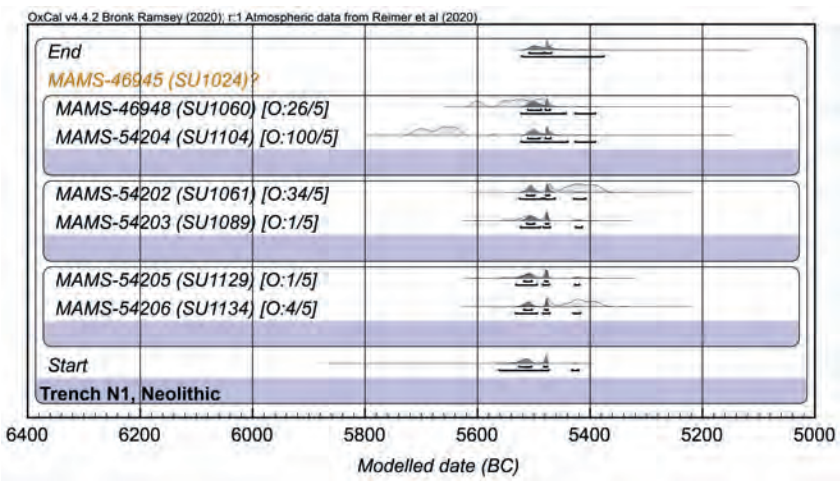


Fig. 13. Bayesian model for the Neolithic in trench N1 (Graphics: L. Webster).

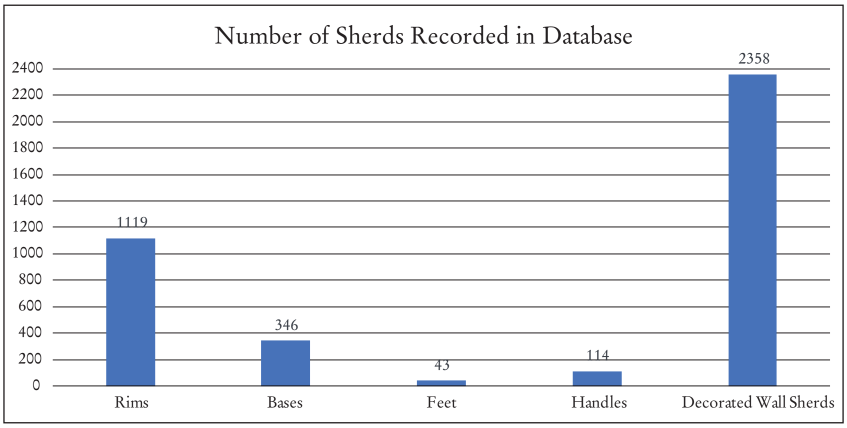


Fig. 14. Graph showing the proportion of different diagnostic sherd categories recorded in the project database up until April 2022 (Graphics: C. Burke).

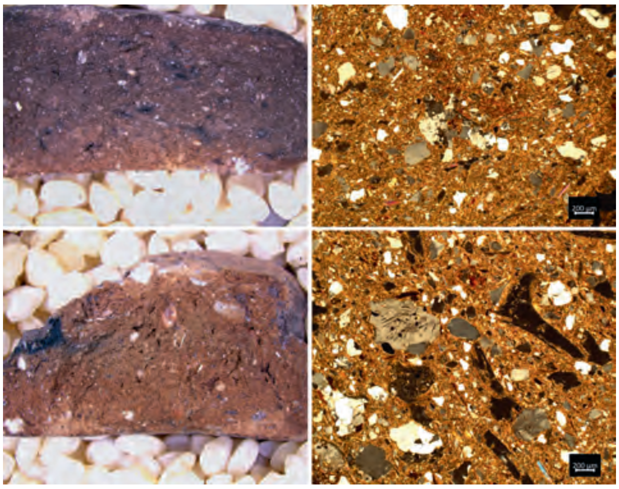


Fig. 15. Macro and micro images of the silicate rich sandy fabrics at Svinjarička Čuka, the bottom image also showing dark elongated remains of organic temper (Photos: C. Burke).

finishes. The varied techniques used are indicative of production by multiple potters who had different approaches to their craft but shared raw material choices in relation to utilising clay sources within the local environment of the site and shared ideas of what the vessel should look like, no doubt more heavily informed by consumer preferences as well as their own cultural context of learning. These results are comparable to technological practices and raw material choices found in other analytical studies of Starčevo pottery from sites across southeast Europe[16] indicative of a broader Starčevo ceramic koine.

As with all Starčevo assemblages, the pottery at Svinjarička Čuka is broadly divided between jars (207 diagnostic sherds in database) and bowls (730 diagnostic sherds in database) (Figs. 16–17), with excavation of deeper layers during 2021 and additional refitting work at the National Museum Leskovac, helping to expand the previously published range of shape variation.[17]

Jars and thick-walled large shapes can be more difficult to identify compared to fine ware and painted bowls due to a lack of diagnostic features, particularly in relation to wall sherds and some smaller jar types sharing similar rim profiles to unpainted bowl types. However, those that are definitely categorised as jars can be roughly divided between smaller and larger types, the largest being classified as storage jars due to their profile and diagnostic dimensions (with an average wall thickness of 2 cm and average rim diameter of 30 cm). Their large sizes suggest they were probably quite cumbersome and less portable than other jar types, although there is, of course, the possibility of a range of different functions.[18] The larger jars are usually globular with slightly flaring rims or with a short neck/collar, whilst medium to smaller types, which are more common, display globular, conical or pear-shaped profiles, and include funnel necks and narrow conical mouths (Fig. 16). Jars can display horizontal or vertical loop handles, with smaller varieties including pierced knob handles on the belly, most likely for hanging the vessel up. The jar profiles and rim types are especially comparable to types LO00, LO10, LO30, LO40, LO50 and LO60 at Blagotin[19] and similar to the Early

16 Kreiter et al. 2013. – Dzhanfezova, Doherty, Elenski 2014. – Vuković, Svilar 2016. – de Groot 2019. – Spataro 2019. – Spataro et al. 2019. – Dzhanfezova, Doherty, Grębska-Kulow 2020. – Papadakou, Kotsakis, Urem-Kotsou 2021.

17 Horejs et al. 2019a. – Burke 2022a. – Burke 2022b.

18 Burke 2022a, 77.

19 Vuković 2004, 151–153.

Fig. 16. Examples of jar profiles from Svinjarička Čuka. – Top row left to right: pear-shaped jar from SU 87, globular jar with flaring rim from SU 1047. – Bottom row left to right: conical-necked jar from SU 1044, funnel neck amphora from SU 124, globular-biconical closed vessel from SU 45 (Graphics: D. Blattner, M. Börner).

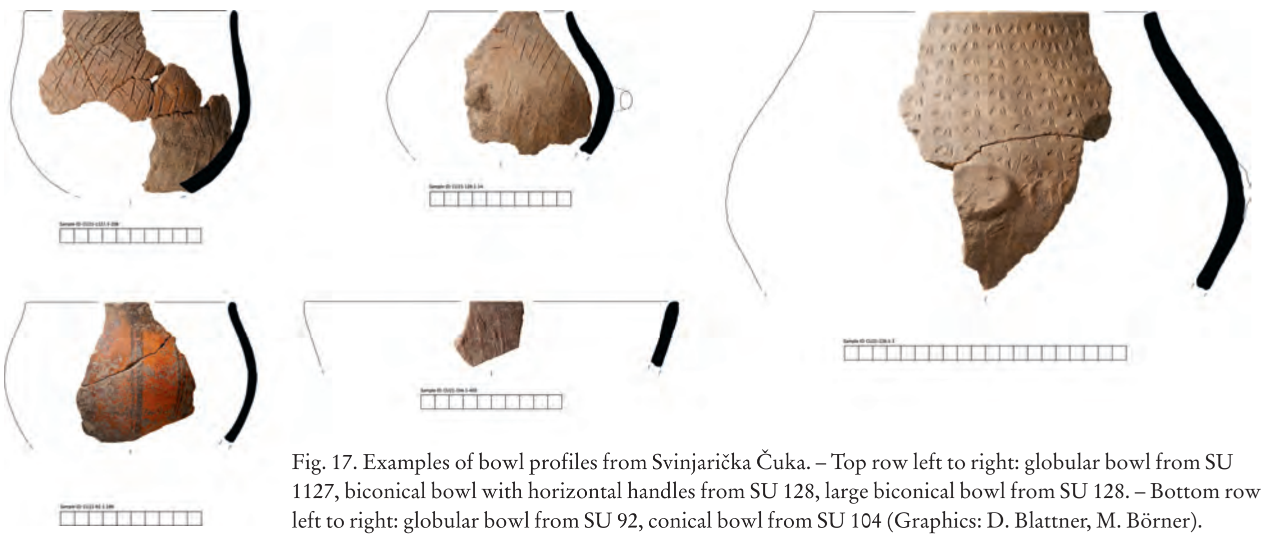


Fig. 17. Examples of bowl profiles from Svinjarička Čuka. – Top row left to right: globular bowl from SU 1127, biconical bowl with horizontal handles from SU 128, large biconical bowl from SU 128. – Bottom row left to right: globular bowl from SU 92, conical bowl from SU 104 (Graphics: D. Blattner, M. Börner).

Neolithic profiles at Lepenski Vir[20] and Gălăbnik phases VI–IX.[21]

Like the jars, bowls can be broadly divided between smaller and larger shapes, the former being more abundant in the assemblage. Larger types, with an average rim diameter of 30 cm and wall thickness of 1 cm, are usually conical, globular, or in some cases, biconical in shape (Fig. 17) and most likely relate to larger-scale activities compared

20 Perić, Nikolić 2016, 252 and Fig. 212.
21 Pavúk, Bakamska 2021, 122–126.

Fig. 18. Examples of surface modification and decorative styles (Photos: F. Ostmann, N. Pantic).

to the more abundant smaller types. The smaller varieties have an average rim diameter between 16 and 20 cm and a wall thickness of 0.6 cm, and are often biconical with either a sharp or more rounded carination at the belly, accompanied by globular and hemispherical to S-profile types. The bowl shapes at Svinjarička Čuka are comparable to profiles from many Starčevo sites both within and outside of Serbia, such as Blagotin (e.g. types ZL00 ZL40, ZL50 and ZP00),[22] Starčevo Grad,[23] Alsónyék,[24] Gălăbnik VII–X[25] and Balgarchevo I, particularly bowl type 2.2b.[26] However, at Svinjarička Čuka monochrome polished or burnished finishes are not common. Instead, surfaces are predominantly treated with barbotine, roughened, incised or painted finishes, indicative of being later in the Starčevo sequence (see below). As previously discussed,[27] the majority of the recorded pottery at Svinjarička Čuka is unpainted (Fig. 18), dominated by roughened or pseudo barbotine (35 %) and barbotine types (12 %), alongside incised wares (12 %), accompanied by smaller amounts of impressed (1 %) and 'Impresso' wares (<1 %). Smoothed, polished and burnished surfaces, and surfaces with applied decoration combined make up approximately 12 % of the fully recorded assemblage that displays some form of surface modification.

Barbotine is divided between structured barbotine, where there are vertical grooves and striations on the vessel, and the unstructured variety, where the surface displays clay droplets and an unorganised patterning, whilst roughened surfaces display no striking features. Both barbotine and roughened surfaces appear on a wide variety of vessel shapes and sizes, from large storage jars to small bowls, although notably, these finishes are more common on jars and conical bowl shapes. The broad distribution of these surface finishes demonstrates that they are not associated with a specific functional class, vessel size, or consumption activity at Svinjarička Čuka, but are more likely related to general aesthetic qualities and pottery sets. Incised pottery is usually linear with chevron, zig-zag and cross-hatch designs, the former being common on biconical bowls in particular but also including small and medium jar shapes. These finishes and motifs are consistent with those of other Starčevo assemblages such as linear incised pottery at Grivac II–III,[28] Blagotin,[29] and Donja Branjevina;[30] the small number of applied cordons also find parallels at Donja Branjevina such as the zig-zag type,[31] as do the rosettes of both barbotine and incised style.[32] The Impresso wares encompass a variety of motifs and decorative techniques, being both impressed and incised, with and without tools, and represent a type of

22 Vuković 2004, 152–153.
23 Arandjelović, Garašanin 1954, 69–73.
24 Oross et al. 2016, 97–98.
25 Pavúk, Bakamska 2021, 108–109, 158–162.
26 Pernicheva-Perets, Grębska-Kulow, Kulov 2011, 175.
27 Horejs et al. 2019a. – Burke 2022a. – Burke 2022b.

28 Bogdanović 2008a, 102.
29 Vuković 2004, 148.
30 Karmanski 2005, 306 and Pl. CCIX.
31 Karmanski 2005, 112 and Pl. XXVIII.
32 Karmanski 2005, 302 and Pl. CCV.

SU	Rims	Bases	Decorated Wall Sherds	Handles	Total Diagnostic Sherds	Undiagnostic Wall Sherds
45	195	59	486	20	760	1608
72	22	11	64	4	101	336
75	65	31	210	9	315	399
104	184	50	477	19	730	1030
107	41	15	131	3	190	565
120	40	12	121	2	175	189
123	28	15	67	5	115	143
124	10	3	25	0	38	61
130	6	2	21	1	30	21

Tab. 2. Overview of pottery statistics and broad dating for SUs associated with the possible 'Starčevo house'.

surface decoration that has a very large distribution which has formed a central focus in discussions of spheres of cultural influence and contact.[33] The motifs and techniques of execution at Svinjarička Čuka correspond particularly well with those analysed at Pavlovac,[34] as well as Impresso types at Blagotin, and outside of Serbia, such as at Galovo in Croatia[35] and Anzabegovo in North Macedonia.[36]

Pottery with slipped or coated surfaces (Fig. 18) accounts for up to 20 % of the fully recorded assemblage, whilst painted pottery forms less than 6 %; certainly, the low proportion of painted pottery is typical of Starčevo assemblages. Slipped or coated surfaces at Svinjarička Čuka are usually red in colour, alongside smaller amounts of cream-buff examples. Painted motifs can appear on pottery that is slipped or on vessels that do not appear to have been coated first but are commonly polished or burnished. Motifs on the pottery recorded to date are commonly black linear, spiraloid or curvilinear, although a small number of red painted and some brown painted sherds have also been excavated in 2021 (both less than 1 % of the pottery recorded to date). The motifs on the pottery have parallels to Starčevo sites across southeast Europe such as Starčevo Grad,[37] Alsónyék,[38] and Gălăbnik VIII–X.[39] There are particularly striking parallels to the black on red spiral, and the brown on brown painted spiraloid motifs from Balgarchevo I[40] and parallels to brown on orange motifs from Anzabegovo II (spiraloid) and III (linear),[41] all of which usually occur on similar bowl shapes.

The range of sizes, shapes and decorative styles found at Svinjarička Čuka suggests not only a degree of chronological variation between earlier and later phases, but also different contexts and methods of use for these vessels that probably included food preparation, potential craft activities and small-scale storage.[42]

4.1. Pottery from the Potential 'Starčevo House'

This section will discuss the pottery from SUs 45, 72, 75, 104, 107, 120, 123, 124 and 130 (See Tab. 1 for overview). Of these SUs, 45, 75 and 104 have had all their diagnostic sherds entered into the project database, whilst the remaining SUs have undergone basic processing, photographic and statistical recording. Generally, all SUs contain five or fewer sherds from later periods, whilst SUs 124 and 130 have no later material; as such, all layers are considered as Starčevo.

The pottery from this area is commonly fragmented and abraded, and whilst it was not possible to identify a specific distribution pattern for particular pottery types, it was notable that certain SU and grid squares contained higher sherd counts and better-preserved sherds with more joins. In general, the SUs associated with the potential structure yielded a very varied repertoire of shapes and surface finishes, from storage jars to painted bowls (Fig. 19). Of particular

33 Çilingiroğlu 2010.
34 Vuković, Svilar 2016.
35 Minichreiter 2007.
36 Gimbutas 1976, 55.
37 Fewkes, Goldman, Ehrich 1933, 45–45.
38 Oross et al. 2016, 96–98.
39 Pavúk, Bakamska 2021, 156–171.
40 Pernicheva-Perets, Grębska-Kulow, Kulov 2011, 457–458 and Pls. I/5–14, II/1–7.
41 Gimbutas 1976, 55–64.
42 Burke 2022a.

note was the presence of a number of monochrome sherds belonging to a large globular vessel from SU 75 that could be partially refitted (Fig. 19/left image in row two). Additionally, SUs 104, 123 and 124 contained many of the best-preserved sherds and refits, suggesting that the pottery had not moved around as much as in other SUs, with a good mix of bowl and jar types. Of special note was a dark linear painted bowl refitted from SUs 104 and 123 (Fig. 18/middle of row four) whose decoration is a direct match for a dark linear painted piece from the nearby site of Čekmin,[43] highlighting strong local typo-technological traditions. The area also yielded several pieces of a spiraloid bowl (Fig. 19/row one) and well-executed linear incised decorated pottery (Fig. 19/row two).

Also of note was the high number of pedestal bases in this area (18 fully recorded to date, 10 of which come from SU 45 alone), including an unusual red pedestal base with a curvy profile from SU 104 (Fig.19/left image in row three), for which, although it is similar to tripod bases published from other sites such as Donja Branjevina,[44] we have yet to find an exact match. Additionally, there were a number of semi-pierced pedestal bases in relatively close proximity, with two in grid A4 of SU 75 and one in grid B4 of SU 104. As discussed elsewhere,[45] the semi-frilled holes are from secondary use of these bases and may be related to something like a bow drill, and whilst pedestal bases, including those with such holes have been found in other parts of the site, they are not usually found in this abundance in close proximity. As such, the examples within these SUs may relate to original activities within the potential 'Starčevo house'. In addition to the Starčevo ceramics, well-preserved Vinča small and large bowl types were found in SUs 45, 104 and 123 related to disturbance from a probable Vinča pit (examples in Fig. 19/right image in row four), and testify to the continued use of the site during the Neolithic. Taken together, the assemblage from the SUs associated with the potential 'Starčevo house' fit well with the pottery types and their relative proportions found from the majority of other SUs at Svinjarička Čuka. The condition of the pottery, with a high level of fragmentation but low number of refits, and the general absence of distinctive distribution patterning, suggests that the pottery was not lying within its primary context of use. Instead, it seems more likely this relates to the trampling of pottery within possible floor layers identified by the excavators, and the infilling of the potential structure after its abandonment, when it was probably used as a refuse area.

43 Bulatović, Jović 2009, 340.

44 Karmanski 2005, 165 and Pl. LXXVII.

45 Burke 2022b.

4.2. Starčevo Pottery Dating

The absence of polychrome and of white painted pottery at Svinjarička Čuka and the comparatively small amounts of Impresso ware suggest that the assemblage excavated to date is Starčevo II–III but not before Starčevo II, with similar pottery styles at Rudnik III–IV,[46] Dubrava I,[47] and Tečić.[48] The radiocarbon dating of layers containing similar pottery styles at other Starčevo sites matches the dates from Svinjarička Čuka, with such assemblages dating to between 5700/5600–5500, including those outside of Serbia, in particular related to similar painted motifs and frequencies (e.g. Alsónyék).[49] The relative proportions of the different pottery surface finishes at Svinjarička Čuka also correspond to the 5700/5600–5500 range within the large-scale study by Michela Spataro which has collated radiocarbon dates and pottery frequencies at 13 different sites.[50] Importantly, the presence of shared pottery types and styles not only shows similar chronological synchronicity to other Early Neolithic sites across southeast Europe, but also demonstrates that the community at Svinjarička Čuka subscribed to widely held ideas about what vessels should look like.

5. Lithic Analyses

As for the previous season, lithic raw materials used for chipped stone production were identified according to the methodological approach outlined in Barbara Horejs and colleagues.[51] In brief, each individual artefact was macroscopically and stereo-microscopically grouped to gain petrological and microfacies information, which helps to assign particular materials to local or extra local source regions based on our knowledge from previous raw material surveys and geological studies in the wider region.[52] The study of technological features was carried out following the *chaîne opératoire* concept, determining which stages of the lithic reduction process are present within the assemblage to gain first insights into the economic behaviour of Svinjarička Čuka's Neolithic inhabitants. For the current study, the focus was on use horizons associated with what has been interpreted as a Starčevo house structure to test

46 Dimitrijević 1974, 74. – Nikolić 2005, 55–56.

47 Nikolić 2005, 57.

48 Galović 1962 cited in Nikolić 2005, 58.

49 Oross et al. 2016, 103–106.

50 Spataro 2019, 43.

51 Horejs et al. 2019a, 202–203.

52 Brandl, Hauzenberger 2018.

Fig. 19. Examples of diagnostic pottery from SUs relating to the potential 'Starčevo house'. – Row one: SU 45. – Row two: SU 75. – Row three: SU 104. – Row four left: SU 107. – Row four right: examples including Vinča sherds from SU 123 (Photos: F. Ostmann).

Raw material	NLS local	NLS prov. indet.	NLS white	NLS/opal	'Balkan Flint'	Chert prov. indet.	Indet. burnt	Jasper	Clear quartz	Quartz
technical category	no#	no#	no#	no#	no#	no#	no#	no#	no#	no#
raw/unworked	2									
tested	2									1
pre-prep/precore	1									
cores	9							1		1
blade unretouched	9									1
blade used/retouched	6									
flakes unretouched	87									13
flakes used/retouched	10							1		
debris unretouched	138							4		
debris used/retouched	0									
minidebitage <15 mm	10									
ALL	**274**							**6**		**16**
weight in g	3642.7							72.95		201.6

Fig. 20. Lithic assemblage from SU 45 (Graphics: M. Brandl).

variability in raw material use inside in contrast to outside of the building, which is one important step towards identifying the lithic raw material economy. Additionally, the assemblage from each individual use horizon is discussed from a lithic perspective.

5.1. Sequence of Use Horizons inside the 'Starčevo House'

From youngest to oldest, the use horizons SUs 45–75–104 and 120–123–130 (interpreted as the inside area of the house) and 72=107 (outside area) as displayed in Fig. 6 were investigated, displaying different patterns of raw material and artefact distribution. In the uppermost horizon SU 45, only local lacustrine chert (NLS), jaspers and quartz were identified. Of those, NLS makes up the largest group by far, followed by quartz and only accompanied by a small number of jasper artefacts (Fig. 20).

