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RIMSKE STAKLARSKE RADIONICE NA PODRUČJU HRVATSKOG DIJELA PROVINCIJE PANONIJE

UDK: 904:748(497.5)''652''

Izvorni znanstveni rad

U radu su obrađene i nanovo analizirane antičke peći iz Siska i Vinkovaca, za koje se pretpostavlja da su staklarske, odnosno da su se u rimskome razdoblju koristile za izradu staklenih posuda. S obzirom na to da te peći do sada nisu detaljno obrađene naša je namjera bila, na temelju dostupnih podataka, analizirati stanje i pokušati saznati nešto više o funkciji tih peći. U radu smo se osvrnuli i na pretpostavku o mogućnosti staklarske proizvodnje i na Štrbincima te općenito problemu dokazivanja rimskih staklarskih radionica i njihove proizvodnje na području hrvatskog dijela provincije Panonije.

Ključne riječi: staklarske radionice, staklarske peći, staklarski otpad, sekundarna proizvodnja, Sisak, Vinkovci, Panonija, Hrvatska

ROMAN GLASS WORKSHOPS IN THE CROATIAN PART OF THE PROVINCE OF PANNONIA

UDC: 904:748(497.5)''652''

Original scientific paper

This work contains an examination and renewed analysis of Roman kilns from Sisak and Vinkovci which are assumed to have been used to make glass vessels in the Roman period. Since these kilns have not been considered in detail previously, our intention is to analyze their status and attempt to learn something more of their function based on available data. We also consider hypothesis on the possibility of glass production at Štrbinci as well, and the general problem of proving the existence of Roman glass workshops and their output in the Croatian part of the province of Pannonia.

Key words: glass workshop, glass furnaces, glass waste, secondary production, Sisak, Vinkovci, Pannonia, Croatia

Pretpostavlja se da su na prostoru cijele Hrvatske do sada pronađene samo tri staklarske peći: u Saloni, Sisku i Vinkovcima. U Saloni je peć pronađena 70-ih godina prošlog stoljeća na području sjeverno od salonitanske kurije. Točnije, pronađen je spremnik za taljenje staklene mase koji se nalazio unutar peći, a na čijem dnu su zatečeni ostaci rastaljenog stakla. Također je pronađen i dio krovne opeke peći te veća količina staklenih ulomaka, kao i rastaljenih grumena stakla, grudice različitih oksida za bojenje, ostaci ugljena, i drugo. Smatra se da je peć bila u upotrebi od 1. do 4. st., s time da je prvotno služila za taljenje metala, a kasnije za proizvodnju staklenih predmeta. Ne zna se u kojem se razdoblju koristila kao staklarska peć.¹

Konteksti u kojima su pronađene sisačka i vinkovačka peć u potpunosti se razlikuje od onog salonitanskoga, ponajviše zbog toga što osim djelomično sačuvanih peći nikakvi drugi konkretni nalazi na temelju kojih bismo sa sigurnošću mogli utvrditi da je zaista riječ o staklarskima nisu uočeni.

Peć iz Siska

Godine 1998. prilikom zaštitnih arheoloških istraživanja u ulici Ante Starčevića 37 u Sisku pronađena su dva sloja rimske arhitekture, oba datirana u 1. st.² Mlađi sloj čine ostaci temelja dvaju zidova te dvije kružne konstrukcije. Zid koji se pružao u smjeru sjever-jug nalazio se između dviju kružnih konstrukcija, tako da se jedna od njih, ona manja, nalazila zapadno od zida, a druga, većih dimenzija, istočno od zida. Drugi zid pružao se u smjeru istok-zapad, dotičući manju kružnu konstrukciju s istočne strane (sl. 1 i 2).

Veća kružna konstrukcija smještena istočno od zida ostatak je zdenca za vodu, kao dijela radioničkog kompleksa. Bila je

¹ Clairmont 1975, 59; Buljević 1999, 20, 21.

² Lolić, Petrincec 2000, 42.

It is generally assumed that thus far only three glass furnaces have been found in the entire territory of today's Croatia: in Salona, Sisak and Vinkovci. A furnace was discovered in Salona in the area north of the Salona curia already in the 1970s. Specifically, a tank for glass melting, normally located inside the furnace, was discovered, and the remains of melted glass were found on its bottom. A part of the dome bricks of the furnace and a considerable quantity of glass fragments were found, as well as melted glass lumps, grains of various oxide dyes, charcoal remains, etc. The furnace is believed to have been in use from the first to fourth centuries, although it was initially used for smelting and only later to make glass objects. The period in which it was used as a glass furnace is not known.¹

The context in which the Sisak and Vinkovci kilns were found differ entirely from that in Salona, mostly because little other direct evidence was noted besides the remains of the kilns, which could serve as the basis for an unequivocal conclusion that these were truly glass furnaces.

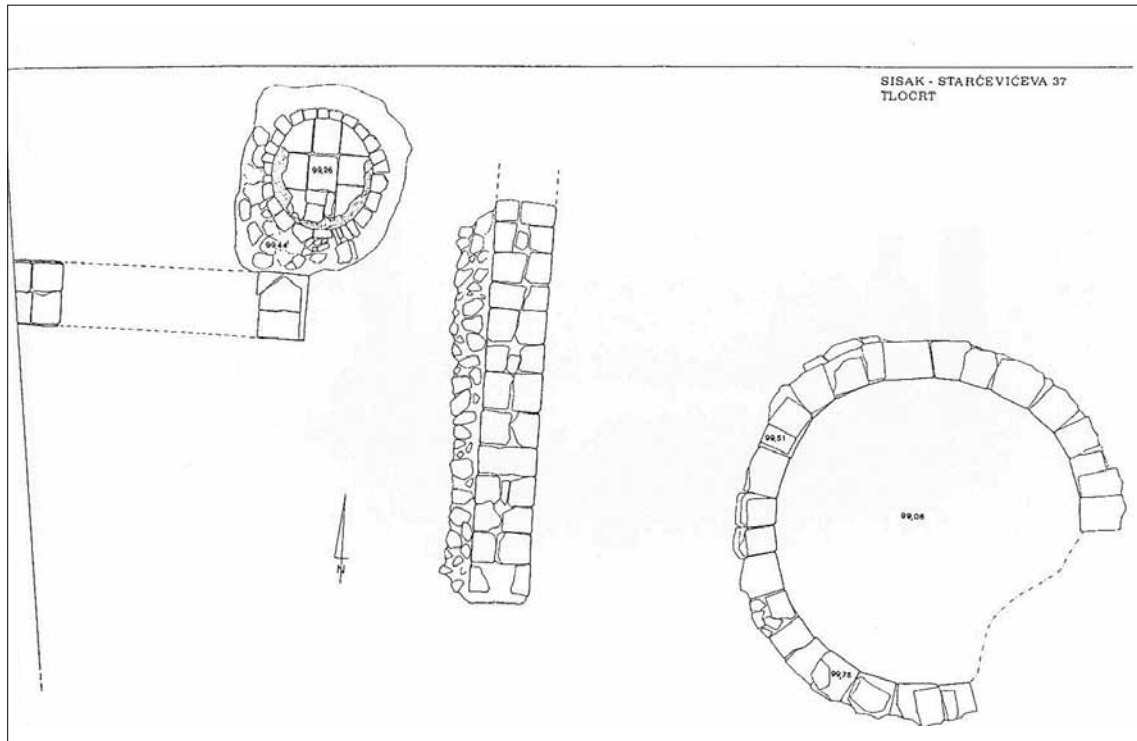
The furnace in Sisak

In 1998, during rescue archaeological excavation at the street address Ante Starčevića 37 in Sisak, two layers of Roman architecture were found, both dated to the first century.² The younger layer consists of the remains of foundations for two walls and two circular structures. The wall, extending in the north-south direction, was situated between the two circular structures, so that one of them, the smaller one, was west of the wall, while the other, with larger dimensions, was east of the wall. The other wall extended in an east-west direction, touching the smaller circular structure on its eastern side (Figs. 1 and 2).

The larger circular structure situated east of the wall is the remains of a water well, which

¹ Clairmont 1975, 59; Buljević 1999, 20, 21.

