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ASTRAGAL BELT FROM KABLAROVAC AND SEVERAL CHANCE FINDS FROM THE VICINITY OF ŠID

ABSTRACT

This paper presents astragal belt which was discovered in 1989, in the course of archaeological excavations on Kablarovac site, not far from Gradina on Bosut river site, as well as several chance finds that are kept in "Zavičajna arheološka zbirka" in Šid. The main focus of this paper concerns typological and chronological analysis of astragal belt, based on belt buckle and the accompanying belt segments. Chance finds of astragal belt segments are analyzed as well.

KEYWORDS: ASTRAGAL BELT, BUCKLE, SEGMENTS OF ASTRAGAL BELTS, GRADINA ON BOSUT RIVER, SREM, LATE IRON AGE, TYPOLOGY, CHRONOLOGY

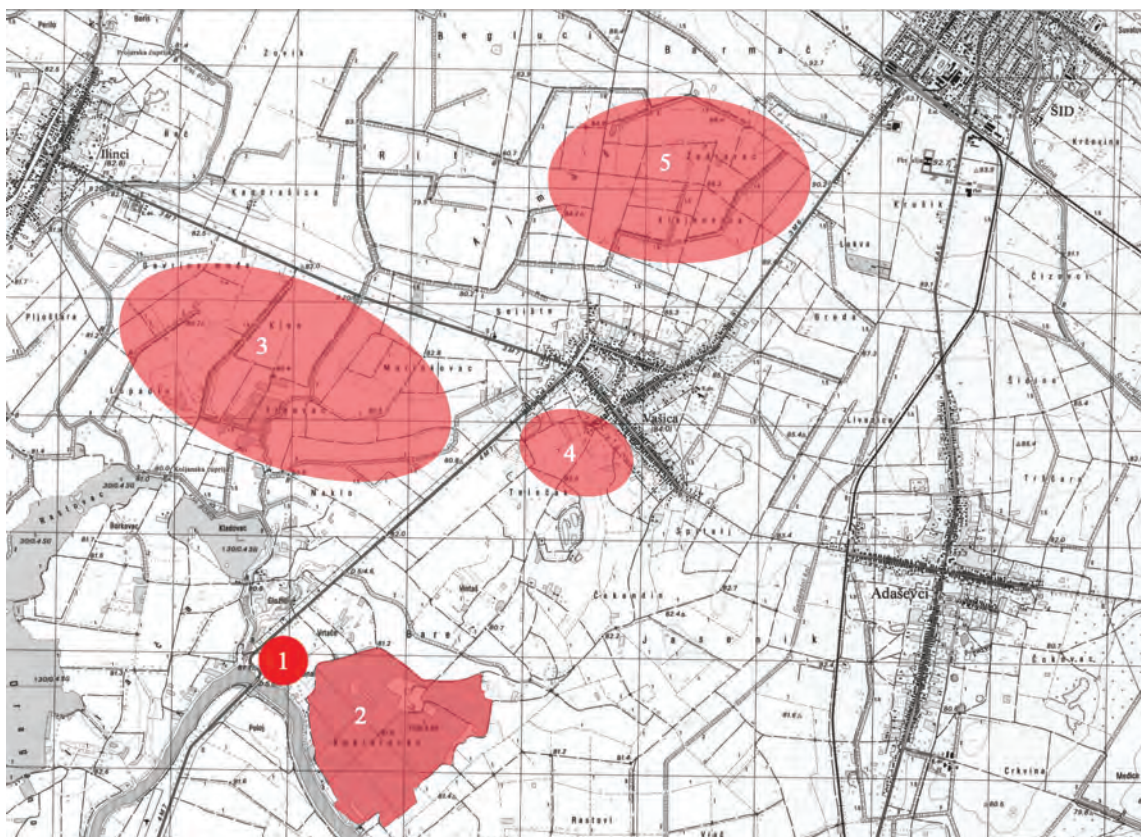
Multilayered archaeological site Gradina on Bosut River is situated on the left bank of the eponymous river, in the Vašica village, west Srem (Map 1/1).¹ The site is comprised of fortified tell and wide suburbs outside of the defensive ditch, which stretched on both banks of the Bosut River. First mention of Gradina on Bosut River site is related to the late XIX century, when Antun Bogetić, a monk from Sotin, collected first archaeological artifacts, and on that occasion gave a detailed plan of the site. In the following 80 years, Gradina on Bosut River site practically does not exist in archaeological literature, until the build-

ing of the bridge on Bosut River in 1960, which to a great extent damaged the site, draw attention of the archaeologists. Not long after, first protective excavations were conducted, in the period from 1964 to 1965. A decade later, in 1975, systematic archaeological excavations begin, which lasted until 1989 without interruption (Medović, Medović 2011: 5-7), while last protective archaeological excavations took place in 2013. All of the aforementioned excavations provided detailed stratigraphic situation, so today we can speak about cultural layers on Gradina starting from the Late Neolithic to the very end of the Middle Age.²

The excavations in 1989 were focused on Kablarovac area (Map 1/2), some 800 meters eastern

¹ The article results from the project: *Archaeology of Serbia: cultural identity, factors of integration, technological processes and the role of the central Balkans in European prehistory (no. OI177020), visualization (no 47018)*, funded by The Ministry of Education, Science and Technological Development of the Republic of Serbia.

² The results of the excavations of the Gradina on Bosut River site are published on several occasions: Popović 1981; Поповић и Радојчић 1996; Popović 2003; Medović i Medović 2011; Сремац 2014; idem 2016.



Map 1 1. Gradina on Bosut River; 2. Kablarovac; 3-5. Locations from which chance finds of belt segments originate (Gradina – Ilinci – Vašica area).

from Gradina itself, where a periphery of a Late Iron Age necropolis was explored. On that occasion, parts of at least three astragal belts were recovered,³ of which two have been previously published (Popović 2003: 311 and further; Арсенијевић 2013: 56-57), while parts of the third belt were handed over to “Zavičajna arheološka zbirka” in Šid after conservation in Musem of Vojvodina in Novi Sad,⁴ and until now remained unpublished.⁵ Aside from the excavated part of the necropolis, pottery workshops registered at Kalodžinci site not far from Gradina, as well as series of chance finds (pottery, fibulae, coins) from unexcavated sites in Ilinci (Klenovac, Džombulja, Umka) and Vašica

(Kapela, Popine krčevine, Galića šljivik, Vrtače) villages can be associated to the Late Iron Age period (Map 1/3-5). Observed in a wider geographical context, the whole Gradina – Ilinci – Vašica area is rich with Late Iron Age archaeological finds.

The main focus of this paper will be on mentioned unpublished astragal belt, its typological and chronological analysis, as well as the analysis of several chance finds that are kept in “Zavičajna arheološka zbirka” in Šid, and originate from the aforementioned sites and routes. The goal of this paper is to associate this unpublished finds with general geographical, chronological and typological classification of astragal belts,⁶ while on the other hand the paper will not deal with any social and ethnic issues associated with this kind of objects.

³ For detailed information on astragal belts refer to: Božić 1981; Vasić 1989; Jovanović 1998; Filipović, Mladenović 2017.

⁴ Parts of astragal belt came to “Zavičajna arheološka zbirka” in Šid with no supporting documentation.

⁵ An illustration of belt was provided in the popular science publication Radosavljević, Sremac 2013: sl. 18.

⁶ Typological analysis of belt buckles will be based on Арсенијевић 2013, and the typology of astragal belts segments will be based on Filipović, Mladenović 2017.

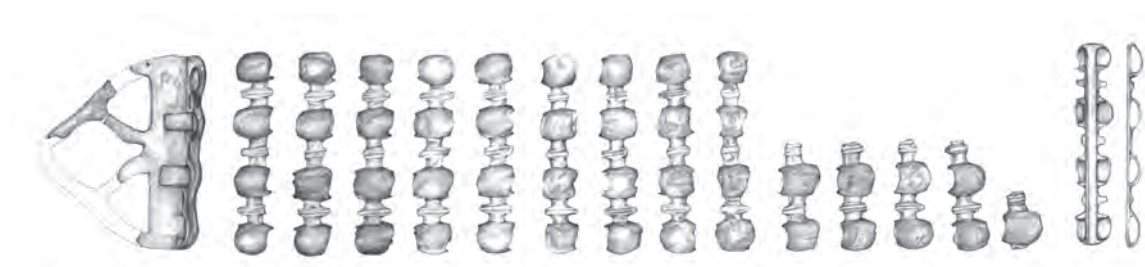


Fig. 1 Astragal belt from Kablarovac.

* * *

On astragal belt from Kablarovac (Fig. 1) nine completely and five fragmented bronze segments are preserved, as well as one fragmented belt buckle. Bronze belt buckle from Kablarovac is comprised of rectangular plate with loops for attaching onto belt preserved on the back side. The belt was probably made out of some organic material. Two prongs which connected at some point emerge from the plate, forming a triangular field. Inside this triangular field, one larger, rhomboid perforation, and two smaller, triangular perforations are observed. The only similar example of belt buckle is found in Donja Dolina, as chance find from the Iron Age necropolis (Marić 1964: T. XIV/25). However, this example is decorated with punctuated ornament with double concentric circles and smaller puncture in the middle, which are equally arranged on the entire surface of the buckle, while our example lacks any decoration. S. Arsenijević classifies this buckle into her type VII – donjodolinski (triangular belt buckles of perforated type), and dates it to the III century B.C. (Arsenijević 2013: 59, tabela 12). From Kablarovac also comes two mentioned belt buckles (Popović 2003: 319, T. 4/14-15), but these are younger examples, the so-called elongated bell-shape modeled belts (Dizdar, Tonc in print).

Completely preserved segments of this belt are comprised of four calottes, three horizontal bars, and four loops for sewing onto belt (Fig. 2). Horizontal bars on all segments are decorated with two horizontal incisions. Four segments have two calottes, and two horizontal bars preserved, while one segment has only one calotte and one hori-

zontal bar preserved. On fragmented segments the number of loops for sewing onto belt corresponds to the number of preserved calottes. Based on the round shape of calottes, clearly defined transition from calotte to horizontal bar, as well as characteristic decoration comprised of incised horizontal lines, all segments of this belt can be classified into the Osijek variant of Srem type (Filipović, Mladenović 2017: 159-163). This variant of segments is most abundant on the territory of present day Srem, while it's distribution is connected to a wide territory between Balaton Lake in Hungary and Mačva in Serbia, and further to the east towards Great Morava and Dunav rivers confluence, but similar examples are known from the territories of Slovakia and Romania (Pieta 2014: 149-152, Obr. 19/1; Rustoiu 2011: 166, Fig. 4/4), and further to the south, in the South Morava River Basin (Булатовић 2007: 167-169, T. XLII/3).

Segments of astragal belt from Kablarovac are similar to one of the previously published belt from this site (Popović 2003: 319, T. 4/13), as well as to examples from Donja Dolina, Vučedol near Vukovar, Donji grad in Osijek, Nikinci, Čair near

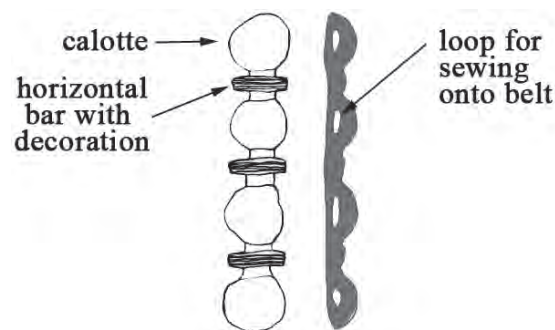


Fig. 2 Constructive elements of an astragal belt segment.

Stari Kostolac (Jovanović 1998: T. II/10, T. V/10, T. IV/7-8, T. V/4, T. IX/1-2), Batina (Maráz 1983: T. III/ 1), and example from Paulje necropolis in Brezjak (Булатовић, Филиповић и Глигорић 2017: 132, kat. 51, T. XX/51). Relatively large number of examples similar to ours are also found on sites Beremend, Lengyel, Gerenyápuszta, Regöly, Kosd (Jovanović 1998: T. X/40-41, 43-44, T. XI/3) and Mözs-Tolna (Gaál 2001: 10. tábla, 11. tábla) in Hungary.

* * *

“Zavičajna arheološka zbirka” in Šid also keeps 23 segments of astragal belts, in different degree of preservation. Only two segments are completely preserved, one segment has four calottes preserved, one segment has three calottes preserved, 15 segments have two calottes preserved, and four segments have only one calotte preserved. All this segments are chance finds recovered from aforementioned Gradina – Ilinci – Vašica area.

1. Segment of astragal belt that consists of four calottes, and three horizontal bars. Horizontal bars are decorated with horizontal lines. Bronze, casting; length 5,6 cm, width 1,2 cm (T. I/1).

2. Segment of astragal belt that consists of four calottes, and three horizontal bars. Horizontal bars are decorated with horizontal lines. Bronze, casting; length 6,3 cm, width 1,5 cm (T. I/2).

3. Preserved fragment of astragal belt segment with three calottes, and two horizontal bars. Horizontal bars are decorated with horizontal lines. Bronze, casting; length 4,6 cm, width 1 cm (T. I/3).

4. Preserved fragment of astragal belt segment with two calottes, and two horizontal bars. Horizontal bars are decorated with horizontal lines. Bronze, casting; length 3,5 cm, width 1,4 cm (T. I/4).

5. Refer to Cat. No. 4. Bronze, casting; length 3,3 cm, width 1,1 cm (T. I/5).

6. Refer to Cat. No. 4. Bronze, casting; length 3,6 cm, width 1,2 cm (T. I/6).

7. Refer to Cat. No. 4. Bronze, casting; length

3,2 cm, width 1,2 cm (T. I/7).

8. Preserved fragment of astragal belt segment with two calottes, and one horizontal bar. Horizontal bar is decorated with horizontal lines. Bronze, casting; length 2,6 cm, width 1 cm (T. I/8).

9. Refer to Cat. No. 8. Bronze, casting; length 2,7 cm, width 0,8 cm (T. I/9).

10. Refer to Cat. No. 8. Bronze, casting; length 3,1 cm, width 0,8 cm (T. I/10).

11. Refer to Cat. No. 8. Bronze, casting; length 2,4 cm, width 1,2 cm (T. I/11).

12. Preserved fragment of astragal belt segment with two calottes, and two horizontal bars. Bronze, casting; length 3,5 cm, width 1,2 cm (T. I/12).

13. Preserved fragment of astragal belt segment with two calottes, and one horizontal bar. Bronze, casting; length 3,3 cm, width 1,2 cm (T. I/13).

14. Refer to Cat. No. 13. Bronze, casting; length 2,7 cm, width 1,2 cm (T. I/14).

15. Refer to Cat. No. 13. Bronze, casting; length 2,9 cm, width 1 cm (T. I/15).

16. Preserved fragment of astragal belt segment with one calotte, and one horizontal bar. Horizontal bar is decorated with horizontal lines. Bronze, casting; length 1,9 cm, width 1,4 cm (T. I/16).

17. Refer to Cat. No. 15. Bronze, casting; length 1,4 cm, width 0,7 cm (T. I/17).

18. Preserved fragment of astragal belt segment with one calotte. Bronze, casting; length 1,3 cm, width 1,1 cm (T. I/18).

19. Preserved fragment of astragal belt segment with three calottes, and two horizontal bars. Horizontal bars are decorated with horizontal lines. Bronze, casting; length 3,5 cm, width 1,4 cm (T. I/19).

20. Preserved fragment of astragal belt segment with two calottes, and one horizontal bar. Horizontal bar is decorated with horizontal lines. Bronze, casting; length 2,9 cm, width 1,1 cm (T. I/20).

21. Preserved fragment of astragal belt segment with two calottes, and one horizontal bar. Bronze, casting; length 2,7 cm, width 1,2 cm (T. I/21).

22. Preserved fragment of astragal belt segment with one calotte, and one horizontal bar. Horizontal

tal bar is decorated with horizontal lines. Bronze, casting; length 1,6 cm, width 0,9 cm (T. I/22).

23. Preserved fragment of astragal belt segment with four calottes, and four horizontal bars. Horizontal bars are decorated with oblique rib. Bronze, casting; length 5 cm, width 1 cm (T. I/23).

Concerning the typology, all presented segments can be classified into the Srem (Osijek and Belgrade variants) and Dunaszekcső types. Most examples (18) belong to the Osijek variant of Srem type (Filipović, Mladenović 2017: 159-163). These are examples with round calottes, clearly defined transition from calotte to horizontal bar, and for this type characteristic decoration consisting of horizontal incisions (T. I/1-17). The decoration differs from example to example, meaning that the number of incisions is different, so we find examples with one, two, or three incisions. Also, due to the preservation degree of some segments, incisions are not clearly visible, but based on the other constructive elements one can assume that they belong to this type and variant. Similar to the examples from Kablarovac, with which they display certain similarities, we find close analogies for this segments on various sites and finds from the territory of Srem (Jovanović 1998: T. V/3-5, T. X/ 17, 20, 22, 34; Filipović i Mladenović 2017: T. 1/2-20, 22-26, 28-30, 36-37, 42-53, 57-58, T.2/67) and Hungary (Jovanović 1998: T. X/40-41, 43-44, T. XI/3; Gaál 2001: 10. tábla, 11. tábla; Almássy 2014: 241, fig. 3/1), and on sites Donji grad in Osijek (Jovanović 1998: T. IV/4-7), and Vukovar (Jovanović 1998: T. V/10).

Examples with calottes whose shape is more rectangular with rounded edges, and shorter and rounder horizontal bars decorated with wider oblique incisions are classified into the Belgrade variant (Srem type) (T. I/18-21). As with the segments of previous variant, these segments also display certain differences concerning the number of lines that comprise the decoration of horizontal bar. We find examples similar to ours first of all in the territory of Srem, in Laćarak (Filipović i Mladenović 2017: T. 1/31-32, 34-35, 38-39, 51,

54), Krušedol, Prhovo, Novi Banovci and Surčin (Jovanović 1998: T. VI/7, T. VI/5-6, T. VII/9-12).⁷

Only one example is classified into the Dunaszekcső type (T. I/22). The transition from calotte to horizontal bar is not so distinct, and horizontal bars are decorated with ribs, and maybe even oblique incisions, although the state of preservation of the segment surface is not suitable for more detailed analysis. We find examples similar to ours also in the territory of Srem (Sremska Mitrovica, Novi Banovci) (Jovanović 1998: T. VII/4, 20), in Svrljig (Filipović i Mladenović 2017: T. 2/59-60), and Blato site near Vinkovci (Dizdar 2015, fig. 11: 4-5). Since this type of astragal belt segments has very wide territorial distribution, similar examples are also found in the territories of Hungary, Romania, and Slovakia (Jovanović 1998: T. X/42, T. XI/4-8; Rustiou 1996: fig. 73; *idem* 2012: pl. 3/5-6; Březinová, Samuel 2007: obr. 45).

* * *

In order to determine as precise chronology as possible for astragal belt from Kablarovac, we must approach this issue from two different perspectives. We must first deal with the chronology of the Kablarovac belt buckle, which is a problem by itself, bearing in mind that not a single find of this type of belt buckle comes from enclosed context. As previously mentioned, the most similar example to ours comes from Donja Dolina site, and even as it was discovered in the course of the necropolis excavation, it represents a chance find. Z. Marić (Marić 1964: 40-43) dates the finds from the necropolis to Donjodolinska II phase, i.e. period from 500 to 360 years BC. Among chance finds from necropolis we find chronologically very diverse material, like different types of double pins (Marić 1964: T. XIII/3, 4), which R. Vasić dates into a very long period from the VII to II century BC (Vasić 2003: 118-120, 123-126),⁸ then sev-

⁷ Isolated examples typologically similar to ours are discovered at Căpâlna site in Romania (Glodariu, Moga 1989: T. XII: 10,12).

⁸ For the territory of western Bosnia and Herzegovina, dating is closer to the V and IV century BC (Vasić 2003: 126).

eral examples of bronze buttons (Marić 1964: T. XIV/15, 20), which can be based on analogies be dated to the VII and VI century BC (Videski, Temov 2005: 17-18, kat. 71-81), but also three-looped and one-looped astragal belt buckles (Marić 1964: T. XIV/24, 28, 29), dated to the III century BC by S. Arsenijević. The appearance of such a chronologically diverse finds does not surprise, having in mind that burials are continuously practiced at Donja Dolina from the beginning of the VII century BC, to the final decades of the II century BC (Marić 1964: 32-49). On the other hand, no finds from enclosed contexts originate from Kablarovac, so in terms of chronology we must point out finds of a composite bell-shaped belt buckle of astragal belt with button-like decoration (Popović 2003: T. 4/14), which S. Arsenijević dates to the end of the III and II century BC (Арсенијевић 2013: 56-57), and finds of Laminici type belt buckles (Popović 2003: T. 5/11, 12) dated to the III and I century BC (Арсенијевић 2013: 74-75), as well as one Middle La Tène fibula which P. Popović based on similar examples from Baraće site in Đerdap and Čubursko brdo site near Negotin dates to the end of the III and the beginning of II century BC (Popović 2003: 313, T. 4/2).

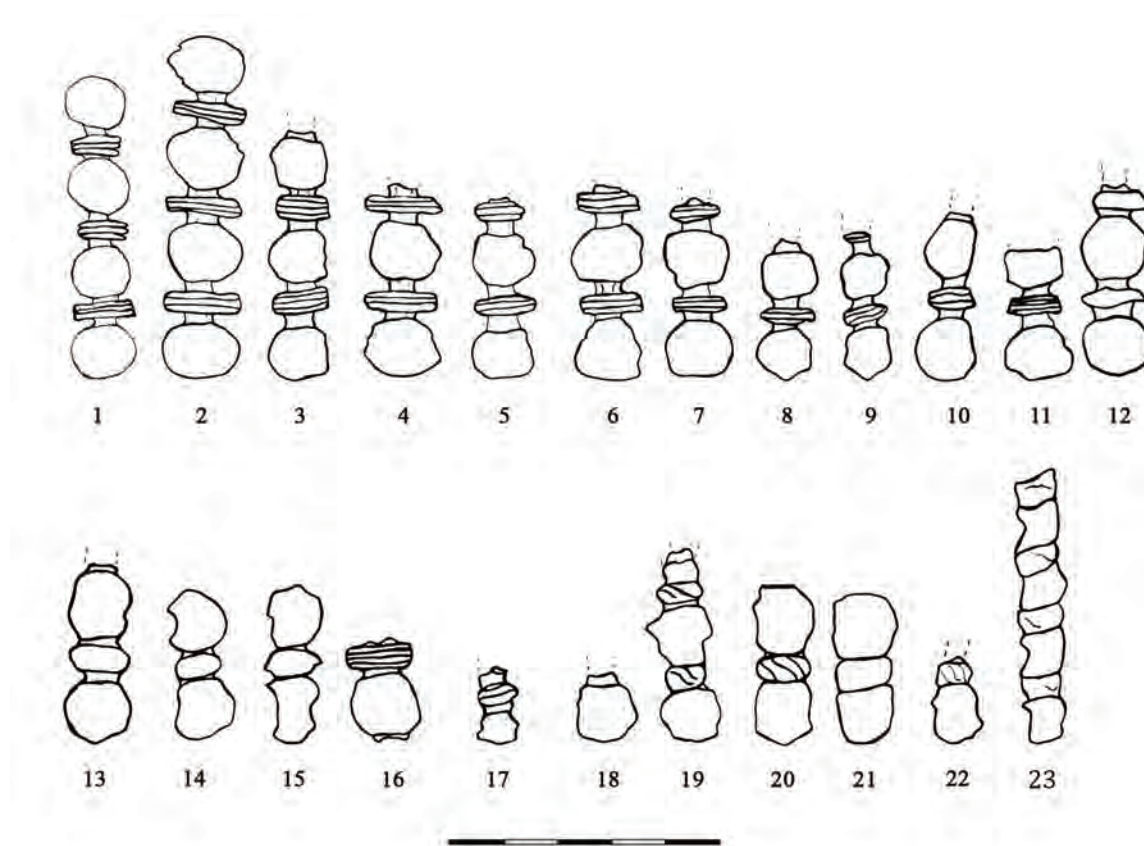
The chronology of astragal belt segments that make up astragal belt from Kablarovac, can be very useful in determining the chronology of the belt itself. As previously noted, all segments of this belt are classified into the Srem type, Osijek variant, for which we find numerous analogies on the territories of Srem and Hungary (Filipović, Mladenović 2017:161, karta 2). Based on grave finds from Novi Jankovci, and Vinkovci (Silos site), as well as from sites Beremend, Szárazd-Genyápuszta, Mözs-Tolna, and Kosd in Hungary, M. Dizdar and A. Tonc date the upper chronological border for the appearance of this type of astragal belt segments to the VI century BC (Dizdar, Tonc in print), bearing in mind that based on similar finds from Grave 1 of Mound XV at the Paulje necropolis, where they appear together with bronze bracelets with crossed and slightly thinned

ends, this chronological border could be placed even to the end of the VII century BC (Булатовић, Филиповић, Глигорић 2017: 132-134, кат. бр. 51-58). The lower chronological border is defined solely by Grave 26 from Osijek, which is dated to the end of the III and the beginning of II century BC (Dizdar, Tonc in print).

Considering all of the aforementioned, dating of astragal belt from Kablarovac represents an undisclosed issue for now, having in mind that the finds discovered at sites where this belt buckle type appears (Donja Dolina and Kablarovac) are dated into a very long period from the end of the VII to I century BC. Based on the type/variant to which the segments of the belt are classified, the lower chronological border could be dated to the end of the III and the beginning of II century BC, which is also the lower chronological border for appearance of this type of astragal belt segments. Precise defining of the upper chronological border is significantly uncertain, primarily to the fact that this type of belt buckle appears with chronologically diverse finds. Based on those finds and the chronology of segments, upper chronological border could be dated to the VI century BC, although based on the constructive elements of the buckle, and the fact that it could represent a certain phase of evolutionary development from the three-looped to bell-like belt buckles, our opinion is that the upper chronological border should be dated to the IV century BC. Such a wide chronological span in dating could be more precisely determined by the fact that the finds from Kablarovac are dated to a period from the III to I century BC (Popović 2003: 312-313). Considering this, dating of the astragal belt from Kablarovac could rather be placed into the III or the very beginning of II century BC,⁹ but earlier dating should not be excluded.

Speaking of chance finds of astragal belt segments from Gradina – Ilinci – Vašica area, they can only be dated based on the chronology of the belonging type/variant. Examples classified into

⁹ S. Arsenijević also dates belt buckle from Donja Dolina into the III century BC (Арсенијевић 2013: 56-57, tab. 12).



T. I Segments of astragal belts discovered in Gradina – Ilinci – Vašica area.

the Osijek variant (Srem type) (T. I/1-17) are dated to the period from the VI to III or the beginning of II century BC, examples classified into the Belgrade variant (Srem type) (T. I/18-21) into the II and I century BC, while example classified into the Dunaszekcső type (T. I/22) is dated into the period from the mid II to the end of I century BC (Filipović, Mladenović 2017).¹⁰

* * *

Astragal belt from Kablarovac to a certain extent complements our previous knowledge of appearance of various types of astragal belts, which depends both on belt buckle type, and also on the type of accompanying belt segments. It also fits into previously suggested concept of the center of production and distribution of this type

of segments in the territory of Srem (Filipović, Mladenović 2017). The type of belt buckle can be pointed out as a certain specifikum of this belt, as it represents a lone find in the territory of Srem, while similar example was found only in Donja Dolina. Such observation could in a certain way point out to distribution and use of this type of belt buckles on a wider territory of Sava river region. Likewise, future finds could provide answer to the issue of precise chronological positioning of this type of belt buckles, and at the same time issues of the initial territory, from which the distribution could be followed. On the other hand this could contribute to solving certain issues concerning the reasons for switching the place of production for some of the astragal belt segment types.

¹⁰ Such dating of the Dunaszekcső type segments has to be taken with a certain caution, since the number of segments coming from enclosed contexts is low.

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REZIME**ASTRAGALNI POJAS IZ KAB-LAROVCA I NEKOLIKO SLUČAJNIH NALAZA IZ OKOLINE ŠIDA**

KLJUČNE REČI: ASTRAGALNI POJAS, KOPČA, ČLANCI ASTRAGALNIH POJASEVA, GRADINA NA BOSUTU, SREM, MLADE GVOZDENO DOBA, TIPOLOGIJA, HRONOLOGIJA.

U radu se prikazuje astragalni pojas koji je otkriven 1989. godine prilikom arheoloških istraživanja lokaliteta Kablarovac nedaleko od Gradine na Bosutu, kao i nekoliko slučajnih nalaza članaka astragalnih pojaseva iz okoline Šida, koji se danas čuvaju u Zavičajnoj arheološkoj zbirci. Na astragalnom pojasu iz Kablarovca sačuvano je devet kompletnih i pet fragmentovanih bronzanih članaka, kao i jedna fragmentovana pojasna kopča, koja se sastoji od pravougaone pločice na čijoj su zadnjoj strani očuvani otvori za pričvršćivanje na pojas. Sa pločice polaze dva kraka, koja su se spajala, i time formirala pravilno trougaono polje. Unutar njega, nalazi se jedna veća romboidna perforacija, kao i dve manje, trougaone perforacije. Jedini primerak sličan kopči sa Kablarovca nalazimo u Donjoj Dolini, kao slučajan nalaz sa nekropole starijeg gvozdenog doba. Kompletno sačuvani članci ovog pojasa se sastoje od po četiri kalote, tri poprečne prečage, i četiri rupe za prišivanje pojasa. Poprečne prečage su na svim člancima ukrašene sa po dva horizontalna ureza. Četiri članka imaju očuvane po dve kalote, i dve poprečne prečage, dok je na jednom članku sačuvana samo jedna kalota i jedna poprečna prečaga. Kod fragmentovanih članaka broj rupa za prišivanje pojasa odgovara broju kalota, a poprečne prečage takođe su ukrašene sa po dva horizontalna ureza. Na osnovu kružnog oblika kalota, te jasno izdvojenog prelaza iz kalote u poprečnu prečagu, ali i karakterističnog ukrasa koji je sačinjen od urezanih horizontalnih linija, svi članci ovog pojasa mogu su opredeliti u tip Srem, varijantu Osijek. Ova varijanta članaka najviše je zastupljena na teritoriji današnjeg Srema,

dok joj se distribucija vezuje za prostoru teritoriju između jezera Balaton u Mađarskoj i Mačve u Srbiji, te dalje na istok prema ušću Velike Morave u Dunav, ali su slični primerci poznati i sa teritorije Slovačke i Rumunije i prema jugu, u basenu Južne Morave. Članci pojasa iz Kablarovca slični su jednom od ranije publikovanih primeraka sa istog lokaliteta, te primercima iz Donje Doline, Vučedola kod Vukovara, Donjeg grada u Osijeku, Nikinaca, Čaira kod Starog Kostolca, Batine, kao i primerku sa nekropole Paulje u Brezjaku. Srazmerno veći broj primeraka sličnih našem nalazimo i na lokalitetima Beremend, Lengyel, Gerenyápuszta, Regöly, Kosd i Mözs-Tolna na teritoriji Mađarske. Na osnovu pokretnih nalaza iz grobova iz Novih Jankovca i Vinkovaca (lokalitet Silos), te Beremenda, Százard-Gerenyápuszte, Mözs-Tolne i Kosda u Mađarskoj, M. Dizdar i A. Tonc postavljaju gornju hronološku granicu pojave ovog tipa članaka u drugu polovinu VI veka pre n.e., s tim da bi se na osnovu sličnih nalaza iz groba 1 humke XV sa Paulja, gde se javljaju i bronzane narukvice sa prebačenim i blago stanjenim krajevima, ova granica mogla pomeriti čak i u kraj VII veka pre n.e. Donja hronološka granica za ovaj tip članaka definisana je jedino grobom 26 iz Osijeka, koji je opredeljen u sam kraj III ili početak II veka pre n.e.

U zavičajnoj arheološkoj zbirci u Šidu čuva se i 22 članka astragalnih pojaseva, različitog stepena očuvanosti. Samo je jedan članak u potpunosti očuvan, po jedan članak ima očuvane četiri, odnosno tri kalote, 15 članaka ima očuvane dve kalote i na četiri članka je očuvana samo jedna kalota. Svi oni su slučajni nalazi koji su otkriveni na pomenutom potesu Gradina – Ilinci – Vašica. Tipološki posmatrano, svi prikazani članci mogu se opredeliti u tipove Srem (varijante Osijek i Beograd) i Dunaszekcső. Primerke koji pripadaju varijanti Osijek (tip Srem) trebalo bi opredeliti u period od VI do III ili početka II veka pre n.e., a primerke varijante Beograd (tip Srem) u II i I vek pre n.e., dok bi primerak tipa Dunaszekcső pripadao periodu od sredine II do kraja I veka pre n.e.

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ROMAN BRICK KILN FROM THE EASTERN NECROPOLIS OF VIMINACIUM

ABSTRACT

During the construction of water supply network for the Viminacium archaeological park in 2013, the brick kiln on the site Pirivoj was discovered. More specifically, the kiln was found on the eastern part of city necropolis. The biggest number of brick kilns at Viminacium was discovered on the southern city's necropolis during the 1980's, and three kilns were found at the site Pećine within the craft center. The newly discovered kiln at the site Pirivoj was built from unfired bricks and mud mortar, with a minimal use of brick. It belongs to the type of the combustion kiln with a single channel. The furnace chamber and grill kiln have been preserved to a greater extent, while the firing chamber was only partially conserved with walls in the height of 70 cm. A vaulted firing port was located on the west side. Based on the layers within the kiln, two phases of use can be distinguished. Beneath the furnace chamber floor, an ancient well was found and which was used at the time before kiln was built. Based on small objects kiln is dated to the 3rd century AD.

KEYWORDS: BRICK KILN, BRICK PRODUCTION, NECROPOLIS, PIRIVOJ, VIMINACIUM, 3RD CENTURY AD.

INTRODUCTION

During the construction of water supply network for the Viminacium archaeological park in 2013, the brick kiln on the site Pirivoj was discovered.¹ It presents the first brick kiln discovered on the eastern part of city necropolis, regarding that all other similar kilns were found on the southern city necropolis or on the area western from the Mlava River, at present day Kostolac

(Fig. 1). Although during the research no evidence about the owner of this brick was found, the position of brick, its dating, and specific construction led researchers to open new questions on brick work-activity at Viminacium.

BRICK KILNS AT VIMINACIUM

Viminacium is a roman city, situated on the right bank of Mlava River, near the confluence of Mlava and Dunav River, in close vicinity to present day Kostolac. Viminacium was formed in 1st century AD as a military camp of legion VII Claudia, whereas subsequently civilian settlement

¹ The article results 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, digitalization and 3D visualization (no 47018)*, funded by The Ministry of Education, Science and Technological Development of the Republic of Serbia.

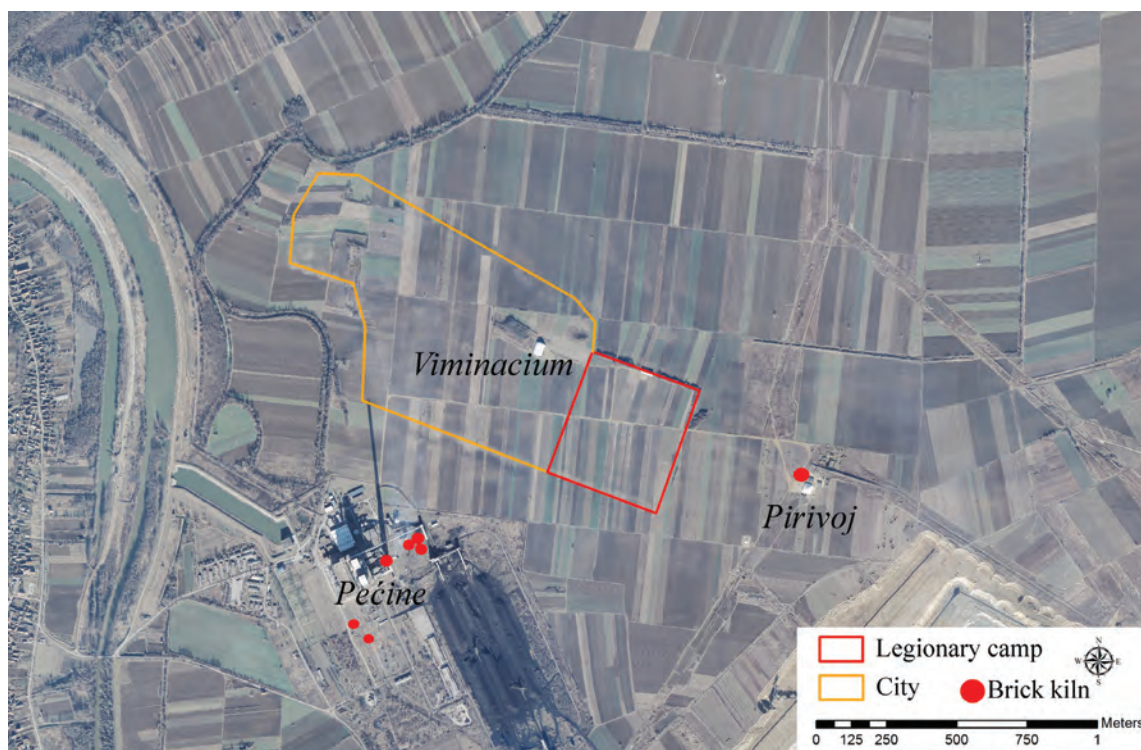


Fig. 1. Viminacium – location of excavated brick kilns.

emerged from the camp. It was the biggest city and the capital of Roman province of Moesia Superior, while in late Antique it becomes the capital of Moesia Prima (Спасић-Ђурић 2002: 21). At the time of Emperor Hadrian in 117 AD Viminacium obtained the status of *municipium*, while in 3rd century AD the city was in full development, as it is evidenced by the fact that at that time, in 239 AD during the reign of Gordian III the city received status of *colonia* (Mirković 1986: 21-59; Спасић-Ђурић 2002: 25). Viminacium was devastated by Huns in 441 AD.

During many years of research, at the sites close to the city of Viminacium, 16 brick and 20 ceramic kilns have been discovered, which testifies that ceramic and brick production was very well developed at Viminacium. Since bricks were one of the main building materials in Antiquity, it is not surprise that the big number of brick kilns were found. The bricks from Viminacium are found throughout the territory of Moesia and a part of Pannonia, indicating that its consistent

quality during the continuous production from 1st to 4th century AD, production and trade were very well-organized (Спасић-Ђурић 2002: 121). The first three brick kilns were discovered in 1956 in Novi Kostolac (Ненадовић, Јуришић 1956: 129-130). The kilns were arranged in a triangle, built on the same principle.² Most of the brick kilns at Viminacium were discovered between 1977 and 1992, during protective excavations of the southern city's necropolis, at the area of Thermal power plant Kostolac B. As noted by Č. Jordović, in the area of the southern city's necropolis, at sites Pećine and Livade kod ćuprije 11 brick kilns and 14 ceramic kilns were discovered (Јордовић 1994: 96). However, not all kilns were published, only those from the area of Craftsmen center (Јордовић 1994: 96-104, ceramic kilns number 4-7 and brick kilns number 8-10). The Crafts-

² During 2015 in Novi Kostolac, western from Mlava River, inside the Thermal power plant Kostolac A, a new brick kiln was discovered, which is preliminary dated to the late Antiquity. At the moment, researchers are analyzing the kiln and preparing it for publication.



Fig. 2. Brick kilns from the craftsmen's centre on the site Pećine during the excavations (after Nikolić 2013: 28, Fig.12).

men center (ceramic-brick complex) consisted of three brick kilns and four ceramic kilns, a well, and a porch for the production and drying of the products, which were found in an area of about 700 m² (Fig. 2). A. Raičković analyzed pottery from Craftsmen center and published another four pottery kilns from this area (Raičković 2007: 13, kilns number 1-3, 11). In the following years, three brick kilns and four ceramic kilns from the site Pećine were published (Raičković, Redžić 2006: 81-106). One brick kiln was found below the chimneys of today's thermal power plant Kostolac B, while two more were found near the early Christian memoria, Church A and Church B. All discovered kilns have been dated to the end of 2nd and throughout 3rd century. Since most of the kilns had brick stamp of *Legia VII Claudia*, they are interpreted as military kilns. Newly discovered kiln in 2013 at the site Pirivoj is the first brick kiln excavated in eastern necropolis, where so far only one ceramic kiln was found (Raičkov-

ić, Vuković 2009: 7-11). Those studied ceramic kilns differ from brick kilns, since they were smaller with a basis circular in shape. However, the objects found inside the furnace chamber in some of the ceramic kilns showed that sometimes inside them bricks could be found or vice versa (Jeremić 2001: 133-134). Nevertheless, in this paper we will accept the traditional division and all the kilns with circular basis we will observe as ceramics, and all which are rectangular in shape will be observed as brick kilns. Since ceramic kilns are not the subject of this paper, they will not be further discussed.

THE SITE PIRIVOJ

The site Pirivoj is located eastern from the military camp of *Legio VII Claudia*. The excavations of this site begin in 1997, and were intensifying in 2002-2007. At this area, a large number

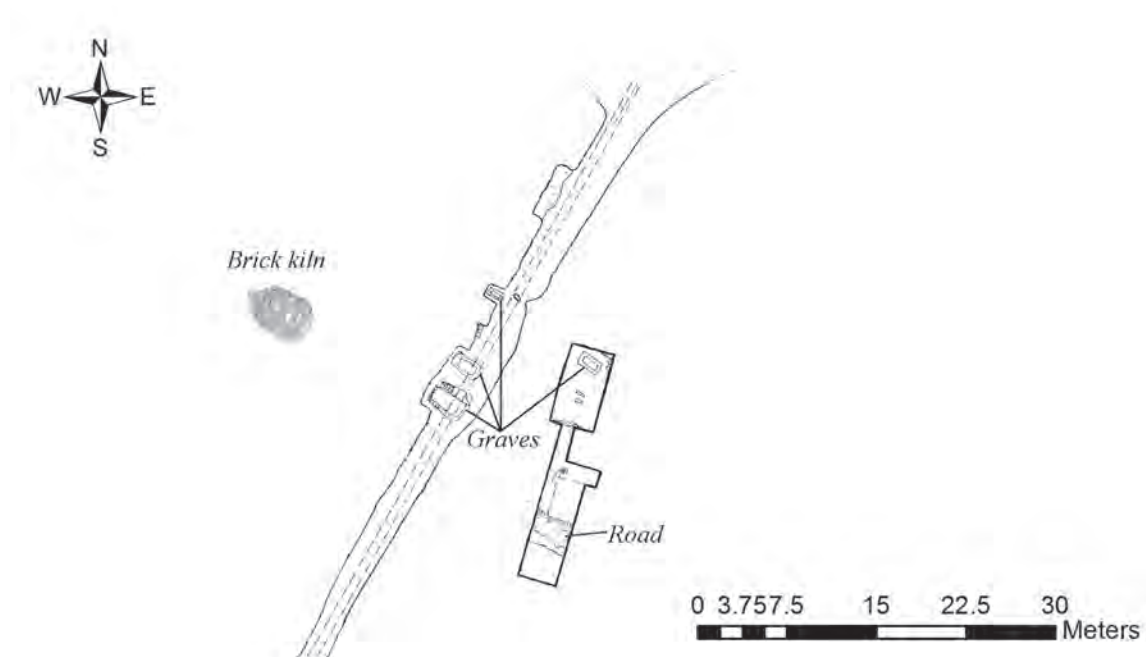


Fig. 3. Section of the site Pirivoj with position of excavated kiln, graves and road.

of graves have been discovered, which together with graves found at sites Kod Koraba and Nad Klepečkom belongs to eastern necropolis (Golubović, Korać 2015). The graves are dated to the end of 1st century AD to the 4th century AD. There are finds of cremations, inhumation burials in simple burial pits or burials in wooden or brick coffins (Golubović 2008; Redžić 2008), and one luxury fresco painted tomb (Korać 2007: 261, G 160). The most significant finding is the discovery of the mausoleum, which was built of large stone blocks and surrounded by a fence wall, dated to the middle of the 3rd century (Korać, Golubović and Mrdić 2009: 91-95). An area southwest from the necropolis was investigated and based on small objects it is dated to the beginning of 2nd to the beginning of 4th century AD and interpreted as landfill of material from the sacrificial surface of the necropolis (Raičković, Milovanović 2010: 7-56; Vuković 2010: 57-82).

The newly discovered brick kiln was found 425 m from the eastern gate of the military camp, near the road that from the camp led to the east, to Veliko Gradište (Pincum) and which was also at-

tested on the aerial photo. The road has been also confirmed by excavations and it is located in the immediate vicinity of the brick kiln, and the nearest graves are 12 m far from the kiln (Fig. 3).³ According to the reconstruction of road directions, the brick kiln was located only a few meters away from the road.

THE NEWLY DISCOVERED BRICK KILN

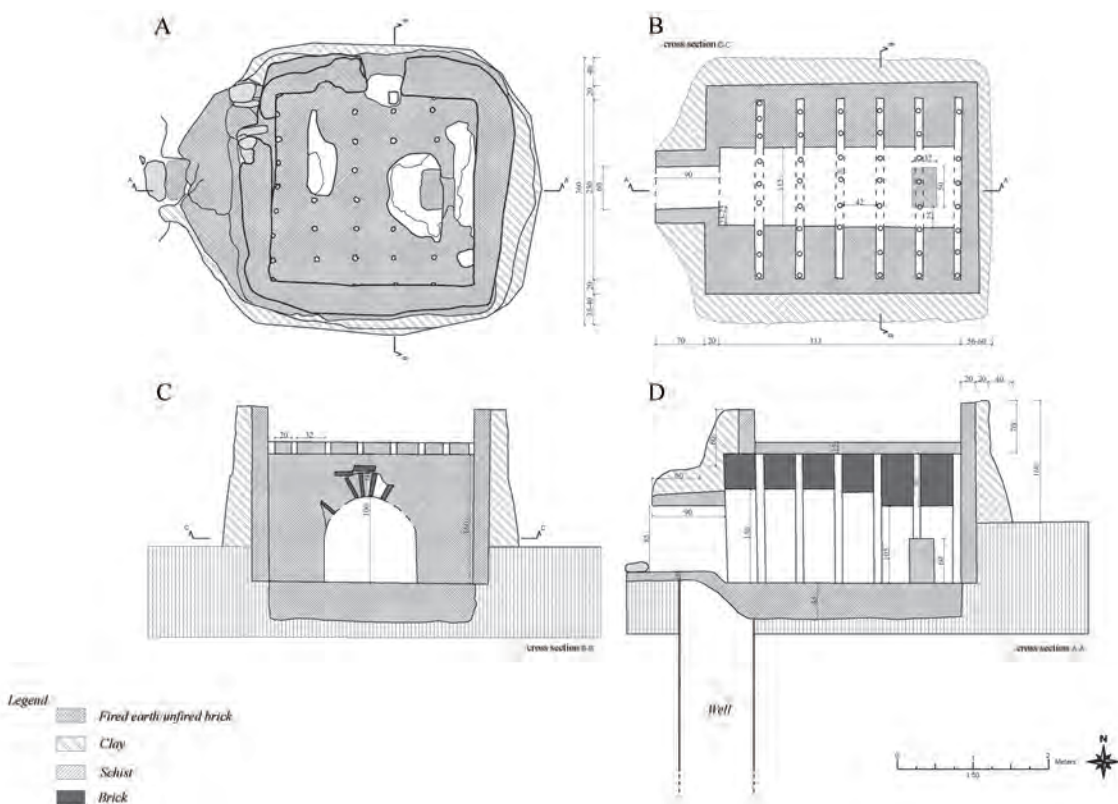
During the excavations in 2013 a brick kiln was discovered, with external dimensions 4.30 x 3.60 m, and height 2.30 m (Fig. 4, 5).⁴ The furnace chamber and grill have been preserved to a greater extent, while from the upper chamber only walls were partially conserved. The kiln was built from unfired bricks coated with mud, while the bricks were used only for arched elements of the furnace

³ Documentation of the Archeological Institute, project Viminacijum.

⁴ In order to investigate the kiln, a trench 5x5m was opened. The excavation team members were Mladen Jovičić, Bebi-na Milovanović, Svetlana Petaković and Ilija Danković.



Fig. 4. Remains of brick kiln from the site Pirivoj.



chamber. It is oriented towards west-east with an opening to the west. The kiln is dug into 80 cm deep sterile soil and above it at 1 m into the cultural layer of 2nd century AD. Since the kiln is located within the archaeological park where it will be presented to the public, it couldn't be deconstructed and the cross sections couldn't be made. Constructional parts of the kiln were reconstructed on the basis of external observations and according to the analogies with the so far explored kilns.

According to an ideal reconstruction, each kiln consists of: 1) prefurnium – furnace chamber with an opening, main tunnel and the side tunnels; 2) the grill – floor of the upper chamber on which unfired bricks were placed; 3) the upper chamber, where the baking process is carried out (Fig. 6). The bricks were first dried in the open air, and after they were placed on the floor of upper chamber, while the fire was stocked up in the lower chamber, and the hot air was circulated through the round opening of the grill to the upper chamber. Upon completion of stacking bricks, the upper lining of the kiln was coated with mud, and the dome or roof was formed (Jordović 1994: 103). The furnace chamber of kiln was dug into sterile soil, while the place for bricks was above ground, which is also the case with kiln from Pirivoj site. The upper chamber presents the place where baking of bricks was taking place. The chamber could have had a shape of dome or truncated pyramid (Jordović 1994: 104). On top of it there must have been an opening that improved air circulation. The chamber above the grill went to a height of 2 m, which is the case with modern rural kilns in Požarevac region, as well as with the kiln from Pompei (Jeremić 2011: 151). Upon completion of the baking process, the roof covering was taking off and the bricks were extracted. At the next baking, the process was repeated and structural walls were coated with a new layer of clay (Raičković 2007: 15).

The remains of the upper chamber of the kiln from Pirivoj were found on the relative depth of 30 cm (Fig. 7). The height of the chamber walls was maximum 70 cm. The dimensions of the chamber

were 2.70 x 2.50 m. The walls were built of unfired bricks, with a 2 cm thick clay coat, of which three layers of coating were visible. The walls from unfired bricks were 20 cm thick, and their external surfaces were covered with 20-30 cm of clay. Small parts of the kiln walls mixed with soil, pieces of broken bricks, *tegulae*, *imbrices*, floor tiles and pottery fragments were found inside the upper chamber.

The kiln grill was formed with the layer of unfired bricks with a thickness up to 15 cm, which were placed down on the pillars and arches of the furnace chamber. After burning the unfired bricks were merged into one monolithic structure. It had a 8 x 6 rows of holes for the flow of hot air (only the most western row had 9 holes), which were approximately 7 cm in diameter. The distance between the openings is 45-50 cm over a one axis, or 33 cm per second axis. On the grill two damages are visible: on the west the one recently formed due to construction of water supply network for the Viminacium archaeological park; on the east the big damage that was formed during Antiquity. Work kiln temperature was typically varied from 950 to 1000° C. In the case when the temperature was higher than 1200° C, it could cause vitrification, melting of unfired bricks and clay, which could therefore formed stalactites (Jeremić 2001: 152, note 67). This phenomenon was visible throughout the eastern half of the kiln, the grill and the pillars of the furnace chamber were damaged and melted, and larger pieces of grill were found inside the furnace chamber.

A vaulted firing port was placed on the west side (Fig. 8). The walls and barrel vault were made from the unfired bricks. The entrance had dimensions of 85 x 60 x 85 cm. The floor of the opening was made of burnt clay, with thicknesses up to 20 cm. At the vaulted construction the the clay layer was placed in the form of the calotte.

The furnace chamber consists of a central tunnel, orientated west-east, with dimensions 3.30 x 1.15 m, and the 6 side tunnels, orientated north-south, with dimensions 70 x 10 cm, and with

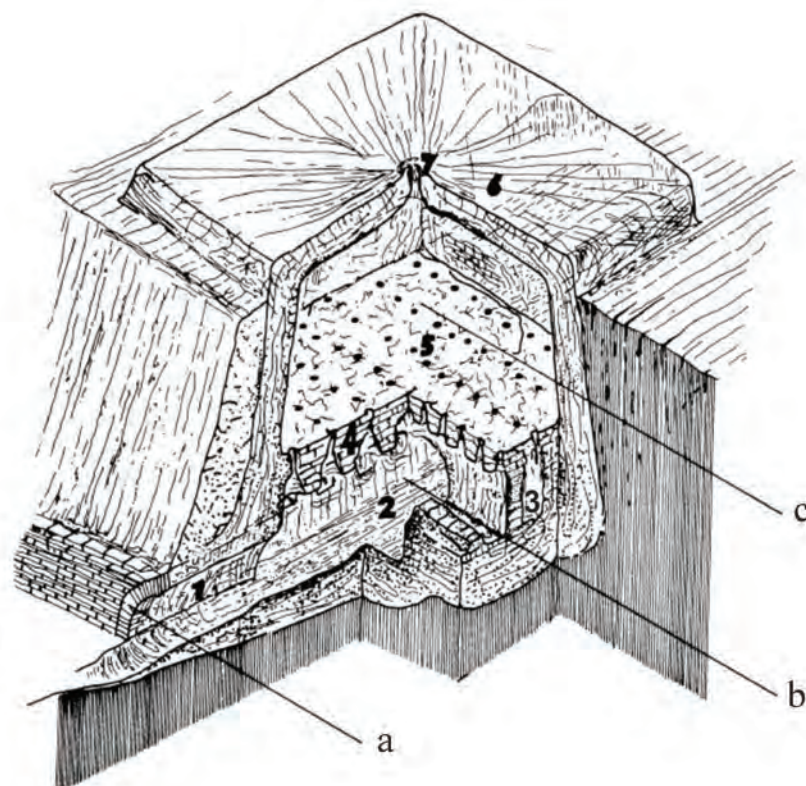


Fig. 6. The brick kiln - reconstruction: a) prefurnim; b) furnace-chamber; c) upper chamber; 1) vaulted firing port; 2) main tunnel; 3) side tunnel; 4) arch; 5) grill; 6) truncated pyramid roof of the upper chamber; 7) vent for smoke (after Јордовић 1994: 104, Pl.3).



Fig. 7. Brick kiln from Pirivoj – remains of upper chamber and grill.

height 1.60 m (Fig. 9). It was dug into the soil and was formed with six cross walls which were connected with arches and then formed a false vault. The height of central tunnel was 1.30 m on the west and 1.05 m on the east. The width of the cross walls is 42 cm, and height from the floor to the grill was up to 1.60 m. The arches between cross walls were formed with unfired bricks and *tegulae* bonded with clay. The space above the arch to the grill was filled with four layers of horizontal placed *tegulae*, which were also bonded with clay. In the eastern part of the central tunnel, between the fifth and sixth cross wall, there was a pillar made from unfired bricks. It had dimensions of 50 x 30 x 60 cm. Since so far researchers didn't find any analogies, it has been hypothesized that its function was probably for better air circulation or that these pillar allowed less burning space which enabled higher temperature. Above this pillar, the damages of the grill, walls and arch were detected, probably caused by the highest temperature during the last use of the kiln. All the interior surfaces of the furnace chamber were lined with several layers of clay mixed with chaff.

The floor of the kiln was dug into the sterile soil. After burning, the layer of fired soil was formed, with the thickness of up to 45 cm. During the excavations two levels of floor were detected (Fig. 10). After the burning, above the original floor, the first layer of hard gray ash, with a thickness of 3 cm was formed. Over this, the layer of compact soil, with the thickness of 18-20 cm, was placed and on that way floor was leveled. The pieces of broken bricks mixed with clay were lined up and the second floor was formed. Above this floor, the second layer of ash was observed, with a thickness of 5-10 cm. On the basis of this layers it is possible that the kiln was completely restored, which was also visible in the cross walls of the furnace chamber and the walls of the upper chamber which were lined with three layers of clay. It could be hypothesized that this kiln was used for a longer period, which is not uncommon, since the restoration were also noticed on the oth-

er kilns found at Viminacium (Raičković 2007: 11-12; Jordović 1994: 100).

In front of the kiln opening there was a pit which was only partially excavated. The pit was spreading toward the west and it was deeper than the floor of the furnace chamber opening. By analogy with so far explored kilns at Viminacium, the pit had probably large dimension and was used initially as a source of clay, and then after as a working space and fuel deposit.

The biggest surprise during the excavations was a finding of roman well (Fig. 11). It was at the entrance to the furnace chamber, beneath the floor of burned soil. This well was in use at the time before the construction of the kiln; it is filled and probably forgotten before construction of the kiln. The well has a diameter of 1.0 m, it is circular in shape, and it was dug into a layer of sterile soil. It is found at the relative depth of 2.5 m and excavated to a depth of 5.5 m, after which excavations were stopped since there were no safe conditions for further diggings. It is filled with a dark soil in which the pottery fragments were found and dated to the 2nd and the beginning of the 3rd century AD. The well is important since it represents the *terminus post quem* for the dating of the kiln.

However, certainly when digging up the hole for the construction of the kiln, Roman craftsmen have come across a circular hole with different soil hardness and which was not stable as the rest of the excavated area. It could be suggest that nevertheless they decided to fill up the well, and to build up a kiln above, since the digging of a new place would require a lot of time and effort. In addition to the well, next to the kiln two waste pits (pit 1 and 2) were found, which are dated to the period prior to its construction.



Fig. 8. Vaulted firing port and pit located western from the kiln.



Fig. 9. Main tunnel and pillar in the east part of the kiln.



Fig. 10. Floor of the furnace-chamber with two layers of ashes above it.



Fig. 11. Remains of well under the floor of the furnace-chamber.

THE FINDS

A small number of movable finds were found in the cultural layer in which the kiln was placed and also from the pit 2, and they are presented in the Table 1 and 2. Among the metal finds, there were pieces of military equipment (fitting belt, strap terminal, circular application, part of the scale armor - *lorica squamata*). A fitting belt rectangular in shape (T. I. Fig. 1) has a profiled narrow ends in the form of pelta and a horizontally engraved fluting in the middle. Two perforations were used for fastening the leather strap. More than 50 copies of this type are known from the area of Upper Moesia and it is assumed that there was a produced center for this kind of fitting belt. Most of the examples from Viminacium were found in graves with coins of Hadrian. Therefore, it is considered that this period presents a beginning of its production, which continued until the end of the 2nd century AD. Identical example was found at the same site and belongs to the type XVII / 4 (Pirivoj, C-559; Redžić 2013: 192, T. XLVI, Fig. 419). Part of the strap terminal (T. I. Fig. 2) is stored in the form of a double bent bronze band with two rivets for fastening the belt. From the pendant only a square ring is preserved, while the sword-shaped terminal is missing. The strips are atypical in shape, profiled in the middle and no direct analogies were found. This type is more common from the second quarter to the end of the 2nd century AD, although there are also finds from the late Antique period (Redžić 2013: 323, T. LXX, 812-814). One piece of the scale armour (*lorica squamata*; T. I. Fig. 3) was found in pit 2, which is older than kiln. This piece of equipment is often found in military camps along the middle and lower Danube (Vujović 2013: 32-33, Pl. I, 14, 36, Pl. III, 7). It has two perforations on both lateral sides and one the upper side. The lack of perforations which are used to connect scale with upper and lower rows, are dating this piece of armour in the first half of the 2nd century AD (Radman-Livaja 2004: 79, 177-179, T. 28-30).

An intensely profiled bronze fibulae of so-called Black Sea- Danubian Basin type is mostly present in the territory of Upper Moesia. In Viminacium, there are over sixty examples of this type distributed in six variants. An example from the layer (T. I. Fig. 4) belongs to a third variant, characterized by a thickening of the bow, as well as wide flat foot. Fibulae of this type are dated to the end of the 1st century to the middle of the 3rd century AD (Redžić 2007: 25-26). Most of the other findings belong to chronologically insensitive material (the stylus, fragmented medical or cosmetic instruments, bone sewing needle, triangular arrowhead; T. I. Fig. 5-14).

Among the ceramic finds, lamps are dominated. The best preserved lamp (T. II. Fig. 15) was the one with two rounded and elongated nozzle with volutes. On the disk rosette is depicted. It has leaf-shaped handle, while the base is formed in the shape of a ring. On the territory of Viminacium these examples are dated from the period of Tiberius to Septimius Severus (Korać 1995: 76-80). According to the typology fragmented lamps (T. II. Figs. 16-19) belong to type with a rounded-nozzle. These examples are the most common finds in almost all the Roman provinces, and also in Viminacium where these lamps are the most numerous after the lamps with stamps (firma lamp). With a number of variants and the sub-variants, this type of lamps in Viminacium is chronologically determined to the first decades of the 1st century until the first half of the 3rd century AD (Korać 1995: 116). The fragmented lamp (T. II. Fig. 16) with deep body and flat base, has the shape of little bowl, and such forms are typical for late Antiquity (the end of the 3rd and beginning of 4th century), and are often covered with enamel, although there are exceptions, such as the above mentioned example.

Other ceramic finds comprises two irregularly objects, circular in shape, made of clay. The object with the smaller diameter (T. II. Fig. 20) could be used to seal the holes on the grill of the kiln, due to the corresponding diameter. The second

object of a larger diameter (R-13.2 cm; T. II. Fig. 23) could be used for different purposes (weight, floor tile, cover, etc...), and thus its function remains unknown.

The fragmented find made of burnt clay (T. II. Fig. 21), circular in shape with relief radial lines (spokes) on the one side, and the central perforation, represents a wheel of a children's toy (Raičković, Redžić, Rogić 2006: 79, 83, T II, Fig. 11; Premk 1994-1995: 143-155, Fig. 8). The part of the roman terracotta figurine with remains of white engobe represents female thighs with the remains of the legs. Only the front side of figurine is preserved and it was made in mold (T. II. Fig. 22). One can assume that it is a figurine of the goddess Venus. The terracotta figurines are numerous in Viminacium and are assumed to present cheap replacement for figurines made from stone or metal. Those figurines could have had multiple purposes. They were used as votive offering in temples and home chapels and were placed in the graves as a cult objects. The terracotta goddess figurines are often present in funeral deposits and are usually associated with Venus Funeraria (Јовановић 2000: 13-14, 18). However, some of them were also used as a toy (Raičković, Redžić, Rogić 2006: 78, 82, T. I. Fig. 1-5; Pejović 1995: 37-62; Veličković 1957).

During the research of kiln a small amount of pottery fragments was found.⁵ The pottery from the layer in which the kiln was dig into is dated to the 2nd century, and pottery fragments from the well are dated to the 2nd and the beginning of 3rd century. The same case is with above mentioned small finds from the layer, well and pit 2. Small fragments of pottery dated to the beginning of the 4th century were found in the rubble inside the kiln, when the kiln was out of use. Thus, the use of the kiln can be dated somewhere between third decade of the 3rd century and to the first/second decade of the 4th century.