While all elements of the *chaîne opératoire* are represented in NLS, only selected parts of the sequence are documented for the other two raw material groups. Interestingly, cores exist from all three raw material types, while unretouched flakes are entirely missing from the jasper group, which yielded one retouched flake instead. The lithic assemblage from SU 75 consists of NLS, clear quartz and vein quartz. As in SU 45, local NLS dominated this assemblage, covering all stages of lithic production from prepared nodules to discarded chipping and heat debris, which makes up the majority of all lithics in this context (Fig. 21). In the small quartz assemblage, one core is made from clear quartz and one from vein quartz, with the latter yielding few pieces of unretouched debitage.

The next oldest use horizon, SU 104, is the archaeological horizon with the richest and most diverse lithic collection (Fig. 22). This assemblage covers all lithic raw material varieties documented so far from Svinjarička Čuka, except for obsidian. Again, local cherts (NLS) represent the majority of all lithics, whereby debris and unretouched flakes clearly dominate. Except precores, all stages of the *chaîne opératoire* are present, indicating on-site production using the local material. All other materials are only present in marginal amounts. NLS of undetermined origin (including a characteristic white variety which was frequently used for modified tools) is also present in small amounts. The potential sources of those types are still the subject of ongoing raw material and provenance analyses. Jasper, a locally available resource, is only represented by five specimens; however, the total weight contrasts with this low number of pieces, showing that large nodules (one flake core and a piece of fire debris) were used at the site. Clear quartz and vein quartz occur in very small numbers, which corresponds to the general observation from this context. Worth mentioning is the presence of two blades (one of which is retouched) and two unretouched flakes produced from 'Balkan Flint' (BF), which attests to the embeddedness of the site's inhabitants within the larger socio-economic framework of the time around the middle of the 6^{th} millennium BC in the Balkans.

The lowest level of use horizons inside the Starčevo house structure is represented by SUs 120, 123 and 130 (Fig. 23). Consistently, local cherts make up the vast majority of the assemblage, with unretouched flakes and

Raw material	NLS local	NLS prov. indet.	NLS white	NLS/opal	'Balkan Flint'	Chert prov. indet.	Indet. burnt	Jasper	Clear quartz	Quartz
technical category	no#	no#	no#	no#	no#	no#	no#	no#	no#	no#
raw/unworked										
tested										
pre-prep/precore	1									
cores	2								1	1
blade unretouched	6									
blade used/retouched	2									
flakes unretouched	23									2
flakes used/retouched	1									
debris unretouched	49									
debris used/retouched	1									
minidebitage <15 mm										
ALL	**85**								**1**	**3**
weight in g	1747.7								2.5	89.2

Fig. 21. Lithic assemblage from SU 75 (Graphics: M. Brandl).

Raw material	NLS local	NLS prov. indet.	NLS white	NLS/opal	'Balkan Flint'	Chert prov. indet.	Indet. burnt	Jasper	Clear quartz	Quartz
technical category	no#	no#	no#	no#	no#	no#	no#	no#	no#	no#
raw/unworked										
tested	2									
pre-prep/precore										
cores	7	1				1		1		
blade unretouched	12				1		1	1		
blade used/retouched	4		2		1					
flakes unretouched	64			1	2	1		1	1	4
flakes used/retouched	6									1
debris unretouched	110						2	2		
debris used/retouched	1									
minidebitage <15 mm	10									
ALL	**216**	**1**	**2**	**1**	**4**	**2**	**3**	**5**	**1**	**5**
weight in g	2229.4	5.8	4.25	5.5	10.2	8.3	5.7	111	2.9	42.9

Fig. 22. Lithic assemblage from SU 104 (Graphics: M. Brandl).

debris being the dominating types. One jasper precore and an unretouched blade of opal from the same geological context as the local NLS, together with flakes produced on local quartz (one of which is additionally retouched), complete this lithic collection, which altogether fits well into the observed overall pattern of raw material use within this house structure.

The overall pattern of lithic raw material use from all use horizons within the Starčevo structure is illustrated in Fig. 24.

5.2. Use Horizons outside the 'Starčevo House'

Adjacent to the documented structure are SUs 72 and 107, which were ultimately equated. The lithic assemblage of SU 72=107 (Fig. 25) displays similar trends compared to the patterns observed inside the house structure (compare Figs. 24, 26): local NLS is the dominating raw material variety, covering most elements of the *chaîne opératoire* including minidebitage, which indicates on-site lithic production. Modified tools are represented in the form of retouched blades and flakes, demonstrating that the finished tools

Raw material	NLS local	NLS prov. indet.	NLS white	NLS/opal	'Balkan Flint'	Chert prov. indet.	Indet. burnt	Jasper	Clear quartz	Quartz
technical category	no#	no#	no#	no#	no#	no#	no#	no#	no#	no#
raw/unworked										
tested										
pre-prep/precore										
cores	6								1	1
blade unretouched	2									
blade used/retouched	2			1						
flakes unretouched	13									3
flakes used/retouched	4									1
debris unretouched	29									
debris used/retouched										
minidebitage <15 mm										
ALL	**56**			**1**				**1**		**4**
weight in g	497.2			1.2				55.7		31.2

Fig. 23. Lithic assemblage from SU 120–123–130 (Graphics: M. Brandl).

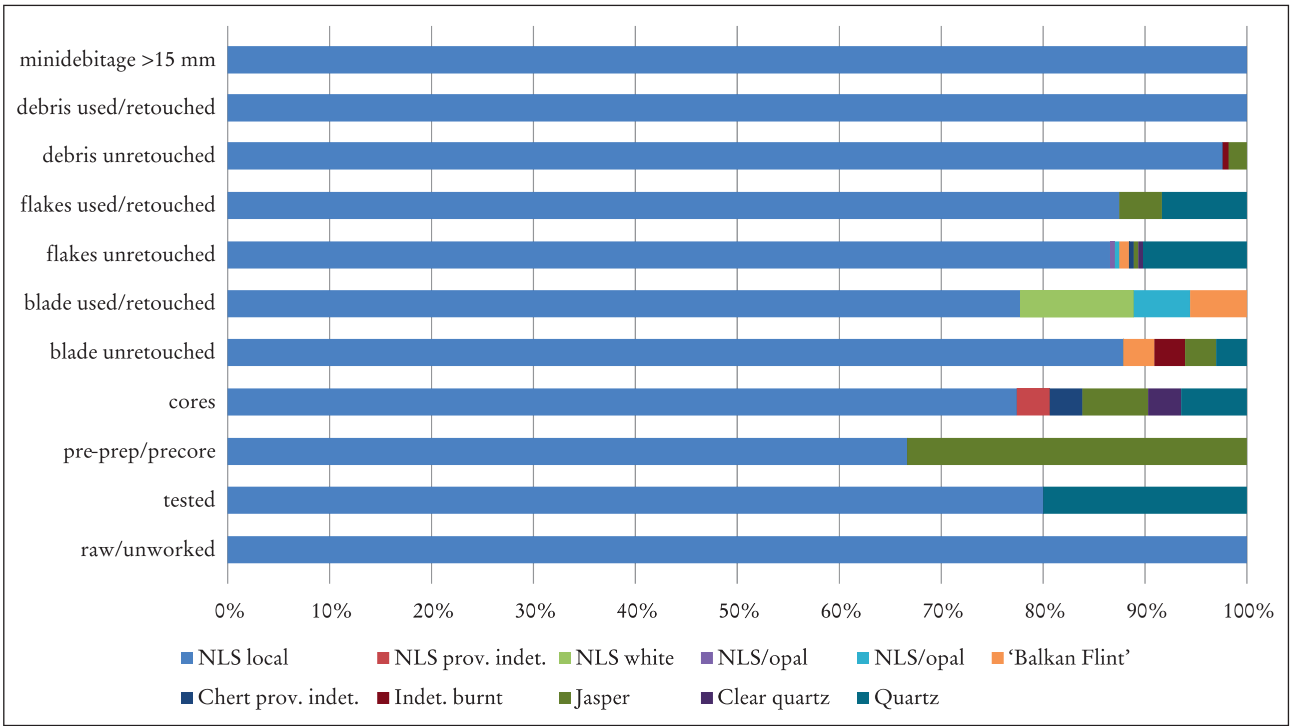


Fig. 24. Overall distribution of lithic raw materials in relation to technological elements in all use horizons inside the 'Starčevo house' (Graphics: M. Brandl).

were also readily used. Two blades from cherts (NLS) of unknown provenance, one piece of jasper debris and – like in SUs 120, 123, 130 – four quartz flakes, of which one is a retouched tool, represent the additional components of this lithic assemblage.

5.3. Conclusion

Within the investigated lithic assemblage connected to a 'Starčevo house' structure, including finds from the inside as well as outside use horizons, raw material use overall follows a consistent pattern in which local cherts of

Raw material	NLS local	NLS prov. indet.	NLS white	NLS/opal	'Balkan Flint'	Chert prov. indet.	Indet. burnt	Jasper	Clear quartz	Quartz
technical category	no#	no#	no#	no#	no#	no#	no#	no#	no#	no#
raw/unworked										
tested										
pre-prep/precore										
cores	2									
blade unretouched	1	1	1							
blade used/retouched	3									
flakes unretouched	16									3
flakes used/retouched	5									1
debris unretouched	46							1		
debris used/retouched										
minidebitage <15 mm	1									
ALL	**74**	**1**	**1**					**1**		**4**
weight in g	513.9	0.5	0.4					0.8		26.3

Fig. 25. Lithic assemblage from SU 72=107 (Graphics: M. Brandl).

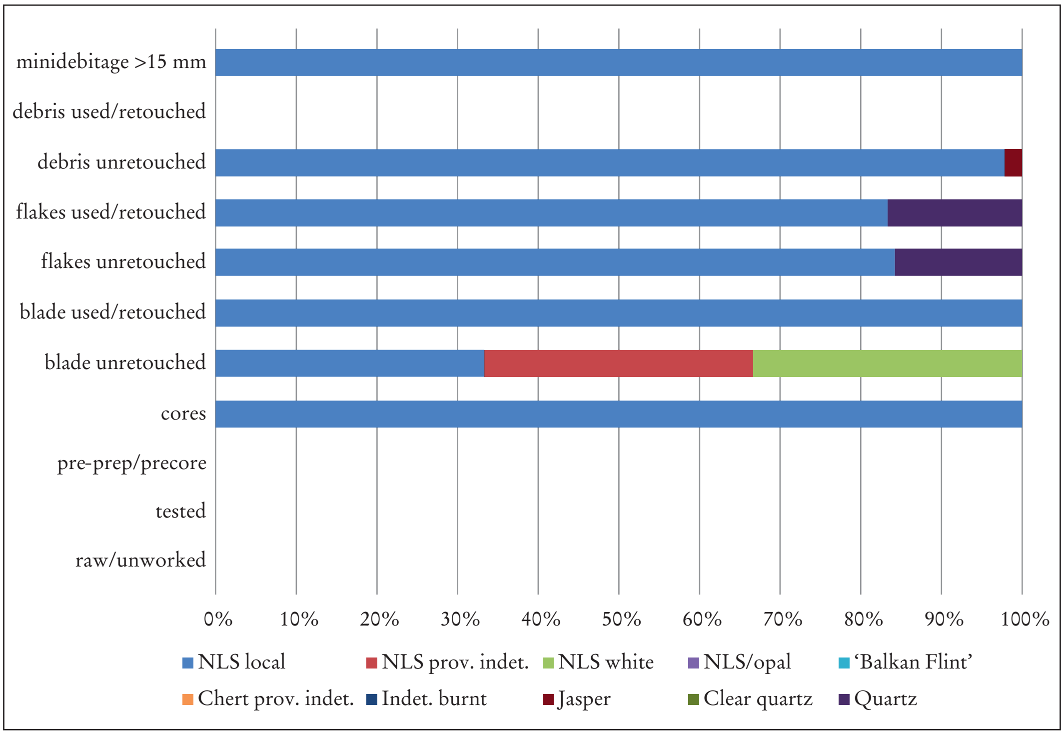


Fig. 26. Overall distribution of lithic raw materials in relation to technological elements in the use horizons outside of the Starčevo structure (SU 72=107) (Graphics: M. Brandl).

Neogene lacustrine origin (NLS) represent the dominating elements. The most diverse assemblage is connected with SU 104, which yielded the richest selection of lithic raw materials, including 'Balkan Flint' and clear quartz (Fig. 22). Technological observations based on the study of the house context point towards a basic core reduction strategy for producing simple flakes of varying sizes and shapes, predominantly using locally available raw materials (Figs. 27–28).

Additionally, blades were produced in the framework of a mixed flake-blade technology as observable from discarded cores. Consequently, both flakes and blades represent target

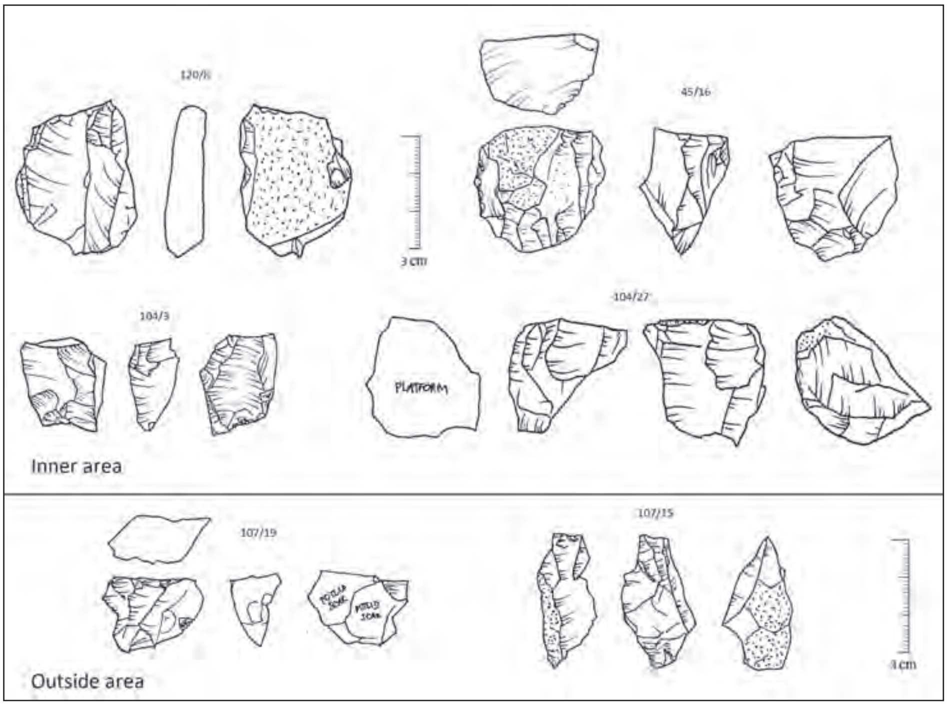


Fig. 27. Different core types from the inner and outside areas of the house structure (uni-, multidirectional and bipolar cores) (Graphics: B. Milić).

Fig. 28. Selected lithics from SU 104 illustrating elements of the *chaîne opératoire* and raw material varieties (Photo: F. Ostmann).

products as indicated by the frequency of retouched tools from both categories. The most common production method was hard hammer percussion within this generally 'expedient' technology, mainly involving cherts (NLS) of local origin, supplemented by minor components of local jasper and quartz. Cherts of unknown origin are clearly underrepresented, whereby one specific material, a white non-translucent variety, was more frequently used for regular blade production and modified tools (see Figs. 22, 25). Generally, regular blade production is very rare on local materials and is mainly attested for exogenous materials in the assemblage discussed here, for example two blade fragments (No. 2 and 21) from SU 104 produced on 'Balkan Flint'.

'Balkan Flint', a honey-yellow, high-quality raw material with characteristic white spots, has been proposed as one marker for tracing the spread of the Neolithic lifeway in the Balkans.[53] The best-known deposits of this kind of material are located in northern Bulgaria, more precisely on the Moesian platform.[54] Other potential source areas of visually similar materials were reported from the Lower Danube Valley in Romania[55] and northeastern Serbia within the wider Đerdap area.[56] Additional deposits carrying similar materials have to be expected in areas further to the south and west;[57] however, in-depth characterisation and provenance analyses of 'Balkan Flint' on a broader scale, especially beyond Bulgaria,[58] have only just commenced.

Despite these difficulties associated with the 'Balkan Flint' phenomenon, preliminary assessments are possible: the distribution of more or less standardised toolkits mainly comprising blade products (often used as sickle blades) made from this particular kind of raw material commencing around 6200 BC is closely related to the wider Karanovo I-Starčevo-Körös-Criș cultural complexes.[59] These toolkits, as well as individual pieces of 'Balkan Flint' occur in Early Neolithic sites in Bulgaria, Romania, Hungary, Serbia and North Macedonia.[60]

From this perspective, Svinjarička Čuka represents a settlement located at the southern fringe of the main 'Balkan Flint' distribution area during the Early Neolithic that was well integrated into the supra-regional economic networks at play in the Balkans, facilitating Neolithisation processes on various scales.

The enlarged dataset from the new excavations at Svinjarička Čuka enabled us to evaluate the preliminary insights we were able to gain from the lithic assemblage available in 2018. As in the specific context which was the focus of our study in this paper, the general core reduction system rests on detaching flakes and blades (to a much lesser extent than flakes) from uni- and multidirectional cores, with the use of direct hard and soft percussion in most cases. The presence of numerous hammerstones confirms the use of direct hard percussion, which is visible from cores and flakes. The recycling of old cores towards their secondary use as hammerstones speaks in favour of a full exploitation of the available material. This is also noticed from the presence of a number of exhausted cores that had often undergone repair, despite a minimal initial preparation. An expedient technology and material recycling is also visible through the existence of a quite significant number of bipolar cores and corresponding products made on an anvil, which suggests a continuous use of small nodules and various flake blanks. Only rarely does the local character relate to a more regular blade or bladelet production from the tiny cores, which appear to be executed with much more careful preparation of raw materials and core maintenance. Finally, the entire assemblage, with numerous cores, final products and knapping debris, undoubtedly shows the on-site production of tools related to local raw materials, while parts of the *chaîne opératoire* linked to the presence of other raw materials are still missing, for instance in the case of artefacts corresponding to 'Balkan Flint' and some more regular blade products from as yet unprovenanced raw materials. The previous observations,[61] including comparisons with other sites relevant for our study region and time period, e.g. Blagotin, Šalitrena pećina, Donja Branjevina, Ušće Kameničkog potoka and Knjepište,[62] were confirmed in the course of this new investigation. Beneficially, however, they now rest on a more solid database after individual raw material and technological analysis of altogether over 4000 lithic artefacts. Currently, the lithic evidence at Svinjarička Čuka appears slightly different, with the technological character of the assemblage remaining highly predetermined and influenced by locally available raw materials, knapped in an expedient way, with less curation of cores and a high percentage of flakes, in tandem with an important element associated with the recycling of raw materials and produced blanks. Moreover, comparisons of our material with assemblages from North Macedonia are important for assessing potential links with regions in the south as a special interest of the NEOTECH project. Despite variation in the published records in terms of available completed studies and discrepancies in site chronologies, we see differences in general trends of blank production, particularly related to blade-based and/or blade-oriented components, which denote the Early and Middle Neolithic (first half of the 6th millennium BC) as far as evidence from Pelagonia (Vrbjanska Čuka) and the Skopje Plain (Govrlevo) is concerned.[63] However, further evidence from Svinjarička Čuka is necessary (referring to different site phases rather than a larger assemblage size) to examine the potential connections with sites in the south such as Anzabegovo (with the initial study of chipped stones

53 See, e.g., Gurova 2012. – Gurova et al. 2016.

54 Gurova, Nachev 2008. – Gurova 2012. – Gurova et al. 2016.

55 Ciornei, Maris, Soare 2014.

56 Šarić 2003. – Antonović, Vitezović, Šarić 2019, 64.

57 See, e.g., Perlès 2001, 202.

58 Andreeva, Stefanova, Gurova 2014. – Gurova et al. 2022.

59 Gurova 2008. – Gurova et al. 2016, 423–424.

60 See, e.g., Elster 1976, 265. – Biagi, Starnini 2010. – Gurova 2012. – Biagi, Starnini 2013. – Gurova 2016.

61 Horejs et al. 2019a, 207–208.

62 Šarić 2005. – Šarić 2006. – Šarić 2014. – Bogosavljević, Petrovic, Starović 2016.

63 Mazzucco et al. 2022, 20.

Small finds from Neolithic contexts	Total	S1	N1
Polished stone tool	23	11	12
Bead	19	4	15
Bone tool	19	3	16
Ceramic object	20	9	11
'Cult table'	29	8	21
Disc	8	3	5
Figurine	35	17	18
Loom weight	58	18	40
Pendant	2	1	1
Perforated disc	22	8	14
Sling bullet	7	3	4
Spindle whorl	18	4	14
Stamp	2	1	1
Stone tool	38	15	23
Undefined/Unclear	4	0	4
Total	326	111	216

Tab. 3. Categories and amounts of Neolithic artefacts and small finds at Svinjarička Čuka 2019 and 2021.

by Ernestine S. Elster)[64] or Rug Bair,[65] which was already used for comparisons with Serbian chipped stone collections from the 6th millennium BC with regard to the role of local production and use of certain raw materials (e.g. quartz or 'Balkan Flint'), production of regular blades, and the presence of specific retouched tool types (e.g. drills scrapers, macro-blades, and geometrics).

6. Starčevo Artefacts and Small Finds

Altogether 326 artefacts and small finds have been newly excavated in the Neolithic contexts (Tab. 3). The most numerous categories in the Neolithic deposits are loom weights (58 pieces), followed by fragments of figurines (35 pieces), stone tools (23 axes/adzes, 38 miscellaneous stone tools), so-called 'cult tables' (29 pieces) and ceramic discs (22 perforated, 8 not perforated). The study of the figurines has not been accomplished yet; the detailed and contextual analyses of the artefacts are currently in progress, which is why they are only described briefly and presented summarily in this report.

