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Untangling the Taphonomy of Charred Plant Remains in Ritual Contexts: Late Antique and Medieval Churches and Graves from Croatia

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ABSTRACT

Food has played a central role in death rituals throughout human history, yet finding evidence of these practices in the archaeological record can be problematic. In particular, linking charred plant remains to inhumation burials requires careful consideration of the taphonomic processes involved. Here we focus on the recovery of charred plant macro-remains from four Late Antique and medieval cemeteries and one late medieval church in Croatia. The results showed low densities of both charcoal and other charred plant macro-remains, suggesting that the remains are general settlement debris that was accidentally deposited within the cemeteries and church context. At Bribirska Glavica, the sampling of stratigraphic layers at the multi-level cemetery allowed a greater understanding of taphonomic processes and corroborated the identification of a rubbish dump linked to an adjacent Roman villa. The results provide important insights for future sampling strategies, including the importance of taking control samples outside the graves and radiocarbon dating to determine whether botanical remains are related to the burials.

KEYWORDS

archaeobotany; inhumation burials; Roman; Migration period; food offerings

Introduction

Botanical remains found within burials can indicate a direct association with individuals and provide an important source of information about burial customs, diet, and even the economy. The treatment of a dead body, the building of a grave structure, items interred with the deceased, and the performance of funerary rituals are actions that are socially and culturally driven. Cremation and inhumation burials follow distinct internment activities and preserve environmental remains differently. Regarding cremations, the burning of the body can provide suitable conditions to allow food/plant remains to survive, while for inhumations, food/plant remains are less likely to encounter fire but could preserve through mineralization, waterlogging, or desiccation. Thus, identifying associated charred botanical remains within inhumations can be difficult. Additionally, the likelihood that botanical remains are deposited in the grave will be linked with the burial customs at the time. In Croatia, offerings are, as in previous periods, still found in 8th to early 9th century A.D. graves, but grave goods soon become rare acts linked with non-Christian burial practices (Reed 2019). Consequently, archaeobotanical studies have typically focused on cremation burials, while for the medieval period, inhumations are seldom sampled. Even though ascribing meaning to funerary customs can be particularly complex, exploring the extent to which variation existed in botanical tributes, especially between demography, family groupings, or estimated socioeconomic status, provides an important means for developing better insights into society over time and space (e.g. Ives 2021).

In Croatia, cemeteries and religious buildings play a central role in the study of burial customs, rituals, and the Christianization of Croatia from the 5th century A.D. onwards. Numerous

inhumation cemeteries and religious buildings have been excavated, yet only one late Avar (710–810 A.D.) cemetery in Nuštar, Croatia, has published archaeobotanical data from this period (Rapan Papeša, Kenéz, and Pető 2015). Instead, other remains, such as animal bones, have been identified within inhumation graves at several cemeteries in Croatia from this period (e.g. Rapan Papeša and Šmalcelj Novaković 2016; Vinski-Gasparini and Ercegović 1958). For example, Migration period graves at Stari Jankovci–Gatina, dated to the end of the 7th to the first half of 8th century A.D., contained ceramic vessels, large mammal bones, and eggshells (Rapan Papeša 2007). The presence of these other food items could suggest the possible presence of plant-derived offerings, yet without sampling it is difficult to know whether such remains have survived in the archaeological record. The aim of this paper is therefore twofold. First, we present new archaeobotanical data collected from four cemeteries and one church located in present-day Croatia (Figure 1) to explore what the plant remains can tell us about these sites. Second, this paper will examine the sampling and interpretation of inhumation burials more generally and discuss the importance of sampling at such sites. The period under study here covers the 4th–16th century A.D., which represents the Late Antique and Migration period (3rd–8th century A.D.), the early Middle Ages (9th–12th century A.D.), and the high and late Middle Ages (12th–16th century A.D.).

Examining Charred Plant Remains from Inhumation Graves

Scientific analysis of graves, especially to identify diet, has been tackled using various approaches ranging from

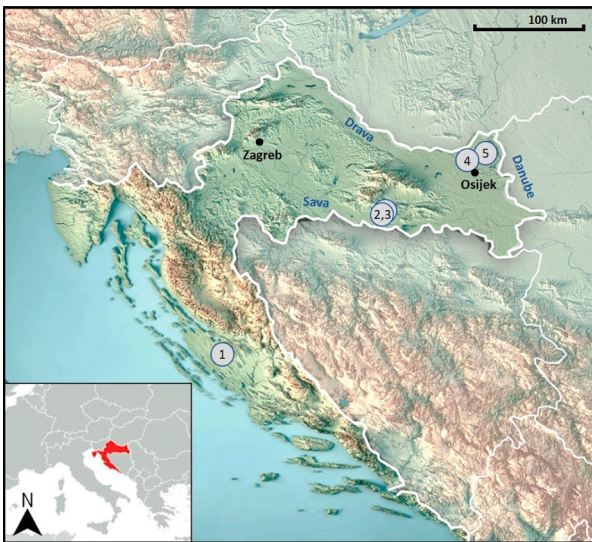


Figure 1. Location of the sites under study: 1) Bribirska glavica, 2) Prvča, 3) Njive Ivandol, 4) Novi Čeminac–Jauhov Salaš, and 5) Zmajevac.

zoarchaeological and archaeobotanical analysis to bioarchaeological methods (e.g. Crabtree 1995; Hansson and Bergström 2002). Archaeochemical approaches involve paleodontological and stable isotopic analysis of human and animal remains but also organic (mostly lipid) residue studies of ancient food vessels (e.g. Vidal-Ronchas et al. 2018). In terms of plant remains, studies have examined the contents of graves through the recovery of pollen, seeds, wood, charcoal, leaves, phytoliths, coprolites, and plant resins (e.g. Brettell et al. 2015; Karg et al. 2014). In addition, micromorphology provides significant potential for understanding the depositional formation processes and post-depositional alterations relating to burial taphonomy (e.g. Aspöck and Banerjea 2016; Burns et al. 2017). Linked to this is the field of funerary taphonomy, which studies how taphonomic changes aid the interpretation of funerary practices (Knüsel and Robb 2016, 655). Here, the principles of taphonomy are used to reconstruct the sequence of events surrounding death and burial, as well as distinguishing taphonomic alterations from human modification of human remains. For example, skeletal disarticulation patterns can be diagnostic of environmental conditions (e.g. flooding), animal behavior (e.g. scavenging), and/or human action (e.g. ritual displacement of bones), aiding the reconstruction of the events that formed a burial feature (Mickleburgh 2018). This is particularly important when considering the early Middle Age phenomenon of intentionally re-opening graves, where inhumations are disturbed and sometimes objects are removed (Klevnäs et al. 2021).