DISCUSSION

This is single tunnel kiln, rectangular in shape, of a standard type (Normaltyp according to Berger), which has been dated to the Roman Imperial period until 260 year AD (Berger 1969: 32). Most of the kilns from Viminacium belongs to this type, such as the kilns from Craftsmen center or the other kilns from Pećine, which are dated to the 2nd and 3rd century AD (Jordović 1994: 99-101; Raičković, Redžić 2006: 84-85). However, such kilns in our region appeared after 260 AD, such as the case with kiln of the same type from Čukujevac near Kraljevo, which is dated to the end of the 3rd century AD (Јамић-Валовић 1985: 21-30); the five kilns from Sirmium dated to the 3rd and 4th century (Jeremić 2001: 144-148, kilns no. 3-7); kilns from Stalać and Bakionica from the 4th century AD (Минић 1991: 313; Бућић, Петровић 1984: 8-15). Therefore, the kiln from Pirivoj dated to the 3rd and the beginning of the 4th century AD is not an exception. At Viminacijumu there are also examples of doubled-tunnelled kiln (Zweikammertip (Berger 1969: 18)). That kiln was found beneath the chimney of Thermal Power plant Kostolac B (Raičković, Redžić 2008: 85-86, the furnace no. 3), and is similar to two kilns from Sirmium (Jeremić 2001: 141-144, furnace no. 1 and 2).

The construction and dimensions of kiln from Pirivoj are similar the the other kilns excavated in Viminacium. Based on the size it belongs to kilns of medium size. The only unusual detail is pillar in the eastern part of the central furnace chamber and so far there are no analogies. All the interior surfaces of the furnace chamber were lined with several layers of clay mixed with chaff, such as the case with other kilns at Viminacium (Raičković, Redžić 2008: 85) or Stalać (Минић 1991: 310) and Sirmium (Jeremić 2001: 143-148). The thickness of the grill of this kiln is 15 cm. The average thickness of the grill from kilns found in Hungary and Germany was from 8 to 20 cm, while in the kilns from Serbia, Slovenia and Albania is from 30 to 37 cm (Jeremić 2001: 150), so this grill from

⁵ The authors are grateful to Snežana Nikolić and Ana Bogdanović, who analyzed pottery finds.

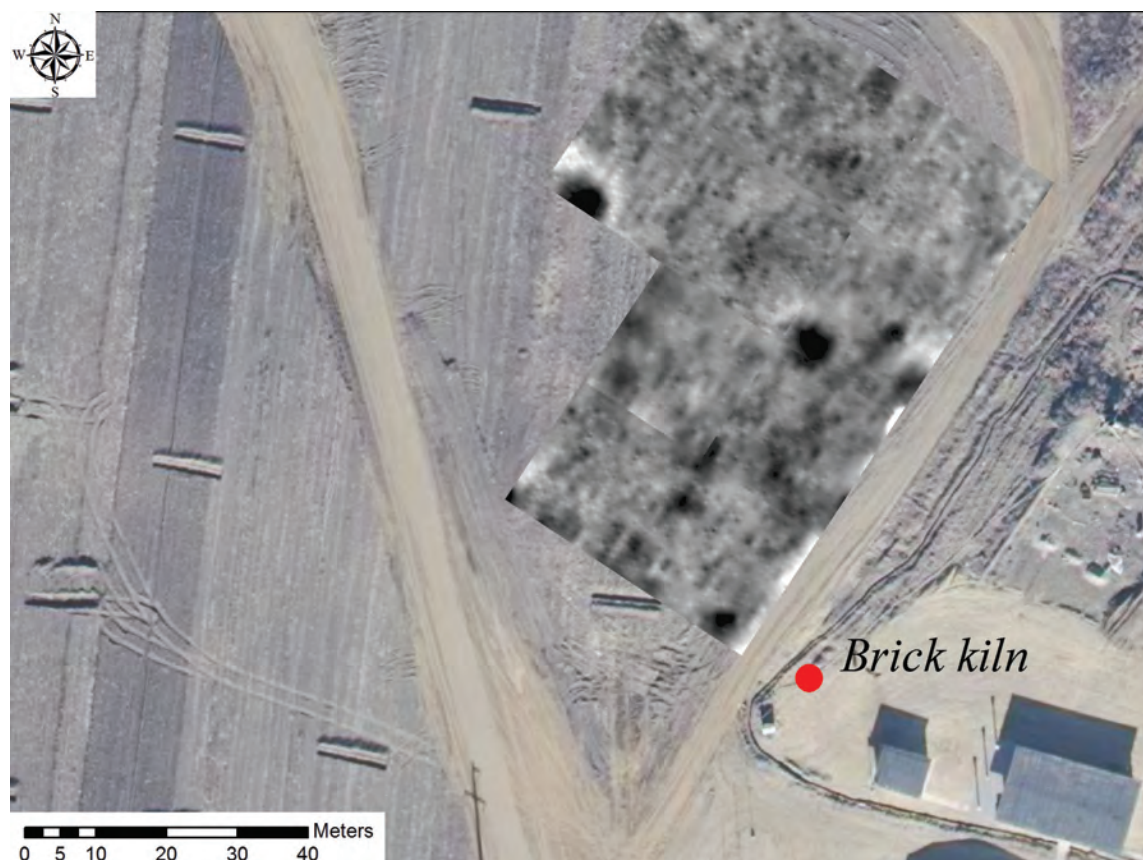


Fig. 12. Section of the site Pirivoj with the results of geomagnetic prospection. North and north-west from the kiln there are anomalies with high magnetic value, which could present remains of the kilns (documentation of Center for New Technology Viminacium).

Pirivoj belongs to thinner. As mention above, a high temperature in the eastern part could cause vitrification, melting of grill and walls (Jeremić 2001: 152, note 67). This phenomenon is noted in the Late Antique kiln from the site Progarski vinogradi in Srem, where scholars considered that the temperature, which caused destruction of the kiln, could be around 1500° C (Dimitrijević 1969: 108). The similar situation is observed for kiln No. 3 from Sirmium, where the temperature was 1200° C (Jeremić 2001: 152, note 67, Fig.18).

The discovery of this kiln raises several questions. First, is it an isolated kiln or it was a part of new Craftsmen center? As seen above, in the case of Viminacium (Jordović 1994), Sirmium (Jeremić 2001) and Stalać (Минић 1991: 314), the kilns are usually made in pair or even more and are part of workshop complex. Workshops were widespread throughout Upper Moesia and in addition to Vi-

minacium, it is considered that the workshops for making bricks existed in Singidunum, Margum, Pincum, Cuppae, Bononia, Diana and Aquae (Mirković 1968: 130-142). This part of the necropolis has not been yet fully explored, but the results of the geomagnetic prospection shows a strong anomaly in the vicinity, so one cannot exclude the possibility that there are more kilns, and that this kiln is part of a Craftsmen center (Fig. 12).⁶

The second question remains open, since the builder or the owner of the kiln is unknown. Roman kiln could be private, military and imperial. In the roman province of Upper Moesia precedence in the production of bricks had military brickyards, and the largest number of bricks was produced in the workshops of the legion VII Claudia (Jevtović

⁶ Geomagnetic prospection was done by experts from the Center for new technology Viminacium. The authors would like to thank Vladimir Miletic for this data.

2013). The brick stamps of this legion were found in the kilns from Craftsmen center, which is also attributed to this military unit and identified as a military workshop (Jordović 1994: 95). Although brick of the military workshop are dominating, bricks with stamps from private workshops were also numerous at Viminacium (Mirković 1968: 141; Spasić-Đurić 2002: 144). Concerning the kiln from Pirivoj, there were no findings of bricks with stamps, probably because the cross section of the kiln was not made, since the kiln is supposed to be presented to the public within Archaeological Park. However, the vicinity of military camp supports the hypothesis that the builders and owners of the kiln could be legionnaires of VII Claudia.

The brick workshops were built outside the urban zones, since outbreak of fire was highly possible and because of more space for work. Furthermore, the proximity to water resources and the quality clay land were very important for these workshops. Kilns from the area south of the city were situated near the necropolis, and this location was abundant of quality soil and located near the Mlava River, although the well was found within the Craftsmen centre (Jordović 1994: 95-96). The kilns from Sremska Mitrovica were also found at the necropolis (eastern necropolis of Sirmium (Jeremić 2001: 131)). Therefore, it is not unusual that kiln from Pirivoj was also found in the eastern necropolis. At Pirivoj a well was also found, which belongs to the phase before the construction of kiln. Since the trench was of smaller dimensions, the remains of well which could be used for the purpose of the kiln, if any, couldn't be fully excavated. Anyway, it can be assumed that in close vicinity there was well or more of them (since it was far from the river) as indicated by the ground water source, documented at this location. Concerning the raw materials, it can be noted that in rural areas around Požarevac kilns of similar construction still exist, and Stig region is known for high-quality clay for bricks (Jeremić 2001: 151, Fig. 30-35). Roman clay pits are found at several Viminacium sites, and the nearest was at site

Rit, which is located 1 km north from this kiln.⁷ At the end of the 19th century Mihajlo Valtrović noted that east from Pećine, at the site Korabe, there was a big clay pit for bricks, which local inhabitants used as building material and considered to have been used by the Romans (Валтровић 1884: 98-99). Based on these findings, one can conclude that Pirivoj was abundant with the quality raw materials. Furthermore, the proximity of communication was very useful for delivering products to the market, and as mention above the communication was very close to the kiln.

CONCLUSION

The brick industry at Viminacium was very active during the entire antique period, from the 1st to the end of the 4th century AD (Jordović 1994: 105). The kiln from Pirivoj is important since it is constructed above the well, used in the 2nd and beginning of 3rd century AD, while the pottery finds from the rubbish are dated to the beginning of the 4th century AD. Therefore, the use of the kiln can be placed to the middle and the second half of the 3rd century AD. It exists at the time of the most intensive development of the city and burying at the necropolis. It is dated to the similar time, as is the case with kilns from Craftsmen center at the south necropolis. This kiln is significant since it could be evidence for new, so far unknown Craftsmen centre.

THE CATALOGUE

1. A fitting bronze belt rectangular in shape with a profiled narrow ends in the form of pelta and a horizontally engraved fluting in the middle. Two perforations were used for fastening the leather strap. Dimensions: 5.2 x 1.8 cm. In the layer, relative depth 60 cm, C-1302.

⁷ Clay deposit, used as a source for raw material throughout the 2nd century AD, was filled in 3rd century AD (Dančević, Petaković 2014: 61).

2. Part of the strap terminal stored in the form of a double bent bronze band with two rivets for fastening the belt. From the pendant only a square ring is preserved, while the sword-shaped terminal is missing. In the layer, relative depth 110 cm, C-1304.
3. One piece of the bronze scale armour (*lorica squamata*) with two perforations on the both lateral sides and one the upper side. Dimensions 4.5 x 2 cm. Pit 2, C-1310.
4. An intensely profiled bronze fibulae characterized by a thickening of the bow, as well as wide flat foot. Length 4.6 cm. In the layer, relative depth 60 cm, C-1303.
5. Silver application circular in shape decorated in repoussage technique. Diameter 2.2 cm. In the layer, relative depth 120 cm, C-1305.
6. Fragment of bronze medical instrument profiled at one end. Length 2.8 cm. In the layer, relative depth 40 cm, C-1315.
7. Fragment of bronze stylus. Only the flat, semi-circular end is preserved. Length 4.4 cm. In the layer, relative depth 120 cm, C-1318.
8. Fragment of bronze item rectangular in shape, with strip intersection. Dimensions 6.3 x 1.9 cm. In the layer, relative depth 145 cm, C-1322.
9. Fragmented iron triangular arrowhead. Length 3.3 cm. In the layer, relative depth 40 cm, C-1316.
10. Fragmented bronze instrument with thickened end. Medical or cosmetrical instrument. Length 10.5 cm. In the layer, relative depth 2 m, C-1313.
11. Bronze sewing needle with rectangular loop. Length 13 cm. In the layer, relative depth 150 cm, C-1320.
12. Fragmented sewing needle with perforations on the top. From pit 2, C-1311.
13. Fragment of bronze chain. In the layer, relative depth 125 cm, C-1317.
14. Miniature hexagonal green glass bead. Length 0.5 cm. In the layer, relative depth 90 cm, C-1301.
15. The lamp with two rounded and elongated nozzle with volutes. On the disk rosette is depicted. It has leaf-shaped handle, while the base is formed in the shape of a ring. Red baked clay. The diameter of the disc is 8.9 cm, the diameter of base is 4.4, height is 8.9 cm. In the layer, relative depth 160 cm, C-1307.
16. The ceramic lamp with deep body and flat base. The disc and nozzle are fragmented. The handle is horizontal with perforation circular in shape. Red baked clay. The diameter is 6 cm. From the layer, C-1308.
17. The ceramic fragmented lamp with flat base and strip handle. Red baked clay. The diameter of the basis is 3.4 cm, height 3.9 cm. In the layer, relative depth 160 cm, C-1309.
18. The ceramic lamp with concave disc and concentric circles. The nozzle is fragmented. It has strip handle. Red baked clay. The diameter of the disc is 7.1 cm, the diameter of the basis is 2.9 cm, height 4.5 cm. In the layer, relative depth 150 cm, C-1319.
19. The flat basis of ceramic lamp with fragmented deep body. The disc has not been preserved. The fragment of the handle is preserved. Red baked clay. The diameter of the basis is 3.8 cm. In the layer, relative depth 160 cm, C-1321.
20. The ceramic item circular in shape (perhaps used as a cover for grill holes?). The diameter 7.9 cm. In the layer, relative depth 125 cm, C-1323.
21. The fragment of ceramic toy wheel, circular in shape with relief radial lines (spokes) on the one side. Red baked clay. The semi-diameter is 3.3 cm. In the layer, relative depth 120 cm, C-1306.
22. The part of the roman terracotta figurine represents female thighs with the remains of the legs (the goddess Venus?). Red baked clay with remains of white engobe. Length 7.2 cm; width 3.7 cm. In the layer, relative depth 120 cm, C-1324.
23. The ceramic item circular in shape. Red baked clay. The diameter 13.2 cm. In the layer, relative depth 240 cm, C-1314.

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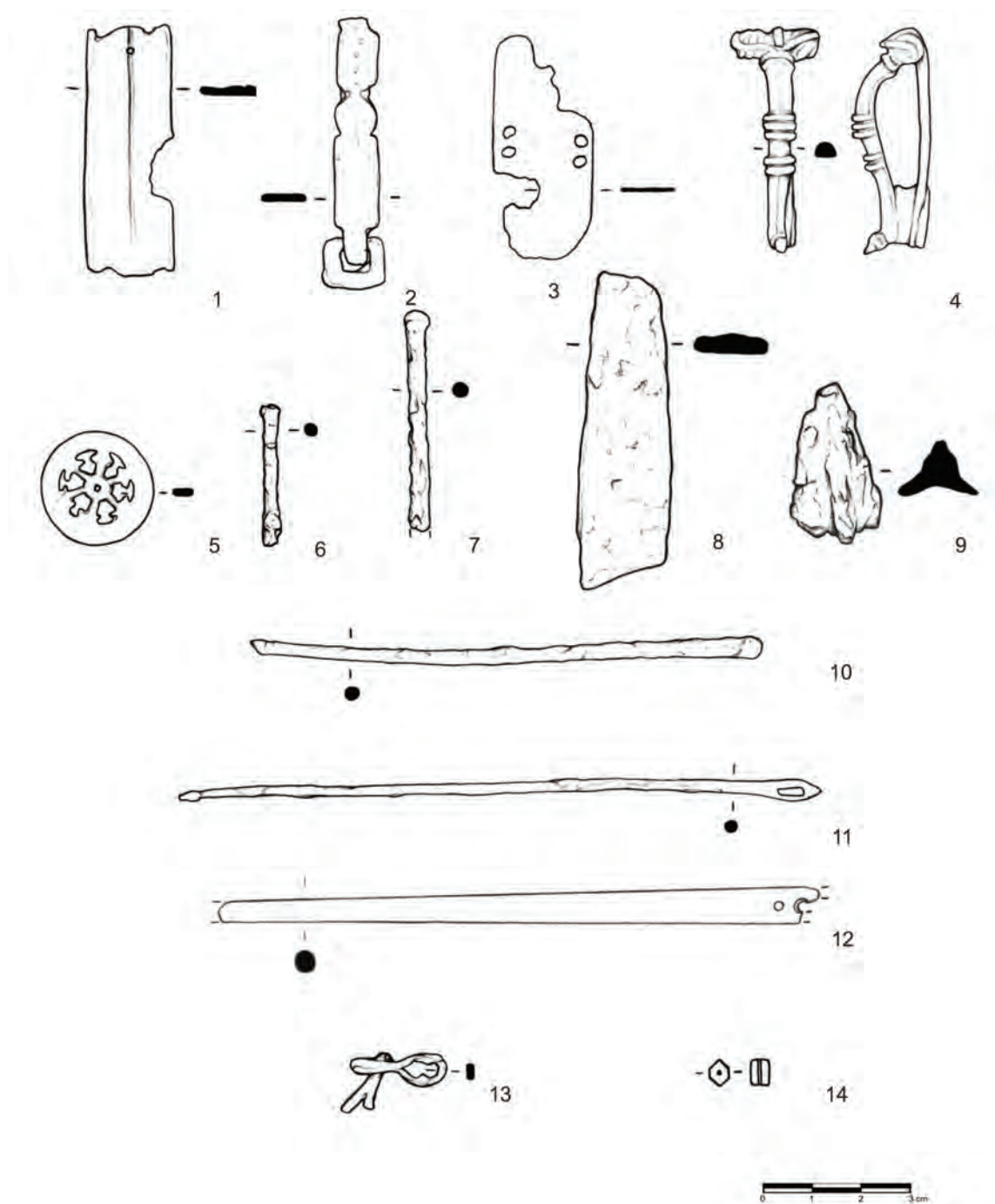
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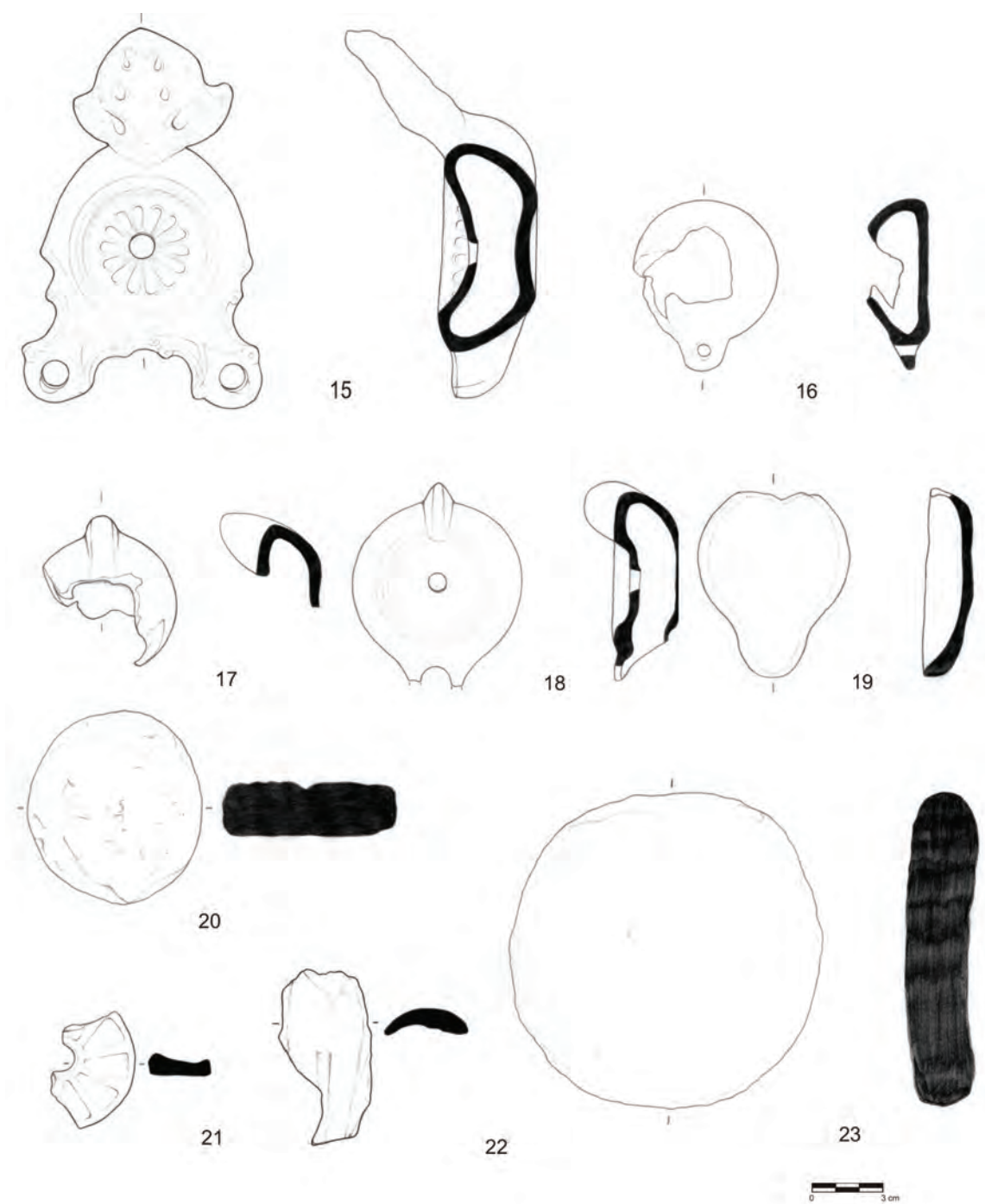
REZIME
RIMSKA CIGLARSKA PEĆ
SA ISTOČNE NEKROPOLE
VIMINACIJUMA

KLJUČNE REČI: CIGLARSKA PEĆ, PROIZVODNJA OPEKA, PIRIVOJ, VIMINACIUM, III VEK NOVE ERE.

Prilikom izgradnje vodovodne mreže za potrebe arheološkog parka Viminacijum 2013. godine došlo se do otkrića ciglarske peći na lokaciji Pirivoj. Peć se nalazila na prostoru istočne gradske nekropole. Više ciglarskih peći je otkriveno na Viminacijumu tokom zaštitnih iskopavanja južnih gradskih nekropola, 80-ih godina 20. veka, a tri peći istražene su na lokalitetu Pećine u okviru Zanatskog centra. Novootkrivena peć na lokalitetu Pirivoj građena je od nepečene cigle i blatnog maltera, uz minimalnu upotrebu opeke. Pripada tipu peći sa jednim ložišnim kanalom. Ložište i rešetka peći očuvani su u većoj meri, a od komore za pečenje samo delimično zidovi u visini od 70 cm. Lučnog zasvedeni otvor ložišta nalazio se na zapadnoj strani. Na osnovu slojeva unutar peći, mogu se izdvojiti dve faze korišćenja. Ispod podnice ložišta peći je pronađen antički bunar koji je korišćen u vremenu pre njene izgradnje. Peć se na osnovu pokretnog materijala datuje u III i početak IV veka.



T. I. Finds from layer: fig. 1-8; 10-11; 13-14. Finds from pit 2: fig. 9; 12.



T. II. Lamps and other clay finds from layer.

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ARCHAEOLOGICAL RESEARCH OF LAZAR'S TOWN IN KRUŠEVAC

ABSTRACT

In the work the results of archaeological excavations in the city of Lazar's town Kruševac were represented. The brief overview of the oldest historical sources relating to medieval Kruševac was presented. Research has shown that the plateau of Lazar's town was inhabited during all periods of prehistory. Individual findings, testify about life in ancient and early Byzantine period, while there are also indications of the medieval town, which was preceded to a great construction achievement, when the capital of Moravian Serbia was raised. The question is, how will future archaeological excavations of Lazar's town supplement our understanding of this complex, and how this research can be presented in accordance with the requirements of the times in which we live.

KEYWORDS: KRUŠEVAC, LAZAR'S TOWN, ARCHAEOLOGICAL RESEARCH, PRESENTATION.

Medieval capital of Prince Lazar, is located almost in the center of today's Kruševac, which provides great opportunities for the presentation and tour of the locality. At the same time, there is a question of how this medieval fortress can be incorporated into the core of the third millennium.

If you take into account that the flow of modern life do not pass this area, which, over the last decade, got several construction stamps - the construction of a church home of Lazarica, partial reconstruction of the interior of the church chapel Prince Lazar, the construction of footpaths in the Archaeological Park, reconstruction and adaptation of National Museum of Kruševac and construction of public toilets. In a view of the fact that there is increasingly thinking that it is necessary to reconstruct medieval walls in their full extent and height, thinking about it is inevitably, how archaeological research of Lazar's town, can be incorporated in this process.

BEFORE ARCHAEOLOGICAL RESEARCH

Potential, which Kruševac has through the remains of the medieval period, was noted back in the XIX century. Then the need was spotted that Lazarica Church, whose appearance was significantly altered as a result of a number of unskilled work and intervention, return to its original appearance. By order of the Ministry of Education and Religious Affairs, on the May 29, 1887 the commissions visited Kruševac, consisting of experts Mihailo Valtrović, Aleksandar Bugarski and Dušan Živanović. The Commission having examined the condition of the building and submitted a proposal on how to repair.

M. Valtrović states: „Once restored Lazar's Church, and when it arises again in its first form, composition and structure, Kruševac will be able to boast about old times, what no other town in the Kingdom does not have.“ The same commit-

tee in 1889, according to personal preference of Queen Natalija, produced a plan of restoration. By the queen's desire, too, mortar was broken, on the south facade, in the form of strips of 40 cm wide, in order to at least partially perceive the masonry of the church (Ристић 1983: 129).

Before the big campaigns of archaeological research of Lazar's town, which was carried out in the seventh decade of the XX century, only Lazarica church and the remains of Donjon tower, with traces of the ramparts were known. Architect Aleksandar Deroko tried to reconstruct the appearance of fortifications, but due to the scarcity of data, only managed to present his vision of the former seems of Donjon tower.

Quote from Deroko works best reflects how much, just sixty years ago, was known about medieval Kruševac: „Today of the town only the parts of tower - donjons rest, through which entered into the city, and with it some of the city wall. The tower was built with white stones (which is rare). On the floor walked up by the stairs made in the wall. At the city there was the Lazar's court church of St. Stephen – Lazarica, which has been preserved to this day“ (Дероко 1950: 122-123).

Historical data do not show a lot about the time when Kruševac was raising. The earliest known reference to Kruševac in historical documents found in Bologna transcript of Ravanica founding charter, which was probably issued in 1377.

His most valuable endowment, the Ravanica, Lazar started building in 1376/77. Construction lasted until the 1381. During that period, the founding charter of the monastery was issued. As noted above, for the year of issue 1377 is usually referred. Charter of Ravanica, which the original is not preserved, we know on the basis of three transcripts (Vrdnik, Bologna and Ravanica). For the theme of our work is a significant rewrite of Bologna.

Foregoing transcript of Ravanica charter is preserved in the University Library in Bologna. The transcript is, part of the collection of the Count Ferdinand Luigi Marsili. Count Marsili, in

the period from 1699-1701, as an Austrian officer, was the chairman of the commission made for determination the Austrian-Turkish border along the Sava river.

Text of Bologna transcripts occupies five pages written in script, which was characteristic of Serbian Cyrillic in the late XVIII century. On each side there are 43 printed lines, except the last, on which there are 27 rows. In this text Kruševac is given as a place, in which relation the geographical position of village Spizla is determined, the village nearby Kruševac. Today is not known about which village was talked about. Although the transcript does not state explicitly that the city of Kruševac, we can accept the hypothesis, was already a significant, and probably fixed area, in relation to which the position of the other places were determined (Младеновић 2003: 91).

The first explicit mention of medieval Kruševac, defined as the place or city, can be found in the charter issued on the feast of St. Stephen, at January 9, 1387. This charter the Prince Lazar was issued to the people of Dubrovnik “in the famous town of Kruševac my dominions.” Original charter was preserved and it is located in the Historic Archives of Dubrovnik. Prince Lazar by this Charter confirms the benefits to the Dubrovnik, given through the earlier commands and laws. Charter was written in script on paper. Unfortunately, the document is damaged and lacks the lower middle section (ten written lines), and some part are torn in places where the paper was folded (Младеновић 2003: 191).

The question arises, whether the prince Lazar issued the charter with which he determined to raise his capital city. There are no indications to suggest that such a charter was drawn up. To the eventual happy discovery documents, we must satisfy with the archaeological findings that testify about the establishment of capital of Moravian Serbia.

ARCHAEOLOGY PROVIDES ANSWERS

Systematic studies of medieval Serbian capital have been carried out between 1961-1971. Excavations took place, because the urban construction plan of Kruševac covered decoration the plateau of Lazar's town. National Museum of Kruševac, demanded they carry out preliminary archaeological research before it. Since the proposal is accepted, the National Museum of Kruševac participated in this research, in collaboration with the Archaeological Institute in Belgrade and the Institute for Protection of Cultural Monuments of Belgrade (Васиљевић 2007: 125-127).

After a great campaign, archaeologists are still a few times, on a smaller scale, have investigated Lazar's town. Thus, at the 1986-1987 the area, where the building of Old Menzulana is situated, was excavated, in 1995 the audit excavations were carried out at the small town and Donjon tower. In 1998 the place, where previously the old Parish Church of Lazarica was situated was examined. In 2002 the rescue excavations were carried out along the projected route of the access path to the church of Lazarica. The last time in 2010 and 2012 the sounding excavations were done around the museum building (Васиљевић 2012: 2-3).

Archaeological researches have enabled to gain basic knowledge about the city, determine the direction of the walls and determine the existence of forty buildings. Archaeologists have expressed to light the remains of palaces, stables, blacksmith, tanks, craft workshops. Movable archaeological material, provided an insight into the daily life of courtiers of Prince Lazar, through the findings of pottery, jewelry, glass, craft tools, implements and weapons.

The excavations have shown that the plateau, where the medieval Kruševac emerged, was inhabited in the Neolithic period. Continuous settlement was rarely interrupted, as confirmed by the findings from the Bronze and Iron Ages, as well as preserved traces of Roman and early Byzantine

period. Serious indications point to the existence of a medieval settlement, which existed before the big architectural enterprise of Prince Lazar.

Prehistoric layers, found in the area of the Lazar's town, speaks of continuity of settlement from the Neolithic period, Copper, Bronze Age and Iron Age. Based on the findings, the largest prehistoric settlement in this place belonged to the holders of Starčevo culture. Findings from the Vinča period are scarce, but are of great importance, since they belong to the very beginnings of this cultural group.

Relatively scarce, but very distinctive pottery, dating from the Eneolithic epoch points to the existence of smaller settlements from several phases of cultural groups Krivodol-Salkuca-Bubanj and Kostolac cultural group. More numerous pottery from the Bronze Age, documenting life in this location in the early and middle Bronze Age, during the Cultural of double handled goblets, from Protovatin and Vatin period. More prevalent is ceramic of Brnjica cultural groups. Numerous finds of pottery, characteristic of the Iron Age, found the Great Morava river basin. Community, which at that time lived in Kruševac, ethnocultural will connect with the group from Great Morava basin. Typical ceramic, Kalakača horizon, then the one from the phase of Lanište I, Lanište II –Basarabi and the early Iron Age, suggests that this area until the arrival of the Romans, seemed ethnocultural unity with Great Morava Basin (Стојић, Чађеновић 2006: 101-121).

Ancient layer, within the complex of the Lazar's town, is not yet ascertained. Individual findings suggest the possibility of its existence. Thus, during the archaeological excavations, found a metal figurine of young Roman clad in a toga. Figurine is represented standing, in the reverse position. Roman has stretched forth his right hand, which is missing the handful where the most likely holding upright spear or long stick. Pursuant to the cavities of the left hand fist, it is assumed that in that cavity was located the end of money bags, roll or similar small object. Figurine was found "in a layer of

brown earth and rubble from recent period”.

From the area of the Lazar's town, and his close environment, come the Roman coins. During the systematic archaeological survey were found six pieces of Roman bronze coins. Field diaries recorded that in 1961, two Roman coins were found, “in the fifth layer of excavation, in the third square, bronze coins of Constantine the Great”, and in the humus layer in the fifth sector and the first square: “Large Roman bronze”. During excavations in 1962 the following Roman coins were found: on the October 10 “Roman coins”, October the 13 “large bronze – Mark Antoninus”. During excavation, on June 29, 1965 the “Roman copper coin with a lot of obscure characters, diameter 2.5 cm,” was found and on the August 14 of the same year “at a depth of 90 cm one Roman coin was found”. It is not known where the referred coins are today.

During the excavation in 1998, at the area where previously the old parish hall of the church of Lazarica was situated, Roman layer was not captured again, and the only undisputed finding is the ancient Roman bronze coins from the third century *Hereni Etruscilla*, minted in *Viminacium*. It was noted that, near the medieval fortress, about a hundred meters away to the west, a silver penny, minted during the reign of Emperor Nerva was found (96-98 AD). It is worth to mention a description of the findings, which dates from 1953. The findings were found near the northeastern corner of the Kruševac fortification. On the occasion when the holes for the tank petrol pump at 1.30 m depth was digging, “five burner for a weevil made of baked earth” were found. This might be the Roman lamps – weevils. The trace for these objects is lost, so it is unlikely that we will be able to find accurate information about them (Рашкович 2000: 9-24).

As we discovered, the ancient horizon in the area of the Lazar's town was not caught. The logic of continuity of the settlement of this area, point to the possibility that the Kruševac had a rich ancient history. Large construction activity at the time of Prince Lazar, who produced well-known

buildings and walls, on the other hand may have destroyed the traces of activities of the ancient man on the site.

Just a bit more information we have about the early Byzantine period in this locality. During the archaeological excavations on the site where the Old Menzulana was situated, postal station from the Turkish period, near the northeast corner of the fortress, pointed to the possibility of the existence of buildings from the sixth century. During the excavations, which were carried out in 1986-1987 early Byzantine bricks and money of the emperor Anastasius I, were discovered (491-518). Copper coins of Anastasius were discovered “in the layer of burnt which corresponding to the log cabin”. According to the head of the excavations, O. Vukadin, “money and the bricks most likely belongs to some structure located in the immediate vicinity” (Вукадин 1988: 288-289).

Indications for the existence of the facility from the early Byzantine period, are very indicative. When we add to this the incidental findings from the immediate environment, the version of the existence of fortifications whose crew consisted of Gothic unit it becomes possible. From the circle of former factory “22 July”, about two hundred meters north of the town of Kruševac, derived incidental finding of belt buckles with clamp shaped like the letter S. The buckle can be approximately dated to the V century and can be associated with the presence of the Ostrogoths. There are indications that, at this point, there was a large necropolis, which covered a wide range of Kruševac fortifications. It is possible that the necropolis had a late antique and early Byzantine phase (Рашкович 2002: 45).

In the connection with the above mentioned findings and indications we can also bring a gold belt buckle with a massive thorn. Clip comes from an unknown site from Kruševac. It is now in the National Museum in Belgrade. The clip is purchased at the beginning of the XX century in Kruševac. Z. Vinski says: “It was additionally determined that the clip comes from a destroyed

tomb in Kruševac" (Vinski 1964: 173).

As we move away further in the later centuries of the Middle Age, we come to a situation that archaeological findings do not confirm the logical possibility that Prince Lazar built his capital at a place where the medieval settlement existed earlier than the eighth decade of the fourteenth century.

About the possibility of the existence of settlements or necropolis, a precursor of Lazar's town, testified tombstone built into the belfry of Lazarica church. On the board, within the text of the tomb, names Vukota and Medoš were carved. Part of the inscription on which the year of building of the tombstone is inscribed is damaged, so the years can not be precisely determined. Most often mentioned year is 1300 (Ковачевић 1980: 26-27).

Since the board is probably not taken from a greater distance, it indicates the possibility of existence of a necropolis from the XIII-XIV century, and with it on, the possibility that there was a church and a nearby a village, which belonged to the necropolis. If this assumption is correct, Vukota and Medoš would be the oldest residents of Kruševac, which we know the names.

The excavations from 1961 noted the existence of the building, which by their characteristics points indicated the possibility that it was a church building. On the eastern side of the field at the boundary between the plateau and the slopes, where the continuation of the wall was expected, there was not superior result. It was discovered the part of the building, which by means of its construction, width and position of the walls does not match the known elements of the defensive wall. It is the wall width 0.60 m, built of boulders and oriented in a north – south direction. From inside the building, two administrative walls enclose a rectangular room. The distance between them is 5.30 m. The outer wall is continued in both directions. On the opposite side from the administrative walls, from the outside, there is a semicircular wall that closes one apsidal area. In the following over the slope, there is a level of plastered surfaces with large stones, which follows the slope

(Јордовић, Јуришић 1970: 289-320).

Although only a small part of the object is discovered, it could be recognized as a church of the settlement which preceded of the Lazar's Kruševac. Next to the church, there could be graves with tombstones. This older church could be demolished at the time of raising Lazarica. Then, its construction materials, along with the nearby tombstones, was used for the construction of a new church. Of course, all of this remains theoretical, for which we have no confirmation of sufficient evidence in the archaeological record.

KRUŠEVAC OF THE PRINCE LAZAR RETURNS FROM EPIK TO THE DAYLIGHT

The results of archaeological excavations have shown that Lazar's town erected in two construction stages. The first a small city was erected, protected by a trench and a tower, and then, in the second phase of construction, by walls made of crushed stone the whole plateau of Lazar's town was protected. In this way, the fort was established, which extended in the direction of north-west-southeast and included an area of the approximately 300 x 200 meters.

Rampart, strengthened by towers at unequal distances, closed space within the ellipse. Within the protected area, the two groups were separated, small and large city. Small Town, "fort in the fort", was located on the northeast, the lowest part of the plateau. In contrast to a small town in the southwestern part of the fort was a large city, where a church and a whole Lazarica secular constructions were built (Fig. 1).

The city was built on two occasions. The first a small fortified city was built, protected by a dry moat, which could be filled with water from a nearby stream Kožetinski, and protected with a powerful Donjon tower. This part of the fort was built with rude stone. Then with the walls, which were made of quarry stone, a plateau was surrounded,



Fig. 1 Complex of secular buildings in Lazar's town (photo: Ljubiša Vasiljević).

which formed a Large town and fortress complex was completed (Ковачевић 1980: 12-68).

It was noted that the buildings erected in the fort, were not organically tied to the walls, but they stood alone in space. This is another indication of a new time, despite constant attempts to connect it with the glorious era that preceded it, however, it presented a first act of the last Serbian medieval drama, known as the Moravian Serbia.

The complex of Lazar's town included Lazarića church. Besides not large dimension, church has, with its beauty and harmony of architecture, decoration of façades and numerous plastic decoration charmed contemporaries who described it with adjective *The Most Beautiful*.

Built in honor of the eldest son of Lazar, the church was dedicated to St. Archdeacon Stephen. As a source of Moravian architecture, most original creation of Serbian medieval and the last great

contribution of Byzantine cultural to the world heritage. Lazarica is a mythical place where, according to tradition, Kosovo heroes took communion before going on a decisive battle.

Moving archaeological finds (pottery, weapons, armors, tools, coins, jewelry, glass) are allowed to complete the picture of the life of the inhabitants of the medieval Krusevac. The most numerous and the most illustrative is ceramic. Maybe not so attractive, but unavoidable reflection of the spirit of that time, is the table pottery that shows the wealth of ornaments and beauty of the color.

Ceramic describes a style of an era in which the Byzantine forms and motif of decorating once again shined. Belts with floral ornaments, rosettes, spirals, concentric and twisted circles were decorated bowls, dishes, cups and three foil jugs.

At this point one has to wonder about the reasons that led Prince Lazar to raise its capital city

right at this location. We can notice the fact that the Holy Prince, even he was trying by all means to present itself as legitimate prosecutor of the continuity of the state of Nemanjić, he decided not to select any of the old Serbian capital for the new center, but to build a new capital.

Slightly elevated plateau, on which is placed a Serbian city that is mostly mentioned in songs, with its strategic advantages is far behind nearby Bagdala, and not to mention the nearby mountain Jastrebac, whose elevations provide opportunities for much better protection.

It becomes more clearly, that military and strategic reasons did not led Prince in choosing the location of its new capital. The real reason is, probably, the that the Kruševac is a major transport hub on the Serbian medieval roads. From the north – south direction, right around the Kruševac passes the road which at the north, with Braničevo and Belgrade, connected it with the old center of Nemanjić State, Bela Crkva or Kuršumlja and, through it, with Novo Brdo and Prizren and foreland. Just behind Kruševac, that communication intersected with transversal that church centers – Banja, Arilje and Žiča connected with a roadmap that, even as the ancient Via Militaris, connect Constantinople with Central Europe (Бошковић 1980: 7-11).

Prince Lazar is in the history and tradition, the best known as a warrior and martyr, suffered for freedom and Christian faith. These data indicate that the prince, while he built the foundations of the state, in another way, imagine his historic role. As we have just seen, the Prince raised the capital in the area, which is dictated by the choice of commercial and economic reasons. State of Prince Lazar, was a place where some of the noblest men and greatest artists of his time were welcome and accepted in, which were at the Moravian Serbia found refuge from the tempests which covered the southern Balkans and threatened the rest of Europe.

One gets the impression that the prince wanted to make the economic leader and cultural center of this part of Europe, which, strengthened after the economic and cultural boom, could become an

insurmountable barrier to external threats. That's why the parallels with ancient Greece can be imposed. We can imagine the prince's ambition, that among scattered Serbian areas, rise his state up to the leaders place, in the why that Athens has been between the ancient Greek states, which with economic power and the culture protecting Balkans from the Persian invasion for a half a century.

Concatenation of historical circumstances led to the fateful Battle of Kosovo, when the wheel of history and memory has been reversed, and the memory of Prince Lazar was transferred to the battlefield and a harrowing plight, a trait that is associated with another ancient superpower – Sparta. Consequences of the Battle of Kosovo, in terms of tradition and epic poetry can be compared only with the famous battle at Thermopylae gorge. In both cases, the defeat on the battlefield turned into a great spiritual victory, which provides strength and inspiration for future generations. Although some other areas, eventually brought the same qualities, we can say that Prince Lazar, symbolically, want to build the Serbian Athens, but, during the ruthless historical events, his state took a place in consciousness of Serbian people, similar to the spirit of the Greeks, as well as Europeans, which occupied Sparta.

After the Kosovo tragedy, Kruševac remains the center of Serbia until the early XV century, when Despot Stefan moved to the capital, Belgrade. Despot will continue to temporarily reside in his hometown, as evidenced by numerous letters that were signed in Kruševac. During the first half of the XV century, Kruševac alternately ruled by Serbs, Hungarians and Turks. There is evidence that the Hungarian King Vladislav Jagelonac (1424-1444) lived in Kruševac, where between 6 and 13 January 1444, issued a memorandum (Покаи 1985: 145-150).

The Turks finally take Kruševac in 1455 year, with brief interruptions, and ruled the city in next four centuries. This is the period in which the Kruševac was named Aladža Hisar, translated Šarengrad, when it became the center of the homony-



Fig. 2 Discovered ruins during archaeological excavations 2010 (photo: Sanja Rutić).

mous Sandžak (Амедоски 2007: 157-169).

Lazar's town still keeps many doubts, whose solution is a task for archaeologists, who will looking for a solution in a future researches, but also in interpretations of already discovered findings. During the archaeological excavations carried out in 2010 and 2012 the findings about the continuity of settlement in prehistoric times have been confirmed, from Starčevo culture through layers from Copper, Bronze and Iron Ages. On the investigated area were not detected ancient and early Byzantine traces. The existence of smaller buildings that can be determined in the fourteenth century, and the layers of the XV and XVI centuries, have been established (Vasiljević, Rutić 2014: 78-79). (Figs. 2, 3).

During this study there was an unusual discovery of three skeletons of horses, which were carefully placed at the exact distance of five meters between the skeleton (Fig. 4). Archaeological material found near the skeleton probably belongs to the period of the XV-XVI century. The most char-

acteristic findings were the large number of stone cannonballs and large pieces of metal that could be left over after the making cannonballs, which is typical for that period. This discovery certainly has to do with some historical event that occurred during this period in Kruševac, regardless if it comes to a battle or stay rulers, nobles and church dignitaries, where something unexpected happened which led to a storage substructure in this way.

Instead of conclusion the question is imposed, how archaeological excavations in the Lazar's town which will be implemented in the future, can supplement our understanding of this complex, and how that research can be presented and accessible to people who live in the third millennium. Previous research has enabled it, in large part, to study how Kruševac looked in the XIV century, and even in earlier times.

New research should be conducted, preferably every year, even if it would be possible to open only few probes. We believe that the results of the research conducted should be presented to the



Fig. 3 Construction of stone (photo: Sanja Rutić).



Fig. 4 Horse skeleton (photo: Ljubiša Vasiljević).

public as quickly as possible, through exhibitions, which do not have to be a megalomaniac than informative, or in the form of attractive presentations. Archaeology exhibition of paintings, which the National Museum of Kruševac prepared for the manifestation Museum Night at 2012 showed that the audience was very interested to learn about the process of archaeological research, and the recently discovered findings. Archaeology at the exhibition of paintings, presented the six sites, including Lazar's Town, which the National Museum of Kruševac explored in previous years (other locations are Ukosa in the Grad Stalać, Bedem in Mascare, Gradac in the Donje Leviće, Branik in Dedina and Suvaja). The sites are represented through photos and videos, which presented characteristic moments and findings obtained during the researches.

In any case, Lazar's town hides many uncertainties, of which someone maybe will figure out by the results of the future research.

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REZIME

ARHEOLOŠKA ISTRAŽIVANJA LAZAREVOG GRADA U KRUŠEVCU

KLJUČNE REČI: KRUŠEVAC, LAZAREV GRAD, ARHEOLOŠKA ISTRAŽIVANJA, PREZENTACIJA.

U radu su predstavljeni rezultati arheoloških istraživanja Lazarevog grada u Kruševcu. Prikazan je i kratak osvrt na najstarije istorijske izvore vezane za srednjovekovni Kruševac. Istraživanja su pokazala da je plato Lazarevog grada bio naseljen tokom svih perioda u praistoriji. Pojedinačni nalazi svedoče o životu u antičkom i ranovizantijskom periodu, dok postoje i indicije o srednjovekovnom naselju, koje je prethodilo velikom građevinskom poduhvatu tokom čije je realizacije podignuta prestonica Moravske Srbije. Postavlja se pitanje koliko će buduća arheološka istraživanja Lazarevog grada dopuniti saznanja o ovom kompleksu i na koji način rezultati istraživanja mogu biti prezentovana u skladu sa zahtevima vremena u kome živimo.

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COINS OF THE VIMINACIUM MINT FROM THE PEĆINE NECROPOLIS (VIMINACIUM)

ABSTRACT

During the extensive rescue archaeological investigations of the southern necropolises of Viminacium, on one of them – the necropolis called Pećine – 96 coins from the provincial mint Viminacium were found. Of those, 46 pieces were found in graves, and 50 in a layer on the necropolis. Four specimens from the special editions stand out, belonging to the types with vexilla, Victoria and Moesia-Pax.

KEYWORDS: ROMAN PROVINCIAL COINAGE, THE VIMINACIUM MINT, PEĆINE.

In the area of the southern necropolises of Viminacium, due to the construction of the TPP Kostolac 2, starting from 1977,¹ the extensive rescue archaeological investigations were carried out (Зотовић 1986: 41, ref. 4; 54-55; Зотовић, Јордовић 1990: 2; Vojvoda, Mrđić 2015: 9, ref. 2).² Three Roman necropolises were registered at the locality of Pećine, of which the youngest one was formed in the middle of the 1st century and where cremation and inhumation of the deceased were practiced simultaneously. At the same time, another necropolis was formed in Pećine where the deceased were cremated only, with the exception of the appearance of graves with inhumation, which in all cases were children's graves. Change of the funeral ritual that occurred around the middle of the 3rd century led to the abandonment of

these burial grounds and the formation of new ones where the only form of burial became inhumation. At that time, the necropolis Burdelj was formed as was the third necropolis on Pećine, of which the first was used until about the mid-4th century, and the second until the mid-5th century (Vojvoda, Mrđić 2015: 9, ref. 3-4).

There are 96 coins of the provincial mint Viminacium that were recorded at three necropolises of the locality Pećine, which is 2.65% of the total number discovered during the survey (3613 pcs.).³ This represents a slightly higher percentage compared to the neighbouring necropolis called Više grobalja, where 59 coins were registered, which is 2.15% of the total number of coins that were found (2736 pcs.) (Vojvoda, Mrđić 2015: 14-15, ref. 12, cat. nos. 2546-2604). From the 96 coins

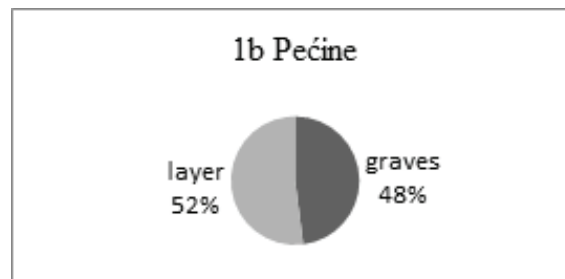
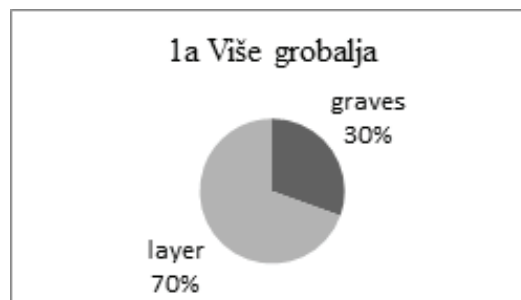
¹ The article results from the project: *Viminacium, Roman city and military camp – research of the material and no material culture of inhabitants by using the modern technologies of remote detection, geophysics, GIS, digitalization and 3D visualization* (no. 47018), funded by The Ministry of Education, Science and Technological Development of the Republic of Serbia.

² Within this area, nine necropolises were separated, and five of them belong to the Roman period: Više grobalja, three necropolises in the locality of Pećine, and Burdelj.

³ Over time, a number of pieces have been lost. Coins that could be processed (3613 specimens) are in most cases unpreserved, which makes their determination difficult. In addition to well preserved specimens, the finding contains a number of copies of imperial and provincial coinage, which could be determined only by century, and a smaller number of coins that are damaged or fragmented to such an extent that it was impossible to reliably classify them into centuries. I kindly thank to my colleague Dragana Spasić-Đurić from the National Museum in Požarevac for the provided material.

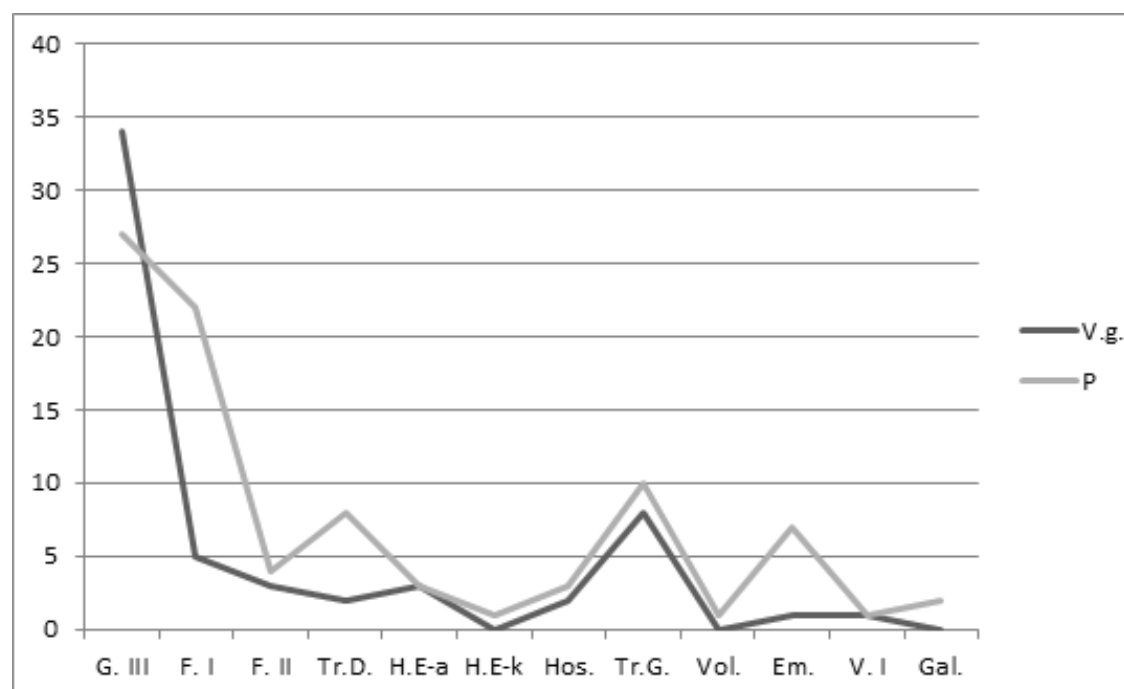
of the Viminacium mint, 46 (48%) were found in the graves, and 50 (52%) in the layer on the necropolis, which mostly originated from individual or collective sacrificial areas formed above the graves. There is a certain difference in relation to the Više grobalja necropolis, where 18 pieces. (30.50%) were registered in the graves, and 41 pieces (69.50%) were from the sacrificial areas.

The lack of small bronze coins of Senate issues in circulation in the Danube and Balkan provinces at the beginning of the 3rd century was probably the chief reason for the opening of the mint for provincial coinage in Viminacium, and then in Sarmizegetusa (Dacia) (Борић-Брешковић 1976: 8, ref. 2; Црнобрња 1993: 17-19). Macedonian mints of provincial coinage supplied Upper Moesia to a certain extent in the first two centuries (Borić-Brešković 2011: 420-426), at the time when the problem of the deficiency of small bronze coins was not so noticeable. Apparently, this problem manifested to a greater extent after closing of the mint in Stobi, at the time of the Caracalla's reign (Borić-Brešković 2011: 415, ref. 3), which led to the mass appearance of provincial coinage from the Bithynian mint of Nicaea in circulation. The dominant incidence of Nicaean issues in circulation in Upper Moesia is evident in the third and fourth decade of the 3rd century, i.e., during the rule of Alexander Severus and Gordian III. However, after the year 239 and the start of operation of the mint in Viminacium, the Nicaean issues almost disappeared from circulation in the territories of Upper Moesia and Lower Pannonia, where, obviously, the problem of the shortage of money was the most evident. It is interesting to note that after the closing of the Stobi mint, noticeable issues of autonomous money started to be minted again in Macedonia (the Koinon of Macedonia), and unlike the Nicaean money, apparently did not have a greater share of the circulation in the territory of Moesia at this time (Војвода, Петровић 2011: 288; Војвода, Јесретић 2012: 121; Војвода 2013: 159-160; Vojvoda, Mrđić 2015: 13-17; Vojvoda 2017: 133).



Graph 1 a and b – Incidence of the Viminacium mint specimens in graves and layers at the Više grobalja necropolises (1a) and at Pećine (1b).

Out of the 96 coins of the Viminacium provincial coinage from the Pećine necropolis, 27 were issues made for Gordian III, 26 for Philip I and Philip II, 15 for Trajan Decius and family, 11 for Trebonianus Gallus and Volusian, 7 for Aemilian and 3 for Valerian I and Gallienus. It was not possible to determine the issuer for 7 coins but from that number, one comes from year XII and one from year XIII of the local era, and with a certain dose of reservation we can assume that they belong to the issues of Trebonianus Gallus or Volusian (Table 1). By observing both necropolises together, the issues of Gordian III are the most common, which is understandable since they are the first issues of the mint since its opening. This difference is much greater in the Više grobalja necropolis (34 pcs. from the total number of 59) than in Pećine (27 pcs. out of total number of 96). This is followed by a number of issues of Philip I, then until Aemilian a gradual decline was recorded, while the issues of Valerian I and Gallienus are sporadic, which is the ratio that repeats in



Graph 2 - Incidence of the Viminacium mint specimens in graves and layers in the Više grobalja and Pećine necropolises, by rulers

both necropolises (Table 1, Graph 2). If we would compare the incidence of the number of samples by the years of the local era, it turns out that the largest number on both necropolises is registered in year IV (17), followed by XII (15), I and XIII (each with 13), XIV (12), II (10), others between 9 and 5 pieces, while year VIII of the local era (3) is represented by the smallest number (Table 1).

Comparison of the above mentioned data on the number of incidences (according to different criteria) on the Više grobalja and Pećine necropolises with the collection of Svetozar St. Dušanić, is not the most rewarding task. On the one hand, we have information originating from archaeological investigations, and on the other, we have data from the private collection that has been created for decades.⁴ Nonetheless, certain parallels can be

drawn and they are not unfounded, referring in the first place to the number of specimens of the individual issuers. The only difference is observed in relation to the number of coins of Gordian III and Philip I, which is in the collection of Svetozar St. Dušanić in favour of the latter emperor (506 Gordian III versus 545 of Philip I and his family). As was the case in the Viminacium necropolises, this number gradually declined starting from Trajan Decius.⁵ If we observe the incidence by years of the local era, the situation from the Viminacium necropolises repeats - in the first place there are AN XII and IV. Major deviations in the number of registered specimens are recorded in years: I to III, VIII and XIV.

In most of the recorded coins on the Pećine necropolis, there are no deviations from the usual reverse iconographic schemes known in the work

⁴ Private numismatic collections are formed in different ways, according to the interests, knowledge and financial possibilities of the collectors. Some strive to collect only preserved and rare specimens, others tend to gather as many different types as possible although they are not well preserved. A third type combines the first two methods, while others still focus only on a certain iconographic topic. The collection of Svetozar St. Dušanić contains 1700 copies of the provincial Viminacium mint, represents all

rulers and members of the families for whom the mint was working, repeats many types even though they are common presentations, and in 3.88% (or 66 pcs.), additionally presents extraordinary types though some of them are also repeated. All this indicates that the collector had, so called, a "museological" approach to collecting.

⁵ Борић-Брешковић 1976: 16, Table 3.

emp/an	I	II	III	IV	V	VI	VII	VIII	VIII	XI	XII	XIII	XIV	XVI	?	Σ V.g.	Σ P	Σ V.g. + P	Σ emp.
G. III*	8	8	5	9											4	34			
	5	2	1	8	2										9		27	61	61
Ph. I					1	1		3								5			
					4	5	5	4	2						2		22	27	34
Ph. II									1						2	3			
						3				1							4	7	
Tr.D.										1	1					2			
										5	3						8	10	22
H.Ea										1	2					3			
											2				1		3	6	
H.E																/			
											1						1	1	
Hos.											2					2			
											2	1					3	5	
Tr.G.											1	6	1			8			
												4	4		2		10	18	19
Vol.																/			
												1					1	1	
Aem.													1			1			
													6	1			7	8	8
V.I														1		1			
														1			1	2	4

emp/an	I	II	III	IV	V	VI	VII	VIII	VIII	XI	XII	XIII	XIV	XVI	?	Σ V.g.	Σ P	Σ V.g. + P	Σ emp.
Gall.																/			
Vim. ?														2		/	2	2	
											1	1			5		7	7	
Σ	13	10	6	17	7	9	5	7	3	8	15	13	12	5	25	59	96	155	155

Table 1 – Incidence of the Viminacium mint specimens in graves and layer in the Više grobalja and Pećine necropolises by rulers and years of the local era.

*G. III – Gordian III, Ph. I – Philip I, Ph. II – Philip II, Tr.D. – Trajan Decius, H.Ea. – Herennia Etruscilla, H.E. – Herennius Etruscus,

Hos. – Hostilian, Tr.G. – Trebonianus Gatus, Vol. – Volusianus, Aem. – Aemilianus, V.I – Valerian I, Gall. – Gallienus;

V.g. – Više grobalja, P – Pećine.

of this mint, and we find the basic type of presentation (personification with a diadem on the head, dressed in a stola, standing in a frontal position, between a bull and a lion, with head turned to the left and hands laid over the animals' head). In addition, several specimens stand out with extraordinary reverse motifs, such as the middle bronze of Gordian III from the fourth year of the local era (cat. 12). It is a presentation of personification, dressed in a stola and palla that stands at the front, with a head turned to the left, between a lion and a bull. In each hand one vexillum is held, with the numbers VII and IIII.⁶ Extraordinary types of the Viminacium mint issues appear in years III, V, VI, XI, XII, XIII and XIV of the local era. In these types, the traditional personification character is retained, but its basic appearance depending on the idea it expresses, is complemented by various attributes (Fides, Pax, Victoria, etc.) (Борић-Брешковић 1986: 128-129). The reasons for the appearance of vexillum in the provincial money are explained differently.⁷ According to some, they were minted in an effort to highlight the military character of the settlement and the origin of its population, and therefore to emphasize the importance of cities as the veteran colonies. According to the others, vexilla on colonial money indicates the presence (short-term departure, stay or transit) of the vexillatio of some legions. The third opinion is that the choice of these types provides evidence that municipal mints supplied legions, auxiliary units and veterans with bronze money (Борић-Брешковић 1986: 134-135, ref. 63-65). Concerning our extraordinary specimen of Gordian III with vexilla, most authors agree that coinage of year IIII of the local era were minted in an indirect or direct connection with the Gordian's Persian war (Борић-Брешковић 1986: 137, ref. 70).

Two pieces of the middle bronze of Philip II

6 In the catalogue of the St. Dušanić collection, 13 such specimens were recorded; cf. Борић-Брешковић 1976: 54-55, kat. 475-487; Борић-Брешковић 1986: 136.

7 The motif of vexillum on provincial money is popular in the eastern provinces, especially Syria; cf. Борић-Брешковић 1986: 134.

(cat. 50-51), both from year VI of the local era belong to the rare issues that were registered on the Pećine necropolis (Борић-Брешковић 1986: Т. XI, 2, 4; Juhasz 2010: 34, fig. 40). Victoria heading to the left, between a lion and a bull, holding a wreath in the right hand and a palm branch in the left is presented on the reverse. The same motif appears at the time of the independent issues of Philip I, during year V of the local era. The coinage for Philip II began only after he obtained the title of Caesar, i.e., in year VI. Certain researchers have interpreted the appearance of this type with some of the successes over Carpi, but the Carpi invasion in 245 did not have to influence the issuance of this type. The issuance of the type with Victoria of Philip II could belong to the beginning of year VI of the local era, or the last months of 244 due to the pronounced stylistic connection with the first Roman emission of Philip I from the same year (RIC IV.3, No. 50). For the special Viminacium editions of Philip II, the classic form of Victoria was used (RIC IV.3, No. 50, Victoria steps) transmitting part of the father's merits on the East to the son, following the example of simultaneous emperors' issues of Philip I with AVGG (RIC IV.3, 51) by which he included in imperial successes the members of his *domus augustae*.⁸

The last extraordinary appearance recorded on the Pećine necropolis is the large bronze of Trajan Decius (cat. 55) from year XI of the local era. The representation of the personification is, in comparison with the basic type, unchanged, but in the raised right hand it holds a branch, and in the left-hand slanted sceptre.⁹ The presentation of

Pax, i.e., Moesia – Pax, as a propaganda message of year XI of the Viminacium era, clearly defines the program of reign and the Roman peace based on victory. Regardless of whether it is a *pax augusta in terms of the pax romana or pax augusti, to which analogies with a complete legend on Decius imperial coinage are primarily referred, this type expresses the principle of imperial peace despite the nuances in the expression* (Борић-Брешковић 1986, 152-153, ref. 154).

