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ARCHAEOBOTANY AT NEOLITHIC SITES IN SERBIA: A CRITICAL OVERVIEW OF THE METHODS AND RESULTS

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Abstract: This paper summarises archaeobotanical research in Serbia, more specifically, the analysis of plant remains from Neolithic sites and deposits (c. 6200–4500 cal BC). It offers an overview of the type of material analysed (macro- and micro-remains) and the relevant literature, and describes the charred seed assemblages in terms of the recovery method, the archaeological context, and the identified crop and wild taxa. Certain past and present methodological issues and problems regarding archaeobotanical analysis in Serbia are recognised, and the 'usefulness' of the obtained results for archaeological interpretations and reconstructions discussed.

Key words: Neolithic, Serbia, archaeobotany, plant macro-remains, sampling, recovery

Apstrakt: U radu je predstavljen istorijat arheobotaničkih istraživanja neolitskih nalazišta (6200–4500 p.n.e.) na tlu Srbije i pregled metoda prikupljanja biljnih ostataka, a sumirani su i rezultati dosadašnjih analiza – metod uzimanja uzoraka, arheološki konteksti, identifikovane vrste žitarica i divlje vrste. Na primeru ovih lokaliteta i raspoloživih arheobotaničkih podataka razmotreni su ključni problemi u vezi sa načinom izdvajanja biljnih ostataka tokom iskopavanja, odnosno uzimanjem arheobotaničkih uzoraka, kao i sa mogućnošću upotrebe dobijenih rezultata u interpretaciji arheoloških konteksta i rekonstrukciji aktivnosti u vezi sa eksploatacijom biljnih resursa.

Ključne reči: neolit, Srbija, arheobotanika, makro-biljni ostaci, uzorkovanje, metod prikupljanja

ARCHAEOBOTANY

The focus of archaeobotanical investigations are plant remains from archaeological deposits. The evidence generally shows that plants had a central role in the subsistence and economy of past communities, which in turn were very much influenced by the availability and abundance of plant resources. Archaeobotany provides information about economic, but also social and cultural aspects of life in the past, as well as the environment and environmental changes. Results of the analysis of plant remains recovered from archaeological deposits can help reconstruct human-plant relationships, and contribute to the overall understanding of human life in different places at different time periods (Jacomet 2007).

Significant advances have been made in archaeobotanical research across the world since the time of the first archaeobotanical analysis in the 19th century[1]. The potential of the discipline and the scientific value of the information it can offer have been widely recognised. In addition to the data obtained from macroscopic plant remains (wood, seed, chaff, fruit etc), which were the focus of the analysis in its early days, the second half of the 20th century saw the development of techniques for extraction and analysis of microscopic remains (pollen, phytoliths, starch grains). Combined, these sources provide remarkably detailed insight into the human past and, importantly, into human interactions with the environment (Hastorf 1999; Jacomet and Kreuz 1999; Pearsall 2000; Jacomet 2007). The increasing role of archaeobotany in archaeological research has been further reinforced by the development of new and efficient methods of recovery of macro-plant material, particularly charred (carbonised) remains: a step forward was made from *in situ* collection of only those visible by naked eye to extensive sampling, and from small-scale sieving of soil to flotation – nowadays a standard way of extracting macro-botanical material from archaeological deposits at many sites (Wagner 1988; Fuller 2007). Similarly, for the recovery of pollen grains and phytoliths from sediments specialised laboratory-based chemical treatments and processes have been developed (e.g. Pearsall 2000; Piperno 2006).

Along with the 'evolution' of field and laboratory methods that have improved the resolution of archaeobotanical data, development of theory and interpretation in archaeobotany has been substantial, resulting in the widening scope of study that addresses many archaeological questions and issues, general and specific (Fuller 2007). Archaeobotanists have moved on from 'mere' recognition, identification and quantification of the remains in archaeological deposits characteristic of early studies, towards consideration of complex and multiple aspects of plant use in the past, such as availability and role of domesticated *vs*. non-domesticated plant resources and changes in their importance through time and space, specific plant-based activities, crop growing conditions, agricultural practices and cultivation systems, food preparation and consumption habits, human and animal diet, culinary practices, palaeoenvironment, sociality of plant use. In addition, some previously made observations and hypotheses, for example on the emergence and spread of farming in south-west Asia have been tested and new reconstructions offered (e.g. Fuller *et al*. 2011; Fuller 2012). Furthermore, ethnographic, experimental, biological and ecological data are increasingly used in archaeobotanical interpretation and reconstructions, as well as the results of genetic, micro-biological and stable isotope analysis, allowing for interdisciplinary approaches and integration with other lines of evidence in archaeology (e.g. Hastorf 1999; Jacomet and Kreuz 1999; Pearsall 2000; Bogaard 2004; Jacomet 2007; Fairbairn and Weiss 2009; VanDerwarker and Peres 2010; Fraser *et al*. 2011).

ARCHAEOBOTANY IN SERBIA

Archaeobotanical study has made an impressive progress in recent years and, given the prospects and potential of archaeobotanical research, it is evident that it now holds an extremely important place in archaeological investigations worldwide. However, archaeobotanical analyses have not become a regular component of archaeological projects in Serbia, and they are nowhere near as common as studies of some other forms of evidence (e.g. pottery, lithics, art/symbolic objects). Botanical remains from a relatively small number of sites (of any time/culture period) in Serbia have been recovered and analysed in detail, and the results published. By and large, this could be understood as a consequence of the highly time-consuming and labour-intensive nature of archaeobotanical analysis that also requires specific (and expensive) field and laboratory equipment. The lack

1 Conducted by the German scholar C. Kunth in 1826 on desiccated plant remains found in ancient Egyptian burial chambers (Pearsall 2000: 4).

of specialists in the field and/or institutionalised archaeobotanical training for aspiring ones is another serious constraint to the wider application of archaeobotanical approaches. A likely contributing factor to the disregard of the discipline and its slow progress is the surprisingly widespread misperception among Serbian archaeologists of archaeobotany as a natural science and (hence) irrelevant to the study of human behaviour and social patterns of the past. The rare detailed and well-constructed archaeobotanical studies in Serbia are insufficient for any systematic archaeobotanical 'coverage' of the region and of the established chronological phases. Consequently, it is still difficult in Serbia to discuss current topics in archaeobotany or integrate archaeobotanical evidence from this part of the Balkans into a broader archaeological picture and contribute to the regional or multidisciplinary studies (such as e.g. Colledge *et al*. 2005; Colledge and Connoly 2007).

Another main issue in archaeobotanical research in Serbia relates to the methods used for recovery of plant material from archaeological sites, which have largely determined (i.e. limited) the level, type, scope and resolution of the analysis. As will be shown below, only archaeobotanically sampled (Neolithic) sites yielded information more or less 'adequate' for detailed archaeobotanical characterisation of individual contexts and deposits, chronological sequences, site-level analysis, intra- and inter-site comparisons etc. and offered some data on plant use and plant-related activities. It has been continuously reiterated in archaeobotanical and archaeological literature that, the way in which the material is collected in the field, and the locations from which it derives, greatly influence and determine the subsequent analysis and interpretation. Archaeobotanical sampling and good sampling strategies, as well as advanced techniques for processing of the samples, are major pre-conditions to a successful archaeobotanical analysis (e.g. Keeley 1978; van der Veen 1983; Jones 1991; Pearsall 2000). Therefore, throughout the paper, we stress the need for carefully designed archaeobotanical sampling and recovery techniques appropriate for the research questions, and recommend consideration of their limiting and biasing effect on the assemblage before attempting any interpretation of the plant material.

OVERVIEW OF THE RESEARCH

The first known analysis of plant material in Serbia was carried out by Russian agronomist S. Lomejko on the hand-collected remains from the Neolithic site of Vinča during excavations in the early 20th century. The material derived from a ceramic bowl and consisted of charred grains of "few wheat species" (M. Vasić field notes 25/07/1911: entries 7–8; Vasić 1936: 170–173). It was not until the 1970s that systematic collection of archaeobotanical material was initiated at some Serbian sites, mainly by European archaeobotanists with a general interest in understanding the spread of agriculture from south-west Asia to Europe. The evidence from the Neolithic Balkans was expected to shed more light on the routes of spread of early farming and the 'suite' of domesticates brought to Europe; thus the work was primarily aimed at collection and analysis of macro-remains of cultivated species from the Neolithic levels and sites.

M. Hopf (1958, 1961, 1966/67, 1974) analysed seeds/fruits from several Neolithic sites in present-day Bosnia and Herzegovina (Gornja Tuzla, Lisičići, Lug near Goražde), FYR Macedonia (Vršnik), central Serbia (Selevac, Vinča near Kragujevac) and Kosovo (Valač and Predionica). W. van Zeist analysed macro-remains from two sites in northern Serbia (Vojvodina): those collected from Neolithic to early Roman deposits of the multi-layered site of Gomolava, and the Iron Age sites of Kalakača and Gradina upon Bosut (van Zeist 1975, 2001/2002; van Zeist in Medović 1988). J. Renfrew presented the results of her analysis of macro-remains from the Neolithic sites of Starčevo – Grad and Medvednjak in Serbia, and Obre I, Obre II and Kakanj in Bosnia (Renfrew 1979). M. Hopf and J. Renfrew also examined plant impressions in pottery and daub found at Starčevo – Grad (Renfrew 1979) and

Vinča – Kragujevac, Lisičići, Gornja Tuzla and Predionica (Hopf 1958, 1961, 1966/67, 1974).

The research continued in the 1980s as part of several international archaeological projects. G. Willcox carried out analysis of macro-remains from the Bronze Age site of Novačka Ćuprija (Krstić *et al.* 1986; Bankoff and Winter 1990). K.E. Behre provided identifications of few seeds extracted from pollen samples taken at the Neolithic site of Divostin[2] (Grüger and Beug 1988). F.S. McLaren and R.N.L.B. Hubbard examined macro-botanical material from Neolithic Selevac (McLaren and Hubbard 1990).

