DISSERTATIONES ARCHAEOLOGICAE

ex Instituto Archaeologico Universitatis de Rolando Eötvös nominatae

Ser. 3. No. 9. | 2021

Dissertationes Archaeologicae

ex Instituto Archaeologico
Universitatis de Rolando Eötvös nominatae
Ser. 3. No. 9.

Budapest 2021

Dissertationes Archaeologicae ex Instituto Archaeologico
Universitatis de Rolando Eötvös nominatae

Ser. 3. No. 9.

Aviable online at http://ojs.elte.hu/dissarch
Contact: dissarch@btk.elte.hu
ISSN 2064-4574 (online)

PKP
PUBLIC
KNOWLEDGE
PROJECT

Layout and cover design: Gábor Váczi

Budapest 2021

Contents

Articles

Field Reports

Thesis Review Articles

Building techniques and building materials in Brigetio

With the virtual reconstruction of House I/a of the civil town of Brigetio

Linda Dobosi

MTA–ELTE Research Group for Interdisciplinary Archaeology

dobosi.linda@btk.elte.hu

Received 19 November 2021 | Accepted 18 December 2021 | Published 2 March 2022

Abstract: Review article of PhD thesis submitted in 2020 to the Archaeological Doctoral Programme, Doctoral School of History, Eötvös Loránd University, Budapest under the supervision of László Borhy.

Keywords: Roman domestic architecture, strip house, adobe walls, wooden ceiling, heating

Introduction

The civil town of Brigetio under present-day Komárom-Szőny in Hungary was the focus of archaeological research for two and a half decades. The planned excavations between 1992–2016 were led by László Borhy (MHAS, rector of the Eötvös Loránd University) and Emese Számadó (director of the Komáromi Klapka György Museum, Komárom) at the so-called Komárom/Szőny-Vásártér site, the only unbuilt area within the walls of the Roman *municipium*. During the archaeological investigation a roughly 3000 m^2 area was uncovered in the centre of the Roman settlement, revealing an orthogonal road system and long strip buildings with living quarters as well as workshops. The research project was concluded with a geophysical survey of the whole area of the Vásártér in 2019.

After the excavation, all unearthed remains of the Roman houses were analysed from an architectural point of view from the founding of the civil town at the beginning of the 2nd century AD to its abandonment in the second half of the 3rd century AD. After the house plans were clarified and the construction phases were dated, the building materials and building techniques were examined. The results of this study enabled the virtual reconstruction of the town houses of Brigetio. In this paper, the reconstruction process of the best-known building, the so-called House I/a will be presented.

The site

The archaeological site of Komárom/Szőny-Vásártér lies in the heart of the Roman civil town of Brigetio, two km west of the *castra legionis* and the *canabae legionis* of Brigetio. The civil town was probably founded at the beginning of the 2nd century AD, soon after the legionary fortress had been built. It flourished during the Antonine dynasty and lived its heyday under the Severan emperors[1] when an amphitheatre was built in the southwestern corner of the town.[2] The settlement was

1 Barkóczi 1951, 28; Borhy – Számadó 2003, 151-153; Borhy et al. 2011, 49–51. About Brigetio in general: see Borhy 2019 and Borhy 2021.

2 Borhy 2009, 15.

 Crossref doi 10.17204/dissarch.2021.313

elevated to the rank of municipium most probably in 194 by emperor Septimius Severus (193–211),[3] and became a *colonia* at a later unknown date.[4] However, soon after the middle of the 3rd century AD, the houses of the civil town were abandoned for no apparent reason, apart from the general instability connected to barbarian invasions along the *limes* and the economic crisis of the 3rd century.[5] Life seems to have been going on in the *canabae* and the legionary fortress for still another century.

During the excavations at Komárom/Szőny-Vásártér the ruins of eight buildings were unearthed[6] and traces of others were revealed by a geophysical survey in the central part of the civil town *(Fig. 1)*.[7] This part had been thought to have been the *forum* area of the *municipium*, however, instead of a *forum* the remains of an industrial–commercial–living quarter came to light with several additional buildings, such as glass, metal, and bone manufacturing workshops along with a bakery.[8]

Most of the remains can be dated to the Severan era, the heyday of the civil town. Based on the datable coin and ceramic finds that could be linked to specific structures, four main construction phases have transpired at Vásártér *(Fig. 2)*.

The earliest structures can be dated to the first half of the 2nd century AD. Post holes and impressions of ground beams are the only traces of the early earth-fast and timber-framed structures. These were soon replaced by mud and stud walls, also built in the first half of the 2nd century. It is important to note that the north-south orientation of these structures matches that of later walls.[9] The first adobe walls with stone foundations seem to have appeared during the second half of the 2nd century along with stone-walled cellars. The Antonine era showed the first signs of economic upsurge in the civil town. Finally, approximately 90% of the remains unearthed at Vásártér have been linked to the third construction phase during the Severan era when richly decorated strip houses with proper stone foundations, terrazzo floors and hypocaust heating systems were built. Constructions were still going on with great intensity during the second quarter of the 3rd century. However, after the middle of the century, building activity appears to have stopped, as only a well and one wall can be dated to the fourth construction phase in the second half of the 3rd century. A few decades later, in the 270–280s the civil town was abandoned and the houses were left to decay.

The strip houses and their construction

The houses excavated at Vásártér belonged to the characteristic type of the north western provinces *(Fig. 3)*, the so-called strip houses (also known as *Streifenhaus* or *gallorömisches Haus*).[10]

Although strip houses were built fitting local customs and using local building materials, they are easy to recognize based on a few characteristics. They were built on long, narrow parcels with elongated, rectangular plans, perpendicular to the road. Their average width measured 7–12 m,

3 Barkóczi 1951, 28; Barkóczi 1953, 202; Kovács 2007, 146; Mráv 2013, 208–209.
4 Barkóczi 1951, 28; Borhy – Számadó 2003, 151–153; Borhy et al. 2011, 49–51.
5 Borhy – Számadó 2003, 151–153; Borhy et al. 2011, 49–51; Juhász 2018, 18–19.
6 More about the houses: Dobosi – Borhy 2011; Dobosi 2014.
7 The geophysical survey was conducted by Zsombor Klembala (Department of Geophysics and Space Department, Eötvös Loránd University), László Rupnik (Institute of Archaeological Sciences, Eötvös Loránd University), and András Bödőcs (Institute of Archaeological Sciences, Eötvös Loránd University).
8 About the various workshops: Dobosi 2014; Bartus 2001; Bartus 2003; Dévai – Gelencsér 2012a; Dévai – Gelencsér 2012b; Sey 2015.
9 See also: Dobosi – Borhy 2015, 186.
10 Perring 2002, 55–56; Czysz 2016, 61–66; Kortüm 2005, 252–253; Ditmar-Trauth 1995, 1–2; Oelmann 1923.

Fig. 1. Plan of the excavation and geophysical survey at the Komárom/Szőny-Vásártér site (Drawing: L. Dobosi).

Fig. 2. Construction phases of the civil town at the Komárom/Szőny-Vásártér site (Drawing: L. Dobosi).

Fig. 3. Plan of the northern part of Vásártér (Drawing: L. Dobosi).

and their length could be anywhere from 20–25 m to 50–60 m. The houses were usually separated by narrow alleys of 0.5–1.0 m called *angiportus/angiportum*. The front room of the house opening to the street was generally occupied by a shop or a workshop, followed by storage rooms. The rear end near the backyards and gardens was used as the domestic dwelling area. The house sometimes had a cellar, and the latrina was placed somewhere in the backyard.[11]

The largest and most elaborate strip houses, paralleling urban villas, had complex plans including several small yards for providing light and ventilation.[12]

Strip houses in Pannonia have been found in abundance: for example, in Aquincum, Carnuntum, and Vindobona,[13] and the buildings unearthed in Brigetio also match this category. The roughly 60 m long and 11.5 m wide strip houses at Vásártér lay in a north-south direction and were separated by narrow alleys merely 0.7–0.8 m wide. As most of the excavated remains belonged to the first half of the 3rd century AD, the Severan construction phase of the houses described here is the best known.

Fig. 4. Collapsed adobe walls at Komárom/Szőny-Vásártér (Photos: D. Bartus and Zs. Kurovszky).

The strip houses of Brigetio were built in the 3rd century AD from adobe bricks on stone foundations. Although about half of the walls were robbed and survived only in negative, the adobe walls are well known to us: 0.25–0.6 m deep and 0.45–0.6 m wide foundation trenches were filled with a concreted mixture of rubble and limestone. On top of the foundation, there was a 0.4–0.5 m high plinth of roughly coursed stone blocks of irregular shape with abundant mortar. The 0.3×0.45×0.1 m adobe bricks were laid on the levelled top surface of the plinth. The resulting 0.45 m wide walls were

11 Perring 2002, 55–56; Czysz 2016, 61–66; Kortüm 2005, 252–253; Ditmar-Trauth 1995, 1–2; Mac Mahon 2005, 48–51.

12 Kortüm 2005, 255.

13 Summarizing works about the strip houses of Aquincum and Carnuntum for example: Zsidi 2008; Láng – Bíró 2018; Cencic 2003; Müller 2008.