Regardless of the short-lived work of a provincial mint in Viminacium, its issues have great importance for studying the money circulation and historical events of the middle of the 3rd century. From the very beginning, the mint stands out with a great monetary production and wide circulation. On the other hand, precise chronological data (designation of the local era on the reverse) represent some of the most reliable historical sources, irrespective of some disagreements that have occurred about accurate dating at the beginning of the local era.¹⁰ For these reasons, it is of the utmost importance not only to collect material from the whole area of circulation of this kind of coinage, but from Viminacium itself. This is the case primarily, because it is a material that originates from archaeological investigations, from closed units, which allow, apart from numismatic analyses, numerous and broader considerations of the role of money in funeral rituals.

⁸ Any later date would have assumed a more likely stylistic influence of the type RIC IV.3, no. 51 (Victoria stands to the left—not walking!), with VICTORIA AVGG on the reverse where the family includes Philip I and Otacilius. Philip II did not become Caesar concurrently with his father's rising to the rank of Augustus, but between these two events there was a time span of up to several months. The chronological accuracy of obtaining the title of Caesar Philip II is confirmed by the minting of Viminacium. For a detailed analysis of differences, dating and interpretations of this type, cf. Борић-Брешковић 1986: 147-148, 163.

⁹ In the catalogue of the St. Dušanić collection, 6 such

specimens were recorded; cf. Борић-Брешковић 1976: 75-76, kat. 1084-1089, but here with Victoriola at the top of the sceptre; Juhasz 2010: 31, fig. 29.

¹⁰ About the work of the mint (opening, interruptions in minting, closing, local era) cf. Борић-Брешковић 1976: 8-17; Борић-Брешковић 1986: 123, ref. 1-5 with the quoted bibliography.

CATALOGUE**Abbreviations**

Cat. –catalogue number

obv. –obverse

rev. –reverse

Wt. –weight (gr)

Size –diameter (mm)

Axis –axis according to cardinal directions

G –inhumation burials

G1 –cremation burials

Ref. –reference

Vim. Coll. – records of field documentation (C number)

r. –right

l. –left

dr. –draped

cuir. – cuirassed

laur. – laureate

rad. – radiate

stg. –standing

std. –seated

hld. – holding

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GORDIANUS III

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
1	IMP CAES M ANT GORDIANVS AVG Bust dr. cuir. r., head rad.	P M S CO-L VIM ex - AN•I• Personification stg. front, head l., between lion and bull, hands above animals heads. ¹	5,89 23,05 N	Trench 309	35	239-240	5313/4
2	IMP CAES M ANT GORDIANVS AVG Similar.	P M S CO-L VIM ex - AN•I• NT	5,19 22,11 N	Trench 436	35	239-240	13297

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
3	IMP CAES M ANT GORDIANVS AVG Bust dr. cuir. r., head laur.	P M S CO-L VIM ex - AN•I• NT	4,51 21,85 NE	G – 1967	64	239-240	11655
4	[...] ANT GORDIA[...] Similar.	P M S CO-L VIM ex - AN•I• NT	4,41 20,93 NE	G – 5162	64	239-240	12383 NC
5	[IMP] CAES M ANT [GORDIANVS] [AVG] Similar.	[P M S CO] - L VIM ex - AN•I• NT	4,15 21,56 NE	Trench 159	64	239-240	1885
6	IMP CAES [M ANT] GORDIANVS AVG Bust dr. cuir. r., head rad.	P M S CO-L VIM AN •I•I• NT	6.68 21.68 N	Ternch 353	127	240-241	10201 NC
7	IMP CAES [M ANT] GORDIANVS AVG Bust dr. cuir. r., head laur.	P M S CO-L VIM AN II NT	3,92 21,50 N	Trench 344	148	240-241	9013 NC
8	IMP GORDIANVS PIVS FEL AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM AN III NT	19,10 30,88 N	Trench 357	168	242-243	10186 NC
9	IMP GORDIANVS [PIVS FEL AVG] Bust dr. cuir. r., head laur.	P M S CO-L VIM AN IIII NT	20,95 29,52 NE	Trench 33	306	242-243	170

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
10 za ilus	IMP GORDIANVS PIVS FEL AVG Similar.	P M S CO-L VIM AN IIII NT	20,63 29,59 S	G1 – 1146	306	242-243	13499
11	IMP GORDIANVS PIVS FEL [AVG] Similar.	P M S CO-L VIM AN IIII NT	20,36 30,70 S	Trench 159	306	242-243	5097 NC
12	IMP GORDIANVS PIVS FEL AVG Bust dr., cuir., r., head rad.	P M S C-[OL VIM] AN IIII Personification stg. front, head l., between lion and bull; in each hand hld. vexillum with VII and IIII.	8,41 22,39 NE	G – 4259	475	242-243	11374/1 NC
13	IMP GORDIANVS PIVS FEL AVG Similar.	P M S C-OL VIM AN IIII NT.	7,31 22,50 N	G – 3700	405	242-243	10924
14	IMP GORDIANVS PIVS FEL AVG Similar.	P M S C-OL VIM AN IIII NT.	7,30 24,28 N	Trench 248	405	242-243	3553
15	IMP GORDIANVS PIVS FEL AVG Similar.	P M S C-OL VIM AN IIII NT.	6,98 22,88 N	Trench 159	405	242-243	1964
16	IMP GORDIANVS [PIVS FEL AVG] Similar.	P M S C-OL VIM AN IIII NT.	6,65 25,00 N	Trench 309	405	242-243	5454
17	IMP GORDIANVS PIVS FEL AVG Similar.	P M S C-OL VIM AN [...] NT.	5,83 23,97 N	G – 3733	/	239-243 AN I to IIII (?)	10948

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
18	[IMP] CEAS M ANT GORDIANVS [AVG] Similar.	P M S CO-L VIM ex – Illegible. NT	4,62 21,34 S	G – 4255	/	239-241 AN I – IV (?)	11359 NC
19	IMP CAES [M ANT] GORDIANVS AVG Similar.	Illegible. ex – AN [...] NT	4,56 23,33 S	G – 1967	/	239-243 AN I to III (?)	5484 NC
20	Illegible. Similar.	P M S C-OL [VIM] ex – Illegible. NT	1,51 17,39 S	G – 2288	/	239-241 AN I to III (?)	6139
21	IMP GORDIANVS PIVS FEL AVG Bust dr., cuir., r., head laur.	P M S C-OL VIM ex - AN•V• NT.	18,66 28,55 N	G – 1071	492	243-244	3872
22	IMP GORDIANVS [PIVS FEL AVG] Similar.	P M S C-[OL VIM] ex - AN•V• NT.	15,86 28,30 N	G – 5346	492	243-244	12678
23	Illegible. Bust r., head laur.	[P] M S C-O[L] [VIM] ex – Illegible. NT	10,54 24,75 N	Trench 187	/	243-244	2586
24	Illegible Bust r., head laur.	P M S CO-L [VIM] ex – Illegible. NT.	4,06 19,65 N	Trench 3	/	243-244	422
25	Illegible Bust r., head laur.	Illegible. ex – Illegible. NT	3,34 21,19 N	G – 1141	/	243-244	4058 Broken. NC
26	[...] GORDI[...] Similar.	P M S C-[OL] [VIM] ex – Illegible. NT.	2,63 18,87 N	Trench 250	/	239-244	4633 NC

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
27	Illegible. Bust r., head laur.	P M S [...] ex – Illegible. NT	2,54 19,00 N	G – 816	/	243-244	2730

PHILIP I

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
28	IMP M IVL PHILIPVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex – AN V NT.	17,94 29,32 S	G – 1071	508	243-244	3873
29	IMP M IVL PHILIPVS AVG Bust dr. cuir. r., head rad.	P M S C-OL VIM ex – AN V NT.	7,65 23,82 NE	G – 4561	595	243-244	11598 NC
30	IMP M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN V NT.	6,84 23,69 S	Trench 328	595	243-244	7539 NC
31	IMP M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN V NT.	5,62 22,02 S	G – 4228	595	243-244	11329 NC
32	IMP M IVL PHILIPVS AVG Bust dr. cuir. r., head laur.	P M S C-[OL VIM] ex – AN VI NT.	20,47 30,50 S	Squ. 13	617	244-245	12596 NC
33	IMP M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN VI NT.	18,51 28,37 S	G – 1071	617	244-245	3870
34	IMP M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN VI NT.	18,49 29,02 S	G – 5186	617	244-245	12410 NC

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
35	IMP M IVL PHILIPVS AVG Similar.	P M S C-[OL] [VIM] ex – AN VI NT.	15,21 29,11 NE	G – 1071	617	244-245	3869
36	IMP M [IVL] [PHILI]PVS AVG Similar.	P M S C-OL VIM ex – AN VI NT.	14,68 27,16 S	G – 2049	617	244-245	5638 NC
37	IMP M IVL PHILIPVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex – AN VII NT.	20,28 29,46 NE	G – 1071	716	245-246	3876
38	IMP M IVL PHILIPVS AVG Similar.	P M S C-[OL] [VIM] ex – AN VII NT.	17,96 28,62 NE	G – 1668	716	245-246	4900/1 NC
39	IMP M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN VII NT.	17,75 28,75 S	Trench 323	716	245-246	6674 NC
40	Illegible. Similar.	Illegible. ex – AN VII NT.	16,39 29,76 N	G – 1501	716	245-246	4582/1 NC
41	Illegible. Similar.	P M S C-OL VIM ex – AN VII NT.	15,62 29,43 S	Trench 323	716	245-246	9792 NC
42	IMP M IVL PHILIPVS AVG Bust dr. cuir. r., head laur.	[P M S C]-OL VIM ex – AN VIII NT.	19,46 29,27 S	G1 – 541	827	246-247	6028 NC
43	IMP [...] Similar.	P M S C-OL VIM ex – AN VIII NT.	16,86 29,37 SW	Trench 355	827	246-247	10110 NC

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
44	IMP M IVL PH[ILI]PVS AVG Similar.	Illegible. ex - AN VIII NT.	15,60 29,48 NE	Trench 69	827	246-247	745
45	IMP M IVL PHILIPVS AVG Similar.	P M S C-[OL] [VIM] ex – AN VIII NT.	14,61 28,98 N	G – 1435	827	246-247	4455 NC
46	[IMP] [M] [IVL] PHILIPVS AVG Bust dr. cuir. r., head laur.	P M S C-[OL] [VIM] ex – AN VIII NT.	13,13 28,68 S	G – 1378	920	247-248	4445
47	[IMP] M IVL PHILIPVS AVG Similar.	P M S C-OL VIM ex – AN VIII NT.	12,63 27,83 S	Trench 265	920	247-248	3630
48	[IM]P M IVL PHILIPPVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex – Illegible. NT.	13,28 27,90 S	Trench 6	/	243-247 AN V to VIII (?)	18
49	IMP M IVL PHILIPP[...] Similar.	[P] [M] [S] C-OL VIM ex – Illegible. NT.	19,67 29,42 N	G – 1071	/	243-247 AN V to VIII (?)	3868

PHILIP II
Striking under Philip I
AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
50 ilust.	M IVL PHILIPPVS CAES Bust dr. r., head bare.	P M S - C-OL VIM ex – AN VI Victory adv. l. between lion and bull, r. hld. wreath, l. hld. palm.	7,22 22,02 N	G – 978	Borić- Brešković /; SNG III Ljubljana, no. 2373	244-245	3272
51	M IVL PHILIPPVS CAES Bust dr. r., head bare.	P M S C-OL VIM ex – AN VI Similar.	4,47 21,37 N	G – 7	Borić- Brešković /; SNG III Ljubljana, no. 2373	244-245	6511
52	Illegible. Bust dr. cuir. (?) r., head bare (?).	Illegible. ex – AN VI (?)	20,88 30,37 S	Leveling	1005 (?)	244-245 (?)	10970/3 NC
53	IMP M IVL PH[ILIPVS] [AVG] Bust dr. cuir. r., head laur.	Illegible. ex - AN XI NT.	15.04 29.16 S	Section IA	1044	249-250	1446

TRAJAN DECIUS
AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
54	IMP CAES C MES Q DECIVS PF AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex - AN XI NT.	15,85 28,57 S	Trench 131	1052	249-250	1710

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
55	IMP CAES C MES Q DECIVS PF AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex - AN XI Personification hld. branch in r. hand, in l. transverse sceptre.	14,48 28,61 S	G – 5335	1084 (but here without Victori- ola)	249-250	12671 NC
56	IMP TRAIANVS DECIVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex - AN XI NT.	13,40 27,45 N	Leveling	1090	249-250	10970/1 NC
57	IMP TRAIANVS DECIVS AVG Similar.	P M S C-OL VIM ex - AN XI NT.	11,82 27,39 S	Trench 324	1090	249-250	6702
58	IMP TRAIANVS DECIVS AVG Similar.	P M S C-OL VIM ex - AN XI NT.	11,02 26,63 S	G – 938	1090	249-250	3128
59	IMP TRAIANVS DECIVS AVG Similar.	P M S C-OL VIM ex - AN XII NT.	12,58 26,91 N	Leveling	1157	250-251	10970/2 NC
60	IMP TRAIANVS DECIVS AVG Similar.	P M S C-OL VIM ex - AN XII NT.	10,38 26,84 N	G – 3758	1157	250-251	10958/2 NC
61	IMP C M Q TRAIANVS DECIVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM ex - AN XII NT.	13,23 26,59 S	Section IA	1188	250-251	1327

HERENIA ETRUSCILLA

Striking under Trajan Decius

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
62	HER ETRVSCILLA AVG Bust dr., r., head diad.	P M S C-OL VII AN XII NT.	13,40 26,55 S	Leveling	1229	250-251	11756 NC
63	HER ETRVSCILLA AVG Similar.	P M S C-OL VII AN XII NT.	10,22 25,68 S	G – 3758	1229	250-251	10958/3 NC
64	HER ETRVSCILLA AVG Similar.	P M S C-OL VII AN [...] NT.	12,24 26,52 S	G – 3758	1212 or 1229 (?)	249-251 AN XI or XII (?)	10958/4 NC

HERENNIUS ETRUSCUS

Striking under Trajan Decius

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
65	Q H ET MES DEC CAVS Bust dr. cuir. r., head bare.	P M S C-OL VIM AN XII NT.	11,78 26,01 S	G – 5239	1266	250-251	12470/1

HOSTILIAN

Striking under Trajan Decius

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
66	C VAL HOST M QVINTVS [CAE] Bust dr. cuir. r., head bare.	P M S C-OL VIM AN XII NT.	13,49 27,93 S	G – 5227	1287	250-251	12469
67	[...] M QVINTVS [...] Similar.	P M S C-OL VIM AN XII NT.	11,45 25,98 S	Squ. 14	1287	250-251	12697

HOSTILIAN

Striking under Trebonianus Gallus

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
68	C VAL HOS[...] Bust dr. cuir. r., head laur.	P M S C-OL VIM AN XIII NT.	3,80 19,40 S	G – 4299	1367	251-252	11394

TREBONIANUS GALLUS

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
69	IMP C GALLVS P FELIX AVG Bust dr. cuir. r., head laur.	P M S C-OL VII AN XIII NT.	12,08 25,43 S	G – 4586	1479	251-252	11622/1
70	IMP C GALLVS P FELIX AVG Similar.	P M S C-OL VII AN XIII NT.	9,55 26,85 N	Trench 159	1479	251-252	4788 NC

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
71	IMP C GALLVS P FELIX AVG Similar.	P M S C-OL VII AN XIII NT.	9,34 25,78 S	G – 1668	1479	251-252	4900/2 NC
72	[IMP] C GALLVS P FELIX AVG Bust dr. cuir. r., head laur.	P M S C-OL VIII AN XIII NT.	2,89 19,52 S	G – 1668	/ add. small modul	251-252	11621 NC
73	IMP C GALLVS P FELIX AVG Bust dr. cuir. r., head laur.	P M S C-OL VII AN XIV NT.	11,38 27,53 N	Section IA	1529	252-253	4900/3 NC
74	IMP C GALL[VS P FELIX] AVG Similar.	P M S C-OL VII AN XIV NT.	11,08 27,75 N529	Trench 353	1529	252-253	9744 NC
75	IMP C GALLVS P FELIX AVG Similar.	P M S C-OL VII AN XIV NT.	10,36 26,68 S	Section IA	1529	252-253	1304
76	IMP C GALLVS P FELIX AVG Similar.	P M S C-O[...] AN XIV NT.	8,10 27,54 S	G – 2272	1529	252-253	6165
77	Illegible. Similar.	P M S C-OL VII ex – Illegible. NT.	12,14 27,86 S	Trench 290	/	250-253 AN XII to XIV	6298
78	[IMP] [C] [GA] LLVS P FELIX AVG Similar.	P M S C-OL VII ex – Illegible. NT.	8,74 26,27 S	Trench 288	/	250-253 AN XII to XIV	4817 NC

VOLUSIANUS

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
79	IMP CAE C VIB VOLVSIANO AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM AN XIII NT.	12,29 27,93 S	Section IA	1598	251-252	1380

AEMILIANUS

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
80	IMP C EMIL EMILIANO AVG Bust dr. cuir. r., head laur.	P M S C-OL VII AN XIV NT.	10,29 27,52 S	G – 2252	1642	253	6183
81	[...] EMILIANO AVG Similar.	P M S C-OL [VIM] AN XIV NT.	7,95 24,78 N	Leveling	1642	253	6443/2
82	IMP C M AEMIL [...] Similar.	P M S C-OL VIM AN XIV NT.	9.58 25.64 S	Trench 219	1644	253	3187
83	IMP C M AEMIL AEMILIANVS AVG Similar.	P M S C-OL VIM AN XIV NT.	8,86 25,34 NE	Trench 80	1644	253	814
84	[...]ILIANVS AVG Similar.	P M S C-O[L VIM] AN XIV NT.	8,04 27,37 N	Trench 327	1644	253	8381 NC

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
85	IMP C EMIL EMILIANO A Similar.	P M S C-OL VIM AN XIV NT.	10,26 25,25 N	Trench 335	1646	253	7806
86	IMP C M AEMIL AEMILIANVS AVG Bust dr. cuir. r., head laur.	P M S C-OL VIM AN XVI NT.	8,87 26,77 S	G – 1006	1674	254-255	3687

VALERIANUS I

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
87	IMP VALERIANVS P AVG Bust dr. cuir. r., head laur.	P M S C-OL VII AN XVI NT.	10,86 26,74 S	G – 5239	1676	254-255	12470/2

GALLIENUS

AE

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Ref. Borić- Brešković 1976	Date	Vim. Coll.
88 za ilust.	IMP GALLIENVS P AVG Bust dr. cuir. r., head laur.	P M S C-OL VII AN XVI NT.	10,80 27,58 N	Trench 309	1693	254-255	5313/5
89	IMP C GALLIENVS AVG Similar.	P M S C-OL VIM AN XVI NT.	10,93 28,04 N	Leveling	1697	254-255	11010 NC

VIMINACIUM

Unknown ruler

Cat.	Obverse	Reverse	Wt. Size Axis	Position of find.	Date	Vim. Coll.
90	Illegible. Bust r.	P M S C-OL VIM ex - AN XII NT	9,18 25,33 S	Trench 173	250-251 T. Gallus or Volusianus	2264
91	[...] AVG Bust r.	P M S C-OL VIM ex - AN XIII NT	11,11 26,76 N	Trench 289	251-252 T. Gallus or Volusianus	4265 NC
92	Illegible. Bust r.	P M S C-OL [VIM] ex – Illegible. NT	8,80 25,54 N	G1 – 1108	T. Gallus (?)	12321
93	Illegible. Bust r.	Illegible. NT	8,62 25,44 NE	Trench 159		4438 NC
94	Illegible. Bust r.	Illegible. NT.	7,84 25,63 N	Trench 86		804

95	Illegible. Worn.	Illegible. NT	4,80 22,78 /	G1 – 1047		11445 Burned. NC
96	Illegible. Bust r.	Illegible. NT	3,01 19,06 /	Trench 159		4539 NC

(Footnotes)

1 Onwards this type = NT (normal type).

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REZIME

NOVAC KOVNICE VIMINACIJUM SA NEKROPOLE PEĆINE (VIMINACIJUM)

KLJUČNE REČI: RIMSKO PROVINCIJALNO KOVANJE, KOVNICA VIMINACIJUM, PEĆINE.

Na području južnih nekropola Viminacijuma su, zaradi izgradnje TE Kostolac 2, počev od 1977.g. obavljena obimna zaštitna arheološka istraživanja. Na tri nekropole lokaliteta Pećine zabeleženo je 96 primeraka novčića provincijske kovnice Viminacijum, što čini 2,65% od ukupnog broja primeraka koji su otkriveni prilikom istraživanja (3613). Ovo predstavlja nešto veći procenat u odnosu na susednu nekropolu Više grobalja, gde je registrovano 59 primeraka novca što iznosi 2,15% od ukupnog broja pronađenih novčića (2736). Od 96 primeraka kovnice Viminacijuma, 46 (48%) pronađeno je u grobovima, a 50 (52%) u sloju na nekropoli, koji u najvećem broju potiču sa pojedinačnih ili kolektivnih žrtvenih površina formiranih iznad grobova. Izvesna razlika uočava se u odnosu na nekropolu Više grobalja, gde je u grobovima registrovano 18 kom. (30,50%), a sa žrtvenih površina 41 kom. (69,50%).

Od 96 primeraka viminacijumskog provincijskog kovanja sa nekropole Pećine, 27 pripada emisijama kovanim za Gordijana III, 26 Filipu I i Filipu II, 15 Trajanu Deciju i porodici, 11 Trebonijanu Galu i Voluzijanu, 7 Emilijanu i 3 Valerijanu I i Galijenu. Kod 7 primeraka nije bilo moguće odrediti izdavača, ali od tog broja jedan potiče iz XII i jedan iz XIII godine lokalne ere, a sa određenom dozom rezerve možemo pretpostaviti da pripadaju emisijama Trebonijana Gala ili Voluzijana (Tabela 1).

U najvećem broju zabeleženih primeraka na nekropoli Pećine nema odstupanja od uobičajenih reversnih ikonografskih shema poznatih u radu ove kovnice, već se susrećemo sa osnovnim tipom predstave (personifikacija sa dijademom na

glavi, obučena u stolu, stoji spreda, između bika i lava, glavom okrenuta na levo i ruku spuštenih nad glavama životinja). Pored toga, nekoliko primeraka izdvaja se sa vanrednim reversnim motivima, kao što je srednja bronza Gordijana III iz četvrte godine lokalne ere (kat. 12). U ređa izdanja koja su registrovana na nekropoli Pećine spadaju i dva primerka srednje bronzne Filipa II (kat. 50-51) oba iz VI godine lokalne ere. Na reversu je predstavljena Viktorija koja korača na levo, između lava i bika, u desnoj ruci drži venac a u levoj palminu granu. Poslednja vanredna predstava zabeležena na nekropoli Pećine je velika bronza Trajana Decija (kat. 55) iz XI godine lokalne ere. Predstava personifikacije je u odnosu na osnovni tip nepormenjena, ali u podignutoj desnoj ruci drži grančicu, a u levoj koso položen skiptar.

Bez obzira na kratkotrajni rad provincijske kovnice u Viminacijumum, njena izdanja imaju veliki značaj za proučavanje cirkulacije novca i istorijskih događaja sredine 3.v. Od samog početka kovnica se izdvaja velikom monetarnom produkcijom i širokom cirkulacijom. Sa druge strane, precizni hronološki podaci (oznaka lokalne ere na reversu) predstavljaju jedan od najpouzdanijih istorijskih izvora, bez obzira na izvesne nesuglasice koje su se pojavljivale u pogledu tačnog datovanja početka lokalne ere. Iz ovih razloga, od najvećeg značaja je, ne samo prikupljanje građe sa celog područja cirkulacije ove vrste moneta, već sa samog Viminacijuma. U prvom redu, zato što se radi o materijalu koji potiče sa arheoloških istraživanja, iz zatvorenih celina, koje omogućavaju, osim numizmatičkih analiza, brojna i šira razmatranja uloge novca u pogrebnim ritualima.



Kat. 10.



Kat. 37.



Kat. 50.



Kat. 54.



Kat. 62.



Kat. 65.



Kat. 68.



Kat. 72.



Kat. 79.



Kat. 86.



Kat. 87.



Kat. 88.



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THE MYCENAEAN LINEAR B “ROSETTA STONE” TO MINOAN LINEAR A TABLET HT 31 (HAGHIA TRIADA) VESSELS AND POTTERY

ABSTRACT

In partnership with The Association of Historical Studies, Koryvantes (Athens), we address past and current prospects for the decipherment of the Minoan language, which has never met with any credible success in the 117 years since the first discovery of Minoan Linear A tablets by Sir Arthur Evans at Knossos in 1900. A considerable number of philologists and historical linguists, some of them amateurs, claim to have deciphered the Minoan language, yet no one has ever formulated a convincing decipherment. We advance a unique and entirely untested approach to unravelling the text of Minoan Linear A tablet HT 31 (Haghia Triada), based on the principle of cross-correlative retrogressive extrapolation (CCRE) from Mycenaean Linear B to Linear A. HT 31 so closely parallels Mycenaean Linear B tablet, Pylos Py TA 641-1952 (Ventris) that the latter effectively serves as a kind of “Rosetta Stone” for the former. There is also credible evidence that a Mycenaean derived superstratum imposed itself on Linear A as the result of the Mycenaean conquest of Knossos and Crete ca. 1500 – 1450 BCE or, failing that, their all but absolute suzerainty over Knossos and its dependencies. Approximately 300 or 26 % of 1166 intact words in Linear A are very likely of Mycenaean origin.

KEYWORDS: MINOAN, LINEAR A, DECIPHERMENT, SYLLABARIES, CROSS-CORRELATIVE RETROGRESSIVE EXTRAPOLATION (CCRE), POTTERY, LINEAR B, IDEOGRAMS, SUPERSYLLABOGRAMS, SUPERSTRATUM, MYCENAEAN GREEK

Past attempts at deciphering Minoan Linear A and their consistent failures:

Is the quest to decipher Minoan Linear A a pipe dream? If we are to believe the results of the fruitless efforts to decipher the language over the past 117 years since the first Linear A tablets were unearthed by Sir Arthur Evans at Knossos in 1900, the answer would have to be yes. Let us review just a few of the more significant yet futile efforts at deciphering Minoan Linear A.

In his review of *Minoan Mantras, The quiet decipherment of Linear A*¹, Joseph Alexander MacGillivray cites several failed attempts to decipher the language. MacGillivray considers Hubert La Marle’s decipherment the most credible candidate, asserting that, “... the texts record Minoan Sanskrit

... *passim*... On the Psychro vessel La Marle reads: ‘I have been ritually purified in olive oil and sacred water for my lady Assara.’” But this florid interpretation flies in the face of the sounder hypothesis that Minoan Linear A, like its immediate descendent, Mycenaean Linear B, is in all probability intended primarily for the purposes of inventory taking, of which the language is never flowery.

Next, we have Gary A. Rendsburg’s review of Jan Best’s “Decipherment” of Minoan Linear A², in which he flatly rejects Best’s thesis that Minoan Linear A is of *various Semitic* origins, rather than just *one (italics mine)*, characterizing Best’s philology as “outlandish”. Yet Rendsburg goes on to flatly contradict himself, by classifying Minoan Linear A as Semitic, but *only* in Cyrus Gordon’s

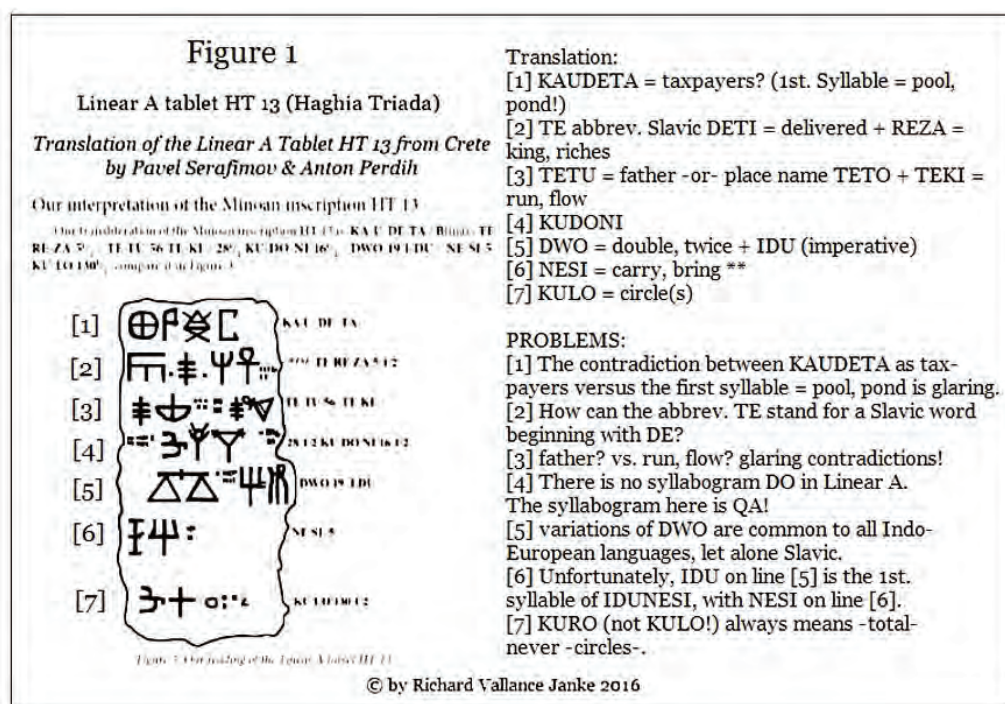


Fig. 1 – So-called decipherment of Minoan Linear A tablet HT by Pavel Serafimov and Anton Perdih

case. Rendsburg claims that *multiple incidences* of one class of proto-languages upon which Minoan Linear A is supposedly based are constitutionally invalid, while in the same breath declaring that one proto-language in same class is valid, but only in one case. You cannot have it both ways.

Next we have *Breaking the Code: a first translation of the 'lost' language of Linear A*, by Sam Connolly³, in which he approaches the decipherment of Minoan Linear A in an entirely novel way, by drawing comparisons between the archaeology of various ancient cultures and religions. According to him, this approach results in the first tentative translations of Linear A texts. This premise is dubious, as the next "decipherment" makes all too plain.

Linear A Decipherment: Translation of Minoan Inscriptions in Linear A, by Stuart L. Harris⁴

Like the previous author, but taking the thesis further than can be warranted, Harris makes the conflicted claim that the Minoans were a cultural patchwork of Danes, Swedes, Finns, Poles, Sumerians, Egyptians *et alii*. The problem this poses for me as a philologist is that this sort of commingling of so many diverse ethnicities is by nature utterly snarled

by an inescapable linguistic trap. It is impossible for any single language, in this case, Minoan, to be an offshoot of so many utterly *unrelated* cultures. According to Harris, a variety of techniques supposedly allowed Linear A to compress 1,700 words into *one syllable* and an additional 8,000 words into *two*. But anyone can claim to telescope words in any language whatsoever into just one or two syllables, and have us believe that whatever language he has arbitrarily chosen is the so-called "code breaker". The language he has chosen to base his decipherment on is proto-Finnish, another non starter.

Then there is the truly bizarre cross-correlation of Minoan Linear A with an ancient Niger-Congo dialect, *Minoan Signs, and African Decipherment*, by C.J.K. Campbell-Dunn⁵, in which he triumphantly asserts, "But we can say that the 'unknown language' is no longer unknown. It is African..." The decipherment is utterly implausible.

To summarize, all of the aforementioned books and articles make the untenable claim that they have in fact deciphered Minoan Linear A *as a language*, a claim which no professional philologist or historical linguist would ever dare make.

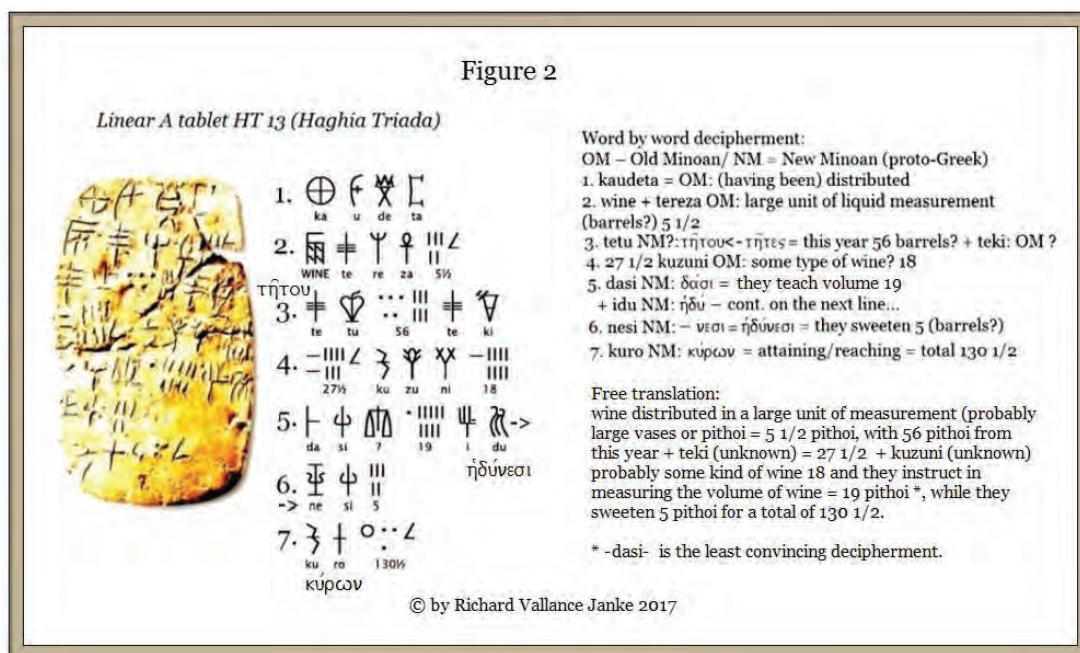


Fig. 2 – Translation of most of the vocabulary of Minoan Linear A tablet HT 13 by Richard Vallance Janke

Last, but far from least, we encounter a Proto-Slavic interpretation of Minoan Linear A tablet HT 13 (Haghia Triada) — another decipherment gone awry.

Pavel Serafimov and Anton Perdih, in their *Translation of the Linear A Tablet HT 13 from Crete*,⁶ have made a concerted effort to cross-correlate their contextual reading of Minoan Linear A tablet HT 13 (Haghia Triada) with proto-Slavic. But their decipherment swiftly crumbles into a morass of self-contradictions and ambiguities at cross purposes. Like so many other philologists grappling with the decipherment of Minoan Linear A, Serafimov and Perdih make the practically universal assumption, which I for one reject as spurious, that if we are to succeed in deciphering Minoan Linear A at all, we must first come in contact with an actual “known” proto-language upon which practically all philologists insist, Linear A must be based. The fundamental problem inherent to this approach is that each and every one of these would-be decipherers has boxed himself into a particular proto-language which he assumes, in utter faith and with all too often cavalier confidence, simply has to be the proto-language upon Minoan Linear A must be based. In any case, Michael Ventris finally succeeded in

recognizing Linear B as the script of Mycenaean Greek in 1952, after 3 years of fruitless endeavours at identifying the language as being possibly Etruscan or other languages, all non-starters. Not only was the language *unknown*, but also the script, which at last turned out to be a syllabary. The point is that it is possible to discover a “new” ancient language, even when the linguist attempting the decipherment has no idea from the outset what the language, let alone the script, is supposed to represent. So the argument that you need to know which language is represented before you can decipher it is invalidated *a priori* by Michael Ventris’ years long struggle to decipher Linear B, which he finally was able to crack only when all other alternatives than early Greek (i.e. Mycenaean) were eliminated.

Let us take a closer look at Serafimov’s and Perdih’s unavailing attempt at deciphering Minoan Linear A HT 31 versus my own translation. First the decipherment of Pavel Serafimov and Anton Perdih (Fig. 1).

As the Notes in Figure 1 make it abundantly clear, this decipherment is constantly at odds with itself, and then, my own decipherment (Fig. 2).

What is particularly striking about Richard Vallance Janke’s decipherment of HT 13 (Haghia

Triada) is that the tablet appears to incorporate a number of words derived from Mycenaean Greek. But how is this even possible?

Old Minoan versus New Minoan:

We must draw a clear-cut distinction between Old Minoan and New Minoan, the latter overlaid on Old Minoan with the Mycenaean conquest of Knossos, its dependencies and Crete ca. 1500-1450 BCE. Even if, as many historians allege, there was no actual invasion, we can be sure that the Mycenaean exercised all but absolute suzerainty over the Minoans. Either way, the influx of Mycenaean vocabulary into Old Minoan appears to have imposed a broad *superstratum* on Old Minoan, which was to substantially transform a significant quantity of its vocabulary (26 %), if not its syntax. The conclusion we must nevertheless draw is that Old Minoan is very likely not proto-Greek, since there is no substantive evidence for its bearing any resemblance to it or *any* other ancient (proto-) language (class or family). That leaves us facing the prospect that Old Minoan may have been a language isolate, like modern Basque. But there is no practical way of substantiating this.

The imposition of a lexical *superstratum* on a target language by a source language:

Since the Mycenaean either conquered Knossos and its Cretan satellite settlements outright or exercised near absolute suzerainty over them, we can readily enough surmise that, as a consequence, Mycenaean vocabulary must have infiltrated the Old Minoan language. This phenomenon is actually not unique to that language. There is another language which has witnessed a massive influx of vocabulary as a direct result of conquest, and that language is English. Frankly, it is surprising that no one seems to have considered the plausible parallel between the Mycenaean incursion into Crete ca. 1450 BCE and the Norman French invasion of England. The Norman French conquest of England by William the Conqueror in 1066 AD was to set in motion a massive overhaul of the vocabulary of the English language.

Prior to 1066 AD, Anglo-Saxon (Old English) was the only English, period. Its syntax and vocabulary were strictly Germanic. But after 1066, all that was to change drastically. From 1100 – ca. 1450 AD, Norman French became the official language of the English royal court and the judiciary and exerted a prodigious influence on English literature¹², as attested by *The Canterbury Tales* by Geoffrey Chaucer alone. The influx of Norman French vocabulary soared to at least 10,000 words. Small wonder modern English contains more French words than Germanic. French vocabulary comprises 29 % of English. In fact, the combined percentage of French, Latin and Greek loanwords amounts to 64 %, more than double the Anglo-Saxon and Germanic vocabulary (26 %). So while English is classified as a Germanic language in its syntax and grammar, the *superstratum* of French, Latin and Greek words necessarily gainsays the influence of Germanic vocabulary on Middle and Modern English. Syntactically, the language is Germanic; the vocabulary is preponderantly non-Germanic.

And that is the whole point. If the Norman conquest of England resulted in a massive overhaul of English vocabulary, might we not imagine a similar phenomenon metamorphosing the Minoan language? This hypothesis allows us some latitude in conjecturing a similar scenario for the incursion of Mycenaean vocabulary into Linear A. The influx of some 300 Mycenaean words (26 %) out of a total of some 1166 intact words in Linear A was due to the conquest of Knossos and Minoan Crete by the Mycenaean in around 1500-1450 BCE or, failing that, by their outright suzerainty over the Minoan civilization. This phenomenon is akin to the Norman French conquest of English in 1066 AD, some 2600 years later. Conquest of a prior civilization entailing the assimilation of a foreign source language's vocabulary into the target language of origin is referred to as *Elite Dominance*. Suzerainty without conquest is called *Demography Subsistence*. In either case, the result is substantially the same.

Conclusions concerning the many failed attempts at deciphering Minoan Linear A:

The worst of all the pretensions of the authors of monographs and tractata claiming to have deciphered Minoan Linear A are their authors' untenable claims that they have all but fully deciphered it. How is it even remotely possible that all of these *soi-disant* decipherers of Minoan Linear A can claim to have discovered the so-called magic bullet in the guise of the proto-language upon which their decipherment has been based, when the proto-languages they invoke are so wildly disparate? They have scoured not a few proto-languages, some of them Indo-European (such as Proto-Slavic and the extinct Anatolian languages), others non proto-Indo-European, running the gamut from Akkadian, Anatolian, Egyptian, Hebrew, Hittite, Hurrian, Luwian, Pelasgian, Phoenician, Phrygian, Proto-Canaanite, Sanskrit and Ugaritic, Uralic (proto-Finnish) to proto-Semitic and Sumerian. While it is patently impossible that all of these proto-languages could be at the base of the Minoan language, it is conceivable that one of them might be. But which one? Given the tangled mass of contradictions these so-called decipherments land us in, we are left with no alternative but to conclude that only one of these so-called proto-languages is liable to stand any linguistic test of verisimilitude. And that one is Hurrian.

Instead, I have adopted the unique approach of declaring that it does not matter what proto-language (Old) Minoan derives from, or for that matter, whether or not it, like modern Basque, is a *language isolate*, meaning a natural (spoken) language, ancient (dead) or modern (alive) with no demonstrable genealogical or genetic relationship with any other language whatsoever or alternatively, *a language that has not been demonstrated to descend from an ancestor common with any other language in the world. (italics mine)*.

On the other hand, the probable imposition of a Mycenaean Greek derived superstratum on Old Minoan would appear to substantiate the hypothesis that Linear A is a *composite* of Old Minoan (mostly Hurrian?) and New Minoan, the latter consisting of a substantial Mycenaean derived vo-

cabulary, which by my count runs to at least 300 words (i.e. 26 %) out of a total of 1166 words ¹¹ in the entire Linear A repertoire. This is a significant total, which cannot simply be brushed aside.

Pylos tablet Py TA 641-1952 (Ventris), the "Rosetta Stone" to Minoan Linear A tablet HT 31 (Haghia Triada) vessels and pottery:

Glen Gordon, in the February 2107 issue of *Journey to Ancient Civilizations*, poses this thought-provoking question, "If a Minoan version of a Rosetta Stone pops up... *passim*..., watch public interest rise tenfold." The answer to his question is finally upon us. Actually, it has been staring us in the face for a very long time. It is none other than Linear B tablet Pylos Py TA 641-1952 (Ventris), which is the "Rosetta Stone" for Minoan Linear A tablet HT 31 (Haghia Triada). The parallels between the ideograms on these two tablets (Table 1) are so remarkable we can postulate that we are dealing with very similar text on both tablets, although in a different order (not that this matters much). The process I have coined whereby we are able to determine the lexicographic values of the Old Minoan Linear A terms commensurate with their Mycenaean Linear B counterparts I designate as *cross-correlative retrogressive extrapolation* (CCRE). This methodology allows us to extrapolate the (almost) precise semiotic values for each of the Old Minoan Linear A words in turn attached to their respective ideograms. Since the name of each and every vessel on HT 31 is spelled out in full (Fig. 3), we find ourselves facing the curious co-incidence that these Old Minoan A terms appear analogous to their Mycenaean Linear B counterparts on the Pylos tablet. All we need do is cross-correlate each Minoan Linear A term for a pottery or vessel type with its counterpart on the Pylos tablet and *voilà*, we have nailed down every single vessel type on HT 31. From this point on, it becomes only a matter of time for us to translate practically all of HT 31 from Minoan Linear A into English.

The 6 words for vessel types in Minoan Linear A: Linear A tablet HT 31 (Haghia Triada)

Table 1
Parallel comparison of ideograms for vessels on Minoan Linear A tablet HT 31 (Haghia Triada)
& Mycenaean Linear B Pylos Py TA 641-1952 (Ventris)

HT 31 HT 31 (Haghia Triada)	TA 641-1952 TA 641-1952 (Ventris)		
 <i>puko</i> = tripod 	 <i>tripode</i> = tripod 	 <i>karopa3 (karopai)</i> = kylis 	 <i>qeto</i> = kylis
CCRE = cross-correlative retrogressive extrapolation			
 <i>supu</i> = very large pithos 	 <i>dipa mezo'e qetorou'e</i> = See HT 31 	 <i>supa3ra (supaira)</i> = small cups (with handles?) 	 <i>dipa meuriyo owowe</i> See HT 31
 <i>qapa3 (qapai)</i> = large pithos 	 <i>dipa mezo'e tirou'e</i> = See HT 31 	 <i>pataqe</i> = very small cups without handles 	 <i>dipa meuriyo anowe</i> See HT 31
CCRE = cross-correlative retrogressive extrapolation			

NOTE:
Ideograms are in the order they appear on HT 31 (Haghia Triada),
not in that of Pylos tablet Py TA 641-1952 (Ventris)

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Table 1 – Ideograms for vessels on Minoan Linear A tablet HT 31 (Haghia Triada)
and Mycenaean Linear B tablet Pylos TA 641-1952 (Ventris)

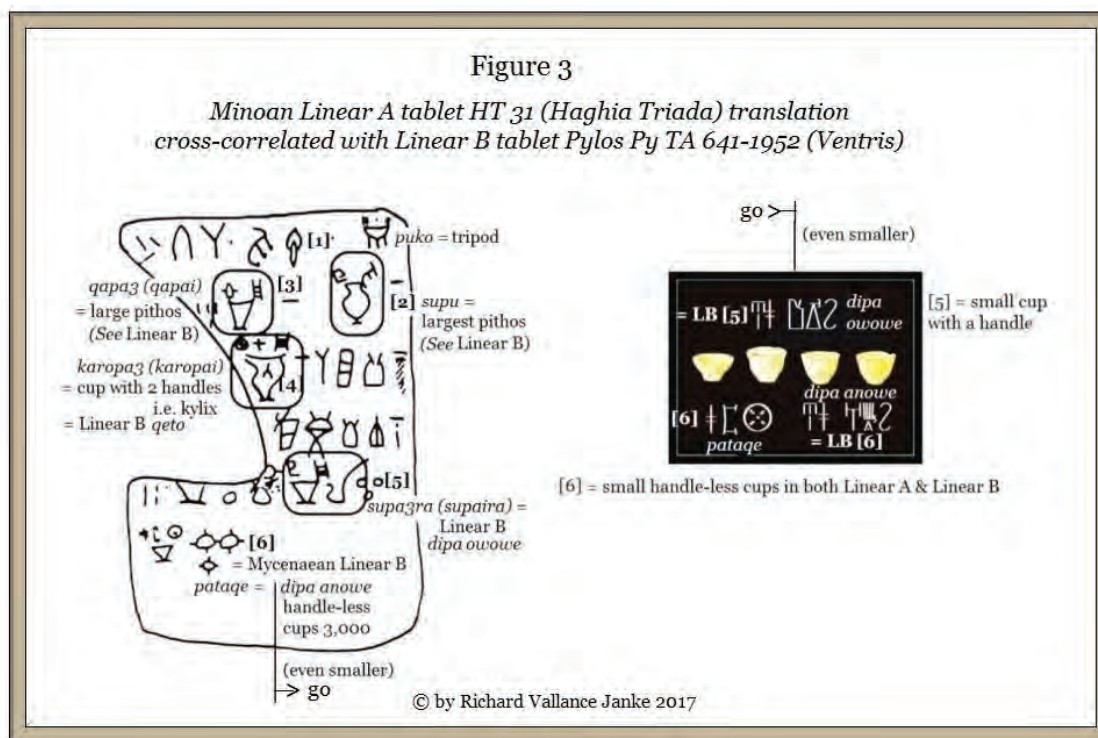


Fig. 3 – The vocabulary for vessels and pottery on Minoan Linear A tablet HT 31 (Haghia Triada)

On Linear A tablet HT 31 (Haghia Triada), in addition to the word *puko* = “tripod” in Minoan Linear A, we find 5 more vessel types, as illustrat-

ed in Figure 3 above, all of which we can translate with reasonable accuracy. The first 3 are *qapa3* (*qapai*), *supu* and *karopa3* (*karopai*), each of

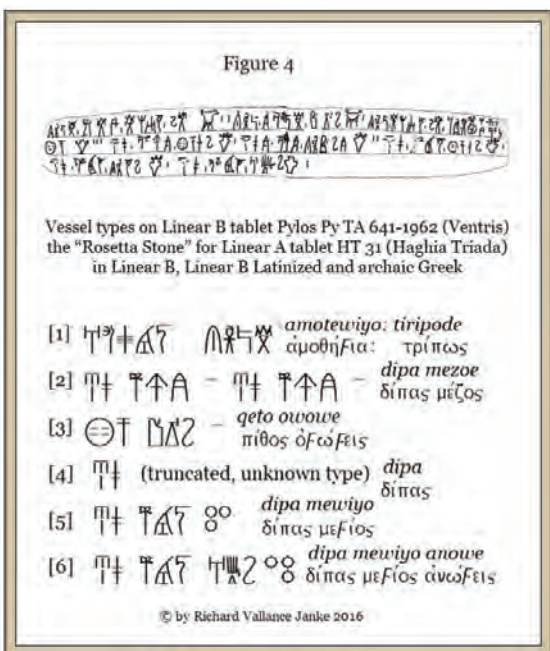


Fig. 4 – Vessel types on Linear B tablet Pylos Py TA 641-1952 (Ventris)

which is counted only 10 times. This figure is highly significant, given that the next 2 vessels, *supa3* (*supaira*) and *pataqe*, are counted 300 and 3,000 times successively, inexorably leading us to draw the conclusion that (*supa3ra*) *supaira* and *pataqe* are much smaller vessels than the first 3. Of the first 3, one is very likely to be the equivalent of *dipa mezoe*, the largest vessel on Pylos Linear B tablet Py TA 641-1952 (Ventris). Which one I cannot say for sure, but I lay my bet on the second, *supu*.

Linear A tablet tagged 19 and the Minoan word for “tripod” = *puko* (confirmation)

This tablet confirms that the Minoan Linear A word for “tripod” is *puko*. Its co-incidence with the same word plus the ideogram for “tripod” on Haghia Triada tablet HT 31 is too great for it to be otherwise. This interpretation is in stark contrast to that of Prof. John G. Younger, who in his *Linear A Texts in phonetic transcription HT (Haghia Triada)*¹¹, takes *puko* on HT 31 to signify “bronze”. But he has singularly failed to take into account



Fig. 5 – The six vessel types enumerated on Minoan Linear A tablet HT 31 (Haghia Triada)

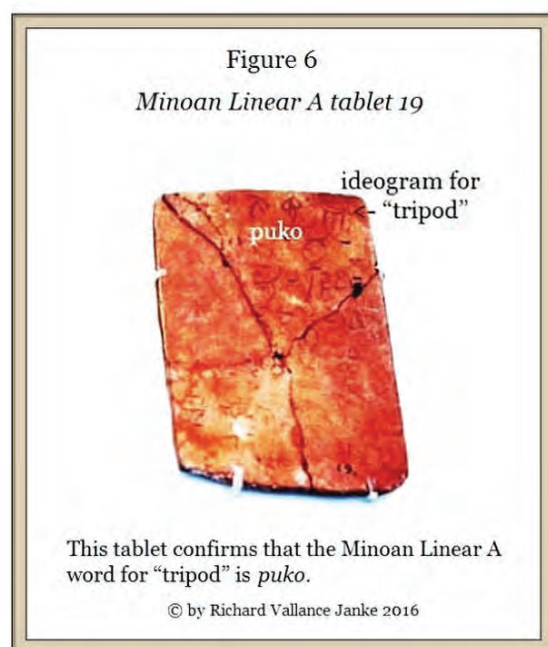


Fig. 6 – Confirmation on Linear A tablet 19 that puko = “tripod”

two compelling factors facilitating the correct decipherment of *puko*. The first of these is that, as the Google image search on Minoan tripods conclusively reveals, almost all Minoan tripods were made of kiln fired *pottery* and not of bronze, as illustrated in Figure 5.

In his decipherment of *puko* as “bronze”, Younger entirely overlooks Linear A tablet 19 (Figure 6), which repeats the exact same formula for *puko* as found on HT 31. On both tablets the formula is on the *first line*. It is as follows: the Linear A word *puko* immediately followed by the standard Minoan *ideogram* for “tripod” (and not for “bronze”). Ideograms for vessels in both Minoan Linear A and Mycenaean Linear B always describe the vessel type itself, and never an attribute of it. Since there were so very few bronze Minoan tripods, it is highly unlikely that a bronze tablet would be itemized on *two* Linear A tablets. It is furthermore to be noted that the Minoan ideogram for “tripod” is for all intents and purposes identical to that in Mycenaean Linear B. So we are left with no other alternative than to pronounce the lexeme *puko* as identical to its Mycenaean Linear B equivalent, *tiripode* = “tripod”.

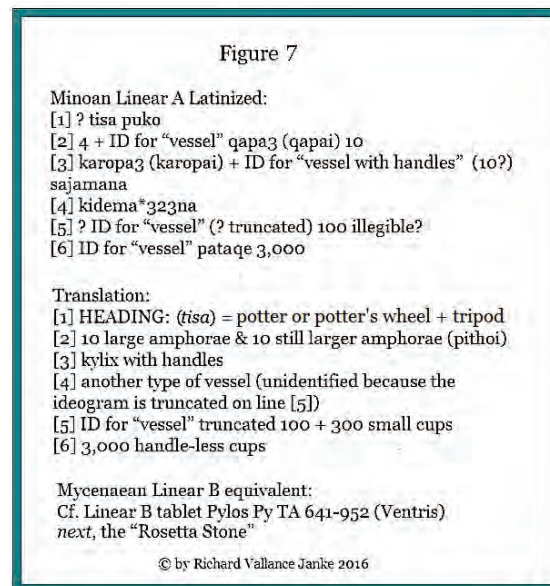


Fig. 7 – Richard Vallance Janke’s decipherment of Linear A tablet HT 31 (Haghia Triada)

With respect to my own decipherment of HT 31 (Haghia Triada),

I leave it up to you to decide for yourself whether or not the assumptions I have made with reference to the 6 specific major vessel types on this tablet are in fact what I take them to be. Direct cross-correlative extrapolation with the terms for vessel types on Pylos tablet Py TA 641-1952 (Ventris) appears to confirm my translations of the 6 major vessel types on HT 31 (Haghia Triada). The parallelism between the vessel types in Linear B tablet Pylos Py TA 641-1952 (Ventris) and the Old Minoan vessel types on Linear A HT 31 is so remarkable that it cannot be cavalierly dismissed. But there is even more compelling evidence that my decipherment of HT 31 is as accurate as I have postulated. It is this. The larger of two Linear A tablets in the A.Y. Nicolaus Museum, Crete (Fig. 8), sports seven supersyllabograms, more than any other Minoan Linear A tablet, and as such plays a key role as a *cross-correlative template within Linear A itself*, confirming the precise semiotic values of the 2 Old Minoan Linear A lexemes, *supu* and *karopa3* (*karopai*) which I have already deciphered as “a very large amphora” and “a kylix” respectively on Linear A tablet HT 31. In the first

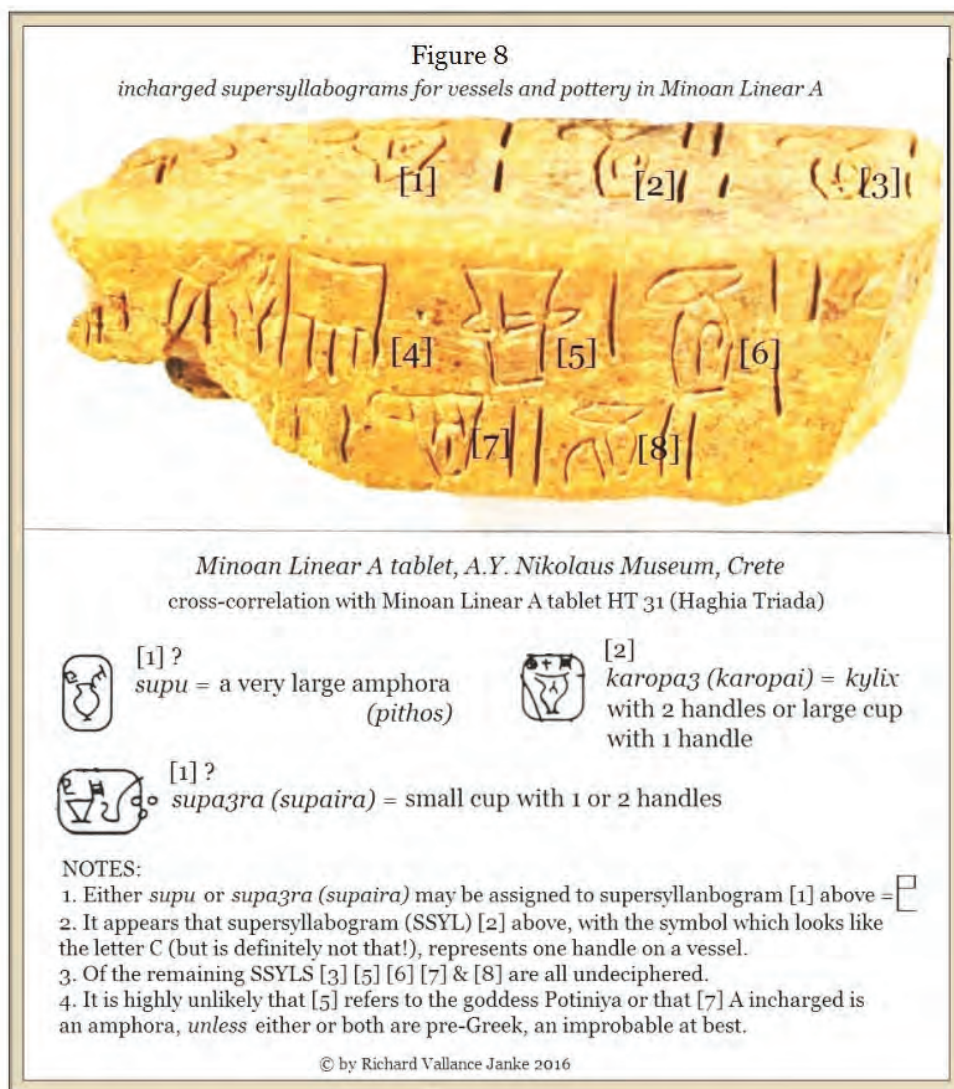


Fig. 8 – The 7 Minoan Linear A supersyllabograms inscribed on the larger of two tablets at the A.Y Nikolaus Museum, Crete

place, the ideogram for a vessel on the A.Y. Nikolaus Museum tablet with the supersyllabogram SU *incharged* bears the semiotic value *supu* = “a very large amphora”. Secondly, the incharged supersyllabogram tagged [2] in Figure 8 has what looks like the Latin consonant C incharged in it. What the C symbolizes is either one handle on one side or two handles on both sides of the vessel it portrays. It is apparent from this incharged ideogram that this vessel is likely to be *karopa3 (karopai)*, “a kylix”, confirming that my translation of *karo-pa3 (karopai)* as “kylix” on HT 31 is on target. From this frame of reference, it is quite clear that the A.Y. Nikolaus Museum tablet serves the same

cross-correlative role *within* Minoan Linear A as does Pylos tablet Py TA 641-1952 (Ventris) by retrogressive extrapolation from Mycenaean Linear B. These two *entirely independent* cross-correlative templates doubly confirm that our decipherments of *supu* as “a very large amphora” and *karopa3 (karopai)* as “a kylix” are in all probability valid. Thus, along with the Minoan Linear A term *puku* = “a tripod”, we have unravelled the semiotic values of three Old Minoan Linear A terms never before satisfactorily deciphered.

In conclusion, we can typify our decipherment of Minoan Linear A tablet HT 31 (Haghia Triada) as quite satisfactory. The only remaining doubts which

nag me are my translation of [1] *tisa* as a heading, "pottery wheel" or "potter" and [4] *kidema**332na as yet another type of vessel. Of these two decipherments, the second is more convincing than the first. Yet in spite of my reticence over *tisa* as "description of pottery", or literally, "all pottery", it appears to fit the context well enough.

Prospects for the decipherment of Minoan Linear A:

How far can we go in deciphering Minoan Linear A? First the bad news. While we can decipher some Old Minoan Linear A terms whenever select tablets on which they appear contain *ideograms* to assist us with them, in the total absence of such aids, there is little or no chance for us to decipher Linear A tablets with words *alone* on them. This is an all but insurmountable stumbling block to any comprehensive decipherment of Linear A. It is nothing short of a Catch-22. Ideograms in Minoan Linear A happen to turn up with far greater frequency on tablets dealing with vessels and pottery, leaving us with considerably greater scope for the satisfactory decipherment of Linear A terms *in that sector alone* of the Minoan economy, but also leaving us facing the dim prospect that it is going to prove a tough slog to even approach any credible decipherment of any Old Minoan Linear A word which is *not* directly associated with an ideogram in all other economic sectors.

On the other hand, the presence of a substantial Mycenaean Greek derived superstratum in Linear A leads us to the contrary hypothesis that the 300 or so maximum putative Mycenaean words which are found on a number of Linear A tablets appear to substantiate the case that these words at least constitute a Greek vocabulary, a.k.a. New Minoan, which is *entirely independent of Old Minoan*, the latter remaining recalcitrant to any attempt at decipherment. We must therefore draw a clear-cut distinction between Old Minoan, as yet indecipherable, and New Minoan, which is eminently decipherable.

The 5 Principles of Cross-correlative retrogressive extrapolation (CCRE):

If we are to make any headway at all in the even-

tual decipherment of Old Minoan, there are certain principles which bind us. There are 5 of them:

1. (The so-called negative factor). *It is a totally futile enterprise to undertake a decipherment of the Old Minoan language by correlating it with any other ancient language*, except surprisingly for Mycenaean Greek, with its much larger lexicon of at least 4,500 terms, through the technique of direct or indirect derivation from the latter. All past and present researchers and philologists attempting to decipher Minoan Linear A have made the assumption that they had first to determine what family or class of language it must or may have belonged to before they even begin to attempt decipherment. This is a false premise, a non starter. It is a total waste of time trying to pigeon-hole the lost Old Minoan language in any class of language, whether Indo-European or not. It will get us absolutely nowhere. So I have concluded that it serves us best to decipher the Old Minoan language *on its own terms, i.e. internally, as well as externally, by cross-correlating tablets with (quasi-) parallel Mycenaean Linear B tablets*. Once again, however, we must draw an express distinction between Old Minoan, the language all decipherers to date have utterly failed to decipher, and New Minoan, which has been and is clearly susceptible to decipherment.