² Lolić, Petrincec 2000, 42.



Sl. / Fig. 1: Sisak, tlocrt ostataka arhitekture / Sisak, floor-plan of architectural remains (Vidošević 2003, 13)

promjera 2,60 m, a sačuvana u visini od 70 cm. Druga, manja kružna konstrukcija, smještena zapadno od zida, promjera je 85-90 cm, sagrađena od opeke s popločanim dnom također od opeke i prekrivenim slojem vapnene žbuke. Konstrukcija je bila zapunjena šutom u kojoj su pronađeni ulomci staklenih posuda i rastaljenog stakla. Upravo zbog tih nalaza pretpostavlja se da je riječ o staklarskoj peći.³ Uokolo peći pronađeni su ostaci popločenja od opeke. Sloj u kojemu su zatečeni peć, zdenac i zidovi datiran je u razdoblje oko sredine ili u 2. polovinu 1. st. te se smatra, na temelju nalaza keramike, da je arhitektura mogla biti u funkciji i u 2. st.

Za sisačku peć također ne možemo sa sigurnošću reći je li služila za izradu staklenih posuda ili ne. O lokalitetu se pisalo već nekoliko puta,⁴ međutim u tim se

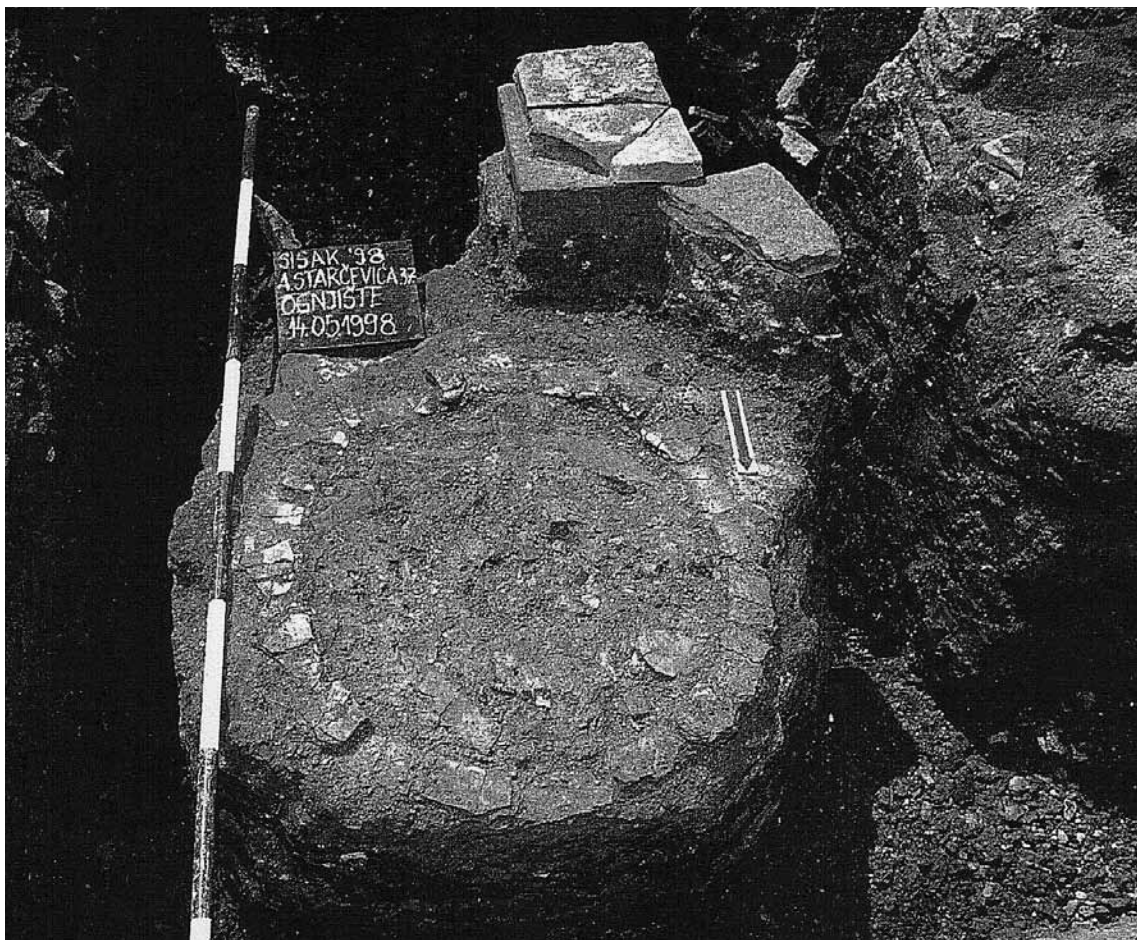
was part of the workshop complex. It was 2.6 m in diameter, and preserved to a height of 70 cm. The other, smaller circular structure, situated west of the wall, is 85-90 cm in diameter, made of brick with a brick lined floor that is covered by a layer of lime plaster. The structure was filled with construction debris, in which shards of glass vessels and melted glass were found. These finds in fact led to the assumption that this was a glass furnace.³ Remains of brick lining were found around the furnace. The layer in which the furnace, well and walls were found has been dated to the mid- or latter half of the first century, and based on the pottery finds, it is believed that the architecture may have been in use into the second century.

In the case of the Sisak furnace as well, it cannot be said with certainty whether or not it was used to make glass vessels. The site

³ Vidošević 2003, 12.

⁴ Burkowsky 2000, 42; Vidošević 2003, 12, 13.

³ Vidošević 2003, 12.



Sl. / Fig. 2: Fotografija peći iz Siska / Photograph of the furnace from Sisak (Burkowsky 1999, 67)

objavama spominje samo činjenica da je peć istražena te se određuje kao staklarska. Na jednome mjestu navodi se da su u peći pronađeni stakleni ulomci i polomljeno staklo,⁵ ali se nigdje ne spominje količina tog stakla, ili o ulomcima kakvih posuda je riječ, i slično. Stoga se može pretpostaviti da je najvjerojatnije riječ o izrazito maloj količini stakla. Nigdje se ne spominje je li općenito na lokalitetu zatečeno staklo, staklene posude ili nešto što bi se moglo povezati s proizvodnjom stakla.

⁵ Vidošević 2003, 12.

has already been written about several times.⁴ However, these texts only mention the fact that the structure was examined and that it was classified as a glass furnace. One such text mentions that glass shards and broken glass were found in the furnace,⁵ but the quantity of this glass is not specified, nor the type of vessels the shards belonged to nor any similar information. Therefore, it may be assumed that this was probably a very small quantity of glass. Nowhere is there any mention as to whether glass, glass vessels or something that may be associated with glass production were found at the site in general.

⁴ Burkowsky 2000, 42; Vidošević 2003, 12, 13.

⁵ Vidošević 2003, 12.

Po svome obliku, dimenzijama te materijalu od kojeg je sagrađena, sisačka peć odgovara općem izgledu (sl. 3a, b) rimskih staklarskih peći⁶, međutim to je da-