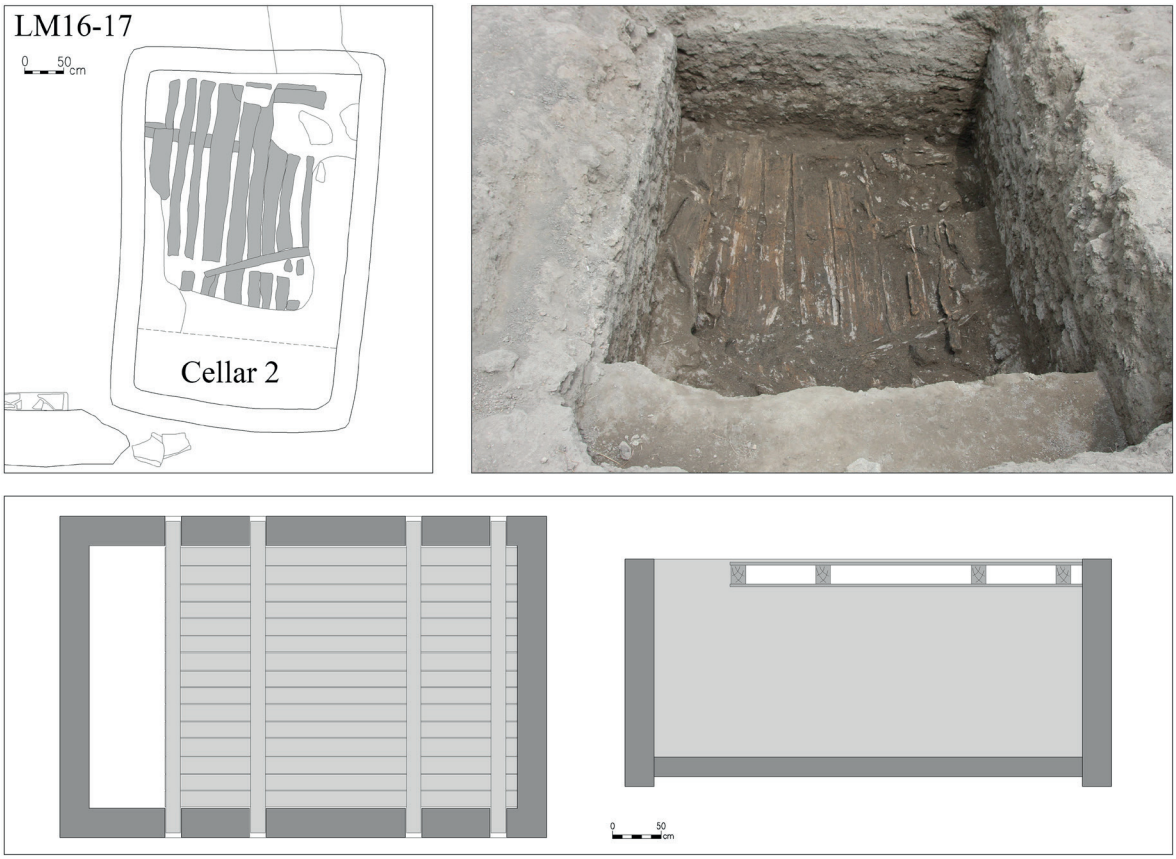

Fig. 5. Wooden ceiling of Cellar 2 (Drawing: L. Dobosi, photo: D. Bartus).

covered with several layers of plaster on both sides.[14] Some of the adobe structures fell over and survived underground, thus creating tangible evidence of this wall type *(Fig. 4)*.

Romans thought that adobe walls were able to carry a second story (Plin., *Nat.hist.* XXXV.48.173, and Vitr., *De arch.* II.8.17). Based on the writings of Roman authors and the archaeological evidence in Pannonia and other provinces of the Empire, mudbrick walls must have been widespread outside Rome.[15] We know of adobe walls from the legionary fortress and *canabae* of Brigetio[16] and the counter fortress of Brigetio at Celamantia (Iža-Leányvár, Slovakia).[17] In Aquincum and Carnuntum, adobe walls on stone foundations were built from about the middle of the 2nd century AD to the middle of the 3rd century AD.[18] Researchers in England and France have found that there was no standardized brick size due to the fact that mud bricks were generally made on or near the construction site.[19]

Most ceilings in Brigetio were probably made of wood and bundles of reed covered with plaster and decorated with stuccos and paintings, as attested by finds from Vásártér. The wooden ceiling of the

14 Dobosi – Borhy 2015, 186–188.

15 Authors on the subject of adobe walls or sun-dried brick making: Vitruvius II.3.1–4. and II.8.17–19; Plinius XXXV.48.170–173, and VII.56.194; Cato Agr. 14; Cetius Faventinus 11; Palladius I.11, and VI.12. For others, see Gerding 2016.

16 Bartus et al. 2016, 69.

17 Hajnalová – Rajtár 2009, 196. Mudbrick size: 250×400×80–150 mm.

18 Láng 2012, 119–122, 214–219; Groh et al. 2014, 387.

19 de Chazelles 2003, 4; Perring 2002, 99–102. For example: Colchester 430×290×50 mm, Lion Walk 222×185×95 mm, and North Hill 330×279×38 mm. Clément 2016, 155–157: brick sizes in Lyon were around 440×290×75 mm, 285×140×70 mm, and 210×120×60 mm.

so-called Cellar 2 collapsed into the cellar and was extraordinarily well preserved by the surrounding soil: 0.16–0.22 m wide planks covered both the upper and the under sides of the joists *(Fig. 5)*. Cellar 2 measured about 4.40×2.70 m and the ceiling must have caved in after the 170s AD.[20] Based on the sockets in the masonry, Cellar 1 must have had a similar wooden ceiling. In this case, only the sockets of the wooden joists could be seen in the masonry. The 3.95×2.55 m sized Cellar 1 was probably put out of use in the last quarter of the 2nd century AD.[21]

The painted barrel-vaulted ceiling of Room I/1 also had a wooden construction. In essence not much different from the ceiling of the cellars, the joists of the arched ceiling were covered with wooden planks or bundles of reed from underneath. This was covered with plaster and decorated with mythological painting. The location of the seven joists was clearly visible on the surface of the paintings as a series of longitudinal cracks *(Fig. 6)*.[22] When reconstructing the cross section of the barrel vault, it was revealed that the joists were placed in a way which made the marking out of the geometry as simple as possible. The small Room I/1 of 4.20×3.0 m must have had an impressive appearance with its painted barrel vault *(Fig. 6)*. This type of vaulted ceiling was called *camara* by Vitruvius (Vitr., *De arch.* VII.3.1–3), and *camerae canniciae* by Cetius Faventinus (*Cet.Fav.* XXI) and Palladius (*Pallad.* I.13) in their detailed descriptions of the building of these curved ceilings. Archaeological evidence of vaulted ceilings can be found in abundance in Pompeii and Herculaneum in the form of sockets in the masonry,[23] and can be reconstructed based on the fallen pieces of the painting that decorated the ceiling: for example, in the *villa rustica* of Bad Neuenahr-Ahrweiler or the Haus 17 in Schwarzenacker,[24] or in Savaria (Szombathely),[25] Aquincum[26] and Gorsium (Tác).[27] A flat ceiling made of bulrush (*Schoenoplectus lacustris*) has been reconstructed in the Iseum of Savaria,[28] and a wooden one in Trier.[29]

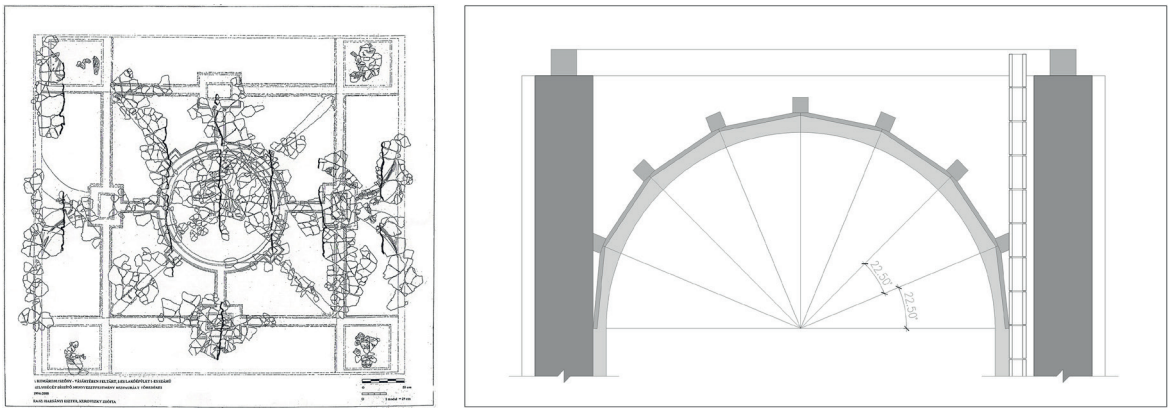

Fig. 6. Barrel-vault of Room I/1 (Drawings: E. Harsányi – Zs. Kurovszky and L. Dobosi).

20 Bartus – Borhy 2016, 102–105.
21 Bartus – Borhy 2016, 101–102; Szórádi 2010; Dobosi 2014.
22 Harsányi – Kurovszky 2001a, 26–27; Harsányi – Kurovszky 2001b; Harsányi – Kurovszky 2001c; Harsányi – Kurovszky 2010a, 30–31.
23 Adam 2007, 200, 226–227.
24 Gogräfe 1991; Gogräfe 2004, 224–225.
25 Kurovszky 2006, 457–461: János Szily Street, Szombathely, middle of the 2nd century AD.
26 Láng 2006, 66–67: north of the civil town.
27 Harsányi 2016, 35: Building no. XCIV in Gorsium, middle third of the 3rd century AD.
28 Harsányi – Kurovszky 2017, 526.
29 Steffny 1998.