Between 1990 and 2000 the archaeobotanical work in Serbia was mainly conducted by H. Kroll and K. Borojević. Kroll supervised flotation and subsequent laboratory work at the Bronze-Iron Age site of Feudvar in Vojvodina; he published in detail the results of several different groups of finds (Kroll 1990a, 1990b, 1991a, 1991b, 1992, 1995, 1997) and the overview of the exceptionally rich assemblage (Kroll 1998), as well as the results of collaborative work with K. Borojević on some specific aspects of Feudvar einkorn remains (Kroll and Borojević 1988, 1998–9); in addition, Borojević (1991) analysed emmer from Feudvar in more detail.

Borojević further analysed macro-remains from two Neolithic sites in western Serbia (Belotić and Petnica; Borojević 1990a), the late Iron Age (La Téne) horizon at Gomolava (Borojević 1988a, 1990b) and the early-Byzantine site of Svetinja near Kostolac (Borojević 1988b). Borojević's doctoral thesis (1998) and the resulting book (2006) give a thorough account of the archaeobotanical work completed within the international archaeological excavations of the late Neolithic site of Opovo (Tringham *et al.* 1985, 1992). Among other aspects, the publications present details on the Opovo sampling strategy, method of recovery and the results of analysis of botanical remains, and they provide careful reconstruction of the vegetation around the site, as well as the reconstruction of agricultural practices and their implications for social and cultural development of the community. From 2000 K. Borojević continues her work in Serbia by conducting the analysis of hand-collected plant remains from medieval fortress of Ras (Borojević 2002, 2005), while she has also taken part in the archaeobotanical research at late Neolithic Vinča – Belo Brdo (Borojević 2010).

A. Medović has been working on macro-plant remains from a number of sites in Serbia: Neolithic Starčevo – Grad (2011a); the Bronze/Iron Age site of Židovar (2003); late Bronze Age Hisar (2005, 2011b, 2012); early Iron Age Gradina upon Bosut (2010a, 2011c); late Iron Age (La Téne) Čarnok (2006, 2011d); the 4th century AD site of Čurug (2009); the I/II century AD Roman *vicus* in Hrtkovci –Vranj (2010b); Roman imperial palace in Gamzigrad (Dimitrijević and Medović 2007; Medović 2008). Medović has also looked at aspects of wild plant use such as their role as medicine or spice (Kišgeci and Medović 2006) and a source of natural dye (Medović 2011e).

The present authors have carried out the analysis of macro-remains from assorted sites in Serbia: the Neolithic sites of Slatina – Turska česma (Drenovac), Motel – Slatina, Dunjićki šljivari – Međureč, Stubline near Obrenovac, and Pavlovac – Gumnište (Obradović, unpublished), and the Mesolithic site of Vlasac, late Neolithic Vinča – Belo Brdo, Belovode and Pločnik, early Chalcolithic site of Bubanj, early Iron Age Kalakača, and early Bronze Age Vatin and Ranutovac (Filipović 2004, 2011, unpublished data from Ranutovac; Filipović *et al.* 2010; Allué *et al.* in press; Filipović and Tasić 2012).

In addition to the collection and analysis of archaeobotanical remains, plant material was observed in the deposits, but not examined in detail, at a few sites (see Table 1): Batka – Perlez (Marinković 2004: 19), Matejski Brod (Radišić 1984: 21), Grivac (Gavela 1958: 247), Stapari (Chapman 1981: 117), Zlatara – Ruma (Leković 1995: 29), Banjica (Todorović and Cermanović-Kuzmanović 1961: 14) and Nosa – Biserna obala (Grbić 1959: 14; D. Garašanin 1959, 1960;

2 Pollen samples from the Neolithic site of Grivac, also collected and analysed by Grüger and Beug (1988) did not yield any seeds.

Garašanin 1973: 26). At several early medieval sites (4–9th century AD) in Vojvodina imprints of crop and weed seeds were discovered on over 300 house-wall and ceiling fragments, and pottery sherds (Jevtić 1999/2000).

The analysis of wood charcoal often relied on material collected *in situ*, as was the case at Gomolava in seasons 1967–1972 (van Zeist 1975: 317, 2001/2002: 111, Table 7), Selevac (Hopf 1974) and Ras (Vilotić 1999; Vilotić and Radošević 2000). At several other sites, wood charcoal from a small number of samples (*c.* 2) was extracted and analysed: Gamzigrad, Hrtkovci – Vranj, Gradina upon Bosut, and Čarnok (Medović 2008, 2010b, 2011c, 2011d). Wood charcoal from Divostin and Grivac was retrieved from pollen samples (Grüger and Beug 1988). Only at Novačka Ćuprija, Opovo, Ranutovac, Bubanj and Vlasac were wood remains extracted from systematically collected flotation samples (Bankoff and Winter 1990; Borojević 1998: Table 5.1, 2006: Table 4.2; Filipović *et al.* 2010, unpublished data from Bubanj and Ranutovac; Allué *et al.* in press).

Pollen analysis have been limited to a few sites: two Mesolithic/early Neolithic sites in the Danube Gorges (the Iron Gates) – Lepenski Vir (Gigov 1969) and Vlasac (Cârciumaru 1978), the Neolithic – Roman occupation phases at Gomolava (Bottema 1975; Bottema and Ottaway 1982), the above mentioned Divostin and Grivac (Grüger and Beug 1988), and, recently, at the Upper Palaeolithic (Late Pleistocene) cave site of Baranica where pollen grains were extracted from hyena coprolites (Argant and Dimitrijević 2007). An informal pilot-study of pollen grains from the Neolithic–Early Bronze Age site of Jaričište 1 – Mali Borak was conducted as part of the educational programme at the Petnica Science Centre, Serbia (T. Radišić *et al.* 2010).

Helpful overviews of archaeological finds of plant remains at prehistoric sites in former Yugoslavia were offered by K. Borojević (1998: Table 1.1, 2006: Table: 2.5) and M. Jovanović (2004); they include information on the site, culture period, plant taxa and bibliographic sources.

ARCHAEOBOTANY AT NEOLITHIC SITES IN SERBIA

A large number of Neolithic sites have been excavated in Serbia and some of the results collated and published (e.g. Chapman 1981; Srejović 1988; Tasić 1997)[3]. The research has mainly been concerned with establishing the chronology, attribution of the sites to various cultures/culture complexes, tracking 'foreign influences' and demographic movements, exploring spatial relationships between the sites and, in very few cases, with aspects (ecological, social etc.) of subsistence economy. Although the importance of the plant record for understanding human–environment interactions in the Neolithic has been recognised, the scarcity of available data (particularly for the early Neolithic) posed considerable limitations to explaining and interpreting the new developments from a botanical perspective. As was often emphasized in the 'early' (1960s/70s) papers on Neolithic economy in the Balkans, "[...] there is still an alarming shortage of detailed economic evidence from early Neolithic sites in the Balkans. Plant remains and animal bones have been reported from Neolithic sites scattered across the area ... but in many cases the recovery of this kind of economic evidence was not the primary objective of excavation and, as a result, the methods employed to gather such evidence have rarely been sufficiently refined to meet the stringent requirement of modern faunal and plant analysis" (Barker 1975: 85). Nearly forty years on, and this observation is still valid for the territory of present-day Serbia.

The paucity of archaeobotanical information and the lack of detailed analysis led to the use of indirect evidence for considerations of the agricultural character and economy of the excavat-

3 'Neolithic' denotes sites dating approximately from the period between 6200 and 4500 BC (Whittle *et al.* 2002; Borić 2009), i.e. where remains attributed to Starčevo-Cri -Körös (henceforth Starčevo) and/or Vinča cultures have been detected. (Late) Vinča culture sites are sometimes considered as belonging to Aeneolithic/Copper Age (e.g. Bottema and Ottaway 1982; Chapman 2000: Table 1.1).

ed Neolithic sites. For example, aspects such as 'favourable' location of sites for cultivation (e.g. proximity to water courses and fertile soil), 'permanency' of residential architecture, 'crop cultivation-related' artefactual evidence (e.g. soil working/digging tools, sickle blades, grinding stones, storage pits and vessels) and presence/absence of remains of domesticated animals have each been understood as a 'confirmation' of the Neolithic/farming status of the sites (e.g. Garašanin 1973; Gavela 1958; Glišić 1968; Tringham 1971; Barker 1975; Chapman 1981; Jovanović 2004; Antonović 2005). Unfortunately, without the archaeobotanical data, these other lines of evidence, either individually or combined, offered only a very coarse picture of potential crop husbandry and exploitation of plant resources in the Neolithic of Serbia. The conclusions and inferences on the Neolithic economy in the region remain very general and based chiefly on the (direct) evidence from other parts of the Balkans (e.g. Greece and Bulgaria) and the Near East.

We here present the currently available (un)published archaeobotanical evidence from Neolithic sites in Serbia, and discuss the results of the analysis and the corresponding interpretations in light of the methods used for recovery of plant material and the archaeological context of the remains. Table 1 provides the list of sites for which any plant material has been analysed or simply recorded in the field, and summarises data on the type of material, method of recovery, archaeological context and the relevant published sources. The geographic location of the sites is shown in Figure 1.

THE TYPE OF REMAINS

Charred macro-remains have been the main focus of archaeobotanical analysis in Serbia. Indeed, charred macro-remains are the most commonly preserved plant material at archaeological sites in Serbia, as opposed to desiccated or waterlogged material, as yet not encountered. Remains preserved by silicification/calcification[4] and mineralisation[5] sometimes accompany charred material in the samples, and they have been recorded in some instances (Borojević 1998, 2006; van Zeist 2001/2002; Filipović 2004; Medović 2011a; Obradović, unpublished data). Impressions of plant parts in pottery and daub were observed at several sites – at Starčevo (Renfrew 1979), Vinča near Kragujevac (Hopf 1974), Opovo (Borojević 1998, 2006), Vinča – Belo Brdo (Tasić *et al.* 2007) and Drenovac (Perić and Obradović 2012).