6.1. Textile Production

Loom weights, spindle whorls and perforated discs indicate textile production at the site (Fig. 29). The 58 loom weights appear in all stages of fragmentation, from complete or only slightly damaged pieces to those present only as small fragments. Their forms are almost always oval or round (3–7 cm diameter), sometimes with a flattened base, and a perforation through the middle (0.60–1.60 cm diameter). Two weights show a more uncommon conical form with a flat bottom and a perforation through the top part, possibly related to a later intrusion.[66] In addition to the large number of loom weights, 18 spindle whorls with a flattened biconical form (3.50–4.40 cm diameter) and central perforation (0.50–1 cm diameter) attest to textile production at the site. Several of the spindle whorls are only roughly made with an uneven or dented surface or off-centre perforation. This also applies to the one decorated piece. Secondarily used sherds with a hole drilled through the middle and the breaks ground into a roughly circular shape are also frequently interpreted as spindle whorls,[67] although smaller pieces – especially those made from painted or slipped sherds – could have been used as beads or pendants, too.[68] Most of the perforated sherds were only present in fragments, but, where observable, their diameter (3.30–5.70 cm diameter) and perforation (0.50–1.20 cm diameter) were similar to spindle whorls. Two reused sherds were only partly perforated. Assemblages of loom weights, spindle whorls and perforated discs were also recovered in the context of the 'Starčevo house', indicating textile production within this area (Fig. 29).

6.2. Personal Ornaments

19 beads were recovered from Neolithic contexts, with the majority coming from the northern trench N1. Both beads made of stone (8 beads) and ceramic ones (11 beads) were present and measured around 1–1.30 cm in diameter. The stone beads all showed flat, disc-like shapes and were made from orange-brown stone, while most of the ceramic beads were slightly thicker but still disc-shaped. Two other ceramic beads had a biconical shape and two ceramic beads were spherical, while one of the spherical beads was hollow. Similar shapes and materials are known from Starčevo contexts in Serbia, Romania and Hungary,[69] although the orange-brown colour of the stone beads is uncommon. The flat ceramic beads also show parallels to beads recovered from Ilindentsi in southwest Bulgaria.[70] A fragment of a cylindrical ceramic pendant with a horizontal perforation and two polished and perforated bone discs probably had a similar ornamental function (Fig. 30).

64 Ester 1976.
65 Anastasova, Dimitrovska 2014.
66 McPherron et al. 1988, 337.
67 Oross, Whittle 2007. – Bogdanović 2008b.
68 McPherron, Rasson, Galdikas 1988, 325.
69 Boroneanț, Mărgărit, Bonsall 2019.
70 Grębska-Kulow, Gurova, Zidarov 2021.

Fig. 29. Tools for textile production recovered in the 'Starčevo house' (SUs 104, 120, 128) (Photo: F. Ostmann).

Fig. 30. Beads, fragment of a bangle and a bone disc from trench N1 (Photo: F. Ostmann).

Three ring-like ceramic fragments with a round cross-section, highly polished surface and a diameter of 4–6 cm and a fourth one with a trapezoidal cross-section are interpreted as fragments of ceramic bangles. Similar bangles are known from Drenovac.[71] An additional labret derived from the Neolithic layers, in this case smaller (1 cm length) and T-shaped.[72]

6.3. Stone Tools

Altogether 23 polished stones tools were recovered in Neolithic contexts, of which 13 were axes and 10 adzes, ranging from 3 cm in length and 7.5 g in weight for the smallest complete adze to 10 cm in length and 174 g in weight for the largest complete axe. Three axes show damage on the neck, possibly from secondary use as a pounder or pestle. Eight of the polished tools were only present as small fragments with less than 30 % of the original preserved, while another seven were mostly preserved but showed damage either on the chipping edge or had parts broken off, rendering them unsuitable for use. By contrast, six adzes and two axes were completely preserved and still functional, leading to the question of why they were deposited.

One intriguing context in this regard is a floor horizon of the earlier Starčevo house phase (SU 104 Fig. 9). Six polished stone tools were recovered from this layer (Fig. 31), while the find accumulations above it held no polished stone tools at all.

One of the recovered tools was present as a small fragment, but three more showed only slight damage and two adzes were completely preserved. These complete adzes were, however, much more roughly made than similar tools from the site, with their surface only cursorily polished and uneven parts of the stone ignored. Evidence for stone tool production at the site comes from one of the slightly damaged pieces in this context, a semi-finished product. A smoothed blank was only partly, but finely polished on one side, with the other side left rough. A break at the top might have been the reason for it being discarded. A stone fragment chipped from a larger stone tool, probably for recycling purposes, comes from the same layer. In addition to the polished stone tools, there were a number of miscellaneous stone tools showing signs of use, often only present as fragments. Among these are three quartz hammerstones as well as six small fragments of whetstones, which show heavy signs of use.

71 Perić 2008 and personal communication.
72 Cf. Horejs et al. 2019a, 200–201 and Fig. 3.

Fig. 31. Assemblage of polished stone tools from the earlier floor SU 104 in the 'Starčevo house' (Photo: F. Ostmann).

6.4. 'Cult Tables'

The group of the so-called 'cult tables' was enlarged by 29 additionally recovered fragments. Both triangular and square forms were present and decorations show a wide variety from impressed or incised triangles, crosshatching, linear incisions, fluting and applied knobs to a slipped and polished surface. The quality of the decoration and form varies greatly as well: roughly formed pieces with lopsided decoration as well as finely made pieces are present, which is common with 'cult tables'.[73] The legs have a U-shaped, V-shaped or round cross-section, while the receptacles are triangular or round. All of the 'cult tables' were only present in fragments, mostly of the legs, but sometimes with part of the receptacle still attached, or only fragments of the receptacle present. It is also notable that despite their characteristic decorations, which should facilitate refitting of the pieces, only one join was found for two pieces, again coming from the earlier floor SU 104 in the 'Starčevo house'.

6.5. Other Small Finds

Other newly recovered Neolithic small finds include seven sling bullets made of clay and with a biconical form, two stamps and several small ceramic 'tokens'. The two stamps were completely or almost completely preserved and both showed incised zig-zag motifs. Eight small ceramic 'tokens' in geometric shapes (4 cones, 1 round, 2 teardrop-shaped, 1 rectangular) with a length between 1.30 and 1.90 cm were recovered from different contexts, though their function remains unclear.

7. Grinding Kits and Related Analyses

Grinding and pounding tools are among the most frequent find categories in the archaeological record, as they are universal crushers for foodstuffs and other materials. Usually, they are part of the standard inventory of households, where they appear as pairs of active and passive tools (Tab. 4). The analysis of these grinding kits rather than single objects is essential to understand the functional roles of the tools.

The grinding stones from Svinjarička Čuka belong in a time frame coinciding with the start of the Neolithisation process of the central Balkans[74] and are among the earliest studied in southeastern Europe. Overall, the state of research for these tools is very inconsistent in time and space. However, in periods and regions linked to the earliest large-scale integration of cereals into the diet and the onset of agricultural societies, like the period discussed here (Starčevo-Körös-Criș, 6200–5500 BC), grinding stones have to gain

73 Cf. Horejs et al. 2019a, 200–201 and Figs. 6–10 with further literature.

74 Horejs et al. 2019a.

Terms	Other known labels	Role	Possible use	Haptic	Possible motions
Handstone Flat active tools that are held horizontal	grinder, ball, sphere, rubbing stones, Läufer, Molette, hammerstones	Active: it is moved on another surface	Grinding (= crushing by applying pressure) Pounding (= crushing by hitting) Dehusking	One or two hands, depending on the size	Horizontal: circular, oval, bidirectional flat, bidirectional pendular Vertical: bidirectional
Pestle Active tools that are held vertical	pounders for mortars, pilons, Stößel	Active: it is moved on another surface	Grinding (= crushing by applying pressure) Pounding (= crushing by hitting) Dehusking	One or two hands, depending on the size	Horizontal: bidirectional-rolling on the surface, circular-flat, bidirectional flat Vertical: bidirectional Oblique: circular-lateral
Netherstones Passive tools standing on the ground, set into the ground, or on stone pavements and other installations	grinding stones, querns, slabs, grinding dishes, mortars, mortiers, Reibsteine, Unterlieger	Passive: remains immobile during work	Grinding (= crushing by applying pressure) Pounding (= crushing by hitting) Dehusking	Lying horizontally or standing oblique	See above

Tab. 4. Overview of the terminology used.

more attention, as their role as indicators for changes in diets, innovations in cooking practices and in the development of local cuisines is a central one. For Serbia there are two main studies including Neolithic grinding tools in the analyses: a comprehensive study on all macro-lithic tools conducted by Dragana Antonović,[75] comprising finds of grinding stones from Belovode, Čučuge, Divostin, Donja Branjevina, Lepenski Vir, Supska, Velesnica, and Vinča, and a more recent study by Vesna Vučković[76] on macro-lithic tools from the central Balkans, including several grinding stones from the sites Motel Slatina, Turska Česma, Medjureč, At, Potporanj, Benska bara, Kremenilo, Vrajano, Čelina, Koraća Han, Pavlovac, Tumba Madžari; the focus is on the Late Neolithic layers of all these sites.

Fifty-nine grinding stones (including abraders) have been discovered at Svinjarička Čuka between 2019 and 2021. Their documentation was carried out through an innovative, multivariate method called *4M* (*The Multivariate Macro Micro Method*)[77] to obtain a maximum of information. The other important aim was to establish a fast and practical documentation and analysis workflow, particularly for the excavation and for research into grinding stones in general. Four *attributes* have been regarded as essential for the description of the material and the functional determination, which is the focus of our analyses (Tab. 5).

For each attribute, different documentation and analysis methods have been chosen. All attributes and the results of their analysis have then been combined in a single explanatory model to reconstruct motions during work, processing techniques, positions of the body, products processed, and a secure functional interpretation.[78]

Jenny Adams,[79] Laure Dubreuil,[80] Caroline Hamon,[81] Elspeth Hayes and colleagues[82] and Laura Dietrich[83] have described macroscopic and microscopic shapes and wear. Based on these characteristics, the following features and descriptive criteria have been defined for the attributes outlined above, with 'markers' being a combination of two or more attributes.

So far, there is evidence for three types of grinding kits and one type of abrader from the site (Fig. 32). Most Neolithic grinding stones (selected finds on Pls. 1–3) were made of vulcanite and sandstone and belong to kits 1 and 3, including a fragment of a handstone from the 'Starčevo house' (SU 104, Pl. 3/2). One other comes from a large Neolithic pit (SU 1099, Pl. 3/1), and four are reused implements found in a later context (SU 1057, Pls. 1–2).

Kit 1 is the most widespread type in the Neolithic of the central Balkans.[84] All objects from the site are heavily

75 Antonović 2003.
76 Vučković 2019.
77 Dietrich, Horejs, Brandl in preparation.
78 Dietrich, Horejs, Brandl in preparation.
79 Adams 2002. – Adams et al. 2009. – Adams 2014.
80 Dubreuil 2002. – Dubreuil et al. 2015.
81 Hamon 2008.
82 Hayes, Pardoe, Fullagar 2018.
83 Dietrich 2021a. – Dietrich 2021b.
84 Cf. Vučković 2019.

Attributes	Relevant documentation and analysis methods
1. Morphology respectively shape deformations	Macroscopic analysis and 3D documentation: photogrammetry and 3D modelling using *Reality Capture*
2. Surface topography	Computed roughness of point clouds using the open source software *CloudCompare*
3. Surface texture	Macrophotography; tactile analyses directly on objects; transfer of the results through drawing on 3D models and macrophotographs in *Procreate* (the size of the 3D models was reduced with the open access software *Meshmixer*); macroscopic analyses; geological analysis
4. Production and wear markers including residues	Macroscopic and microscopic analyses with a digital microscope at 10–20× resolution; microphotography; residue analyses by polarised light microscopy (starch and phytoliths)

Tab. 5. Attributes and relevant documentation and analysis methods.

Feature	Descriptive criteria
Flattening of the surface	strong/medium/weak
Grains	rounded/flattened/broken
Striations	deep/fine; short/long
Polish (intensity)	highly reflective/low reflective/dull
Polish (distribution)	covering/concentrated
Erosion	thinning down at sides and corners
Concaveness	thinning down in a concave shape
Wear marker 1	deep parallel gouges (large striations) with rounded and flat spots in between; fine striation on grains
Wear marker 2	flattened area with medium thick, dense striations
Wear marker 3	loose rounded spots with fine striations
Wear marker 4	field of scar negatives
Wear marker 5	extended zone with flat plateaus on grains
Wear marker 6	strong flattening, dense striations, and pigment
Burning traces	black spots
Pigments	pigments of different colours
Breakage	scar marks
Texture (tactile)	very smooth/smooth/rough
Production marker 1	flake negatives
Production marker 2	pecking in steps
Production marker 3	pecking
Curation marker 1	pecking/roughening
Curation marker 2	both sides as active working faces

Tab. 6. The descriptive criteria for the attributes and features.

used, as visible on the 3D-model surfaces after removing the coloured textures (examples on Pls. 1–3), and most of them are broken. The combined documentation through photogrammetry and macrophotography has the advantage of permitting analysis of the surface topography by removing the coloured texture (see the grey meshes on Pls. 1–3) and by using directed side lighting, which adds dimensions in comparison with the frontal light used in photogrammetry.

The combination of attributes and features indicates bi-directional grinding motions with both hands and very hard pressure as the main processing technique (Fig. 33), as well as regular roughening as maintenance and curation. Wear marker 1 (Fig. 33), which is consistent with the processing of cereals,[85] is most frequent on the Neolithic finds, including the handstone from the large pit (SU 1099, Pl. 3/1) and all four reused objects (SU 1057, Pls. 1–2).

The latter are highly interesting for the study of use wear as well as of practices of use and reuse at the site.[86] The complex is composed of four objects – three fragmented handstones (Pl. 2) and a completely preserved netherstone Pl. 1)

85 Hayes, Pardoe, Fullagar 2018.
86 Dietrich, Horejs, Brandl in preparation.

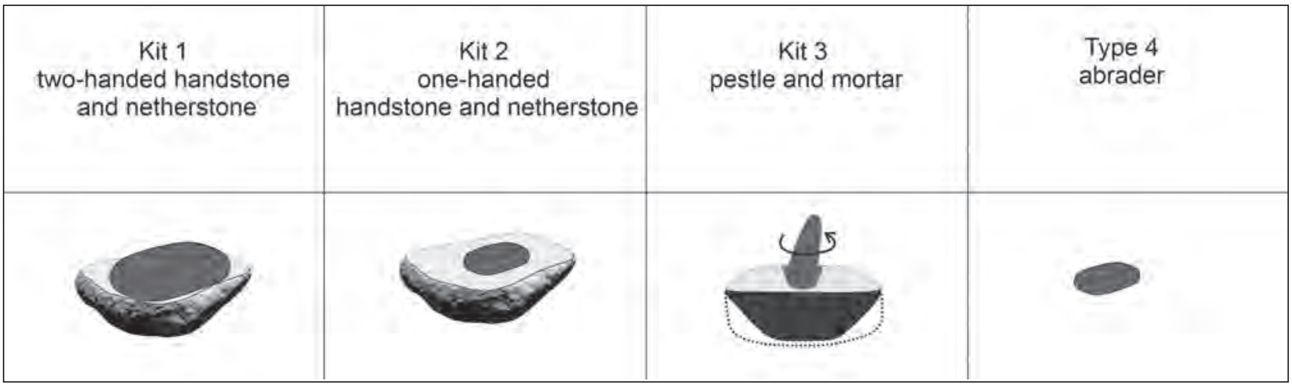


Fig. 32. Schematic reconstruction of the grinding tool types at Svinjarička Čuka (Graphics: L. Dietrich).

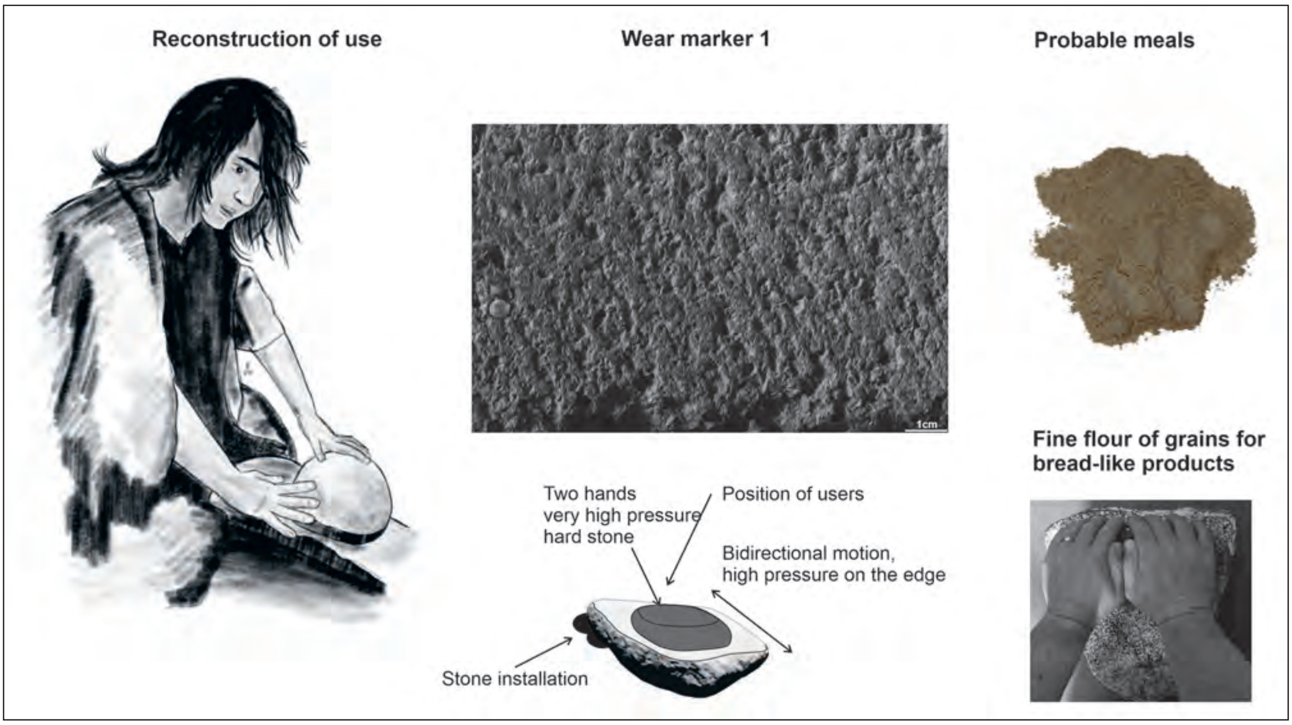


Fig. 33. Reconstruction of Neolithic kit 1 and its use at Svinjarička Čuka (Left, drawing: J. Notroff. – Middle, macrophoto and reconstruction: L. Dietrich. – Right, experimental work with einkorn: L. Dietrich).

– which have good analogies in the Neolithic[87] but were found in the fill of a Bronze Age pit (SU 1057). On the netherstone (Pl. 1), the Neolithic wear and curation markers (Tab. 6/wear markers 1, 4 and curation marker 1) are partially superposed by non-Neolithic wear markers (Tab. 6/ wear marker 2). The specific configuration of wear marker 1 shows harder pressure on one of the broad sides, indicating an initial oblique position of the netherstone during grinding, best explained by the stone being fixed in an installation. Such fixed installations on stone bases are very frequently known from ethnographic studies.[88] In this setup, during grinding, the entire body is contributing to this very exhausting task, helping to raise pressure in order to obtain fine flour from the processed grains. This has also been observed during experimental work.[89] The use-wear analysis

87 Antonović 2003. – Antonović 2006. – Vučković 2019.

88 Robitaille 2016.

89 Dietrich 2021b.

PERIOD	Stratigraphic Unit (SU)	TNF
Neolithic	23, 25, 26, 27, 30, 45, 46, 49, 50, 51, 72, 74, 75, 82, 83, 84, 85, 86, 88, 1024, 1032, 1047, 1048, 1059, 1060, 1061, 1063, 1067, 1069, 1070	2072
Eneolithic	42, 61, 63	49
MBA/LBA	1014, 1055, 1057	42
EIA	1046, 1051	412
Mixed	3, 32, 36, 37, 39, 40, 41, 43, 48, 52, 60, 67, 70, 71, 76, 77, 79, 81, 1034, 1035, 1036, 1037, 1040, 1041, 1043, 1044, 1045, 1050, 1054, 1065, 1071	2176
TOTAL	69 SUs	4751

Tab. 7. Total number of animal fragments (TNF) by period and (combined) SUs discovered at the site of Svinjarička Čuka during the 2019 excavation season.

thus indicates an original (Neolithic) use of the netherstone in a fixed installation, most probably followed by a displacement and a secondary, possibly Bronze Age, use, as its context indicates. The younger wear marker 2 covers only the centre of the netherstone, indicating secondary grinding within a kit of type 2.

Not only finds of kit type 1 but also other finds, belonging to kit type 3, indicate the use of grinding stones in fixed installations in the Neolithic. Two mortars and one pestle are currently the subject of a combined use-wear and residue analysis in order to reconstruct processing practices and the products in relation to the archaeological context. Preliminary observations indicate their use for rotary grinding, similar to Anatolian finds.[90]

In conclusion, the preliminary analysis of the grinding stones gives important insights not only into the processing practices and the use of plant food resources at Svinjarička Čuka (in addition to the macro-botanical information), but also on the Anatolian connections during the Early and Middle Neolithic. Also, it will establish a documentation methodology and practicable workflow within the 4M method to gain a maximum of information from traces on these objects.