All the roofs at Vásártér were covered with ceramic roof tiles. In terms of form, Roman roofs were generally gable or shed roofs, based on the depictions.[30] The timber construction of the roofs in Brigetio did not survive but examples or depictions from other parts of the Empire suggest prop-and-lintel roofs as well as tie-beam trusses.[31] In smaller domestic buildings, the wooden structure of the roofs was probably kept as simple as possible.

The pitch of Roman roofs is generally thought to have been low, however, it varied considerably with construction type, climate, and roofing material.[32] Known examples from different parts of the Empire attest to roof pitches between about 20 and 47.5 degrees on domestic buildings.[33]

The pitch of the roof can be estimated based on the shape of the *tegulae*. The cutouts on the *tegulae* allow us to size up the overlap between two tegulae, which in turn indicates the possible pitch if the roof is to be watertight. The size of the cutouts on the Vásártér *tegulae* allows for a roof pitch of about 30 degrees. Apparently, the lowest row of the *imbrices* was not sealed with antefixes but with smoothed and whitewashed lumps of mortar. The *tegulae* collected at Vásártér came in two different sizes: the *tegulae* measuring 500–525×390–405 mm were more frequent, while the smaller ones were 452–470×325–340 mm in size. The average weight of a single *tegula* was about 12 kg. Only one size of *imbrices* could be ascertained measuring 440–450×160–200 mm and weighing 2.5 kg.

The type of the floor was chiefly determined by the function of rooms. The courtyards were covered with gravel, while indoors earth or terrazzo floors were used, the latter with or without a hypocaust heating system.[34] Terrazzo floors are also known by the names *cocciopesto* or *opus signinum* but the exact meaning of the latter is debated.[35] All the terrazzo floors that could be dated with Samian ware finds were built in the first half of the 3rd century and were built similarly to the description of Vitruvius (Vitr., *De arch.* VII.1.1–3).

Some of the floors were probably tiled: the small floor tiles of dogbone shape appearing sporadically at Vásártér could not be linked to a specific room or building. The big 45×75 mm tiles were all made in a maximum of two moulds. Traces of mosaic or *opus sectile* floors were not found at Vásártér although both floor types are known from similar contexts in Aquincum and Carnuntum. The floor levels of the strip houses at Vásártér followed gradually the slope of the terrain, which fell slightly to the south. Thus, the floor level at the northern end of the excavated area was some 0.6 m higher than at the southern end.

30 Adam 2007, 206–207; Camardo – Notomista 2015, 44; Perring 2002, 119–120.

31 Ulrich 2007, 125–149; Adam 2007, 205–212; Camardo – Notomista 2015, 47–50.

32 Perring 2002, 120.

33 In some cases, the pitch of the roof could be measured on the collapsed gable wall. A few examples: *villa rustica* at Oberndorf-Bochingen, 33°, *tegula-imbrex* (Sommer 2005, 282–285; Sommer 2011, 255–257); *villa rustica*, Sharvards Farm, Meonstoke, 47.5° slate (Perring 2002, 120; King – Potter 1990); *villa rustica*, Carsington, 40°, *tegula-imbrex*; *villa rustica*, Redlands Farm, 22.5° (Keevill 1996, 51; Keevill 1995, 28), *tegula-imbrex*. A *tegula-imbrex* roof in Augusta Raurica must have been about 25–30° steep (Hufschmid 1996, 215). In the case of the Casa del Rilievo di Telefo, the roof pitch has been reconstructed based on the surviving timber elements: circa 20° (Camardo – Notomista 2015, 47).

34 See also: Dobosi – Borhy 2015, 188–189.

35 The words *opus signinum* or *opera signa* seem to have had a different meaning in the works of different authors, and researchers disagree as to what they actually meant. French researchers, such as J.-P. Adam, P. Gros, and V. Vassal, use the term exclusively for a floor type. In contrast, Italian researchers, for example C. F. Giuliani, M. Grandi Carletti, and P. Braconi, think that the term indicated any kind of hydraulic construction, while J. M. Puche Fontanilles thinks that it signified a certain kind of cistern construction. See: Puche Fontanilles 2015, 7–14; Braconi 2008, 251–252; Vassal 2006, 16–21; Gros 2006; Cifarelli et al. 2017, 163–166.

Most of the rooms must have been heated by portable ovens or braziers, none of which survived. Of the eight unearthed building parts, three contained the remains of a hypocaust heating system, and we know of a further three domestic ovens. According to a study by H. Boman, the built hearths and ovens in Pompeii were all built along the exterior walls of the houses, so as not to heat the surrounding rooms.[36] In contrast, all three domestic hearths identified in Brigetio are built in a way to give heat to the neighbouring room *(Fig. 7)*. This can probably be explained by the differences in climate: in Pompeii it was important to keep the rooms cool in the summer, while in Pannonia the heat of cooking and baking was used to heat the rooms in the winter.

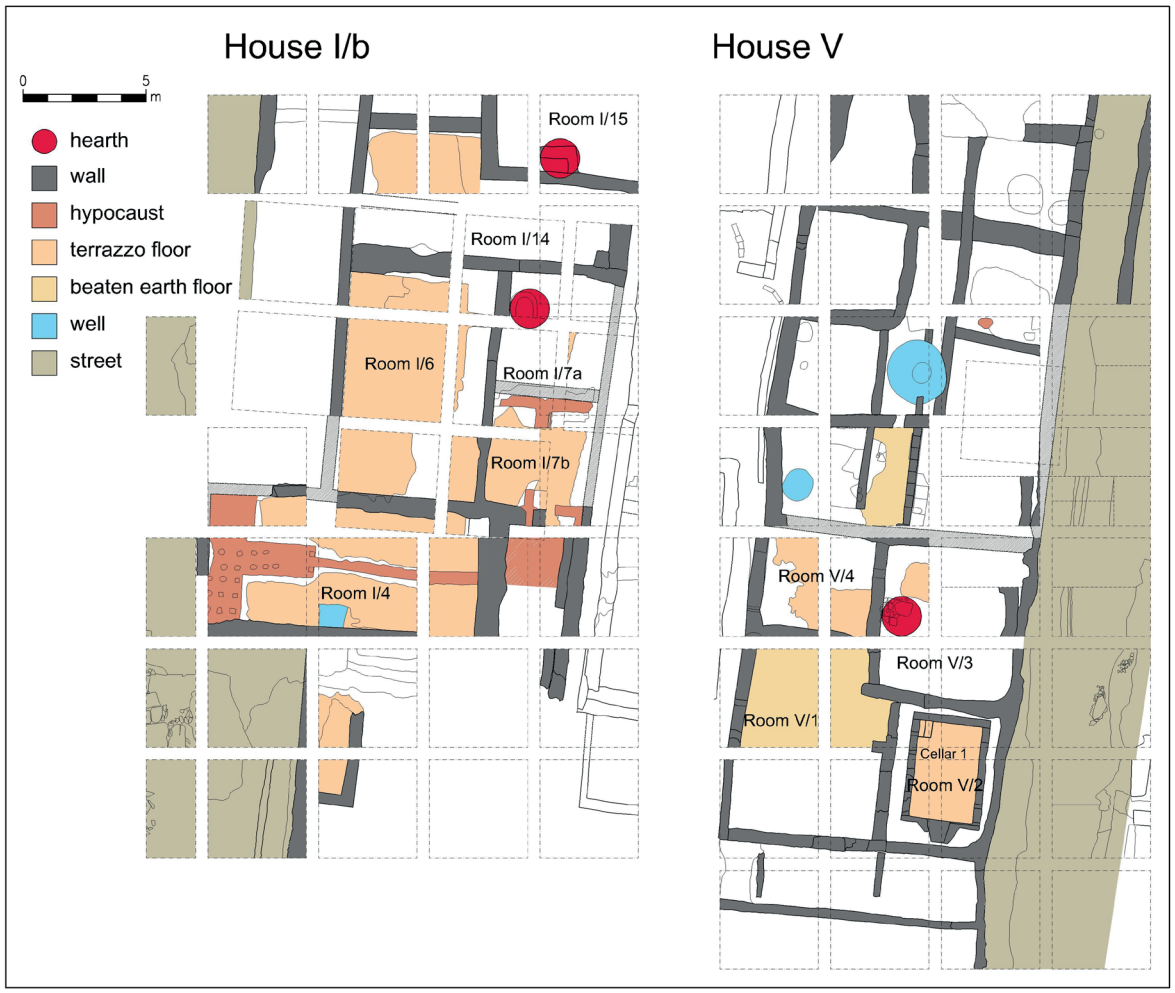

Fig. 7. The interior position of the three identified hearths in Houses I/b and V (Drawing: L. Dobosi).

Two rooms were heated by a hypocaust both in Houses I/a and I/b, and one room in House IV.[37] Regarding the underfloor arrangement, all three types of hypocausts were present at Vásártér: pillar hypocausts, channel hypocausts and composite hypocausts, all in a great variety of building materials. The pillars of the *suspensura* were made of 0.02×0.02×0.05 m tiles in one case, of 0.30×0.30×10 m stone blocks in another, and of *tubuli* filled with mortar in the third. The *praefurnia* have not been preserved, their location is to be deduced from the geometry of the hypocausts and the houses themselves.