Generally, in Europe, the sampling and identification of archaeobotanical remains within medieval inhumation graves is limited due to preservation issues. Typically, for inhumations, plants/food remains usually represent two modes of inclusion: plants placed on top of the coffin or lining the grave and plant/floral/food remains placed inside the coffin/tomb (e.g. Ives 2021). To recover such remains, some form of preservation needs to occur. This could include mineralization, where plant parts come into contact with minerals, mainly nitrates or phosphates, but also contact with metals, like bronze and iron (Lempiäinen-Avci, Laakso, and Alenius 2017). Plant remains can also preserve by

waterlogging, where the anaerobic conditions prevent decomposition (Ives 2021), as well as through desiccation, which occurs in arid environments (Day 2013). Finally, plant remains can be recovered carbonized, which occurs when organic matter comes into contact with fire under anoxic conditions. However, whether carbonized plant remains can be interpreted as offerings within an inhumation may be challenging, especially if there is no direct evidence of burning associated with the grave. When recovered, carbonized remains could represent three different types of deposits: primary deposits, consisting of remains that became charred in the same context; secondary deposits, when remains that became charred during a single burning event are redeposited in another context; or, tertiary deposits, where remains become charred during different events and possibly at different locations and are redeposited within a single context (Schiffer 1987). Thus, the identification and interpretation of archaeobotanical remains in inhumations, and cemeteries more broadly, require careful consideration of the taphonomic processes involved.

Depending on the questions being asked, a range of sampling strategies have been used to retrieve plant remains from inhumations. At Ii Hamina, Finland, macro- and microfossil remains were collected from the abdomen area of five 15th–16th century A.D. skeletons buried with indications of wooden coffins (Tranberg 2015). The macro-remains were limited; however, the pollen results suggested that grasses (Poaceae), and to a lesser extent sedges (*Carex*), were used in the graves, probably as bedding material. The exceptionally high proportion of Cichoriaceae type pollen found in a dual grave at the site indicated that these flowering plants were likely put into the grave in a summertime ceremony, together with flowers of the aster and bellflower families (Tranberg 2015). Samples were also collected from the pelvis and head area of a burial within a Late Antique (4th–6th century A.D.) sarcophagus from Tsitsamuri, Georgia (Kvavadze et al. 2008). By examining pollen, seeds, mites, and molluscs, the excavators concluded that the deceased was interred on a bed made of plants gathered from the local environment in early summer. This phenomenon is also seen in northwestern Europe, where individuals were laid atop a layer of straw, moss, herbs, or other wild/weed species (e.g. Deforce, Van Hove, and Willems 2015; Gilchrist and Sloane 2005; Veeckman 1997; Vermeeren and van Haaster 2002).

Usually, a burial is considered the result of a single event and the grave content described as a discrete unit. However, archaeobotanical remains are plagued with problems of intrusion and residuality (e.g. Pelling et al. 2015). This is particularly prevalent in areas with a long history of human occupation, cultivation, grazing, and bioturbation (Borojevic 2011). For example, in Europe, prehistoric pit burial inhumations were often found in disused storage pits, and so the carbonized plant remains from these contexts could be ascribed to general settlement rubbish burnt before, or at the time of, the burial, although deliberate deposition could not be ruled out (Pollard 2001). Thus, if the burial site is located next to or over settlement activity, or an earlier burial ground, the earth used to fill the grave may contain residue from previous periods (Hansson and Bergström 2002). This was the case for a Roman inhumation located in Vinkovci, Croatia, where charred plant remains were interpreted as settlement rubbish due to the low quantities recovered and the lack of evidence of associated burning

with the grave (Reed et al. 2019). At Zličín, Prague, a Migration period burial ground was examined for plant macro-remains, charred and uncharred wood, and pollen to assess the relationship between various types of plant remains and to identify plant intrusion and residuality at the site, especially as looting had occurred (Šálková et al. 2016). One useful method used by the excavators was to radiocarbon date selected charred plant remains, from which it was determined that some of the remains were contaminants from much younger periods. Thus, the low density of charred plant and wood remains were linked with secondary re-deposition within the graves, while the non-charred wood remains were suggested to represent remains of the coffins.