2. Cross-correlation between the Old Minoan language and the Mycenaean syllabary:

Notice that in 1. above I italicized the word *cross-correlating*. It is only by the process of cross-correlation with a known language that we can even begin to decipher an unknown one. The known language with which Old Minoan must be cross-correlated is Mycenaean in Linear B, if for no other reason than that the Linear B syllabary is directly derived from its predecessor, Linear A, with a modicum of changes required by the latter to represent the phonology of Mycenaean Greek more or less accurately. Mycenaean has also adopted most of the same ideograms, however often adapted to their own particular needs, or for other reasons streamlined.

The application of the principle of CCRE is squarely based on the approach taken by the brilliant French philologist, Jean-François Champellion, who finally deciphered Egyptian hieroglyphics in 1822, 23 years after they were discovered on the history-making Rosetta Stone in Egypt in 1799. He made the brilliant assumption that the stone, on which was inscribed the identical text in three languages, the first two being Demotic and ancient Greek, *must have the exact same text in Egyptian hieroglyphics*. And it does. Here is where the principle of cross-correlation comes charging to the fore. If a given text in an unknown ancient language appears on the same tablet as at least one known language (in this case two), a truly observant philologist cannot help but draw the all but ineluctable conclusion that the text of the unknown language must be identical to that of the known. Champellion had hit bull's eye.

But Pylos tablet Py TA 641-1952 (Ventris) is *not* the Mycenaean Linear B "Rosetta Stone" for Minoan Linear A tablet HT 31 (Haghia Triada) in the same sense that the Rosetta Stone conclusively served to decipher the ancient Egyptian language. Linear B tablet Pylos Py TA 641-1952 (Ventris) is the Mycenaean Linear B "Rosetta Stone" for Minoan Linear A tablet HT 31 (Haghia Triada) only in the sense that it enables us to decipher most of the *vocabulary alone* on the latter. It does not and cannot facilitate the actual decipherment of Old Minoan itself. Currently, given the paucity of extant Minoan Linear A tablets and fragments, of which most are mere fragments (the majority of which are for all intents and purposes illegible), that longed-for quixotic objective is still beyond our reach. And yet, armed with my premise that Linear A HT 31 by and large mirrors Pylos Py TA 641-1952 (Ventris), I forged right ahead and drew a direct comparison between the two. Both tablets mention (almost) the same types of vessels on at least *six* occasions.

By extrapolation of Old Minoan Linear A terms from their Mycenaean Linear B equivalents, I certainly do not mean to imply that the former can be directly divined from the latter,

since that is impossible, given that Mycenaean Greek is a known language whereas Old Minoan is unknown. What I mean is simply this: there is a very good chance that an Old Minoan word which appears on a Linear A tablet which shares an (almost) identical ideogram and relatively similar placement of (quasi-) identical text with its reasonably similar Mycenaean counterpart very likely shares the same or very similar meaning. The clincher here is *context*. If the (quasi-) identical ideograms on both the Minoan Linear A and Mycenaean Linear B tablets are similar or identical (as is the case with the ideogram for "tripod"), then we have something substantive to go on.

3. Parallel ideograms on Linear A and Linear B tablets:

We can glean direct or indirect cues from parallel *ideograms* on (quasi-) similar Minoan Linear A and Mycenaean Linear B tablets, with the proviso that indirect clues are considerably less satisfactory than direct. The presence of similar or of the same ideograms for vessels on both of the aforementioned tablets has allowed me to decipher a very small subset of Minoan Linear A vocabulary on Linear A tablet HT 31 alone.

4. We should turn to reliable archaeological evidence where this is available:

Archaeological evidence lends further credence to my decipherments of four of the five other vessel types on HT 31, namely, *karopa3* (*karopai*), *nere*, *qapa3* (*qapai*) and *tetu*. The problem here is, which one of the largest of the *six* terms for vessels is the largest of them all, approximately equivalent to the Greek *pithos*? I have concluded that Minoan Linear A words terminating in the ultimate masculine singular **u** appear in most instances to designate the very largest in their class. So it would appear that *supu* is the most likely candidate equivalent to the ancient Greek *pithos*.

5. Both Minoan Linear A and Mycenaean Linear B are highly formalized and standardized artificial formulaic subsets of their respective languages:

This is the most important principle of all. It is critical to understand that Minoan Linear A and

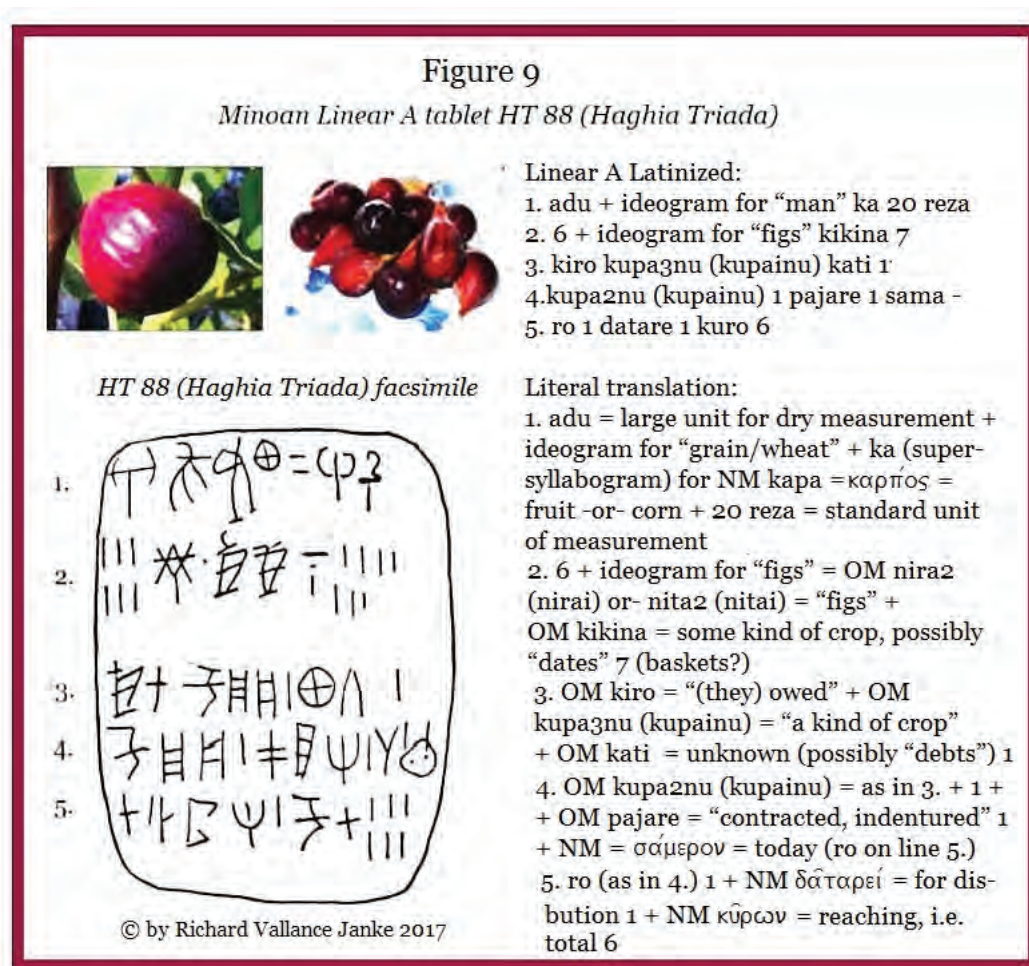


Fig. 9 – Facsimile of Minoan Linear A tablet HT 88 dealing with figs and other staple crops

Mycenaean Linear B both deal with inventories and the process of inventorying livestock, crops, military matters, commodities such as vessels and pottery and textiles and in some cases religious rites. Any philologist or historical linguist who has not taken this imperative into account has completely missed the boat. Unfortunately, the majority of so-called decipherers of Minoan Linear A have failed to do pay heed to what is the most germane tenet of all, the fact that both syllabaries deal mostly with inventories, and that these inventories are cast in *fully standardized, formulaic language*.

Since Minoan Linear A and Mycenaean Linear B both inventory livestock, crops, military matters and commodities such as vessels and pottery and textiles, it only makes sense that a particular inventory on a Mycenaean Linear B tablet, e.g.

Linear B Pylos tablet TA Py 641-1952 (Ventris), which appears very similar to one on a Minoan Linear A tablet (Haghia Triada HT 31) is more likely than not to bear fruit in an acceptable decipherment of the latter. Armed with this premise, I was able to decipher Minoan Linear A HT 31. The credible outcome convinced me to commit myself to working on the operating principle that Minoan Linear A tablets which closely parallel their Linear B counterparts, in the presence of commensurate ideograms, can be at least be partially deciphered (*See principle 2 above*).

6. Combinatory accumulation of principles: The greater the number of these 5 principles entering *simultaneously* into the equation for the decipherment of any Old Minoan word in particular, the greater our chances of "getting it right". Where-

ever all 5 principles apply, you can be sure that the chances for a correct decipherment are significantly higher than those instances where fewer come into play. Caveat: yet even the application of these 5 principles, singly or in tandem (and the more we can apply, the better) cannot guarantee that some of our "translations" are entirely valid. On the other hand, at least to date, it is virtually impossible to decipher any Old Minoan Linear A words on any tablet to which any or all of the aforementioned principles *cannot* be squarely applied.

What is the Old Minoan word for "fig(s)"? A Mystery at last solved?

Is it possible to divine the word for "fig(s)" in Minoan Linear A? Along with numerous other tablets in both Minoan Linear A and Mycenaean Linear B, Linear A tablet HT 88 contains the supersyllabogram NI on the second line:

Free translation: dry measurement of wheat in something like "bushels" (a mere approximation), plus 20 standard units of corn, 6 (baskets of) figs and 7 baskets of some kind of crop (possibly dates): they owed a debt once (lit.: 1 debt) for some kind of crop (unknown), plus 1 unit of the same kind of crop (repeated) indentured today, for distribution once, for a total of 6.

What is the actual word for "fig(s)" in Minoan Linear A? The odd thing about this supersyllabogram NI is that it was taken over lock-stock-and-barrel by the Mycenaeans. We will probably never know why, but it is clear that they thought it expedient to hang onto it. I have always been determined to reconstruct the Minoan word for "fig(s)". In spite of apparently insurmountable obstacles, I was to break the impasse by turning once again to cross-correlation. If we turn to the lexeme for "fig" is in several languages, we find a leading clue to the riddle of its orthography in Minoan Linear A. To achieve this goal, I selected 13 languages, ancient and modern, belonging to 6 different classes. I discovered that all but one of the lexemes for "fig" are either monosyllabic or disyllabic. In one instance only is it trisyllabic, *pesnika*, in Serbian. Here are the words for "fig" in 13 languages be-

longing to 6 different language classes:

KEY to language classes: AU = Austronesian/ IN = Indo-European/ LI = language isolate/ NC = Niger-Congo/ SE = Semitic/ UR = Uralic.

AU: Indonesian *ara* Malay *raja* Maori *piki* | IN: French *figue* | German *Feige* | Greek (Mycenaean) *suza* | Italian *fico* | Latin *ficus* | Norwegian *fiken* | Portuguese *figo* | Serbian *pesnika* | Spanish *higo*

LI: Basque *piku* (borrowed from Indo-European) | NC: Swahili *mtimi* (sub-class = Bantu) | SE: Maltese *tin* (the only Semitic language in Latin script) | UR: Finnish *kuva*



The Minoan for "fig(s)" cannot be monosyllabic, because the supersyllabogram for "fig" in both Minoan Linear A and Mycenaean Linear B is NI. But is it feasible to reconstruct the Minoan Linear A for "fig"? Surprisingly, the answer is yes. It just so happens that most Minoan Linear A words which are *diminutives* are *feminine*, bearing the ultimate *pa3* (*pai*), *ra2* (*rai*) or *ta2* (*tai*). Under the circumstances, it only takes one small step to restore the two best candidates for the Minoan Linear A for "fig" (Fig. 10).

I am quite convinced that the Minoan Linear A word for "fig(s)" is either *nira2* (*nirai*) or *nita2* (*nitai*), *nire* or *nite* in the plural, as these are the only plausible alternative *diminutive ultimates*, in view of the fact that *pa3* (*pai*) has no plural.

Measurement in Minoan Linear A:


Immediately pursuant to my decipherment of HT 31 (Haghia Triada) on vessels and pottery, I turned my attention to five words recurring on a number of Minoan Linear A tablets, *reza*, *adureza*, *dureza*, *kireza* and *tereza*. Philologists such as Andras Zeke of the Minoan Language Blog had consistently "deciphered" these five terms as toponyms or place names, but I was immediately suspicious of such interpretations, given that 4 of them have prefixes prepended to what remarkably looks like their own root or stem, *reza*. These I took to be terms of measurement. If they are indeed that, the total number of terms relative to measurement of large, not minute, quantities in

Figure 10

$\begin{matrix} \text{XX} \\ | \\ \text{NI} \end{matrix}$

|



What is the Minoan Linear A word for figs?

$\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \neq \begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *nipa3 (nipai)*, but this one is impossible because there is no syllabogram PE in Linear A.

$\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} = \begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *nira2 (nirai) plural =* $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *nire*
 or $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *or* $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *nitaz (nitai) plural =* $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *nite*

These are the only possible alternatives for Linear B

$\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} = \begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix} \begin{matrix} \text{PE} \end{matrix}$ *suza = figs*
 $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix}$ *ni* $\begin{matrix} \text{XX} \\ | \\ \text{PE} \end{matrix}$ *vi*

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Fig. 10 – What is the Minoan word for “fig(s)”?

Minoan Linear A is at least five.

These five units of measurement in Minoan Linear A (precise values unknown) are: *reza* = standard unit of measurement (linear) | *adureza* = dry unit of measurement (something like “a bushel” or “a bale”?) for grains (barley and wheat) and dry goods only | *dureza* = unit of measurement (unknown) [1] | *kireza* = dry measurement for figs (a basket) [2] | *tereza* = standard dry or liquid unit of measurement, in the latter case something along the lines of “a large jug”, “a flask” or “a gallon”:

Zakros tablet ZA 1, illustrates the standard unit of measurement, *kireza*, for figs:

NOTES:

[1] While I have been utterly unable to quantify what standard unit of measurement *dureza* is supposed to represent, even the standard units for *reza*,

adureza & *tereza* are also mere approximations.

[2] While *kireza* appears to be the standard unit for the measurement of a basket of figs, this still begs the question, what size is the basket? The basket size cannot be larger than can reasonably be carried on one shoulder by a woman, since that is the way baskets were carried in practically every ancient culture. So in this case, the approximation for the standard unit of measurement figs, *kireza*, is considerably more accurate than the others.

Now if we compare the variables in the prefixes to the root, *reza* (*adu*, *du*, *ki* & *te*) with the similar practice of suffixes appended to roots in Mycenaean Linear B, which employs the *direct opposite practice* we have just expounded for Minoan Linear A, we nevertheless discover that the same level of consistency and coherence applies

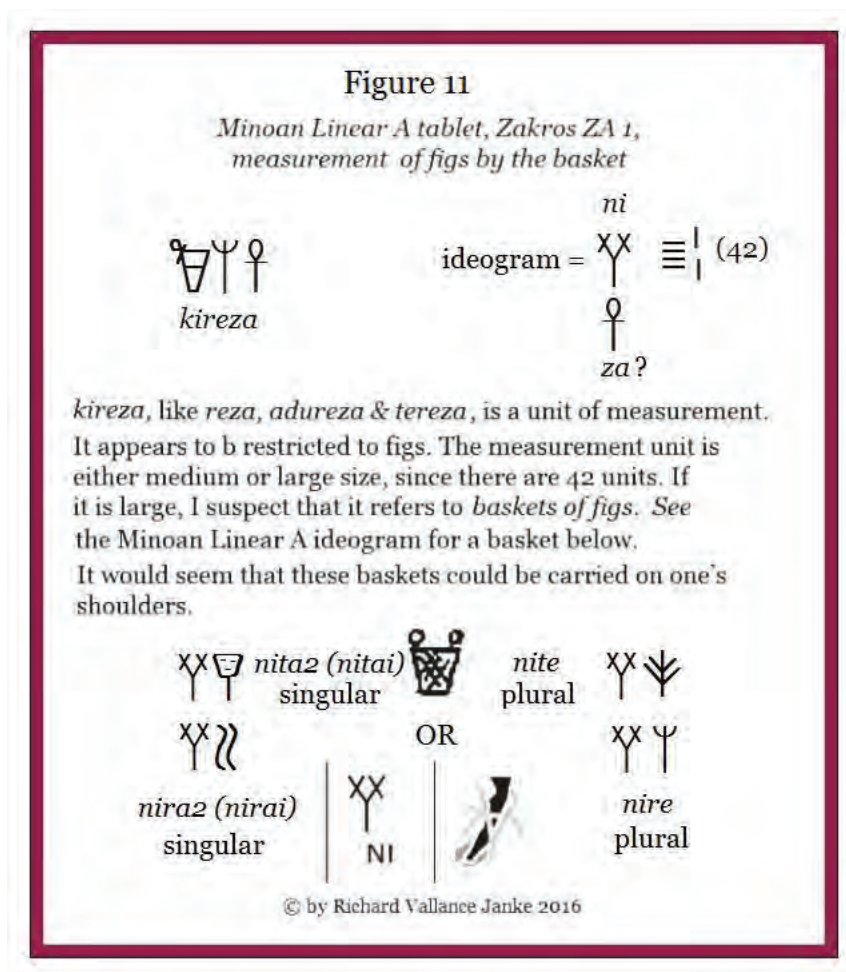









Fig. 11 – The standard unit for the volumetric measurement of figs, kireza = 1 basket carried on the shoulders

equally to both languages, as illustrated by the following table (Table 2), in which the 4 *prefixes* listed above for Minoan Linear A *precede* the invariable root, *reza*, while in Mycenaean Linear B the *invariable* roots *precede* the *variable* suffixes. These Linear B roots are, respectively, *raw*, which references anything to do with military personnel, *tri*, which refers to anything related to the number 3 and *wana*, which references any connotation of kingship or royalty in Mycenaean Greek.

While the practices for affixing are apposite in Minoan Linear A (which *prepends* *prefixes* to the *root* or *stem*) and in Mycenaean Linear B (which *appends* *suffixes* to the *root* or *stem*), the procedure the two languages follow is actually one and the same, flipped on its head either way you view it, i.e. from the perspective of Mycenaean Linear B or

vice versa, from that of Minoan Linear A.

The underlying principle which circumscribes this procedure is the *cognitive frame*, as propounded by the philologist, Eugenio R. Luján⁹. So let us simply call the procedure (whether from the perspective of Minoan Linear or its opposite in Mycenaean Linear B) just that, the cognitive frame, which is also the template for it. As Eugenio R. Luján so succinctly summarizes it in his article, "Previous work on semantic maps has shown how the *polysemy* of grammatical morphemes is not random, but structured according to underlying principles... *passim*... Although the semantic map methodology has not been applied to the analysis of word formation patterns, there is no reason to suppose that *derivational morphemes* behave differently from grammatical morphemes. In fact,

	ra-wa-ke-ta	λαγαγέτας	lafagetas	official title (= leader of the people)
<p><i>Mycaenean Linear B</i></p> <p>In Linear B the prefixes are not metrograms.</p>				
	ti-ri-po/ ti-ri-po-de	τρίπος/τρίπους	tripos/tripous	tripod (kind of stool)
	ti-ri-po-di-ko	τριποδίσκοι	tripodiskoi	small tripods
	ti-ri-se-ro-e	τρισιρώει (>τρισηρώεις)	trisiroei (>triseiro'is)	divine epithet (= 'the trice heroine')
	wa-na-ka/ wa-na-ka-te/ wa-na-ka-to/ wa-na-ke-te	Φανάξ/ Φανάκτος/ Φανάκτει	vanax/ vanaktos/ vanaktei	wanax, king, leader aristocrat
	wa-na-ka-te-ra/ wa-na-ka-te-ro	Φανάκτερα/ Φανάκτέρων (>ανάκτορα)	vanaktera/ vanakteron (>anaktora)	premises of the wanax
	wa-na-sa	Φανάσσα	vanassa	queen

Minoan Linear A

Minoan Linear A units of measurement:

reza = standard unit of measurement

root = reza

adureza = unit of dry measurement

dureza = unit of measurement (unknown)

kireza = unit of measurement for figs = 1 basket

tereza = unit of liquid measurement

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Table 2 – Variable affixes for units of measurement in Mycenaean Linear B and Minoan Linear A

taking into account the findings of the intensive work done in the field of grammaticalization in the last thirty years or so, we know now that *lexical and grammatical morphemes constitute a continuum, and their meanings are organized in the same way—inside a cognitive frame,...*” (pg. 163) and most significantly, “In contrast to the lexicon, the number of derivational morphemes and word formation patterns in any given language is *limited*.” *Ibid.* (all italics mine)

I wish to lay particular stress on this last observation by Eugenio R. Luján, because he is right

on the money. In terms of my own explanation of how the procedure of the cognitive frame works, what this means in this case is: the *derivational morphemes* (i.e. the prefixes in Minoan Linear A and the suffixes in Mycenaean Linear B) are very limited in comparison with the orthographic and grammatical lexicon in either language, or for that matter, in any language, ancient or modern. (*italics mine*)

All of this brings us full circle back to my original assumption, namely, that *adureza*, *dureza*, *kireza* and *tereza* are all derivational morphemes

of *reza* in Minoan Linear A and that the suffixes appended to the roots *raw*, *tri* and *wana* in Mycenaean Linear B are also derivational morphemes. The gravest problem with the decipherment of HT 13 (Haghia Triada) advanced by Pavel Serafimov and Anton Perdih is that it does not take the cognitive frame or map of derivational morphemes into account at all. Instead, the authors advance completely unrelated meanings for each of these terms (*reza*, *adureza*, *dureza*, *kireza* and *tereza*), entirely oblivious to the fact that they all share the same root, *reza*. This factor alone casts profound doubt on their decipherment.

On the other hand, my own decipherment of HT 13 (See Figure 2 *supra*) takes the procedure of the cognitive frame or map of derivational morphemes squarely into account, with the very same procedure applied to derivational morphemes in Mycenaean Linear B, though in the opposite direction. For the sake of consistency, let us refer to the cognitive frame or map of derivational morphemes in Minoan Linear A as *regressive*, given that the variables (the prefixes, *adu*, *du*, *ki* & *te*) precede the root, *reza*, and the same frame as *progressive* in Mycenaean Linear B, in light of the fact that the root or stem is followed by the *variable suffixes* (derivational morphemes). Be it as it may, prefixes and suffixes are both classed under the umbrella term, *affixes*. The procedure amounts to one and the same either way.

For this reason alone I am convinced that my decipherment of HT 13 is on the right track, even if it is not totally accurate, which it cannot be anyway, in view of the fact that four of the five standard units of measurement for large quantities in Minoan Linear A (*reza*, *adureza*, *dureza* and *tereza*) will never be known with any measure of accuracy, given that we can have no idea whatsoever what the standard units for any metrogram in either Minoan Linear A or Mycenaean Linear B actually were. The further we as philologists regress diachronistically in the historical timeline, the less determinable and reliable metrograms are.

CONCLUSIONS:

In an article of this nature, I must of necessity focus on those Old Minoan Linear A terms which offer the greatest insight into the a small subset of the *vocabulary* alone of the language, but not the language itself. Anyone who dares claim he or she has "deciphered" the Minoan language is skating on very thin ice. Any attempt to decipher the Old Minoan language is severely trammelled by the incontestable fact that no one knows what the language is or even what language family or class it belongs to, if any. All we can hope to do at the present juncture is to decipher a very small subset of its vocabulary, that and nothing else. This has been made possible because the *syllabary* has already been deciphered. It is precisely because the syllabary itself has been deciphered that we have any access at all to Old Minoan vocabulary. We must recall that for Michael Ventris, the decipherment of Mycenaean Linear B was a far more daunting travail from the outset, because no one in the world, including himself, knew what the Linear B syllabic signs signified. It took him some three years to figure them out and he never actually nailed them until he finally realized in June 1952 that Linear B was a very early form of Greek, which we now know as Mycenaean Greek. But the situation is far different with Minoan Linear A. We can "read" the syllabary. We can "read" the words, even if we have not understood what the vast majority of them mean... at least to date. The only exception to the obdurate wall of indecipherable Minoan words appears to be the vocabulary of Linear A tablet HT 31 (Haghia Triada), which is susceptible to decipherment only because we have been able to cross-correlate its vocabulary, as qualified by attendant ideograms, with similar vocabulary-cum-ideograms on Linear B tablet Pylos Py TA 641-1952 (Ventris).

On the other hand, the prospects for the decipherment of New Minoan are propitious. Recently, I compiled the fullest Linear A Lexicon ever, far more comprehensive than Prof. John G.

Younger's *Linear A Texts in phonetic transcription*, which disappoints simply because it is so incomplete. I was able to substantiate this conclusion, that Prof. Younger's Reverse Lexicon is all too inadequate, by scanning the vocabulary of every last Linear A tablet and fragment which he has identified on his site, *Linear A texts in phonetic transcription*.¹¹ And he has missed none. As it turns out, there are no fewer than 291 intact Linear A words on the tablets which are not listed in Prof. Younger's Reverse Lexicon, exposing the glaring deficiencies in the latter. In fact, taking the 291 additional intact Linear A words not in the Lexicon into account, we wind up with a total of 1166, or 291 more than the 814 intact words in Prof. John G. Younger's *Linear A Texts in phonetic transcription*, by my count.¹² Of the total of 1166, approximately 750 or 64 % are Old Minoan, whereas some 300 words or 26 %, which we characterize as New Minoan, are of probable Mycenaean origin, amounting to a significant subset of the Linear A syllabary. As for the remaining 10 %, linguistic sources run the gamut from Akkadian, Anatolian, Egyptian, Hebrew, Hittite, Hurrian, Luwian, Pelasgian, Phoenician, Phrygian, Proto-Canaanite, Sanskrit and Ugaritic, Uralic (proto-Finnish) to proto-Semitic and Sumerian, Hurrian being the most plausible candidate. So we must clearly distinguish between the Linear A syllabary and the *languages* it represents, which is only Old Minoan for 64 % of the vocabulary of the syllabary itself, while the remaining 26 % of the Linear A syllabary is not Old Minoan at all, but rather New Minoan, in other words, Mycenaean in origin.

Since the New Minoan lexicon of words derived from Mycenaean Greek consists of some 300 terms (exclusive of onomastics and topomastics), it is not possible to reproduce it here. However, this table of a small subset of 33 New Minoan Greek words serves to illustrate the substantive impact of the superstratum derived from Mycenaean Greek on Linear A, on the understanding that, while the Linear A syllabary itself is the re-

pository of Old Minoan for 64 % of all vocabulary in Linear A, it is also the medium for Mycenaean Greek derivations for the remaining 26 % of all vocabulary in the syllabary. We must therefore not confuse the Linear syllabary with the language it is supposed to represent, since on the one hand it is the syllabary of Old Minoan, yet on the other it is also that of New Minoan, the Mycenaean Greek derived superstratum.

Here then is Table 3,

Finally, I would be remiss were I not to fully acknowledge the impeccable research parallel to my own conducted by Yuriy Mosenkis, professor at the Kyiv National Taras Shevchenko University, Ukraine, member of the Ukrainian Higher Education Academy of Sciences and one of the world's most highly qualified linguists in diachronic historical linguistics, who has also been researching Minoan Linear A at length. Prof. Mosenkis has provided ample evidence that the Minoan language may, at least in part, incorporate a substantive Mycenaean Greek superstratum.¹³ With respect to New Minoan, in view of the comprehensive etymological, semiotic and morphological research undertaken by Prof. Mosenkis, coterminous with my own, I am confident that our joint research demonstrates that New Minoan is a Mycenaean Greek derived superstratum introduced into the Linear A syllabary in its latter days (ca. 1450-1400 BCE), shortly before the adoption of the new "official" scribal script, Linear B, which brought about its eventual demise.

As for Old Minoan, I am left with no alternative but to concede that it is still largely indecipherable, and will probably remain so for the foreseeable future. But that does not imply that at least a small subset of Old Minoan is indecipherable. Quite the contrary. In those cases where ideograms, accompanied by terms with which they are inextricably bound, come into play, decipherment of such terms is well within reach, as is clearly attested by Linear A tablet HT 31 (Haghia Triada), which so closely parallels Linear B tablet Pylos Py TA 641-1952 (Ventris), its so-called "Rosetta

ATIKA αὐτίκα	immediately, presently
ḌURA₂ δούραι	slaves (fem. pl.)
DUSI δύσις	the west
IA ἴα	arrow (plural with sing. meaning)
IDA Ἴδα	(Mount) Ida
IDAMATE Ἰδαματε	Mother goddess of Mount Ida
IDAMETE Ἰδαμετε	= Ἰδαματε Mother goddess of Mount Ida
IDAREA Ἰδάρεα	goddess Rhea of Mount Ida
IDUNESI ἰδύνεσι	they sweeten (wine)
IMA ἱμάς	harness, leather strap
IMETU ἱμέρτος	lovely
ISE ἴση	the same
JAMI ἱάμι ἱάμει	as a treatment/ remedy (instrumental)
JASAJA ἱασαία	a healer (fem.)
JASEA ἱασεία	a healer
JATA/JATAI/JATAPI ἱάτα ἱάται ἱάταφι	curable (fem. + dat. sing + instr. pl.)
JATE ἱάτερ	physician, doctor
JATEO ἱάτρον	physician, doctor (acc.)
KAKU χαλκός	copper * Scores and scores of Minoan Linear A words terminate in <i>u</i> .
KERO κηρός	bees-wax, wax These I take to be masculine, and in some cases neuter,
MITA μίνθα	minth being equivalent to the Greek ultimates <i>ος</i> & <i>ον</i> .
MUKO μυχός	corner, recess
NATI ναστή	firm, well-kneaded
NEA νέη	a new (fem.)
ODAMIA οὐδαμία	no one (fem.)
OPI ὅπι	where
RADU ῥάβδος	a rod/stick
ROIKA ῥοικά	crooked = Linear B
TAPA τάρφα	thick, close = Linear B
TEJAI θεῖαι	goddesses
TENATA τεῖνάτα	stretched?
WINU <i>Ῥινυ</i> <i>Ῥινος</i> <i>Ῥοίνος</i>	wine = Linear B <i>wono</i> <i>Ῥοίνος</i>
WIREU <i>Ῥίρευ</i>	priest = Linear B <i>ῥερευ</i> ἱερός

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Table 3 — selective list of 33 probable Mycenaean Greek derived words out of a total of som 300 in Linear A

Stone". But we can go even further. Tablets such as HT 13 (Haghia Triada), on which we discover at least as many New Minoan as Old Minoan words, afford us some latitude in determining the likely meaning of at least some of the Old Minoan words on them in context with New Minoan words with which they *are immediately adjacent (italics mine)*. And the greater the number of New Minoan terms on any Linear A tablet, the greater are our chances of deciphering at least some of the Old Minoan words adjacent to them. So at least a small subset of Old Minoan vocabulary is ac-

tually susceptible to decipherment. This is a new development, not foreseen by previous linguists attempting to decipher Linear A. So while the desideratum of deciphering Old Minoan as a whole is not within reach for the foreseeable future, at least some of its vocabulary already appears to be decipherable.

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Although Prof. John G. Younger has tallied some 847 Linear A words on his site, *Linear A Texts in phonetic transcription*, his lexicon is far from complete. Consequently, it has been necessary for me to draw all of the intact Linear words from every last Linear A tablet and fragment on Prof. Younger's site. The difficulty here is that his lexicon includes even those Linear A words containing unknown syllabograms, many of which are assigned numeric values only, e.g. *309 *318 *319 *346-348 etc. And there are a number of them. The problem with all of these syllabograms is that no one knows what their phonetic values are. So it goes without saying that every last Minoan Linear A word which contains even one of these unknown syllabograms should, properly speaking, be disqualified. Moreover, there is redundancy in some of the vocabulary, since quite a few Linear A words on his site are simply variants of one another. To cite just a few examples, we have: *daka/daki/daku/dakuna*; *maru/maruku/maruri*; *nesa, nesaki, nesakimi*; and *tami, tamia, tamisi*. Consequently, I have also eliminated all of the variants on any given term. This leaves us with a remaindered total of 847.

12. *See Bibliography*, Wogan-Browne, Jocelyn, et al. 2009
13. *See Bibliography*, Mosenkis, Urii. 2017.

ABBREVIATIONS

AJA American Journal of Archaeology
A&S Archaeology and Science (Belgrade)
BCH Bulletin de Correspondance hellénique
ET Études Crétoises
Europa Europa. Festschrift E. Grumach
EJA European Journal of Archaeology
FAV Faventia: Revista de filologia clàssica
JES Journal of European Studies
KADM Kadmos: Zeitschrift für Vor- und Früh-griechische Epigraphik
LD Linguistic Discovery
MIN Minos: Revista de Filología Egea
REI Revue des études indo-européennes

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ROMAN ARCHAEOZOOLOGY IN SERBIA: STATE OF THE DISCIPLINE AND PRELIMINARY RESULTS

ABSTRACT

Roman archaeozoology is a relatively young discipline in Serbia. In the course of the 20th century only a few papers regarding animal remains from the Roman period sites in Serbia have been published, while in the past decade archaeozoology has gathered momentum in Serbia, and so did the Roman archaeozoology. This paper reviews available (published and unpublished) archaeozoological data from Roman sites in Serbia, gives a short overview of research topics and also offers suggestions for future studies.

KEYWORDS: ARCHAEOZOOLOGY, ROMAN PERIOD, HISTORY OF RESEARCH, SERBIA.

INTRODUCTION¹

Animal bones, along with ceramics, are among the most frequent finds in Roman sites in Serbia. Faunal remains have generally been ignored and at times not even collected in the field. The number of Roman sites with published archaeozoological data is incomparably smaller than the total number of excavated ones. This is the consequence of a lack of specialists - archaeozoologists, but also of the cultural-historical approach prevailing in Serbian archaeology, especially when historical periods are concerned. Archaeozoological studies of Roman sites in Serbia have traditionally been in

a subaltern position compared to the studies of architecture, written sources, ceramic, iconographic and other finds. However, in the past decade, with the inclusion of Archaeozoology as subjects and modules in primary, master and PhD studies at the Department of Archaeology of the Faculty of Philosophy in Belgrade, several specialists in the field of archaeozoology have evolved, and as a consequence, archaeozoology has gathered momentum in Serbia and so did Roman archaeozoology, along with the recognition of the possibilities that archaeozoological studies open in the reconstruction and illumination of different aspects of life in Roman provinces in Serbia. This paper reviews the published archaeozoological data from Roman sites in Serbia, gives a short overview of research topics and also offers suggestions for future studies.

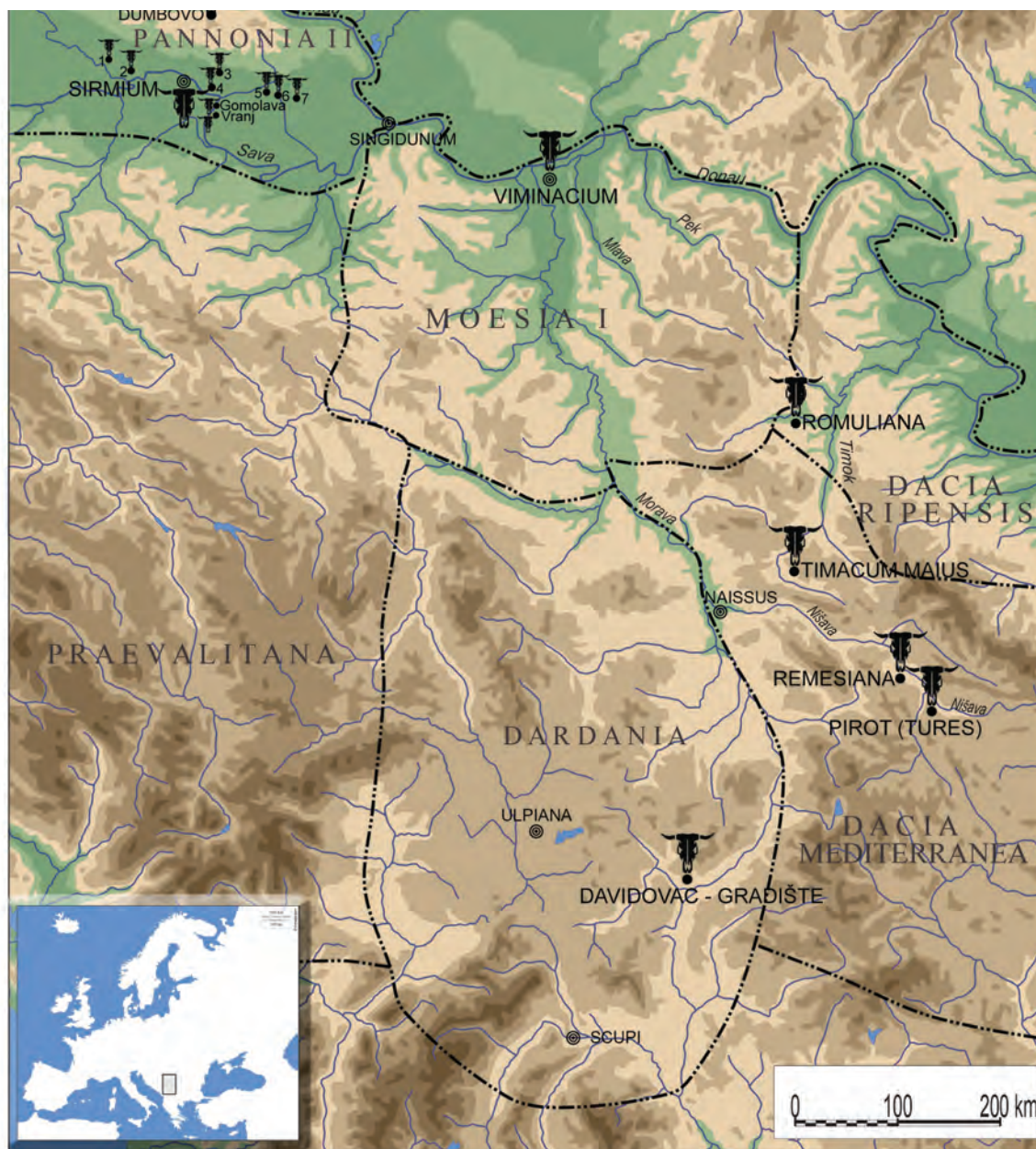
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ROMAN ARCHAEOZOOLOGY IN SERBIA: HISTORY OF THE DISCIPLINE (FIG. 1)

The first archaeozoological papers in Serbia, that have come quite late when compared to the trends in Europe, referred to the mesolithic/neo-lithic site of Lepenski Vir and were published by S. Bökönyi (Bökönyi 1970, 1969), who was at the time the only specialist working in the region, mostly at prehistoric sites. However, the first Roman archaeozoological paper appeared even later and came from the late Roman site of Dumbovo in Vojvodina and was published by the same author (Bökönyi 1976). A large portion of archaeozoological data from Roman sites in Serbia came from Vojvodina region. During the last two decades of the 20th century Svetlana Blažić, a biologist from the Museum of Vojvodina in Novi Sad, was the only hired archaeozoologist in Serbia. From the Roman period sites, she has analyzed faunal remains from *villa rustica* at the site Vranj, near Hrtkovci (Blažić 1993), Roman layers of the site Gomolava, as well as the bones that had been collected during the rescue excavations of the highway route through Srem (sites Prosine, Prhovo; Prosine, Pećinci; Zlatara, Ruma; Kudoš, Šašinci; Livade, Sremska Mitrovica; Gajići, Adaševci; Mitrovačke Livade, Sremska Mitrovica) (Blažić 1995). These were mostly small settlements and villa remains, while the NISP was often very small. Dragana Nedeljković, a paleontologist hired by the Museum of Srem, has analyzed and reported on animal remains from the Roman city of Sirmium, which had been the capital of Late Roman Empire, from the sites of „*lokalitet 80*“ (Nedeljković 1997) and „*lokalitet 85*“ (Nedeljković 2009), but also remains of horses from the hippodrome in Sirmium (Gilić 1994). Sirmium animal bones were also part of the PhD study of a Dutch archaeozoologist R. Lauwerier (Lauwerier 1978).

One of the biggest faunal collections in Serbia comes from the Roman site of Viminacium, containing animal bones that have been analyzed

since 2009, by the author of this paper. Until now, animal remains have been analyzed from the area of the dump of the eastern necropolis (Vuković 2010) and the settlement and villas to the east from the city (the site called *Nad Klepečkom*) (Vuković - Bogdanović forthcoming), while the biggest assemblage comes from the Roman amphitheater and its surroundings (Vuković 2015, Vuković and Bogdanović 2013, Vuković 2011) the analyses of which are still in progress. Archaeozoological results of rescue excavations during protective excavations of the road E 75/E 80 in southern and eastern Serbia, from the late antique settlements at sites Davidovac-Gradište in southern Serbia (Miladinović-Radmilović, Vuković - Bogdanović, and Marković 2016) and Pirot-Sarlah basilica in eastern Serbia have also been analyzed. In Pirot, which used to be a road station in Roman times (*Turres*), faunal remains from the site called Pirot-Staro Vašarište where a high percentage of horse remains had been detected were also analyzed and made public (Vuković - Bogdanović and Pejić 2016). Another road station assemblage came from the nearby road station *Timacum Maius* at the site Niševac-Svrljig and was analyzed by I. Stojanović (Stojanović 2013). A small assemblage of animal remains from a tomb outside the 4th century palace Felix Romuliana (site Gamzigrad) was studied and the results published along with plant remains by V. Dimitrijević and A. Medović (Dimitrijević and Medović 2007). Animal bones that had been found within graves at the late Roman necropolis in Remesiana (eastern Serbia), among which chicken bones were predominant were described in a paper published by J. Jovanović and J. Bulatović (Јовановић and Булатовић 2013). Papers of S. Bökönyi, S. Blažić and D. Nedeljković mostly consist of the lists of identified animals and biometric data, while skeletal, age and sex profiles and also butchery patterns have become known only from recently published papers (Miladinović-Radmilović, Vuković - Bogdanović, and Marković 2016, Vuković - Bogdanović and Pejić 2016, Vuković 2015, 2010, Stojanović 2013)



1. Gajići, Adaševci 2. Bregovi, Atovac, Kuzmin 3. Zlatara, Ruma 4. Kudoš, Šašinci
5. Prosine, Pećinci 6. Prosine, Prhovo 7. Malo Kuvalovo, Kmješevci

Fig. 1 The location of the sites with known archaeozoological data within the map of the Late Roman Provinces in the territory of Serbia.

FAUNAL COMPOSITIONS AND DIETARY PATTERNS

Animal remains from Roman period sites are often butchery and food waste, so by studying the composition of the most important meat providing animals (cattle, pig, sheep and goat), it is possi-

ble to gain an insight into their general respective importance at different sites. For this reason, the presence of different animals in faunal assemblages, where NISP exceeds 450, was counted and the results compared (Table 1/Fig. 2). According to these data, cattle was the most important domestic animal in Roman provinces in Serbia. Cattle

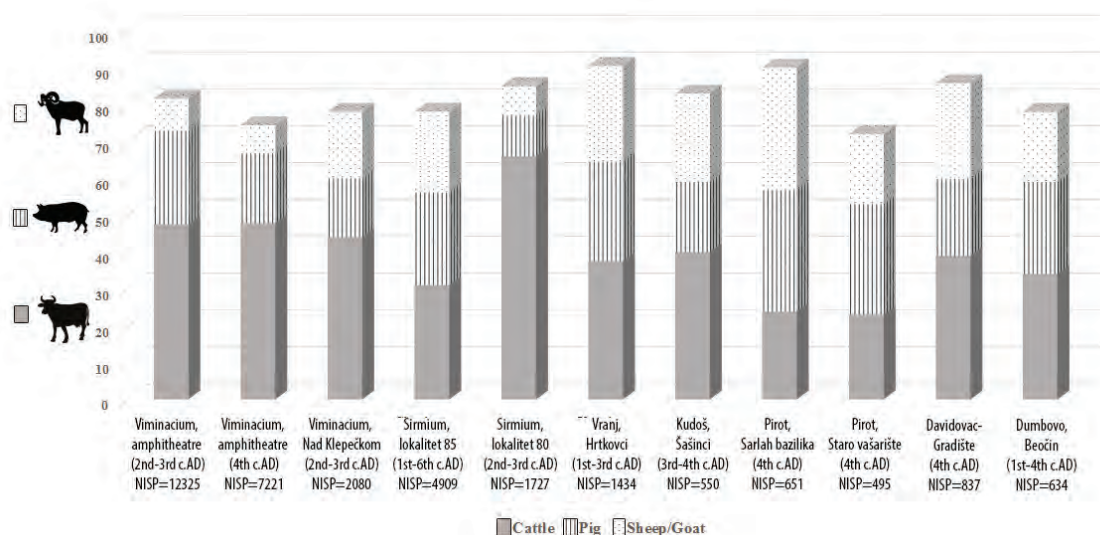


Fig. 2 Contribution of cattle, pig and sheep/goat remains (in percentages) from Roman period assemblages in Serbia, where NISP exceeds 450. Data taken from table 1.

remains prevail in relation to other domesticates at the majority of sites, while in Pirot (eastern Serbia) they are outnumbered by pigs and sheep/goats. The highest importance of cattle, rising up to 40% and more, is noticed especially at urban sites (*Sirmium* and *Viminacium*), but also at other sites, villas and settlements. The second most common animals are either pigs or sheep/goats. Their importance is probably influenced by both environmental conditions, just as a higher percentage of sheep/goats is also observable in pastoral farming regions nowadays, but there are also cultural preferences. Cattle-dominant food pattern is observable at Romano-British sites, especially in towns and military assemblages, but sometimes also in Spain, France, Germany and other Danube provinces, while “typical” Roman food pattern is characterized by high percentages of pig bones (King 1999). Cattle were the most common animals in the periods that preceded Roman invasion in the territory of present-day Serbia, according to very few published data that mainly come from northern Serbia (Vojvodina) (Radišić 2016, Blažić 2006, 1992), so the continuity between the Iron Age and the Roman period is apparent.

Skeletal, age and sex profiles and butchery pat-

terns were included only in recent papers and come mainly from Viminacium (Vuković - Bogdanović forthcoming, Vuković 2015, 2010), and also from Davidovac-Gradište (Miladinović-Radmić, Vuković - Bogdanović, and Marković 2016) and sites in Pirot (Vuković - Bogdanović and Pejić 2016). Butchery patterns of domestic animals, especially of cattle, are in accordance with the same patterns that have been observed in urban settlements across the Empire (Maltby 2015, Maltby 2010, Lauwerier 1988, Peters 1998, Seetah 2006, 2004) and refer to butcher activities of specialists. Cutting and chopping marks made by both knives and cleavers, observed on cranial and postcranial bones, point to the skinning, disarticulating and filleting of animal corpses and also to meat preservation (i.e. perforated scapula blades) (Dobney, Jaques, and Irvig 1996). Split long bones and also a significant number of impact marks are remnants of marrow extraction (Fig. 3). Saw marks observed on antlers and horns, but also on long bones are indicative of bone working activities (Seetah 2006, 125). Cattle were mainly bred until adulthood, pigs were mostly slaughtered in juvenile age, and as for sheep and goats there is an equal ratio of both juvenile and adult animals. These data point

SITE	REFERENCE	NISP	Cattle (%)	Pig (%)	Sheep/Goat (%)	Game (%)	Equids (%)
Bregovi, Atovac, Kuzmin (4th-6th century AD)	Blažić 1995	?	45.3	14.9	22.1	4.5	7.7
Davidovac – Gradište (4th century AD)	Miladinović-Radmić, Vuković-Bogdanović i Marković 2016	837	39	20.8	26	3	3,8
Dumbovo, Beočin (1st-4th century AD)	Bökönyi 1976	634	34	25	19	1.4	7,4
Gajići, Adaševci (3rd-4th century AD)	Blažić 1995	26	43.2	11.5	15.4	11.6	11.5
Kudoš, Šašinci (3rd-4th century AD)	Blažić 1995	550	40	19	24	4.4	10.5
Livade, Sremska Mitrovica (23) (3rd century AD)	Blažić 1995	?	39.3	/	16.7	33.3	16.7
Livade, Sremska Mitrovica (26) (1st-3rd century AD)	Blažić 1995	?	10.7	/	89.3	/	/
Mitrovačke livade, Sremska Mitrovica (4th century AD)	Blažić 1995	142	54.9	8.2	19.7	/	16.2
Niševac, Svrlijig (2nd-4th century AD)	Stojanović 2013	181	34.3	19.3	24.9	8.3	12.6
Pirot, Sarlah bazilika (4th century AD)	unpublished data	651	23.8	32.9	33.3	1	2,8
Pirot, Staro vašarište (4th century AD)	Vuković-Bogdanović i Pejić 2016	495	23	30	19	1.9	25
Prosine, Pećinci (3rd-4th century AD)	Blažić 1995	?	43.5	11.3	19.4	11.3	6.5
Prosine, Prhovo (3rd-4th century AD)	Blažić 1995	?	47.8	11.6	7.8	8.4	11.1
Remesiana, Gladno Polje (4th century AD)	Jovanović and Bulatović 2013	50	/	/	/	/	/
Romuliana, Gamzigrad (3rd-4th century AD)	Dimitrijević and Medović 2007	54	/	/	/	/	/
Sirmium, lokalitet 80 (2nd-3rd century AD)	Nedeljković 1997	1727	66	11	8	4	9,5
Sirmium, lokalitet 85 (1st-4th century AD)	Nedeljković 2009	4909	31	25.1	22	4.6	2,5
Viminacium, Pirivoj (2nd-3rd century)	Vuković 2010	419	25.1	12.9	6.7	0.7	2.4
Viminacium, Amphitheater (2nd-3rd century AD)	Vuković 2015, unpublished data	12325	47.5	25.4	8.7	3	4.3

SITE	REFERENCE	NISP	Cattle (%)	Pig (%)	Sheep/Goat (%)	Game (%)	Equids (%)
Viminacium, Amphitheater (4th century AD)	unpublished data	7221	47.8	19	7.6	2.3	5.5
Viminacium, Nad klepečkom (2nd-3rd century AD)	Vuković-Bogdanović, in preparation	2080	44	16	18	0.3	10
Vranj, Hrtkovci (1st-3rd century AD)	Blažić 1993	1434	37.5	27	26	5.7	0,7
Zlatara, Ruma (3rd-4th century AD)	Blažić 1995	?	45.1	7.8	16.7	11.8	11.8

Table 1 List of Roman period sites in Serbia (in alphabetical order) with known archaeozoological data and references. The table also includes NISP (Number of identified specimens) for each site (if known) and also contributions of the cattle, pig, sheep/goats, equids and game. Unpublished data come from the reports/documentation of the author of the paper.

to the modes of animal keeping (adult specimens were used for secondary products: milk, wool and traction, while juvenile animals were killed for meat), but also to diet preferences as meat of adult cattle had obviously been consumed.

Meat was also acquired from domestic fowl, but in smaller quantities. Contribution of bird remains is cca 2-4% in faunal assemblages in Roman sites in Serbia (Vuković 2015, Nedeljković 2009, 1997, Blažić 2006). The most common birds are chicken, while occasionally bones of domestic goose and domestic duck are also found.

There are suggestions that horses were sometimes, in smaller quantities, eaten too (Vuković 2015). Butchering marks, observed on equid remains from Viminacium, point to skinning, but also dismembering and filleting activities. However, no special butchery patterns exist on equid remains, such as on other livestock bones, so those animals were probably not systematically butchered.

HUSBANDRY PRACTICES

One of the most common and conspicuous feature of animal keeping and breeding in Roman times is improved husbandry. The appearance of very large cattle, sheep and goats throughout Roman provinces that is evidenced by biometric

analyses of animal remains is also testified by Roman sites in Serbia. During the late Iron age cattle wither heights reached the lowermost point (106-109) cm in the region (Blažić 2006, Radišić 2016), while at Roman sites wither heights range from 100 to 140 cm (Blažić 2006, Vuković 2015, Nedeljković 2009, 1997), which suggest the presence of small “local” breeds and also of improved breeds of cattle. The wither heights of sheep reach up to 82 cm, while for goats they go up to 73 cm (Blažić 2006, Vuković 2015, Nedeljković 2009, 1997), so these results are also in accordance with the presence of improved Roman livestock.

The increase of cattle size is linked to the Roman acquisition and has been evidenced throughout Europe (Lauwerier 1988, Maltby 2016, Grau-Solgestoa 2015, Peters 1998, Audoin-Rouzeau 1993). It is usually explained by the import of large breeds from other provinces (mainly Italy), and their crossbreeding with local breeds, but also by import of new foodstuffs and selection of specific local breeds (Bökönyi 1974, Albarella, Johnstone, and Vickers 2008, MacKinnon 2010, Grau-Solgestoa 2015). However, improved breeds of cattle enabled a wide range of new advantages, such as an increased quantity of meat which was a necessity due to the growth of the cities and the population in them, but also greater strength of traction animals.



Fig. 3 Butchery marks on cattle scapula and radius and ulna from Viminacium amphitheater (Vuković 2015).

HUNTING AND FISHING

A minor percentage of wild fauna was quite common in Roman times – and this also refers to Serbian sites. The percentage varies between 0.5 and 6%. The most frequent animal is the red deer, while roe deer, wild boar, hare, wolf, fox are also present (Blažić 2006, Nedeljković 2009, 1997, Vuković 2015). A significant number of brown bear remains has been reported from the area of the Viminacium amphitheater (Vuković 2015, 2011), which is probably related to the participa-

tion of these animals in Roman games.

Animal bones at Roman sites were collected by hand, so there is a bias in the recovery of small and fragile bones, such as fish and bird remains. However, as a small percentage of fish has been detected, the settlers of Roman provinces probably did not significantly rely on fish resources. Among fish, there are remains of local freshwater fish (cyprinids, catfish, pike, perch, etc.) (Nedeljković 2009, 1997, Blažić 2006), but also of large migratory beluga fish (Vuković 2015).

PACK AND DRAUGHT ANIMALS

The most common animals that have been used for transport ever since the time they had been domesticated are horses. Horse and donkey remains are common in Roman sites in Serbia, while the presence of their hybrids, mules, has been hypothesized according to morphometric features in Viminacium (Vuković 2015), Romuliana (Dimitrijević and Medović 2007) and Pirot (Roman Turres) (Vuković-Bogdanović and Pejić 2016). Mules were highly valued animals in Roman times and they were mostly used as pack animals, for drawing vehicles - civilian and official for the State post (*cursus publicus*) (Toynbee 1973: 185-192). Since there had been no previous attempts by archaeozoologists to identify mules, their presence can be hypothesized at other sites, too. Improved stock breeding was also evidenced on horse skeletal remains from Roman times in Serbia, where confirmation was found of the presence of smaller, probably autochthonous, horses with wither heights from 122 to 133 cm and improved Roman horses, with wither height between 142 and 150 cm (Miladinović-Radmilović, Vuković - Bogdanović, and Marković 2016, Vuković-Bogdanović and Pejić 2016, Vuković 2015, 2010, Nedeljković 2009, 1997, Gilić 1994, Blažić 2006, 1995).

The contribution of equid remains in faunal assemblages from Roman cities and settlements generally amounts to 2-4%; in villas it is slightly higher as it reaches up to 10%, while one site, Pirot-Sarlah basilika, stands out with its unusually high contribution of equid bones – 25%. The site is located within the modern city of Pirot in eastern Serbia, which has been associated with the Roman road station *Mansio Turres*, mentioned in Roman itineraries. It is suggested that equid remains from the site are actually the remains of animals that had been bred for the road station (as pack animals for the transport of post and goods), or that they had been bred for the army unit that had probably been stationed in the vicinity of the site (Vuković - Bogdanović and Pejić 2016).

Besides horses, cattle, primarily oxen, were also used for transportation, as it is depicted on numerous monuments and mentioned in ancient texts (Toynbee 1973: 149-162). Pathological alternation on cattle bones that have been studied on Sirmium assemblage were linked to the usage of those animals for transport and draught (Marković et al. 2014). Camels, whose remains have also been attested in Roman sites in Serbia, were also used as pack animals (see section “Exotics”).

ANIMALS AS PETS

As nowadays, the most common pets in Roman times were cats and dogs. Domestic cat and dog remains are common in Roman sites in Serbia, too. According to wither heights of dogs from Roman sites in Serbia that span from 23 to 74 cm (according to Harcourt 1974), different breeds of dogs existed in the region, the smallest, probably toy dogs and also, bigger ones, that were kept not only as pets, but also as shepherd and hunting dogs (Blažić 2006, Vuković 2015, Nedeljković 2009, 1997).

EXOTICS

The most common “exotic” animal within sites throughout the Roman world is the camel. Camel remains in Serbia have been found in big cities, such as Viminacium and Sirmium, but also within smaller settlements and villas along the main roads (Vranj-Hrtkovci, Davidovac-Gradište, Pirot-Sarlah basilika) (Vuković-Bogdanović and Blažić 2014). According to morphometric analyses of the bones, it is suggested that the bones belonged to hybrids of one- and two-humped camels and also two-humped camels. They were used as beasts of burden in Roman times (Toynbee 1973: 137-140), either for military use, for carrying equipment, or for civilian use. The fragmented skeleton of a hybrid camel (Fig. 4) found in the layers that buried the arena of Viminacium amphitheatre (Vuković

and Bogdanović 2013) is the only camel skeleton in European sites throughout the Empire.

“Exotics” include also mollusk remains, mostly Mediterranean shells, such as oyster shells that had probably been imported as luxurious food, and murex snails that were used for pigment extraction in antiquity (Vuković 2015, Nedeljković 2009, 1997, Blažić 2006). Exceptionally, there are also finds of exotic shells, such as *Cyprea tigris*, *Cyprea pantherina* and *Pinctada margaritifera*. Mediterranean shells were sometimes found as grave goods, mostly in graves of women and children (Spasić-Đurić 2015b, 51, 2015a).

ANIMALS IN RITUAL AND FUNERARY CONTEXTS

It is generally very difficult to recognize ritual behavior in archaeological remains and therefore by interpreting special deposits of animal bones it is even more intricate to make a distinction between ritual deposits and food refuse or butchery waste. However, several researchers (eg. Groot 2009, Morris 2008, Grant 1984a, b) introduced certain criteria for the identification of ritual in animal bone assemblages, such as “association of one or more individuals, difference in butchery patterns, association with other finds”, etc. (Groot 2009, 117). Several deposits of animal bones from Viminacium have been linked to ceremonies. These include dog burials, based on the bones found inside human graves or isolated, burials with grave goods, as, for instance, a burial of a young dog of a small breed with two ceramic lamps (Fig. 5). A skeleton of a skinned dog and a structural deposition of a dog buried together with a horse’s skull, both from eastern Viminacium necropolis, were interpreted as offerings to chthonic gods (Vuković and Jovičić 2015). Such a deposition (a dog’s skeleton and a horse’s skull) has also been discovered underneath the entrance to the amphitheater, and is believed to be a foundational deposit - the remnant of a ritual

that was in the connection with the construction of the amphitheater (Vuković 2015). A skeleton of a male horse of improved breed that had been buried beneath a human grave at the late Roman necropolis at the site Davidovac-Gradište near Vranje (Miladinović-Radmilović, Vuković-Bogdanović and Marković 2016) is the only published Roman horse burial within the region. Several horse burials have been reported from the southern necropolis of Viminacium (site „Više groblja“) (Зотовић, Јордовић 1990), but, unfortunately, that was within earlier excavations of the site when no proper archaeozoological analyses were executed and the bones were discarded. Animal bones as grave goods are known only from the late Roman necropolis in Remesiana – where chicken bones were interpreted either as food offerings or offerings to deities (Јовановић, Булатовић 2013).

CONCLUSION

Although there are not many surveys of archaeozoological material from Roman sites in Serbia, especially in view of the number of excavated sites, previous and especially recent analyses enable at least understanding of animal exploitation, consumption of animals and their products and other human-animal interrelationships in the Roman provinces on the territory of present-day Serbia, whose overview has been presented in this paper.

There is an urgency to analyze new assemblages, and also to continue working on the material the analyses of which are in progress. New data will enable us to look into the diachronic perspectives on animal husbandry and meat diet in Roman provinces in Serbia, and also to compare different aspects of animal usage between different types of sites: urban, military, rural, etc. Research questions regarding food production (where food was produced and who produced it) might also be opened by new data. Isotopic analysis and genetic studies, the most promising and popular researches in present day archaeology, could improve the insight into



Fig. 4 Fragmented camel skeleton from Viminacium amphitheater (Vuković and Bogdanović 2013).

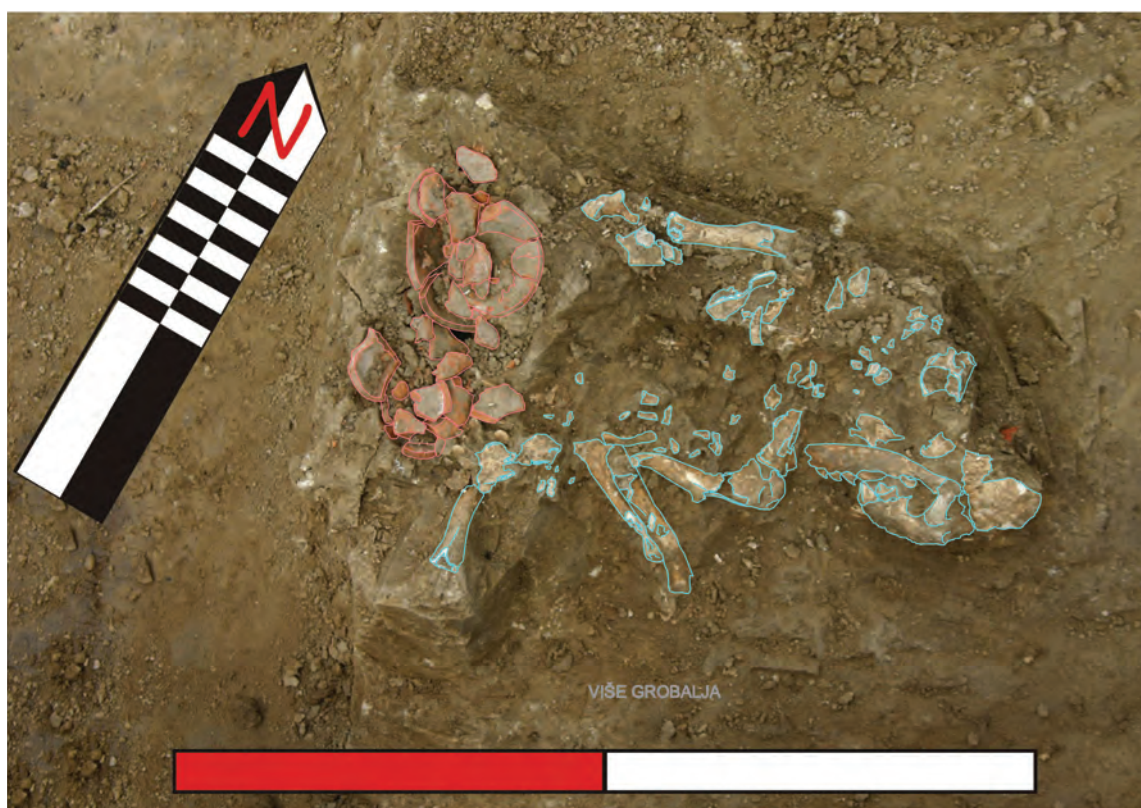


Fig. 5 A dog burial with two terracota lamps from the southern necropolis of Viminacium (after Vuković-Bogdanović and Jovičić 2015, drawing by Željko Jovanović)

the origin, migrations and diet of animals that lived in Balkan provinces of the Roman Empire.