We can say little about the doors and windows of Brigetio. Closer inspection of the twelve threshold remains tells us that the doors were roughly the same size, about 1.3 m wide. There is only one excep-

36 Boman 2005, 61–65.
37 See also Dobosi – Borhy 2015, 190–192.

tion: the door of the building on the southern side of the bakery was 2.0 m wide. The doors in external walls had stone thresholds, while doors in internal walls had wooden ones. No traces of the door structures survived, but based on former research, most doors are expected to have been double *(bifores)*. Some of the door openings might have been covered with curtains.[38]

We only know the location, shape, and size of the window of Cellar 1, but even here no traces concerning its structure have survived. The large number of window glass shards found everywhere at Vásártér points to the existence of glazed windows.[39]

The plaster of the northern wall of Cellar 1 preserved the impression of a narrow and steep wooden staircase with an incline of about 45 degrees.[40] There were no signs of stairs or ladders leading to a possible second story, which makes it even more probable that these were single-storey houses. Three sockets in both the western and eastern walls of Cellar 1 belonged to wooden shelves. 1.0 m above ground the shelves were supported by beams of 120×150 mm protruding from the wall.

There was no aqueduct in the civil town of Brigetio although the legionary fortress and the military town received drinking water through a 20 km long aqueduct coming from Tata. Water came from wells and cisterns in the civil town, where three wells and two cisterns were found. Presumably every household or workshop had its own source of water. Rainwater was carried off via narrow channels lined with stones and *tegulae*. All channels fell to the south, making use of the slope of the terrain and channelling the rainwater to the vegetable gardens or fields that lay south of the strip houses.[41]

House I/a

The appr. 11.5 m wide House I/a lay in the middle of Insula 1, between two other strip houses, House I/b and House V. The full length of House I/a probably measured about 65 m, but only its southern half has been excavated. Its main entrance must have opened on its northern end from the Limes-road. The southern 31-meter-long segment of the house gave place to the living quarters *(Fig 3; Fig. 8)*. A row of three *cubiculae* stood along an L-shaped corridor opposite a small courtyard. The corridor either had a solid wall with windows to the courtyard, or an open *porticus*.[42] Two of the *cubiculae*, Rooms I/1 and I/2, were heated with a hypocaust heating system, and the barrel-vaulted Room I/1 was decorated with mythological paintings of Pegasus, Andromeda and Perseus. Further to the south two large rooms followed, Rooms I/5 and I/9, and the house ended with Room I/10 opening to the backyard. This room might have had a porch-like, semi-open appearance.

Taking a closer look at House I/a, it is apparent that most of its floors and about half of its foundation walls have survived, but nothing of the superstructure has remained *in situ*.

The reconstruction process for House I/a

The reconstruction of a house based on a few, roughly 1700-year-old remains is not straightforward. It is a complex architectural planning procedure based on incomplete data, consequently there can

38 Lauritsen 2011; Lauritsen 2012; Ulrich 2007, 178–201; Stephenson 2014, 18–21.

39 Dévai 2011, 142.

40 Dobosi – Borhy 2015, 195; Dobosi 2014, 20–21.

41 It is also possible that the north-south running channels were connected to a larger east–west running channel along Street C, but this has not been verified by excavation yet.

42 It might even have been a *porticus fenestrata*, as we see in Pompeii, Herculaneum or Augusta Raurica: Vipard 2003; Vipard 2009; Hufschmid 2013.

never be a single perfect solution to the problem, only a series of more or less feasible possibilities. Due to inaccuracies during the excavation and in the ground plan of the house, a corrected ground plan has been used.

Fig. 8. The plan of House I/a and the mythological paintings of Room I/1 (Drawing: L. Dobosi, photos: Cs. Török, E. Számadó).

The first step of the reconstruction was to summarize all available information in a table and put it into three main categories: "known for certain", "not certain but probable" and "not known at all" *(Table 1)*. The position of the walls, the preserved floors, hypocausts, traces of thresholds, and other preserved structures went into the first group. After the careful survey of the ruins, a number of points could be deduced that were put into the second group. We can assume that the walls were 0.45 m wide adobe walls, the ceilings were made of wood, the perished floors were either earthen or, in one case, terrazzo (collapsed over the hypocaust of Room I/2), the pitch of the roof was around 30 degrees, and we can make an educated guess about the location of the *praefurnia*. We know nothing certain, however, concerning the height of the buildings, the shape of the roofs or the location, size, and shape of most of the doors and windows. This set of data is also visualized on a plan *(Fig. 9)*.

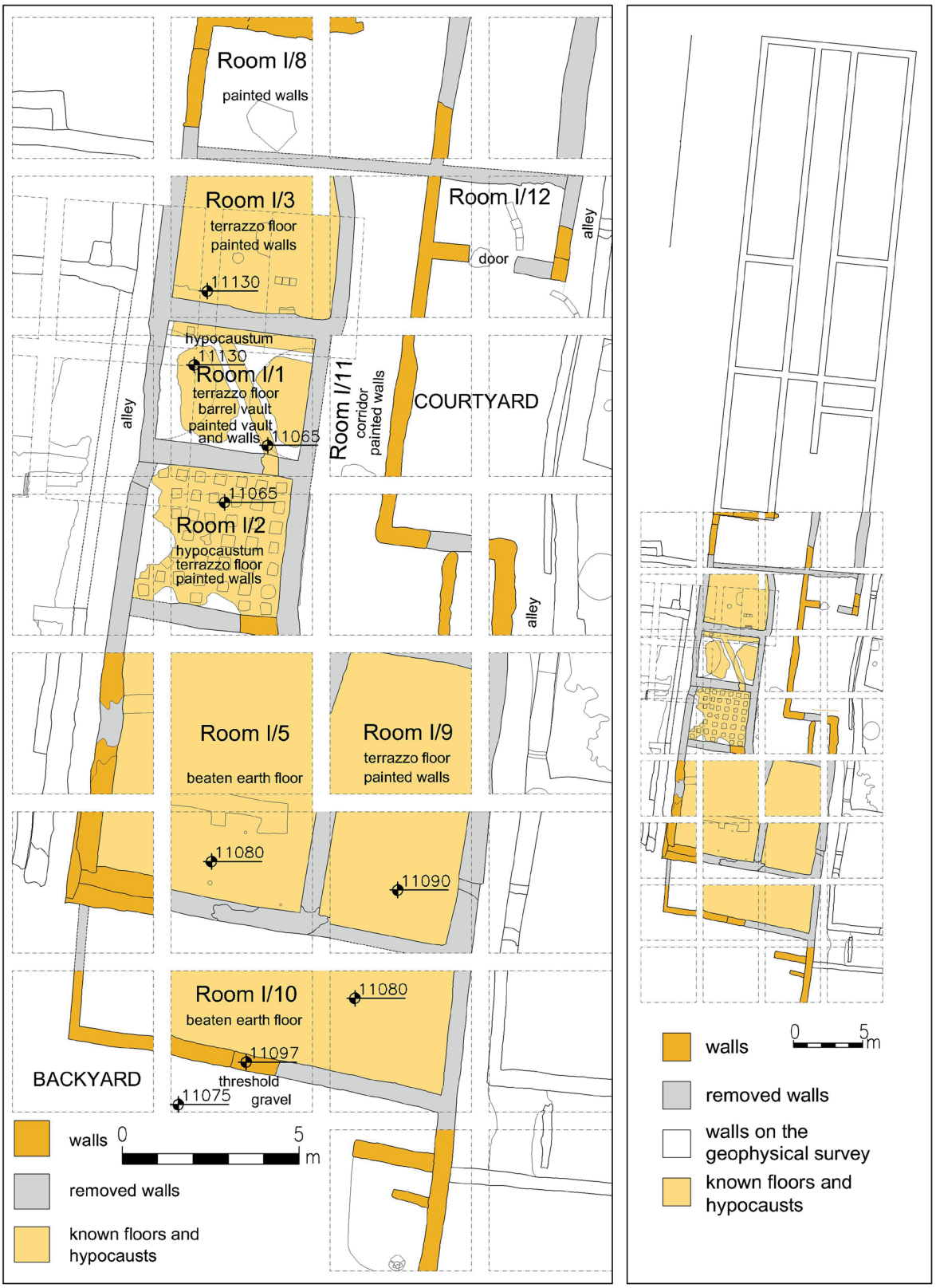

Fig. 9. Plan of House I/a (Drawing: L. Dobosi).

Table 1. Initial information about House I/a.

Known / not known	*Construction*
Known for certain	location of walls and of removed walls; roughly half of the foundation walls *in situ* (*opus incertum*, 0.5–0.6 m thick)
	terrazzo floor of Rooms I/1, I/3, I/9
	beaten earth floor of Rooms I/5, I/10
	floor type of Room I/2: terrazzo, without exact vertical position (probably the same as Room I/1 and I/3)
	hypocaust heating channels of Rooms I/1 and I/2 without the exact location of the *praefurnium*
	location and width of doors on the exterior walls of Rooms I/10 and I/12
	shape and orientation (East–West) of barrel vault in Room I/1
	paintings of the barrel vault and walls of Room I/1
	roofing material: *tegula-imbrex*
Not certain but probable	foundation walls: *opus incertum* 0.5–0.6 m thick
	wall structure: adobe brick walls 0.45 m thick
	wooden ceilings: flat or curved
Not known at all	height of the walls, internal height of rooms
	single storey?
	missing floors
	exterior wall of Room I/11 corridor along courtyard: wall or *porticus*?
	shape, pitch, and wooden structure of roofs
	location, shape, and size of doors and windows

Due to the systematic evacuation of the houses around the 270s–280s, the scarce find material gives little clue to the function of the rooms. Therefore, each room has been analysed based on four characteristics: the size, the presence of a hypocaust (yes or no), the floor type (beaten earth or terrazzo floor), and the quality of wall paintings (figural, geometric, or white). This has helped in separating the representative spaces of the houses from the purely functional ones.