The density and location of the plant remains recovered is therefore an important aspect in determining association. A study of 16th century A.D. Finnish inhumation graves showed that only two of 158 analyzed graves had archaeobotanical remains that could be reliably connected to burial customs or diet (Lempiäinen-Avci, Laakso, and Alenius 2017). That was because in grave no. 22 at Kappelinmäki, Lappeenranta, 5719 mineralized seeds of raspberry (*Rubus idaeus*) were found in the pelvis area and in the vicinity of the stomach of the deceased. The high concentration of seed remains made it more likely to be linked with the body. Association was also clear at Porvoo Cathedral, where leaves and stems of *Sphagnum* moss were found attached to the sampled piece of human skull, which also still had hair attached (Lempiäinen-Avci, Laakso, and Alenius 2017). However, the other charred and uncharred macro-remains and pollen from the rest of the 156 graves examined at the site were interpreted as representing weeds from the local environment that were accidentally incorporated in the burials. In the UK, samples collected from a Roman inhumation burial showed remarkably well-preserved charred remains of wheat (spelt, bread wheat, and emmer), as well as an abundance of chaff, including spikelet folks, culm nodes, and palea/lemma fragments (Webley 2006, 28). From this, it was suggested that ears of wheat were being deliberately burnt and placed with the body as a ritual offering. Linking charred plant remains to Avar Age graves at Nuštar, Croatia, however, proved difficult. Here, samples were collected from different depths and places, particularly around the head, chest, pelvis, legs, and within any vessels (Rapan Papeša, Kenéz, and Pető 2015). Interestingly, evidence of food offerings was common in the graves, including the interment of animal bones, serving dishes, and metal hoops for wooden pails, as well as 32 pieces of charred porridge-like lumps from the archaeobotanical samples, yet, evidence of plant macro-fossils and phytoliths was limited and thought to be accidental inclusions from the local environment. Porridge-like residues were also identified within pots deposited in Avar Age graves at Petőfibánya, Hungary (Toth et al. 2019) and may indicate some sort of food offering and/or ritual deposit.

Materials

Bribirska glavica

Bribirska glavica is located in the Šibenik hinterland, about 13 km to the northwest of Skradin, in northern Dalmatia (see Figure 1). The site, located at the top of a 300 m high

hill, has a long and complex history of occupation from pre-history to the Roman municipium *Varvaria*, then to the medieval *Breberium* up to modern times. Excavations demonstrated continuity of settlement on the hilltop from at least the Roman period through to the late Middle Ages. From 2014, the Varvaria/Breberium/Bribir Archaeological Project conducted excavations within the church of Sts. Joachim and Ann, the adjoining mausoleum, and the graveyard immediately around the church (Ghica et al. 2017, 2018). From 2016–2019, archaeobotanical samples were collected from the trenches around the church. Here, funerary contexts were comprised of clusters of overlapping individual graves, mostly consisting of drystone structures or simple stone lining, ossuaries of various sizes, and tombs, many of which show signs of rearrangements and multiple use. The stratigraphy of the trenches excavated since 2014 is therefore extremely complex, with multiple graves located one on top of another. To only sample secure contexts, judgment sampling was practiced. In total, 38 samples were collected from graves and areas of stratigraphic significance (Table 1). For the graves, soil was usually collected from just under the skeleton around the head, abdomen, and feet.

Zmajevac

Archaeological excavations were conducted at Zmajevac (Mocsolás), located in the Kneževi Vinogradi municipality within Osijek-Baranja County, from 1999–2008, exploring the largest Late Antique necropolis along the Croatian *limes* (Roman frontier) thus far. The excavations have so far uncovered ca. 1700 m² of the site, with 175 graves, 17 of which were brick tombs, found arranged in more or less regular rows generally oriented northeast-southwest (Filipović 2010). Graves were clearly defined, and only rarely did a grave cut into another. Iron nails in some of the graves point to remains of wooden coffins. Within 142 graves, several associated finds were recovered, including jewelry, toiletries, belts, different ceramic and glass vessels, and coins (Filipović 2010). Anthropological analysis has shown that both men and women were buried in the necropolis, as well as several children. The oldest currency is attributed to Emperor Gallienus, from just after the middle of the 3rd century A.D., and the most recent is from the second half of the 4th century A.D. Most of the coin finds date to the 4th century A.D. and probably link to a period of increased defense of the *limes*, when one of the units from the *Legio VI Herculia* was stationed there. These defenses subsequently collapsed, and by the end of the 4th century and early 5th century A.D., this area was occupied by the Huns, as demonstrated by the famous Hunnic brace found at the fort in Zmajevac (Filipović and Šeparović 2017). Of the graves, 137 were sampled for archaeobotanical remains, concentrating on the soil surrounding the skeleton.

Novi Čeminac–Jauhov Salaš

The site of Novi Čeminac–Jauhov Salaš was excavated in 2014 and 2015 during the protective archaeological research on the highway route A5, section Osijek–Beli Manastir, within Osijek-Baranja County. The excavation revealed numerous archaeological structures dated from prehistory to the late Middle Ages. Eleven graves were also discovered on the site and were dated to the 5th century A.D. The

Table 1. The study sites.

Site	Type	No. of Samples	Location of Samples	Date	References
Bribirska glavica	Cemetery	39	Between graves and around the head, abdomen, and feet	2nd–15th century A.D.	Ghica et al. 2017, 2018
Zmajevac	Cemetery	137	Around the head, abdomen, and feet	mid-3rd–4th century A.D.	Filipović 2010; Filipović and Šeparović 2017
Novi Čeminac–Jauhov Salaš	Cemetery	10	Around the head and torso	5th–early 6th century A.D.	Balen et al. 2016; Dugonjić, Fileš Kramberger, and Balen in press
Njive Ivandol	Cemetery	5	Around head, abdomen, and feet	13th–16th century A.D.	Mihaljević, Horvat, and Matković 2015
Prvča	Church	2	Church floor	14th–17th century A.D.	Mihaljević, Ivanušec, and Matković 2014

cemetery consisted of two groups: the north group (graves 2, 3, 4, 5, and 6) and the south group (graves 7, 8, 9, 10, and 11). The discovered remains belong to four men (graves 3, 5, 6, and 9), four women (2, 4, 7, and 8), and two children (10 and 11). The distance between the two groups measures approximately 45 m. An exception which stands out amongst the others is grave number 1, where the deceased was a man placed in the grave in a foetal position on his right hip (Balén et al. 2016, 19–21). Anthropological analyses of his remains have shown numerous bacterial infections and contagious diseases, and changes on his bones point to leprosy. Artificial cranial modification is observed on 6 out of the 11 skeletons, that is, in graves 4, 5, 7, 8, 9, and 10 (Šlaus et al. 2015). The remains of a child 6–7 years old belonging to grave 10 represent the first finding of a child with an artificially modified skull in Croatia. It was buried with a necklace of glass, amber beads, and a belt buckle. Ten samples were collected from around the head and body of the skeletons of graves 1, 4, 5, 7, 8, 9, 10, and 11.