⁶ Dugo vremena jedini dokaz o izgledu rimskih staklarskih peći bili su prikazi na keramičkim svjetiljkama pronađenima u Aseriji, Ferrari i Spodnjim Škofijama u blizini Kopra (Abramić 1959; Baldoni 1987; Fadić 2004; Lazar 2003a, 227). Prikazi na svjetiljkama iz Ferrare i Slovenije identični su, te su najvjerojatnije izrađeni u istom kalupu, dok se prikaz na svjetiljci iz Aserije razlikuje u tome, što je na njoj ispisano ime ATHENIO. Na dobro očuvanom reljefu svjetiljke iz Slovenije nalazi se prikaz staklara koji sjedi ispred peći i puše u cijev. S druge strane peći prikazana je još jedna osoba, najvjerojatnije staklarev pomoćnik, koji promatra nešto što drži u svojoj ruci. Peć se sastoji od dva dijela: donji kružni dio, koji je služio kao ložište, te gornji četvrtasti s kupolom koji je služio za zagrijavanje stakla (Lazar 2003a, 230). Da su rimske staklarske peći zaista izgledale kao što je prikazano na svjetiljkama, potvrđeno je tek 2000. god., kada su u Lyonu pronađene dvije staklarske peći, od čega je jedna sačuvana u cijelosti, odnosno imala je sačuvan i gornji dio. Peć je podijeljena na dva dijela: donji kružni, koji je služio kao ložište, te gornji s kupolom, koji je najvjerojatnije služio za hlađenje posuda, budući da nikakvi stakleni otpaci nisu pronađeni (Foy, Nenna 2001, 48, 49). Peć je datirana u 1. st. pos. Kr. Većina pronađenih staklarskih peći imala je isti oblik kao i ova lyonska, a izrađivane su od opeka i tegula pomiješanih s glinom. Na lokalitetima je većinom pronađeno više peći na jednom mjestu, međutim ne zna se kako je radionica funkcionirala. Peći su bile relativno malih dimenzija, 45-65 cm, a svaka je imala samo jedan otvor, što bi značilo da je samo jedan staklar mogao raditi na njoj. Više peći na jednom mjestu vjerojatno je bilo potrebno zato da bi više staklara moglo izrađivati predmete istovremeno, odnosno da bi proizvodnja bila brža. Problem dinamike proizvodnje rimskih staklarskih peći bio je u tome što je svaka peć imala samo jedan otvor, stoga je samo jedan staklar mogao raditi na njoj. Međutim, u kasnijem rimskom razdoblju postojali su i drugačiji oblici rimskih staklarskih peći. Na području Hambacher Forsta, 35 km zapadno od Kelna, pronađeno je šest radioničkih centara u kojima su zabilježena četiri različita tipa peći: kružne ili ovalne, polukružne, kvadratne do pravokutne i pravokutne. Ne zna se je li oblik pojedine peći podrazumijevao i određenu fazu proizvodnje. Peći su najvjerojatnije u upotrebi bile tijekom 2. polovine 4. st. (Wedepohl, Gaitzsch, Follmann Schulz 2003, 56).

In terms of its form, dimensions and the materials from which it is made, the Sisak furnace corresponds to the general appearance (Fig. 3a, b) of Roman glass furnaces,⁶

⁶ For the longest time, the sole evidence for the appearance of Roman glass furnaces were depictions on the ceramic lamps found in Asseria, Ferrara and Spodnje Škofije near Kopar (Abramić 1959; Baldoni 1987; Fadić 2004; Lazar 2003a, 227). The depictions on the lamps from Ferrara and Slovenia are identical, and they were probably made in the same cast, while the depiction on the lamp from Asseria differs in that the name ATHENIO is written on it. The well-preserved relief lamp from Slovenia features an image of a glassblower sitting in front of a furnace blowing into a tube. Another person is shown on the other side of the furnace, mostly likely the glassblower's apprentice, who is observing something held in his hand. The furnace consist of two parts: the lower circular section, which served as the combustion chamber, and an upper section with a dome which served to work with the glass (Lazar 2003a, 230). That Roman glass furnaces truly appeared as shown on the lamps was only confirmed in 2000, when two glass furnaces were discovered in Lyon, of which one was preserved in its entirety, i.e., its upper section was also preserved. The furnace is divided into two sections: the lower circular section, which served as the combustion chamber, and an upper section with a dome, which was probably used to anneal vessels, since no glass discards were found (Foy, Nenna 2001, 48, 49). The furnace was dated to the first century AD. Most glass furnaces found have the same shape as the one in Lyon, and they are made of brick and tegulae mixed with clay. In most cases, several furnaces were found at a single site, although there is no knowledge as to how the workshops functioned. The furnaces had relatively modest dimensions, 45-65 cm, and each had only one opening, which would mean that only one glassmaker could work at one. Several furnaces in a single location were probably necessary so that more glassmakers could make objects at the same time, i.e., so that production would proceed more rapidly. The problem of the production tempo of Roman glass furnaces lay in the fact that each furnace had only a single opening, so only one glassmaker could work at it at one time. However, in the later Roman period, the glass furnaces had different shapes. In the area of Hambacher Forst, 35 km, west of Cologne, six workshop centres were found in which four different types of furnaces were recorded: circular or oval, semi-circular, square to rectangular and rectangular. Whether or not the shape of individual furnaces also implied a certain production phase is not known. The furnaces were probably used during the latter half of the fourth century (Wedepohl, Gaitzsch, Follmann Schulz 2003, 56).

leko od sigurnog dokaza za njeno određenje. Nisu, naime, pronađeni stakleni otpaci, alatke, ostaci posuda za taljenje i slično, odnosno elementi na temelju kojih bismo mogli pouzdano ustanoviti namjenu tog objekta. Ako je ipak riječ o staklarskoj peći, onda je sačuvan samo njezin donji dio, koji je vjerojatno služio za taljenje stakla. Ložište nije sačuvano, kao niti gornji kupolasti dio. S obzirom na kontekst u kojemu je peć pronađena, odnosno na postojanje zidova uokolo te na zdenac u neposrednoj blizini, mogli bismo pretpostaviti da je riječ o radioničkom kompleksu. Međutim, pitanje njegove naravi, odnosno proizvodnje koja se ondje odvijala, i dalje ostaje otvoreno.

Vrlo je vjerojatno da je Sisak imao aktivnu staklarsku proizvodnju, samo je pitanje otkada. Opisana peć datirana je na temelju novca, koji je pronađen u njezinoj neposrednoj blizini, u 1. st., a kao što smo već spomenule, moguće da je bila aktivna i u 2. st. Aktivnost lokalnih panonskih radionica smješta se u kasno rimsko razdoblje,⁷ međutim Sisak je već u vrijeme cara Vespazijana dobio status kolonije (*Colonia Flavia Siscia*), dok je za vrijeme cara Dioklecijana bio sjedište Panonije Savije.⁸ Također, kroz čitavo rimsko razdoblje imao je i važnu prometnu ulogu.⁹ Ne bi smjelo biti dvojbe o tome da su staklarske radionice u Sisku postojale i prije 3. ili 4. stoljeća. S jedne strane, u prilog tome ide i velika količina stakla, cjelovitih posuda i ulomaka, te nekoliko većih ulomaka sirovog stakla do sada pronađenih iz ranijeg rimskog razdoblja, što je

although this is far from certain evidence for its classification. This is because none of the following were found: glass waste, tools, remains of crucibles and similar accessories, i.e., elements which would allow the certain determination of the purpose of this structure. Even if this is a glassmaking furnace, then only part of it has been preserved – the part used for glass melting. The combustion chamber has not been preserved, nor the upper domed portion. Given the context in which the kiln was found, i.e., the existence of walls around it and the well in its immediate vicinity, it is safe to assume that this was a workshop complex. However, the question of its nature, meaning the type of production that proceeded there, remains open.

It is very likely that glass production existed in Sisak, the only question is from which period of time. The above-described furnace was dated on the basis of coins found in its immediate vicinity to the first century, and as we have already mentioned, it is possible that it was also active in the second century as well. The activity of the local Pannonian workshops has been assumed for the late Roman period,⁷ although Sisak had already acquired colonial status (*Colonia Flavia Siscia*) during the reign of Emperor Vespasian, while during the reign of Emperor Diocletian it was the seat of Pannonia Savia.⁸ Additionally, throughout the Roman era it played an important transit role.⁹ There should be no doubt that glass workshops existed in Sisak even prior to the third and fourth centuries. On the one hand, this is additionally confirmed by the high quantity of glass, complete glass vessels and shards, and several larger

⁷ Šaranović Svetek 1986, 53; Gregl 1997, 72; Košćević 2003, 92.

