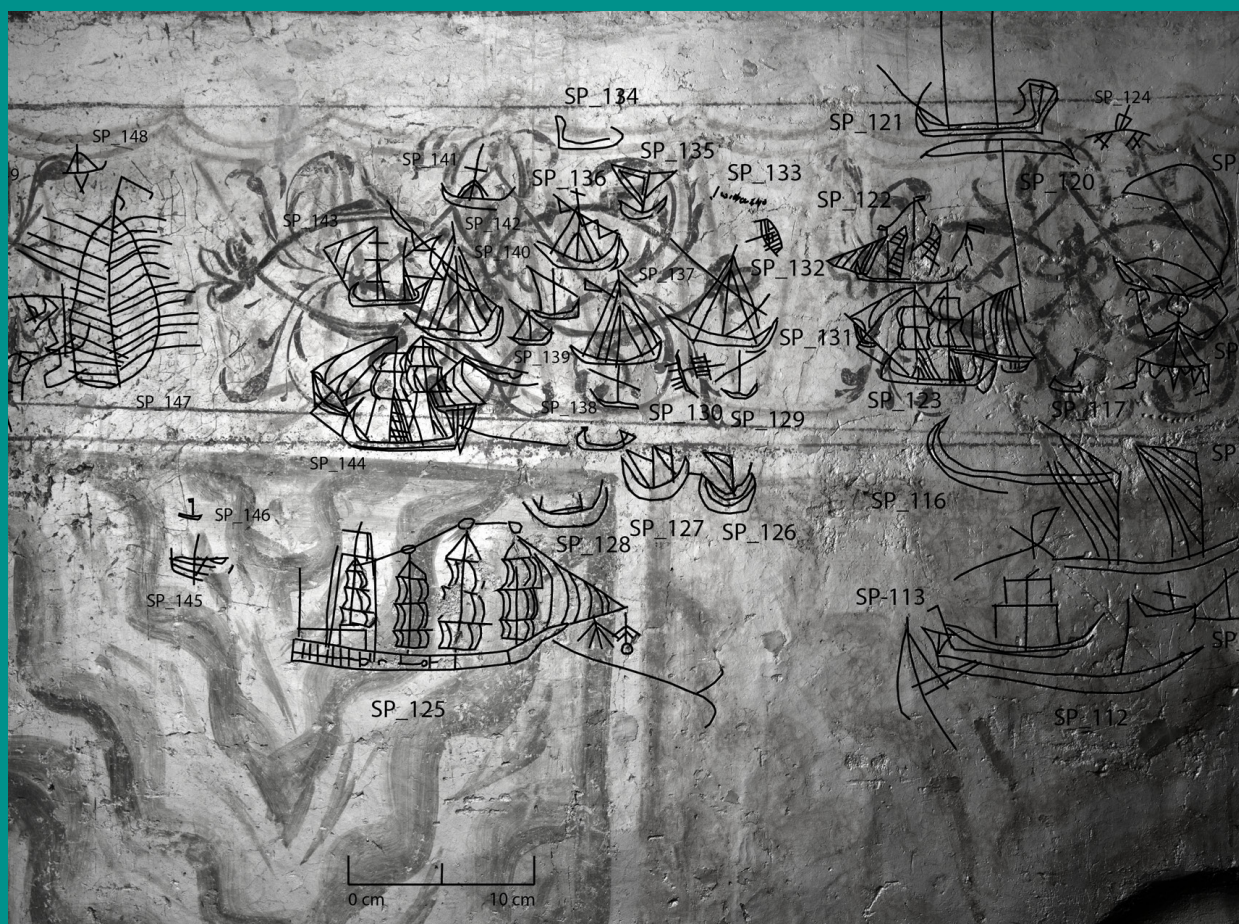




1892 - 1921 - 1948

БЪЛГАРСКА АКАДЕМИЯ НА НАУКИТЕ
НАЦИОНАЛЕН АРХЕОЛОГИЧЕСКИ ИНСТИТУТ С МУЗЕЙ
BULGARIAN ACADEMY OF SCIENCES
NATIONAL ARCHAEOLOGICAL INSTITUTE WITH MUSEUM

ИНТЕРДИСЦИПЛИНАРНИ ИЗСЛЕДВАНИЯ XXVII / 2022 INTERDISCIPLINARY STUDIES



София – Sofia

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ИНТЕРДИСЦИПЛИНАРНИ ИЗСЛЕДВАНИЯ
XXVII
INTERDISCIPLINARY STUDIES

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Food for the soul, wood for the body: archaeobotanical studies on charred plant remains from *tumuli* No 4 and No 5 at Golemiya kairyak locality near the village of Mogila, Yambol region, Southeastern Bulgaria

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ABSTRACT

Up to now there has been a little archaeobotanical research on plants and plant-based foods utilised in mortuary practices during the Roman period in the province of Thrace. This paper presents the preliminary archaeobotanical study on four cremation burials in *tumuli* No 4 and No 5, part of the cemetery at Golemiya Kairyak locality, located in the northern part of the Roman province of Thrace (present-day southeastern Bulgaria). Based on the analyses of the burial practices and inventory, the *tumuli* and the related structures could be dated between the second half of the 2nd and the early 3rd century AD.

All of the studied cremation burial pits contained pyre debris and grave inventories. Three of these features showed a typical assemblage consisting of cereals, bread and/or similar processed food remains, as well as nuts and fruits. Among the charred plant remains deposited in the grave pits were locally grown species such as *T. monococcum* L., *T. aestivum* L. ssp. *compactum*, *Vicia faba* L., *Cicer arietinum* L., *Juglans regia* L., *Vitis vinifera* ssp. *vinifera*, *Pyrus communis* L., as well as imported kernels of *Pinus pinea* L. The archaeobotanical material from *tumuli* No 4 and No 5 provides opportunity to study some of the taphonomic processes documented in burial contexts and successfully complements the data about ritual use of plants in mortuary practices in the province of Thrace.

Keywords: plant offerings, archaeobotanical remains, *tumuli*, cremation burials, Roman period, the province of Thrace

INTRODUCTION

Ritual plant offering and communal funeral feasting were common and widespread mortuary practices in the Roman world. There was a broad perception that sacrificial offering of food and drinks to the deceased was intended to sustain them on their journey to the afterlife. This represented part of a sacrificial contract with the deities believed to receive the dead into the afterlife. The sharing and giving of food between the living and the dead may have created solidarity, group identity and social memory (Williams 2004, 422). The archaeobotanical study of plant food offerings in cremation graves and cemeteries of the Roman period seems to have attracted greater interest in the last 15 years, resulting in various publications on Gallo – Roman cemeteries in France (Bouby, Marinval 2004; Preiss et al. 2005), Roman burials in Bel-

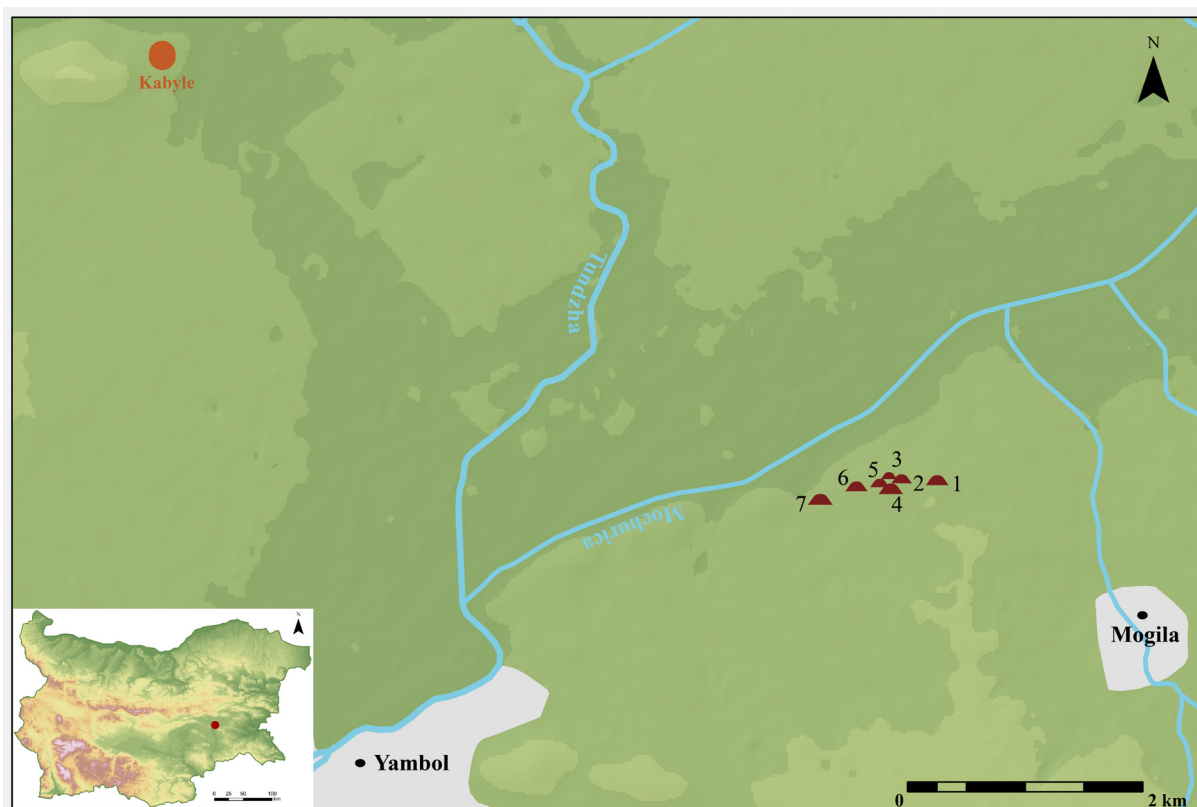


Fig.1. Map of Bulgaria with the location of the tumular cemetery at the Golemiya Kairyak locality

gium (Cooremans 2008), the Netherlands (Bakels 2005), Germany (Kreuz1995a, b; 2000), the United Kingdom (Davis, de Moulins 2000), Northern Italy (Rottoli, Castiglioni 2011), Croatia (Lodwick et al. 2018) and Switzerland (Petrucci-Bavaud et al. 2000; Pfaffli et al. 2004; Jacomet et al. 2006). However, the earliest research into plant offerings in cremation cemeteries in Italy dates back to the 1950s, when H. Helbæk (1953; 1956; 1960) studied finds from pre-urban Rome. This was much later followed by the studies undertaken on a cemetery at Pompeii (Matterne, Derreumaux 2008).

Communal feasting was an important part of Thracian ritual, and it accompanied every important event – from weddings, political agreements and military victories to funerals (*see* Георгиева и др. 1999). The available archaeological and archaeobotanical data shows that during the Roman period, and in particular between the 1st and 2nd centuries AD, food sacrifices and funeral feasting were still elements of the burial rituals in Thrace. Unfortunately, up to now there have been few studies on archaeobotanical evidence on plants and plant-based foods, associated with mortuary practices in the province of Thrace. Their role within ritual contexts has been interpreted mainly in the light of archaeological observations made by the excavators of the sites. According to the available data, both domestic and wild animals were sacrificed together with plant offerings such as fruit, nuts, bread and pastries, seeds, herbs and mushrooms (e.g. Георгиева 2000; Гетов 1989, 47 – 65; Праматаров 2018, 16 – 17; Теодосиев, Манов 1993). The presence of plant offerings in burial contexts has been investigated and highlighted by R. Georgieva (Георгиева 2000), discussing both their symbolic and utilitarian functions. Archaeobotanical analysis of plants and bread-like remains, some of which related to burial contexts from the Roman period, have been carried out and discussed by Tz. Popova (Попова



Fig. 2. Structure No 2 (cremation burial), tumulus No 4 (photo provided by the excavators of the site)



Fig. 3. Structure No 3 (cremation burial), tumulus No 4 (photo provided by the excavators of the site)

1986; 2002; Popova 2016). However, a more systemized research, based mainly on archaeobotanical data from ritual contexts, has been done by I. Hristova (Hristova I. 2015). *Pinus pinea* remains and their role in mortuary practices in Hellenistic and Roman times has been reviewed by Tz. Popova and H. Hristova (Popova, Hristova H. 2017). In spite of these studies, the state of the archaeobotanical evidence is still fragmentary. More research is required and more precise sampling strategies need to be carried out during excavations.

This paper presents the preliminary results from the archaeobotanical investigation of four cremation burials in burial mounds No 4 and No 5, part of the Roman cemetery at Golemiya Kairyak locality near the village of Mogila, Southeastern Bulgaria. It suggests an interpretation of the ritual and symbolic function of the analysed plant taxa, along with a discussion of how and when they entered the burial context.

ARCHAEOLOGICAL SETTING

Burial mounds (*tumuli*) became one of the main burial features in the period between the 1st and 3rd centuries AD for almost the entire territory of the Roman province of Thrace. According to Pramatarov (Праматаров 2018, 9 – 11) several types of tumular can be conditionally distinguished: 1) a single *tumulus*; 2) a group of several *tumuli* (from 2 to 7 mounds), 3) small tumular cemeteries (between 8 – 20 mounds), 4) large groups of *tumuli* (over 20 mounds). The classification was mainly determined by the number of embankments, the distance between them and by the internal organizational model of the *tumuli* (which could be linear, circular or “scattered”). From a topographical point of view, the cemeteries during this period were located in the plains of the province and in its semi-mountainous areas, up to 800 m above sea level (Праматаров 2018, 9 – 11).

Nowadays, the Roman period necropolis at Golemiya Kairyak locality lies in the territory of the village of Mogila, Yambol district. However, during the Roman period it was situated in the northern part of the Roman province of Thrace (the present-day Southeastern Bulgaria). The cemetery consists of 7 *tumuli* (Fig. 1). Archaeological excavations and archaeobotanical studies were carried out at *tumuli* No 4 and No 5 in 2018, as part of a project between the Institute of Archaeology and Ethnology – Polish Academy of Sciences and the Regional Historical Museum at Yambol. The project was supported under Project No. NCN OPUS 2017/25/B/HS3/02516 of the National Science Centre – Poland (Александров и др. 2019a, 179 – 182).

Burial mound No 4

Tumulus No 4 is hemispherical in shape with an oval base of 20 x 25 m and a height of 1.8 m. During the excavations two cremation burials and two features related to funerary practices were discovered and studied. The primary feature (documented as Feature No 2) represents a grave pit, rectangular in shape, dug into the ancient humus soil horizon. The excavators of the site suggest that the body of the deceased had been first placed upon a funeral pyre. After that, the skeletal remains, pyre debris and iron nails from the cremation activity were collected and all placed together at the bottom of the pit (Fig. 2). An earthen mound with a height of 0.8 – 1 m and a diameter of 6 m was then heaped up above the grave. The inventory consists of six clay vessels, an iron medallion with golden encrusted plate, a bronze coin of Lucius Verus (161 – 169 AD), animal bones and burnt plant offerings. The anthropological analysis of the human remains suggests that they belong to an adult (female?) individual (Александров и др. 2019a, 178 – 179).

In the northern periphery of the *tumulus*, Feature No 3, a cremation burial, was excavated (Fig. 3). The funerary ritual had been performed in the same way in that pyre debris was collected and placed at the bottom of the grave pit. A ceramic bowl, pieces of a bronze vessel, plant offerings and animal bones were found in the grave pit as well (Александров и др. 2019a, 178 – 180).

These two graves were surrounded by a round stone wall. In the periphery, two other features related to the mortuary practices were found (Fig. 4). Finally, an earth mound with a diameter of 16 m and height of 1.7 m was piled up. Based on the analysis of the funerary practices and grave inventory, the mound and its features could be dated to the second half of the 2nd century AD (Александров и др. 2019a, 179 – 180).

Burial mound No 5

Burial mound No 5 is hemispherical in shape, with a diameter of 20 m and a height of 1 m (Fig. 5). The centre of the mound is at an altitude 173.99 m. At its highest part there is an oval-shaped trench with a diameter of 1 x 0.8 m and depth up to 0.8 m. The mound was completely

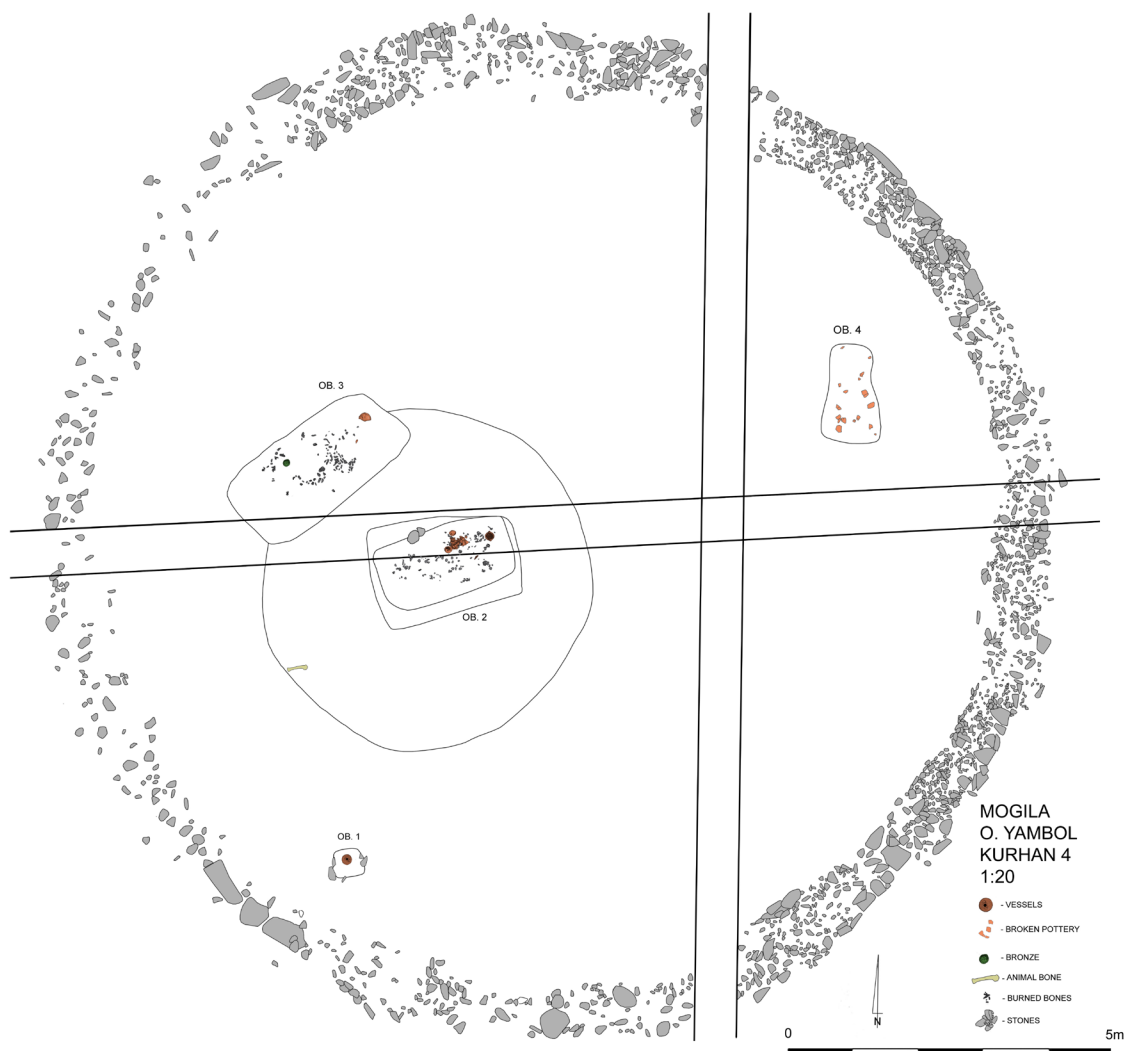


Fig. 4. Plan of the excavated burial features in tumulus No 4 (Александров и др. 2019a, 179)

investigated with 6 cremation burials, 4 inhumation burials as well as 3 features related to mortuary practices. Features No 7, 9 and 10 (cremation burials) had been placed in the central part of the barrow. Features No 1 – 3 (cremation burials) were situated in the mound's periphery where the other features related to mortuary practices were found as well. The inhumation burials (No 8, 11 – 13) were discovered in the southern part. All features were enclosed by a stone wall and an earthen mound had been accumulated above, with a diameter of 13 m and height of 1 m (Fig. 5). Based on the analysis of mortuary practices and the grave goods, the *tumulus* and the related structures could be dated to between the second half of the 2nd century and the early 3rd century AD (Александров и др. 2019b, 180 – 182).

METHODS AND MATERIALS

The archaeobotanical field strategy involved probabilistic or judgemental sampling within representative features. These were ashy deposits in the grave pits (pyre debris) and the content of ceramic vessels that had been part of the grave inventory. However, sampling procedures

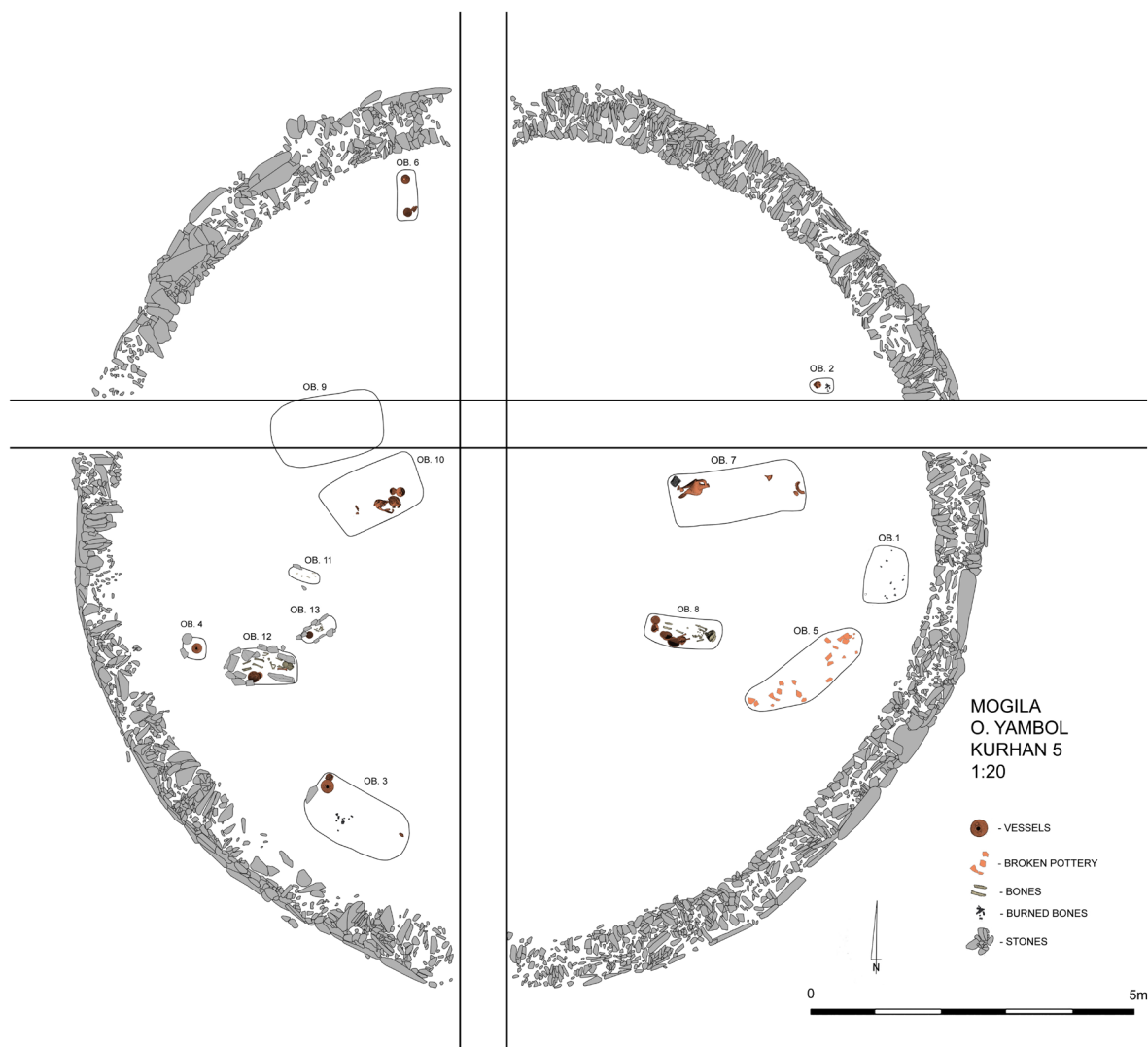


Fig. 5. Plan of the excavated burial features in tumulus No 5 (Александров и др. 2019b, 181)

varied by context. Readily visible charred plant remains were gathered manually (for example fragments of charred wood), but in the sections with higher charcoal density, soil samples were collected and processed using a bucket flotation. A sieve with 1x1 mm mesh size was used. The volume of each sample was measured prior to flotation.

Twenty six soil samples (or a total of 213 l) were processed. However, only sixteen of the samples, collected from the cremation grave pits, could be defined as informative and representative. A significant amount (3.100 kg) of charred archaeobotanical remains were recovered and sorted according to their preserved integrity.¹ More than 6 000 charred remains were analysed, probably representing only a small fraction of the original plant deposit as not all the contexts were processed by flotation. The ubiquity of each plant taxon has been calculated per context as a percentage proportion of the total number of remains. Each fraction underwent preliminary visual examination with illuminated magnifying glass. Identification of taxa was carried out using a stereomicroscope BRESSER Advance ICD at magnification between 20x and 40x.

¹ Measured in dry condition, after the flotation procedure.

For the anthracological analysis, each fragment was broken manually. The anatomical characteristics of the wood were observed in transverse, tangential and radial planes, using a reflected light microscope with dark field illumination and magnifications between 20x and 50x. Identification was based on identification keys, wood anatomical atlas (Schweingrüber 1978) and a reference collection of charred wood specimens.²

RESULTS

A total of 11 different taxa and bread-like fragments, have been identified. The archaeobotanical assemblage consists of two separate categories: **1)** ritual plant food offerings (approximately 5 in number, 3% of the studied material); **2)** fire wood and/or remains of the cremation facility (approximately 94,7%).

Ritual plant food offerings

A total of 418 charred plant food remains were identified in the samples, including grains of cereal and leguminous crops, fruits and nuts, bread-like/porridge (?) fragments, also seeds of *Vitis vinifera* ssp. *vinifera* and *Pyrus communis*, stones of *Prunus* sp., nutshells of *Juglans regia*, bracts of cones, shells and kernels of *Pinus pinea*. Cereal crops are represented by 2 taxa – einkorn (*Triticum monococcum* L.) and club wheat (*Triticum aestivum* ssp. *compactum* Host). However, einkorn is predominant as it occurs in all samples. Two leguminous species have been identified – chickpeas (*Cicer arietinum* L.) and fava bean (*Vicia faba* L.).

The state of preservation of the analysed plant remains varied from sample to sample, but also from one type of plant remains to another. Considerable differences in the degree of carbonisation were encountered (i.e. *Pinus pinea* nutshells were found both open and closed) (Fig. 6). Nutshells, stones, seeds, kernels and remains of cones were found fragmented but fairly well preserved. Pulses and cereal grains were preserved better, although *testa* was disturbed in places.

Firewood

A significant number of charred wood remains were found. The charcoal assemblage was composed of shapeless pieces of wood and bark, as well as fragments of branches and twigs, varying in size between 2 mm and 5 cm in length and between 3 cm and 5 cm in diameter. Four different taxa were identified, although the samples were clearly dominated by a single wood taxon – *Quercus* sp. The analysis has shown that *Fagus sylvatica* L., *Acer campestre* L. and *Pinus* sp. also occurred in representative amounts.

Structure No 2 (cremation burial) within mound No 4

A total of 5 samples from the grave pit were collected and analysed. The amount of recovered archaeobotanical remains is significant (approximately 2 kg).³ The content of three ceramic vessels was sampled as well, but no archaeobotanical material was found.

The archaeobotanical assemblage consisted of charred einkorn grains (*Triticum monococcum* L.), fava bean (*Vicia faba* L.), chickpea (*Cicer arietinum* L.), grape seeds (*Vitis vinifera* ssp. *vinifera*), pear seeds (*Pyrus communis* L.), stones of *Prunus* sp, fragmented walnut shells and nuts of *Juglans regia* L., as well as small parts of stem of herbaceous plant whose precise identification was not possible due to its poor state of preservation (Diagram 1). Of particular

²Reference collection kept at the Department of Interdisciplinary Research and Archaeological Map of Bulgaria, NAIM – BAS, provided by Assoc. Prof. Dr. Tzvetana Popova.

³Charred plant remains, measured after flotation in dry condition.



Fig. 6. Charred nutshells of *Pinus pinea* found in cremation burial No 2, tumulus No 4 (photo by H. Hristova)



Fig. 7. Charred cone fragments of *Pinus pinea* found in cremation burial No 2, tumulus No 4 (photo by H. Hristova)

interest is the large amount of charred *Pinus pinea* L. nutshells (some of them semi-opened), kernels, scales and other small and unidentifiable parts of the pine cone (Fig.7). Fragments of bread/cereal porridge (?) were found as well (Figs. 8 – 9). The components of the dough have not been investigated yet, but the primary examination shows that they have an irregular shape, bumpy surface and a porous inner structure with negative imprints of grains.