Njive Ivandol

Njive is located in Požega-Slavonia county on the northern slopes of Mount Požega, south of today's settlement of Ivandol. Archaeological research in 2013 and 2014 revealed a rotunda church around which inhumation burials were found. During excavations, a total of 36 graves were found along the walls of the sacral structure. The deceased were laid in an extended position on their back and oriented parallel to the church wall. Fragments of ceramics were found in all layers; however, their poor preservation restricted more precise dating beyond the late Middle Ages, 13th–16th century A.D. (Mihaljević, Horvat, and Matković 2015). Metal finds were also discovered at the locality, the most numerous of which were wrought iron nails, followed by a few finds of coins and arrow tips. Samples were collected from graves 1, 2, 4, 6, and 7. Grave 4, in particular, was located along the eastern wall of the apse orientated east-west, below a level of rubble. The grave fill was dark brown with a fine trace of charcoal; however, the grave was disturbed, with the grave cut only being visible on one side.

Prvča

Prvča is situated southwest of the city of Nova Gradiška in Brod-Posavina county. The Chapel of Svih Svetih (All Saints) in Prvča is a single nave, remodeled medieval building, enclosed by an apse and a bell tower incorporated into the western façade. Originally a smaller Romanesque church with an apse, it was built in the 13th century A.D. on the

property of Petar and Ivan Borić, descendants of Borić Ban. Conservation and archaeological investigations were carried out in 2014 within the church, and pottery finds suggest a possible date from the 13th–16th century A.D. (Mihaljević, Ivanušec, and Matković 2014). Two samples were collected from trench 2 (foundations), next to the southern portal of the Romanesque church.

Methods

The carbonized plant macro-remains were retrieved using machine flotation at all sites except Bribir, where bucket flotation occurred. A 0.5 mm sieve was used to collect the flots with a 1 mm mesh for the heavy residue at all sites except Bribir, where a 250 µm mesh was used. All samples were 100% sorted, and plant macro-remains were identified using a low power (7–40x) binocular microscope. Identifications were made based on well-established morphological criteria and by comparison with modern reference material. The nomenclature of scientific plant names follows, for cultivars, Zohary and Hopf (2000) and, for wild plants, Flora Croatica Database (Nikolić 2018). Free-threshing tetraploid (*Triticum turgidum/durum*) and hexaploid (*Triticum aestivum/compactum*) wheat grains were not distinguished within the samples due to morphological similarities in the grains and absence of diagnostic rachis fragments. Oat (*Avena* sp.) was also not distinguished between the wild or cultivated variety due to the absence of diagnostic oat florets.

A standardized counting method was used, whereby each grain counts as one and the minimum number of individuals (MNI) was estimated for fragments of grains. Glume base fragments were counted as one unless clearly representing part of another fragment, while whole spikelet forks were counted as two glume bases. The fruit and weed remains were counted as one, except where large seeds were broken and clearly represented the same parts of one seed. Measurements were also recorded for the volume (ml) of charcoal recovered within a flot and noted whether lumps larger than 5 mm were found.

Dating

Samples for radiocarbon dating were collected from strategic levels at Bribir. One date calibrated by Beta Analytic using BetaCal 3.21 using the IntCal13 calibration curve was taken from a part of a carbonized pear (*Pyrus pyraeaster*; Figure 2) recovered from SU1448. This returned a date of 1864–1708 CAL B.P., which calibrated to A.D. 86–242, at 95.4% probability. Radiocarbon dates were not collected from the



Figure 2. A carbonized wild pear (*Pyrus pyraster*) from SU1448, dated to the Roman period at Bribirska glavica.

other sites; instead, they were dated relatively, using parallels of associated material.

Results

Identifiable charred plant remains were recovered from 46 of the 192 samples collected from the sites. The quantity of remains was, however, extremely low, with most samples containing only one or two finds. With the exception of Bribir, sample sizes were only a few liters per sample (exact volumes were not recorded). At Bribir, large volumes of soil (e.g. up to 400 L) were collected from certain stratigraphic units, but densities remained low, with samples rarely going over 1 seed per liter (Supplemental Material 1). Generally, seeds from all the sites were poorly preserved, with only fragments of epidermis remaining, and some were clearly distorted. Charcoal volume was also recorded but was present in very low quantities across the sites. Bribir is the only site with pieces larger than 5 mm, while the rest mostly had small flecks.

Bribirska glavica

Carbonized plant remains were identified in 33 of the 39 samples collected from Bribir. One sample, retrieved in layer SU1031 from trench T8, contained 10 non-carbonized whole almonds and no other evidence of charcoal or charred plant remains. The context was a layer just below the modern-day surface, dated to the 15th century A.D. However, it is possible that contamination occurred through natural processes, such as animals burrowing to store food. Thus, these remains were identified as intrusive and excluded from the analyses. Of the carbonized remains, cereals were the most numerous, with 103 identified grains and 102 cereal fragments. These included 40 barley grains (*Hordeum vulgare*), three of which were twisted, suggesting the presence of the six-grained variety, and 18 free-threshing wheat grains (*Triticum aestivum/durum*). A few grains of emmer (*Triticum dicoccum*), einkorn (*Triticum monococcum*), and broomcorn millet (*Panicum miliaceum*) were also identified. One emmer glume base and unidentified glume fragments, as well as one unidentified rachis fragment, were found. Several pulses were identified, including 29 lentils (*Lens culinaris*). Fruit and nut remains included olives (*Olea europaea*), grape pips, and possibly a whole raisin (*Vitis vinifera*; Figure 3), as well as a whole wild pear (*Pyrus pyraster*; see Figure 2). The second biggest category was that of the wild/weed

species, where a wide range of mostly singular finds were identified, including several grasses (*Avena* sp. and *Lolium* sp.), mallow (*Malva* sp.) seeds, and legumes (*Trifolium* sp. and *Medicago* sp.). Small lumps of carbonized fruit flesh and possible food remains, such as bread or porridge, were found in several samples; however, to confirm this, scanning electron microscope (SEM) analyses should be done in the future (González Carretero, Wollstonecroft, and Fuller 2017; Valamoti et al. 2019). Although charcoal seemed to be abundant while excavating, the charcoal density within the samples was extremely low, with only a couple of lumps measuring over 5 mm being recovered across all samples.