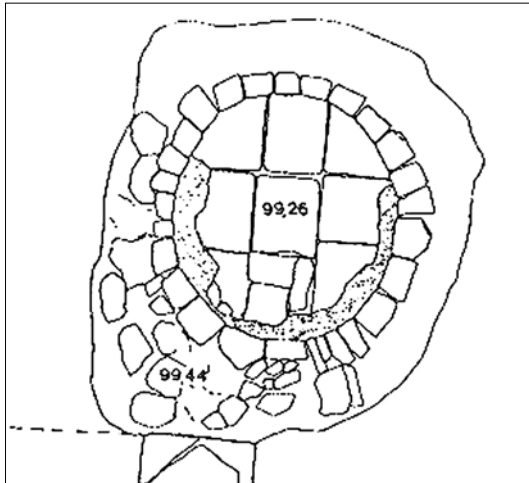
⁸ Šašel 1974, 702; Burkowsky 1999, 30; Lolić 2003, 131; Wiewegh 2003.

⁹ U Sisku su se odvajale dvije glavne ceste: prva je prolazila kroz Andautoniju do Poetovija, druga je išla dijagonalno preko graničnog područja sa Savom, prolazila kroz Cibale, i spojila se na glavnu cestu za Sirmij (Soproni 1980, 211).

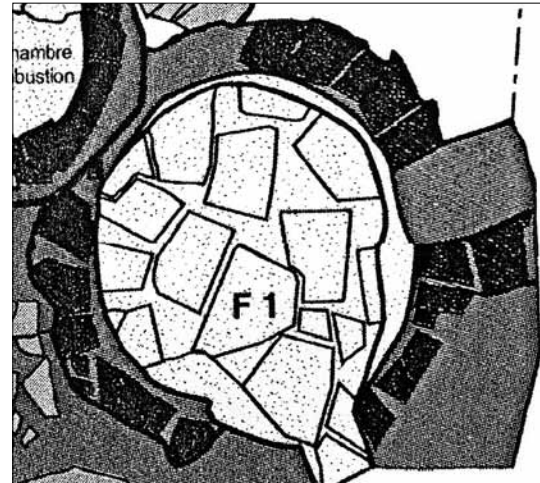
⁷ Šaranović Svetek 1986, 53; Gregl 1997, 72; Košćević 2003, 92.

⁸ Šašel 1974, 702; Burkowsky 1999, 30; Lolić 2003, 131; Wiewegh 2003.

⁹ Two main roads branched off from Sisak: the first passed through Andautonia to Poetovio, while the other ran diagonally across the border zone with the Sava River and passed through Cibalae, and intersected with the main road for Sirmium (Soproni 1980, 211).



Sl. / Fig. 3a: Peć, Sisak / Furnace, Sisak (Vidošević 2003, 13)



Sl. / Fig. 3b: Staklarska peć, Lyon / Glass furnace, Lyon (Foy, Nenna 2001, 48)

iznimka. Naime, većina stakla iz Panonije datirana je u kasnije razdoblje. Međutim, tipološki gledano staklene posude iz Siska tipični su primjerci ranorimskog staklenog posuđa rasprostranjenog diljem Carstva i za sada niti struktura stakla¹⁰, kvaliteta izrade niti tipologija ili neki drugi elementi ne upućuju na panonsku proizvodnju.

¹⁰ Ako usporedimo posude iz Siska s kasnoantičkim, npr. iz Vinkovaca ili Štrbinaca, jasno je vidljiva razlika u kvaliteti stakla izradi. Naime, na stijenkama posuda iz Siska, koje su ranorimske, mjehurića te vertikalnih linija kao posljedica irizacije, gotovo nema ili su slabije vidljivi, a posude su većinom svijetloplave ili svijetlozelene boje, te pravilnije oblikovane. Mjehurići su posljedica plina u staklenoj smjesi, koji kod dovoljno visoke temperature prilikom obrade stakla isplivaju na površinu; posude puhane iz takve čiste smjese nemaju mjehurića. U lokalnim, naročito kasnoantičkim radionicama, staklari nisu vodili računa o tome i u smjesi su ostali mjehurići koji su vidljivi i na staklenim proizvodima (Henderson 2001, 30; Lazar 2003, 224-227). Za razliku od sisačkih, kod kasnoantičkih posuda prisutni su svi nabrojani elementi, a posude su većinom tamnozeleno boje, što upućuje i na recikliranje stakla i, vjerojatno, panonsku proizvodnju.

pieces of raw glass thus far found from the early Imperial period, which is an exception. Namely, the bulk of the glass material from Pannonia is dated to the late Roman period. However, from the typological standpoint, the glass vessels from Sisak are typical examples of early Roman glass vessels widespread throughout the Empire and thus far neither the structure of the glass,¹⁰ the quality of its rendering nor the typology or other elements point to local Pannonian production.

¹⁰ If the vessels from Sisak are compared to those from Late Roman period, such as, for example, those from Vinkovci or Štrbinci, the differences in the quality of the glass and its forming are clearly visible. The walls of the vessels from Sisak, which are early Roman, contain almost no bubbles and vertical lines resulting from irisation, or they are hardly visible, and the vessels are mostly light blue or light green, with more standard formation. Tiny bubbles result from gases in the glass admixture, which surface when temperature is high enough during glass melting; vessels blown from such a fine raw glass have no bubbles. In local and, particularly, Late Roman workshops, glassworkers did not take this into account and bubbles remained in the glass which were then visible on the glass products (Henderson 2001, 30; Lazar 2003, 224-227). As opposed to the Sisak vessels, the Late Roman vessels all feature these elements, and the vessels are mostly dark green, which indicates the recycling of glass and, probably, local Pannonian production.

Peć iz Vinkovaca

Prilikom zaštitnih arheoloških istraživanja, 2008. god. u Ulici bana Josipa Jelačića 11 u Vinkovcima, pronađeni su ostaci rimske peći, a s obzirom na to da je u peći pronađeno rastaljeno staklo, istraživači su zaključili da je riječ o staklarskoj peći.¹¹ Peć je bila ukopana u predzdravični sloj, stoga kada je skinuta njezina konstrukcija ostao je dobro vidljiv negativ dimenzija 2,80x0,70 m. S obzirom na to da je recentni ukop oštetio peć po dužini, sačuvano je samo pola donjeg dijela, dimenzija 2,36x0,68 m. Donji dio je pravokutnog oblika i sastoji se od dva zasebna, najvjerojatnije kvadratna dijela sagrađena od opeke, dimenzija 1,28x0,68 m te 1,08x0,40 m. S obzirom na lošu sačuvanost tih ostataka, nije moguće sa sigurnošću ustanoviti namjenu komora. Na temelju analogija s drugim pećima, možemo samo pretpostaviti da je jedan dio vjerojatno služio za taljenje staklene smjese, budući da je dio rastaljene smjese i sačuvan, dok je drugi dio vjerojatno služio za hlađenje gotovih posuda ili također za taljenje stakla. Ložište nije sačuvano, kao ni gornji dio peći, za koji možemo samo pretpostaviti da je također bio pravokutnog oblika s kupolom. Na temelju novca Konstancija II., pronađenog ispod sloja pepela, peć je datirana u razdoblje 1. pol. i sredinu 4. st.¹² Uz samu peć zatečen je i ostatak urušenja od rimskih opeka, za koji bismo mogli pretpostaviti da je urušenje gornjeg kupolastog dijela peći, ili eventualno ostatak neke arhitekture koja ju je okruživala. S druge strane, moguće da to urušenje uopće nije povezano s ostatkom peći.

Do sada je poznato tek nekoliko staklarskih peći pravokutnog oblika. U Srijemskoj Mitrovici (*Sirmium*) pronađene su tri pravokutne peći: jedna je imala sačuvano pravokutno ložište, druga se sastojala od

¹¹ Vulić 2009, 100; Rapan Papeša 2009.

¹² Vulić 2009, 100.