8. Animal Remains

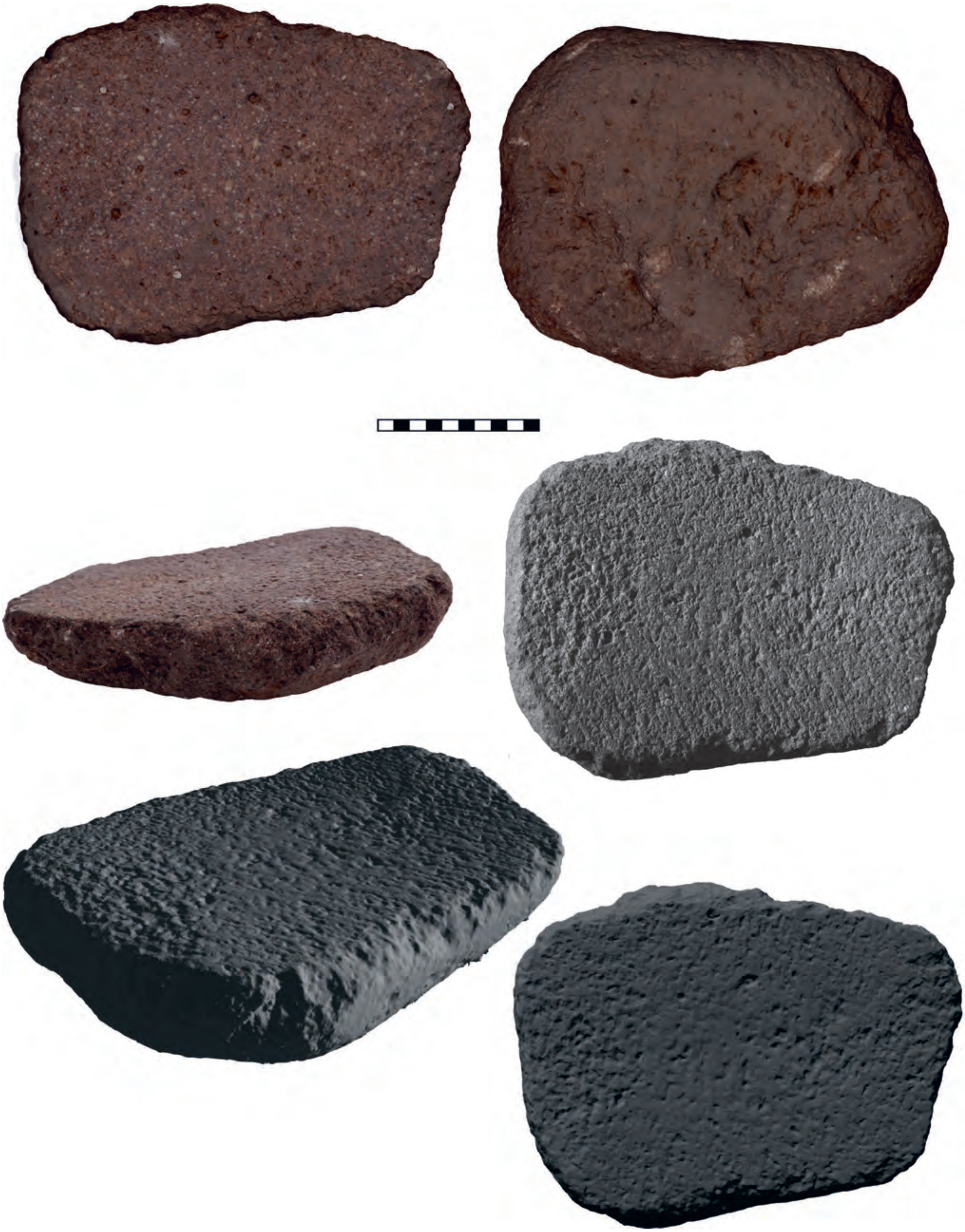
Animal remains recovered during the 2019 excavation season at the site of Svinjarička Čuka were analysed, and preliminary results are presented and discussed here, while the analysis of animal remains from 2021 is still ongoing and the results will be published additionally elsewhere. The applied recording protocol and zooarchaeological methods were the same as the ones used and described in detail previously.[91]

In total, 4751 animal remains were recovered at the site in the 2019 excavation season. Out of this total number of animal fragments (TNF) from the site, 2728 specimens were collected from the SUs excavated in trench S1, while the remaining 2023 were recovered from those in trench N1. Along with animal remains, five human skull fragments were also found. Out of the total number (69) of SUs with animal remains excavated in 2019, 30 SUs were dated to the Early Neolithic, 3 to the Eneolithic, 3 to the Middle/Late Bronze Age (MBA/LBA), and 2 to the Early Iron Age (EIA) (Tab. 7). The remaining 31 SUs (Tab. 7) are unsecure contexts, i.e. topsoil or artificial layers with relocated and mixed archaeological material from different periods, and animal remains found in them, although recorded, have not been analysed further.

8.1. Distribution of Taxa

Out of 2575 animal remains from undisturbed SUs excavated in 2019, the majority of them (80.5 %) are from SUs dated to the Early Neolithic, followed by those from the Early Iron Age (16 %), Eneolithic (1.9 %) and Middle Bronze Age/Late Bronze Age (1.6 %) (Tab. 7). Only 291 (11.3 %) animal remains from these undisturbed SUs (Tab. 7) were identified to a species or at least to a genus level due to their high level of fragmentation. This low percentage of specimens identified to the lowest taxonomic level is the consequence of their fragmentation. In general, animal remains from Svinjarička Čuka are very highly fragmented. Complete specimens constitute only 0.9 % of the sample, and except one sheep metatarsal bone from the Early Neolithic SU 75, all the others are dense and firm short bones – carpals, tarsals or phalanges. Bone fragmentation appears to have primarily been the result of human activities – butchery, marrow exploitation, tool making, or their disposal. However, although highly fragmented, the animal remains from the site of Svinjarička Čuka are well preserved, and only an extremely small proportion (around 0.2 % of the total) of mammal remains bear marks of light

90 Dietrich 2021a.
91 Horejs et al. 2019a.



Pl. 1. CU21-1057-3 (Graphics: L. Dietrich).

Pl. 2. 1. CU21-1057-4. – 2. CU21-1057-1 (Graphics: L. Dietrich).

Pl. 3. 1. CU21-1099-7-1. – 2. CU21-104-15 (Graphics: L. Dietrich).

		EARLY NEOLITHIC	ENEOLITHIC	MBA/LBA	EARLY IRON AGE
Common name	**Latin name**	NISP	NISP	NISP	NISP
Domestic cattle	*Bos taurus*	70	2	1	20
Domestic pig	*Sus domesticus*	36	1	4	14
Wild pig	*Sus scrofa*	1	/	/	/
Sheep/goat	*Ovis/Capra*	84	3	3	33
Dog	*Canis familiaris*	1	/	/	1
Horse	*Equus caballus*	/	/	/	1
Red deer	*Cervus elaphus*	8	/	/	2
Roe deer	*Capreolus capreolus*	/	/	/	1
Bear	*Ursus arctos*	1	/	/	/
Wolf	*Canis lupus*	1	/	/	/
Hare	*Lepus europaeus*	1	/	/	1
Total identified mammals		**203**	**6**	**8**	**73**
Unidentified mammals		1869	43	34	338
Frog	*Rana* sp.	/	/	/	1
TOTAL		**2072**	**49**	**42**	**412**

Tab. 8. Distribution of various animal taxa at Svinjarička Čuka by period as NISP (= Number of Identified Specimens).

surface weathering (e.g. flaking or cracking of the surface) (stage 1, following Anna K. Behrensmeyer criteria).[92] This indicates that animal remains were not exposed for a long time on the surface, and that they were buried soon after disposal.

With the exception of one humerus of a frog (*Rana* sp.), all the other recovered specimens belong to mammals (Tab. 8). In total, remains of 13 mammal species – 6 domestic and 7 wild – were identified in the 2019 faunal assemblage from Svinjarička Čuka. Except one horse calcaneus found in the Early Iron Age SU 1051, remains of all the other domesticates – cattle, pig, caprines and dog – were identified previously in the 2018 faunal assemblage from the site.[93] Remains of the following wild species were also identified in the 2019 faunal assemblage: red and roe deer, wild boar, bear, wolf and hare (Tab. 8).

Early Neolithic SUs (taken together) from trench S1 yielded more animal remains then those SUs from trench N1. Around 77 % of the Early Neolithic faunal sample was collected in SUs from trench S1. The number of animal remains varies by SUs in both trenches. Animal remains were the most numerous in SU 45 from trench S1, and this unit alone yielded 43 % of the total Early Neolithic faunal sample. Overall, remains of caprines are the most abundant and comprise 41.9 % NISP of the Early Neolithic faunal sample (Tab. 2). They are followed by domestic cattle (34.5 % NISP), domestic pig (17.7 % NISP) and red deer (3.9 % NISP). All other identified species in the Early Neolithic faunal sample – dog, wild pig, bear, wolf and hare – are represented by one specimen each. Approximately 3 % of specimens from the Early Neolithic faunal sample had visible traces of burning, and their colour ranged from black in carbonised to white in calcined specimens. Gnawing marks were noticed on 1.3 % of the specimens, while butchery marks, in the form of short and long cuts, were found in only five specimens (domestic cattle radius and humerus, caprine astragalus and rib, and red deer skull fragment). Also, seven worked-bone/tool fragments were found in the Early Neolithic SUs. Except for one domestic cattle astragalus which was used as an ad hoc tool (polisher), all the other specimens with modifications were long and metapodial bones or ribs of large(cattle)-sized mammals.

Faunal samples from the Eneolithic SUs in trench S1 and the Middle Bronze Age/Late Bronze Age SUs in trench N1 are extremely small, and due to the high fragmentation, only six and eight specimens respectively were identified to the species level (Tab. 8), all of them belonging to the main domesticates – cattle, caprines and pig. Only one domestic cattle calcaneus from the Eneolithic sample had gnawing marks, as well as one pig humerus from the Middle Bronze Age/Late Bronze Age sample. Two specimens from the Middle Bronze Age/Late Bronze Age sample were carbonised, while one long bone of medium(sheep)-sized mammal had manufacturing traces.

92 Behrensmeyer 1978.
93 Horejs et al. 2019a.

In the Early Iron Age faunal sample (Tab. 8) from the SUs in trench N1, remains of caprines comprise 45.1 % NISP, and they are followed by domestic cattle (27.4 % NISP) and domestic pig (19.2 % NISP). Other identified species are horse, dog, hare, red and roe deer. Carbonised or calcined specimens comprise 4.4 % of the Early Iron Age faunal sample, while gnawing marks were observed on 3.9 % of specimens. Only three specimens – one caprine tibia and two medium(sheep)-sized mammal ribs had butchery marks, while manufacturing traces were observed on four specimens (domestic pig tibia, two large(cattle)-sized mammal long bones and one rib).

9. Archaeobotanical Results from the Neolithic Contexts Excavated in 2018–2019 and their Place in a Broader Spatiotemporal Context

The archaeobotanical samples taken during the 2018, 2019 and 2021 excavation seasons at Svinjarička Čuka included many from the Neolithic contexts (SUs) identified in trenches S1 and N1. Results of the analysis of a subset of these samples have been described in the previous report.[94] Here, we combine the published data and observations with those generated following the 2019 excavation season. The analysis of the samples taken during the 2021 season is in progress and the results will be presented together with those that will be produced after the 2022 field season. Back in 2018, an initial set of questions was posed in relation to the preservation of plant remains and the evidence of plant production and consumption at Svinjarička Čuka.[95] The results of the first two seasons of archaeobotanical field- and laboratory work provide answers to some of them. The Neolithic evidence is particularly significant for understanding the diffusion of crops and their growing conditions in the first millennium of agricultural history of the central Balkans. This underscores the importance of the assemblage from Svinjarička Čuka in a wider spatiotemporal context.

9.1. Summary Description of the Archaeobotanical Sampling, Recovery and Analysis

Archaeological layers, features and other units of general importance to the researchers were sampled for macroscopic plant remains. A variety of contexts is represented in the archaeobotanical dataset: pits, daub structures, stratigraphic or arbitrary layers, vessel content. From large or complex SUs (e.g. pits or use surfaces), multiple samples were taken. In 2018, 38 samples from 21 contexts were selected, totalling 446 litres of sediment. In 2019, 89 samples from 24 SUs were taken, amounting to c. 1042 litres of sediment. Processing of the samples took place in the immediate vicinity of the excavation area and was done using the water tank constructed in 2018, to which water was supplied from a large plastic reservoir placed on elevated terrain. Flotation was conducted by a student (Amalia Sabanov, Belgrade) and a local worker (Đokica Kostić, Lebane), and was partly supervised by a senior flotation officer (Dragana Perovanović, Belgrade). As noted in the previous season, processing of the samples was rather time-consuming and the outcome not always satisfactory due to the water pressure being too low to break down the hard, clayey sediment. In the 2021 season, flotation was carried out in Lebane, at the location where the team was accommodated; water was supplied from the tap, and this accelerated the process.

The light and heavy fractions of the samples were collected and dried in pieces of fine-meshed cloth (with openings of less than 0.5 mm) for the floating residue, and mosquito net (with openings of 1 mm) for the non-floating material; they were subsequently transferred into labelled plastic bags for transport to the lab. Dragana Perovanović sorted heavy fractions in their entirety (100 %), with the naked eye, and extracted the following materials: plant remains (seed/fruit and wood charcoal), lithics, animal bone, pieces of malachite and beads. Light fractions were observed under a low-magnification (8×–40×) stereo-microscope and seed/fruit and wood charcoal remains were extracted, which were then combined with the remains from the respective heavy fractions. Seed/fruit remains were identified to the level of family, genus or species. Some of them were too eroded or fragmented to allow (precise) identification; they are recorded as broadly determined or indeterminate taxonomic categories. A small selection of the remains was submitted for radiocarbon dating.

Wood charcoal fragments from each sample were recorded by volume. Those from the samples attributed to Neolithic contexts were selected for anthracological analysis (see below). Three of the SUs (SUs 43, 1043 and 1051) contained large charcoal pieces; these were collected directly from the soil and wrapped up in aluminium foil. In 2019, sampling for plant micro-remains (phytoliths and starch) was also carried out in the field for the first time at a site in Serbia. Micro-botanical subsamples were selected from 14 flotation samples by taking three tablespoons of the sediment and emptying them into a clean resealable plastic bag. Another 8 samples were taken in the same way, directly from the SUs of interest – for instance, the inside of a wholly preserved pot and the area around a ground stone (possible quern base).

94 Horejs et al. 2019a.
95 Horejs et al. 2019a.

9.2. Results

So far, 68 samples (779 litres of sediment) from 12 Neolithic SUs in trenches S1 and N1 have been analysed. The taxonomic category and quantity of the remains per SU are given in Tab. 9. Many of the SUs were sampled more than once (e.g. 30 samples were selected from the use horizon SU 45). The quantities of the remains within each SU are here amalgamated because no obvious differences have been observed in the composition and richness between the samples from the same SU; detailed sample-by-sample data are available in the project's archive.

Charring was the major route of preservation; only one mineralised seed was present. Most of the remains are fragmented or heavily eroded, which conforms to their derivation from 'secondary' contexts, that is, not those in/near which they were charred (e.g. hearths, ovens, ash pits). They were redeposited in the course of the use of the site and this caused damage, particularly to cereal grains, while also being a reason for the overall low quantities of plant remains. In terms of abundance and density of plant remains in the samples from the 2019 season, they repeat the pattern seen in the samples from the previous season – both are generally low, especially in trench N1, with the majority of samples yielding less than one seed/fruit item per litre of soil. This applies to wood charcoal as well: only c. 60 ml of it was present in the samples, with 2.8 ml as a maximum in a single sample. Late intrusion into Neolithic layers from overlying deposits is documented by the presence of 3 charred grains of common millet in two samples; one of them (sample 8, SU 45) was AMS-dated to the Iron Age.[96] Intrusions are possible among other remains too, as demonstrated by some of the absolute dates on grains recovered in 2018.[97] The repertoire of plants identified in the 2019 assemblage is similar to that documented in the samples from the 2018 season. Sorting of the heavy residue was particularly useful for retrieving fragments of fruit stone of (damson) plum and shell of hazelnut. Together with the remains of Cornelian cherry and sloe, they testify to the collection and use of fruit from small trees growing along the edges of forests or woodland openings. These habitats also provided wild berries, such as those recorded in the samples (wild strawberry, raspberry, elderberry). Among crop remains, those of barley (primarily grain) are the most prominent; many of them belong to the hulled variety and perhaps this was the main cereal type grown by the Neolithic dwellers of Svinjarička Čuka. Based on the quantity and frequency of occurrence, emmer may have been the principal wheat type, followed by einkorn. The few finds of Timopheev's wheat add to the spectrum of wheat types. These three glume wheat species could have been grown in a combination, as a maslin crop, perhaps to reduce the risk of crop failure. Of the two pulses recognised in the Neolithic dataset, lentil seeds are more common than pea seeds. The assemblage of potential crop weeds (arable and ruderal plants) is floristically highly diverse. Future examination of the functional ecology of these species will shed some light on the agricultural field management and crop growing conditions.

9.3. The Neolithic Plant Evidence in a Wider Chronological and Geographical Context

A recent study used a large set of radiocarbon dates to reconstruct the population dynamics in the Neolithic central Balkans.[98] It identified two 'boom' episodes: one starting around 6250 BC and culminating towards 6000 BC; and one starting after about 5800 BC and peaking around 5600 BC. Based on the radiocarbon dates from Neolithic layers at Svinjarička Čuka, including those on crop remains, the earliest excavated traces of occupation here would fall in the second 'population boom' phase. The Pusta Reka may also have been settled in the earlier phase of Neolithisation of the central Balkans, as suggested by the results of the systematic surveys of the Leskovac Basin.[99] Evidence of an earlier Neolithic occupation would add to the so far very scarce settlement record from the end of the 7th millennium BC in the territory of Serbia; out of more than 300 Early Neolithic sites known, fewer than 30 returned pre-6th millennium BC dates.[100] Archaeobotanical analysis at a few of these sites confirmed the presence of cereals and pulses – at Blagotin (einkorn and emmer), Medjureč (wheat and barley) and Drenovac (einkorn, emmer and barley) perhaps as early as 6200 BC.[101] Moreover, at Drenovac, a large deposit of lentils and peas was discovered in a daub structure dated to the end of the 7th millennium BC.[102] These early sites are located in areas of relatively open landscape with access to different kinds of vegetation and diverse soils.[103] Svinjarička Čuka is also situated in a geographical zone characterised by different soil types, including hydromorphic and forest soils, and exposed to a sub-Mediterranean influence penetrating up

96 Filipović, Obradović, de Vareilles in press.
97 Horejs et al. 2019a, 185–186.
98 Porčić et al. 2021.
99 Horejs et al. 2018.
100 Porčić et al. 2021.
101 Jezik 1998. – Whittle et al. 2002. – Perić 2012. – Perić et al. 2020.
102 Obradović 2013.
103 Cf. Barker 1975. – Marinova et al. 2013.

Svinjarička Čuka, Neolithic SUs		SU		23	26	27	30	45	50	1024	1060	1063	1067	1127	1130
		Trench		S1	S1	S1	S1	S1	S1	N1	N1	N1	N1	N1	N1
		Number of samples		1	3	1	3	30	4	12	9	1	1	2	1
		Sample volume (l)	779	12	36	12	36	353	48	144	96	12	5	15	10
		Wood charcoal (ml)	59.3	0.6	1.9	0.7	2.4	28.2	3.4	12.0	5.7	0.6	1.3	0.7	1.8
		Total remains	714	6	24	13	30	373	129	58	29	10	7	20	15
		Density	0.9	0.5	0.7	1.1	0.8	1.1	2.7	0.4	0.3	0.8	1.4	1.3	1.5
Plant taxon		**Plant part**	**Total**												
CEREALS															
Triticum monococcum	einkorn	grain	28					15	3	4	1			1	4
Triticum dicoccum	emmer	grain	44		4		1	25	5	2	3	2		1	1
Triticum dicoccum	emmer	glume base	2					2							
Triticum monococcum/dicoccum	einkorn/emmer	grain	19		1	3		9	4	1	1				
Triticum timopheevii s.l.	Timopheev's wheat	grain	3					2	1						
Triticum timopheevii s.l.	Timopheev's wheat	glume base	4		2					2					
Triticum sp., hulled	glume wheat	grain	10	1	2			6			1				
Triticum sp.	wheat	grain	26				2	16	2	4	1		1		
Hordeum vulgare var. *vulgare*	hulled barley	grain	77		1		1	44	24	2	1	1		3	
Hordeum vulgare, cf. hulled	hulled barley	rachis	1					1							
Hordeum vulgare	barley	grain	143	1	5		8	79	35	4	3	1	1	3	3
Panicum miliaceum	common millet	grain	3					2			1				
Cerealia indeterminata	indeterminate cereal	grain	96	2	2	2	6	54	9	9	4	1	1	4	2
PULSES															
Lens culinaris	lentil	seed	25			3		8	10	1	2		1		
Pisum sativum	pea	seed	4				1		2		1				
Leguminosae sativae	indeterminate pulse	seed	7		2			1	2		1	1			
WILD-GATHERED PLANTS															
Cornus mas	Cornelian cherry	fruit stone fragment	22					7	7	7				1	
Cornus sanguinea	dogwood	fruit stone fragment	2						2						
Corylus avellana	common hazel	fragment of nutshell	9					3						6	
cf. *Ficus carica*	fig	seed	1					1							
Fragaria vesca	wild strawberry	seed	16		1		4	8	3						
Phragmites communis	common reed	culm fragment	1										1		
Physalis alkekengi	Chinese lantern	seed	3		1			1	1						
Prunus domestica var. *insititia*	European plum	fruit stone fragment	20			2		15		3					
Prunus spinosa	sloe	fruit stone fragment	6					2	3	1					
Prunus sp.	plum	fruit stone fragment	8					3	1	1	1	2			
Quercus sp.	oak	cotyledon	1					1							
Rubus idaeus	raspberry	seed	2					2							
Sambucus nigra	elderberry	seed	2									1		1	
Sambucus nigra/racemosa	(red) elderberry	seed	1							1					
Sambucus ebulus	dwarf elder	seed	10	1			1	5	1		2				
Sambucus sp.		seed	2					1		1					
ARABLE/RUDERAL PLANTS															
Artemisia sp.		seed	1							1					
Atriplex sp.		seed	1										1		
cf. *Avena* sp.		fruit	2				1	1							
Bromus secalinus		fruit	1					1							
Chenopodium album		seed	4		1			1			1		1		
Chenopodium sp.		seed	5				2	3							
Digitaria sp.		fruit	1						1						
Echinochloa crus-galli		fruit	1								1				
Fallopia convolvulus		fruit	8	1	1			3	1		1				1
Galium aparine		seed	1					1							
Galium cf. *spurium*		seed	1					1							