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**REZIME
RIMSKA ARHEOZOOLOGIJA U
SRBIJI: STANJE DISCIPLINE I
PRELIMINARNI REZULTATI**

KLJUČNE REČI: ARHEOZOOLOGIJA, RIMSKI PERIOD, ISTORIЈAT ISTRAŽIVANJA, SRBIJA.

Životinjske kosti, uz keramiku, na većini antičkih lokaliteta u našoj zemlji, predstavljaju najzastupljenije nalaze. Ostaci faune dugo su bili zanemarivani, a postoje lokaliteti na kojima se još uvek ne sakupljaju. Broj antičkih nalazišta u Srbiji, sa publikovanim arheozoološkim podacima, nesrazmerno je manji u odnosu na broj istraženih nalazišta. To je, pre svega, rezultat nedostatka stručnog kadra, ali i kulturnoistorijskog pristupa, koji je prisutan u srpskoj arheologiji, pogotovo u antičkoj arheologiji. Arheozoološke studije sa antičkih nalazišta u našoj zemlji uglavnom su zauzimale podređeni položaj u odnosu na proučavanje arhitekture, antičkih izvora, keramičkih nalaza i predstava na spomenicima. Intenzivni razvoj srpske arheozoologije, a samim tim i rimske arheozoologije, primetan je u poslednjih desetak godina, zahvaljujući uvođenju kurseva iz arheozoologije na osnovnim, master i doktorskim akademskim studijama arheologije na Filozofskom fakultetu u Beogradu, odnosno zahvaljujući mogućnosti obrazovanja i usavršavanja arheologa u oblasti arheozoologije.

Najveći broj publikovanih rezultata faunističke analize potiče sa teritorije Vojvodine. Veliki do-

prinos analizi faune arheoloških lokaliteta Vojvodine dala je S. Blažić iz Muzeja Vojvodine, koja je obradila faunu iz *villae rusticae* na lokalitetu Vranj kod Hrtkovaca (Blažić 1993), rimske slojeve Gomolave, ostatke životinja, koji su prikupljeni prilikom zaštitnih iskopavanja na trasi autoputa kroz Srem (Blažić 1995). Faunom Sirmijuma bavi se D. Nedeljković, koja je obradila materijal sa „lokaliteta 80“ (Nedeljković 1997) i „lokaliteta 85“ u Sirmijumu (Nedeljković 2009), kao i ostatke konja sa sirmijumskog hipodroma (Gilić 1994). Ostatke faune rimskog naselja u Dumbovu kod Beočina analizirao je Š. Bekenji (Bökönyi 1976). Najveća faunistička zbirka potiče sa lokaliteta Viminacijum, gde ostatke životinja analizira autorka rada. Do sada su analizirani ostaci životinja sa prostora istočne gradske nekropole (Vuković 2010) i naselja i vila, koji su istraženi istočno od grada (lokalitet Nad klepečkom) (Vuković-Bogdanović forthcoming), dok najveći uzorak, čije analize su u toku, potiče sa prostora amfiteatra i njegovog okruženja (Vuković 2015, Vuković and Bogdanović 2013, Vuković 2011). Životinjske kosti analizirane su i na nalazištima rimskog perioda, u okviru zaštitnih istraživanja na trasi Koridora 10, i to na lokalitetima Pirot-Sarlah Bazilika i Davidovac-Gradište (Miladinović-Radmilović, Vuković - Bogdanović, and Marković 2016). U Pirotu, gde je ubifikovana putna stanica *Mansio Turres*, potiče faunistička zbirka, koja se izdvaja visokim udelom ekvida (Vuković - Bogdanović and Pejić 2016). Sa lokaliteta Niševac-Svrljig, u čijoj blizini se nalazila još jedna putna stanica, Timacum Maius, ostatke životinja analizirala je I. Stojanović (Stojanović 2013). Na lokalitetu Gamzigrad (Felix Romuliana) obrađeni su ostaci životinja iz grobnice, koja je otkrivena van zidina Romuliane (Dimitrijević and Medović 2007). Na kasnoantičkoj nekropoli inhumiranih pokojnika u Remežijani, analizirani su ostaci životinja, koji su pronađeni kao prilozi u grobovima, što predstavlja jedinu studiju ovog tipa na rimskim nalazištima u Srbiji (Јовановић and Булатовић 2013).

Dominantna vrsta u većini faunističkih zbir-

ki sa rimskih nalazišta u Srbiji je goveče, pogotovo u većim urbanim centrima (Viminacijum i Sirmijum), te se može pretpostaviti da je meso ovih životinja najčešće korišćeno u ishrani. Na drugom mestu po zastupljenosti nalaze se ostaci svinja ili ovaca i koza, što je, verovatno, uslovljeno i prirodnim okruženjem, kao i kulturnim odabirom. Razvijeno stočarstvo, kao jedna od osnovnih odlika gajenja životinja u rimsko doba, a koje se pretpostavlja na osnovu biometrijskih karakteristika ekonomski najznačajnijih životinja, uočeno je i na rimskim nalazištima u Srbiji, gde se javljaju sitne, lokalne rase, kao i krupne, unapređene rase goveda, ovaca i koza. Ekvidi: konji, magarci i njihovi hibridi – mule, čine uobičajeni deo faunističkih zbirki, a može se zaključiti da su ove životinje prevashodno korišćene za transport i prenos tereta. Za prenos tereta korišćene su i kamile, koje su uvođene širom provincija, a čiji ostaci su pronalazeni na većem broju nalazišta u Srbiji uz glavne puteve. Osim kamila, od egzotičnih vrsta pronađene su ljušture mediteranskih školjki i puževa, koje se često mogu naći u ljudskim grobovima. Psi i mačke, koji su u velikom broju pronalazeni na rimskim nalazištima u Srbiji, korišćeni su pre svega kao kućni ljubimci. Lov nije imao veliki ekonomski značaj, budući da ostaci divljih životinja, čine zanemarljiv udeo u rimskim faunističkim zbirkama u Srbiji. Od di-

vljih sisara, pronađeni su u najvećem broju ostaci jelena, ali i srndaća, divljih svinja, zečeva, vukova i lisica, dok je na prostoru viminacijumskog amfiteatra pronađen veći broj kostiju mrkog medveda, što se dovodi u vezu sa namenom ovog objekta. Poput lova, ni ribolov nije imao značajniju ulogu u ishrani stanovnika rimskih provincija na tlu Srbije, a uglavnom su pronalazeni ostaci slatkovodnih dunavskih riba, kao i krupnih, migratornih riba moruna. Poneki konteksti sa životinjskim ostacima, kao što su sahrane pasa sa prilozima, ili u okviru ljudskih grobova, kao i kombinovani depoziti (lobanja konja i skelet psa), povezani su sa ritualnim aktivnostima, koje su praktikovane u rimskim provincijama na tlu Srbije.

Buduća istraživanja, koja se odnose na rimsku arheozoologiju u Srbiji, trebalo bi pre svega fokusirati na analizu materijala sa lokaliteta, iz kojih ne postoje arheozoološki podaci. Sa većim brojem nalazišta, sa obrađenim kostima, biće moguće otvoriti nova istraživačka pitanja, kao što su dijahroničko posmatranje ishrane, ekonomije i stočarstva, razlike u obrascima ishrane između različitih tipova nalazišta (gradska, seoska, vojna) i dr. Primenom najaktuelnijih analiza u arheologiji, genetičkih analiza i analiza stabilnih izotopa, biće moguće proširiti saznanja o poreklu, ishrani i migracijama životinja u rimskim provincijama na tlu Srbije.

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FAUNAL REMAINS FROM FORTIFIED MEDIEVAL CASTLE AT THE KULINA-SOLOTUŠA SITE (WESTERN SERBIA)

ABSTRACT

Two archaeological campaigns were carried out during 2007 and 2008 at fortified castle at the Kulina-Solotuša site, dating from 15th century, placed on the eastern slopes of Tara mountain. This paper presents the results of archaeozoological analysis of faunal material collected during 2008 campaign in squares B1-B9 and V1. Domestic animals outnumber wild species. The most important among them are cattle, sheep, goats and pigs, while the remains of horses, dogs and domestic fowl are far less present. The game consists of wild boar, red deer, roe deer, brown bear and hare. Age of animals, fragmentation and the presence of a large number of butchery traces indicate that most of the animal bones are remains of food.

KEYWORDS: FAUNAL REMAINS, MEDIEVAL CASTLE, SOLOTUŠA, ANIMAL HUSBANDRY, HUNTING, DIET STRATEGY.

INTRODUCTION¹

Archaeological site Kulina is located in the village of Solotuša, on the eastern slopes of Tara mountain, 10 km south-west of Bajina Bašta (Fig. 1). The fortress is located on a very inaccessible point, at the top of the hill which slopes steeply toward the Solotuška river, at 830 m above sea level (Дероко 1950: 150). The most accessible approach is from the south and south-east, because on the west, north and east castle is surrounded by steep cliffs. Archaeological excavation were carried out during 2007 and 2008, conducted by

Dr Đorđe Janković. The team consisted of Pero Praštalo, MA, manager of field work, and archaeologists Sanja Crnobrnja and Dragan Milanović (Јанковић и Праштало, 2007). The castle ground plan is of approximated trapezoidal shape, measuring 20x30 m. The walls were built of half-dressed stone filled with rubble, and their thickness is 1.20-1.70 m. In the south-eastern corner of the building is a circular tower, joined with the mass of the walls.

The interior of the castle is divided into squares (4x4 m) (Fig. 2). The excavations in 2007 started at the northern part, i.e. chamber A, whose area is 96 m². On this occasion, eastern part of the chamber was excavated to the end, while the western part was researched to the floor level. Vertical stratigraphy has shown that under a layer of rubble, formed by the demolition of the walls, is a cultural layer (0.10 to 0.20 m thickness) which is,

¹ This paper presents a summary and a corrected version of the final thesis, defended on September 30, 2014, at the Department of Archeology, Faculty of Philosophy, University of Belgrade. I wish to express my gratitude to professor Dr Vesna Dimitrijević for helping me in preparation of this work, and assistant professor Dr Dejan Radičević for giving me opportunity to work with faunal material from Kulina-Solotuša site.



Fig. 1 Geographical position of Kulina-Solotuša site.

on the basis of the archaeological material, dated to the 15th century. The same year, the archaeological research of the south-western part of the castle has started, and in this location, similar vertical stratigraphy, types of findings and their chronology were recorded². Archeological work continued in 2008, and the excavation of the chamber A were completed. At the northeastern part, excavations of the chamber B were started, where a cistern with a well were detected, circular in section, built in dry-stone wall technique. In chamber A, under a layer of the 15th century, the early Byzantine walls were found. Similar walls were detected in the chamber B, as well as in the southern part of fortification³. Since the archaeological excavation were not continued, early Byzantine walls are not completely defined, yet.

² The excavation information for Kulina-Solotuša site was taken from field documentation for 2007 campaign.

³ The excavation information for Kulina-Solotuša site was taken from field documentation for 2008 campaign.

MATERIALS AND METHODS

The sample of faunal material, collected by hand during 2008 campaign in squares B1-B6 (chamber B with a cistern), B7-B9 (the eastern wall of the fortress and tower in the south-eastern corner) and V1 (eastern entrance to the fortified castle), has been analysed (Fig. 2).

Quantification is given by NISP (Number of Identified Specimens) and MNI (Minimal Number of Individuals). The Number of Identified Specimens includes all specimens attributed to particular taxon. The Minimal Number of Individuals was counted on the basis of the most frequent element of a particular taxon, combined with age and sex differences within the most frequent element.

Taxonomic identification of mammals and birds was carried out consulting relevant literature (Boessneck 1969; Schmid 1972; Prummel and Frisch 1986; Prummel 1988; Boyd et al. 1994; Cohen and Serjeantson 1996; Halstead, Collins

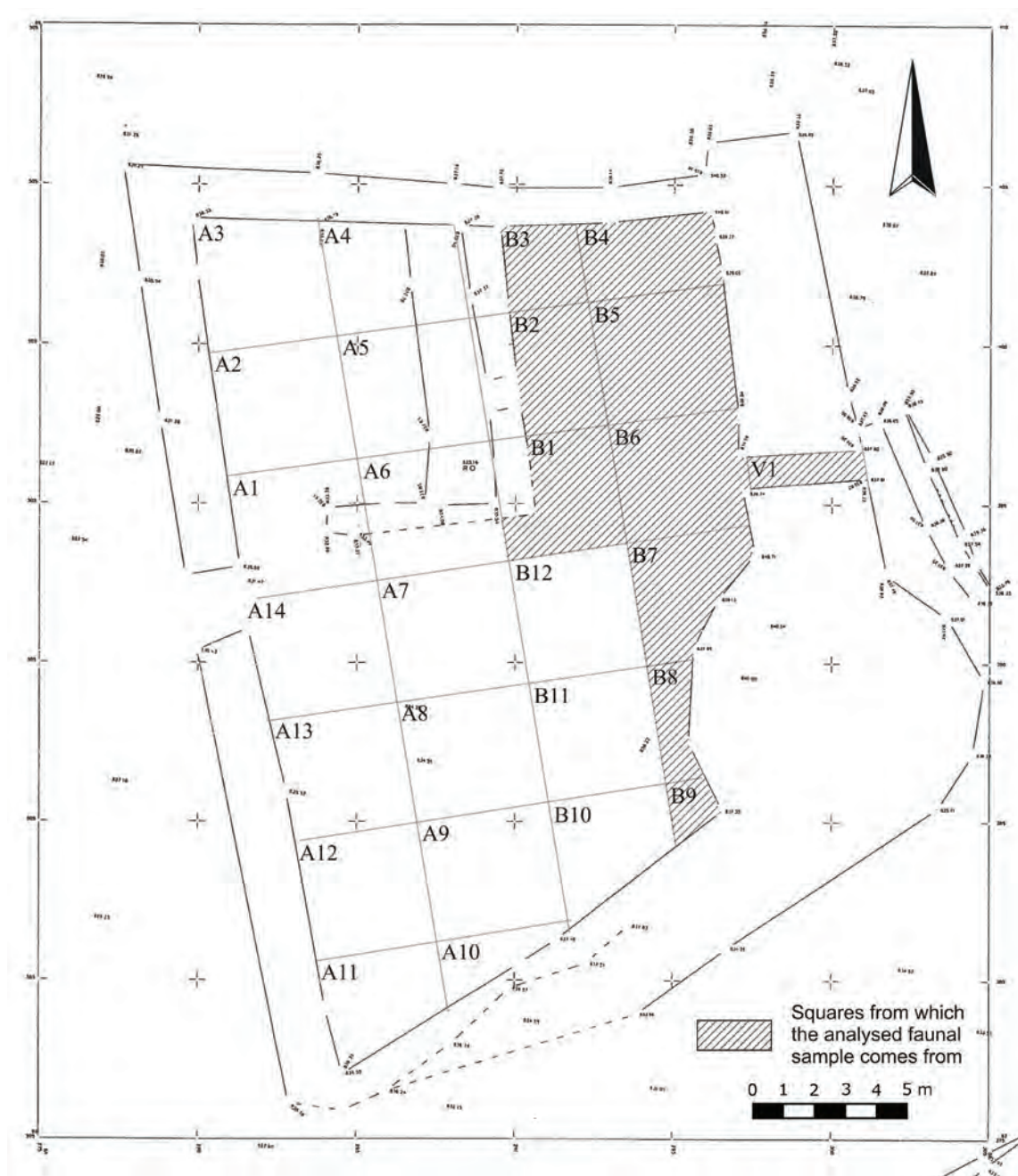


Fig. 2 Castle ground plan with marked squares from which the analysed faunal sample comes from.

and Isaakidou 2002; Johnstone 2004; Budras et al. 2009; Frandson, Lee Wilke and Dee Fails 2009; Zeder and Lapham 2010; Zeder and Pilaar 2010), and based on comparison with specimens from the Archaeozoological Reference Collection of Laboratory for Bioarchaeology, Faculty of Philosophy in Belgrade.

Traces of taphonomic processes - weathering,

gnawing, burning, and traces of anthropogenic activities were all recorded. The age determination was based on the time of eruption and attrition of teeth (Silver 1969; Hilson 2005), and the epiphyseal fusion (Silver, 1969; Schmid, 1972). Since the bone epiphysis fuse at different age, the material was divided into three groups based on the age at which fusion generally occurs. The first

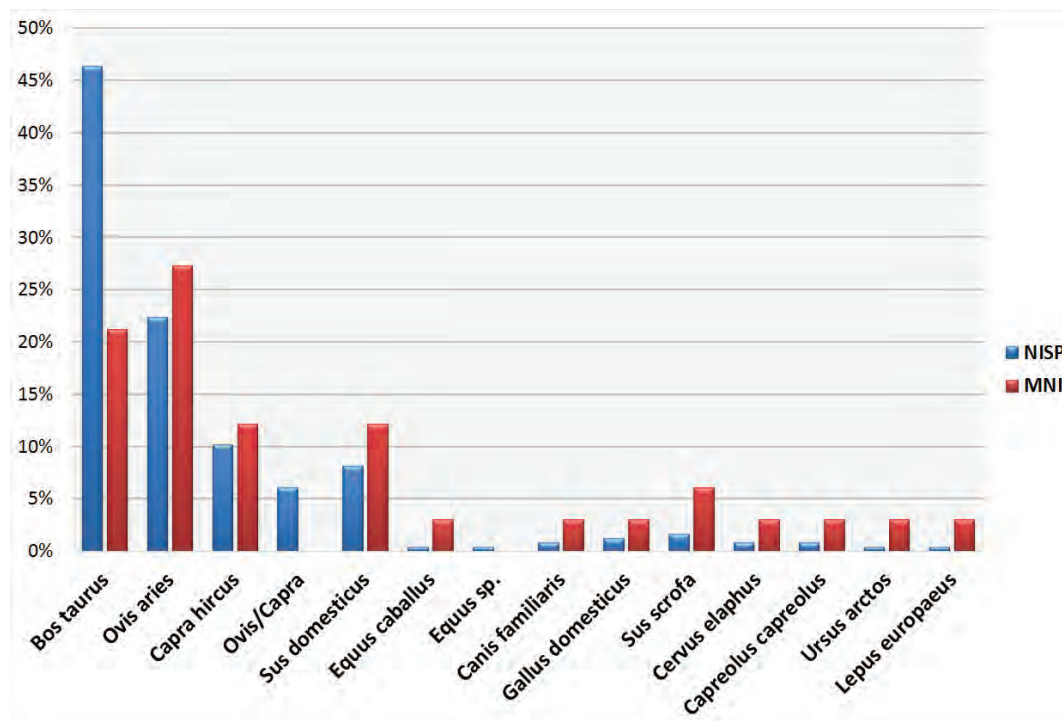


Fig. 3 Percentual distribution of various animal taxa expressed as NISP (number of identified specimens) and MNI (minimal number of individuals).

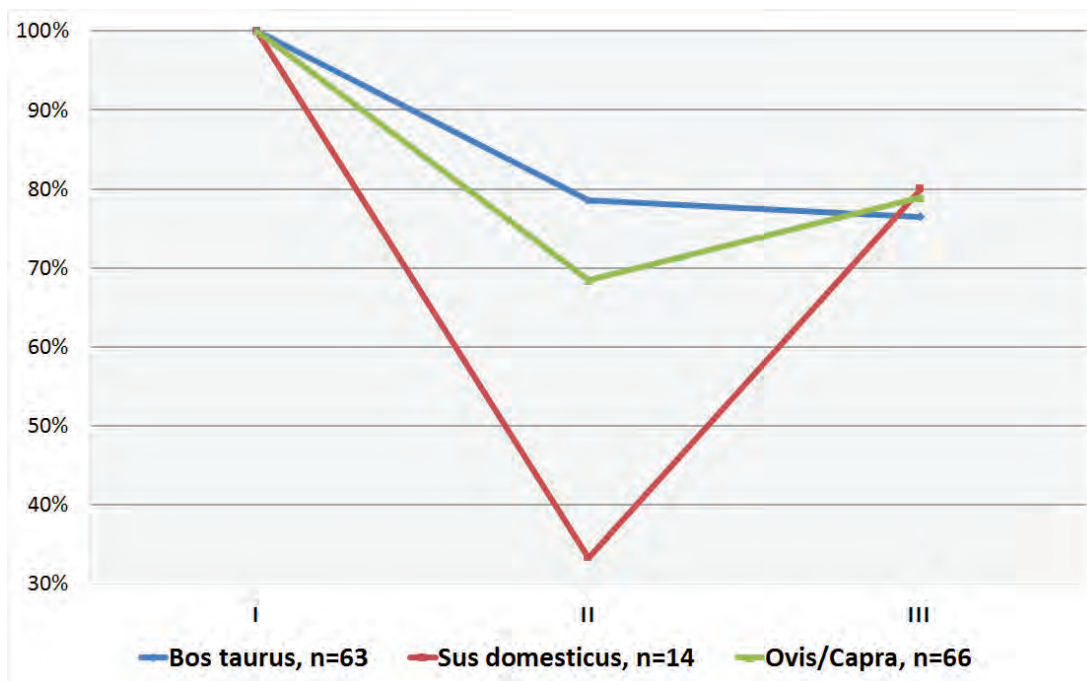


Fig. 4 Survivorship curves of cattle, sheep/goat and pig (I – 12 months of age at sheep, goat and pig and 24 months of age at cattle; II – 18 months of age at sheep and goat and 24 months of age at pig and cattle; III – more than 36 months at sheep, goat and pig and more than 42 months of age at cattle).

group are bones which epiphysis fuse at juvenile age, which is around the first year in sheep, goats and pigs, and around the second year in cattle. The second group are the bones whose epiphysis

fuse at subadult age, i.e., from the second to third year in sheep, goats and pigs, and from the third to fourth year in cattle. The third group consists of bones which epiphysis fuse at adult age (Reitz

and Wing 2008: 72, 194). Age structure, obtained on the basis of the degree of epiphysial fusion is expressed by the survivorship curve.

Measurements were taken following the standards from A. von den Driesch (1976). Withers heights for cattle were calculated using the factors given by Matolcsi (1970), for sheep and pig using Teichert (1975), for goat using Schramm (1967), and for dog using Harcourt (1974).

FAUNAL COMPOSITION AND TAPHONOMY

Out of 559 specimens, 246 were identified to the species level (44%). Domestic animals (96%) outnumber game (4%). Domestic fauna consisted of: cattle (*Bos taurus*), sheep (*Ovis aries*), goats (*Capra hircus*), pigs (*Sus domesticus*), horses (*Equus caballus*), dogs (*Canis familiaris*) and domestic fowl (*Gallus domesticus*). Game included wild boar (*Sus scrofa*), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), brown bear (*Ursus arctos*) and hare (*Lepus europaeus*). Due to the high degree of fragmentation some of the specimens were identified to the class level and they were placed into large-sized and medium-sized mammals categories (Table 1). Those were mainly small fragments of long bones, ribs and vertebral bones, which probably belonged to cattle, sheep, goat or pig, but could not be attributed to them certainly.

Based on the Number of Identified Specimens (NISP), the most frequent animals are cattle (46.3%), followed by sheep and goats (38.6%), pigs (8.1%), and wild boar (1.6%). According to the Minimal Number of Individuals, the most frequent animals are sheep and goat (39.5%), followed by cattle (21.2%), pig (12.2%), wild boar (6.1%) and other animal species (Fig. 3).

Bone fragmentatiton is highly present and it is the consequence of human activities such as animal butchery and breaking of the bones in order to obtain bone marrow. Whole bones represent only

5% of the sample, and the most numerous being tarsal bones, followed by phalanges and patellae, because these bones are not suitable for processing and are not rich in meat.

Traces of weathering, caused by exposition to atmospheric influences before burying in the sediment, were present on 35.4% specimens. These are mostly slight cracking of the bone and foliation of the periosteum. That indicates that the bones were relatively quickly stored and that the chemical characteristics of sediments were suitable for the relatively good preservation of skeletal remains. Bones with burning traces at the ends are present and indicate the preparation of food, i.e. the baking, are represented in the material with 0.8%. Traces of gnawing, mostly by dogs, were present on 33.3% of all identified specimens.

Taxon	NISP
<i>Bos taurus</i>	114
<i>Ovis aries</i>	55
<i>Capra hircus</i>	25
<i>Ovis/Capra</i>	15
<i>Sus domesticus</i>	20
<i>Equus caballus</i>	1
<i>Equus sp.</i>	1
<i>Canis familiaris</i>	2
<i>Gallus domesticus</i>	3
Domestic animals, total	236
<i>Sus scrofa</i>	4
<i>Cervus elaphus</i>	2
<i>Ursus arctos</i>	1
<i>Capreolus capreolus</i>	2
<i>Lepus europaeus</i>	1
Wild animals, total	10
Large-sized mammals	80
Medium-sized mammals	233
Faunal remains identified to the class level, total	313
Total	559

Table 1 The distribution of various animal taxa expressed as NISP (number of identified specimens).

DOMESTIC ANIMALS

Cattle (Bos taurus)

The cattle is the most frequent species among analyzed material. It represents 46.3% of the identified bones (Fig. 3), and at least 7 individuals were determined, according to MNI, based on right tibiae. The most numerous cattle body parts were tibiae, metapodial bones, tarsal bones, and mandibles. Based on morphology of pelvic bones, there are two female and one male individuals in faunal sample from Kulina-Solotuša site.

Based by time of eruption and attrition of teeth, it is assumed that adult cattle older than 3 or 4 years are predominantly present. Only one mandible belonged to a calf under two years of age. The epiphysial fusion shows that there is no specimen younger than 2 years. The most of the cattle were slaughtered as subadult or adult animals, probably because of longer exploitation of secondary products (Fig. 4).

Exostoses were noticed on volar side of one metacarpal bone, plantar side of six metatarsal bones and three calcanei. Since appearing on the metapodial and tarsal bones, but not being caused by the fracture of the bone, the reason of bone tissue accumulation could be consequence of burden overload, and/or weight of the individuals, which were probably used as working animals for agricultural work or towing.

More than half of the cattle bones (60%) showed cutting or chopping marks, which are the most numerous on metapodial bones, mandibles and tibiae. Butchery marks are inflicted by cleavers, big and small knives during the disarticulation of a carcass, filleting, and skinning.

During the medieval period the trend of animal husbandry declines. This is mostly reflected in withers' height and type of cattle horns. The withers' height is about 30 cm lower than during the Roman period. In Europe, cattle mostly belonged to the small *brachyceros* type (withers' height about 112 cm) with short and thin horns, and narrow, wavy frontal ridge (Bökönyi 1974: 134-136).

Based on the length of one metatarsal bone, the withers' height of cattle was calculated and its value is 78.3 cm. This value is noticeably lower in regard to other medieval sites in Serbia where ranges from 111.23 to 119 cm (Блажић 1995: 343; Блажић 1999a: 36; Blažić 1999b: 443; Марковић 2015: 401).

Sheep (Ovis aries) and goat (Capra hircus)

Sheep and goats were the second numerous species (38.6%) (Fig. 3). It is difficult, on the basis of osteological material, to distinguish sheep and goat, primarily because of the great similarity in the skeleton structure of these two species. Therefore, some of the specimens are classified as *Ovis/ Capra* (6%). Sheep bones (22.4%) are more numerous than goat bones (10.2%). At least 9 sheep are present, according to MNI, based on right tibiae, and at least 4 goats, according to MNI, based on left radii. According to this parameter, sheep and goats were the most numerous species (39%). Although they are often being kept together, these two species are distinguished, among other things, by the quality of the meat and secondary products, and it is important to separate their bones in the material, primarily due to the reconstruction of economic strategy (Davis 1987: 33).

Based on morphology of pelvic bone, there are two female sheep. Exostoses were noticed on medial side of distal part of one sheep's metatarsal bone.

Among sheep and goat specimens almost all body parts are present. The most numerous sheep bones are tibiae (20%), scapulae (12.7%), radii and mandibles (each by 9%). The most frequent goat bones are radii (24%), mandibles (16%), tibiae, metacarpal bones and the 1st phalanges (each by 12%). The other parts of skeleton are present with less than 10%.

Time of eruption and attrition of teeth shows that one sheep younger than a year is present and that the rest of the individuals are adult, while goat juveniles and individual older than 2 years are equally present (each by 2). Based by time of

epiphysial fusion, there is no individual younger than a year. The most of sheep and goats are sub-adult or adult, suggesting that they have primarily been kept for dairy food and wool (Fig. 4).

Butchery marks were found on 41% of the bones, most of them on the long bones - tibiae, humeri, radii and metapodials. They are inflicted by knives and cleavers during the disarticulation of a carcass, portioning and filleting meat.

During the medieval period, withers' height of sheep also decreased and it differed throughout Europe. The average withers' height in Russia was 65 cm (Цалкин, 1956), 61 cm in Poland (Kubasiewicz i Gawlikowski, 1965), in Hungary under 59 cm, in Central Europe between 54-64 cm, while in Western Europe ranged from 51-62 cm (Bökönyi, 1974). After the Copper age, sheep withers' height reached the lowest measures, it was about 5 cm lower as compared to the Roman period sheep. However, in the late middle Ages, during the 14th and the 15th century and onward, sheep become larger, what is confirmed in the Carpathian Basin. During the period from the 14th to the 17th century, increased the withers' height at about 70 cm, which is the difference of 10 cm, in comparison with the period from the 10th to the 13th century in Hungary (Bökönyi 1974: 188). During the middle Ages, the rams had thick, three-sided horns, and sheep had small, rudimentary horns (Bökönyi 1974: 181). Hornless sheep rarely occur, as well as those with horns rolled forward, almost horizontally. Pictured on the fresco painting, located on the south wall of the nave of the St. Demetrius church in Peć, painted between 1338-1346, in Nativity scene, shepherds with sheep and goats with different types of horns are shown (Théodoridès 1964: 387; Петковић 1982: 18).

Medieval goats are smaller than Roman, but, from the 14th century, a noticeable increase in height is observed. Males tend to have large, twisted horns, although there were individuals without horns (Bökönyi 1974: 198-200).

The withers' height of sheep was calculated and its value is 61.4 cm (based on astragalus),

62.7 cm (based on radii) and 60 cm (based on calcanei). Goat's withers' height based on radii is 67.2 cm. The average withers' height of sheep and goats is similar comparing to other medieval sites in Serbia (Блажић 1999a: 38; Blažić 1999b: 444; Марковић 2015: 400).

*Pig (*Sus domesticus*)*

Pig bones were the third most common bone finds at the fortified medieval castle of Kulina-Solotuša site. It represents 8.1% of the identified bones (Fig. 3), and at least 4 individuals were determined, according to MNI, based on right tibiae. The most numerous pig's body parts are limb bones – humerus, ulna, radius, femur, tibia and metatarsal bones (75%). An epigenetic modification was observed at one humerus - missing foramen in the fossa olecrani (Fig. 5).

Based on time of eruption and attrition of teeth, it is assumed that there are two individuals between 1 and 2 years of age, and two individuals older than 17 months. The epiphysial fusion data show that the majority of pigs were slaughtered in between their first and third years when the meat is of highest quality (Fig. 4). Presence of adult specimens shows that some pigs were kept longer for reproduction.

Half of the pig bones carried butchery marks, but they are the most numerous on tibiae and radii. They are inflicted by cleavers, big and small knives during the disarticulation of a carcass and filleting meat.

A primitive breed of pigs was reared on the territory of Central and Eastern Europe in the middle Ages. Due to the different diets and natural conditions there is a big difference between them, which is primarily reflected in size - in the western part of Central Europe, pigs are larger, while smaller in the eastern part of Central Europe and Eastern Europe. The withers' height of pig is in the range from 52 cm to 91 cm, with a mean value of 73 cm (Bökönyi 1974: 201, 221-4).

Based on length of one radius, the withers' height of pig was calculated and its value is 77



Fig. 5 Left humerus of pig with epigenetic modification – missing foramen in fossa olecrani (cranial).

cm. This value is higher than the one from Studenica monastery which is 62.5 cm (Марковић 2015: 401).

Horse (*Equus caballus*)

Equids are represented with two bones - first phalanx and tibia (Fig. 3). It is difficult, on the basis of osteological material, to distinguish horse and mule, primarily because of the great similarity in the skeleton structure of these two species. According to the parameters given by Peters (Peters, 1998) and Johnstone (Johnstone, 2004), horses are represented with one bone – first phalanx, and at least one individual. Exostoses were noticed on volar side of the first phalanx. Since the second specimen, tibia, was fragmented, it could not be attributed to horse or mule with certainty.

The epiphysial fusion shows that, according to the first phalanx, there is one specimen older than 13-15 months, and, according to the tibia, there is



Fig. 6 Left radius and ulna of dog (cranial).

one specimen older than 3-3.5 years (Silver 1969: 285-286).

Although equids were probably used for traction and transport, butchery marks found on caudal side of tibia inflicted by knife during the filleting process, suggest that equid meat was occasionally consumed.

In the beginning of the medieval period heavy *cold blood* horses became more frequent in the Central Europe (withers' height more than 163 cm). Breeds began to emerge among the light *warm blood* horses (average withers' height between 147/8 and 163 cm) and this process became fully developed at the Late Middle Ages. In medieval Russia, the average withers' height of horses was 132.5 cm, in medieval Latvia was 122.4 cm, and in Central Europe was between 126 and 138 cm (Bökönyi 1974: 292-293).

The first traces of keeping of horses and asses together occurred in West Asia in the first half

of the second millennium B.C. Therefore, the first mules should be sought there. They were brought to Europe from South-West Asia. The first mule might have appeared in South-East Europe in the 7th century B.C. (Bökönyi 1974: 305-307). During the Roman period mules have had significant role in army, because they were burden animals (Johnstone 2004:72-73). Since mules are more persistent animals than horses, they were used for carrying the burden, draught, agricultural works and riding.

In general, remains of equids are not frequent at medieval archaeological sites in present-day Serbia. Horses are present at sites in Srem - Prosine at Pećinci (2.6%) and Malo Kuvalovo at Krnješevci (2.63%) (Блажић 1995: 344), as well as Ras-Gradina site in south-western Serbia (0.71%) (Блажић 1999a: 34; Blažić 1999b: 441). Since the only one specimen from faunal sample from Kulina-Solotuša site was attributed as a horse (0.4%), this value is the closest approximate to one from Ras fortress. Mules are present at Roman sites Felix Romuliana (Dimitrijević and Medović 2007: 315), Viminacium (Vuković 2015: 83) and travel station Mansio Turres (Vuković-Bogdanović i Pejić 2016: 88), and at one medieval Slavic settlement at Pančevo-Livade site in present-day Vojvodina (Младеновић 2015:17). Withers' height could not be determined as the only one long bone present in material is fragmented.

Dog (Canis familiaris)

Dog is represented by 2 specimens (Fig. 3), and at least one individual is present. Left ulna and left radius belong to the same individual which is at least one year of age (Fig. 6) (Silver 1969: 285). Dog remains are significantly more represented at the sites Malo Kuvalovo at Krnješevci and Prosine at Pećinci in Srem than at Kulina-Solotuša site (Блажић 1995: 343-344).

Dogs were not bred for economic reasons. They were used in hunting, as pets and guards. Before the Roman period, there were only small dog breeds and dogs of medium height, and then a new breeds was introduced, whose number

increased significantly since the Middle Ages (Bökönyi 1974: 66, 327).

Apart from species bred for meat production whose bones were often fragmented, dog's long bones have been preserved as whole and they enabled calculation the withers' height which value based on ulna is 55.5 cm and based on radius is 59.6 cm. Since this is the same individual, this difference is not insignificant and points to some imprecision in calculating dog withers' height based on data given by Harcourt (Harcourt, 1974). According to these values it can be assumed that it was medium-sized dog.

Although dog remains are still a rare find at sites on medieval Serbian states territories, they represent 2.6% of remains at the site Malo Kuvalovo at Krnješevci and 5% of faunal remains at the site Prosine at Pećinci (5%) in Srem (Блажић 1995: 343-344). It can be noticed that already mentioned sites in Srem are richer in dog remains than Kulina-Solotuša site.

Domestic fowl (Gallus domesticus)

Fowl is represented with 3 bones and at least 1 individual is present (Fig. 3). Left tibia and the left tarsometatarsus belong to the same, adult individual. The third bone, coracoid, also belongs to adult individual.

Domestic fowl was introduced in the Mediterranean area around the 8th century BC, and in central Europe by the 7th century BC (Poole 2010: 156). According to the sources, different domestic fowl types were known across the Roman Empire, since at least the Imperial and Early Byzantine periods - the large domestic fowl was used for fighting and smaller types were kept for their eggs (De Cupere et al. 2005:1587). Due to the high reproduction and easy available source of protein - meat and eggs, domestic fowl were the most commonly kept poultry during medieval period.

Apart from Kulina-Solotuša site sample, sparse remains of domestic fowl were also noticed in material from Ras fortress (1.28%) (Блажић 1999a: 39; Blažić 1999b: 441) and from Gradina-Trešn-

jevica site (2.7%) (Булатовић и Марковић 2013: 293). On the other hand, high percentage of fowl remains was recorded in the Studenica monastery, especially in the sample from the room 1 building V (22%), as well as in sample from area outside of south-eastern monastery wall (19.9%) (Марковић 2015: 397; Marković, Radišić i Bikić 2016: 102).

GAME

Among wild animals, the wild boar (*Sus scrofa*) was the most numerous, represented by four specimens – two maxillae, one atlas and one humerus (Fig. 3). At least two individuals were determined, according to the MNI, based on left maxillae. Based on time of eruption and attrition of teeth, it is assumed that there are two individuals older than 32 months. Butchery marks were found on all specimens and they are inflicted by knives and cleavers during the skinning, disarticulation of a carcass, portioning and filleting meat.

Red deer (*Cervus elaphus*) is represented by 2 specimens, and at least one adult individual is present (Fig. 3). Left scapula and left ulna carried butchery marks inflicted during the disarticulation of a carcass and filleting meat.

Roe deer (*Capreolus capreolus*) is also represented by 2 specimens – one scapula and one antler (Fig. 3). At least one individual is determined. Antler indicates the presence of male individual, because only the males grow antlers. Butchery marks were inflicted by cleaver during the cutting off antler (Fig. 7). It is possible that antlers were used for tool production, as indicated by the presence of one specimen with a cut-off points.

Other species were represented only by single specimen: an ulna from brown bear (*Ursus arctos*) and one scapula from hare (*Lepus europaeus*) (Fig. 3). Butchery marks were detected on brown bear's ulna and they are inflicted by knife during the skinning. This is not surprising, since bears were mainly hunted for their fur. Butchery marks were also present on hare's scapula and they point



Fig. 7 Left antler of roe deer with butchery marks and modification traces (lateral).

to the process of disarticulation of skeleton.

In general, hunting was of relatively little importance for the inhabitants of the medieval settlements. This is the case with this and with other sites in on medieval Serbian states territories, where the remains of wild species were usually represented with less than 10% (Блажић 1999a: 32; Blažić 1999b: 440; Булатовић и Марковић 2013: 293; Марковић 2015: 397). A bit higher percentage of wild species were noticed at the sites in Srem: Malo Kuvalovo at Krnješevci - 16%, Prosine site at Pećinci 10%, and Žirovac at Ruma 35.5% (Блажић 1995:343).

CONCLUSION

This paper presents the results of archaeozoological analysis of faunal material from fortified castle at the Kulina-Solotuša site. Animal remains were collected from squares B1-B6 (chamber B with a cistern), B7-B9 (the eastern wall of the fortress and tower in the south-eastern corner) and V1 (eastern entrance to the fortified castle) (Fig. 2). This area was probably used as a waste disposal from which the analysed faunal remains come from. It is still not clear why this part of the castle was used for that purpose. Presence of faunal remains at this place might suggest that the inhabitants of the castle were not able to dispose waste outside of castle because of the possible siege. Faunal sample is small, but considering the fact that archaeozoological publications of contemporaneous sites in Serbia are not numerous, it was used to provide informations about relationships between people and animals, dietary strategies, and uses of the animals in medieval Serbian states.

The age of animals, fragmentation and the presence of a large number of butchery traces indicate that most of the animal bones from Kulina-Solotuša site are remains of food. Quite few dog bones represent most probably remains of pets kept in castle.

Domestic animals had the most important role in the economy of the site. Based on the Number of Identified Specimens (NISP), the most frequent among them were cattle, sheep and goats, and pig, while remains of horse, dog and domestic fowl were rare (Fig. 3).

Faunal composition and animal exploitation pattern are consistent with other medieval sites. Differences are notable in frequency of distribution of different taxa. Percentage ratio between the economically most important domestic species at Kulina-Solotuša site differ from those of the material from the other sites in medieval Serbian state - Ras fortress (Блажић 1999a: 32; Blažić 1999b: 440), Gradina-Trešnjevica fortress (Булатовић и Марковић 2013: 293), and Studenica mon-

astery (Марковић 2015: 397). Namely, the most frequent species among remains from these sites are sheep and goats, while cattle remains are the most frequent at Kulina-Solotuša site. Cattle are, also, the most frequent species at the lowland sites in Srem – Malo Kuvalovo at Krnješevci, Žirovac at Ruma and Prosine at Pećinci (Блажић 1995:343). This is an interesting observation because Kulina-Solotuša site has more similar geographical position to Ras and Gradina-Trešnjevica fortresses.

During the medieval period small local domestic breeds were kept across the Europe. Metric analysis has shown that domestic animals from castle at Kulina-Solotuša site were relatively common for that period concerning size and growth.

Among the hunted species were wild boar, red deer, roe deer, brown bear and hare. According to the NISP and MNI, wild boar is the most numerous wild species. Since the sample is small, it can only be assumed which was the most important hunting species at the Kulina-Solotuša site (Fig. 3). At the other medieval sites in Serbia, the most hunted species was the red deer (Блажић 1995:343, Блажић 1999a: 32; Blažić 1999b: 440; Булатовић и Марковић 2013: 293), and in the case of monastery Studenica, hare (Марковић 2015: 397). Based on a small number of game remains, it can be assumed that mostly adult individuals have been hunted.

Although the sample is small, the results provide basic information on animal husbandry, hunting and diet strategy of the inhabitants of castle at the Kulina-Solotuša site. Archaeozoological analysis of the faunal remains from the other parts of the castle are in progress and it will complete the data obtained in this analysis.

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REZIME
OSTACI ŽIVOTINJA
IZ UTVRĐENOG
SREDNJOVEKOVNOG ZAMKA
NA LOKALITETU KULINA-
SOLOTUŠA

KLJUČNE REČI: OSTACI ŽIVOTINJA, SREDNJOVEKOVNI ZAMAK, SOLOTUŠA, STOČARSTVO, LOV, STRATEGIJA ISHRANE.

Materijal koji je analiziran u ovom radu potiče iz utvrđenog zamka na lokalitetu Kulina-Solotuša, koji je u 15. veku podignut na planini Tari (Sl. 1). Uzorak faune ručno je sakupljen tokom arheoloških istraživanja 2008. godine u kvadratima B1-B6 (prostorija B sa cisternom), B7-B9 (prostor uz istočni zid utvrđenja i kula u jugoistočnom uglu) i V1 (istočni ulaz u zamak) (Sl. 2). Ovaj prostor je u jednom trenutku korišćen za odlaganje otpada. Razlozi za to su, za sada, nepoznati, ali je moguće da usled opsade zamka stanovnici nisu bili u mogućnosti da otpad odlazu van njega. Uzorak je mali ali je usled malobrojnih arheozooloških publikacija o uzorcima sa istovremenih lokaliteta u Srbiji iskorišćen kako bi se dobili podaci o odnosu ljudi i životinja, načinu ishrane i eksploatacije životinja i njihovih produkata u srpskim srednjovekovnim zemljama.

Arheozoološka analiza faunističkog materijala je pokazala da on predstavlja, uglavnom, ostatke hrane i da se može svrstati u kategoriju stambenog otpada ovog zamka. Stepenn fragmentacije je jako visok – 89%, dok je očuvanost kostiju i zuba relativno dobra. Tragovi površinskog raspadanja kosti zabeleženi su na 35.4% ukupnog broja određenih primeraka, dok se tragovi gorenja javljaju na samo 0.8% primeraka. Kostii na kojima se nalaze tragovi glodanja, uglavnom pasa, čine 33.3% materijala.

Uzorak faune sadrži 559 fragmenata, od kojih je do roda i vrste određeno njih 246. Kostii domaćih životinja (96%) znatno su zastupljenije od divljih (4%). Ovakav odnos nije neuobičajen za ovaj period, budući da je situacija slična i na

ostalim srednjovekovnim lokalitetima u Srbiji (Блажић 1995; Блажић 1999a; Блажић 1999b; Булатовић и Марковић 2013; Марковић 2016).

U materijalu su prisutne sledeće domaće vrste – goveče (*Bos taurus*), ovca (*Ovis aries*), koza (*Capra hircus*), svinja (*Sus domesticus*), konj (*Equus caballus*), pas (*Canis familiaris*), domaća kokoš (*Gallus domesticus*), kao i sledeće divlje vrste – divlja svinja (*Sus scrofa*), jelen (*Cervus elaphus*), srndać (*Capreolus capreolus*), mrki medved (*Ursus arctos*) i zec (*Lepus europaeus*). Usled visokog stepena fragmentacije, neke primerci određeni su do klase i svrstani su u kategoriju krupnih i srednje krupnih sisara (Tabela 1).

Strategija ishrane stanovnika ovog utvrđenja bila je zasnovana na uzgoju domaćih životinja. Najviše je gajeno goveče (46.3%), zatim ovce i koze (38.6%) i svinje (8.1%) (Sl. 3). Ove vrste su ujedno bile i glavni izvor hrane. Gajenje goveda, ovaca i koza bilo je usmereno na eksploataciju sekundarnih proizvoda – mleka i vune (Sl. 4). Pored toga, goveda su verovatno korišćena i za vuču. Podaci o starosti svinja pokazuju da su u ishrani uglavnom korišćene životinje između jedne i tri godine starosti (Sl. 4). Prisustvo adultnih jedinki ukazuje na to da su neke jedinke gajene duže zbog reprodukcije. U ishrani je korišćeno i meso ekvida, na šta ukazuju tragovi filetiranja na jednoj

tibiji. Ostaci ptica su malobrojni ali ukazuju na to da su stanovnici ovog zamka mogli koristiti i meso i jaja domaće kokoši.

Lov nije imao značajno mesto u ekonomiji. Najzastupljenija divlja vrsta je divlja svinja (Sl. 3). Na osnovu prisutnih primeraka može se zaključiti da je lov bio orijentisan prema odraslim jedinkama, na čijim su kostima zabeleženi i tragovi dranja, dezartikulacije skeleta i filetiranja. U ishrani je korišćeno i meso srndaća i jelena, na čijim su kostima, takođe, primećeni tragovi dezartikulacije skeleta i filetiranja. Moguće je da su rogovi srndaća korišćeni za izradu predmeta na šta ukazuje prisustvo jednog roga sa odsečenim paroščima (Sl. 7). Zec je, takođe, korišćen u ishrani, ali je verovatno lovljen i zbog krzna. U materijalu je prisutna i jedna kost mrkog medveda, na kojoj su primećeni tragovi dranja, odnosno, uklanjanja krzna.

Tragovi kasapljenja zabeleženi su na 52% primeraka. Nastali su tokom dranja, dezartikulacije skeleta, filetiranja i komadanja mesa, korišćenjem različitih noževa i satara.

Iako je uzorak mali, ovim istraživanjem dobijeni su preliminarni podaci o stočarstvu, lovu i ishrani stanovnika zamka na lokalitetu Kulina-Solotuša. Analiza faunističkog materijala koji potiče iz ostalih delova zamka je u toku i ona će upotpuniti podatke dobijene ovom analizom.

APPENDIX

Bone measurements according to the standardized system of A. von den Driesch (1976)

Mere kostiju po standardizovanom sistemu A. fon den Driš (1976), prilagođeno

Meas. 1	Length: Gonion caudale – aboral border of the alveolus of M_3
Meas. 2	Length: Gonion caudale – oral border of the alveolus of P_2
Meas. 3	Length: Gonion caudale – the most aboral indentation of the mental foramen
Meas. 4	Aboral height of the vertical ramus: Gonion ventrale – highest point of the condyle process
Meas. 5	Middle height of the vertical ramus: Gonion ventrale – deepest point of the mandibular notch
Meas. 6	Oral height of the vertical ramus: Gonion ventrale - Coronion
Meas. 7	Length
Meas. 8	Greatest (oro-aboral) diameter of the horncore base
Meas. 9	Least (latero-medial) diameter of the horncore base
Meas. 10	Distal circumference of the burr
L	Length
B	Breadth
GL	Greatest length
GB	Greatest breadth
H (D_2 , P_2 , M_1)	Height of the mandible in front of D_2 , P_2 or M_1
H (M_3)	Height of the mandible behind M_3
BFcr	Greatest breadth of the Facies articularis cranialis
SVB	Smallest breadth of the vertebra
SLC	Smallest length of the Collum scapulae
GLP	Greatest length of the Processus articularis
LG	Length of the glenoid cavity
BG	Breadth of the glenoid cavity
Bp	Greatest breadth of the proximal end
Dp	Depth of the proximal end
SD	Smallest breadth of the diaphysis

Bd	Greatest breadth of the distal end
Dd	Depth of the distal end
BT	Greatest breadth of the trochlea
DPA	Depth across the processus anconaeus
SDO	Smallest depth of the olecranon
BPC	Greatest breadth across the coronoid process
BFp	Greatest breadth of the Facies articularis proximalis
BFd	Greatest breadth of the Facies articularis distalis
LA	Length of the acetabulum including the lip
LAR	Length of the acetabulum of the rim
SB	Smallest breadth of the shaft of ilium
GLl	Greatest length of the lateral half
GLm	Greatest length of the medial half
DI	Greatest depth of the lateral half
Dm	Greatest depth of the medial half
GLpe	Greatest length of the peripheral (abaxial) half
DLS	Greatest diagonal length of the sole
MBS	Middle breadth of the sole
Ld	Length of the dorsal surface
Lm	Medial length
BF	Breadth of the Facies articularis basalis
La	Axial length: from the Tuberculum centrale to the distal border of the Trochlea tibiotarsi
Dip	Greatest diagonal of the proximal end: from the Condylus medialis femoralis to the Crista lateralis

Bos taurus

Scapula		
SLC	52.8	42.5
GLP	61.6	51.8
LG	53.6	48.9
BG	44.1	38.3

Mandibula					
P ₂ -P ₄	/	/	47.5	0	54.7
H (P ₂)	/	30.7	29.5	24.4	29.1
H (M ₁)	/	/	47.2	/	41.4
M ₁ -M ₃	/	/	/	/	84.1
L M ₃	31.2	/	/	31.7	36.6
B M ₃	12.7	/	/	14.7	12.8
H (M ₃)	/	/	/	62.7	68.5
P ₂ -M ₃	/	/	/	/	138.9
Meas. 1	/	/	/	/	99.7
Meas. 2	/	/	/	/	236.9
Meas. 3	/	/	/	/	300.1
Meas. 4	/	/	/	/	136.5
Meas. 5	/	/	/	/	142.2
Meas. 6	/	/	/	/	193.5

Radius+Ulna		
Bd	60.2	52.9
Dd	49.4	/
BFd	44.9	48.2

Radius							
Bp	/	61.5	62.4	63.6	72	63.5	63.4
BFp	/	56.3	56.8	58.1	67.1	60.4	60.5
Bd	63.7	/	/	/	/	/	/
BFd	51.5	/	/	/	/	/	/

Ulna						
DPA	45.2	47.7	/	49.7	/	/
SDO	/	40.1	/	/	/	/
BPC	32.2	36.2	38.1	38.4	35.7	35.9

Pelvis	
LA	61.9
LAR	49.9

Sacrum	
HFcr	24.8

Patella	
GB	37.4

Tibia											
Bp	/	/	/	/	69.8	/	88.2	/	/	/	/
SD	/	/	/	/	/	30.9	/	/	/	/	/
Bd	58.7	56.1	52.8	48.5	/	54.8	/	54.3	56.3	54.9	50.3
Dd	39.7	38.7	/	35.1	/	39.8	/	42.3	42.6	44.3	38.8

Intermedium	
GB	33.4

Carpale 2+3	
GB	40.2

Os centrotarsale		
GB	49.2	52.7

Carpale 4+5	
GB	22.9

Calcaneus							
GL	112.7	/	115.9	/	/	114.3	/
GB	35.8	38.1	39.1	41.6	37.5	37.9	31.2

Astragalus							
GLI	61.5	55.6	63.8	59.4	58.2	52.1	51.7
GLm	52.8	/	57.5	52.8	54.5	48.4	48.1
DL	31.7	32.1	36.9	31.8	35.3	29.3	28.9
DM	32.8	33.7	30.8	/	31.8	/	24.7
BD	38.3	/	41.1	36.4	37.9	34.9	32.3

Metacarpus												
Bp	49.7	50.6	51.1	/	48.1	46.6	47.1	46.9	47	/	47.7	46.3
Dp	29.2	30.1	30.9	/	29.3	29.1	28.4	27.9	25.7	/	30.1	25.3
SD	25.9	/	/	/	27.4	/	24.8	/	21.9	/	24.4	24.7
Bd	/	/	/	55.2	/	/	/	/	/	49.1	/	/
Dd	/	/	/	28.8	/	/	/	/	/	27.3	/	/

Metatarsus							
GL	/	148.3	/	/	/	/	/
Bp	43.6	33.1	39.3	37.6	38.8	33.2	37.8
Dp	/	34.6	38.9	36.2	39.4	30.8	37.3
SD	/	18.3	/	/	/	18.5	/
Bd	/	41.6	/	/	/	/	/
Dd	/	24.1	/	/	/	/	/
Withers' height (cm)	/	78.3	/	/	/	/	/

Phalanx I						
GLpe	/	54.9	49.5	/	51.5	51.6
Bp	30.6	/	/	/	25.6	25.2
Dp	33.2	/	/	/	/	/
SD	26.1	26.9	21.9	/	19.1	21.7
Bd	/	/	/	24.1	24.9	22.1

Phalanx II	
GL	32.3
GLpe	32.7
Bp	21.6
Dp	24.5
SD	19.1
Bd	17.8
Dd	20.8

Phalanx III			
DLS	55.7	57.4	49.9
Ld	15.4	18.1	41.2
MBS	44.7	/	16.5

Ovis aries

Horn core			
Meas. 7	116.2	/	/
Meas. 8	37.9	25.4	23.3
Meas. 9	25.6	16.2	15.7

Mandibula					
D ₂ -D ₄	/	/	30.1	/	30.9
H (D ₂)	/	/	11.5	10.3	12.4
L D ₄	/	/	17.2	/	17.6
B D ₄	/	/	4.9	/	5.1
P ₂ -P ₄	21.1	22.5	/	/	/
H (P ₂)	15.4	15.2	/	/	/
H (M ₁)	/	/	/	/	21.1

Maxilla	
P ² -P ⁴	24.7
L praemaxillae	67.3

M ₃	
L	19.7
B	6.9

Axis	
BFcr	17.9
SVB	24.3

Scapula							
SLC	21.9	21.3	19.9	20.8	19.6	21.8	18.6
GLP	/	/	34.4	/	34.7	31.8	32.6
LG	/	24.9	26.7	/	26.4	25.3	21.4
BG	/	/	21.3	/	23.5	19.3	20.3

Humerus			
Bd	29.9	29.6	29.5
Dd	24.3	/	23.7
BT	30.6	28.3	28.4

Radius					
GL	/	/	149.5	163.9	/
Bp	/	/	33.1	32.2	27.5
BFp	/	/	29.1	30.1	25.8
Dp	/	/	26.4	15.9	/
SD	/	/	15.4	16.3	/
Bd	28.1	34.8	28.3	29.6	/
BFd	24.2	/	20.4	25.7	/
Dd	/	22.7	22.5	20.2	/
Withers' height (cm)	/	/	59.8	65.6	/

Ulna	
DPA	25.9
SDO	21.2
BPC	19.6

Pelvis		
SB	9.8	/
LA	27.2	26.5
LAR	/	23.2

Femur		
Bp	/	44.3
SD	/	21.7
Bd	38.2	/
Dd	45.1	/

Tibia											
Bp	/	41.3	/	/	43.6	/	/	/	/	/	/
Dp	/	39.8	/	/	42.8	/	/	/	/	/	/
SD	/	/	11.9	13.8	/	14.7	/	13.9	13.7	25.2	/
Bd	24.8	/	24.1	25.2	/	28.2	25.8	25.6	24.8	20.1	25.2
Dd	19.8	/	19.9	13.8	/	27.9	19.1	21.7	21.2	/	18.9

Astragalus			
GLl	29.7	29.5	28.8
GLm	25.9	27.9	27.2
DI	17.9	16.1	16.9
Bd	19.3	19.6	18.2
Withers' height (cm)	62.2	61.8	60.3

Radiale	
GB	19.2

Calcaneus	
GL	55.7
GB	19.9
Withers' height (cm)	60

Metacarpus				
Bp	19.8	23.2	25.5	7
Dp	18.7	16.5	/	/
SD	12.9	/	11.8	/
Bd	26.3	/	17.5	26.6
Dd	/	/	/	15.4

Metatarsus				
Bp	19.8	19.4	22.7	21.1
Dp	18.7	18.9	22	19.1
SD	12.9	11.7	13.3	11.5
Bd	26.3	/	/	/

Capra hircus

Mandibula				
D ₂ -D ₄	/	29.3	31.4	/
H (D ₂)	/	12.7	13.9	/
L D ₄	/	16.7	17.9	/
B D ₄	/	4.8	5.2	/
P ₂ -P ₄	27.3	/	/	21.3
H (P ₂)	16.2	/	/	15.8
H (M ₁)	/	21.7	/	21.4
L (M ₁)	/	14.1	/	/
M ₁ -M ₃	/	/	/	37.3

H (M ₃)	/	/	/	72.9
P ₂ -M ₃	/	/	/	38.7

Horn core	
Meas. 8	33.3
Meas. 9	22.4

Scapula	
SLC	17.5
GLP	33.6
LG	26.9

Humerus		
SD	14.1	/
Bd	31.6	29.9
BT	30.4	/

Ulna+Radius		
DPA	25.6	/
Bp	29.6	33.2
BFp	28.5	31.9
BPC	/	25.5

Radius			
GL	/	168.9	/
Bp	31.7	31.7	29.9
BFp	29.9	31.3	28.7
SD	19.7	18.5	15.8
Bd	/	29.9	/

BFd	/	25.7	/
Withers' height (cm)	/	67.2	/

Femur	
Bd	36.1
Dd	45.9

Tibia			
Bp	41.4	/	/
SD	/	14.5	13.4
Bd	/	23.9	24.7
Dd	/	20.5	17.9

Astragalus	
GLl	29.5
GLm	27.6
DI	11.8
Dm	16.9

Phalanx I			
GLpe	37.8	35.4	/
Bp	12.2	12.3	/
Dp	/	14.4	/
SD	10.5	10.2	8.6
Bd	11.2	11.5	9.7
Dd	/	10.4	9.2

Metacarpus			
Bp	24.8	24.8	25.7
Dp	20.1	17.1	18.3
SD	14.1	14.5	17.1

Ovis/Capra

Scapula	
SLC	19.2
LG	20.3
BG	21.8

Tibia			
Bd	21.8	21.4	25.3
Dd	14.3	15.8	19.1

Femur	
Dd	42.8

Sus domesticus

Mandibula		
D ₂ -D ₄	/	34.6
H (D ₂)	/	23.5
L D ₄	/	18.1
B D ₄	/	7.9
L M ₃	29.2	/
B M ₃	15.1	/

I ₁	
L	50.2
B	6.9

Scapula		
SLC	22.4	25.2
GLP	30.8	36.2
LG	/	29.7
BG	21.9	27.5

Humerus		
Bd	42.2	36.8
Dd	42.1	/
BT	35.7	31.4

Radius		
GL	146.4	/
Bp	28.5	27.2
BFp	28.1	26.9
Dp	19.6	/
SD	17.2	/
Bd	32.9	/
BFd	29.1	/
Dd	24.3	/
Withers' height (cm)	77	/

Ulna	
DPA	34.9
SDO	26.7
BPC	22.5

Femur		
Bd	41.2	51.3
Dd	51.3	51.5

Tibia	
Dp	21.8
Bd	25.7
Dd	22.8

Metatarsus III		
Bp	13.2	16.8
Dp	19.7	19.1
SD	7.2	11.1

Equus caballus

Phalanx I	
GL	78.1
Bp	51.7
BFp	47.5
Dp	35.1
SD	34.1
Bd	45.6
BFd	42.3
Dd	22.9

Equus sp.

Tibia	
Bp	89.8

Canis familiaris

Ulna	
GL	197.3
DPA	28.1
BPC	20.5
Withers' height (cm)	55.5

Radius	
GL	181.3
Bp	19.6
SD	14.1
Bd	22.6
Withers' height (cm)	59.6

Gallus domesticus

Os coracoideus	
GL	45.5
Lm	43.1
Bf	10.3
SD	4.2

Tibia	
GL	122.2
La	118.7
Dip	22.1
SC	6.4
Bd	12.5
Dd	12.7

Tarsometatarsus	
Bp	13.6
Dp	11.1

Sus scrofa

Maxilla		
M ¹ -M ³	80.3	84.3
L M ³	39.7	42.8
B M ³	24.1	/

Atlas	
BFcr	67.1

Humerus	
Bd	56.3
Dd	55.3
BT	45.9

Cervus elaphus

Scapula	
SLC	37.1
LG	36.2
BG	34.4

Ulna	
BPC	36.3

Capreolus capreolus

Antler	
Meas. 10	84.2

Scapula	
SLC	18.4
LG	22.4
BG	20.2

Lepus europaeus

Scapula	
SLC	7.1
GLP	16.1
LG	13.8

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IS IT POSSIBLE TO DEVELOP AND MAINTAIN ARCHAEOLOGICAL AWARENESS AND KNOWLEDGE IN A SMALL TOWN IN POLAND?