Plant material is preserved as charred after it has been subjected to burning (or smouldering) which transforms the plant parts (particularly the dense or woody parts) to almost pure carbon (Jacomet and Kreuz 1999; Jacomet 2007). The plants/plant parts most likely to become charred and hence preserved are those used as fuel, or present in fuel (e.g. in animal dung): firewood, plant processing by-products (straw, chaff, weed seed, nutshell, fruit stone, weed seeds), and dung-derived material (small and/or hard-coated seeds). Plant parts used for food can get accidentally burnt during food preparation, or if storage areas are cleaned out using fire (e.g. when grain is infested by insects). Charring can also be a result of general, accidental or hostile, fires when whole structures or their parts are destroyed. Most common at archaeological sites are charred plant assemblages resulting from fuel and food burning, and they usually consist of wood, remains of crops and their weeds and, to a lesser extent, wild food plants. They are therefore suitable for the reconstruction of agricultural practices and the study of collection and use of wild plants (Dennell 1976; Hillman 1981; van der Veen 1992, 2007; Miller and Smart 1984; Charles 1998; Bogaard 2004). Charred plant assemblages, particularly wood remains, also offer important information on the past environment – vegetation and land-

4 Natural accumulation of minerals in cells during plant growth, common in monocotyledons (Piperno 2006: 41).

5 Replacement of the original plant tissues by minerals - carbonates and phosphates - from the local environment (Green 1979).

Figure 1. Map showing location of the Neolithic sites mentioned in the text; **Slika 1.** Karta sa položajem neolitskih lokaliteta koji se pominju u tekstu: **1**. Banjica **2**. Batka – Perlez **3**. Belotić **4**. Nosa – Biserna obala **5**. Blagotin **6**. Divostin **7**. Drenovac **8**. Dunjićki šljivari – Međureč **9**. Gomolava **10**. Grivac **11**. Jaričište – Mali Borak **12**. Matejski brod **13**. Medvednjak **14**. Motel – Slatina **15**. Opovo **16**. Pavlovac – Gumnište **17**. Petnica **18**. Predionica **19**. Selevac **20**. Stapari **21**. Starčevo – Grad **22**. Stubline **23**. Valač **24**. Vinča – Belo Brdo **25**. Vinča (Kragujevac) **26**. Zlatara

Table 1. List of Neolithic sites in Serbia with information on the type of collected plant remains, archaeobotanical sampling and recovery method, and a summary of the analysed archaeological contexts

Tabela 1. Spisak neolitskih lokaliteta u Srbiji sa podacima o tipu prikupljenog biljnog uzorka, arheobotaničko uzimanje uzoraka i metod izdvajanja, i rezimirana analiza arheološkog konteksta

	Site	Cultural attribution	Seed/ fruit	Wood charcoal	Plant impressions in pottery and/or daub	Pollen	Collection/sampling method	Sample size	Recovery by flotation	Context	Indoor	Storage	References
1	**Batka (Perlez)**	Starčevo	x				observed *in situ*				x		Marinković 2004
2	**Matejski Brod**	Vinča	x				observed *in situ*			charred contents of ceramic vessels (?)	x	x	Radišić 1984
3	**Nosa – Biserna obala**	Starčevo	x				observed *in situ*			outdoor storage pits/granaries		x	Garašanin 1959, 1973; Grbić 1959
4	**Motel – Slatina (Paraćin)**	Vinča	x				*in situ* collection			fire installation			Obradović, unpublished
5	**Zlatara (Ruma)**	Starčevo	x				*in situ* collection			clay surface/basin ("grain processing area")	x		Leković 1995
6	**Belotić**	Starčevo	x				*in situ* collection			pit			Borojević 1990
7	**Banjica**	Vinča	x				*in situ* collection			house floor, near two grinding stones	x	x	Todorović and Cermanović 1961
8	**Medvednjak**	Vinča	x				*in situ* collection			inside two ceramic bowls and on the floor	x	x	Galović 1975
9	**Petnica**	Vinča	x				*in situ* collection			storage pit	x	x	Jež 1975; Borojević 1990
10	**Stapari**	Vinča	x				*in situ* collection			pithos	x	x	Chapman 1981
11	**Stubline**	Vinča	x				*in situ* collection			pithos abutting fire-installation	x	x	Crnobrnja 2009
12	**Vinča (Kragujevac)**	Vinča			x		*in situ* collection						Hopf 1974
13	**Starčevo – Grad**	Starčevo	x		x		1) *in situ* collection			pit-dwellings			Renfrew 1973, 1979
							2) judgement sampling	10 l	Y	pit-dwellings	x		Medović 2011
14	**Gomolava**	Vinča	x	x		x	*in situ* collection; judgment and random sampling	up to 50 l	Y	pits; arbitrary - squares of 2x2 m grid	x	x	van Zeist 1975, 2001/2002; Bottema 1975; Bottema and Ottaway 1982
15	**Jaričište 1 – Mali Borak**	Starčevo, Vinča	x				judgement sampling		Y		x		M. Marić, pers. comm.
16	**Dunjićki šljivari - Međureč**	Starčevo	x				judgement sampling	up to 10 l	Y	fire installation, pit			Obradović, unpublished
17	**Pavlovac – Gumnište**	Vinča	x				judgement sampling	min. 10 l	Y	fire installations, ashy deposits, content of ceramic vessels, clusters (of pottery sherds etc), floors, postholes, pits, ditches.	x		Obradović, unpublished
18	**Selevac**	Vinča	x				1) *in situ* collection			grain silos	x	x	Hopf 1974
							2) systematic sampling		Y*	house interior	x	(x)	McLaren and Hubbard 1990
19	**Opovo**	Vinča	x	x			random and systematic sampling	3 kg; 10 l	Y	oven, house floor, pits, bedding trench	x		Borojević 1998, 2006
20	**Blagotin**	Starčevo	x				systematic sampling	2 l	Y	layers/deposits from pit-dwellings and the area inbetween them	x		Jezik 1998
21	**Drenovac**	Starčevo, Vinča	x		x		systematic sampling	min. 10 l	Y	fire installations, storage containers, ashy deposits, content of ceramic vessels, clusters (of pottery sherds etc), floors, postholes, pits, ditches.	x	x	Obradović, unpublished
22	**Vinča – Belo Brdo**	Vinča	x		x		systematic sampling	10-30 l	Y	fire installations, concentrations of charred material, ashy deposits, content of ceramic vessels, clusters (of pottery and other objects), floors, house rubble, post-holes, pits, ditches, area inbetween houses.	x	x	Filipović 2004; Borojević 2010
23	**Divostin**	Starčevo	x	x		x	retrieved from pollen samples			blocks of 5-15cm from excavated layers			Grüger and Beug 1988
23	**Divostin**	Vinča	x			x	retrieved from pollen samples			blocks of 5-15cm from excavated layers			Grüger and Beug 1988
24	**Grivac**	Starčevo				x	retrieved from pollen samples			blocks of 5-15cm from excavated layers			Grüger and Beug 1988
24	**Grivac**	Vinča	x	x		x	retrieved from pollen samples			blocks of 5-15cm from excavated layers			Grüger and Beug 1988

*****also, wet-screening

scape around archaeological sites, availability and accessibility of different resources, and changes in vegetation composition (e.g. Asouti and Austin 2005).

Clearly, the chances of plants becoming charred are largely determined by human agency – those that have been brought on site and have come into contact with fire are most likely to be found in the deposits; therefore, plant species and plant parts found in charred assemblages likely represent only a (small) portion of the plants that were actually in use (Jacomet 2007; van der Veen 2007). Moreover, charring itself imposes a bias due to the variability in charring conditions (e.g. temperature, duration) and a variable plant 'response' to charring – for instance, soft plant parts are rarely found in charred assemblages and the most likely to survive are hard, more durable parts such as seeds/grains of crops and shells/stones and hard-coated seeds of wild plants (Wilson 1984; Boardman and Jones 1990; Braadbaart 2004). Charred plant assemblages therefore include a narrower range of materials than, for example, desiccated or waterlogged plant assemblages, which tend to contain fragile plant tissues such as light chaff of cereals (Jacomet *et al.* 1989; van der Veen 2007).

THE METHODS OF RECOVERY OF CHARRED MACRO-REMAINS

Given that charred assemblages tend to represent only a small fragment of a 'complete picture', archaeobotanical field methods should be designed with the aim of maximising the rate of retrieval of the remains from archaeological deposits. This is best achieved by systematic recovery of all size classes of botanical material using flotation. It is, however, impractical, time-consuming and too expensive to process all the excavated soil from a site; sampling – i.e. taking limited amounts of the removed soil from all or selected deposits – speeds up the process and is feasible in the excavation routine (Pearsall 2000).

Of the twenty-four Neolithic sites in Serbia for which (un)published archaeobotanical data were available, some form of sampling for seed/fruit/charcoal remains was applied only at twelve (Table 1). Flotation was the main method of recovery at these sites. Notably, at half of the analysed Neolithic sites macro-botanical remains were registered and/or collected *in situ*, that is, only when spotted by an excavator.

The sampling method varies from site to site. Systematic sampling ("total" or "blanket" sampling – Jones 1991; Pearsall 2000)[6] was carried out at Blagotin (Jezik 1998) and has been a standard procedure at Vinča – Belo Brdo since 2001 (Filipović 2004), and in the 2010 and 2011 excavation seasons at Drenovac (Perić and Obradović 2012). At Blagotin, samples of 2 l of soil were routinely taken from all excavated deposits, while from features and various concentrations of materials the entire matrix was collected. Similarly, in the current archaeobotanical investigations at Drenovac, a minimum of 10 l of soil is collected from all excavated units, whereas all available soil from features such as fire places, bins and small pits is processed. The on-going excavations at the site of Vinča – Belo Brdo include sampling of every excavated unit; samples from arbitrary layers have soil volume of 10 l, while the volume of those deriving from features and structures can have a maximum of 30 l (which is the agreed standard sample size), depending on the availability of soil.