Fig. 8 – 9. Charred nutshells and kernels of *Pinus pinea*, found in cremation burial No 2, tumulus No 4 (photo by H. Hristova)

Anthracological analysis has shown the use of three deciduous and one coniferous species – oak (*Quercus* sp.), beech (*Fagus sylvatica* L.), field maple (*Acer campestre* L.) and pine (*Pinus* sp.). A high concentration of fragmented branches and bark remains was found.

Structure No 3 (cremation burial) within tumulus No 4

A total of 3 samples from structure No 3 were analysed. Charred remains belonged to einkorn (*Triticum monococcum* L.) and club wheat (*Triticum aestivum* ssp. *compactum*), grape (*Vitis vinifera* ssp. *vinifera*) and walnut (*Juglans regia* L.). Small bread/cereal porridge fragments were also found. Charred wood was from *Quercus* sp. and *Fagus sylvatica* L. (Diagram 2).

Structure No 7 (cremation burial) within tumulus No 5

The archaeobotanical remains from structure No 7 were recovered from a total of 3 samples. Einkorn (*Triticum monococcum* L.), grape seeds (*Vitis vinifera* ssp. *vinifera*), walnut shells (*Juglans regia* L.) and small shapeless pieces of bread or cereal porridge were identified. The analysis of charred wood has shown the persistent use of oak (*Quercus* sp.), pine (*Pinus* sp.) and beech (*Fagus sylvatica* L.) (Diagram 3).

Structure No 10 (cremation burial) within tumulus No 5

2 samples from structure No 10 were analysed. The archaeobotanical assemblage consisted of six grape seeds (*Vitis vinifera* ssp. *vinifera*) and a small number of einkorn grains. Charred wood remains belonged to *Quercus* sp. (Diagram 4).

DISCUSSION

Food for the soul

Cremation burials provide a great opportunity for the preservation of funeral feast remains or plant offerings for the deceased (Lodwick et al. 2018, 7). According to K. Pramatarov (Праматаров 2018, 16 – 17) there are two ways that food offerings could enter a burial context. Directly, if they were intentionally placed on the *bustum*, or indirectly when ritually burnt plants together with pyre debris were collected from the *ustrinum* and placed in the *cinerarium*, the

Tumulus 4/Structure 2(A)

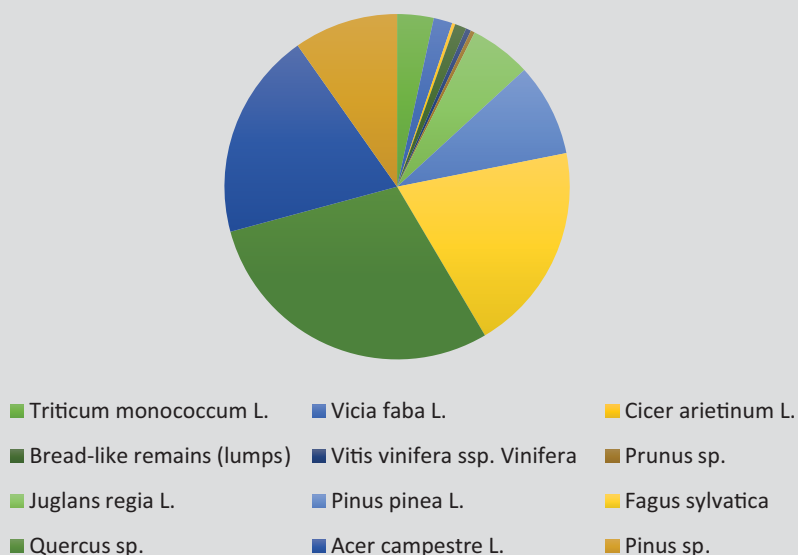


Diagram 1. Quantative ratio between the plant taxa represented in the samples from cremation burial No 2, tumulus No 4

Tumulus 4/Structure 3

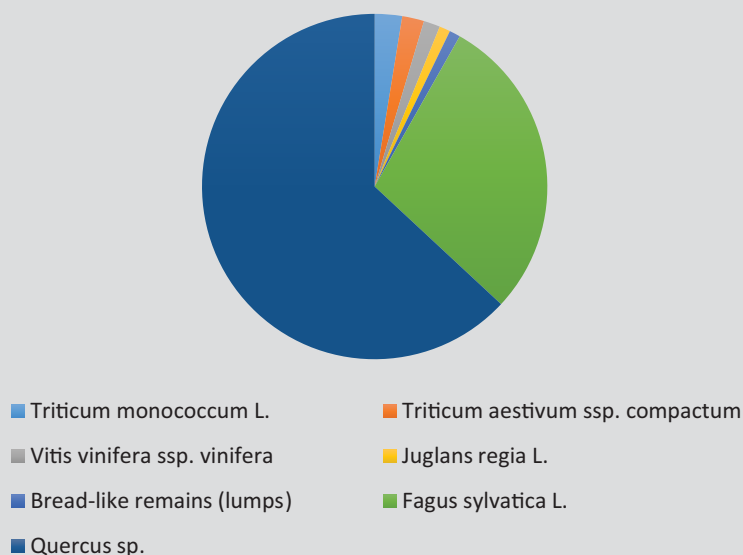


Diagram 2. Quantative ratio between the plant taxa represented in the samples from cremation burial No 3, tumulus No 4

grave or ritual pit/wooden chest/baskets or vessels. Plants may also have derived from funerary meals, although, such ritual meals are more likely to have been preserved only if there is evidence of other features related to mortuary practices at the site (Lodwick et al. 2018, 8).

What we know from the analysis of the archaeobotanical material from *tumuli* No 4 and No 5 is that some of the plant remains underwent several types of macro structural changes. This consisted of deformation, fragmentation and changes in size due to a long – term high temperature exposure, while other remains were fairly well preserved. We may suggest that ritual foods were placed or had fallen in the periphery of the burning fire which might have con-

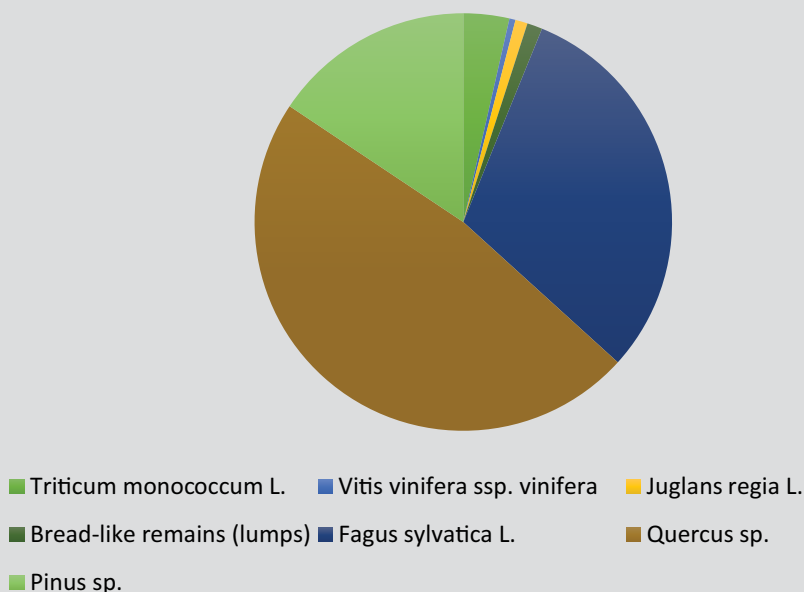
Tumulus 5/Structure 7

Diagram 3. Quantative ratio between the plant taxa represented in the samples from cremation burial No 7, tumulus No 5

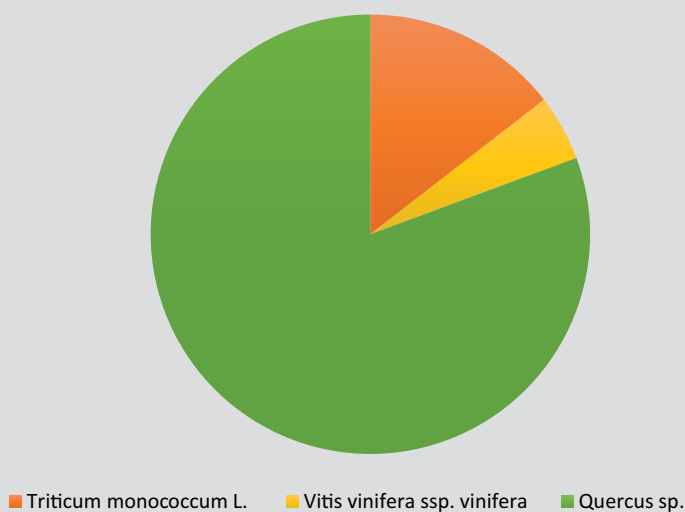
Tumulus 5/Structure 10

Diagram 4. Quantative ratio between the plant taxa represented in the samples from cremation burial No 10, tumulus No 5

tributed to their state of preservation. However, there is no certain evidence as to whether they were burnt on the pyre, before or after the cremation. They could equally be defined either as pyre debris or as burial offerings. The presence of fragmented stones and seeds of fleshy fruits, and bread remains, suggests that part of the meals consumed at the funeral ceremony could have been deposited as well.

The preservation of carbonized plant food remains in a ritual context and associated with cremation burials is a relatively common phenomenon, although a number of processes may result in a loss of significant information. Since all of the offerings were subject to combus-

tion, the selective preservation which may occur in the majority of settlement sites for example can be ruled out. Plant remains from settlement sites are selectively preserved depending on whether they are subjected to processing, cooking or storage. They have differing probabilities of coming into contact with fire and thus being preserved. Non-selective combustion of all the remains might therefore provide a more realistic picture of the cultivated/imported and collected plants present (Rottoli, Castiglioni 2011, 500). All species, represented in the samples from *tumuli* No 4 and No 5, belong to the natural vegetation of the region or are grown locally, except for the Mediterranean stone pine which cannot thrive on the territory of Bulgaria due to unfavourable climatic conditions. In particular, the majority of the investigated cremation burials from the province of Thrace contain locally grown cereal and leguminous crops, fruits and nuts in different quantities and ratios (see I. Hristova 2015, 124 – 125). However, R. Georgieva (Георгиева 2000) notes that sacrificial plant food may also have included edible mushrooms, herbs (thyme, horsetail, etc.) and other imported plant goods such as olives, pistachios, dates and figs. The expansion of trade networks and road systems, the establishment of military installations, etc., would have meant a greater access to new food items which could then be incorporated within the local burial rites. The imported foodstuffs were probably distributed in small quantities and were considered a privilege of the individuals with higher social status (see Popova, Hristova 2017). This phenomenon has been testified in the samples from *tumulus* No 4 as well. *Pinus pinea* L. remains were found only in the charcoal assemblage of feature No 2, fully corresponding to the rich grave inventory, and suggesting a more special treatment or mortuary differentiation of the deceased. The presence of cone scales and other cone parts indicate that probably the entire cone was imported for reasons beyond food consumption (Lodwick 2015, 59 – 60).

The archaeobotanical assemblage of the sampled contexts from *tumuli* No 4 and No 5 suggests that certain plant foods (such as wheat, walnut, grapes and fleshy fruits) were traditionally placed as a sacrificial offering of the deceased. This could be dictated by various religious beliefs. For example, it is assumed that walnuts symbolize the World Tree or were probably seen as a symbol of fertility (Георгиева P. 2000, 161). In the Greek world the broad bean, or field bean (*Vicia faba* L.), was closely connected to Demeter and Kore. It was not only an important staple food, but it was also associated with the souls of deceased people (Ciarialdi 1999). In Ancient Rome, the plant was of symbolic and sacred importance. In the annual ritual of the *Fabariae Calendae* (Calends of the Beans) in the beginning of June, a sacrifice of mashed broad beans with lard was offered to Dea Carna, the Goddess of death and life (von Stokar 1951, 521). According to R. Georgieva (Георгиева P. 2000) fava beans were connected to the Orphic mystery, and their symbolic presence among the other funerary plant offerings could be related to the religious syncretism that was evident across the eastern provinces at that time, incorporating some of the Orphic rites of the Thracians. Pine kernels and grapes were associated with Dionysus and Sabazios. However, the placement of such gifts could be dictated by local taste preferences or was intended only to emphasize the prestige of the dead (Георгиева P. 2000, 161 – 162). M. Gimbutas 1989 suggests that cultivation and the cult of the dead are linked together in many ways. The dead body or the skeletal remains of the deceased are placed into the earth in one form or another in the same way grains are planted. Both enter another dimension, hidden from other spheres of existence (Gimbutas 1989, 321). The insignificant presence of grains and pulses of the principal crops does not allow any particular conclusions to be drawn with respect to possible ritual preferences.

Wood for the body

The main criteria for wood collection and use in the pyres might have been its availability in the region. The cremation of a human body is a long process that requires high temperatures, and this means that a large volume of good quality firewood would be needed in a short space of time (Herman 1990). M. Fuhrman (Fuhrman 1971) notes that in written Roman sources there is only one single record mentioning fuel wood selection in cremations. It comes from Tacitus who reports the use of *certislignis* ('certain woods') for the cremation of Germanic nobles (*Germania*, XXVII).

Three of the studied features were fairly poor in wood remains, but cremation burial No 2 contained a variety of types, dominated by *Quercus* sp. Oak forests represent the dominant vegetation type in the lowlands and foothills of Bulgaria and the use of oak wood as fuel in the cremation process is to be expected (Hristova I. 2015, 129). Unfortunately, it is hard to conclude whether the wood used at *tumuli* No 4 and No 5 was gathered according to its availability or whether it was deliberately selected. However, it is worth noting that the same wood taxa have been reported in burial contexts from other parts of the Roman Empire (e.g., Costa Vaz et al. 2020; Deforce, Haneca 2012). We may suggest that during this period both sacrificial plant food offerings and fuel wood may have had important symbolic functions in the mortuary practices in the province of Thrace.

CONCLUSION

All of the studied cremation burial pits at *tumuli* No 4 and No 5 contained pyre debris and grave inventory. The archaeobotanical assemblage consisted of cereals, bread and/or similar processed food remains, nuts and fruits. It successfully complements the data about the ritual use of plants in mortuary practices in the province of Thrace. However, future archaeobotanical analyses of the bread-like remains and wood fragments may reveal more detailed information of the taphonomic processes that occur in burial contexts.

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REFERENCES

- Александров и др. 2019а:** С. Александров, П. Влодарчак, С. Бакърджиев, Т. Вълчев. Археологически разкопки на надгробна могила № 4, могилен некропол в м. Големия кайряк, с. Могила, обл. Ямбол. – Археологически открития и разкопки през 2018 г. София, 2019, 178 – 180.
- Александров и др. 2019б:** С. Александров, П. Влодарчак, С. Бакърджиев, Т. Вълчев. Археологически разкопки на надгробна могила № 5, могилен некропол в м. Големия кайряк, с. Могила, обл. Ямбол. – Археологически открития и разкопки през 2018 г. София, 2019, 180 – 182.
- Георгиева 2000:** Р. Георгиева. Раннотракийската обредност в надгробните могили в римската епоха. – *Seminarium Thracicum* 4, 2000, 153 – 171.
- Георгиева и др. 1999:** Р. Георгиева, Т. Спиридонов, М. Рехо. Погребението (края на II – I хил. пр.Хр.). – В: Р. Георгиева, Т. Спиридонов, М. Рехо. Етнология на траките, 1999, 216 – 232.

- Гетов 1989:** Л. Гетов. Тракийски могилен некропол от римската епоха при Кабиле. – В: Кабиле, Т. 1, София, 1989, 47 – 65.
- Попова 1986:** Ц. Попова. Палеозтнотанические находки от некрополе у с. Ветрен, Силистренского округа. – Интердисциплинарни изследвания XIV/A, 1986, 237 – 257.
- Попова 2002:** Ц. Попова. Анализ на растителен материал от надгробната „Дядо Минчова“ могила край с. Житосвят, Карнобатско. – В: Д. Момчилов (ред.). История и култура на Карнобатския край 4. Варна: Зограф, 2002, 167 – 170.
- Праматаров 2018:** К. Праматаров. Извънградски некрополи в провинция Тракия (I – III в.). Автореферат, Софийски университет „Св. Климент Охридски“.
- Теодосиев, Манов 1993:** Н. Теодосиев, М. Манов. Могилно погребение при с. Драгодан, Кюстендилско. – Археология 1, 1993, 31 – 34.
- Bakels 2005:** C. Bakels. Botanischerestenuit Romeinse graven ene'e'nmiddeleeuwse of post-middeleeuwse paalkuil (Botanical remains from Roman graves and one medieval or post-medieval post-hole). – In: Ball EAG (ed.). Dood en begraven langs de Romeinse weg. Het onderzoek van een grafveld uit de Romeinse tijd bij Cuijk. – Grotestraat Bergbezink bassin (Dead and buried along the Roman road. The research of a graveyard from the Roman period at Cuijk-Grotestraat Bergbezink bassin). (Archol. rapport 40) Archeologisch Onderzoek, Leiden, 2005, 95 – 102.
- Bouby, Marival 2004:** L. Bouby, P. Marival. Fruits and seeds from Roman cremations in Limagne (Massif central) and the spatial variability of plant offerings in France. – Journal of Archaeological Science 31, 2004, 77 – 86.
- Ciaraldi 1999:** M. Ciaraldi. Food Offerings at the Archaic/Hellenistic sanctuary of Demeter and Persephone at Monte Papalucio (Oria, Apulia, Southern Italy). – Accordia Research Papers 7, 1999, 75 – 91.
- Cooremans 2008:** B. Cooremans. The Roman cemeteries of Tienen and Tongeren: results from archaeobotanical analysis of the cremation graves. – Vegetation History and Archaeobotany 17, 2008, 3 – 13.
- Costa Vaz et. al. 2020:** F. Costa Vaz, C. B. Boas Braga, J. Tereso, C. Olivera. Food for the dead, fuel for the pyre: symbolism and function of plant remains in provincial Roman cremation rituals in the necropolis of Bracara Augusta (NW Iberia). – Quaternary International. <https://doi.org/10.1016/j.quaint.2020.08.054>.
- Davis, de Moulins 2000:** A. Davis, D. de Moulins. The plant remains. – In: B. Barber, D. Bowsher (eds.). The eastern cemetery of Roman London. Excavations 1983 – 1990. (MoLAS Monograph 4). Museum of London, London, 2000, 369 – 378.
- Deforce, Haneca 2012:** K. Deforce, K. Haneca. Ashes to ashes. Fuelwood selection in Roman cremation rituals in Northern Gaul. – Journal of Archaeological Science 39, 2012, 1338 – 1348. [10.1016/j.jas.2011.12.024](https://doi.org/10.1016/j.jas.2011.12.024).
- Fuhrmann 1971:** M. Fuhrmann. *Tacitus. Germania*. Reclam, Stuttgart 1971.
- Gimbutas 1989:** M. Gimbutas. The Language of the Goddess. Thames & Hudson, London, 1989.
- Helbæk 1953:** H. Helbæk. Appendix I. – In: E. Gjerstad (ed). Early Rome I. (Acta Instituti Romani Regni Sueciae, S. 4, 17, 1). The Swedish Institute in Rome, Lund, 1953, 155 – 157.
- Helbæk 1956:** H. Helbæk. Appendix I. Vegetables in the funeral meals of preurban Rome. – In: Early Rome II, The Tombs (Acta Instituti Romani Regni Sueciae, S. 4, 17, 2). The Swedish Institute in Rome, Lund, 1956, 287 – 294.
- Helbæk 1960:** H. Helbæk. Appendix I. – In: E. Gjerstad (ed.). Early Rome III (Acta Instituti Romani Regni Sueciae, S. 4; 17, 3). The Swedish Institute in Rome, Lund.
- Hermann 1990:** B. Hermann. Hinweise auf die zur Leichenverbrennung benutzten Holzarten. – In: F. M. Andraschko, W.-R. Teegen (eds.), Gedenkschrift für Jürgen Driehaus, Mainz, 1990, 91 – 96.
- Hristova 2015:** I. Hristova. The use of plants in ritual context during Antiquity in Bulgaria: over-

view of the archaeobotanical evidence. – Bulgarian e-Journal of Archaeology/Българско е-Списание за Археология. (2), 2015, 117 – 135.

Jacomet et al. 2006: S. Jacomet, M. Petrucci-Bavaud, M. Kühn. Samen und Früchte. – In: C. Schucany (ed.). Die römische Villa von Biberist. – Spitalhof/SO (Grabungen 1982, 1983, 1986 – 1989). Untersuchungen im Wirtschaftsteil und Überlegungen zum Umland. Verlag Bernhard Albert Greiner, Remshalden, 2006, 579 – 624.

Kreuz 1995a: A. Kreuz. Funktionale und konzeptionelle archäobotanische. Daten aus römerzeitlichen Brandbestattungen. Ber Komm Archäol Landesforsch Hessen 3, 1995, 93 – 97.

Kreuz 1995b: A. Kreuz. Pflanzenreste aus römischen Brandgräbern und ihre kulturhistorische, agrar- und vegetationsgeschichtliche Bedeutung. – In: Ph. Blänske, A. Kreuz, V. Rupp (eds). Archäologische und naturwissenschaftliche Untersuchungen an zwei römischen Brandgräbern in der Wetterau. Germania 73, 1995, 111 – 123.

Kreuz 2000: A. Kreuz. Functional and conceptual archaeobotanical data from Roman cremations. – In: J. Pearce, M. Millet and M. Struck (eds.). Burial, society and context in the Roman world [Roman Burial Archaeology Conference, Durham]. Oxbow Books, Oxford, 2000, 45 – 51.

Lodwick 2015: L. Lodwick. Identifying ritual deposition of plant remains: a case study of stone pine cones in Roman Britain. – In: TRAC 2014: Proceedings of the Twenty – Fourth Annual Theoretical Roman Archaeology Conference, edited by Tom Brindle, Martyn Allen, Emma Durham and Alex Smith, Oxford: Oxbow, 2015, 54 – 69.

Lodwick et al. 2018: L. Lodwick, K. Reed, T. Leleković, H. Tulic. Exploring Roman Ritual Behaviours through Plant Remains from Pannonia Inferior. – Environmental Archaeology 24, 2018.

Matterne, Derreumaux 2008: V. Matterne, M. Derreumaux. A Franco – Italian investigation of funerary rituals in the Roman world, “Les rites et la mort à Pompéi”, the plant part: a preliminary report. Veget. Hist. Archaeobot. 17, 2008, 105 – 112.

Petrucci-Bavaud et al. 2000: M. Petrucci-Bavaud, A. Schlumbaum, S. Jacomet. Bestimmung der botanischen Makroreste. – In: D. Hintermann (ed.). Der Südfriedhof von Vindonissa. Archäologische und naturwissenschaftliche Untersuchungen im römerzeitlichen Gräberfeld Vindisch – Dägerli. Veröffentlichungen der Gesellschaft pro Vindonissa 17, 2000, 151 – 168.

Pfaffli et al. 2004: B. Pfaffli, H. Sütterlin, Ö. Akeret, S. Deschler-Erb, E. Langenegger, A. Schlumbaum. Die Gräber aus dem Areal der Sägerei Ruder – ein Ausschnitt aus dem Nordwest Gräberfeld von Augusta Raurica. Jahresberichte aus Augst Kaiseraugst, 2004.

Popova 2016: Tz. Popova. Bread remains in archaeological contexts. – In: K. Bucvarov, R. Glessner (eds.). Southeast Europe and Anatolia in Prehistory. Essays in Honor of Vassil Nikolov on his 65th Anniversary. Hebbel, Bonn, 2016, 519 – 526.

Popova, Hristova 2017: Tz. Popova, H. Hristova. Trees of eternity – *Pinus pinea* L. in daily life, rituals, religion and symbolism. Archaeobotanical evidence from the territory of Bulgaria. – Journal of Archaeological Science: Reports. 19. 10.1016/j.jasrep. 2017.06.012.

Preiss, Matterne, Latron 2005: S. Preiss, V. Matterne, F. Latron. An approach to funerary rituals in the Roman provinces: plant remains from a Gallo-Roman cemetery at Faulquemont (Moselle, France). – Vegetation History and Archaeobotany 14, 2005, 362 – 372.

Rottoli, Castiglioni 2011: M. Rottoli, M. Cottini. Plant offerings from Roman cremation in northern Italy: a review. – Vegetation History and Archaeobotany 20, 495 – 506.

Schweingruber 1978: F. Schweingruber. Wood Anatomy. Swiss Federal Institute of Forestry Research, CH – 8903, Birmensdorf, 1978.

von Stokar 1951: W. von Stokar. Die Urgeschichte des Hausbrottes. Barth, Leipzig, 1951.

Williams 2004: H. Williams. Potted histories – cremation, ceramics and social memory in early Roman Britain. – Oxford Journal of Archaeology 23 (4), 2004, 417 – 427.

Храна за душата, дърво за тялото: археоботанични изследвания на овъглени растителни останки от могили № 4 и № 5 в местността Големия кайряк при с. Могила, област Ямбол, Югоизточна България

Ханна Христова

РЕЗЮМЕ

Настоящото изследване се фокусира върху растенията и растителната храна в погребалната обредност в римската провинция Тракия, представяйки данните от първичните археоботанични анализи на растителни останки, открити в гробове с трупои́згаряне в надгробни могили № 4 и № 5 в м. Големия кайряк, Ямболско, датирани във II в. сл. Хр. Представителният им брой предоставя добра възможност за изследване на тафономичните процеси и разкрива детайли от погребалните практики в изследвания район.

През 2018 г., по време на археологическото проучване на двете могили са събрани 26 проби, в които са идентифицирани овъглени останки от 10 растителни вида. Сходствата в резултатите от отделните структури свидетелстват за поставянето на ритуална храна на кладата – хляб, зърно, плодове и ядки. Особен интерес предизвиква структура 2А, където растителните „дарове“ са най-многобройни. Сред тях са и голямо количество останки от ядки и шишарки на средиземноморски чадърест бор (*Pinus pinea* L.), смятани за луксозна вносна стока. Антракологичният анализ показва, че използваните за кладата дървесни видове са такива, които развиват висока температура при горене – бук (*Fagus sylvatica*), дъб (*Quercus sp.*) и бор (*Pinus sp.*). Изследваните археоботанични материали успешно допълват данните за местните и импортните растителни видове, както и за мястото им в погребалната обредност през II в. сл. Хр. в римската провинция Тракия.

Ключови думи: ритуална храна, археоботанични анализи, растителни останки, надгробни могили, гробове с трупои́згаряне, римска епоха, римска провинция Тракия

Advanced photographic methods in studying ship graffiti from medieval churches in Nessebar

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ABSTRACT

This article discusses the application of advanced computational photographic techniques in recording and surveying graffiti from medieval and post-medieval churches in the historical town of Nessebar on the Bulgarian Black Sea coast. Reflectance Transformation Imaging (RTI), Close-range photogrammetry, and Gigapixel panorama photography were used in a project for the documentation and research of historical graffiti in four churches in Nessebar. The project aims to create a complete record and database of these important historical monuments according to modern standards making the most of advanced technical opportunities for scientific documentation. The authors demonstrate the advantages of these techniques in the recording and the study of the graffiti in greater detail than was possible before, as well as in the assessment of their state of preservation and the opportunities for their publication and presentation at high standards. In order to evaluate the performance of the methods during the analysis process, the novel dataset of ship graffiti was compared to earlier research studies.

Keywords: ship graffiti, Reflectance Transformation Imaging (RTI), Close-range Photogrammetry, Gigapixel panorama photography, medieval churches, Nessebar

INTRODUCTION

Since 2018, a team of archaeologists from the Bulgarian Center for Underwater Archaeology (CUA), the Archaeological Museum in Nessebar, the National Archaeological Institute with Museum at the Bulgarian Academy of Sciences (NAIM – BAS) and the Balkan Heritage Foundation (BHF) have undertaken a project aimed at recording historical graffiti, mostly of ships, from four medieval and post-medieval churches in Nessebar, a UNESCO World Heritage town on the Bulgarian Black Sea coast (Fig. 1). The project has been financially and technically supported by the Ministry of Culture, the BHF, and the CUA. Its ultimate aims are:

- to create a complete record and database of these important historical monuments according to modern standards and advanced technical capabilities for scientific documentation.