If we look at the plant remains per trench (Figures 4, 5), trenches T1, T23, and T24 have a relatively high number of identified items. However, these still equate to low densities, with T24 having the highest at 1.16 seeds per liter. T24 also has a low number of unidentified cereal fragments and unidentified plant remains and showed a much higher level of preservation than the other trenches. In contrast, T1, sample SU1020 had ca. 250 unidentified plant fragments and generally poor preservation. Across these trenches, the proportion of cereals (excluding cereal indet.), pulses, fruit/nuts, and wild/weed seed remains are relatively similar. At the other end of the scale, trenches T8, T15, T18, and T22 all have less than 10 identified plant items and densities of less than 0.6 grains per liter.



Figure 3. A carbonized raisin (*Vitis vinifera*) from SU1448, dated to the Roman period at Bribirska glavica.

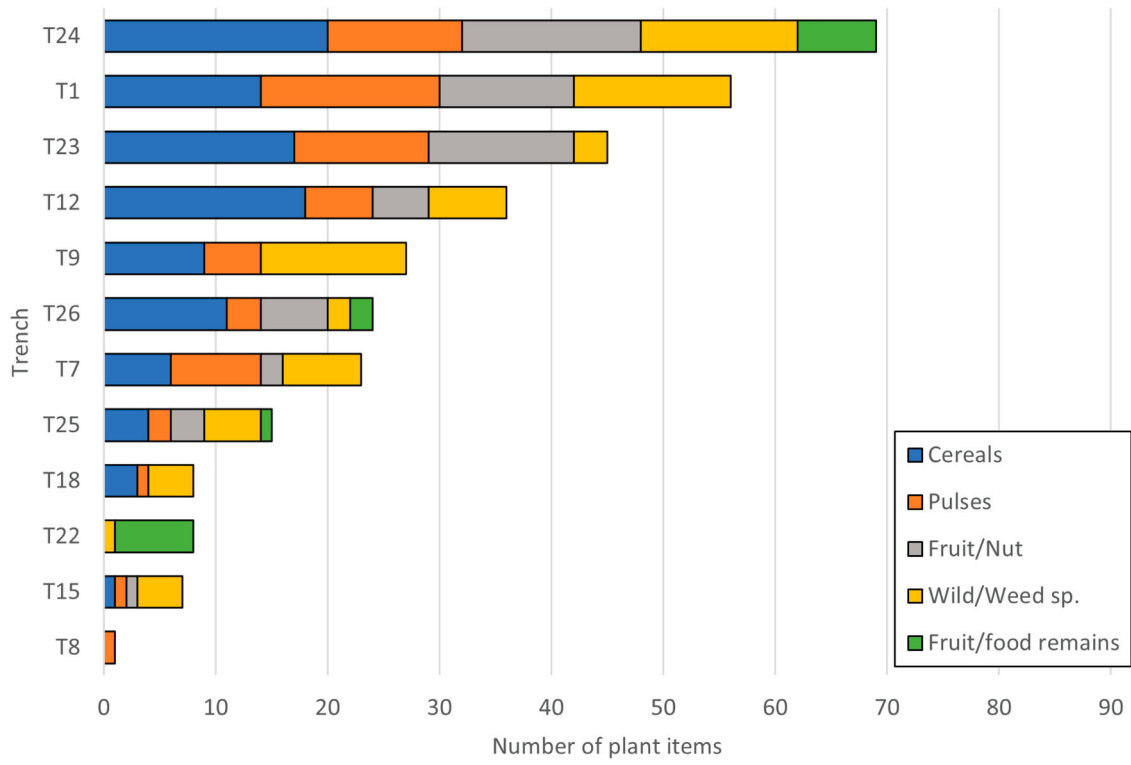


Figure 4. Number of plant items per plant group per trench at Bribirska glavica.