The furnace from Vinkovci

During rescue archaeological research in Vinkovci in 2008 at the street address Bana Josipa Jelačića 11, the remains of a Roman oven were found, and since melted glass was found inside it, researchers concluded that this was a glass furnace.¹¹ The furnace was dug in a layer immediately above sterile soil, so when its structure was removed, its impression with dimensions of 2.8 x 0.7 m was clearly visible. Since the recent dig damaged the kiln down its length, only half of the lower section was preserved, with dimensions of 2.36 x 0.68 m. The lower part is rectangular and consists of two separate, probably square sections made of brick, with dimensions of 1.28 x 0.68 m and 1.08 x 0.4 m. Given the poor condition of these remains, it is impossible to ascertain the purpose of the chamber with any certainty. Based on the analogies with other furnaces, it may only be assumed that one part was probably used to melt glass, since some of this melted glass has been preserved, while the other section was probably used to anneal finished vessels or also to melt glass. The combustion chamber has not been preserved, nor has the furnace's upper section, which may only be assumed to have had a rectangular shape with a dome. Based on the coins of Constantius II, found below a layer of ash, the furnace has been dated to the first half of the fourth century.¹² A ruin consisting of Roman bricks was found next to the furnace itself, and this may be assumed to have been the remains of the dome section of the furnace, or possibly the remains of some architectural element that surrounded it. On the other hand, it is possible that this debris is entirely unconnected to the remains of the furnace.

Thus far, only a few rectangular glass furnaces are known. Three rectangular furnaces were discovered in Srijemska Mitrovica (*Sirmium*): one had a preserved rectangular com-

¹¹ Vulić 2009, 100; Rapan Papeša 2009.

¹² Vulić 2009, 100.

dva dijela,¹³ jednog pravokutnog a drugog kvadratnog, dok je treća bila pravokutnog oblika.¹⁴

U ostacima radioničkog kompleksa rimske kolonije Auguste Raurice¹⁵ pronađene su također tri pravokutne peći, za koje se pretpostavlja da nisu služile za taljenje stakla, već za hlađenje gotovih posuda.¹⁶ Pravokutne peći pronađene su i na lokalitetu Hambacher Forst u Njemačkoj¹⁷.

¹³ Milošević 1976, 102-108; Ružić 1994, 63.

¹⁴ Peć 1 dosta je udaljena od peći 2 i 3 pa se smatra da su postojale dvije radionice u različitim vremenskim razdobljima. Nije poznato zbog čega je prva radionica prestala s proizvodnjom, moguće zbog požara, dok se proizvodnja u druge dvije radionice datira u razdoblje 4. do sredine 5. st. Također nije sigurno jesu li radionice proizvele staklene predmete ili su se bavile pretapanjem stakla polomljenih posuda, s obzirom na to da nisu nađeni kalupi niti staklarske alatke (Ružić 1994, 66).

¹⁵ U regiji Äussere Reben, u naselju Kaiseraugst u Švicarskoj, odnosno području donjeg grada nekadašnje rimske kolonije Auguste Raurice, pronađena su dva staklarska centra. Jedan je imao 14 peći, koje su bile u upotrebi u razdoblju od približno 130. do 160. god., a drugi samo jednu koja se koristila u prvoj četvrtini 3. st. (Fischer 2009, 137). Peći se prema obliku i namjeni mogu podijeliti u tri tipa: kružne, koje su se koristile za taljenje sirovog i reciklažnog stakla, pravokutne koje su se koristile za hlađenje gotovih proizvoda te pravokutne peći sa spremnicima čija se funkcija ne može sa sigurnošću odrediti (Fischer 2009, 137).

¹⁶ Fischer 2009, 137.

¹⁷ Na području Hambacher Forsta, 35 km zapadno od Kelna, pronađeno je šest radioničkih centara u kojima su zabilježena četiri različita tipa peći: kružne ili ovalne, polukružne, kvadratne do pravokutne i pravokutne. Ne zna se je li oblik pojedine peći podrazumijevao i određenu fazu proizvodnje. Peći su najvjerojatnije u upotrebi bile tijekom 2. pol. 4. st. (Wedepohl, Gaitzsch, Follmann Schulz 2003, 56; Seibel 2000). Jedan od ovih šest radioničkih centara u Hambacher Forstu služio je za primarnu proizvodnju stakla, odnosno sirovog stakla, što potvrđuje pronađena peć, zapravo spremnik, dimenzija 1,7x1,1 m. Smatra se da se je u peći mogao proizvesti blok sirovog stakla težine 1,1 tone, otprilike svakih dvadesetak dana (Wedepohl, Gaitzsch, Follmann Schulz 2003, 60).

bustion chamber, the other consisted of two parts,¹³ one rectangular and the other square, and the third was rectangular.¹⁴

Three rectangular furnaces were also found in the remains of the workshop complex of the Roman colony of Augusta Raurica,¹⁵ and it is believed that they were not used to melt glass, but rather to anneal finished products.¹⁶ Rectangular furnaces were also found at the Hambacher Forst site in Germany.¹⁷ It is diffi-

¹³ Milošević 1976, 102-108; Ružić 1994, 63.

¹⁴ Furnace 1 is rather far from furnaces 2 and 3, so it is believed that there were two workshops that operated in different periods. Why the first workshop ceased production is not known (a fire is possible), while production in the other two workshops has been dated to the period spanning the fourth to mid-fifth centuries. It is also uncertain as to whether the workshops produced glass objects or melted the recycled glass, given that no moulds nor glassmaking tools were found (Ružić 1994, 66).

¹⁵ Two glass production centres were found in the Äussere Reben region, in the village of Kaiseraugst in Switzerland, i.e., the territory of the lower town of the former Roman colony of Augusta Raurica. One had 14 furnaces, which were used during the period from roughly 130 to 160 AD, while the other had only a single furnace that was used in the first quarter of the third century (Fischer 2009, 137). The furnaces may be divided into three types based on their form: circular, which were used to melt raw and recycled glass, rectangular, which were used to anneal finished products, and rectangular furnaces with chambers whose function cannot be ascertained (Fischer 2009, 137).

¹⁶ Fischer 2009, 137.

¹⁷ At the Hambacher Forst area, 35 km west of Cologne, six workshop centres were discovered in which four different furnace types were recorded: circular or oval, semi-circular, square to rectangular and rectangular. Whether or not the shape of individual furnaces also implied a certain production phase is not known. The furnaces were probably used during the latter half of the fourth century (Wedepohl, Gaitzsch, Follmann Schulz 2003, 56; Seibel 2000). One of these six workshop centres in Hambacher Forst was used for primary glass production, i.e., to make raw glass, which is confirmed by the furnace discovered, actually a tank furnace, with dimensions of 1.7 x 1.1 m. It is believed that a block of raw glass weighing 1.1 ton could be produced in the furnace roughly every ten days (Wedepohl, Gaitzsch, Follmann Schulz 2003, 60).



Sl. / Fig. 4a: Ostaci staklarske peći iz Vinkovaca / Remains of glass furnace from Vinkovci (fototeka Gradskog muzeja Vinkovci / photothèque of the Vinkovci Town Museum)



Sl. / Fig. 4b: Rastaljeno staklo u peći / Melted glass in a furnace (fototeka Gradskog muzeja Vinkovci / photothèque of the Vinkovci Town Museum)

Teško je reći je li se i vinkovačka peć koristila za hlađenje gotovih posuda, budući da je ona bila jedina takva konstrukcija na lokalitetu, odnosno da u njezinoj blizini nije pronađena druga peć koja se eventualno mogla koristiti za izradu posuda.

Postoje dva tipa rimskih peći:¹⁸ 1. s keramičkim posudama za taljenje stakla (sl. 5a); 2. sa spremnicima za taljenje stakla (sl. 5b).¹⁹

Zanimljivo je da na cijelome lokalitetu u Vinkovcima, pa tako ni u peći ili njezinoj blizini, nije pronađena ni jedna staklena posuda ili bilo kakvi stakleni ulomci. Također nije uočen nikakav stakleni otpad, sirovine ili alatke za proizvodnju stakla, kao ni ostaci keramičkih posuda u kojima se staklo talilo. S obzirom na to, moguće da se radi o peći koja je imala spremnik za taljenje od opeke, kao ona u Saloni.

Na lokalitetu (sl. 6) nisu zatečeni nikakvi drugi nalazi, primjerice ostaci arhitekture, keramika ili neki drugi pokretni nalazi, koji bi potvrdili pretpostavku o namjeni te konstrukcije. Stoga je na temelju samih istraženih ostataka peći, bez ikakvih drugih elemenata, nemoguće govoriti o točnom vremenu kada je ona bila u upotrebi

to say whether the Vinkovci furnace was used as an annealing oven, since it was the only such structure at the site and no other furnaces that could have been used to make vessels were found in its vicinity.