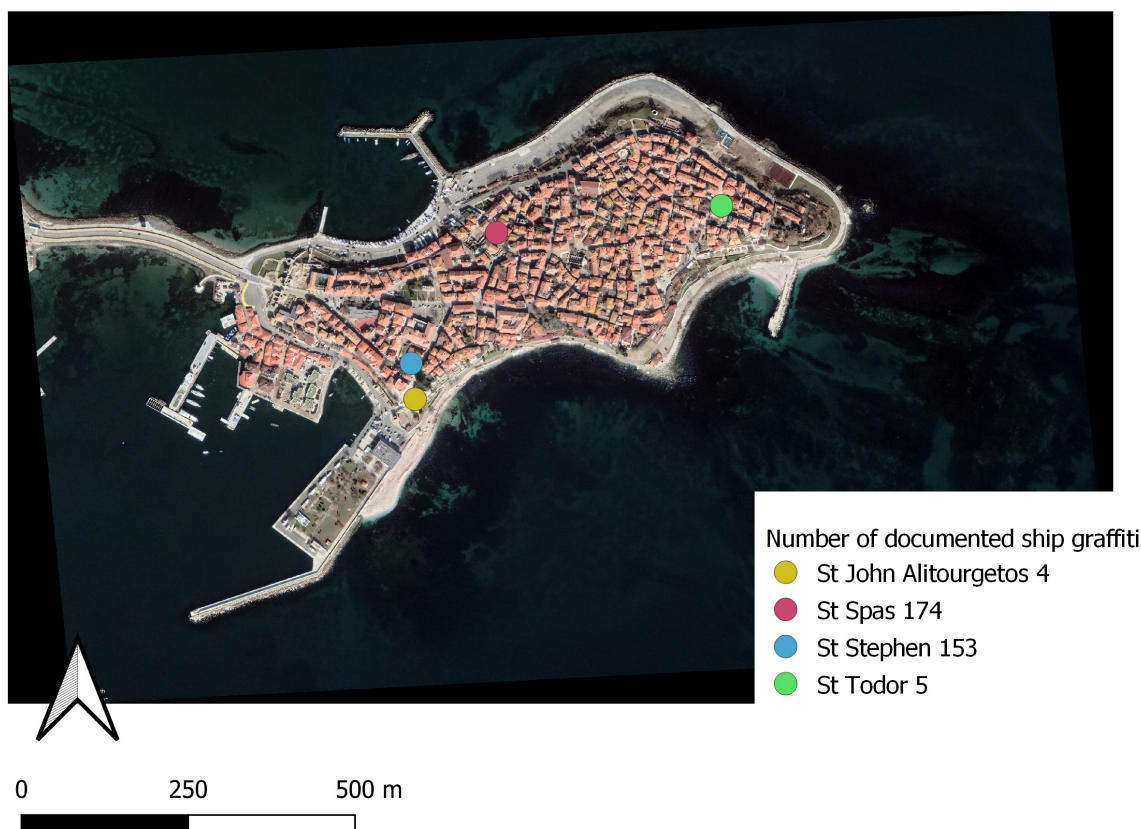


Fig. 1. The map of Nessebar showing the locations of the churches with the number of documented ship graffiti in each of them

- to assess the graffiti's state of preservation and conservation.
- to generate the graffiti's presentation and communication with the public through publications, exhibitions, and an online database, accessible free of charge.
- to offer broader and more objective perspectives in studying a relatively understudied discipline, namely seafaring and shipbuilding in the western Black Sea during the post-medieval period.

The advanced computational photographic techniques used so far are Reflectance Transformation Imaging (RTI), Photogrammetry, and Gigapixel Panorama Photography. They facilitate capturing small-scale details of the graffiti and the visualization of elements barely visible by a naked eye. In addition, the precise documentation supports the scientific analysis of the monuments and gives various opportunities for their visualization and presentation.

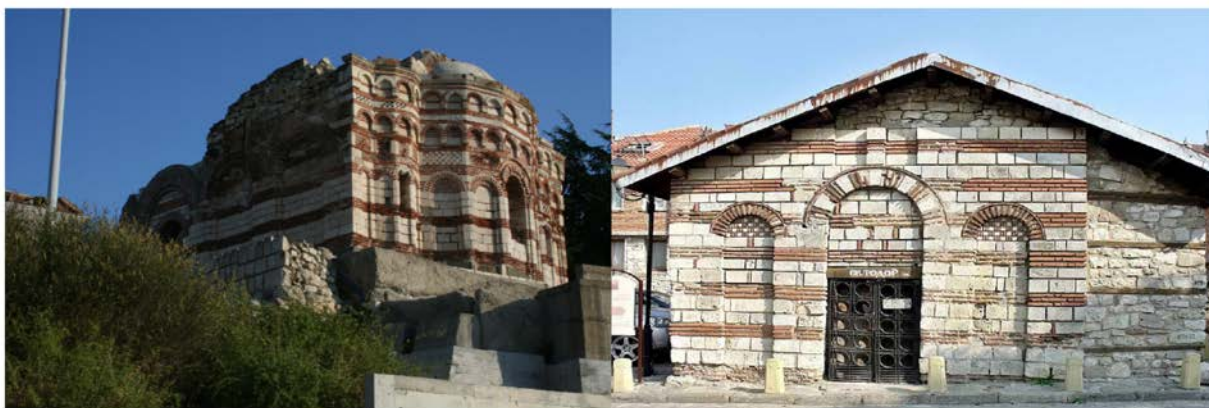
MATERIALS AND METHODS

The Graffiti in Nessebar Churches

Several hundred historical graffiti have been registered in four medieval and post-medieval churches in Nessebar. These are St. Spas (Church of the Holy Saviour/The Holy Ascension of the Lord, 17th century), St. Stephen (built in the 11th century and reconstructed in the 13th, 16th, and 18th centuries), St. Todor (built in the 13th, and reconstructed in the 18th century), and St. John Alitourgetos (13th – 14th century) (Fig. 2). The biggest group of ship graffiti numbers over 300 and it is also the most studied (Villain-Gandossi 1979; Овчаров Н. и др. 2019; Georgieva,



a) St. Stephen (11th century, reconstructed in 13th, 16th, 18th centuries) b) St. Spas (17th century)



c) St. John Alitourgetos (13th – 14th century)

d) St. Todor (13th – 14th century, reconstructed in 18th century)

Fig. 2 Nessebar medieval churches where ship graffiti were documented with advanced photographic methods in the current study

Prahov 2020). Another group represents personal names and years, but so far, these graffiti have not been studied at all. According to the depicted years, they can be dated mainly to the 19th century. There are also single graffiti of heraldic symbols on St. John Alitourgetos church, dated by early researchers to the 14th century (Овчаров Н. 1992). Several graffiti of animals (horses, birds, a goat) in St. Spas and St. Stephen churches, graffiti of buildings in St. Todor, as well as schematic anthropomorphic images in St. Stephen church could be associated chronologically with the larger group of ship graffiti. The graffiti were notched on various places on the inner and outer façades of the buildings, on murals (St. Spas and St. Stephen) or on separate stones (St. Todor, St. John Alitourgetos). Most of the ship graffiti were incised on the decorative rectangular frames (panels) of the low murals level in St. Spas and St. Stephen churches (imitation of the semi-precious stone plates decorating the luxurious late antique churches) and in the second level with floral decorative elements which are at human head height (1.6 – 2 m). This level is still quite suitable for notching the images. Most of these panels are carved with several ship images, which are sometimes organized in logical compositions. Many of the ship graffiti, and almost all graffiti of names and years, are depicted on the upper murals level with the figural images of saints and scenes from the New Testament. Many of these overlap one another, as is the case with the eastern wall of St. Stephen's narthex where several dozens of ship graffiti are densely covered with later notched names, years and still unidentified incisions. The high-

est incised graffiti are those of names and years, some of them at more than 3 meters in height, which is an obstacle for their documentation. In general, the ship graffiti are located at a height between 1 and 3 m, most of them between 1 and 1.8 meters (Fig. 3). The graffiti of names and years are located at a height between 1.5 and 4 m, with most found between 1.8 and 3 m. This shows a somewhat topological chronology of earlier – lower level, and later – higher level graffiti. An exception is a group of precisely incised ship graffiti on St. Stephen church's exterior façade that is located at 3 – 4 m height on the east-facing wall, now under the roof, which once belonged to the western wall of an upper floor that resembled a gallery (Рашенов 2006, 17). These are some of the most representative and largest depictions of this group.

So far, the research has focused only on the group of ship graffiti since they represent an important historical source of information for seafaring, shipbuilding traditions, and the worldview of the population in Nessebar and that of the Western Black Sea coast in the post-medieval period. The ship graffiti were dated by N. Ovcharov (Овчаров Н. 1992), on the basis of their typological characteristics and the information for the building, reconstruction, and wall-painting of the churches, between the 17th and 19th centuries. This was a period when the Western Black Sea coast and most of the Balkan Peninsula were part of the Ottoman Empire. Only the graffiti from St. John Alitourgetos could be dated to an earlier period (13th – 14th century).

Depiction of ship graffiti in holy places, such as churches and monasteries (buildings or rock cut temples), mosques, shrines, and sanctuaries, is a widespread phenomenon in the Mediterranean and its hinterland (Artzy 1999; Champion 2015; Demesticha et al. 2017; Meinardus 1972; Michail 2015).

In Bulgaria, late medieval or post-medieval ship graffiti are also known from inland, *e.g.* from the church of Holy Forty Martyrs in Veliko Tarnovo Dermendjiev, Koseva (Дерменджиев, Коцева 2000), the church St. George in Kyustendil (Mitov 2018), Imaret Mosque in Plovdiv M. Champion (Овчаров Н. 1987), and Aladzha rock cut monastery near Varna (Todorov 1981).

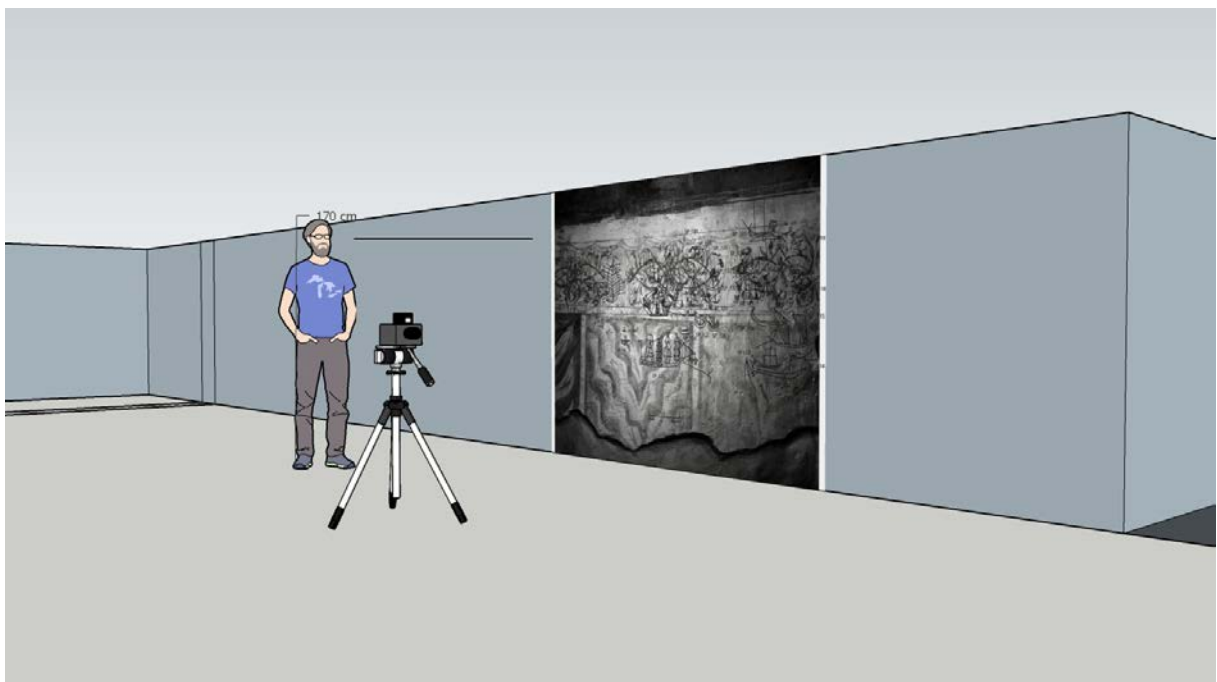


Fig. 3. The most common location of ship graffiti in the interior of the churches is at human eye level

A separate group of ship graffiti are the medieval ones discovered in the medieval Bulgarian capital cities of Pliska and Preslav, and the ones in Nikopol on the Danube which were dated to the 10th century (Ovcharov D. 1977; Овчаров Д. 1981).

The origin and reasons for incising ships in various, mostly sacred, places are still not conclusively known. The most plausible and widely accepted hypothesis considers them ‘ex-voto’ representations (Artzy 1999; Demesticha et al. 2017; Michail 2015). Champion 2015 suggests that these carvings were left by medieval religious mariners inside the holy temples, and compares this practice with the British tradition known as ‘church ships’, according to which wooden ship models were left hanging from the churches’ roofs as votive offerings for safe return from a voyage (Champion 2015, 345). Such practice was also common in other countries. In his work N. Ovcharov (Ovcharov N. 1993, 8 – 9) interprets ship graffiti as ‘snapshots or photographic pictures of the things that had excited the people’s minds, as well as representation of objects (i.e. ships) that were ‘worshipped by seamen and fishermen’ (Овчаров Н. 1992, 8 – 9).

It is not clear if the graffiti in Nessebar had been notched in the period when the churches were still functioning or after their abandonment. However, the quantity of the graffiti, seriously damaging the wall paintings, suggests the latter. The tradition of notching objects or names in churches contradicts the canons of the Church and would not have been tolerated by the clergy.

The ship depictions in Nessebar are a schematic but often accurate and correct representation of a ship’s or a boat’s hull and its rigging system. The details and the shapes of the hulls, masts, sails, riggings, anchors, their position, and other specific details show that they were notched by people whose life was closely connected with the sea, and who knew the seafarer’s craft.

The ship graffiti in Nessebar are an important source of historical and anthropological information about shipbuilding, seafaring, and the life and worldview of the marine communities along the Western Black Sea coast. They complement the relatively poor data from the written historical sources and the archaeological record for the region from the 17th – 19th century. Despite the importance of Nessebar’s graffiti as cultural heritage monuments, they have not yet been comprehensively documented and published nor studied; consequently, they have not been the subject of research. C. Villain-Gandossi (1981) analyzed and published 64 ship graffiti from St. Stephen and four from St. John Alitourgetos, along with photographs and technical drawings of some of them (Villain-Gandossi 1981, 405 – 420). N. Ovcharov (Овчаров Н. 1992) published more than 200 drawings (imprints) of single ships or compositions of several ships along with drawings (imprints) of them in his monograph dedicated to seafaring along the Western Black Sea coast from the 14th – 19th century. His fieldwork for copying the graffiti covered three of the churches. These were St. Spas, St. Stephen and St. John Alitourgetos (Овчаров Н. 1992). The graffiti in St. Todor church were only recently discovered (Georgieva et al. 2019).

Today, the technological advances in the methods for cultural heritage documentation gives wider and more objective perspectives for the presentation, communication, study, and interpretation of graffiti. Their publication and presentation according to the modern standards and technical opportunities will encourage further studies of the barely known discipline of seafaring in the western Black Sea during the post-medieval period.

Computational Photography Methods

In the field documentation of the graffiti from Nessebar several photographic methods were used. These were as follows: Reflectance Transformation Imaging (RTI), Close-range Photogrammetry, and Gigapixel panorama photography. Several software products were rou-

tinely used to process the generated images (models), including Adobe Creative Cloud package, Cloud Compare, Agisoft Metashape, RTI Builder and Viewer, ImageJ, and D-stretch plugin.

Reflectance Transformation Imaging (RTI)

Recording with RTI was the principal method applied in this project. RTI is a computational photographic method for documentation, exploration, and visualization of the surfaces of various cultural heritage monuments. The technique makes it possible to examine, document, and visualize surface details, even those invisible to the naked eye (Mudge et al. 2006; Palma et al. 2010). This method uses a series of photographs (best practice suggests approximately 60 images) of an object taken with a stationary camera and flashlight, pointed from different angles and at the same distance. Specialized software called RTI Builder combines the images through the Polynomial Texture Mapping (PTM) or Hemispherical Harmonics (HSH) fitting algorithms. The resulting output is a single RTI file that presents the detailed surface morphology of the object in an interactive manner. The model, manipulated via the RTI Viewer software, allows the object to be viewed by the researcher from a different angle of illumination, *i. e.* through shading enhancement methods and at the desired magnification. The software also offers other options for viewing and presentation, thus producing ‘increased photorealism’ of an object (Caine and Magen 2011; Malzbender et al. 2001) (Figs. 4 a, b, c, d, e, f). A processed image with a clear enough visualization of all details in the frame can then be further edited and exported for graphical illustration (Fig. 4f).

RTI is a widely available technique since the software package RTI Builder and the associated RTI Viewer are open-source developed and provided by Cultural Heritage Imaging (CHI, NG, USA) along with manuals and instructions for their use (<http://culturalheritageimaging.org/Technologies/RTI/>). The necessary equipment is a camera, lens, tripod, external flash



Fig. 4a. RTI shot of a panel from the south wall of the church St. Spas without enhancement. Here the fresco is also visible, which can sometimes confuse the researcher during analysis of small-scale details



Fig. 4b, 4c, 4d. RTI models of a panel from the south wall of the church St. Spas with the use of 'Specular enhancement' method. Some areas of the shots are quite illuminated, which could prevent the researcher from presenting evenly the small-scale details of the picture. This is the most common limitation of RTI



Fig. 4e. RTI model of a panel from the south wall of the church St. Spas with the use of 'Normals visualization' method. Here the texture of the fresco is excluded in order to facilitate analysis of the small-scale details. In order to achieve better results in this case, the high-resolution setting is very important. The method works quite well when the object's surface has high relief

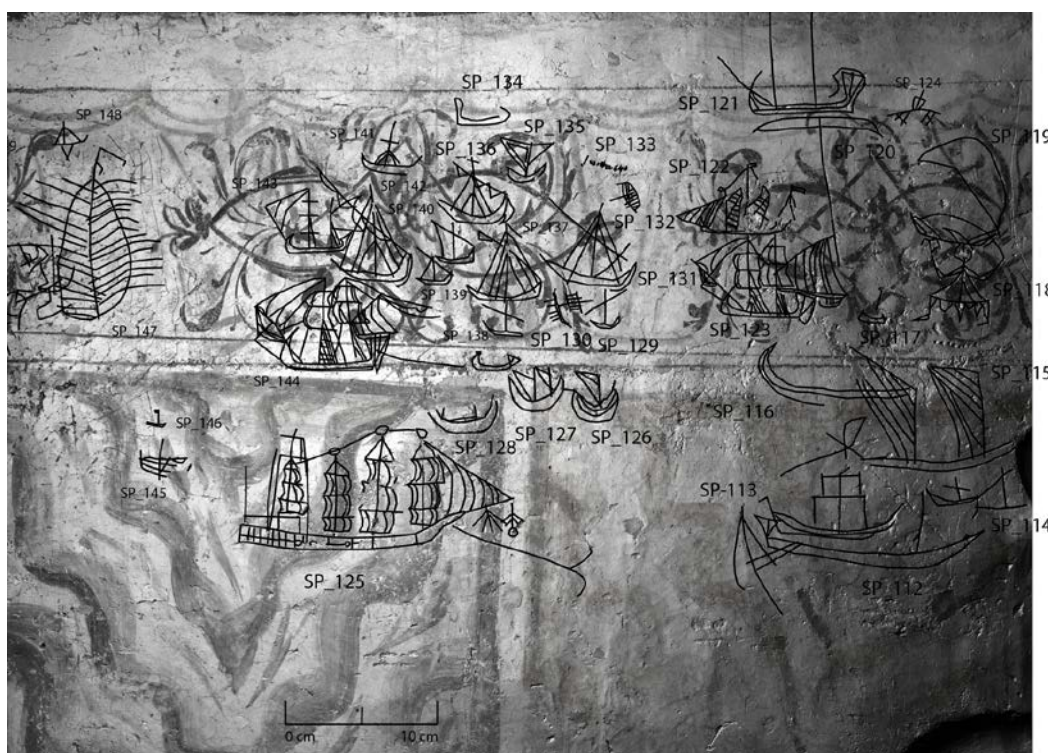


Fig. 4f. A RTI model of a panel from the south wall of the church St. Spas is used as a background in the creation of a technical drawing, thus allowing the researcher to present all details of the scene precisely and correctly

with a remote transmitter, computer, and a black sphere with a polished surface. The sphere is placed next to the artifact or monument within the image frame. The reflection of the flash on the sphere, recorded on any picture, provides RTI Builder with the necessary information about the location of the flash, which is then used in the construction of the model (Fig. 5).

Numerous RTI projects have been implemented for documentation and exploration of various monuments and artifacts in numismatics, epigraphy, rock art, fine arts, wood carving, metal, ceramics, paper art and craft, architecture and more (Caine and Magen 2011; Earl et al. 2010; Mudge et al. 2006).

In the course of graffiti RTI recording in the Nessebar's churches, the two DSLR cameras and lenses used were Nikon D750 and Nikon D500 with 60 mm and 105 mm macro NIKKOR lenses. They were mounted on a tripod and controlled by a wireless transmitter for greater stability. The cameras were synchronized with the external flashes – either “Nikon Speedlight SB-800” or “Godox”. The shooting distance varied between 1 – 2 m, thus providing sufficient detail and resolution of the images. The positioning of the camera and the composition of image frames was in accordance with the graffiti compositions on the walls (Fig. 6). The single graffiti and some more representative and important ones were recorded separately. When several graffiti were incised close to one another, the composition of the pictures aimed to include the entire group of epigraphic monuments. If this was impossible, the graffiti were combined in several groups. The biggest challenge was to compose the shooting frames on the wall areas

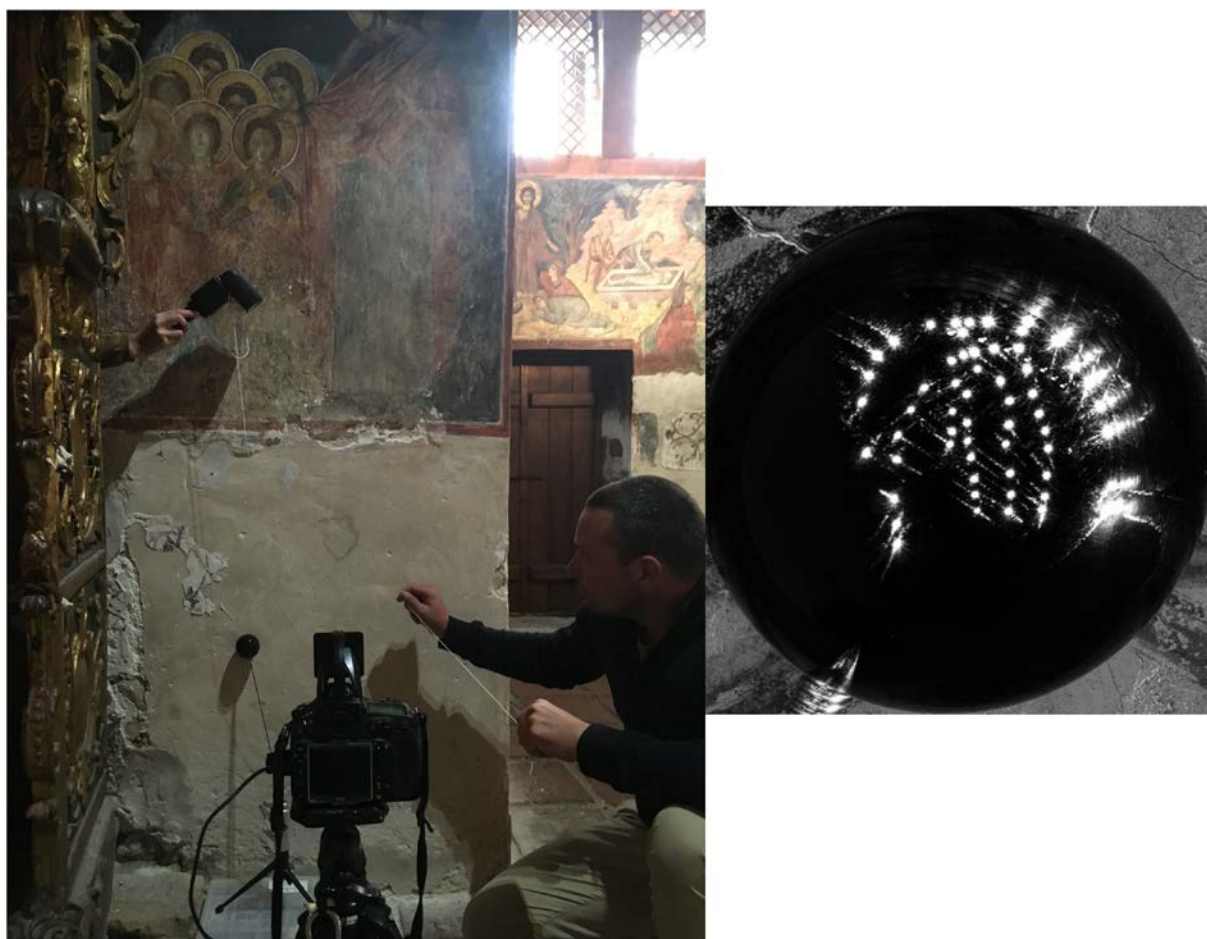


Fig. 5. Black polished sphere used in capturing a scene compiles all reflected flash lights

with high concentrations of graffiti of ships or names and years, some of them overlapping one another (e.g. the narthex of St. Stephen church with numerous graffiti of ships, names and years, and the upper wall painting register in St. Spas and St. Stephen churches with a concentration of graffiti of names and years as well as some ships). At this stage of fieldwork, priority in the documentation was given to the ship graffiti. The recording of complex scenes of several interconnected graffiti of ships, boats, ropes, and anchors depicted over larger areas on the walls presented another challenge. In these cases, we attempted to include all interrelated graffiti when possible, given the size of these complex compositions. If necessary, the camera distance was increased, but this reduced the image resolution. RTI recording of graffiti in the corners of the churches or in some niches or window holes was also quite difficult due to obstacles with the positioning of the camera and the flash at the necessary distance and with the illumination of the graffiti from each side. Another serious challenge was to record the highest graffiti on the walls. In these cases, the camera tripods were set on platforms, and the flash was fitted on a long telescopic monopod. For the documentation of the exterior ship graffiti located under the roof of St. Stephen church, a stable metal scaffolding was used (Fig. 7). When graffiti were incised too high on the church walls or in some small niches, the application of the RTI technique was unsuitable due to technical restrictions. In these cases the documentation was replicated using close-range photogrammetry.



Fig. 6. Precise framing of a panel from the south wall inside the church St. Spas. Positioning of the camera at an accurate distance of 1.50 m in accordance with the size of the scene



Fig. 7. Capturing of the highest located graffiti in the yard of church St. Stephen with the use of scaffolding

Photogrammetry

With its wide range of applications and techniques, photogrammetry has become commonplace in cultural heritage documentation over the past decade. Photogrammetry is a useful tool for the documentation of small features such as graffiti through the extraction of line drawings to scale from the 3D models. However, the dense 3D models can also be used for detailed analysis and interpretation. Like RTI, photogrammetry is a non-invasive recording method that can be executed quickly and accurately in the field, with further processing to enhance the details done off-site.

During the 2020 season of this project, close-range photogrammetry was done on one of the exterior graffiti of the church of St. Stephen and on five panels on the exterior of the church of St. John Alitourgetos. This included three on the east wall and one each on the north and west walls. The on-site photography was done using a Nikon D750 24 megapixel full-frame DSLR camera and a Nikkor 100mm FX lens. The photos were taken from a distance of about 1 m, which provided a ground sample distance of 0.05×0.05 mm. Therefore, one pixel in the image represents 0.5×0.5 mm in space. The estimated *a priori* accuracy of 0.3 mm provides the limit of detail which can be seen and detected in the models. The models were built in Agisoft Metashape (v1.5.4) and scaled using a scale card visible in the images. On average, the panels of St. John were between 30 and 50 sq cm, and the resulting point clouds had on average 5 million vertices.

