ARHEOLOGIJA I PRIRODNE NAUKE
ARCHAEOLOGY AND SCIENCE

NO. 8 (2012)

ARHEOLOGIJA I PRIRODNE NAUKE

Center for New Technology
Archaeological Institute Belgrade

ARCHAEOLOGY AND SCIENCE 8 2012

Belgrade 2013

Centar za nove tehnologije
Arheološki institut Beograd

ARHEOLOGIJA I PRIRODNE NAUKE 8 2012

Beograd 2013.

Published:
Center for New Technology Viminacium
Archaeological Institute Belgrade
Kneza Mihaila 35/IV
11000 Belgrade, Serbia
e-mail: cnt@mi.sanu.ac.rs
Tel. +381 11 2637191

For the publishers:
Miomir Korać
Slaviša Perić

Editor-in-chief:
Miomir Korać

Translation:
Milica Tapavički-Ilić

Lecturer:
Dave Calcutt

Graphic design:
Nemanja Milićević

Print:
Digital Art Company Beograd

Printed in:
500 copies

ISSN 1452-7448

Izdavači:
Centar za nove tehnologije Viminacium
Arheološki institut Beograd
Kneza Mihaila 35/IV
11000 Beograd, Srbija
e-mail: cnt@mi.sanu.ac.rs
Tel. +381 11 2637191

Za izdavače:
Miomir Korać
Slaviša Perić

Urednik:
Miomir Korać

Prevod:
Milica Tapavički-Ilić

Lektor:
Dejv Kalkat

Dizajn i tehničko uređenje:
Nemanja Milićević

Štampa:
Digital Art Company Beograd

Tiraž:
500 primeraka

ISSN 1452-7448

CONTENTS

ROKSANA CHOWANIEC,
University of Warsaw, Institute of Archaeology,
Warsaw, Poland
email: roksana.chowaniec@uw.edu.pl

MATERA MARCIN,
University of Warsaw, Institute of Archaeology,
Warsaw, Poland

UDC: 904:738.6”652”(450.82);
902.2(450.82)”2010”
Original research article
Received: May 13th 2013
Accepted: October 15th 2013

NEW TERRACOTTA FIGURINE OF DEMETER/CERES FROM THE SOUTH–EASTERN SICILY

ABSTRACT

On a southern hill slope facing the Tellaro River valley, in the autumn of 2010 during a field survey, the new female terracotta figurine has been found. The figure can be interpreted as a representation of the goddess Demeter/Ceres, whose cult was very common in Sicily. However newly discovered terracotta coming from a context dated by the accompanying ceramic assemblage to the Middle Imperial period.

Keywords: terracotta figurine, Demeter/Ceres, field survey, pottery, cult.

To a dynamically developing Rome the island of Sicily appeared tempting as much for its fertile land as for, and perhaps foremost, its strategic location. Conquering it and other islands on the Mediterranean Sea weakened Carthage, Rome’s biggest rival in the 3rd century BC. (Bringmann 2007: 107–108). According to the relation between Rome and local cultures on Sicily cf. Language and Linguistic Contacts in Ancient Sicily, O. Tribulato (ed.), Cambridge 2012; Wilson R.J.A., Hellenistic Sicily, c. 270-100 BC, in The Hellenistic West. Rethinking in Ancient Mediterranean, J.W.W. Prag, Quinn J.C. (eds.), Cambridge 2013, 79-119.

Upon closer investigation of historical and archaeological sources, the seemingly well studied history of the first Roman *provincia* reveals many gaps and uncertainties. These are due mostly to the state of research, but also to meagre scholarly interest in the archaeology of Sicily after the Punic wars. There are multiple unanswered questions, like how did the Greek colonies change after the 212-210 BC, the year that Marcus Claudius Marcellus sealed the conquest of Sicily? (The military operation followed a renouncement of the alliance with Rome by Hieronymus, ruler of Syracuse, successor and grandson of Hiero II, who had sought instead the help of the enemy in Carthage.) How was the island’s economy restructured after that? Did the new, foreign, Roman administration and the presence of Rome in an agriculturally rich Sicily turn cities into rural centres and the countryside into a food resource? What did direct subordination to Roman authority mean for the Greek colonies and was Roman rule effective enough to penetrate island structures?

From Cicero we know that in Sicily the Romans experimented with governing newly conquered peoples, learning how to dominate by trial and error (Cicero II.1.2; cf also Clemente 1980:

105; Zambon 2008). First and foremost, officials were dispatched to Sicily and Sardinia already in 227 BC, swelling thus the praetors' ranks. By the end of the Second Punic War Rome's control over Sicily was judged firm enough for the praetor's role to be reduced to administration, legislation, and tax collection. However, the island remained proud and in a sense it retained its independence with local traditions lingering in the shadow of Roman expansion. For example, Greek remained Sicily's commonly spoken tongue until the end of the 1st century BC (Fraschetti 1981: 51–77; Wilson 1990a: 67), and perhaps even longer, despite the Roman conquest.[1] Greek models of civic organisation, literature and law were adopted by Roman colonists (on lasting Greek traditions, cf.: Vermeule 1977; Gazda and Haeckl (ed.) 1994) and the works of Greek historians: Timaios of *Tauromenion* (modern Taormina) and Philinos of *Akragas* (modern Agrigento) continued to be the main sources for studying Roman history (Bringmann 2007: 118, no. 2). Moreover, the Greek heritage influenced Roman culture and religion.[2] Romans banned participation in ceremonies dedicated to foreign cults, but in practice it was impossible to control the enforcement of this law, especially in distant Sicily, where the attitude towards the Roman state was fairly anarchistic in many places.

Most likely, lasting Greek religious customs and their influence on Roman culture appear to be exemplified by a newly discovered terracotta figurine 'coming' from a context of the other pottery finds, dated to the Middle Imperial period. The site is situated not far from Contrada Granieri–Contrada Olia (Alia)–Contrada Sbriulia, com. Noto, prov. Siracusa, south of Valle Ruglia. It was found in the autumn of 2010[3] during a field survey carried out with appropriate permits on the grounds of an agreement signed between the Institute of Archaeology of the University of Warsaw and Soprintendenza dei Beni Culturali e Ambientali di Siracusa[4] represented by the Director of the Servizio Beni Archeologici Dr Rosa Lanteri[5]. The site lies on a southern hill slope facing the Tellaro River valley. It is exposed ground with a gradient reaching 45 degrees (Fig. 1). The uncovered finds must have been washed down the slope from the summit and were dispersed evenly over an area of 120 ares. The nature of the finds and the location indicate that the site was a settlement. It may have been a farm, which would hardly come as a surprise, given the fertility of the surrounding land.

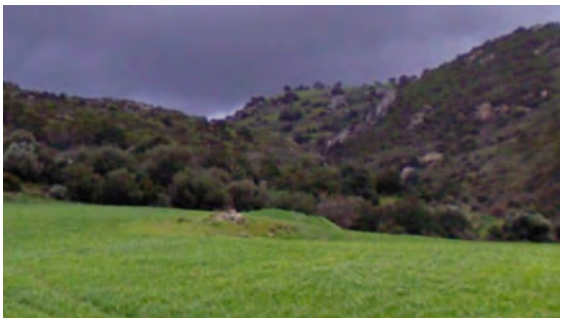


Fig. 1 The view on the site and neighborhood

The female terracotta figurine is preserved from the thighs up (Fig. 2). The uncovered fragment measures 14.4 cm in height and a maximum of 0.9 cm in width. The clay is light beige with dark pink core, containing medium–grained inclusions of limestone and quartz. The outer surface of the statuette is somewhat porous and severely calcified. The figure portrays a standing female. Her right hand holds a 'torch' vertically against the right side of her body, the upper part of the object resting against her shoulder. Simplified features can be distinguished in the oval face. The tall headdress, *polos*, on her head terminates in a veil that flows to the shoulders and is clearly visible in front. The figure is clad most probably in a long dress (chiton?) and a shawl, *epiblema*, draped around the shoulders. The terracotta was mould–made and is hollow inside. The back is slightly

1 Also Latin inscriptions are practically absent from Sicily prior to the invasion by Sextus Pompeius, cf. Wilson 1990: 30. New evidence Tribulato O., Siculi bilingues? Latin in the inscriptions of early Roman Sicily, in Language and Linguistic Contacts in Ancient Sicily, O. Tribulato (ed.), Cambridge 2012, 291-325.

2 E.g. the introduction of the cult of Cybele in Rome already at the end of the Second Punic War or the diffusion of the cult of Aphrodite of *Eryx* (Erice) in 215 BC (cf: Spaeth 1996: 12–13).

3 The researches have been possible thanks to the grant of the National Science Centre (N N109 104940), as well as private sponsors.

4 The documentation and artifact have been presented immediately to the Soprintendenza dei Beni Culturali e Ambientali di Siracusa.

5 I would like to thank warmly all the participants of the 2010 season at *Akrai*. Special sincere thanks I would like to dedicate for Dr Rosa Lanteri and Marta Fituła (R.CH.).

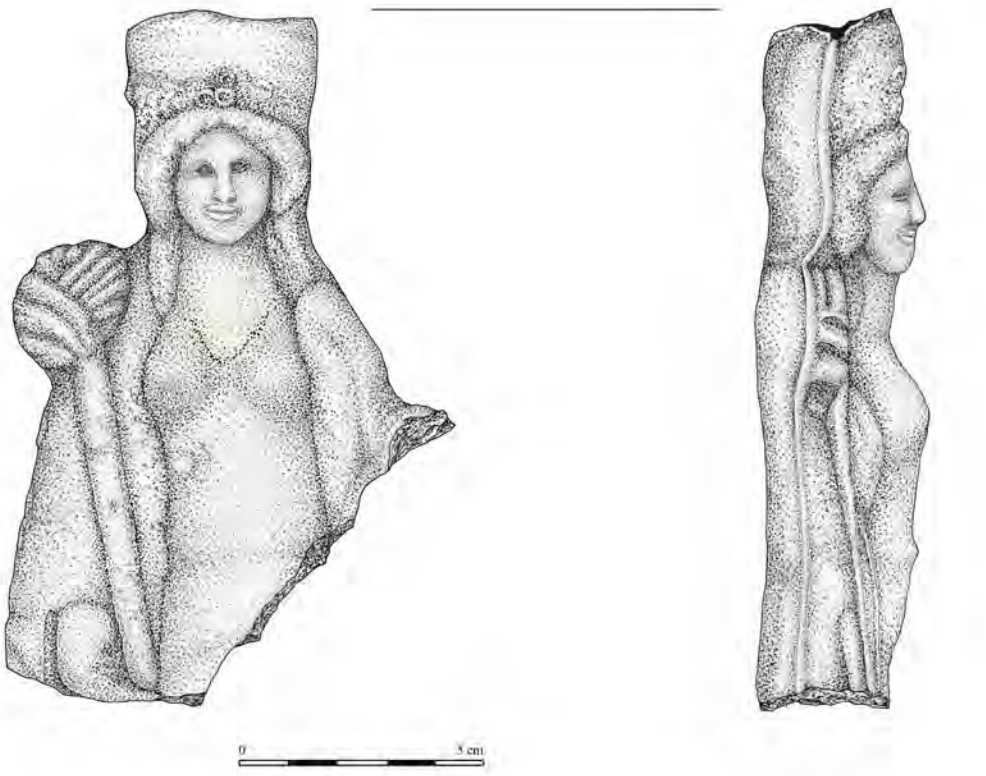


Fig. 2 The new terracotta figurine. Draw by P. Szczęsnowicz and K. Dejtrowska

convex and there is an oval opening on the left side in the middle (fragmentarily preserved). The base, on which the figurine had once stood, is not preserved. The terracotta has been made roughly and the drawing of details is imprecisely.

The figure could be interpreted as a representation of the goddess Demeter/Ceres, whose cult was very common in Sicily (cf. Hinz 1998). The cult of Demeter, in Rome referred to as Ceres, Mother Earth, a goddess of nature, good harvest and fertility, and especially of cereals, was particularly popular on the island (cf. for example: Ciacieri 1895; Gentili 1959–1960; Voza 1976–1977; Polacco 1986 and many others). These beliefs did not have much in common with the original mother–goddess cult. The Sicilian cult had especially importance in regions[6] where agriculture had always constituted the foundation of the local economy, as well as on very specially religion and political situation in each colony. Imitations of Eleusinian Mysteries were organised throughout the Greek world (Kubiak 1999: 218–219). Demeter as the bringer of seasons was also exalted in poetry, an example of which is a Homeric hymn in her praise: *I begin to sing of Demeter, the holy goddess with the beautiful hair (...) Lady Demeter, bringer of* hôrai, *giver of splendid gifts* (Foley 1994). The goddess was also the subject of writings by Diodorus Siculus (V.1–3) and Cicero (II.4.106), who described her cult in Sicily, Ovid, who pointed out the existence of a lively cult centre of Demeter in a meadow near the city of *Henna* (modern–day Enna), as well Claudius Claudianus of Alexandria, who set the plot of his *De raptu Proserpinae* on the island. The repeated descriptions gave life to a conviction, supported by the remarkably fertile soil on the island, that Demeter was of Sicilian origin (Sacks 1995: 107). Myths referring to her origin were created generally throughout the Greek world, but Sicily was a favoured location (Ciaceri 1911). However some

6 Cult of Demeter and Kore sporadically appeared as a civic gods, except Thebes and Sicily and Magna Graecia (cf. Larson 2007: 69)

accounts claim that she arrived from Crete (Nonni Panopolitani Dionysiaca 6. 121; cf also: Kerényi 2002: 209). In the context of Sicily, Demeter is described as the one who contended with Hephaestus for rule of the island and control over Etna (Grimal 1987: 71).

The presence of Demeter was connected with good harvests, and her absence from the land with catastrophes and infertility of the land (for more on the cult of Demeter, cf. Larson 2007: 69–76). For this reason the ancients sought her favour by establishing cult places, which were often located practically in the wilderness, for instance, in forests or on rocky cliffs[7]. The Greek world offered Demeter cows, honey and fruit, while the Romans brought her corn ears, fruit and pigs. The goddess was portrayed as a beautiful, mature woman. Her most common representation is a figure, standing or seated, with a sad face, dressed in a chiton and an outer garment (himation or *epiblema*), wearing a wreath of corn ears (*corona spicea)*, *polos*, *kalathos* or veil, or with hair tied with a ribbon, holding a torch, corn ears, scythe, jug, fruit or sceptre. Her attributes included a narcissus or poppy; her favourite bird was a crane and her preferred offering a pig. The described representations of Demeter correspond very well with how the goddess (Raffiotta 2007: 61–66, tabl. 13:54–57, 14:60–61) was depicted in the figure from Contrada Granieri–Contrada Olia (Alia)–Contrada Sbriulia.

The same site also yielded numerous ceramic vessel fragments, including a few dozen sherds of amphorae, tableware and kitchenware. The context was dated by the toe of an Africana Grande IIB amphora[8] (Fig. 3a) and the rim of an African Red Slip Ware form 32/58 according to J. W. Hayes (Fig. 3b). The dating of Africana II Grande amphora types falls within the period from the end of the 2nd century AD to the 4th/5th century AD (Keay 1984: 116, 392, no 18; Peacock 1986: 156, no 18; and on 3rd – beginning of 5th AD cf. Sciallano, Sibella 1991: 81, no 18). [9] As for the ARSW vessel form 32/58, it is dated to the end of the 3rd–early 4th century AD (Hayes 1972: 96).

Beside the abovementioned forms, fragments of amphorae types 20 (Fig. 3c) and 23 (Fig. 3d) in H. Dressel's typology were also identified (CIL XV, 2, tabl. 2). Dressel 20 amphorae[10] are also referred to in the literature as Camulodunum 187 (Hawkes, Hull 1947: 252–253), Callender 11 (Callender 1965: 19–20), Beltrán V (Beltrán

7 The places devoted to the Demeter's cult can be simply identified by the votive artifacts as pottery, terracottas of standing women holding torches and piglets, olive lamps, clay pomegranates (Larson 2007: 70, 83).

8 Amphorae of the mentioned type were classified on the grounds of finds from Ostia as type III – Ostia III, cf. Panella 1973: 580. F. Zevi and A. Tchernia distinguished two variants of the same type of vessels referred to as Africana I Piccolo and Africana II Grande, and the latter was divided by C. Panella into four subgroups: IIA, IIB, IIC and IID, cf. Zevi, Tchernia 1969: 173–180; Panella 1972: 98, fig. 61–62; Panella 1973: 580–582; Manacorda 1977: 124–125. In S. J. Keay's typology, the Africana Grande IIB amphora type was designated as VBis, cf. Keay 1984: 115–118. In some publications the applied typology does not include the subdivisions proposed by C. Panella, cf. Beltrán Lloris 1970: 549–556, type 56; Peacock, Williams 1986: 155–157, class 34; Sciallano, Sibella 1991: 81; Dyczek 1999: 153–157, type 26 (English edition: Dyczek 2001: 194–198, type 26); Paraschiv 2006: 124–125, type 5

9 The earliest examples come from a shipwreck discovered off the coast of Monaco, where they appeared in a context dated from the end of the 2nd century AD to the first quarter of the 4th century AD, cf. Mouchot 1968–1969: 159; Keay 1984: 116; Panella 1983: 235. The earliest examples of Africana Grande IIB amphorae from Ostia are dated to AD 230–250, cf. Panella 1983: 586 sq, no. 18. C. Raynaud and M. Bonifay date these amphorae to AD 220–320 (Raynaud, Bonifay 1993: 17). D. Manacorda supplies information on this type of amphorae identified in layers dated to the 4th and early 5th century AD (Manacorda 1977: 162 sq, no. 18).

10 In H. Dressel's typology created on the basis of finds from Monte Testaccio different variants of vessels were erroneously distinguished as two separate forms, Dressel 20 and Dressel 25; cf. Dyczek 1999: 76; Dyczek 2001: 93–94. Excavations on sites in *Colonia Augusta Rauricorum* and *Castrum Rauracense* verified the typology of the Dressel 25 type. The form was established as the earliest of the variants of Dressel 20 vessels and designated as Dressel 20A: Martin–Kilcher 1983: 53–54. In spite of this some researchers still distinguish Dressel 25 amphorae as a separate form: Paraschiv 2006: 62–64, no. 18, type 23 (Dressel 25) and type 24 (Dressel 20). In the cumulative typology of D. P. S. Peacock and D. F. Williams this form was classified as type 24: Peacock, Williams 1986: 134–135, no 18, class 24. Amphorae of this type are common finds on the *limes Germanicum*. Various designations are applied to this form found in the region of Germania: Haltern 71: Loeschcke 1909: 257–258; Hofheim 76: Ritterling 1913: 302–305, Figs. 73–74; Niederbieber 78: Oelmann 1914: 65–66, Fig. 48; Oberaden 83: Albrecht 1942: Pl. 35, 83; Gose 1950: 38, Pl. 61, nr. 439–442; and Rödgen 70: Schönberger, Simon 1976: 113, 195.

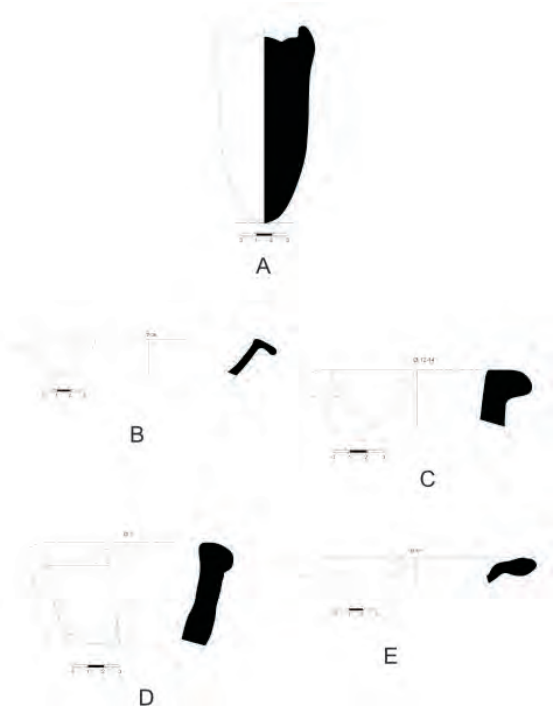


Fig. 3 The pottery finds. Draw by M. Woińska

Lloris 1970: 464–492, no 18), Ostia I (Panella 1970: 108–109: Panella 1983: 522–535), Peacock and Williams class 25 (Peacock, Williams 1986: 136–140, no 18), Kelemen 18 (Kelemen 1990: 160–171), Bjelajac VIII (Bjelajac 1996: 33–35), Dyczek 8 (Dyczek 1999: 76–81; Dyczek 2001: 93–99), and Paraschiv 24 (Paraschiv 2006: 62–64, no 18). Their dating (including Dressel 25 amphora types) spans a period from the end of the 1st century BC to the second half of the 3rd century AD (Peacock, Williams 1986: 135–136, no 18; Sciallano, Sibella 1991: 65, no 18).[11] Considering the formal traits of their morphology, Dressel 23 amphorae should be genealogically associated with the Dressel 20 form discussed above (Beltrán Lloris 1970: 514–517, no 18; Remesal Rodríguez 1983: 119, 125; Martin–Kilcher 1987: 337–348, no 32; Keay 1984: 140, no 18; Remesal Rodríguez 1989: 121–153). In the literature on the subject they are also referred to as: Keay XIII (Keay 1984: 140–146, no 18),[12] Peacock, Williams class 26 (Peacock, Williams 1986: 14, no 18), Bjelajac IX (Bjelajac 1996: 35–36, no 29), and Paraschiv 25 (Paraschiv 2006: 64–65, no 18). S. Martin–Kilcher classified this form of amphora as variant H of the Dressel 20 type (Martin–Kilcher 1987: 56, no 32). The beginnings of production of Dressel 23 amphorae go back as far as the beginning of the 3rd century AD (Manacorda 1977: 137 sq).[13] This amphora type went out of use in the late 6th and early 7th century AD (Keay 1984: 142, no 18).

A rim fragment from a grey ware bowl, most likely an imitation in form of Late Roman red–slip ware (Fig. 3e), completes the ceramic assemblage of finds.

The bulk of the pottery from the site in question sets its chronology provisionally in the 3rd–4th century AD. The dating is certain, although surprising given the find of the terracotta figurine of Demeter/Ceres. To be sure, multiple phasing of the site cannot be excluded, in which case the surface pottery finds will not date the context fully. We also can not disqualify that the terracotta went downhill or has been redeposited here from somewhere else in the neighborhood. It is also probable, however, that the figure could reflect lasting Greek traditions in the realities of Roman Sicily, especially its south–eastern part, where according to the literary and archaeological evidence the cult of Demeter was deeply rooted and where Roman Ceres could show the iconography of Greek Demeter (Voza 1976–1977: 556–559; Hinz 1988: no 7; Shapiro 2002: 82–95; Greco 2002: 110–118; di Stefano ed. 2008). The longevity of the cult of Demeter is proven by numerous mentions in written sources and by the archaeological record. Already from the beginning of the 3rd century BC, and especially in the 2nd century BC, under the influence of Hellenistic cities and Greek heritage, the cult of Ceres gained popularity among Roman women and attributes of Demeter were adopted for the iconography of Ceres (Spaeth 1996: 11).

11 Although according to D. Manacorda these amphorae occurred sporadically even in the 4th century, cf. Manacorda 1977: 135 sq, no 18). According to the classification proposed by S. Martin–Kilcher, individual variants of Dressel 20 amphorae are dated as follows: Dressel 20A: 10 BC – AD 30; Dressel 20B: 30 BC – AD 50; Dressel 20C: AD 50–70; Dressel 20D: AD 70–110; Dressel 20E: AD 110–150; Dressel 20F: AD 150–210; Dressel 20G: AD 210–280 (Martin–Kichler 1987: 53–58 and annexes 1–2; Raynaud 1993: 25–26).

12 S. J. Keay divided this type of amphora into five variants (A to E). M. Beltrán Lloris proposed two variants A–B (Beltrán Lloris 1970: 514–517, no 18).

13 D. Manacorda also discusses fragments of this type of amphorae from Ostia, dated to the first and second quarters of the 3rd century AD.

Livy reported that after the battle of Cannae *the City was thrown into such universal mourning that the annual celebration of the festival of Ceres was suspended* (Livy V, 22.56.4).

Cicero, already referred to above, wrote that *insulam Siciliam totam esse Cerei et Liberae consecrata*, and the non–Greek inhabitants of Sicily considered it absolutely natural (Cicero II.4.111, no 2).[14] An inscription from the vicinity of Avola in prov. Siracusa, dated to the 1st century BC, shows that Roman settlers engaged as *prostatai* in local cults of Demeter together with the local population (Manganaro 1976 (1985): 159; Wilson 1990b: 29, 30, no 4; Manganaro 1996: 79). The lasting cult of Demeter/Ceres was connected not only with deeply rooted agrarian traditions, but also specifically with grain shipped from Sicily to Rome (Bell 1972; Bell 1981: 97). Therefore, with the fall of the Republic, when Sicilian produce (including grain) ceased to play as important a role (Erdkamp 2005: 209–225), the cult goddess witnessed a decline. The dwindling importance of a major cult centre in Enna (more about Enna cult cf. Schipporeit 2008), visited still in 133 BC by official delegations of Roman officials bearing offerings to the goddess, illustrates these processes (Wilson 1990b: 288; de Miro 2000: 90). Coins bearing an image of the goddess were struck here until the end of the 1st century BC[15] and the presence of an inscription mentioning a *sacerdos Cereris*, dated to the early 2nd century AD, testifies to the persistence of the cult, albeit on a local scale (Wilson 1990b: 288, no 4).[16]

Traditional cults were also upheld in other regions. During the Imperial period the festival of Ceres was celebrated in Catania, Halaesa, on Malta, in Palermo and Taormina (about tradition cf. de Miro 2000: 90). Probably also the inscription dated to the 1st century AD found in Palermo has been dedicated to Ceres as well as dedication of priest from Tindaris dated to middle of Imperial period (Wilson 1990b: 289). The festival of Ceres in Catania was described by Lucius Caecilius Firmianus Lactantius (ca. 240–ca. 320), who rendered the Catanian festivities equal to the religious feast at Enna. The celebration in Catania took place on 16 August, as confirmed by a Latin graffito from the 1st/2nd century AD found in the eastern part of the city, along Vittorio Emanuele street (Santangelo 1919–1920: 174:180). The survival of beliefs is also visible in archaeological material, for instance in the form of finds of Centuripe statues from the 2nd century AD (Patané 2011: 51–52, fig. 43–45) or a production centre of statues of this goddess in Halaesa from the turn of the 2nd century AD (Wilson 1990: 289, no 4). The figure from Contrada Granieri–Contrada Olia (Alia)–Contrada Sbriulia may have been placed in a household shrine and used for an extended time.

We have also some evidence of Ceres in the iconography outside of Sicily, where Ceres hold the classic attributes of Demeter, for example a bronze statute dated to the 2nd-3rd century AD from collection of Bibliothèque National de France in Paris (Spaeth 1996: 23, fig. 12).

In a sense, the cult of the goddess lasted and lasts until today. In medieval time the story of Grain Maiden of Milan could be connected with the Demeter/Ceres (Spaeth 1996: 31). As late as in the 19th century the farmers from the vicinity of Eleusis decorated statues of Demeter with flowers to ensure a good harvest. Perhaps the feast of Our Lady of the Herbs,[17] celebrated [in Poland] on 15 August, could also be a relic of a Demeter cult.

BIBLIOGRAPHY

Bell, M. 1972
The terracottas of Morgantina 400–50 B.C., Michigan: Ann Arbor.

Bell, M. 1981
The Terracottas. Morgantina Studies. Volume 1., Princeton–New Jersey: Princeton University Press.

14 On the cult of Ceres on Sicily cf. Cicero II.4.99 and II.5.187. Describing the Silician–Roman cults, Cicero focused mostly on Ceres, omitting many other deities and stressing that she was of lesser importance to the Romans than to the Greeks (Frazel 2009: 84).

15 Obv. Veiled head of Ceres with corn ears l.; Rev.: Pluto and Proserpina in quadriga r. Inscription: L MVNATIVS M CESTIVS; Enna; 44/36 BC (RIC 1992: 177, Pl. 39:661, type 661; Caltabiano 2008: 127–128)

16 It may be testimony of a lasting tradition or of copying information on the cult from earlier sources.

17 This feast is celebrated since the 5th century AD. In Poland it is Our Lady of the Herbs, in Germany, of the Flowers; in Estonia, of the Rye and in the Czech Republic, of the Spices.

Beltrán Lloris, M. 1970
Las anforas romanas en España, Zaragoza: Institución Fernando el Católico.

Bjelajac, L. 1996
Amfore gornjo mezijskog Podunavlja, Beograd: Arheoloski Institut.

Bringmann, K. 2007
A History of the Roman Republic, Cambridge: Polity Press.

Callender, M. H. 1965
Roman Amphorae with Index of Stamps, London–Ney York: Oxford University Press.

Caltabiano, C. M. 2008
Il 'ruolo; di Demetra nel document monetale greco, in: *Demetra. La divinità, i santuari, il culto, la leggenda*. Di Stefano C. A. (ed.). Atti del I Congresso Internazionale, Enna, 1-4 luglio 2004. Pisa–Roma: Fabrizio Serra Editore, 123–134.

Ciaceri, E. 1895
Il culto di Demetra e Kore nell'antica Sicilia, Catania: Brancato Editore.

Ciaceri, E. 1911
Culti e miti nella storia dell'antica Sicilia, Catania: F. Battiato.

Clemente, G. 1988
Sicily and Rome. The Impact of Empire on a Roman Province, in: *Forms of Control and Subordination in Antiquity*. Yuge T., Doi M. (eds.). Proceeding of the International Symposium for Studies on Ancient World, January 1986, Tokyo. Leiden–New York–København–Köln: The Society for Studies on Resistance Movements and E. J., Brill, 105–120.

De Miro, E. 2000
Agrigento. I. I santuari urbani. L'area sacra tra il tempio di Zeus e porta V, Roma: L'Erma di Bretschneider.

Di Stefano, A. C. (ed.) 2008
Demetra. La divinità, i santuari, il culto, la leggenda. Atti del I Congresso Internazionale, Enna, 1–4 luglio 2004. Pisa–Roma: Fabrizio Serra.

Dyczek, P. 1999
Amfory rzymskie z obszaru dolnego Dunaju. Dystrybucja amfor i transportowanych w nich produktów w I–III w. po Chr., Warszawa: Instytut Archeologii Uniwersytetu Warszawskiego.

Dyczek, P. 2001
Roman Amphorae of the 1st – 3rd Centuries AD Found on the Lower Danube. Typology, Warsaw: Wydawnictwa Uniwersytetu Warszawskiego.

Erdkamp, P. 2005
The Grain Market in the Roman Empire. A Social, Political, and Economic Study, Cambridge: Cambridge University Press.

Fraschetti A. 1981
Per una prosopografia dello sfruttamento: Romani e Italici in Sicilia (212–44 a.c), in: *Società romana e produzione schiavistica. I. L'Italia: insediamenti e forme economiche*, Giardina A., Schiavone A. (eds.). Rome–Bari: Laterza, 51–77

Frazel, T. D. 2009
The Rhetoric of Cicero's In Verrem. Hypomnemata 179. Göttingen: Vandenhoeck & Ruprecht.

Gazda, E. K. and Haeckl, A. E. (ed.) 1994
Roman Art in the Private Sphere. New Perspective on the Architecture and Decor of the Domus, Villa, and Insula, Michigan: University of Michigan Press.

Gose, E. 1950
Gefässtypen der römischen Keramik im Rheinland, Beihefte der Bonner Jahrbücher 1, Kevelaer: Butzon & Bercker.

Greco, E. 2002
Sanctuaries of Magna Graecia and Sicily, in: *Magna Graecia. Greek Art from South Italy and Sicily*, Bennett M.J., Paul J. (eds.). New York: Cleveland Museum of Art, 98–119.

Grimal, P. 1987
Słownik mitologii greckiej i rzymskiej, Wrocław–Warszawa–Kraków–Gdańsk–Łódź: Zakład Narodowy im. Ossolińskich.

Hawkes, C. F. C. and Hull, M. R. 1947
Camulodunum. First Report on the Excavations at Colchester 1930–1939, Reports of Research Committee of the Society of Antiquaries of London 14, Oxford–London: Society of Antiquaries.

Hayes, J. W. 1972
Late Roman Pottery, London: British School at Rome.

Hinz, V. 1988
Der Kult von Demeter und Kore auf Sizilien und der Magna Graecia, Palilia 4, Wiesbaden: Dr Ludwig Reichard. Verlag.

Keay, S. J. 1984
Late Roman Amphorae in the Western Mediterranean. A typology and economic study: the Catalan evidence, British Archaeological Reports International Series, vol. I, 196, Oxford: Archaeopress.

Kelemen, M. H. 1990
Roman Amphorae in Pannonia III, Acta Archaeologica Academiae Scientiarum Hungaricae 42: 147–193.

Kerényi, K. 2002
Mitologia Greków, Warszawa: Wydawnictwo KR.

Kubiak, Z. 1999
Mitologia Greków i Rzymian, Warszawa: Wydawnictwo Świat Książki.

Larson, J. 2007
Ancient Greek Cults. A Guide, New York–London: Routledge.

Loeschcke, S. 1909
Keramische Funde in Haltern. Ein Beitrag zur Geschichte der augusteischen Kultur in Deutschland, Mitteilungen der Altertums–Kommission für Westfalen 5: 101–322.

Manacorda, D. 1977
Anfore, in: *Ostia IV, Le terme del Nuotatore. Scavo dell'ambiente XVI e dell'area XXV*. Carandini A., Panella C. (eds.). Studi Miscellanei 23, 116–265.

Manganaro, G. 1976 (1985)
Il tempio greco in Sicilia. Architettura e culti, Atti della Ia riunione scientifica della scuola di perfezionamento in archeologia classica dell'Università di Catania, Siracusa, 24–27 Novembre 1976, Contributi dell'Istituto di Storia Antica dell'Università di Milano XVI: 148–164.

Manganaro, G. 1996
Figurazioni e dediche religiose della Sicilia greca e romana, Zeitschrift für Papyrologie und Epigraphik 113: 77–81.

Martin–Kilcher, S. 1983
Les amphores romaines à huile de Bétique (Dressel 20 et 23) d'Augst (Colonia Augusta Rauricorum) et Kaiseraugst (Castrum Rauracense). Un rapport préliminaire, in: *Produccion y comercio del aceite en la Antigüedad. Segundo Congreso Internacional (Sevilla, 24–28 Febrero 1982)*, Blázquez Martínez J. M. and Remesal Rodríguez J. (eds.), Madrid: Universidad Complutense, 337–347.

Martin–Kilcher, S. 1987
Die römischen Amphoren aus Augst und Kaiseraugst. Ein Beitrag zur römischen Handels und Kulturgeschichte 1: Die Südspanischen ölamphoren (gruppe 1). Forschungen in Augst 7, Augst: Römermuseum.

Mouchot, D. 1968–1969
Épave romaine 'A' du port de Monaco, Bulletin du Musée d'Anthropologie Prehistorique de Monaco 15: 159–201.

Oelmann, F. 1914
Die Keramik des Kastells Niederbieber. Materialien zur römisch–germanischen Keramik I, Frankfurt am Main: J. Baer.

Panella, C. 1970
Anfore, in: *Ostia II. Le terme del Nuotatore. Scavo dell'ambiente I*, Berti F., Carandini A. and Panella C. (eds.). Studi Miscellanei 16: 102–156.

Panella, C. 1972
Annotazioni in margine alle stratigrafie dell Terme Ostiensi del Nuotatore, in: *Recherches sur*

les amphores romaines, Baldacci P., Kapitän G., Lamboglia N., Panella C., Rodríguez Almeida E., Sciarra B., Tchernia A. and Zevi F. (eds.). Collection de l'cole Française de Rome 10. Paris: École Française de Rome, 69–106.

Panella, C. 1983
Appunti su un gruppo di anfore della prima, media e tarda etá imperiale, in: *Ostia III. Le terme del Nuotatore. Scavi degli ambienti III, VI, VII*, Carandini A. and Panella C. (eds.). Studi Miscellanei 21: 460–633.

Panella, C. 1983
I contenitori oleari presenti ad Ostia in eta' antonina: analisi tipologica, epigrafica, quantitative, in: *Produccion y comercio del aceite en la Antigüedad. Segundo Congreso Internacional (Sevilla, 24–28 Febrero 1982)*, Blázquez Martínez J. M. and Remesal Rodríguez J. (eds.), Madrid: Universidad Complutense, 225–261.

Paraschiv, D. 2006
Amfore romane şi romano–bizantine în zona Dunării de Jos (sec. I – VII p. Chr.), Iaşi: Fundaţiei Axis.

Patané, R. P. A. 2011
Impero di Roma e passato Troiano nella società del II secolo. Il punto di vista di un famiglia di Centuripe, Quaderni del Museo Civico Lanuvino 3, Roma: Aracne.

Peacock, D. P. S. and Williams, D. F. 1986
Amphorae and the Roman Economy. An Introductory Guide, London: Longman.

Raffiotta, S. 2007
Terrecotte figurate dal santuario di San Francesco Bisconti a Morgantina, Enna: EditOpera.

Raynaud, C. 1993
Amphores de Bétique, in: *Mélanges d'histoire et d'archéologie de Lattes. Dictionnaire des céramiques antiques (VIIe s. av. n.è. – VIIe de n.è.) en Méditerranée nord–occidentale (Provence, Languedoc, Ampurdan)*, Py M. (ed.). Lattara 6, Lattes, 23–27.

Raynaud, C. and Bonifay, M. 1993
Amphores africaines, in: *Mélanges d'histoire et d'archéologie de Lattes. Dictionnaire des céramiques antiques (VIIe s. av. n.è. – VIIe de n.è.) en Méditerranée nord–occidentale (Provence, Languedoc, Ampurdan)*, Py M. (ed.). Lattara 6, Lattes, 15–22.

Remesal Rodríguez, J. 1983
Transformaciones en la exportación del aceite bético a mediados del siglo III d. C., in: *Producción y comercio del aceite en la Antigüedad. Segundo Congreso Internacional (Sevilla, 24–28 Febrero 1982)*, Blázquez Martínez J. M. and Remesal Rodríguez J. (eds.). Madrid, 115–131.

Remesal Rodríguez, J. 1989
Tres nuevos centros productores de ánforas Dressel 20 y 23. Los sellos de Lvcivs Fabivs Cilo, Ariadna 6: 121–153.

Ritterling, E. 1913
Das frührömische Lager bei Hofheim im Taunus, Annalen des Vereins für Nassauische Altertumskunde und Geschichtsforschung 40, 1912, Wiesbaden: Bechtold, 302–305.

RIC 1992
Roman Provincial Coinage I. From Death of Caesar to the Death of Vitellius (44 BC – AD 69), vol. 1, Burnett A., Amandry M. and Ripollès P. P. (eds.), London: British Museum Press and Bibliothèque Nationale.

Sacks, D. 1995
Encyclopedia of the Ancient Greek World, New York: Facts on File.

Santangelo, S. 19119–1920
Il graffito catanese e la festa do Cerere, Archivo Storico per la Sicilia Orientale XVI–XVII: 174–180.
Schipporeit S., *Enna and Eleusis*, in: *Demetra. La divinità, i santuari, il culto, la leggenda*. Di Stefano C. A. (ed.). Atti del I Congresso Internazionale, Enna, 1-4 luglio 2004. Pisa–Roma: Fabrizio Serra Editore, 41–46.

Schönberger, H. and Simon, G.-H. 1976
Das Augusteische Römerlager Rödgen. Die Funde aus den frühkaiserzeitlichen Lagern Rödgen, Friedberg und Bad Nauheim, Limesforschungen 15, Berlin: Gebr. Mann.

Sciallano, M. and Sibella, P. 1991
Amphores. Comment les identifier?, Aix–en–Provence: Edisud.

Shapiro, H. A. 2002
Demeter and Persephone in Western Greece: Migration of Myth and Cult, in: *Magna Graecia. Greek Art from South Italy and Sicily*, Bennett M. J., Paul J., Iozzo M. and White B. M. (eds.). New York: Hudson Hills Press, 82–95.

Spaeth, B. S. 1996
The Roman Goddess Ceres, Austin: University of Texas Press.

Wilson, R. J. A. 1990a
Roman Architecture in a Greek World: the Example of Sicily, in: *Architecture and Architectural Sculpture in the Roman Empire*, Henig M. (ed.). Oxford University Committee for Archaeology, Monograph 29: 67–90.

Wilson, R. J. A. 1990b
Sicily under the Roman Empire. The Archaeology of Roman Province, 36 BC – AD 535, Warminster: Aris & Phillips.