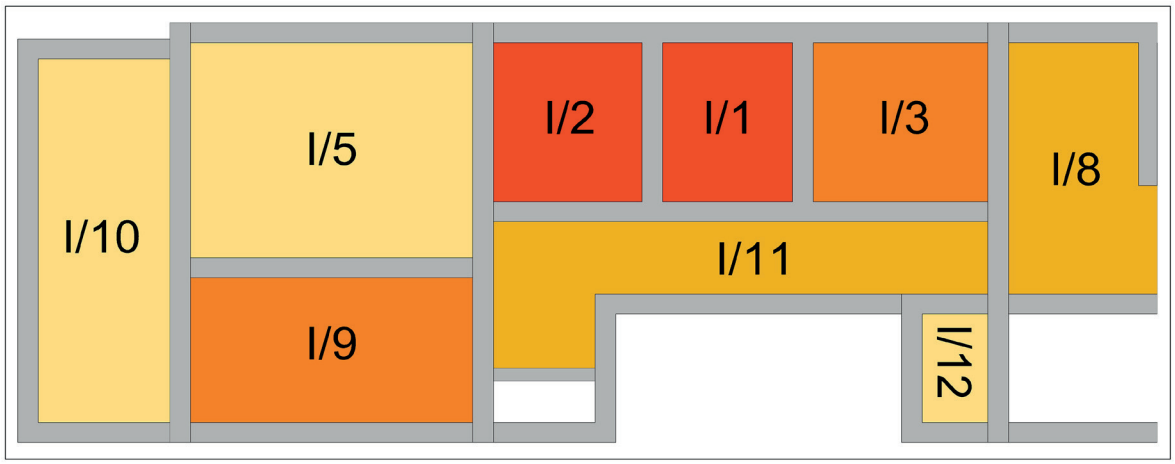

Fig. 10. Schematic plan of House I/a for separating representative rooms from functional ones. Red: most representative, light yellow: least representative (Drawing: L. Dobosi).

The most representative room of the house was the smallest Room I/1, which had hypocaust heating, terrazzo floor, a barrel-vaulted ceiling, and elaborate wall paintings depicting mythological scenes and the personification of the four seasons. Room I/2 must have been likewise representative, but its wall paintings have not been restored and evaluated yet. Rooms I/3 and I/9 had terrazzo floors and simply painted walls, but no underfloor heating. The floors of Rooms I/8 and I/11 did not survive, but they were covered in colourful geometric wall paintings. Rooms I/5, I/10, and I/12 were the simplest with beaten earth floors and no paintings *(Tab. 2; Fig. 10)*.

Table 2. Characteristics of rooms in House I/a.

Room	*size*	*hypocaust*	*floor type*	*wall painting*	*possible function*
I/1	15.2 m²	+	terrazzo	figural	cubiculum
I/2	17.4 m²	+	terrazzo	?	cubiculum
I/3	20.5 m²	–	terrazzo	white	cubiculum
I/5	44.6 m²	–	earth	?	?
I/8	?	–	?	geometric	?
I/9	30.0 m²	–	terrazzo	white?	?
I/10	35.2 m²	–	earth	?	back porch? semi-open?
I/11	35.9 m²	–	?	geometric?	corridor semi-open?
I/12	5.3 m²	–	?	?	?

In the third step, the volume of the building and the shape of the roofs were estimated. For this, the house plan was divided into segments along the transverse walls that extended through the whole building *(Fig. 11)*. Each segment thus created means a separate segment of roof structure.

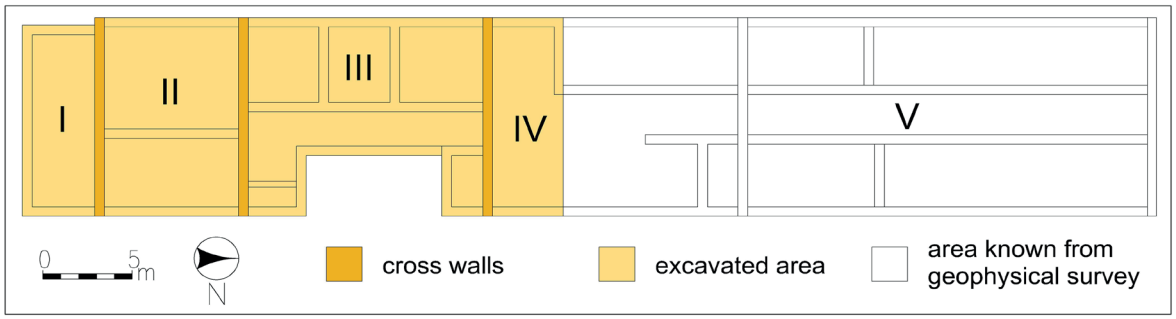

Fig. 11. Dividing House I/a into segments (Drawing: L. Dobosi).

The roof shape of segments II and IV seems straightforward: gable roofs are the most likely solution. For segment I, two possibilities come to mind: gable roof or shed roof. The most complex part of the building is segment III, for which four versions have been outlined *(Fig. 12)*.

After the feasibility and likelihood of each had been considered, the first two sketches were rejected. Putting together all four segments provides several possible versions for the volume of the house *(Fig. 13)*.

In the next step, plausible construction solutions were sought for the different roof versions, which meant static calculations for the timber roof structure. The height of the walls was determined after checking the load bearing capacity of the walls at critical points.

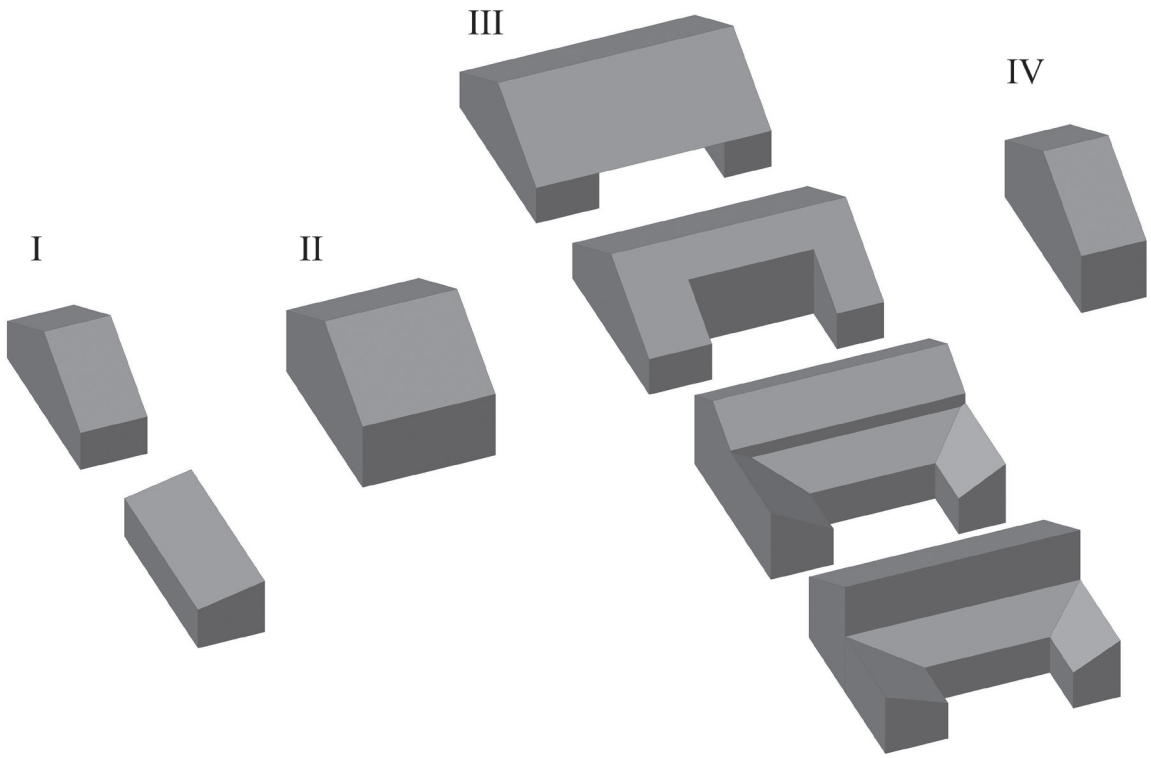

Fig. 12. Roof shape sketches for the individual segments of House I/a (Drawing: L. Dobosi).