Numerous post-processing methods can be used to enhance 3D models to visualize and enhance graffiti. A common method in the literature is to import the models into mesh analysis software such as MeshLab (Prada & Wordsworth 2018; Lopez et al. 2019) or 3D Studio



Fig. 8. Results of photogrammetric processing of an exterior panel on the west wall of the church of St. John Alitourgetos before and after the algorithms were applied

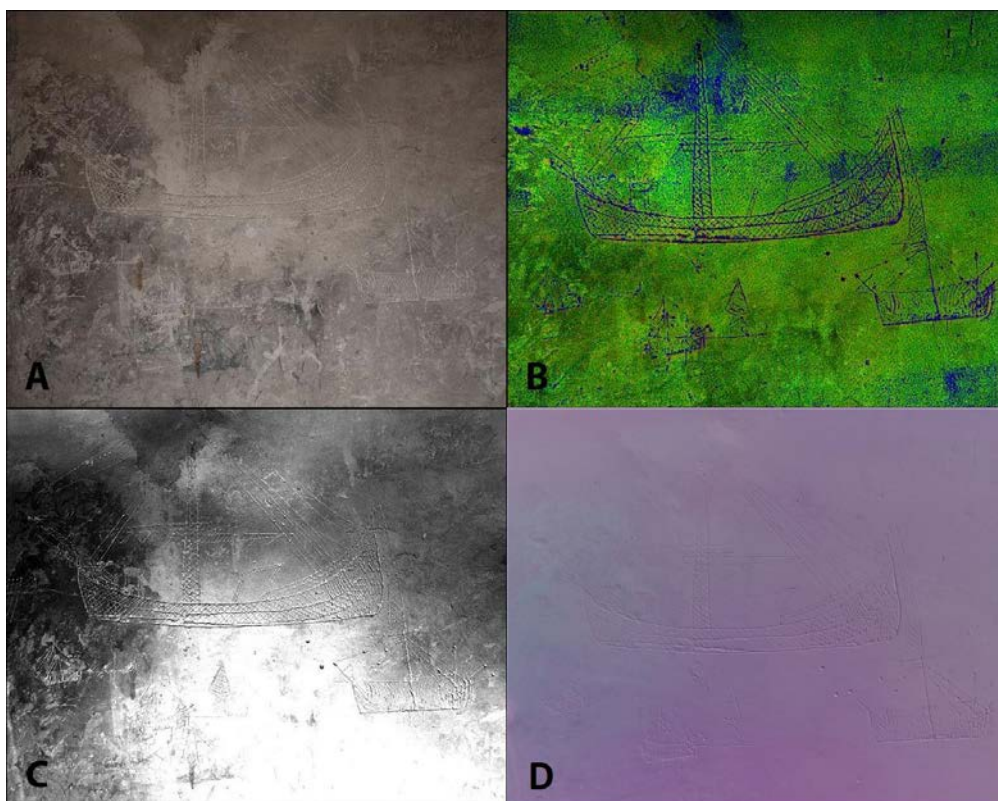


Fig. 9. Comparison of results from photogrammetry and RTI processing on an exterior panel at the church of St. Stephen: (A) RGB orthophoto; (B) photogrammetric results; (C) RTI results; (D) normal map

Max (Bertocci et al. 2018), where an artificial raking light can be introduced to the model that mimics the effect of RTI using the normal maps. Other methods include the use of computer algorithms such as the Multivariate Alteration Detection (MAD) algorithm, which is used to highlight changes in surfaces (Abate et al. 2019).

For this project, the models were exported as .obj files and then imported into Cloud Compare (v2.7.0), an open-source 3D point cloud program, for further processing. The .obj files

were opened in Cloud Compare and two algorithms were run on the point clouds. These were PCV (ambient occlusion) (Tarini et al. 2003) and Poisson Surface Reconstruction developed by Kazhdan et al. (2006). PCV uses the normals of the point cloud to compute the illumination from a theoretical sphere of light at each point of the cloud. The resulting scalar field is applied to the point cloud and can be modified to increase contrast to enhance features. Poisson Surface Reconstruction generates a triangulated mesh from a point cloud with normals. Similarly to PCV, the resulting scalar field can be adjusted to refine the visibility of features (Fig. 8). In this way, models of both methods, photogrammetry and RTI, used to document the large panel on the exterior of the Church of St. Stephen, were compared in post-processing (Fig. 9).

360-degree Photography and Gigapixel Panorama

Virtual tours and virtual reality experiences are quickly becoming a common marketing trend in heritage. An increased number of museums, galleries, and historical sites are presenting themselves to the world through these new media. The experience of being able to explore, wonder, and play in these online environments while learning, conveys innovative power and an opportunity to provide unrestricted access to these museums and sites without putting the heritage at risk. The Smithsonian Museum in the United States has a virtual tour of the past and present exhibits available on their website, and this allows the public to view these important artifacts of the past even after exhibits have ended. The British Museum offers virtual tours through Google Street View as well as having an online catalog. Archaeological and heritage sites themselves have not been left out of this movement. Some more notable examples include the virtual tour of Stonehenge by English Heritage (2017), the Acropolis virtual tour by the Acropolis Restoration Service (2014), and the virtual tours of five Egyptian sites, including tombs not open to the public by Harvard University (2020). Around the world, it is becoming a necessity to have an online presence.

A 360° virtual tour of the St. Stephen church was completed during the 2020 season to promote this important monument and create a virtual visualization that can be used by researchers and the public from all over the world. In total, nine 360° panoramas were created, each with a 500-megapixel resolution (Fig. 10). This corresponds to six panoramas in the *naos* and three panoramas in the *narthex*. The panoramas have been combined into a virtual tour



Fig. 10. 360-degree panorama of the naos in the church St. Stephen



Fig. 11. Gigapixel panorama on the narthex of St. Stephen church which serves as a map of the graffiti models

which can be accessed at: <https://360.gigascan.bg/360/360GigaScan/VRTours/StStephen.html>. The tour includes all of the panoramas taken, and when the tour is online, it can be used to promote the museum and encourage more visitors to the site itself. The next goal concerning the public communication and presentation of the graffiti is their incorporation in the virtual tours for the distance tourists and the researchers.

Moreover, such data is a digital archive, which preserves the knowledge and conditions of the site at a certain point in time, such as in the museum setting. It can also be used as a research tool by academics who are unable to access the site physically. In this way, researchers can, for example, track any regress at the site in order to make plans for conservation and reconstruction. In addition to the 360° virtual tour, a Gigapixel panorama was created of the entire eastern wall of the narthex in the church of St. Stephen, where the graffiti were documented (Fig. 11). This high-resolution image serves as a map to locate all the RTI panels. Due to its high detail, this is an excellent archival document containing information on the condition of the frescoes at this specific point in time.

Gigapixel images have a resolution equal to or greater than 1,000 megapixels. To properly stitch a panoramic image (both for 360° and gigapixel images), the camera and lens have to rotate around a no-parallax point, which corresponds to the entrance pupil of the lens. Rotation around this point eliminates the effect of parallax, which is the movement of two distant objects relative to one another when viewed from different angles. In this project, we employed two devices from Dr. Clauss Bild- und Datentechnik GmbH. These were the Rodeon piXplorer for the gigapixel panorama and the piXplorer 500 for the 360° photography. A Nikon D500 camera with a 105 mm lens was attached to the Rodeon piXplorer.

Color Decorrelation Stretching (D-Stretch plugin)

Colors are generally represented in digital imaging by a three-component vector, such as the commonly used Red, Green and Blue components of the RGB, which is the default of most digital imaging systems. Color Decorrelation Stretching is a technique for enhancing contrast in non-standard color spaces, such as XYZ and LAB. Since the 1980s, this technique has been increasingly applied to terrestrial sites and is recognized as one of the most important tools for documenting rock art (Brady, Gunn 2012, 629). With the creation of the D-Stretch plugin for ImageJ, a scientific image processing toolkit developed by the US National Institutes of Health, these complex algorithms can now be easily manipulated by non-specialist users. Color Decorrelation, and D-Stretch in particular, has yielded spectacular results in the digital reconstruction of degraded, faded, and damaged wall paintings at Angkor Wat in Cambodia (Tan et al. 2014), but it also gave great results in the survey of the frescoes in Balsha in 2015 (Bevan et al. 2015, 146).

D-Stretch takes similar colors that are perceptually hard to distinguish with a naked eye and redistributes them evenly throughout the entire color space. The algorithm performs an inverse transformation to bring these stretched colors back to the original, native RGB space, but with different hue variances (Harman 2008). This new decorrelated representation of the original colors, though does not restore the original pigments. The new image may be technicolored in quite an artificial way (Fig. 12) (Bevan et al. 2015, 146).

RESULTS

The advanced photographic techniques (mostly RTI) made it possible to capture the graffiti in Nessebar's churches in great detail and visualize subtle relief elements, some invisible to the unaided eye, to uncover previously unknown graffiti or parts of them.

Graffiti from the church St. Spas

In the nave of the church St. Spas, a total of 174 ship graffiti were recorded with RTI. After applying the technique and analysis of the images with various surface enhancement

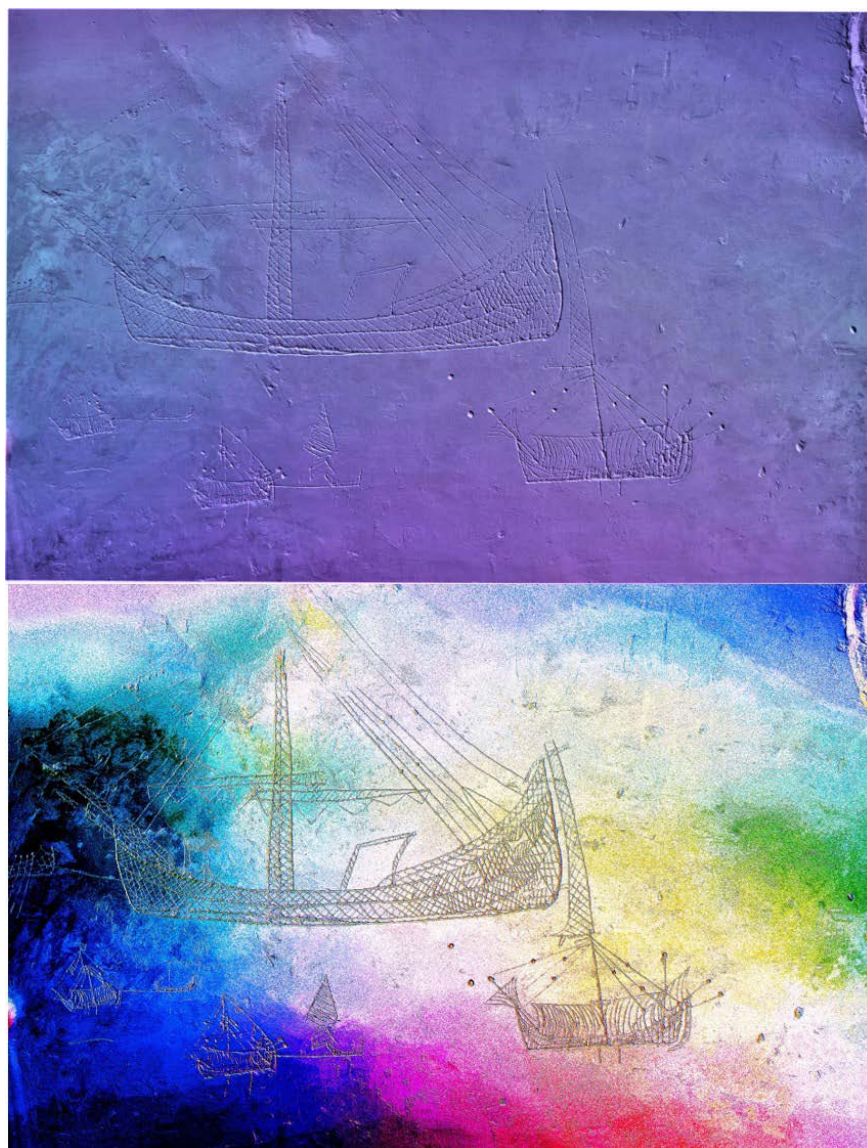


Fig. 12. Representation of a ship graffiti from St. Stephen church with Normals Visualization effect (up) and with DStretch Plugin (down)

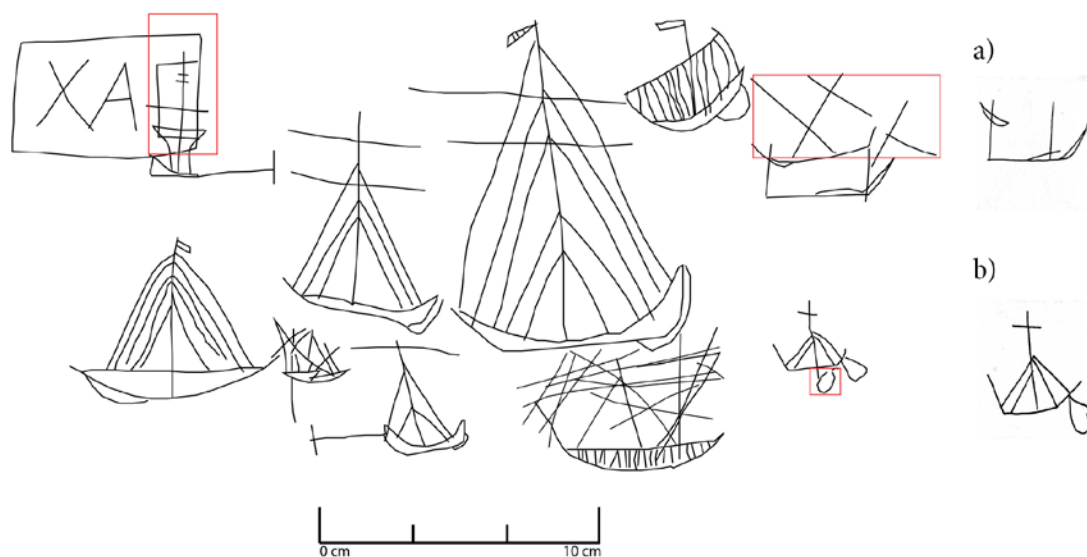


Fig. 13. New elements of some ship graffiti were found (framed in red) during comparative analysis with the technical drawings from N. Ovcharov's catalogue (1992): a) ship graffiti No 61; b) ship graffiti No 62

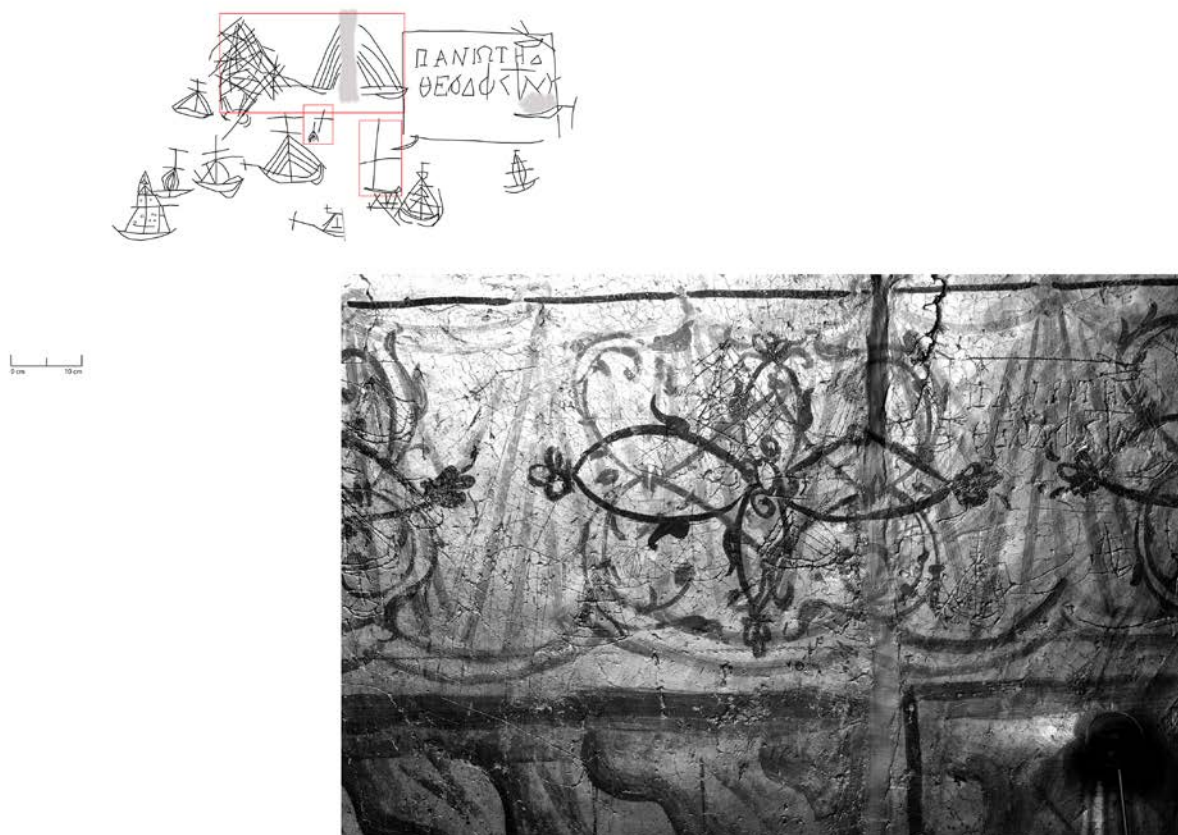


Fig. 14. Some elements of the graffiti have been erased with paint during conservation of the murals in the past. This is a sign that these monuments have been neglected at the time. Framed in red are elements registered during the current project

methods, we registered previously undocumented details of some of the graffiti (Fig. 13), as well as 35 ship graffiti that are not included in the publications from the second half of the 20th century. Several ship graffiti have been partially covered and even filled in with paint in previously undertaken conservation procedures against the constant erosion of the murals inside the church (Fig. 14). In his catalog accompanying the monograph, N. Ovcharov presented 139 ship graffiti from the church St. Spas (Овчаров Н. 1992).

During the current survey, 10 of these ship graffiti were not discovered. Five of them seem to have been presented on the sides of the south entrance but are lost today. Ship graffiti from the north wall of the nave presented in N. Ovcharov's catalog under the numbers 50, 51, 52, 89 were not discovered in the course of our work. A graffito under the number 134 in his catalog from the south wall was also not found.

Graffiti from the church St. Stephen

We recorded 153 ship graffiti overall in the church St. Stephen using RTI, 114 in the nave and altar, 24 in the narthex, and 15 on the western wall outside. Many of the graffiti are somewhat schematic representations of ships with fewer details. Some seem half-erased or incomplete. Only a few of the surviving graffiti resemble depictions of both ships and boats in detail. These are mostly the graffiti of ships on the western wall outside the church, where preservation is good. However, their future preservation may be endangered due to their constant exposure to various weather forces. The application of the RTI method in the *narthex* of the church was considered successful to a certain extent. The whole eastern wall, which today is covered with a roof, was incised with hundreds of graffiti of all types, consisting mainly of inscriptions of names and years, as well as some vessels. Most graffiti seem to have been incised very lightly on the plaster and are at present almost erased and illegible. Most graffiti at this location were covered with paint during the conservation of the wall paintings. It is not inconceivable that some graffiti were completely filled in with paint, which demonstrates that the cultural heritage value of these monuments has been neglected until now. The overlapping of numerous graffiti and the large area covered made it problematic to compose and position the frame for the RTI recording (Fig. 15). For this reason, the whole wall was recorded in 46 separate, overlapping RTI models. The compositional arrangement of the camera was aligned with the identified ship graffiti, although it is possible that we missed some parts of graffiti during the setting of the camera's position.

Graffiti from the church St. Todor

The graffiti on the outer façade of the church St. Todor were registered and documented for the first time during season 2018. In total, 20 graffiti were registered and documented. There were three from the south wall, two from the east, nine from the north, and six from the west. They are located on individual stones, and most of them are in a very poor state of preservation. The graffiti are eroded, with the main details of the drawing either barely noticeable or completely erased. Five graffiti are of ships, two of buildings, and the rest are years and Greek letters. Three of the ship graffiti (two from the south and one from the east walls) are turned upside down, suggesting they are not in their original position (Fig. 16). This assumption is supported by the fact that the southern and eastern walls were rebuilt in the 18th – 19th centuries, probably reusing the stones with graffiti originating elsewhere.

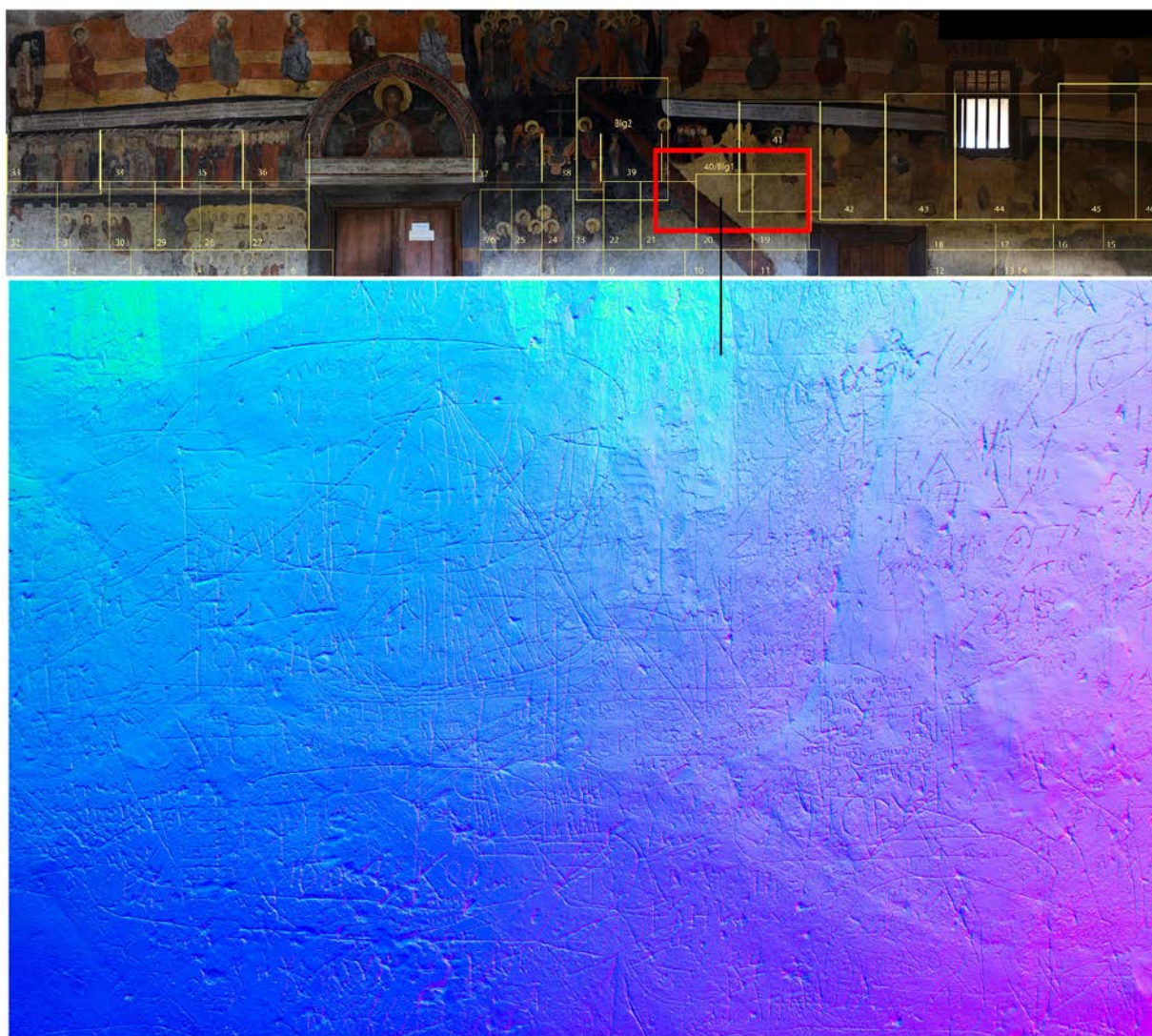


Fig. 15. The overlapping of graffiti on large areas on the church of St. Stephen's narthex is an overwhelming challenge for framing

Graffiti from the church St. John Alitourgetos

Four graffiti of ships, six different inscriptions, and one heraldic symbol in total were documented with photogrammetry on the façades of church St. John Alitourgetos. The graffiti are under the same environmental risks as those on St. Stephen exterior walls, and deterioration of the incisions is already visible as a result of stone erosion processes. The high-resolution photogrammetric models of the most eroded graffiti (a ship graffiti from the east wall and inscriptions from the west wall) show that even the most advanced methods are incapable of recovering details that have been irreversibly lost over the centuries.

DISCUSSION

The application of the computational photographic techniques allowed the research team to document the ship graffiti according to the modern technical capabilities and standards for cultural heritage documentation work, as well as to uncover new, previously undocumented graffiti or part of them.



Fig. 16. Standard photographic shots of graffiti on St. Todor church which show that three of the ship graffiti are positioned upside-down

The current results demonstrate that RTI is a method that can be used for both analysis of small-scale details and the dissemination of high resolution photographs for academia and the public. The availability of such materials allows their further analysis and enhances their use by scholars. Compared with the photogrammetric method, we consider RTI enhancement tools more suitable for analyzing the ship graffiti's complexity, as they contain multiple shading positions. This is a necessity for the visualization of details from any angle. In this respect, it is a unique two-dimensional method that has many characteristics of a three-dimensional one. However, an uneven distribution of light, causing shadowing of some details across an image, can be considered a limitation, especially when the image is intended for wide dissemination.

This limitation could be minimized with the use of some graphical enhancement tools as well as with the *Normals Visualisation* algorithm. Nevertheless, while RTI can provide more information than the photogrammetric workflow for detecting small incisions in the stone, the photogrammetry is more compact, as well as being time and cost-efficient. We propose that the photogrammetric workflow can be used to highlight areas of interest that require further investigation, specifically when RTI is unsuitable for use, such as in areas where accessibility is a constraint.

CONCLUSION

Between 2018 and 2020, most of the historical graffiti in Nessebar were documented and a digital archive of these monuments was submitted to the National Institute for Immovable Cultural Heritage, "Ancient Nessebar" Museum, the Centre for Underwater Archaeology at the Bulgarian Ministry of Culture and to the National Archeological Institute with Museum at the Bulgarian Academy of Sciences. The availability of the archive will also allow graffiti's further analyses and use by scholars.

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REFERENCES

Георгиева и др. 2019: З. Георгиева, Н. Прахов, К. Димитров. Недеструктивно проучване и документиране на графити от средновековните църкви „Св. Спас“ и „Св. Тодор“ в Несебър. – Археологически открития и разкопки през 2018 г. София, 2019, 682 – 685.

Георгиева, Прахов 2020: З. Георгиева, Н. Прахов. Недеструктивно проучване и документиране на графити от средновековна църква „Св. Стефан“ (Новата митрополия) в Несебър. – Археологически открития и разкопки през 2019 г. Книга I. София, 2020, 140 – 144.

Дерменджиев, Косева 2000: Е. Дерменджиев, Д. Косева. Графитни рисунки върху стенописния календар от притвора на търновската църква „Св. 40 мъченици“. – *Palaeobulgarica*/Старобългаристика 24, 4, 2000, 84 – 96.

Овчаров 1981: Д. Овчаров. Раннесредновековные изображения кораблей (граффиты) из гг. Плиска и Преслав. – *Byzantinobulgarica* VII, Nessebre, 1981, 399 – 404.

Овчаров 1987: Н. Овчаров. Рисунките-графити от „Имарет Джамия“ в Пловдив като извор за историята на Средиземноморието през XV век. – Разкопки и проучвания 18, София, 1987.

Овчаров 1992: Н. Овчаров. Корабоплаването по българското Черноморско крайбрежие от

XIV – XIX век (по данни от рисунките-графити в църквите на Несебър). София, 1992.

Рашенов 2006: А. Рашенов. Месемврийски църкви. 2006 (Фототипно издание, 1932), Музей „Старинен Несебър“.

Abate, Trentin 2019: D. Abate, M. Trentin. Hidden Graffiti Identification on Marble Surfaces Through Photogrammetry and Remote Sensing Techniques. – International Archives of the Photogrammetry, Remote Sensing & Spatial Information Sciences XLII-2/W15, 1 – 8, <https://doi.org/10.5194/isprs-archives-XLII-2-W15-1>, 2019.

Artzy 1999: M. Artzy. Carved Ship Graffiti – an Ancient Ritual? – In: H. Tzalas (ed.). Proceedings of the 5th International Symposium on Ship Construction in Antiquity 5, Nauplia, 1999, 21 – 30.

Bertocci et al. 2018: S. Bertocci, G. Verdiani, M. Sevketoğlu. Graffiti photogrammetry, extracting the signs from the walls of the Kyrenia Castle. – In: Proceedings of the 23rd International Conference on Cultural Heritage and New Technologies, Vienna. CHNT 23, 2018, 2019.

Bevan et al. 2015: G. Bevan, M. Raykovska, I. Vasilev. Integration of different computational photographic modalities in high-accuracy 3D building models: the case of the church of St. Petka, Bulgaria. – In: ВИРТУАЛНА АРХЕОЛОГИЯ (ефективност на методите), 2015, 139 – 157.

Brady, Gunn 2012: L. Brady, R. Gunn. Digital enhancement of deteriorated and superimposed pigment art: methods and case studies. – In: J. McDonald, P. Veth (eds.). A Companion to Rock Art, 2012, Chichester: John Wiley & Sons, 625 – 643.

Caine, Magen 2011: M. Caine, M. Magen. Pixels and Parchment: – The Application of RTI and Infrared Imaging to the Dead Sea Scrolls. EVA London, 2011.

Champion 2015: M. Champion. Medieval Ship Graffiti in English Churches: Interpretation and function. – The Mariner's Mirror 101 (3), 2015, 343 – 350.

Demesticha et al. 2017: S. Demesticha, K. Delouca, M. Trentin, N. Bakirtzis, A. Neophytou. Seamen on Land? A Preliminary Analysis of Medieval Ship Graffiti on Cyprus. – International Journal of Nautical Archaeology 46(2), 2017, 346 – 381.