Vermeule, C. C. 1977
Greek Sculpture and Roman Taste. The Purpose and Setting of Graeco–Roman Art in Italy and the Greek Imperial East, Ann Arbor: University of Michigan Press

Voza, G. 1976–1977
L'attività della Soprintendenza alle Antichità della Sicilia Orientale: Siracusa, Kokalos XXII–XXIII: 556–559.

Zambon, E. 2008
Tradition and Innovation: Sicily between Hellenism and Rome, Stuttgart: Franz Steiner Verlag.

Zevi, F. and Tchernia, A. 1969
Amphores Byzacène au Bas–Empire, Antiquités Africanes 3: 173–214.

Written Sources:
Cicero, *The Verrine Orations. Books 1–2*, vol. I, Loeb Classical Library 221, Greenwood L.H.G. trans., Cambridge 1928.
Diodorus Siculus, *The Library of History*, vol. III, Loeb Classical Library 340, Oldfather C.H. trans., London 1939, book V.1–3 (p. 97–105).
The Homeric Hymn to Demeter. Translation, Commentary, and Interpretive Essays, Foley H. (ed.). Princeton 1994.
Livy, *History of Rome*, vol. V, books 21–22, Loeb Classical Library 233, Foster B.O. transl., London 1929.
Nonni Panopolitani Dionysiaca 6. 121, Bibliotheca Scriptorum Graecorum et Romanorum Teubneriana, Lipsiae 1909–1911.

REZIME

NOVA TERAKOTA FIGURINA DEMETRE/CERERE IZ JUGOISTOČNE SICILIJE

Ključne reči: terakota figurina, Demetra/Cerera, terensko istraživanje, keramika, kult.

Rim je započeo svoja velika osvajanja u III veku pre nove ere i među prvim pokorenim zemljama bila je Sicilija, zahvaljujući pre svega svojoj plodnoj zemlji, ali još više strateškoj poziciji na Mediteranu. Kako je Ciceron jedanput rekao, stvarajući upravu ovde, Rimljani su učili kako da vladaju nad pokorenim narodima. Do kraja drugog Punskog rata procenjeno je da je rimska vlast dovoljno čvrsta i da nije više potrebno prisustvo pretora, pa se rimska vlast svela na nivo uprave, zakonodavstva i naplatu poreza. Ipak, Sicilija je ostala ponosna u smislu očuvanja svoje lokalne tradicije. Grčko nasleđe je uticalo na rimsku kulturu i religiju. Terakota figurina Demetre/Cerere o kojoj govorimo u ovom radu, je pravi primer koji to pokazuje.

Na južnoj padini brda, koje je okrenuto ka dolini Telaro reke, u jesen 2010 godine, tokom terenskih istraživanja, otkrivena je figurina od terakote. Figurina je protumačena kao predstava boginje Demetre/Cerere čiji je kult bio popularan na Siciliji. Prethodno već pomenuti Ciceron je

napisao da je *insulam Siciliam totam esse Cerei et Liberae consecrate* i da negrčko stanovništvo Sicilije smatra to sasvim prirodno. Novi nalaz terakote potiče iz konteksta koji je keramičkim materjalom datovan u srednji carski period.

EMILIJA NIKOLIĆ, Institute of Archaeology,
Belgrade, Serbia
emilij@gmail.com

UDC: 904:72”652”(497.11);
904:738”652”(497.11)
Original research article
Received: September 15th 2013
Accepted: October 15th 2013

CONTRIBUTION TO THE STUDY OF ROMAN ARCHITECTURE IN VIMINACIUM: CONSTRUCTION MATERIALS AND BUILDING TECHNIQUES*

ABSTRACT

Owing to the facts that Viminacium has, for centuries, had its buildings destroyed and that small number of buildings have been investigated so far, there are only a very few visible traces of its architecture. Therefore, the study of construction materials and building techniques represents just a small contribution to the general study of its architecture.Locally produced brick and stone from the nearby quarry, bound with lime mortar, represented basic construction materials of Viminacium. Those, available materials, influenced the development of the applied building techniques.

Keywords: *Viminacium*, green schist, brick, limestone, lime mortar, “crvenka“, *opus incertum mixtum, opus testaceum*, “trpanac“, pozzolanic feature.

CONSTRUCTION MATERIALS OF VIMINACIUM BUILDINGS**

One of the basic rules of ancient Roman architecture was the usage of local materials. (Radivojevic, Kurtović-Folić 2006: 693) This rule was also applied to the buildings of ancient Viminacium.

Stone

The basic stone type used by the Romans from Viminacium was green schist, locally called “zelenac” (the green stone), presumably deriving from the quarry in the nearby village of Ram, in which it is still being quarried. (Fig. 1) The village of Ram, actually Roman *Lederata* and the later mediaeval fortresses, is situated some 15 km from Viminacium. The fortress visible today is Turkish, dates from the 15th century and was also built of this stone. (Fig. 2) (Каниц 1989:538-539). Green schist is a stone often found in the quarries of eastern Serbia and is, therefore, often present in many of the historic buildings of this area. Roman metallurgic centre dated to the period from the end of the 3rd to the end of the 4th century, Kraku lu Jordan, today an archaeological site near Kučevo, possesses walls completely built out of the same stone quarried from the hill in which the centre is situated. (Bartel, Kondić 1979:133,135) Other stone types present in the walls of the Viminacium buildings

*The article derives from the project: *Viminacium, Roman city and military camp – research of material and non material culture of inhabitants by using the modern technologies of remote detection, geophysics, GIS, digitalisation and 3D visualisation (no 47018)*, funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia.

**The author owes the gratitude to Ivana Delić - Nikolić, geologist from the Institute for testing materials in Belgrade, for the research of Viminacium mortars and valuable advices and conclusions on the topic.

Fig. 1 Green schist from Ram quarry, Photo by the author.

excavated so far include limestone in the large blocks forming the walls of huge buildings, very rare deposits of tufa, as well as sandstone in large blocks, used for the final layer of roads. Sandstone was used for the entrance to the northern gate of the Viminacium fort, as well as at one of the amphitheatre entrances.

Since today there are a very few visible architectural remains at Viminacium, one can gain data about the use of stone from reports about old archaeological research, and also from travel reports from the 19th century.

Fig. 2 Mediaeval Ram fortress. Photo by the author.

In 1974, in one of the trenches which was later covered, a building was excavated, with large limestone blocks used for the staircase and for strengthening of the wall angles.(Zotović 1974:48-49, Table XXV, Каниц 1987:177) The socle of the Early Byzantine building at the site "Svetinja" was built out of large stone blocks brought from the destroyed Roman buildings of Viminacium. (Popovic 1987:6-9) It is interesting to read parts of the book by the Austrian travel-writer Felix Kanitz, in which *Viminacium* is mentioned and how its remains were scattered over its surrounding area, among which there were column parts measuring 0.70 m in diameter and 2.85m in length. (Каниц 1987:177)

Nevertheless, near Viminacium there are no sources of limestone or sandstone, or any other sort of stone suitable for cutting into regular rectangular blocks. (Васић 1907:67) Stone sarcophagi, both simple ones and those having stone plates, were brought from distant quarries". (Валтровић 1884:124) The Romans used waterways to transport stone. In the case of Viminacium, these rivers were The Mlava and The Danube. Most likely, the quarries of limestone used for the Viminacium buildings would have been located along the Danube, upstream, from Kostolac, via Smederevo and Grocka, towards Belgrade. (Fig. 3a i 3b) This opinion is supported by the writings of Felix Kanitz about the quest for the ancient settlement *Aureus Mons* near Smederevo, towards the settlement of Seone. He writes that "the stones

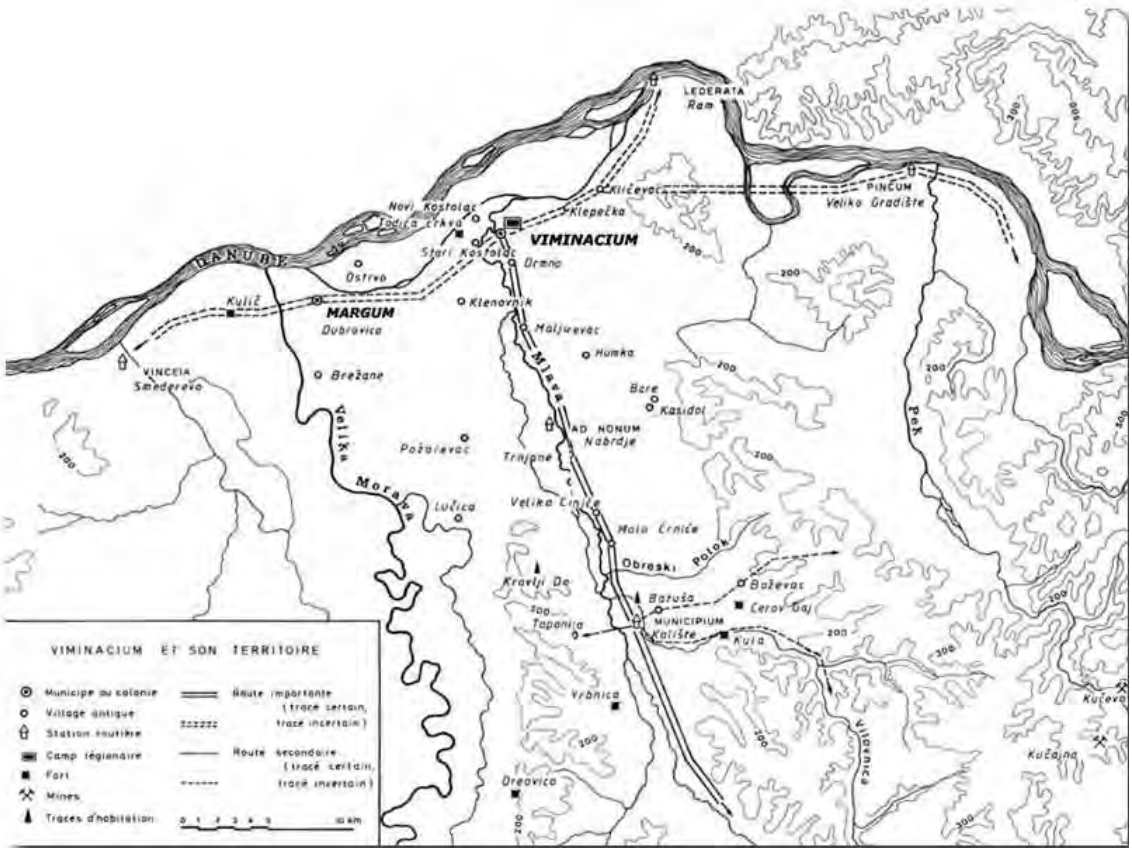


Fig. 3a Viminacium and Margum with Danube. Mirković, Miroslava. *Inscriptions de la Mésie Supérieure, vol II, Viminacium et Margum*. Beograd: Centre d'études épigraphiques et numismatiques, De la Faculté de philosophie de l'Université de Beograd, 1986

Fig. 3b Roman towns and forts along the Danube. Mirković, Miroslava i Dušanić, Slobodan. *Inscriptions de la Mésie Supérieure, vol I, Singidunum et le nord-ouest de la province*. Beograd: Centre d'études épigraphiques et numismatiques, De la Faculté de philosophie de l'Université de Beograd, 1976.

for its walls, partly preserved, originate from Višnjica, lying to the northwest at a distance of some 25 km". (Каниц, 1987, 155), and in later writings it is mentioned as a place situated some 24 to 25 miles away from Viminacium. (Mirković 1968: 61) Kanitz also reports on the quest for the ancient settlement *Vinceia,* also close to Smederevo, near the settlement of Ćirilovac: "...we soon actually discovered foundations made of Ram mica shale and walls of bricks and Tertiar limestone from Višnjica". (Каниц 1987:157) During archaeological research in 1964 in the modern Belgrade suburb of Višnjica, a Byzantine fort from the 6th century *Ad Octavum* was discovered, with buildings "made of stone blocks from the nearby quarry". (Каталог непокретних добара на подручју Града Београда)

Here, modern quarries in the vicinity of Kučevo, Žagubica and Petrovac na Mlavi should

Fig. 4 "Proconesic sarcophagus with garlands". Photo by the author.

be mentioned, but also the well-known ones on Avala and Kosmaj, actually the ancient mining centres. As far as the mentioned tufa is concerned, there is a settlement in Homolje near Mlava bearing the same name as tufa in Serbian, ie. Siga, in which there is a quarry. Limestone used for the production of lime mortar made for the mentioned centre Kraku lu Jordan derives from a quarry some 20 kms away from this site, to the west of Kučevo, down the Pek river. (Bartel, Kondić 1979:133,135)

It is important to mention recent research connecting the Roman quarry in the village of Dardagani near Zvornik in Bosnia with ancient *Sirmium*, which actually determines the origin of the limestone used to build this imperial town. According to this research, the limestone was brought to Sirmium along the river Sapna, and later along the Drina and the Sava.(Đurić, Davidović. Maver and Müller, 2006, 103-137) The limestone analyses showed that the stone originated from the quarry in Dardagani, but also from other quarries, in the Eastern Alps and the Mediterranean. (Đurić, Davidović. Maver and Müller 2006:103-137)

Since Viminacium was an important urban centre, it can be presumed that luxurious stones intended for building were often transported to it from distant quarries. An example of expensive and imported materials in the territory of Viminacium is also found in the "Proconesic sarcophagus with garlands" made of Proconesic marble and imported from the modern island of Marmara in Turkey, former *Proconesu.* (Fig. 4) Today it is kept at the lapidarium of the National Museum in Požarevac. (Томовић 1991:69-70).

In 1968, a Roman bath, built in the 3rd century A.D. and used until the 4th century, was discovered under Studentski trg in modern Belgrade (ancient *Singidunum*), for which the Tašmajdan limestone was presumably used. (Бојовић 1977:5-22) Since this stone could have been easily transported down the Danube to Viminacium, it is plausible that it could have been also used for constructing its buildings. It is interesting to note that in the baths of the nearby ancient *Margum*, the modern village of Dubravica near Pozarevac, large quantities of "quite regularly cut stone blocks" were used. (Цуњак 1995-1996:107) Therefore the question of its origin arises, actually its source which, because

Fig. 5 Tombstone probably originated from Viminacium, built in Smederevo fortress wall. Цветковић 2009:37

Fig. 6 Base of a column from Požarevac museum lapidarium. Photo by the author.

of the small distance between these two ancient towns, i.e. 10 miles (Fig. 3b), (Mirković 1968:50) must have also been accessible to the constructors of Viminacium.

Travel reports and notes made by travel-writers from the 19th century mention the use of luxurious stones in the upper parts of some of the Viminacium buildings, such as porphyry pillars made out of single blocks, as well as sarcophagi of granite

Fig. 7 Corinthian capital from Požarevac museum lapidarium. Photo by the author.

porphyry and marble. (Каниц 1987:180-181) In addition, excavation reports mention a pillar made of pink marble.(Поповић 1987:3)

Indications of stone material used in Viminacium can also be obtained through observations of the building material of the nearby area, since "Byzantine and Bulgarian fortresses, Serbian castles and churches" (Каниц 1987: 179), like the Smederevo fort, the Nimnik monastery and a large number of houses in the nearby villages and the town of Požarevac, were made out of bricks and stones from Viminacium (Цветковић 2009: 29, 35, 37, 38). In the priest's house in Stari Kostolac, Kanitz discovered two stone reliefs built in its walls. Within the Smederevo fort walls, many gravestones originated from Viminacium were noted, reliefs and figural sculptures. (Каниц, 1987, 150-152, 165, 177-179, 181) (Fig. 5) It is interesting to mention the secondary usage of the building material for constructing the early Byzantine defense wall on the *Viminacium* site "Svetinja", i.e. fragments of architectural plastic of Viminacium built into it. (Поповић, 2009, 29-44) In the lapidarium of the National Museum in Požarevac, as well as in the Viminacium archaeological park, smaller stone fragments of pillars are exhibited, along with damaged bases and capitels and parts of architraves. (Fig. 6 - Fig.11)

Brick

The basic building material used by the Romans in the territory of modern Serbia was brick. (Radivojevic, Kurtović-Folić 2006:693) Since no stone suitable for building and cutting was available, the Viminacium builders were focused on brick. (Васић 1907:69) All sediments under the site of Viminacium are rich in clay and loess with a high percentage of clayish components covers most of the area (Mašinski fakultet Univerziteta u Beogradu 2010:20-24) which helped the developing of brick "industry" in this Roman city. (Васић 1907:69) Until recently, on one of the sites in the wider Viminacium area, a "former earth mine… a long valley… where the Romans dug out clay for bricks" (Валтровић 1884:98-99) was visible, actually a deep and spacious depression for obtaining earth. (Васић 1907:68-69) It is the site "Kod Koraba", which, after the archaeological research,

Fig. 8 Ionic capital from Požarevac museum. Photo by the author.

was lost due to the strip-mine "Drmno". Mihailo Valtrović wrote that "all the way into Korabe" there is a twenty minute walk to the eastern city gate heading south-east, but he also wrote that "today, farmers take away the earth for plastering their homes." (Валтровић 1884d:98-99) The Romans obtained earth for making bricks and pottery products also from the banks of the river Mlava, which at the time was covered with thick woods and with plenty of high-quality soil. This information is plausible regarding the vicinity of the craftsmen's centre to the river. (Jordović 1994:96)

Fig. 9 Shaft of a column with canelures from Požarevac museum lapidarium

The large number of pottery and brick kilns discovered during the excavation of the craftsmen's

Fig. 10 Shaft of a column from Požarevac museum lapidarium. Photo by the author.

Fig. 11 Shaft of a column from Požarevac museum lapidarium. Photo by the author.

centre testifies to pottery and brick production in Viminacium. Between 1977 and 1992, during the protective research, eleven kilns were excavated, which were used for firing bricks, imbreces and tegulae, as well as fourteen pottery kilns. (Fig. 12) The oldest pottery kiln dates from the 1st century A.D. but the majority date from the 2nd and the 3rd century, and some also from the 4th century. (Jordović 1994:95) The Viminacium brick was important for the building activities in this town, but also in other settlements and fortifications along the Danube limes in Moesia Superior. (Jordović 1994:95) Although brick production in Roman towns was mostly performed by legions, apart from the military production centres, there were also civilian, city and imperial brick factories. In Viminacium, only military brick factories have been discovered so far. (Jordović 1994:95) Owing to the legionary stamps on their products, they can clearly be defined from the rest of the products. (Васић 1907:70, Валтровић 1884с:132, Jordović 1994:95)

In Viminacium, unbaked brick, ie. adobe was also used for building. Examples of such buildings are brick kilns in the craftsmen's centre mentioned above. (Fig. 13) It is important to mention here a natural product which, with its features, can be described as a "natural brick". (Rădan and Rădan 2012) In the nearby hill, above Stari Kostolac, upon which the remains of the mediaeval town of Braničevo were discovered and in which the coal mine "Stari Kostolac" was operating until 1966, (Вучетић 2010:101) a natural raw material is exploited, known locally as "crvenka" (red clay). As a red earth layer, it can easily be identified in the profile of the hill. (Fig. 14) In the road and wall structures of Viminacium, it can be seen in the form of petrified clay clumps, and as researchers of Margum describe it when they write about structures of this nearby settlement that were also made of this material, it is actually present as" pieces of irregularly shaped loess burned during combustion in a coal layer beneath

it." (Марић, 1951, 121) They also mentioned that "such a layer of loess is nowadays encountered in the coal mines of Kostolac and Klenovnik", (Марић 1951:121) which, in the case of Kostolac, actually relates to the aforementioned hill above the village of Stari Kostolac. "Crvenka" cannot be described as a fully geological form and it is known by several different names in the world, such as *scoria, clinker* and *porcelanite* (*porcellanite, porcelainite*) (Bluemie and Jacob 1973:7-11) and also as *cervenice* and *cervenka* in Czech republic. (Geocaching) In the USA, *porcelanite* is widely spread and used as a concrete agregate for building roads or as decorative stone.(United States. EIS Task Force 1976:183) *Scoria* is a name widely used for this form, although it is wrong, since *scoria* is actually related to a volcanic rock, called *porcelanite* by foreign geologists. In Serbia, this form bears no other name than "crvenka".

Coal, mostly lignite, spontaneously combusts when it comes into contact with oxygen and sunlight, and burns the earth layer above it,".(Rădan and Rădan 2012) and thus forms "crvenka" which consists of solid red clays and sand. (Rădan and Rădan 2012: 1) Crvenka is often encountered in the buildings on the outskirts of the Viminacium settlement (Golubović, Korać 2008) (Fig. 15) and, as a less qualitative material, it can probably be connected with periods of crisis in Viminacium, during the 4th and the 5th centuries.Today, it is visible in the substruction of the road entering the legionary fortress through its northern gate, built in the second half of the 1st century A.D. (Viminacium) (Fig. 16) It is also found in the substruction of one of the amphitheatre entrances, (Nikolić, Bogdanović 2012 : 43-44) which could indicate that it was used as a cheap and easily accessible building material, but also that it was used in the early phases of the settlement when brick production was not yet well developed. This conclusion is supported by the fact that the walls of the nearby Margum, built in the second half of the 1st century, were also made of "crvenka". (Марић 1951:121)

Fig. 12 Brick kils from the craftsmen's centre during excavations. Photo-documentation of the Republic Institute for the Protection of Monuments.

In the beginning of the 2nd century A.D, along with the development of Viminacium, the use of fired bricks in its buildings suddenly grew. (Jordović 1994: 105) The greatest number of the

Fig. 13 Brick kiln built of adobe. Photo by the author.

brick kilns excavated so far belongs to this period Ever since then, bricks were commonplace in forming wall faces or the wall cores with mixed material, leveling courses and whole wall structures as an independent building material and also as an pozzolanic additive to lime mortar.

The Viminacium bricks were of different sizes. (Васић 1907:69-70, Валтровић 1884c:131-132) In the wall structures, one most often encounters rectangular bricks, (Fig. 17) while paving was performed with square, rectangular, butterfly-shaped or hexagonal bricks. (Fig. 18) Arched wall-openings were also formed with bricks and the majority of grave constructions (Fig. 19) and their vaults (Fig. 20) were also built of bricks.(Милошевић 2006)

Mortar

Lime mortars used in Roman civil engineering were made according to a recipe specifying both their content and mix ratio. Depending on the type and accessibility of the materials necessary for producing mortar, mortar features differed from region to region.

There is a hypothesis that on the outskirts of the Roman Empire only non-hydraulic mortars were used. (Ringbom, Hale, Heinemeier, Lindroos, Brock 2006) Among the results of laboratory analyses of Viminacium mortars taken from the amphitheatre structures, there is no precisely defined hydraulics which would confirm or deny

Fig. 14 Hill above Stari Kostolac village with visible red layer of „crvenka“. Photo by the author.

Fig. 15 Foundation structure from the bulding in the temple complex with visible „crvenka“.
Golubović, S., Korać, M., 2008

this. (Delić Nikolić I., Miličić Lj., Vušović O., Savić, M., Ivović, B. 2011) After becoming acquainted with ancient mortar recipes and the idea of hydraulicity, comparing them with modern research (Moropoulou, Bakolas, Bisbikou 2000:45-58, Maravelaki-Kalaitzakia, Bakolas, Moropoulou 2003:651-661) and analysing values obtained after the laboratory examination of the Viminacium mortars, (Delić Nikolić I., Miličić Lj. , Vušović O., Savić, M., Ivović, B. 2011) certain conclusions can be drawn regarding its probable hydraulicity, which can be found in a material with pozzolanic features.

There is no research regarding possible natural materials with pozzolanic features used for Roman architecture in the territory of Serbia, including Viminacium. However, the aforementioned laboratory analyses of the amphitheatre mortars, and the existence of volcanic and zeolithic tuffs in the areas of Serbia, (Andrić 2010:189-202, Andrić, 2011, 190-230) can represent a starting point for future research.

In modern times, volcanic tuff is not exploited in Serbia, although there are several beds and it is possible to continue with the exploitation in the Vranje valley. Zeolith is a mineral of sediment rock – zeolithized tuff, and it is nowadays exploited in the Vranje valley, further on, near Kruševac, Brus etc. So far, though, there have been no traces found of any kinds of exploitation of tuff quarries in ancient times in Serbia. The research at hellenistic site Kale in the village Krševica, in the southeast of Serbia, dated to the period from the 3rd to the 4th century B.C., revealed the structures built of tuff. Its possible deposit is 10km to 15km away from Krševica, and 5km away from Vranje, but the traces of ancient quarry have not been discovered yet.(Popović, P. 2008: 101-102).It is interesting to mention the bed of zeolithized tuff in the village of Slanci on the Danube, few kilometers east of above mentioned Višnjica which can be a possible place for ancient exploitation of Viminacium construction purposes.

As artificial materials with pozzolanic features, brick and pottery fragments can be found in mortars of all Viminacium buildings. They were used either minced or crushed. In mortars used for building and core walls filling, brick is visible in the form of larger or smaller fragments, while in the mortars used for plastering and for finishing floor layers, brick is incorporated as a powder which mixed with sand and lime gives the mortar its red colour.(Fig. 21, Fig. 22)

Fig. 16 Substructure of the road entering the northern gate of the legionary fortress. Photo by the author

Nevertheless, not all of the bricks possess pozzolanic features. These features exist only in bricks baked at temperatures lower than 950º C, with a high percentage of clay and with certain chemical features, (Pinheiro, Montenegro, Gumieri 2010) which all can be related exactly to the Viminacium ones. Actually, The Viminacium bricks, as well as all the other ancient

Fig. 17 *Opus testaceum* of Viminacium thermae wall. Photo by the author.

Fig. 18 Brick pavement in Viminacium thermae. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade

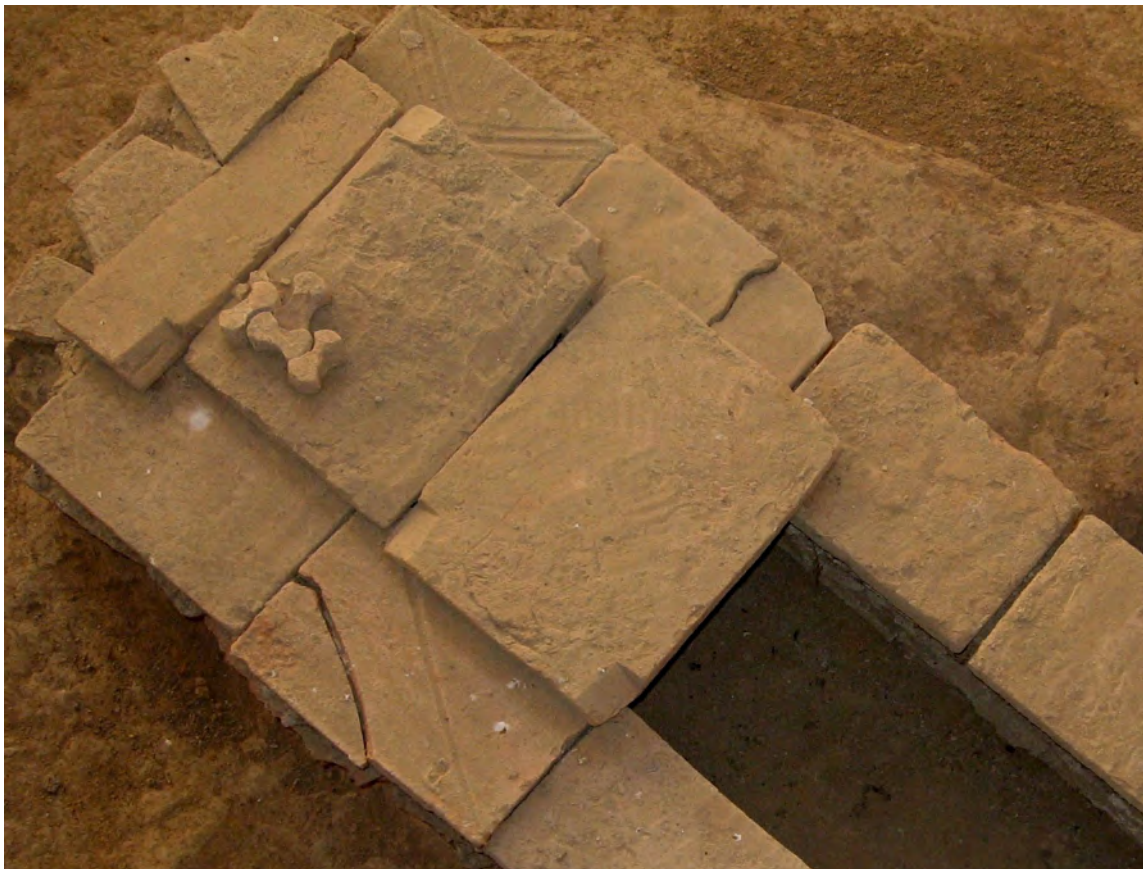


Fig. 19 Grave from "Pirivoj" necropolis in Viminacium built of bricks. Photo by the author.

bricks from the territory of modern Serbia, were fired at a temperature of up to 800ºC. (Radivojevic, Kurtović-Folić 2006:697, Radivojević 2004:34). Also, the overall percentage of certain oxides in Viminacium bricks (Raičković, A. 2012, tabs.2-8) is matching to the one needed for the material with pozzolanic features.

Nevertheless, laboratory analyses of mortars from the Viminacium amphitheatre show that some of the mortars without brick additives, which was also easily visible, (Fig. 23) still possess great strength and high values of aluminium and silicon oxides compared to the ones containing these additives. This most likely means that, while preparing mortars, the builders of Viminacium often used minced or crushed brick as an additive to an aggregate, but also some other, most likely natural mineral aluminosilicate additives, which would have very much improved the mortar features. (Delić Nikolić I., Miličić Lj., Vušović O., Savić, M., Ivović, B. 2011, Nikolić, E., Bogdanović, I. 2012: 59) The possible use of "crvenka" also belongs to the study of natural materials with pozzolanic features which could be used for producing the Viminacium mortars. Worldwide research showed that it can possess pozzolanic characteristics (Gutt, Gaze 1975: 439-450), actually that "naturally burned clay, often present in coal mines", can be possible mortar additive, (Jevtić, Zakić, Harak 2002:60) which probably means that the red colour of the Viminacium mortars could have been derived either from brick additives or from "crvenka".

Apart from lime mortar, the builders of Viminacium also used mud mortar as a binder. It was combined with brick for building pottery kilns (Jordović 1994: 99-101), with stone and brick for tomb constructions, (Васић 1907:70) and was probably used in the walls of the oldest Viminacium buildings.

During the early phases of the legionary fort and the city, wood as a building material was also used, evidence of which is found in holes for wooden piles holding up the wooden stands of the Viminacium amphitheatre (Nikolić, Bogdanović 2012: 43-44, Valtrović 1884:102), and also the remains of the wooden architecture of some other buildings.(Kondić. Zotović 1973:96)

Fig. 20 Vaulted tomb from Viminacium necropolis „Pećine“ built of bricks. Photo by the author.

BUILDING TECHNIQUES OF THE VIMINACIUM BIULDINGS

As in all the other parts of the Roman Empire, the most commonly used building technique in Viminacium was *opus mixtum* - a technique in which a mixture of stone and bricks was used, actually its subgroup, known as *opus incertum mixtum*. Although today one can no longer speak about the upper parts of monumental Viminacium buildings, it is presumed that, because regularly cut stone blocks were unavailable, all of the techniques demanding such a building material were less frequently used. Therefore, according to the Viminacium buildings examined, apart from the already mentioned *opus mixtum* technique, other techniques such as *opus incertum* and *opus testaceum* were also used. Big buildings were also made using the *opus quadratum* technique. Also, there are a few examples of buildings using the *opus spicatum* technique.

The *opus mixtum* technique used in the territory of modern Serbia, including Viminacium, was formed during Late Antiquity under influences from the eastern part of the Empire and it can, therefore, be called the “Byzantine” *opus mixtum.* (Radivojevic, Kurtović-Folić 2006:693) Even though brick as an artificial material with pozzolanic features was added, lime mortar was never able to reach the quality of mortar with added natural materials with pozzolanic features. This led to changes in building techniques in all of the places where such natural materials were not available. (Radivojevic, Kurtović-Folić 2006:693-694) Therefore, stone and bricks were given more importance in supporting structures themselves. Instead of a strong core of “Roman concrete” – *structura caementicia*, typical for traditional Roman architecture, owing most of its good features to qualitative mortar, in the territory of the Eastern Roman Empire there was a strong core of crushed material bound with lime mortar, the so-called “trpanac”, with stone and brick playing very important roles. (Fig.24a, Fig.24b) (Radivojevic, Kurtović-Folić 2006:693-694) Since no stone suitable for cutting into blocks was available in the area of Viminacium, roughly cut stones were mostly used not only for wall cores, but also for wall facings. In such a technique, brick was mostly used as a levelling course, but also where support for another constructive element or a precise wall ending was needed. When walls were thinner, brick layers were placed through the entire cross-section of the

Fig. 21 Lime mortar for plastering of the thermae walls with the addition of brick. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

Fig. 22 Lime mortar for floor layers of the thermae with the addition of brick. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

wall. When vaulting, the upper building parts were probably always made of brick, which can be observed in the preserved Viminacium tombs.

Walls of lower and underground parts or foundations of Viminacium buildings were almost always made using the *opus incertum* technique. However, it is certain that some of the foundations were built out of stone blocks, as mentioned by Mihailo Valtrović, the first Viminacium explorer, who wrote that the "foundations of some of the buildings were very deep and made of large stone blocks". (Валтровић 1884с:95)

Due to the appearance of locally found schist, the upper parts of the Viminacium buildings made in the *opus incertum* and *opus incertum mixtum* technique were probably plastered, which can be actually seen on the walls of excavated thermae building. (Fig. 26) Nevertheless, even though stone that could easily be cut into blocks was not locally available, it can be assumed that the walls of some of the important buildings, apart from those using the *opus quadratum* technique, were also built in the *opus vittatum mixtum* technique in order to obtain a decorative effect when there was no mortar as a finishing layer.

Walls made completely of stones bonded with lime mortar, in the inconsistent not carefully build *opus quadratum* technique, but which still followed the rule of placing headers and stretchers, with smaller holes filled in with small pieces of stone and bricks, can be observed in the arched arena wall of the amphitheatre building,(Fig. 27a, Fig.27b, Fig.28a, Fig.28b, Fig.29) dated to the period between the first quarter of the 2nd century A.D. and the beginning of the 4th century A.D. (Nikolić, Bogdanović 2012: 44) The same case of filling in spaces between large stone blocks is encountered in the walls of ancient *Doclea.* (Živanović, Stamenković 2012:126-127) Technique *opus quadratum* in the Viminacium amphitheatre is used as a combination of two methods. The first is a mutual alternation of the rows of headers and stretchers, typical for walls built without a bonding material. The second is an alternation of headers and stretchers in each row, in this building they were placed with no specific pattern. The irregularity of both of the methods is reflected in different block heights. (Radivojević 2004:49-50, Acocella 2006:67, Adam 1999:206-207) The same way of performing the *opus quadratum* technique is encountered in the already mentioned walls of *Doclea*. (Živanović, Stamenković 2012:126-127) Some parts of the arched wall were irregularly built of fragmented bricks

Fig. 23 Wall of the city rampart with the picture of the hard lime mortar without addition of brick. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

and schist , most likely due to some later repair of the wall which, for some reason, had collapsed and for which the material originating from some ruined buildings was used. (Fig. 28a) A lack of money and time or an inability to obtain the same stone blocks for repair, after a collapse, fire, war damage or something similar, led to a wall repair of this kind. Examples of such filling in of destroyed walls can be seen in *Pompeii,* where after the earthquake, walls were filled in using different techniques and with different materials from the ruins and pottery. (Adam 1999:307-309) In other walls of the amphitheatre, built-in parts of architectural plastic and tombstones can be seen, as well as stone construction parts from the other buildings, actually spolia,, which can also be seen in wall of *Doclea*. (Živanović, Stamenković 2012:127)

It can be presumed that great Viminacium buildings were constructed with massive walls, like the fort and the amphitheatre, actually the first public buildings, in the *opus quadratum* technique. Still, in the amphitheatre, most likely due to lack of limestone blocks, the builders also used the *opus incertum* technique wherever it was possible. All of the rooms around the arena were built from schist using this technique and only the corner supports were made of limestone blocks. (Fig, 25) Regarding the city walls, their northern part, preserved up to a height of 2.25m, was examined several decades ago, and showed that it was built "of cut blocks bound with mortar". (Zotović 1974:48)

Building with large stone blocks can be linked to the greatest prosperity of Viminacium in the 2nd and 3rd centuries. Although they were massive structures, early Byzantine walls at the site of "Svetinja" were built out of broken stone pieces and bricks with lots of mortar. They were also built out of the aforementioned stone blocks derived from ancient ruins, but only in the layer of socle. (Popović 1987:432-445) During the first research of Viminacium in 1882, Mihailo Valtrović found a round fort tower preserved up to 1.60 m with walls which were 2.30 m thick, made of "cut and uncut stones". (Валтровић 1884c:95) He also wrote about great stone blocks, 3.0 m long and 0.50 m thick, used to pave a street. (Валтровић, 1884c, 99) what can be connected to usage of large limestone or sandstone blocks, but also to large schist blocks which is the case with recently excavated street in Viminacium. (Fig.30a) and the road leading through the northern gate of Viminacium fort.(Fig. 30b)

Fig. 24a Trpanac in the wall of Viminacium thermae. Photo documentation of the project Viminacium, Archaeological Institute.

With the exception of stone sarcophagi made of limestone and sandstone, which can be seen exhibited in archaeological park of Viminacium and lapidariums in Požarevac and Belgrade, single graves from Viminacium mostly represent constructions made of bricks, sometimes mixed with small stone pieces,[1] although huge grave constructions made of schist were also discovered.[2] "In the very vicinity of Viminacium there is no stone suitable for cutting. Therefore, the graves known so far were mostly made of bricks, for which there was a lot of suitable clay".(Валтровић 1884d:124) This is what some hundred and thirty years ago, Mihailo Valtrović wrote. Over 13,000 graves excavated later in Viminacium (Golubović 1999:9), proved him right.

Apart from the *opus mixtum* technique, Late Antique architecture of the Eastern Roman Empire also included walls entirely made of bricks, in a technique which can be called "Byzantine" *opus testaceum* This is different from the *opus testaceum* technique which includes walls plastered with bricks and filled with "Roman concrete". (Radivojevic, Kurtović-Folić 2006:693-694) It is presumed that in Viminacium, owing to own brick production and accessibility to clay sources, the "Byzantine" *opus testaceum* technique was frequently used in upper wall structures. The role of bricks was certainly very important in the construction of buildings, forming their skeletal structures in most cases, with schist used for filling.

An example of the change of building techniques through phases of a building can best be observed in the Viminacium baths, dated to the period from the 1st to the 4th century. (Zotović 1973:47-50, Kondić, Zotović 1974:94-98, Milovanović 2008: 51-55) Here we encounter the techniques *opus incertum,* (Fig.31) used for constructing the foundations and undeground walls, and *opus testaceum, opus incertum mixtum* and *opus mixtum* for the upper parts of the building. Soon after the earliest research of the baths, it was evident that there were

Fig. 24b Trpanac in the arched arena wall of the Viminacium amphitheatre. Photo by the author.

three phases of existence, (Kondić, Zotović 1974:97) exactly like it was the case with the buildings described at the beginning of the 20th century by Miloje Vasić. (Mirković 1968:62) The oldest, first phase of the thermae, dated to the 1st century, was not investigated at the level of its walls, but its existence is presumed according to a hypocaust which was placed under the level of the second phase. The middle phase, from the 3rd century, includes the apsidal walls built in the most frequently used *opus incertum mixtum* technique, with levelling courses consisting of three brick rows. (Fig. 32) Another technique was also used, called simply *opus mixtum,*

1 About the types of grave constructions and materials used for their building see in: др Милоје Васић, „Неколике гробне конструкције из Виминацијума", Старинар н.р. II (Београд: Српско археолошко друштво, 1907), 67.

2 Ascertained after looking into the field documentation of the project Viminacium of the Archaeological Institute.

Fig. 25 *Opus incertum* in the rooms outside the arena of the amphitheatre with visible blocks of limestone on the wall corners. Photo by the author.

Fig. 26 Plastered wall of an apse in Viminacium thermae. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

Fig. 27a. Arched wall of the amphitheatre arena. Photo by the author.

Fig. 27b Arched wall of the amphitheatre arena, detail. Photo by the author.