Svinjarička Čuka, Neolithic SUs	SU		23	26	27	30	45	50	1024	1060	1063	1067	1127	1130
	Trench		S1	S1	S1	S1	S1	S1	N1	N1	N1	N1	N1	N1
	Number of samples		1	3	1	3	30	4	12	9	1	1	2	1
	Sample volume (l)	779	12	36	12	36	353	48	144	96	12	5	15	10
	Wood charcoal (ml)	59.3	0.6	1.9	0.7	2.4	28.2	3.4	12.0	5.7	0.6	1.3	0.7	1.8
	Total remains	714	6	24	13	30	373	129	58	29	10	7	20	15
	Density	0.9	0.5	0.7	1.1	0.8	1.1	2.7	0.4	0.3	0.8	1.4	1.3	1.5
Galium palustre type	seed	1								1				
Galium sp.	seed	1					1							
Galium/Asperulla	seed	1					1							
Hypericum perforatum	seed	6					6							
Lamium type	seed	1					1							
Lolium sp., small-seeded	fruit	3						1	2					
Mentha sp.	seed	1					1							
Phleum sp.	fruit	1												1
Plantago sp.	seed	1					1							
Poa sp.	fruit	3					2	1						
Polycnemum arvense	seed	1					1							
Polygonum aviculare	fruit	2						1	1					
Polygonum lapathifolium	fruit	1					1							
Rumex acetosella	fruit	1						1						
Setaria viridis/verticillata	fruit	1					1							
Solanum dulcamara	seed	2		1	1									
Solanum sp.	seed	1								1				
Tecurium chamaedrys	seed	1					1							
Teucrium sp.	seed	1					1							
Trifolium arvense	seed	2							1					1
Trifolium pratense type	seed	2					1			1				
cf. *Trifolium* sp.	seed	1					1							
Verbena officinalis	seed	4					3	1						
Veronica hederifolia	seed	1					1							
Veronica hederifolia	seed, mineralised	3							3					
Vicia/Lathyrus sp.	seed	1						1						
BROADLY IDENTIFIED														
Brassicaceae, small-seeded	seed	2							1		1			
Compositae, small-seeded	seed	1					1							
Fabaceae/Crucifereae	seed	1							1					
Lamiaceae, small-seeded	seed	2					2							
Poaceae, large-seeded	fruit	2			1				1					
Poaceae, small-seeded	fruit	3				1	1	1						
Solanaceae	seed	1					1							
indeterminate seed		11					8	2	1					
indeterminate seed	fragment	11			1	2	3	3	1					1
fruit stone	fragment	1							1					
nutshell/fruit stone	fragment	9					7		1					1
pod	fragment	2					2							
indeterminate fruit	fragment	19					12	1			6			
cf. fruit flesh or skin	fragments	38					29	4		2			1	2
"food" (volume in ml)	amorphous fragments	0.05					0.26	0.03						
"food"/fruit	amorphous fragments	2							2					
needle leaf (? *Pinus* sp.)	fragment	1					1							
indeterminate vegetal matter	amorphous fragments	21					25			2	3		1	
fungal spore		11					8					1	1	1
mouse pellet		1							1					

Tab. 9. Botanical taxa from Neolithic contexts excavated 2018–2019 at Svinjarička Čuka.

the Vardar and down the Južna and Velika Morava River courses.[104] These conditions would have been favourable for growing Neolithic crops; whether crop cultivation was indeed practised at (all of the) Early Neolithic sites, and on what scale, is impossible to tell based on the current, limited evidence. There is a little more archaeobotanical evidence from the second quarter of the 6th millennium BC, the later phase of the Starčevo Culture in the central Balkans. By this time, communities residing in the Iron Gates were consuming cereals, as documented by the presence of cereal starch in the dental calculus of some of the individuals buried in the area.[105] The so far available ^{14}C-dates for Starčevo layers at Belovode, At, Jaričište and Svinjarička Čuka place the finds of crops at these sites in the period 5700–5300 BC.[106] In comparison to the archaeobotanical evidence from these other, earlier and contemporary Neolithic sites, where einkorn and emmer represent the most prominent components of the crop spectrum, the crop assemblage from Svinjarička Čuka is different, as it is dominated by (hulled) barley. At most of the other analysed Early and Late Neolithic sites in the central Balkans, remains of barley are much less common than wheat; therefore, the importance of barley as a crop to the early farmers was questioned.[107] Barley is frequently found at Late Neolithic sites in the western Balkans and, at least in one case, in a relatively high quantity – at the site of Korića Han in Bosnia and Herzegovina, where 160 grains of naked barley were discovered within a concentration of cereals dominated by einkorn.[108] It is suggested that the greater visibility of barley along the Adriatic coast perhaps shows that this crop was better suited to cultivation on the thin karstic soils.[109] In reference to Svinjarička Čuka, it might be that the prehistoric soil cover in the Leskovac Basin was more favourable to barley than wheat cultivation, and/or that the local climate, receiving sub-Mediterranean influences, supported this. That einkorn, emmer and Timopheev's wheat were all present at Svinjarička Čuka, probably from as early as 5600 BC, is significant, as it adds to the growing evidence of a diverse spectrum of crops available to the Early Neolithic groups in the Balkans. Three or four types of wheat, one or two types of barley, lentil and pea mark the first centuries of farming in the central and western Balkans. What was grown or consumed locally may have had to do with the local biogeoclimatic conditions and the farmers' or consumers' choice. Along with the wide range of cultivars, throughout the Neolithic, advantage was taken of locally available sources of edible wild fruit and nuts.

It is expected that the continuing archaeobotanical and other analyses at Svinjarička Čuka will bring us closer to understanding how important crop cultivation, and plant consumption in general, were to the Early Neolithic dwellers. We hope to be able to make inferences on how much effort they invested into creation of the agricultural niche in the Leskovac Basin and through what kind of plant-related practices. This should lead us to a refined reconstruction of the subsistence base and strategies of the first food producers of the central Balkans.

10. Charcoal Collected during the Field Campaigns in 2018–2019

In the following, the analysis of charred wood remains derived from Neolithic sediment samples collected during the 2018 and 2019 field seasons at Svinjarička Čuka is presented. The aim of the investigation was twofold: to get an overview of the exploited woodland, and to start to investigate the use of wood resources by the Neolithic inhabitants. Therefore, 66 samples from promising archaeological structures attributed to the Neolithic contexts were selected for the analysis.

10.1. Sample Collection and Treatment

Charcoal remains from floated samples were chosen for the wood anatomical identification. For each of the samples, five identifications were made in order to achieve the 330 identified pieces desired. This amount is seen to be a minimum number to allow a first insight into the wood resources used at the site, and it also corresponds to the generally small amounts of charcoals in the samples.[110] The size of the identified fragments varied between edge lengths of c. 7 mm and 2 mm; smaller fragments were dismissed due to the high proportion of indeterminate ones among them[111] and their susceptibility to being relocated between different occupation layers.[112] The identification of the charred wood remains was done to the highest possible level, usually to the genus, and in some cases to the subfamily or wood type. The latter include two or more genera that cannot be distinguished based on their anatomical features. For identification, a binocular microscope and a reflected light microscope were used, with magnification of up to 500×.

104 Milovanović et al. 2017. – Pavlović et al. 2017.
105 Jovanović et al. 2021.
106 See overview in Filipović, Obradović, de Vareilles in press.
107 Filipović 2014.
108 de Vareilles 2018.
109 de Vareilles 2018.
110 Cf. Asouti, Austin 2005, 7.
111 Cf. Asouti, Austin 2005, 7.
112 Carcaillet 2001, 26.

10.2. Results

The charred wood material allows for an initial insight into the wood assemblage from the Neolithic phase of life at Svinjarička Čuka. The 330 charred wood fragments contained 302 fragments that could be identified, and they document 12 taxa. Another 17 fragments could be identified as presumably belonging to a specific taxon ('cf.') and 11 fragments remained undetermined (Tab. 10), the reasons being bad preservation, vitrification or anatomical irregularities such as branching. One sample was excluded from the analysis because it originates from the Eneolithic layer. In total, 297 identified fragments come from the Starčevo contexts. The assemblage (Tab. 10) is dominated by *Quercus* (oak), followed by *Cornus* (dogwood) and *Carpinus/Ostrya* type (hornbeam type). Further regularly occurring taxa are Maloideae (pomaceous fruit), *Corylus* (hazel) and *Prunus* (wild plum). Other trees are present as single finds: *Abies* (fir), *Acer* (maple), *Fraxinus* (ash), *Pinus* (pine) and *Ulmus* (elm). Due to the low number of fragments, not only count percentages but also the frequency of occurrence of the taxa were used to interpret the results.

10.3. Discussion

Figs. 34 and 35 illustrate the count percentages and frequencies of the wood taxa documented in trenches N1 and S1. The assemblage includes the remains of a range of plants, with varying ecological requirements. In general, all these plants can today be found in mixed deciduous forests or along forest edges. Before commenting on the specific taxa, some general thoughts on the evidence of exploitation of wood resources are offered.

In order to be able to interpret an assemblage, the origin of the investigated material has to be understood: understanding the archaeological context is crucial for the interpretation of anthracological data. The nature of archaeological features preconditions the value of the charcoal assemblage for specific research. In order to collect general data on the exploited vegetation, the investigation of wood assemblages derived from non-specialised archaeological features is desired. Archaeological contexts built up over longer periods – the so-called 'synthetic deposits'[113] – tend to accumulate remains of a wide range of taxa present in the surrounding vegetation, because the material in them originates from varied activities and is, therefore, more diverse than what would be expected in deposits created by single activities or events. For instance, contexts such as collapsed walls and fireplaces may have been created in a short time span or may have even been connected to single events. Thus, the likely uniform composition of their wood charcoal content can be misleading due to a possibly high degree of selectivity of resources for the particular activity/use. Due to the selective human use of wood resources, the quantitative anthracological data cannot be taken as a precise reflection of the quantitative presence of individual taxa in the exploited woodland resources. The 'human filter' distorts the amounts of individual taxa in archaeological assemblages compared to their occurrence in the exploited vegetation.[114]

In addition to these limitations, the small number of charcoal fragments retrieved from Svinjarička Čuka does not offer a detailed insight into the composition of the vegetation in the surroundings of the site. Nevertheless, the investigated material gives valuable hints as to the Neolithic exploitation of wood resources and vegetation on a local scale.

The investigated features belong to building structures. Several of the analysed SUs can be interpreted as synthetic deposits (SUs 23, 27, 30, 45, 1060, 1063, 1067). Other archaeological contexts seem to represent short time intervals, such as SUs 26 and 1024, which represent collapsed architecture and are thus thought to be mainly dominated by timber; they may be less representative in terms of the structure of near-site vegetation. As Figs. 34 and 35 illustrate, the suggested distinction between long-term and short-term deposits is not evident in the wood charcoal record. The results for SU 26 may be misleading due to the small number of fragments identified. The synthetic deposits from trench S1 fit well into the assumed composition of charcoal assemblages of varied origin: the large number of taxa allows for the interpretation of the material as representing the remains of fuel. Although the material from SU1024 is probably mainly derived from timber, the assemblage contains a larger number of taxa than the synthetic deposits. Here, the small numbers of identifications particularly complicate the interpretation and, therefore, the differentiation between timber versus fuel wood was not attempted.

Acquisition of wood is thought to have followed the principle of least effort.[115] This means that wood for fuel was probably collected within a short spatial range, either seasonally or during other everyday activities. It can be assumed that the Neolithic residents of Svinjarička Čuka had certain knowledge of wood properties (e.g. burning quality, durability). Thus, selective use of some taxa may have been

113 Théry-Parisot, Chabal, Chrzavzez 2010, 143.

114 Théry-Parisot, Chabal, Chrzavzez 2010, 142–143.

115 Shackleton, Prins 1992.

Sample	Trench	SU	Deposit	Phase	Taxon	*Abies*	*Taxus*	*Pinus*	*Acer*	*Carpinus/ Ostrya*	*Cornus*	*Corylus*
						Fir	Yew	Pine	Maple	Hornbeam type	Dogwood	Hazel
1024-10-01	N1	1024	architecture	Starčevo		.	.	.	.	.	.	.
1024-10-02	N2	1024	architecture	Starčevo		.	.	.	.	.	.	.
1024-10-03	N3	1024	architecture	Starčevo		.	.	.	.	.	.	.
1024-10-04	N4	1024	architecture	Starčevo		.	.	.	.	.	1	.
1024-10-05	N5	1024	architecture	Starčevo		.	.	.	.	.	.	.
1024-10-06	N6	1024	architecture	Starčevo		.	.	.	.	.	1	.
1024-10-07	N7	1024	architecture	Starčevo		.	.	.	.	.	2	.
1024-10-08	N8	1024	architecture	Starčevo		.	.	.	.	.	1	1
1024-10-08	N9	1024	architecture	Starčevo		.	.	.	.	.	.	.
1024-10-09	N10	1024	architecture	Starčevo		.	.	.	.	.	1	1
1024-10-10	N11	1024	architecture	Starčevo		.	.	.	.	.	1	.
1024-10-11	N12	1024	architecture	Starčevo		.	.	.	1	1	1	.
1060-10-01	N13	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1060-10-02	N14	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1060-10-08	N15	1060	synthetic	Starčevo		.	.	.	.	.	2	.
1060-10-10	N16	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1060-10-11	N17	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1060-10-12	N18	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1060-10-13	N19	1060	synthetic	Starčevo		.	.	.	.	.	1	.
1060-10-14	N20	1060	synthetic	Starčevo		.	1	.	.	.	1	.
1060-10-15	N21	1060	synthetic	Starčevo		.	.	.	.	.	.	.
1063-10-01	N22	1063	synthetic	Starčevo		.	.	.	.	.	.	.
1067-10-01	N23	1067	synthetic	Starčevo		.	.	.	.	.	.	.
25-10-01	S1	25	synthetic	Starčevo		.	.	.	.	.	.	1
26-10-01	S2	26	arichtecture	Starčevo		.	.	.	.	.	.	.
26-10-02	S3	26	arichtecture	Starčevo		.	.	.	.	.	1	2
26-10-03	S4	26	arichtecture	Starčevo		.	.	.	.	.	.	.
27-10-01	S5	27	synthetic	Starčevo		.	.	.	.	.	.	.
30-10-01	S6	30	synthetic	Starčevo		.	.	.	.	.	.	.
30-10-02	S7	30	synthetic	Starčevo		.	.	.	.	.	3	1
30-10-03	S8	30	synthetic	Starčevo		.	.	.	.	.	.	.
45-10-01	S9	45	synthetic	Starčevo		.	.	.	.	.	.	3
45-10-02	S10	45	synthetic	Starčevo		.	.	.	.	.	2	.
45-10-03	S11	45	synthetic	Starčevo		.	.	.	.	1	2	.
45-10-04	S12	45	synthetic	Starčevo		.	.	.	.	.	2	.
45-10-05	S13	45	synthetic	Starčevo		1	.	.	.	.	.	.
45-10-06	S14	45	synthetic	Starčevo		.	.	.	.	4	.	.
45-10-07	S15	45	synthetic	Starčevo		.	.	.	.	.	3	.
45-10-08	S16	45	synthetic	Starčevo		.	.	.	2	.	.	.

Tab. 10. Total amounts of charred wood fragments with edge lengths >355 µm from the field campaigns at Svinjarička Čuka 2018–2019.

Fraxinus	*Maloideae*	*Prunus*	*Quercus*	*Ulmus*	*Indet*	cf. *Acer*	cf. *Cornus*	cf. *Corylus*	cf. *Fraxinus*	cf. Maloideae	cf. *Prunus*	cf. *Quercus*	Sum	Sample
Ash	Pomaceous fruit	Stone fruit	Oak	Elm	Undetermined	cf. Maple	cf. Dogwood	cf. Hazel	cf. Ash	cf. Pomaceous fruit	cf. Stone fruit	cf. Oak		
.	.	.	5	.	.	.	.	.	.	.	.		5	1024-10-01
.	.	.	5	.	.	.	.	.	.	.	.	.	5	1024-10-02
.	.	1	2	.	1	.	.	.	.	.	1	.	5	1024-10-03
.	.	.	3	.	1	.	.	.	.	.	.	.	5	1024-10-04
.	.	.	5	.	.	.	.	.	.	.	.	.	5	1024-10-05
.	.	.	4	.	.	.	.	.	.	.	.	.	5	1024-10-06
.	.	.	3	.	.	.	.	.	.	.	.	.	5	1024-10-07
.	.	.	3	.	.	.	.	.	.	.	.	.	5	1024-10-08
.	1	.	4	.	.	.	.	.	.	.	.	.	5	1024-10-08
.	1	.	1	.	.	.	1	.	.	.	.	.	5	1024-10-09
.	.	.	4	.	.	.	.	.	.	.	.	.	5	1024-10-10
.	.	.	1	.	1	.	.	.	.	.	.	.	5	1024-10-11
.	.	.	5	.	.	.	.	.	.	.	.	.	5	1060-10-01
.	.	.	4	.	.	.	.	.	.	.	.	1	5	1060-10-02
.	.	.	3	.	.	.	.	.	.	.	.	.	5	1060-10-08
.	.	.	4	.	.	.	.	.	.	.	1	.	5	1060-10-10
.	.	.	5	.	.	.	.	.	.	.	.	.	5	1060-10-11
.	.	2	3	.	.	.	.	.	.	.	.	.	5	1060-10-12
.	.	.	4	.	.	.	.	.	.	.	.	.	5	1060-10-13
.	.	.	3	.	.	.	.	.	.	.	.	.	5	1060-10-14
.	.	.	4	.	1	.	.	.	.	.	.	.	5	1060-10-15
1	1	.	2	.	.	.	.	.	.	.	.	1	5	1063-10-01
.	.	.	4	.	.	.	1	.	.	.	.	.	5	1067-10-01
.	1	.	3	.	.	.	.	.	.	.	.	.	5	25-10-01
.	.	.	3	.	1	.	.	.	.	.	.	1	5	26-10-01
.	1	.	1	.	.	.	.	.	.	.	.	.	5	26-10-02
1	.	1	1	.	1	.	.	.	.	.	1	.	5	26-10-03
.	2	.	3	.	.	.	.	.	.	.	.	.	5	27-10-01
.	3	.	1	.	1	.	.	.	.	.	.	.	5	30-10-01
.	.	.	1	.	.	.	.	.	.	.	.	.	5	30-10-02
.	.	1	2	.	1	.	.	1	.	.	.	.	5	30-10-03
.	.	1	1	.	.	.	.	.	.	.	.	.	5	45-10-01
1	.	1	1	.	.	.	.	.	.	.	.	.	5	45-10-02
.	.	1	1	.	.	.	.	.	.	.	.	.	5	45-10-03
.	.	.	3	.	.	.	.	.	.	.	.	.	5	45-10-04
.	1	.	2	1	.	.	.	.	.	.	.	.	5	45-10-05
.	.	.	1	.	.	.	.	.	.	.	.	.	5	45-10-06
.	.	.	2	.	.	.	.	.	.	.	.	.	5	45-10-07
.	.	.	3	.	.	.	.	.	.	.	.	.	5	45-10-08

Sample	Trench	SU	Deposit	Phase	Taxon	*Abies*	*Taxus*	*Pinus*	*Acer*	*Carpinus/ Ostrya*	*Cornus*	*Corylus*
						Fir	Yew	Pine	Maple	Hornbeam type	Dogwood	Hazel
45-10-09	S17	45	synthetic	Starčevo		.	.	.	.	.	2	1
45-10-10	S18	45	synthetic	Starčevo		.	.	.	.	.	1	.
45-10-11	S19	45	synthetic	Starčevo		.	.	.	.	.	1	1
45-10-12	S20	45	synthetic	Starčevo		.	.	.	.	1	2	.
45-10-14	S21	45	synthetic	Starčevo		.	.	.	.	2	1	.
45-10-15	S22	45	synthetic	Starčevo		.	.	.	.	1	.	.
45-10-16	S23	45	synthetic	Starčevo		.	.	.	.	4	1	.
45-10-17	S24	45	synthetic	Starčevo		.	.	.	.	.	.	.
45-10-18	S25	45	synthetic	Starčevo		.	.	.	.	.	.	.
45-10-19	S26	45	synthetic	Starčevo		.	.	.	.	.	.	.
45-10-19	S27	45	synthetic	Starčevo		.	.	.	.	.	2	.
45-10-20	S28	45	synthetic	Starčevo		.	.	.	.	.	.	.
45-10-21	S29	45	synthetic	Starčevo		.	.	1	.	1	.	.
45-10-22	S30	45	synthetic	Starčevo		.	.	.	1	2	.	.
45-10-23	S31	45	synthetic	Starčevo		.	.	.	.	3	1	.
45-10-24	S32	45	synthetic	Starčevo		.	.	.	.	.	1	.
45-10-25	S33	45	synthetic	Starčevo		.	.	.	.	1	1	.
45-10-26	S34	45	synthetic	Starčevo			.	.	.	.	.	.
45-10-27	S35	45	synthetic	Starčevo			.	.	.	.	.	.
45-10-28	S36	45	synthetic	Starčevo			.	.	.	4	.	.
45-10-29	S37	45	synthetic	Starčevo			.	.	.	.	.	.
45-10-30	S38	45	synthetic	Starčevo		1	.	.	.	.	1	.
50-10-01	S39	50	synthetic	Starčevo			.	.	.	1	2	.
50-10-02	S40	50	synthetic	Starčevo			.	.	.	.	.	2
50-10-03	S41	50	synthetic	Starčevo			.	.	.	.	3	1
50-10-04	S42	50	synthetic	Starčevo			.	.	.	1	1	.
51-10-01	S43	51	?	Eneolithic			.	.	.	.	3	.
Sum						2	1	1	4	27	48	14
Sum N1						0	1	0	1	1	12	2
Architecture N1 (fragments)						.	.	.	1	1	8	2
Synthetic deposits N1 (fragments)						.	1	.	.	.	4	.
Sum S1						2	0	1	3	26	36	12
Architecture S1 (fragments)						.	.	.	.	.	1	2
Synthetic deposits S1 (fragments)						2	.	1	3	26	32	10
Count percentages N1						0.0	0.9	0.0	0.9	0.9	10.4	1.7
Count percentages S1						0.9	0.0	0.5	1.4	12.1	16.7	5.6
Count percentages total						0.6	0.3	0.3	1.2	8.2	14.5	4.2

Tab. 10 continued.