Earl et al. 2010: G. Earl, G. Beale, K. Martinez, H. Pagi and others. Polynomial texture mapping and related imaging technologies for the recording, analysis and presentation of archaeological materials. International Archives of Photogrammetry, Remote Sensing and Spatial Information Sciences 38, 2010.

Harman 2008: J. Harman. Using Decorrelation Stretch to Enhance Rock Art Images. 2008. Available: <http://www.dstretch.com/AlgorithmDescription.html>. Accessed 28 January 2021.

Kazhdan et al. 2006: M. Kazhdan, M. Bolitho, H. Hoppe, H. Poisson surface reconstruction. – In: Proceedings of the fourth Eurographics symposium on Geometry processing, 7, 2006.

Lopez et al. 2019: J. López, C. Hoyer, A. Rebentisch, A. Roesch, K. Herkert, N. Huber, H. Floss. Tool mark analyses for the identification of palaeolithic art and modern graffiti. The case of Grottes d'Agneux in Rully (Saône-et-Loire, France). Digital Applications in Archaeology and Cultural Heritage, 2019.

Malzbender et al. 2001: T. Malzbender, D. Gelb, H. Wolters. Polynomial texture maps. Proceedings of the 28th annual conference on Computer graphics and interactive techniques. New York, USA: Association for Computing Machinery, 2001, 519 – 528.

Meinardus 1972: O. F. A. Meinardus. Medieval Navigation according to Akidographemata in Byzantine Churches and Monasteries. – Δελτίον Χριστιανικής Αρχαιολογικής Εταιρείας, 6 (1970 – 1972), 1972, 29 – 52.

Michail 2015: M. Michail. Ship graffiti in context: a preliminary study of Cypriot patterns. paper presented at the Cypriot cultural details. – Proceedings of the 10th Post Graduate Cypriot Archaeology Conference, Oxford, Philadelphia, Oxbow Books, 2015, 41 – 64.

Mitov 2018: Y. Mitov. Pictorial graffiti – a source about the medieval culture. An example from the church St. George in Kyustendil. – In: The Bulgarian Kingdom. Collection commemorating the 60th anniversary of Assoc. Prof. Georgi N. Nikolov. Responsible ed. Assoc. Prof. Angel Nikolov. Sofia, Uni-

versity Publishing House “St. Kliment Ohridski”, 2018, 845.

Mudge et al. 2006: M. Mudge, T. Malzbender, C. Schroer, M. Lum. New Reflection Transformation Imaging Methods for Rock Art and Multiple-Viewpoint Display. VAST. Citeseer, 2006, 195 – 202.

Ovcharov 1977: D. Ovcharov. Ship graffiti from medieval Bulgaria. – International Journal of Nautical Archaeology 6 (1), 1977, 59 – 61.

Ovcharov 1993: N. Ovcharov. Ships and Shipping in the Black Sea, 14th – 19th centuries. Sofia, 1993, St. Kliment Ohridski University Press. [English translation]

Palma et al. 2010: G. Palma, M. Corsini, P. Cignoni, R. Scopigno, M. Mudge. Dynamic shading enhancement for reflectance transformation imaging. – Journal on Computing and Cultural Heritage 3 (2), 2010, 1 – 20.

Prada, Wordsworth 2018: L. Prada, P. D. Wordsworth. Evolving Epigraphic Standards in the Field: Documenting Late Period and Graeco-Roman Egyptian Graffiti through Photogrammetry at Elkab. – In: The Materiality of Texts from Ancient Egypt, 2018, 76 – 93.

Tan et al. 2014: N. H. Tan, I. Sokrithy, H. Than, K. Chan. The hidden paintings of Angkor Wat, – Antiquity 88 (340), 2014, 549 – 565.

Tarini et al. 2003: M. Tarini, P. Cignoni, R. Scopigno. Visibility based methods and assessment for detail-recovery. – In: IEEE Visualization, 2003. VIS 2003, 457 – 464. IEEE.

Todorov 1981: I. Todorov. Bulgarian ships. Sofia, 1981, State publisher “Technique”.

Villain-Gandossi 1981: C. Villain-Gandossi. Graffiti de bateaux a Nessebar. – Byzantinobulgarica VII, Nessebre, 1981, 405 – 420.

Модерни фотографски методи за изучаване на графитни изображения на кораби от средновековни църкви в Несебър

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РЕЗЮМЕ

Статията е посветена на прилагането на модерни фотографски техники при документиране на графити от средновековни църкви в град Несебър. Рефлексно-преобразователна фотография, фотограмметрия и гигапикселова панорамна фотография бяха използвани при документиране на графитни изображения на кораби в църквите „Св. Спас“, „Св. Стефан“, „Св. Йоан Алитургетос“ и „Св. Тодор“. Целта на проекта е за тези важни исторически паметници да се създаде архив и цялостна база данни, отговарящи на съвременните стандарти и технически възможности за научна документация. Авторите демонстрират предимствата на тези техники при подробното проучване на графитите, при оценката на тяхното физическо състояние и възможностите за публикуването и представянето им според съвременните стандарти. За да се оцени ефективността на модерните методи, беше направен сравнителен анализ с графити на кораби, документиран при изследвания от XX век.

Ключови думи: графитни изображения на кораби; Reflectance Transformation Imaging (RTI); Close-range Photogrammetry; Gigapixel panorama photography; средновековни църкви; Несебър

New archaeobotanical evidence about *Olea europaea subsp. europaea* from the territory of Bulgaria

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ABSTRACT

This paper presents new data on the appearance of the olive in the territory of Bulgaria, based on archaeobotanical studies. To date, evidence for the presence of olive findings is still limited and unpublished.

This paper will focus on results of olive remains found in 9 archaeological sites in the territory of Bulgaria. The results from the archaeobotanical analysis show that these findings belong to the cultivated form *Olea europaea subsp. europaea*. The earliest remains from the territory of Bulgaria date back between the 5th and 3rd century BCE. During this period olives were not only consumed, but were also transformed into olive oil and other derivative products and this was traded. So far, the presence of olives in the territory of Bulgaria has been very poorly recorded. The material resulting from the ritual hearths in the cemetery at Sozopol (Apollonia Pontica) provides important information about some of the practices of funerary rites associated with the use of plants. In the light of this paucity, the archaeobotanical evidence from these 9 archaeological sites is of particular interest. It is obvious that in the 3rd century BCE olives were imported together with other species such as stone pine nuts, figs, etc. Its presence shows contacts with the Mediterranean region. The information obtained sheds light on the significance of *Olea europaea subsp. europaea*, not only as a nutritional resource, but also as an important component in ritual practices.

Keywords: olive, archaeobotanical evidence, ritual practices, Bulgaria

INTRODUCTION

Olive cultivation and olive oil production were inseparably linked to the Mediterranean region and its cuisine. The olive tree is one of the oldest species that produced fruit in the Old World together with grape vine, fig and date palm (Zohary, Spiegel-Roy 1975). According to Franke and Hammer (1979), the deliberate cultivation of fruit trees began in the Middle East by 4000 BCE. The main species from the initial wave of fruit domestication were olive, grape, fig and date. During the Bronze Age, olives, grapes and figs, together with cereals and pulses emerged as the main triad of products in the Mediterranean, including the Aegean (Zohary, Hopf 2000). Y. Melamed, M. Kislev and E. Weiss report some of the earliest finds of date olive stones date back to ca. 780 000 years BP from Acheulian Gesher Benot Ya'akov, Hula Valley (Melamed et al. 2013) and ca. 23,000 BP Epipalaeolithic Ohalo II, Sea of Galilee, Israel (Kislev et al. 2002; Weiss 2009). The finds belong to the Neolithic and Chalcolithic have been found in sites on the territory of the Levant. D. Zohary, P. Spiegel-Roy and R. Neef found that the earliest appearance of olive horticulture outside the natural area of distribution is from the Late

Chalcolithic Tuleilat Ghassul (ca. 6800 – 5800 cal. BP), north of the Dead Sea, Jordan (Zohary, Spiegel-Roy 1975; Neef 1990).

Data for the production of olive oil in some settlements from Chalcolithic sites are also reported in the publications of Gophna & Kislev (1979); Weiss (2015), Tell Saf (Gophna & Kislev 1979), Tell Shuna North, and Tell Abu Hamid (Neef 1990). E. Weiss (Weiss 2015), provides detailed information on the distribution of olive finds, as well as the latest genetic research on the origin of olives, citing Besnard et al. (2013). According to them, the current olives originate from three main Quaternary lines: the Middle East (including Cyprus), the Aegean and the Strait of Gibraltar. The initial domestication was in the northern Levant, followed by a spread across the Mediterranean basin to its western parts. The genetic stock of the domesticated olive became enriched along the way by repeated hybridization with local wild *oleaster* populations. The evidence from living plants therefore shows that the domesticated olive originated from the Mediterranean *oleaster* wild forms (Besnard et al. 2013 cited in Weiss 2015).

Recent studies based on morphometric parameters of olive endocarps are related to the studies in Teral's research (Teral, Alonso, Buxo et al. 2014). Based on morphometric studies, it has been shown that morphological changes in the endocarps of olives during domestication, both geographically and chronologically, offer new criteria for identifying olive varieties. Comparative analyses show that cultivated and wild forms can be distinguished from cultivated forms by shape analysis, but not by size. Comparative data has been obtained from archeological samples, modern varieties, as well as from both early and autochthonous domestication of olives in the northwestern Mediterranean area. This has proved that the cultivated forms appeared in the regions during the Chalcolithic/Bronze Age and this is confirmed by agricultural and selective practices from that time (Teral, Alonso, Buxo et al. 2014).

Based on pollen data Langgut, Chedadi, Carrión et al. (2019) proves that the earliest olive cultivation originated in the southern Levant – about 6500 BCE. In the early and mid-6000 BP. olive was cultivated in the Aegean. According to them, from these two areas olives migrate and spread in the Mediterranean and about 3200 BP. It was cultivated in Anatolia, Italy – 3400 BCE. and on the Iberian Peninsula in the middle / end of the 3rd millennium (Langgut, Chedadi, Carrión et al. 2019).

Olive remains have been discovered in numerous sites in the Mediterranean basin. The earliest archaeobotanical evidence of olive, probably wild, was discovered in Israel and is dated to 8150 to 7850 cal. BCE (Kislev, Nadel, Carmi 1992; Kislev, Harlan 2012). According to Runnels and Hansen the domestication of the olive tree in Greece can be dated back to 2000 BCE (Runnels, Hansen 1986). However, they are not certain about the extensive production of olive oil during this period. Y. Hamilakis considers that there is no substantial evidence to support the hypothesis of systemic cultivation prior to the Minoan period (Hamilakis 1996). There is also a lack of archaeobotanical evidence. This is related to the problems in distinguishing the form and size of wild and cultivated species. E. Margaritis reports a detailed report by Y. Hamilakis on all archaeobotanical olive remains from southern Greece, and in particular from Crete (Margaritis 2005; Hamilakis 1996). Other authors (Valamoti et al. 2018; Margaritis, Jones 2008) provide detailed information on a number of sites on the territory of Greece.

In contrast to Greece and other Mediterranean countries, data on olives stones in the territory of Bulgaria are extremely scarce. This may be explained by the specific geographical conditions which mean that the olive does not grow in the territory of Bulgaria. One of the ways for olives to reach Bulgarian territory was through trade relations with other neighbor-



Fig. 1. Map of Bulgaria showing the location of the archeological sites with olive stones: 1 – Kalfata, 2 – Messarite, 3 – Lidl Supermarket site, Sozopol, 4 – Water cycle, Sozopol, 5 – Markeli fortress, 6 – Yatrus fortress, 7 – Kabyle, 8 – Orlovo, 9 – Kapitan Andreevo

ing countries and in this aspect the work is important and provides the earliest data on olives in the region.

GEOGRAPHICAL AND ARCHAEOLOGICAL SETTING

The archaeobotanical finds of olives cover different regions of the territory of Bulgaria (Fig. 1). The olive findings have been found in 9 archeological sites on the territory of the country. Four of them cover the area around the town of Sozopol: Apollonia-Kalfata cemetery, Messarite – 4, Water cycle and Lidl Supermarket. The other five are found in Markeli, Yatrus, Kabyle, Kapitan Andreevo and Orlovo.

The olive remains found at the *tumulus* in Kabyle – *tumulus* No 3 are from ritual funeral. The remains from Kapitan Andreevo site and Orlovo were found in ritual pits. The finds from the fortresses of Markeli and Yatrus do not have reliable contexts.

All archaeobotanical samples from the area of Sozopol come from ritual hearths. The chronological scope of the studied sites from the region of Sozopol generally covers the period of functioning of the cemetery – from the middle of the 5th to the middle of the 3rd century BCE.

Some of them are concentrated on the territory of the ancient cemetery of Apollonia Pontica – one of the most important Greek colonies on the Western Black Sea coast. It is one of the greatest and oldest, but also among the best studied sites, located along the Pontic coast.

Apollonia Pontica occupies a narrow rocky peninsula a little less than 1 km long with a maximum width of 200 m. The peninsula now goes by its Greek name, Skamni. There are three offshore islands, Sveti Kirik, which is the nearest; Sveti Ivan and Sveti Petar, which is further north (Baralis et al. 2016).

The earliest population data about the appearance of inhabitants in the area of Sozopol (Apollonia Pontica) are for about 4000 BCE. A prehistoric settlement already existed at the end of the 5th millennium BCE. The archaeological excavation in the hills around Sozopol shows that in the middle of the 2nd millennium BCE the territory of the contemporary town was inhabited by people with a typical Thracian culture, in this case known as Skirnyanin.

Ancient authors wrote that in the 11th century BCE a group of settlers, originating from the Asia Minor polis of Miletus and from the city of Phokaea, founded on the land of the Sozopol peninsula, a new polis called by them Apollonia. It was named after the God Apollo who was worshiped there as curer. By the 5th century BCE the territory of Apollonia Pontica expanded from the cape of Atiya alongside Meden Rid hills as far as the cape named Maslen Noss and alongside the Bourgas sea coast as far as the present-day town of Pomorie, where a new settlement, called Anhialo, was founded (Димитров 2004).

Some of the archaeological materials considered in this work come from the cemetery located outside the town, to the south of Sozopol. According to K. Panayotova the excavation leader, the cemetery can be dated between the 4th and the 2nd century BCE and functioned for about 300 – 350 years (Панайотова 2003).

The analysed archaeobotanical materials were collected during the excavation of several archaeological sites located in the area of Sozopol.

Kalfata

It is an ancient cemetery located a short distance away from the Black Sea coast, not far from the modern town of Sozopol. The cemetery existed for about 300 – 350 years and can be dated to the between the 4th and the 2nd century BCE. In most cases, cremation was performed. Grave goods included ceramic bowls, *lekythoi*, jugs, mirrors, earrings, etc. Animal bones and plant remains were often found in the pits (Hermany 2010).

Messarite 4 – a rural complex of Apollonia Pontica's *chora*

The site is located on a terraced area, on the upper slope, on the western face of the mountain range (base level, alt. 67.03 m) that overlooks the Sveta Marina waterway. During the five campaigns, carried out in the period between 2011 and 2015, the presence of an impressive rural complex was revealed (Baralis et al. 2016). The northern building was founded in the second quarter of the 5th century BCE. This building is the oldest rural towered edifice known to this day in the Black Sea area, where this architectural style became predominant during the 3rd century BCE. Pottery finds include several amphorae fragments from the first half of the 5th century (Lesbos, Chios, proto-Thasian series of Zeest type) (Baralis et al. 2016). The inventory of the newly discovered burials in Messarite 4 consists of unguentaria (five), a net-pattern lekythos, an iron strigil, a knife, a finger ring and bronze coins of Apollonia Pontica (Панайотова и др. 2017).

Lidl Supermarket site, Sozopol

The site is located at the intersection of the ring road of Sozopol, north of the modern cemetery of the town, about 350 m from the actual Black Sea coast. During the rescue excava-

tions, carried out due to the construction of a Lidl store, a Roman burial site was discovered (3rd century BCE). The tomb was used during the early Hellenistic and the early Roman periods (Богданова и др.).

Kapitan Andreevo pit sanctuary

The site is located in the Upper Thracian Plain, located on one of the terraces of the Maritza River (Fig. 1). Structures belonging to a pit sanctuary were identified. The site of Kapitan Andreevo covers several chronological periods including Early Bronze Age, Early Iron Age, Hellenistic period and Early Middle Ages. A total of 130 pits was recorded. These structures are relatively small, predominantly in the shape of a truncated cone. Typical ceramic forms include jars, cups, pots and small storage vessels. 4th to 5th century pottery shows early wheel-turned forms (Попов и др. 2017).

The Yatrus fortress

The Yatrus fortress is located in the lower part of the Yantra River, near the village of Krivina (Fig. 1). The fortress was built in the 4th century BCE and became an important Roman military centre on the Lower Danube limes. During the 7th century, the Avars destroyed the fortress. Later (8th century CE) a Bulgarian settlement with a defensive stone wall and towers emerged. As a result of the archaeological excavations, the eastern gate, several public buildings and two Christian basilica were discovered, as well as several building levels from Late Antiquity, for example B/2 (between the second half of the 4th century and the first half of the 5th century). At the end of this period, all buildings on the territory of the fort were completely destroyed and by 600 CE, the castle was also finally destroyed (www.museumruse.com/ruseznanie/yatrus.html).

Markeli fortress

Markeli fortress is located at the western end of the Hissar Hills, about 8 km from the town of Karnobat (Fig. 1). The fortress was built in Late Antiquity when it was surrounded by a fortress wall. Later in the Middle Ages defensive ramparts were built. The choice of the site of Markeli fortress is of great strategic importance.

The first fortress was built in Late Antiquity (4th – 6th century CE), as part of the fortification system of the Eastern Roman (Byzantine) Empire. The ceramics discovered during the archaeological excavations confirm its existence as early as the Late Iron Age (1st millennium BCE). In the Middle Ages, Markeli fortress played an important role in the political life of the Balkans (Момчилов 2009).

Kabyle

It is a village in south-eastern Bulgaria, located at the foothills of Zaichi Vrah, near the Tundzha River (Fig. 1). It is an ancient Thracian city, founded around the 4th century BCE. Mogila No. 3 is a part of the western cemetery in the Ivan Jordanova mogila locality in the vicinity of Kabyle. The burial mound is 18 m in diameter and is 1 m high. At a depth of 1 – 1.40 m, five non-inventoried secondary burials were discovered. In the Southeast sector, a secondary burial was found with an on-site cremation in a large pit (Велков и др. 1990).

Orlovo

The village of Orlovo is located 12 km to the southeast of Haskovo (Fig. 1). The archaeological site is a complex of negative structures interpreted as one of the so-called 'pit fields.' The structures have different shapes, depths and fill sequences. They belong to the Late Neolithic,

Early and Late Chalcolithic, Middle Bronze Age, Early and Late Iron Age, and probably had a variety of functions (utilitarian, ritual, economic, etc.) (Лещаков, Тодорова, Тонков 2019).

MATERIALS AND METHODS

The archaeobotanical samples were recovered from different archaeological contexts including ritual hearths, pits and burial contexts. Archaeobotanical remains were collected by flotation. A part of the material was collected manually. The identification of the plant remains, seeds and grains, was carried out using Novex a binocular microscope. For the identification of the grains and seeds we used the reference collection kept at the Department of Interdisciplinary

Research and Archaeological Map of Bulgaria at NAIM – BAS and atlases (Cappers, Neel & Bekker 2009; Vilarias 1992). The charred wood was defined by a microscope with reflected light. The use of such a microscope allows the structure of the charred wood to be directly observed. Three anatomical schemes were studied. These were transversal, longitudinal-tangential and longitudinal radial. For definition of the wood, specialized atlases and referent collections were consulted (Schweingruber 1988).

RESULTS

Messarite 4 – a rural complex of Apollonia Pontica's *chora*

The charred olive stones from Mesarite were found in 3 of the investigated ritual hearths at the site. The samples include sediments from three contexts. These were stratigraphic units: US 139, 157, 162. The hearths contained plant remains, fragments of bowls, loom weights, *lekythoi*, *askoi*, astragalos and other representative ceramic vessels of this period. Olive stones were identified in the following contexts (Table 1).

Sq. J 0 – SU 139

The findings which represent charred remains of various types of fruits include 9 whole olive stones (*Olea europaea*), 3 peach stone fragments (*Pyrus sp.*), 1 almond fragment (*Prunus dulcis*), 8 hazelnut fragments (*Corylus avellana*) and small bread pieces, all placed in a hearth, near burial No 18. It can be dated to the last quarter of the 4th century BCE.

Sq. L 2 – SU 157

At the border between squares L 2 and M 2, near burials No 22 and No 23 – US 157, an open oval-shaped hearth was discovered. Several fragments of different types of plants remains were found. This includes a plum stone, one grain of bread wheat, as well as a half of an olive stone. The feature can be dated to the last quarter of the 4th century BCE.

Sq. J 4 – SU 162

During the excavation of the area in square J 4 – US 162, under and around a fish plate (near burial No 16 and a hearth) an olive stone was also found. The feature can be dated to the end of 4th – beginning of the 3rd century BCE.

The samples from **Water Cycle Site** originate mainly from the ritual hearth No 1 and burial No 1. In one of these samples 2 small olive stones were found. Thus, the total number of olive remains from the Mesarite site is 12 whole stones and 4 fragments.

Apollonia-Kalfata cemetery

The archaeobotanical remains were collected from 2 ritual hearths – No 2 and No 4 (Table 1).

Table. 1. Archaeological sites on the territory of Bulgaria with olive stones

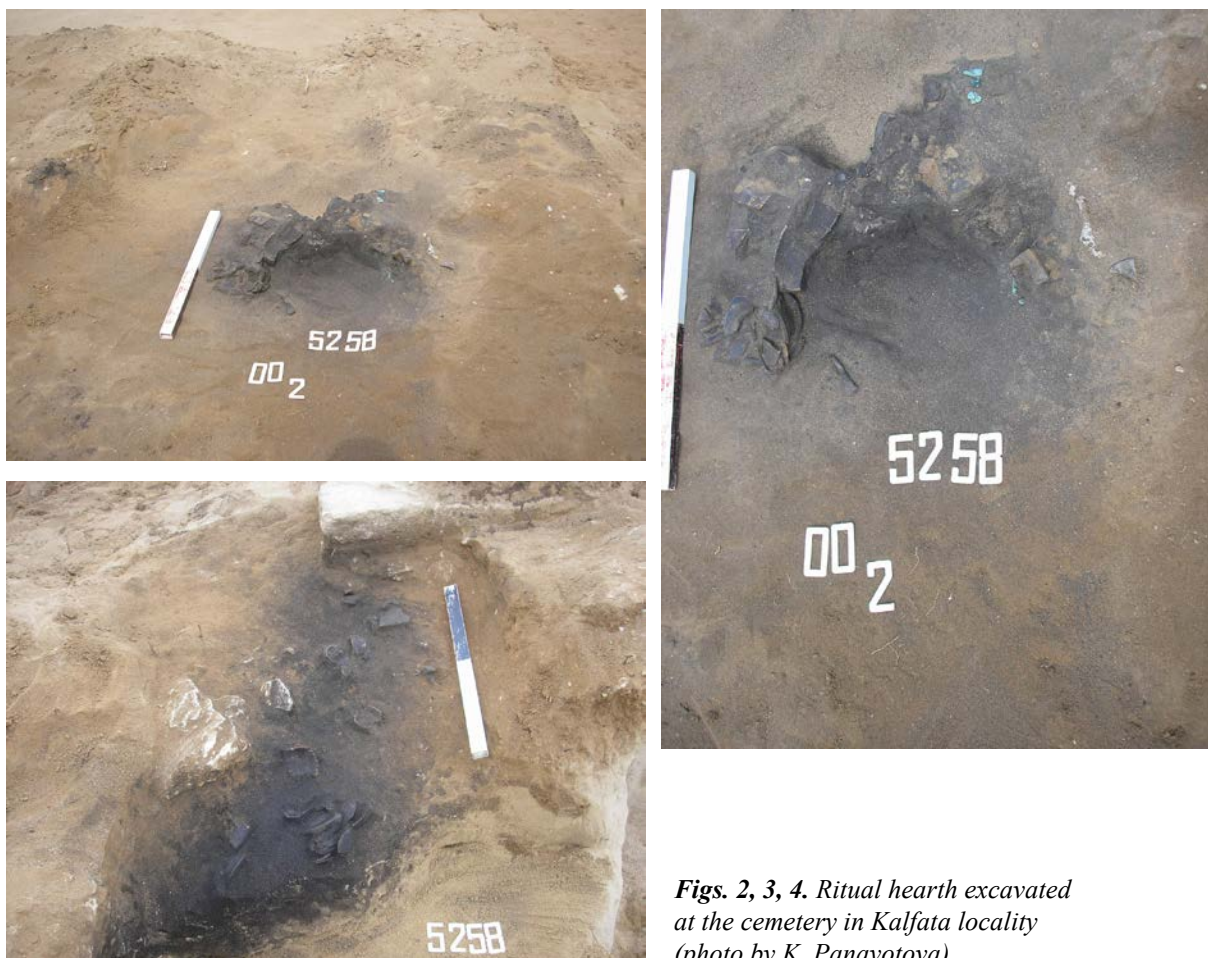
LOCATION	CONTEXT	PLANTS REMAINS	WHOLE	FRAGMENTS	DATES	AUTORS
MESARITE 4	sq. J 0 – US 139	<i>Prunus institia</i>	1		IV c. BC	Popova, unpublished
	hearth - 1/2 SUD	<i>Olea europaea subsp. europaea</i>	3			
	funeral, ritual food offering					
MESARITE 4	US 139 near burial N18	<i>Olea europaea subsp. europaea</i>	6	1	IV c. BC	Popova, unpublished
	funeral, ritual food offering	<i>Corylus avellana</i>		8		
		<i>Prunus amygdalus</i>		1		
		<i>Prunus persica</i>		3		
MESARITE 4	sq. L 2, US 157	<i>Pomoideae</i>		1	IV c. BC	Popova, unpublished
	near graves N 22 and N 23	<i>Prunus sp.</i>		1		
	funeral, ritual food offering	<i>Quercus sp.</i>		5		
		<i>Triticum aestivo/durum</i>	1	1		
		<i>Olea europaea subsp. europaea</i>		1		
MESARITE 4	Sq. J 4, US 162					Popova, unpublished
	near grave N16, hearth 1	<i>Olea europaea subsp. europaea</i>	1		IV – III c. BC	
	funeral, ritual food offering					
MESSARI- Water Cycle	hearth № 1	<i>Olea europaea subsp. europaea</i>	1		IV c. BC	Popova, unpublished
	funeral, ritual food offering					
KALFATA	UPI 5258 - hearth № 4	<i>Corylus avellana</i>	4		IV – II c. BC	Popova, unpublished
	funeral, ritual food offering	<i>Cornus mas</i>	4			
		<i>Olea europaea subsp. europaea</i>	1			
KALFATA	UPI 5098, hearth №2	<i>Pinus pinea</i>		21	IV – II c. BC	Popova, unpublished
	funeral, ritual food offering	<i>Pistacia vera</i>		1		
		<i>Olea europaea subsp. europaea</i>		2		
LIDL SUPERMARKET	hearth № 3	<i>Corylus avellana</i>	51		III c. BC	Popova, unpublished
	funeral, ritual food offering	<i>Prunus persica</i>	3			
		<i>Prunus institia</i>	1			
		<i>Prunus amygdalus</i>	2			
		<i>Olea europaea subsp. europaea</i>	26			
JATRUS FORTRESS	unknown context	<i>Oliva europea var. sativa</i>	2		IV – V c.	Neef 2007
KABYL	tumulus № 3	<i>Olea europaea subsp. europaea</i>	?		II c.	Velkov 1990
	funeral, ritual food offering	<i>Juglans regia</i>	?			
		<i>Phaenyx dactilifera</i>	?			
		<i>Pinus pinea</i> - cone	?			
KAPITAN ANDREEVO	ritual pit	<i>Olea europaea subsp. europaea</i>	1		Early Iron Age	Hristova 2016
MARKELI FORTRESS	unknown context	<i>Olea europaea subsp. europaea</i>	1		IV – VI c. Late Antiquity	Hristova 2012
ORLOVO	pit (ritual?)	<i>Triticum monococcum</i>	8		2 – 1 c. BC	Hristova, unpublished
		<i>Triticum aestivo/durum</i>	16		Late Hellenistic period	
		<i>Panicum miliaceum</i>	3			
		<i>Olea europaea subsp. europaea</i>	1			

Hearth No 2 (UPI 5089)

The hearth is located 0.95m to the east of a skull found in grave No 37. Associated remains include, a fish plate, an amphora handle, which was found in the western part of the hearth, a kylix and other fragmented vessels. The archaeobotanical materials from this area consisted of 21 pine stones, 1 fragment of pistachio and 2 halves of olives. The feature can be dated to the second half of the 4th century BCE.