At the site of Opovo, stratified random sampling was applied ("probabilistic" sampling – van der Veen 1983; Jones 1991)[7]. In the first excavation season (1985) deposits from and beneath features were sampled. In the following seasons, sampling included random selection of $1m^2$ out of every (mainly arbitrary) layer in each 2 m^2 quadrant within the excavated 16x20 m area, while in case of features samples were taken from all of them, and their different parts (ar-

6 Samples, usually of standardised size, taken from all excavated deposits.

7 Collection of samples from, in a statistical sense, randomly selected deposits (van der Veen 1983).

chitectural elements) were sometimes also distinguished; house rubble was occasionally sampled (Borojević 1998: 35–36, 2006: 13–14). The sample size was initially 3 kg, later raised to 10 l; multiple samples were also taken from deposits where charred remains were visible *in situ*.

The sampling strategy at Gomolava ranged from *in situ* collection of visible charred material (in seasons 1955, 1967–1972 and 1979 – Bottema and Ottaway 1982; Borojević 1988) to systematic sampling and flotation in seasons 1972–1977 (van Zeist 1975, 2001/2002). Stratified random sampling of each of the 1x1 m excavated quadrants was applied in a 2x2 m test-trench explored separately from the 'main' excavations; 2–4 randomly selected buckets of soil from each 30 cm spit of every quadrant were taken for analysis (Bottema and Ottaway 1982).

Regular sampling was applied at Selevac; over 300 samples were processed and examined, and the results from 47 samples published. The details of sampling (e.g. whether all excavated or only selected deposits were sampled) were not provided (Tringham and Stevanović 1990: 76; McLaren and Hubbard 1990). At the site of Jaričište 1 – Mali Borak, located within the vast archaeologically investigated area of the Kolubara Mining Basin (Blagojević and Arsić 2008), samples were occasionally collected from contexts containing traces of burning in the form of burnt (scorched) soil, or where charred plant remains were visible to the excavators. Flotation samples were also taken from the locations where recovery of small finds (i.e. malachite beads) from the heavy fraction was a priority (M. Marić, *pers. comm.).*

At Međureč, recovery of plant remains was not initially intended and the soil samples were sporadically taken from deposits within well-defined contexts. The samples were later submitted for archaeobotanical analysis; their size was not uniform but most of them had volume of less than 10 l (Perić and Obradović 2012). Within the development-led excavation at Pavlovac – Gumnište, samples of about 10 l were regularly taken from each feature and well-defined context; multiple samples of *c.* 10 l were removed from each excavated layer of large features such as (stratified) fills of pits and ditches/enclosures (Perić and Obradović 2012).

Macro-plant remains from Divostin and Grivac were retrieved from pollen samples (5–15 cm thick blocks of soil) and were represented by few seeds (only at Divostin) and a very small number of wood charcoal fragments (Grüger and Beug 1988). As part of the recent excavations at Starčevo – Grad a total of three samples of 10 l volume were taken from the Neolithic levels (Medović 2011a).

COMMENTARY ON THE FIELD METHODS

Observation of botanical material *in situ* can sometimes help identify the function of features (e.g. hearths, rake-outs) and establish the spatial relationship between plant and other remains and artefacts. However, relying solely on the naked eye of an excavator limits the recovery of archaeobotanical material to what is easily visible in the soil, which is dependent upon many factors such as the colour and texture of soil, available light during excavation, tools and techniques used in excavation, experience and interest of the excavator (Pearsall 2000: 12; see also Jarman *et al.* 1972: 39). Furthermore, only deposits that contain readily visible charred remainstend to be archaeobotanically examined. *In situ* observation or *ad hoc* collection of chance finds of archaeobotanical remains heavily bias the assemblage towards larger remains and/or concentrations of material; many plant taxa tend to be omitted, while the importance of those present is likely misrepresented. Clearly, material registered or collected in this haphazard way cannot be regarded as representative of all plant remains at a site, and any meaningful considerations of the results and intra- and inter-site comparisons are practically impossible (Green 1982; van der Veen 1983; Jones 1991).

If one of the research goals of archaeological investigations is to understand and explain human interactions with the environment and the role of plants at a particular site, then archaeobotanical sampling has to be employed as a regular part of the excavations. Only strategic sampling enables reliable assessment of the botanical content of the deposits, and offers insight into the composition/diversity of crop and wild plant assemblages; variations in quantity and types of remains; spatial, contextual and chronological patterns; relationships between particular debris and certain structures and contexts; differences in the formation of the archaeological record and so on (e.g. Green 1982; Jones 1991; Popper and Hastorf 1988; Pearsall 2000).

Ideally, archaeobotanical (flotation) samples should be taken from all excavated deposits (i.e. "total" or "blanket" sampling – Jones 1991; Lennstrom and Hastorf 1995; Pearsall 2000), but, depending on the size of a site and scale of excavation, this could lead to a large number of samples that cannot be processed and analysed within the available time and manpower. As an illustration, a backlog of some 100 flotation samples and residues (heavy fraction) from excavation seasons 2002–2007 at Vinča – Belo Brdo has only been processed in 2009. Similarly, a number of unprocessed archaeobotanical samples awaiting attention have been stored in museums and archaeology departments around Serbia. Clearly, a well thought out sampling method (and the overall research design) has to take into account 'external' limitations such as the available time and money.

Another possibility is to sample contexts in a statistically random manner ("probabilistic" sampling – Jones 1991) – for example 10% of each feature, or 10% of every feature, class are randomly selected and sampled (Keeley 1978; van der Veen 1983). The samples collected in this way from a 2x2 m column at Gomolava provided a useful chronological picture of changes in abundance and frequency of the represented taxa. Presumably, this strategy best reflects the heterogeneity of the archaeobotanical record and is, therefore, statistically highly valid, while it also allows for objective comparison of data among sites (Jones 1991); moreover, it facilitates recognition and evaluation of the 'background noise' – the taxa common to all deposits and/or rare taxa (Keeley 1978; G. Jones 1991). However, important deposits (e.g. *in situ* burnt plant remains) can in this way be completely omitted, and the method tends to produce uniform assemblages – with no marked differences between features or sites (cf. Hole 1969; Green 1982; Fuller *et al.* 2005).

From the above overview, it appears that the most common method of archaeobotanical sampling at the sites in Serbia has been "human subjective" (van der Veen 1983: 194), i.e. sampling of well defined, sealed contexts, or contexts regarded as archaeologically or otherwise important, and those that are apparently 'rich' in plant macro-remains (e.g. concentrations of charred material). This could be described as "judgment" or "purposive" sampling (van der Veen 1983; Jones 1991). Whereas this strategy is certainly more cost-effective and potentially less time-consuming than total sampling, it does not guarantee the recovery of a representative assemblage of macro-remains (at the site-level). For example, only three Neolithic deposits have been deemed 'interesting' and thus sampled at the site of Starčevo (Medović 2011a). Similarly, where plant remains were not (always) the primary target (e.g. at Međureč and Jaričište 1 – Mali Borak, see above), few samples are taken and not necessarily from botanically rich deposits, either assumed or obvious. Although the low presence of charred macro-remains at Međureč (e.g. 45 seeds from nine samples – Obradović, unpublished data) and Starčevo (26 charred seeds from three samples –Medović 2011a) echoes the scarcity of macro-plant remains seen at some other early Neolithic sites in the central Balkans (e.g. Blagotin and Foeni–Salaş – Jezik 1998), it could in these instances be a result of a 'too selective' judgment sampling. The assumed productive contexts (in terms of charred plant remains) such as hearths and ovens often contain small amounts of charred material, since regular burning within these features turns seeds etc. into ash, and/or because they are regularly cleaned. The remains are more likely to be found around fire-installations, spread on the floor, or in rubbish pits where hearth/oven debris and floor sweepings have been disposed of (Pearsall 2000; Fuller *et al*. 2005). On the other hand, extensive (accidental) burning will potentially lead to preservation of whole stores of plants/plant parts, as, for instance, silos A and B at Selevac (Hopf 1974; Renfrew 1979: 254); a 10 cm thick layer of soil rich in charred material on the floor of House 7 at Selevac understood as deriving from storage in some form of wooden container raised up on posts ("above-ground granary" – Tringham and Stevanović 1990: 104); a concentration of plant remains in a section of House 7 at Banjica interpreted as contents of a, probably wooden, "storage box" (Todorović and Cermanović-Kuzmanović 1961; Tripković 2007); and large quantities of charred seeds in the "pantry" of the burnt House 01/06 at Vinča – Belo Brdo (Borojević 2010). Similar deposits have not yet been reported for early Neolithic (Starčevo culture) sites in Serbia, but their absence could at least partly be due to the lack, or inappropriateness, of the sampling method, as indicated by the recent find of a store of charred legumes in Starčevo levels at Drenovac (Perić and Obradović 2012).

In addition to the sampling procedure determining the level of representativeness and reliability of the evidence, the size (volume or weight of soil) of the samples is also of relevance. For most analysis, it is essential that the quantity of identifiable items from each sample exceeds a certain number, so as to enable statistical manipulation of the data (Green 1979; Badham and Jones 1985; G. Jones 1991). It is perhaps reasonable to expect that, the larger the sample, the higher the number and diversity of botanical (and other) remains recovered, even from relatively 'poor' deposits. This, however, cannot be seen as a rule, since botanical 'richness' varies within and among different deposits and is not directly dependant on the soil volume (Keeley 1978; G. Jones 1991). For example, a small sample from an *in situ* charred plant storage will likely have greater botanical content than a large sample from (non-burnt) wall remains. Nonetheless, in order to ensure comparability between deposits, features and sites, and to simplify the procedure in the field to the convenience of the excavators, it is desirable to establish the targeted volume of samples which will, of course, take into account the possibility for timely processing and analysis (Green 1979).