Fig. 28a Arched wall of the amphitheatre arena with visible repairs. Photo by the author.

in which stones and bricks were placed in the wall facing structure in no particular order and with large amounts of mortar. (Fig. 33) However, specific areas with slight groupings of stones and bricks can be noticeable here, along with one or four levelling courses. These can be understood as repairs, i.e. the renewing of a destroyed wall, since this is the only part of the building in which it is visible. The walls

Fig. 28b Arched wall of the amphitheatre arena with visible repairs, details. Photo by the author.

of the youngest third phase, dated to the 4th century, and which was the most damaged one, represent parts of the upper structures. (Fig. 34) The remains are preserved only to a small height and were mostly built of whole bricks and without stones, using the "Byzantine" *opus testaceum* technique, and, much less frequently, using the *opus incertum mixtum* technique.

Within the craftsmen's centre, dated to the 2nd and 3rd centuries A.D, (Jordović 1994:103-104) in the pottery kilns area, there is a wall between two kilns preserved up to a height of 3.60m, (Jordović 1994:103-104), that possesses an interesting structure. It was built of green schist and bricks, with a visible attempt to place schist into regular rows, and use the *opus vittatum mixtum* technique. Inevitably, due to the irregularities, when this kind of stone is used, it is described as the *opus incertum mixtum* technique. Partly visible, regular rows of densely placed stones are alternated with a row of bricks with almost invisible mortar joints, which is as a rule repeated six times, after which the building was continued with only schist structures. Another wall of this centre was built using the same technique, and is semi-circular in shape and preserved up to the height of 2.70 m. (Fig. 25)

Fig. 29 Arched wall of the amphitheatre with visible bigger and smaller pieces of stone. Photo by the author.

(Jordović 1994:103-104)

It is interesting to mention examples of the *opus spicatum* technique in the Viminacium buildings, very rarely used for constructing Roman buildings. (Radivojević 2004:56, Adam 1999:288-289) The first example is shown in the lowest zone of the surrounding walls of a tomb G-5336 from the site "Pećine", dated into the middle of the 4th century, (Milošević 2006:126-129, app.530) in which a wall was built using this technique, and consists completely of bricks.[3] (Fig.36) Using the *opus spicatum* technique, but combining stone and bricks, the foundations of one more building, from the site "Više Burdelja", but with undetermined purpose, were made. They were built on the older necropolis and dated into the second half of the 4th century. (Jeremić 1978:55-57, plate XXXI, Milošević 2006:147-149, apps. 548-557) For its construction, secondarily used material was also used, such as bricks and tombstones.[4]

3 Ascertained after looking into the photo documentation of the project Viminacium of the Archaeological Institute.

4 Ascertained after looking into the photo documentation of the project Viminacium of the Archaeological Institute

Fig. 30a Street paved with large green schist blocks. Photo by the author.

Fig. 30b Street paved with large green schist blocks. Photo by the author.

Fig. 31 *Opus incertum* in the walls of Viminacium thermae. Photo by the author.

Fig. 32 *Opus incertum mixtum* in the walls of Viminacium thermae. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

Fig. 33 *Opus mixtum* in the walls of Viminacium thermae. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

Fig. 34 *Opus testaceum* in the walls of Viminacium thermae. Photo documentation of the Project Viminacium, Archaeological Institute Belgrade.

Fig. 35. *Opus incertum mixtum* done similarly to *opus vittatum mixtum* in the wall of the craftsmen's centre. Photo by the author.

Fig. 36 *Opus spicatum* in the wall of the tomb.
Photo-documentation of the Republic Institute for the Protection of Monuments.

CONCLUSION

The use of building materials in a certain age, the methods of their exploitation and production, as well as the techniques of building, can offer valuable data about life in general in an area.

The architecture of Viminacium was, in accordance with general features of ancient Roman architecture, often being forced to be reduced and rationalised in the use of local materials for most of the buildings, but also monumental and luxurious in the use of hard-to-obtain and expensive materials for the most important buildings of this city, the capital of a province on the outskirts of the Roman Empire.

The Viminacium buildings showed that building techniques are in direct connection with building periods of Roman buildings. The techniques followed the basic principles of Roman architecture, but also applied varieties from this part of the eastern Empire, and always respected features of the locally available materials that played an important role throughout the existence of Viminacium, during the ancient, Late Antique and Early Byzantine periods, spanning from the 1st to the 7th century A.D.

BIBLIOGRAPHY

Acocella, A. 2006
Stone Architecture. Ancient and modern constructive skills. Trans. Alice Fisher and Patrick John Barr. Milan: Skira-Lucense

Adam, J. P. 1999
Roman Building:Materials And Techniques (1989). Trans. Anthony Matthews. London: Routledge

Andrić, Lj. 2010
"Proizvodnja nemetaličnih mineralnih sirovina/ Production of Non-metalic Mineral Raw Materials", u: *Mineralnosirovinski kompleks Srbije danas: izazovi i raskršća (Mineral- Resources complex of Serbia today: Challenges and Crossroads)*. Beograd: Akademija inženjerskih nauka Srbije, Rudarsko-geološki fakultet Univerziteta u Beogradu, Privredna komora Srbije,189-202

Bartel, B., Kondić,V. and Werner, M.R. 1979
"Excavations at Kraku'lu Yordan, Northeast Serbia: Preliminary Report, 1973-76 Seasons." *Journal of Field Archaeology* Vol. 6, No. 2. Boston: Boston University, 127-149

Geokaching
"Between the villages of Osvetimany and Medlovice lies the only locality with porcelain jasper (porcellanite) in Moravia - Medlovice quarry", http://www.geocaching.com/seek/cache_details.aspx?guid=67bdbf9a-e155-43c7-a7e1-10ed837a774e (accessed September, 21st 2012)

Bluemie, J. P., Jacob, A. F., 1973.
Geology along the South Loop Road: Theodore Roosevelt National Memorial Park - North Dacota Geological Survey, Educational Series 4. Medora: Theodore Roosevelt Nature and History Association

Бојовић, Д., 1977
"Римске терме у парку на Студентском тргу у Београду". *Годишњак града Београда* XXIV. Београд: Музеј града Београда, 5-22

Цуњак , Мр М.,1995-1996
"Терме на Орашју – Дубравица код Пожаревца" *Viminacivm* 10. Пожаревац: Народни музеј Пожаревац, 105-120

Đurić, B., Davidović, J., Maver, A., Müller, H.W., 2006
"Stone use in Roman towns. Resources, transport, products and clients. Case study Sirmium. First Report". *Старинар* 56. Београд: Археолошки институт, 103-137

Golubović, S., 1999
"A Grave In a Shape of a Well From the Necropolis of Viminacium". *Archaeologia Bulgarica* Vol.3. Sofia: Nous Publishers, 9-22

Golubović, S., Korać, M., 2008
"The Recent Discovery of a Temple Complex at Viminacium". *Roma 2008 – International Congress of Classical Archaeology: Meeting Between Cultures In the Ancient Mediterranean* http://151.12.58.75/archeologia/bao_document/poster/5_Golubovic_Korac.pdf (accessed September, 17th 2012).

Gutt, W., Gaze, M. E., 1975
"Trinidad porcellanite as a pozzolan". *Materials and Structures* Vol.8, No.6. Dordrecht: Kluwer Academic Publishers, 439-450

Delić Nikolić I., Miličić Lj. , Vušović O., Savić, M., Ivović, B. 2011
Izveštaj o ispitivanju uzoraka maltera sa amfiteatra arheološkog nalazišta Viminacijum. Beograd, Institut za ispitivanje materijala a.d.

Jeremić, M.,1978
"Viminacium – Kostolac: Arhitektura na lokalitetu „Više Burdelja". *Arheološki pregled* 19. Beograd: Savez arheoloških društava Jugoslavije, 55-57

Jevtić, D., Zakić D., Harak, S., 2002
"Ispitivanje različitih tipova maltera spravljenih na bazi opekarskog loma". *Materijali i konstrukcije* 45. Beograd: Društvo za ispitivanje i istraživanje materijala i konstrukcija Srbije, 60-63

Jordović, Č., 1994
"Grnčarski i ciglarski centar u Viminacijumu". *Saopštenja* XXVI. Beograd: Zavod za zaštitu spomenika kulture Srbije, 95-106

Каниц, Ф., 1989
Србија: Земља и становништво од римског доба до краја XIX века, Прва књига. Београд: Српска књижевна задруга

Каталог непокретних добара на подручју Града Београда.
"Археолошко налазиште, Утврђење *Ad Octavum*, Вишњица"
http://151.12.58.75/archeologia/bao_document/poster/5_Golubovic_Korac.pdf (accessed July 17, 2013).

Kondić, V., Zotović, Lj., 1974
"Viminacium – rezultati arheoloških istraživanja u 1974. godini"., *Arheološki pregled* 16. Beograd: Savez arheoloških društava Jugoslavije, 94-97

Maravelaki-Kalaitzakia, P., Bakolas, A., Moropoulou, A.,2003.
"Physico-chemical study of Cretan ancient mortars". *Cement and Concrete Research* 33. Elsevier,, 651-661

Марић, Р., 1951
"Ископавања на Орашју, претходни извештај о радовима у 1945-1949 години". *Старинар* II. Београд: Археолошки институт, 113-132

Mašinski fakultet Univerziteta u Beogradu, 2010
TE Kostolac B, postrojenje za odsumporavanje dimnih gasova: Studija o proceni uticaja na životnu sredinu. Beograd: JP Elektroprivreda Srbije

Миловановић, Б., 2008.
"Извештај са систематских археолошких ископавања на локалитету Терме – Виминацијум 2004. године". *Археолошки преглед* н.с. 2/3 (2004/5). Београд: Министарство културе Републике Србије и Српско археолошко друштво, 51-54

Милошевић, Г., 2006
Архитектура гробница у римским централнобалканским провинцијама од IV до VI века. Unpublished PhD thesis, defended at Faculty of Architecture, Belgrade

Милошевић, Г., 1987
"Рановизантијска архитектура на Светињи у Костолцу". *Старинар* XXXVIII. Београд: Археолошки институт, 39-63

Mirković, M., 1968
Rimski gradovi na Dunavu u Gornjoj Meziji. Beograd: Arheološko društvo Jugoslavije

Moropoulou, A., Bakolas, A., Bisbikou, K., 2000
"Investigation of the technology of historic mortars". *Journal of Cultural Heritage* 1. Elsevier, 45–58

Nikolić, E., Bogdanović, I., 2012
"Proučavanje maltera iz viminacijumskog amfiteatra kao osnova za njegovu buduću konzervaciju i restauraciju". In: Arheologija u Srbiji: Projekti Arheološkog instituta u 2011. godini. Eds. V.Bikić, S.Golubović, D.Antonović, Beograd: Arheološki institut, 58-61

Nikolić, S., Bogdanović, I., 2012
"Istraživanja viminacijumskog amfiteatra u toku 2011. godine". In: Arheologija u Srbiji: Projekti Arheološkog instituta u 2011.godini. Eds. V.Bikić, S.Golubović, D.Antonović, Beograd: Arheološki institut, 42-46

Pinheiro, I. S., Montenegro, L.C., and Gumieri, A.G., 2010
"Pozzolanic Activity of Recycled Red Ceramic Bricks". *Second International Conference on Sustainable Construction Materials and Technologies* 2010, http://www.claisse.info/2010%20papers/l31.pdf **(**accessed March 25th, 2012).

Popović, P., 2008
"Archaeological Finds From the Vaulted Building at Krševica". Старинар LVIII. Београд: Археолошки институт, 95-106

Поповић, М., 1987
"Светиња, нови подаци о рановизантијском Виминацијуму". *Старинар* XXXVIII. Београд: Археолошки институт, 1-37

Rădan, S.-C., Rădan, S,2012
"Coal palaeofires in the western Dacic Basin: geophysical, mineralogical and geochemical signatures recovered from porcelanites and clinkers; a case history". *Second International Conference on Coal Fire Research ICCFR 2012*, http://www.coalfire.org/conference/index.php/iccfr2/2010/paper/view/75 (accessed September 21st, 2012)

Radivojević, A., 2004
Konstrukcije i tehnike građenja antičkog Rima. Beograd: Orion Art

Radivojević, A., Kurtović-Folić, N., 2006
”Evolution of Bricks and Brick Masonry in the Early History of Its Use in the Region of Today’s Serbia”. *J. Mater. Civ. Eng.* 18, SPECIAL ISSUE: Innovative Materials and Technologies for Construction and Restoration. Reston, VA: American Society of Civil Engineers, 692-699

Raičković, A., 2012.
Keramičke posude iz grobova tipa Mala Kopašnica Sase. Unpublished PhD thesis, defended at Faculty of Philosophy, Belgrade

Ringbom, Å., Hale, J., Heinemeier, J., Lindroos, A., Brock, F., 2006
“The Use of Mortar Dating in Archaeological Studies of Classical and Medieval Structures”. *Second International Congress on Construction History 2006*, http://www.arct.cam.ac.uk/Downloads/ichs/vol-3-2613-2634-ringbom.pdf (accessed March 25, 2012).

Томовић, Др М., 1991
“Проконески саркофаг са гирландама из Viminacivma“. *Viminacivm* 6. Пожаревац: Народни музеј Пожаревац, 69-82

United States. EIS Task Force., 1976
Alaska natural gas transportation system: final environmental impact statement, Vol.6. The Department : for sale by the Supt. of Docs., U.S. Govt. Print. Off

Валтровић, М., 1884a
“Откопавања у Костолцу“. *Старинар* 1, 3. део. Београд: Српско археолошко друштво, 89-104

Валтровић, М., 1884d
“Откопавања у Костолцу“. *Старинар* 1, 4. део. Београд: Српско археолошко друштво, 121-142

Васић, М., 1895
“Колонија Виминацијум: археолошка студија“. *Старинар* XII. Београд: Српско археолошки друштво, 1-6

Васић, др М., 1907
“Неколике гробне конструкције из Виминацијума“. *Старинар* н.р.II. Београд: Српско археолошко друштво, 66-98

Вучетић, М., 2010
Из историје српских угљенокопа: Јаме костолачког мајдана. Београд: ЈП „Електропривреда Србије“

Zotović, Lj., 1974
“Viminacium“. *Arheološki pregled* 15. Beograd: Savez arheoloških društava Jugoslavije, 47-50

Živanović, M , Stamenković, A., 2012
“O gradskim bedemima antičlke Dokleje/On city Walls of Ancient Doclea”. U/In: *Nova Antička Duklja III/New Ancient Doclea II,* ur/ed.Dragan Radović. Podgorica: JU Muzeji i galerije Podgorice/ Museums and Galleries of Podgorica, 115-143.

REZIME

PRILOG PROUČAVANJU RIMSKE ARHITEKTURE VIMINACIJUMA: KONSTRUKTIVNI MATERIJALI I TEHNIKE ZIDANJA

Ključne reči: Viminacium, zeleni škriljac, opeka, krečnjak, krečni malter, „crvenka”, *opus incertum mixtum, opus testaceum,* „trpanac“, pucolansko svojstvo.

Najčešće korišćen kamen za izgradnju antičkog Viminacijuma je bio zeleni škriljac, pogodan za temeljne i podzemne konstrukcije građevina. S obzirom da je skoro neizvodljivo obrađivati ovu vrstu kamena u pravilne blokove, zidovi zidani od škriljca su obilato zalivani krečnim malterom. Kao samostalan konstruktivni materijal škriljac nije bio pogodan za zidanje nadzemnih struktura. Zato je najčešća tehnika graditeljstva Viminacijuma bila *opus incertum mixtum,* koja je uz škriljac podrazumevala i upotrebu opeke.

Odsustvo prirodnih materijala sa pucolanskim svojstvima, neophodnih za nastanak „rimskog betona“, takođe je uticalo na upotrebu određenih tehnika građenja Viminacijuma. Zato je tehnika *opus incertum mixtum* predstavljala takozvani „vizantijski“ tip, gde je pored opeke, koja je čak i kao sloj za izravnavanje uticala na izgled i ponašanje čitave konstrukcije, veoma

važnu ulogu nosilo jegro zida, odnosno „trpanac“, kao jedna od glavnih odlika graditeljstva Istočnog Rimskog carstva. Opeka kao lokalni proizvod Viminacijuma formirala je i samostalnu tehniku građenja, „vizantijski“ *opus testaceum*, koja je u određenim periodima bila jednako zastupljena kao i već pomenuta *opus incertum mixtum*.

VOJISLAV FILIPOVIĆ,
Institute of Archaeology,
Belgrade, Serbia
email: vfilipov1@gmail.com

VLADIMIR PETROVIĆ,
Institute of Balkan Studies of SASA,
Belgrade, Serbia

UDC: 904"652/653"(497.11); 7.025(497.11)
Original research article
Received: March, 03rd 2013
Accepted: October 15th 2013

DESTRUCTION OF ARCHAEOLOGICAL AND CULTURAL HERITAGE IN THE AREA OF SVRLJIG

ABSTRACT

After a large survey of the territory in the region of Svrljig over the past seven years, we found the very desperate situation on the ground. At the archaeological sites we clearly noticed the traces of activities by the people who illegally possess metal detectors. Roman, byzantine and medieval fortifications, ramparts and towers are often completely drilled with the deep holes that measure up to several meters, while the walls are often cut and dig under the foundations. The most vulnerable archaeological site is the Svrljig-fortress. During the 1999 bombing, the local treasure hunters blew up two towers of Svrljig-fortress by dynamite. The round tower then collapsed to a height of about 3 m, while the rectangular is brought beyond recognition. Architectural structures in the suburbs are also targeted by local treasure hunters. At the Gradac site, next to the village of Grbavče, only 25 years ago were registered the remains of fortifications with walls about 1.5 m wide, several towers and small suburb. Today, this site on the small hill is completely bare.

Keywords: cultural heritage, area of Svrljig, Roman, byzantine and medieval fortifications.

The difficulties in the protection of cultural heritage have been present in Serbia for more than two decades. We cannot declare that our colleagues in the field of protection of cultural heritage are not trying to fight against this persistent problem. It is obvious that the relevant institutions and individuals did not have the enough power and legislative capacity to combat this social phenomenon or at least to reduce it to a smaller extent. This communication will try to display the very serious situation in southeastern Serbia, more precisely in the small municipality of Svrljig in the Timok river valley.

Over the past seven years, the region of Svrljig was examined in the professional manner by the team of archeologists from Belgrade (Петровић, Филиповић и Миливојевић 2012 with complete older literature). After a large survey of the territory, we found the very desperate situation on the ground (Филиповић и Миливојевић 2008), especially in terms of damage to antique roman and medieval architecture.

At the archaeological sites that do not have the visible architectural remains above ground we clearly noticed the traces of activities by the people who illegally possess metal detectors. Almost

all sites have drilled holes and dimples with the depth to 20 cm (fig. 1). In this context, it should be emphasized the destruction of cultural layers in many of so far even unregistered caves. Moreover, the natural fractures in the rocks are considered to

Fig. 1 Big hole under the village stone cross made by treasure hunters

be the alleged "roadmap" to a hidden treasure and deepened by picks or heavy machinery where possible and often undermine by dynamite. Cultural layers of Prekonoška cave, one of the first paleontological and archaeological cave sites in Serbia, which was explored even in 19th century are today dug, heavily damaged and lost to science.

Roman, byzantine and medieval fortifications, ramparts and towers are often completely drilled with the deep holes that measure up to several meters, while the walls are often cut and dig under the foundations. The most vulnerable archaeological site and the most famous in scientific literature is the Svrljig-grad fortress. Felix Kanitz and Jovan Misković accurately describe the remains of the fort 125 years ago, saying that the round tower, with 4 floors and doors, was preserved 10 m in height, while the rectangular tower was better preserved, with a height of about 12 m. Experts from the Institute for Protection of Cultural Monuments in Niš visited the area about 25 years ago and then concluded a satisfactory degree of conservation of the architecture (fig. 2a). During the 1999 bombing, the local treasure hunters took advantage of the war and they blew up two towers by dynamite. The round tower then collapsed to a height of about 3 m (fig. 2b), while the rectangular is brought beyond recognition and its height does not exceed 2 m. Architectural structures in the suburbs are also targeted by local treasure hunters. At the fort Kulište in the village of Manojlica, defensive rampart is cut with a hole about 2 m wide and 2.5 m deep. Below the fort, at the plateau next to the Manojlička River, the half meter wide hole is recently dug, with the depth of more than 3 m and length of about 6 m. At the site Gradac next to the village of Grbavče only 25 years ago (fig. 3a) were registered the remains of fortifications with walls about 1.5 m wide, several towers and small suburb. Today, this site on the small mount is completely bare (fig. 3b), and on its milder slopes local treasure hunters continue to chase for treasures and to destroy the foundations of this fortress.

Holy places - churches, church grounds, hermitage-caves, mosques and stone crosses with votive trees, have also been targeted more recently by teams searching for buried treasure. The most endangered are abandoned church grounds, but in the last couple of years the holes were dug in the church yards, especially where there is no permanent priest. The most vulnerable sanctities and in the mean time the oldest churches in the area of Svrljig are four churches under the fortress of Svrljig-grad at the place called Banjica. Only one of those four churches is less destructed due to the fact that it is next to an asphalt road and traffic. However, around this church about 15 graves were desecrated, the grave stones are misplaced and all around is visible a large number of holes. Christian churches in the lower terrain were damaged to a greater extent. In the middle of the northern wall of the one large church we noticed a big hole about 2 m large and 3 m deep. Along its northern wall it exists an excavated zone more than 3 m wide, dug to the bottom of the wall foundation. The St. Stephen church with the late antique barrel-vaulted brick grave is the most destructed of all the holy places. Place of compound of the north wall of the narthex and the church is completely

Fig. 2a Round tower on the Svrljig fort, 1984

cut through with a 2 m wide hole and more than 10 m^3 of construction and demolition material was removed. Barrel-vaulted brick tomb with niches in the walls is completely destroyed. The fourth church, non-registered so far in the literature, also suffered substantial damage. There are two large holes measuring 4 x 3 m and 3 x 2 m and about 2 m deep, next to which are large grave stone plaques. All around lie scattered bones of deceased. In the suburb of the Svrljig-grad fortress at the slope in the direction of the village Varoš are the remains of the mosque from the Ottoman period also significantly destroyed by hunters for treasure. In the village of Manojlica, not far from the Svrljig-grad fortress is a small, not too long ago renovated church of St. Constantine and Helen, with an old school next to the sanctity. Since the church is not in a permanent use and that the priest holds the service only few times a year, the church and school were also targeted by teams of diggers for treasure. In the yard, next to the bell tower, gaping a big hole measuring 2 x 2 m and 1.5 m deep. Votive crosses and oaks are also left at the mercy of treasure seekers. At some places, stone crosses were knocked down and under them pits were dug. At the end of this text, let us mention the old and abandoned mills and barns, some of which are completely ruined and brought to the unrecognizable level, by dynamite and heavy machinery.

From the facts and illustrations presented here we can determine some conclusions and identify specific, primarily negative trends regarding the wanton destruction of cultural heritage. Until 20 years ago one of the obstacles for destruction of cultural heritage was among other things the respect for churches and holy places. As we have seen in several cases, this respect is rapidly disappearing today. Moreover, old churches and other holy places are fertile ground for searching for treasuries because at least three reasons. First, they had never been previously dug by the treasury hunters, which provide a greater "potential" for the contemporary diggers, driven by the old stereotype in the people's mind that the church itself has to be rich and full of precious metals. Second, in addition to churches and stone inscriptions

Fig. 2b Round tower on the Svrljig fort, 2007

are often found old coins, often worthless, that were left there many decades or centuries before, which only make the further argument to nowadays treasury hunters that "there is something." At the last place is the fact that many churches have lost their ever-present priest, and that the people comes only once a year to those holy places.

BIBLIOGRAPHY

Петровић, П. В., Филиповић, В. и Миливојевић С. 2012.
Сврљишка област у праисторији, антици и средњем веку, Београд-Сврљиг.

Филиповић, В. и Миливојевић, С. 2008.
Уништавање археолошких локалитета, утврђења и сакралних места у области Сврљига, *Етно-културолошки зборник* XII, Сврљиг, Етно-културолошка радионица, 107–112.

REZIME

UNIŠTAVANJE ARHEOLOŠKOG I KULTURNOG NASLEĐA U OBLASTI SRVLJIGA

Ključne reči: kulturno nasleđe, oblast Svrljiga, rimska vizantijska i srednjovekovna utvrđenja.

Na osnovu višegodišnjeg intenzivnog terenskog rada i dokumentovanih slučajeva, u radu se govori o uništavanju kulturne baštine na teritoriji Svrljiga. Najviše su ugroženi arhitektonski ostaci starih crkava i utvrđenja, ali je takođe dokumentovano i uništavanje grobova, zavetnih krstova, kopanje u okviru porti aktivnih crkava, kao i ruiniranje i rušenje starih škola, vodenica i pojata. Na arheološkim lokalitetima koji nemaju vidljive ostatke arhitekture jasno se uočavaju tragovi rada osoba koji nelegalno poseduju detektore za metal (sl. 1). U ovom kontekstu, posebno treba naglasiti uništavanje kulturnih slojeva po mnogobrojnim i do sada čak neregistrovanim pećinama i potkapinama. Slojevi Prekonoške pećine danas su potpuno prekopani i izgubljeni za nauku.

Na antičkim, vizantijskim i srednjovekovnim utvrđenjima, bedemi i kule očuvani do visine od nekoliko metara i prekriveni šutom i gustom vegetacijom, često su potpuno izbušeni rupama dubine i do nekoliko metara, dok se zidovi neretko presecaju i kopaju ispod temelja. Najugroženije utvrđenje je, svakako, stari grad Svrljig. Kanic i Mišković precizno opisuju njegove ostatke pre 125 godina i kažu da okrugla kula sa 4 sprata i očuvanim vratima ima 10 m u visinu, dok je pravougaona kula bila još bolje očuvana, sa visinom od oko 12 m. I pre 25 godina konstatovan je zadovoljavajući stepen očuvanosti arhitekture na Svrljig gradu (sl. 2a), ali su tokom bombardovanja 1999. godine lokalni tragači za blagom iskoristili ratno stanje i dinamitom razneli obe kule. Okrugla kula tada je srušena do visine od oko 3 m (sl. 2b), dok je pravougaona dovedena do neprepoznatljivosti i njena visina ne prelazi 2 m. Na lokalitetu Gradac u selu Grbavče, do samo pre 25 godina registrovani su vidljivi ostaci utvrđenja sa bedemima širine oko 1.5 m, nekoliko kula i manjim podgrađem (sl. 3a). Danas je ovo brdo potpuno ogoljeno (sl. 3b).

Fig. 3a Grbavče fort, 1984

Fig. 3b Grbavče fort, 2007

ERIC DE SENA,
American Research Center in Sofia,
Sofia, Bulgaria
sofiadirector@arcsofia.org

UDC: 904:72”652”(498) ; 902.2(498)”2010”
Original research article
Received: April 05th 2013
Accepted: October 15th 2013

POROLISSUM: A CASE STUDY IN THE ARCHAEOLOGICAL HERITAGE OF ROMANIA

ABSTRACT

This paper presents an overview of the Roman site, Porolissum, located in northwestern Romania. The first section concerns the history of the site and an overview of its preserved features. The second section characterizes the stakeholders at Porolissum, the challenges and the activities of the stakeholders to confront the challenges. The conclusion suggests that the site can be better administered and promoted with the development of a clear vision, a business plan, better cooperation between the stakeholders and support from central authorities in Bucharest.

Keywords: Porolissum, Roman, Romania.

I INTRODUCTION.

Located in northwestern Romania, the Roman city of Porolissum is one of the most important archaeological sites in the Balkans. Porolissum served as a crucial military center and developed into a small Roman city with trade connections between the empire and *barbaricum*. The author of this paper served as co-director of the Porolissum Forum Project together with Alexandru V. Matei 2004-10 and with Robert Wanner in 2011 and is, therefore, very familiar with the management and promotion of the site. This paper discusses the manner in which the site is administered, investigated and promoted by a variety of stakeholders.

II OVERVIEW OF THE ARCHAEOLOGICAL SITE OF POROLISSUM

Established in AD 106 by Trajan, Porolissum was the northernmost military center of Roman Dacia and was a *municipium* by at least the early Severan period (Fig 1). It initially served as the primary military base in the hierarchy of the Roman defensive network in northern Dacia with secondary fortresses located at Tihău (Gudea 1985), Romita-Certiae (Matei and Bajusz 1997), Romanaşi (Tamba 1997) and Buciumi (Chirilă et al. 1972; Landes-Gyemant and Gudea 2001). The city is set upon the summit and slopes of Pomet Hill on the southern side of a mountain pass that allowed communication between the Transylvanian region of the Carpathian Mountains and the Pannonian Plains. In addition to protecting a ma-

Fig. 1 Map indicating the location of Porolissum (E.C. De Sena and J.P. Ikäheimo)

jor corridor into northern Dacia, the location of Porolissum affords a commanding view of a 20 mile stretch of the Roman *limes* and offers a line of vision toward one of the most important native Dacian sites, Şimleu Silvaniei some 16 miles to the west (Pop et al., 2006), probably *Dacidava* mentioned by Claudius Ptolomeus (*Geography III, Dacia*).

The original Roman military center at Porolissum consisted of several thousand legionary and auxiliary soldiers (Petolescu 1997, 66-141; Gudea and Schüller 1998, 120; Matei 2003, 279-281). During the earliest phase of occupation, the cohorts appear to have been grouped into a series of wooden fortresses on Pomet Hill and nearby Citera Hill (Matei 2003; Diaconescu 2004). Within a few decades, the soldiers were consolidated into the large stone fortress which still dominates Pomet Hill. This event may have coincided with Hadrian's reorganization of Dacia and the establishment of Porolissum as the capital of Dacia Porolissensis and was certainly no later than the construction of a stone amphitheater in AD 157 (C.I.L. 03, 00836; Bajusz 1997, 1999). By the time soldiers were consolidated into the stone fortress, a sizable *vicus* had developed on the eastern and southern slopes of Pomet Hill. The later second and early third centuries AD witnessed further political, demographic and urban developments. The city was renamed *municipium Septimium Porolissensis* during the reign of either Septimius Severus or Caracalla. It was also during the Severan period that the amphitheater and a pair of temples were renovated (Bajusz 1999; Gudea 1989, Gudea and Tamba 2001, 11-18); many of the structures excavated by the Porolissum Forum Project team were also rebuilt/renovated at this time.

The late Roman (AD 235-271) and immediate post-Roman (AD 271-375) periods of Porolissum are not fully understood. While there is a gap in the sequence of coins between ca. AD 262 and 325 (Găzdac 2006), there are no signs of destruction or rapid abandonment of the site (cf. Inomata and Webb 2003). Regardless of the process of the Romans' withdrawal, there is some evidence that Porolissum was inhabited at least sporadically over the course of the next century and that the inhabitants even maintained some commercial relations with the Romans until the late fourth century, attested by a small number of late Ro-

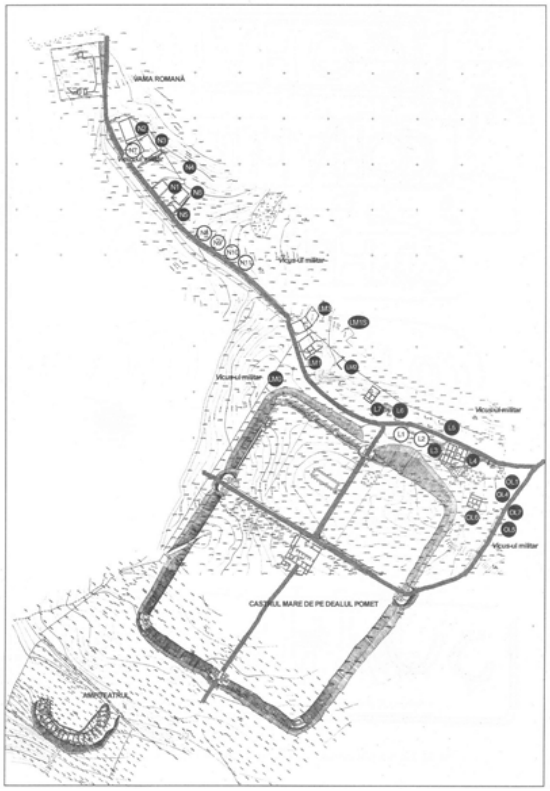


Fig. 2 Plan of excavated areas of Porolissum (Tamba 2009, fig 25)

man coins dating to AD 325-375 (Găzdac 2006).

There is no evidence of land usage after the late 4th c. AD and the process of decay, spoliation and forestation led to the vanishing of the city. By the early modern period, the site had been forgotten and it was not until the 19th century, when a land baron had his peasants cut timber, that the site was re-discovered. Excavations through the mid 20th century were limited and focused primarily upon the fortress. Systematic excavations led by scholars from Cluj and Zalău only began in 1977.

While much of the ancient city remains to be excavated, archaeologists have revealed a 1 km stretch of Roman road as well as an adjacent sequence of houses, temples and commercial spaces (Fig. 2). The two most spectacular features are the military base, with its iconic, albeit completely rebuilt, Porta Praetoria (Fig. 3), and an amphitheater whose backdrop is a breathtaking Transylvanian landscape. Most of the architectural features only protrude 50-80 cm from the ground and have been "capped" with cement to help preserve them. Fortunately there are no environmental or human-provoked risks that endanger the site. Considering that archaeological work has been conducted nearly every year since 1977, the Salaj County Museum constructed dormitory facilities about 30 years ago for teams of archaeologists. There are no facilities for touristic visitors to the site.

III CHALLENGES AND SOLUTIONS

There are three primary concerns regarding the archaeological site of Porolissum: scientific research, upkeep and conservation, promotion and tourism. Several different stakeholders play official and unofficial roles in achieving results:

- ***Salaj County Government***. The archaeological patrimony of Romania is controlled by the State while county or municipal administrators ultimately manage sites. Porolissum is, therefore, managed under the authority of the Salaj county government, which allocates a certain amount of funding. Much of the funding for Porolissum is channeled through the Salaj County Museum of History and Art, while some county funds are applied directly to the site. Within the county government is an officer of culture and tourism, who organizes some of the popular events staged at the site (see below). Unfortunately, the County does not always consult with the archaeologists at the Museum and, therefore, decisions are sometimes poor. The County is primarily interested in using Porolissum as a tourist attraction and, hence, viewed as a mechanism to gain revenue (i.e., very little interest in science or upkeep).
- ***Salaj County Museum of History and Art.*** As the name implies, this museum is a component of the county, although not all funding derives from the county.[1] The Museum is led by a director, whilst a research staff covers each of the major fields of study from Stone and Bronze Age archaeology through modern ethnography and art. The primary duty of the Staff is to conduct research and to safeguard and investigate the historical and cultural heritage of the county. Museum staff is

1 The archaeologists are frequently involved in salvage projects, which provides the second largest amount of funding for the Museum.

Fig. 3 Porolissum, Porta Praetoria

also called upon to develop exhibitions and engage in other museum activities. The Museum oversees all archaeological activities in Salaj County, except that Porolissum is sometimes overseen by a Staff member of the Institute of Archaeology in Cluj or Babeș-Bolyai University (see below). In terms of Porolissum, the Museum directly oversees the upkeep of the site, hiring laborers to clean the site. The Museum has a strong interest in the well-being of the site, from a scientific point of view and from the point of view of upkeep and maintenance. The Museum gains a small amount of revenue from ticket sales and public events they sponsor.

- ***The Institute of Archaeology of Cluj-Napoca and archaeologists based at Babeș*-Bolyai *University of Cluj-Napoca***. Archaeologists at these institutions in Cluj-Napoca clearly have a stake in Porolissum, since this is one of the most important archaeological sites in all Romania. Many archaeologists seek to conduct research on aspects of the site, which may involve excavation or the study of material, such as coins or oil lamps from the site. Some of the senior archaeologists, however, have sought to control the scientific direction of the site. The primary interest of archaeologists from these institutions is research.
- ***Foreign archaeologists and students.*** Over the years Profs. Gudea and Matei sought collaborations with international teams. Many collaborations were short-lived; however, a small number, including the Porolissum Forum Project (Fig. 4) and the University of Cologne/ Babeș-Bolyai University Castrum Project endured for many years. In both cases, members of the foreign team not only explored the site scientifically, but developed an emotional link to the site that has led many team members to promote

Fig. 4 Porolissum Forum Project, 2004

Porolissum to scholars and the general public in Europe and the USA. Collectively, these two teams trained about 200 western students. The main interest of the foreign teams is research; the foreign teams are interested in the well-being of the site and in attracting other scholars and tourists.

- ***Local business owners.*** Local business owners are clearly interested in economic returns from visitors to the site. A very small number of business owners give back to Porolissum, generally in the form of small donations of hundreds or, perhaps one thousand euro that are used for book publications or events at Porolissum.

In terms of scientific research, Porolissum is still largely unexplored. Many of the primary architectural features have been investigated and published to some degree; however, there are many questions, particularly regarding matters of site history and anthropology which, until now, have not been addressed adequately. Archaeological work has always involved Romanian teams, while in recent years there have been a small number of partnerships with foreign scholars. Because Porolissum is among the best preserved sites in Romania, it has been the venue of political struggles between senior scholars from the Institute of Archaeology, Babeș-Bolyai University and the Salaj County Museum. Prof. Nicolae Gudea served as scientific director of Porolissum for two decades until an agreement was made whereby he oversaw excavations in the area of the castrum and Alexandru Matei (former director of the Salaj County Museum) oversaw excavations in the municipium. With the retirement of Prof. Gudea and the death of Dr. Matei, Prof. Coriolan Opreanu (Institute of Archaeology) is the current scientific director of Porolissum.

In the 1990's, after the fall of Communism, Profs. Gudea and Matei began to seek foreign collaborators. Funding from Bucharest is quite limited and economic resources from foundations are difficult to obtain. Therefore, Profs. Gudea and Matei believed that foreign archaeologists could provide valuable scientific input as well as funds for projects. In the late 1990's Matei worked with Dutch archaeologists to survey the municipium using magnetometry, while a Spanish team excavated with him for one season. In 2004, Matei struck

Fig. 5 Views of the on-site dormitory for archaeological teams, winter 2011

a partnership with the author of this paper, forming the Porolissum Forum Project. Prof. Gudea's most successful international collaborators hailed from University of Cologne. This team investigated a subterranean structure in the castrum, adjacent to the principia. The final year of both projects was 2011. In 2012, Prof. Opreanu was the sole explorer of the site, excavating two trenches along the north wall of the castrum and commissioning a campaign of geophysical prospection near the amphitheater and throughout the municipium. If the scientific direction of archaeological projects has often been in the hands of scholars from Cluj-Napoca, upkeep and conservation of the site has always been entirely in the hands of the Salaj County Museum. The 50+ acres of the site need to be cleared of tall grass each year; garbage is collected and minor repairs are made on standing architecture. The Museum has a small group of site curators who direct laborers that maintain the site. While the state of standing architectural features is generally stable, the re-built Porta Praetoria is deteriorating and is in need of repair. An attempt was made by a foreign member of one of the archaeological teams to gain the support of the World Monuments Fund; however, the site was not viewed as endangered and, therefore, funding was declined. Also in a poor state is the 30-year old dormitory. Two buildings consisting of kitchens, bedrooms, a common room and a bathroom were constructed in the 1980's for archaeological teams. Basic maintenance and repairs are generally made each year by the Museum; however, settling has caused significant structural damage in one of the buildings, while time has simply left many of the rooms and facilities in a poor state (Fig. 5). The county, so far, which is ultimately responsible for financing the site, has not responded adequately.

Promotion of the site to potential visitors seems to be a key. If the state is unable to finance the upkeep of such an important archaeological site and if outside grant money is scarce, revenue generated through visitors to Porolissum may be an answer. The two primary stakeholders, namely the County Museum and Salaj County itself, have developed several initiatives to promote the site and increase the number of tourists. The initiatives generally involve some sort of spectacle.

The most popular initiative of the Salaj County Museum is Porolissum Day(s), an annual festival of one or two days that involves food, lessons in history and site tours, music, dance and reenactment groups (Figs. 6-7). A key mover of this was Alexandru Matei, director of the Museum 1985-2001 and 2009-10. Working with county authorities and a small number of reenactment groups, Matei implemented his concept for the first time in 2006. Due to a lack of interest and funds, the event was not staged for several years; however, thanks to some funds from the Museum and the generosity of the Porolissum Forum Project, an event was held in summer 2009. The County began to support this project in 2010 and it has become a steady event. The event, generally staged in late summer, takes months of planning on the part of the Museum and attracts many hundreds of visitors. Entrance fees are not collected, but some revenue is generated through the sale of food and drink as well as some merchandise. There are a number of groups dressed in costumes who perform music or dance and who demonstrate horsemanship or skills with weapons. In recent years, the culminating reenactment event is a staged battle involving dozens

Fig. 6 Porolissum Day 2012

Fig. 7 Porolissum Day 2012

of passionate reenactors. One year involved the siege of the castrum by Vandals, while last year's performance focused upon the emperor Trajan. The 2009 event concluded with the screening of "Gladiator", while the 2010 event concluded with an acoustic rock concert by local musicians.