Hearth No 4 (UPI 5258)

The hearth is located to the east of the first block of parabolic sector 3. During the study of this facility charred kernels, fragments of *lekythoi* with palmette motifs, beads, weights, as



Figs. 2, 3, 4. Ritual hearth excavated at the cemetery in Kalfata locality (photo by K. Panayotova)

well as fragments of a fish plate, were discovered. The feature can be dated to 375 – 350 BCE (Figs. 2, 3 and 4).

Lidl Supermarket – Sozopol site. A burial facility dated to the 3rd century BCE was discovered. In hearth No 3 a variety of charred fruits were found. A total amount of 26 charred olive stones was found. They were deposited together with hazelnuts, peaches, almonds and plums.

Yatrus fortress

The archaeobotanical samples were collected by Neef (2007). They cover two occupation periods of the fortress. These are periods B/C (second half of the 4th century – first half of the 5th century CE). He reports the presence of a small number of peach stones (*Prunus persica*), cherry (*Prunus avium*), apple / pear (*Pyrus/Malus*) and two olive stones in the samples from period B (Neef 2007).

Markeli fortress

The presence of olive stones in the Markeli Fortress has been reported by I. Hristova (2015) but the exact context was not established. She reports only a single olive find. It is likely to be dated between the 4th and the 6th century CE, or more broadly during the Late Antiquity.

Kabyle – Mogila No 3

It is a part of the western cemetery in the area „Ivan Yordanova Mogila”. Olive remains were discovered along with other grave goods during the excavation of a secondary burial. The

burial inventory includes a gold earring, ceramic unvuentarium, ceramic jug, iron nails, charred stone, cone fragments, olive and figs and a poorly preserved bronze coin of the imperial ace from the beginning of the 2nd century CE from the period of Trajan or Hadrian (Velkov et al. 1990). Unfortunately, there is no information about the exact context nor the amount of olive stone remains.

Kapitan Andreevo

I. Hristova (2015) reports an olive stone in the analysis of Kapitan Andreevo ritual pits. She writes: “Barley and hulled wheat (especially einkorn) are the dominant species in the samples from the EIA. Leguminous crops are presented only by a single item of grass pea. The olive (*Olea europaea*) stone is an interesting find as well”.

Orlovo

Structure No 179.3 is dated to the Late Hellenistic period, approximately 2nd – 1th centuries BCE (Лещаков, Тодорова, Тонков 2019). The pit contained a layer of fragment plasters charcoal, charcoal remains and the olive stones. Olive remains were found together with einkorn, bread wheat, millet and charred oak wood fragments.

DISCUSSION

The analyzed material from ritual hearths and pit sanctuaries, investigated in the territory of the Bulgaria provides important information about the the practice of funerary rites related to the use of plants or plant products.

All olive remains were charred. The good preservation of the olive remains allowed their identification as *Olea europaea subsp.europaea* (Figs. 5, 6).The findings from the five sites of cemetery at Kalfata, Messarite 4, Lidl Supermarket, Whater circle and Kabyle – Mound No 3 are connected with ritual contexts, namely with hearths. The find from the Kapitan Andreevo site was discovered in a ritual pit. For Markeli fortress and Yatrus fortress we do not have accurate information about the exact location of the discoveries. A total number of 29 whole and 19 fragmented olive stones were found in the burial facility at the site Lidl Supermarket – Sozopol. In Kalfata olive is represented by 2 charred stone halves, and in Messarite 4 ten whole kernels were found.

Plant remains from ritual hearths in the cemeteries reveal important aspects of the funeral practices related to plant food use, and also provide valuable information on the prevalence of different plant species in a given area, and the diet of the ancient people.



Figs. 5, 6. Charred olive stones from the archaeological site Lidl Supermarket (photo by Tz. Popova)

At the sites mentioned above, olive stones were found together with other archaeobotanical remains such as pine nuts, hazelnuts, pistachios, almonds, walnuts, grape pips and peach stones, which represent the use of ritual food (Popova, Hristova 2017; 2018). In the present archaeological context, fruits occupy a large percentage of the plant remains. This suggests that they had a special role in the diet and daily life of the ancient societies. Perhaps some of them were charged with certain symbolic functions. Prevailing in the discussed sites are the following fruits: almonds (*Prunus dulcis* L.), figs (*Ficus carica* L.), grapes (*Vitis vinifera* ssp. *vinifera*), walnuts (*Juglans regia* L.), pears (*Pyrus communis* L.), hazelnuts (*Corylus avellana* L.), pistachios (*Pistacia vera* L.), pine nuts (*Pinus spinea* L.) and olives (*Olea europea* ssp. *europea* L.). They were burned in special ritual fires, often located near the grave pits. The question remains when and where these plant remains were burned. We can also ask, whether they were burned with the body of the deceased or separately and whether the burning of organic grave offerings took place the same day or the following day as the cremation itself. E. Margaritis and M. Jones offer an interesting hypothesis. When burning the bones, a very high temperature must be ensured for performing the ritual (Margaritis, Jones 2008). By the means of experimental burning, E. Margaritis and M. Jones prove that at 400°C the olive oil will burn and at 470°C it turns into ashes, suggesting that two combustion processes occurred (Margaritis, Jones 2008). According to them, there is a process of depositing the plants products – the second burning process has a controlled temperature (acts of destruction and acts of preservation). This model could possibly also be applied to the investigated ritual hearths of the cemetery of ancient Apollonia Pontica, which would be confirmed by the good preservation of the remains. Regardless of whether the dead body was burnt or buried, whether a *stelae* or a mound rises above its burial, the remains founded in the ritual hearths indicate that food was an integral part of funeral rituals. The burning of gifts in ceremonial fires was only one of the manifestations of the worship of the deceased, which continued with periodic visits and libations at their burials (Панайотова 1998).

ARCHAEOBOTANICAL EVIDENCE

Olive remains have been discovered at numerous sites in the Mediterranean area. The earliest olive findings, probably wild, are from several settlements in Israel (Table 2). Kislev et al. (1992) reported the findings of olive from the following sites: the settlement of Ohalo II, Sea of Galilee, Israel, dated Epi-Paleolithic; Nahal Zehora, Mount Carmel dated to 8150 – 7850 cal BP Pottery Neolithic, (Kislev, Hartmann 2012); Mount Carmel, 7000 BP, Late Neolithic (Galili et al. 1989) and Dhali Agridhi Aceramic Neolithic (Stewart 1974). Olive is one of the most important plants, whether it is for the production of olive oil or for direct consumption of the fruit. Archaeobotanical evidence of one of the earliest olive finds in Greece shows that its use began during the Bronze Age. The materials from the Early Bronze Age settlement of Dhaskalio such as stones, leaves and charred wood remains also prove its use (Margaritis 2013).

“...Olive trees were initially managed for their branches and their leaves to produce fodder, fuel and building material. Pruning produced stronger and more numerous branches which led to the production of better fruits.” (Margaritis 2013).

Detailed summary of the findings of olive stones and charcoal from a number of archaeological sites, covering the period 7000 – 2000 BCE in Greece is given by Valamoti et al. (2018). On the basis of these data S. Valamoti et al. (2018) conclude that olive cultivation was introduced in the Aegean region in 4 000 BCE and the production of olive oil was primarily for

Table 2. Archaeobotanical evidence for olive stones (*Olea europaea subsp. europaea* L.)

Location	Country	Identification	Date	References
Ohalo II, Sea of Galilee	Israel	Olea – gathering	Epi-Palaeolithic	Kislev et al. 1992
Nahal Zehora, Mount Carmel	Israel	Olea – gathering	8,150 – 7,850 cal BP Pottery Neolithic	Kislev, Harlann 2012
Mount Carmel	Israel	Olea – gathering	7000 B. P. – Late Neolithic	Galili et al. 1989
Dhali Agridhi	Cyprus	<i>Olea europaea subsp. europaea</i>	Aceramic Neolithic	Stewart 1974
			Aceramic Neolithic	
Cap Andreas Kastros	Cyprus	<i>Olea europaea subsp. europaea</i>	Aceramic Neolithic – 6400±200 to 7,755±125 uncal BP=8700 – 6800 cal BP	van Zeist 1981
Khirokitia	Cyprus	<i>Olea europaea subsp. europaea</i>	Aceramic Neolithic; cal 7500 uncal BP ca. 8400 – 8200 cal BP	Waines and Stanley Price 1975
Grotta dell'Uzzo, Sicily	Italy	<i>Olea europaea subsp. europaea</i>	Middle Neolithic (ca. 6750 – 6450)	Constantini 1989
Cova de Cendres	Spain	<i>Olea europea</i> <i>var. oleaster</i>	Early Neolithic (Cardial culture) 6340±70 uncal BP=7400 – 7050 cal BP	Buxo 1997
Cueva de Nerja, Malaga	Spain	<i>Olea europaea subsp. europaea</i>	Late Neolithic 5065±140 uncal BP ca BP 6200 – 5500 cal BP	Hopf and Pelicer Catalan 1970
El Argar culture sites	S-E Spain	<i>Olea europaea subsp. europaea</i>	Early Bronze age (ca. 4150 – 3350 cal BP)	Stika, Jurich, 1998
Nahal Oren, Mt. Carmel	Israel	<i>Olea europaea subsp. europaea</i>	Natufian and Early Neolithic	Noy et al. 1973
Tuleilat Ghassul	Israel	<i>Olea europaea subsp. europaea</i>	Chalcolithic (ca 6800 – 5800 cal BP)	Zohary and Spiegel-Roy 1975
Tell Saf	Jordan	<i>Olea europaea subsp. europaea</i>	Chalcolithic	Gophna and Kislev 1979
Tel Shuna North	Jordan	<i>Olea europaea subsp. europaea</i>	Chalcolithic	Neef 1990
Tell Abu Hamid	Jordan Valley	<i>Olea europaea subsp. europaea</i>	Chalcolithic	Neef 1990
Arad	Israel	<i>Olea europaea subsp. europaea</i>	Early Bronze Age ca. 4900 – 4700 cal BP	Hopf 1978
Bab edh-Dhra	Jordan	<i>Olea europaea subsp. europaea</i>	Early Bronze Age cal 4900 – cal BP	Mc Creery 1979
Tell es Sa'idiyeh	Jordan	<i>Olea europaea subsp. europaea</i>	Early Bronze Age	Cartwright 2003
Tell Sukas	Syria	<i>Olea europaea subsp. europaea</i>	5000 BP	Helbaek 1962
Troy	Turkey	<i>Olea europaea subsp. europaea</i>	ca. 4850 – 4200 cal BP	Riehl 1997
Makri, Alonia	Greece	<i>Olea europaea subsp. europaea</i>	Early and Middle Bronze Age	Adams and Simmons 1996
Dhascalio	Greece	<i>Olea europaea subsp. europaea</i> <i>stones and leaves</i>	Early Bronze Age	Margaritis 2013
97 archaeological sites	Greece	<i>Olea europaea subsp. europaea</i>	7000 – 3000 BC to the late 1 st millenium	Valamoti, et al. 2018
Agia Aikaterini Square Kastelli, Khania	Greece	<i>Olea europaea subsp. europaea</i>	Minoan period	Sarpaki 2016
Latare	France	<i>Olea europaea subsp. europaea</i>	475 – 350	Alonso, Rovira 2009
Tarrega Leida	Spain	<i>Olea europaea subsp. europaea</i>	2800 – 2000 BC	Alonso, Perez-Jorda, Rovira 2015
Galera Granada	Spain	<i>Olea europaea subsp. europaea</i>	1300 BC	Alonso, Perez-Jorda, Rovira 2015
Ulastret, Girona	Spain	<i>Olea europaea subsp. europaea</i>	4800 – 600 BC	Alonso, Perez-Jorda, Rovira 2015
Moixent, Valencia	Spain	<i>Olea europaea subsp. europaea</i>	600 – 500 BC	Alonso, Perez-Jorda, Rovira 2015
Tivissa-Tarragona	Spain	<i>Olea europaea subsp. europaea</i>	600 – 200 BC	Alonso, Perez-Jorda, Rovira 2015

the elites and ritual purposes. It began to increase during the Bronze Age and reached its peak during the Mycenaean period.

According to Karnava, Kolia and Margaritis (2015) the earliest evidence of olive oil production and its equipment can be traced back to the 1st millennium BCE in Klazomenai on the east coast of the Aegean Sea (6th century BCE). The archaeological site of Azorias in Crete included facilities and part of the equipment of an oil press, dated also to the Archaic period. Partial evidence of oil production is found in different archeological sites such as: (Halieis in the Argolid, Rachi and Isthmia, Olynthos/Argilos/Vrasna and Chalcidice) dated to the 4th to 3rd centuries BCE. Keos facilities and complete on-site equipment prove the uniqueness and successive stages of olive oil production. The facility was built during the classical period and continued to be used until the late Hellenistic period (Karnava, Kolia, Margaritis 2015).

CONCLUSION

The studied olive remains from the territory of Bulgaria belong to the 5th to 3rd centuries BCE. During this period in the Mediterranean region and Greece olives were not only being consumed directly, but also used for olive oil production.

So far, the presence of olives in the territory of Bulgaria has been very poorly recorded.

The climatic conditions of this territory do not allow the olive tree to develop. This proves that olives were the subject of trade relations with neighboring countries and were highly valued to be placed in burial contexts.

In this regard, the archaeobotanical evidence of these 9 archeological sites is of particular interest and it is in the Mesarite 4, as well as in the cemetery of Kalfata, that the earliest olive findings for the territory of Bulgaria are documented. They show that in the 3rd century BCE olive was also an imported valuable product and, among other imported species, such as stone pine nuts and figs, it was present not only as a food but also in ritual activities and funerary rites (Popova, Hristova 2017).

The information obtained sheds light on those of significance of this kind, not only as a nutritional resource but also as an important attribute in ritual practices.

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REFERENCES:

Богданова, Попова и др. 2017: Т. Богданова, М. Попова и др. Късноантична сграда и следи от селскостопанска дейност от гръцкия период в обект „Супермаркет, паркинг, трафопост и съпътстваща инфраструктура“, УПИ XIII-5194, 5195, 5259, 5260, 5261, УПИ I-5.859 и УПИ 67800.5.160“, гр. Созопол. – Археологически открития и разкопки през 2016 г. София, 2017, 245 – 248.

Велков, Гетов, Делев и др. 1990: В. Велков, Л. Гетов, П. Делев и др. Некрополи на Кабиле. Разкопки в Кабиле и неговата околност. – Археологически открития и разкопки през 1989 г. София, 1990, 57 – 62.

Димитров 2004: Б. Димитров. Созопол. Пътеводител. Унив. издателство „Св. Кл. Охридски“, 2004.

Лещаков, Тодорова, Тонков 2019: П. Лещаков, Н. Тодорова, Н. Тонков. Спасителни археологически проучвания на обект от късната праистория, бронзовата и желязната епоха в м. Белене, с. Орлово, общ. Хасково. – Археологически открития и разкопки през 2018 г. София, 2019, 36 – 38.

Момчилов 2009: Д. Момчилов. Средновековният град Маркели (обзор по археологически данни). – Конференция „Пътувания през Средновековието“. Пътуванията в средновековна България. Материали от първата национална конференция „Пътуване към България. Пътуванията в средновековна България и съвременният туризъм“. Шумен, 8 – 11.05. 2008. Абагар. Велико Търново, 2009, 199 – 213.

Панайотова 1998: К. Панайотова. Некрополът на Аполония Понтика в м. Калфата – Археология XXXIX, 1998, 3 – 4, 11– 24.

Панайотова 2003: К. Панайотова. Обредни огнища в некрополите на Аполония Понтика. – В: Studia Archaeologica, Suppl. I. In memoriam P. Gorbanov. Университетско издателство „Св. Климент Охридски“, 2003, София, 133 – 141.

Панайотова, Богданова, Баралис, 2017: К. Панайотова, Т. Богданова, А. Баралис. Селищна структура и некропол на територията на Аполония Понтика. – Археологически открития и разкопки през 2016 г. София, 2017, 241 – 245.

Попов, Василева, Дянкова 2008: Х. Попов, Д. Василева, Г. Дянкова. Капитан Андреево – Спасителни разкопки на ямно поле от желязната епоха и ранносредновековно селище при с. Капитан Андреево – Обект № 27, км. 312+550-312+850 по трасето на железопътна линия Пловдив – Капитан Андреево. – Археологически открития и разкопки през 2007 г., София, 2008, 194 – 198.

Adams, Simmons 1996: R. Adams, D. Simmons. Archaeobotanical remains. – In: D. Frankel, J. M. Webb (eds.). Makri Alonia, an Early and Middle Bronze age town in Cyprus excavation 1990 – 1994, Jonsered, Paul Astrom, 1996, 233 – 236.

Alonso, Perez-Jorda, Rovira 2015: N. Alonso, G. Perez-Jorda, N. Rovira. Gathering and consumption of wild fruits in the east of the Iberian Peninsula from the 3rd to the 1st millennium BC. – Quaternary International XXX, 2015, 1 – 17.

Alonso, Rovira 2009: N. Alonso, N. Rovira. Consommation et traitement des produits vegetaux a Lattara entre -475 et -350. LATTARA 2, 2009, 1 – 58.

Asouti 2003: E. Asouti. Wood charcoal from Santorini (Thera): new evidence for climate, vegetation and timber imports in the Aegean Bronze Age. – Antiquity 77, issue 297, 2003, 471 – 484, DOI: <https://doi.org/10.1017/S0003598X0009253X>

Baralis, Panayotova et al. 2016: A. Baralis, K. Panayotova, T. Bogdanova, M. Gyuzelev, D. Nedev, K. Gospodinov. Apollonia Pontica (Sozopol, Bulgaria): the results of the Franco-Bulgarian archaeological mission. – In: The Black Sea in the Light of New Archaeological Data and Theoretical Approaches. Proceedings of the 2nd International Workshop on the Black Sea in Antiquity held in Thessaloniki, 18 – 20 September 2015. Edited by Manolis Manoledakis, 2016, 153 – 179.

Besnard, Khadari et al. 2013: G. Besnard, B. Khadari, M. Navascues, M. Fernandez-Mazuecos, A. El Bakkali, N. Arrigo, D. Baali-Cherif, V. Bronini-Bronzini de Caraffa, S. Santoni, P. Vargos and V. Savolainen. The complex history of the olive tree: from Late Quaternary diversification of Mediterranean lineages to primary domestication in the northern Levant. – Proc. R. Soc. B: Biol. Sci. 280(1756):20122833.

Buxo 1997: R. Buxo. Presence of *Olea eropea* and *Vitis vinifera* in archaeological sites from the Iberian Peninsula. – Lagasalia 19, 1997, 271 – 282.

Cartwright 2003: C. Cartwright. Grapes or raisins? An Early Bronze Age lender under the microscope. – Antiquity 77, 2003, 345.

Cappers, Neel, Bekker 2009: R. Cappers, R., Neel, R., Bekker. Digital atlas of economic plants. www.plantalas.eu/ea.php-15k

Constantini 1989: L. Constantini. Plant Exploitation at Grotta dell'Uzzo, Sicily: New evidence for the transition from Mesolithic to Neolithic subsistence in southern Europe. – In: D. Harris and G. Hillman (eds.). *Foraging and farming: the evolution of the plant exploitation*, London, Unwin and Hyman, 1989, 197 – 206.

Franke, Hammer 1976: G. Franke and K. Hammer (eds.). *Früchte der Erde*. Leipzig, Jena, Berlin Urania – Verlag.

Galili, Veinstein-Evron, Zohary 1989: E. Galili, M. Veinstein-Evron, D. Zohary. Appearance of olives in submerged Neolithic sites along the Carmel coast. – *Journal of the Israel Prehistoric Society* 22, 1989, 95 – 97.

Gophna, Kislev 1979: R. Gophna, M. Kislev. Tell Saf (1977 – 1978). – *Revue Biblique* 86, 1979, 112 – 114.

Hamilakis 1996: Y. Hamilakis. Wine, oil and the dialectics of power in Bronze Age Crete: a review of the evidence. – *Oxford Journal of Archaeology* 15, 1996, 15, 1 – 32.

Helbaek 1962: H. Helbaek. Les grains carbonisés de la 48ème couche des fouilles de Tell Souk-as. – *Annales Archéologiques de Syrie* 11 – 12, 1962, 185 – 186.

Hermany 2010: A. Hermany. Apollonia de pont. La necropole de Kalfata. Fouilles franco-bulgares (2002 – 2004). – *Bibliothèque d'Archéologies Méditerranéenne et Africaine* – 5, ed. France/Centre Camille Jullian, Chapitre 2: Description des tombes. Dépôt set foyers, 2010, 83 – 116.

Hopf 1978: M. Hopf. Plant remains. Strata V – I. – In: R. Amiran (ed.). *Early Arad I, the Chalcolithic settlement and Early Bronze City*. Jerusalem. The Israel Exploration Society, 1978, 64 – 82.

Hopf, Mellicer Catalan, 1970: M. Hopf, M. Mellicer Catalan. Neolithische getreidefunde in der Hohle von Nerja (Prov. Malaga). – *Madrid Mitteilungen* 11, 1970, 18 – 34.

Hristova 2015: I. Hristova. The use of plants in ritual context during Antiquity in Bulgaria. Overview of the archaeobotanical evidence. – *Bulgarian e-Journal of archaeology* 5. 2, 2015, 117 – 137.

Karnava, Kolia, Margaritis 2015: A. Karnava, E. Kolia, E. Margaritis. A Classical/Hellenistic Oil Pressing Installation in Foti-Vroskopos, Keos. – In: A. Diler, K. Şenol, A. Aydinoglu (eds.). *Olive oil and wine production in eastern Mediterranean during antiquity*. International symposium proceedings 17 – 19 November, 2011, Urla – Turkey. İzmir, 2015, 107 – 125.

Kislev, Nadel, Carmi, 1992: M. Kislev, D. Nadel, I. Carmi. Epipalaeolithic (19,000 BP) cereal and fruit diet at Ohalo II, Sea of Galilee, Israel. – *Review of Palaeobotany and Palynology* 73 (1 – 4), 1992, 161 – 166.

Kislev, Simchoni, Weiss 2002: M. Kislev, O. Simchoni, E. Weiss. Reconstruction of the landscape, human economy, and hut use according to seeds and fruit remains from Ohalo II. – In: D. Nadel (ed.). *Ohalo IIa 23,000-year-old fisher-hunter-gatherers' camp on the shore of the Sea of Galilee*. Haifa: Hecht Museum, University of Haifa; Catalogue No. 20, 2002, 21 – 23.

Kislev, Harlan 2012: M. Kislev, A. Harlan. Food crops from Nahal Zehora II. – In: A. Gopher. (ed.). *Village communities of the Pottery Neolithic period in the Menashe Hills, Israel*. Tel Aviv, Tel Aviv University Sonia and Marco Nadler Institute of Archaeology, Monograph. series.

Langgut, Cheddadi, Carrión et al. 2019: D. Langgut, R. Cheddadi, J-S. Carrión, M. Cavanagh, D. Colonbaroli, V. J. Eastwood, R. Greenberg, T. Litt, A-M. Mercuri, A. Miebach, C. Nell Roberts, H. Wolrdring, J. Woodbridge. The origin and spread of olive cultivation in the Mediterranean Basin: The fossil pollen evidence. *The Holocene*, 2019, 1 – 21, DOI: 10.1177/0959683619826654

Margaritis 2005: E. Margaritis. Olive and vine farming in Hellenistic Pieria: an archaeobotanical case study of settlements from Macedonia, Greece. Doctoral Thesis, University of Cambridge.

Margaritis 2013: E. Margaritis. Foodstuffs, fruit tree cultivation and occupation patterns at Dhaskalio. – In: *The Settlement at Dhaskalio*. C. Renfrew, O. Philaniotou, N. Brodie, G. Gavalas & M. J. Boyd (eds). (McDonald Institute Monographs). Cambridge: McDonald Institute for Archaeological Research, 2013, 389 – 404.

Margaritis, Jones 2008: E. Margaritis, M. Gones. Crop processing of *Olea europaea* L.: an experimental approach for the interpretation of archaeobotanical olive remains. – *Veget. Hist. Archaeobotany*, 2008, 381 – 392, DOI 10.1007/s00334-007-0122-x

McCreery 1979: D. McCreery. Flotation of the Bab edh Dhra and Numeira plants remains. – *Annual of the American Schools of Oriental Research* 46, 1979, 165 – 169.

Melamed, Kislev et al. 2013: Y. Melamed, M. Kislev, O. Simchoni. Extinction of water plants in the Hula Valley: evidence for climate change. *J. Hum. Evol.* 60, 2013, 320 – 327.

Neef 1990: R. Neef. Introduction, development and environmental implications of olive cultivation. The evidence from Jordan. – In: S. Bottema, G. Entijes-Nieborg and W. van Zais (eds.). *Man's role in the chapping of the eastern Mediterranean landscape*. Rotterdam, Balkema, 1990, 295 – 306.

Neef 2007: R. Neef. Archäobotanische Untersuchungen in spätantiken Iatrus/Krivina (Grabungskampagnen 1992 – 2000). – In: G. von Bülow et al. (Hrsgs.), *Iatrus-Krivina. Spätantike Befestigung und frühmittelalterliche Siedlung an der unteren Donau. Band VI: Ergebnisse der Ausgrabungen 1992–2000*, 415 – 445. *Limesforschungen* 28 Archäobotanische Untersuchungen im spätantiken Iatrus / Krivina (Grabungskampagnen 1992 – 2000). Von Reinder, 2007, 415 – 447.

Noy, Legge, Hidds 1973: T. Noy, A. Legge, E. Hidds. Recent excavation at Nahal Oren, Israel. *Proceeding of the Prehistory Society*, 1973, 39, 75 – 99.

Popova, Hristova 2017: Tz. Popova, H. Hristova. Trees of eternity – *Pinus pinea* L. in daily life, rituals, religion and symbolism. Archaeobotanical evidence from the territory of Bulgaria. – *Journal of Archaeological Science*, Elsevier, 2017, DOI: <https://doi.org/10.1016/j.jasrep.2017.06.012> <https://www.journals.elsevier.com/journal-of-archaeological-science> I F 3.030 e-accessed 23.10.2019.

Popova, Hristova 2018: Tz. Popova, H. Hristova. Taste of the Mediterranean – archaeobotanical evidence about imported food plans in the territory of Bulgaria. 12.02.2018–15.04 2018. *RAC*, 2018, Edinburg.

Riehl 1997: S. Riehl. Bronze Age environment and economy in the Troad: the archaeobotany of Kumtepe and Troy. PhD thesis. University of Tübingen, 1997.

Runnels, Hansen 1986: C. N. Runnels, J. Hansen. The olive in the prehistoric Aegean: the evidence for domestication in the early Bronze Age. – *Oxford J. Archaeol.* 5, 1986, 299 – 308.

Sarpaki 2016: A. Sarpaki. The archaeobotanical remains from EM to Panio at the Greek-Swedish excavations. – In: E. Hallager, P. Hallager (eds.). *The Greek-Swedish excavations at the Agia Aikaterini Square Kastelli, Khania 1970 – 1987, 2001, 2005 and 2008. Vol. 5:1 – 2. Late Minoan IIIA Vol. 5:1 – 2. The Late Minoan IIIA:1 and II Settlements, Text and Plates. no. 47:5:1 – 2, Series: Acta Ath-4°*, 2016.

Stewart 1974: R. Stewart. Paleobotanical investigation: 1972 season. – In: L. Stager, A. Walker, G. Wright, (eds.). *American expedition to Idalion, Cyprus. – Bulletin of the American Schools of Oriental Research, Supplementary Studies, no. 18, The American Schools of Oriental Research*, 1974, 122 – 129.

Stika, Jurich 1998: H-P. Stika, B. Jurich. Pflanzenreste aus der Probegrabung 1991 im bronzezeitlichen Siedlungsplatz el Argar, prov. Almería, südostspanien. – *Madrider Mitteilungen* 39, 1998, 35 – 48.

Schweingruber 1988: F. Schweingruber. Microscopic wood anatomy. Swiss federal institute of forestry research, CH-8903 Birmensdorf, ed. Zuercher AG, CH-6301 Zug.

Teral, Alonso, Buxo et al. 2014: J-F. Teral, N. Alonso, R. Buxo, N. Chatti, L. Fabre, G. Fiorentino, Ph. Marinval, G. Perez-Jorda, B. Pradat, N. Rovira, P. Alibert. Historical biogeography of olive domestication (*Olea europaea* L.) as revealed by geometrical morphometry applied to biological and archaeological material. – *Journal of Biogeography* 31, 200, 2014, 63 – 77.

Valamoti, Gratzogia, Ntinou 2018: S-M. Valamoti, E. Gratzogia, M. Ntinou. Did Greek colonisation bring olive growing to the north? An integrated archaeobotanical investigation of the spread of *Olea europaea* in Greece from the 7th to the 1st millennium BC. – *Vegetation History and Archaeobotany* 27, 2018, 177 – 195, DOI: 10.1007/s00334-017-0631-1

Weiss 2009: E. Weiss. Glimpsing into a hut: economy and society of Ohalo II inhabitants. – In:

A. Fairbairn, E. Weiss (eds.). From foragers to farmers: papers in honour of Gordon C. Hillman. Oxford, UK: Oxbow Books, 2009, 153 – 160.