There are two types of Roman furnaces:¹⁸ 1. with crucibles for melting glass (Fig. 5a); 2. with tanks for melting glass (Fig. 5b).¹⁹

It is interesting that not a single glass vessel or any type of glass shards or fragments were found anywhere at the site in Vinkovci, neither in the furnace nor in its vicinity. Similarly, no glass waste, raw materials nor glass-making tools were observed, nor any remains of the crucibles in which glass was melted. Given these factors, it is possible that this was a furnace that had a melting tank made of brick, like the one in Salona.

No other finds were discovered at the site (Fig. 6), such as, for example, remains of architecture, pottery or some other small finds that would confirm the hypothesis on the purpose of this structure. Thus, based on the actual examined remains of the furnace, without any other elements, it is impossible to speak of any precise time when it was in use and what exactly its function was. What can

¹⁸ Charleston 1978, 11.

¹⁹ Rekonstrukcije rimskih staklarskih peći preuzete su s internet stranice <http://www.romanglassmakers.co.uk/> (25.8.2013.).

¹⁸ Charleston 1978, 11.

¹⁹ The reconstructions of Roman glass furnaces were taken from the web-site <http://www.romanglassmakers.co.uk/> (25.8.2013.).



Sl. / Fig. 5a: Peć s posudama / Furnace with crucibles (<http://www.romanglassmakers.co.uk/>) (25.8.2013.)



Sl. / Fig. 5b: Peć sa spremnikom za staklo / Furnace with chamber for glass (<http://www.romanglassmakers.co.uk/>) (25.8.2013.)

te čemu je točno služila. Ono što sa sigurnošću možemo reći jest to da je staklarska radionica u Cibalama u razdoblju kasne antike mogla biti aktivna, što potvrđuje i pronalazak staklenih posuda datiranih u 4. st. Naime, svi elementi poput kvalitete stakla i tehnike izrade, oblici posuda, njihova boja te analogije s istim ili sličnim posudama, ali i nedostatak analogija za pojedine oblike u drugim provincijama, upućuju na domaću proizvodnju. Je li radionica bila smještena upravo na ovome području gdje je pronađena peć, teško je reći, kao i to je li postojala samo jedna ili ih je bilo više. Arheološki dokazi za sada su nedovoljni za potvrdu pretpostavke o staklarskoj peći u Cibalama.

Peć je pronađena na lokalitetu koji je u rimsko doba pripadao rubnome dijelu grada, što i odgovara smještaju staklarskih radionica. Zbog mogućnosti požara, sve rimske staklarske radionice u zapadnom dijelu Carstva bile su smještene na rubnim dijelovima grada. Međutim, tako nije bilo i na istočnom Mediteranu, gdje radionice nisu nužno bile smještene izvan gradova, što potvrđuje i pronalazak bizantske radionice u središtu Bet She'ana.²⁰

²⁰ Stern 1999, 458.

be concluded with certainty is that a glass workshop in Cibalae in Late Roman period may have been active, which is confirmed by the discovery of glass vessels dated to the fourth century. This is because all elements, such as the quality of the glass and glass-working skills, the vessel forms, their colour and analogies with the same or similar vessels, as well as the absence of analogies for individual forms in other provinces, point to local production. Whether the workshop was located in precisely this area where the furnace was discovered is difficult to say, just as it is similarly difficult to state whether there was only one or several. Thus far, the archaeological evidence is insufficient for any confirmation of the hypothesis of a glass-making workshop in Cibalae.

The furnace was discovered at a site which was in the periphery of the town during the Roman era, which corresponds to the customary location of glass workshops. Due to the possibility of fires, Roman glass workshops in the western half of the Empire were situated at the peripheries of cities. However, this was not the case in the eastern Mediterranean, where workshops were not necessarily situated outside of cities, which is confirmed by the discovery of Byzantine workshops in the centre of Bet She'an.²⁰

²⁰ Stern 1999, 458.

Štrbinci

B. Migotti²¹ pretpostavila je aktivnost staklarske radionice i na Štrbincima, na temelju nalaza poput ostataka staklaste smjese u jednoj od lončarskih peći, veće količine narukvica od crnog stakla te nekolicine prstenova i umetaka od plavog stakla srodnih privjescima iz Arheološkog muzeja u Splitu, međutim znatno lošije kvalitete, na temelju čega i jest pretpostavljena njihova lokalna proizvodnja.²² Također su pronađeni manji komadi staklene troske, te komadić kremen²³ uz smrvljene staklene posude u grobu, za koji B. Migotti²⁴ smatra da ako je zaista stavljen kao prilog, mogao bi izravno i simbolički upućivati na izradu staklenih predmeta na Štrbincima. Nažalost, staklarska peć na Štrbincima za sada nije pronađena budući da naselje nije istraživano osim nekropole. Ostaci staklastog sloja u lončarskoj peći ne mogu biti dokaz o tome da su se u toj peći izrađivale staklene posude zbog toga što staklasti sloj nastaje fuzijom silicija na keramici ili zidu peći. Također, za sada nikakve analize staklenih posuda nisu izrađene, stoga, iako kremen jest sastojak rimskog stakla, ali ne uvijek osnovni,²⁵ ne znamo je li bio osnovni sastojak sirovog stakla od kojeg su štrbinačke posude izrađene ili nije. Međutim, na lokalitetu je pronađen zaista velik broj staklenih predmeta, koji količinski nadilaze sve ostale nalaze. Od posuda dominiraju stožaste čaše, kao tipičan kasnoantički oblik posude, te ovalni vrčevi i kuglaste boce. Različiti elementi, poput lošije kvalitete izrade, odnosno asimetričnosti navedenih posuda ili lošeg oblikovanja pojedinih dijelova, zatim lošije kvalitete stakla, odnosno vidljivih

²¹ Migotti 1998, 100.

²² Migotti 1998a, 14; Migotti 2000.

²³ Kremen pijesak jedan je od sastojaka sirovog stakla.

²⁴ Migotti 2009, 164.

²⁵ Henderson 2000, 25.

Štrbinci

B. Migotti²¹ assumed that a glass workshop was also active in Štrbinci, based on finds such as remains of molten glass in one of the pottery kilns, considerable quantities of bracelets made of so-called black glass and several rings and inserts made of blue glass similar to the pendants from the Archaeological Museum in Split, albeit of lower quality, which is precisely why it is believed they were locally produced.²² Small quantities of glass slag and a piece of flint were also found²³ together with intentionally crushed glass vessels in a grave, which Migotti²⁴ believed, insofar as it was truly deposited as goods, may directly and symbolically indicate the production of glass objects in Štrbinci. Unfortunately, a glass-making furnace has not yet been discovered at Štrbinci, since other than the necropolis the settlement has not been researched. The remains of a glass slag in the pottery kiln cannot serve as evidence that glass vessels were made in it, because glass slag is formed by the fusion of silicon on ceramic or the wall of the kiln. Also, so far no analyses of the glass vessels have been made, so even though quartz is a constituent (albeit not always basic) of Roman glass,²⁵ there is no way of knowing whether it was a basic constituent of the raw glass from which the Štrbinci vessels were made. However, a truly high quantity of glass items were found at the site, a quantity that surpasses that of all other finds. Conical beakers, as a typical Late Roman vessel form, as well as oval jugs and cylindrical bottles, dominate among the vessels. Various elements, such as the lower quality of glass workmanship, i.e., the asymmetry of these vessels or the poorer formation of individual parts, and then the poor quality of glass, i.e., the visible bubbles and