The Museum organized a very interesting one-time event in 2010, "Archaeology and Art" (Figs. 8-9). A dozen artists from the region were invited to stay at Porolissum for four days. During this time, the artists explored the site with archaeologists and learned about the processes of excavation and discoveries of the 2010 projects. The fourth day involved an exhibition of the artists' work – photography, paintings, drawings and sculpture. While a very interesting concept and event, not many members of the public attended the exhibition.

Far more popular are music concerts and disco nights in the amphitheater, organized by the County administration (Fig. 10). Several times each summer, the County invites musical performers of various genres, from traditional folk music to chalga/manele formations, and DJ's. These events attract hundreds of visitors to the site. There is nothing particularly related to the archaeology and history of the site that accompanies these musical events; the amphitheater is simply used as a venue. Because of the nature of the music and the likely participants, alcohol and cigarette consumption is high and trash is scattered throughout and beyond the amphitheater. Cleaning crews eventually liberate the site of trash, but this is one major negative impact of such events.

Another popular "cultural" type of event that draws hundreds of people, albeit a more respectful class of person, are film screenings. Recently, the County has organized 2-3 film screenings per summer, both Romanian and foreign films. Once again, there is no direct archaeological connection to the event – the amphitheater, once again, is used as a pleasant venue on warm summer nights at Porolissum (Figs. 11-12).

All of these popular events attract visitors and some revenue is gained by the organizers; however, little is done to improve the condition of the site with these funds. Moreover, many of the visitors come strictly for the event and may not return for the simple pleasure of visiting the site. Statistics are not readily accessible; however, the number of visitors to Porolissum who are drawn by the history and archaeology of the site is in the range of 1500-2000 per year, whilst the same number of visitors is attracted by the entertainment events.

Fig. 8 Porolissum, "Archaeology and Art 2010"

While the total number of visitors per year is only in the low thousands, the County needs to find a creative way to facilitate visitors. Currently, there are two small wooden shacks at the entrance to the archaeological site which serve the ticket distributors and from which visitors can purchase souvenirs. There are no on site facili-

Fig. 9 Porolissum, "Archaeology and Art 2010"

Fig. 10 Poster for a music festival at Porolissum

ties to provide refreshments or for the biological needs of visitors. There are plans, however, by the County to pave a new road and parking area and to construct a small visitor's center. Problematically, the County does not consult with the archaeologists of the Museum who know the site.

IV CONCLUSIONS

Fig. 11 Porolissum, film festival 2012

Fig. 12 Porolissum, film festival 2012

The managers of nearly all archaeological and historical sites in the world are facing many of the same challenges. In 1977, Porolissum was a traditional archaeological site frequented by archaeologists and a few visitors. By the 1980s and 90s some of the leaders began to maintain and develop the site by constructing excavation facilities, cap walls, rebuild the Porta Praetoria, and attract foreign teams of archaeologists as well as more tourists. All of the research projects and popular events have had benefits. They have attracted both archaeologists (Romania and foreign) and visitors (primarily Romanian and nearby countries); promoted education (archaeology students on projects and general public via Roman festivals/entertainment); and, established contemporary engagement with the site (art show, movies, etc.). The author of this paper has seen significant positive changes at Porolissum since his first visit in 2003, but more can be done.

The stakeholders must realize that Porolissum is not Pompeii – there will never be millions of visitors annually and revenue from ticket sales and events will never be very large. The leader(s) should have realistic expectations and make best use of their unique resources and opportunities. Porolissum is intrinsically important and, therefore, the site requires care. Porolissum will benefit by the establishment of a clear vision and a business plan to achieve goals, improved cooperation between stakeholders, and increased support from Bucharest:

- **Vision and Goals**. A single individual, preferably a staff member of the Museum, should be appointed to oversee all aspects of Porolissum: coordination of research, caretaking and preservation, infrastructure, and public relations. This site administrator should develop a vision with immediate, middle-term and long-range goals; (s)he should develop a business plan. In developing a vision and a business plan, the site director should consult with a range of specialists – financial, preservation, archaeology, tourism. This is the way in which all successful historical sites are managed.
- **Cooperation.** The two primary stakeholders surrounding Porolissum are the Salaj County Government and the Salaj County Museum. Both have good ideas; however, there is little effective communication. Clearly, the Museum should act as the driving force of Porolissum as their staff possesses the most knowledge of and experience with the site (both scientific and logistical). All programs regarding the public must be coordinated and both stakeholders should be involved in making key decisions. All parties, includ-

ing the secondary stakeholders, need to resolve differences (when they exist) and think about what is right for Porolissum. The well-being of the site should be elevated above careers and egos.

- **Interest from Above.** Bucharest has to invest more in the cultural patrimony of Romania. Even countries with more developed economies, such as France, rely strongly on tourism. Bucharest must learn to value historical sites as a resource and invest in maintenance, staff, and international advertising campaigns (if you build it, no one will come unless you advertise). If money is lacking, the State should work to indentify private and corporate sponsors to develop and maintain historical sites.

BIBLIOGRAPHY

Bajusz, I. 1997
Inscripţia CIL III 836 şi realitatae arheologică. Date preliminare privind amfiteatrul de la Porolissum. *Civilizaţia romană* în *Dacia*. M. Barbulescu (ed.) Cluj-Napoca, 92-101.

Bajusz, I. 1999
Propunere de reconstituire a amfiteatrul de piatră de la Porolissum. *Napoca. 1880 de ani de la* începtul *vieţii urbane*. Cluj-Napoca, 11-31.

Chirilă, E. et al. 1972
Das Römerlager von Buciumi. Beiträge zur untersuchung des Limes der Dacia Porolissensis, Cluj-Napoca.

Diaconescu, A. 2004
The towns of Roman Dacia: an overview of recent archaeological research. *Roman Dacia. The Making of a Provincial Society*. W.S. Hanson and I.P. Haynes (eds.). Journal of Roman Archaeology Supplemental Series 56: 87-142.

Găzdac, C. 2006
Coins from Roman Sites and Collections of Roman Coins from Romania. Vol. II. Porolissum. Mega Printing House (Cluj-Napoca).

Gudea, N. 1985
Contribuţi la istoria militară a Daciei Porolissensis I. Linie înaintată de turnuri şi fortificaţii mici de pe sectorul de nord-vest al limes-ului provinciei între castrele Bologa şi Tihau, *Acta Musei Porolissensis* IX: 143-218.

Gudea, N. 1989
Porolissum. Un complex daco-roman la marginea de Nord a Imperiului Roman, I. Zalău: Acta Musei Porolissensis XIII.

Gudea, N. and Schüller, W. 1998
Porolissum. Ausschnitte aus dem Leben einer dakisch-romischen Granzsiedlung aus dem Nord-Wester der Provinz Dacia Porolissensis. Amsterdam.

Gudea, N. and Tamba, G.D. 2001
Porolissum. Un complex daco-roman la marginea de Nord a Imperiului Roman, III. Despre tempul zeului Iupiter Dolichenus din Municipium Septimium. Zalău: Bibliotheca Musei Porolissensis.

Inomata, T. and Webb, R.W. (eds.) 2003
The Archaeology of Settlement Abandonment in Middle America. University of Utah Press.

Landes-Gyemant, A. and Gudea, N. 2001
Das Römerkastel von Buciumi. Vorschläge für eine grafische Wiederherstellung, *Saalburg Jahrbuch* 51: 127-151.

Matei, A.V. 2003
Despre castrele romane de la Porolissum. Un nou castru din tempul lui Traian descoperit la Porolissum, *Acta Musei Porolissensis* XXV: 277-298.

Matei, A.V. and Bajusz, I. 1997
Castrul Roman de la Romita-Certiae. Zalău: Ghid al Monumentelor din Dacia Porolissensis 4, Zalău.

Petolescu, C.C. 1997
Die Auxiliarreinheiten im römischen Dakien. *Contribuţi la cunoaşterea armatei romane din provinciile dacice*. N. Gudea (ed.), Cluj-Napoca, 66-141.

Pop, H. et al. 2006
Şimleu *Silvanie I. Istoricul Cercetărilor*. Editura

Mega, Cluj-Napoca.

Tamba, G.D. 1997
Castrul roman de la Românaşi – Largiana. Ghid al monumentelor arheologice din Dacia Porolissensis 3, Zalău.

Tamba, G.D. 2009
Porolissum. Asezarea civila (vici militaris) a castrului mare de la Porolissum. Ed Mega, Cluj-Napoca.

REZIME

POROLISSUM: PRIMER ARHEOLOŠKOG NASLEĐA RUMUNIJE

Key words: Porolissum, rimski, Rumunija.

Smešten u severozapadnoj Rumuniji, rimski grad Porolissum je svrstan među najvažnije arheološke lokalitete na Balkanu. Porolissum je bio vojni centar od izuzetnog značaja, koji se razvio u omanji rimski grad, sa trgovačkim vezama **širom** imperije i barbarikuma. U tekstu se govori o tome kako se upravlja ovim lokalitetom, kako se on istražuje i na koje se sve načine promoviše.[2]

Postoje tri najvažnija faktora koji se odnose na arheološki lokalitet Porolissum: naučno istraživanje, zatim održavanje i konzervacija i najzad promocija i turizam. Nekoliko različitih elemenata igraju zvaničnu ili pak nezvaničnu ulogu u postizanju ovih rezultata:

- ***Uprava okruga Salaj***. Arheološkim nasleđem Rumunije upravljaju država i okružna ili opštinska uprava. Tako Porolissum spada u okrilje uprave okruga Salaj, koja raspolaže određenom količinom sredstava za te svrhe. U sastavu okružne uprave je zvaničnik za kulturu i turizam koji organizuje neke od popularnih događanja koja se odvijaju na samom loklitetu. U nekoliko navrata svakog leta, okružna Uprava poziva muzičare i DJ-eve različitih muzičkih pravaca, od tradicionalne narodne muzike do najmodernije i organizuje dva do tri filmska festivala na kojima se prikazuju kako rumunski, tako i strani filmovi. Ove muzičke festivale ne prati ništa **što** bi stajalo u vezi sa arheologijom ili istorijom lokaliteta; amfiteatar se jednostavno koristi kao bina. Ovi događaji na lokalitet privuku na stotine posetilaca. Uprava okruga je prvenstveno zainteresovana za Porolissum kao turističku atrakciju, pa se on stoga posmatra kao mehanizam za sticanje dobiti.
- ***Muzej Istorije i Umetnosti okruga Salaj.*** Muzej čuva i istražuje istorijsko i kulturno nasleđe okruga Salaj, ali od 2010. nije odgovoran za naučnu interpretaciju Porolissum-a. Muzej direktno nadgleda održavanje Porolissum-a i najmi radnike koji su zaduženi za održavanje lokaliteta. U cilju promocije, najpopularnija inicijativa Muzeja okruga Salaj su tzv. Dani Porolissum-a, koji se svake godine održavaju tokom jednog ili dva dana, a obuhvataju hranu, predavanja o istoriji i obilaske lokaliteta, muziku, ples i grupe kostimirane u istorijske kostime. Jedan od najzanimljivijih jednokratnih događaja iz 2010. godine, "Arheologija i Umetnost", na lokalitet je, u period od **četiri** dana, doveo na desetine umetnika iz ove oblasti. Umetnici su obišli lokalitet sa arheolozima i saznali dosta toga o iskopavanjima i otkrićima iz 2010.; vrhunac ovog događaja je bila izložba sa radovima ovih umetnika. Muzej ima manju dobit od prodaje ulaznica i javnih događaja koje sponzoriše.
- ***Arheološki Institut Cluj-Napoca i arheolozi sa Babeş-Bolyai Univerziteta u Cluj-Napoca***. Arheolozi iz ovih institucija u Cluj-Napoca imaju najvažniju ulogu u Porolissum-u, s obzirom da je on jedan od najvažnijih lokaliteta u celoj Rumuniji. Mnogi arheolozi **žele** da rukovode iskopavanjima na ovom lokalitetu ili pak

2 Ovo je rezime članka napisanog za akta simpozijuma "Archaeological Heritage – its Role in Education, Presentation and Popularization of Science," koji je Arheološki Institut Srpske Akademije Nauka organizovao na Viminacijumu u oktobru 2012. Autor ovog članka je radio kao pomoćni direktor projekta Porolissum Forum Project, od 2004. do 2010. zajedno sa Alexandru V. Matei, a u 2011. sa Robert Wanner-om i dobro je upoznat sa upravom i promocijom lokaliteta.

da proučavaju nalaze, npr. novčiće ili žiške. Izvestan broj starijih arheologa se izborio da vrši kontorlu nad istraživanjima na lokalitetu.[3] Jedini interes arheologa iz ovih institucija jeste istraživanje.

Rukovodioci gotovo svih arheoloških ili istorijskih lokaliteta **širom** sveta suočavaju se sa mnogim od ovih izazova. Tokom 1977, Porolissum je predstavljao tradicionalan arheološki lokalitet koji su brojni arheolozi **često** posećivali, kao i manji broj posetilaca. Tokom 80-tih i 90-tih, neki od tadašnjih rukovodilaca su otpočeli sa održavanjem i razvojem lokaliteta tako **što** su izgradili prostorije za arheologe i za nalaze, rekonstruisali zidine, rekonstruisali *porta praetoria*-ju i na lokalitet privukli inostrane arheološke ekipe, ali i veći broj turista. Od toga su korist imali istraživački projekti, ali i popularni događaji. Oni su animirali kako arheologe (rumunske i inostrane) tako i posetioce (prvenstveno rumunske i iz susednih zemalja); promovisali su obrazovanje (studenti arheologije na projektima i široka publika – posetioci rimskih festivala/zabave). Takođe su uspostavili angažmane vezane za lokalitet (umetničke programe, filmove itd.). Autor ovog članka je uočio mnoge pozitivne promene u Porolissum-u od 2003., kada je prvi put posetio lokalitet, iako još mnogo toga može biti urađeno.

Popularni događaju privlače posetioce, a izvesnu dobit imaju i organizatori; međutim, iz ovog fonda se malo toga ulaže u poboljšanje samog lokaliteta. Štaviše, mnogi posetioci dolaze na lokalitet isključivo zbog pojedinih događaja i ne vraćaju se da bi uživali u poseti samom lokalitetu kao takvom. Iako se ukupan godišnji broj psetilaca izražava u samo nekoliko hiljada, postoji potreba za smeštajem posetilaca. Trenutno postoje dve manje drvene kolibe na ulazu u arheološki lokalitet, koje služe za prodaju ulaznica i u kojima posetioci mogu da kupe suvenire. Ne postoje prostorije u kojima bi se prodavala osveženja, niti za biološke potrebe posetilaca.

Čelnici treba da shvate da Porolissum nije Pompeji – on nikada neće privući na milone posetilaca na godišnjem nivou, niti će dobiti od prodaje ulaznica ili povremenih događaja biti jako visoke. Rukovodioc(i) treba da imaju realna očekivanja i da na najbolji način iskoriste svoj jedinstveni potencijal i mogućnosti. Porolissum je suštinski važan i zbog toga ga je potrebno čuvati. Porolissum će ići u pozitivnom pravcu ako se uspostave jasna vizija i plan kako da se stigne do ciljeva, ako se poboljša saradnja među čelnicima i ako dobije veću podršku iz Bukurešta:

- **Vizija i ciljevi**. Pojedinac, izabran po mogućstvu među osobljem muzeja, treba da bude imenovan da sagleda sve aspekte Porolissum-a: rukovođenje istraživanjem, zaštita i konzervacija, infrastruktura i odnosi sa javnošću. Rukovodilac lokaliteta treba da razvije plan koji sadrži trenutne, kratkoročne i dugoročne ciljeve; takav pojedinac treba da razvije poslovni plan. Tokom razrađivanja vizije i poslovnog plana, rukovodilac lokaliteta treba da se savetuje sa nizom stručnjaka – finansijskih, konzervatorskih, arheoloških i turističkih. Na ovaj način se upravlja svim uspešnim arheološkim lokalitetima.
- **Saradnja.** Dva najvažnija čelnika u okolini Porolissum-a su Uprava okruga Salaj i Muzej Istorije i Umetnosti okruga Salaj. Oba imaju dobre ideje; međutim, malo je efikasne komunikacije među njima. Jasno je da Muzej treba da predstavlja rukovodeću snagu Porolissum-a, s obzirom da njegovo osoblje ima najveće znanje o lokalitetu i najviše iskustva sa njim (kako naučno, tako i logističko). Svi programi koji podrazumevaju učešće široke publike treba da budu usklađeni i oba čelnika treba da budu uključena u donošenje ključnih odluka. Svi činioci, uključujući i drugostepene čelnike, treba da prevaziđu razlike (kada ih ima) i da shvate šta je ispravno za Porolissum. Dobrobit lokaliteta treba da se izdigne iznad pojedinačnih karijera i ega.
- **Zainteresovanost iz centra.** Bukurešt treba više da ulaže u kulturno nasleđe Rumunije. **Čak** i zemlje sa mnogo razvijenijom ekonomijom, kao npr. Francuska, mnogo polažu na turizam. Bukurešt treba da počne da ceni istorijske lokalitete kao potencijale i da ulaže u održavanje, osoblje i međunarodne reklamne kampanje. Ukoliko nedostaje novac, država mora da nađe privatne i korporacijske sponzore da bi razvijala i održavala istorijske lokalitete.

3 Coriolan Opreanu (Arheološki institut Cluj-Napoca) je od 2010. naučni direktor i od 2012. samostalni istraživač ovog lokaliteta.

MAGDALENA MANASKOVA,
Archaeological and Historical Museum of Vinica,
Vinica, Macedonia
magde26@hotmail.com

UDC: 904:738.6(497.17)"04/05";
902.2(497.17)"2010"
Original research article
Received: February 27th 2013
Accepted: October 15th 2013

ARCHAEOLOGICAL SITE'S UTILIZATION AND POPULARIZATION-THE CASE OF THE ARCHAEOLOGICAL SITE KALE VINICA

ABSTRACT

Archaeological site Kale-Vinica is known in the world science because of the exclusive finds from the 5-th and the beginning of the 6-th century - the terracotta reliefs with Christian motifs, known mostly by its popular name as terracotta "icons".
Despite the very long archaeological researches (since 1985) and world-wide exhibitions of the reliefs (Rome, Vatican, Munich, Paris, Moscow etc.), the archaeological site is insufficiently scientifically and commercially popularized. It is still mostly a subject of interest for the experts only.
Vinica's City Museum recently started to shape the knowledge about the value of city's archaeological heritage, using the methods and the experience from archaeological sites in Japan.
This article is about the implementation of the action plan created together by experts from Ritsumeikan University in Kyoto and Vinica City Museum in which historic preservation methods are used to rejuvenate Vinica both economically and socially. The ideas that emerged from the action plan developed into bigger, international project called "Building Cross-Border Cultural Cooperation". After thirty long years, first steps into promoting Vinica's most famous archaeological site are made, and finally, archaeological heritage should no longer be shy about becoming brand and no longer afraid of popularity.

Keywords: archaeology, utilization, popularization, eco tourism, terracotta icons, Vinica.

INTRODUCTION

The value of a cultural resource cannot truly be measured, but professionals must try to establish one (Stertz, 2004:3). According to the opinion by foreign and domestic professionals, the archaeological site Kale-Vinica, deserves a lot of attention.

Under Roman rule, one of the larger settlements within the area was positioned approximately in the present location of the town Vinica. Remains of that settlement have so far been found at several locations. However, its expansion throughout Roman time, is without doubt connected to the intensification of trading, mining, metal processing and pottery, of which there are serious traces, and the position on one of the main trading roads from that period. Throughout that period, the

need for protection of people and acquired goods was clearly raised, and therefore at the archaeological site Kale, as a convenient strategic point, a fortified city (castle) was erected (T.I, fig.1). The fortified city covered an interior surface of approximately 2.5 hectares (Balabanov, 2007:6).

During the Early Christian period, life in Vinica's fortress was in full bloom. We hereby take into consideration the archaeological finding of terracotta reliefs, also known as the terracotta icons from Vinica, a unique of this kind in the entire world. The terracotta icons are an affirmation of the highly developed knowledge of the Christian religion and its complex symbolism even in the 5-th centuries.

The terracotta icons from Vinica are clay plates, molded with the help of stone matrixes so that their front contains a relief impression with a specific iconographic content made in several identical replicas. The motifs are from the Old and the New Testament. All relief forms have been created in a way that indicates a profound comprehension of the religion, which one rarely encounters outside the Byzantine metropolis (Dimitrova, 2012:13-16).

The significance of these artifacts is even greater because their purpose or exact function is still covered in mystery and lays hidden beneath the vast unexplored area around and in the fortress. Numerous archaeologists and art historians are still trying to solve the puzzle left by the former residents of the Vinica's fortress (T. II, fig.1, 2).

However, the archaeological site is insufficiently scientifically and commercially popularized and since it was first discovered in 1985, not up until 2010 the authorities started to work on its promotion in a more serious matter.

THE LONG TERM PROJECT "REDISCOVERING VINIC A"

During the one month course for cultural tourism development in Japan, a long term project called "Rediscovering Vinica" was developed by the author of this text in cooperation with Professor Masafumi Yamasaki from Ritsumeikan University in Kyoto.

The main goals of this project are:

1) Preservation and utilization of different historic structures and archaeological sites;

2) Maintaining historic landscape of the town and maintaining archaeological sites;

4) Inheriting and nurturing traditional events, traditional culture and arts.

Engaging entities:

1) Municipality of Vinica-administrative authorities;

2) Citizens and private organizations;

3) NGOs.

To fulfill the project objectives, Vinica Museum's team is trying to create new values for the existing historic heritage and to promote community development centered on historic and archaeological heritage. Also one of the measures is the nurture of the traditional culture and arts through joint efforts by the government and private enterprises.

ARCHAEOLOGICAL SITE KALE - UTILIZATION AND POPULARIZATION

Within the project, the main role in fulfilling its goals has the utilization and popularization of the archaeological site Kale. The first step, along with the improvement of the infrastructure, is to change the concept from "dead heritage" to "living heritage".

COMPARISON BETWEEN ARCHAEOLOGICAL HERITAGE AND LIVING HERITAGE FROM THE VIEWPOINT OF TOURISM PROMOTION[1]

The implementation of this part of the project is trough education and promotion of eco tourism. The ecotourism does not protect the heritage by putting up a fence, prohibiting the visitors to come in, but allows the visitors to access the archaeological site and the museum with proper management and lets them understand the biology and the attractiveness of what they are seeing. The visitors who deeply understand the value of the heritage through interpretation by eco tourism guide will recognize the importance of archaeological sites and start assisting in protection and management by

1 By Professor Noriaki Nishiyama, Graduate School of Hokkaido University – Center for Advanced Tourism Studies, as a part of the lecture called "The view and issues of international cooperation on cultural heritage from the tourism perspective", not published.

	Tourism based on archaeological heritage	Tourism based on living heritage
Successor of Heritage	Archaeological heritage is usually separated from current society, culture and community.	Successors of a heritage concerned culture, live in the Heritage area.
Potentiality of further heritage creation	There are possibilities for experts to discover archaeological heritage.	There are possibilities for residents to create new cultural heritage (heritage for tourism).
Tourism space and living space	The archaeological site is separated from living environment.	Living space is shared with tourism space.
Interpretation	Only experts can interpret.	Residents can be interpreters.
Significance	There is a clear understanding concerning the value of archaeological sites and the method of maintenance.	There are difficulties in understanding the value and maintenance of the site because of its complexity.

giving donations or volunteering (T. III, fig. 1).
Ecotourism aims to expand the heritage protection movement based on the experience and activities. To change the ways things are done often involves detailed explanation of what is actually done and why it is valuable to those groups in society who have the power to affect change.

That's why this phase of the project which is in progress, is implemented trough educational presentations and information events for local government authorities, interested non-governmental organizations and local residents.

The following presentations were held by our museum's staff:
-"How is done in Japan"- focused mainly on explaining the role of the Municipality in the action plan.
-"Days of craftsmanship"- distribution of promotional material in order to promote crafts and improve the quality of craft products (T. IV, fig. 1).
-"Cultural Heritage management and development of eco tourism".
- "The Archaeological Treasuries of Vinica".

Along with this educational phase, in June 2011, a joint project between Macedonia and Bulgaria called "Building a Cross-Border Cultural Cooperation" was launched. The project's overall objective was to improve the economic, social, cultural and ecological sustainability in the cross-border region, all by protection, promotion and sustainable utilization of cultural heritage. With a grant from European Union's IPA program, the main project activities were: construction of pedestrian way and bikeway to "St. Nikola" site near the town of Bansko, road construction, a parking lot and lighting for the archaeological site "Kale"-Vinica, as well as development of joint management plan for cultural sites, exchange of best practices in management of cultural sites trough seminars. The part of the project concerning the archaeological site Kale was fully developed according to the priorities detected in the long term project "Rediscovering Vinica" (T. V, fig. 1).

In the last year, our museum started to work on another international project called "Innovative approaches to the use of cultural assets of the past for tourism development" (Project acronym-CULTURISMO). In this project, which is still developing, we want to use new technologies in promoting the cultural assets. The general project aim is promotion of archaeological heritage by using common tools, such as:
-Integrated Information Management Tool for handling information about the archaeological

T I fig. 1 Archaeological Site Kale - Vinica

sites in the area. The system will provide an open web-GIS platform for the archaeological, historical and cultural data to the public.

- Virtual/Interactive Museum, including virtual tours, interactive activities such as puzzles with the museum's exhibits, tests and riddles with images, text and music. Virtual visits will be allowed with the help of video cameras and mobile communication equipment (smart phones, pads est.)

- Summer schools and camps for survey and exchange of experience (http://haemus.org.mk/vinica-field-school-2013/).

The project consists of 6 logically linked work packages, which are divided into several activities and sub-activities, and the Lake Biwa Museum in Japan is used as an example (T. VI, fig. 1)

CONCLUSION

The mission of Vinica City Museum for protection and promotion of the archaeological site Kale started with the museum's opening in 2006. So far, the outputs and results are comprehensive. The projects that the museum is working on have become more than just a popularization of the archaeological sites and the cultural assets. They are of added value because of the direct connection to the sustainable development policy of the local society.

T II fig. 1 The Psychopomp Michael, terracotta relief

Archaeological heritage should no longer be shy about becoming brand and no longer afraid of popularity and the role of the museum in the society is also different. Museum are no longer passive viewers, they are taking active role in the social and economic development of their own community.

BIBLIOGRAPHY

Balabanov, K. 2007
Vinica, Ancient City and Centre of Early Christian Art, Vinica: Municipality of Vinica.

Dimitrova, E. 2012
The Vinica Mystery - The Ceramic Treasuries of a Late Antique Fortress, Vinica.

Kuroda, N. 2008
Conservation of cultural landscape in Shirakawa-go, (https://www-docs.tu-cottbus.de/denkmalpflege/public/Tagungen/J-G_Colloquium/06_Kuroda.pdf), accessed on 25.02.2013.

Stertz, A. D. 2004
Cultural Resource Management on Public Lands: A Public Emphasis for a Changing Industry, (http://prdp2fs.ess.usda.gov/Internet/FSE_DOCUMENTS/fsm9_002129.pdf), accessed on 27. 02. 2013.

T II fig. 2 The Sixty-sixth Old Testament Psalm, terracotta relief

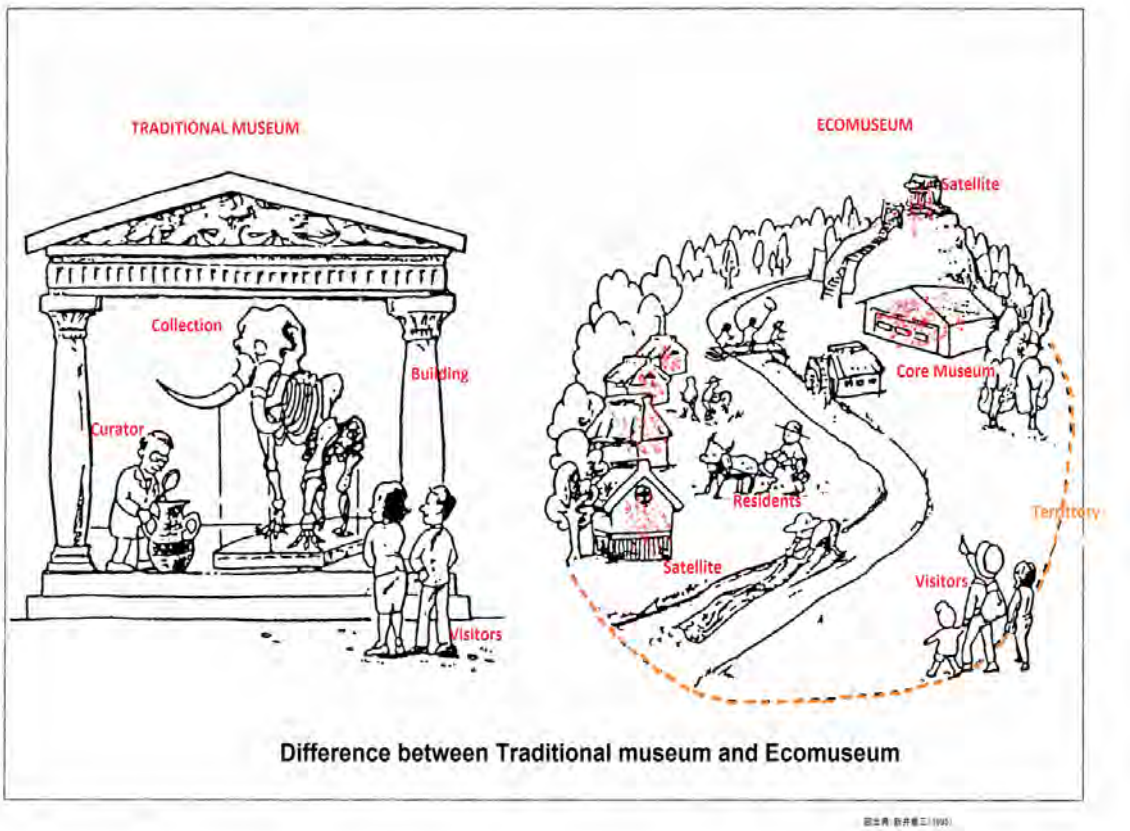
REZIME

UTILIZACIJA I POPULARIZACIJA ARHEOLOŠKIH LOKALITETA KROZ PRIMER ARHEOLOŠKOG LOKALITETA "KALE" U VINICI

Ključne reči: arheologija, utilizacija, eko turizam, terakotne ikone, Vinica.

Arheološki lokalitet Kale – Vinica poznat je u svetskoj arheološkoj nauci kao ekskluzivno arheološko nalazište terakotnih ikona iz 5. i 6. Veka. Tu su poznate keramičke ploče sa hrišćanskim motivima iz Starog i Novog Zaveta. Arheološki lokalitet Kale nije dovoljno poznat naučnoj kao i široj javnosti, nije komercijalno popularizovan i pored veoma dugog perioda istraživanja (početkom 1985. godine) i brojnih izložba terakotnih ikona širom sveta (Rim, Vatikan, Minhen, Pariz, Moskva i td).

Muzej grada Vinice je nedavno počeo da oblikuje znanje o vrednosti arheološkog nasleđa,



T III fig. 1 The Difference between Traditional and Eco Museum (by By Professor Noriaki Nishiyama, Graduate School of Hokkaido University - Center for Advanced Tourism Studies)

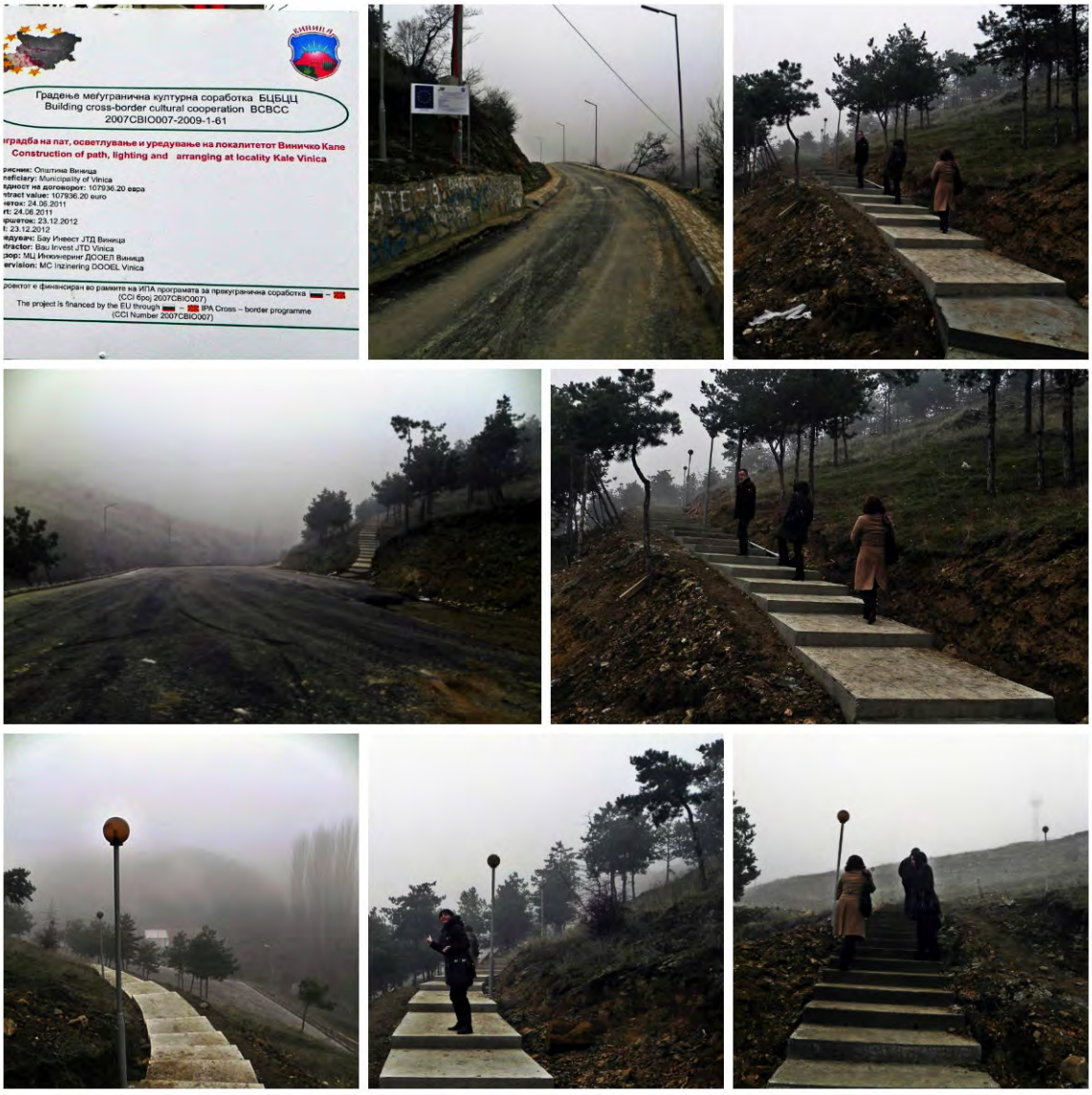
koristeći metode i rutine koje se primenjuju u Japanu.

Ovaj članak se odnosi na implementaciju akcionog plana koji je kreiran u saradnji sa ekspertima iz Ricumejkan Univerziteta u Kjotu.

Naime, radi se o ekonomskom i socijalnom razvoju Vinice koristeći se potencijalom kulturnog i arheološkog nasleđa. Ideje koje su proizašle iz desetogodišnjeg plana, razvile su se u veliki međunarodni projekat nazvan "Izgradnja međugranične kulturne saradnje". Sa ovim projektom je predviđeno infrastrukturno uređenje arheološkog lokaliteta Kale, čime bi se omogućilo turistima da lakše dođu do lokaliteta i kao i večernje posete nalazištu. Realizacija ovog projekta je samo mali deo akcionog plana, a radi se i na edukacii targetnih grupa. Sledeći korak, veoma malom muzeja grada Vinice, je digitalizacija samog muzeja i razvoj koncepta o eko muzeju.

Svi ovi projekti imaju za cilj da iskoriste veoma veliki potencijal arheološkog nasleđa Vinice za turističku promociju grada i time doprineti ekonomskom i socijalnom razvitku. Arheološko nasleđe se ne mora više stideti brendiranja kao komercijalni i nenaučni momenat njegove popularizacije, a uloga muzeja u društvu postaje jedan od nosioca ekonomskog napretka.

T IV fig. 1 educational leaflet



T V fig. 1 Project "Building Cross-Border Cultural Cooperation"

T VI fig. 1 Lake Biwa Museum, Japan

BOSHKO ANGELOVSKI
Ministry of culture of R. of Macedonia,
Deputy head of department for protection of cultural heritage
Skopje, Macedonia
e-mail: boshko81@hotmail.com

UDC: 902/904:371.383(497.7);
902/904:659(497.7)
Original research article
Received: March 5th 2013
Accepted: October 15th 2013

EDUCATIONAL AND PRESENTATIONAL ASPECTS AS ECONOMIC POTENTIAL OF ARCHEOLOGICAL HERITAGE

ABSTRACT

One of the essential aspects of the archaeological heritage as a testimony to the past is to maintain and supplement the knowledge that humanity must nurture and transmit to future generations. The main approach in its treatment should be based on the integrality of the scientific processing and educational moment as its logical consequence, which has strong influence in the process of satisfying the curiosity of the visitors.

In this context it is particularly important to achieve a balance between these two aspects, these models whose interaction determines the true valuation of the site, which are a treasure and a resource for history, art, architecture, social development and the wars in one epoch. Simultaneously, this approach allows the creation of conditions for its proper interpretation and presentation. On the other hand it is necessary that presentation as a part of educational process to be design in a way in which it will be released from the stereotypes and will satisfy the needs of modern man as consumer that has a high built standards.

Achieving economic benefits from archaeological heritage is a particularly sensitive issue whose treatment implies a highly meaningful approach in which the imperative must be preserving the integrity of the good in the process of its commercialization. In this way, the model of managing of the archaeological sites that include finding of the most appropriate way for preservation, conservation, presentation and tourist attraction should have more important place and role. As a consequence and main goal in this kind of treatment of the archaeological heritage is the providing the complete sustainability of the heritage which will secure its long living.

Keywords: education, presentation, reconstruction, experimental archaeology, cultural heritage; neolith village, prehistoric settlement, fortress.

One of the crucial aspects of archeological heritage as testimony of the past is maintaining and complementing the knowledge that mankind has to nurture and transfer to future generations. The major approach of the approach to its treatment should be based on the integrality of the scientific processing and educational moment and the presentation as its logical consequences.

In this context it is of fundamental importance to maintain a balance between these aspects, these models whose interaction determines the accurate valorization of the site that represents treasury and resource for history, art, architecture social development and wars of a certain era. Simultaneously, this kind of an approach enables creation of con-

Fig. 1 Reconstruction of the Neolithic village Tumba-Madzari

ditions for its adequate interpretation and presentation.

It is necessary to create education and presentation in a manner that is free of stereotypes and in a way that shall meet the needs of modern time and the contemporary human whose standards as culture consumer become more and more refined and sophisticated.

This process must incorporate all concerned sides, and above all the state and its cultural policy with obvious projection of archeological and cultural heritage, and consequently conditions should be created for emphasizing the true values of the process by the academic community and the accessibility of the knowledge by education and presentation of the wider public, i.e. the visitors (ICOMOS 1 1990). These two categories are mutually dependent and in that direction they should be interacted and complemented.

The beginnings of the interest for the archeological heritage could be dated in the period of renaissance, neoclassicism and romanticism i.e. the beginning of the archeological excavations of Pompeii and Herculaneum. That interest mainly refers to experts while the increased interest for the remains of the past of the wider public started during the 19 century and is related to the marketing that promoted mass tourism, and in that context promotion of archeological sites that must be visited (Silberman 2007: 181-2). Education and presentation denote the essential principles in the approach towards preservation of cultural heritage (Blagojević, Milošević and Radivojević 2009: 37).