Weiss 2015: E. Weiss. Beginnings of Fruit Growing in the Old World – two generations later, – Israel Journal of Plant Sciences, 2015, 62:1-2, 75 – 85, DOI: [10.1080/07929978.2015.1007718](https://doi.org/10.1080/07929978.2015.1007718) To link to this article: <http://dx.doi.org/10.1080/07929978.2015.1007718>

Waines, Stanley Price 1975-1977: J. Waines, N. Stanley Price. Plants remains from Khirokitia in Cyprus. – Paleorient 3, 1975 – 1977, 281 – 284.

Vilatis, 1992: J. Vilatis. Atlas de malas hierbas, Ediciones Mundi Prensa, 2 edicion, 1992, 301p.

Van Zeist 1981: W. Van Zeist. Plants remains from Cap Andreas – Kastros (Cyprus). – In: Le A. Brun (ed.). Un site néolithique Précéramique en Chypre: Cap Andreas – Kastros, Paris, Recherche sur le Grandes Civilisations, 1981, 95 – 100.

Zohary, Spiegel-Roy 1975: D. Zohary. P. Spiegel-Roy. Beginnings of fruit growing in the Old World. – Science 187, 1975, 319 – 327.

Zohary, Hopf 2000: D. Zohary, M. Hopf. Domestication of plants in the Old World. The origin and spread of cultivated plants in West Asia, Europe and Nile Valley. 3rd revised edition. Oxford Science Publication, Clarendon Press, Oxford, 2000.

<https://bg.wikipedia.org/wiki/%D0%9C%D0%B0%D1%80%D0%BA%D0%B5%D0%BB%D0%B8> E-accessed 23.03.2021

www.museumruse.com/ruseznanie/yatrus.html Драгоев Д. Римски и ранновизантийски кастел Ятрус. E-accessed 22.04.2021

Нови археоботанични свидетелства за *Olea europaea subsp. europaea* от територията на България

Цветана Попова

РЕЗЮМЕ

Тази статия представя нови археоботанични данни за появата на маслината на територията на България. Находки на маслини в археологическите обекти досега почти не са регистрирани въпреки значителните археоботанични изследвания. Статията се фокусира върху резултатите от археоботанични изследвания на овъглени останки от маслини, открити в 9 археологически обекта на територията на страната. В резултат на анализите се доказва, че най-ранните находки на култивираната форма *Olea europaea subsp. europaea* от територията на България се датират между V и III век пр. Хр. Материалът, получен от ритуалните огнища в некропола на територията на Созопол (Аполония Понтика), дава важна информация за някои от практиките при погребалните обреди, свързани с използването на растения. В тази връзка археоботаничните доказателства от тези 9 археологически обекта представляват особен интерес. Очевидно е, че през III в. пр. н. е. маслините са били внесени заедно с други видове, като шам фъстък, пиния, фурми и др. Присъствието ѝ показва външни контакти със Средиземноморския регион. Получената информация хвърля светлина върху значението на *Olea europaea subsp. europaea*, не само като хранителен ресурс, но и като важен атрибутивен елемент в ритуалните практики.

Ключови думи: маслина, археоботанични данни, ритуални практики, България

The use of mollusc shells for ornaments in the Bronze Age of the southern Carpathian basin

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ABSTRACT

Mollusc shells have been used for the production of ornaments since the Palaeolithic times. Some of the world's oldest decorative items were, in fact, made from shells. Their smooth surfaces, durability and bright colours, were some of the reasons why they were aesthetically attractive to numerous prehistoric communities. Ornaments made from shell often had symbolic value – they were used to display status, prestige, belonging to a group, and may be used as indicators for trade and exchange routes. However, although they were in use in the prehistoric period, they have received less attention from researchers studying periods after the Neolithic. This paper will provide an overview on the use of shells for ornaments in the Bronze Age Maros culture in the southern Carpathian basin. They have so far been analysed only within the context of burial equipment and their relation to other jewellery items, mainly metal objects. However, they may provide an additional insight into some of the symbolic aspects, cultural attitudes towards certain raw materials, as well some aspects of trade and exchange.

Key words: mollusc shells, *Columbella*, *Dentalium*, *Bivalvia*, ornaments, Bronze Age, Maros culture

INTRODUCTION

The phylum *Mollusca* is second largest phylum in the animal kingdom. Their characteristic is an exoskeleton or shell. The role of this shell is to enclose, support and protect the soft parts of the animal. The mollusc shells are composite materials, comprised of calcium carbonate, in the form of calcite or aragonite, crystallised out in an organic matrix. Because of this the material is durable and resilient (Bar-Yosef Mayer 2011; Claassen 1998; Negra, Lipparini 2004).

Shells found within archaeological contexts may provide data regarding palaeoenvironment and diet (Claassen 1998 and references therein; see also Álvarez Fernández, Carvajal Contreras 2010; Colonese et al. 2011; Szabó et al. 2014; inter al.), as well as data on some other aspects of economy. Shells could be used in numerous ways such as the production of pigments or as admixture into clay for pottery production, etc. (e. g., Alberti 2008; Reese 1987; to mention just a few). Furthermore, entire or modified shells may have been used as objects in themselves, for example as containers, trumpets, gaming pieces or even money. They may have been transformed into tools, ornaments or objects of art. Shell pieces may have been part of some composite decoration, for example as inlays (Álvarez Fernández, Carvajal Contreras 2010; Bar-Yosef Mayer 2005; Çakırlar 2011; Claassen 1998, 175 – 196; Colonese et al. 2011; Mărgărit et al. 2018; Szabó et al. 2014; Taborin 1993, 321– 328, inter al.). Shells were exotic

items that often came from distant sources and they were also durable and distinctive looking. This made them particularly attractive for the production of ornamental items, not only for decoration, but also as amulets, symbols of personal or group identity, status, wealth and prestige (see Trubitt 2003, and references therein).

Some of the earliest evidence for the intentional collection and use of mollusc shells comes from the site of Qafzeh in Israel, dated to approximately 92,000 BP. Here there was evidence of valves of *Bivalvia* being used as containers. Among these there were also several *Glycymeris* sp. shells with natural perforations, strung together, some with ochre stains on them (Bar-Yosef Mayer et al. 2009). At the site of the Blombos cave in South Africa were found perforated *Nassarius kraussianus* shells, dated into 70 – 75,000 BP (d’Errico et al. 2005; Vanhaeren et al. 2013). Evidence of early use of shell beads by modern humans was also noted at the western Asian site of Skhul and the North African site of Oued Djebbana, dated to 100,000 to 135,000 years BP (Vanhaeren et al. 2006).

Since the early Upper Palaeolithic, the evidence of their consistent use is abundant across Europe and in the Near East (Bar-Yosef Mayer 2008; Cattelain 2012; Taborin 1993; 2004), and shell ornaments were present in numerous communities throughout prehistory (e.g., Álvarez Fernández 2006; Bar-Yosef Mayer 2005; Bar-Yosef Mayer et al. 2017; Borrello 2004; Borrello, Micheli, 2004; Çakırlar ed. 2011; Cattelain 2012; Ifantidis, Nikolaidou 2011; Ifantidis 2019; Mărgărit et al. 2018; Mărgărit, Boroneanţ 2020; Séfériadès 2010; Szabó et al. 2014; Taborin, 1993; 2004). They continued to be used even after the introduction of new luxurious raw materials such as copper and gold (e.g., Bar-Yosef Mayer 2011; Mărgărit 2008; Mărgărit, Dimache 2019; Todorova 2002; Vitezović 2017a; 2017b). However, although they were still relatively frequent in the Metal Ages, ornaments made from shells have received less attention in contrast with both the earlier periods and the contemporaneous metal ornaments (with some notable exceptions, e.g., Ljuština et al. 2019; Mărgărit 2008; Mărgărit, Dimache 2019). Here will be presented the shell ornaments from two necropoles located in northern Serbia, Ostojićevo and Mokrin – the raw material selection, typological repertoire, use wear traces, as well as reconstruction of the mode of use and possible symbolic significance will be discussed.

THE ARCHAEOLOGICAL BACKGROUND

The Early Bronze Age Maros or Moriš culture was widespread in the southern Carpathian basin in the area around the confluence of Tisza (Tisa) and Maros (Moriš) rivers in north-western Serbia, south-eastern Hungary, and south-western Romania (Garašanin 1983; Tasić 1974). It is considered as one of the prehistoric cultures where metals became more frequent and where traces of social stratification may be noted (Harding 2004; Milašinović 2009; O’Shea 1996). Numerous sites were excavated, both settlement sites and necropoles, revealing rich and diverse material culture. In particular, cemeteries have attracted a lot of attention from researchers with rich burial equipment, that included ceramic vessels, copper and stone tools and weapons, as well as jewellery and clothing accessories, made from bronze, gold, osseous and lithic raw materials (Girić 1971; Milašinović 2008; 2009; O’Shea 1996; Tasić 1974).

In Serbia, two large cemeteries were excavated, Mokrin and Ostojićevo, located in the Banat region (Fig. 1). The site of Mokrin is situated 12 km from the town of Kikinda, while Ostojićevo is 24 km to the north-west from Kikinda. Both sites were excavated by the National museum from Kikinda; Mokrin in the 1960s, and Ostojićevo in the period between 1981 and 1991 (Girić 1959; Milašinović 2008; 2009). At Mokrin, 312 graves were uncovered, belonging

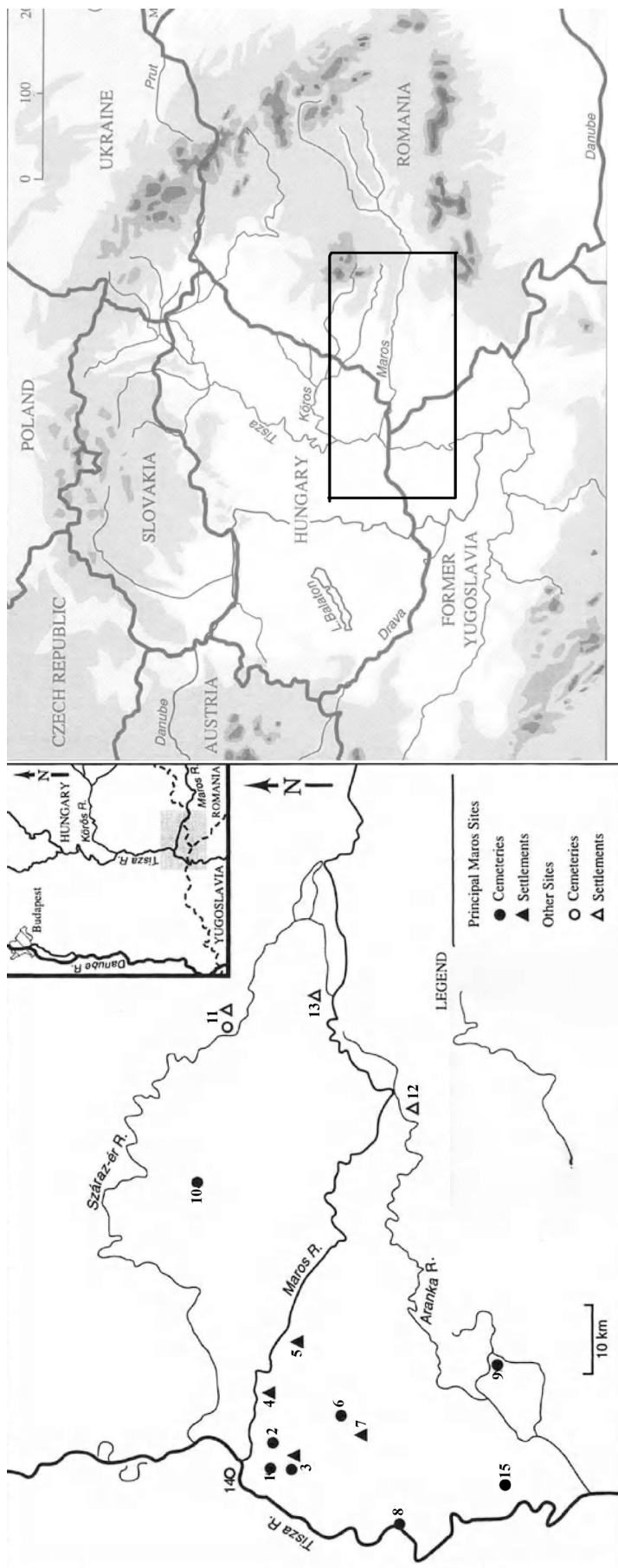


Fig. 1. Map of the Maros culture: 1. Szöreg, 2. Deszk A, F, 3. Ósentriván, 4. Klárafalva – Hajdova, 5. Kiszombor – Új Élet, 6. Óbeba, 7. Rabe, 8. Novi Kneževac, 9. Mokrin, 10. Pitvaros, 11. Battonya, 12. Perjámos, 13. Pécska, 14. Tápé and 15. Ostojićevo (adapted after O'Shea 1996; Milišinić 2009)

to the Maros culture (Girić 1971), and at Ostojićevo 77 graves were attributed to the Maros culture (out of 285 Early and Middle Bronze Age burials excavated at the site) (Milašinović 2008; 2009). Absolute dates obtained from the necropolis in Mokrin place it in the period between the 21st and 19th centuries BC (Forenbaher 1993: t. 1, 244; O'Shea 1996, 37; and references therein).

MATERIALS AND METHODS

Among the diverse findings in these graves, ornaments made from shells were recovered from several burials (Girić 1971; Vitezović 2017a; 2017b; 2021). They have been thus far analysed only within the context of burial equipment and their relation to other jewellery items (see O'Shea 1996). However, they have not yet been examined in detail for technological traits (manufacturing and use wear traces). Furthermore, recent study on the origin of *Columbella* shells (Ljuština et al. 2019), emphasised the need for more detailed study focused on shell ornaments.

Mokrin yielded particularly rich assemblage of shell ornaments (see Girić 1971 for details), while at the site of Ostojićevo shells were less frequent (Vitezović 2021).

All the osseous ornaments today kept in the National Museum in Kikinda were analysed by the author from the technological and typological viewpoint, with particular emphasis on the raw material selection, traces of manufacture and traces of use (see Vitezović 2016 and references therein). The species of the shells were determined by macroscopic analysis and following reference work on main biology and archaeological shells (Álvarez Fernández 2006; Bar-Yosef Mayer 2008; Borrello 2004; Borello, Micheli 2004; Dance 1992; Dimitrijević 2014; Dimitrijević, Tripković 2006; Negra, Lipparini 2004; Taborin 1993, et al.).⁴ Artefacts were examined with hand lens and USB microscope with 5x-50x enlargements, and selected items from Mokrin were examined with the Scanning Electron Microscope at The Faculty of Mining and Mineralogy, University of Belgrade. The analytical criteria for the technological and functional interpretations follow previously published work (in particular, Bonnardin 2008; 2009; Cristiani et al. 2020; d'Errico 1993; Dupont et al. 2014; Francis 1982; Guzzo Falci 2015; Guzzo Falci et al. 2018; Mărgărit et al. 2018; Winnicka 2016; et al.).

SHELL ORNAMENTS FROM THE CEMETERIES OF OSTOJICEVO AND MOKRIN: THE TECHNO-TYPOLOGICAL AND FUNCTIONAL ANALYSES

Dentalium (*Scaphopoda*) shells

Ornaments usually labelled as *Dentalium* beads in fact encompass diverse shells of the class *Scaphopoda*, which are marine molluscs commonly known as “tusk” or “tooth” shells. While *Dentalium* is a commonly used term, recently it was pointed that “*Scaphopoda* shells” or “*Scaphopoda* beads” are more appropriate terms (Kurzawska et al. 2013). *Scaphopoda* shells have a shape of an elongated, usually curved, tapered tube, open at both ends. They may be smooth or sculptured, and their length is usually from 2 to 50 mm. Complete *Scaphopoda* shells usually have a very narrow apex, 1 mm or less in diameter. Therefore, for use as beads shells were used that had an apex already broken or one that had been intentionally removed (see Bar-Yosef Mayer 2008; Kurzawska et al. 2013).

⁴Selected items from Mokrin were double checked with dr. Biljana Mitrović from the Natural history museum in Belgrade – see Ljuština et al. 2019 for details. Also, the website <http://www.marinespecies.org/> was consulted.



Fig. 2. Reconstructed necklace containing *Dentalium* beads (Mokrin, grave no. 215)

Dentalium (*Scaphopod*) beads were recovered at both Mokrin and Ostojićevo (Figs. 2, 9 and 10). Their length is usually around 25 mm, and their width 5 – 7 mm. Their surfaces are not well preserved, therefore, it is difficult to determine whether they were fossil shells or not.⁵ Also it is difficult to analyse the manufacturing and use wear traces. Their ends are smooth, therefore, it was not possible to determine whether they were used as collected or whether they had been modified (ends cut off or snapped off) (cf. Bar-Yosef Mayer 2008). Their outer surfaces are in some specimens, damaged by taphonomic agents because they have stains and concretions. However, certain smoothing and polish of the surfaces caused by use may be noted on some of the specimens.

At Ostojićevo, within burial no. 120 five *Dentalium* (*Scaphopod*) beads were discovered, and within burial no. 186 only two. At Mokrin, they are more frequent as one or several beads were noted in twenty-eight graves (Girić 1971). They were usually located either in the neck area (e.g., graves nos. 97, 136, 182, 215, 227), suggesting they were most likely part of a necklace, or in the waist area (e.g., graves no. 139, 228), suggesting they were decorations on the belt or some other piece of garment or something similar. These ornamental items have been interpreted as sashes by O'Shea 1996, however, it is possible that some of these beads were part of some other ornamental item. Usually, *Dentalium* (*Scaphopod*) shells were found along with other decorative objects such as perforated teeth, bone beads or metal ornaments, suggesting they were mixed and combined together into different jewellery types (Girić 1971).

Bivalvia shells

Among utilised *Bivalvia* shells, *Glycymeris*, *Cardidae* and *Unio* shells were identified with certainty, and there is also the possibility that among some poorly preserved items additional species were represented. *Bivalvia* shells were usually found to have been modified

⁵ The criteria for distinguishing fossil from fresh molluscs follow Dimitrijević, Tripković 2006; cf. also Dimitrijević 2014 for the availability of fossil *Dentalium* shells in the Danube valley. However, the small sample size and poor preservation at Ostojićevo do not allow firm conclusions regarding the origins of the molluscs.



Fig. 3. *Cardium* shell with perforation (Mokrin, grave no. 252)



Fig. 4. *Glycymeris* shell with perforation (Mokrin, grave no. 245)

into applications. For example, one valve had been used and perforation was added at the apex. These shells were generally poorly preserved, with eroded surfaces and in general they were fragmented. In addition, perforations had intensive traces of wear, therefore it was not possible to reconstruct with certainty the method of manufacture. Most likely the shell surface was first abraded and then pierced. Use wear consisted of polish and sometimes the perforation was not regular, but deformed from use.

At Ostojićevo, only the *Glycymeris* shells were identified with certainty because some of the shells were too fragmented. They were not as frequent. Five were discovered within grave no. 120 and three within grave no. 230. At Mokrin, *Glycymeris* and *Cardidae* shells were found in several graves (Figs. 3 and 4) including graves nos. 69 and 155, with rich shell ornaments (seven *Cardium* shells and one gastropod shell in grave no. 69, and seven different *Bivalvia* in grave no. 155) (Fig. 8), as well as single finds or just a few shells from grave nos. 53, 73, 247 or 286 (Girić 1971). They were discovered both at the neck and waist areas of skeletons, suggesting they were part of diverse ornamental items such as necklaces, belts or sashes, etc.

Shells of freshwater mollusc *Unio* were recovered from several graves. One was found at Ostojićevo (grave no. 250), and several at Mokrin (including graves nos. 201, 205, 207, 213,

219 and 244) (Girić 1971; Vitezović 2021). Some of them did not have traces of modification, while some were not sufficiently preserved to determine whether they were intentionally perforated or not. Shells that were certainly intentionally perforated and used as ornaments are rare, but include, for example, a shell discovered in grave no. 246 at Mokrin. This shell was modified in the same manner as the marine *Bivalvia* shells. It had perforation at the apex and was slightly worn from use.

Bivalvia shells were also used for the production of discoid beads. These beads were rather small in size, and had been made from segments of different shells. Usually the perforation was made first and then the outer surfaces were smoothed and polished in order to obtain their final shape (cf. Francis 1982 for the reconstruction of this manufacturing method). Shell discoid beads were not very frequent. The majority of discoid beads were made from other materials. Usually, these beads were discovered near the neck area of the skeletons (Girić 1971), suggesting they were most likely combined into necklaces.

Columbella shells

Columbella is a genus of small sea snails, marine gastropod molluscs in the family *Columbellidae*. *Columbella* shells discovered at Mokrin were first interpreted as being fossil shells (Girić 1971), however, recent examination of some of them revealed that these were fresh shells, most likely all of them *Columbella rustica* (Ljuština et al. 2019). *Columbella* shells were used for beads. At the mesial part of the shell a perforation was made, usually of irregular circular shape, that could have been produced by direct or indirect percussion (see Cristiani et al. 2020 for experimental research on possible methods of making perforations). The top part of the shell could be removed and left open.

Columbella rustica shell beads were found at both Ostojićevo and Mokrin (Figs. 5 and 11). They had perforation, made by piercing in the middle of the shell, usually of irregular circular shape. The majority of them were intensively used. Besides worn perforations, surfaces also displayed polish and weathering, with prominent parts sometimes abraded (Fig. 6). At Ostojićevo, *Columbella* beads were rare. They were noted within three graves only; seven beads within grave no. 208, two in grave no. 230, and just one within grave no. 283 (Vitezović 2021). At Mokrin, they occurred in twenty-eight graves (Figs. 5, 9, 10 and 11). From some graves only a few shells were recovered, while in several they were quite numerous. For example, just one bead was found in grave no. 305, eleven were found in grave no. 38, while from grave no. 104 seventy-three shells were recovered. Individuals buried in these graves were mainly adults (21 individuals), both male (12) and female (14) (Girić 1971).

Columbella beads were used and combined with other decorative objects into composite jewellery or garments, such as head ornaments, sashes or belts, etc. For example, in grave no. 136 in the neck area were discovered one perforated animal tooth, three *Dentalium* beads and three *Columbella* beads, along with thirteen kaolin beads (Girić 1971, 106 – 107). In the graves nos. 74 and 90, they were discovered behind the back of the skeleton, along with bronze buttons (Girić 1971, 76, 84) (Fig. 11). In grave no. 129, *Columbella* beads were noted behind the skull, so they could have been either part of the necklace or head garment. In grave no. 242 were discovered remains of a belt, probably made from leather, with applications on it and buttons made from copper. Some buttons were scattered in the vicinity, along with thirteen *Columbella* beads, that were most likely part of the same belt (Girić 1971, 152 – 153).

At Mokrin, *Columbella* beads were encountered in graves that are considered rich (Girić



Fig. 5. *Columbella* beads (Mokrin, grave no. 246)

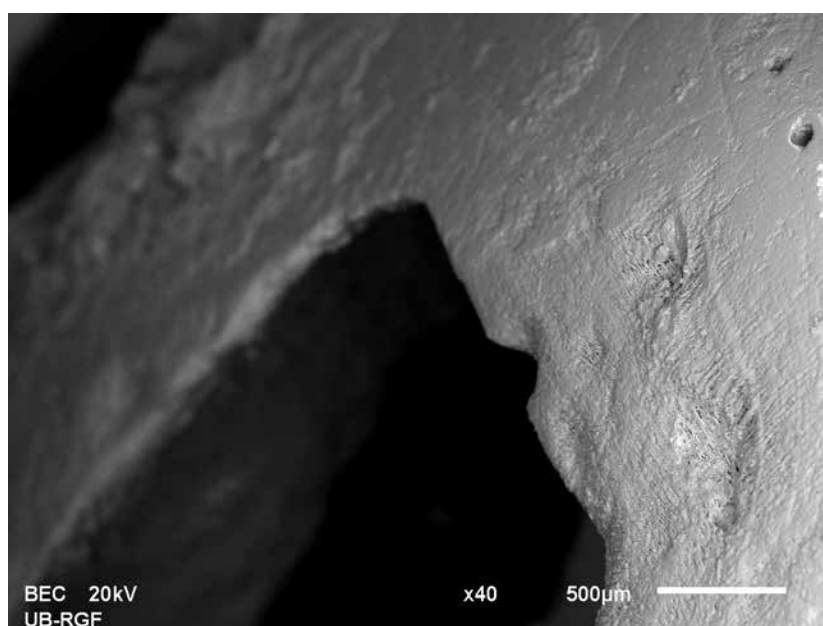


Fig. 6. Detail of the perforation on one of the *Columbella* beads from Mokrin, photo taken with SEM

1971; see also Ljuština et al. 2019). Golden ornaments were discovered within thirteen graves at Mokrin, and five of them also contained *Columbella* beads. For example, in grave no. 7, a head ornament with nine *Columbella* beads was found, along with pendants made from golden wire (Girić 1971, 40 – 41), while in grave no. 123 one *Columbella* bead was discovered, along with several ornamental items made from gold (Girić 1971, 100). The richest finding of *Columbella* beads, from grave no. 104, where in the waist area 73 shells were discovered, also included several hundred kaolin beads, over seventy perforated teeth, thirty-two bone beads, and ten salteleons made from copper; probably decoration on a belt or other clothing item (Girić 1971, 91).

It is interesting to note that one such bead was discovered at the Maros culture settlement of Pecica-Șanțul Mare in Romania (Nicodemus, Lemke 2016, Fig. 2b), showing these items were worn daily and were not restricted to funeral equipment.

Gastropoda and other shells

Besides these shells, several ornaments made from other mollusc species were also discovered. The majority of them, however, were badly preserved, and it is not possible to say more regarding their species or what type of ornament they could have been part of. Some of them were fragments of some *Gastropoda* shells and may be classified into a group of irregular beads. For example, in grave no. 245 at Mokrin, one fragmented gastropod shell was found, only its innermost segment, most likely used as some type of bead (Fig. 7). This insufficient preservation may be due to taphonomic agents, although it is possible that some of them were in fact recycled from broken pieces of other shell ornaments.