A common practice at the Neolithic (but also later) sites in Serbia appears to have been removal of a minimum of *c*. 10 l of soil for archaeobotanical samples (see Table 1), while the maximum varies between 30 l or so at Vinča – Belo Brdo (though, in practice, some samples are larger) and 50 l at Gomolava (van Zeist 2001/2002: 90). One exception is Blagotin, where samples of 2 l were routinely taken (Jezik 1998). In most cases, volume is the basic measure of sample size (instead of weight), and probably more useful if trying to establish a relationship between the volume of samples and the volume of original deposits. If weight of soil is measured, one must account for differential moisture content of the soil and its constituents, particularly if comparisons are made between the (wet) weight of a sample and (dry) weight of the macro-botanical content (Green 1982).

Various soil volume standardisations have been suggested as appropriate for the recovery of macro-botanical remains from samples – from e.g. 5 l of soil (Green 1979), up to 40–60 l (D. Jones 2011) or even 75 l (Murray and Rackham 1994). The sample volume should, however, depend on the research aims. For instance, if the primary goal is documenting the spread of domesticated plants by recording only presence or absence of crop species, then small samples from a limited number of contexts could be sufficient (cf. Popper and Hastorf 1988: 7; Jones 1991). In this view, (even) data based on material collected *in situ* (without sampling), containing only a few seeds, could be used as an indicator and perhaps a guide for future excavations. However, in order to move beyond a list of (commonly) occurring species, a 'sufficient' number of remains from each sampled deposit is required (e.g. 200 items – Kenward *et al*. 1980: 3; 400–500 items – van der Veen and Fieller 1982). Since it is "plant material that is being sampled, and not soil", it then makes more sense to standardise the soil volume based on the *number of seeds considered representative of a deposit*, and/or adequate for answering the research questions (Badham and Jones 1985: 15). A 10 l sample from an unproductive deposit is unlikely to yield a reasonable number of remains (e.g. 30) and the question here is whether processing more soil from a poor deposit is likely to produce more seeds. Initial assessment of small samples from a range of contexts helps determine their botanical productivity and come up with an appropriate sample size.

There are rarely time, labour and budget in Serbian archaeology for any preparatory work that would inform the research design and structure the sampling procedure, or allow for alterations of the method if the fieldwork shows they are necessary. Furthermore, archaeobotanical analyses in Serbia tend to be carried out (long) after the excavations, and so are in a way detached from the fieldwork; thus, archaeobotanists have to rely on the excavators and their decisions in the field, and do their best with what is available (cf. Green 1982: 42). Depending on the scale of excavation, and from the cost-effectiveness point of view, some form of judgement sampling is probably the only currently viable strategy for excavations in Serbia (Filipović and Marić forthcoming/2013). However, it is crucial to establish the relationship between 'judgements' and the research questions, and to extensively apply the experience and knowledge derived from previously analysed archaeobotanical assemblages (in Serbia and elsewhere). Fluctuations in sample volume may not be problematic, since the number of remains per litre of deposit (i.e. botanical density) depends on the rate of deposition of the material, which may in turn depend on the nature of deposit or, rather, the behavioural episode it represents (G. Jones 1991: 67). In general, for Neolithic sites in Serbia, from contexts obviously rich in charred remains, or showing traces of burning, as well as from defined features, at least 30 l of soil (wherever possible) should be removed for flotation, since large samples from rich deposits are likely to yield at least a high number of remains, if not a high number of taxa. This is particularly useful if sufficient numbers of plant parts of certain taxa (e.g. crops) are required for morphological or crop processing analysis etc. or for comparison of features/structures of similar assumed function (Green 1982; Jones 1991). Seemingly 'poor' contexts must not be ignored; at least 10 l of soil should be taken from deposits that do not contain visible charred remains, or even more soil – for a chance to retrieve rare taxa. Small-sized samples can also be taken from deposits excavated within a grid-system (e.g. floors). Any subsequent sub-sampling of large and amalgamation of small samples or (random) selection of samples for a detailed study can be conducted in the laboratory (e.g. G. Jones 1991; Pearsall 2000: 111–116).

THE ARCHAEOLOGICAL CONTEXT OF PLANT MATERIAL

Information on archaeological contexts from which the recorded plant remains originate is available for the majority of the considered sites and is summarised in Table 1. Common locations where charred remains were collected *in situ* or spotted by the excavators include features interpreted as indoor storage and/or food preparation contexts (storage bins, pits-granaries, pithoi and ceramic vessels) and outdoor pits described as rubbish pits and/or plant storage facilities (silos, granaries). This gives an idea as to what sort of contexts contained immediately visible charred material and/or were considered by archaeologists as important (mainly for clarifying the function of the features).

In cases where archaeobotanical sampling was applied, botanical material from a range of contexts, i.e. fire installations (ovens and hearths), storage containers, postholes, pits, floors, walls, is represented in the assemblage. However, detailed information on the contextual association of the analysed remains has not been provided for all the sites, hence the overview is limited.

The majority of plant remains from Blagotin were found in pit-houses, and were mostly present in two (out of the three recognised) levels – the top level ("capping horizon") and the layers at the bottom of pit features ("living horizon") (Jezik 1998). The samples from Starčevo – Grad were taken from the basal layers in two semi-subterranean structures interpreted as a dwelling and its supporting unit; in the latter, the sampled location was the findspot of a cluster of fishing net weights and a fragmented grinding stone (Medović 2011a). At Gomolava, seven out of 41 analysed samples from the Vinča culture layers originate from pits (van Zeist 2001/2002: Table 1). In addition to the material initially collected from two clay-lined pits at Selevac (silos A and B; Hopf 1974), the presence of (concentrations of) charred remains on the floors of excavated houses were understood as displaced contents of crop stores (Tringham and Stevanović 1990: 104). The archaeobotanical report from Selevac does not offer information on the archaeological context of the analysed samples (McLaren and Hubbard 1990).

To date the most detailed and interpretatively far-reaching archaeobotanical investigation in Serbia is the study of macro-plant assemblage from Opovo (Borojević 1998; 2006). Here, the analysed material was recovered mainly from pits, and, in a few cases, from floors, an oven, a bedding trench and a posthole. This is so far the only study in Serbia which, among other aspects, discusses plant remains in relation to the archaeological contexts from which they derive and comments on the taphonomy of the material. In addition to Opovo, archaeobotanical interpretation of the function and history of archaeological contexts in which the remains were found has been attempted for two other Neolithic sites in Serbia – Selevac and Blagotin (Hopf 1974; Jezik 1998). In these three studies, the composition and richness of the botanical assemblages has been used as a basis for inferences on the functions of the sampled contexts, for comparisons between the features, structures, occupation phases, for recognition of activity areas and patterns in spatial distribution of the material and so on (Borojević 1998, 2006; Jezik 1998).

COMMENTARY ON THE ARCHAEOLOGICAL CONTEXT OF CHARRED MACRO-REMAINS

There has been a tendency among archaeologists in Serbia to use the available archaeobotanical data to, essentially, confirm (less so to reject) impressions or interpretations made in the field of the past function of the excavated contexts, without considering the nature of the botanical evidence. For instance, mere presence of plant remains in a pit is often understood as a 'proof' of its use as a plant storage facility. As an illustration, "outdoor pits" discovered at the site of Nosa were described as crop storage facilities based on their overall architecture (size, shape, manufacture); the finds of charred crop remains in them were seen as a 'confirmation' of their suggested function (Grbić 1959; Garašanin 1973). Similarly, pit features at Petnica have been described as "granaries" in reference to the small amount of charred seeds collected from these contexts (Jež 1985: 49). At Zlatara, a clay surface has been interpreted as a "grain processing area" based on the observed remains of "cereals" in the overlying matrix (Leković 1995). Furthermore, at a number of sites, the function of pits or pithoi as storage facilities for "grains" is also suggested without stating any reference to the plant material possibly contained within – for instance at Banjica (Todorović and Cermanović-Kuzmanović 1961), Matejski brod (Radišić 1984), and Vinča – Belo Brdo (Stalio 1984).

While the functional interpretation of, for example, pits as silos could perhaps be well-grounded and justified based on the non-archaeobotanical evidence, we call for caution when assigning a purpose to a context using charred plant remains. When exploring the link between archaeological deposits and the derived charred material, it is critical to establish whether *in situ* burning has occurred in e.g. a feature, structure, or a layer, since, clearly, plants/plant parts only become charred if exposed to high temperatures. Charred plant remains can be considered an 'original' component of the context in which they were found only if they were burnt/charred in that particular context. In other words, the derived botanical material may in fact represent plant parts charred elsewhere and subsequently (re)deposited in the context in which archaeologists find them; it is, therefore, crucial to find out if there is a relationship between the context and the fire that resulted in charring of the respective plant material (e.g. Hillman 1981, 1984; Fuller *et al*. 2005; van der Veen 2007). Thus, the association between pits, or any other context type, and their charred botanical content is not straightforward and the offered interpretations could be problematic.

The flawed assumption about a direct relationship between an archaeological context and its charred plant assemblage can lead to misunderstandings of the 'history' of the context. Also, the plant evidence itself may be misinterpreted using solely non-archaeobotanical ('external') data, such as context type and other present (artefactual) evidence, and erroneous conclusions can be drawn about the activities that produced the plant material and/or resulted in its deposition. For example, the situations noted above – where combinations of (fragments of) large ceramic vessels and plant remains are found in the same context, or where presence of plant material is recorded in pits – are regularly described as the evidence of a) storage, b) most probably storage of cereal grain, c) storage of cereal grain in pottery vessels or in subterranean granaries, and d) the pits and vessels being designed especially for storage purposes, whereby their size and/or location are sometimes used to infer the "household" or "communal" scale of storage (e.g. at Nosa and Vinča – D. Garašanin 1959; Stalio 1984). Also, the crop species identified in the surmised storage contexts are often declared most important in the economy of the sites, and the region (e.g. Jovanović 2004: 103).