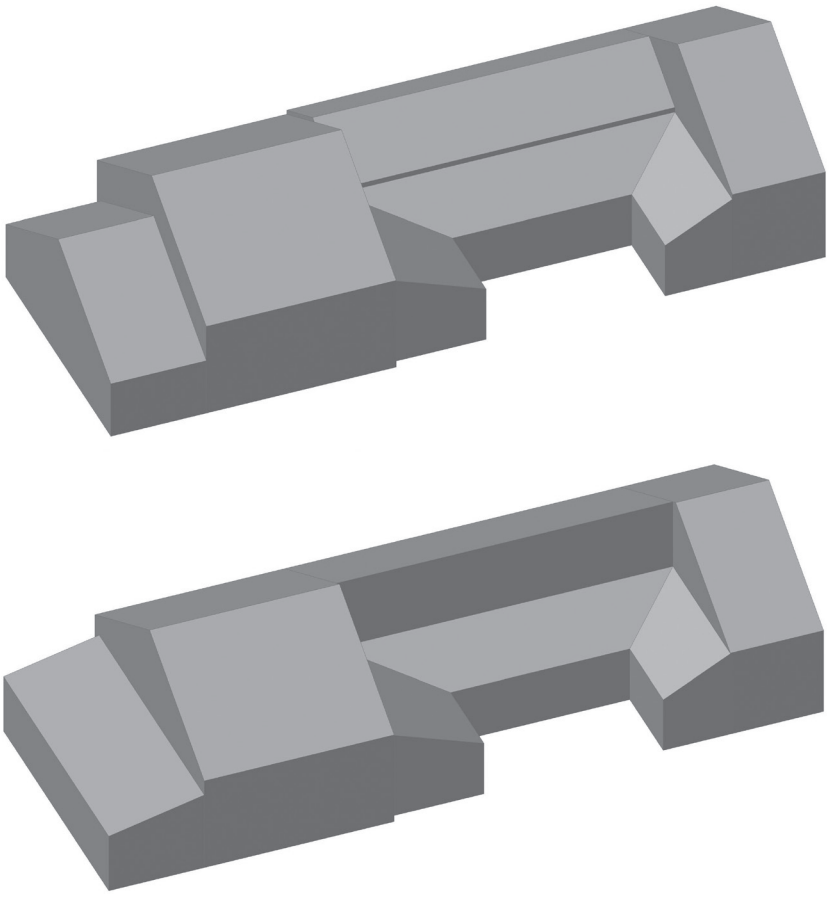

Fig. 13. Two possible volume versions for House I/a (Drawing: L. Dobosi).

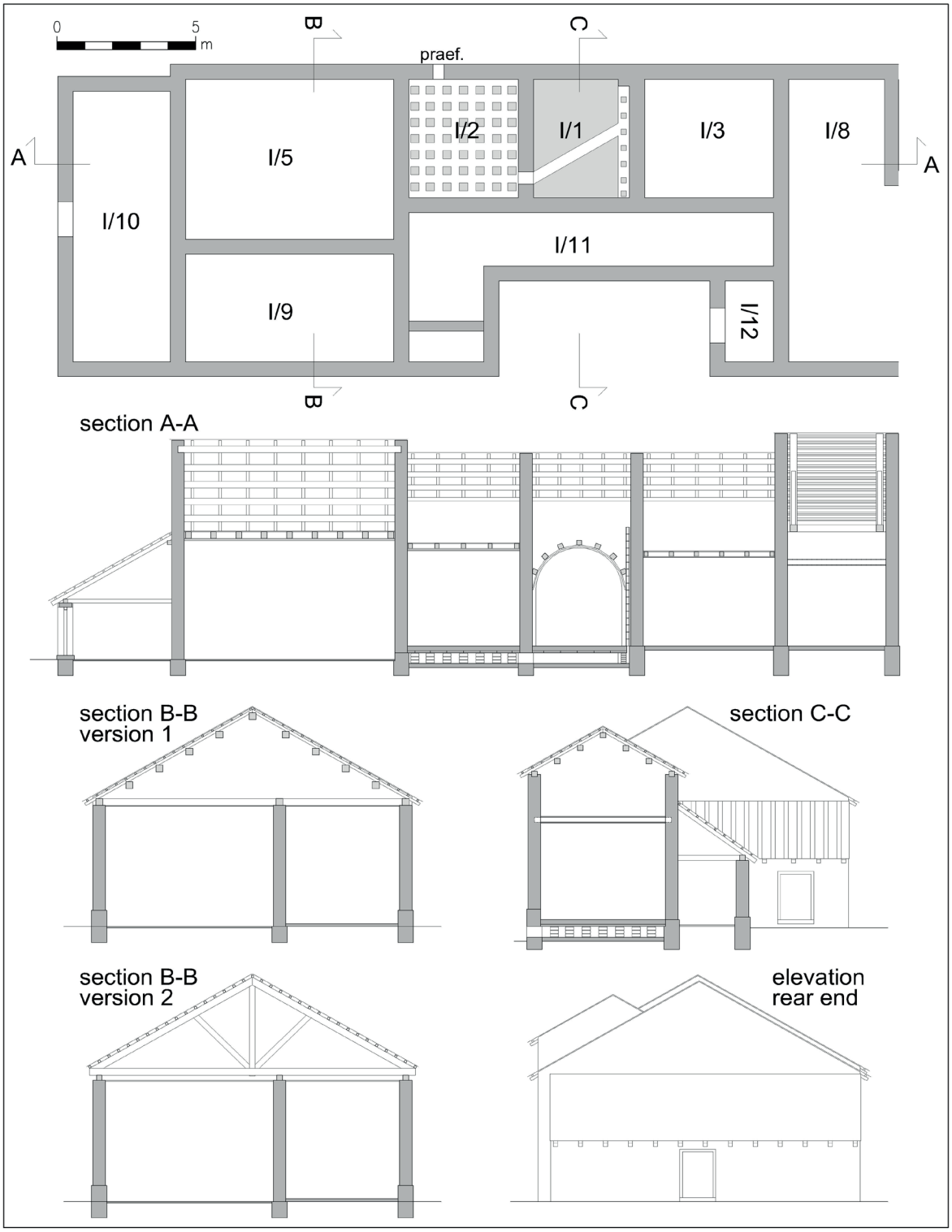

Fig. 14. Possible sections for House I/a (Drawing: L. Dobosi).

When drawing possible sections of the house, the problem of the internal height of the rooms came up *(Fig. 14)*. The remains of House I/a gave no clue about the height of the rooms, and in Brigetio the approximate height of only one room is known: the height of the wall paintings in Room III/1 of House III added up to at least 3.70 m.[43] Therefore, the recommendations of Vitruvius and surviving

43 Harsányi – Kurovszky 2010b, 101. However, only the width of the room is known (c. 5.5 m), the length is unknown.

examples from Pompeii, Herculaneum and Ostia were called on for help. Vitruvius determined the height of the rooms in accordance with their function, compared to their length and width (Vitr., *De arch.* VI.3.4–7). In general, the height of a rectangular room should be half the sum of its length and width, and the height of a square room should be one and a half times its width (Vitr., *De arch.* VI.3.8). In the case of House I/a this would mean an internal height of 4.18 m for Room I/2 and a height of 6.73 m for the large Room I/5, which seems inordinately high.

The internal height of rooms in Pompeii and Herculaneum appears to be between 2.60 and 3.80 m according to the collection of J.-P. Adam,[44] while the average height in Ostia might be around 3.50 m.[45] The height of two rooms of a *domus* in Fréjus must have been around 3.19–3.50 m.[46]

The question of the location, shape and size of the doors and windows still remains open, along with the problem whether Rooms I/10 and I/11 had solid walls or open porticos. Without the intention of solving these questions, several versions have been drawn *(Fig. 15)*.

Fig. 15. Different versions of reconstruction for House I/a (Drawing: L. Dobosi).

44 Adam 2007, 200–205.
45 Meiggs 1973, 240.
46 Timár 2011, 55–56.

Conclusion

The Roman town houses unearthed in the civil town of Brigetio at the so-called Komárom/Szőny-Vásártér site were strip houses with living quarters and workshops. Almost all remains can be linked to the Severan period of the town, the first half of the 3rd century, although four construction phases can be distinguished from the first half of the 2nd century to the second half of the 3rd century. The roughly 11.5 m wide and 60–65 m long houses were built on narrow parcels and were separated by narrow alleys 0.7–0.8 m wide.

The analysis of the building structures, walls, ceilings, floors, roofs and other elements has made it possible to attempt the virtual reconstruction of the town houses of Brigetio. Of the eight unearthed buildings, the bakery and the three best known strip houses have been reconstructed. The reconstruction process of House I/a has been presented in this paper.

Sources

Cato: De Agricultura.

Cetius Faventinus, M.: De Diversis Fabricis Architectonicae.

Palladius, R. T. A.: Opus agriculturae

Plinius, C. Sec. Epistularum Libri Decem.

Vitruvius, M. P.: De architectura.

References

Adam, J.-P. 2007: *Roman building. Materials and Techniques.* London–New York.

Barkóczi, L. 1951: Brigetio. *Dissertationes Pannonicae* II/22. Budapest.

Barkóczi, L. 1953: Beiträge zum Rang der Lagerstadt am Ende des II. und Anfang des III. Jahrhunderts. *Acta Archaeologica Hungarica* 3, 201–203.

Bartus, D. 2001: Csontfaragó műhely Brigetióban? – Az 1999–2000-ben feltárt faragott csonttárgyak katalógusa (Kat. 54–162). In: Borhy, L. – Számadó, E. (szerk.): *Római kori csontfaragványok és modern hamisítványok. Csontfaragóművészet Brigetióban.* Acta Archaeologica Brigetionensia I/2. Komárom, 28–54.