Fraxinus	*Maloideae*	*Prunus*	*Quercus*	*Ulmus*	*Indet*	cf. *Acer*	cf. *Cornus*	cf. *Corylus*	cf. *Fraxinus*	cf. Maloideae	cf. *Prunus*	cf. *Quercus*	Sum	Sample
Ash	Pomaceous fruit	Stone fruit	Oak	Elm	Undetermined	cf. Maple	cf. Dogwood	cf. Hazel	cf. Ash	cf. Pomaceous fruit	cf. Stone fruit	cf. Oak		
.	.	.	2	.	.	.	.	.	.	.	.	.	5	45-10-09
.	.	.	2	.	1	.	.	.	.	.	1	.	5	45-10-10
2	.	.	.	.	.	.	.	.	1	.	.	.	5	45-10-11
.	.	.	2	.	.	.	.	.	.	.	.	.	5	45-10-12
.	.	.	1	.	1	.	.	.	.	.	.	.	5	45-10-14
.	2	.	2	.	.	.	.	.	.	.	.	.	5	45-10-15
.	.	.	.	.	.	.	.	.	.	.	.	.	5	45-10-16
.	.	.	5	.	.	.	.	.	.	.	.	.	5	45-10-17
.	.	.	5	.	.	.	.	.	.	.	.	.	5	45-10-18
.	.	.	5	.	.	.	.	.	.	.	.	.	5	45-10-19
.	.	.	3	.	.	.	.	.	.	.	.	.	5	45-10-19
.	.	.	5	.	.	.	.	.	.	.	.	.	5	45-10-20
.	1	.	1	.	.	.	.	.	.	.	.	1	5	45-10-21
.	.	.	1	.	.	1	.	.	.	.	.	.	5	45-10-22
.	.	.	1	.	.	.	.	.	.	.	.	.	5	45-10-23
.	1	.	2	.	1	.	.	.	.	.	.	.	5	45-10-24
1	1	.	1	.	.	.	.	.	.	.	.	.	5	45-10-25
.	.	.	5	.	.	.	.	.	.	.	.	.	5	45-10-26
.	2	.	3	.	.	.	.	.	.	.	.	.	5	45-10-27
.	.	.	1	.	.	.	.	.	.	.	.	.	5	45-10-28
.	.	.	2	.	.	.	1	.	2	.	.	.	5	45-10-29
.	1	.	2	.	.	.	.	.	.	.	.	.	5	45-10-30
.	.	1	1	.	.	.	.	.	.	.	.	.	5	50-10-01
.	.	.	3	.	.	.	.	.	.	.	.	.	5	50-10-02
.	.	.	1	.	.	.	.	.	.	.	.	.	5	50-10-03
.	.	.	2	.	.	.	.	.	.	1	.	.	5	50-10-04
.	.	.	1	1	.	.	.	.	.	.	.	.	5	51-10-01
6	19	9	169	2	11	1	3	1	3	1	4	4	330	Sum
1	3	3	81	0	4	0	2	0	0	0	2	2	115	Sum N1
.	2	1	40	.	3	.	1	.	.	.	1	.	60	Architecture N1 (fragments)
1	1	2	41	.	1	.	1	.	.	.	1	2	55	Synthetic deposits N1 (fragments)
5	16	6	88	2	7	1	1	1	3	1	2	2	215	Sum S1
1	1	1	5	.	2	.	.	.	.	.	1	1	15	Architecture S1 (fragments)
4	15	5	82	1	5	1	1	1	3	1	1	1	195	Synthetic deposits S1 (fragments)
0.9	2.6	2.6	70.4	0.0	3.5	0.0	1.7	0.0	0.0	0.0	1.7	1.7	100.0	Count percentages N1
2.3	7.4	2.8	40.9	0.9	3.3	0.5	0.5	0.5	1.4	0.5	0.9	0.9	100.0	Count percentages S1
1.8	5.8	2.7	51.2	0.6	3.3	0.3	0.9	0.3	0.9	0.3	1.2	1.2	100.0	Count percentages total

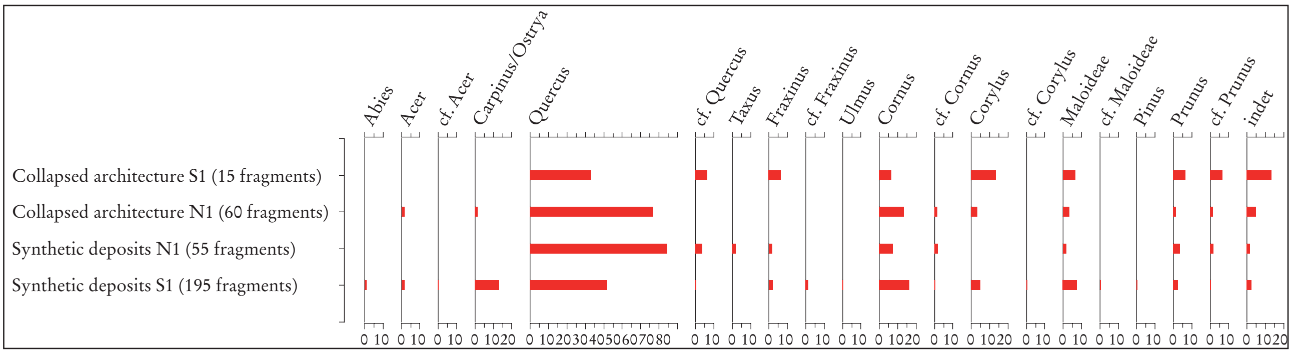


Fig. 34. Count percentages of taxa in trenches N1 and S1 in distinct archaeological structures (Graphics: T. Schroedter).

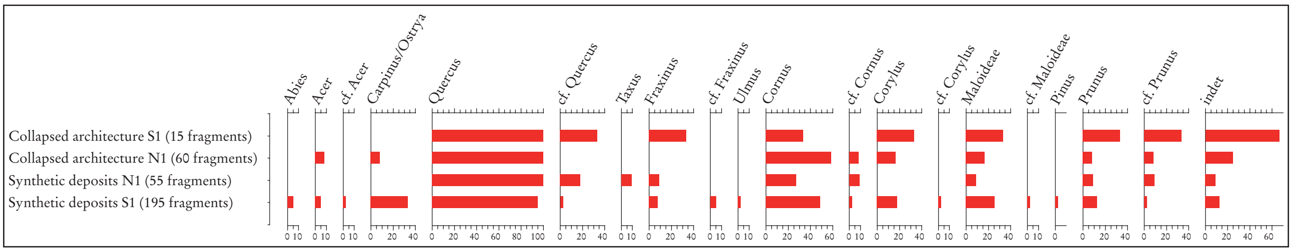


Fig. 35. Frequencies of taxa in trenches N1 and S1 in distinct archaeological structures (Graphics: T. Schroedter).

practised, as long as the preferred resource was available in sufficient amounts in the local landscape.

10.4. Exploited Vegetation

The assemblage suggests the use of oak-dominated mixed deciduous woodland, with rich understorey, documented as the presence of light-demanding trees (e.g. hazel, dogwood, plum). The occurrence of hornbeam and maple can be associated with the mixed deciduous woodland. This corresponds to evidence from the wider region.[116] Even today, the potential natural vegetation in the region consists of mixed deciduous woodland.[117] Ash and elm indicate zones characterised by a certain level of moisture, as indicated by the regular occurrence of these taxa in riparian forests. The presence of possible riparian vegetation in the direct vicinity of the site is not clearly visible in the wood charcoal record, otherwise the amounts of ash and elm would probably be higher and remains of alder (*Alnus*) would be expected. The light-demanding taxa, primarily dogwood, but also pomaceous fruits, hazel and plum, indicate the presence of bright stands. These could have taken different forms, such as rich understorey in oak-dominated woodland, or small to medium openings in the landscape to establish agriculture and animal husbandry, where the margins of the intensively used areas would have offered good conditions for a range of light-demanding species.

10.5. Timber and Fuel Wood

The predominance in the assemblage of oak and dogwood indicates the prevailing use of these taxa. Oak was likely the dominant tree in the surroundings; its preferential use was probably determined by its availability but also by its favourable qualities in terms of building and burning. It is likely that the Neolithic demand for oak as timber was met by the local woodland. The percentages of light-demanding taxa do not reflect major opening of the landscape – they suggest small-scale opening and the exploitation of nearby vegetation as part of the daily activities. The SUs representing architectural structures contain some taxa not typically used as building material, perhaps indicating a more complex archaeological situation or (also) their use as wattle.

10.6. Dual Use of Light-demanding Species?

All documented light-demanding taxa were regularly exploited for their fruits during the Neolithic in the Balkans.[118]

116 Marinova, Ntinou 2018.
117 Bohn, Neuhäusl 2000.
118 Kroll 2013. – Marinova, Krauss 2014. – de Vareilles et al. 2022, 20.

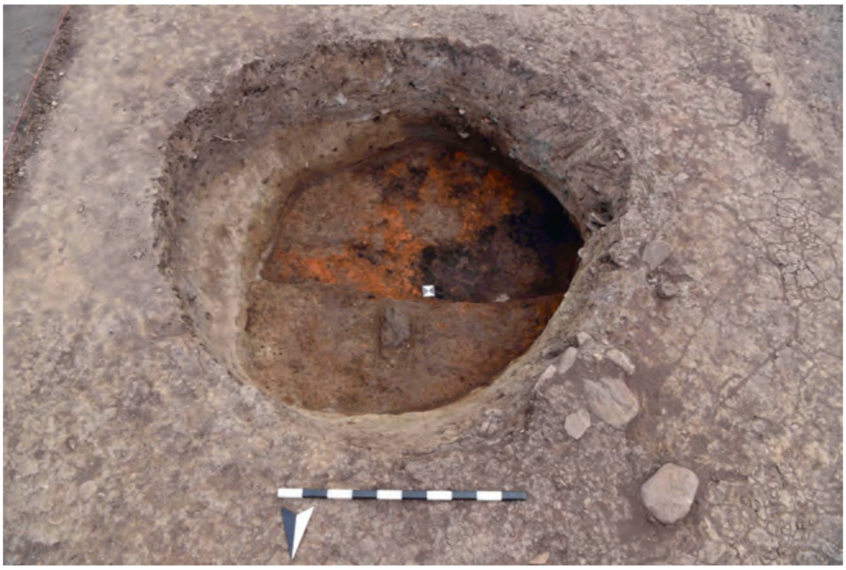


Fig. 36. Top view of the Middle Bronze Age pit (SUs 1055, 1074) following the excavations (Photo: F. Ostmann).

In this region, the genus hazel includes two species, *Corylus avellana* and *Corylus colurna*, both of which grow fruits of high caloric value. The genus *Cornus* here includes two species: *Cornus mas* (Cornelian cherry) and *Cornus sanguinea* (common dogwood). Cornelian cherry fruits are regularly consumed fresh or in another form, while the fruit stones contain oil that can also be used. The genus *Prunus* includes several species exploited for their juicy fruits. The subfamily Maloideae includes, among others, apple (*Malus*), pear (*Pyrus*) and hawthorn (*Crataegus*), all providing edible fruit. This group is regularly present in wood charcoal assemblages in the Neolithic.[119] Except for dogwood, these trees and shrubs are present in very low numbers or single finds in the analysed samples from Svinjarička Čuka. The hardness and flexibility of *Cornus* wood may have been the properties desired for woodworking or the manufacture of implements and weapons (arrows, lances).[120]

10.7. Conclusion

The investigated wood charcoal material gives an initial insight into the wood resources in the surroundings of Svinjarička Čuka. Despite the limited material, a range of taxa was documented, offering valuable insight into the Neolithic vegetation in the area of Svinjarička Čuka. Mixed deciduous oak woodland was exploited, providing sufficient resources for timber and fuel. Only small-scale landscape openness is reflected in the wood charcoal assemblage, as the percentages and frequencies of the light-demanding taxa suggest. The identified light-demanding taxa support the macro-botanical record, suggesting their dual exploitation – as sources of edible fruits and wood for fuel.

11. Excavation Results for the Metal Ages

11.1. A Middle Bronze Age Pit

An irregularly oval pit (SUs 1055, 1074) was recorded in quadrant S30 in trench N1 (Figs. 3–4). The pit was cut by a later Early Iron Age pit (SUs 1051, 1054), and the separation of archaeological materials was based on the difference in the quality and colour of soil infill and the typological characteristics of recorded potsherds. The upper dimensions of the Middle Bronze Age pit were not defined completely due to the aforementioned Iron Age disturbances, yet the excavated area in total covered approximately 2.2 × 2.5 m (including both the Middle Bronze Age and the Early Iron Age pit) (Fig. 36).

The depth of the pit, measured from the surrounding SU 1050 (Neolithic level) is approximately 1.2 m. The infill of the pit was comprised of loose light-grey ashy soil mixed with potsherds, animal bones, and lumps of daub. The soil within the pit was interspersed with small chunks of charcoal and pieces of burnt wood, all indicating a significant degree of burning. Besides numerous potsherds, the pit yielded finds of ceramic loom weights and bone tools. Pottery recorded within the pit bears typological characteristics of

119 Kreuz 1990. – Marinova, Thiébault 2008. – Schroedter et al. 2012.
120 Hegi 1926, 1553.

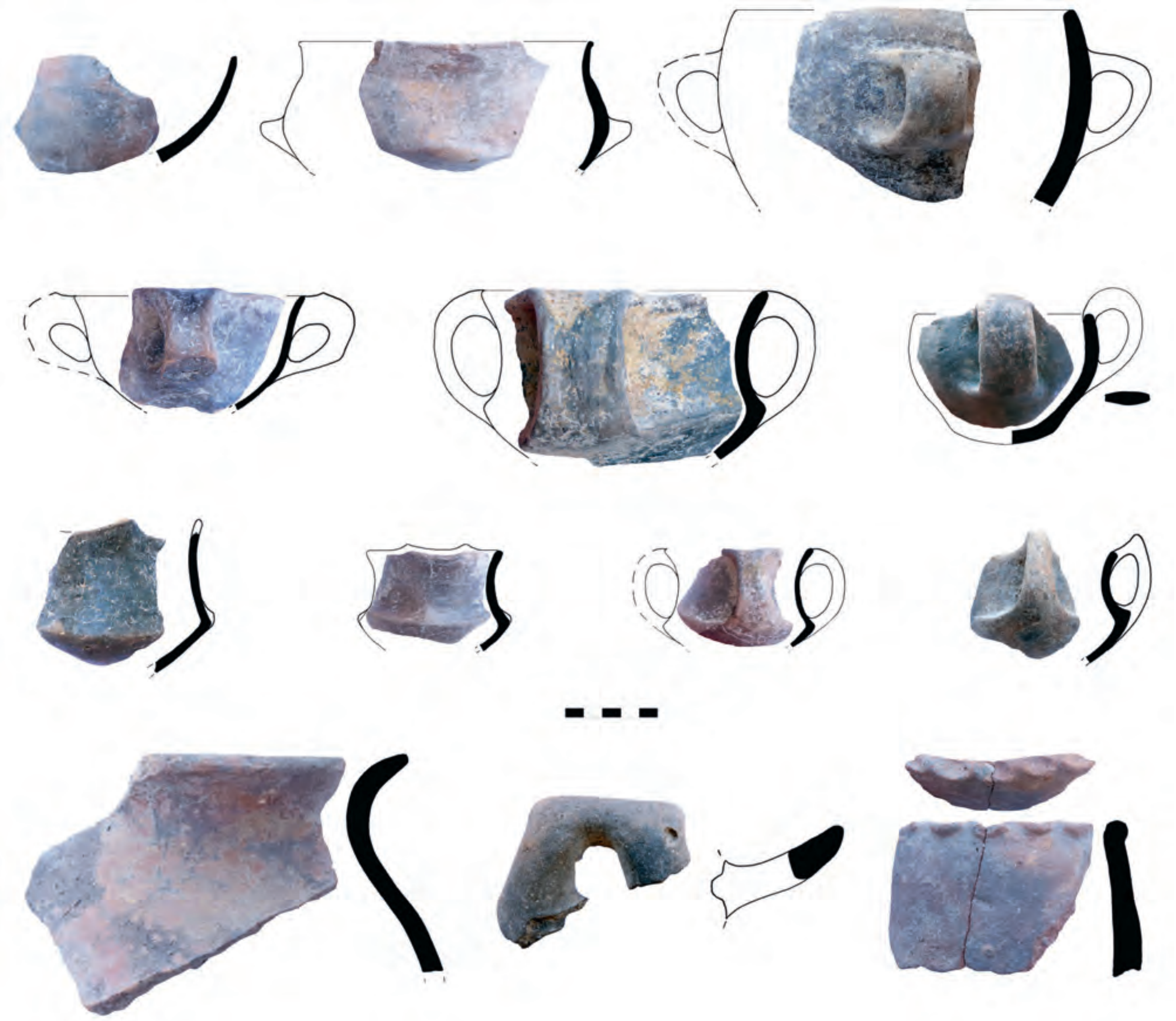


Fig. 37. A selection of characteristic pottery from the Middle Bronze Age pit (SUs 1055, 1074) (Graphics: A. Bulatović).

the so-called Bubanj-Hum IV-Ljuljaci cultural group.[121] Its main characteristics are beakers with emphasised junctions, two handles that slightly surpass the rim, and triangular and trapezoidal modelled extensions on the vessel mouth.[122] Other forms recorded within the pit are conical and S-profiled bowls with or without handles, conical or S-profiled cups with one or two handles and larger pots decorated with finger impressions on the body or the rim (Fig. 37).

Two radiocarbon dates (MAMS-46947 and MAMS-46940, a seed and a tooth respectively) originate from the pit and place it most likely in the 18th–17th centuries BC (Fig. 38).

Such dates correspond to the existing Middle Bronze Age date from the site,[123] as well as radiocarbon dates from sites that display similar typological characteristics (Ljuljaci, Trnjane, Hajdučka Česma, Čoka Njica, Ružana).[124]

11.2. A Late Bronze Age House

The feature was recorded during the 2017 geomagnetic survey, as a rectangular anomaly with the dimensions of

121 Bulatović, Stankowski 2012.
122 Bulatović 2021.
123 Horejs et al. 2019a.
124 Gogâltan 1999. – Gavranović et al. 2020. – Kapuran, Gavranović, Mehofer 2020.

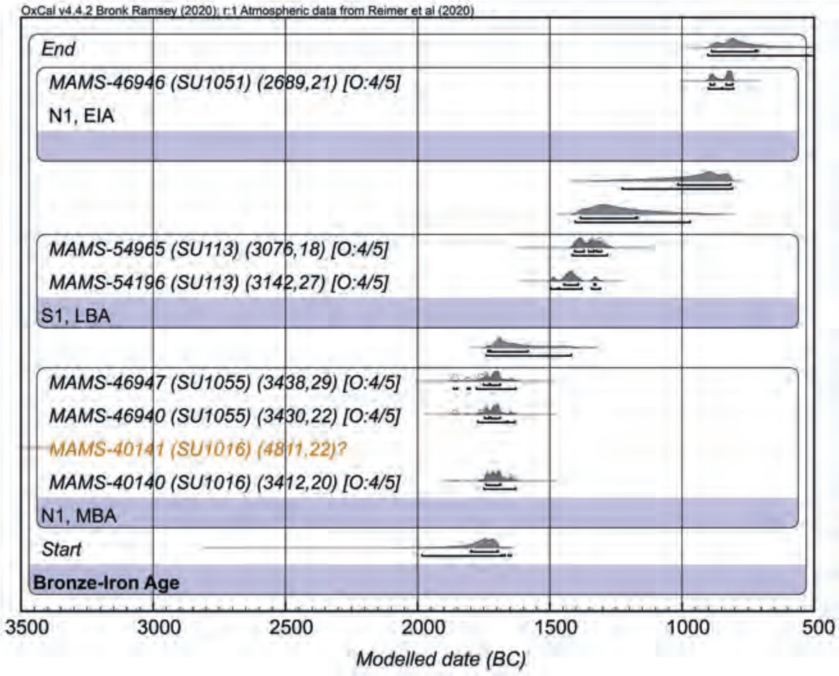


Fig. 38. Modelled absolute dates for Bronze and Iron Age features (Graphics: L Webster).

approximately 7 × 5 m, oriented northwest-southeast. The feature, recorded in squares S20–21 and T20–21 in trench S1, was marked as an area of high archaeological potential.[125] The ongoing excavations of the structure started in 2019 when the first remains of solid architecture were recorded in square S21, represented by burnt daub. Since the excavations in 2021, which were focused on square T21, the northern portion of the house is excavated up to the level of architecture, meaning the level at which the presumed house walls become completely visible. The vertical stratigraphy within squares S21 and T21 is identical. The topsoil, with mixed material including late antique finds, is followed by a thin and disturbed layer with mixed pottery (Neolithic, Bronze Age, Iron Age), corresponding to the Early Iron Age layer within trench S1, as indicated by potsherds recorded within it such as slightly biconical bowls with an inverted and faceted rim.[126] This layer is followed by the Late Bronze Age layer (SUs 67, 113 and 114), defined as the inventory of the house (house destruction layer), which lies above SU 68, meaning house walls represented by articulated pieces of burnt daub. The aforementioned layer yielded numerous potsherds typical for the Late Bronze Age Brnjica group, common for the South Morava Basin and its surroundings.[127] Some of those characteristic elements connected with the Brnjica group are amphorae with a ring-shaped thickening on the inner side of the rim, S-profiled bowls, arched handles with button-shaped extensions, fan-shaped and wishbone handles, all recorded within the so-called inventory layer.[128] However, it should be highlighted that those ceramic forms typical for the Brnjica group possess a distinct style in decoration, comprised of incised triangles filled with triangular pricks and circular motifs comprised of triangular pricks, positioned on almost any part of the vessel, with the emphasis on the upper and outer sides of rims and handles (Fig. 39).

The decoration is often filled with white paste. Such a manner of decoration is known from other Brnjica-related sites within the entire territory of the cultural group, and represents an exception rather than a common characteristic (Končulj and Krševica near Vranje, Bobište and Sastanci near Leskovac, Donja Toponica in Niš, Mađilka in Pirot, Graštica in Kosovo).[129] Aside from potsherds, the layer yielded a number of ceramic spindle whorls, a clay firedog, a grindstone, and several bronze objects, possibly indicating

125 Horejs et al. 2019a, 180 and Fig. 2.
126 Bulatović 2019.

127 Srejović 1960. – Lasić 1996. – Bulatović 2000. – Stojić 2001a. – Stojić 2001b. – Bulatović, Stankowski 2012.
128 Bulatović, Stankowski 2012, 355–357, 389–391 and Tab. 16.
129 Jevtić 1990, Pl. III/5, 7, 9; IV/1, 6, 7; V/5. – Lazić 1996, Pl. XIX/1a-3. – Bulatović 2007, Pl. LI/46–48, LXII/14–16. – Bulatović, Jović 2009, Pl. X/27, XXV/86–89. – Bulatović, Stankowski 2012, Pl. XV/1–9.

Fig. 39. A selection of characteristic pottery from the Late Bronze Age house (SUs 67, 113, 114) (Graphics: A. Bulatović).

the everyday activities of its inhabitants, such as weaving and food processing. The architectural remains of the Late Bronze Age house (SU 68) are comprised of variously sized pieces of burnt daub, with wattle impressions, articulated in an approximately rectangular shape and therefore completely matching the recorded anomaly. The state of preservation of the daub varies due to agricultural activities at the site and the superimposed layers. Some of the well-preserved pieces of daub indicate a possible existence of decorated portions of walls and a stamped clay floor (Fig. 40).