In summary, there are various problems with these perceptions, including taphonomic factors affecting plant assemblages prior to the deposition of the material (plant processing, food preparation, charring etc – e.g. Dennell 1976; Hillman 1981, 1984; Jones 1987; Boardman and Jones 1990; van der Veen 2007) which largely determine what kind of material ends up in archaeological layers. In reference to the archaeological context of charred plant remains, it is important to note that, after charring and initial ('primary') deposition, plant material could have been moved from its 'original' location to a 'secondary' context (e.g. from an oven to a rubbish pit), or even 'tertiary' context (e.g. contents of rubbish pits/heaps used as building material), from which it is excavated (e.g. Miksicek 1987; cf. Hubbard and Clapham 1992; Fuller *et al*. 2005). Hence, the 'final' or excavated location of plant material can be entirely different to the one where the material became preserved. Charred botanical remains can be understood as specifically related to the context in which they are found only if *in situ* burning can be identified, and also if their composition is different from the composition of the remains derived from the surrounding contexts. For example, if the contents of a pit/bin/vessel are, by their composition, distinguishable from the remains found around, above and below it (e.g. in the floor into which the pit was dug or the overlying deposits), they can be argued to reflect its purpose and/or activities related to it (e.g. Green 1982; Miksicek 1987; Pearsall 2000: 67).

Given the uncertainty surrounding the association of charred plant material with the archaeological context from which it derives, the context itself should not be the main guideline when investigating aspects of plant-use. Instead, the composition of charred assemblages provides the most useful source of information for understanding plant-related and other human activities in the past. The spectrum of plant parts and species, and their absolute numbers or proportions in an assemblage, are, among others, the best indicators of the 'origin' of the assemblage (e.g. crop cultivation, wild plant gathering) and the activities/processes that created and shaped the assemblage, while they can also help identify the purpose of the context in which they are found (e.g. Hillman 1973, 1981, 1984; G. Jones 1984, 1987; Fuller *et al*. 2005). As an example, the published results from the Neolithic levels at Gomolava on charred remains recovered from the contexts described as pits (van Zeist 2001/2002: Tables 1–2) can be used to assess the (possible) function of these features. Namely, in all but one of the seven considered pit-samples, remains of crop processing by-products – in this case hulled wheat chaff (*Triticum monococcum/ dicoccum* glume bases) – largely outnumber the product (i.e. grain of one or the other hulled wheat), suggesting that the samples represent residue from cleaning of crops, which further implies the use of pits (at least at one stage) for discard of household rubbish. On the other hand, five samples from other (non-pit) contexts contain much higher quantities of hulled wheat grain compared to chaff, perhaps indicating burnt crop stores (van Zeist 2001/2002: Table 2). While this impression clearly requires further examination, it highlights the importance of comparisons of plant assemblages from different contexts based on their composition, particularly with regard to crop parts (grain *vs*. chaff), in order to arrive at archaeobotanically informed inferences on human-plant interactions at the context- and site-level.

THE CROP, WILD/WEED AND COLLECTED TAXA

Information on botanical determination of charred macro-remains is currently available for 15 sites, 9 of which were in some way sampled for archaeobotanical material; *in situ* collected plant remains from six sites have been identified. The remaining six sites where the charred material was hand-picked have not been archaeobotanically analysed; the presence of cereals has been mentioned in excavation reports for some of them (e.g. Banjica, Batka – Perlez, Zlatara), but without archaeobotanical analysis it remains unclear what the category "cereals" actually stands for. The list of identified crop, wild/weed and collected taxa is given in Table 2 and their presence/absence (based on seed/ chaff/fruit stone/nutshell) noted for each of the considered sites. The data shown include results provided in the published reports and those deriving from ongoing analysis of the material from Drenovac, Međureč, Motel–Slatina and Vinča–Belo Brdo (Perić and Obradović 2012; Filipović, unpublished data from Vinča–Belo Brdo).

From the data shown it becomes clear that the archaeobotanically sampled Neolithic sites yielded much more diverse crop and wild/weed assemblages than the non-sampled ones (or where macro-remains were extracted from pollen samples – the case of Divostin). This contrast could, therefore, be understood as a product of differences among sites in sampling and recovery/collection method. Besides, in the case of the archaeobotanically sampled sites, the varying number of analysed samples (e.g. from as few as 3 from Starčevo to over 80 from Vinča – Belo Brdo and Vinča culture levels at Drenovac, to 267 from Opovo) probably influences the overall abundance and diversity of the assemblages (see Table 2).

COMMENTARY ON THE CHARRED SEED/FRUIT ASSEMBLAGE

Notwithstanding the methodological constraints to the interpretation of the available data, some very broad inferences on the representation of crop and wild taxa across the sites and cultures are offered here, with more specific comments on some of the taxa. The results of wood charcoal and pollen analysis are not included in the discussion.

CROPS

In general, it seems that a similar spectrum of crops occurs at the considered sites, both early-middle Neolithic (Starčevo culture) and late Neolithic (Vinča culture). Throughout the Neolithic, hulled wheats (einkorn and emmer) appear most frequent (i.e. occurring at the majority of sites), followed by hulled barley. Interestingly, the presented data do not reflect the previously noted dominance of einkorn relative to emmer for the Neolithic central Balkans (e.g. Hopf 1974; McLaren and Hubbard 1990: 248; Borojević 2006: Table 2.5) and, instead, show presence of both wheats at all sampled sites (and most of the non-sampled Vinča culture sites – see Table

Table 2. List of crop, wild/weed and collected taxa identified at Neolithic sites in Serbia
Tabela 2. Spisak žitarica, divljih/korovskih i prikupljenih vrsta koje su indentifikovane na neolitskim lokalitetima u Srbiji

	Starčevo culture							Vinča culture									
TAXA	**Blagotin**	**Drenovac**	**Međureč**	**Starčevo**	**Belotić**	**Divostin**	**Nosa**	**Drenovac**	**Gomolava**	**Opovo**	**Selevac**	**Vinča – Belo Brdo**	**Motel – Slatina**	**Divostin**	**Medvednjak**	**Petnica**	**Vinča (K)**
number of analysed samples		*50*	*10*	*3*	*non-sampled*			*80*	*41*	*267*	*47*	*82*	*2*	*non-sampled*			
CROPS																	
Triticum monococcum (1-grain)	x	x	x	x				x	x	x	x	x	x		x	x	
Triticum monococcum (2-grain)											(x)						
Triticum dicoccum	x	x	x	x		x		x	x	x	x	x	x		x	x	x
Triticum sp., 'new type'												x					
Triticum durum/aestivum					x				x			x	x	x	x		
Triticum sp.		x	x					x		x		x				x	
Hordeum vulgare, hulled	x		x	x	x				x	x	x					x	
Hordeum vulgare var. *nudum*					x											x	
Hordeum vulgare								x				x					
Panicum miliaceum				x			x	x	x			x					
Lens culinaris	x	x						x	x	x	x	x	x				
cf. *Lathyrus sativus/cicera*														(x)			
Pisum sativum		x						x	x		x	x					
Vicia ervilia								x				x					
Linum usitatissimum								x	x	x		x					
COLLECTED TAXA																	
Cornus mas	x	x	x	x				x	x	x	x	x					
Corylus avellana											x						
Fagus sp.							x										
Fragaria vesca									x	x							
Malus pumila	x																
Malus sylvestris									x								
Malus sp.				x													
Phragmites communis												x					
Physalis alkekengi								x	x		x	x					
Prunus sp.												x					
Pyrus sp.	x										x	x					
Quercus sp.							x					x					
Rubus fruticosus	x								x			x					
Rubus caesius											x						
Rubus sp.		x	x					x		x		x					
Sambucus nigra									x	x	x	x					
Sambucus ebulus				x*					x	x		x					

2). This contrast may be simply due to the inclusion of fewer sites, and only those located in present-day Serbia in the current overview, unlike e.g. Borojević 2006 (Table 2.5) where available data for a wider region (i.e. former Yugoslavia plus the site of Uivar in Romania) have been given. Thus, at least for the territory of Serbia it appears that einkorn and emmer have similar representation across the sites. Another reason behind the different picture of the frequency of einkorn and emmer is the somewhat easier and potentially more precise identification of einkorn grain and chaff (especially grain) compared to emmer (e.g. van Zeist 1975: 318; Hillman *et al.* 1996); it is possible that indeterminate categories such as *Triticum monococcum/dicoccum* and

Table 2. continued
Tabela 2. nastavak

	Starčevo culture							Vinča culture									
TAXA	**Blagotin**	**Drenovac**	**Međureč**	**Starčevo**	**Belotić**	**Divostin**	**Nosa**	**Drenovac**	**Gomolava**	**Opovo**	**Selevac**	**Vinča – Belo Brdo**	**Motel – Slatina**	**Divostin**	**Medvednjak**	**Petnica**	**Vinča (K)**
number of analysed samples		*50*	*10*	*3*	*non-sampled*			*80*	*41*	*267*	*47*	*82*	*2*	*non-sampled*			
Sambucus sp.		x						x									
Trapa natans									x	x		(x)					
Vitis vinifera (ssp. *sylvestris*)									x	x*							
WILD/WEED TAXA																	
Agrostemma githago									x								
Ajuga chamaepitys									x								
Amaranthus sp.												x					
Atropa belladonna									x								
Avena sp.		x						x	x		x	x					
Bromus arvensis									x								
Bromus secalinus												x					
Bromus sp.								x		x	x	x					
Carex sp.									x		x						
Chenopodium album		x	x					x	x								
Chenopodium hybridum									x								
Chenopodium polyspermum									x								
Chenopodium sp.	x	x						x		x	x	x					
Convolvulus arvensis type												x					
Echinochloa crus-galli		x						x				x					
Euphorbia helioscopia									x								
Galium aparine								x		x		x					
Galium spurium									x								
Galium sp.		x						x	x			x					
Hyoscyamus niger		x						x									
Lithospermum arvense		x						x									
Lithospermum officinale										x		x*					
Lolium sp.			(x)					x		x	x						
Medicago sp.												x					
Papaver sp.	x																
Phalaris sp.												x					
Plantago lancelota									x								
Polygonum aviculare											x	x					
Polygonum convolvulus		x		x				x	x			x					
Polygonum sp.	x	x	x					x		x	x	x					

Triticum sp. grain listed in the archaeobotanical reports include a number of unrecognisable emmer grains.