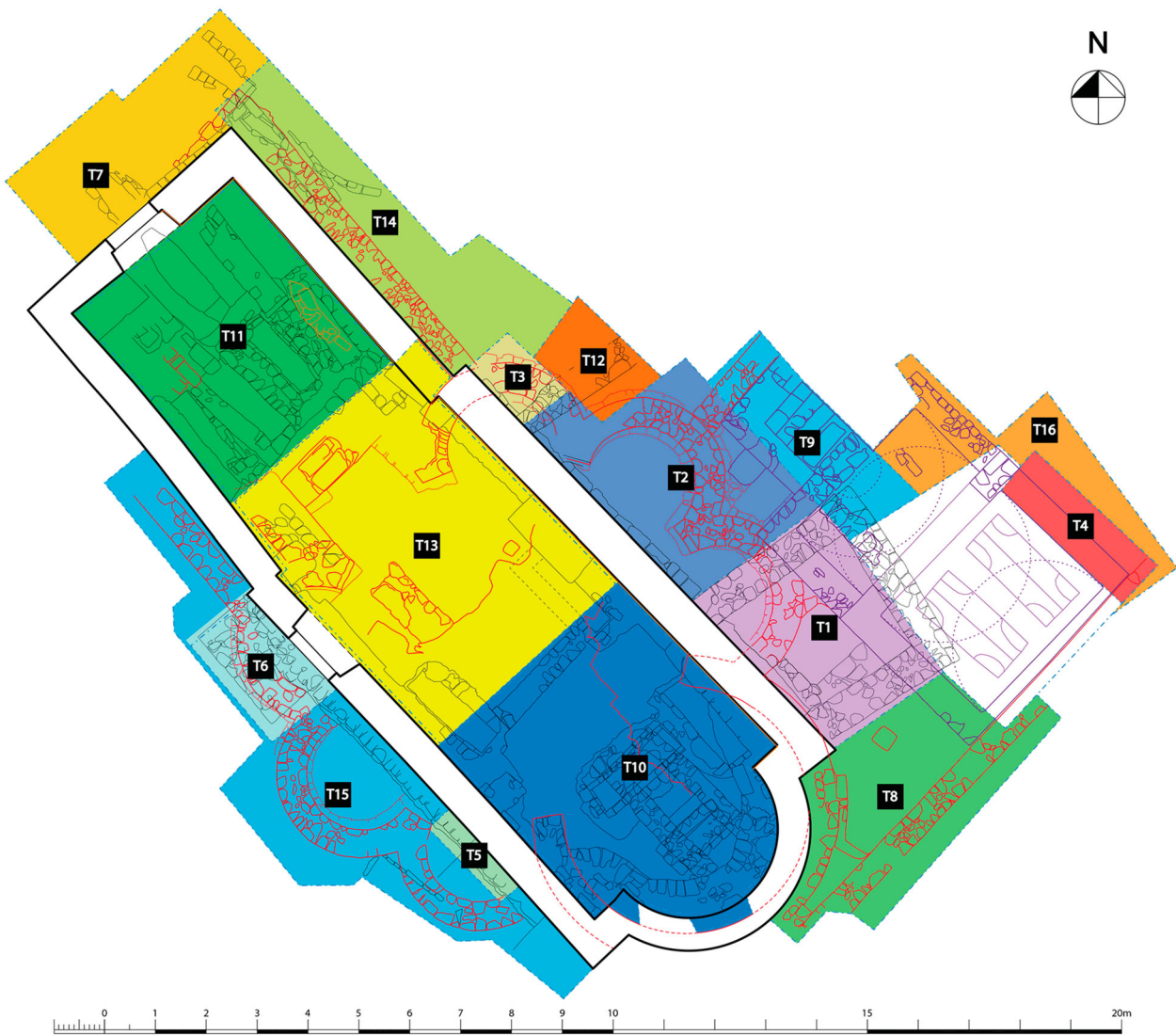


Figure 5. Plan of the trenches excavated between 2014 and 2016 at Bribirska glavica (V. Ghica).

Zmajevac

Carbonized plant remains were identified from only 4 of the 137 samples (graves 47, 64, 73, and 97) at Zmajevac. Grave 64 contained one grain of barley, one free-threshing wheat grain, and some cereals remains (see Supplemental Material 1). Graves 47 and 97 only contained one weed seed each, one indeterminate grass, and one bedstraw (*Galium aparine*) seed, while grave 73 contained one indeterminate cereal grain. From all the graves sampled, only a few micro-flecks of charcoal were spotted in the samples.

Novi Čeminac–Jauhov Salaš

Carbonized plant remains were recovered from graves 1, 7, 9, and 11 and samples 390 and 851 at Novi Čeminac–Jauhov Salaš. Two grains of barley were recovered from grave 7 and two from sample 390, while the rest contained singular indeterminate cereal fragments (see Supplemental Material 1). Sample 390 also contained common dogwood (*Cornus sanguinea*), while sample 851 contained a fragment of cornelian cherry (*Cornus mas*), as well as a cinquefoil (*Potentilla palustris*) and a violet (*Viola* sp.) seed. Grave 11 also contained a singular indeterminate legume. Charcoal density was very low within the graves, and in many, just micro-flecks were spotted.

Njive Ivandol

Only grave 4 yielded carbonized plant remains at Njive Ivandol. Here, one free-threshing wheat, some cereal remains, and a couple of grasses (*Bromus* sp. and *Setaria* sp.) were identified (see Supplemental Material 1). Charcoal density was very low within the graves, and, in many, just micro-flecks were spotted.

Prvča

Both samples recovered from the foundation of the southern part of the church contained carbonized remains. This included one broomcorn millet grain, an indeterminate wheat grain, and two cereal fragments (see Supplemental Material 1). In addition, one grape pip (*Vitis vinifera*) and seven wild/weed seeds of goosefoot (*Chenopodium album*) and grasses (*Lolium* sp. and *Setaria glauca*) were identified. Charcoal density was very low within the graves, and, in many, just micro-flecks were spotted.

Discussion

In Croatia, burial traditions from the 4th century A.D. onwards can be particularly complex, in part due perhaps to episodes of migration and invasion, and won't be discussed in detail here (see Petrinec 2012; Sokol 2015). Instead, this section examines evidence of food offerings in Late Antique and medieval graves, the taphonomy of the archaeobotanical remains from Croatia, and explores what this may tell us about the sites and communities they represent.

Plant use in Late Antique and medieval burial rituals

In the preceding Roman period, cemeteries and tombs were gathering places for the living, as well as the dead. Family and

friends would come to graves regularly to share a meal and offer food in honor of the deceased. Grave goods included bowls, cups and dishes, and food, as well as other mementos, while some burial sites included hearths for cooking and even water fountains (Jensen 2008). This practice persisted in certain areas up until the 8th/9th century A.D., when grave goods began to disappear from European burials as societies converted to Christianity (Härke 2014). However, despite the often-vehement disapproval of the Church, grave goods persisted and can be seen in various funerary contexts throughout Europe during the Middle Ages (Gilchrist 2005). Typically, graves with offerings are linked to pagan practices, although this association has been criticized in the last decades. Instead, localized hybrid religious practices very probably emerged, being performed in private alongside more public and even official religious settings (Gilchrist 2008; Reed 2019; Watkins 2004). Reasons for the deposition of grave goods comprise a wide range of possibilities, with marked regional differences and with considerable changes over time, which can make it difficult to interpret their intended purposes (Härke 2014).