The basis of that concept should be directed towards the most immediate environment, its authorities, as well as the young population, by organizing visits of schools and finally the wider public in order to introduce the values of the specific historical and archeological heritage and their approach to the subject target groups. In fact education should be the primary goal of the ap-

proach of managing archeological heritage (Stone and Planel 1999: 83). The essence is the visitor, regardless of the category of the visitor, to acquire concrete knowledge of the site and the period when it functioned with all specifics of its live. In such a manner the visitor receives a solid basis in order to be able to communicate with the site and to experience its values, and at the same time this knowledge should be transferred in a way that will ensure its permanence since only like that the educational mission will be accomplished and the visitor shall not be just a mere silent witness of the remains of a e certain era. This will ensure space and basis for visiting the site again and will contribute to the development and strengthening of the protective consciousness of the visitors. In the direction of creation of wide spectrum of visitors' experience big emphasis is put on video and multimedia that offer a sense of inclusion and interaction, (Silberman 2007: 184) since they are successful models in the educational process and the process of presentation of archeological heritage.

In this context we should emphasize the importance of reconstructive i.e. experimental archeology. Although it is a relatively new segment in archeology, it is a model with strong potential for satisfying the educational and presentational aspects that stand out of the frames of the usual and established principles of presentation. It provides opening of wide perspective for creating a concept of self sustainability of the site which is the key element that will ensure its continual existence as a center for education and new expert and scientific knowledge. Namely, its main function is to satisfy five key elements: interpretation, education, development of tourism, exploration i.e. experiment and local or cultural identity (Stone and Planel 1999: 15).

All together, reconstructive archeology through visualization and achieving personal contact with the visitors enables gaining of permanent knowledge of a certain era, when concrete objects or the remains of the movable material culture existed, which are the subject of this presentation (Stone and Planel 1999: 16).

One of its advantages in a scientific and expert sense is that it also opens possibility for scientific research, verification or rejection of specific assumptions, using authentic methodology based on analysis of material proofs and written sources (Stone and Planel 1999: 177). Specifically it should contribute to development, strengthening and preserving scientific standards.

Reconstructive and experimental archeology opens strong perspectives in terms of its educational potential by organizing authentic workshops that will ensure for the visitor to have insight to the techniques and technologies of making of various items that were used during that certain age, starting with utility objects, ceramics, different types of tools and even technique for making weapons and military equipment. The visitor shall not only gain specific knowledge of the production techniques but also will have the opportunity to feel the useful value of a certain object. At the same time this model represents a perfect method for the presentation of archeological heritage, especially sites that do not have concrete, spectacular physical remains and even those which have, taking into account that sometimes it is more interesting for the visitor to gain concrete and tangible knowledge than to experience the remains of stones and stone structures.

Thus, archeological heritage shall be put into function which will initiate its commercialization and will also meet one important aspect, the economic one, which is a significant potential of the approach that leads to providing continual operation of the site, i.e. the specific archeological heritage. In that context apart from the scientific and educational aspect it also has strong potential to entertain the public.

In the Republic of Macedonia, as a classical model for preservation and presentation of archeological heritage, the method of conservation is used which basically meets the principles of expertise and providing proper protection, but it is not popular enough regarding presentation and education especially when it comes to the wider public.

As far as reconstructive and experimental archeology is concerned, and its putting in the function of education and presentation, it is in an initial phase making the first steps to acquiring personal status in the science of archeology. In this direction, the first project that uses the segment of experimental archeology with the tendency to implement educational programs and as a presentational model, in the Republic of Mace-

Fig. 2 Reconstruction of the Fortress Kale in Skopje

donia is the reconstruction of a neolith village at the archeological site "Tumba Madzari" in Skopje (T-I, fig.1). When the houses were reconstructed scientific data from the excavated archeological remains were used, ceramic altars in the shape of house models dating from the neolith of Azanbegovo – Vrshnik and Velusko – Porodine cultural group, as well as contemporary models of houses in the villages with building tradition lasting for ages. The reconstruction of the neolith village includes four houses and a kraal tries to make familiar to the wider public the conditions and environment including all specifics of everyday live back then (http://www.tumbamadzari.org.mk/mk/muzej-na-otvoreno/muzej-na-otvoreno.php).

Another project in which educational archeology functions in favor of education and presentation of archeological heritage is the reconstruc-

tion of the prehistoric settlement in the waters of Lake Ohrid, near the city of Ohrid. Namely, it is an excavated site within the framework of a project for underwater archeology and on this basis scientific and expert assumptions were made for partial reconstruction of a settlement that was built on a joint wooden platform (T-II, fug.1).

On the basis of the movable archeological material the time frame of this settlement covers the period of bronze age and the beginning of the iron age, i.e. 1500-700 B.C.

Within this museum complex it is also intended to restore a roman castra and by that the whole concept of presentation shall be complete and it will enable for the visitor to be transported from one to another time era.

This kind of an approach within the context of the fact that the city represents an attractive tourist destination justifies the concept of the museum complex which has a strong potential to be self sustainable and this will satisfy one of the crucial aspects of the approach to presentation.

Other examples of presentation of archeological heritage are two projects for restoration and reconstruction of the fortresses in Ohrid and Skopje. These fortifications date from the period of early, i.e. late antique and they received their full exterior design with the building phases during the middle ages and the Ottoman period (T-III, fig.1, T-IV, fig.1).

This model of presentation of a monument of culture provides enriched view, especially when object is experienced from a distance, but in order to accomplish the goal in terms of its popularization, as well as its educational aspects it is necessary to integrate contents with which the space will be animated on a way which will provide its full revitalization. Accordingly, the economic aspect shall be largely met, i.e. the self sustainability of the site.

The integral approach of the aspects of education and presentation will ensure that the moment of fascination by the remains of the past to be not just exclusive sensation reserved for the professional and scientific public but also to be part of experience of the wider public. Consequently, the perception of the cultural, i.e. archeological heritage will be changed and due to this one new reality, present and the future will be experienced and in the same time it will secure the concept of self sustainable development.

BIBLIOGRAPHY

Blagojević, M. R., Milošević, G. and Radivojević, A. 2009.
A new approach to renewal and presentation of an archaeological site as unique cultural landscape, *Spatium*, International Review, 20.

ICOMOS 1990
Charter for the Protection and Management of the Archaeological Heritage 1.

Silberman A. N, 2007
Sustainable Heritage? Public Archaeological Interpretation and the Marketed Past, University of Massachusetts – Amherst, Selected Works.

Stone, P.G. and Planel, P.G., 1999
The constructed past, Experimental archaeology, education and the public, London & New York.

REZIME

ASPEKTI PREZENTACIJE I EDUKACIJE ARHEOLOŠKOG NASLEĐA KAO EKONOMSKI POTENCIJAL

Ključne reči: edukacija, prezentacija, rekonstrukcija, eksperimentalna arheologija, kulturno nasleđe, neolitsko selo, preistorijsko naselje, utvrđenje.

Jedan od suštinskih aspekata arheološkog nasleđa kao svedočanstvo o prošlosti je održavanje i dopuna znanja koje čovečanstvo mora negovati i preneti budućim generacijama.

Neophodno je, u tom pogledu, osmisliti edukaciju i prezentaciju na način koji je oslobođen od svih stereotipa i koji u isto vreme zadovoljava potrebe modernog vremena i čoveka.

Začeci interesa o kulturnog nasleđa mogu se vezati za početak arheoloških istraživanja Pompeje i Herkulanuma u Italiji koje se uglavnom vezuju za stručnu javnost, dok se veći interes može se povezati za marketinški razvoj početkom 19 veka.

Edukacija i prezentacija moraju biti glavni principi koji sadrže zaštitu kulturnog nasleđa. Tokom stvaranja jednog širokog spektra iskustava za posetitelje, trebalo bi da se da posebni akcent na

video i multimedije koji omogućavaju osećanje uključenosti i interakcije. U ovom kontekstu trebalo bi se još više naglasiti značenje rekonstruktivne arheologije koja omogućava zadovoljavanje pet osnovnih principa: interpretacija, edukacija, razvoj turizma, eksperiment i kulturni identitet.

Rekonstruktivna arheologija omogućuje stavljanje arheološkog nasleđa u funkciju čime bi se podstakla komercijalizacija i zadovoljavanje ekonomskog aspekta, što omogućava kontinuitet, postojanje i funkcionisanje arheološkog lokaliteta.

Prvi koraci eksperimentalne arheologije na teritoriji Republike Makedonije u cilju zaštite, edukacije i prezentacije, pretstavljaju rekonstrukcije neolitskog sela Tumba Maćari i neposrednoj blizini Skoplja, zatim rekonstrukcija srednjovekovne tvrđave u centru Skoplja, rekonstrukcija palafitnog naselja na Ohridskom jezeru i rekonstrukcija stare Ohridske tvrđave. Ovaj način prezentacije i edukacije omogućava da fascinacija arheološke prošlosti nije više ekskluzivno pravo stručnoj i naučnoj javnosti, već deo doživljavanja stanovništva, čime nastaje promena percepcije kulturnog, odnosno arheološkog nasleđa.

JAGODA ŠARIĆ, PhD students, University of Belgrade Faculty of Architecture,
Belgrade, Serbia
jagoda.saric@yahoo.com

IVA MARKOVIĆ, PhD students, University of Belgrade Faculty of Architecture,
Belgrade, Serbia

MLADEN PEŠIĆ, PhD students, University of Belgrade Faculty of Architecture,
Belgrade, Serbia

UDC: 069.5:902 ; 727.7:902/904
Original research article
Received: March 04th 2013
Accepted: October 15th 2013

CONTEMPORARY EXHIBITION-ARCHITECTURAL CONCEPT IN THE PRESENTATION OF ARCHAEOLOGICAL HERITAGE

ABSTRACT

This paper has the aim to examine new discourses and knowledge of past practices through relevant examples in the presentation of the past. During the research of contemporary exhibition and architectural concepts, the intention is to study and show the invisible alternative history through the exhibition as a medium, where history is interpreted as a constructed narrative. In addition, the idea is to study the contemporary exhibition interpretations of historical heritage, as a form of production of contemporary architectural practice. Past has two levels of observation: on the one hand, what happened once remains unchanged forever, but on the other hand, the explanation or interpretation is changed. One of the main objectives of the research will be searching for the answer to the question on how it is possible to remember, reconstruct and recycle the past through the presentation of historical heritage. In social memory theories, by storing certain contents and forgetting others, information from the past is brought into the specific line, or the system that becomes the basis for the interpretation of the world. Culture of remembrance, which includes all forms of public use of memory, studies the mechanisms of social transmission, design, maintenance and processing of the past. The term memory is interpreted as the storage of the past, but on the other hand, the memory, according to Todor Kuljic, is "the grip into the past always from the new present". Memories activate and once again bring up the burning question of the content of the past with the aim of interpreting the present and constructing a vision of the future and in that sense the memory is not a true view of the past, but "the result of construction and reality", i.e. the interspace between stories and historical facts. Passing of time also means recognition and distance, which cultural monument always tends to overcome. Due to its physical presence, it aims to create an error in time and establish a direct connection with the events and individuals it memorizes. The main role of the intentional monuments is to keep memories alive and as Alois Riegl states, "the deliberate value of remembrance simply requires immortality, eternal present and continuous existence."

Keywords: memory, history, exhibition, presentation, medium, archaeological presentation.

INTRODUCTION

As well as all cultural objects, monuments and archaeological heritage, when they are displayed in an exhibition, they form a complex system which is the result of the relationship between exhibits themselves, concepts of their exposure and physical framework, i.e. the space where they are exhibited. Cultural monuments convey a deliberate testimony about a particular time, place or event within the historical and social time (context), but also, they often carry a different, unintended meaning. On a general level, for each monument and every form of its presentation, one might ask about relations and meanings they produce when time and social relations are transformed into material form, or when they are summarized into space which becomes our measure and way of understanding from that moment on.

While building the social identity, it is of great importance to have the process of establishing and accepting certain values through the creation of common culture of memory, and every representation of the past that stands as its part. Spatial articulation of memory is a complex artificial set of different aesthetic and social values. Spaces where the past is represented are the places where not only desirable common memories are constructed, but also values that construct the present, i.e. anticipated future, are indicated. Exhibition is not the medium where the monument is exhibited; exhibition space "does not mean the action of extending items, but the action of their relationship."(Premerl, 1970: 70) The key question of this paper is the theoretical relationship between exhibition, memory and cultural monuments that have influence on the interpretation of the past.

The main idea of this paper is to use summarized theoretical consideration, i.e. the definition and comparative analysis of the key concepts related to the culture of memory and practice of exposure, as well as the parallel display of relevant examples of contemporary exhibition and architectural concepts of presenting archaeological heritage, to review new discourses and knowledge about practices in the presentation of the past. The aim is to reflect on how to explore archaeological heritage from the position of architectural discourse and to isolate possible research questions.

PAST, CULTURE OF MEMORY, MONUMENTS, EXHIBITIONS

By keeping certain contents and forgetting others, information from the past are brought into certain order, i.e. the system which becomes the basis for interpreting the world. Past has two levels of observation: on the one hand, what happened before remains unchanged forever, but on the other hand, explanation or interpretation is changed. Culture of memory, which includes all forms of public use of memory, belongs to the level of interpretation and explanation of various forms of preserving and presenting the past. The phenomenon of memory contains two not confronted but complementary terms, and those are memory and remembrance which are not always possible to be terminologically distinguished. Memory is the capability of storage, i.e. keeping the contents from the past, while the remembrance is an active process of «imprinting and actualization»(Asman, 1999: 121) of specific contents(*ibid*: 121-135), or according to Todor Kuljic, "an intervention in the past always from the new present." (Kuljić, 2006:8) Memory triggers and once again actualizes the contents of the past in order to interpret the present and construct visions of the future, and regarding this, the common memory is not the true vision of the past, but "the result of construction and reality"(*ibid*.), i.e. placed into space between stories and historical facts.

In an important text, "The modern cult of monuments: its essence and its meaning" (1903), Alois Riegl (Reigl, 1996: 69-83) deals with the theoretical elaboration of the meaning of monuments (expressed in the system of protection of cultural heritage), the original values(*ibid*.)[1] and different perceptions of the monument. At the very beginning he defines a monument as a «man-made creation, built with the purpose to keep certain personal acts and events vivid in the minds of future generations»(*ibid*.: 69) and concludes that both unintentional and intentional monuments are determined by monumental values. The key difference is that the values of intentional monuments

1 Riegl distinguishes three types of monuments values: intentional monumental value (gewollte Erinnerungswert), historical value (historic Welt) and age value (Alteswert). In author's proposed concept of age, the monument logic is inverted - transience, before durability becomes its characteristic. Ibid. pp 69-83.

are always determined in the moment of creation, while the values of unintentional monuments are always relative and are the case of subjective, rather than objective marking. According to Riegl's primarily visual analysis, the meaning is determined at the time of perception and the observer is the one that actually constitutes the monument.

Passing of time also means recognition and distance, which intentional monument always wants to overcome. By its physical presence, it has the intention to create an error in time and establish a direct connection with event or individuals it memorizes. The main role of intentional monument is to keep memories alive and as Riegl states - "a thoughtful value of remembrance simply requires immortality, eternal present and continuous existence."(*ibid.*:78).

It is necessary to consider the spatial meaning of the monument through the simultaneous relationship between space and form, i.e. to examine the spatial phenomenon of monument presentation and space it enables and builds. The relationship between cultural monuments and architecture is determined by the fact that the exposure takes place within a space - gallery, museum or other exhibition area. The exhibition is always pre-defined by its physical frame; while on the other hand, the architecture of each exhibition is a place, framework, boundary within which the exposure takes place. Exhibitions can also be defined as phenomena that are limited by space and time(Alpers,1991: 26), and in contemporary interpretation they can be understood in three aspects - as a medium, an institution and an independent art form. Medium of the exhibition, as well as all the media, is very often determined by some other medium: architecture of exhibition space, light, colour, printed material and catalogues, and of course the exhibits themselves (Curley, 2004).

In a variety of different definitions, one of the exhibition definitions provided by Ivo Maroevic says that exhibitions are «events where the society and time meet and connect in space.»(Maroević, 1994: 290). According to this definition, exhibition is determined as an event while at the same time exhibitions can be defined as a place where public opinion is «produced» and «constituted» but also as the place where the exchange of certain (social) values and powers takes place(Bennett, 1996: 82). Editors of the book "Thinking about Exhibitions" agree with the definition of exhibition as a place of exchange and say that "exhibitions are the primary place of exchange in the political economy of art, where the importance is constructed, maintained and occasionally deconstructed. Partly a spectacle, partly a socio-historical event (the fact), and partly a structuring tool, exhibitions set up and frame the cultural significance of art."(Greenber, 1996: 2).

Although the presentation of archaeological heritage actually means confirmed and unchangeable historical facts, these exhibitions do not include the complete and closed systems. Their meanings and valuation change, expand and invert according to the way of conceptualization of reality in time and space within which the particular exhibition is interpreted(Gavrilović, 2009: 2).

Depending on the context within which it is interpreted, the concept of exhibition can be understood on many levels. Since this is about a complex social phenomenon, depending on the way of observation, exhibitions are determined doubly, as an act of "public display" (works of art, manufactured goods, things from nature, etc.) and as "the space where the exhibition takes place."(Kastelić, 2011) Defined this way, exhibition exists both as an event and space, i.e. as action and place (location)(*ibid.*). Considered as events, exhibitions are almost always a set of psychological, aesthetic and ideological layers, and thus can be interpreted and understood only if they are perceived and understood on the broader horizon of social events. Seen as a place, exhibition spaces are full of discourse, exhibition is not only what appears to the eye, and not only does it include a superficial picture or display, but it also includes a set of ideas, languages and mechanisms within which it is materialized using mostly the world of art and culture as the mechanism of meaning and purpose production (*ibid.*).

Each monument represents one part of the past i.e. the values and meanings it takes. The concept of representation can be defined as "something that stands instead of something else" (Ddanto, 2006: 165), and representation is also the production of meaning through language. This concept has a place in the study of culture because it connects meaning and language with culture, and in that sense Stuart Hall distinguish-

es a constructivist theory because he recognizes the social nature of language, i.e. as he states, "things are not meaningful : we construct the meaning."(Hall, 1997: 13-75) On the other hand, Ginzburg points out the ambiguity which the concept of representation contains, and which can be clearly seen through the monument itself. The monument stands instead of the reality it presents, and in that way, it recalls absence, while it simultaneously makes the reality visible and thus suggests the presence (Ginzburg, 2002: 63-89).

Memory implies emotional and cognitive relationship of the individual to his or her personal experience, and although it is never a fully unconscious activity, it always contains unintentional perception and unconscious reaction. That is an active creative process where the original experience is not reproduced, but with the help of "memory traces"(Kuljić, 2006: 57) the image of that experience is reconstructed. Models of memory within the memory theories differ according to the pictures which should be remembered, i.e. according to the complex system of metaphors which is not the language used to describe the subject of memory, but the way it is revealed and constituted. Picturesque is basically the idea of memory, and according to Aleida Assman, images "serve as figures of thought which limit the conceptual fields and according to them, the theory is oriented"(Asman, 1999: 121).

On the other hand, memory is the part of society and culture where the results of memories are stored, and it implies "a deliberate approach to the past"(Kuljić, 2006: 11) and often belongs to the institutional apparatus of society. Because of its constant change, it cannot be considered a passive activity.

Memories are the plays that reconstruct the past from the immediate present, but they also contain reconstructions of the past, closer or further periods of the past, or how Maurice Halbwash points out, "memory is an image dressed in other images, a generic image transferred to the past"(Albvaš, 1999: 74).[2] However, in our memory, already seen pictures of the past do not last, but according to Halbwash, the thing that survives in one society are the signs that provide constant reconstruction of certain parts of the past.

Memory is always followed by oblivion, or how Aleida Assman states "we can remember only if we are able to forget."(Asman, 2011: 72) Unconscious or often deliberately set in a social sense, oblivion is not actually the opposite of memory, but an inseparable and indispensable part of its complex selective mechanism. If the memory triggers contents of the past from current perspective, then the oblivion is actually "deactualization of the part of our experience"(Kuljić, 2006: 61) and within cultural theories it is particularly interesting as an intentional strategy used to bring the contents of the past to a certain order.

CONCLUSION

Within the grasp that the field of architecture involves not only creation in order to meet spatial and utilitarian needs, but also contains the field of theoretical considerations which represent the first step in the process of objectification in the form of concrete objects or patterns of activity, this paper examines theoretical consideration as the basis for studying archaeological heritage from the position of architectural discourse. In that sense, analysis was presented and relationships were established between the concepts of monument, exhibition, representation and memory, which were highlighted as crucial.

In additional research, besides the idea to explore contemporary interpretations of exhibiting cultural heritage as one of the forms of production of contemporary architectural practice, the intent is to examine and present the invisible, alternative history through exhibition as a medium, where history is interpreted as a constructed narrative. It is necessary to examine the way of understanding the past, and therefore the social frameworks that generate it, which depends on the construction of memory and the way it is changed. This approach is consistent with contemporary research about the culture of memory, which raises the question on how at some point of time a specific *place* (Prlenda, 2006: 21-43).[3] forms the

2 In the 1920s, , the French sociologist Maurice Halbwash was the first to theoretically considered social frameworks of memory, considering that although in the physical sense only individuals remember, and social groups define and construct the memory. Moris Albvaš, „Kolektivno i istorijsko pamćenje", *REČ- časopis za književnost i kulturu, i društvena pitanja* (Beogard), br. 56.2 (1999), 74.

3 According to Pierre Nora, places of memory occur at the moment when the real, lived memory disappears, i.e.

memory and shapes our understanding of the present moment, i.e. tries to make sense on how "time and memory create stories."(Young, 2006, 203)

During the research of presentations of contemporary architectural concepts and archaeological heritage, these exhibitions should be considered primarily as institutions, i.e. the place of interaction between different identities through the choice of exhibits, their presentation, spatial disposition, as well as the selection and use of supporting texts. The main emphasis is on defining the exhibition potentials to reflect the change of historical, political and cultural events, and function as a place for promotion of discussions on relevant social and cultural issues.

BIBLIOGRAPHY

Albvaš, M. 1999
Kolektivno i istorijsko pamćenje, *REČ- časopis za književnost i kulturu, i društvena pitanja* (Beogard), 56. 2: 74.

Asman, A. 1999
O metaforici sećanja, *REČ- časopis za književnost i kulturu, i društvena pitanja* (Beograd) 56. 2: 121.

Asman, A. 1994
Duga senka prošlosti, Beograd: Biblioteka XX.

Bennett, T. 1996
The Exhibitionary Complex, in *Thinking about Exhibition*, Reesa Greenberg, Sandy Nairne, and Bruce W. Ferguson (ed.), New York: Routledge: 82.

Curley, N. 2011
Exhibition, accessed December 20, http://csmt.uchicago.edu/glossary2004/exhibition.htm.

Danto, A. 2006
Zašto je suspstituciona teorija reprezentacije nespojiva sa tradicionalnim određenjem estetike?, Kritika filozofije umetnosti A.C. Dantoa", *Filozofija i društvo* (Beograd), 1: 165.

Gavrilović, Lj. 2007
O politikama, identitetima i druge muzejske priče, Beograd: Narodni muzej.

Ginzburg, C. 2002
Representation (The Word, The Idea, The Thing), in *Wooden Eyes:Nine reflewctions on Distance*, New York: Columbia University press: 63-89.

Greenberg, R., Ferguson B. W. and Nairne, S., 1996
Introduction**,** in *Thinking about exhibitions*, Reesa Greenberg, Bruce W. Ferguson and Sandy Nairne (ed.), New York: Routledge: 2.

Hall, S. 1997
The work of representation, in *Representation:-cultural representations and signifying practices*, Stuart Hall (ed.), London: SAGE Publications: 13-75.

Kastelic, M. 2011
Contemporary exhibition: The rhetoric of the image, accessed December 12., http://koperseminar.pbworks.com/w/page/6815898/Papers.

Kuljić, T. 2006
Kultura sećanja, Teorijska objašnjenja upotrebe prošlosti, Beograd : Čigoja.

Nora, P. 2006
Između pamćewa i historije. Problematika mjesta, in *Kultura pamćenja i Historija,* Maja Brkljačić and Sandra Prlenda (ed.) Zagreb:Golden Marketing –Tehnička Knjiga: 21-43.

Maroević, I. 1994
Izložba kao oblik muzejske komunikacije, *Osječki zbornik* 21: 290.

Premerl, T. 1970
Prostorna akcija spomenika, *Arhitektura* (Zagreb) 106 : 70.

Reigl, A. 1996 (1901)
The Modern Cult of Monuments*:* Its Essence and Its Development, Karin Bruckner with Karen Wil-

continues to exist only in the form of reconstructed past. They are established by a social group, and they represent the symbiosis of historiography and group memory (museums, archives, cemeteries, collections, holidays, anniversaries, monuments, etc.).

Pierre Nora, „Između pamćewa i historije. Problematika mjesta", u *Kultura pamćenja i Historija,* ur. Maja Brkljačić i Sandra Prlenda (Zagreb:Golden Marketing – Tehnička Knjiga,2006), 21-43.

liams (translators), in: *Historical and philosophical issues in the conservation of cultural heritage*, Nicholas Stanley Price, Mansfield Kirby Talley, Alessandra Melucco Vaccaro (ed.) Los Angeles: Getty Publications: 69-83.

Svetlana Alpers, S. 1991
The Museum as a Way of Seeing, in: *Exhibiting Cultures*, . Ivan Karp and Steven D. Lavine (ed.), Washington, DC: Smithsonian Institution Press: 26.

Young, J. 2006
Tekstura sjećanja, in *Kultura pamćenja i Historija*, Maja Brkljačić and Sandra Prlenda (ed.) Zagreb:Golden Marketing – Tehnička Knjiga: 203.

REZIME

SAVREMENIIZLOŽBENO ARHITEKTONSKI KONCEPTI U PREZENTACIJI ARHEOLOŠKOG NASLEĐA

Ključne reči: sećanje, istorija, izložba,prezentacija, medijum, arheološka prezentacija.

U okviru shvatanja da polje delovanja arhitekture ne obuhvata samo kreiranje sa ciljem zadovoljenja prostornih i utilitarnih potreba, već joj sve više pripada i polje teorijskih razmatranja koje predstavlja prvi korak u postupku objektivizacije u vidu konkretnih objekata ili modela delovanja, ovaj rad se bavio teorijskim razmatranjem kao osnovom za proučavanje arheološkog nasleđa iz pozicije arhitektonskog diskursa. U tom smislu, prikazana je analiza i uspostavljene su relacije između pojmova spomenik, izložba, reprezentacija i sećanje, koji su izdvojeni kao ključni.

U daljim istraživanjima pored ideje da se istraže savremene interpretacije izlaganja kulturnog nasleđa kao jedan od oblika produkcije savremene arhitektonske prakse, namera je da se prouče i prikažu nevidljive, alternativne istorije kroz izložbu kao medijum, gde je istorija interpretirana kao konstruisan narativ. Potrebno je ispitati na koji način razumevanje prošlosti, a samim tim i društvenih okvira koji je generišu, zavisi od konstrukcije sećanja i na koji način se ono menja. Ovaj pristup je u skladu sa savremenim istraživanjima kulture sećanja koja postavljaju pitanja kako u određenom trenutku vremena pojedino *mesto* formira sećanje i na koji način ono oblikuje naše razumevanje sadašnjeg trenutka, odnosno pokušavaju da rastumače kako se od "vremena i sjećanja stvaraju prič[e]"[1].

Tokom istraživanja savremenih arhitektonskih koncepcija prezentacije arheološkog nasleđa potrebno je ove izložbe razmatrati prevashodno kao institucije, odnosno kao mesto interakcije različitih identiteta kroz izbor eksponata, njihovu prezentaciju, prostornu dispoziciju kao i kroz odabir i upotrebu pratećih tekstova. Glavni akcenat je na definisanju potencijala izložbi da reflektuju promene istorijskih, političkih i kulturnih dešavanja kao i da funkcionišu kao mesta za promovisanje rasprave o relevantnim društvenim i kulturnim pitanjima.

1 James Young, „Tekstura sjećanja", u *Kultura pamćenja i Historija*, ur. Maja Brkljačić i Sandra Prlenda (Zagreb:Golden Marketing –Tehnička Knjiga,2006), 203.

MARIO NOVAK,
Anthropological Centre, Croatian Academy of Sciences and Arts,
Zagreb, Croatia
mnovak@hazu.hr

UDC: 902:572(497.5)
Original research article
Received: March 5th 2013
Accepted: October 15th 2013

THE ROLE OF BIOARCHAEOLOGY IN PRESENTATION AND POPULARISATION OF SCIENCE IN CROATIA

ABSTRACT

The paper briefly presents the historical development and current status of bioarchaeological research in Croatia. Special emphasis is placed on activities that are performed continuously over the past twenty years with the purpose of promotion and presentation of bioarchaeology as a science among professionals (archaeologists) and in general public, especially among younger audience. The promotion of bioarchaeology among archaeologists includes joint publications of scientific articles between archaeologists and bioarcheologists, bioarchaeological lectures at professional meetings and joint organization of exhibitions and book presentations. In general public these activities consist of public lectures in schools and faculties, organisation of bioarchaeological workshops, organised visits to the bioarchaeological labs, and numerous appearances of bioarchaeologists in mass media (newspapers, television, radio, Internet). All of these activities have led to a significant change in the perception of bioarchaeology, both among archaeologists and in general public, and today in Croatia all archaeological excavations of human skeletal remains result in bioarchaeological studies of the recovered material, while frequent appearances in media, combined with public lectures and presentations, have made bioarchaeology one of the most popular scientific branches with a very positive response in general public.

Keywords: bioarchaeology, Croatia, science, presentation, lectures, mass media, workshops.

INTRODUCTION

Bioarchaeology is a science that studies human skeletal and dental remains from archaeological context; it also reconstructs living conditions and quality of life of archaeological populations. Bioarchaeology serves as a supplement to the archaeological and historical data, but it also reveals important information that can not be obtained by the archaeological excavations and historical studies. The term was first used by a British archaeologist G. Clark (1972) in order to define the study and analysis of animal bones found during archaeological excavations. In 1977 American archaeologist

J. Buikstra (1977) provided a new definition of bioarchaeology which is still used - a study of human skeletal remains found during archaeological excavations. Today, terms such as osteoarchaeology, skeletal biology or palaeoosteology are sometimes used instead of the term bioarchaeology. Biological anthropology during the 19th and the first half of the 20th century was reduced to descriptive, mostly anatomically oriented descriptions of human skeletal remains or recognised pathological conditions that sometimes supplemented archaeological publications. During the 60's of the last century analytical methods and theories that enabled a new approach to the study of human osteological remains started to develop, and the major difference was in the shift from the typological way of thinking toward the orientation based on the idea of studying the interaction processes between human biological and socio-cultural phenomena, and the study of biological structures (e.g. Baker 1966; Johnston 1966).

This new approach has led to the fact that human bones were analysed in the context of human interaction with its environment and ecological system that surrounds it. This development was prompted by several factors. The first factor was the development of multivariate statistical methods and their use in bioarchaeological analyses (e.g. Jantz 1973; Rösing and Schwidetzky 1977), significantly facilitated by the increased availability of personal computers that allowed quick and easy application of these analyses. Another factor was the shift in focus of anthropological analyses from the descriptive characterisation of one individual toward the entire population that became the main object of study. Furthermore, reliable and standard methods for determination of sex (e.g. Giles and Elliot 1963; Phenice 1969) and age at death (e.g. Fazekas and Kósa 1978; Gilbert and McKern 1973) on human skeletal material were developed and generally accepted. Finally, large, precisely dated and thoroughly documented archaeological collections of skeletal material have become available for bioarchaeological studies.

SHORT HISTORY OF BIOARCHAEOLOGY IN CROATIA

The beginnings of bioarchaeological research in Croatia are related to the paleoanthropological studies carried out by D. Gorjanović-Kramberger at the end of 19th and the beginning of the 20th century (Gorjanović-Kramberger 1899, 1906). His analysis of the Neanderthal skeletal material recovered from Hušnjakovo brdo near Krapina significantly contributed to the acceptance of the existence of fossil man, and thus, to the acceptance of the concept of the evolution of mankind (Šlaus *et al*. 2011). Bioarchaeological analyses of modern man in Croatia began after the Second World War with two major publications by F. Ivaniček. In these works he presented the results of detailed paleodemographic and craniometric analyses of the medieval sites of Bijelo Brdo (Ivaniček 1949) and Ptuj (Ivaniček 1951). Two decades later G. Pilarić published several papers that focused on the craniometric characteristics of Early Mediaeval Croat populations (Pilarić 1967, 1968). During the 80's Serbian anthropologist Ž. Mikić also published results of the anthropological analysis of several Croatian mediaeval populations (Mikić 1983, 1990).

During this period a major leap forward in Croatian physical anthropology and bioarchaeology began mostly due the founding of the Croatian Anthropological Society and the scientific journal *Collegium Antropologicum* in 1977 by H. Maver and P. Rudan. They organised numerous international scientific workshops such as the annually held *School of Biological Anthropology* that led to the founding of the first scientific and educational institution dedicated exclusively to anthropological research in Croatia - the Institute of Anthropology in Zagreb established in 1992.

BIOARCHAEOLOGY IN CROATIA TODAY

Modern bioarchaeological studies, equal to those carried out in Europe and the United States, began in Croatia during the early 90's of the last century. Today, bioarchaeological and physical anthropological analyses are performed in numerous Croatian scientific centres of excellence such as the Institute of Anthropology (I. Janković, Z. Premužić, P. Rajić Šikanjić), the Department of Archaeology at the Faculty of Humanities and Social Sciences in Zagreb (Z. Hincak), the Institute for Archaeology in Zagreb (J. Boljunčić), the University Centre for Forensic Sciences in Split (Š. Anđelinović, I. Anterić, Ž. Bašić), the Department of Dental Anthropology at the School of Dental Medicine in Zagreb (H. Brkić, M. Vodanović), and the Anthropological Centre of the Croatian Academy of Sciences and

Arts (Ž. Bedić, M. Novak, M. Šlaus, V. Vyroubal). The results of these studies are published in monographs and in the domestic and international peer-reviewed journals of the highest quality[1].

The leading centre for bioarchaeological research in Croatia today is the Anthropological Centre of the Croatian Academy of Sciences and Arts in Zagreb where several scientists are actively engaged in bioarchaeological studies of archaeological populations from the territory of Croatia, but also from the neighbouring countries. They study a wide range of topics including demography, subadult stress, infectious diseases, dental pathologies, bone trauma, vertebral pathologies, etc. Biorchaeologists from the Anthropological Centre corroborate with numerous scientists from Croatia and abroad covering a wide range of scientific disciplines such as archaeology, history, molecular genetics, radiology, dentistry, etc. The osteological collection of the Anthropological Centre of the Croatian Academy, established in 1991, is the largest collection of human skeletal material in Croatia - it holds skeletal material from numerous archaeological sites in Croatia dating from the Mesolithic period to the 19th century AD with a total number of over 5000 skeletons.

In addition to scientific work, Croatian bioarchaeologists participate in educational activities as lecturers at several universities in Croatia. The courses in bioarchaeology are taught at the Department of Archaeology at the University in Zadar and the Department of Archaeology at the Faculty of Humanities and Social Sciences in Zagreb, while courses in Forensic Anthropology, which include topics in bioarchaeology, are taught at the Chair of Anthropology at the Faculty of Humanities and Social Sciences in Zagreb and the University Centre for Forensic Sciences in Split.

PRESENTATION AND POPULARISATION OF BIOARCHAEOLOGY IN CROATIA

Efforts in presentation and popularisation of bioarchaeology in Croatia have been carried out continuously for the last 20 years. These actions are conducted simultaneously on two fronts - among professionals (archaeologists) and in general public. The efforts in popularisation of bioarchaeology among the professional public (archaeologists) mostly include joint publications of scientific articles/books between archaeologists and bioarchaeologists (Fig. 1) and lectures with topics in bioarchaeology at professional meetings such as the annual scientific meetings of the Croatian Archaeological Society. Today, as a result of these actions bioarchaeological articles are published in all major Croatian archaeological journals as well as in numerous international archaeological/anthropological/medical journals. Also, several books in Croatian and English languages dealing with bioarchaeological studies were published recently gaining considerable attention and positive feedback from archaeologists, but also from the mass media. All the mentioned efforts resulted in the increased interest of archaeologists for the preservation and analysis of human skeletal material. The vast majority of Croatian archaeologists today are aware of the usefulness of bioarchaeological analyses for reconstructing the quality of life of past populations, and the result is that virtually all human bones found in archaeological sites in Croatia today are analysed (Šlaus *et al*. 2011).

A special category of lectures with bioarchaeological topics are those held as part of the presentations of archaeological monographs and during the openings of archaeological exhibitions. A close collaboration of archaeologists and bioarchaeologists is of key importance in organising such events, and in this context it is necessary to mention two archaeological institutions from Croatia that understood the importance of such an approach and the mutual cooperation in the promotion of science - the Institute of Archaeology from Zagreb and the Archaeological Museum Zadar. Bioarchaeologists from the Anthropological Centre of the Croatian Academy closely corroborate with archaeologists from these two institutions for more than a decade in the preparation of exhibitions and lectures, as well as in media appearances such as the press conference on the occasion of discovery and opening of the Early Mediaeval sarcophagus of monk Juraj in Zadar in the spring of 2011.

Very important are the actions carried out in presentation and popularisation of bioarchaeology among general audience, especially among the school children and students. Presentation

1 For a complete list of publications published up until year 2011 see Šlaus et al. (2011).

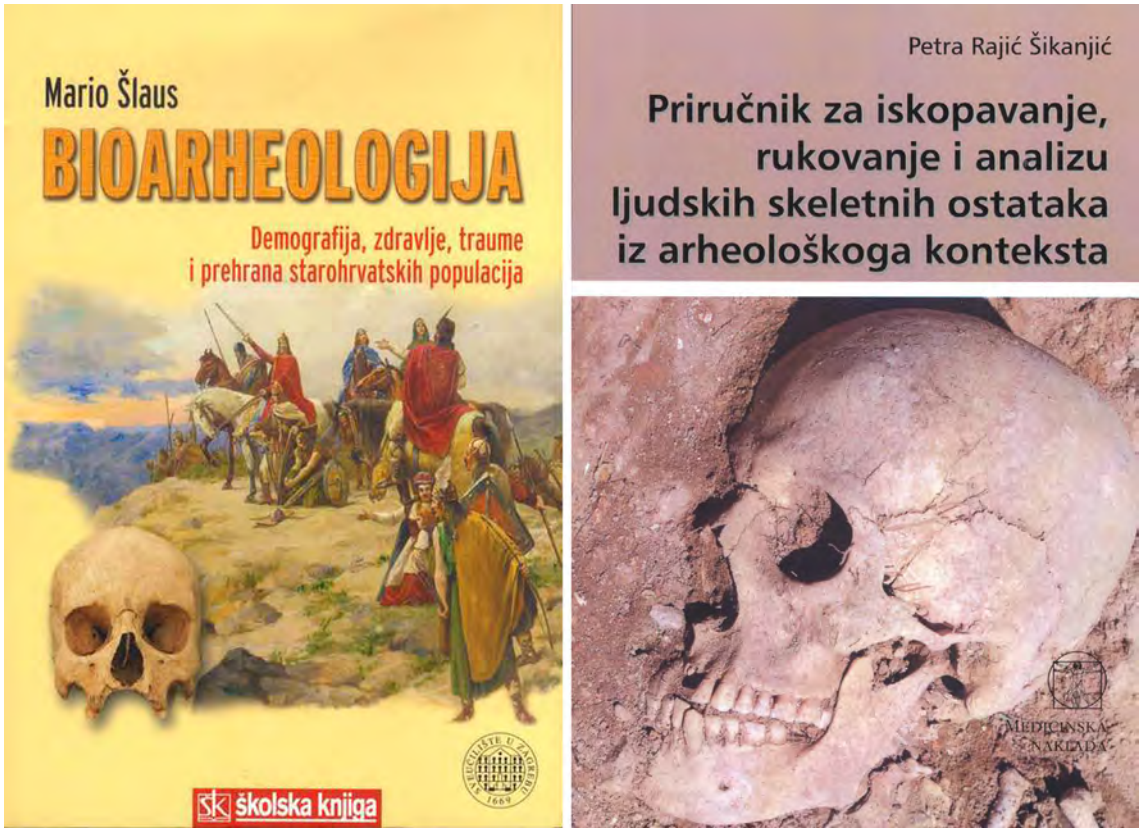


Fig. 1 Books with bioarchaeological topics published in Croatia in the last few years.

of bioarchaeology in this target group is primarily done through lectures in high schools and/or universities, through organised arrival of students to the osteological laboratory where they are introduced with methods and techniques used in the bioarchaeological analyses, and through public lectures held during various science manifestations. Very important for the promotion of bioarchaeology among students is the already mentioned *School of Biological Anthropology* organised by the Institute of Anthropology in Zagreb, held annually, with lecturers who are the world's biggest experts in the field of biological anthropology. In this context one should not ignore the event launched in 2011 named Croatian Academy Open Door Days, also taking place once a year, during which two highly attended bioarchaeological workshops with lectures were held (Fig. 2), with a vast majority of younger visitors.