ABSTRACT

The author of the paper aims at demonstrating her endeavours to spark interest in ancient times and cultures of the world in a small town in Poland, namely Pułtusk – her hometown. Although there is a university in Pułtusk, it is still quite difficult incite people's curiosity. We live in such times that time is money and for parents more important are languages and fortunately still physical education as well, but much more rarely knowledge children can acquire, for instance in the humanities. Notwithstanding all of the difficulties, the present author not only conducts once a year archaeological workshop to celebrate the Children's Day, but also she managed to open the Humanistic University for Children in 2012. This makes a positive example and proves that when one tries hard he/she is inevitably doomed to success. Therefore, this case may be treated as a precedent. The present author hopes very much that in the upcoming years there will be more and more Universities for Children in small towns allowing children from localities lying away of municipal centres to develop their curiosity for the world, their interests and skills.

The following paper, illustrated with very many photos, was presented at the conference held at the Archaeological park of Viminacium from 5th to 8th of October 2012 to which the author was kindly invited. However, it is its revised version.

KEYWORDS: ARCHAEOLOGY, POPULARISATION, WORKSHOPS FOR CHILDREN, OPEN LECTURES, ANCIENT HISTORY, SMALL TOWNS IN POLAND.

Archaeology and its heritage currently seem to be of interest to many. Notwithstanding this, however, one can observe fewer students studying the humanities in Poland. Therefore Polish educational programmes are seeing cuts in the number of history teaching hours. It is said this is part of changing the ways in which young people are prepared for the social changes taking place in the world, globalisation and commercialisation.

The present author, as Egyptologist, archaeologist, philologist and above all academic teacher, feels responsible that she should share her and her colleagues' knowledge with the rest of Polish society, with special regard to small Polish towns,

in large part because she was born in one of them.

There is a crucial and vivid role to be played by the popularisation of archaeological, cultural and historical heritage and its impact in terms of raising awareness of our archaeological and historical roots. In Poland the situation is more difficult in towns than in cities. In Pułtusk, the hometown of this author, however, it is more promising because of its *Alma Mater Studiorum*: Pułtusk Academy of Humanities.

Since 2004 this author has been making efforts to popularise scholarly knowledge among the inhabitants of Pułtusk. A range of activities aimed at involving various age groups in the town have



Archaeological workshop for children, June 2010, Archives of the Pultusk Academy of Humanities.



Archaeological workshop for children, June 2011, Archives of the Pultusk Academy of Humanities.



Archaeological workshop for children, June 2011, Archives of the Pultusk Academy of Humanities.



Archaeological workshop for children, June 2012, Archives of the Pultusk Academy of Humanities.

been organised. The usually good atmosphere and the ready help of many people involved let us carry out such organisational endeavours. While difficulties have also been encountered, the organisational work is done and solutions to problems found. Above all, the collaboration of Joanna Popielska-Grzybowska with her students, whose assistance is truly invaluable, is of great importance. Furthermore, we always seek ways to collaborate with the local authorities and in particular the local media (newspapers and TV) to promote these events.

Therefore, from the very beginning we have had contacts with the media both to advertise and promote our activities. Articles appear before and after the planned events. We are co-operating with local newspapers and in particular with Lech Chybowski and Izabela Mierzejewska-Koba. Most of the events are filmed by our colleague, Paweł Kiela (head of multimedia service at the Pułtusk Academy of Humanities).

When bigger events are conducted informa-

tion is usually published on the PAP's Science and Scholarship in Poland pages online by Szymon Zdziębowski (a former student of the author).

As mentioned above, since 2004 varied ventures to popularise archaeology have been organised. These include Polish and foreign discoveries as well as methods of archaeological research. Since then every year on June 1st the present au-



Archaeological workshop for children, June 2012, Archives of the Pultusk Academy of Humanities.



An open lecture on history of Venice, dr Piero Pasini, Ca' Foscari University of Venice, and secondary school students, June 2012, photo by dr J. Popielska-Grzybowska.



Pultusk Humanistic University for Children, music, 2012, photo by dr J. Popielska-Grzybowska.

thor, with the assistance of her students, conducts archaeological workshops to celebrate Children's Day (Popielska-Grzybowska 2012: 141-143). Various activities in which children are involved are performed. These workshops have already been described in the quoted paper (*loc. cit.*). The idea also started to help develop a new venture, the University for Children, led by this author who



Pultusk Humanistic University for Children, archaeozoology, dr Urszula Iwaszczuk, 2012, photo by dr J. Popielska-Grzybowska.

was assisted by Wioleta Michałowska in the academic year 2012/2013 and since 2014 she has been supported by Joanna Rosińska. Every two weeks children aged from 3 to 11 meet at the Pultusk Academy of Humanities to take part in chatty lessons combined with workshops designed for them. Different, times and various cultures from all over the world are the topics of our meetings. Many and varied, mental as well as manual, activities are performed, both for children and with them.

We support and intersperse our talks and workshops with books, posters, board games, jigsaw puzzles, some fake artefacts and real artefacts as well. We often use PowerPoint presentations to illustrate the topic presented to children to make it easier for them to imagine and feel what life was like in ancient times or is in other countries. Often guests, specialists in a given area of knowledge, are invited, for instance an archeozoologist (Dr. Urszula Iwaszczuk), artists, painters (Barbara Popielska) or musicians.



Dr Andrzej Ćwiek, egiptolog

Absolwent archeologii śródziemnomorskiej na Uniwersytecie Warszawskim (praca mgr 1994 „Małe Piramidy Schodkowe”, doktorat 2003 „Relief Decoration in the Royal Funerary Complexes of the Old Kingdom”).

Od 2001 kurator Galerii Egipskiej w Muzeum Archeologicznym w Poznaniu i adiunkt w Instytucie Prahistorii Uniwersytetu im. Adama Mickiewicza (wykłada archeologię Egiptu, egipską sztukę, architekturę, religie, hieroglify).

Od 1993 uczestnik prac polskich misji archeologicznych w Egipcie: w Tell Atrib, Sakkarze i Deir-el-Bahari. Obecnie zastępca kierownika polskiej misji archeologiczno-konserwatorskiej w świątyni królowej Hatszepsut w Deir-el-Bahari.



Dr Joanna Popielska-Grzybowska, egiptolog, Kierownik Katedry Kultury Afryki Instytutu Antropologii i Archeologii Akademii Humanistycznej im. Aleksandra Gieysztora

Absolwentka archeologii śródziemnomorskiej na Uniwersytecie Warszawskim /praca magisterska „Atum w Tekstach Piramid”; rozprawa doktorska „The Pyramid Texts as a Source of Topoi in the Coffin Texts (Based on Diagnostic Spells)”/.

Absolwentka Podyplomowego Studium Humanistycznego w Instytucie Badań Literackich Polskiej Akademii Nauk (profil humanistyczny: literaturoznawstwo, historia, historia filozofii oraz

historia sztuki).

W latach 1998-2006 prowadziła zajęcia z języka staroegipskiego i języka Tekstów Piramid na Uniwersytecie Warszawskim.

Od roku 2004 pracuje, początkowo jako asystent, obecnie jako adiunkt w Akademii Humanistycznej im. Aleksandra Gieysztora w Pułsku, gdzie prowadzi zajęcia z archeologii Egiptu i krajów basenu Morza Śródziemnego oraz hieroglifów.

Współautorka książki „Tajemnice papirusów” (Wrocław - Warszawa - Kraków 2005), autorka licznych artykułów naukowych w języku polskim i językach obcych.



Jadwiga Iwaszczuk, archeolog Egiptu

Absolwentka archeologii śródziemnomorskiej na Uniwersytecie Warszawskim (praca magisterska „Świątynia egipska w okresie podynaścicznym i archaicznym”). W latach 2002-2004 pracowała w Polskim Centrum Archeologii Śródziemnomorskiej w Kairze.

Od roku 2007 pracuje jako asystent w Zairadzie Archeologii Śródziemnomorskiej Polskiej Akademii Nauk, gdzie pisze rozprawę doktorską poświęconą topografii Teb w okresie panowania królowej Hatshepsut.

Od roku 1999 uczestniczy w badaniach na terenie Egiptu, jest stałym członkiem polskiej misji archeologiczno-konserwatorskiej w świątyni królowej Hatszepsut w Deir-el Bahari, brała udział w pracach misji polsko-egipskiej w Peluzjum. Współpracowała również z misją amerykańską Giza Plateau Mapping Project.

Autorka artykułów naukowych związanych z jej pracami w Deir el-Bahari.

**KOD PIRAMID**

Zasyfrowany przekaz od kosmitów, pomniki przybyszów z Atlantydy, Biblia wykuta w kamieniu, starożytne centra lecznicze, broń masowego rażenia? O piramidach słyszymy prawie codziennie. Wspólnym mianownikiem

newsów są tytuły. „Tajemnice piramid”, „Zagadka Wielkiej Piramidy”, „Niezwykła energia piramid”... Czy jednak „tajemnice piramid” istnieją naprawdę? Ależ oczywiście! Tyle, że nie mają nic wspólnego z kosmitami. I najważniejszą kwestią nie jest wcale to, jak Egipcjanie zważyli na kupę te miliony kamiennych bloków. Wbiew wynikającemu z niewiedzy – przekonaniu zwolenników iluzji, wiedza egiptologiczna na temat piramid jest nie tylko rozległa, ale i fascynująca. Piramidy a właściwie zespoły architektoniczne, w których piramidy stanowiły centralny element, nie były po prostu grobowcami, w każdym razie



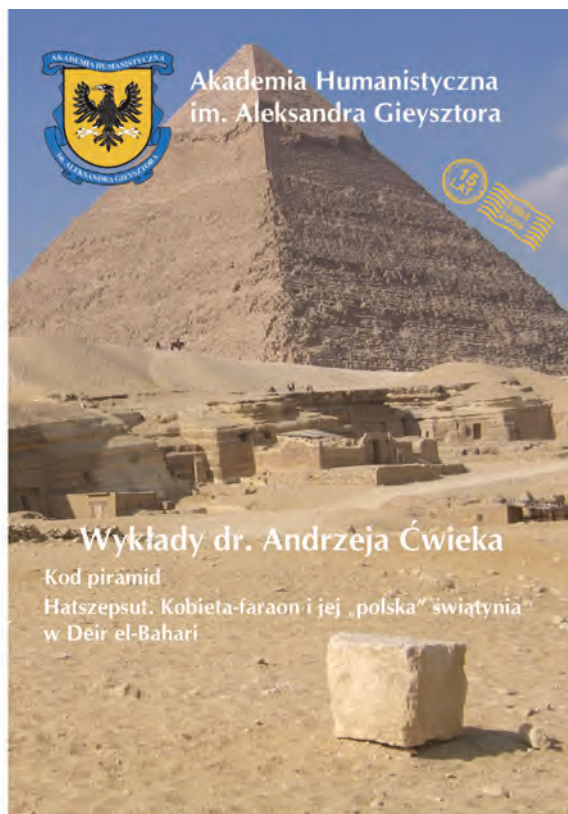
nie w dzisiejszym znaczeniu tego słowa. Każdy z nich miał być zarazem *Resurrection Machine* i wieczną siedlzbą faraona, żyjącego i panującego po śmierci.

Czym były i co tak naprawdę wiemy o tym kto, kiedy, jak i po co wybudował piramidy?
Spróbujemy odcodować zaszyfrowany przekaz starożytnych budowli...

HATSZEPSUT, KOBIETA-FARAON I JEJ „POLSKA” ŚWIATYNIA W DEIR EL-BAHARI



Fascynujące dzieje królowej, która jako jedna z niewiele kobiet w historii Egiptu odważyła się zasiąść na tronie Horusa, zapisane są dosłownie i w przenośni – na kamieniach świątyni w Deir el-Bahari, jej „siedziby milionów lat” na zachodnim brzegu Teb. Wątki romantyczne zderzają się tu z najpoważniejszymi



kwestiami egipskiej religii i ideologii władzy. Legenda o jej boskim pochodzeniu, tajemnica dostojnika Senenmuta, wychowawcy jej córki i domniemanego kochanka, kwestie pozycji Totmesa



III, przez dwadzieścia lat odsuwanego na drugi plan (choć formalnie współzrządzającego z Hatszepsut), i zarządzanego przez niego później *dannatio memoriae* królowej o tym wszystkim mówią mury świątyni. Niezwykła architektura i dekoracja tej budowli ujawnia złożony i głęboki przekaz wiary starożytnych w odrodzenie faraona po śmierci, stanowiąc jednocześnie narzędzie mające zapewnić Hatszepsut owo wieczne życie i panowanie.

Od czterdziestu siedmiu lat świątynia Hatszepsut stanowi teren prac polskich egypтоlogów, architektów i konserwatorów, badających ją i możliwie rekonstruujących jej pierwotny wygląd. Przyczyną jej dawną świętość, na chwałę wielkiej królowej i ku zadowoleniu turystów poocy specjaliści sprawują, że świątynia Hatszepsut jest znowu miejscem magicznym, w pełni zasługującą na swą starożytną nazwę Dziesięć Dziesięć, „Najświętsze ze świątyń”, „Najbardziej wyjątkowe z wyjątkowych [miejsc]”.

Warsztaty egiptologiczne

POZNAJ Tajemnice Starożytnych Egipcjan (dla dzieci od 6 do 12 lat)

Zapraszamy dzieci w wieku 6-12 lat na przygodę ze starożytnym Egiptem podczas warsztatów artystyczno-literackich.

Warsztaty odbędą się 1 czerwca 2009 r.

w Akademii Humanistycznej im. Aleksandra Gieysztora

przy ul. Daszyńskiego 17 w Puławsku

sala A o godz. 18.30.

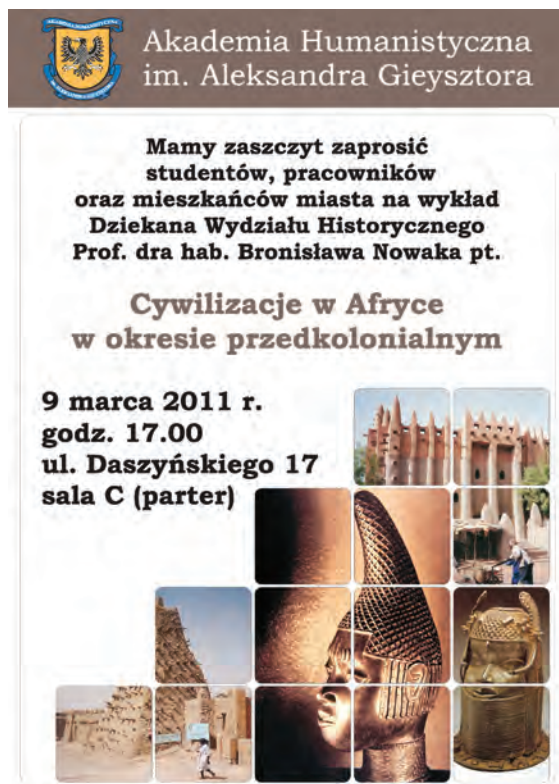
Warsztaty poprowadzą:

- Dr Joanna Popielska-Grzybowska,

- Dr Andrzej Cwiek
- Jolanta Iwaszczyk

Dorosłych towarzyszących dzieciom zapraszamy na kawę i ciasteczka prosto z Egiptu.

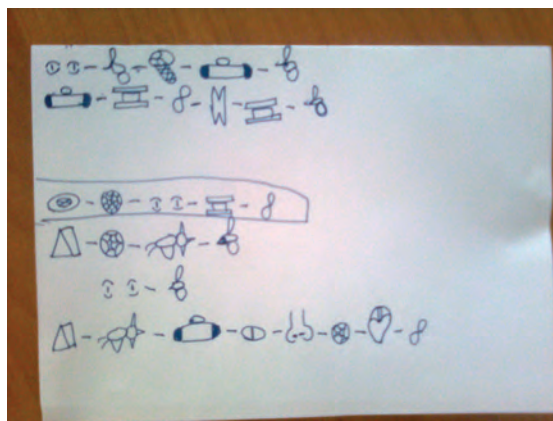




An open lecture on postcolonial Africa by prof. Bronisław Nowak, Archives of the Pultusk Academy of Humanities.



Open lecture on postcolonial Africa by prof. Bronisław Nowak, Archives of the Pultusk Academy of Humanities.



Pultusk University for Children, New writing system invented by one of the students, 2014, photo by J. Grzybowska.



Pultusk Humanistic University for Children, Chinese culture workshop, 2012, photo by J. Grzybowska.

We aim to inform children about all aspects of human culture in an attractive way, demonstrating similarities and differences and thus inspiring kids to discover their own interests, capabilities and talents, stimulating their will to learn and teaching them tolerance. Amusement and group work develops children's social behaviour, teaches cooperation and integrates them with the aim of achieving a collective goal.

Moreover, at the Pultusk Academy of Humanities there also existed an Archaeological-Anthropological Circle for secondary schools' students.

Over the last six years, and even before the University for Children and Youth Group were opened, students from secondary schools, mainly from the Liceum named after Piotr Skarga, have been coming to the lectures at the Academy. These lectures are above all devoted to ancient history

and the history of the Vikings, depending on the lecturer, namely her/his scholarly specialisation and the research conducted by them.

Other initiatives are open lectures by Polish and/or foreign scholars. Archaeologists, historians and historians of art come to present their current research to the public, namely to share them with the inhabitants of Pułtusk. There have been lectures familiarising people with the cultures and cultural heritage of Ancient Egypt (lectures on Saqqara excavations delivered by prof. Karol Myśliwiec, dr Kamil O. Kuraszkiewicz and Agnieszka Kowalska; on the Giza Plateau Mapping Project by dr Anna Wodzińska; on ancient Egyptian religious texts and beliefs and on ancient Egyptian language and writing by dr Joanna Popielska-Grzybowska; on Egyptian pyramids by dr Andrzej Ćwiek; on Polish mission and discoveries in the Hatshepsut temple by dr Andrzej Ćwiek and dr Jadwiga Iwaszczuk), Sudan (lectures on archaeological excavations by prof. Mahmoud El-Tayeb and Henryk Paner; a lecture on everyday life in contemporary Sudan by prof. Mahmoud El-Tayeb), the Near East, Bible studies included (a lecture on archaeology and the Bible by dr Jacek Konik), cultures of different peoples of Africa (a lecture on postcolonial Africa by prof. Bronisław Nowak); cultures and cultural changes in Europe (lectures on the Vikings by prof. Władysław Duczko; a lecture on the history of Venice by dr Piero Pasini) as well as on cultural heritage of China (prof. Li Qikun). The last under the auspices of prof. Jerzy Gąssowski.

Scholarly and popularising cultural heritage conferences and symposia are also organised.

Since 2012 when the lecture, which had been a base of this paper at the Archaeological Park in Viminacium was delivered, some things have changed for the better. Last October Humanistic University for Children has commenced the fifth year of its existence.

Furthermore, the present author together with many other enthusiasts belongs, as a charter member, to the Society of the Children's Universities



Pułtusk University for Children, Portugal – workshop, 2015, photo by J. Popielska-Grzybowska.

created in 2015 with its abode in Warsaw. Added to this, the Humanistic University for Children based at the Pułtusk Academy of Humanities was presented at four Congresses of the Children's Universities in Warsaw (<http://www.dzieci.edu.pl/>).

Joanna Popielska-Grzybowska has also initiated collaboration with the volunteers that come to Poland supported by the Erasmus plus European programme and the FIYE Poland (=Centre of International Youths' Exchange and Volunteering; http://www.fiyepoland.pl/index.php?option=com_content&view=article&id=36&Itemid=18&lang=pl). The volunteers who come to Pułtusk and Warsaw from all over the world are invited to the Humanistic University for Children to familiarise our young students with their countries, their culture, traditions and languages as well. To date we had the opportunity to talk to the children about the following countries: Portugal, Spain, Russia, Ukraine, Italy, Greece, Finland, Colombia and Brazil, France, Germany, Austria and Turkey. The next planned meeting will be devoted to Italy and Costa Rica. Thanks to availability of the foreign



Pultusk University for Children,
Archaeological excavations, June 2016,
photo by J. Popielska-Grzybowska.

guests and their will to share their knowledge and experiences of different cultures, the children from the Humanistic University for Children from such a small town as Pultusk is (20.000 inhabitants), have an exceptional opportunity to get to know various people even from very remote countries and their cultural heritage.

Consequently our presentations regarding ancient cultures such as: ancient Egypt, ancient Greece and Rome as well as ancient Sumer and all other Near Eastern civilizations and cultures, may become much more aware of the contemporary differences between today's people too. Consequently, we believe and do hope, they become more tolerant and open-minded adults.

Moreover, we invited older children and adolescents to cooperate with us and present their passions to the younger colleagues.

It may be added that the children receive student record books and at the end of each year of education diplomas.

Furthermore, we have created two web sites

of our University. One on Facebook (<https://pl-pl.facebook.com/Humanistyczny-Uniwersytet-dla-Dzieci-921603594560721/>) and the other one (www.hud.edu.pl). The logo and all illustrations are designed by our young students. The videos promoting our lectures and workshops are filmed by one of the alumni.

In cooperation with the Faculty of Elementary Education of the Pultusk Academy of Humanities the present author – as a representative of the Transcultural Section of the *Scientific Society Educare* (http://tneudcare.e-kei.pl/?page_id=87) – organised in 2015 the conference “Kreatywne postrzeganie świata przez dziecko” (=“Child's creative perception of the world”) at which our activities were demonstrated to scholars and teachers from Pultusk and the region.

Within the works of the *Scientific Society Educare* the Humanistic University for Children is displayed and discussed very frequently (http://tneudcare.e-kei.pl/?page_id=42).

Joanna Popielska-Grzybowska has succeeded in establishing a cooperation with the Mayor and Vice-Mayor of the town and the Directors of the District Authority Office who support our endeavours, for example by supplying transport for our scholarly excursions, as it occurred last academic year when we went to archaeological excavations led by Izabela Jakubowska in the Castle in Ciechanów.

The present author gives a lot of mini-lectures and chatty-lectures in many Pultusk kindergartens: Miejskie Przedszkole no 4, Urwis, Malinowe Przedszkole, In 2014/2015 she was invited to conduct a series of workshops in the Miejskie Przedszkole no 4 (=Town Kindergarten no 4). The “lessons” were all devoted to ancient Egypt and archaeologists as well as their work. Moreover, a former student of the Humanistic University for Children wrote a scenario of a play about ancient Egyptian gods and the Kindergarten children guided by the student and their educators prepared a play which was put on the stage at the Pultusk Academy of Humanities (<https://www.youtube>.



Pultusk Humanistic University for Children. Inauguration of the academic year 2016/2017, Archives of the Pultusk Academy of Humanities.

com/watch?v=k8F-PZ53ST0). It took place as a part of the above-mentioned conference.

Two years ago a collaboration with the Nasielecki Children's University (<http://europaimy.org/www/pl/aktualnosci/286-v-semestr-nasielskiego-universytetu-dzieciecego>) was set up.

The future seems to be very promising as we intend to establish a branch of the Pultusk Humanistic University for Children in Ciechanów – a bigger town which was the capital of the voivodeship, but now is suffering from lack of captivating educational offers for younger children.

Therefore, as one may observe, we neither resigned nor stopped trying and making more and more efforts to animate and re-animate non-formal education of our young generations in Pultusk and the other towns in its vicinity.

However, as the Humanistic University for Children is based on volunteer work of the coordinator, the assistant and the lecturers and we still do not have our children-friendly, cosy room, the next crucial step is to gain external financing what we are constantly trying to achieve.

It is interesting how these endeavours have impacted the lives of local people. At the very beginning when the above-mentioned events started to be organised not many people attended. At first it seemed local people neither had much interest nor much will to participate in “scholarly” – and thus perhaps boring – meetings. However, every year more and more are coming. When it turned

out how interesting and different from other free-time activities they were, people began to come and bring their children and friends along to gain some knowledge and to have some fun as well.

Notwithstanding all the financial problems that appear when organising workshops, chatty talks, lectures or conferences, what we do brings a lot of pleasure and satisfaction from a well done job and the smiles on participants' faces make up for every single effort.

All in all, although it may sometimes be difficult to develop and maintain archaeological and cultural awareness and knowledge among the inhabitants of a small town in Poland, it is possible to do so and thus the question formulated in the title of this paper can be answered in the affirmative.

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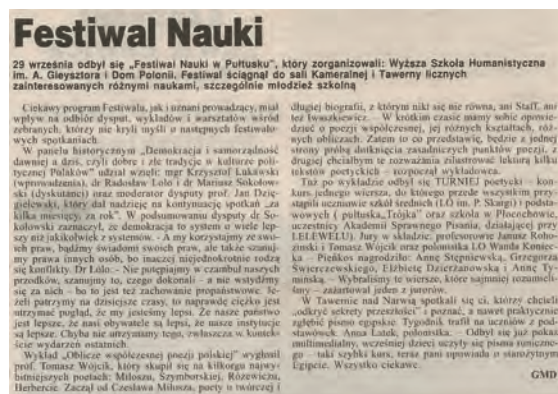
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REZIME

DA LI JE MOGUĆE PODSTAĆI I OČUVATI ZNANJE I SVEST O ZNAČAJU ARHEOLOGIJU U MALOM GRADU U POLJSKOJ?

KLJUČNE REČI: ARHEOLOGIJA, POPULARIZACIJA, RADONICE ZA DECU, OTVORENA PREDAVANJA, DREVNA ISTORIJA, MALI GRADOVI U POLJSKOJ.

U današnje vreme čini se da su mnogima zanimljivi arheologija i njena zaostavština.

Bez obzira na to, primećuje se da je u Poljskoj sve manje studenata humanističkih nauka, pa se iz tog razloga u poljskim obrazovnim programima predviđa smanjenje broja sati za nastavu iz istorije. Smatra se da se i time vrši promena načina na koji se mladi spremaju za društvene promene koje se odvijaju u svetu, globalizaciju i komercijalizaciju.

Autorka, kao egiptolog, arheolog, filolog, a pre svega akademski profesor, smatra da ima odgovornost da svoje znanje i znanje svojih kolega podeli sa javnošću u Poljskoj, s posebnim osvrtom na male poljske gradove, pre svega zbog toga što je rođena u jednom od njih. Potrebno je odigrati presudnu i snažnu ulogu u popularizaciji arheološke i istorijske baštine koja će uticati na podizanje svesti o našim arheološkim i istorijskim korenima. Od 2004. godine ova autorka pokušava da popularizuje naučna saznanja stanovnicima Pultuska. Organizovano je niz aktivnosti usmerenih na uključivanje različitih starosnih grupa u gradu. Organizuju se otvorena predavanja, konferencije i simpozijumi na kojima se kulturna baština predstavlja na naučan i popularan način. Svi naši naponi pokazuju da je organizovanje takvih događaja u Pultusku, jednom od poljskih gradića, veoma ohrabrujuće.

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ARCHERY IN ANCIENT GREECE: OPERATIONAL PRACTICE AND TACTICS

ABSTRACT

The issue of ancient Greek archery looms in mist, as it passed to history as a distrusted weapon, alien to the codes of honorable battle. Though, it had been kept in high respect. There was a full tactical and technical doctrine, as both literary and representational sources testify. Starting from Hercules, son of Zeus proper and demi-god and hero par excellence in the Greek lore, he is mentioned to shoot at point targets with great accuracy and at extended range with venomous arrows. Other known archers of the era are Odysseus and the non-Greek Paris, who is the most prominent; whole contingents though are mentioned as archer bodies and shoot over the first lines of the friendly formations. After this period of lords and soldiers trained to the bow, the classical Greeks use solid bodies of archers. They are few and mostly conscripted or imported by tyrants and other despised rulers. But although despised, whole areas are proficient with the bow and engulf its culture and the weapon is used with surgical accuracy against the prominent archer invader, Persia, with calamitous effect in both land and sea. The shooting technique and tactics of the era imply direct shots, but indirect, high-arc aiming is also mentioned some decades later as a known skill. By the time of Alexander, a standard doctrine which includes small but picked archer forces (losing their commanders thrice in 3 years) indicates their effectiveness in maneuver warfare over difficult terrain and in special operations.

KEYWORDS: ARCHERY, ANCIENT GREECE, THE BRONZE AGE, THE ARCHAIC ERA, THE CLASSICAL ERA.

1. INTRODUCTION

The issue of ancient Greek archery looms in mist, as it passed to history as a distrusted weapon, alien to the codes of honorable battle. The most famous ancient warriors, the Mycenaean era Achilles and the classical era Spartans distrusted it. Though, it had been kept in high respect and its use was far from forbidden in serious warfare. There was a full tactical and technical doctrine, as both documentary and representational

sources inform us. It was never the choice of the rank and file, as it had been in other cultures, or as was the spear/javelin in the Greek world, but it was neither ignored nor despised as much as the sources directly imply. It was respected and feared and, when conditions both permitted and demanded, its use was acceptable, massive and quite successful.



Fig. 1 Mycenaean Archers are combined with body-shield infantry from the “Lion hunt dagger”.

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2. THE DOCUMENTARY EVIDENCE

First period:

the Bronze Age and the heroic ethos

Starting from Hercules, son of Zeus proper (Hes. Sh. 52-56 & 103-105) and demi-god and hero par excellence in the Greek lore, he is an exiled prince whose scheming parents are banned from Tiryns (Hes. Sh. 80-81), when they claim rights to the throne of Mycenae. They find asylum in Thebes (*ibid*) after Oedipus (Hes. Sh. 83) and Hercules is champion of the city (Hes. Sh. 103-105). Hercules lives at the highlands off Thebes for quite sometimes and links to mountaineers and hill people and spends much of his life in mountainous terrain.

Hercules is mentioned to shoot at point targets with great accuracy and at extended range. The hero was immensely strong and widest of stature, which directly implies a powerful bow; his arrows, after a point in his career, where venomous, painted to the venom of the Hydra. He is rarely mentioned as armed in the proper, heroic way with conventional arms and armor (Hes. Sh. 122-138). Instead, he wears a lion skin and uses a club or a mace. His bow is passed to his follower Philoktetes who kindled his funeral pyre.

This picture of Hercules is very informative if compared to some figures described in the Iliad. There, the bow is despised by the Greek heroes, but not of the high command. There are two ar-

cher contingents and four renowned archers in the Greek force. First is Philoktetes, the follower of Hercules, who leads an archer contingent numbering 350 men in seven 50-oared ships (Hom. Il. II-718/20). Odysseus, the most prominent of stature (and perhaps the best known archer), does not lead an archer contingent. He has not brought his weapon, which is at least two generations old, almost the age of the one of Hercules. It is a gift from a previous renowned archer (Ifitos), friend to Odysseus (Hom. Od. xxi-25/30) and Odysseus never carries it in war (Hom. Od. xxi-39/41). The weapon has definitely wooden parts, as in Odyssey the owner inspects the weapon before bracing it to ensure that it is not compromised by woodworm (Hom. Od. xxi-394/6). The weapon shoots extremely straight; so straight that the arrow passes through the holes of 12 axes (Hom. Od. xxi-75/7). No matter which holes are implied, the 12 axes take a minimum of 1m to be put, which means the arrow would drop 10 cm or less in trajectory for a span of more than 1m. He also possesses poisonous arrows, just as Hercules did, having imported the venom from north-western Greece, from the up-to-know mysterious Tafiens (Hom. Od. i-260/5). His bow is very difficult to brace without deep knowledge of its secrets: everybody else fails, but he himself does so with minimal effort (Hom. Od. xxi-410), showing it was a matter of technique, not of strength and most probably concerns a recurve bow. It is an important issue that Odysseus had been very afraid of the Suitors getting proper body shields when

trapping them, which means he doubted for the penetrating power of the weapon (Hom. Od. xxii-146/8): Indeed, in the Iliad we read of no arrows piercing shields and wounding the carrier, which is not the case with spears.

Teukros is the most efficient archer in Iliad from the Greek heroes. He is no leader, but the brother of one. He is adept with spear and shield and reverts fast to them whenever needed (Hom. Il. XV-478/82). He possesses no famous bow, but he is adept in fighting in conjunction to his brother Ajax, taking refuge behind his large shield before and after shooting his arrows with excellent accuracy in direct aiming (Hom. Il. VIII-265/72) [Figure 1].

Meriones, the Cretan, no 2 in command of its contingent, is a much acclaimed warrior with shield and spear (Hom. Il. XIII-255/8) and owns and operates a chariot (Hom. Il. XXIII-351). He only shoots at one instance during the fighting in the Iliad and this to a fleeing opponent (Hom. Il. XIII-650); though, he outdoes most lethal Teukros in an archery contest shooting at a pigeon (Hom. Il. XXIII-870/6). His bow is also nothing worthwhile-or, at least, nothing is mentioned. He uses it also when on guard duty and lends it to Odysseus for his scouting mission, along with helmet and sword (Hom. Il. X-260/1).

Last is the contingent of Ajax the Lesser, 40 ships full of archers (numbering up to 2000). They are explicitly mentioned to carry no armor and to shoot from behind friendly lines (Hom. Il. XIII-716/22). They are thus very much accomplished in shooting indirectly and massively- in high arc. Their leader, though, is no archer; he is a very good and kinetic warrior with light armor but excellent in spearfight (Hom. Il. II-529/30).

The combined picture is that there was an era of great archers who were also the greatest of heroes (Ifitos and his father Eurytos are mentioned as such but relevant lore is lost to us). This era was less civilized, definitely rural and the best warriors were not armored but clad in skins, as Roman *Velites*; light, independent, on foot and wielding powerful hand-weapons for close-in. At that

time a respectful weapon was the mace or club, either as stand-alone (Arithoos at Hom. Il. VII-137/41) or as adjacent to bow (Hercules). These hero archers had no hesitation or restrains to the use of poison. But this culture of the bow was a thing of the “past” within the Achaean heroes of the Iliad, the bow was considered unheroic and uncivilized (Odysseus never brought his bow in war: Hom. Od. xxi-39/41) although tactically useful (second-best warriors used it, as did rank-and-file in some contingents). Trojan nobility, though, persisted with the bow in skill, form, function and mentality, but they also avoided the use of venomous arrows.

Paris, on the Trojan side, is adept with armor shield and spear, but when shooting his bow, he does so while hidden, in a sniper approach (Hom. Il. XI-379). In his first battle appearance he brandishes bow and spears but has no armor and gets from his brother Lykaon when he is challenged to duel (Hom. Il. III-332/3). Paris appears in leopard skin, bearing bow, sword and spears (Hom. Il. III-15/18), thus reminding of Hercules, a person hated and despised in Troy. Consequently, the similarity of the appearance must imply not an aspiration of the heroic past, but the existence of a category of warriors, lightly armed for missile warfare with bow and hand weapon (Paris opts for sword, Hercules for club/mace) and clad in skins. Dolon, a Trojan scout, captured by Greeks, is armed with bow and spear and is dressed in wolfskin (Hom. Il. X-333/6). Odysseus, in his one and only appearance as an archer in the Iliad, has taken from Meriones bow, quiver, helmet and sword for his scouting mission (Hom. Il. X-260/1).

Paris' brother Helenos shoots his arrows while in a melee (Hom. Il. XIII-580/96), he bears full armor and reverts to sword for close combat (Hom. Il. XIII-576/7). But the most prominent archers are Pandaros from Lycia (Hom. Il. V-172/3), belonging to a contingent which fights conventionally, and the Paionean contingent, composed of archers (Hom. Il. II-848), although their leader is killed in close combat.



Fig 2: "Parentaxis": a Scythian archer, with gorytos and at a semi-kneeling position. fires covered by the shields of hoplites . Copyrights : Munich, Antikensammlungen Collection (550-500 BC)

The mentioning of bow in the Iliad is usually in the plural, meaning bows consisting of two parts. The bow of Pandaros is made of horn (Hom. Il. IV-109), which rather implies a bow consisting also of horn parts. His arrow is feathered, iron-tipped and rather short (Hom. Il. IV-123). The rear of the shaft is carved to forestall fingers slipping due to blood or sweat (Hom. Il. IV-122) and pierces three plates of armor when wounding Menelaos (Hom. Il. IV-133/5). It is important to remember that the armor of Menelaos staves off an arrow shot by Helenos from point-blank range (Hom. Il. XIII-585) -and Helenos, a prince royal, is not supposed to have an inferior weapon.

In the Iliad the bow is carried either hung from the shoulder (Hom. Il. X-333), straight or diagonally; it may also be carried in a holster, as Pandaros', but this is separate from the quiver (Hom. Il. IV-105, Hom. Il. IV-116), in stark difference with the Scythian Gorytos which is a later invention.

Second period; the Archaic Era 8th-6th centuries BC

The successors of Hercules, the Dorians, overwhelmed central and southern Greece after a famine all the way to Crete (Hdt VII.171). They developed the warrior culture of Dorian Sparta,

hating the bow (Thuc IV.40,2), and the culture of Dorian Crete, embracing it more than any other area in Greece. The Dorian Spartans hire Dorian Cretan archers in their 9th or 8th century first war against fellow Dorian Messenians (Paus. 4.8.3) embracing the bow operationally and spawning the mercenary culture for the first time in this Greek era-and creating the Cretan archer-mercenary, an archetypal figure. These archers are deployed “behind the heavy infantry, in the Ancient way”, (Paus Mess 8,12), reminding the deployment of Locrian archers (Hom. Il. XIII. 716-22).

Third period: the Classical era 5-4th centuries BC

With the exception of local peculiarities as in Crete, the archers in Greek service are either imported foreigners (possibly Greeks from other areas, Cretans being the usual choice -Thuc VI.43), or natives developed in authoritarian regimes as internal security. The tyrant Polycrates of Samos has 1000 of them, (Hdt. 3.39) definitely Greeks and possibly (but not probably) Samians and Peisistratos of Athens a body of Scythians. Figure 2]. Irrespective of their origin they can integrate into a phalanx and shoot covered by the hoplite shield formation (“parentaxis”, Figure 2), most probably from a semi-kneeled position. This concept is very near the previous Mycenaean (in the Iliad) –and Near Eastern- method of use. The Cretans serve, as mercenaries, against the Persians as excellently illustrated by P. Green in “The year of Salamis” and the Athenian democracy has quite a number of archers in 480 BC, to post 4 to each trireme (which means at least 720 men) according to the Stele of Troezen. It is very interesting that after Peisistratus there were none, in 490 BC in Marathon, to defend the city (Hdt. 6.112)! Cretans or Athenians, 300 of these archers (another 400 may be with the fleet) fight in 479 BC in Plataea where they excel against the Persian cavalry (Hdt. 9.22) and they are the only missile troops worth of the name in the Greek side in number, skill and

impact-so much that the Spartans request their assistance when under Persian arrow storm to fend off the attackers (Hdt. 9.60). The shooting of the horse of the Persian cavalry commander implies a direct shot, which in turn suggests *parentaxis* within the elite hoplite unit and not *epitaxis* behind them, which allows only for indirect fire.

As the Scythians cannot be imported since 510 BC as the Persian Empire cut both land and sea routes to the Black Sea, these archers are Greeks and possibly account for the shielded and/or armored archers illustrated in art (Figure 3). This implies holding the bow at the left hand with also the antilabe of the hoplon shield. It is a cumbersome practice when used from standing position, but kneeling alleviates the problem as the shield may rest its rimmed edge on the ground. Half-kneeling is the standard shooting position for Scythians in Greek art (Figure 2) as horsemen with short bows feel their waist more comfortable than when standing. The Greek archers do not use the asymmetric Scythian bow, as there is no need to do so when on foot. They are depicted with both simple-curvature self bows (“Libyan bow”, Figure 5) and with composite, symmetric ones (Figure 3), but the disdaining for the weapon resulted in very few references and no description of such examples. Scythian asymmetric bows shown for heroes, as is Hercules (who was always on foot) are simply anachronisms to place a really powerful weapon of the day (or of the age) in the hero’s hands. Still, the Greek bow is not very big, as is the longbow. Both Herodotus and Xenophon are impressed by long bows; the former in Persian hands (Hdt. 7.61) and the latter in Cardouchian hands (Xen. Anab. IV.3). Moreover, the Indian longbow made a lasting impression to Alexander’s troops (Arr. Ind.16.6.6), but perhaps to their forefathers as well, since Indians were present in Xerxes’ host (Hdt. 7.62).

In late Mycenaean frescoes from ancient Pylos, light infantry using small two-handled circular shields exist. These fit well with the bronze-covered small circular shields Xenophon says Cretan



Fig. 3 Native Greek archers possibly account for the shielded and/or armored archers illustrated in art . Copyrights : London, British Museum (525-475 BC).

archers had (Xen. Anab. V.2.28-32), and there is no mention about them being rimmed or rimless; though the term proper means rimless. Xenophon, writing almost half a century before Aristotle (the latter classified the shields more definitely) never used the terms “hoplon”/”shield” and “pelte” inconsistently. With pelte shield, light, small and rimless, the holding of the bow when standing while having the shield at the forearm at the ready is easy. The shield is moved a bit up and the antilabe is at the wrist instead of the palm. As pelte shields always had belts to hang them at the back when fleeing, this was another option, although less practical in exchanging fire. But having the

pelte at the forearm permitted a very fast shoot-shield cycle, clearly advantageous against unshielded archers in skirmish in broken ground or other kinds of non-set battles. A well-trained Cretan would use the time of covering-which brings the left hand and thus the bow near the center of the chest- to nock the new arrow to his bow and draw as soon as ready, cutting on the time and exposure. It is no accident that Thucydides says that in 424 BC the archers of the Athenian task force in Aetolia kept the local javelineers at bay over extra-rough terrain as long as they had arrows; then slaughter ensued (Thuc. 3.98,1).

Although our sources keep silence, there is no

need to exclude lightly shielded archery for 9th century Cretans in Spartan pay or 5th century ones fighting against the Persians. The ability to combine with heavy infantry is also long-standing.

Fourth Period:

The era and the army of Alexander the Great

We have no record of arms, or armor of the archers of the army of Alexander. His main archer force are native Macedonians and mercenary and allied Cretans. The army of Alexander is not different from other Greek armies of the Era in any revolutionary way. But it incorporated so many evolutionary changes, both of his own and of other quasi-contemporary generals that the whole was revolutionary. We know a lot on archers' organization and operations. The tactical units are the 500-men lochoi, and this is the probable strength of the archer arm when the expedition began, to climb to perhaps 2.000, half Cretan and half Macedonian (Arr. An. III.12) 3 years later-before large numbers of Asian natives are incorporated in the army. Their use is according to the late 5th century Greek doctrine: not massive fire but mobile fire available in 3-D context and broken ground. They are supporting flying columns and special operations (i.e. in Arr. An. I.27 they are used for storming a mountain pass), being incorporated in every fast detachment/task force led by Alexander to lightning action. They are used in support of shock troops in urban warfare and in siege, which ascertains their ability to fire fast, upstanding and on the move (Arr. An. I.1). They take casualties, especially if trapped by heavy opponent in limiting ground, as in Thebes, where they suffered a terrible blow when cornered by hoplites as the shock action they supported did not broke through, to allow them to burst into freer terrain and deliver volume fire (Arr. An. I.8). The most incredible is the casualty rate of the Master of Archers (Toxarchos), with three fatalities in less than 2 years (Arr. An. I.8 & I.22 & I.28), two in being in siege action (Arr. An. I.8 & I.22), as they always support the storming parties. In set battle they

are mingled with shock troops-especially heavy cavalry (Arr. An. IV.4) to offer fire support in a fluid and concentrated manner in time and space – or they are assigned to certain parts of the line to provide massive, concentrated counterfire against Persian archery (Arr. An. II.9). The distinction of their service and the way they are used shows a culmination of all previously spotted features and assets: mobility in terms of speed and negotiating difficult terrain, stamina, initiative, adaptability, ability to shoot fast and accurately and deliver a considerable volume of arrows in time- and space-sensitive conditions and resilience. These imply lack or lightness of armor, an array of arms (perhaps javelins and surely side arms such as swords/sabers), shield and possibly helmet, and the ability to shoot fast and accurately while standing and on the run-perhaps not while running, but stopping for a shot and then running again to a new position, like modern infantry in assault.

From that point, Greek archery is not evolved any further. The Diadochi outfit and train other Greek –and non-Greek also- stock as archers in the Cretan style, while incorporating native archers of the conquered nations, such as Jews used by the Seleucids along with Cretans or Cretan-type to suppress the revolt of the Antiocheans (Maccabees 11.45-47).

3. DEFINING ATTRIBUTES OF GREEK ARCHERY

Drawing and shooting “from the hip”: the skill of the elite in Mycenaean-era archery

In both sides of the Trojan War there is evidence of quickdraw skills. Helenos and Teukros shoot in a melee and face opponents who charge from close by. Instead of switching to sidearm as they could not rearm with spear and shield in a few seconds' time, they shoot arrows at their assailants but are unsuccessful and get injured. Helenos arrow is deflected by Menelaos' armor and he gets



Fig. 4 The quiver in Greek practice is carried diagonally to the back and its opening (usually covered) is just behind the right shoulder. Copyrights : London, British Museum (500-450 BC).

injured at his hand by spearthrust (Hom. Il. XIII-593/5), while Teukros is injured at chest by a stone (Hom. Il. VIII-320/30) before releasing his arrow. Meriones, when in an archery contest with Teukros has an arrow at the ready and grabs the bow from the hands of his competitor (in an obvious rule to use the same weapon to test skill only) and shoots immediately at the target pigeon (Hom. Il. XXIII-870/6) which was freed by Teukros erratic shot cutting the fabric that kept it confined (Hom. Il. XXIII-866). The procedure obviously does not allow for kneeling to assume shooting position.

Precision Aiming by a master archer

The important thing is that we know exactly how Pandaros shoots. Homer mentions that he is hiding behind friendly shields (Hom. Il. IV-114),

which might imply semi-kneeling posture, which in turn means a rather short bow and thus impossible to make from the horns of a wild goat ONLY, as these are specifically mentioned to be much longer. That the bow is short we know for sure since Pandaros draws both arrow and string (Hom. Il. IV-122), and only to the chest (Hom. Il. IV-121/3). This most probably implies to the chest at the side of the bow, a mere palm longer than his extended arm. At this draw, the arrowpoint was touching the bow proper, meaning this was the maximal draw. In such a case one cannot shoot with accuracy by aiming along the arrowshaft, as it is too low. Thus, the aiming was probably accomplished by boresighting the point to the target and keeping the shaft straight under. The distance was calculated empirically to define the elevation. This high-head aiming is seen in later statues and



Fig. 5 Depiction of a self bow ("longbow") in the hands of Artemis.
Copyrights : Madrid, Museo Arqueologico Nacional (500-450 BC).

paintings and is very different to the longbow direct aiming along the shaft (which is drawn to the ear) as used by Welsh, English, far-easterners and perhaps Persians as well.

The novel use: manoeuvre as force multiplier

The interesting point is that at the 5th century the archer contingents are not missile troops firing en masse, but light troops using motion, maneuver and fluidity in the battlespace, and perhaps able to shoot almost on the move (a skill perhaps inherited from their Mycenaean forefathers as noted before). The novelty is that the maneuver here is limited in speed but extended to a third dimension in rough terrain, an issue never tackled by all previous and contemporary archer cultures which combined the missile power of the bow with cavalry, either chariot or horse and/or camel and elephant versions of the cavalry arm.

In the Greek mobile archery, shooting is direct and the arrows are small; Cretan archers in 400 BC fire spent Persian arrows back by shooting high, in indirect mode because these arrows were too big for their bows (Xen. Anab. III.4.16). This shows a high degree of experience, skill, initiative and adaptability; it also tells about the superiority of the Persian bow in range, as witnessed and attest-

ed by Xenophon himself (Xen. Anab. III.3). The high-arc shooting is mentioned as something unusual and exceptional, showing the limited range of either the standard Greek archery or the knowledge of a professional soldier on this subject.

The novel use of the archers is a complicated issue. The expeditionary warfare undertaken by the Athenians needed specialist troops to operate far, in unknown terrain and for indefinite periods, as sieges had no seasonal limitations. This turn in events started from the effort to expel the Persians from European soil but went on to all civil wars Athens caused later on. Scythians were reintroduced in 446 BC (Andoc. 1 Oration 3.5), and in 434 BC a decree was issued to both civic and alien archers. Cretan archers, in small numbers, are among the other archers sent in Sicily in 415 BC (Thuc. VI.43), evidently to offer capabilities unavailable to other archers in Athenian roster – most probably the shielded foot-archery skill. In the same context, after the Pylian Disaster of 425 BC, Spartans reintroduced archers (and cavalry) to fend off Athenian raids from Pylos and rebel Helot encroachments (Thuc. IV.55). Western Greeks, in Sicily and southern Italy used archery in both native and mercenary alien forms, without leaving any record on the *modus operanti*, organization, skill and equipment.

4. CONCLUSIONS AND SUGGESTIONS

The hoplite ideal, followed by the agrarian society, drives the tiny Greek communities away from the archer. The hoplite is the best choice to colonize the Mediterranean with few ships, manned with few colonists and sent everywhere but in tiny numbers per place. It is also a better choice to impose oligarchies or to fight in a strict framework of Justice-in-war with their neighboring communities and, in general, to occupy and hold terrain-which is vital for food and feed production. To save horse and extend virtue, the bow is prohibited in some set-piece battles to allow hoplite skill to show, while its construction is expensive and tricky and mastering it demands time and practice ill-afforded by the agrarian (farmer) or bourgeois (such as craftsmen) part-time warriors. Its exclusion is a matter of choice. Archery is a tricky discipline and it needs constant and hard practicing to acquire skills and keep them honed. But the same is with hoplite gear. Hoplite gear is expensive, but it became more affordable for the civic body than the middle-age panoplies ever were. Being a hoplite was very tricky, but the essentials were attainable with some hard but short practice, in a year of mandatory service in 4th-century Athens. But the essentials of the archery are just as easy to learn, and the weapon is by no means more expensive than standard hoplite gear. Greece is a land excellent for pasture, to acquire the raw materials for bows of the best quality. The Greeks simply preferred the spear. It is obvious that the few communities which chose differently (Crete for example) had no difficulty in producing excellent archers and descent weapons, as did much poorer areas throughout history, such as the steppe. In this framework, the Greek archery survived discretely and flourished in its second youth with the advent of comprehensive and integrated multi-arm expeditionary forces able to operate in difficult terrain. The Cretan large arrowheads, so reminiscent of the ones English longbowmen used

against horses, imply evolution and adaptation. The striking similarities in form and weapons in an unbroken succession of representational evidence spanning 900 years, show the continuity and nativeness of the important though uncelebrated Greek archery tradition.

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Fig. 6 Asymmetric bow of the Scythian type.
Copyrights : Paris, Cabinet des Medailles (500-450 BC).

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REZIME

STRELIČARSTVO U ANTIČKOJ GRČKOJ: OPERATIVNA PRAKSA I TAKTIKE

**KLJUČNE REČI: STRELIČARSTVO, ANTIČKA
GRČKA, BRONZANO DOBA, ARHAJSKI PERIOD,
KLASIČNI PERIOD.**

Ispod vela magle pomalja se pitanje drevnog grčkog streličarstva, jer se u prošlosti smatralo nepouzdanim i neprimerenim principima časne borbe. Uprkos tome bilo je cenjeno. Postojala je cela taktička i tehnička doktrina, o čemu svedoče predstave i pisani izvori. Još je za Herkulesa, Zevsovog sina, koji je smatran pravim i

polubožanstvom i izvanrednim herojem u grčkoj mitologiji, spomenuto da je gađao udaljene mete sa velikom preciznošću i da je to činio sa otrovnim strelama. Drugi poznati streličari iz ove ere su Odisej i Paris, koji se iako nije bio Grk, u tome najviše istakao; pominju se tako čitave jedinice streličara koji gađaju preko prvih linija prijateljskih formacija. Nakon ovog perioda kada su i plemstvo i vojnici bili obučavani za korišćenje luka i strele, klasični Grci koriste streličare kao živi zid. Njih je malo i uglavnom su ih regrutovali ili dovodili iz stranih zemalja tirani i ostali omraženi vladari. Iako je ta veština prezirana, u čitavim oblastima ona se razvijala i ukorenjivala u njihovu kulturu. Ovo oružje se koristilo sa hiru-rškom preciznošću protiv istaknutog streličarskog napadača, Persije, sa poražavajućim efektom i na kopnu i na moru. Tehnike gađanja i taktike iz tog doba podrazumevaju direktno nišanje, ali se i indirektno ciljanje visokim lukom takođe pominje nekoliko decenija kasnije kao poznata veština. Do Aleksandrovog doba, standardna doktrina koja uključuje male, ali odabrane streličarske snage (gubi svoje komandante tri puta za tri godine) ukazuje na njihovu efikasnost u manevarskom ratu na teškom terenu i u posebnim operacijama.

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DUEL AND SINGLE COMBAT: THE HOMERIC RESONANCE OF THE ELITE FIGHTERS – PRACTICE OF THE BRONZE AGE ART OF WAR

ABSTRACT

The Homeric epics are the only descriptive literary source which possess enough detail to interpret material and illustrative evidence into a functional context of war fighting, especially with a view to technique, tactics and, to a lesser extend overall practice. The instrumental role of fighting between two elite, heavily armed warriors is indeed a nice read or story, but this does not exclude functionality and realism; the middle-ages warfare is an exact analogue. Thus if the epic is taken at face value as it was used to be and clearly intended to be, a coherent picture emerges, with armies based on 50-strong basic units, different troop types used in specific mission profiles in tactically competent ways, maneuvering reminiscent of much later eras and both massive and individual approaches for a decisive outcome. The latter, seen both during the campaign of Alexander but also in the Middle Ages is described in great extend and produces an integrated picture of the skills and methods involved, both in set-piece, ritualistic and strictly regulated duels and in more or less random, but unregulated and spontaneous personal encounters leading to single combat within the context of a larger fight.

KEYWORDS: DUEL, SINGLE COMBAT, BRONZE AGE, TROJAN WAR, HOMERIC EPIC, ILIAD, TACTICS, ARMY ORGANIZATION, WEAPONRY, PHALANX.

Archeology and tablet deciphering have done much to unravel the material aspect of bronze age world to today's observer. But there is a discernible lack of descriptive evidence, literary or other, to combine with findings and illustrative art of the era into a coherent, functional picture. Especially in warfighting, the commemorative texts of Egyptian pharaonic monuments and similar ones of the fertile crescent provide little information on warfighting. The only vivid and coherent description available is the Hellenic Homeric epics; although we only possess a heavily edited, Athenian-man-

dated 6th century BC version with detectable forgery, the main structure provides a large and coherent picture with cases of exemplary detail usually sunned by philologists as "figures of speech" and by historians as "unreliable lore". Still, the massive confrontation which shook and crumbled the bronze age Aegean is described in terms precisely understandable by modern-day military personnel and in detail not seen in literature till the 4th century BC military treatises and historical texts written by war professionals for their kind.

Armies organization and command

There is no question that the Trojan and allied army is a feudal conglomerate under the personal command of the Lord of the Hosts of Troy, Prince Hector (who might or might not have been crown prince). The high command, though, rests with the crown council, comprised by the king and a 7-member senate (Hom. II.III-146) which may veto his plans or impose decisions of strategy (Hom. II.XV-721/3). After 10 years behind Troy's walls (a timeframe not exaggerated, if compared with the siege of Tyre 598-585 BC by the Babylonians), allied relief contingents have arrived before Prince Hector's offering major battle to the invaders (Othryoneus in Hom. II. XIII-364, Asteropaios in Hom. II.XXI-156); they continue to arrive by the day and are thrown piecemeal into battle, as they arrive (XXII-434). The basic administrative unit are the 50 men and the total size of the army is approximately 50.000: 1.000 campfires, with 50 men sleeping, sitting or eating around each one of them (Hom. II.VIII-558/9).

The Greek army had the same basic unit of 50, as the main ship is the 50-oared galley (pentekonter) of unknown model (Hom. II II-720, XVI-170). Nevertheless there are some very large ships carrying 120 troops of a certain contingent (Hom. II. II-510); whether all of them were doubling as rowers or not is not stated. There were also 20-oared galleys for other missions (I-309). But the similarities of the two armies stop there.

The Greek army is NOT a feudal levy, but an integrated organization with distinct functions and specialist units. During the most part of the Iliad it is indeed operating-and with little success- as a feudal levy as well, since Achilles, the mind and soul of the army and acting Commander-in-Chief/CiC (as indicated in Hom. II XXIV-651/8 and directly stated in Hom. Od. III-106) is estranged. Just before the new series of clashes, narrated by Homer in the Iliad, which occur during the 10th year of the war, the elderly tactician Nestor advises the High Commander Agamemnon to deploy

the army in feudal manner (Hom. II II-361/8). This means that for 9 years the army was NOT deployed in such a manner, and this differentiation is obviously due to the absence of Achilles. Once he is back, he clearly issues all the executive directions and orders (Hom. II XIX-155, XXIV-670) and the army is no feudal assembly, but an efficient war machine once more, operating with a plan and efficiency and not simply clashing with the enemy. There are tactical units and respective leaders/commanders (Lochoi, 500-strong in Achilles' own contingent Hom. II XVI-168/73) although their command is not specified as organic or *ad hoc*. The decimal system thus implied fits well with the 10-man Oka of the tablets. Many scholars detect dramatic effect and poetic projection in the advice of Nestor, but had it been so the poet would have easily projected it into the past, as he did in other cases, as with the pursuit of Aeneas (Hom. II XX-187/91).

Tactics

For army tactics, Achilles favors charge and clash (Hom. II XX-354/5) and Patroclus, fighting in his stead, does the same (Hom. II XVI-394/8); this is not always the choice of neither commander (Hector, Agamemnon), who may stop their advance at a distance and exchange missile fire (Hom. II XV-710), as did the European armies of the 16-18th centuries, while skirmishers, usually the well-protected nobles, may jump in between opposing armies and strike targets of opportunity as exemplified by Antilochos (Hom. II XIII-559). After a prolonged exchange which has softened up the one opponent, the other one charges (Hom. II XI-85/90). The reason for avoiding the clash from the first encounter is obviously the lying of the advantage with the offensive weapons; thus rushing to contact with a large and expedient in missile warfare enemy body is ill-advised. Shields and armor are more often penetrated in close quarter combat than not. Menelaus, an important and powerful and wealthy king is hit by



Fig. 1 The arrowpoint (which is explicitly mentioned as “iron” IV-123) pierces through three successive armor parts (IV-133/5); such a succession of armor parts is indicative of Dendra-type panoply and would not have been found in other body parts. Photo credits : Association of Historical Studies KORYVANTES - koryvantes.org

an arrow and wounded by Pandaros after the arrowpoint (which is explicitly mentioned as “iron” Hom. II IV-123) pierces through three successive armor parts (Hom. II IV-133/5); such a succession of armor parts is indicative of Dendra-type panoply and would not have been found in other body parts; the respective armor would have been pierced more easily. But the same warrior’s cuirass deflects Helenos’ arrow from point-blank (Hom. II XIII-585/95). Only Achilles (with armor made by a God) suffers no penetration-his greave even staves off a direct spearcast (Hom. II XXI-591/4). But he himself is not very confident on the subject (Hom. II XX-261/5). Despite this fact, he chooses to strike Hector in a spot not covered by his own, captured armor: as the latter charges leaning forward, Achilles thrusts at the joint of neck and shoulder (Hom. II XXII-322/6).

Although panoplies are routinely penetrated by missiles, the thing is different with the shields. Archery is not mentioned to pierce shields. Most lethal spearcasts and thrusts are delivered around shield coverage, directly to the body armor or to unprotected body parts. The dramatic description of spearwounds may or may not reflect absence of armor. Such conclusions may be drawn *ex silencio* only in thorough descriptions. Few hits on armor are repulsed, occasionally resulting in broken spearpoints or even spears-but the latter is considered a god-sent stroke of misfortune (Hom. II VI-306, XIII-564/5) -most probably a failed weapon, or flawed of manufacture. Helmets are routinely giving way under direct hits (thrusts Hom. II XX-398 -and blows Hom. II XX-475), but are also responsible for some spectacular saves: Hector, Paris and Menelaus are saved by spearcast, swordcut and straight-axe blow respectively (Hom. II XI-350, III-362, XIII-615). Shields, on the other hand are just as often pierced as they repel the points (Ajax’s and Achilles’ shields are never pierced). Actually, this may imply an imbalance in favor of the shield: piercing it is mentioned as a worthwhile accomplishment and is not a matter of fact. The frequent remark that enemy missiles press hard

a hero imply a number of them hitting the mark without piercing it (i.e Hom. II XV 727). Achilles cast is legendary for piercing everything in its way (Hom. II XX-99/100), a reputation well-deserved as there is no mention of any parrying of his cast (contrarily to more than a couple of misses) and the very enlightening report that when he missed Asteropeios and the spear was driven deep into earth, his opponent was unable thrice to retrieve it (Hom. II XXI-170/6). There is direct reporting of efforts to javelin down an opponent behind and not through the shield (Hom. II XVI-312, XVI-609) and Achilles’ cast to Aeneas, which brought the latter into a disadvantage, stroke the shield next to the rim, at its thinnest (Hom. II XX-274/7), begging the question of deliberate aim at that part of the shield versus a miss by the narrowest margin in an effort to target the missile by –or, rather, over-the shield.

Phalanx

Greeks have the option to revert to very tight phalanx formations (Hom. II XIII-129/131, XVII-352/65); the Trojans cannot reciprocate, nor break them. Of course such formations allow no maneuvering and are used only in last resort and desperate times. It is an open issue whether this difference in formation capability is due to the shields used or to any other factor, such as training, character, morale or drill. Tower shields are not mentioned for Trojans, who do use figure-of-8 body-shields, as do many Greeks; Hector has a body shield which demands dexterity in moving and handling (Hom. II VII-238/9) and when thrown back it is felt at heel and neck while running (Hom. II VI-118); and he is no exception, but the rule. His shield is described also as symmetric (Hom. II XI-61, VII-250), the greek wording not meaning circular, as usually interpreted, but 8-figured. Both enemies use round shields of small or moderate size and other, non-circular shapes, especially with the Trojans and their allies. There might also be double-grip shields, as in Pylos

frescoes, reminiscent of argive shields. The only tower shield directly mentioned is the one of Ajax the Great, who is a most static warrior, never on a chariot or part of any maneuver. Homeric language is inconsistent (such pitfalls ARE indeed expected in poetic synthesis), but it is the only one that might be called “sakos”, as the greek term implies something rectangular-ish, which is not compatible with the figure- of- 8 or the elliptical or the round shields.

The Homeric phalanx is a patchwork of intermingled problems and doubts. The way standard shield-bearers, armed with extra-long lances (*egxeiae*), were deployed is one of such problems. A close phalanx would have them crushed by the leading teams of chariotry. An open deployment would expose them to runners and light infantry. The fresco of Thera, showing a dispersion which allows motion so as to avoid being trampled by the chariot, might imply a relaxed formation which, by means of the length of the lances, allows multiple coverage/ support to a comrade from swarming light infantry.