Bartus, D. 2003: Adatok a brigetiói csontfaragó műhely lokalizálásához (Angaben zur Lokalisierung der Beinschnitzwerkstatt von Brigetio). *Komárom-Esztergom Megyei Múzeumok Közleményei* 10, 55–75.

Bartus, D. – Borhy, L. 2016: A brigetiói „pincesor". *Ókor* 15, 101–107.

Bartus, D. – Borhy, L. – Czajlik, Z. 2016: Recent research in the *canabae* and legionary fortress of Brigetio (2014–2015). In: Beszédes, J. (ed.): *Legionary Fortress and Canabae Legionis in Pannonia. International Archaeological Conference.* Aquincum Nostrum II/7. Budapest, 63–72.

Boman, H. 2005: White Light – White Heat. The use of Fire as a Light and Heat Source in an Atrium House in Roman Pompeii. *Current Swedish Archaeology* 13, 59–75. doi: 10.37718/CSA.2005.04

Borhy, L. 2001: *Pannoniai falfestmény. A Négy Évszak, az Idő és a Csillagok ábrázolása egy brigetiói mennyezetfestményen.* Budapest.

Borhy, L. 2009: *Brigetiói amphitheatrumok?* Budapest.

Borhy, L. 2019: Brigetio – Kultur einer römischen Grenzstadt an der Donau. *Humboldt-Nachrichten* 36, 29-56. http://www.humboldt.hu/sites/default/files/hn36-29-56-borhy_brigetio_-_kultur_einer_romischen_grenzstadt_an_der_donau.pdf (last access: 18. 11. 2021)

Borhy, L. 2021: *Brigetio – Egy pannoniai határváros társadalma és kultúrája.* Székfoglaló előadások a Magyar Tudományos Akadémián. Budapest. doi: 10.36820/szekfoglalo.2021.borhy

Borhy, L. – Harsányi, E. – Kovács, L. O. – Kurovszky, Zs. – Magyar, M. – Paetz gen. Schieck, A. – Pásztókai-Szeőke, J. – Számadó, E. 2010: *Római kori falfestmények Brigetióból. A komáromi Klapka György Múzeum római kori falfestményeinek katalógusa.* Acta Archaeologica Brigetionensia I/3. Komárom.

Borhy, L. – Bartus, D. – Czajlik, Z. – Rupnik, L. – Számadó, E. 2011: Brigetio (Komárom/Szőny): Táborváros a Duna mellett (Brigetio [Komárom/Szőny]: Fortress/city next to the Danube). In: Visy, Zs. (ed.): *A Ripa Pannonica Magyarországon mint világörökségi helyszín – Romans on the Danube. The Ripa Pannonica in Hungary as a World Heritage Site.* Pécs, 42–51.

Borhy, L. – Számadó, E. 2003: Brigetio. In: Visy, Zs. (ed.): *The Roman Army in Pannonia. An Archaeological Guide of the Ripa Pannonica.* Pécs, 75–77, 151–153.

Braconi, P. 2008: Ostracus, astrico e lastrico: i pavimenti in cocciopesto degli antichi e l'opus signinum dei moderni. In: Angelelli, C. – Rinaldi, F. (eds): *Atti del XIV Colloquio dell'Associazione Italiana per lo Studio e la Conservazione del Mosaico. Spoleto 7–9 febraio 2007.* Tivoli, 251–263.

Camardo, D. – Notomista, M. 2015: The roof and suspended ceiling of the marble room in the House of the Telephus Relief at Herculaneum. *Journal of Roman Archaeology* 28, 39–70. doi: 10.1017/S1047759415002408

Cencic, J. 2003: Römische Wohnbauten in Carnuntum. *Carnuntum Jahrbuch*, 9–116.

de Chazelles, C-A. 2003: Témoignages croisés sur les constructions antiques en terre crue: textes latins et données archéologiques. *Techniques & Culture* 41, 1–27. doi: 10.4000/tc.55

Cifarelli, F. M. – Colaiacomo, F. – Kay, S. – Smith, C. J. – Ceccarelli, L. – Panzieri, C. 2017: Alle origini delle *signina opera*: la grande vasca di Prato Felici dagli scavi del *Segni Project.* In: Fiore, A. – Gisotti, G. – Lena, G. – Masciocco, L. (eds): *Tecnica di idraulica antica. Atti del convegno nazionale.* Roma, 18 novembre 2016. Geologia dell'Ambiente 3. Roma, 163–166.

Clément, B. 2016: L'industrie de la brique crue dans la *colonia Lugdunum.* Typologie, approvisionnement et organisation de la production. In: Camporeale, S. – DeLaine, J. – Pizzo, A. (eds): *Arqueologia de la construcción, V. Man-made materials, engineering and infrastructure: proceedings of the 5th International Workshop on the archaeology of Roman construction, Oxford, April 11–12, 2015.* Anejos de Archivo Español de Arqueología 77. Madrid, 145–163.

Czysz, W. 2016: Per analogiam – Rekonstruktionsmöglichkeiten von Streifenhäusern im römischen Vicus. In: Pfeil, M (Hrsg.): *Römische Vici und Verkehrsinfrastruktur in Raetien und Noricum: Colloquium Bedaium Seebruck, 26-28. März 2015.* Schriftenreihe des Bayerischen Landesamtes für Denkmalpflege 15. München, 59–67.

Dévai, K. 2011: A Komárom/Szőny-Vásártéri ásatások római kori üvegleletei (Glass Vessels Found at the Excavations of Komárom/Szőny-Vásártér). *Komárom-Esztergom Megyei Múzeumok Közleményei* 17, 133–150.

Dévai, K. – Gelencsér, Á. 2012a: Római kori lakóépület és üvegműhely Brigetióból (The secondary glass workshop in civil town of Brigetio). *Komárom-Esztergom Megyei Múzeumok Közleményei* 18, 59–102.

Dévai, K. – Gelencsér, Á. 2012b: Római kori lakóház és üveggyártó műhely Brigetióban. In: Bíró, Sz. – Vámos, P. (szerk.): *FiRKák II. Fiatal Római Koros Kutatók II. Konferenciakötete.* Győr, 439–468.

Ditmar-Trauth, G. 1995: *Das Gallorömische Haus. Zu Wesen und Verbreitung des Wohnhauses der gallorömischen Bevölkerüng im Imperium Romanum.* Hamburg.

Dobosi, L. 2014: *Városi lakóházépítészet Brigetióban. A Komárom/Szőny-Vásártér lelőhelyen 1999-2013 között folytatott ásatások építészeti vonatkozású eredményei.* Acta Archaeologica Brigetionensia I/6. Komárom.

Dobosi, L. – Borhy, L. 2011: The Municipium of Brigetio. Roman Houses at Komárom/Szőny-Vásártér. *Periodica Polytechnica Architecture* 42, 3–10. doi: 10.3311/pp.ar.2011-2.01

Dobosi, L. – Borhy, L. 2015: Roman building techniques observed in the *municipium* of Brigetio. *Acta Archaeologica Academiae Scientiarum Hungaricae* 66, 183–202. doi: 10.1556/072.2015.66.1.8

Gerding, H. 2016: *Later*, *laterculus*, and *testa*. New perspectives on Latin brick terminology. *Opuscula* 9, 7–31. doi: 10.30549/opathrom-09-02

Gogräfe, R. 1991: Wand- und Deckenmalerei der villa rustica „Am Silberberg" bei Bad Neuenahr-Ahrweiler. *Kölner Jahrbuch für Vor- und Frühgeschichte* 24, 219–225.

Gogräfe, R. 2004: Flach- und Tonnendecken in der östlichen *provincia Belgica* und der nördlichen *Germania superior*. In: Borhy, L. (ed.): *Plafonds et voûtes à l'époque antique. Actes du VIII^e Colloque international de l'Association Internationale pour la Peinture Murale Antique (AIPMA) 15–19 mai 2001, Budapest–Veszprém.* Budapest, 221–231.

Groh, S. – Láng, O. – Sedlmayer, H. – Zsidi, P. 2014: Neues zur Urbanistik der Zivilstädte von Aquincum-Budapest und Carnuntum-Petronell. Auswertung und archäologische Interpretation der geophysikalischen Messungen 2011 und 2012. *Acta Archaeologica Academiae Scientiarum Hungaricae* 65, 361–404. doi: 10.1556/AArch.65.2014.2.5

Gros, P. 2006: L'opus signinum selon Vitruve et dans la terminologie archéologique contemporaine. In: Gros, P.: *Vitruve et la tradition des traités d'architecture: Fabrica et ratiocinatio.* Publications de l'Ecole française de Rome. Rome, 2006. doi: 10.4000/books.efr.2450

Hajnalová, M. – Rajtár, J. 2009: Supply and subsistence: the Roman fort at Iža. In: Hanson, W. S. (ed.): *The Army and Frontiers of Rome. Papers offered to David J. Breeze on the occasion of his sixty-fifth birthday and his retirement from historic Scotland.* Portsmouth, 195–207.