The mass media played the most important role in the promotion and presentation of bioarchaeology to the general public in Croatia, in addition to workshops, lectures and exhibitions. It may be safely said that the mass media in Croatia recognised bioarchaeology as a very attractive branch of science in which humanities and natural sciences are combined, and that the mass media played a crucial role in creating a positive opinion toward the bioarchaeology in the general public.

Bioarchaeological topics in Croatia today can be found in all major daily and weekly newspapers (*Večernji list*, *Jutarnji list*, *24 sata*, *Globus*, etc.) (Fig. 3). Except in the newspapers, bioarchaeological topics are also systematically covered by numerous Internet news portals. But, probably the most important role in the affirmation of bioarchaeology in Croatia had the state-owned Croatian Television and Croatian Radio. In the last decade, as a part of its scientific, educational and informational programs, Croatian Television broadcasted many reports describing the work of bioarchaeologists in the laboratory and during excavations, while numerous bioarchaeologists gave interviews in which they presented their work; on several occasions TV documentaries (*Scientia Croatica*, *It is good to know*, *Scientific Five*, *Moment of Truth*, etc.) dealing with specific bioarchaeological topics with the participation of

Fig. 2 Bioarchaeological workshop held during the Croatian Academy Open Door Days in November 2011.

leading Croatian bioarchaeologists were shown. Croatian Radio also intensively covers such topics - as an example, bioarchaeologists from the Anthropological Centre of the Croatian Academy appeared twice on the show titled *Wonderful New World* during December 2012. As for the commercial television and radio stations, they also continuously monitor the work of Croatian bioarchaeologists, but mostly through informational programs.

Along with all the facts mentioned above, it should be noted that the shooting of a documentary drama titled *Written in Bones* has just been finished. It was filmed by the Croatian Television with participation of the bioarchaeologists from the Anthropological Centre of the Croatian Academy along with numerous experts from other scientific fields such as historians, archaeologists, physicians, molecular biologists from Croatia and abroad. The show consists of five episodes, with each episode covering certain aspects presented through bioarchaeological studies of human skeletal remains from the Croatian archaeological sites dated from the Early Neolithic to the Late Middle Ages. In a popular, but scientifically accurate manner the show will try to reconstruct the living conditions of past populations, which should contribute to further acceptance and popularisation of bioarchaeology as a science among wider audience in Croatia.

All actions comprehensively described in this chapter led to a significant change of attitude toward bioarchaeology in Croatia during the last two decades. Twenty years ago most archaeologists in Croatia regarded human bones as redundant material that just backfilled museum storerooms and from which one could not obtain new and useful data, so most of the skeletal material from archaeological context was re-buried in unmarked mass graves without any labels or even burned on huge pyres. Today, all archaeological excavations of human skeletal remains in Croatia result in bioarchaeological studies and publication of the obtained results due to the multidisciplinary approach and intense cooperation between field archaeologists and bioarchaeologists. The similar attitude also prevailed among the general public - most people saw bioarchaeology as an unnecessary scientific branch on which taxpayer's money was wasted. But, as a result of frequent appearances in mass media, combined with public lectures and presentations, today bioarchaeology is one of the most popular scientific branches in Croatia with extremely positive response in general public. Of course, numerous forensic

Fig. 3 Article from the weekly magazine Globus describing the work of bioarchaeological team from the Anthropological Centre of the Croatian Academy.

TV shows broadcasted on several TV stations also helped to change this attitude so bioarchaeological teams are sometimes referred to as "CSI bioarchaeology team Croatia" in the mass media.

FUTURE PLANS

Although it can be said that the bioarchaeology in Croatia today is very popular with a positive feedback among both professionals and general audience the additional efforts are necessary in order to make this scientific branch even more attractive. These actions should be concentrated into two directions. The first includes stronger cooperation between Croatian bioarchaeologists and those from the wider region, i.e. work on mutual scientific projects, creation of large osteological databases that will not be limited by contemporary boundaries, and organisation of joint scientific meetings. The second one is more oriented toward the general public and is mostly based on the multimedia approach - it consists of informing the public, especially younger audience, about bioarchaeology and its goals through new media such as Facebook and Twitter as well as the creation of large online bioarchaeological databases that will be available to all interested parties.

BIBLIOGRAPHY

Baker, P.T. 1966
Human biological variation as an adaptive response to the environment, *Eugenics Quarterly* 13(2): 81-91.

Buikstra, J.E. 1977
Biocultural dimensions of archaeological study: a regional perspective, in: *Biocultural Adaptation in Prehistoric America*, R.L. Blakely, (ed.), Ath-

ens: University of Georgia: 67-84.

Clark, G. 1972
Star Carr: a case study in Bioarchaeology, Boston: Addison Wesley modular publications.

Fazekas, I.G., and Kósa, F 1978
Forensic fetal osteology, Budapest: Akadémiai Kiadó.

Gilbert, B.M., and McKern, T.W. 1973
A method for aging the female os pubis, *American Journal of Physical Anthropology* 38(1): 31-38.

Giles, E., and Elliot, O. 1963
Sex determination by discriminant function analysis of the crania, *American Journal of Physical Anthropology* 21(1): 53-68.

Gorjanović-Kramberger, D. 1899
Paleolitički ostaci čovjeka i njegovih suvremenika iz diluvija u Krapini, *Ljetopis Jugoslavenske akademije znanosti i umjetnosti* 14: 90-98.

Gorjanović-Kramberger, D. 1906
Der diluviale Mensch von Krapina in Kroatien. Ein Beitrag zur Paläoanthropologie, Wiesbaden: Kriedel.

Ivaniček, F. 1949
Istraživanje nekropole ranog srednjeg vijeka u Bijelom Brdu, *Ljetopis Jugoslavenske akademije znanosti i umjetnosti* 55: 111-144.

Ivaniček, F. 1951
Staroslavenska nekropola u Ptuju – rezultati antropoloških istraživanja, Ljubljana: Slovenska akademija znanosti in umetnosti.

Jantz, R.L. 1973
Microevolutionary change in Arikara crania: A multivariate analysis, *American Journal of Physical Anthropology* 38(1): 15-26.

Johnston, F. E. 1966
The population approach to human variation, *Annals of the New York Academy of Sciences* 134: 507-515.

Mikić, Ž. 1983
Antropološki prikaz srednjovekovnih stanovnika Ričica, in: J. Jeličić, (ed.), *Ričice – nekropole stećaka*, Split: Regionalni zavod za zaštitu spomenika kulture, 45-59.

Mikić, Ž. 1990
Antropološki profil srednjovekovne nekropole u Mravincima kod Splita, *Vjesnik za arheologiju i historiju dalmatinsku* 83: 225-232.

Phenice, T.W. 1969
A newly developed visual method of sexing the os pubis, *American Journal of Physical Anthropology* 30(2): 297-301.

Pilarić, G. 1967
Antropološka istraživanja starohrvatskog groblja u Daraž-Bošnjacima 1961. godine, *Arheološki radovi i rasprave* 4/5: 419-443.

Pilarić, G. 1968
Fenotipske značajke bjelobrdskih lubanja iz ranog srednjeg vijeka, *Arheološki radovi i rasprave* 6: 263-291.

Rösing, F.-W., and Schwidetzky, I. 1977
Vergleichend-statistische Untersuchungen zur Anthropologie des frühen Mittelalters (500-1000 n.d.Z.), *Homo* 28: 65-116.

Šlaus, M., Novak, M., and Vodanović, M. 2011
Croatia, in: N. Marquez Grant, L. Fibiger (eds.), *The Routledge Handbook of Archaeological Human Remains and Legislation: An International Guide to Laws and Practice in the Excavation and Treatment of Archaeological Human Remains*, Routledge: London: 83-96.

REZIME

ULOGA BIOARHEOLOGIJE U PROMOCIJI I POPULARIZACIJI NAUKE U HRVATSKOJ

Ključne reči: bioarheologija, Hrvatska, nauka, prezentacija, predavanja, mediji, radionice.

Rad ukratko prikazuje istorijski razvoj i trenutni status bioarheoloških istraživanja u Hrvatskoj. Poseban akcenat je stavljen na aktivnosti koje se obavljaju u kontinuitetu u poslednjih dvadeset godina u promociji i prezentaciji bioarheologije kao nauke među profesionalcima (arheolozima) i u široj javnosti, posebno među mlađom publikom. Promocija bioarhaeologije među arheolozima obuhvata zajedničke publikacije naučnih članaka između arheologa i bioarheologa, bioarheološka predavanja na stručnim skupovima i zajedničko organizovanje izložbi i prezentacije knjiga. U najširoj javnosti ove aktivnosti se sastoje od javnih predavanja u školama i na fakultetima, organizovanja bioarheoloških radionica, organizovanih poseta bioarheološkim laboratorijama, kao i brojnih nastupa bioarheologa u javnim medijima (novine, televizija, radio, internet). Sve ove aktivnosti dovele su do značajne promene u percepciji bioarheologije, među arheolozima i u široj javnosti, pa danas u Hrvatskoj sva arheološka iskopavanja ljudskih skeletnih ostataka rezultuju bioarheološkim studijama pronađenog materijala, dok su česte pojave u medijima, u kombinaciji sa javnim predavanjima i prezentacijama, učinili bioarheologiju jednom od najpopularnijih naučnih grana, sa veoma pozitivnim stavom u javnosti.

.

MILICA TAPAVIČKI-ILIĆ,[1] Institute of Archaeology, Belgrade, Serbia
e-mail: mtapavic@sbb.rs

JELENA ANĐELKOVIĆ GRAŠAR, Institute of Archaeology, Belgrade, Serbia

UDC: 069.15:902/904(4)
Original research article
Received: September 5th 2013
Accepted: October 15th 2013

OPENARCH, EUROPEAN PROJECT OF POPULARIZING ARCHAEOLOGY[2]

ABSTRACT

OpenArch is a five year cultural project with eleven partners from eight European countries, based on EXARC's key strengths - its supportive community and international perspective. OpenArch aims to build a permanent partnership of archaeological open-air museums, raising standards among participants and improving the visitor experience across Europe. The web-site with all the relevant data: www.openarch.eu.

Keywords: OpenArch, EU cultural project, archaeological open-air museum, experimental archaeology, visitor.

The leading partner of the project is Calafell (CAT), while the other partners are Foteviken (SE), Kierikki (FI), Archeon (NL), Hunebedcentrum (NL), AÖZA (DE), Terramara di Montale (IT), National Museum Wales (UK), University of Exeter (UK), Viminacium (RS) and EXARC (NL).
La Ciutadella Ibérica de Calafell (CAT) is a centre of experimental archaeology, an archaeological open-air museum where visitors can see what life was like in the Iron Age, 2.500 years ago. It is the first archaeological site in the Iberian Peninsula to have been reconstructed which used experimental archaeological techniques. More at www.ciutadellaiberica.com.
The Archaeological Open-Air Museum of Foteviken is situated 25 km south of Malmö (SE). It is situated within the city wall, open towards the sea, and represents the world's only attempt to recreate an entire Viking Age town. It shows a number of streets with 23 houses and homesteads, reflecting life in a late Viking Age and early Middle Age town in 1134 AD. More at www.foteviken.se.

The archaeological exhibition at the Kierikki Stone Age Centre (FI) displays objects from the Stone Age. In addition, activity programs in the reconstructed Stone Age Village offer a unique

1 During the symposium "Archaeological Heritage – its Role in Education, Presentation and Popularisation of Science", held in Viminacium from 5-8. October 2012, the lecture entitled "OpenArch, European Project of Popularizing Archaeology" was presented by Milica Tapavički-Ilić and Jelena Anđelković Grašar. The content of this paper is vested in the beneficiaries, who possess the ownership on all of the reports and documents relating to it.

2 This project has been funded with support from the European Commission. This publication [communication] reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained there in.

opportunity to experience life as it was lived thousands of years ago. Other attractions include a restaurant, hotel and museum shop. More data available at www.kierikki.fi. Founded in 1994, Archeon (NL) covers 10,000 years of human development in the Netherlands. From hunter-gatherers in the Stone Age and farmers in the Bronze and Iron Ages, through the Roman period and right up to everyday life in 1340 AD. "Archaeo-interpreters" show what life was like in "their time" in the 43 reconstructed buildings. Read more at www.archeon.nl.

Lying on the Hondsrug in Borger, in the north of The Netherlands, the Hunebedcentrum (NL) takes its visitors back to prehistoric times and shows the lives of the first farmers in Drenthe. They constructed impressive monumental tombs and the remains of 54 of them can still be seen, the largest of which stand right next to the centre. Find out more at www.hunebedcentrum.nl. The "Stone Age Park Dithmarschen" in Albersdorf (Schleswig-Holstein, DE) is being reconstructed as a Neolithic cultural landscape from ca. 3.000 BC. Lying close to megalithic tombs and grave mounds dating from the first farmers in Northern Germany, the site offers educational activities like flint knapping, archery and leatherwork. More at www.steinzeitpark-dithmarschen.de.

The terramara of Montale, near Modena (IT) is a typical Bronze Age settlement with pile dwellings surrounded with a ditch of water and imposing earthwork fortifications. Next to the site is an Open-Air Museum with life-size reconstructions of two houses furnished with replicas of the original finds dating back 3.500 years. Read more at www.parcomontale.it.

Amgueddfa Cymru, St. Fagans National History Museum is located to the northwest of Cardiff. The museum was created in 1946. in the grounds of St. Fagans Castle. It features dozens of reconstructed buildings, brought from across Wales, and three Iron Age roundhouses based on excavated examples. St. Fagans is one of Europe's leading open-air museums and has been voted one of the UK's favourite tourist attractions. Find out more under www.museumwales.ac.uk/en/stfagans.

Archaeology at the University of Exeter is a vibrant academic community offering excellent teaching and research. They are ranked 2nd in the United Kingdom for their world-leading and internationally recognised research and many staff publish on experimental archaeology. They offer high levels of student satisfaction and encourage students to use experimental methods. Read more at www.exeter.ac.uk/archaeology.

Viminacium is an ancient Roman site on the right bank of the Danube in eastern Serbia. In an area of about 450 ha, there are the remains of a military camp, a city and cemeteries. Remains of a Roman bath, a mausoleum, an amphitheatre and one of the gates of the military camp can be seen, as well as a replica of a Roman villa. More at www.viminacium.org.rs. EXARC is the ICOM Affiliated Organisation representing archaeological open-air museums and experimental archaeology. EXARC raises the standard of scientific research and public presentation among its membership through collaborative projects, conferences and publications. More data available at www.exarc.net.

PROJECT'S FOCUSES

The main idea of **archaeological open-air museums is** to present both the tangible and intangible past to the public. The tangible parts of Archaeological Open-Air Museums are the archaeological remains and the reconstructions of these (houses, tools, complete environments). The intangible and most interesting part of an **archaeological open-air museum** is the story of the people that once lived there. One of the project's focuses is to revive the past as much as possible, in the best possible way. This is why the work in OpenArch is divided into Work Packages. All Work Packages are the responsibility of the entire partnership, but one or two partners coordinate them.

MEETINGS AND WORKSHOPS

OpenArch meetings are theoretically focused events, with presentations/lectures and discussion groups. These are open and of interest to a broader audience. Workshops are practically focused 'working together' gatherings for staff of the **archaeological open-air museums** with the aim of exchanging insight into specific methods and improving each oth-

er's skills/abilities. At every workshop within the OpenArch project, different Work Packages are addressed, as modules. The workshops and meetings are open to staff and other interested persons from outside the organiser museums. Several meetings have taken place so far. After the kick-off meeting in January 2011. in Calafell and the meeting in October 2011. in Borger, participants met again in April 2012. in Modena (IT). The meeting dealt with the implementation of the OpenArch project activities, with a specific focus on the Dialogue with Skills, a topic coordinated by the Italian partner in cooperation with the German partner Archäologisch-Ökologisches Zentrum Albersdorf. The core of the program was the workshop "Smiths in Bronze Age Europe", planned with a pedagogical and hands on approach. Its aim was to provide a reference guide for skilled experts and craftsmen as well as managers dealing with Bronze Casting presentations in Archaeological Open-Air Museums.

The meeting in September 2012. in Foteviken (SE) followed, during which the over-arching theme was the challenges of interpreting and engaging public interest in open-air museums and archaeological/ historic sites. For two days, the linked themes "Management & communication strategies at open-air/archaeological museums", "Working with volunteers" and "How can performance of various kinds contribute to and extend the work of such museums and sites?" were discussed.

In April 2013, all of the OpenArch partners met in Archeon (NL). The conference revolved around "The Dialogue with the Visitor". Archaeological open-air museums (AOAM) face unique challenges concerning their interaction with visitors. Through themes concerning the *Story of the Site* and the *Visitor's Experience*, the participants explored these challenges and how to meet them. During the conference, speakers from various disciplines and backgrounds engaged visitors and each other on diverse subjects. The goal was to gain a better understanding of both the stories we tell – the intangible heritage preserved by AOAM – and how the visitor experiences these. The participants also looked at best practices in (games) design, theatre, amusement parks and others. Additionally, there were workshops and demonstrations of historical food preparation, as well as lectures on the subject. In September 2013, the meeting was held in AÖZA (DE). Since the Albersdorf museum is participating in the "Dialogue with skills", the main topic during this conference was "Stone in Prehistory". Furthermore, an international scientific conference was organised about archaeological research and experiments. There were also practical workshops at the open-air museum, with demonstrations and different activities regarding working with stone. At the public forum, there was time and space for an intensive exchange of experiences and ideas. During the last day of the conference, a site visit took place on the traces of landscapes and settlement history on the North Sea coast.

STAFF EXCHANGES

Staff Exchanges within the OpenArch project are considered to be a tool for the interchange of best practices between staff of different museums. The target-groups of staff exchanges are the day to day workers of the museum, the ones that are closer to the general public and schools. Mainly, by means of this activity, the participants of the project reach one of the EU objectives: to enhance the cross-border mobility of artists and workers in the cultural sector. The staff exchanges have predefined themes. They are mainly prepared by the front-line staff of the museum, i.e. by the cultural actors and artists. The University of Exeter, Department of Archaeology (UK) is organising various workshops for OpenArch partners' staff, where they can learn more about experimental archaeology, not just the academic background, but much more on how this can be applied in archaeological open-air museums. Two workshops are planned every year, with about three museums participating each time. Subjects range from house construction to publishing and didactics.

EXPERIMENTAL ACTIONS

Archaeological remains and objects are tangible remains of past civilizations. They need to be interpreted to give meaning today,

and interpretation is dependent on experiments. Experiments and experimental actions are needed to understand how objects were made, how constructions might have appeared and, not least, how people in the past behaved. Some of the OpenArch experimental actions included pottery making, constructing a Stone Age hut, skinning a reindeer, making drums of leather, making a trunk boat, performing a "Roman" cremation and planting "Roman" grapevine.

BRINGING THE MESSAGE TO THE INTERESTED

OpenArch has several means of bringing our message to those people who may be interested. The EXARC Journal is published both in hard copy and online. Besides that, several websites reach thousands of people. The websites are being updated several times per week. The Community Manager is also active on several social media, including LinkedIn, Facebook and Twitter. Here people are notified about new activities and products, updates from our partners and much more. Search for 'experimental archaeology' or 'archaeological open-air museums'.

REZIME

OPENARCH, EVROPSKI PROJEKAT POPULARIZACIJE ARHEOLOGIJE

Ključne reči: OpenArch, projekat kulture Evropske Unije, arheološki muzej na otvorenom, eksperimentalna arheologija, posetilac.

OpenArch je petogodišnji projekat kulture Evropske Unije, koji obuhvata jedanaest partnera iz osam evropskih zemalja. Cilj projekta je da se oformi dugotrajno partnerstvo među učesnicima – arheološkim muzejima na otvorenom. Projekat obuhvata izvođenje arheoloških eksperimenata, razmenu muzejskog osoblja i intenzivan dijalog sa posetiocima, u cilju dobijanja podataka o tome kako oni doživljavaju ovakve muzeje. Istovremeno se, u okviru projekta, radi na dijalogu sa naučnicima-arheolozima, radi formiranja određenih standarda za izvođenje arheoloških eksperimenata, ali i sa zanatlijama, čija je pomoć često neophodna kada su u pitanju ovakvi eksperimenti. Najzad, projektom je predviđena izrada većeg broja publikacija i multimedijalnih prezentacija vezanih za teme projekta.

SNEŽANA GOLUBOVIĆ,
Institute of Archaeology
Belgrade, Serbia
arheosneska@gmail.com

NEMANJA MRĐIĆ, Institute of Archaeology
Belgrade, Serbia

UDC: 069:904(37)"652";
338.48:902(4-12)"2012"
Original research article
Received: September 13th2013
Accepted: October 15th 2013

T-PAS – PROJECT ON TOURIST PROMOTION OF THE ARCHAEOLOGICAL SITES ALONG THE ROUTE AQUILEIA, EMONA, VIMINACIUM

ABSTRACT

The Project T-PAS, the first project of the European Union in which Viminacium (Archaeological Institute) has participated, started in January 2012. The T-PAS project's main objectives are promoting, both culturally and as a tourist destination, the ancient Roman route connecting Aquileia and Viminacium which passes through Emona (modern Ljubljana). During almost two years of the project several goals are achieved: social-economic study, touristic publication, publication about historical research, three conferences were held from October 2012 till March 2013, touring exhibition was held in every of these three sites, several didactic laboratories, and adaptation of the game for popularization of archaeology among school children.

Keywords: T-PAS, Roman routes, Aquileia, Emona, Viminacium.

The Project T-PAS, the first project of the European Union in which Viminacium (Archaeological Institute) has participated, officially started in July 2011, although actually in January 2012. The partners of the T-PAS project met on 12-13th January 2012, in Aquileia, for the kick-off meeting. It was a great occasion to reinforce the cooperation, share the work program for the months to come and to set ambitious objectives to be achieved in areas such as the cultural and tourist valorisation of the old Roman route connecting *Aquileia*, *Iulia Emona* and *Viminacium* (Fig. 1). The T-PAS project's main objectives are promoting, both culturally and as a tourist destination, the ancient Roman route connecting *Aquileia* and *Viminacium* which passes through *Emona* (modern Ljubljana).

The project is co-financed by the European Union through the Culture Programme (2007-2013). It is coordinated by the Fondazione Aquileia, which collaborates with two co-beneficiaries, the City Museum of Ljubljana (Emona) and the Serbian Archaeological Institute of Belgrade - Project Viminacium. It was expected to last 24 months, starting on 1st July 2011 and concluding on 30th June 2013. How-

Fig. 1 Map with the Roman road connecting Aquileia, Emona and Viminacium

ever, since it first started in January, the project was prolonged until 30th September 2013. Three ancient cities included in the project, Aquileia, Emona and Viminacium, developed and flourished in the period from the 1st to the 4th century AD, thanks to, among other things, the good road network. The most important road was the one connecting these three cities. The importance of these cities in the period of antiquity was enormous.

AQUILEIA – Representative: Fondazione Aquileia (Fig. 2)

Fig. 2 The Basilica of Aquileia

The colony of Aquileia was founded in 181 BC, on the banks of the River Natiso, serving as a frontier garrison for the Roman conquest of North-Eastern Italy.

Built on a polygonal perimeter, the city grew fast through the fruits of its farming and animal husbandry and the development of large-scale trade, enabled by its river port. Aquileia

Fig. 3 Emona – Early Christian baptisterium

became one of the most important cities in Italy. Over time, a complex road network linked it to the rest of the peninsula and, during the 1st century BC, also to the Illirian, Istrian and Danube areas. During the 4th century, imperial residences were built in Aquileia and it was the seat of the Imperial Mint between 284 and 425 AD. Of particular importance was the construction, in the second decade of the 4th century, of a basilica.The patriarchal basilica, an outstanding building with an exceptional mosaic pavement, played a key role in the evangelisation of a large region of central Europe.This dominant feature of Aquileia was constructed as a horseshoe-shaped complex of three main halls.However, this proved to be inadequate to house the worshippers and pilgrims so, in 345AD, a vast structure replaced the northern arm. It later had to undergo a series of renovations and modifications that were to last until modern times. In 452 AD, the city was conquered by Attila and the Huns and suffered serious damage.This led to the northern part of the city being progressively abandoned *(*Aquileia 2012).

EMONA – Representative: The City Museum of Ljubljana (Fig. 3)

In the first decade of the 1st century, in an area of what is now Ljubljana, along the left bank of the Ljubljanica River, the Romans established their colony *Colonia Iulia Emona*. The city was settled by colonists from northern Italy. Emona flourished from the 1st to the 5th century. It was laid out in a rectangle with a central square or *forum* and a system of rectangular intersecting streets, between which were sites for buildings.The Roman Emona sites in Ljubljana can be seen in several parts to the west of the old town centre, for example the house with the beautifully reconstructed floor mosaics.

From the late 4th to the late 6th century, Emona was the seat of a bishopric. The intensive contacts pursued by the early Christian community of Emona with the ecclesiastical circle of Milan are reflected in the architecture of the early Christian complex. The remains of a baptistery with a pool, mosaics, and part of a portico can also be seen in the centre of the modern town (Županek 2010: 9–16).

VIMINACIUM – Representative: The Archaeological Institute of Belgrade (Fig. 4)

Viminacium, a Roman town and important military centre of the Upper Moesia, was established at the confluence of The Mlava with The Danube (Mirković 1968: 56; Mirković 1986). It was located on the important military route leading from Singidunum to the south, towards Naissus. Three roads crosscut this area, connecting the town with the eastern, western and southern regions of the Roman Empire. At the same time, Viminacium was an important military and civil Danubian port (Popović 1968: 24–49).

Viminacium was the fort of the *Legio VII Claudia* erected on the right bank of The Mlava, and settled almost continuously from the 2nd to 4th century. A civil settlement was established beside the military one, and was noted in epigraphic sources. Its traces have been confirmed archaeologically to the west of the fort. The settlement received municipal status under Hadrian in 117. The status of colony was obtained at the end of 239, under Gordian III. Permission to mint coins was also granted at this time. In the 4th century, it became an Episcopal centre. Two bishops are confirmed: Amantinus and Cyriacus. Its economic downfall started in the mid-3rd century and accelerated in the late 3rd and 4th century. In 441, during the Hunic invasion, Viminacium was destroyed, but was rebuilt under Justinian, 80 years after the Huns' withdrawal (Mirković 1968: 58-73).

Over the course of 400 years, cemeteries were established beside the fort, city and *canabae legionis* (Pećine, Više Grobalja, Na rupi, Kod bresta), encompassing a chronological span between the 1st and the 4th centuries (Jovanović 1984; Zotović, Jordović 199; Korać, Golubović 2009). Since the 1970s, due to the construction of a thermo electric power plant, more than 13,000 graves with 30,000 pieces of inventory have been excavated.

Owing to the general importance of the road in Roman times, the T-PAS project is based on a complex work plan focused on increasing scientific knowledge based on archaeological excavations and also on tourist interest in the ancient Roman route connecting these three important sites. Naturally, along the road there are

Fig. 4 Viminacium mausoleum

also some very important Roman sites and other Roman cities which could have been included in the project such as, for example, Siscia. At the very beginning, during the kick-off meeting in Aquileia, when the duties of each partner were being discussed, it was agreed that the Archaeological Institute of Belgrade would have the obligation to print leaflets and other promotional material such as notebooks, pencils and USB sticks. The City Museum of Ljubljana would create a web-site, while the Foundation Aquileia would be in charge of publications.

The main activities which were foreseen included many joint activities for the international partnership. First was the preparation of a mutual report on the state the 3 archaeological sites. On 21st June 2012, at the Final Forum for the presentation of the results of the research on Agenda 21 for culture, in Aquileia, Fondazione Aquileia presented the results of the participatory actions carried out in Aquileia with the support of Focus lab s.r.l. to the public. This was aimed at sharing best practices on the implementation of the Agenda 21 for culture and identifying cultural and economic development opportunities for the city. An open Forum designed to present the objectives of foreseen activities at the beginning of the works, followed by the organisation of various focus groups,were conceived to perform in-depth analysisof particular issues of interest with participatory methodologies.

The Viminacium team started early in the spring of 2012 with the preparation and design of materials that would be used as promotional material for the project T-PAS. The panels, which were not planned in the beginning, turned out to be very useful during all the activities related to the project dedicated to "IUVENES ROMANI" or "young Romans" with the intention of bringing Roman culture closer to school children. Their first use was on 20th June 2012, when the celebration of "100 years of Požarevac Gymnasium" was organised in Domus. During that celebration, a competition of Latin language skills took place (Fig. 5). In addition, they were used at the "Manifestation of Roman everyday life" which took place at Viminacium on every Friday in June under the name of IUVENES ROMANI ("Young Romans" or "Children in the Roman period"). These events were designed for slightly younger school children (Fig. 6).

Fig. 5 Celebration of Požarevac Gymnasium

Fig. 6 Manifestation of Roman everyday life IUVENES ROMANI

The next activities included promotions at national fairs. For that purpose each partner had the leaflet in English and its own language which were intended to be distributed at national fairs. Fondazione Aquileia first distributed them at the national fair in Assisi in September 2012. From 12th to 15th November 2012, Fondazione also participated in the Borsa Mediterranea del Turismo Archeologico, held in Paestum. The Archaeological Institute of Belgrade participated with a stand at the International Fair of Tourism (ITTFA), held in Belgrade from 21st to 24th February 2013. It was a great opportunity to promote the T-PAS project's objectives and results by distributing flyers, posters and merchandising material and informing visitors of the financed action's progress (Fig. 7). In the months before the national fairs, activities were intensified around socio-economic analysis.This started with the compilingof the questionnaires unique for each partner and was followed by analysis and a comprehensive study. This required a huge effort on the part of colleagues dealing with tourism and management and also included experts in this sector. The studies were completed on time and will provide guidelines for future joint actions. By the middle of 2012, the Archaeological Institute finished the socio-economic analyses with concrete development proposals, the preparation for research and the organisation of participatory actions connected to Agenda 21 for Culture.

In conclusion what is Viminacium's contribution? Aquileia is a well-known and frequently visited Roman city (1, 300, 000 visitors per year) and Emona is situated in the modern town of Ljubljana and easily approachable butViminacium is in a plain field far from the urban zone. Nevertheless, its example shows how to achieve the successful touristic development of a cultural and historical place, on both the national and international level. It offers great support to the local socio-economic development, even though its considerationof the importance of culture and heritage is undeveloped. It lacks the financial support of the state and is always having to make compromises with, it seems, conflicting sides of the industry.This is all achieved with the great efforts of its developers, scientists and exceptional local enthusiasts. This is the recipe of success of Viminacium, from which we are trying to extract the formula for the future development of archaeological sites globally.

In June 2012, the partners started preparing for the touring exhibitions. It is important to point out that all exchanges of photos, drawings and texts in integral versions or translations would not have been possible without a stable internet connection. In the case of Aquileia and Emona, considering their urban nature,this stability was to be expected. However, in the case of Viminacium, in the middle ofa field with Wi-Fi, it provided perfect proof of the function of an on- site,-scientific-research centre in a rural setting. After a number of months, the partners completed the work on the panels with photos and text. The panels tell the story of the ancient road and explain its commercial and military role, providing a particular focus on daily life during the Roman age. The touring exhibition was first opened during the conference of archaeological parks in the framework of the T-PAS project, held in Ljubljana on 23rd October 2012. In January 2013, Fondazione Aquileia hosted the exhibition in "Süd Halle" in Aquileia. The exhibition was open to visitors until 20th February 2013. Due to difficulties with customs and shipments from the EU to Serbia, the touring exhibition only arrived at Viminacium at the beginning of July and was open to visitors until the end of September (Fig. 8).

Three Conferences were held from October 2012 to March 2013. The first was on 23rd October in Ljubljana under the title of "Archaeological parks - Conservation, presentation, promotion", followed on 19th of January, in Aquileia by "Archaeology and archaeological parks. Comparison of experiences", then, finally, on 20th of March at Viminacium "Archaeological parks - Formula for development – Preservation of the cultural, historical and natural heritage with promotion of tourism" (Fig. 9). These events had great scientific value, bringing together international experts on archaeology and archaeological parks, whilst also giving cultural operators the possibility to learn from examples of best practices for the management of archaeological parks and activities of cultural and tourist valorisation of archaeological sites. The three partners had a mid-term meeting at Viminacium on 6th to7th of November 2012 which was also considered as a study visit for Fondazi-

Fig. 7 Promoting T-PAS project at Belgrade Fair

Fig. 8 Opening of Touring Exhibition in Domus Scientiarum at Viminacium

one Aquileia and the City Museum of Ljubljana. The partners had the opportunity to share achieved results, plan future activities and discuss critical issues. On the occasion of the meeting, the partnership also took part in, along with some invited external experts, a study visit to the archaeological site of Viminacium, learning in depth its invaluable heritage and benefiting from a very positive exchange of know-how and best practices on didactic, cultural and tourist promotion and scientific activities. During the meeting an idea from the Viminacium team to create a new didactic game gained the support of all the included members. The following months were especially testing, but an exciting was timespent composing thespecial design and suitable content for the game. Naturally it resulted in an interesting, useful and visually engaging game which was of great benefit to the workshops for children.

The first didactic laboratories were organised in May, in Viminacium. Specifically, the Archaeological Institute realised, with the support of The Centre for New Technology and local schools, a set of didactic laboratories focused on archaeology and, in particular, on the Roman route from Aquileia to Viminacium, via Emona. A particularly special occasion was the presentation of the game produced specifically for the project T-PAS, which proved to be a great success. After the presentation, a photo contest was also organised, stimulating pupils to take pictures of particular details of the archaeological site. At Viminacium, on 18th May, an exhibition dedicated to 17 centuries of The Milan Edict, in cooperation with The National Museum in Belgrade, was opened. This lasted until 18th June. This was the perfect occasion for the photo contest, because pupils were able to take photos of the most valuable objects from the late antique period and demonstrate their artistic talents (Fig. 10). In July and August 2013, at the Viminacium site, with the support of The Centre for the Popularisation of Science, the Archaeological Institute realised, with schools from Belgrade, a set of didactic laboratories in the framework of a summer school of science (from Thursday until Saturday). On the Friday, the focus was on archaeology and, in particular, on the Roman Aquileia-Emona-Viminaciumroute. Children were involved in lessons on Roman history and archaeology, in practical workshops for the production of Roman pottery, as well as with practical participation in field work, such as excavations at the archaeological site of Viminacium (Fig. 11).

The didactic laboratories on archaeology were organised in Aquileia in June. Fondazione Aquileia, with the support of Julia Global Service, realised a set of didactic laboratories with local schools. Besides lessons on Roman history and archaeology, children were involved in practical workshops for the production of Roman lamps and Roman games and in outdoor visits of the main elements of the heritage of the city of Aquileia, including Museo Archeologico Nazionale. A photo contest was also organised, “Lo scatto antico”, stimulating pupils to take pictures of particular details of the archaeological site. The partners of the T-PAS project met in Ljubljana on 10th to 11th July 2013 for a final meeting (Fig. 12), which gave them the opportunity to share achieved results, plan the project closure and to discuss its impacts and results. Immediately after, on 12th July 2013, Fondazione Aquileia and the Archaeological Institute of Belgrade were

Fig. 9 Conference about archaeological parks in Domus Scientiarum at Viminacium

Fig. 10 Photo-contest for school children

Fig. 11 Summer school of science – field work

Fig. 12 Final meeting at Ljubljana

involved, together with several invited external experts, in a study visit to the archaeological site of Emona. This was organised by the City Museum of Ljubljana. It was a great opportunity to get to know the invaluable heritage of the Roman city and to share and transfer best practices related to scientific, didactic and cultural and tourist promotion activities among cultural operators. The Archaeological Institute of Belgrade completed a study visit to the archaeological site of Aquileia on 13th July 2013. Fondazione Aquileia hosted a study visit to the Roman city for staff and the Archaeological Institute of Belgrade's external invited experts. On that occasion they had the opportunity to learn about the invaluable heritage of Aquileia and to visit the exhibition "Costantino e Teodoro. Aquileia nel IV secolo".

After considering creating a tourist opportunity for schools that would include all three sites, it was concluded that it would be easier for the partners from Aquileia and Emona. This is because for schools from Serbia it is much more complicated to organise an excursion that involves three different countries, especially for those children under 11. This activity could not, therefore, be fulfilled equally by all partners.

Nevertheless, at the same time, the members of all three teams worked on a tourist publication, as well as a historical-archaeological analysis of the Roman road that connected the three sites.

In conclusion, the aim of the whole project is not only to share the experiences of the partners in the field of the popularisation of science, but also to spread knowledge among school children about the three sites including the roman roads and, inevitably, the development of Roman Empire as a whole. Only in this way will it become familiar to future generations. Therefore, the goal of the project is to promote the protection and preservation of our archaeological heritage, but also the promotion of archaeology and other sciences. It helps by improving the educational programs in schools in Italy, Slovenia and Serbia. In other words, it expands the knowledge of the younger generation about our own, European and world cultural-historical heritage. As a part of the route "Roads of Roman Emperors", it will become a part of a global scientific and cultural network.
Cultural tourism is a specific aspect of tourism which, among others, connects cultural-historical places and allows tourists to learn something about one (in our case more than one) nation's history and folklore. The popularisation of science is necessary in order to develop this kind of tourism, but it cannot occur without the basic science, archaeology, which provides the conditions necessary for economic development.

BIBLIOGRAPHY

Aquileia 2012
Aquileia: Crossroad of the Roman Empire: economy, society, art – Documentary exposition on the history of Aquileia.

Županek, B. 2010
Emona: rimsko mesto in njegova dediščina, in Emona: myth and reality; ed. B. Županek, Ljubljana, 9–26.

Mirković, M. 1968
Rimski gradovi na Dunavu u Gornjoj Meziji, Beograd.

Mirković, M. 1986
Inscriptions de la Mésie Supérieure, Vol. II, Beograd.

Popović, V. 1968
Uvod u topografiju Viminacijuma, *Starinar* XVIII, 24–49.

Jovanović, B. 1984
Les sepultures de la necropole celtique de Pećine pres de Kostolac (Serbie du nord), *Etudes Celtiques* XXI, Paris, 63–93.

Zotović, Lj., Jordović Č. 1990
Viminacium 1 - nekropola Više grobalja, Beograd.

Korać, M., Golubović, S. 2009
Viminacium - Više Grobalja 281-530 (kremacija) 268-560 (inhumacija), Tom II, Beograd.

REZIME

T-PAS – PROJEKAT TURISTIČKE PROMOCIJE ARHEOLOŠKIH LOKALITETA DUŽ RIMSKOG PUTA KOJI SPAJA AKVILEJU, EMONU I VIMINACIJUM

Ključne reči: T-PAS, rimski putevi, Akvileja, Emona, Viminacijum.

Projekat T-PAS, prvi projekat Evropske unije u kome je učestvovao Viminacijum (Arheološki institut), počeo je u januaru 2012 godine. To je bila odlična prilika da se uspostavi saradnja, napravi zajednički program rada, postave ambiciozni ciljevi koje su zatim i ostvareni u oblastima kao što su kulturne i turističke valorizacije starog rimskog puta koji povezuje Akvileju, Emonu i Viminacijum. Projekat je sufinansiran od strane Evropske unije preko Programa Kultura 2007-2013. i njime je koordinirala Fondacija Akvileje (Akvileja) sa dva partnera: Muzejom grada Ljubljane (Emona) i Arheološkim institutom (Beograd), odnosno projektom Viminacijum. Na samom početku dogovoreno je da će Arheološki institut imati obavezu da štampa letke, postere i drugi promotivni materijal, Muzej grada Ljubljane će kreirati sajt, a Fondacija Akvileja će biti zadužena za publikacije. Usledile su aktivnosti poput promocija na nacionalnim sajmovima, organizovanje tri konferencije u periodu od oktobra 2012. do marta 2013. godine o arheološkim parkovima, konzervaciji i izaštiti kulturnog nasleđa. Tokom gotovo dve godine projekta postignuto je nekoliko ciljeva: završena je socijalno-ekonomska studija, odštampana je turistička publikacija, elektronska publikacija, publikacija o naučno-istorijskim istraživanjima, realizovane su putujuće izložbe fotografija na svakom od ova tri lokaliteta koje su bile veoma posećene, održano je više didaktičkih laboratorija u kojima je učestvovalo nekoliko stotina dece i, kao potpuno novi proizvod izvan prvobitnih planova, adaptirana je igra dizajnirana za popularizaciju rimskih puteva za decu školskog uzrasta.