Body- shield-bearers, armed with extra-long lances (*egxeiae*) were most probably NOT deployed in tight phalanx. First, being able to get INTO the shield is important when NOT in phalanx. In phalanx, enough to go behind the shield, as hoplites would show some centuries later. A close phalanx would have been crushed by the leading teams of chariotry, especially if supported by powerful and accurate missile fire. An open deployment, however, would expose them to runners and light infantry. The fresco of Thera, showing a dispersion which allows motion so as to avoid being trampled by the chariot, while by the length of the lances remaining able to support a comrade from light infantry swarm, is perhaps a more viable paradigm. The dispersed troopers do not offer a solid target for massive archery but must be picked one by one, which is tricky if they are not in even spaces and straight lines and files. The spears offer crossfires, and evasion of charging chariots while lancing at the team or

the crew is possible. The concept is still viable if lance is substituted for spear, and archers can be swarming within the formation. The shorter spear might turn the formation a bit denser, but not too much; this might be the Homeric paradigm for both opponents.

The greek dense phalanx is clearly depending on three things (Hom. II XIV-371/82): men (must be heavy and strong, not light and agile), shields and spears. Longer spears are better suited for porcupine formations and it is very probable that explicit reference to spearfighters in both armies implies use of long spears- rather lances “*egxea*”- instead of the more typical “dory” double-use spear which was the current standard and seen in Pylos’ fresco arming light infantry. For the Greeks the best case-study is the contingent of Avantes, while a Thracian contingent is the respective from the Trojan side (Hom. II IV-533). It is explicitly mentioned for Avantes that their spears break through cuirasses (II-543/5) and armor; thus they are special weapons compared to standard “*dorata*”. But the heart of the issue lies with the shields: Homer mentions partial redistribution of weaponry (unevenly issued as a result of conscription practices, a millennia-old problem) to have the heavy shields in front, to shield a phalanx (Hom. II XIV-376/7). This is not necessarily correct: the lighter shields, termed «*laiseia*» (Hom. II V-453) and being either the Warrior Vase reverse crescent copper-faced models, or circular ones, either one-handed (as the Herzsprung example) or two-handed, as in Pylos frescoes, allow denser packaging; and denser packaging of men means a more threatening and repulsive wall of spearheads (as shown by the Macedonian phalanx, which, according to Diodoros, just brought back to life the Homeric phalanx), which clearly intercepted Hector and the Trojan onslaught (Hom. II XIII-145).

The last issue on greek tactics is the “tower” (Hom. II IV-334), an effective offensive but not defensive formation. It must have been similar to 19th century columns used by the Napoleonic French infantry for prompt assault minimizing

exposure to line fire and giving momentum in the collision. The rationale should have been similar in the bronze age and a kind of drill would have allowed transformation of infantry units. It is possible that this kind of formation was in the heart of classical assault formations as the deep phalanxes of Thebans in Delion (424 BC/ Thuc. IV, 93); Nemea (394 BC/, Xen. Hell. IV, II, 14); Leuctra (371 BC/ Xen. Hell. VI, IV, 11); and second Mantinea (362 BC/ Xen. Hell. VII, V, 13).

Personal skill and duel practices

The elite, heroic warriors combine heavy armor with mobility; both Achilles and Hector are fleet of foot, excellent charioteers, big of stature and very strong, epitomizing the heroic concept of “tall, strong and brave” while adding the “fast”. The succession of offensive and defensive postures, techniques and choices in duels (both formal and informal-especially in the latter) is intriguing. Combined with the characteristics of the prominent fighters (big stature, heavy, high-tech armor and fleetness of foot), the issue is highly reminiscent of current protocols for air battles by fighter pilots, who engage the enemy successively using the longer-range weapons to gain time and advantage as they close in for shots with shorter range ones. In the Homeric duel, both antagonists start with a spear and range is essential. Thus a spearcast, especially a sudden or stealthy one might finish the issue immediately and effectively. If the shot missed, though, the warrior is at a disadvantage. A cast spear, if perceived, can be evaded or parried and the enemy may retaliate. As the first offender is spearless, the retaliatory strike may not be another, waited-for cast, which entails a very high probability of being evaded or parried as it is expected; a spearthrust is much more probable. The thrust permits better aiming, applies more strength so as to pierce shield and armor or even helmet (Hom. Il XX-395), does not spend the weapon allowing an immediate repeat of the assault and it may allow secondary, cut/

slash follow-ups if the thrust is dodged. Practically a swift close-up for a spearthrust is the best offensive option if the adversary is spearless, keeping the offender way out of secondary weapons’ range. Achilles does so twice with Hector (Hom. Il XX-440/6) and Hector himself prefers thrusting at Patroclus, not casting (Hom. Il XVI-820). The reason the thrust is superseded by spearcasts in terms of frequency is the inherent surprise/stealth of the latter- not to mention the distance advantage: The cast, naturally, outranges the thrust by far, thus many warriors missing their mark with a shot, easily resort to flight rather than sustain an enemy retaliation, with much better possibilities to make good their escape than if engaged in closer range.

The truth, though, is that once a spear is cast, the targeted warrior, if able to perceive it (not a very usual thing) must take some action. At the time he spends to evade (Paris in Hom. Il. III-360) or parry (Achilles in Hom. Il XX-261/3), the offender, if fleet and fast, has the opportunity to close the distance and position himself favorably for a second shot. This is either with the secondary weapon, delivering a blow from point-blank, or with a second, reserve spear –which is rarely, if ever, cast. Thus, an early spearcast even if missing its mark, may be advantageous: if hitting the shield, it may weight it down (Hom. Il XX-276/83). If parried or evaded, it has pushed the target into the defensive allowing the offender a better footing while reverting to the secondary weapon from close range, perhaps within the minimum range of the enemy’s primary weapon. In Hom. Il XX-259/ 290 Aeneas had the first cast and Achilles, after parrying it, reciprocated and followed suit with the sword. Aeneas, despite having the first shot, reverts to stone, which means he is not in position to draw sword and receive the attack: Achilles’ cast kept him busy long enough for his adversary to acquire a definite advantage. Thus, when casting a spear, the heroes chased after their cast using the force of the cast proper to follow the missile- and not to recoil as today’s athletes.

A secondary reason for this follow-up might be to retrieve the weapon (Hom. Il III-529); though, the main reason is to press the attack home with the sword, as does Menelaus against Paris (Hom. Il III-361/62), and Achilles against Aeneas (Hom. Il XX-283/5) before the initiative is seized by the opponent. In Hom. Il XIII-512 Idomeneus is described as of age so as not to be able to follow up.

It might have been a Trojan tactic to aim for the legs when facing heavy opponents. The proverbial “Achilles’ heel” is not an isolated incidence. In Hom. Il XI-379 Paris’ arrow nails Diomedes’ foot to the ground by hitting the ankle. It might be more of skill and intention and less of luck to hit two prominent heroes at the same spot, heroes with highly regarded armor, one of them having previously survived a direct hit of an iron-tipped arrow at the cuirass (Diomedes, struck by Pandaros in Hom. Il V-99). Last, Agenor shot his spear at Achilles’ shin (Hom. Il XXI-591), which is the same concept-or possibly a slight miss, if he aimed for the ankle and foot and missed his precise mark as Achilles charged forward, taking thus the shot on the brand-new, god-forged greave which sustained it admirably.

The weapons

The warrior is always equipped with a general purpose spear, for casting and thrusting alike, and generally carried in pairs (Hom. Il VI-104, XIII-559). This reminds us of the very later Persian “palta” of the cavalry, much praised by Xenophon (Xen. Hell. III-4.14 and Eq XII-12). The pair of spears is mentioned many a time Hector jumps out of his chariot, and this might imply that he changes weapons, from long chariot lance to pair of spears. It is obvious that both lance and spears are routinely secured within the chariot. An excellent example is Patroclus who sets out with two spears in Hom. Il XVI-139 but after casting one to Sarpedon’s mate and never recovering it he is explicitly mentioned as fighting hence with one (Hom. Il XVI-733, XVI-801), which he does not cast and for missile he re-

verts to stones while having the spear at his left hand. In another very enlightening excerpt (Hom. Il XIII-559), Antilochos, son of Nestor (a master charioteer in Hom. Il XXIII-306/8), is mentioned as fast, agile and always eager to fight, either casting from afar, or charging at contact to thrust with his spear. In both cases the spear is the main weapon, which vividly illustrates the merit of the two-role “dory” which can be thrown or thrust and is carried in pairs.

The use of secondary weapons is important, after the spear is cast or broken: there is one mention of the straight axe, in Trojan ally’s use (Hom. Il XIII-612 *αξίνη* instead of “πέλεκυς”/ regular axe for tree falling in Hom. Il XXIII-115) and then a direct mention of both straight and conventional axes in Hom. Il XV-710. The usual choice is the sword. Homeric terminology is inconsistent, but one can discern the very long, thrusting weapon (“fasganon” in Homer pakana in the tablets) and the sturdy, double use “aor”, which chops off limbs and heads (Hom. Il XX-481). A distinguished such weapon is mentioned as being of Thracian origin, imported to Troy for prince Helenos. In Homer, though, swords often break. Though, during the middle ages the main kind of straight sword (the broadsword) was triangular and long; despite this fact it was excellent cutting weapon, and it might well have been the same with fasganon: apart from the obvious, to kill someone thrusting through a body shield-perhaps the *raison-d’etre* for copper-covered body-shields in Iliad, which are not mentioned in Odyssey- the long, smart, thin weapon might have been excellent in finding an opening in body armor plate interface to pierce (as did the rapier in Europe) or to precisely slash- a good reason for neckguards in the Dendra panoply. On the other hand, the role of aor is straightforward: to defeat, not circumvent, armor. Thrusting (Hom. Il XXI-179) or chopping/cutting, it is a weapon of force combined with good technique. Its use allows breaking helmets and splitting the heads (Hom. Il XX-475), decapitating (Hom. Il XX-481) or



Fig. 2 Reverting to secondary weapon as missiles are spent.
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maiming by cutting through armor plate. Straight or bulged near the point (“oarlike”, Hom. II XV-713, XX-475), iron or copper/bronze, the aor is the weapon of the stronger, not the most versatile warrior, and it is parried only by a shield, preferably a bodyshield—which is perhaps the reason fasganon did not go straight out of favor once aor had been introduced.

It is a little appreciated fact that swordplay, as form and technique, is directly affected by other field parameters, the most prominent being the missile factor: battlefields where missile fire is abundant (not only arrows, but javelins and slingstones as well) deny the opportunity for advanced, picturesque swordplay as interpreted for the middle ages. The well-trained swordfighter has to combine his blade with a shield and merit lies to swift, accurate and powerful blows while offering the least opening when moving his shield—not just to the immediate opponent, but to a hidden archer as well.

To surmise the above, if two heroes close at each other in the open, for an informal duel (not formal single combat) each must decide if throwing a spear, to finish the engagement early on, is the best option, or charging head-on for a spearthrust is best. The cast is minimal danger, but in open confrontation, especially on the run, misses are often. If the weapon misses indeed, the opponent may return the cast at leisure, but this entails a high probability of missing as well; on the contrary, the only antagonist with a spear at hand has a very nice opportunity to approach at ease with the spear as a thrusting weapon (Hom. II XIII-605) and attempt any number of thrusts with virtual impunity, as any spear outranges any hand weapon (sword, mace, axe). The equalizer is the fact that once a spear or javelin is incoming, the target must take evasive or parrying action, thus offering a minor but crucial window of opportunity in terms of time, posture and geometry to the offender for drawing his sidearm of choice and pressing the assault home. This might lead either to delaying the cast till the last moment, which produces a quickdraw situation, eventually termi-

nating with both opponents hit by simultaneous spearcasts (Hom. II V-655/60) or both opponents exchanging spearthrusting (Hom. II XV-528/536); it may also lead to both opponents reverting to their sidearms in time (Hom. II XIII-610/615). As the sidearm is a substitute for the spear, the same rules apply: both antagonists go for the first blow, with cases of strokes from both opponents been delivered simultaneously (Hom. II XIII-610/615); else, a succession of blows ensues (Hom. II XVI-335/340).

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REZIME

DVOBOJ I POJEDINAČNA BORBA: HOMERSKI EHO O VEŠTINI ELITNIH BORACA U UMETNOSTI – NAČIN RATOVANJA U BRONZANOM DOBU

KLJUČNE REČI: DVOBOJ, POJEDINAČNA BORBA, BRONZANO DOBA, TROJANSKI RAT, HOMEROVI EPOVI, ILIJADA, TAKTIKA, VOJNA ORGANIZACIJA, ORUŽJE, FALANGA.

Homerovi epovi su jedini književni izvor sa dovoljno detaljnih opisa za tumačenje materijalnih i ilustrativnih dokaza i njihovo stavljanje u funkcionalni kontekst ratnog sukoba, naročito u pogledu tehnike, taktike, a u manjoj meri i celokupne veštine. Opis borbe između dva elitna, teško naoružana ratnika je zaista dobro štivo ili priča, ali to ne isključuje funkcionalnost i realizam; srednjovekovno ratovanje pruža preciznu analogiju. Dakle, ukoliko ep prihvatimo kao činjenicu, kao što je i prihvaćan i kao što mu je i bio cilj, pojavljuje se koherentna slika, sa vojskom koja se sastoji od 50 jakih osnovnih jedinica, različitih vrsta trupa koje se koriste za specifične vrste misija na taktički kompetentne načine, a čiji manevri podsećaju na mnogo kasnije periode, sa oba pristupa i masovnim i individualnim, kako bi došlo do odlučujućeg ishoda. Ovaj poslednji, koji se vidi i tokom Aleksandrovih ratnih pohoda, ali i u srednjem veku, naširoko je opisan i daje objedinjenu sliku o primenjenim veštinama i metodama, kako u elaboriranim, ritualnim i strogo regulisanim dvobojima, tako i u manje ili više nasumičnim, ali neregulisanim i spontanim ličnim susretima koji dovode do pojedinačnih borbi u kontekstu veće borbe.

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LINUX SERVICES VULNERABILITIES ASSESSMENT

ABSTRACT

Tools for analysing vulnerable services on the system can provide valuable information about the status of operating systems in terms of protection. The research in this paper included 29 Linux operating systems. The collected information consists of a large amount of data about the presence of various network services on a system that present potential security flaws. Thus, the vulnerabilities of Linux operating systems that are installed by default (with certain added services) are presented, with the aim of pointing out potential security vulnerabilities. These vulnerabilities or omissions can occur due to incorrectly configured services, well known bugs in the system or program, an outdated system and its services, and the use of poor protection in configuration. The purpose of this assessment is to identify security flaws (vulnerable services) on Linux systems installed by default.

KEYWORDS: VULNERABILITY ANALYSIS, VULNERABILITY ASSESSMENT, LINUX VULNERABILITIES, OS VULNERABILITIES.

By using tools for analysing vulnerable services on the system it is possible to obtain valuable information about the system and the network in terms of protection.¹ As will be shown, the collected information will include a large number of data on the presence of various network services on the

system that present potential security flaws. These omissions can occur due to incorrectly configured services, well known bugs in the system or program, an outdated system and its services, as well as the use of poor protection in configuration. The task of this test is to identify vulnerabilities in order to correct all recognized security flaws (vulnerable services) on the systems that are installed by default. All relevant sources reporting vulnerabilities on systems are included and shown in Table 1.

The vulnerability problem can also be seen through the Symantec Vulnerabilities Report for

¹ The article results from the project: *Viminacium, Roman city and military camp – research of the material and no material culture of inhabitants by using the modern technologies of remote detection, geophysics, GIS, digitalization and 3D visualization* (no 47018), funded by The Ministry of Education, Science and Technological Development of the Republic of Serbia.

Source name	Web address of the source
APPLE-SA (Apple Security Announce)	http://lists.apple.com/archives/security-announce
BID	http://www.securityfocus.com/bid/
CERT CA	http://www.us-cert.gov/ncas/alerts/
CERT TA	http://www.us-cert.gov/ncas/alerts/
CERT-VN	http://www.kb.cert.org/vuls/
CVE (Common Vulnerabilities and Exposures)	http://web.nvd.nist.gov/view/vuln/search i http://cve.mitre.org/
DEBIAN DSA (Debian Security Announce)	http://www.debian.org/security/
IAVM (Information Assurance Vulnerability Management)	http://ias.e.disa.mil/index2.html
MANDRAKE MDKSA (Mandrake Security Announce)	http://www.mandriva.com/en/support/security/advisories/
MS (Microsoft Security)	http://technet.microsoft.com/en-us/security/dn481339
MSKB (Microsoft Knowledge Base)	http://support.microsoft.com/
NETBSD	ftp://ftp.netbsd.org/pub/NetBSD/security/advisories/
OSVDB (Open Sourced Vulnerability Database)	http://www.osvdb.org/
OVAL (Open Vulnerability and Assessment Language)	http://oval.mitre.org/find/
REDHAT RHSA (Redhat Security Announce)	http://www.redhat.com/mailman/listinfo/rhsa-announce
SANS	http://www.sans.org/critical-security-controls/
SECTRACK (SecurityTracker)	http://securitytracker.com/
SECUNIA	http://secunia.com/advisories
SGI	ftp://patches.sgi.com/support/free/security/advisories/
SUSE SUSE-SA (SUSE Security Announce)	https://www.suse.com/support/security/advisories/
XF (X-force)	http://xforce.iss.net/

Table 1 Sources that publish vulnerabilities on operating systems

2011, according to which the number of vulnerabilities was 4989², which means that almost 95

² This number is based on a large number of sources including mailing lists and recommendations of many producers of programs and equipment.
Source: http://www.symantec.com/threatreport/topic.jsp?id=vulnerability_trends&aid=total_number_of_vulnerabilities

new vulnerabilities occur every week³. The period between publishing vulnerability and applying a patch to a vulnerable program or service on the system is a critical period. The tool used for this

³ Source: http://www.symantec.com/threatreport/topic.jsp?id=vulnerability_trends&aid=total_number_of_vulnerabilities

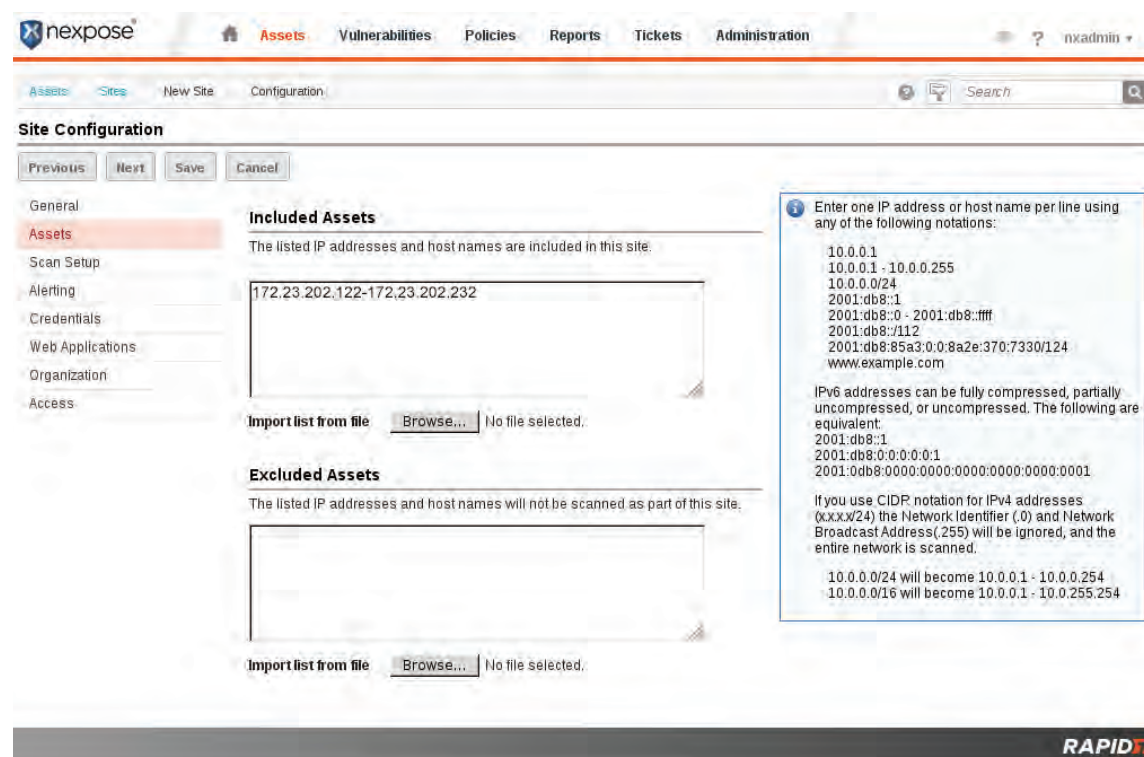


Fig. 1 Preparing the Rapid 7 Nexpose tool for scanning the Linux services

work is called RAPID 7 Nexpose (Fig. 1). The vulnerabilities scan date refers to August 2011 and November 2013 (it is understood that after finalization of this work new vulnerabilities will appear on operating systems and services). With this tool, it is possible to perform planned and selective testing over network services, servers within an organization, and key services in the search for vulnerabilities that can be misused by attackers. In practice, corrective measures are proposed after system scanning. The total number of operating systems covered by this survey is 29 Linux operating systems.

The virtual environment for research purposes with the operating systems shown in the tables (Table 3, Table 4) was realized within the VMware ESX 5.1.0 platform, the IBM x3650 M3 server and the EMC VNX5300 system, thereby achieving a centralized consolidation of all virtual computer systems intended for testing. Thus a stable platform for effective vulnerability testing with a high level of security was provided.

The virtual environment platform is VMware ESXi 5.1.0, which is implemented on the IBMx3650 server and the EMC VNX5300 Storage system (Korać 2014).

Server specifications for the IBMx3650 M3:

- 8 CPU Cores (2 x 4C Xeon E5620 80W, 2.4 GHZ 12MB cache
- 56 GB RAM PC3L-10600 ECC DDR3 1333 MHz memory
- 4x IBM 900 GB SAS HDD
- ServeRAID M5014 SAS/SATA controller
- IBM 460W Redundant Power Supply
- IBM UltraSlim Enhanced SATA Multi-Burner

The EMC VNX5300 storage system, with mounted virtual machines for testing purposes, consists of an Intel Xeon 5600 processor, with 16GB cache memory, 8 x 8Gbit FC port, 8 x 1GbE port, 25 x 600GB SAS 15k RPM, 25 x 2TB NL- SAS 7k RPM drives, 5 x 100GB FAST Cache Flash drive, rack cabinet VNX-40U, support for additional capacity expansion, support for CIFS, NFS, iSCSI and FC protocols, Local Protection

VNX5300 CONTROL STATION - EMC RACK
2 x 1GBE DM MODULE 4 PORT FOR VNX5300
VNX5300 ADD ON DM+FC SLIC-EMC RACK
VNX5300 DME: 1 D M+FC SLIC-EMC RACK
VNX5300 DPE; 15X3.5 DRIVES EMC RACK 8X600GB 15K
3 x 3U DAE WITH 15X3.5 INCH DRIVE SLOTS WITH RACK
5 x 100GB FAST CACHE FLSH 15X3.5IN DPE/DAE
17x 600GB 15K SAS DISK DRIVE
VNX 40U RACK WITH CONSOLE
EMC VNX5300 4 PORT 8G FC IO MODULE PAIR
ADDITIONAL 8 G FC SFP FOR VNX 51/53
RACK-40U-60 PWR CORD IEC 309
EMC DOCUMENTATION KIT FOR VNX5300
SECURITY & COMPLIANCE SUITE FOR VNX5300
LOCAL PROTECTION SUITE FOR VNX5300
FAST CACHE FOR VNX5300
BASE FILE LICENSE (CIFS AND FTP) FOR VNX5300
ADV FILE LICENSE (NFS; MPFS AND PNFS) FOR VNX5300
UNISPHERE UNIFIED & VNX OE VNX5300
25 x 2TB 7200RPM 6GB SAS DISK DRIVE
EMC 2ND OPTIONAL SPS
EMC ENHANCED SOFTWARE SUPPORT

Table 2 Specification of the EMC VNX 5300 storage system

Suite licenses, Security & Compliance Suite licenses, redundant power supplies. Table 2 contains a more detailed specification of this system.

The following tables show the operating systems included in vulnerability scanning with the RAPID 7 Nexpose⁴ tool:

Table 3 lists the versions of Linux operating systems with added services, the names of the computers with the IP addresses that are included in the scan, by the Rapid7 Nexpose tool.

In the following table (Table 4), services that are additionally hoisted (with default configura-

tions) on Linux operating systems after default installation of the operating system are displayed.

Table 5 shows an overview of the total number of detected vulnerabilities and their relevant sources related to Linux operating systems in 2011 and 2013:

In Table 6 the number of vulnerabilities on Linux OS is presented with detailed review according to severity (Critical – Cr, Serious – Se, Moderate – Mo, Total – To)

The testing was carried out on 29 Linux operating systems. In 2011, 312 unique vulnerabilities were found, and at the level of all scanned Linux

⁴ <https://www.rapid7.com/products/nexpose/>

No.	Operating System	Computer Name	IP Address
1.	Mandriva Linux Enterprise Server 5.2 x86	mandriva52enx86	172.23.202.124
2.	Mandriva Linux Enterprise Server 5.2 x64	mandriva52enx64	172.23.202.220
3.	Red Hat Enterprise Linux 4.8 AS x64	rhel48asx64	172.23.202.126
4.	Red Hat Enterprise Linux 4.8 AS x86	rhel48asx86	172.23.202.225
5.	Red Hat Enterprise Linux 5.2 x86	redhat52entx86	172.23.202.194
6.	Red Hat Enterprise Linux 5.2 x64	redhat52entx64	172.23.202.226
7.	Red Hat Enterprise Linux 5.1 x86	redhat51entx86	172.23.202.193
8.	Red Hat Enterprise Linux 5.1 x64	redhat51entx64	172.23.202.227
9.	Red Hat Enterprise Linux 5.6 x64	redhat56entx64	172.23.202.195
10.	Red Hat Enterprise Linux 5.6 x86	redhat56entx86	172.23.202.222
11.	Centos 5.6 x64	centos56x64	172.23.202.196
12.	Centos 5.6 x86	centos56x86	172.23.202.221
13.	Kubuntu 11.04 x86 desktop	kubun1104dskx86	172.23.202.122
14.	Ubuntu 11.04 x64 desktop	ubunt1104dskx64	172.23.202.200
15.	Ubuntu 11.04 x86 desktop	ubunt1104dskx86	172.23.202.230
16.	Ubuntu 11.04 x64 server	ubunt1104srvx64	172.23.202.135
17.	Ubuntu 11.04 x86 server	ubunt1104srvx86	172.23.202.231
18.	Kubuntu 11.04 x86 desktop	kubun1104dskx64	172.23.202.232
19.	Ubuntu 10.04.2 LTS x64 server	ubunt1004srvx64	172.23.202.133
20.	Ubuntu 10.04.2 LTS x86 server	ubunt1004srvx86	172.23.202.132
21.	Kubuntu 10.04.2 desktop x86	kubun1004dskx86	172.23.202.123
22.	Kubuntu 10.04.2 desktop x64	kubun1004dskx64	172.23.202.229
23.	Debian 60 x86	debian60x86	172.23.202.197
24.	SciLinux 60 x64	sciLinux60x64	172.23.202.199
25.	SciLinux 60 x86	sciLinux60x86	172.23.202.224
26.	Fedora 15 x86	fedora15x86	172.23.202.198
27.	Fedora 15 x64	fedora15x64	172.23.202.223
28.	Slackware 13.37 x86	slackware1337	172.23.202.131
29.	Opensuse 11.4 x86	opensuse1104x86	172.23.202.125

Table 3 Linux operating systems

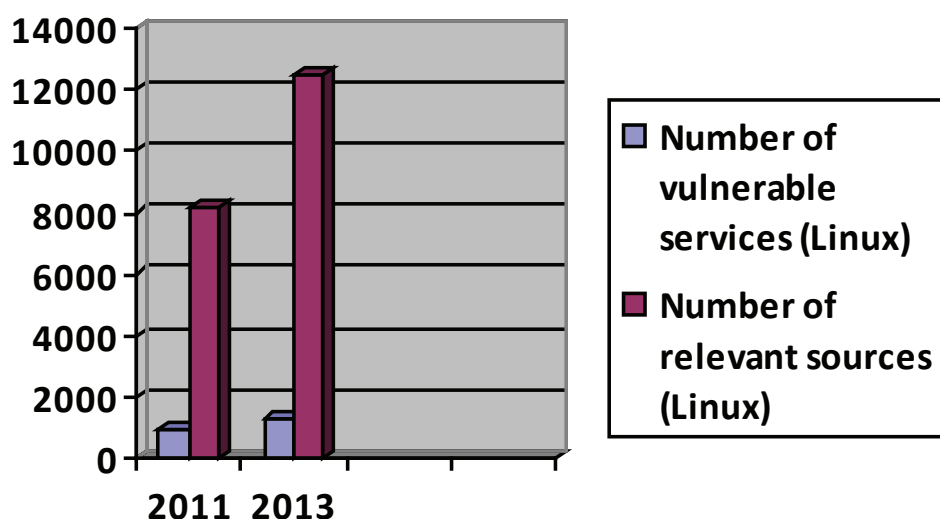
systems, the total number is 914 vulnerabilities (Table 6, Graph 1). Out of this number, 37 critical, 221 serious and 54 moderate vulnerabilities were found (Graph 2), respectively; considering all scanned systems together 118 critical, 644 serious and 152 moderate vulnerabilities (Table 6) were

found. Critical vulnerabilities require emergency intervention. They can be easily abused by a malicious attacker and by their exploitation it is possible to obtain total control over the affected computer system. Serious vulnerabilities are more difficult to exploit and in most cases they can not provide

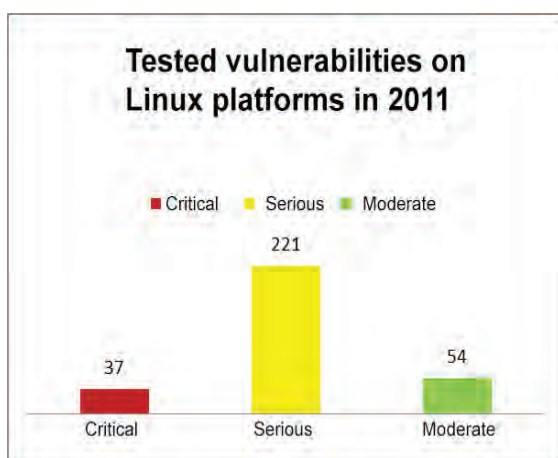
No.	Operating system	IP Address	Added Services
1.	Mandriva Linux Enterprise Server 5.2 x86	172.23.202.124	Apache, PHP, MySql, Tomcat, SSH, FTP, HTTPS
2.	Mandriva Linux Enterprise Server 5.2 x64	172.23.202.220	Apache, PHP, MySql, Tomcat, SSH, FTP, HTTPS
3.	Red Hat Enterprise Linux 4.8 AS x64	172.23.202.126	Apache, PHP, MySql, SSH, FTP, HTTPS
4.	Red Hat Enterprise Linux 4.8 AS x86	172.23.202.225	Apache, PHP, MySql, SSH, FTP, HTTPS
5.	Red Hat Enterprise Linux 5.2 x86	172.23.202.194	Apache, PHP, MySql, SSH, FTP
6.	Red Hat Enterprise Linux 5.2 x64	172.23.202.226	Apache, PHP, MySql, SSH, FTP
7.	Red Hat Enterprise Linux 5.1 x86	172.23.202.193	Apache, PHP, MySql, SSH, FTP
8.	Red Hat Enterprise Linux 5.1 x64	172.23.202.227	Apache, PHP, MySql, SSH, FTP
9.	Red Hat Enterprise Linux 5.6 x64	172.23.202.195	Apache, PHP, MySql, SSH, FTP
10.	Red Hat Enterprise Linux 5.6 x86	172.23.202.222	Apache, PHP, MySql, SSH, FTP
11.	Centos 5.6 x64	172.23.202.196	Apache, PHP, MySql, SSH, FTP
12.	Centos 5.6 x86	172.23.202.221	Apache, PHP, MySql, SSH, FTP
13.	Kubuntu 11.04 x86 desktop	172.23.202.122	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA
14.	Ubuntu 11.04 x64 desktop	172.23.202.200	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA
15.	Ubuntu 11.04 x86 desktop	172.23.202.230	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA
16.	Ubuntu 11.04 x64 server	172.23.202.135	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA
17.	Ubuntu 11.04 x86 server	172.23.202.231	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA
18.	Kubuntu 11.04 x86 desktop	172.23.202.232	Apache, PHP, MySql, SSH, FTP, IMAP (Dovecot), IMAPS, POP, POPS, SAM-BA

19.	Ubuntu 10.04.2 lts x64 server	172.23.202.133	Apache, PHP, MySql, SSH, FTP, Tomcat, IMAP (Dovecot), IMAPS, POP, POPS, SAMBA
20.	Ubuntu 10.04.2 lts x86 server	172.23.202.132	Apache, PHP, MySql, SSH, FTP, Tomcat, IMAP (Dovecot), IMAPS, POP, POPS, SAMBA
21.	Kubuntu 10.04.2 desktop x86	172.23.202.123	Apache, PHP, MySql, SSH, FTP, Tomcat, IMAP (Dovecot), IMAPS, POP, POPS, SAMBA
22.	Kubuntu 10.04.2 desktop x64	172.23.202.229	Apache, PHP, MySql, SSH, FTP, Tomcat, IMAP (Dovecot), IMAPS, POP, POPS, SAMBA
23.	Debian 60 x86	172.23.202.197	Apache, PHP, MySql, SSH, FTP, IMAP, IMAPS, POP, SAMBA
24.	SciLinux 60 x64	172.23.202.199	Apache, PHP, MySql, SSH, FTP
25.	SciLinux 60 x86	172.23.202.224	Apache, PHP, MySql, SSH, FTP
26.	Fedora 15 x86	172.23.202.198	Apache, PHP, MySql, SSH, FTP, NTP
27.	Fedora 15 x64	172.23.202.223	Apache, PHP, MySql, SSH, FTP, NTP
28.	Slackware 13.37 x86	172.23.202.131	Apache, PHP, MySql, SSH, FTP, NTP, SMTP
29.	Opensuse 11.4 x86	172.23.202.125	Apache, PHP, MySql, SSH, FTP

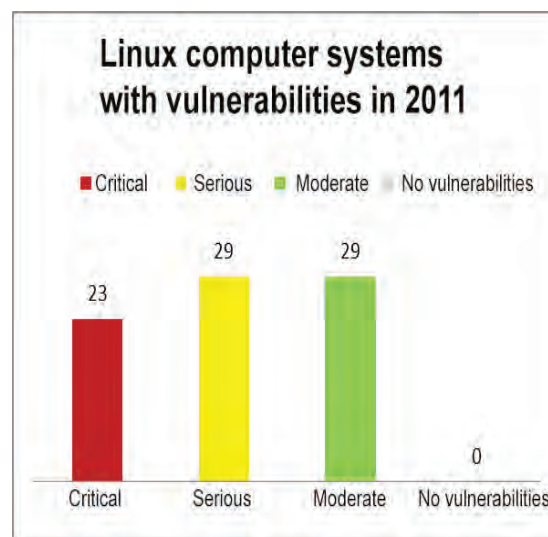
Table 4 Services hoisted on Linux Operating Systems



Graph 1 Presentation of vulnerable services found on Linux OS with the number of relevant sources reporting vulnerabilities in 2011 and 2013



Graph 2 Found vulnerabilities on tested Linux OS in 2011



Graph 3 Number of Linux computing systems by severity of vulnerability in 2011

simultaneous access to the system. When it comes to moderate vulnerabilities, they most often provide information that attackers can use to organize future attacks on computer systems in the network. Moderate vulnerabilities must also be resolved in a timely manner, but they are not as urgent as the previous two. When the computing systems are viewed individually, 118 critical, 644 serious and 152 moderate vulnerabilities were found. Critical vulnerabilities were found in 23 computer systems and they are most susceptible to attack. Serious vulnerabilities were found in 29 computer systems. Moderate vulnerabilities are also present in 29 operating systems (Graph 3). Overview of detected vulnerabilities according to frequency in the examined systems in 2011 is given in Graph 11. None of the tested systems were without vulnerability.

In 2013, 462 unique vulnerabilities were found, and at the level of all scanned Linux systems, the total number is 1307 vulnerabilities (Table 5, Graph 2). Out of this number, 46 critical, 344 serious and 72 moderate vulnerabilities were found (Graph 5). When considering computer systems individually, 149 critical, 953 serious and 205 moderate vulnerabilities were found (Table 6). Critical vulnerabilities were found on 24 computer systems and they are most susceptible to attack. Serious vulnerabilities were found in 29 computer systems.

Moderate vulnerabilities are also present on 29 operating systems (Graph 6). Overview of vulnerabilities according to the frequency found on tested systems in 2013 is given in Graph 14. None of the examined systems were without vulnerability.

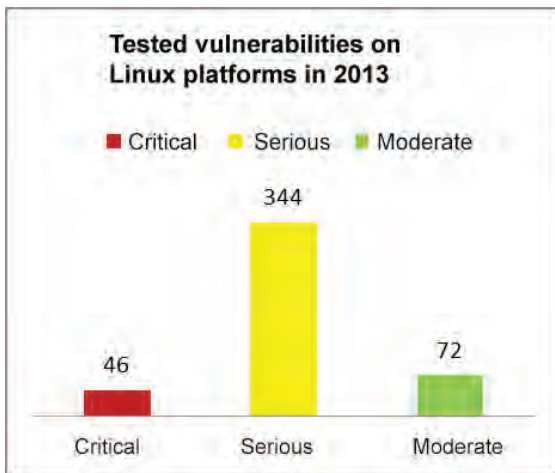
Some services are added on the Linux systems in order to show the actual impact on system vulnerability caused by increasing the number of services. Added services are shown in Table 4. After a default installation and additional services, it can be concluded that none of the tested systems were without vulnerability. Also, there is a noticeable increase in system vulnerability in the period from 2011 to 2013 (Table 6). As can be seen in Graph 15, the critical vulnerabilities increased from 118 to 149, serious vulnerabilities increased from 644 to 953 and moderate increased from 152 to 205.

Significant growth of vulnerability sources has been also noted on Linux operating systems from 8172 to 12456 (Table 6, Graph 1), which shows a significant increase in vulnerability and their abuse in different ways (Korać 2014). The expectation that Linux operating systems after the added services will have a significant increase in the number of vulnerabilities is confirmed and that can be noticed through the growth of critical, serious and moderate vulnerabilities on the system.

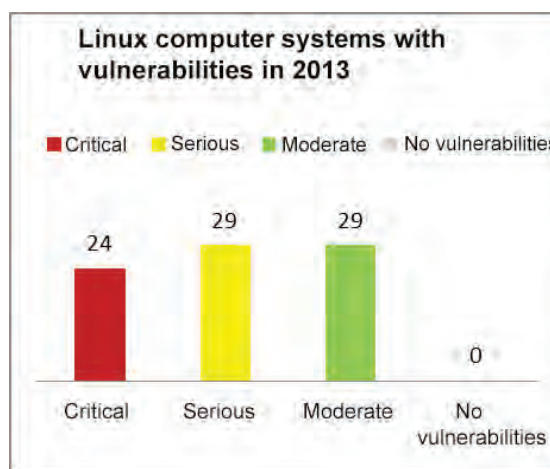
No.	Operating system	IP Address	Number of vulnerabilities in 2011	Number of vulnerabilities in 2013	Difference	No. of sources in 2011	No. of sources in 2013
1.	Mandriva Linux Enterprise Server 5.2 x86	172.23.202.124	43	58	15	314	483
2.	Mandriva Linux Enterprise Server 5.2 x64	172.23.202.220	43	58	15	314	483
3.	Red Hat Enterprise Linux 4.8 AS x64	172.23.202.126	50	56	6	698	801
4.	Red Hat Enterprise Linux 4.8 AS x86	172.23.202.225	50	56	6	698	801
5.	Red Hat Enterprise Linux 5.2 x86	172.23.202.194	47	57	10	599	735
6.	Red Hat Enterprise Linux 5.2 x64	172.23.202.226	47	57	10	599	735
7.	Red Hat Enterprise Linux 5.1 x86	172.23.202.193	47	57	10	599	735
8.	Red Hat Enterprise Linux 5.1 x64	172.23.202.227	47	57	10	599	735
9.	Red Hat Enterprise Linux 5.6 x64	172.23.202.195	45	56	11	578	722
10.	Red Hat Enterprise Linux 5.6 x86	172.23.202.222	45	56	11	578	722
11.	Centos 5.6 x64	172.23.202.196	45	56	11	578	722
12.	Centos 5.6 x86	172.23.202.221	45	56	11	578	722
13.	Kubuntu 11.04 x86 desktop	172.23.202.122	22	39	17	55	210
14.	Ubuntu 11.04 x64 desktop	172.23.202.200	22	39	17	55	210
15.	Ubuntu 11.04 x86 desktop	172.23.202.230	22	39	17	55	210
16.	Ubuntu 11.04 x64 server	172.23.202.135	22	39	17	55	210
17.	Ubuntu 11.04 x86 server	172.23.202.231	22	39	17	55	210
18.	Kubuntu 11.04 x86 desktop	172.23.202.232	22	39	17	55	210
19.	Ubuntu 10.04.2 LTS x64 server	172.23.202.133	30	44	14	151	308
20.	Ubuntu 10.04.2 LTS x86 server	172.23.202.132	30	44	14	151	308
21.	Kubuntu 10.04.2 desktop x86	172.23.202.123	30	44	14	151	308
22.	Kubuntu 10.04.2 desktop x64	172.23.202.229	30	44	14	151	308
23.	Debian 60 x86	172.23.202.197	23	39	16	99	261
24.	SciLinux 60 x64	172.23.202.199	19	35	16	103	261

25.	SciLinux 60 x86	172.23.202.224	19	35	16	103	261
26.	Fedora 15 x86	172.23.202.198	14	30	16	50	194
27.	Fedora 15 x64	172.23.202.223	14	30	16	50	194
28.	Slackware 13.37 x86	172.23.202.131	11	26	15	53	212
29.	Opensuse 11.4 x86	172.23.202.125	8	22	14	48	185
TOTAL			914	1307	393	8172	12456

Table 5 Linux vulnerabilities and their sources from 2011 and 2013



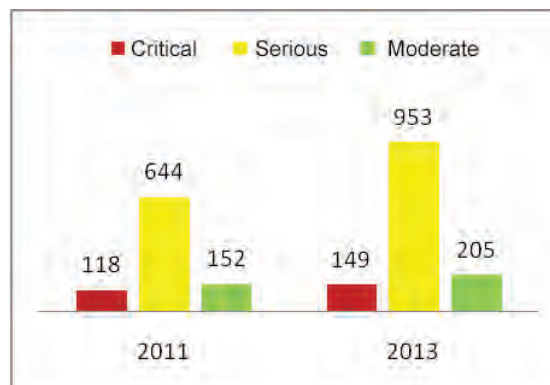
Graph 5 Found vulnerabilities on tested Linux OS in 2013



Graph 6 Number of Linux computing systems by severity of vulnerability in 2013

CONCLUSION

The aim of the experimental research in this paper is twofold. On the one hand, vulnerable services that can endanger the security of the system are presented, and on the other, it is possible to apply adequate proactive protection measures. When it comes to protection, it should be noted that there is no unique technology - no silver bullet that can solve all security issues in the organization. If one wants to achieve a certain goal in life, a lot of effort must be made. In this sense, achieving maximum protection is no exception. Implementing an acceptable level of security in an organization depends on the invested resources. By increasing the use of procedural and technical protection measures, the protection of the system and the level of security throughout the organization are increased. As experimental verification the scan of vulnerability of Linux operating systems with the Rapid 7 Nexpose tool was



Graph 8 Global overview of vulnerabilities for all Linux operating systems by years

performed. In this way, the vulnerabilities of the Linux operating systems installed by default are presented, with an aim to indicate potential security vulnerabilities. It has been confirmed that after default installations, no computer system is without vulnerabilities. With Linux operating systems after the added services, the number of critical, serious and moderate vulnerabilities on the system is significantly increased as expected.



Graph 4 Overview of found vulnerabilities by frequency in tested systems in 2011 for Linux OS



Graph 7 Overview of found vulnerabilities by frequency on tested systems in 2013 for Linux OS

No.	Operating system	IP Address	Number of vulnerabilities in 2011				Number of vulnerabilities in 2013			
			Cr	Se	Mo	To	Cr	Se	Mo	To
1.	Mandriva Linux Enterprise Server 5.2 x86	172.23.202.124	6	30	7	43	7	40	11	58
2.	Mandriva Linux Enterprise Server 5.2 x64	172.23.202.220	6	30	7	43	7	40	11	58
3.	Red Hat Enterprise Linux 4.8 AS x64	172.23.202.126	10	35	5	50	10	41	5	56
4.	Red Hat Enterprise Linux 4.8 AS x86	172.23.202.225	10	35	5	50	10	41	5	56
5.	Red Hat Enterprise Linux 5.2 x86	172.23.202.194	5	37	5	47	5	46	6	57
6.	Red Hat Enterprise Linux 5.2 x64	172.23.202.226	5	37	5	47	5	46	6	57
7.	Red Hat Enterprise Linux 5.1 x86	172.23.202.193	5	37	5	47	5	46	6	57
8.	Red Hat Enterprise Linux 5.1 x64	172.23.202.227	5	37	5	47	5	46	6	57
9.	Red Hat Enterprise Linux 5.6 x64	172.23.202.195	5	35	5	45	5	45	6	56
10.	Red Hat Enterprise Linux 5.6 x86	172.23.202.222	5	35	5	45	5	45	6	56
11.	Centos 5.6 x64	172.23.202.196	5	35	5	45	5	45	6	56
12.	Centos 5.6 x86	172.23.202.221	5	35	5	45	5	45	6	56
13.	Kubuntu 11.04 x86 desktop	172.23.202.122	4	12	6	22	7	23	9	39
14.	Ubuntu 11.04 x64 desktop	172.23.202.200	4	12	6	22	7	23	9	39
15.	Ubuntu 11.04 x86 desktop	172.23.202.230	4	12	6	22	7	23	9	39
16.	Ubuntu 11.04 x64 server	172.23.202.135	4	12	6	22	7	23	9	39
17.	Ubuntu 11.04 x86 server	172.23.202.231	4	12	6	22	7	23	9	39
18.	Kubuntu 11.04 x86 desktop	172.23.202.232	4	12	6	22	7	23	9	39
19.	Ubuntu 10.04.2 lts x64 server	172.23.202.133	5	19	6	30	7	30	7	44
20.	Ubuntu 10.04.2 lts x86 server	172.23.202.132	5	19	6	30	7	30	7	44
21.	Kubuntu 10.04.2 desktop x86	172.23.202.123	5	19	6	30	7	30	7	44
22.	Kubuntu 10.04.2 desktop x64	172.23.202.229	5	19	6	30	7	30	7	44
23.	Debian 60 x86	172.23.202.197	2	17	4	23	4	30	5	39
24.	SciLinux 60 x64	172.23.202.199	0	15	4	19	0	29	6	35

25.	SciLinux 60 x86	172.23.202.224	0	15	4	19	0	29	6	35
26.	Fedora 15 x86	172.23.202.198	0	10	4	14	0	23	7	30
27.	Fedora 15 x64	172.23.202.223	0	10	4	14	0	23	7	30
28.	Slackware 13.37 x86	172.23.202.131	0	6	5	11	1	18	7	26
29.	Opensuse 11.4 x86	172.23.202.125	0	5	3	8	0	17	5	22
TOTAL			118	644	152	914	149	953	205	1307

Table 6 Number of vulnerable services found on Linux OS classified according to severity

The total number of scanned Linux systems is 29. In this way, vulnerabilities are detected on the system, and then appropriate measures are proposed to overcome the identified security problems.

With proper and regular use of tools for scanning and logging of vulnerabilities on systems, in the presence of a forensic expert, it is possible to get detailed insight into illegal processes in the system and to prevent further illegal activities within a network or a particular computer system. By integrating the results of proactive digital forensics together with systems of preventive protection, detection and analysis of vulnerability, as well as the implementation of multilayer protection architecture (Korać 2010), with timely response to incidental or illegal activities (with a digital forensics specialist), it is possible to increase system security and achieve optimal level protection to an adequately defined security policy.

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Korać, V. 2014

Digitalna forenzika u funkciji zaštite informacionog sistema baziranog na Linux i Windows platformama, unpublished doctoral thesis, Univerzitet u Beogradu, 2014.

REZIME ISPITIVANJE LINUX SERVISA NA RANJIVOSTI

Alati za analizu ranjivih servisa na sistemu mogu pružiti dragocene informacije o stanju operativnih sistema sa stanovišta zaštite. Istraživanje u ovom radu je obuhvatilo 29 Linux operativnih sistema. Prikupljene informacije obuhvataju veliki broj podataka o prisustvu različitih mrežnih servisa na sistemu koji predstavljaju potencijalne bezbednosne propuste. Na taj način su prezentovane, ranjivosti difoltno instaliranih Linux operativnih sistema (sa pridodatim određenim servisima) sa ciljem ukazivanja na potencijalne bezbednosne ranjivosti. Ove ranjivosti odnosno propusti mogu nastati zbog pogrešno konfigurisanih servisa, poznatih grešaka (eng. Well known bug) u sistemu ili programu, neažuriranosti sistema i njegovih servisa, kao i zbog upotrebe slabe zaštite u konfiguraciji. Cilj ovog ispitivanja jeste da se identifikuju bezbednosni propusti (ranjivi servisi) na difoltno instaliranim Linux sistemima.

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WINDOWS DEFAULT SERVICES VULNERABILITIES ASSESSMENT

ABSTRACT

By using tools for analysing vulnerable services on the system it is possible to obtain valuable information about the system and the network in terms of protection. The research in this paper included 51 Windows operating systems. The collected information consists of a large amount of data about the presence of various network services on a system that present potential security flaws. Thus, the vulnerabilities of Windows operating systems that are installed by default are presented, with the aim of pointing out potential security vulnerabilities. These vulnerabilities or omissions can occur due to incorrectly configured services, well known bugs in the system or program, an outdated system and its services, and the use of poor protection in configuration. The aim of this assessment is to identify and correct accordingly all recognized security flaws (vulnerable services) on Windows systems installed by default.

KEYWORDS: VULNERABILITY ANALYSIS, VULNERABILITY ASSESSMENT, WINDOWS VULNERABILITIES, OS VULNERABILITIES.

In the system of protection, vulnerabilities can be in software, hardware, configuration and people (Grubor and Gotić 2012).¹ In this research paper, the focus is on discovering the vulnerability of the

operating system software, i.e., operating system services. By using tools for analysing vulnerable services on the system it is possible to obtain valuable information about the system and the network in terms of protection. As will be shown, the collected information will include a large number of data on the presence of various network services on the system that present potential security flaws. These omissions can occur due to incorrectly configured services, well known bugs in the system or

¹ The article results from the project: *Viminacium, Roman city and military camp – research of the material and no material culture of inhabitants by using the modern technologies of remote detection, geophysics, GIS, digitalization and 3D visualization* (no 47018), funded by The Ministry of Education, Science and Technological Development of the Republic of Serbia.

Source name	Web address of the source
APPLE-SA (Apple Security Announce)	http://lists.apple.com/archives/security-announce
BID	http://www.securityfocus.com/bid/
CERT CA	http://www.us-cert.gov/ncas/alerts/
CERT TA	http://www.us-cert.gov/ncas/alerts/
CERT-VN	http://www.kb.cert.org/vuls/
CVE (Common Vulnerabilities and Exposures)	http://web.nvd.nist.gov/view/vuln/search i http://cve.mitre.org/
DEBIAN DSA (Debian Security Announce)	http://www.debian.org/security/
IAVM (Information Assurance Vulnerability Management)	http://iase.disa.mil/index2.html
MANDRAKE MDKSA (Mandrake Security Announce)	http://www.mandriva.com/en/support/security/advisories/
MS (Microsoft security)	http://technet.microsoft.com/en-us/security/dn481339
MSKB (Microsoft Knowledge Base)	http://support.microsoft.com/
NETBSD	ftp://ftp.netbsd.org/pub/NetBSD/security/advisories/
OSVDB (Open Sourced Vulnerability Database)	http://www.osvdb.org/
OVAL (Open Vulnerability and Assessment Language)	http://oval.mitre.org/find/
REDHAT RHSA (Redhat Security Announce)	http://www.redhat.com/mailman/listinfo/rhsa-announce
SANS	http://www.sans.org/critical-security-controls/
SECTRACK (SecurityTracker)	http://securitytracker.com/
SECUNIA	http://secunia.com/advisories
SGI	ftp://patches.sgi.com/support/free/security/advisories/
SUSE SUSE-SA (SUSE Security Announce)	https://www.suse.com/support/security/advisories/
XF (X-force)	http://xforce.iss.net/

Table 1 Sources that publish vulnerabilities on operating systems

program, an outdated system and its services, as well as the use of poor protection in configuration. The task of this test is to identify and correct all recognized security flaws (vulnerable services) on the systems that are installed by default. All relevant sources reporting vulnerabilities on systems are included and shown in Table 1.

The vulnerability problem can also be seen through the Symantec Vulnerability Report for

2011, according to which the number of vulnerabilities was 4989², which means that almost 95 new vulnerabilities occur every week³. The peri-

² This number is based on a large number of sources including mailing lists and recommendations of many producers of programs and equipment.

Source: http://www.symantec.com/threatreport/topic.jsp?id=vulnerability_trends&aid=total_number_of_vulnerabilities

³ ISource: http://www.symantec.com/threatreport/topic.jsp?id=vulnerability_trends&aid=total_number_of_vulnerabilities

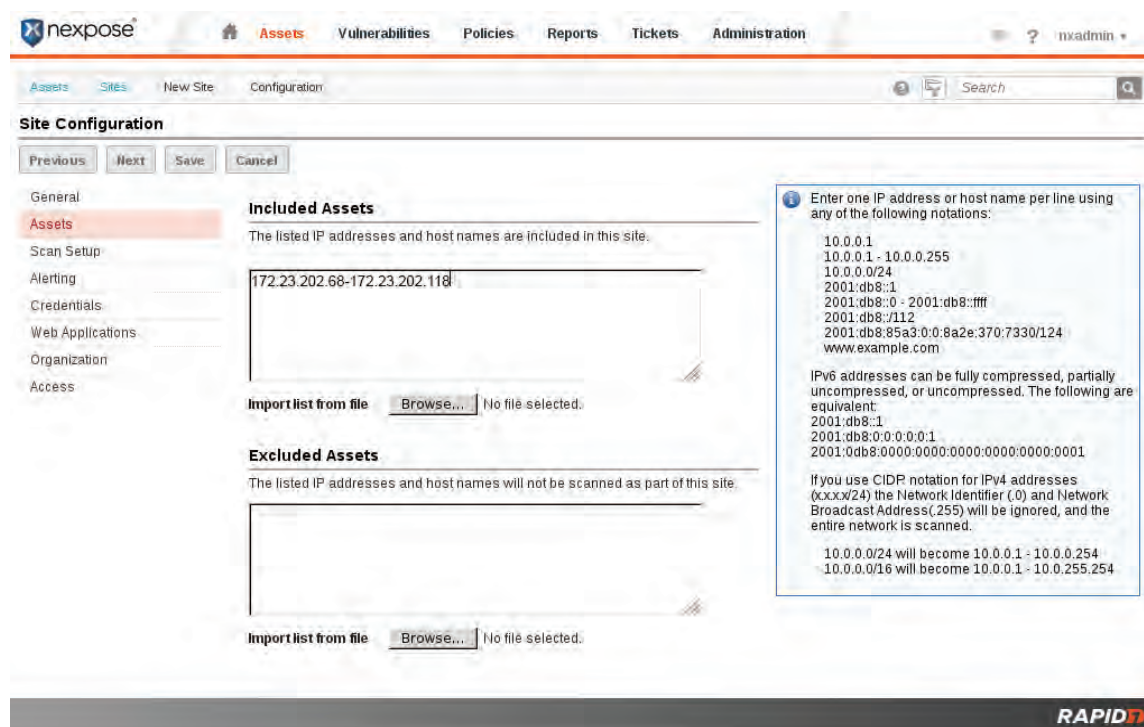


Fig. 1 Preparation of the Rapid 7 Nexpose tool for scanning of the service

od between publishing a vulnerability and applying a patch to a vulnerable program or service on the system is a critical period. The tool used for this work is called RAPID 7 Nexpose (Figure 1). With this tool, it is possible to perform planned and selective testing over network services, servers within an organization, and key services in the search for vulnerabilities that can be misused by attackers. In practice, corrective measures are proposed after system scanning. The total number of operating systems covered by this survey is 51 Windows operating systems.

The virtual environment for research purposes with the operating systems shown in the tables (Table 3., Table 4.) was realized within the VMware ESX 5.1.0 platform, the IBM x3650 M3 server and the EMC VNX5300 system, thereby achieving a centralized consolidation of all virtual computer systems intended for testing. Thus a stable platform for effective vulnerability testing with a high level of security was provided.

The virtual environment platform is VMWare ESXi 5.1.0, which is implemented on vulnerabilities

the IBMx3650 server (Figure 2.) and the EMC VNX5300 Storage system.

Server specifications for the IBMx3650 M3:

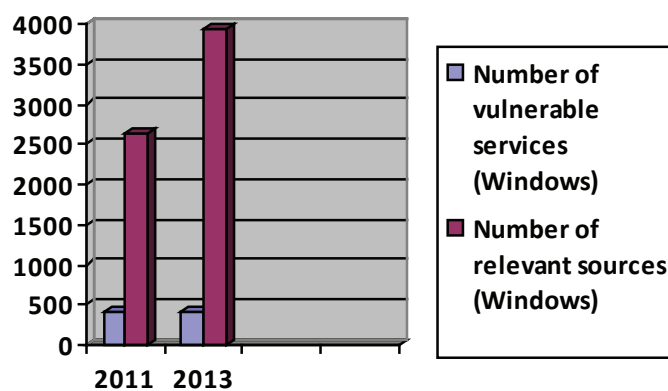
- 8 CPU Cores (2 x 4C Xeon E5620 80W, 2.4 GHZ 12MB cache
- 56 GB RAM PC3L-10600 ECC DDR3 1333 MHz memory
- 4x IBM 900 GB SAS HDD
- ServeRAID M5014 SAS/SATA controller
- IBM 460W Redundant Power Supply
- IBM UltraSlim Enhanced SATA Multi-Burner

The EMC VNX5300 storage system, with mounted virtual machines for testing purposes, consists of an Intel Xeon 5600 processor, with 16GB cache memory, 8 x 8Gbit FC port, 8 x 1GbE port, 25 x 600GB SAS 15k RPM, 25 x 2TB NL- SAS 7k RPM drives, 5 x 100GB FAST Cache Flash drive, rack cabinet VNX-40U, support for additional capacity expansion, support for CIFS, NFS, iSCSI and FC protocols, Local Protection Suite licenses, Security & Compliance Suite licenses, redundant power supplies. Table 2 contains a more detailed specification of this system.