DISCUSSION

Shells used for ornaments in the Maros culture include a variety of species. They include *Dentalium* (*Scaphopod*), several different *Bivalvia*, both marine and freshwater, *Columbella*, as well as a few more species that could not be identified with certainty which occurred in small quantities. These were the shells used for ornaments in numerous other prehistoric cultures, since the Palaeolithic period (e.g. Álvarez Fernández 2006; Bar-Yosef Mayer 2005; Cattelain 2012; Ifantidis 2019; Taborin 1993), in more or less the same manner. *Dentalium* (*Scaphopod*)



Fig. 7. Fragmented gastropod (Mokrin, grave no. 245)

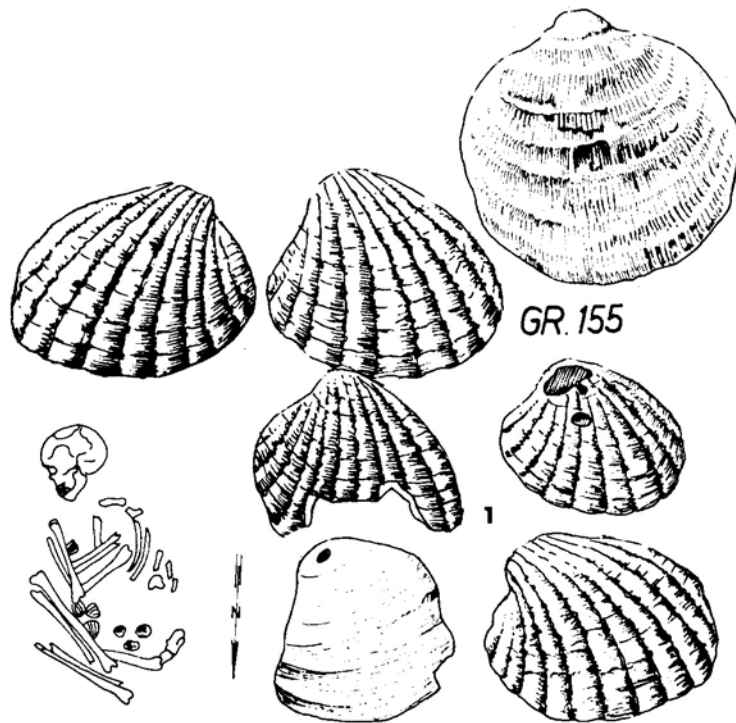


Fig. 8. Mokrin, grave no. 155, with ornaments made from *Bivalvia* shells (after Girić 1971: t. 43)

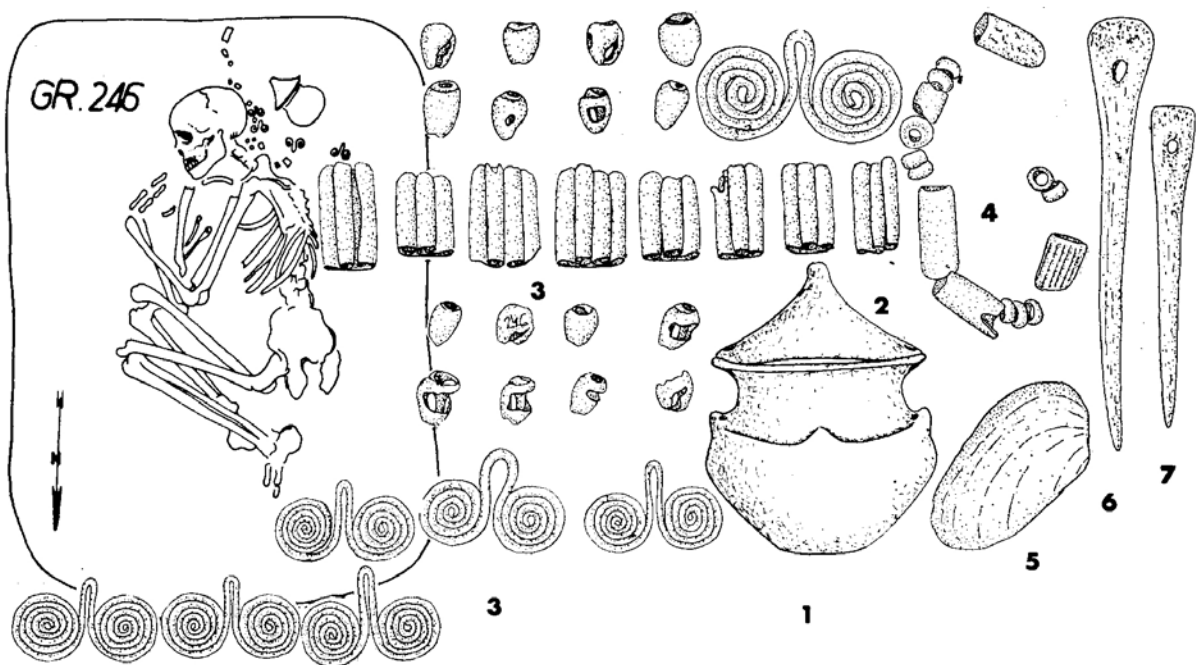


Fig. 9. Mokrin, grave no. 246, containing *Columbella* and *Dentalium* beads (after Girić 1971: t. 66)

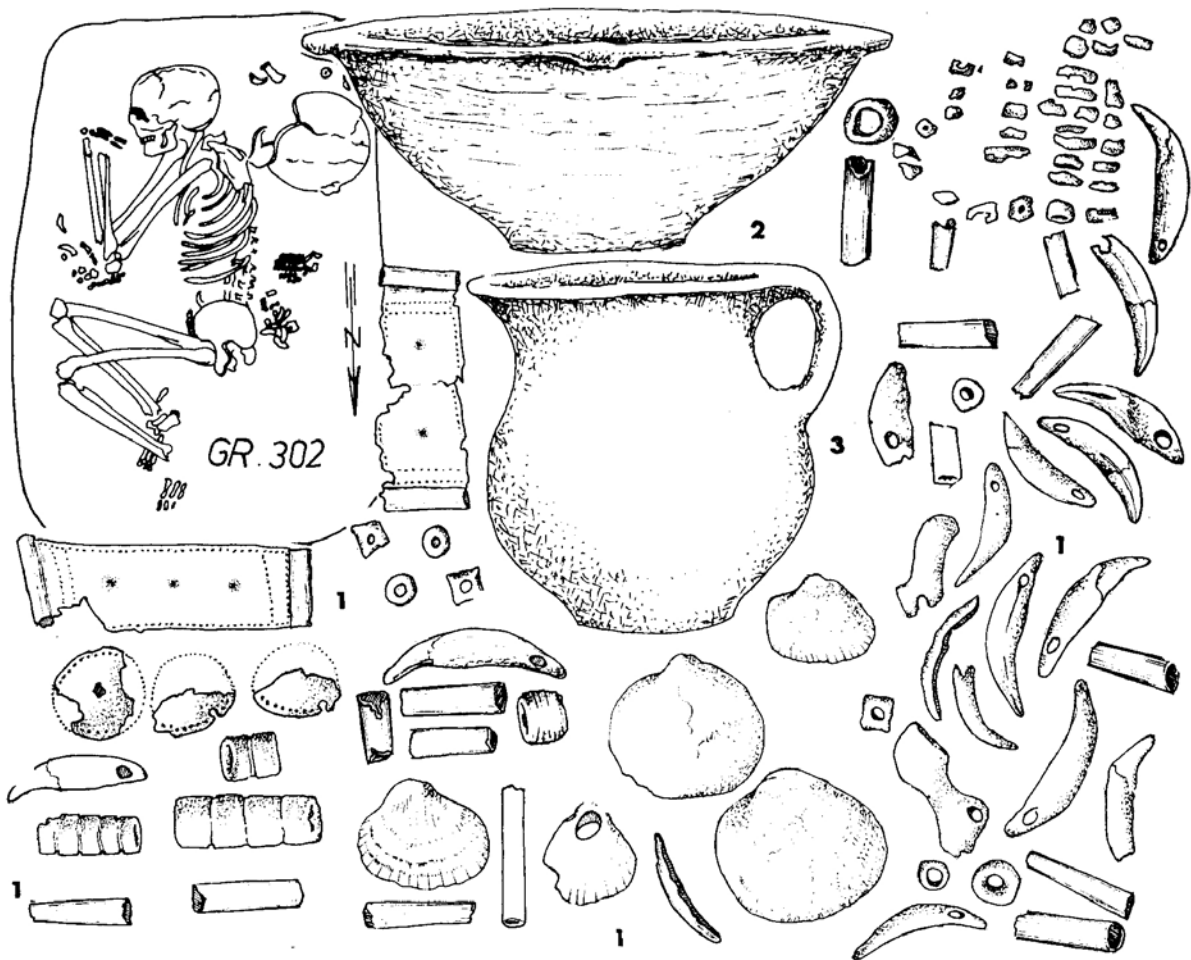


Fig. 10. Mokrin, grave no. 302, containing *Dentalium*, *Columbella* and *Cardium* shells (after Girić 1971: t. 80)

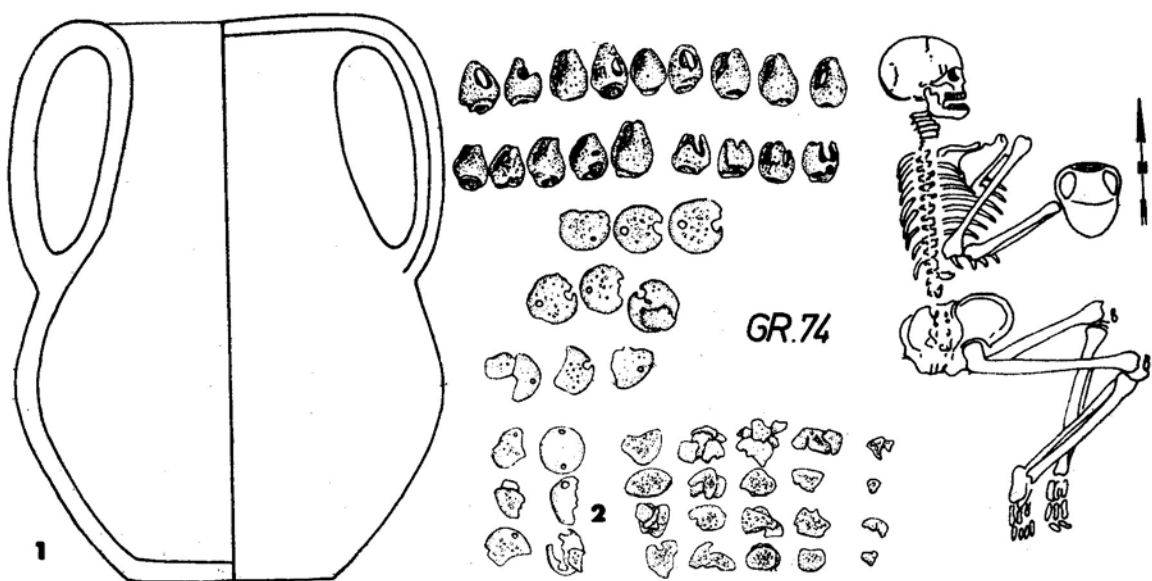


Fig. 11. Mokrin, grave no. 74, with *Columbella* beads (after Girić 1971: t. 20)

and *Columbella* were used for beads as found or with minimal modifications, while *Bivalvia* shells were modified into applications and beads.

There were several methods for acquiring shells. Freshwater shells were obtained locally, most likely directly collected by the community that used them, while marine shells were acquired through exchange. There is a possibility that some fossil shells were used, but it is difficult to determine whether they were acquired directly by Maros culture communities or whether they were part of a wider trade network.

Although there were some differences in the frequency of shell ornaments discovered at Mokrin and Ostojićevo, they did not show major differences regarding the types and modes of use, suggesting there was some common fashion and/or common symbolical meaning and value of these ornaments among Maros culture communities. Comparing with other Maros culture cemeteries, Mokrin has particularly rich and diverse shell ornaments. For example, the grave of a female no. 246 contained a head ornament with sixteen *Columbella* beads, a necklace with five *Dentalium* beads, and there was one *Unio* shell in the left hand (Girić 1971, 155 – 156) (Fig. 9). In grave no. 302, where an adult woman was buried, a head ornament consisting of thirteen *Dentalium* beads, two *Columbella* beads, seven *Cardium* shells, and other elements made from animal teeth and other raw materials was discovered (Girić 1971: 186 – 187) (Fig. 10).

At other Maros culture cemeteries, shells were rather rare. Head ornaments containing *Columbella* beads were noted within three graves at Szöreg, while at the sites of Deszk F, Ószentiván, Pítvaros or Óbéba they were not found (O'Shea 1996, 111). The items decorated with *Cardium*, *Columbella* and/or *Dentalium* shells, interpreted as sashes, again were the most frequent and the richest at Mokrin. At Deszk F, just one *Dentalium* and *Columbella* were found, while *Cardium* was not present, while at Szöreg three graves contained *Dentalium* ornaments (10, 2 and just one piece – the one with ten specimens of *Dentalium* also contained four *Cardium* shells), and *Columbellae* were present in two graves (O'Shea 1996, 116).

RESULTS

Shell ornaments were most often used in combination with ornaments made from other raw materials, either of animal origin, such as perforated teeth, kaoline or metal. Use wear traces were not well preserved in some of the examples. However, we should note that some specimens had quite prominent use wear traces. On beads from *Columbella* shells there were the best-preserved traces of intensive use. Their perforations were heavily worn and often deformed (Fig. 6). This suggests that the jewellery items that contained these beads were not made just for burial purposes, but were used during everyday life, and this is supported by the finds from settlements, such as one shell from the site of Pecica-Şanţul Mare (Nicodemus, Lemke 2016).

Long usage noted on the majority of the shell ornaments, suggests that they were valued, and there is also a possibility that some of the ornaments were inherited, since some of the beads were found in graves of younger individuals. For example, grave no. 247, where a young girl was buried, contained a necklace composed of *Dentalium* beads and perforated teeth, and in the hand of the buried individual was one *Cardium* shell (Girić 1971, 15 – 157). Their presence in graves with richer funerary equipment, including gold jewellery also supports the hypothesis they were valued, and probably also displayed wealth and prestige. Shells were associated with both male and female graves, but it is possible that they had played a certain role in displaying identity, perhaps that of group belonging.

CONCLUDING REMARKS

Shells were an important part of the material culture of the Maros culture communities. They were valued items, probably representing wealth and prestige, and perhaps also used to indicate group or individual identity. This was suggested by their long functioning and by their presence in graves in association with rich burial equipment, including gold. They also revealed a complex pattern of trade and exchange routes among the Bronze Age communities not only in the region of the southern Carpathian basin, but also in more distant areas.

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REFERENCES:

- Alberti 2008:** M. Alberti. Murex shells as raw materials: purple industry and its by-products. Interpreting the archaeological record. – *Kaskal* 5, 2008, 73 – 90.
- Álvarez Fernández 2006:** E. Álvarez Fernández. Los objetos de adorno-colgantes del Paleolítico Superior y del Mesolítico en la Cornisa Cantábrica y en el Valle del Ebro: una visión europea, PhD thesis, Ediciones Universidad de Salamanca, Salamanca, 2006.
- Álvarez Fernández, Carvajal Contreras 2010:** E. Álvarez Fernández, Carvajal Contreras. Not only Food. Marine, Terrestrial and Freshwater Molluscs in Archaeological Sites. – Proceedings of the 2nd Meeting of the ICAZ Archaeomalocology Working Group (Santander, February 19th – 22nd 2008), Munibe, Suplemento 31, Sociedad de Ciencias Aranzadi, San Sebastián, 2010.
- Bar-Yosef Mayer 2005:** D. E. Bar-Yosef Mayer. The exploitation of shells as beads in the Palaeolithic and Neolithic of the Levant. – *Paléorient* 31 (1), 2005, 176 – 185.
- Bar-Yosef Mayer 2008:** D. E. Bar-Yosef Mayer. Dentalium Shells Used by Hunter-Gatherers and Pastoralists in the Levant. – *Archaeofauna* 17, 2008, 103 – 10.
- Bar-Yosef Mayer 2011:** D. E. Bar-Yosef Mayer. Nawamis, Shells, and Early Bronze Age Pastoralism. – In: M. S. Chesson (ed.), *Daily life, materiality, and complexity in early urban communities of the southern Levant: papers in honor of Walter E. Rast and R. Thomas Schaub*. Winona Lake, Indiana. Eisenbrauns, 2011, 185 – 195.
- Bar-Yosef Mayer et al. 2009:** D. E. Bar-Yosef Mayer, B. Vandermeersch, O. Bar-Yosef. Shells and ochre in Middle Paleolithic Qafzeh Cave, Israel: indications for modern behavior. – *Journal of Human evolution* 56 (3), 2009, 307 – 314, <https://doi.org/10.1016/j.jhevol.2008.10.005>
- Bar-Yosef Mayer et al. 2017:** D. E. Bar-Yosef Mayer, C. Bonsall, A. M. Choyke (eds.). *Not just for show*, Oxbow books, Oxford, 2017.
- Bonnardin 2008:** S. Bonnardin. From traces to the function of ornaments: some neolithic examples. – In: L. Longo, N. Skakun (eds.), *Prehistoric Technology 40 years later: Functional studies and the Russian legacy*. – Proceedings of the International Congress, Verona (Italy), 20 – 23 April 2005. BAR International Series 1783, Archaeopress, Oxford, 2008, 297 – 308.
- Bonnardin 2009:** S. Bonnardin. La parure funéraire au Néolithique ancien dans les Bassins parisiens et rhénans. Rubané, Hinkelstein et Villeneuve-Saint-Germain. Paris. – Société Préhistorique Française, Mémoire XLIX, 2009.
- Borrello 2004:** M. Borello. Le conchiglie nella preistoria e nella protostoria. – *Preistoria Alpina*, Suppl. 1, vol. 40, 2004, 19 – 42.
- Borrello, Micheli 2004:** M. Borello, R. Micheli. *Spondylus gaederopus*, gioiello dell'Europa preistorica. – *Preistoria Alpina*, Suppl. 1, vol. 40, 2004, 71 – 82.

Çakırlar 2011: C. Çakırlar (ed.). Archaeomalacology revisited. Non-dietary use of molluscs in archaeological settings, Oxbow books, Oxford, 2011.

Cattelain 2012: P. Cattelain. Les parures au Paléolithique et au Mésolithique: coquillages, dents, os, ivoire et pierres... – In: P. Cattelain, N. Bozet, G. V. Di Stazio (eds.). La parure de Cro-Magnon à Clovis “Il n’y a pas d’Âge(s) pour se faire beau”. Éditions CEDARC, Paris, 2012, 7 – 35.

Claassen 1998: C. Claassen. Shells. Cambridge University Press, Cambridge, 1998.

Colonese et al. 2011: A. C. Colonese, M. A. Mannino, D. E. Bar-Yosef Mayer, D. A. Fad, J. C. Finlayson, D. Lubell, M. C. Stiner. Marine mollusc exploitation in Mediterranean prehistory: An overview – Quaternary International 239, 2011, 86 – 103.

Cristiani et al. 2020: E. Cristiani, A. Zupancich, B. Cvitkušić. Combining microscopic analysis and GIS to analyse experimental perforations on *Columbella rustica* shells. – In: M. Mărgărit, A. Boroneanţ (eds.). Beauty and the eye of the beholder. Personal adornments across the millennia. Cetatea de Scaun, Târgoviște, 2020, 27 – 40.

Dance 1992: S. P. Dance. Shells. London: Harper Collins Publishers, 1992.

d’Errico 1993: F. d’Errico. Identification des traces de manipulation, suspension, polissage sur l’art mobilier en os, bois de cervidés, ivoire. – In: P. Anderson, S. Beyries, M. Otte, and H. Plisson (eds.), Traces et fonction: Les gestes retrouvés. Études et recherches archéologiques de l’Université de Liège 50. Liège: Centre de Recherches Archéologiques du CNRS, Université de Liège, 1993, 177 – 188.

d’Errico et al. 2005: F. d’Errico, C. Henshilwood, M. Vanhaeren, K. van Niekerk. Nassarius kraussianus shell beads from Blombos Cave: evidence for symbolic behaviour in the Middle Stone Age. – Journal of Human Evolution 48, 2005, 3 – 24.

Dimitrijević 2014: V. Dimitrijević. The provenance and use of fossil scaphopod shells at the Late Neolithic/Eneolithic site Vinča-Belo Brdo, Serbia. – In: K. Szabó, C. Dupont, V. Dimitrijević, L. S. Gómez Gastélum, N. Serrand (eds.). Archaeomalacology: Shells in the Archaeological Record. Archaeopress, BAR International Series 2666, Oxford, 2014, 33 – 41.

Dimitrijević, Tripković 2006: V. Dimitrijević, B. Tripković. Spondylus and Glycymeris Bracelets: Trade Reflections at Neolithic Vinča-Belo Brdo. – Documenta praehistorica 33, 2006, 237 – 252.

Dupont et al. 2014: C. Dupont, L. Laporte, P. Courtaud, H. Duday, Y. Gruet. Perforated shells from an Early Mesolithic cemetery at La Vergne (Charente-Maritime, France): from acquisition to use and (sometimes) to wear. – In: K. Szabó, C. Dupont, V. Dimitrijević, L. S. Gómez Gastélum, N. Serrand (eds.). Archaeomalacology: Shells in the Archaeological Record. Archaeopress, BAR International Series 2666, Oxford, 2014, 43 – 52.

Forenbaher 1993: S. Forenbaher. Radiocarbon dates and absolute chronology of the central European Early Bronze Age. – Antiquity 67, 1993, 218 – 220, 235 – 256.

Francis 1982: P. Francis. Experiments with early techniques for making whole shells into beads. – Current Anthropology 23/6, 1982, 713 – 714.

Garašanin 1983: M. Garašanin. Moriška (mokrinska) grupa. – In: A. Benac (ed.). Praistorija jugoslavenskih zemalja IV. Bronzno doba, Sarajevo: Svjetlost, 1983, 476 – 491.

Girić 1971: M. Girić. Mokrin. Nekropola ranog bronzanog doba. Washington, Kikinda and Beograd: Smithsonian Institution. – Washington, Narodni muzej Kikinda and Arheološko društvo Jugoslavije.

Guzzo Falci 2015: C. Guzzo Falci. Stringing beads together: a microwear study of bodily ornaments in late pre-Colonial north-central Venezuela and north-western Dominican Republic. Master thesis, University of Leiden, Leiden, 2015.

Guzzo Falci et al. 2018: C. Guzzo Falci, J. Cuisin, A. Delpuech, A. van Gijn and C. L. Hofman. New Insights into Use-Wear Development in Bodily Ornaments Through the Study of Ethnographic Collections. – Journal of Archaeological Method and Theory 26 (2), 2018, 755 – 805; <https://doi.org/10.1007/s10816-018-9389-8>

Harding 2004: A. Harding. *European Societies in the Bronze Age*. Cambridge University press, Cambridge, 2004.

Ifantidis 2019: F. Ifantidis. *Practices of personal adornment in Neolithic Greece*. Archaeopress Publishing Ltd, Oxford, 2019.

Ifantidis, Nikolaidou 2011: F. Ifantidis, M. Nikolaidou (eds.). *Spondylus in prehistory. New data and approaches*. BAR International Series 2216, Archaeopress, Oxford, 2011.

Kurzawska et al. 2013: A. Kurzawska, D. E. Bar-Yosef Mayer, H. K. Mienis. *Scaphopod Shells in the Natufian Culture*. – In: O. Bar-Yosef, F. R. Valla (eds.). *Natufian Foragers in the Levant. Terminal Pleistocene Social Changes in Western Asia*. International Monographs in Prehistory Archaeological Series 19. Ann Arbor, Michigan, 2013, 611 – 621.

Ljuština et al. 2019: M. Ljuština, M. Krečković, T. Radišić. Notes on *Columbella* shells from the Bronze Age necropolis Mokrin, Northern Serbia. – In: V. Sîrbu, A. Comşa, D. Hortopan (eds.). *Digging in the Past of Old Europe. Studies in Honor of Cristian Schuster at his 60th Anniversary*. Editura Istros a Muzeul Brăilei “Carol I”, Târgu Jiu – Brăila, 2019, 189 – 202.

Mărgărit 2008: M. Mărgărit. Les perles en valves de *Unio* dans l’habitat énéolithique de Hâr. – *Annales d’Université „Valahia” Târgoviște, Section d’Archéologie et d’Histoire*, tome X, n. 1, 2008, 73 – 77.

Mărgărit et al. 2018: M. Mărgărit, P. Mirea, V. Radu. Exploitation of aquatic resources for adornment and tool processing at Măgura ‘Buduiasca’ (‘Boldul lui Moş Ivănuş’) Neolithic settlement (southern Romania). – *Quaternary International* 472, Part A, 5 April, 2018, 49 – 59. <https://doi.org/10.1016/j.quaint.2017.10.032>

Mărgărit, Dimche 2019: M. Mărgărit, M. Dimache. Personal adornments from the Eneolithic necropolis of Chirnogi-Şuviţa Iorgulescu (Romania). – *Documenta Praehistorica* 46, 2019, 398 – 413. <https://doi.org/10.4312/dp.46.25>

Mărgărit, Boroneanţ 2020: M. Mărgărit, A. Boroneanţ (eds.). *Beauty and the eye of the beholder. Personal adornments across the millennia*. Cetatea de Scaun, Târgovişte, 2020.

Milašinović 2008: L. Milašinović. *Grobovi moriške kulture nekropole bronzanog doba u Ostojićevu*. MPhil thesis. Belgrade: Faculty of Philosophy, University of Belgrade, 2008.

Milašinović 2009: L. Milašinović. *Osvrt na moguću rekonstrukciju društvene strukture na moriškom sloju nekropole u Ostojićevu* (Review on possibility of socail structure reconstruction on the Maros culture finds from the necropolis at Ostojićevo). – *Rad Muzeja Vojvodine* 51, 2004, 65 – 70.

Negra, Lipparini 2004: O. Negra, G. Z. Lipparini. *Gasteropodi, Bivalvi, Scafopodi*. – *Preistoria Alpina*, suppl. 1, vol. 40, 2004, 9 – 14.

Nicodemus, Lemke 2016: A. Nicodemus, A. K. Lemke. Specialized bone working in the bronze age? The organization of production at Pecica-Şanţul Mare, Romania. – *Cuadernos del Instituto Nacional de Antropología y Pensamiento Latinoamericano*. – *Series Especiales* 3/2, 2016, 103 – 20.

O’Shea 1996: J. O’Shea. *Villagers of the Maros. A Portrait of an Early Bronze Age Society*. New York/London, Plenum Press, 1996.

Reese 1987: D. S. Reese. Palaikastro shells and Bronze Age purple-dye production in the Mediterranean Basin. – *The Annual of the British School of Archaeology at Athens* 82, 1987, 201 – 206.

Séfériadès 2010: M. L. Séfériadès. *Spondylus and long-distance trade in prehistoric Europe*. – In: D. Anthony (ed.) *The Lost World of Old Europe: The Danube Valley 5000 – 3500 BC. Lost world of Europe. The Danube Valley 5000 – 3500 BC*. The Institute for the study of the Ancient World, Princeton University Press, New York, Princeton and Oxford, 2010, 178 – 190.

Szabó et al. 2014: K. Szabó, C. Dupont, V. Dimitrijevic, L. G. Gastélum, S. Gulyás, N. Serrand (eds.). *Archaeomalacology: Shells in the Archaeological Record*. Archaeopress. BAR International Series 2666, Oxford, 2014.

Taborin 1993: Y. Taborin. *La parure en coquillage au paléolithique*. – *XIX^e supplément à Gallia*

Préhistoire. CNRS Editions, 1993.

Taborin 2004: Y. Taborin. Langage sans parole. La parure aux temps préhistoriques. La Maison des roches, Paris, 1993.

Tasić 1974: N. Tasić. Bronzano doba. – In: B. Brukner, B. Jovanović & N. Tasić. Praistorija Vojvodine. Institut za izučavanje Istorije Vojvodine, Savez arheoloških društava Jugoslavije, Novi Sad, 1974, 185 – 256.

Todorova 2002: H. Todorova. Die Mollusken in den Gräberfeldern von Durankulak. – In: H. Todorova (ed.). Durankulak. Die Prähistorischen Gräberfelder. Band II, Teil 1, Sofia, 2002, 177 – 186.

Trubitt 2003: M. B. D. Trubitt. The production and exchange of marine shell prestige goods, – Journal of Archaeological Research 11, 2003, 243 – 277, <https://link.springer.com/article/10.1023/A:1025028814962>

Vanhaeren et al. 2006: M. Vanhaeren, F. d’Errico, C. Stringer, S. L. James, J. A. Todd, H. K. Mienis. Middle Palaeolithic Shell Beads in Israël and Algeria. – Science 321, 2006, 1785 – 1788.

Vanhaeren et al. 2013: M. Vanhaeren, F. d’Errico, K. L. van Niekerk, C. S. Henshilwood, R. M. Erasmus. Thinking strings: Additional evidence for personal ornament use in the Middle Stone Age at Blombos Cave, South Africa. – Journal of Human Evolution 64, Issue 6, June, 2013, 500 – 517, <https://doi.org/10.1016/j.jhevol.2013.02.001>

Vitezović 2016: S. Vitezović. Metodologija proučavanja praistorijskih koštanih industrija, Srpsko arheološko društvo, Beograd.

Vitezović 2017a: S. Vitezović. Jewellery from osseous materials in the bronze age in the southern Carpathian basin. – In: “Contact, circulation, exchange in past societies: approaches from the bone artefacts”. First meeting Uispp Commission Bone Artefact. 2 & 3 March 2017. University of Trnava, Trnava, 2017, 13.

Vitezović 2017b: S. Vitezović. Osseous raw materials as ornaments in the Bronze Age: the case study of Mokrin. – In: S. Vitezović, D. Antonović (eds.). Archaeotechnology studies: Raw material exploitation from prehistory to the Middle Ages. Srpsko arheološko društvo, Beograd, 201, 2017, 59 – 84.

Vitezović 2021: S. Vitezović. Osseous artifacts from the Maros-culture necropolis at Ostojićevo (northern Serbia). – In: M. Wild, B. A. Thurber, S. Rhodes, C. Gates St-Pierre (eds.). Bones at a Crossroads: Integrating Worked Bone Research with Archaeometry and Social Zooarchaeology, Sidestone Press, Leiden, 2001, 99 – 118.

Winnicka 2016: K. Winnicka. More than Meets the Eye: Microscopic and Technological Studies on Early Bronze Age Bone and Antler Beads from Kichary Nowe, South-Eastern Poland. – In: S. Vitezović (ed.). Close to the Bone: Current Studies in Bone Technologies, Institute of Archaeology, Belgrade, 2016, 376 – 394.

Използване на черупки от мекотели за орнаменти през бронзовата епоха в Южнокарпатския басейн

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РЕЗЮМЕ

Черупките от мекотели са се използвали за направата на орнаменти още от палеолита; някои от най-старите декоративни елементи в света всъщност са били изработени от мидени черупки. Гладките им повърхности и блестящите цветове са някои от причините те да бъдат естетически привлекателни за много праисторически общности. Орнаментите, направени от черупки, често са имали символична стойност – те са били използвани за показване на статут, престиж, принадлежност към група и могат да бъдат индикатори за търговски и обменни маршрути. Въпреки това те са получили по-малко внимание от изследователите. В тази статия ще бъде направен преглед на използването на черупки за орнаменти в културата Марос от бронзовата епоха в Южнокарпатския басейн. Досега те са били анализирани само в контекста на погребалния инвентар и връзката им с други накити. Те обаче могат да дадат допълнителна информация за някои от символните аспекти и културното отношение към определени суровини, както и някои аспекти на търговията и обмена.

Ключови думи: черупки от мекотели, *Columbella*, *Dentalium*, *Bivalvia*, орнаменти, бронзова епоха, култура Марос