In Dalmatia, 5th–8th century A.D. cemeteries show a mix of burial customs, including cremations and inhumations, grave structures, including tombs and stone-lined graves, and a range of grave goods such as ceramic pots and personal adornments (Sokol 2015). In some 7th–8th century A.D. graves, evidence of burning is seen inside and around the graves, which has been associated with “Slav paganism” (Džino 2010, 133; Petrinec 2015). In Britain, a similar phenomenon occurs in Anglo-Saxon burials, where a fire appears to have been lit in the grave before an inhumation took place or occasionally where the body itself was partially burnt (Meaney 1964, 64). In addition, 9th–12th century A.D. graves in Britain containing evenly spread oak charcoal within the grave cut have been interpreted in light of a rite linked with ideas of cleanliness and protection, serving to define a space for the body against the “filthy” earth (Holloway 2009, 267–273). Evidence of medieval burials with a charcoal or ash layer under, within, or on top of the coffin or body has also been noted in northwestern Europe and was understood to have served both practical and symbolic purposes (Daniell 1997; Džino 2010, 134; Gilchrist 2008; Gilchrist and Sloane 2005; Holloway 2009). In Britain, over 56 reported examples exist from the 13th–15th century A.D., with the ash layer being interpreted as ash from a domestic hearth (Gilchrist 2008, 145). Charcoal fragments are also found in perforated pottery vessels that occur in graves dating between the 11th and the 15th century A.D. in many regions in northwestern Europe (Baeten et al. 2014). These pots are believed to have been used as incense burners during the funeral ceremony and were placed in the grave during the burial (Gilchrist and Sloane 2005, 273).

Although rare, food remains are recovered within inhumations, particularly during the Late Antique and early medieval periods. This is particularly the case with Avar graves, where food remains, such as animal and fish bones and eggshells, have been recorded (e.g. Bugarski 2009; Rapan Papeša, Kenéz, and Pető 2015; Young 1978). Eggshells have also been found in medieval Croatian graves at Gajine in Kaštel Sućurac, Glavičine in Solin, Stombrate in Bijaćci, Dubravice near Skradin, Borinovce in Trilj, and Putalj in Kaštel Sućurac (Milošević 2015; Petrinec 2015). Interestingly, eggshells were also recovered from two late medieval graves at Bribirska

glavica (Milošević 2015). Areas of burning, along with remains of animal bones and ceramics, have also been seen at Late Antique cemeteries such as Orlić (Croatia) and Sultići (Bosnia and Herzegovina), where the pits were interpreted as places of feasting and worship within the cemetery, rather than evidence of a cremation burial (Petrinec 2015, 101).

Evidence of plant remains is rarer still, but their absence in the archaeological record may simply be a result of poor preservation and lack of sampling rather than indicative of the non-inclusion of plants in mortuary contexts. A traveler's account from 1564 noted that when visiting Jagodina, Serbia, bread, meat, and wine were placed in the grave with the deceased (Šnevajs 1928, 268). Ethnographic examples also highlight the use of plants in burial ceremonies in Croatia and the surrounding countries (Šnevajs 1928). For example, in Đurđevac Croatia, Miholek (2002) observed the placing of rosemary on the chest of children, as well as flower wreaths on their head. Vuković (2019, 21, 47) observed a range of grave gifts, from grapes to candies, wine, and cigarettes being placed with the deceased in Vojvodina, Serbia. This was also noted for rural populations in Semberija, Bosnia and Herzegovina (Bajić 1979, 331–333). For younger individuals, pillows filled with straw and basil were sometimes used (Bajić 1979, 332). Certain dishes are also linked with funeral rites and commemorating the dead. For example, the cooking of *kolivo*, a dish based on boiled wheat, has been and is still used today liturgically in the Eastern Orthodox Church for commemorations of the dead (Čirgić 2018). Thus, it is likely that in some cases, plants, whether used for food or decorative/symbolic purposes, could have been part of Late Antique and medieval burial practices, especially in small rural communities.

Inhumation graves

As outlined above, the density of the plant remains and their position, as well as examining the context and other associated finds, help us to untangle the taphonomy of inhumation graves. No concentrations of charred plant remains were recovered from the Croatian graves. Densities were very low within all samples and, with the exception of SU1448 at Bribir, all the plant remains were poorly preserved. Charcoal fragmentation, size, and state of erosion have been used in studies to understand combustion temperatures and depositional and post-depositional processes (e.g. Lancelotti et al. 2010). Ceramics have also been analyzed with the aim of identifying depositional and post-depositional processes (e.g. Jennings 2015). For example, Martín-Seijo and colleagues (2017) undertook a systematic and numerical appraisal of the fragmentation and preservation conditions of ceramics and charcoal within a pit. They proposed that the high fragmentation and erosion observed suggested that they, along with the plant remains, had been thrown around the site before finding their way into the pit.

At Zmajevac and Njive Ivandol, nearly every grave contained microscopic flecks of charcoal. No lumps larger than 1 mm were found in any of the samples. A few smaller fragments of charcoal were present at Novi Čeminac–Jauhov Salaš; however, again, nothing larger than 1 mm, and generally only a few flecks in each sample have been found. This would suggest that the contexts containing plant remains probably represent secondary or even tertiary deposits, probably from past settlement occupation near or on the site or

from a contemporary settlement. At Novi Čeminac–Jauhov Salaš, the site had prehistoric pits nearby, as well as a contemporary settlement. Thus, in such situations, it would be recommended that radiocarbon dates be taken of the plant remains to confirm association with the period under study. This is particularly important when pulling together regional data, as the barley which was recovered from Novi Čeminac–Jauhov Salaš was grown from the Neolithic period (ca. 6000 B.C.; Reed 2015) onwards in Croatia and so could be related to nearby prehistoric features.