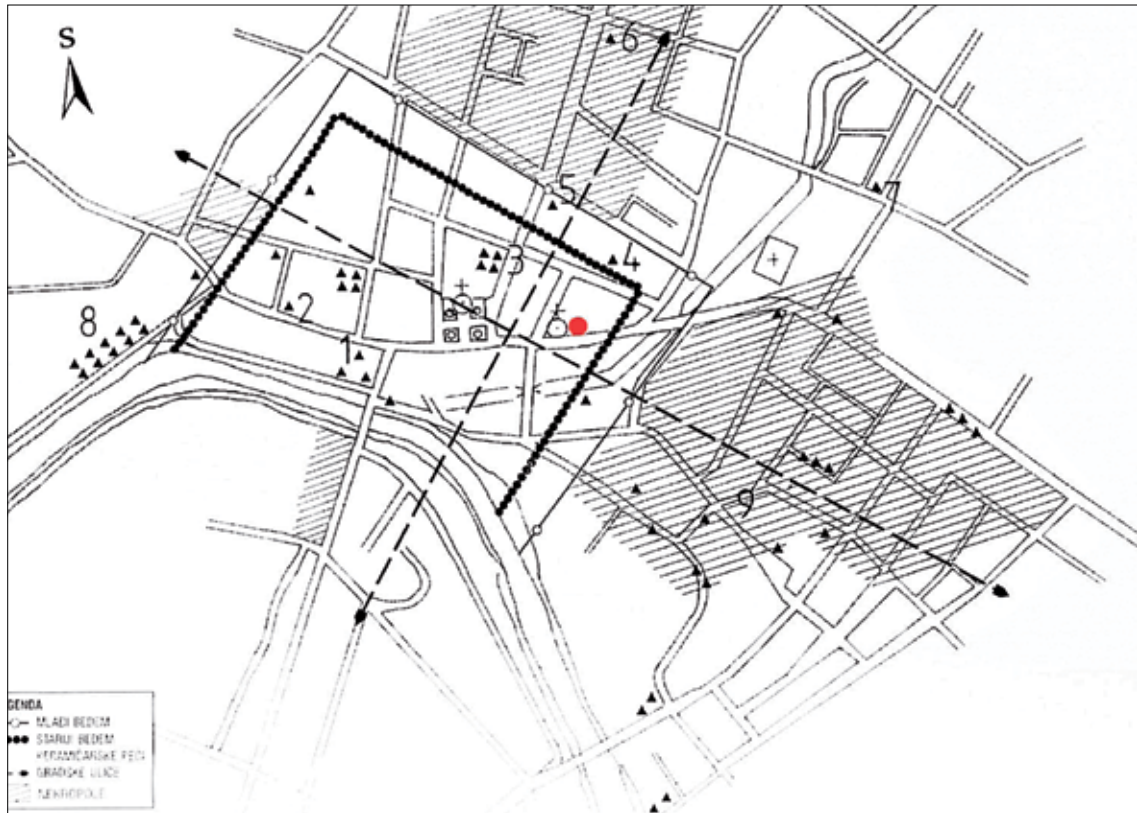
²¹ Migotti 1998, 100.

²² Migotti 1998a, 14; Migotti 2000.

²³ Quartz sand is one of the components of raw glass.

²⁴ Migotti 2009, 164.

²⁵ Henderson 2000, 25.



Sl. / Fig. 6: Karta Cibala s položajem lokaliteta na kojemu je pronađena peć / Map of Cibalae with location of the site at which the furnace was found (Iskra Janošić 2001, 112)

mjhurića i vertikalnih linija na stijenka-
ma, boja (različite nijanse zelene), oblik
i datacija, ponajviše u razdoblje 4. st.,
upućuju na južnopanonsku proizvodnju.
U prilog tome ide i činjenica da je riječ
o uobičajenim stolnim posudama i svjet-
ljkama za svakodnevnu upotrebu, ali i
analogije s istim ili sličnim posudama te
nedostatak analogija za pojedine oblike
što također upućuje na južnopanonsku
proizvodnju. Stoga, upravo zbog nave-
denih činjenica, nikako ne možemo sa si-
gurnošću isključiti mogućnost staklarske
proizvodnje i na Štrbincima, što bi ujedno
značilo da su se na Štrbincima u razdo-
blju 4. i prve pol. 5. st., jer to je razdo-
blje u koje je većina materijala datirana,
proizvodile i staklene posude, ali i nakitni
predmeti. Međutim, za sada još uvijek ne
možemo sa sigurnošću tvrditi da su ove
posude zaista proizvod južnopanonskih
radionica smještenih na području današ-

vertical lines on the walls, colour (various
shades of green), form and dating, most in the
fourth century, indicate local southern Pan-
nonian production. This conclusion is based
on the fact that these are examples of ordi-
nary tableware and lamps for everyday use,
as well as comparisons with similar vessels
and a lack of analogies for individual forms,
which also points to southern Pannonian pro-
duction. Thus, due precisely to these facts,
we certainly cannot discount the possibility
of glass production at Štrbinci as well, which
would also mean that glass vessels, as well as
glass jewellery, were produced in Štrbinci in
the fourth and first half of the fifth centuries,
because this is the period to which most of
the materials were dated. However, for now
it is still impossible to state with certainty
that these vessels were truly the product of
southern Pannonian workshops in the territo-
ry of today's northern Croatia, because such
workshops have not yet been archeologically

nje sjeverne Hrvatske, zato što te radionice još uvijek nisu arheološki dokazane. Nedostaje još dosta konkretnih arheoloških dokaza na temelju kojih bismo te pretpostavke mogli potvrditi.

Ne zna se kada su s radom započele radionice u hrvatskom dijelu nekadašnje provincije Panonije. Da bismo mogli potvrditi da su pronađene peći iz Siska i Vinkovaca zaista staklarske, nedostaju najvažniji arheološki dokazi (posude za taljenje, stakleni otpaci, alatke i slično). S obzirom na to da stakleni materijal sjeverne Hrvatske u većem dijelu nije objavljen, nije poznato u kojem opsegu je postojala trgovina između pojedinih gradova. Prilikom obrade posuda s područja sjeverne Hrvatske, pronašli smo određenu, ali malu, količinu istih ili sličnih posuda na različitim lokalitetima, ili u neposrednoj blizini. Npr. analogija za jedan balzamarij²⁶ pronađena je u Muzeju Slavonije u Osijeku.²⁷ Svi elementi: oblik posude, loša kvaliteta stakla, loša kvaliteta izrade i slično, gotovo su isti i upućuju na panonsku ili južnopanonsku proizvodnju. Identičan slučaj je i s bocom s brušenom ornamentikom sa štrbinačke nekropole²⁸ koja ima analogiju u jednoj gotovo identičnoj boci iz osječkog muzeja²⁹ te kuglastim bocama s ljevkastim vratom koje su pronađene na Štrbincima, Osijeku i Dalju.³⁰ Sličnih primjeraka ima i više, a oni svakako idu u prilog intenzivnoj razmjeni između gradova. Jedna mogućnost jest ta da su se ovi navedeni tipovi posuda proizvodili u jednoj od mogućih u tekstu navedenih radionica. Drugo moguće rješenje jest da su se isti oblici posuda proizvodili u različitim radionicama. Zbog činjenice da staklarske radionice nisu potvrđene niti u Vin-

proven to exist. Much of the direct archaeological evidence that would serve as the basis for confirming this hypothesis is still absent.

When the workshops in the Croatian part of the former province of Pannonia began its production is not known. Missing is the most important archaeological evidence (crucibles, glass waste, tools, etc.) that would confirm that the ovens found in Sisak and Vinkovci were truly used for glass production. Since the glass materials from northern Croatia have largely gone unpublished, the extent to which trade between individual cities existed is not known. When processing the vessels from the territory of northern Croatia, we found a certain – albeit small – quantity of the same or similar vessel forms at different sites, or in their immediate vicinity. For example, an analogy to a balsamarium²⁶ was found in the Museum of Slavonia in Osijek.²⁷ All elements – the vessel form, the poor glass quality, the poor workmanship and similar features – are almost identical, pointing to Pannonian or southern Pannonian production. The case of the bottle with engraved decoration from the Štrbinci necropolis²⁸ is an identical example, as it has an analogy in a virtually identical bottle from the Osijek Museum,²⁹ while spherical bottles with funnelled necks were found in Štrbinci, Osijek and Dalj.³⁰ There are more similar examples, and they certainly support the theory of intense trade between cities. One possibility is that these vessel types were made in one of the workshops mentioned herein. Another possible solution is that these same vessel forms were produced in different workshops. Since glass workshops have not been confirmed in Vinkovci nor in Osijek, nor in Štrbinci for that matter, it is difficult to say whether these aforementioned vessel types were produced

²⁶ Dimitrijević 1979, 175, T. 21/4.