The concentration and disposition of daub pieces in the central portion of the excavated part of the house indicates the possible existence of a kiln, which again corresponds to the anomaly recorded during the geomagnetic survey.[130] An absolute date (seed) from the inventory layer places the house in the 15th–14th century BC, which at the moment is one of the earliest dates for the Brnjica group.[131]

130 The northern half of the anomaly/house, spatially corresponding to the potential kiln, was marked as a possible deeper pit.

131 Bulatović, Gori, Vander Linden 2018.

Fig. 40. Remains of a stamped clay floor from the Late Bronze Age house (SUs 67, 113, 114) (Photo: F. Ostmann).

Fig. 41. Burnt daub which sealed the Early Iron Age pit (SUs 1051) after its removal (Photo: F. Ostmann).

11.3. Early Iron Age Pits

The Early Iron Age pit recorded in quadrant S30 cuts into the aforementioned Middle Bronze Age pit (SUs 1055, 1074). The pit itself was comprised of two distinct and clearly separated features. The upper portion of the pit (SU 1054) was represented by a concentration of medium- to large-sized lumps of burnt daub with wattle impressions that covered the surface of approximately 1.1 × 1.5 m (Fig. 41).

Apart from the daub, the SU was comprised of small chunks of carbonised wood, reddish soil, and sporadically occurring potsherds. The lower portion of the pit (SU 1051), in fact, sealed with the daub, was comprised of dark-brown soil mixed with carbonised wood, smaller lumps of daub, stone, and potsherds. The dimensions of the pit correspond to the given dimensions of the Middle Bronze Age pit (2.2 × 2.5 m, with a depth of 1.2 m compared to the SU 1050). The ceramic inventory of the pit is comprised of a considerable number of slightly biconical bowls with inverted rims, decorated with parallel oblique channels. Rims of those bowls often possess a rectangular extension decorated with incised hatched triangles or grooves, or combinations of incisions and grooves (Fig. 42).

Other decorative elements characteristic of the pit are modelled bands with finger impressions on pots, corded motifs, oblique channels on vessel bellies, incised hatched triangles, and pricks. The absolute date (seed) positions the pit in the 9th century BC.

The excavation campaigns in 2019 and 2021 have further supplemented our knowledge of prehistoric settling at the site of Svinjarička Čuka during the Metal Ages. In addition

Fig. 42. A selection of characteristic pottery from the Early Iron Age pit (SU 1051) (Graphics: A. Bulatović).

to the excavated features attributed to the Middle and Late Bronze Age, as well as the Early Iron Age, the ceramic inventory of certain stratigraphic units and several absolute dates indicate that the settling at the site can be traced back to the Late Eneolithic. Indicative potsherds from SUs 1035 and 1036, decorated with fields comprised of vertical rows of short incisions and oval notches, display the typological characteristics of the Late Eneolithic Coţofeni-Kostolac group.[132] On the other hand, several absolute dates and scarce potsherds point towards the Early Bronze Age settling at the site, yet unfortunately, a cultural layer of this

132 Kapuran, Bulatović 2012.

period has not been recorded. Therefore, one could suggest the possible existence of the Early Bronze Age settlement on the top of the site, a few dozen metres toward the west. The recorded features and layers from the Metal Ages fit into the existing cultural and chronological narrative of the given territory. During the Early Bronze Age, this territory was inhabited by the bearers of the Bubanj-Hum III group, which gradually evolved into the Bubanj-Hum IV-Ljuljaci group,[133] with stylistic and typological characteristics identical to the ceramic inventory of the Middle Bronze Age pit from the site (SU 1055). Further, the pit chronologically corresponds to the Middle Bronze Age of the South Morava Basin, meaning the Bubanj-Hum IV-Ljuljaci group. The remains of the Late Bronze Age house (SU 68) and its ceramic inventory (SUs 67, 113 and 114) are firmly attributed to the Brnjica group, as the main representative of the period in the southern parts of the central Balkans. Chronologically, the absolute date from the Late Bronze Age house precedes the existing dates for the Brnjica group (Svinjište, Medijana, Pelince),[134] and together with a characteristic style in decoration might represent an earlier variant of the Brnjica group, or the closest link between the Middle and Late Bronze Age in the South Morava Basin. Likewise, the Early Iron Age pits from the site (SUs 1046, 1051) both typologically and chronologically correspond to the concurrent sites within the Leskovac Basin. Those sites are attributed to the later phase of the Early Iron Age I, characterised by intensive contacts with the bearers of cultural groups from the north and the east (Insula Banului, Kalakača, and Pšeničevo-Babadag groups), such as incised hatched triangles, parallel grooves, channels and stamped concentric circles.[135] The continuation of excavations at the site will focus on the total research of the Late Bronze Age house, its architecture and its absolute chronology, as well as a more precise definition of possible features attributed to the Late Eneolithic and the Early Bronze Age at the site.

12. Summary

Excavations and related material and scientific analyses at Svinjarička Čuka in 2019 and 2021 offer new data for the Neolithisation process of the central Balkans, and the important river corridor along the Vardar-Morava route in particular. The interdisciplinary approach provides various perspectives for this Starčevo site, including first solid results for domestic activities and dwellings, subsistence and food preparation processes and environmental conditions. An area totalling 225 m^2 in the small elevated river terrace has been investigated so far and revealed Starčevo Neolithic domestic features of an earlier and later phase dating to the 57th and 56th centuries BC. The stratigraphical results are supported by 26 radiocarbon dates of short-lived material, presented and discussed using a Bayesian approach. One radiocarbon date of the late 7th millennium from a drilling core points to an earlier occupation below the excavated layers. The younger Starčevo occupation phase revealed a variety of domestic features, including the remains of a wattle-and-daub light dwelling ('Starčevo hut'), a stone installation with an associated vessel and a large pit with burnt daub material indicating another architectural feature not yet excavated.

The remains of a large rectangular (?) structure came from the earlier Neolithic phase and is assigned as a potential 'Starčevo house'. Massive stone slabs and related pits indicate wooden post footings, of which one in the inner part has been renewed. So far, five floors have been identified, which are associated with various installations (platform, hearth, pits, storage) as well as abundant materials (pottery, artefacts, tools, figurines, ornaments). This large structure demonstrates the creation of a domestic space with several renewals by the Svinjarička Čuka community during the 57th and 56th centuries BC. The analyses of the associated pottery allow us to assume that the majority was secondarily deposited within the 'Starčevo house' during the multiple floor installations and/or as infilling after abandonment. Nevertheless, some floor layers contained many of the best-preserved sherds and refits, interpreted by the expert to mean that the pottery had not moved around as much as in other layers. The very varied pottery repertoire from this context includes a good mix of bowl and jar types, such as storage jars, bowls and monochrome globular vessels, dark linear painted and spiraloid painted bowls, linear incised pottery and a high number of pedestal bases. The technological observations on the chipped stones from the 'Starčevo house' point towards a basic core reduction strategy for producing simple flakes of varying sizes and shapes. The lithic raw materials from this context mainly comprises local cherts of Neogene lacustrine origin (NLS). A diverse lithic assemblage also includes 'Balkan Flint' and clear quartz and is connected with one of the identified 'Starčevo house' floors. Various domestic activities can be related to the house context, such as textile production, polished stone tool production or food preparation.

The material studies of Neolithic pottery, chipped stones, other artefacts and small finds demonstrate that the Svinjarička Čuka communities were broadly embedded in

133 Bulatović, Stankowski 2012. – Bulatović 2021.

134 Bulatović, Gori, Vander Linden 2018, 124–125 and Tab. 1.

135 Bulatović 2009. – Bulatović, Jović 2009, 45-47, with cited literature.

the Starčevo technological knowledge, practice and stylistic concepts during the early and middle Neolithic period. First differences come to light in ongoing raw material and technological analyses (e.g. lithics), indicating the impact of locally available sources on particular local technological characters. Furthermore, ongoing scientific analyses of various materials are expected to offer a deeper insight into local versus regional technologies or practice in the future. The first multidisciplinary approach to the Svinjarička Čuka grinding stones and mortars shows very promising results and revealed different types of grinding kits, including the reconstruction of grinding stones in fixed installations.

The study of the Neolithic faunal remains is based on a smaller sample and shows the dominance of caprines, followed by cattle, domestic pig and red deer. Dog, wild pig, bear, wolf and hare are only evident in singular pieces. Burning traces, gnawing and butchery marks are only scarcely observed. The plant repertoire shows a diverse spectrum of crops (barley, einkorn, emmer and Timopheev's wheat), lentil, pea, wild fruits and nuts. Differences from other Starčevo sites become visible and may indicate local varieties related to biogeoclimatic conditions and the community's choice in crop cultivation and plant consumption. Further results allow the first reconstruction of the natural vegetation in the region as oak-dominated mixed deciduous woodland including light-demanding trees such as hazel, dogwood and plum. The preferred exploitation of oak and dogwood by the inhabitants of Svinjarička Čuka not only demonstrates its availability, but also indicates its use as building materials and fuel.

The new results for the Metal Ages allow a preliminary reconstruction of the later occupation on the river terrace going back to the Late Eneolithic period associated with the Coţofeni-Kostolac group. The Early Bronze Age (Bubanj-Hum III group) is not identified with cultural layers yet, but with a few ceramics and radiocarbon dates pointing towards a potential horizontal shift of the human activities upon the terrace. The Middle Bronze Age (Bubanj-Hum IV-Ljuljaci group) occupation of the 19th and 17th centuries BC is well attested with a large pit and infilled material. The following Late Bronze Age (Brnjica group) architectural remains of a house are partially excavated and radiocarbon-dated to the 15th and 14th centuries BC, the later pits belong to the Early Iron Age I period.

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References

Adams 2002

J. L. Adams, Ground Stone Analysis: A Technological Approach. Salt Lake City 2002.

Adams 2014

J. L. Adams, Ground stone use-wear analysis: a review of terminology and experimental methods, Journal of Archaeological Science 48, 2014, 129–138.

Adams et al. 2009

J. L. Adams, S. Delgado, L. Dubreuil, C. Hamon, H. Plisson, R. Risch, Functional analysis of macro-lithic artifacts. In: F. Sternke, L. J. Costa, L. Eigeland (Eds.), Non-flint Raw Material Use in Prehistory: Old Prejudices and New Directions. British Archaeological Reports International Series 1939, Oxford 2009, 43–66.

Anastasova, Dimitrovska 2014

E. Anastasova, V. Dimitrovska, Comparative analyses of the chipped stone assemblages from Piperkov Chiflik (SW Bulgaria) and Rug Bair (east Macedonia). In: V. Petrova, S. Taneva,

K. Boyadjiev (Eds.), In Memoriam Lilyana Pernicheva-Perets. Godisnik na Nacionalnija Archeologičeski Muzej 12, Sofia 2014, 83–96.

Andreeva, Stefanova, Gurova 2014
P. Andreeva, E. Stefanova, M. Gurova, Chert raw materials and artefacts from NE Bulgaria: a combined petrographic and LA-ICP-MS study, Journal of Lithic Studies 1/2, 2014, 25–45.

Antonović 2003
D. Antonović, Neolithic Ground Stone Industry in Serbia. Belgrade 2003.

Antonović 2006
D. Antonović, Stone Tools from Lepenski Vir. Belgrade 2006.

Antonović, Vitezović, Šarić 2019
D. Antonović, S. Vitezović, J. Šarić, The Early Neolithic settlement at Velesnica: lithic and osseous industries. In: V. Filipović, A. Bulatović, A. Kapuran (Eds.) Papers in Honour of Rastko Vasić 80th Birthday. Belgrade 2019, 63–70.

Arandjelović, Garašanin 1954
D. Arandjelović, M. Garašanin, Starčevačka kultura. Ljubljana 1954.

Asouti, Austin 2005
E. Asouti, P. Austin, Reconstructing woodland vegetation and its exploitation by past societies, based on the analysis and interpretation of archaeological wood charcoal macro-remains, Environmental Archaeology 10/1, 2005, 1–18.

Barker 1975
G. Barker, Early Neolithic land use in Yugoslavia, Proceedings of the Prehistoric Society 41, 1975, 85–104.

Behrensmeyer 1978
A. Behrensmeyer, Taphonomic and ecologic information from bone weathering, Paleobiology 4/2, 1978, 150–162.

Biagi, Starnini 2010
P. Biagi, E. Starnini, The Early Neolithic chipped stone assemblages of the Carpathian Basin: typology and raw material circulation. In: J. K. Kozłowski, P. Raczky (Eds.), Neolithization of the Carpathian Basin: Northernmost Distribution of the Starčevo/Körös Culture. Kraków – Budapest 2010, 119–136.

Biagi, Starnini 2013
P. Biagi, E. Starnini, Pre-Balkan platform flint in the Early Neolithic sites of the Carpathian Basin: its occurrence and significance. In: A. Anders, G. Kulcsár (Eds.), Moments in Time. Papers Presented to Pál Raczky on His 60th Birthday. Budapest 2013, 47–60.

Bogdanović 2008a
M. Bogdanović, Grivac: Settlements of Proto-Starčevo and Vinča Culture. Kragujevac 2008.

Bogdanović 2008b
M. Bogdanović, Circular plates, weights of baked clay, whorls, miscellaneous objects. In: M. Bogdanović (Ed.), Grivac: Settlements of Proto-Starčevo and Vinča Culture. Kragujevac 2008, 135–144.

Bogosavljević Petrović, Starović 2016
V. Bogosavljević Petrović, A. Starović, The context of the early Neolithic in Serbia: hidden reflections of Mesolithic continuity?, Glasnik 32, 2016, 7–50.

Bohn, Neuhäusl 2000
U. Bohn, R. Neuhäusl, Karte der natürlichen Vegetation Europas / Map of the Natural Vegetation of Europe: Maßstab / Scale 1:2 500 000. Münster 2000.

Borić et al. 2018
D. Borić, T. Higham, E. Cristiani, V. Dimitrijević, O. Nehlich, S. Griffiths, C. Alexander, B. Mihailović, D. Filipović, E. Allué, M. Buckley, High-resolution AMS dating of architecture, boulder artworks and the transition to farming at Lepenski Vir, Scientific Reports 8, 2018, 14221.

Boroneanţ, Mărgărit, Bonsall 2019
A. Boroneanţ, M. Mărgărit, C. Bonsall, Discoidal beads: novel elements of the Starčevo Early Neolithic package. In: V. Sîrbu, A. Comşa, D. Hortopan (Eds.), Digging in the Past of Old Europe: Studies in Honor of Cristian Schuster at his 60th Anniversary. Brăila 2019, 51–72.

Brami, Horejs 2019
M. Brami, B. Horejs (Eds.), The Central/Western Anatolian Farming Frontier. Proceedings of the Neolithic Workshop Held at 10th ICAANE in Vienna, April 2016. Oriental and European Archaeology 12, Vienna 2019. doi: 10.2307/j.ctvvh866f.

Brandl, Hauzenberger 2018
M. Brandl, C. Hauzenberger, Geochemical sourcing of lithic raw materials from secondary deposits in south Serbia: implications for early Neolithic resource management strategies, Archaeologia Austriaca 102, 2018, 55–70.

Bronk Ramsey 2009a
C. Bronk Ramsey, Bayesian analysis of radiocarbon dates, Radiocarbon 51, 2009, 337–360.

Bronk Ramsey 2009b
C. Bronk Ramsey, Dealing with outliers and offsets in radiocarbon dating, Radiocarbon 51, 2009, 1023–1045.

Bulatović 2000
А. Булатовић, Налазишта брњичке културне групе у Врањско-бујановачкој и Прешевској котлини, Гласник САД 15–16, 2000, 23–42.

Bulatović 2007
А. Булатовић, Врање: Културна стратиграфија праисторијских локалитета у Врањској регији. Belgrade 2007.

Bulatović 2009
A. Bulatović, South Morava Basin in the transitional period from the Bronze to the Iron Age, Старинар н.с. LVII, 2009, 57–82.

Bulatović 2019
A. Bulatović, Particular types of bowls as heralds of a new age in the Balkans: contribution to the study of cultural and possible ethnic movements in southeast Europe at the end of Bronze and the beginning of Iron Age. In: V. Filipović, A. Bulatović, A. Kapuran (Eds.), Papers in Honour of Rastko Vasić 80th Birthday. Belgrade 2019, 215–232.

Bulatović 2021
A. Bulatović, Beakers with trapezoidal mouth as one of the most specific type of Middle Bronze Age vessel in the central Balkans. In: V. Vučković, V. Filipović, B. Stojanović, R. Risch (Eds.), Crafting Pottery in Bronze Age Europe: The Archaeological Background of the CRAFTER Project. Paraćin 2021, 121–147.

Bulatović, Jović 2009
А. Булатовић, С. Јовић, Лесковац: Културна стратиграфија праисторијских локалитета у Лесковачкој регији. Belgrade 2009.

Bulatović, Stankowski 2012
А. Булатовић, Й. Станковски, Бронзано доба у басену Јужне Мораве и долини Пчиње. Belgrade 2012.

Bulatović, Gori, Vander Linden 2018
A. Bulatović, M. Gori, M. Vander Linden, New absolute dates as a contribution to the study of the Late Bronze Age chronology in the central Balkans, Гласник САД 34, 2018, 121–132.
Burke 2022a
C. Burke. Pottery made to be used: Starčevo ceramics from the site of Svinjarička Čuka, Serbia. In: J. Vuković, V. Bikić (Eds.), Pottery Function and Use: A Diachronic Perspective. Belgrade 2022, 68–86.
Burke 2022b
C. Burke. Potting links: the Starčevo ceramic repertoire of Svinjarička Čuka. In: L. Fidanoski, C. Naumov (Eds.), Neolithic in Macedonia: Recent Research and Analyses. Skopje 2022, 7–20.
Carcaillet 2001
C. Carcaillet, Soil particles reworking evidences by AMS ^{14}C dating of charcoal, Earth and Planetary Sciences 332, 2001, 21–28.
Çilingiroğlu 2010
Ç. Çilingiroğlu, The appearance of impressed pottery in the Neolithic Aegean and its implications for maritime networks in the Eastern Mediterranean, Türkiye Bilimler Akademisi Arkeologi Dergisi 13, 2010, 9–22.
Ciornei, Maris, Soare 2014
A. Ciornei, I. Maris, B. Soare, Microfacies analysis of cherts in Upper Palaeolithic sites along the Lower Danube Valley (Romania), Geo-Eco-Marina 20, 2014, 137–169.
De Groot 2019
B. De Groot, Clay recipes, pottery typologies and the neolithisation of southeast Europe: a case study from Džuljunica-Smărdeš, Bulgaria. In: S. Amicone, P. S. Quinn, M. Marić, N. Mirković-Marić, M. Radivojević (Eds.), Tracing Pottery-Making Recipes in the Prehistoric Balkans 6th–4th Millennia BC. Oxford 2019, 54–64.
de Vareilles 2018
A. de Vareilles, Deeply set roots: an archaeobotanical perspective on the origins of crop husbandry in the western Balkans. PhD Dissertation, University College London 2018.
de Vareilles et al. 2022
A. de Vareilles, D. Filipović, D. Obradović, M. Vander Linden, Along the rivers and into the plain: early crop diversity in the central and western Balkans and its relationship with environmental and cultural variables, Quaternary 5/1, 2022, 6. doi: 10.3390/quat5010006.
Dietrich 2021a
L. Dietrich, Plant Food Processing Tools at Early Neolithic Göbekli Tepe. Oxford 2021.
Dietrich 2021b
L. Dietrich, Südwestasien: Erstellung einer Referenzkollektion für makro- und mikroskopische Abnutzungsspuren an Reibsteinen Vorderasiens, E-Forschungsberichte des Deutschen Archäologischen Instituts 2021/1, 1–21.
Dietrich, Horejs, Brandl in preparation
L. Dietrich, B. Horejs, M. Brandl, Biographies in Stone from the Western Balkans: Using and Re-using Early Neolithic Grinding Stones from Svinjarička Čuka, Serbia, in preparation.
Dimitrijević 1974
S. Dimitrijević, Problem stupnjevanja starčevačke kulture s posebnim obzirom na dorinos južnopanonskih nalazišta rješavanju ovih problema, Materijali 10, 1974, 59–122.
Dubreuil 2002
L. Dubreuil, Etude fonctionnelle des outils de broyage natoufiens: nouvelles perspectives sur l'émergence de l'agriculture au Proche-Orient. PhD Dissertation, Université de Bordeaux 2002.
Dubreuil et al. 2015
L. Dubreuil, D. Savage, S. Delgado, H. Plisson, B. Stephenson, I. de la Torre, Current analytical frameworks for studies of use-wear on ground stone tools. In: J. M. Marreiros, J. F. Gibaja Bao, N. Ferreira Bicho (Eds.), Use-Wear and Residue Analysis in Archaeology. Berlin 2015, 105–158.
Dzhanfezova, Doherty, Elenski 2014
T. Dzhanfezova, C. Doherty, N. Elenski, Shaping a future of painting: the early Neolithic pottery from Dzhulyunitsa, north central Bulgaria, Bulgarian e-Journal of Archaeology 4, 2014, 137–159.
Dzhanfezova, Doherty, Gręebska-Kulow 2020
T. Dzhanfezova, C. Doherty, M. Gręebska-Kulow, Understanding diversity in Early Neolithic pottery production, Documenta Praehistorica 47, 2020, 110–125. doi: 10.4312/dp.47.7.
Elster 1976
E. S. Elster, The chipped stone industry. In: M. Gimbutas (Ed.), Neolithic Macedonia As Reflected by Excavations at Anza, southeast Yugoslavia. Los Angeles 1976, 257–278.
Fewkes, Goldman, Ehrich 1933
V. J. Fewkes, H. Goldman, R. W. Ehrich, Excavations at Starčevo, Yugoslavia: Seasons 1931 and 1932, American School of Prehistoric Research Bulletin 9, 1933, 33–55.
Filipović 2014
D. Filipović, Southwest Asian founder and other crops at Neolithic sites in Serbia, Bulgarian e-Journal of Archaeology 4, 2014, 195–215.
Filipović, Obradović, de Vareilles in press
D. Filipović, Đ. Obradović, A. de Vareilles, The first five millennia of agricultural plant food production in the central and western Balkans: archaeobotanical evidence from the Neolithic to the Bronze Age. In: S. M. Valamoti, A. Dimoula, M. Ntinou (Eds.), Cooking with Plants in Ancient Europe and Beyond: Interdisciplinary Approaches to the Archaeology of Plant Foods. Leiden, in press.
Galović 1962
П. Галовић, Неолитско насеље у Течићу код Рековца, Зборнцк Народног музеја 3, 1962, 31–46.
Gavranović et al. 2020
M. Gavranović, A. Kapuran, M. Mehofer, L. Waltenberger, Bronze Age metallurgy in East Serbia / Bronzanodobna metalurgija u istočnoj Srbiji. In: M. Gavranović, B. Horejs (Eds.), Visualizing the Unknown Balkans / Vizualizacija nepoznatog Balkana. Vienna 2020, 59–71.
Gimbutas 1976
M. Gimbutas, Neolithic Macedonia As Reflected by Excavations at Anza, southeast Yugoslavia. Los Angeles 1976.
Gogâltan 1999
F. Gogâltan, Bronzul timpuriu şi mijlociu în Banatul românesc şi pe cursul inferior al Mureşului I: Cronologia şi descoperirile de metal. Timișoara 1999.
Gręebska-Kulow, Gurova, Zidarov 2021
M. Gręebska-Kulow, M. Gurova, P. Zidarov, Anthropomorphic figurines and miniature beads from the Early Neolithic settlement of Ilindentsi, southwest Bulgaria, Bulgarian e-Journal of Archaeology 11, 2021, 1–31. doi: 10.57573/be-ja.11.1-31.