The cemetery at Bribir is slightly more complicated, as it is a multi-level, multi-period graveyard situated next to a Roman villa. The charcoal densities were low; however, a few samples, such as those from SU1490, SU1435, and especially SU1448, contained over 30 charcoal fragments measuring over 5 mm, with several over 1 cm. Some burning was identified in some of the layers (e.g. SU1417), although they generally contained only small (< 5 mm), poorly preserved charcoal. Some of the layers sampled contained items from multiple periods (e.g. SU1278 contained both Roman and medieval pottery fragments). Numerous layers, such as SU1398 and SU1417, also contained bits of buildings, plaster, mortar, tesserae, etc. Overall, ceramic fragments were less than 10 cm in diameter (I. Ožanić Roguljić, personal communication 2021) and identifiable, which could suggest low levels of abrasion and thus limited movement around the site as rubbish before deposition. However, the ceramic analysis is still underway, so these observations may change. Thus, the ceramic fragmentation and mixing of items from different periods, which characterize much of the stratigraphy of the recent excavations in the Bribir cemetery, along with the low densities of the charcoal and plant remains, suggest that the plant remains have moved around the site, being charred during different events and possibly within different time periods, before they were deposited within the context. One exception is SU1448, where the excellent preservation of the wild pear and other plant remains, and the context itself being full of ceramics, animal bones, and large lumps of charcoal, suggest a rubbish layer deposited either in one event or over a short period with little disturbance. Due to its unique character compared to the other samples at the site, the layer was radiocarbon dated, returning an early Roman date. The finds correspond well with Roman archaeobotanical finds recovered in Croatia (Reed and Ožanić Roguljić 2020; Šoštarić and Küster 2001). Nevertheless, the low density prevents any further observations beyond their presence and probable inclusion within the diet of the inhabitants at Bribir during the 2nd or early 3rd century A.D. Unfortunately, the charred plant remains from all these sites provide no further information about religious life at the time.

Church contexts

Although not discussed to a large extent here, archaeobotanical remains from church contexts are also not common in Croatia or the surrounding countries. Gyulai (2010) noted the recovery of archaeobotanical remains from two churches in Hungary, Oroszlány-Vértesszentkereszt and Kaposvár-Kaposszentjakab. At Oroszlány-Vértesszentkereszt, one sample was collected from a burnt layer of the 15th century A.D. cloister and contained 250 cm³ of charred walnut (*Juglans regia*) fragments. At Kaposvár-

Kaposszentjakab, one sample was collected from a burnt layer of the 16th century A.D. cloister and contained charred plant remains: 291 grains of free-threshing wheat (*Triticum aestivum*) and 209 broad beans (*Vicia faba*), as well as a few lentils (*Lens culinaris*), broomcorn millet, oat (*Avena sativa*), and rye (*Secale cereale*) grains and wild/weed seeds (*Agrostemma githago*, *Glaucium corniculatum*, and *Vicia angustifolia*). Not much information is present on the sites, but the remains have been interpreted as representing food remains associated with the sites and have been used in wider discussions about agriculture during the late Middle Ages (Gyulai 2010, 203–213).

At Prvča, the low density of charcoal and plant remains suggests that the remains probably represent residual debris of domestic origin that became accidentally incorporated into the fills. No dateable finds were recovered from these contexts, so without dating the grains, it is hard to directly associate the plant remains to the occupation of the site during the 14th–17th century A.D. However, the plant species recovered (i.e. millet, wheat, and grape) do correspond with other finds from this period in Croatia (Reed et al. 2021) and may add to the wider picture regarding agriculture during the late Middle Ages in Croatia. Unfortunately, the charred plant remains provide no further information about religious life at the time.

Conclusion

The sampling of inhumation burials for archaeobotanical remains is a challenge. The preservation of plant remains in such contexts is typically poor, and if charred remains are found, issues arise as to their connection with the burial act. Here we examined the presence of wood charcoal along with other plant macro-remains to reconstruct site taphonomy and determine if they played a role in burial customs. This method proved useful to show no in situ burning or other evidence of intentional deposition of botanical remains at the Croatian sites. Instead, the botanical remains are probably debris from settlement and other daily activities that became incorporated within the contexts. This was also the case at the Church at Prvča, where the low density of remains indicate general settlement scatter. Overall, the low number of plant remains recovered from the sites makes any further interpretations about local agriculture difficult, especially as it is unclear if they represent crops from the same period.

At Bribir, sampling of secure strategic levels has helped contribute to the understanding of the cemetery's formation. Although not initially sampled for this purpose, these layers have been used here as control samples for the interpretation of the graves, showing similarities in composition of the charred remains and therefore the unlikely presence of ritual plant offerings. The only anomalous sample from Bribir was the identification of a rubbish layer full of plant remains, charcoal, ceramics, animal bones, and other items. These remains, along with radiocarbon dating, showed a clear association with the Roman villa that was built before the church and graveyard. Unfortunately, radiocarbon dating was not conducted at the other sites and so could not be used here to help confirm intrusion. Yet, it is worth highlighting that some of the graves were located near features dated to different periods.

Whether an inhumation will have preserved plant remains is difficult to determine without sampling. Most

studies advocate a multi-proxy approach, whether that is plant macro-remains and pollen or other techniques, to understand depositional practices. Although a range of sampling strategies have been used, focusing around the head and abdomen seems sensible, even if some pre-Christian practices used to bury offerings at the bodies' feet (Petrinec 2015). Recording charcoal densities and taking control samples outside the graves should also be an essential part of the sampling strategy. This is especially important if the burial site is located next to or over settlement activity, is on an earlier burial ground, or is a multi-level graveyard. Thus, if samples are similar, it is highly unlikely that the botanical remains from inside the grave are related to the burial ritual. Taking control samples can also help with the interpretation of site formation processes, especially at multi-level sites. In addition, radiocarbon dating charred remains is important to determine whether the botanical remains recovered even date to the same period as the burials and should be factored into the cost of any grave excavations. More work is clearly needed within this area to develop a better understanding of the inclusion of plant remains within inhumations.

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