The fact that 'new type' wheat only occurs at a single site is likely due to the relatively recent recognition of this morphological type of hulled wheat in archaeological assemblages (Jones *et al.* 2000; Kohler-Schneider 2003). However, there is now a growing body of evidence for the presence of this wheat type at early farming sites in southeast Europe (e.g. Jones *et al.* 2000; Bogaard *et al.* 2007; Walker and Bogaard 2011). Free threshing wheat (*Triticum aestivum/durum*) is virtually absent from Starčevo culture sites (found only among hand-picked material from Belotić), becoming more visible at Vinča culture sites, but

Table 2. continued
Tabela 2. nastavak

	Starčevo culture							Vinča culture									
TAXA	Blagotin	Drenovac	Međureč	Starčevo	Belotić	Divostin	Nosa	Drenovac	Gomolava	Opovo	Selevac	Vinča – Belo Brdo	Motel – Slatina	Divostin	Medvednjak	Petnica	Vinča (K)
number of analysed samples		*50*	*10*	*3*	*non-sampled*			*80*	*41*	*267*	*47*	*82*	*2*	*non-sampled*			
Rumex sp.									x								
Setaria sp.		x		x				x				x					
Silene sp.	x	x						x				x					
Solanum nigrum		x		x					x								
Teucrium sp.												x					
Thymelea passerina												x					
Trifolium sp.												x					
Trigonella sp.												x					
Vicia sp.									x	x		x					
Apiaceae												x					
Cruciferae												x					
Gramineae	x								x			x					
Malvaceae												x					
Solanaceae		x	x					x		x		x					

***** *mineralised seeds only*
(x) - uncertain identification

continues to be less frequent than hulled wheats. Clear distinction between tetraploid (*T. durum/turgidum*) and hexaploid form (*T. aestivum*) is difficult based on the grain, hence the presence of one or the other is usually inferred from the chaff (rachis fragments; Maier 1996) and where these are absent, the identification on morphological grounds cannot be considered secure (e.g. "bread wheat-like grain" from Gomolava – van Zeist 1975).

The finds of broomcorn/common millet (*Panicum milliaceum*) at early Neolithic sites – three seeds from Starčevo (the site is dated to around 5700/5500 cal BC – Whittle *et al.* 2002) and an unknown number from Nosa (the site is dated *c.* 5500 cal BC – Whittle *et al.* 2002) – are ambiguous in terms of their cultivation/domestication status (and perhaps even botanical determination in the case of the remains from Nosa) and it is likely that they are here present as weeds of cultivated crops, as suggested for the sporadic occurrence of millet at early Neolithic sites in Bulgaria (cf. Kreuz *et al.* 2005), Hungary (Bogaard *et al.* 2007) and Romania (Cârciumaru 1996: 79; Walker and Bogaard 2011), though a relatively high number (97) of impressions of millet grains in adobe have been identified at the Neolithic site of Sacarovca in Moldova (Kuzminova *et al.* 1998). In general, other than its confirmed presence in south-east and central Europe, the significance of the millet evidence in Europe prior to 5000 cal BCis as yet unclear (Hunt *et al.* 2008). The frequent finds of millet in Vinča culture deposits at Gomolava (overall date range 4900–4600 cal BC – Orton 2012) could perhaps be indicative in this view (22 out of 41 reported samples contain millet – van Zeist 2001/2002: Table 2), though it is probably not until after the Neolithic that the plant gains importance as a staple crop (cf. van Zeist 1975).

Oat (*Avena* sp.) is here listed as a wild/weed taxon due to its unlikely domestication /cultivation status at the Neolithic sites (van Zeist 1975). As noted by van Zeist (2001/2002: 94–95), in absence of oat floret bases (i.e. oat chaff) no distinction can be made between wild (*A. fatua*) and cultivated oat (*A. sativa*). So far, besides the find of oat grains at Gomolava, only oat awns have been registered at Neolithic sites in Serbia (at Selevac and Drenovac – McLaren and Hubbard 1990: 253; Perić and Obradović 2012).

Pulses appear generally frequent at Vinča culture sites, though this may also be due to the much greater number of analysed samples from the late Neolithic sites. Only lentil and pea have so far been recorded at the Starčevo culture sites. Bitter vetch seems to have come into use later in the Neolithic, or at least becomes 'visible' in archaeological deposits from this period. The large number of bitter vetch seeds in the storage/food preparation area of the burnt House 01/06 at Vinča – Belo Brdo, found mixed with emmer grain and flax seeds (Borojević 2010; Filipović, in preparation), perhaps indicate their use in human diet (e.g. Dönmez 2005; Valamoti *et al*. 2010). Of note is also the presence of grass pea (*Lathyrus sativus/cicera*) in the preliminary analysis of charred material from Vinča culture deposits at Pavlovac – Gumnište, the taxon previously (tentatively) recorded in Serbia only at Divostin.

Flax seeds also appear to be absent from Starčevo sites and layers. They occasionally occur in the samples from Vinča culture deposits, but it is not clear whether they belong to the domesticated flax (*Linum usitatissimum*), or wild flax species. The scarcity of finds (e.g. 13 seeds in a few samples from Gomolava, five seeds at Opovo, and *c*. 30 seeds from Drenovac) and their similar (estimated uncharred) size to that of seeds of wild species growing in the area (e.g. *Linum perenne* and *L. austriacum*) hindered the characterisation of archaeological finds as either domesticated or wild flax (and perhaps present as wild/weed intrusions) (van Zeist 1975: 322–323; van Zeist and Bakker-Heeres 1975; Borojević 1998, 2006; Perić and Obradović 2012). A fragment of woven linen textile and a fragment of cord made from flax fibres discovered at Opovo testify to local flax cultivation and use, or the use of imported linen products (Tringham *et al*. 1992: Fig. 12; Borojević 1998: 70, 2006: 65). A cache of *c*. 380 flax seeds retrieved from near a fire installation (rake-out?) at Vinča – Belo Brdo have been identified as belonging to *L. usitatissimum* using the criteria set out by van Zeist and Bakker-Heeres (1975) for distinguishing between domestic and wild species – i.e. the average length of the completely preserved Vinča seeds is around or over 3 mm, and they show the presence of an asymmetrical notch at the proximal end (Filipović, in preparation). Combined with other finds of flax seeds at Vinča – Belo Brdo (Filipović 2004; Borojević 2010) and the detected impressions of flax-woven textile on some pottery sherds (Ninčić, unpublished report), (local) cultivation of flax (for fibre and oil) could perhaps be inferred for the site.

FRUITS AND NUTS

Remains of edible fruit of some sixteen wild taxa have been recorded at Neolithic sites in Serbia, and they could all represent a collected source. The repertoire of collected taxa found at Vinča culture sites seems much more diverse than that characteristic of Starčevo sites, though this could again be due to the differences between the sites in the level of analysis. Cornelian cherry (*Cornus mas*) appears most common and has been found at all sampled sites. There emerges a picture of continuity in the consumption of the plant, from the Late Mesolithic (Filipović *et al*. 2010; Allué *et al*. in press) throughout the Neolithic and probably later (e.g. Kroll 1998; Medović 2002; Filipović 2011). The same is true for a number of other taxa listed in Table 2 which 'survive' into post-Neolithic periods (e.g. van Zeist 2001/2002; Kroll 1998; Medović 2002; Filipović 2011). The vast majority of gathered taxa are of woodland origin – they occupy upland or river forests, forest edges and clearings, while some (e.g. *Sambucus*, *Physalis*) are also found in ruderal, waste places; few taxa grow in wet environments (*Phragmites* and *Trapa*). Combined with the available wood charcoal and pollen evidence, collected plants provide useful information on the natural vegetation around the sites at the time of the occupation (e.g. Borojević 1998, 2006; van Zeist 2001/2002; Marinova *et al.* 2013).

Sambucus seeds have regularly been found in charred and uncharred (mineralised) conditions at Neolithic sites in Serbia; both *S. ebulus* and *S. nigra* may have had a range of human uses (Borojević 1998, 2006; McLaren and Hubbard 1990; van Zeist 2001/2002; Filipović 2004; Medović 2011a). Though the routes through which the charred and uncharred seeds arrived into the deposits were different, their co-occurrence in the samples may signify archaeological status for both. The uncharred state of *Sambucus* (and other mineralised) seeds perhaps indicates that they could have originated from coprolites or dung (Borojević 1998; van Zeist 2001/2002).

Some level of 'management' of wild fruit resources has been suggested for European Neolithic sites, based on the relatively frequent finds of crab apple (*Malus* sp.) in Okolište in Bosnia, e.g. protection from animals, clearance of (unwanted) vegetation around tree stands etc. (Kirleis and Kroll 2010). Given the fragile nature of charred apple and similar fruits, the *c.* 20 fragmented crab apples (and over 200 apple pips) discovered in association with an oven in the Vinča culture layer at Gomolava represent a fairly rich find; they are taken as firm evidence of the gathering of crab apples. Similarly, charred whole fruits of wild pear (*Pyrus* sp.) are commonly found at Vinča – Belo Brdo, sometimes in deposits related to fire installations (Filipović 2004; Borojević 2010; Filipović and Marić 2013). It seems that, along with the other identified taxa, these wild fruits were an important source of food/drink in the Neolithic; it is possible that some effort was invested into securing the yields.

Although it can invade cultivated fields and, in that context, represent an arable weed (e.g. Davies and Hillman 1988), common reed (*Phragmites communis*) is here included as a collected taxon because of its likely use as a building material. Reed culm impressions in house daub have been identified at Opovo and Vinča – Belo Brdo, and charred reed culm nodes at the latter. It seems that, in addition to the use of wooden posts and strips as building materials, reed stems were also put to use for construction of the wattle for house walls (and perhaps also roofing), which is then daubed with clay amply tempered with straw and chaff (cf. Borojević 1998, 2006; Filipović, unpublished data from Vinča – Belo Brdo).