MARINA KOVAČ,
Museum of Slavonia Osijek, Croatia
marina.kovac@mso.hr

UDC: 069.5:738.5.032(497.5)"2010/2011"
Original research article
Received: March 14th 2013
Accepted: October 15th 2013

EXPERIMENTAL WORKSHOP OF MAKING ROMAN MOSAICS IN THE MUSEUM OF SLAVONIA IN OSIJEK

ABSTRACT

From December 4, 2010 till March 8, 2011 the Museum of Slavonia in Osijek initiated an experimental workshop of making Roman mosaics. There were seven 4-hour sessions in total. Through the production process students were introduced to an indirect technique of making mosaics from start to finish. During short lectures and the making of their own mosaics, students discovered the complexity of the Roman mosaic technique.

Keywords: Roman mosaics, experimental workshop, students, Museum of Slavonia in Osijek, antiquity.

Ever since antiquity, mosaic has been considered as an individual art form. There are few ancient written records of mosaic techniques. The most comprehensive description of making mosaics was written by Pliny the Elder. Pliny the Elder categorized it as a decorative technique, while Marcus Vitruvius Pollio did not separate it from architecture and construction (Vitruvije 1951: 149-150). In the 36th volume, 64th chapter of his Natural History series Pliny the Elder describes the technique for preparation of mosaic ground (Pliny the Elder 1885: 36.64). Given both quantity and quality of works, it is safe to say that mosaics were not only widespread, but also highly valued during the Roman rule in the Mediterranean and beyond.

After the fall of the Western Roman Empire, it survived within the Eastern Roman Empire, until its decline in the 15th century. Once highly valued and admired in the ancient world, it became a "forgotten technique" that was not restored to its full glory even during the Renaissance, when many ancient techniques were being rediscovered. Today, mosaic is defined as a painting technique, amalgamating design, painting, sculpture and architecture from its very beginning. The method of making mosaics has not changed much since ancient times. Advancements in tools and materials have made the process quicker and easier but over all the process is the same.

As an archeologist and art historian, I have always been fascinated with mosaics so I decided to organize an experimental workshop for making of Roman mosaics. The target group were upper-elementary school students from Osijek who showed interest and enthusiasm for the project, together with their art teachers. After the initial show of interest, I went on to develop age-appropriate methods. The making of our first mock-mosaic was photographed every step of the way, which allowed me to present the project to art teachers at their county assembly (Osijek-Baranja Coun-

Fig. 1 Making of our first mock-mosaic / Izrada našeg prvog mozaika

ty). There was also a brief lecture on Roman mosaics and production methods. Moreover, I explained my intention to revitalize the production of Roman mosaics among students through these workshops. Other objective were to introduce ancient culture and lifestyle to the target group, to raise awareness about the need to preserve cultural heritage, to develope creativity and stimulate artistic exploration and finally to encourage independence among participants to continue with the workshops either at their school or at home.

Since mosaic-making has not changed significantly over the centuries, the intention was to present it as both an ancient and a modern technique. Primarily, the idea was to approach it as genuinely as possible and present the technique in all its complexity, putting emphasis on the meticulous and time-consuming process of making *tesserae*, as well as other manufacturing processes.

When the teachers came on board, some of them suggested that members of school art groups would be the most suitable participants. These were mostly students aged 11-14 who were thrilled with the idea of making their own mosaics.

First, there was a brief historical overview, from the mosaic in Uruk to the mosaics of the Late Antique period. In this way, the students were introduced to not only the development of motives and styles, but also to the technical aspects of mosaic production in different civilisations and periods. Then, we continued to describe the procedure of making an actual mosaic which I had created before the workshop. The students could see the making of *tesserae* and then try to produce the pieces themselves. The rubble stone (marble and granite) was acquired at the local masonry. We cut the stone with a cutter for metal which we built into a wooden log, with the blade facing upwards. We set the stone on the blade and hit it at the right place with a sharp double-pointed hammer to make tesserae which were about 1 cm in length.

During our next meeting, I showed the participants pictures of some of the most famous Roman mosaics, such as the mosaics at Villa Romana del Casale from the Piazza Armerina on Sicily, mosaics from Pompeii and the mosaics from the Aquileia basilica. The students were particularly interested in figur-

Fig. 2 Cave Canem mock-mosaic made on the second workshop / Cave Canem mozaik izrađen na drugoj radionici

al motives and one of their favorites was the fish. After selecting the motives, we started drawing pencil sketches on kraft paper. The children only made the outlines of the mosaic with a few decorations, to guide them through the rest of the process. After the sketch was drawn, each student chose their own colour of *tesserae*. To simplify the matter, I decided to apply the indirect method[1]. The students had to put water-based glue on the flattest part of the *tessera* and paste it on the sketch.

Our next meeting was at the restoration workshop in our museum. The museum art restorer Miroslav Benaković[2] helped us put up a wooden frame which we fixed with clamps. When the frame was built, we prepared a mixture of grey, slow-setting plaster. We placed a glass net, which we had previously prepared, on 1 centimetre of plaster. We applied this procedure twice and poured out the rest of the plaster. This is how we made a solid, 4 centimetre-thick surface.

We left the mosaics to dry for several days and then we removed the frames and flipped the mosaics. We washed off the paper and the glue on top of the mosaics with water, sponges,brushes. Once the mosaics were clean, the students were thrilled with the result and immediately started planning an exhibition at their school.

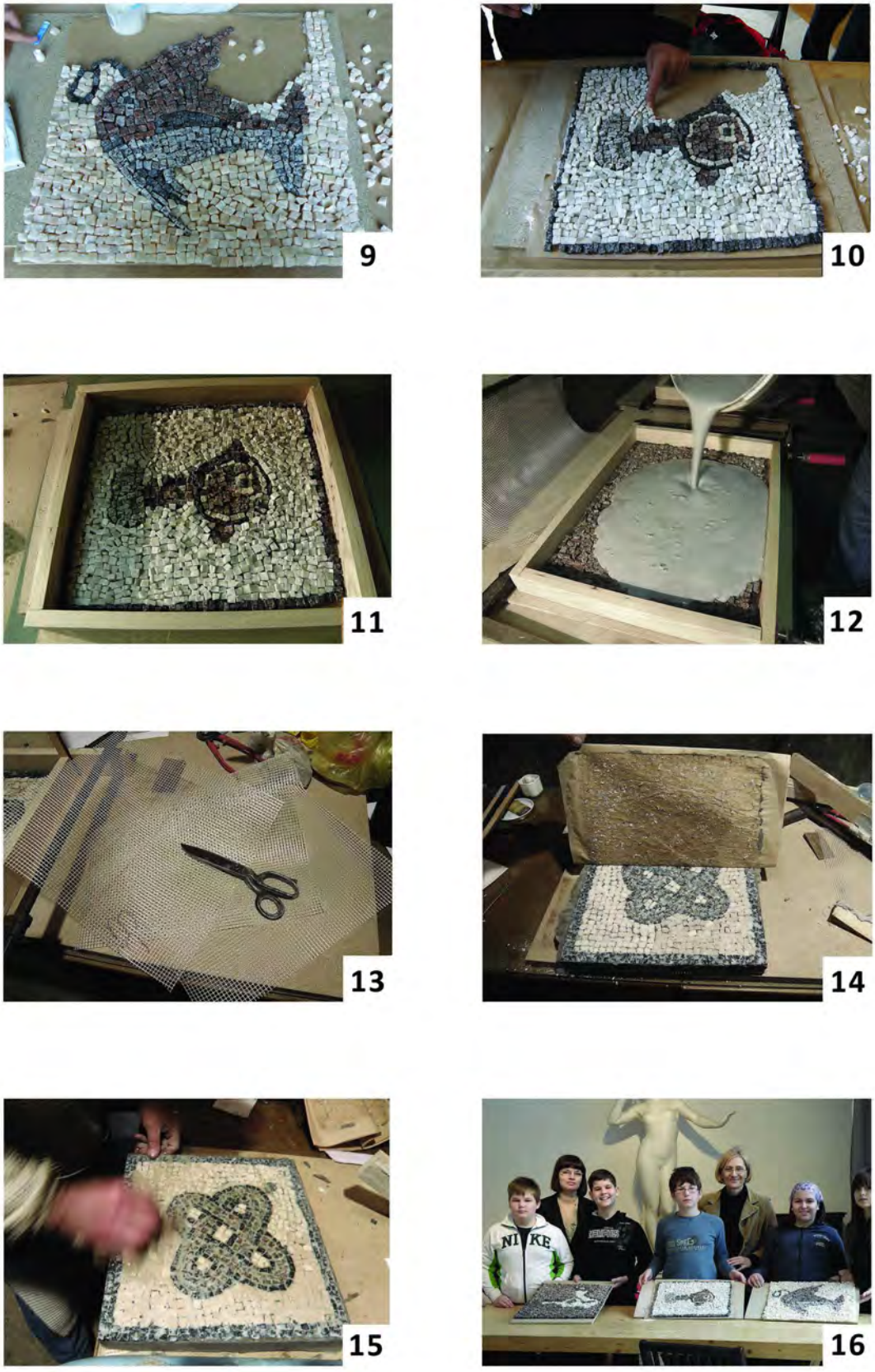
In the meantime, one of the art teachers from another school volunteered her art group for a workshop, and offered their school as the venue. In only two days, twenty students, aged 11-14, managed to put together a well-known motive of a dog, called *Cave Canem* from Pompeii. A colourful mosaic made of marble *tesserae* is scheduled to be set into a table at their school playground. The same art

1 The indirect method is simpler and faster than the direct method but also less harmonious. Tesserae are glued upside down on the sketch with water-based glue and then the mortar or plaster are applied over the back of the tesserae. After that, the mosaic is flipped over, washed and grouted, if needed. The indirect method is optimal for large areas such as wall decorations and compositions made of many small tiles.

2 I want to thank museum art restorer Miroslav Benaković for his help and guidance in process of mosaic- making.

Fig. 3 Our new tesserae cutting device (made by: Miroslav Benaković) / Naš novi rezač tesera (izradio: Miroslav Benaković)

T. 1 Roman mosaic making process - step by step / Proces izrade rimskog mozaika - korak po korak



T. 2 Roman mosaic making process - step by step / Proces izrade rimskog mozaika - korak po korak

group joined our next workshop with similar enthusiasm and helped us make Roman ceramic lamps, which was also a great success.

After the workshops, and more precisely, after the experience of making *tesserae* the museum art restorer assembled a device for cutting Roman *tesserae* that is easy and safe to use for children. The workshops allowed us to create four unique mosaics and build a brand new device, which is, in our humble opinion, more than enough for a trial run.

BIBLIOGRAPHY

Vitruvije 1951
O arhitekturi, Vitruvijevih deset knjiga o arhitekturi, Matija Lopac (prijevod), Sarajevo: Svjetlost.

Pliny the Elder 1885
The Natural History (John Bostock, M. D., F. R. S., H. T. Riley, Esq., B. A., Ed.), Boston: Tufts Univerity. Available though Perseus Digital Librarary. http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3atext%3a1999.02.0137 [10. rujna 2012].

REZIME

EKSPERIMENTALNE RADIONICE ZA IZRADU RIMSKIH MOZAIKA U MUZEJU SLAVONIJE IZ OSIJEKA

Ključne riječi: rimski mozaici, eksperimentalne radionice, učenici, Muzej Slavonije u Osijeku, antički period.

Od 4. decembra 2010. do 8. marta 2011. godine Muzej Slavonije u Osijeku pokrenuo je eksperimentalnu radionicu izrade rimskih mozaika. Održano je sedam radionica u trajanju od četiri sata. Ciljana gupa bili su učenici viših razreda osnovnih škola iz Osijeka, koji su pokazali interes i entuzijazam za projekt.

Cilj je bio upoznati osnovnoškolce s antičkom kulturom i načinom života, podići svest o potrebi očuvanja kulturne baštine, razviti kreativnost, potaknuti umetničko istraživanje i konačno potaknuti nezavisnost među sudionicima kako bi nastavili s radionicama, bilo u njihovoj školi ili kod kuće.

Kroz proces proizvodnje, objašnjen u ovome radu, učenici su upoznati s indirektnom tehnikom izrade mozaika od početka do kraja. Kroz kratka predavanja i izradu vlastitih mozaika učenici su otkrili složenost rimske mozaičke tehnike. Zbog naših radionica stvorili smo četiri jedinstvena mozaika te izradili potpuno novi uređaj za rezanje mozaičkih kockica - *tessera*.

NIKOLINA ADAMOVIĆ,
Belgrade City Museum
Belgrade, Serbia
nikolina.adamovic@mgb.org.rs

NATAŠA POPOVSKA,
Belgrade City Museum
Belgrade, Serbia

UDC: 371.383:902/904(497.11)"200/201";
069.12:902/904(497.11)"200/201"
Original research article
Received: February, 28th 2013
Accepted: October 15th 2013

CREATIVE WORKSHOPS FOR CHILDREN INSPIRED BY ARCHAEOLOGICAL EXHIBITIONS IN BELGRADE CITY MUSEUM

ABSTRACT

In Belgrade City Museum, there were many activities whose overall objective is to popularize the Museum among children who are regarded as the primary target group for these planned activities. Many creative workshops for children were implemented during the last five years, and some of them were inspired by the various archaeological exhibitions which took place at the Museum. Children's workshops consisted of creative work and also had an educational content.

During the first archaeological exhibition, a workshop was organized for children with the concept Life in Clay (exhibition of Neolithic figurines). Children modeled figurines of clay, as Neolithic shapes. The next exhibitions were titled First toast (presentation of cups from Baden period) and Vinča, Fragments for Reconstruction of the Past (exhibition of various objects of Vinča period). Objects similar to those presented in the exhibitions were also modeled in clay by the children attending the Workshop. Workshop connected with a next archaeological exibition Painted ceramics (period from 15th to 18th century) was much more complex. The children who attended this Workshop made plates and bowls using a pottery wheel and then decorated them by a specific painting technique. The last archaeological exhibition in the Belgrade City Museum was named Recte Illuminas (presentation of Roman ceramic lamps). Children painted clay copies of lamps and made candlesticks.

As a result of producing finished products, from the last two workshops, there stemmed the idea for an Exhibition and Sale of the children's finished work, which proved very constructive and intelectually rewarding for all participants.

Keywords: archaeological exhibitions, Belgrade City Museum, ceramics, Children's Club, education, workshops.

The overall objective through the creative educational activities covered in the Workshops, was and is, to heighten a positive awareness for their history, heritage and culture among the children, who are regarded as the primary target group. As a result it is expected to support the popularization of science and the Museum among the younger generation.

The Workshops were located in the authentic ambience of Princess Ljubica's house in

Fig. 1 Exhibition Life in Clay

Fig. 2 Workshop Life in Clay

Belgrade, where archeological exhibitions were located at the same venue. Like many museums in Serbia, Belgrade City Museum has limited financial resources and there is no specialized department for education within the Museum, consequently more simple economical solutions were found. All the programs were organized and realized by archaeologists and art historians employed by the Museum

In each planned Exhibition over the past five years, there were many creative hands-on workshops implemented for children. Some of these were inspired by the various archaeological exhibitions which took place at the Museum. Children's workshops consisted of creative work and also had an educational content and benefit aimed specifically at them as the target group. In parallel, children participating in the creative work gained some knowledge in a relaxed atmosphere encouraged by the curators and educators, who managed to achieve the three basic principles of modern education namely: fun, motivation and close contact with the subject. This involved an active and practical interpretation, which required that the teaching was directed to the participating children as an audience in an open manner. Museums should aim to create public interest in someone or something and they will thus cease to be isolated and remote institutions. (Popović 2011: 20). Solving tasks is a very important educational strategy for museums, so these institutions have to deal with these tasks systematically (Panić 2011: 31,32).

Consequently, the exchange of experience is extremely valuable and necessary in this field of work. For that reason the thematic seminars are relevant to gathering knowledge and its exchange, between experts from different fields of work such as art history, archeology, ethnology, biology, architecture, among others. Seminars on the methodology establish a standard which could be applied in workshops for children with differ-

Fig. 3 Children's finished work: prosopomorphic lid

Fig. 4 Children's finished works: Figurine and altar

Fig. 5 Exhibition First toast

Fig. 6 Workshop First toast

ent levels of prior knowledge, so they can easily and efficiently understood the unique aspects of heritage which is represented in permanent or temporary exhibitions (Čolak Antić 2011: 30). There are numerous examples about how such programs should be maintained within the museums. This will result in influencing our thinking as to the methods that are applied in the organization of permanent workshops inspired by archeology. This is how, initially, the participating children were introduced to the culture of various periods and their history, by providing explanations in keeping with age profiles (5 to 14) and the level of understanding of the children. The establishment of both the workshops and the exhibitions in the one location facilitated the interactive education and the successful imparting of knowledge on the chosen subject. The claim that learning, by its essential nature, is interactive was confirmed through the increasingly vibrant activities and participation by the many museums working with children. Interaction here, in the broadest sense, is understood as the interaction with the physical environment, social environment and is the object of cognition. The creation of cognitive conflict is a very important educational mechanism, which is realising what the child already knows, recognizes, and can view as new knowledge (Павловић Лазаревић 2009: 132).

* * *

All of the archaeological exhibitions in the Museum included ceramic items and consequently, all the workshops included objects modeled in clay by the children who participated. During their creative work, the children were introduced to techniques and technologies of producing clay objects from the various periods chosen.

In 2009 during the first archaeological exhibition, a workshop was organized for children with the concept *Life in clay* (Петровић 2009).

Fig. 7 Imitation of Baden cup

Fig. 8 Exhibition Vinča, Fragments for Reconstruction of the Past

Fig. 9 Children introduce the exhibition content

Fig. 10 Making objects in clay

The Exhibition presented prehistoric art about the Belgrade area and its surroundings from early to late Neolithic (cca 6200-4500 BC). Figural plastic art expressed in clay reflects the spirituality of the people of that time, as well as aspects of their everyday life.

Most of the items were cult objects and symbols of fertility: anthrophomorphic figurines (usually female, like presentations of Great Mother are), animal figurines (sheep, goat, pig, bull etc.), prosopomorphic lids (with presentation of human or animal face) and amulet pendants of various shapes (fig. 1).

All of these objects were very interesting for children. Simple shapes and incised ornamentation were suitable for modeling in clay, so children made various objects in Neolithic shapes, very successfully (fig. 2-4).

The next exhibition took place in early 2010 and was titled *First Toast* (Спасић 2010). The core of this exhibition was the group finds of Baden cups from the Belgrade area from the late Eneolithic period (3600- 2600 BC). Most of the objects are from systematic archaeological investigations. Baden cups belong to the group for serving and consuming. Cups have a very simple shape and are small in size and were made by hand from one lump of clay. The strap was made separately and than joined to the rim. The shapes of these cups can be biconical, globular or cilindrical (fig. 5). The shapes are very similar to the shapes of some cups in use today.

In addition, objects similar to those presented in the Exhibition, were also modeled in plasteline by children in the younger age group attending the Workshop, because they were capable of making such simple shaped objects (fig. 6, 7).

The archaeological exhibition named *Vinča, Fragments for Reconstruction of the Past* , gave children an insight to the various objects of the Vinča period (Игњатовић 2010). This exhibition included ceramic objects found during a system-

Fig. 11 Drowing exhibited items

Fig. 12 Fixing pottery fragments

Fig. 13 Exhibition Painted Ceramics

Fig. 14 Workshop Painted Ceramics

atic exploration of archaeological site Vinča-Belo Brdo, such as: vessels, altars and various objects of figural plastic art. The exhibition also included a presentation of the archaelological exploration and the conservation of the dig site *in situ*, as well as conservation of ceramic objects, and reconstructions of Neolithic settlement (fig. 8, 9) Consequently, there was an intensive education program for children who were introduced to archaeological work and obtained knowledge about the Neolithic materials and culture in a very practical and picturesque fashion. This workshop also consists of work on modeling objects in clay, making drawings of the objects on exhibition and fixing contemporary pottery fragments (fig. 10-12).

The last exhibition also in 2010 was *Painted Ceramics* and involved restoration work, which was undertaken with the idea of gaining a more complete and clear insight into the local culture and heritage (Адамовић 2010). Painted vessels dating from various periods were presented from the Belgrade City Museum collection (from 15th to 18th century) . The majority of these vessels represented excellent pieces of applied art. The presentation included luxurious pottery decorated by sgraffito and majolica techniques (fig. 13).

Workshops connected with this exhibition were extremely complex, as production technology for ceramics from this period is much more involved, as for example sgraffito technique was used. The most abundant remains of sgraffito pottery date from 15th to 17th centuries and originate from the Belgrade fortress, which were discovered

Fig. 15 Making ceramics by pottery wheel

Fig. 16 Painting ceramics

Fig. 17 Workshop in Herceg Novi

during systematic archeological investigations. This type of sgraffito ceramic, developed under Byzantine influence, were made by the fast pottery wheel. The distinguishing feature of this type of pottery is the combination of several decorating techniques, such as: incision, painting and glazing.

The children who attended this latter Workshop made plates and bowls using a pottery wheel and then decorated them in a similar manner to the original technique (fig. 14-16). All these activities were supervised by the experts. After completing the decoration, all items were glazed and fired, so that they could be put to practical use (fig. 28).

Fig. 18 Exhibition Recte Illuminas

The same exhibition was replicated in Herceg Novi - Montenegro 2011 (Adamović 2011). Due to budgetary constraints it was not possible to repeat this kind of more expensive workshop, so a more simple solution had to be found. Hence, contemporary ceramics were broken and exhibited, so that every visitor could try to fix the broken ceramics in conjunction with the restorator (fig. 17).

The last archaeological exhibition in the Belgrade City Museum took place in 2011 and was named *Recte Illuminas*, the exhibition of Roman lamps (Krunić 2011). The central part of the exhibition consisted of objects for illuminating: lamps, hanging lamps, candlesticks, lanterns etc (fig. 18). These objects had been used from the 1st to the 5th century and the most numerous were lamps of clay. The greatest number of lamps were discovered in Roman Singidunum by systematic archaeological exploration.

As this exhibition took place over a period of three months, there were several associated workshops. In the first workshop the children who

Fig. 19 Workshop Recte Illuminas

Fig. 20 Painting lamps

Fig. 21 Children's works before glazing and fireing

participated painted clay copies of Roman lamps. By making clay copies in a mould, those lamps with interesting shapes and decorations were chosen as models suitable for painting and emphasizing shapes: lamps with representations of animals on the disc as dolphin, lion, eagle, dog, bird, as well as some specimens with the portrait of historical person (fig. 19-21). Later, those lamps were glazed and fired and while they were very decorative, they were also ready for practical use (fig. 29).

In the next workshop candlesticks were made in clay by hand and also were painted (fig. 22). Children used their imaginations and made various shaped objects, sometimes inspired by Roman patterns. These objects were also glazed and fired.

Two further workshops promoted decorative art and used different materials, but were also based on the Roman period. The first organized workshop involved Roman glass. This involved a specific glass manufacturing technique known

Fig. 22 Painted candlesticks

as *Mille fiori,* traced to Ancient Roman time. The technique was imitated by applying colored plasteline on contemporary glass (fig. 23, 24).

In the next workshop, the children were introduced to the technique used in the making of Roman mosaic ornaments. The imitations of Roman mosaic ornamentation were made by applying pieces of coloured paper (fig. 25, 26).

As a result of producing finished products, from the workshops: *Painted Ceramics* and *Recte Illuminas*, there stemmed the idea for an Exhibition and Sale of the children's finished work, which proved very constructive and intellectually rewarding for all participants (fig. 27-29).

Fig. 23 Workshop Mille Fiori

Fig. 24 Imitation of Mille Fiori technique

Fig. 25 Workshop Roman Mosaic

Fig. 26 Children's finished works

This was especially the case as the participating children in the Exhibitions were primarily chosen from the more deprived social and economic backgrounds and the realisation of the commercial value accruing to their work certainly improved their confidence and feeling of self worth.

* * *

During the preparation and implementation of the workshops for children in Belgrade City Museum, priority was given to ensure that the youngest participants found the content interesting followed by the creative work which was inspired by the original museum objects on exhibit during the current archaeological exhibitions.

Also, care was taken to avoid the imposition of strict data about items, and keep explanations simple and interesting. Primary aim was to encourage the children to experience the objects themselves, to think about them and reach a conclusion about their manufacture and use. In this way, their educational experience was something more than traditional learning.

The children made objects of clay almost independently, as a result of the archaeological finds, and were involved in all creative processes of making ceramics, where they made shapes of clay, followed by the various stages of drying, baking and painting, which proved to be an exhilarating method to introduce them to the museum items: their historical, artistic and applied content.

By participating in such workshops, the children were able to look at history from a different perspective and were encouraged to think critically, to discuss the importance of an active knowledge of their cultural heritage. These workshops proved to be extremely educational, entertaining and constructive for the children, as they were free to question all about the subject and in the same time to experience their artistic preferences.

Fig. 27 Exhibition and Sale of children's works

Fig. 28 Finished products from Workshop Painted Ceramics

Fig. 29 Finished products from Workshop *Recte Illuminas*

It is our considered opinion that this exposure of the children to various aspects of their historic culture through the workshops is a most constructive way to educate our young citizens and provide them with an appreciation about the various aspects of their history and prepare a future museum visitors, as well as future archaeologists.

BIBLIOGRAPHY

Адамовић, Н. 2009
Рестаурација и реконструкција сликане керамике, *Годишњак града Београда* 55-56 (2008-2009): 89-113.

Adamović, N. 2011
Painted Ceramics from the Collections of the Belgrade City Museum, Exhibition leaflet, Belgrade: Belgrade City Museum.

Čolak-Antić, T. 2011
Seminar ,'Škola nasleđa'', *ICOM Srbija* br.1 (2011): 30-31.

Игњатовић, М. и др. 2010
Винча, Фрагменти за реконструкцију прошлости, Каталог изложбе 58, Београд: Музеј града Београда.

Krunić, S. 2011
Recte Illuminas, Antique Lamps from Belgrade City Museum, Exhibition catalogue No 59, Belgrade: Belgrade City Museum.

Павловић Лазаревић, Г. 2009
Да ли могу опет да дођем? Едукативна радионица у Педагошком музеју, пројекат, *Музеји* бр.2 (н.с.) (2009): 121-163.

Panić, A. 2011
Umetnost bavljenja publikom, *ICOM Srbija* br.1 (2011): 31-34.

Петровић, Б., Катић, В. и Спасић, М. 2009
Живот у глини, Каталог изложбе 55, Београд: Музеј града Београда.

Popović, U. 2011
Istorijat edukacije, ukratko, *ICOM Srbija* br.1 (2011): 20-21.

Спасић, М. 2010
Прва здравица, Прича о баденским шољама из Музеја града Београда, Каталог изложбе 56, Београд: Музеј града Београда.

REZIME

KREATIVNE DEČIJE RADIONICE INSPIRISANE ARHEOLOŠKIM IZLOŽBAMA U MUZEJU GRADA BEOGRADA

Ključne reči*:* arheološke izložbe, Dečiji klub, edukacija, keramika, Muzej grada Beograda, radionice.

U Muzeju grada Beograda, od konstituisanja *Dečijeg kluba* 2004. godine, odvija se niz edukativnih i kreativnih programa, čiji je cilj, pre svega, popularizacija muzeja i upoznavanje mlađe generacije sa našim bogatim kulturnim nasleđem.

Za poslednjih pet godina realizovano je više dečijih radionica inspirisanih arheološkim izložbama, koje su pored kreativnog imale i edukativni koncept. Deca su upoznavana sa kulturnim i istorijskim periodima, odnosno muzejskim predmetima prezentovanim na aktuelnim izložbama, pri čemu se vodilo računa o njihovom uzrastu i mogućnostima pravilnog razumevanja.

Na svim arheološkim izložbama većinom su bili zastupljeni keramički predmeti, tako da su shodno tome sve radionice uključivale oblikovanje predmeta u glini, tokom kojeg su deca bila upoznavana sa tehnologijama izrade i tehnikama ornamentisanja keramičkih predmeta.

Tokom prve arheološke izložbe naslovljene *Život u glini* (izložba neolitske plastike), deca su oblikovala figurine i prosoporfne poklopce u glini, po ugledu na izložene. I tokom naredne izložbe *Prva zdravica,* na kojoj su prezentovane badenske šolje, deca su ponovo oblikovala predmete po ugledu na izložene.

Potom je otvorena izložba *Vinča, Fragmenti za rekonstrukciju prošlosti,* osmišljena kao prezentacija višegodišnjih istraživanja na lokakalitetu Vinča-Belo brdo, koja je uključivala i raznorodne keramičke predmete. Dečija radionica organizovana za tu priliku, bila je srodna predhodnim.

VANJA KORAĆ,
Mathematical Institute,
Belgrade, Serbia
vanja@mi.sanu.ac.rs

UDC: 902/904:004; 572:004
Original research article
Received: October 12th 2013
Accepted: October 15th 2013

DIGITAL ARCHAEOLOGY IN A VIRTUAL ENVIRONMENT

ABSTRACT

In this paper the most important elements are described which should gain special attention while doing digital forensic analysis in a virtual environment. The most important segments of virtual environments themselves are also explained, as well as ways in which they can be of importance for processes of digital forensic analyses. In the paper, two aspects of virtual environment are discussed. The first aspect regards virtual environment as a digital scene of crime. Services and networks of virtual environment are described within it, places in which potential evidence can be found, ways of securing digital scene of crime and preservation of digital proves discovered. The second aspect regards virtual environment as environment for a digital forensic data analysis.

Keywords: digital archaeology, digital forensic, virtual environment, forensic analysis.

When it comes to digital data archaeology in a virtual environment, it is very important to know the virtual environment, its features and possibilities which the environment can offer in the sense of knowing the advantages and disadvantages which can occur during its usage. It should also be mentioned that there are certain differences in the research access of a digital forensic investigator when physical, i.e. virtual machines are concerned.[1] This paper shall not deal with detailed forensic methodology which regards digital virtual environment, but it aims to sterss only the most important elements which should be regarded while performing digital forensic analysis in a virtual environment. The most important segments of a virtual environment itself shall be explained and a way in which they could be of importance for the process of digital forensic analysis.

The idea of virtualization was constructed aiming to make managing of a large number of virtual machines simplier, most of all in order to save space, time, money and energy. As a concept, it appeared already in 1960 with the appearance of mainframe computers and it was reborn with personal computers in 1990. In their paper "Formal requirements for virtualizable third generation architectures" (Popek and Goldberg 1974: 412-421), Popek and Goldberg wrote about requirements for architecture which

1 Virtual machine represents a created environment made with a program package for visualization which possesses a simulated assemblage of hardwares (processor, hard disc, memory, network transmittors and other components) and personal system and application program.

can support a virtual machine describing it as a "effective, isolated duplicate of a real machine". The virtualization itself was described as an idea of virtual machine monitor (VMM).[2]

What is specific for virtual machines is that they use complete hardwares of physical servers. The VM application, the so-called guest, starts its own operation system on a real host machine. In simple words, the VM represents a virtual computer started within a physical computer. For example,a physical server can represent virtual environment with more than twenty virtual machines. Communication between physical server and virtual machines goes over a hypervisor (program supplying virtualization) or over a virtual machine manager via hyper-call. Hypervisor drives system processor, memory and other resources, putting them at disposal to other guest systems on demand (Barrett and Kipper 2010). Hypervisor can supply virtuelization directly on hardware (native VM or Bare-Metal Hypervisor) or on operating system (host VM or Hosted Hypervisor) (Ivaniš 2011). The representatives of virtualization being performed directly on hardware are: VMware ESX[3], Citrix XenServer[4] and Microsoft Hyper-V[5]. The representatives of virtualization being performed on operating systems are: Parallels Desktop[6], Microsoft Virtual Server[7], VMware Server[8] and VMware Workstation[9].

In other words, according to the mentioned concepts, a virtual machine can operate isolated or it can share resources with other virtual machines within the same or other server platform. Due to this specific design and optimized processor operations within realized virtual environment, there is no difference between operating virtual machines and physical machines. There are different types of virtual environment, the most famous ones being *Microsoft Hyper-V*[10], *VMWare Vsphere ESXi*[11], *QEMU*[12], *Citrix XenServer*[13]. This work is focused on two angles of digital forensic in a virtual environment on two angles of digital forensic in a virtual environment. The first one regards virtual environment as a digital crime scene, while the second one regards virtual environment as environment for a digital forensic analysis.

VIRTUAL ENVIRONMENT AS A DIGITAL CRIME SCENE

As every environment, virtual environment can also be compromised in many ways, possibly resulting in compromising virtual machines themselves, as well as operating systems and files positioned within particular environments.

To a digital forensic investigator, to whom a digital crime scene is the actual virtual environment consisting of virtual machines, it is very important to be well-informed and to know how to work in a virtual environment. Access to investigation is based upon locating and accessing physical server which drives virtual machines. It is of great importance that digital forensics sceintist has “live” access to digital machine which is regarded as digital crime scene. In such a way, valuable data and information can be gathered as potential digital evidence during operation of a physical server (Milosavljević and Grubor 2010). A fact should be pointed out that suspect has great possibilities to manipulate with evidence in such a environment, thus making acquiring of digital evidence rather complicated.

2 Virtual machine monitor represents a part of a program with three features. The first one is that VMM offers a environment for programs which is identical to environment on a physical machine. Second, programs being started within in such a virtual environment have a very small reduction of performances when it comes to speed compared to physical machine and thirdly, the VMM fully controls system resources.

3 Available at http://www.vmware.com/products/esxi-and-esx/overview

4 Available at http://www.citrix.com/products/xenserver/overview.html

5 Available at http://www.microsoft.com/en-us/server-cloud/hyper-v-server/default.aspx

6 Available at http://www.parallels.com/

7A vailable at http://www.microsoft.com/windowsserversystem/virtualserver/

8 Available at http://www.vmware.com/products/vcenter-server/

9 Available at http://www.vmware.com/products/workstation/

10 Microsoft Hyper-V, http://www.microsoft.com/en-us/server-cloud/hyper-v-server/ , Accessed 09.02.2012.

11 *VMWare Vsphere ESXi,* http://www.vmware.com/products/vsphere-hypervisor/overview.html , Acessed 09.02.2012.

12 *QEMU*, http://wiki.qemu.org/Main_Page , Acessed 09.02.2012

13 Citrix Xenserver http://www.citrix.com/English/ps2/products/product.asp?contentID=683148 , Acessed 09.02.2012.

Principles regarding digital computer forensics and which are applicable during acquiring, analyzing and presenting digital proves can also be applied at virtual machines in a virtual environment, but with certain differences, which shall be pointed out later on in this paper. It is important to stress that it is necesarry to use only tested and reliable forensic tools (ex. *Access data FTK, Encase, X-Way Forensic*) which support working in a virtual environment and possess compatibility with new operating systems.

If investigation dealing with illegal activities focuses on a virtual environment and if it is conducted according to adequate methodologies, using reliable forensic tools and aiming to find relevant digital proves, investigation shall be successfull. Contrary to that, it can end up unexpectedly. Digital investigation in a virtual environment can be public (official) and corporative, depending on the type of incident. Investigation begins with a physical access to a physical crime scene, where physical evidence is gathered. Further on, digital crime scene is accessed (virtual environment consisting of virtual machines) and it lasts until digital forensic investigator is not finished with investigating digital data ready to be included in a report, i.e. for presenting reconstructed crime or incident. All of the evidence found must be documented, secured, relevant, unchanged and acceptable in court, while the whole investigation (when dealing with official investigation) must be transparent for trial in court (Milosavljević and Grubor 2010).

It should be emphasized that virtual environment is a environment offering a row of positive possibilities through its very useful operations, but it is exactly them that can be abused. For example, operations which can be abused are migrations of virtual machines, manipulations with images of virtual machines, live migration (manipulations connected to „live“ migrations of virtual machines). Some of the abuses can result in controling or abusing virtual machines by a vicious person.

Malicious activities can be detected, since all of the activities are noted on server, i.e. host and it is very important that from the vey beginning, digital forensic investigator approaches investigation and acquiring evidence according to strictly defined procedures, since otherwise loss or dissapearance of important digital data can occur. Forensics in a virtual environment shows more gathered evidence compared to classical digital forensic, since digital forensic investigator must gather information about data packages and about communication between abuser and user upon whom the illegal action was performed. During investigation of virtual environment, everything happens within virtual spaces put on physical (server) machines, being connected to Internet, so actually virtualy they could be anywhere (one of such examples is Cloud computing[14]). In order to search digital places of crime, a digital forensic investigator has to enter digital virtual environment, which is complex and can represent a great problem to a forensic investigator if no preparations were performed. Such preparations include following and filming activities of suspect, as well as getting acquainted with operating systems themselves which are placed inside a virtual environment. Contrary to classical digital forensic, in which physical computer is accessed physically, when one is dealing with forensics in virtual environment, a forensic investigator would not have simple access to a physical machine on which virtual environment was designed. Exactly this is specific about digital forensics in virtual environment. One of the aims of a digital forensic investigator is locating a central spot with virtual computers (not just the location of a virtual machine). This place contains great quantity of useful information which can be used as potential digital proves whitnessing illegal activity. It is also very important that digital forensic investigator is well-acquainted to all of the concepts of virtualization.

14 The way how Cloud computing is functioning as a type of virtual environment: user gains access to a computer placed in far north. This system enables its user safe and cosy work. Great advantage of such a system is that its user does not have to know where his/her computer is situated, while data are always at his/her disposal. The user also does have to worry about computer maintaining and depending on what he/she paid for, the user can have great quantity of space. Making connection with a virtual machine is quite simple. There are certain program clients who are in charge for making connections with servers connected to public networks. After successfull authentification, the user accesses his/her virtual machine.

SERVICES AND ELEMENTS OF VIRTUAL ENVIRONMENT

Further on, a vivid description of important services making virtual environment shall be given. Getting acquainted with them can be of use to digital forensic investigators[15] (Tulloch 2010):

-Virtual machine management service (VMMS) – drives, i.e. determines which operations can be performed in some of the states of virtual machines. The VMMS drives the following states of virtual machines: starting, active state, inactive state, state of snapshot making, state of snapshot application, deleting state snapshots, disc connecting. According to these states, the VMMS drives operations on virtual machines, i.e. children. It does not drive operations like Pause, Recording, Switch-off. This is done with the Virtual machine worker proces (VMWP) process, which is being created when virtual machines are started;

- Virtual machine worker process – is created on a virtual machine and it appears as executive file vmwp.exe participating in a great number of interactions between opeartive system on host and virtual machines (children). These interactions include creating virtual machines and their configutrations, driving pauses and resuming virtual machines, saving and restoring virtual machines and snapshooting states of virtual machines. It also drives memory, in- and out ports on computer's motherboard and driving IRQs. Existence of such a file (vmwp.exe) represents a proof that there are virtual machines of host.

-virtual devices – represent program modules (driving programs) which enable configuration of devices and controlling partitions of virtul machines. They are steered through virtual motherboard (VMB) which is given to each virtual machine;

-driver VMBus – supplies optimized communication between host and child, at the same time representing a part of Hyper-V service;

- Virtual Infrastructure Driver – represents kernel component responsible for regime of virtualization on host, making it possible to drive virtual processor and memory;

- The Windows Hypervisor Interface Library – represents kernel component as dynamic link library (DLL). It enables drives of operating systems to access the processor. As part of operating system, it is placed on host. DLL file makes drivers of operating systems possible to access the processor.

The services named above may not have direct influence on investigation, but it is important to know important processes and their possibilities in hardware communication between processor and hypervisor, actually host and child.

The presence of the files mentioned in shape of virtual devices and drives can indicate existence of virtual machines to a digital forensic investigator.

The Fairbanks Alaska University[16] performs research in the field of volatile data by using virtual introspection (VI). Virtual introspection as a new field of research and development in digital forensics, represents an observation process of state of virtual machine either through Virtual Machine monitor (VMM) or from some other virtual machine which is no subejct to forensic research. They developed a set of tools for Xen environment called VIX tools (Hay and Nance 2008), aiming to reduce the risk of changing evidence while they are examined. This tool also makes "live" analysis on Xen virutal machine possible.[17] Basic access of these tools is to pause suspected virtual machine, then gather necessary data by using the „read only" operation and afterwards end the pause. One of the useful things possible with this tool is memory mapping of the suspected machine and ascribing of the mapped segment to the virtual forensic machine.

NETWORKS IN VIRTUAL ENVIRONMENT

When it comes to networks in virtual environment, there are three different kinds of virtual networks (Tulloch 2010) (Garrison 2010):

Internal virtual networks – this type of network does not rely on physical network adapter, but the physical network adapter is being used.

15 Example is connected to making a Hyper V environment, on whse host Windows server 2008 R2 is installed.

16 http://www.uaf.edu/, 03.01.2012.