²⁷ Bulat 1976, 100.

²⁸ Migotti 2004, 173, 174, 238.

²⁹ Bulat 1976, 89/3, T. VII/6.

³⁰ Migotti 2009, 134, T. XX/3; Bulat 1976, 89/2, T. I/1; 90/15, T. II/4.

²⁶ Dimitrijević 1979, 175, P. 21/4.

²⁷ Bulat 1976, 100.

²⁸ Migotti 2004, 173, 174, 238.

²⁹ Bulat 1976, 89/3, P. VII/6.

³⁰ Migotti 2009, 134, P. XX/3; Bulat 1976, 89/2, P. I/1; 90/15, P. II/4.

kovcima niti u Osijeku, a niti na Štrbincima, teško je reći jesu li spomenuti oblici posuda proizvedeni u Cibalama, Mursi ili nekoj trećoj panonskoj radionici te uvezeni u ove gradove. Promatrajući kasnoantičke staklene posude iz hrvatskog dijela Panonije i tražeći njihove analogije, možemo zamijetiti da se isti ili slični oblici najčešće pojavljuju u Mađarskoj i Srbiji. U Mađarskoj se spominje nekoliko staklarskih radionica: u Arraboni, Brigetiu, Aquincumu te Gorsiumu,³¹ ali i u Srijemskoj Mitrovici,³² stoga je velika vjerojatnost da je upravo jedna od tih radionica, ili možda više njih, bila glavni proizvođač nekih oblika posuda za cijelu Panoniju, pa i susjedne provincije, odnosno Meziju. U Sloveniji i nema baš mnogo analogija za kasnoantičke panonske posude, već samo za rane, zbog toga što na tome području u većoj mjeri prevladava rani materijal, koji u južnoj Panoniji nedostaje. Međutim, to i ne čudi budući da je taj dio Panonije prije našeg dijela potpao pod rimsku vlast.³³ Rani materijal u većoj mjeri prevladava i na području Dalmacije, stoga ni na tome području nema mnogo analogija za kasnoantičke posude s područja hrvatskog dijela Panonije, već isključivo za ranije oblike. Na području Dalmacije, osim Salone, rimske peći za proizvodnju staklenih posuda također nedostaju. Međutim, na temelju izrazito velike količine staklenih posuda, naročito na istočnoj jadranskoj obali, te nekoliko specifičnih tipova karakterističnih upravo za to područje, dana je pretpostavka o lokalnoj rimskoj staklarskoj proizvodnji.³⁴

Kada govorimo o rimskome staklarstvu na području sjeverne Hrvatske, još je puno nepoznanica. Zaključci o tome da su pronađene peći u Sisku i Vinkovcima staklarske po našem su mišljenju ipak pre-

in Cibalae, Mursa or some third Pannonian workshop and imported to these cities. Upon examining Late Roman glass vessels from the Croatian part of Pannonia and seeking comparisons to them, we must note that the same or similar forms most often appear in Hungary and Serbia. Several glass workshops are supposed for Hungary: in Arrabona, Brigetio, Aquincum and Gorsium,³¹ but also in Serbia in Srijemska Mitrovica,³² so there is a great probability that one or perhaps several of these workshops were the primary producers of certain types of glass vessels for all of Pannonia, and even the neighbouring province of Moesia. There are not many analogies to the Late Roman Pannonian vessels in Slovenia, rather only for those dating to early Roman period, because early materials absent in southern Pannonia largely predominate there. However, this should not be surprising, since this part of Pannonia came under Roman rule earlier than the Croatian part of that province.³³ Early glass vessel forms generally predominate in the territory of Dalmatia, so there are not many analogies there to the Late Roman vessels from the Croatian part of Pannonia, rather only for earlier forms. However, based on the exceptionally large quantities of glass vessels, particularly in the eastern Adriatic coast, and several forms of glass vessels specific of precisely this region, a hypothesis on local Roman glass production has been put forward.³⁴

There are still many unknowns with reference to Roman glass production in northern Croatia. The assertions that the oven structures found in Sisak and Pannonia are glass furnaces are, in our opinion, open. The discovery of a lower section or simply the foundations of a kiln with a small piece of melted glass, but without any other archaeological evidence on glasswork *in situ* cannot serve as certain proof that these were without doubt

³¹ Thomas 1980, 382; Barkóczi 1988, 31.

³² Milošević 1976, 102-108.

³³ Šaranović Svetek 1986, 55.

³⁴ Fadić 2004, 95-106.

³¹ Thomas 1980, 382; Barkóczi 1988, 31.

³² Milošević 1976, 102-108.

³³ Šaranović Svetek 1986, 55.

³⁴ Fadić 2004, 95-106.

uranjeni. Pronalazak donjeg dijela ili tek ostataka temelja peći s malim ulomkom rastaljenog stakla, a bez ikakvih drugih arheoloških dokaza o obradi stakla *in situ*, ne može biti siguran dokaz da je bez sumnje riječ o staklarskim pećima. Elementi, na osnovi kojih se nedvojbeno potvrđuje sekundarna proizvodnja, dobro su poznati u međunarodnoj stručnoj literaturi i prihvaćeni.³⁵ Bez ovakvih direktnih nalaza, ideja o lokalnoj proizvodnji jest moguća, ali, nažalost, nije nedvojbeno potvrđena s nalazima.

Nažalost i elementi na kojima je temeljena mogućnost staklarske proizvodnje na Štrbincima, također su nedostatni. Činjenica jest da neki drugi elementi poput tipologije kasnoantičkih posuda, nedostatka njihovih analogija u drugim provincijama, a veći broj sličnih ili istih na našem području, loša kvaliteta stakla kao i same izrade i sl., idu u prilog hipotezi o mogućem postojanju domaće staklarske proizvodnje.

Na kraju moramo ustanoviti da postoje elementi koji upućuju na vjerojatnost postojanja lokalne staklarske proizvodnje na više lokaliteta na području hrvatskog dijela provincije Panonije (grumeni stakla u rijeci, količina staklene građe, tlorisi peći, vjerojatni lokalni oblici posuda). Međutim, brojni neposredni arheološki dokazi obrade stakla³⁶ još uvijek nedostaju i dok se ne pronađu nećemo moći bez sumnje dokazati postojanje rimskih staklarskih radionica na području južne Panonije.

³⁵ Lit. o tome: Amrein 1996; Amrein 2001; Amrein, Hochuli-Gysel 2000; Stern 1999, Stern 2004, Stern 2008; Lazar 2003, 215, sl. 57.

³⁶ Amrein 1996; Amrein 2001; Amrein, Hochuli-Gysel 2000; Lazar 2003, 224-230.

glass furnaces. The elements that would unambiguously confirm secondary production are well known and accepted in the international scholarly literature.³⁵ Without such direct finds, the idea of local production is possible, but, unfortunately, not unequivocally proven with finds.

Unfortunately, the elements upon which the possibility of glass production in Štrbinci are based are also insufficient. To be sure, certain other elements, such as the typology of Late Roman vessels, the lack of analogies in other provinces and the high number of similar or identical vessels in the territory in question, the poor quality of the glass and workmanship, etc., do back the hypothesis on the possible existence of local glass production.

In the end, we must state that there are elements which indicate the likelihood of the existence of local glass production at several sites in the Croatian part of the province of Pannonia (raw glass lumps in the river, the quantity of glass materials, the ground-plan of the furnaces, probable local vessel forms). However, numerous direct archaeological proofs of glassworking³⁶ are still absent, and until they are found we shall not be able to prove without doubt the existence of Roman glass workshops in the territory of southern Pannonia.

³⁵ For sources on this, see Amrein 1996; Amrein 2001; Amrein, Hochuli-Gysel 2000; Stern 1999, Stern 2004, Stern 2008; Lazar 2003, 215, Fig. 57.

³⁶ Amrein 1996; Amrein 2001; Amrein, Hochuli-Gysel 2000; Lazar 2003, 224-230.

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