ARABLE AND RUDERAL (WILD/WEED) TAXA

The wild/weed taxa include species that could have flourished in arable fields and/or other disturbed (i.e. ruderal) areas such as waste ground and settlement and field edges. They could have entered the archaeological deposits together with the harvested crop, and would have been removed in crop processing and discarded into house fires (Hillman 1981, 1984; van der Veen 2007).

Some of the wild/weed taxa could have been collected for food (e.g. Behre 2008); however, they do not occur in any significant numbers at Neolithic sites in Serbia, unlike, for instance, mass finds of *Chenopodium polyspermum* at Bronze/Iron Age Feudvar (Kroll 1990) or somewhat larger numbers of *Polygonum aviculare* and *P. convolvulus* in a sample from Hallstatt layers at Gomolava (van Zeist 2001/2001: Table 4). An additional or alternative 'mode of arrival' for (some) wild/weed taxa could have been via burning of animal dung as fuel, collected from animals grazing on stubble or ruderal vegetation, and/or fed crop processing by-products (e.g. Miller 1984; Miller and Smart 1984; Charles 1998; van Zeist 2001/2002: 314; Filipović 2013).

The arable/ruderal taxa are generally adapted to life in disturbed (anthropogenic) habitats and are, therefore, not suitable for inferences on e.g. the composition and distribution of natural vegetation around the sites. On the other hand, weeds accompanying crops in the fields are highly sensitive to changes in the arable environment and their composition varies in relation to the growing conditions. The archaeobotanical weed records are an indispensable tool for investigations into the growing conditions of crops, and they provide direct evidence of crop husbandry in the past. The biology and ecology of arable weeds have been extensively used in studies of farming practices such as tillage, weeding, irrigation/drainage, and specific aspects of early agriculture such as sowing and harvesting timing and methods, the intensity and scale of cultivation etc. (e.g. Wasylikowa 1981; Behre and Jacomet 1991; van der Veen 1992; Jones 1984, 1987, 1992; Charles *et al.* 1997; Bogaard *et al.* 2000, 2005; Bogaard 2004; Filipović 2013).

Not a single seed of arable/ruderal taxa has been recorded at the sites where plant remains were observed or hand-picked; this, without any doubt, demonstrates the 'negative effect' of the lack of archaeobotanical sampling. Furthermore, although the arable flora of Neolithic sites in Serbia seems diverse, there is a clear distinction in the number of taxa (and, to some extent, in the number of retrieved remains per taxon, as stated in the reports) between the sites represented by a greater number of (large) samples from an array of contexts, and those where few samples were taken.

ARCHAEOBOTANICAL RESEARCH IN SERBIA – PROBLEMS AND PROSPECTS

The well-structured sampling and careful recovery applied at only a few Neolithic sites in Serbia enabled more or less detailed qualitative and/or quantitative analysis of crop and wild remains and enhanced the interpretation of the botanical assemblages. In contrast, at a number of sites charred plant remains were only hand-collected or merely observed during the excavation, and sometimes broadly identified. The downsides of the absence, or inappropriateness, of the field methods for recovery of charred plant material noted above, and the significant differences in sampling strategies across the sites limit the potential for comparison between assemblages using, for example, the array of identified taxa, the frequency and abundance of taxa, information on the contextual association of plant remains, plant-related differences between occupation phases/chronological periods and so on.

In some instances, the presence and type of plant material have been understood as manifesting the purpose of the features in which the remains are found; in other cases, the specifics of the archaeological context and the non-botanical evidence have been used to characterise the derived plant material. The lack of recognition and evaluation of the many processes that produce, affect and shape charred plant assemblages has been remarkable.

Overall, there do not exist sufficient data, certainly not enough reliable data, for well-informed considerations of Neolithic plant-based economy that would include all the analysed sites in the territory of Serbia, or for justifiable conclusions on aspects such as the overall nature and scale of agriculture, dominance/importance of any one of the identified crop species, relationship between e.g. settlement location and pattern and plant resources and so on. Therefore, some/most of the offered interpretations remain unsubstantiated.

Many questions arise in the course of archaeological excavations, and archaeobotany can address a number of them. Results of archaeobotanical analysis can offer a large body of information on a range of aspects of human life in the past; most prominent for the Neolithic are details on the economy, i.e. agricultural production which likely was the 'key to success' of long-lived settlements such as that at Vinča – Belo Brdo. It is essential to establish archaeobotanical investigations at archaeological sites in Serbia and, where possible, to continue this work at the sites that have already provided some information on plant use and plant-related activities. A much more extensive dataset is needed to enable assessment of the role of plants and their importance for human subsistence at different sites and different points in prehistory and history in Serbia, and to provide a basis for the interpretation and reconstruction of past human activities and environment in this part of the world.

Recent work by researchers pursuing this analysis in Serbia (Borojević, Medović, and the present authors) has generated new (and perhaps more 'useful' in terms of interpretation and reconstruction) archaeobotanical and archaeological data from this part of the world; it is hoped that these results (will) shed more light on the role of plants in the past, both at individual sites and across the region and time periods. Clearly, regular publication and presentation of the results to the archaeological community are essential, while the increasing number of demonstrations of the processes and results of the research to a wider audience (e.g. in the form of public lectures, museum exhibitions and workshops) in recent years are an additional route towards raising the awareness of the enormous scientific potential of archaeobotanical study.

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Rezime

ARHEOBOTANIČKA ISTRAŽIVANJA NA NEOLITSKIM LOKALITETIMA U SRBIJI: KRITIČKI PREGLED METODOLOGIJE I REZULTATA

DRAGANA FILIPOVIĆ i ĐURĐA OBRADOVIĆ

U radu je predstavljen istorijat arheobotaničkih istraživanja neolitskih nalazišta (6200–4500 p.n.e.) na tlu Srbije i pregled metoda prikupljanja biljnih ostataka, a sumirani su i rezultati dosadašnjih analiza. Na primeru ovih lokaliteta i raspoloživih arheobotaničkih podataka razmotreni su ključni problemi u vezi sa načinom izdvajanja biljnih ostataka tokom iskopavanja, odnosno uzimanjem arheobotaničkih uzoraka, kao i sa mogućnošću upotrebe dobijenih rezultata u interpretaciji arheoloških konteksta i rekonstrukciji aktivnosti u vezi sa eksploatacijom biljnih resursa.

Arheobotaničke analize uglavnom nisu (bile) planski i sastavni deo arheoloških istraživanja u Srbiji. Biljni ostaci su do skora najčešće ručno sakupljani onda kad su primećene koncentracije ugljenisanog materijala na terenu, ili su prepoznati prilikom obrade druge vrste materijala – lepa ili keramike – u kojima su očuvani otisci biljnih primesa. Ovakvi izvori podataka su ograničeni na arheološke kontekste koji sadrže biljne ostatke vidljive golim okom, i na veoma sužen spektar biljnih vrsta. Na samo 12 neolitskih lokaliteta u Srbiji su uzorci zemlje za arheobotaničku analizu manje-više planski prikupljeni. Način uzimanja uzoraka se razlikuje po izboru konteksta i veličine uzoraka, a uslovljen je i načinom i obimom iskopavanja, mogućnostima i ciljevima istraživanja. Pregled primenjene metodologije po lokalitetima pokazuje koliko razlike u metodama utiču na količinu i tip dobijenih rezultata. Strategija uzimanja arheobotaničkih uzoraka, kao prvi korak u analizi, je izuzetno važna jer u velikoj meri određuje kvalitet podataka i definiše sve naredne faze arheobotaničke analize. Stoga je neophodno veliku pažnju posvetiti osmišljavanju odgovarajuće metodologije uzimanja uzoraka na terenu.

Biljni ostaci konstatovani za vreme iskopavanja u određenim kontekstima korišćeni su, često bez arheobotaničke analize, kao direktan pokazatelj namene datih konteksta i/ili kao potvrda da se ekonomija naselja oslanjala na zemljoradnju. Najbolji primer predstavljaju objekti definisani kao mesta za skladištenja hrane („silosi") na osnovu prisustva biljnih ostataka u njima. Čak i ako ima osnova za iznete pretpostavke o funkciji ove vrste objekata, treba biti oprezan pri razmatranju njihove namene u svetlu nalaza ugljenisanog biljnog materijala. Naime, ugljenisani biljni ostaci otkriveni na mestima gde nisu ustanovljeni tragovi gorenja ne mogu se smatrati *in situ* nalazom, odnosno originalnim sadržajem konteksta, i potom interpretirati kao direktan pokazatelj funkcije konteksta (npr. sadržaj skladišta). Da bi se otkrila „veza" između mesta nalaza ugljenisanih biljnih ostataka i samih ostataka, neophodno je utvrditi da li je do ugljenizacije (gorenja) došlo na licu mesta, odnosno u kontekstu iz kog biljni ostaci potiču. Takođe, analiza sastava i „tipologije" arheobotaničkog materijala predstavlja ključ za razumevanje aktivnosti u vezi sa otkrivenim biljnim ostacima, pa samim tim i procesa formiranja arheološkog konteksta i njegove namene.

Mali broj istraženih lokaliteta i selektivno prikupljanje materijala nisu postavili stabilne osnove za razmatranje pretpostavljene mnogostruke uloge biljaka u neolitu Srbije. Možda će rezultati novih istraživanja pružiti detaljniju sliku o značaju i načinu korišćenja biljaka na našoj teritoriji i omogućiti sagledavanje lokalinih i regionalnih specifičnosti kroz vreme. Nažalost, mali broj stručnjaka, nemogućnost specijalističkog usvršavanja u okviru studija arheologije i nedostatak sredstava umnogome ograničavaju razvoj i primenu arheobotanike u Srbiji.

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