The following tables show the operating sys-

VNX5300 CONTROL STATION - EMC RACK
2 x 1GBE DM MODULE 4 PORT FOR VNX5300
VNX5300 ADD ON DM+FC SLIC-EMC RACK
VNX5300 DME: 1 D M+FC SLIC-EMC RACK
VNX5300 DPE; 15X3.5 DRIVES EMC RACK 8X600GB 15K
3 x 3U DAE WITH 15X3.5 INCH DRIVE SLOTS WITH RACK
5 x 100GB FAST CACHE FLSH 15X3.5IN DPE/DAE
17x 600GB 15K SAS DISK DRIVE
VNX 40U RACK WITH CONSOLE
EMC VNX5300 4 PORT 8G FC IO MODULE PAIR
ADDITIONAL 8 G FC SFP FOR VNX 51/53
RACK-40U-60 PWR CORD IEC 309
EMC DOCUMENTATION KIT FOR VNX5300
SECURITY & COMPLIANCE SUITE FOR VNX5300
LOCAL PROTECTION SUITE FOR VNX5300
FAST CACHE FOR VNX5300
BASE FILE LICENSE (CIFS AND FTP) FOR VNX5300
ADV FILE LICENSE (NFS; MPFS AND PNFS) FOR VNX5300
UNISPHERE UNIFIED & VNX OE VNX5300
25 x 2TB 7200RPM 6GB SAS DISK DRIVE
EMC 2ND OPTIONAL SPS
EMC ENHANCED SOFTWARE SUPPORT

Table 2 Specification of the EMC VNX 5300 storage system



Graph 1 Presentation of vulnerable services found on Windows OS with the number of relevant sources reporting vulnerabilities in 2011 and 2013

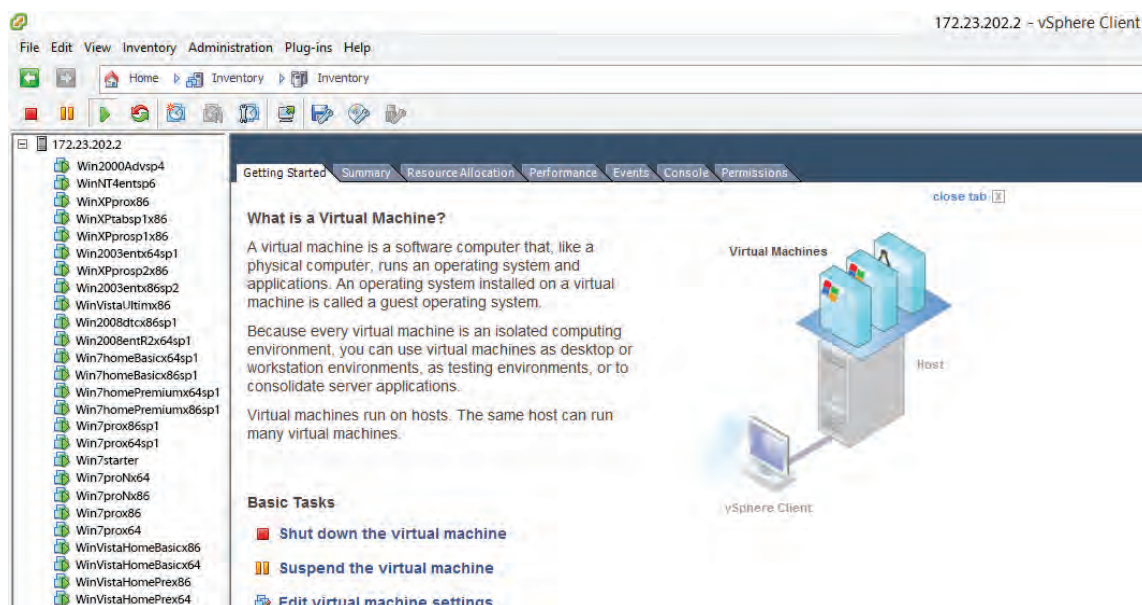


Fig. 1 Part of virtual machines prepared for vulnerable systems scanning

nexpose®

Assets

Vulnerabilities

Policies

Reports

Tickets

Administration

Assets

Sites

Windows OS

Scans

Full audit

Search

Scan Progress

Scan Type	Started	Assets	Vulnerabilities	Elapsed	Status	Scan Log
Manual	Sun 24 Nov 2013 07:33:01 AM CET	51	417	3 minutes	Completed successfully	

Discovered Assets

Address	Name	Operating System	Vulnerabilities	Scan Duration	Scan Status
172.23.202.110	WIN2000ADVANCE	Microsoft Windows 2000	19	18 seconds	Completed
172.23.202.101	WINNT4	Microsoft Windows NT 4.0	22	3 minutes	Completed
172.23.202.105	WINXPPOX86	Microsoft Windows XP	15	48 seconds	Completed
172.23.202.109	WINXPABLET86	Microsoft Windows XP	15	48 seconds	Completed
172.23.202.106	WINXPSP1	Microsoft Windows XP	15	48 seconds	Completed
172.23.202.111	WIN2003ENT86	Microsoft Windows Server 2003 SP1	14	22 seconds	Completed
172.23.202.107	WINXPSP2	Microsoft Windows XP	11	24 seconds	Completed
172.23.202.112	WIN2003ENTSP2	Microsoft Windows Server 2003 SP2	9	22 seconds	Completed
172.23.202.113	VISTAX86ULTIM	Microsoft Windows Vista Ultimate Edition	8	22 seconds	Completed
172.23.202.117	2008DATACX86SP1	Microsoft Windows Server 2008 Datacenter Edition	7	22 seconds	Completed
172.23.202.115	WIN7ULTX86SP1	Microsoft Windows 7 Ultimate Edition SP1	4	22 seconds	Completed
172.23.202.116	WIN7ULTX64	Microsoft Windows 7 Ultimate Edition	4	22 seconds	Completed
172.23.202.108	WINXPSP3	Microsoft Windows XP	4	23 seconds	Completed
172.23.202.118	2008ENTP2X64SP1	Microsoft Windows Server 2008 R2, Enterprise Edition SP1	4	22 seconds	Completed
172.23.202.103	WIN98SE	Microsoft Windows 98 SE (no service pack)	3	11 seconds	Completed
172.23.202.104	WINME	Microsoft Windows 2000 SP2	2	16 seconds	Completed
172.23.202.102		Microsoft Windows for Workgroups 3.11, Windows NT 3.51 SP0 - SP5, or Windows 95	2	47 seconds	Completed

Fig. 3 Completed Rapid 7 Nexpose tool scanning of vulnerable services on Windows platforms

No.	Operating System	Computer Name	IP Address
1.	Windows nt 4 enterprise sp6	NT4entsp6	172.23.202.101
2.	Windows 95 OSR 2.5	Win95OSR	172.23.202.102
3.	Windows 98 se	WIN98SE	172.23.202.103
4.	Windows ME	WINME	172.23.202.104
5.	Windows XP pro x86	WINXPprox86	172.23.202.105
6.	Windows xp pro sp1 x86	WINXPproSP1x86	172.23.202.106
7.	Windows xp pro sp2 x86	WINXPproSP2x86	172.23.202.107
8.	Windows xp pro sp3 x86	WINXPproSP3x86	172.23.202.108
9.	Windows xp tablet pc SP1	WINXPTabX86sp1	172.23.202.109
10.	Windows 2000 advanced server sp4	WIN2000ADVsp4	172.23.202.110
11.	Windows server 2003 Enterprise x64 SP1	WIN2003ENX64sp1	172.23.202.111
12.	Windows Server 2003 Enterprise x86 sp2	WIN2003ENSP2x86	172.23.202.112
13.	Windows Vista ultimate x86	VISTAx86ULT	172.23.202.113
14.	Windows Vista Ultimate SP2 x86	VISTAx86ULTSP2	172.23.202.114
15.	Windows 7 ultimate x86 sp1	WIN7x86ULTSP1	172.23.202.115
16.	Windows 7 ultimate x64	WIN7x64ULT	172.23.202.116
17.	Windows 2008 server datacenter x86 SP1 (kernel as Windows Vista ultim sp2)	2008DTCX86SP1	172.23.202.117
18.	Windows 2008 enterprise x64 server R2 SP1 update June 2011SP1 (kernel as Win- dows 7)	2008entR2X64SP1	172.23.202.118
19.	Windows 7 Home Basic SP1 x64	WIN7x64HoBaSp1	172.23.202.100
20.	Windows 7 Home Basic SP1 x86	WIN7x86HoBaSp1	172.23.202.99
21.	Windows 7 Home Premium SP1 x64	WIN7x64HoPreSp1	172.23.202.98
22.	Windows 7 Home Premium SP1 x86	WIN7x86HoPreSp1	172.23.202.97
23.	Windows 7 Professional SP1 x64	WIN7x64ProSp1	172.23.202.96
24.	Windows 7 Professional SP1 x86	WIN7x86ProSp1	172.23.202.95
25.	Windows 7 starter	WIN7starter	172.23.202.94
26.	Windows 7 Professional N x64	WIN7ProNx64	172.23.202.93
26.	Windows 7 Professional N x86	WIN7ProNx86	172.23.202.92
28.	Windows 7 Professional x64	WIN7Prox64	172.23.202.91
29.	Windows 7 Professional x86	WIN7Prox86	172.23.202.90
30.	Windows Vista Home Basic x86	VISTAx86HoBa	172.23.202.89
31.	Windows Vista Home Basic x64	VISTAx64HoBa	172.23.202.88
32.	Windows Vista Home Premium x86	VISTAx86HoPre	172.23.202.87
33.	Windows Vista Home Premium x64	VISTAx64HoPre	172.23.202.86
34.	Windows Vista Business x86	VISTAx86Bsn	172.23.202.85

35.	Windows Vista Business x64	VISTAx64Bsn	172.23.202.84
36.	Windows Vista Ultimate x64	VISTAx64ULT	172.23.202.83
37.	Windows Vista Home Basic x86 SP2	VISTAx86HoBaSp2	172.23.202.82
38.	Windows Vista Home Basic x64 SP2	VISTAx64HoBaSp2	172.23.202.81
39.	Windows Vista Business x86 SP2	VISTAx86BsnSp2	172.23.202.80
40.	Windows Vista Business x64 SP2	VISTAx64BsnSp2	172.23.202.79
41.	Windows Vista Home Premium x86 SP2	VISTAx86HoPrSp2	172.23.202.78
42.	Windows Vista Home Premium x64 SP2	VISTAx64HoPrSp2	172.23.202.77
43.	Windows 2000 server Sp4	Win2000srv	172.23.202.76
44.	Windows server 2003 Enterprise x86 SP1	WIN2003ENX86sp1	172.23.202.75
45.	Windows server 2003 Standard x86 SP1	WIN2003StX86sp1	172.23.202.74
46.	Windows server 2003 Standard x64 SP1	WIN2003StX64sp1	172.23.202.73
47.	Windows Server 2003 Enterprise x64 SP2	WIN2003ENSP2x64	172.23.202.72
48.	Windows server 2003 Standard x86 SP2	WIN2003StX86sp2	172.23.202.71
49.	Windows server 2003 Standard x64 SP2	WIN2003StX64sp2	172.23.202.70
50.	Windows XP pro sp1 x64	WINXPproSP1x64	172.23.202.69
51.	Windows 2008 server Enterprise x86 SP1	2008EntX86SP1	172.23.202.68

Table 3 Windows operating systems

tems included in vulnerability scanning with the RAPID 7 Nexpose⁴ tool:

Table 3 lists the versions of Windows operating systems, the names of the computers with the IP addresses that are included in the scan, by the Rapid7 Nexpose tool. By default, Windows operating systems are installed without added services.

Table 4 shows an overview of the total number of detected vulnerabilities and their relevant sources related to Windows operating systems in 2011 and 2013.

In Table 5 the number of vulnerabilities on Windows OS is presented with detailed review according to severity (Critical – Cr, Serious – Se, Moderate – Mo, Total – To)

The testing was carried out on 51 Windows operating system. U 2011, 144 unique vulnerabilities were found, and at the level of all scanned Windows systems, the total number is 414 vulnerabilities (Table 5, Graph 1). Out of this number, 79 critical, 43 serious and 22 moderate vulnera-

bilities were found (Graph 2.), respectively considering all scanned systems together 211 critical, 117 serious and 86 moderate vulnerabilities were found (Table 5). Critical vulnerabilities require emergency intervention (Korać 2014). They can be relatively easy abused by a malicious attacker and by their exploitation it is possible to obtain total control over the affected computer system. Serious vulnerabilities are more difficult to exploit and in most cases they can not provide simultaneous access to the system. Concerning moderate vulnerabilities, they most often provide information that attackers can use to organize future attacks on computer systems in the network. Moderate vulnerabilities must also be resolved in a timely manner, but they are not as urgent as the two previously described. As already mentioned, when the computing systems are viewed individually, 211 critical, 117 serious and 86 moderate vulnerabilities were found in total. Critical vulnerabilities were found in a total of 34 computer systems and they are most susceptible to attack

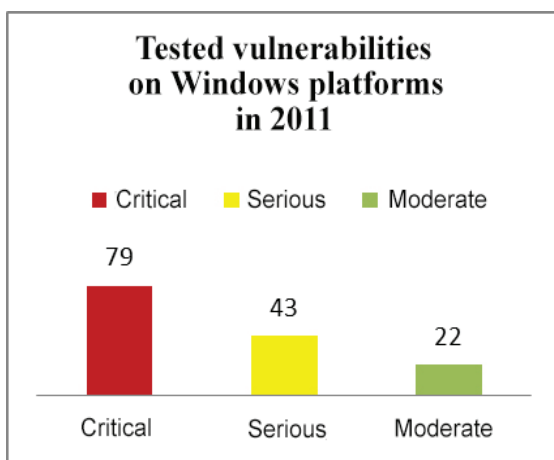
⁴ <https://www.rapid7.com/products/nexpose/>

No.	Operating system	IP address	Number of vulnerabilities in 2011	Number of vulnerabilities in 2013	Difference	No. of sources in 2011	No. of sources in 2011
1.	Windows nt 4 enterprise sp6	172.23.202.101	21	22	1	97	139
2.	Windows 95 OSR 2.5	172.23.202.102	2	2	0	23	27
3.	Windows 98 SE	172.23.202.103	3	3	0	22	27
4.	Windows ME	172.23.202.104	2	2	0	23	23
5.	Windows XP pro x86	172.23.202.105	15	15	0	174	247
6.	Windows XP pro sp1 x86	172.23.202.106	15	15	0	174	248
7.	Windows XP pro sp2 x86	172.23.202.107	11	11	0	54	54
8.	Windows XP pro sp3 x86	172.23.202.108	4	4	0	9	10
9.	Windows XP tablet pc SP1 x86	172.23.202.109	15	15	0	174	248
10.	Windows 2000 advanced server sp4	172.23.202.110	18	19	1	225	54
11.	Windows server 2003 Enterprise x64 SP1	172.23.202.111	14	14	0	89	10
12.	Windows Server 2003 Enterprise x86 sp2	172.23.202.112	9	9	0	41	248
13.	Windows Vista ultimate x86	172.23.202.113	8	8	0	53	307
14.	Windows Vista Ultimate SP2 x86	172.23.202.114	7	7	0	24	135
15.	Windows 7 ultimate x86 sp1	172.23.202.115	4	4	0	8	73
16.	Windows 7 ultimate x64	172.23.202.116	4	4	0	8	57
17.	Windows 2008 server datacenter x86 SP1 (kernel as Windows Vista ultim sp2)	172.23.202.117	7	7	0	24	42
18.	Windows 2008 enterprise x64 server R2 SP1 update June 2011SP1 (kernel as Windows 7)	172.23.202.118	4	4	0	8	8
19.	Windows 7 Home Basic SP1 x64	172.23.202.100	4	4	0	8	8
20.	Windows 7 Home Basic SP1 x86	172.23.202.99	4	4	0	8	42
21.	Windows 7 Home Premium SP1 x64	172.23.202.98	4	4	0	8	8

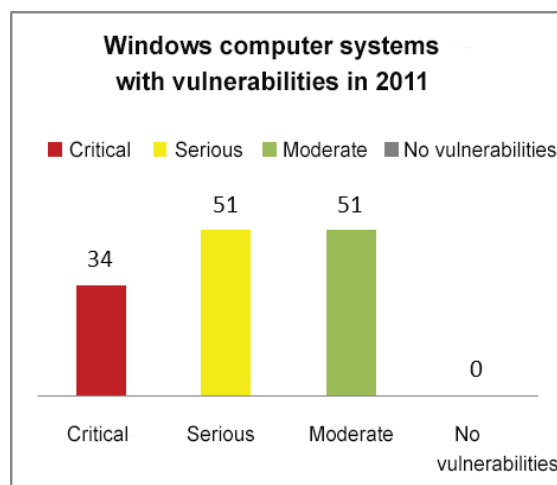
No.	Operating system	IP address	Number of vulnerabilities in 2011	Number of vulnerabilities in 2013	Difference	No. of sources in 2011	No. of sources in 2011
22.	Windows 7 Home Premium SP1 x86	172.23.202.97	4	4	0	8	8
23.	Windows 7 Professional SP1 x64	172.23.202.96	4	4	0	8	8
24.	Windows 7 Professional SP1 x86	172.23.202.95	4	4	0	8	8
25.	Windows 7 starter	172.23.202.94	4	4	0	8	8
26.	Windows 7 Professional N x64	172.23.202.93	4	4	0	8	8
26.	Windows 7 Professional N x86	172.23.202.92	4	4	0	8	8
28.	Windows 7 Professional x64	172.23.202.91	4	4	0	8	8
29.	Windows 7 Professional x86	172.23.202.90	4	4	0	8	8
30.	Windows Vista Home Basic x86	172.23.202.89	8	8	0	53	57
31.	Windows Vista Home Basic x64	172.23.202.88	8	8	0	53	57
32.	Windows Vista Home Premium x86	172.23.202.87	8	8	0	53	57
33.	Windows Vista Home Premium x64	172.23.202.86	8	8	0	53	57
34.	Windows Vista Business x86	172.23.202.85	8	8	0	53	57
35.	Windows Vista Business x64	172.23.202.84	8	8	0	53	57
36.	Windows Vista Ultimate x64	172.23.202.83	8	8	0	53	57
37.	Windows Vista Home Basic x86 SP2	172.23.202.82	7	7	0	24	42
38.	Windows Vista Home Basic x64 SP2	172.23.202.81	7	7	0	24	42
39.	Windows Vista Business x86 SP2	172.23.202.80	7	7	0	24	42
40.	Windows Vista Business x64 SP2	172.23.202.79	7	7	0	24	42
41.	Windows Vista Home Premium x86 SP2	172.23.202.78	7	7	0	24	42
42.	Windows Vista Home Premium x64 SP2	172.23.202.77	7	7	0	24	42
43.	Windows 2000 server Sp4	172.23.202.76	18	19	1	225	307

No.	Operating system	IP address	Number of vulnerabilities in 2011	Number of vulnerabilities in 2013	Difference	No. of sources in 2011	No. of sources in 2011
44.	Windows server 2003 Enterprise x86 SP1	172.23.202.75	14	14	0	89	135
45.	Windows server 2003 Standard x86 SP1	172.23.202.74	14	14	0	89	135
46.	Windows server 2003 Standard x64 SP1	172.23.202.73	14	14	0	89	135
47.	Windows Server 2003 Enterprise x64 SP2	172.23.202.72	9	9	0	41	73
48.	Windows server 2003 Standard x86 SP2	172.23.202.71	9	9	0	41	73
49.	Windows server 2003 Standard x64 SP2	172.23.202.70	9	9	0	41	73
50.	Windows XP pro sp1 x64	172.23.202.69	15	15	0	174	248
51	Windows 2008 server Enterprise x86 SP1	172.23.202.68	7	7	0	24	42
TOTAL			414	417	3	2646	3951

Table 4 Windows vulnerabilities and their sources from 2011 and 2013



Graph 2 Found vulnerabilities on tested Windows OS in 2011

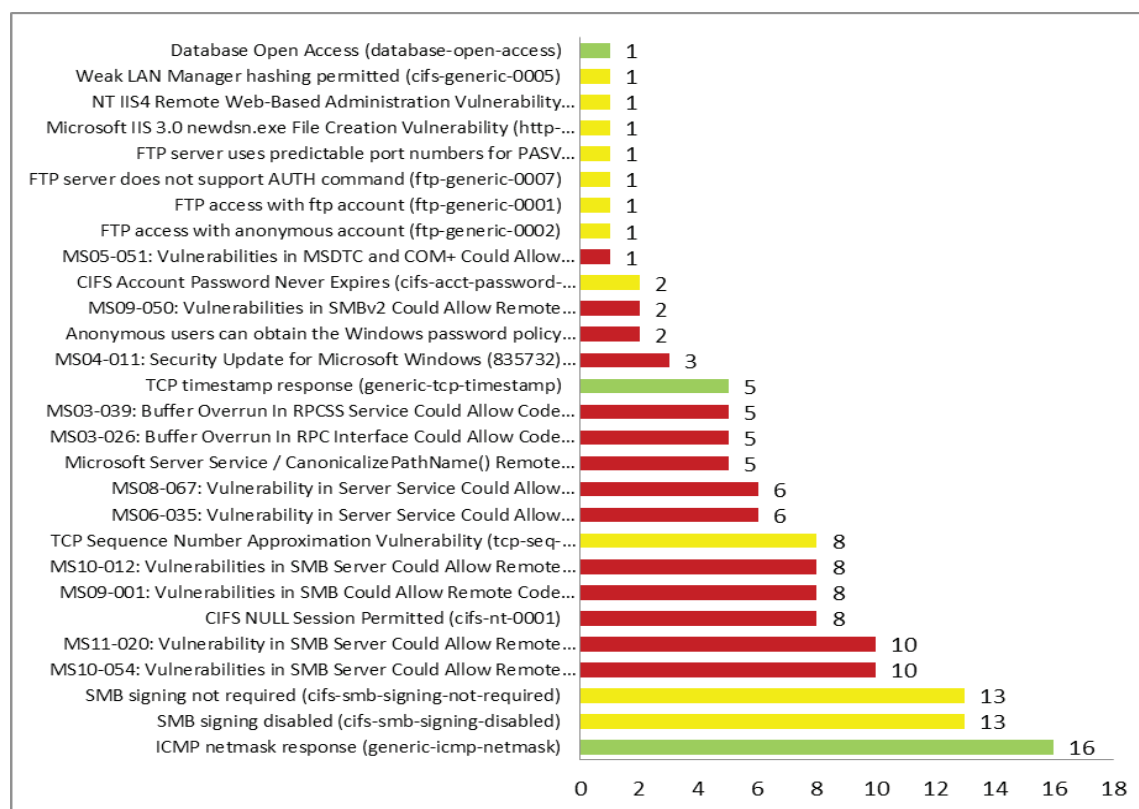


Graph 3 Number of Windows computing systems by severity of vulnerability in 2011

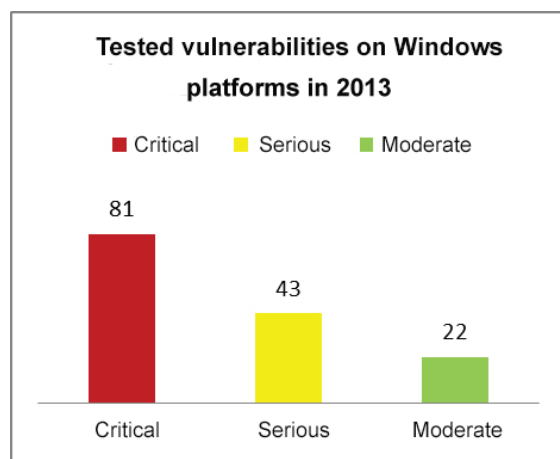
No.	Operating system	IP Address	Number of vulnerabilities in 2011				Number of vulnerabilities in 2013			
			Cr	Se	Mo	To	Cr	Se	Mo	To
1.	Windows nt 4 enterprise sp6	172.23.202.101	9	11	1	21	10	11	1	22
2.	Windows 95 OSR 2.5	172.23.202.102	0	1	1	2	0	1	1	2
3	Windows 98 se	172.23.202.103	0	1	2	3	0	1	2	3
4.	Windows ME	172.23.202.104	0	1	1	2	0	1	1	2
5.	Windows XP pro x86	172.23.202.105	11	3	1	15	11	3	1	15
6.	Windows xp pro sp1 x86	172.23.202.106	11	3	1	15	11	3	1	15
7.	Windows xp pro sp2 x86	172.23.202.107	8	2	1	11	8	2	1	11
8.	Windows xp pro sp3 x86	172.23.202.108	1	2	1	4	1	2	1	4
9.	Windows xp tablet pc SP1	172.23.202.109	11	3	1	15	11	3	1	15
10.	Windows 2000 advanced server sp4	172.23.202.110	13	1	4	18	14	4	1	19
11.	Windows server 2003 Enterprise x64 SP1	172.23.202.111	10	3	1	14	10	3	1	14
12.	Windows Server 2003 Enterprise x86 sp2	172.23.202.112	6	2	1	9	6	2	1	9
13.	Windows Vista ultimate x86	172.23.202.113	4	2	2	8	4	2	2	8
14.	Windows Vista Ultimate SP2 x86	172.23.202.114	3	2	2	7	3	2	2	7
15.	Windows 7 ultimate x86 sp1	172.23.202.115	0	2	2	4	0	2	2	4
16.	Windows 7 ultimate x64	172.23.202.116	0	2	2	4	0	2	2	4
17.	Windows 2008 server Datacenter x86 SP1 (kernel as Windows Vista ultimate sp2)	172.23.202.117	3	2	2	7	3	2	2	7
18.	Windows 2008 enterprise x64 server R2 SP1 update June 2011 (kernel as Windows 7)	172.23.202.118	0	2	2	4	0	2	2	4
19.	Windows 7 Home Basic SP1 x64	172.23.202.100	0	2	2	4	0	2	2	4
20.	Windows 7 Home Basic SP1 x86	172.23.202.99	0	2	2	4	0	2	2	4
21	Windows 7 Home Premium SP1 x64	172.23.202.98	0	2	2	4	0	2	2	4
22.	Windows 7 Home Premium SP1 x86	172.23.202.97	0	2	2	4	0	2	2	4
23.	Windows 7 Professional SP1 x64	172.23.202.96	0	2	2	4	0	2	2	4
24.	Windows 7 Professional SP1 x86	172.23.202.95	0	2	2	4	0	2	2	4
25.	Windows 7 starter	172.23.202.94	0	2	2	4	0	2	2	4
26.	Windows 7 Professional N x64	172.23.202.93	0	2	2	4	0	2	2	4
26.	Windows 7 Professional N x86	172.23.202.92	0	2	2	4	0	2	2	4
28.	Windows 7 Professional x64	172.23.202.91	0	2	2	4	0	2	2	4

No.	Operating system	IP Address	Number of vulnerabilities in 2011				Number of vulnerabilities in 2013			
			Cr	Se	Mo	To	Cr	Se	Mo	To
29.	Windows 7 Professional x86	172.23.202.90	0	2	2	4	0	2	2	4
30.	Windows Vista Home Basic x86	172.23.202.89	4	2	2	8	4	2	2	8
31.	Windows Vista Home Basic x64	172.23.202.88	4	2	2	8	4	2	2	8
32.	Windows Vista Home Premium x86	172.23.202.87	4	2	2	8	4	2	2	8
33.	Windows Vista Home Premium x64	172.23.202.86	4	2	2	8	4	2	2	8
34.	Windows Vista Business x86	172.23.202.85	4	2	2	8	4	2	2	8
35.	Windows Vista Business x64	172.23.202.84	4	2	2	8	4	2	2	8
36.	Windows Vista Ultimate x64	172.23.202.83	4	2	2	8	4	2	2	8
37.	Windows Vista Home Basic x86 SP2	172.23.202.82	3	2	2	7	3	2	2	7
38.	Windows Vista Home Basic x64 SP2	172.23.202.81	3	2	2	7	3	2	2	7
39.	Windows Vista Business x86 SP2	172.23.202.80	3	2	2	7	3	2	2	7
40.	Windows Vista Business x64 SP2	172.23.202.79	3	2	2	7	3	2	2	7
41.	Windows Vista Home Premium x86 SP2	172.23.202.78	3	2	2	7	3	2	2	7
42.	Windows Vista Home Premium x64 SP2	172.23.202.77	3	2	2	7	3	2	2	7
43.	Windows 2000 server Sp4	172.23.202.76	13	4	1	18	14	4	1	19
44.	Windows server 2003 Enterprise x86 SP1	172.23.202.75	10	3	1	14	10	3	1	14
45.	Windows server 2003 Standard x86 SP1	172.23.202.74	10	3	1	14	10	3	1	14
46.	Windows server 2003 Standard x64 SP1	172.23.202.73	10	3	1	14	10	3	1	14
47.	Windows Server 2003 Enterprise x64 SP2	172.23.202.72	6	2	1	9	6	2	1	9
48.	Windows server 2003 Standard x86 SP2	172.23.202.71	6	2	1	9	6	2	1	9
49.	Windows server 2003 Standard x64 SP2	172.23.202.70	6	2	1	9	6	2	1	9
50.	Windows XP pro sp1 x64	172.23.202.69	11	3	1	15	11	3	1	15
51.	Windows 2008 server Enterprise x86 SP1	172.23.202.68	3	2	2	7	3	2	2	7
TOTAL			211	117	86	414	214	120	83	417

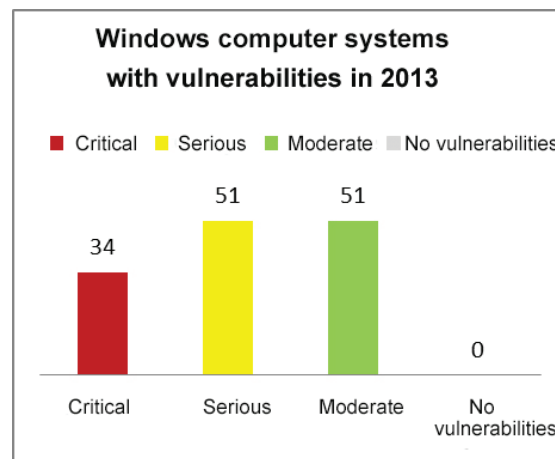
Table 5 Number of vulnerable services on Windows OS classified according to severity



Graph 4 Overview of found vulnerabilities by frequency in tested systems in 2011 for Windows OS



Graph 5. Found vulnerabilities on tested Windows OS in 2013

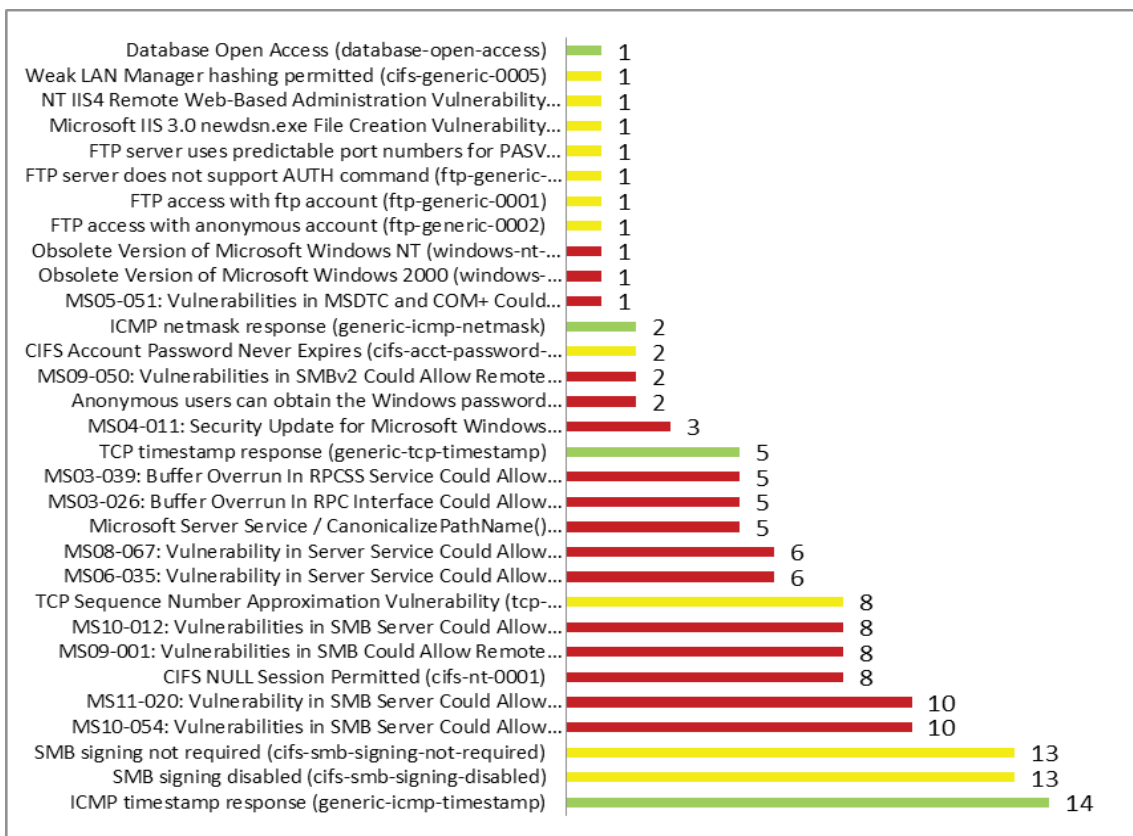


Graph 6 Number of Windows computer systems by severity of vulnerability in 2013

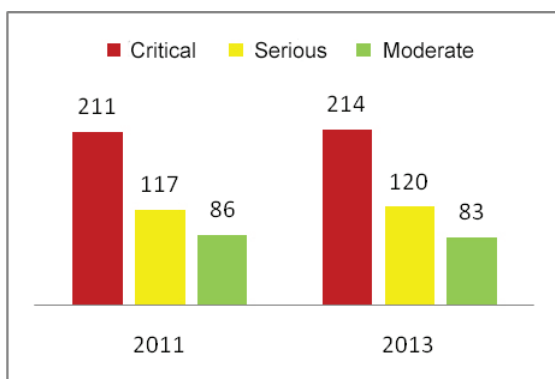
(Graph 3.). Serious vulnerabilities were found in a total of 51 computer systems. Moderate vulnerabilities are also present in 51 operating systems. The presentation of detected vulnerabilities according to frequency in the examined systems in 2011 is given in Graph 4. Although no additional services have been added after the default instal-

lation, it can be concluded that none of the tested systems were without vulnerability.

In 2013, 146 unique vulnerabilities were found, and at the level of all scanned Windows systems, the total number is 417 vulnerabilities (Table 5, Graph 1, Figure 3). Out of this number, 81 critical, 43 serious and 22 moderate vulnera-



Graph 7 Overview of found vulnerabilities by frequency on tested systems in 2013



Graph 8 Global overview of vulnerabilities for all Windows operating systems by year

bilities were found (Graph 5). When considering computer systems individually, 214 critical, 120 serious and 83 moderate vulnerabilities were found. Critical vulnerabilities were found on 34 computer systems and they are most susceptible to attack. Serious vulnerabilities were found in 51 computer systems (Graph 6). Moderate vulnerabilities are also present on 51 operating systems

(Graph 6). The presentation of detected vulnerabilities according to frequency in the examined systems in 2013 is given in Graph 7. Although no additional services have been added after the default installation, it can be concluded that none of the tested systems were without vulnerability.

As presented above it can be concluded that all scanned systems are vulnerable, but there has been no significant increase of vulnerability in the period between 2011 and 2013 (as for the scanned Windows operating systems without installed additional services, see Graph 8). Significant growth of vulnerability sources has been also noted on Windows operating systems from 2646 to 3951 (Table 4, Graph 1). Given that no significant increase of vulnerability has been recorded, while a significant growth of the sources of vulnerabilities has been reported, it can be concluded that the existing vulnerabilities have been misused in various ways.

CONCLUSION

The importance and development of new technologies for business modernization and data transfer are constantly increasing. Unfortunately, illegal activities are spreading at the same time. The problem of computer crime is a complex phenomenon. Since the perpetrators of such acts have the necessary knowledge and use sophisticated techniques for their execution, it is all the more difficult to trace and undoubtedly prove the elements of the criminal offence.

The vulnerability scanning of Windows operating systems has been performed with the *Rapid 7 Nexpose* tool. The aim of this experimental research is actually twofold. On the one hand, vulnerable services that can endanger the security of the system are presented, and on the other, it is possible to apply adequate proactive protection measures based on the recognized vulnerabilities. It has been confirmed that after default installations there is no computer system without vulnerability.

The total number of scanned Windows operating systems is 51. In this way, the vulnerabilities of Windows operating systems installed by default are presented, with an aim to indicate potential security vulnerabilities, as well as adequate preventive measures for system protection.

With proper and regular use of tools for scanning and logging vulnerabilities on systems, it is possible to get detailed insight into illegal processes in the system and to prevent further illegal activities within a network or a particular computer system. By integrating the results of proactive digital forensics together with systems of preventive protection, detection and analysis of vulnerability, as well as by implementing multilayer protection architecture (Korać 2010), with timely response to incidental or illegal activities (with a digital forensics specialist), it is possible to increase system security and achieve an optimal level of protection which is suitable to a defined security policy.

Since this topic covers vulnerability scanning technology on Windows operating systems, this work is exceptionally applicable and useful for

researchers, students in these fields, computer system administrators, legal and social experts, as well as experts in criminal justice.

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REZIME

ISPITIVANJE WINDOWS DIFOLTNIH SERVISA NA RANJIVOSTI

Upotrebom alata za analizu ranjivih servisa na sistemu moguće je dobiti dragocene informacije o sistemu i mreži sa stanovišta zaštite. Istraživanjem je obuhvaćeno 51 Windows operativnih sistema. Prikupljene informacije obuhvataju veliki broj podataka o prisustvu različitih mrežnih servisa na sistemu koji predstavljaju potencijalne bezbednosne propuste. Na taj način su prezentovane, ranjivosti difoltno instaliranih Windows operativnih sistema sa ciljem ukazivanja na potencijalne bezbednosne ranjivosti. Ove ranjivosti odnosno propusti mogu nastati zbog pogrešno konfigurisanih servisa, poznatih grešaka (eng. Well known bug) u sistemu ili programu, neažuriranosti sistema i njegovih servisa, kao i zbog upotrebe slabe zaš-

tite u konfiguraciji. Cilj ovog ispitivanja jeste da se identifikuju i na osnovu toga koriguju svi prepoznati bezbednosni propusti (ranjivi servisi) na difoltno instaliranim Windows sistemima.

PRIKAZI - REVIEWS

Tomasz Gralak, *INFLUENCE FROM THE DANUBIAN ZONE OF THE BARBARICUM ON THE TERRITORY OF POLAND IN LATE ANTIQUITY*, izdanje Wydawnictwo Uniwersytetu Wrocławskiego, Studia Archeologiczne XLII, Wrocław 2012. Knjiga sadrži 225 stranica teksta, 53 stranice podataka o kataloškim jedinicama, 36 stranica bibliografije, 46 tabli sa crtežima i fotografijama nalaza i 15 geografskih karti.

U svom značajnom delu, autor Tomasz Gralak daje uvid u kasnoantičke kulture na teritoriji današnje Poljske, koje su se razvijale pod različitim uticajima. Strani uticaji pristizali su iz različitih pravaca. Za temu ove knjige značajni su aspekti duhovne i materijalne kulture pristigli na prostor Poljske sa dunavskog područja, u okviru Barbarikuma, odnosno svojevrzne sponne severnih zemalja sa antičkim civilizacijama Mediterana. Takođe, dunavski deo Barbarikuma predstavljao je i filter koji je dozvoljavao prolaz samo pojedinih elemenata antičkih kultura, ali i mesto gde su se međusobno pretaпали i spajali određeni kulturni činioci.

Hronološki aspekt opservacije u naslovu je određen u kasnontički period, ali je veliki prostor posvećen i predrimskom (latenskom) periodu, kao i epohi Seobe naroda. Dunavski deo Barbarikuma određen je kao deo sliva Dunava, izvan granica Rimskog Carstva. Ipak, nije moguće uvek sa sigurnošću tvrditi da li su pojedine rukotvorine pristigle na teritoriju Poljske sa druge strane limesa, tranzitom preko ove teritorije. Radi lakšeg razumevanja puteva komunikacije i uticaja, autor predlaže podelu na Gornje, Srednje i Donje Podunavlje. Prvonavedeni prostor komunicirao je sa teritorijama rimskih provincija Recija i Norik, drugi sa Panonijom, slivom reke Tise i današnjom Moravskom i Slovačkom, dok je treći bio povezan sa teritorijom rimske provincije Dakije i današnje Moldavije. Naravno, preciznu granicu između ovih oblasti nije moguće povući.

Osnovu rada predstavljaju arheološki osetljive pojave koje nagoveštavaju veze sa dunavskim područjem. U najvećem broju slučajeva radi se o importima ili imitacijama predmeta vezanih za ovaj region. Reč je o keramičkim i metalnim rukotvorinama, u okviru kojih podrazumevamo i uticaje vezane za tehnologiju proizvodnje posuda rađenih na brzom vitlu. Pružen je pogled i na neke elemente duhovne kulture, poput sakralnih građevina i pogrebnih običaja. Takođe je naveden i primer naseobinskih karakteristika, moguće inspirisanih vezama sa prostorima južno od Karpatskog luka, koji su, razumljivo, morali proći određenu dozu pojednostavljivanja i implentiranja samo ključnih aspekata.

U prvom poglavlju, posvećenom prerimskom periodu, autor se bavi promenama u kulturi na teritoriji Poljske tokom latenskog perioda, u kontekstu povezanosti sa prostranstvima koja su se protezala na jugu, u pravcu Dunavskog basena. Na početku je naglašeno da su komunikacije ljudi tokom praistorije, između prostora Poljske i sliva Dunava, bile otežane velikom geografskom udaljenošću, kao i planinskim vencima Sudeta i Karpata. Ipak, brzo se pojavio prvi značajni lanac komunikacije, čuveni *čilibarski put*, koji je, preko srednjeg dela Dunavskog basena, povezivao deltu Visle sa severnom obalom Jadranskog mora. Vremenom su se razvili i putevi koji su povezivali obale Crnog Mora i Karpate sa baltičkim zemljama i Skandinavijom. Takođe, značajne su i veze koje su spajale Skandinaviju, preko Poljske, sa

obastima u okruženju reke Labe. Ovde navedene komunikacije zaživele su tokom epohe latena, što je predodredilo njihovo korišćenje u prerimskom i rimskom periodu.

Tokom IV veka pre nove ere, klimatske promene u evroazijskoj stepskoj zoni izazvale su, savremenim jezikom rečeno, ekonomske krize i političke nemire, što je rezultiralo migracijama nomadskih grupa.

Za vreme epohe latena, dosadašnja istraživanja utvrdila su postojanje četiri enklave sa naseljima na prostoru južne Poljske, odnosno u Donjoj Šleskoj, Gornjoj Šleskoj, Malopoljskoj i području u okruženju grada Sanoka. U okviru enklava jasno se uočava uticaj pridošlica iz krajeva južno od Sudeta i Karpata. Najveći broj novopridošlih, sa mogućim izuzetkom enklava u Donjoj Šleskoj, pripada populaciji Istočnih Kelta, koji potiču sa podunavskih prostora.

Tokom latena, prostor oko Živjeca i Novog Sonča u južnoj Poljskoj, bio je naseljen nosiocima puhovske kulture, gde su vrlo uočljivi elementi pristigli sa podunavskih teritorija. Naselja puhovske kulture razlikuju se od svih drugih latenskih naseobina u Poljskoj. Reč je naseljima podignutim na značajnim strateškim mestima, odnosno brdsko-planinskim vrhovima. Naselja ovog tipa imaju direktne analogije na prostorima naseljenim Istočnim Keltima i Dačanima, odnosno, predstavljaju direktan upliv pomenutih etničkih grupa kao njihova periferna područja.

Pomeranje populacija duž crnomorskog puta doprinelo je pojavama pševorske, oksivske i poinešti-lukaševske kulture. Istorijski povod za ove procese predstavlja geografska ekspanzija Bastarna i Skira. Na osnovu beležaka antičkih autora, može se zaključiti da je postojbina bar neke od ovih grupa bila Pomeranija, odakle su započeli seobe u pravcu Crnog mora. Najstariji pomen Bastarna na Donjem Dunavu datuje se u 239–229. godinu, dok se prvi zapis vezan za Skire datuje u poslednju deceniju III veka pre nove ere. Arheološku potvrdu ovih dešavanja pronalazimo u okviru poinešti-lukaševske kulture u Moldaviji,

koja se povezuje sa Bastarnima, a poseduje brojne analogije sa jastorfskom kulturom u Pomeraniji.

U okviru svojih migracija, pomenuti narodi prolaze kroz teritoriju današnje Poljske, koja je tokom VII–VI veka doživela osetan pad populacije, tako da je širenje elemenata jastorfske kulture na ovim prostorima bilo olakšano. Tako je, na prostorima Poljske, vremenom došlo do formiranja pševorske, oksivske i zarubinječke kulture. U narednim periodima, došlo je do kontakata između pripadnika ovih kultura sa dunavskim regionom, koji se najvećim delom odvijao tokom dva osnovna pravca – crnomorskim i ćilibarskim putem. Crnomorski put povezivao je prostore Poljske sa dačkim prostorima, dok je put ćilibara predstavljao vezu sa rimskim provincijama Recijom, Norikom i Panonijom.

Pregled kultura u prerimskom periodu završava se osvrtnom na zapadnobaltičke kulture, čija se veza sa Podunavljem gotovo ograničava na rezultate trgovine ćilibarom. Primetno je da su zapadnobaltičke kulture bile u znatno manjoj meri povezane sa dunavskim regionom u odnosu na pševorsku ili oksivsku kulturu. To se ogleda i u tome što se brojni importi, zastupljeni u pševorskoj i oksivskoj kulturi, poput oružja, metalnih vaza i određenih tipova fibula, na javljaju na prostorima zapadnobaltičkih kultura.

Kao zaključak, autor navodi da su uticaji kontakata sa dunavskim područjem imali izuzetan značaj u procesu formiranja najznačajnijih prerimskih kultura na teritoriji Poljske.

U drugom poglavlju, autor se osvrće na veze Podunavlja sa teritorijom Poljske tokom rimskog perioda. Na početku, skrenuta je pažnja na činjenicu da je u tom periodu prostor Podunavlja doživeo veliku promenu vezanu za strukturu stanovništva. Dolazi do laganog nestajanja keltske populacije, započinje proces integrisanja velikog dela ovog područja u okviru Rimskog Carstva, dok na obode ovog područja počinju da se naseljavaju plemena Markomana i Kvada i, nešto kasnije, Sarmata.

U praskozorje rimskog perioda, na prostoru puhovske kulture u Slovačkoj, jasno se uočava

sloj razaranja, povezan sa stranim uticajima, o kojima najviše svedoči arheološki materijal sa приметnim dačkim uticajima. Na prostoru Poljske, sloj razaranja nije tako uočljiv, mada je izvesno da dolazi do promena u kulturi i do napuštanja pojedinih naselja. U svakom slučaju, tokom ranorimskog perioda, puhovska naselja u Poljskoj se i dalje nalazi na periferiji zone uticaja ove kulture.

Istovremeno, u severnim predelima današnje Poljske nastaje nova, vielbarska, kultura. Tada se i u пшеvorskoj kulturi uočavaju promene u dizajnu keramike i metalnih predmeta, koje delimično mogu biti objašnjene i uticajima iz dunavskog basena. Tokom ranorimskog perioda, značajni su kontakti пшеvorske kulture sa Donjim Podunavljem, najuočljiviji u jugoistočnoj Poljskoj. Uticaji pristigli iz rimskih provincija Panonije i Norika ogledaju se prvenstveno u importima (mačevi, metalne vaze, fibule...), ali i nekim elementima pogrebnih rituala. Posebno su zanimljivi uticaji na пшеvorku kulturu, pristigli sa dunavskog područja preko novoformirane vielbarske kulture, manifestovani keramičkom i metalurškom produkcijom, koji su zahvatili samo istočna područja пшеvorske kulture.

Pomenuta vielbarska kultura nastala je na području Istočne Pomeranije, delimično na osnovama oksivske kulture. Posebno je karakterišu dostignuća u zlatarskoj produkciji. Naročito je bila povezana sa regionom Baltika, mada su njeni putevi razmene dobara dosežali do dalekih granica. Sa dunavskim područjem povezivao ju je čilbarski put. I ovu kulturu karakteriše značajno prisustvo importa iz Norika i Panonije (fibule, pojasna oprema, bronzane vaze...). Ovaj fenomen ima kontinuitet u kontaktima započetim još u prerimskom periodu i ogleda se u vezama koje su povezivale vielbarsku kulturu sa jugom preko teritorija Markomana u Bohemskom basenu i Hermundura u Tiringiji, sledeći dalje puteve duž toka Labe i baltičke obale. Primetan je i uticaj pristigao iz Donjeg Podunavlja i crnomorskog područja, mada će oni svoj puni zamah dostići tek u narednim vremenskim periodima.

Područje Donje Odre, odnosno gustovske i lubuške grupe, predstavljalo je značajnu stanicu na putu povezivanja Baltika sa Bohemijom i Gornjim Podunavljem. To objašnjava pojavu velikog broja nalaza sa noričkim obeležjima, koji predstavljaju mešavinu importa i imitacija (metalne posude, narukvice, privesci...).

Tokom ranorimskog perioda, u okviru naselja opredeljenih u zapadnobaltičke kulture, dolazi do formiranja nove kulture, poznate kao bogačevska. Ovaj proces odvijao se pod dva osnovna uticaja pristiglih od susednih varvarskih kultura, ali i na osnovu kontakata sa antičkom civilizacijom, o kojima svedoče nalazi poreklom sa Srednjeg i Gornjeg Podunavlja, prvenstveno noričko-panonske fibule, narukvice, kopče i privesci, ali i njihove imitacije.

Za vreme trajanja ranorimskog perioda, unatoč neprekinutom kontinuitetu u razmeni, iz razloga promena granica kulturnih grupa, može se govoriti i o promenama u pravcima širenja zona uticaja i inspiracija sa dunavskog prostora. Prvu zonu, u kojoj se oseća krizni period, označavaju veze ostvarivane preko puhovske kulture i srodnih grupa. Drugu zonu predstavljaju područja пшеvorske i vielbarske kulture, kao i gustovske i lubuške grupe. Naravno, sve ove zajednice poseduju lokalne nezavisne modele kulturnog razvoja, ali se kod njih i dalje oseća snažan uticaj izazvan kontaktima sa Podunavljem.

Tokom kasne antike, u materijalnoj kulturi jugoistočnih prostora пшеvorske kulture, uočljiv je veliki broj formi u kojima se ogleda uticaj kultura iz Donjeg Podunavlja, u najvećoj meri dačkih kultura (keramika, fibule raznih tipova, privesci lunulastog oblika ukrašeni filigranom i granulacijom, privesci u formi rozete, dekorisani predmeti izrađeni od jelenjih rogova...). Povratni uticaj ove kulture, na prostore Karpata, može se uočiti u nekim elementima pogrebnih rituala, moguće nastalih kao posledica podizanja naselja pripadnika пшеvorske kulture na južnim delovima Karpat-skog masiva, koja su funkcionisala kao enklave i vezivni element između ovih područja.

Novi element u пшевorskoj kulturi predstavlja keramika izrađena na brzom vitlu. Usvajanje ove tehnike povezano je i sa usvajanjem tehnološkog procesa praćenog i pojavom posebnog tipa peći za pečenje keramike. Ovaj proces je najbolje dokumentovan u Malopoljskoj, Šleskoj i pojedinim oblastima centralne Poljske,

Arheološki podaci potvrđuju da su, u kasnoantičkom periodu, nosioci пшеvorske kulture svoje veze sa Podunavljem održavali već utvrđenim putevima – crnomorskim i ćilibarskim. Crnomorski put povezivao je пшеvorsku kulturu sa Srednjim i, delimično, Donjim Podunavljem. Ova povezanost prvenstveno se odlikuje vezama sa rimskom Panonijom, ali i teritorijama nastanjenim Sarmatima.

Veze sa Gornjim Podunavljem odvijale su se pravcima ćilibarskog puta. Ove korelacije arheološki se dokumentuju nalazima tera sigilate i fibula, ali i pojavom novih tipova peći za pečenje keramike.

Tokom kasnoantičkog perioda, nosioci vielbarske kulture, kontakte sa Podunavljem mahom su ostvarivali pravcima crnomorskog puta i njegovim ograncima koji su vodili kroz planinske prolaze na Karpatima. Vielbarska kultura širila se u pravcu juga, pri tome zauzimajući istočne oblasti пшеvorske kulture, što je ponekad sledilo puteve ekonomskih prodora ostvarenih još u ranorimskom periodu. Izvan teritorija Poljske, vielbarska kultura širila se u pravcu pontskih i dačkih oblasti gde je imala značajan uticaj u nastanku tamošnjih kultura. Naravno, kulturni uticaj odvijao se i u suprotnom pravcu, pa su u vielbarskoj kulturi primetni sarmatski i, u nešto manjoj meri, dački uticaji. Uočljiv je i manji broj nalaza poreklom iz Gornjeg Podunavlja, što se, kao i u slučaju пшеvorske kulture, tumači posledicom kriza na teritoriji Rimskog carstva u III veku, koje su dovele do slabljenja veza vielbarske kulture sa ovim prostorima. Sa druge strane, nastanak nepovoljnih klimatskih promena na doveo je do usmeravanja tendencija u vielbarskoj kulturi u pravcu njene ekspanzije u pravcu juga. Slične tendencije, u kasnoantičkom periodu, ogledaju se i u lubošičkoj i zapadnobaltičkim kulturama.

Generalno, kasnoantički period predstavlja vreme brojnih kriza u Rimskom Carstvu, dok na teritoriji Poljske dolazi do smanjenja broja i gustine stanovništva, što sveukupno uzevši, predstavlja značajan elemenat u razvoju međusobnih odnosa i kulturnih prožimanja ovih prostora.

Tokom epohe Seobe naroda, prostor пшеvorske kulture zahvata sveobuhvatan proces dezintegracije i regionalizacije. U skladu sa ovom pojavom, javljaju se i razlike u stepenu inteziteta razmene sa Dunavskim područjem. Oblast koja se najviše izdvaja po ovom pitanju je prostor Beskidskog planinskog lanca, na jugu Poljske, gde dolazi do razvoja i ekspanzije naselja. Na ovom prostoru dobro su dokumentovane veze sa jugoistočnim područjima, uključujući i Podunavlje. Ovde očito dolazi do nastavka neprekinutih tradicija kontakata sa zajednicama naseljenim sa suprotne strane Karpata. Tokom Seobe naroda ovaj uticaj postaje tako jak da se, u delu ovog regiona, formira posebna kulturna grupacija – Severnokarpataska grupa.

Druga grupacija, dobrođenska grupa, razvijala se u Gornjoj Šleskoj i Malopoljskoj. Posebnu karakteristiku grupe predstavljaju pogrebni običaji, koji uključuju razne vrste sahranjivanja spaljenih pokojnika, preuzetih sa dačkom područja. U dobrođenskoj grupi uočavaju se brojni elementi poreklom iz podunavskih oblasti (fibule, pojasna oprema, oružje, keramika...). U svakom slučaju, na prostoru dobrođenske grupe uočavaju se uticaji pristigli sa Karpata i Ponta, koji se mogu vezati za poznočernjahovske horizonte. U ovom trenutku može se računati i sa delimičnim naseljavanjem nove populacije na pomenute prostore.

U poznijim fazama Seobe naroda, na prostoru пшеvorske kulture, nalazi iz Podunavlja uglavnom potiču iz ostava ili imaju karakter slučajnih nalaza. Generalno, nalazi iz ovog perioda poreklom iz Podunavlja ne ukazuju na veze sa konkretnim područjima ili kulturnim grupama, već se isključivo mogu opisati kao opšta dvosmerna saradnja sa južnim oblastima. Izgleda da ovaj proces prati i osetno smanjenje broja stanovništva i početak gubitka grupnog zajedničkog identiteta „poznop-

ševorske“ populacije.

Kao oosebno izdvojeno pitanje u ovoj epohi, autor navodi prisustvo elemenata materijalne kulture Huna. Za geografski najbliže teritorije hunskim posedima na Karpatima, smatraju se podnožja istih planina u istočnim delovima Malopoljske, gde se javljaju nalazi koji se mogu povezati sa Hunima. U Šleskoj, nalazi povezani sa Hunima javljaju se najčešće između reka Bistrice i Olave. Jedan od najznačajnijih nalaza potiče iz Jezdrihovica. U pitanju je grob, najverovatnije ženski, među čijim se prilogima, koji uključuju i zlatni nakit, posebno ističe bronzana posuda, čiji tip se pronalazi na ogromnim prostranstvima od Centralne Azije, preko ruskih stepa, sve do Podunavlja. Ovaj grob možda svedoči o direktnoj hunskoj upravi nad ovim prostorom.

Preostali nalazi vezani za Hune javljaju se u graničnom pojasu između Gornje Šleske i Malopoljske, kao i u jugoistočnom delu Velikopoljske. Ovi nalazi imaju različit karakter i mogu predstavljati posledicu trgovine, ali i vojnih pohoda. Oni ukazuju i na mogućnost da je ova teritorija mogla imati drugačiji politički status u odnosu na Malopoljsku ili Šlesku.

Izvesno je da su hunski prodori imali mnogo veći značaj nego što nam o njima svedoči dostupan arheološki materijal. Njihov dolazak sigurno je predstavljao glavni uzrok depopulizacije pševorskog stanovništva, isto kao i njegove istorijske posledice – seobe Vandala, Sveva i Alana, zabeležene 406. godine. Sa druge strane, luksuzne grobnice, verovatno lokalnih prvaka, ukazuju i na mogućnost da je autohtono stanovništvo moglo uzeti učešća u organizaciji i aktivnosti hunske vojske i uprave i imati koristi od njihovih uspeha.

Naglašeno je da su, tokom Seobe naroda, u mnogim delovima Poljske nastavljeni kontakti sa Srednjim i Donjim Podunavljem i Pontom, o čemu svedoče arheološki nalazi pristigli sa ovih teritorija, što se može tumačiti i prilivom izbeglica, koji su se sklanjali pred hunskom najezdom. Međutim, sličnu pojavu ne pronalazimo kod pripadnika vielbarske kulture, maslomečke grupe i gotskog kul-

turnog kruga, što možemo protumačiti time da je ovo stanovništvo prvo došlo u dodir sa Hunima, pa su se na njih direktno odrazile posledice nove epohe. Tokom poznijih faza epohe Seobe naroda, podunavski elementi javljaju se u okviru vielbarske kulture, što se objašnjava trgovačkim vezama sa Ostrogotima i Gepidima, koji su boravili na obalama Dunava. Ovi elementi prvenstveno se manifestuju prisustvom solida i fibula, koji mogu da svedoče i o vezama novopridošlih plemena.

Period Seobe naroda, na prostorima zapadno-baltičkih kultura, ima sasvim drugačiji karakter. Razaranja, koja su pratila najezdu Huna, nisu zahvatila ovaj prostor u celosti. Nakon kriza koje su zahvatile bogačevsku kulturu, dolazi do uspona olstinske grupe, kada uticaji iz Podunavlja ponovo dobijaju zamah. Veze sa Podunavljem u arheološkom materijalu odražavaju se u imitacijama i importima fibula. Održavanje pomenutih veza u najvećoj meri se objašnjava monopolom ovih zajednica u trgovini ćilibarom. One bivaju, u najvećoj meri, prekinute nakon opadanja uticaja gemanskih zajednica na prostorima Karpata.

Autor ove knjige uspešno je ostvario cilj da predstavi veze arheoloških kultura na teritoriji Poljske, tokom antičkog perioda uzetog u najširem značenju te reči, sa područjem Podunavlja. U radu su predstavljene sve značajne arheološke kulture, arheološki materijal značajan za temu i istorijski podaci koji mogu da pomognu u pronalaženju odgovora na pojedina pitanja. Naravno, pored odgovora, knjiga predstavlja osnov i za nova pitanja, kojih je svestan i sam autor, naglašavajući da ostaju nedorečena pitanja vezana za komunikaciono-trgovačke pravce na zapadnoj periferiji pševorske grupe, ulozi koju je imala reka Odra u vezama sa Podunavljem, nedovoljnom istraženošću lubuške i gustovske grupe ili kontaktima područja pored Baltičkog mora sa zemljama u okruženju Labe i Podunavlja u celini. Kao što se završava veliki broj arheoloških radova, autor na kraju naglašava da će odgovore na ova pitanja dati buduća istraživanja. U svakom slučaju, do novih istraživanja, a i nakon njih, ova knjiga predstav-

ljaće nezaobilazno delo u rukama svih proučavalaca antičkog perioda u Poljskoj, Podunavlju, ali i mnogo širim prostranstvima.

Ljubiša VASILJEVIĆ



IN MEMORIAM

Miroslav Jeremić

16.11.1943 – 02.07.2016.

Prošle godine je otišao, jedan od najistaknutijih znalaca antičke i ranovizantijske epohe, arhitekta, viši naučni saradnik Arheološkog instituta u Beogradu, Miroslav Mića Jeremić. Međutim, verovatno bi mu se najviše svidelo kada bismo rekli, otišao je pretposlednji član čuvene “sirmijumske” sedmorke (takozvanih 7 veličanstvenih: Vladislav, Draganče, Nona, Pjotr, Kele, Mića i Ana).

Čitav svoj radni vek proveo je u Arheološkom institutu, da bi isto toliko godina, učestvovao u arheološkim istraživanjima Sirmijuma u Sremskoj Mitrovici. Poznat ne samo u Srbiji, nego i u bivšoj Jugoslaviji, a isto tako i u evropskim arheološkim krugovima. Kao arhitekta, a ujedno i arheolog, imao je neverovatnu sposobnost sagledavanja kompleksnosti arheoloških lokaliteta, što u istorijskom i arheološkom, tako i u urbanističko-arhitektonskom smislu. Njegova strast u poslu i gotovo, dečja radoznalost, nagonila ga je da, do savršenstva dolazi do neverovatnih, mnogima nevidljivih arheoloških zaključaka. Jednostavno rečeno, umeo je da vidi ono što drugi nisu uspeli da vide. Bez ikakvih pretenzija, da sebe ističe ili nameće svoje mišljenje, davao je potpuno precizne deskripcije, naravno potkrepljene četrdeset peto-

godišnjim istraživanjima i velikom poznavanju. Kao dostojan sledbenik, svog mentora i velikog prijatelja Vladislava Popovića, postao je vrhunski stručnjak, pre svega, u oblasti antičkog i ranovizantijskog urbanizma i arhitekture.

Miroslav Jeremić je rođen 16. novembra 1943. godine u zabitom selu Ranovac (Petrovac na Mlavi), gde je započeo školovanje, a gimnaziju pohađao u Požarevcu, da bi 1968 godine diplomirao na Arhitektonskom fakultetu u Beogradu, gde je 1981. godine magistrirao, a 1998 i doktorirao.

Njegov iscrpan rad, počinje 1970. godine u Arheološkom institutu, da bi već 1973. godine postao član arheološke ekipe Sirmijuma, gde je do kraja svog života radio, a u jednom period i kao rukovodilac arheoloških istraživanja. Za to vreme, smenjivale su se arheološke ekipe SAD-a, Nemačke, a pre svega Francuske, što je rezultiralo mnogobrojnim objavljenim radovima, preko kojih je Sirmijum upoznat sa svetskom, a naročito evropskom arheološkom javnošću. Sa preciznom predanošću, Miroslav Jeremić je beležio svaki detalj na lokalitetima, bilo da se radilo o opeci, kamenu, arhitektonskoj plastici, svemu onome što je karakterisalo arheološke sadržaje.

Pored Sirmijuma, dao je veliki doprinos na istraživanju sakralne arhitekture Caričinog grada, a učestvovao je i na više lokaliteta, među kojima su: Viminacijum, Salona, Medijana, Đerdap II – Pontes i Milutinovac, Balajnac i Krševica. Međutim, ipak se uvek na kraju vraćao “svom” Sirmijumu na kome je magistrirao, doktorirao i napisao svoje kapitalno delo “Sirmijum grad na void”, koje će biti objavljeno.

Ono, u čemu je zaista bio izuzetan, to je njegov jasan, razumljiv i vanserijski prezentovan crtež, lišen svake suvoparnosti, što se najbolje vidi u njegovim rekonstrukcijama Sirmijuma IV veka i Caričinog grada. Objavio je veliki broj naučnih radova, kako u domaćoj, tako i u stranoj arheološkoj literaturi, bilo da se radi o antičkim, rano-vizantijskim ili srednjovekovim gradovima na tlu Jugoslavije, a pre svega Srbije, isto tako učestvovao je na mnogobrojnim inostranim i domaćim kongresima i simpozijumima. Svoje usavršavanje je započeo na arheološkim iskopavanjima u Raveni, zatim na stažu u departmanu za antiku

u Muzeju Luvr u Parizu, učestvovao je kao član arheološke ekipe Francuske škole u Rimu, kao i na arheološkim iskopavanjima u Bolseni. Između ostalog, provodi izvesno vreme u Centru za antičku arhitekturu u Pou (južna Francuska), a u dva navrata boravi kao stipendista Francuske škole u Rimu. Zahvaljujući svemu tome, rezultiralo je nekoliko njegovih predavanja na Univerzitetu Sorbona u Parizu, koja su se ticala novih rezultata istraživanja o Sirmijumu i Saloni. Miroslav Jeremić je bio i član međunarodne asocijacije za kasnu antiku sa sedištem u Parizu.

Zbog izuzetnog doprinosa i dugogodišnje saradnje, francusko Ministarstvo Obrazovanja 2010 godine mu je uručilo Orden Viteza Akademske Palme za unapređivanje francusko-srpske arheološke saradnje.

Mišel, kako su ga od milja svi zvali, pridružio se onima koje je voleo i koji su njega voleli.

Milica Dapčević

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 appropriate 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).

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/ves-ti/09-07-17/akt_o_uredjivanju-casopisa.pdf

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 adequately 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 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 appropriate 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 recommendation 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 Latin alphabet, the abbreviation **et al.** is applied. The abbreviation **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

Classical 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, Поповић 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.

Поповић, И. 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 Improbable, 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>\[pristupljeno 5 juna 2005\]](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 Archaeology, 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, Magistrarska 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 abbreviated *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 pronunciation 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.

- Abbreviation *cf.* (lat. *confer*) - compare

- Abbreviation *e.g.* (lat. *exempli gratia*) - for ex-

ample

- Abbreviation *i.e.* (lat. *id est*) - actually.

12. All of the quoted references 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 article 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 (bilingual, 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 necessary.

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
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