Gronenborn et al. 2021
D. Gronenborn, B. Horejs, M. Börner, M. Ober, Expansion of farming in western Eurasia, 9600–4000 Cal BC (Update Version 2021.2). doi: 10.5281/zenodo.5903164.
Gurova 2008
M. Gurova, Towards an understanding of Early Neolithic populations: a flint perspective from Bulgaria, Documenta Praehistorica 35, 2008, 111–129.
Gurova 2012
M. Gurova, 'Balkan Flint': fiction and/or trajectory to Neolithization. Evidence from Bulgaria, Bulgarian e-Journal of Archaeology / Българско е-Списание за Археология 2/1, 2012, 15–49.
Gurova 2016
M. Gurova, Chipped-stone assemblages from the prehistoric site of Drenovac (Serbia). In: S. Perić (Ed.), The Neolithic in the Middle Morava Valley. Belgrade 2016, 29–58.
Gurova, Nachev 2008
M. Gurova, C. Nachev, Formal Early Neolithic flint toolkits: archaeological and sedimentological aspects. In: R. I. Kostov, B. Gaydarska, M. Gurova, (Eds.), Geoarchaeology and Archaeomineralogy. Proceedings of the International Conference, 29–30 October 2008. Sofia 2008, 29–35.
Gurova et al. 2016
M. Gurova, P. Andreeva, E. Stefanova, Y. Stefanov, M. Kočić, D. Borić, Flint raw material transfers in the prehistoric Lower Danube Basin: an integrated analytical approach, Journal of Archaeological Science: Reports 5, 2016, 422–441.
Gurova et al. 2022
M. Gurova, P. Andreeva, E. Stefanova, A. Aladzhov, C. Bonsall, Petrographic and geochemical analyses of flint raw materials from Bulgaria: a reliable combination for provenance studies of archaeological flint, Quaternary International 615, 2022, 18–32.
Haak et al. 2015
W. Haak, I. Lazaridis, N. Patterson, N. Rohland, S. Mallick, M. Llamas, G. Brandt, S. Nordenfelt, E. Harney, K. Stewardson, Q. Fu, A. Mittnik, E. Bánffy, C. Economou, M. Francken, S. Friederich, R. G. Pena, F. Hallgren, V. Khartanovich, A. Khokhlov, M. Kunst, P. Kuznetsov, H. Meller, O. Mochalov, V. Moiseyev, N. Nicklisch, S. L. Pichler, R. Risch, M. A. Rojo Guerra, C. Roth, A. Szécsényi-Nagy, J. Wahl, M. Meyer, J. Krause, D. Brown, D. Anthony, A. Cooper, K. W. Alt, D. Reich, Massive migration from the steppe was a source for Indo-European languages in Europe, Nature 522/7555, 207–211.
Hamon 2008
C. Hamon, Functional analysis of stone grinding and polishing tools from the earliest Neolithic of north-western Europe, Journal of Archaeological Science 35/6, 2008, 1502–1520.
Hayes, Pardoe, Fullagar 2018
E. Hayes, C. Pardoe, R. Fullagar, Sandstone grinding/pounding tools: use-trace reference libraries and Australian archaeological applications, Journal of Archaeological Science: Reports 20, 2018, 97–114.
Hegi 1926
G. Hegi, Illustrierte Flora von Mitteleuropa V.2: Dicotyledones. III. Teil. Munich 1926.
Hofmanová et al. 2016
Z. Hofmanová, S. Kreutzer, G. Hellenthal, C. Sell, Y. Diekmann, D. Díez-del-Molino, L. van Dorp, S. López, A. Kousathanas, V. Link, K. Kirsanow, L. M. Cassidy, R. Martiniano, M. Strobel, A. Scheu, K. Kotsakis, P. Halstead, S. Triantaphyllou, N. Kyparissi-Apostolika, D. Urem-Kotsou, C. Ziota, F. Adaktylou, S. Gopalan, D. M. Bobo, L. Winkelbach, J. Blöcher, M. Unterländer, C. Leuenberger, Ç. Çilingiroğlu, B. Horejs, F. Gerritsen, S. J. Shennan, D. G. Bradley, M. Currat, K. R. Veeramah, D. Wegmann, M. G. Thomas, C. Papageorgopoulou, J. Burger, Early farmers from across Europe directly descended from Neolithic Aegeans, Proceedings of the National Academy of Sciences 113/25, 2016, 6886–6891. doi: 10.1073/pnas.1523951113.
Horejs, Bulatović 2019
Б. Хорејш, А. Булатовић, Први резултати археолошких истраживања локалитета Свињаричка Чука код Лебана, Лесковачки зборник LIX, 2019, 45–54.
Horejs et al. 2018
B. Horejs, A. Bulatović, C. Meyer, B. Milić, S. Schneider, M. Schlöffel, V. Stevanović, Prehistoric landscapes of the Pusta Reka region (Leskovac): new investigations along the southern Morava River, Journal of the Serbian Archaeological Society 34, 2018, 23–51.
Horejs et al. 2019a
B. Horejs, A. Bulatović, J. Bulatović, M. Brandl, C. Burke, D. Filipović, B. Milić, New insights into the later stage of the Neolithisation process of the central Balkans: first excavations at Svinjarička Čuka 2018, Archaeologia Austriaca 103, 2019, 175–226.
Horejs et al. 2020
B. Horejs, M. Brandl, B. Milić, C. Burke, First farmers and herders in south Serbia / Prvi zemljoradnici i stočari u južnoj Srbiji. In: M. Gavranović, B. Horejs (Eds.), Visualizing the Unknown Balkans / Vizualizacija nepoznatog Balkana. Vienna 2020, 15–31.
Jevtić 1990
M. Јевтић, Праисторијска некропола у Пироту: прилог познавању брњичке групе, Гласник САД 6, 1990, 92–103.
Jezik 1998
S. Jezik, The Origins of Agriculture in Temperate Europe: An Exploration into the Subsistence Strategies of Two Early Neolithic Groups in the Central Balkans, Foeni-Salaş and Blagotin. Master's Thesis, University of Manitoba 1998.
Jovanović et al. 2021
J. Jovanović, R. C. Power, C. de Becdelièvre, G. Goude, S. Stefanović, Microbotanical evidence for the spread of cereal use during the Mesolithic-Neolithic transition in southeastern Europe (Danube Gorges): data from dental calculus analysis, Journal of Archaeological Science 125, 2021, 105288.
Kapuran, Bulatović 2012
А. Капуран, А. Булатовић, Културна група Коцофени-Костолац на територији источне Србије, Старинар н.с. LXII, 2012, 63–94.
Kapuran, Gavranović, Mehofer 2020
A. Kapuran, M. Gavranović, M. Mehofer, Bronze Age settlement and necropolis of Trnjane, near Bor: revision and new research results, Старинар LXX, 2020, 51–84.
Karmanski 2005
S. Karmanski, Donja Branjevina: A Neolithic Settlement near Deronje in the Vojvodina (Serbia). Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Quaderno 10, Trieste 2005.

Krauss et al. 2017
R. Krauss, E. Marinova, H. de Brue, B. Weninger, The rapid spread of early farming from the Aegean into the Balkans via the Submediterranean-Aegean vegetation zone, Quaternary International 496, 2017, 24–41.
Kreiter et al. 2013
A. Kreiter, A. Pető, P. Pánczél, E. Bánffy, Materializing tradition: ceramic production in Early Neolithic Hungary. In: E. Bánffy (Ed.), The Early Neolithic of the Danube-Tisza Interfluve. British Archaeological Reports International Series 2584, Oxford 2013, 127–140.
Kreuz 1990
A. Kreuz, Die ersten Bauern Mitteleuropas: eine archäobotanische Untersuchung zur Umwelt und Landwirtschaft der ältesten Linearbandkeramik. Analecta Praehistorica Leidensia 23, Leiden 1990.
Kroll 2013
H. Kroll, Die Wirtschaft des Umfelds von Okolište: Zagrenice, Kundruci und Donje Moštre. In: J. Müller, K. Rassmann, R. Hofmann, Okolište 1: Untersuchungen einer spätneolithischen Siedlungskammer in Zentralbosnien. Neolithikum und Chalkolithikum in Zentralbosnien 1, Universitätsforschungen zur prähistorischen Archäologie 228, Bonn 2013, 113–122.
Lasić 1996
М. Лазић, Култура Брњица: генеза, развој и хронологија. PhD Dissertation, University of Belgrade 1996.
Marchi et al. 2022
N. Marchi, L. Winkelbach, I. Schulz, M. Brami, Z. Hofmanová, J. Blöcher, C. S. Reyna-Blanco, Y. Diekmann, A. Thiéry, A. Kapopoulou, V. Link, V. Piuz, S. Kreutzer, S. M. Figarska, E. Ganiatsou, A. Pukaj, T. J. Struck, R. N. Gutenkunst, N. Karul, F. Gerritsen, J. Pechtl, J. Peters, A. Zeeb-Lanz, E. Lenneis, M. Teschler-Nicola, S. Triantaphyllou, S. Stefanović, C. Papageorgopoulou, D. Wegmann, J. Burger, L. Excoffier, The genomic origins of the world's first farmers, Cell 185/11, 2022, 1842–1859. doi: 10.1016/j.cell.2022.04.008.
Marinova, Krauss 2014
E. Marinova, R. Krauss, Archaeobotanical evidence on the Neolithisation of northeast Bulgaria in the Balkan-Anatolian context: chronological framework, plant economy and land use, Bulgarian e-Jounal of Archaeology 4/2, 2014, 179–194.
Marinova, Ntinou 2018
E. Marinova, M. Ntinou, Neolithic woodland management and land-use in south-eastern Europe: the anthracological evidence from northern Greece and Bulgaria, Quaternary International 496, 2018, 51–67.
Marinova, Thiébault 2008
E. Marinova, S. Thiébault, Anthracological analysis from Kovačevo, southwest Bulgaria: woodland vegetation and its use during the earliest stages of the European Neolithic, Vegetation History and Archaeobotany 17, 2008, 223–231.
Marinova et al. 2013
E. M. Marinova, D. Filipović, Đ. Obradović, E. Allue, Wild plant resources and land use in Mesolithic and Early Neolithic south-east Europe: archaeobotanical evidence from the Danube catchment of Bulgaria and Serbia, Offa 69–70, 2013, 467–478.
Mazzucco et al. 2022
N. Mazzucco, A. Sabanov, F. Antolín, G. Naumov, L. Fidanoski, J. Gibaja The spread of agriculture in south-eastern Europe: new data from north Macedonia, Antiquity 96/385, 2022, 15–33. doi:10.15184/aqy.2021.32.
McPherron, Rasson, Galdikas 1988
A. McPherron, J. Rasson, B. Galdikas, Other artifact categories. In: A. McPherron, D. Srejović (Eds.), Divostin and the Neolithic of Central Serbia. Ethnology Monographs 10, Pittsburgh 1988, 325–344.
Milovanović et al. 2017
B. Milovanović, V. Ducić, M. Radovanović, M. Milivojević, Climate regionalisation of Serbia according to Köppen climate classification, Journal of the Geographical Institute "Jovan Cvijić" 67, 2017, 103–114.
Minichreiter 2007
K. Minichreiter, Slavonski Brod Galovo: deset godina arheoloških istraživanja / Slavonski Brod Galovo: Ten years of archaeological excavations. Zagreb 2007.
Nikolić 2005
D. Nikolić, The development of pottery in the Middle Neolithic and chronological systems of the Starčevo culture, Journal of the Serbian Archaeological Society 21, 2005, 45–70.
Obradović 2013
Đ. Obradović, New data on early agriculture in the central Balkans: archaeobotanical investigations at Early and Late Neolithic sites in the Morava Valley, Serbia. Poster Presented at the 16th Conference of the International Work Group for Palaeoethnobotany, Thessaloniki, Greece, 2013.
Obradović, Bajčev 2016
Đ. Obradović, O. Bajčev, Neolithic land use in central Pomoravlje: arable potential of soils and agriculture. In: S. Perić (Ed.), The Neolithic in the Middle Morava Valley: New Insights into Settlements and Economy. Paraćin 2016, 61–78.
Oross, Whittle 2007
K. Oross, A. Whittle, Figural representations and other clay objects. In: A. Whittle (Ed.), The Early Neolithic on the Great Hungarian Plain: Investigations of the Körös Culture Site of Ecsegfalva 23, County Békés. Budapest 2007.
Oross et al. 2016
K. Oross, E. Bánffy, A. Osztás, T. Marton, E. Nyerges, K. Kohler, A. Szécsényi-Nagy, K. Alt, C. Ramsey, T. Goslar, B. Kromer, W. Hamilton, The early days of Neolithic Alsónyék: the Starčevo occupation, Bericht der Römisch-Germanischen Kommission 94, 2016, 93–121.
Papadakou, Kotsakis, Urem-Kotsou 2021
T. Papadakou, K. Kotsakis, D. Urem-Kotsou, Distribution of organic-tempered pottery in southeast Europe and the Near East: a complex picture. The case of northern Greece, Open Archaeology 7/1, 2021, 1425–1443. doi: 10.1515/opar-2020-0197.
Pavlović et al. 2017
P. Pavlović, N. Kostić, B. Karadžić, M. Mitrović, The Soils of Serbia. Berlin – Heidelberg 2017.
Pavúk, Bakamska 2021
J. Pavúk, A. Bakamska, Die neolithische Tellsiedlung in Gălăbnik: Studien zur Chronologie des Neolithikums auf dem Balkan. Mit einem Beitrag von Elka Christova Anastasova. Mitteilungen der Prähistorischen Kommission 91, Vienna 2021.
Perić 2012
S. Perić, Die neolithischen Siedlungen in der mittleren Morava-Ebene und die Slatina-Toponymie. In: V. Nikolov, K. Bačvarov (Eds.), Salz und Gold: Die Rolle des Salzes im prähistorischen Europa / Salt and Gold: The Role of Salt in Prehistoric Europe. Proceedings of the International Symposium

(Humboldt-Kolleg) in Provadia, Bulgaria, 30 September – 4 October 2010. Provadia – Veliko Tarnovo 2012, 219–224.

Perić 2008

S. Perić, The oldest cultural horizon of trench XV at Drenovac, Starinar 58, 2008, 29–50.

Perić, Nikolić 2016

S. Perić, N. Nikolić, Lepenski Vir: Stratigraphy, Chronology and Periodization. Belgrade 2016.

Perić et al. 2020

S. Perić, O. Bajčev, I. Stojanović, Đ. Obradović, The Neolithic settlement at Drenovac, Serbia: settlement history and spatial organisation. In: N. Tasić, D. Urem-Kotsou, M. Burić (Eds.), Making Spaces into Places: The North Aegean, the Balkans and Western Anatolia in the Neolithic. British Archaeological Reports International Series 3001, Oxford 2020, 181–189.

Perlès 2001

C. Perlès, The Early Neolithic in Greece: The First Farming Communities in Europe. Cambridge 2001.

Pernicheva-Perets, Grębska-Kulow, Kulov 2011

L. Pernicheva-Perets, M. Grębska-Kulow, I. Kulov, Balgarchevo: The Prehistoric Settlement 1. Sofia 2011.

Porčić et al. 2020

M. Porčić, T. Blagojević, J. Pendić, S. Stefanović, The timing and tempo of the Neolithic expansion across the central Balkans in the light of the new radiocarbon evidence, Journal of Archaeological Science: Reports 33, 2020, 102528. doi: 10.1016/j.jasrep.2020.102528.

Porčić et al. 2021

M. Porčić, T. Blagojević, J. Pendić, S. Stefanović, The Neolithic demographic transition in the central Balkans: population dynamics reconstruction based on new radiocarbon evidence, Philosophical Transactions of the Royal Society B/376, 2021, 20190712. doi: 10.1098/rstb.2019.0712.

Reimer et al. 2020

P. J. Reimer, W. E. N. Austin, E. Bard, A. Bayliss, P. G. Blackwell, C. Bronk Ramsey, M. Butzin, H. Cheng, R. L. Edwards, M. Friedrich, P. M. Grootes, T. P. Guilderson, I. Hajdas, T. J. Heaton, A. G. Hogg, K. A. Hughen, B. Kromer, S. W. Manning, R. Muscheler, J. G. Palmer, C. Pearson, J. van der Plicht, R. W. Reimer, D. A. Richards, E. M. Scott, J. R. Southon, C. S. M. Turney, L. Wacker, F. Adolphi, U. Büntgen, M. Capano, S. M. Fahrni, A. Fogtmann-Schulz, R. Friedrich, P. Köhler, S. Kudsk, F. Miyake, J. Olsen, F. Reinig, M. Sakamoto, A. Sookdeo, S. Talamo, The Intcal20 northern hemisphere radiocarbon age calibration curve (0–55 Cal kBP), Radiocarbon 62, 2020, 725–757.

Robitaille 2016

J. Robitaille, The ground stone industry of the Mursi of Maki, Ethiopia: ethnoarchaeological research on milling and crushing equipment (technique and function), Journal of Lithic Studies 3/3, 2016, 429–456. doi: 10.2218/jls.v3i3.1680.

Šarić 2003

J. Šarić, Stone as material for production of chipped artifacts in Early and Middle Neolithic of Serbia, Starinar LII, 2003, 11–26.

Šarić 2005

J. Šarić, The chipped stone assemblage. In: S. Karmanski, Donja Branjevina: A Neolithic Settlement near Deronje in the Vojvodina (Serbia). Società per la Preistoria e Protostoria della Regione Friuli-Venezia Guilia, Quaderno 10, Trieste 2005, 57–65.

Šarić 2006

J. Šarić, Typology of chipped stone artefacts in the early and middle Neolithic in Serbia, Starinar LVI, 2006, 9–45.

Šarić 2014

J. Šarić, Early and Middle Neolithic Chipped Stone Artefacts from Serbia. Belgrade 2014.

Schroedter et al. 2012

T. Schroedter, R. Hofmann, N. Müller-Scheessel, J. Müller, O. Nelle, Late Neolithic vegetation around three sites in the Visoko Basin, central Bosnia, based on archaeo-anthracology: variation versus selective wood use, Saguntum Extra 13, 2012, 53–63.

Shackleton, Prins 1992

C. M. Shackleton, F. Prins, Charcoal analysis and the "principle of least effort": a conceptual model, Journal of Archaeological Science 19, 1992, 631–637.

Shennan 2018

S. Shennan, The First Farmers of Europe: An Evolutionary Perspective. Cambridge 2018.

Spataro 2019

M. Spataro, Starčevo Ceramic Technology: The First Potters of the Middle Danube Basin. Universitätsforschungen zur prähistorischen Archäologie 341, Bonn 2019.

Spataro et al. 2019

M. Spataro, G. Katsarov, N. Todorova, A. Tsurev, N. Nikolova, N. Yaneva, K. Bacvarov, The chaîne opératoire of 6th millennium BC pottery making in the Maritsa Valley, Bulgaria: ceramics from Nova Nadezhda, Praehistorische Zeitschrift 94/1, 2019, 1–30. doi: 10.1515/pz-2019-0007.

Srejović 1960

D. Srejović, Praistorijska nekropola u Donjoj Brnjici, Glasnik Muzeja Kosova i Metohije IV–V, 1960, 83–135.

Stefanović et al. 2020

S. Stefanović, M. Porčić, T. Blagojević, J. Jovanović, Neolithic settlements in the central Balkans between 6200 and 5300 cal BC: issues of duration and continuity of occupation. In: N. N. Tasić, D. Urem-Kotsou, M. Burić (Eds.), Making Spaces into Places: The North Aegean, the Balkans and Western Anatolia in the Neolithic. British Archaeological Reports International Series 3001, Oxford 2020, 191–199.

Stojić 2001a

М. Стојић, Брњичка културна група у басену Јужне Мораве, Лесковачки зборник XLI, 2001, 15–93.

Stojić 2001b

M. Stojić, The Brnjica cultural group in the South Morava Basin, Starinar L, 2001, 9–59.

Théry-Parisot, Chabal, Chrzavzez 2010

I. Théry-Parisot, L. Chabal, J. Chrzavzez, Anthracology and taphonomy, from wood gathering to charcoal analysis: a review of the taphonomic processes modifying charcoal assemblages, in archaeological contexts, Palaeogeography, Palaeoclimatology, Palaeoecoloy 291, 2010, 142–153.

Vučković 2019

V. Vučković, Neolithic Economy and Macro-lithic Tools of the Central Balkans. PhD Dissertation, Universitat Autònoma de Barcelona, Bellaterra 2019.

Vuković 2004

J. Vuković, Statistic and typological analyses of the Early Neolithic pottery excavated in the structure 03 at the site of Blagotin near Trstenik. In: M. Vasić, P. Vučković, B. Cvetković (Eds.), The

Central Pomoravlje in Neolithization of South-East Europe: The Neolithic in the Middle Morava Valley 1. Belgrade 2004, 83–156.
Vuković, Svilar 2016
J. Vuković, M. Svilar, Early Neolithic impresso-decoration reconsidered: a case study from Pavlovac-Kovačke Njive, southern Serbia, Pontica 48–49/2015–2016, 2016, 73–98.
Whittle et al. 2002
A. Whittle, L. Bartosiewicz, D. Borić, P. Pettitt, M. Richards, In the beginning: new radiocarbon dates for the Early Neolithic in northern Serbia and south-east Hungary, Antaeus 25, 2002, 63–117.

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