17 http://assert.uaf.edu/papers/forensicsVMI_SIGOPS08.pdf, 03.01.2012.

Internal virtual network is used as intranet and it is used for connecting virtual machines on intranet. There is also an option of their connection to host, potentially opening a possibility of children abuse if it comes to compromising the host computer. Malicious attack would aim at the program area with the goal to abuse virtual machines or stop them;

External virtual networks – this type of network relies on physical network adapter and on virtual network adapter, thus making communication of physical and virtual machines possible, in the Intranet as well as towards the Internet. A potential possibility of abuse of host is opened from the outside, but also from virtual machnes themselves, since communication between host and child is opened. Malicious attack would also aim the program area in order to abuse virtual machines or turn them off**;**

Private virtual networks – this type of network does not rely on physical network adapter (similar to Internal virtual network) and no communication with members outside private virtual network is allowed. Host also does not have direct communication with this network, making malicious attacks on this type of network impossible. There is a theoretical possibility of attack, but it is limited to the hardware host part.

Certain tools are used in order to find out host's name, data about network cards (physical and virtual) and their configurations (DHCP parameters, MAC addresses). All these pieces of information about network adapters of virtual machines directly on host are of great importance to a digital forensic investigator in order to get acquainted to the architecture of virtual environment.

PROOF OF THE EXISTENCE OF HARDWARE WHICH SUPPORTS VIRTUALIZATION

Modern concepts of virtualization (for example performing cloud computing) can be made only when specially adapted hardware compatible processors are being used, supported to work with hypervisor. The processors most commonly used for making virtual environments are Intel VT[18] and AMD-V[19]. Why is it important for digital forensic investigator to find out the location of physical server on which there is virtual machine being the subject of investigation? The reason is that that is exactly the way (physical access to host) to prove the existence of such processor types which support hardware virtualization, also proving a possibility of existence of machines which could have been (ab)used for illegal actions, which are on host itself or physical machine. For example, *Properties* of an operating system can offer basic and sufficient information about processor type. Digital forensic investigator can also find data about virtualization in BIOS (under options for adjusting virtualization), which indirectly can influence investigation and acquiring of evidence. The presence of application being driven by virtual machines (virtual machine manager) indicates the existence of virtual machines, but also a place from which virtual machines are being operated, being whitnessed also by log files of the regarded environment.

To a digital forensic investigator, console tools which can operate virtual machines can be of great use in cases when monitoring is needed and getting acquanited live to virtual machines. In such a way, important data can be exposed: names of virtual machines, condition of virtual machines (active or not), in which regime of work they are in, resource usage by virtual machines and data about time and time-zones. Such are for example „last logon" files or „configuration log" files, their operations depending on programs which make virtual environment possible. Profiles or roaming profile files which can be of interest to a digital forensic investigator include NTUSER.dat (specific system registry file) and other application data. In some cases, it can occur that TEMP directory is not copied together with profile and it is necessary to pay special attention to it during forensic investigation of gathered virtual hard disc.

TIME PROOVING

Digital forensic investigator has to pay special attention to time and time zones of the examined virtual machine, of the host itself (if physi-

18 Here the list of Intel processors which support virtualization: http://ark.intel.com/VTList.aspx, 10.02.2012

19 AMD platform for virtualization: http://sites.amd.com/uk/business/it-solutions/virtualization/Pages/amd-v.aspx, 10.02.2012

cal access is possible) and of the environment in which forensic investigation is takin place. It must be ascertained if times match and whether there are differences.[20]

SECURING DIGITAL CRIME SCENES IN VIRTUAL ENVIRONMENT

In order to save all potential digital evidence, in classical digital forensic as well as in forensics of a virtual environment, before live investigation takes place, it is very important to disable network communications of suspected host. It is done by pulling out the network cable from the physical host machine. If host is performing wireless communication to Intranet or Internet, wiresless machine to switch it is connected has to be switched off.

ACESSING RAM

In order to perform a virtual environment with sixteen virtual machines working under Windows 7 operating system for example, at least 16 Gb RAM would be necessary. As minimum RAM memory, Windows 7 requires 1GB RAM. For an operating system on host, minimum 512gb to 4 GB Ram memory would be necessary, depending on the OS responsible for virtualization. Total RAM quantity in such a case is 20gb RAM (16 Gb RAM memory per child and 4 Gb for host). This information is important, since according to it, digital forensic investigator would get to know the total amount of RAM memory which is placed on a physical machine and how much has being by virtual machines.

Gaining information from RAM memory is possible from a part of RAM memory on host which is determined for virtual machine under investigation. It is performed by using live forensic (under the condition that computer was previously not switched off, because then the content of RAM would be deleted) and with application of forensic tools (su Encase[21], *FTK Imager*[22], *X-Way Forensic*[23]) for accessing digital data. When snapshot of a virtual machine is being performed (for example with VMware[24] environment), there is an option to choose whether the snapshot would also switch on the memory. If the investigated virtual machine had this option switchen on while snapshoting, the „vmem" files would be present in snapshooting. A tool created by Chris Betz which can investigate these vmem files is named Memparser[25] (Beek 2010).

VIRTUALNI HARD DISC

Every virtual machine writes its data on a virtual hard disc. For a digital forensic investigator, its location, extensions, size and configuration are of great importance, since virtual hard disc can contain potential digital evidence.

Every child on host must also have a place to write its data. Virtual hard discs can be placed on a SAN[26] (Storage Area Network) or NAS[27] (Network Attached Storage) devices or on local hard discs (Grubor, Njeguš i Ivaniš 2011). Information about size matters because of copying images of a virtual hard disc on its forensic medium, from which further investigation shall take place. This is important if one is dealing with virtual hard discs of great capacity, since they can pro-

20 Documenting time form a virtual machine or from the host can be recorded with a camera, while time of the environment can be recorded on an official TV station or radio.

21 https://www.encase.com/products/Pages/encase-forensic/overview.aspx

22 http://www.accessdata.com/products/digital-forensics/ftk

23 http://www.x-ways.net/forensics/

24 http://www.vmware.com/

25 Acessible at http://sourceforge.net/projects/memparser

26 SAN represents a device for storing data and it functions at the level of data blocks, intended for enterprise solutions. Contrary to NAS devices, the SAN devices allow sharing of storage space into parts which can be ascribed to bigger number of servers with direct attached storage, making great speed of data transmissioning possible. Connection is made through fibre channel. It consists of a great number of high-speed SAS discs (15K rpm). Solid state discs (SSD) can also be used if performanse and saving enery are priorities. There are also vendors offering combined systems, so that data can also be accessible via block access through fibre channel or they can be accessed on the level of databases with expected speed increased up to 100GBps in the decade to come.

27 NAS represents a device for data storage functioning on database level. It connects with computers via local network, mostly via TCP/IP over internet. It consists of a great at number of discs adjusted to operate using SAS SCSI or SATA discs. NAS is most commonly used as a file server supporting file systems and protocoles, for windows networking CIFS, HTTP, linux networking SAMBA, NFS.

longue investigation. For a digital forensic investigator it is important to find out as much information as possible about the number of partitions and to make a snapshot only for those partitions suspected to contain digital prooves. This information can be found in configuration files of the virtual machine itself. Certain extension[28] can indicate the state of virtual machine itself, if it is complete, is it a snapshot or change of state. Such changes can testify installing certain programs and their usage. Regarding classical research of a digital crime scene which deals with physical digital environment exclusively, information regarding condition of a virtual machine can only be placed in a virtual environment. There are also files which bear configuration information of a virtual machine under investigation. It is important to tell discs of defined size from dynamic virtual discs (dynamc capacity enlargement depending on needs). It is also important to stress that some programs for virtualization can drive virtaul hard discs in different ways. This is of importance for digital forensic investigator, since after certain operations on virtual hard discs, their structure can be very much changed. There are operations which can reduce virtual machine size by removing the unused space (on host such a space would be marked with zeros). Further on, there are operations which can convert dynamic virtual discs into the fixed ones and vice versa or to enlarge fixed virtual discs. They can also merge virtual hard discs and merge physical hard disc into a new virtual hard disc.

Since the field of virtualization grows bigger, Microsoft began to integrate virtualization techniques into its operating systems, such as Microsoft Windows 7. In the Configuration menu which regards disk management, it is possible to mount virtual hard disc (VHD) into read-only mode. Another useful operation is bootin the computer from a virtual hard disc (it regards only Windows vhd files). What was called Complete PC backup in Windows Vista, in Windows 7 it is called System image backup and it is saved in vhd formate (Beek 2010). From the perspective of a digital forensic investigator it is very useful, since such an image (which can contain great amount of useful information) can be connected to a forensic computer in read-only mode.

SNAPSHOTS OF VIRTUAL MACHINES

Snapshots of virtual machines have a wide field of usage. They can be used for finding changes on operating system, returning virtual machine into the previous working menu in case installing of a program (applicative or system) influenced change of work of an operating system. For a digital forensic investigator they are of great importance, since by getting to know the moment of illegal action, over snapshooting (reversed) on a forensic machine and with applying forensic tools, a simple overview of a virtual machine for a forensic relevant moment would be performed. according to that, it is possible to gain data from RAM memory or virtual hard disc about action of an illegal virtual machine. Snaphot comparation of the investigated virtual machine aiming to note changes, change of files or identification of hidden files can also be of great interest. The tool which enables tracing of changes on Vmware virtual machines is written by Zairon[29] and it is called Compare Vmware snapshots (Beek 2010).

FORENSIC COPIES OF VIRTUAL MACHINES

When digital forensic is concerned, physical machines made two copies of physical hard disc by using appropriate forensic tools. The first copy, which is numerated, is used to calculate the hash value of MD5 or SHA algorythm, aiming to proove that it was not changed, i.e. integrity of hard disc. This copy represents a proof and it is kept until it is necessary in court to indicate that there were no changes in bits. The second copy is used for performing forensic anaylses on a forensic computer. Recently, when virtual machines came to use, the need arose to make a third hard disc copy for suspected machines, representing a special feature. On such copies there are virtual hard discs and their snapshots, together with all folders and files which describe a virtual machine

28 Extensions of these files are different depending on programs which perform virtual environment.

29 Accessed at http://zairon.wordpress.com/2007/09/19/tool-compare-vmware-snapshots/

under investigation. The third copy is used for investigation on a forensic virtual machine in a similar environment, referred to further on in the paper. Making snapshots of an operating system is an extremely complex process, since integrity of hard disc must remain undamaged. Bootable disc is usually used in such cases, containing all the necessary tools, but external forensic device can be used as well for storing hard disc snaphots of a suspected machine. File analysis from hard disc snapshots should be performed on a forensic computer. Just like with every forensic analysis, documentation has to be kept about gathered prooves. There are even program tools for such a purpose.

MIGRATION OF A VIRTUAL MACHINE

One important feature of a virtual environment (as its component in most cases) is an operation of transferring i.e. migration of virtual machines. It was already mentioned that such an operation is of great advantage for administrator of virtual environment (migrating a virtual machine from one place to the other inside the same physical server or to some other physical server). On the other hand, it can make it possible for a supect to hide evidence of illegal action.

It should be pointed out that when a virtual machine migrates, only information containing data about configuration used for multiplying virtual machines is being transferred. Still, if it comes to export of a virtual machine, all of the data shall be transferred, including snapshots (if there were any). These operations can influence digital forensic investigator to make wrong conclusions if no preparations were performed, i.e. the following of virtual environment.

The goal of a digital forensic investigator for virtual environment is to create the sequence of illegal actions, gathered with digital and physical evidence. The investigator needs to collect data of network adapters, network configuration of the virtual environment itself, domain, data regarding virtual hard discs, data from system snapshoting, data about periphere virtual devices, data from RAM memory etc.

Forensics shall develop towards virtual environment, since some of the classical tools for digital forensic cannon be fully used in a virtual environment either because of their compatibility with later operating systems or because the use of tools is inadequate (dynamic and capacity of hardware are in such a state that complete investigation would become very slow). This is another feature of virtual environment, so it is recommended to perform live forensic investigation of virtual environment whenever possible, making snapshots of partitions or disc parts which might contain potential evidences. It should be pointed out that when investigation is aiming to a virtual environment in which one machine is being suspected for an illegal action, it is also necessary to investigate other virtual machines on forensic working station. All of this indicates certain special features in collecting data and contrary to a classical digital forensic of physical machines.

VIRTUAL ENVIRONMENT AS ENVIRONMENT FOR DIGITAL FORENSIC ANALYSIS

The concept of virtualization and the specifics of digital forensic of a virtual environment were explained at the beginning of this paper, while this part of the paper shall be dedicated to virtual environment representing environment for performing digital archaeology while investigating digital crime scene. General concept of virtual environment and its limitations in applying digital forensic analysis shall be analyzed. The idea of this approach is to apply the process of digital forensic analysis at the same time under conventional and virtual environment independently, which can benefit in reducing duration of digital forensic analysis. The focus of this chapter is a phase of digital investigation, actually digital forensic analysis. The process of digital forensic analysis can include three key phases, as shown by Kruse and Heiser in their model: acquiring evidence, establishing authenticity and analysis (Kruse and Heiser 2010).

Christopher Brown, founder of one of the leading companies dealing with digital forensic (CTO of Technology Pathways LLC[30]) stresses that in the acquiring phase, digital forensic investigator should record and note as many vol-

30 http://www.techpathways.com/Desktop Default.aspx, 31.02.2012

atile data as possible from live system, further switch off the computer and finally create bit stream copy[31] of all of the data storage devices, actually hard discs. Most of the authors claim that making forensic copies i.e. images of a suspected hard disc is relized with programs based on "dd tools"[32] and that the gained forensic copy is kept in dd format or some format based on dd (Nelson, Phillips, Enfinger, and Steuart, 2006)(Rude 2003) (Bunting and Wei 2006). The gained forensic copy i.e. image represents an identical copy of the original disc. It should be mentioned the old rule, according to which image needs to be identical with the original disc, is not applied lately. There is a great number of apropriate image formates of the original hard disc used most commonly, but which are not identical to the original hard disc, since they can contain additional metadata. like investigators' names, notes or hash values. An example for such forensic adequate format is the popular Advanced forensic format - AFF (Garfinkel 2005) (Garfinkel, Malan, Dubec, Stevens and Pham 2006) developed by Dr. Simson Garfinkel and the Basis Technology company.[33] Since this format also includes segmentation of the original snapshot with adding chapetrs, digital forensic investigator bases its finding on investigating the image which is in some way altered, actually not identical with the original.

On the other hand, the dd tools creates a snapshot identical to the original and can be created at the same or at a hard disc of greater capacity and can be driven on another computer system. A problem could occur here regarding re-establishing original environment because of different hardware components' computer combinations. For example, if a snapshot of a researched computer is driven on a computer with different hardware components from the first one, operating system shall try to recognize the differences and add driver programs for the missing hardware components in order to run the operating system successfully. Still in some cases, system would not be able to run successfully or there would be systems and programs which would not be able to run. The mentioned problem also relates to application in a virtual environment, since virtual machines can only simulate basic hardware components and they are not intended to support a great number of hardware devices. That also means that a forensic snapshhot obtained with a „dd tool" cannot be run without adding files with certain parametres needed to run the snapshot in a new environment. There are differnt tools that can solve this roblem. Comercial tools include Encase's Physical Disk Emulator[34] and Technology Pathways'es Prodiscover.[35] Among free tools there are Live View[36] and some free tools by Technology Pathways.

In literature it is still discussed whether data obtained from a virtual environment can be relevant. The reasons are exactly the changes which have to be applied upon the snapshot of the original hard disc (original environment) in order to make running of the virtual environment possible. If it is known that snapshot was much changed, it can imediately be sustained in court, although an IT expert could claim that changes have no influence on presented evidence. Some authors consider that virtual environment in the role of a digital forensic tool has no perspective regarding its application in forensic analysis (Fogie 2004). Still, if virtual environment in the role of digital forensic tool is applied in a combination with classical digital forensic approach, data analysis can be radically reduced and better results can be obtained. One of the models suggesting this approach is the Ben and Huebner model (Bem and Huebner 2007 : 1-13). This model type includes two levels of digital forensic staff. The first one includes digital forensic investigators - professionals (DFIP), fully trained and with great experience, strictly acting according to methods of rules and proceduresof digital forensic investigation. The second level includes digital forensic investigators – computer technicians (DFIRT) with less forensic knowledge

31 These bit-stream copies can be made as bit-for-bit copies or bit-for-bit plus copies. Both ways are widely accepted, while the difference is that bit copy plus implements certain metadata data which aim to tag proof-files in order to preserve the responsibility chain (Nelson, Phillips, Enfinger, and Steuart, 2006) (Bunting and Wei 2006) (Scott 2004).

32http://en.wikipedia.org/wiki/Dd_%28Unix%29, accessed 31.02.2012

33 http://www.basistech.com/e-discovery/ , 13.02.2012

34 http://www.pc-ware.com/medialibrary/central_files/de/hersteller/software/guidance_software/files/guidance_07_06_19_encase_forensic_prosuite.pdf, 16.02.2012

35 http://www.techpathways.com/prodiscoverdft.htm, 16.02.2012

36 http://liveview.sourceforge.net/, 16.02.2012

and experience and do not strictly need to stick to the rules and procedures, since they have no direct influence on the investigatin process. Their role is to search the copies of digital evidence in order to find as many data possible of interest for the investigation and to report everything they find to digital investigators – professionals who, by using relevant forensic techniques approve the finds or search the data further if needed.

The methodology used a show-case would go as follows: computer technicians run a copy of gathered snapshots in a virtual environment (as a virtual machine), treating it as a normal system and search „live" all of the details relevant for the investigation. Although methodology used by computer technicians influences the integrity of gathered snapshots of the original system, it does not influence the investigation. The reason is that computer technician works only with one of the copies of digital snapshots of the suspected hard disc. That means that computer technicians possess good technical, but less forensic knowledge can apply computer forensic techniques also in phases without endangering digital evidence.

It is logical that to one copy, the hashing function aiming to keep the integrity is being applied and it should be kept safe, while the other copy remains with digital investigators – professionals intact and forensically valid.

According to the data obtained by computer technicians, the DFIP can confirm all of the results using adequate forensic tools, strictly sticking to adequate forensic methodology, techniques and procedures.

CLOSING CONSIDERATIONS

Virtual environment, just like any other environment, can be compromited in different ways, which can result in compromizing virtual machines, as well as operating systems and files placed within such a environment. This is why digital archaeology becomes necessary when compromizing computer systems. In this paper, two aspects of virtual environments of were considered. The first aspect regards virtual environment as a digital crime scene. Services and nets of digital environment were described in it, places in which potential evidences can be found, ways of securing digital crime scenes and preserving the discovered digital prooves. The importance of digital forensic investigator's live access to a digital machine regarded as digital crime scene was pointed out. In such a way, it is possible to gather valuable data and information which can represent potential digital evidence. Manipulation possibility in such a environment by a suspect is huge, making the process of collecting digital evidence rather complex. All of the principles regarding digital forensic of a computer which can be applied during collecting, documenting, analysing, preserving integrity and presentation of evidence are applicable also for virtual machines in a digital environment, with certain differences which were pointed out in this paper.

The second aspect regards virtual environment as a environment for digital forensic data analysis. A general concept of virtual environment with described limitations in applying digital forensic analysis was shown. Such a concept shows that process of digital forensic analysis is performed simultaneously in a conventional and virtual environment independently, which can benefit in reducing the duration of digital forensic analysis. This actually means that with such a forensic access, combination of classical and virtual concept, which is being performed as a co-operation of teams on different expertise levels and with applying different tools, can lead to reducing time of a digital forensic analysis. Time is saved and also pressure upon digital investigators – professionals, which is very important since there is a lack of forensic professionals.

BIBLIOGRAPHY

Popek, G. J. and Goldberg, R. P., 1974
Formal requirements for virtualizable third generation architectures, Communications of the ACM 17 (7): 412–421.

Barrett, D. and Kipper, G., 2010
Virtualization and Forensics – A digital forensic Investigator's guide to Virtual Environments, Elsevier Inc., USA.

Ivaniš, N., 2011
Digitalna forenzička istraga u virtuelnom okruženju, master rad, Univerzitet Singidunum

Tulloch, M., 2010
Understanding Microsoft Virtualization Solutions from desktop to the datacentar, second edition, Microsoft Press A Division of Microsoft Corporation One Microsoft Way Redmond.

Hay, B. and Nance, K., 2008
*Forensics Examination of Volatile System Data Using Virtual Introspection***,** SIGOPS Operating Systems Review, ACM Special Interest Group on Operating Systems, Volume 42 Issue 3, ACM.

Beek, C., 2010
Virtual Forensics, TenICT proffesionals, http://securitybananas.com/wp-content/uploads/2010/04/Virtual-Forensics_BlackHatEurope2010_CB.pdf.

Kruse, G. W. and Heiser, G. J., 2010
Computer Forensics Incident response essentials, 14th printing, New York: Addison Wesley, March.

Nelson, B., Phillips, A., Enfinger, F., and Steuart, C., 2006
Guide to Computer Forensics and Investigations, Second Edition, Thomson Course Technology, Boston.

Rude, T., 2003
DD and Computer Forensics, Retrieved October 23.

Bunting, S., and Wei, W., 2006
En Case Computer Forensics: The Official EnCE: EnCase Certified Examiner Study Guide, Indianapolis, in: Wiley Publishing.

Scott, M., 2004
Independent Review of Common Forensics Imaging Tools, Memphis Technology Group, SANS GIAC Paper Submission.

Garfinkel, S., 2005
The Advanced Forensic Format 1.0. 2005, http://stuff.mit.edu/afs/sipb/user/simsong/afflib/affdoc.doc.

Garfinkel, S., Malan, D., Dubec, K., Stevens, C. and Pham, C., 2006
Disk imaging with the advanced forensics format, library and tools, The second Annual IFIP WG 11.9 International Conference on Digital Forensics, National Center for Forensic Science , Orlando, Florida, USA, January 20-February 1.

Fogie, S., 2004
VOOM vs The Virus (CIH), http://voomtech.com/downloads/Shadow%20Eval%20-%20Fogie.pdf.

Bem, D. and Huebner, E., 2007
Computer Forensic Analysis in a Virtual Environment, International Journal of Digital Evidence Fall 2007, Volume 6, Issue 2: 1-13.

Garrison, C., 2010
Digital Forensics for Network, Internet, and Cloud Computing a forensic evidence guide for moving target and data, Elsevier Inc., Burlington, MA 01803, USA.

Milosavljević, M., Grubor, G., 2010
Istraga kompjuterskog kriminala – metodološko tehnološke osnove, Univerzitet Singidunum, Beograd.

Grubor, G., Njeguš, A. i Ivaniš, N., 2011
Glavni faktori uticaja virtuelizacije tipa I na forenzičku istragu", Naučni skup sa međunarodnim učešćem Sinergija.

REZIME

DIGITALNA ARHEOLOGIJA U VIRTUELNOM OKRUŽENJU

Ključne reči: digitalna arheologija, digitalna forenzika, virtuelno okruženje, forenzička analiza.

U ovom radu su opisani najznačajniji elementi kojima treba posvetiti posebnu pažnju prilikom digitalno forenzičke analize u virtuelnom okruženju. Takođe su objašnjeni i najvažniji segmeti samog virtuelnog okruženja i na koji način oni mogu biti značajni za postupak digitalne forenzičke analize. U radu su razmatrane dva aspekta virtuelnog okruženja. Sa prvog aspekta posmatra se virtuelno okruženje kao digitalno mesto krivičnog dela. U njemu su opisani servisi i mreže virtuelnog okruženja, mesta na kome se mogu pronaći potencijalni dokazi, nači-

ni obezbeđenja digitalnog mesta krivičnog dela i očuvanja pronađenih digitalnih dokaza. Drugi aspekt posmatra virtuelno okruženje kao okruženje za digitalno forenzičku analizu podataka. Analiziran je jedan opšti koncept virtuelnog okruženja sa prikazanim ograničenjima u primeni digitalno forenzičke analize. Koncept podrazumeva da se proces digitalno forenzičke analize sprovodi istovremeno pod konvencionalnim i virtuelnim okruženjem nezavisno jedno od drugog, što kao benefit može da ima skraćenje trajanja digitalno forenzičke analize. To zapravo znači da se sa ovakvim forenzičkim pristupom, kombinacijom klasičnog i virtuelnog pristupa, koji se realizuje kroz saradnju timova različitih nivoa stručnosti uz primenu različitih tipova alata rezultati u fazi digitalno forenzičke analize mogu brže dobiti.

GUIDELINES FOR SUBMITTING MANUSCRIPTS FOR THE PERIODICAL ARHEOLOGIJA I PRIRODNE NAUKE (ARCHAEOLOGY AND SCIENCE)

Editorial staff of the periodical *ARHEOLOGIJA I PRIRODNE NAUKE* decided to apply *Akta o uređivanju naučnih časopisa*[1] (Acta about editing scientific periodicals) proposed by the Ministry of Science and technological development of the Republic of Serbia. By applying these acta, complete editing of scientific periodicals is determined, quality of periodicals is promoted and their integration into the international system of exchanging academic information shall become more complete.

Papers submitted to the editorial staff of the periodical *ARHEOLOGIJA I PRIRODNE NAUKE* must be formed in a standard way. Each paper submitted has to contain: title; author's name; name of the institution (affiliation); abstract; key words; main text; resume; illustrations with captions; bibliography; contact address.

1. Titles need to be short and clear, describing content in the best possible way. Words used in titles should be apropriate for indexing and web-searching. If there are no such words withing titles, it is advised to add a subtitle. Titles are to be written in the fifth or sixth line, under the top margin, bold and with font size 14 (pts).

2. Author(s) should give their full name(s), including first name, surname and middle initial.

3. Autor(s) need to state official names and addresses of their employees, including names and addresses of employees which conducted research that lead to the results published. With complex institutions, complete title is to be named (ex.: Belgrade University, Faculty of Philisophy, Archaeological Department, Belgrade).

4. Abstract, consisting of 100-250 words, describes shortly content of the paper. Within abstracts, it is advised to use terms convenient for indexing and web-searching. Abstracts should offer data about aims, methods, results and conclusions of the research. Abstracts should be bilingual (in Serbian, English or some other foreign language). Abstracts in foreign languages need to be adequatly lectured, i.e. posses correct grammar and spelling.

5. Key words need to be terms which describe paper's content in a best way, suitable for indexing and web-searching. They should be named according to a widely accepted international source (lists, indexes, dictionary, thesaurus), like list of key-words Web of Science. The number of key-words should not exceed ten words.

6. The lenght of papers should not exceed 32 pages, DIN A4, including footnotes and illustrations. The main text should be written in Times New Roman or Arial (12 pts), MS Office Word 97 or later, line-spacing 1,5 and with margins 2,54 cm. Main text should not contain illustrations. They are to be submitted as separate files.

7. Apart from Serbian, manuscripts can be submitted in one of worldwide languages (English, German, French). Names of translators, if any, should be stated. Papers submitted should have an abstract and a resume written in some

1 Acta about editing scientific periodicals, proposed by the Ministry of Science and technological development of the Republic of Serbia, can be found at the following web-site: http://www.nauka.gov.rs/cir/images/stories/vesti/09-07-17/akt_o_uredjivanju-casopisa.pdf

other language. If a paper is submitted in a language other than Serbian, there should be an abstract and a resume written in Serbian language. Words, quotations and titles written in some other language should be written in their original form.

Footnotes can be incorporated within the main text. They should contain less important data or apropriate explanations. They are not to be replaced with quoted literature. (An appendix to these Instructions explains the way of quoting to be applied).

8. Abstracts should have the same content as resumes, only in an extended form, whose length is not exceeding 10% of the main text. It is very much desired to submit a resume in a structural form.

9. Illustrations (photographs, tables, drawings, graphs etc.) should be submitted in a proposed manner. Scanned illustrations should be submitted in a 600 dpi resolution, while photographs are to be submitted in a resolution of at least 300 dpi, in formats TIFF, PSD or JPG. Illustrations are to be submitted as separate files and should not be incorporated into the main text. Captions should be submitted bilingually (using the language in which the manuscript was written and in English or some other of the proposed languages).

10. Quoted literature should include bibliographic sources (articles, books etc.) and it should be submitted as a separate part of the manuscript, as a list of references. It is a part of every scientific article, with precisely named bibliographic references which were quoted. Bibliography should be written in a proposed manner, depending on standards precisely described in this instruction. Bibliography should be written using the language and alphabet in which it was originally published.

11. Bibliography's structural elements (author's name, title of work, source etc.) should be written according to standard forms of quoting. Editorial staff of the periodical *ARHEOLOGIJA I PRIRODNE NAUKE* accepted the reccomendation of the Ministry of science and technological development and decided that authors should precisely follow quotation rules named below.

The following examples describe the most frequently quoted kinds of references:

I BOOKS (MONOGRAPHS)

1. Author's books

a. single author

within main text: (Popović 2006)

in bibliography:

Surname, name's initial. Year of publishing

***Title of book* (*italic),* Place: Editor.**

Popović, I. 2006

Roma aeterna inter Savum et Danubium, Works of Roman Art from the Petrović-Vasić Collection, Belgrade: Archaeological Institute.

- Series' name and number is also needed:

Mirković, M. 1968

Rimski gradovi na Dunavu u Gornjoj Meziji, Dissertationes 6, Beograd: Arheološko društvo Jugoslavije.

Papazoglu, F.1969

Srednjobalkanska plemena u predrimsko doba (Tribali, Autarijati, Dardanci, Skordisci i Mezi), Djela 30, Centar za balkanološka ispitivanja 1, Sarajevo: Akademija nauka i umjetnosti Bosne i Hercegovine.

b. two or three authors

Between the names of the first and the second author, or the second and the third author,

"and" should be written, no matter what the main language of the publication.

within main text: (Popović i Borić-Brešković 1994)

in bibliography:

Popović, I. i Borić-Brešković B. 1994

Ostava iz Bele Reke, Arheološke monografije 7, Beograd: Narodni muzej.

Ivanišević, V., Kazanski, M. and Mastykova, A. 2006

Les necropoles de Viminacium a l'Epoque des Grandes Migrations, Monographies 22, Paris: Association des Amis du Centre d'Histoire et Civilisation de Byzance.

c. four or more authors

Books written by four or more authors, within the main text and in Serbian cyrillic, only the first name is written and **i dr.** is added. Books printed in Lati alphabet, the abbrevation ***et al.*** is applied. The abbrevation ***etc.*** is used in cases when there are more than three editors or places of editing.

2. Author's books with added name of the editor

within main text: (Jeremić 2009: 40)

in bibliography:

Jeremić, G. 2009

Saldum, Roman and Early Byzantine Fortification, S. Perić (ed.), Cahiers des Portes de Fer, Monographies 6, Belgrade: Institute of Archaeology.

3. Edited books (instead of the author – editor, translator) - (ed., eds.), (trans.).

within main text: (Поповић 1994)

in bibliography:

Поповић, И. (ур.) 1994

Античко сребро у Србији, Београд: Народни музеј.

within main text: (Morris 2002)

in bibliography:

Morris, I. (ed.) 2002

C*lassical Greece-Ancient Histories and Modern Archaeologies*, Cambridge: Cambridge University Press.

within main text: (Hurst and Owen 2005)

in bibliography:

Hurst, H. and Owen. S.(eds) 2005

Ancient Colonizations-Analogy, Similarity and Difference, London: Duckworth.

within main text: (Радојчић 1960)

in bibliography:

Радојчић, Н. (prev.) 1960

Законик цара Стефана Душана 1349. и 1354., Београд: Српска академија наука и уметности.

4.Way of quoting books without author's name

within main text: (Anon. 1985)

in bibliography:

Anon. 1985

Anonymi Peri strategias, The Anonymous Byzantine Treatise on Strategy, *Three Byzantine Military Treatise* (trans. G.T. Dennis), Washington DC.

5. Simultaneous quoting of several books of the same author

a. written in different alphabets

within main text: (Поповић 2002, Popović 2006)

in bibliography:

Поповић, И. 2002

Накит са Јухора, остава или сакрални тезаурус, Археолошке монографије 14, Посебна издања 36, Београд: Народни музеј и Археолошки институт.

Popović, I. 2006

Roma Aeterna inter Savum et Danubium, Works of Roman Art from the Petrović-Vasić Collection, Belgrade: Archaeological Institute.

b. written in the same year

within main text: (Dawkins 1996a, Dawkins 1996b)

in bibliography:

Dawkins, R. 1996a

Climbing Mount Improbale, London: Viking.

Dawkins, R. 1996b

River out of Eden, London: Pfoenix.

6. Quoting chapters in books (acta)

within main text: (Петровић 1997: 87-90)

in bibliography:

Петровић, Б. 1997

Накит, у: *Античка бронза Сингидунума,* С. Крунић (ур.), Београд: Музеј града, 85-117.

within main text: (Samson 1970: 44-68)

in bibliography:

Samson, C. 1970

Problems of information studies in history, in: *Humanities information research*, S. Stone, (ed.), Sheffield: CRUS, 44-68.

7. Translated books

in bibliography:

Bajron, DŽ. G. 2005 (1812)

Čajld Harold, Z. Paunović (predgovor), N. Tučev (prevod), Beograd: Zavod za udžbenike i nastavna sredstva.

8. Books and articles published in electronic form

within main text: (Fishman 2005: 11)

in bibliography:

Fishman, R. 2005

The rise and fall of suburbia, [e-book], Chester: Casle Press. Available through Anglia Ruskin University Library. http://libweb.anglia.ac.uk>[pristupljeno 5 juna 2005].

II PAPERS PUBLISHED IN PERIODICALS, CONGRESS ACTA AND SIMILAR

within main text: (Vasić 2008: 69, fig.3)

in bibliography:

Surname, name's initial. Year

Title, *Title of the acta (italic)*, Name's initial. Surname, (ed.), Place of editing: Editor, page numbers.

Vasić, M. 2006. Stibadium in Romuliana and Mediana. *Felix Romvliana 50 years of archaeological excavations.* M**.** Vasić (ed.). October, 27-29 2003, Zaječar, Serbia. Belgrade: Institut of Arhcaeology, Committee on Archaeology of Serbian Academy of Sciences and Arts, and Zaječar: National Museum, 69-75.

Series' data are also needed:

Петровић, П. 1997

Римљани на Тимоку, у: *Археологија источне Србије* (Научни скуп Археологија источне Србије, Београд-Доњи Милановац, децембар 1995*)*, М. Лазић (ур.), Центар за археолошка истраживања 18, Београд: Филозофски факултет, 115-131.

III PERIODICALS

within main text: (Бајаловић-Хаџи-Пешић, 2001: 108)

Surname, Name's initial. Year

Title, *Name of the periodical (italic*) number of the periodical: page number.

Бајаловић-Хаџи-Пешић, М. 2001, Налази хабанске и постхабанске керамике у Србији, *Годишњак града Београда* 47-48 (2000-2001): 107–121.

- For periodicals with similar titles, behind

the name of the periodical, place of publishing should be stated in brackets:

Анђелковић, Б. 1988

Праисторијски налази са локалитета Јелица-Градина, *Зборник радова Народног музеја* (Чачак) 18: 81–85.

Анђелковић, Б. 1994

Први резултати анализе мумије из Народног музеја у Београду, *Зборник Народног музеја* (Београд) 15-1: 153–159.

- Depending on the year of publishing *Старинар* is named in its full title:

years 1884-1895 *Старинар Српског археолошког друштва*

years 1906-1914 [novog reda] *Старинар* (н.р.)

years 1922-1942 [treća serija] *Старинар* (т.с.)

years 1950-2010 [nova serija] *Старинар* (н.с.)

- If there is a difference between the year of actual printing and the year of publishing, the second is stated in brackets:

Жеравица, З., и Жеравица, Л. 1979, Средњовековно насеље у Поповици код Неготина, *Старинар* (н.с.) XXVIII-XXIX, (1977-1978): 201–211.

IV PAPER IN PRINT / FORTHCOMING

- (in print), within papers written in English (in print)

- (forthcoming), within papers written in English (forthcoming).

within main text: (Јовановић, in print)

in bibliography:

Јовановић, А. (in print)

Бор и околина у античком периоду, у: *Бор и околина у праисторији, антици и средњем веку*, ур. М. Лазић, Бор и Београд: Музеј рударства и металургије и Филозофски факултет.

Papers overtaken from the internet, from electronic periodicals, are quoted in the same way as printed papers, only there is a full web-address written at the end with http://...

V DOCTORAL AND MASTER THESES

Instead of place of editing and editor, the full name of faculty/university is given, where the thesis was conducted.

within main text: (Ilić, 2005)

in bibliography:

Ilić, O. 2005

Ranohrišćanski pokretni nalazi na području dijeceze Dakije od IV do početka VII veka, Magistarska teza, Filozofski fakultet, Univerzitet u Beogradu.

within main text: (Patch, 1991)

in bibliography:

Patch, D. C. 1991

The Origin and Early Development of Urbanism in Ancient Egypt: A regional Study, Ph.D thesis, University of Pennsylvania.

VI ARTICLES FROM NEWSPAPERS

within main text: (Кашанин, 1929)

in bibliography:

Кашанин, М. 1929, Музеј савремене уметности, *Политика, 23. јул, 7-8.*

MAIN TEXT

Quoting bibliography in the main text according to the pattern (author's surname and year: page number, footnote, figure, table):

(Papazoglu 1969: 52, sl. 4/1, T. 18-4-6)

(Babović 1984: 68; Moritz 1978: 68, figs. 40-41; Tasić 1997: 84, sl. 21)

- Additional data within brackets can be written after a dash:

(Swoboda-Milanović 1958: 55, Taf. 18/24 – olovne pločice).

- The same work of the same author in the next quotation can be quoted abbrevated *ibidem* (*ibid.*: page number).

- The second work of the same author in the next quoting, if there are no quotations in between, is quoted as (*idem* year: page number): (Faltings 1998a: 367; *idem* 1998b: 31–32).

- In papers written in Serbian language, the transcribed exact pronounciation of a foreign author's name is written within the main text, without brackets, but the original name is written in quotation: ...Vencel (Wenzel 1965: T. HS/4).

- If the author, work and page number are the same as in the previous quotation, they are quoted as *loc. cit.* (lat. *loco citato)* – quoted place.

- Abbrevation *cf.* (lat. *confer*) - compare

- Abbrevation *e.g.* (lat. *exempli gratia*) - for example

- Abbrevation *i.e.* (lat. *id est*) - actually.

12. All of the quoted referrences are listed after alphabetic order, if written in English or some other foreign language, initial's order withing author's surname or the initial letter within the quoted title (if the author or editor are not stated).

SUBMITTING PAPERS

13. While submitting, the author should write his/her full contact address in a separate file: address of the institution and e-mail address. If there are several authors, only the contact address of the first author should be written. Author is also obligated to name title and code of the project, i.e. name of the programme under which the artice came to being, as well as the name of the institution which financed the project.

14. Each of the papers submitted to the editorial staff of the periodical *ARHEOLOGIJA I PRIRODNE NAUKE* shall be given to anonymous reviewers. Editorial staff also decides about the categorization of positively evaluated manuscripts, according to the criteria named in the *Akta o uređivanju naučnih časopisa* (Acta about editing scientific periodicals).

15. Manuscripts accepted for printing should be submitted to the editorial secretary. Apart from printed version, papers should be submitted in electronic form, on a CD.

- Printed version should be written as follows: 1. title of work; 2. name, middle initial and surname of the author; 3. author's affiliation; 4. abstract; 5. key words; 6. text body; 7. resume; 8. bibliography; 9. illustrations; 10. captions; 11. author's address (address or e-mail address).

- Digital version should be divided into several files: 1. Word file with the first six parts of paper (1. title; 2. author's name, middle initial and surname; 3. author's affiliation; 4. abstract; 5. key words; 6. text body); 2. Word file with resume; 3. Word file with quoted bibliography; 4. Folder with graphic illustrations; 5. Word file with captions (billingual, Serbian and English or some other language); 6. Word file with author's address.

Manuscripts shall be accepted only if they are written and submitted according to the rules stated above. Should author not agree to the requests of the editorial staff, does not accept remarks of the reviewers or the proof-reader, paper shall not be printed. It is not allowed to change papers after reviews have been submitted, unless they are in accordance with these remarks. Editorial staff holds the right to demand illustrations of lesser quality to be replaced with illustrations of better quality if necessarry.

For additional explanations, please contact the secretary Oliveri Ilić, PhD. (address: Arheološki institut, Kneza Mihaila 35/IV 11000 Beograd; phone: 381 (0)11 2637 191; mobile +381 64 322 0286 or send an e-mail to: o.ilic@ai.ac.rs.

Editorial staff of
ARCHAEOLOGY AND SCIENCE
ARHEOLOGIJA I PRIRODNE NAUKE