Harsányi, E. 2016: Római kori falfestmények készítés-technikája, feltárása, rendszerezése, kutatása. DLA Dissertation, Hungarian University of Fine Arts, Budapest. http://doktori.mke.hu/sites/default/files/doktori/Harsányi%20DLA%20értekezés.pdf (last access: 12. 11. 2021)

Harsányi, E. – Kurovszky, Zs. 2001a: A helyiség építészeti tulajdonságaira vonatkozó észrevételek, a dongaboltozat meghatározása és betájolása. In: Borhy, L.: *Pannoniai falfestmény. A Négy Évszak, az Idő és a Csillagok ábrázolása egy brigetiói mennyezetfestményen.* Budapest, 26–27.

Harsányi, E. – Kurovszky, Zs. 2001b: *A feltárt töredékek összeállítása, restaurálása és bemutatása.* In: Borhy, L.: *Pannoniai falfestmény. A Négy Évszak, az Idő és a Csillagok ábrázolása egy brigetiói mennyezetfestményen.* Budapest, 94–97.

Harsányi, E. – Kurovszky, Zs. 2001c: *A mennyezetfestmény készítéstechnikája.* In: Borhy, L.: *Pannoniai falfestmény. A Négy Évszak, az Idő és a Csillagok ábrázolása egy brigetiói mennyezetfestményen.* Budapest, 98–100.

Harsányi, E. – Kurovszky, Zs 2010a.: A mennyezetfestmény szerkezete. In: Borhy, L. – Harsányi, E. – Kovács, L. O. – Kurovszky, Zs. – Magyar, M. – Paetz gen. Schieck, A. – Pásztókai-Szeőke, J. – Számadó, E. 2010: *Római kori falfestmények Brigetióból. A komáromi Klapka György Múzeum római kori falfestményeinek katalógusa.* Acta Archaeologica Brigetionensia I/3. Komárom, 30–32.

Harsányi, E. – Kurovszky, Zs. 2010b: A falfestmény kompozíciója, főbb szerkezeti elemeinek méretei. In: Borhy, L. – Harsányi, E. – Kovács, L. O. – Kurovszky, Zs. – Magyar, M. – Paetz gen. Schieck, A. – Pásztókai-Szeőke, J. – Számadó, E. 2010: *Római kori falfestmények Brigetióból. A komáromi Klapka György Múzeum római kori falfestményeinek katalógusa.* Acta Archaeologica Brigetionensia I/3. Komárom, 96–101.

Harsányi, E. – Kurovszky, Zs. 2017: Wall Paintings of the Early *Iseum* of Savaria, Pannonia. In: Mols, S. T. A. M. – Moormann, E. M. (eds): *Context and Meaning. Proceedings of the twelfth international conference of the Association Internationale Pour La Peinture Murale Antique, Athens, September 16–20, 2013.* Leuven–Paris–Bristol, CT, 523–527.

Hufschmid, T. 1996: *Kastelen 3. Die Jüngeren Steinbauten in den Insulae 1 und 2 von Augusta Raurica. Untersuchungen zur baugeschichtlichen Entwicklung einer römischen Domus im 2. und 3. Jahrhundert n. Chr.* Forschungen in Augst 23. Augst.

Hufschmid, T. 2013: Zimmer mit Aussicht – eine verglaste Säulenhalle in Insula 39 von Augusta Raurica. *Augusta Raurica – Magazin*, 11–15.

Juhász, L. 2018: Monetary circulation in the municipium of Brigetio. The excavations of Komárom/Szőny-Vásártér (1992–2015). In: Ivanišević, V. – Borić-Brešković, B. – Vojvoda, M. (eds): *Circulation of Antique Coins in Southeastern Europe. Proceedings of the International Numismatic Symposium. Held in Viminacium, Serbia, September 15th to 17th 2017.* Belgrade, 9–21.

Keevill, G. 1995: Processes of Collapse in Romano–British Buildings: a review of evidence. In: Shepherd, E. (ed.): *Interpreting Stratigraphy 5 – 1994 Norvich.* Norvich, 26–37.

Keevill, G. 1996: The reconstruction of the Romano-British villa at Redlands Farm, Northamptonshire. In: Johnson, P. – Haynes I. (eds): *Architecture in Roman Britain.* Council for British Archaeology Research Reports 94. York, 44–55. doi: 10.5284/1081795

King, A. C. – Potter, T. W. 1990: A new domestic building-façade from Roman Britain. *Journal of Roman Archaeology* 3, 195–204. doi: 10.1017/S1047759400010965

Kortüm, K. 2005: Leben und Arbeiten. Privathäuser in städtischen Siedlungen. In: Schmidt, S. (Hrsg.): *Imperium Romanum: Roms Provinzen an Neckar, Rhein und Donau. Begleitband zur Ausstellung des Landes Baden-Württemberg im Kunstgebäude Stuttgart, 1. Oktober 2005 bis 8. Januar 2006.* Stuttgart, 252–259.

Kovács, P. (ed.) 2007: *Az antik Pannonia forrásai a Severus-korban* (Fontes Pannoniae Antiquae in aetate Severorum). Fontes Pannoniae Antiquae 4. Budapest.

Kurovszky, Zs. 2006: A szombathelyi Szily János utcában feltárt falfestménylelet összeállítása és elméleti rekonstrukciója. *Savaria – A Vas Megyei Múzeumok Értesítője* 30, 455–487.

Láng, O. 2006: Római kori beépítettség kutatása az aquincumi polgárvárostól északra fekvő Duna-parton (Investigation of the use of the Danube bank north of the Aquincum Civil Town). *Aquincumi Füzetek* 12, 60–72.

Láng, O. 2012: Urbanisztikai problémák az aquincumi polgárvárosban: az ún. „É-i sáv". PhD Dissertation, Eötvös Lorand University, Budapest. http://doktori.btk.elte.hu/hist/langorsolya/diss.pdf (last access: 12. 11. 2021)

Láng, O. – Bíró, Sz. 2018: „Unpleasant to live in, yet it makes the city rich". Industry and Commerce in Military and Civil Settlements along the Pannonian Limes. In: Sommer, C. S. – Matešić, S. (eds): *Limes XXIII. Proceedings of the 23rd International Congress of Roman Frontier Studies Ingolstadt 2015.* Mainz, 609–619.

Lauritsen, M. T. 2011: Doors in Domestic Space at Pompeii and Herculaneum: A Preliminary Study. In: Mladenović, D. – Russel, B. (eds): *TRAC 2010: Proceedings of the Twentieth Annual Theoretical Roman Archaeology Conference, Oxford 2010.* Oxford, 59–75. doi: 10.16995/TRAC2010_59_75

Lauritsen, M. T. 2012: The Form and Function of Boundaries in the Campanian House. In: Anguissola, A. (ed.): *Privata Luxuria: Towards an Archaeology of Intimacy: Pompeii and Beyond. International Workshop Center for Advanced Studies, Ludwig-Maximilians-Universität München (24–25 March 2011).* Munich, 95–114.

Mac Mahon, A. 2005: The shops and workshops of Roman Britain. In: Mac Mahon, A. – Price, J. (eds): *Roman working lives and urban living.* Oxford, 48–69.

Meiggs, R. 1973: *Roman Ostia.* Oxford.

Mráv, Zs. 2013: Septimius Severus and the Cities of the Middle Danubian Provinces. In: Eck, W. – Fehér, B. – Kovács, P. (eds): *Studia Epigraphica in memoriam Géza Alföldy.* Antiquitas 61 – Reihe, Abhandlungen zur alten Geschichte 61. Bonn, 205–240.

Müller, M. 2008: Wohnbauten in der Zivilsiedlung von Vindobona – Lebensorte. In: Scherrer, P. (Hrsg.): *DOMUS. Das Haus in den Städten der römischen Donauprovinzen. Akten des 3. Internationalen Symposiums über römische Städte in Noricum und Pannonien.* Vienna, 105–121.

Oelmann, F. 1923: Gallo-Römische Strassensiedlungen und Kleinhausbauten. *Bonner Jahrbücher* 128, 77–97.

Perring, D. 2002: *The Roman House in Britain.* London–New York. doi: 10.4324/9780203463857

Puche Fontanilles, J. M. 2015: *In signinis operibus*. Sobre le significado real de *opus signinum*. *Butlletí Arqueològic* 36–37, 7–28.

Sey, N. 2015: Roman Bronze Workshop in the Civil Town of Brigetio. In: Borhy, L. – Tankó, K. – Dévai K. (eds): *Studia Archaeologica Nicolae Szabó LXXV Annos Nato Dedicata*. Budapest, 225–236.

Sommer, S. 2005: Römische Häuser: 12 Meter bis zum First. Die villa rustica von Oberndorf-Boschingen. In: Archäologisches Landesmuseum Baden-Württemberg (Hrsg.): *Imperium Romanum – Roms Grenzen an Neckar, Rhein und Donau*. Baden-Württemberg, 282–285.

Sommer, S. 2011: Grundriss und Wände als Ansatz zur Dachrekonstruktion. In: von Kienlin, A. (Hrsg.): *Holztragwerke der Antike*. BYZAS 11, 247–258.

Steffny, E. 1998: Rekonstruktion der Holzbauart einer römischen Decke des 4. Jahrhunderts. *Arbeitsblätter für Restauratoren* 31, 148–151.

Stephenson, J.W. 2014: Veiling the Late Roman House. *Textile History* 45, 3–31. doi: 10.1179/0040496914Z.00000000035

Szórádi, Zs. 2010: Terra sigillata. Leletek a Brigetio-Vásártéren 2009-ben feltárt pincéből. BA Thesis, Eötvös Loránd University, Budapest.

Timár, L. 2011: *The Spread of the Roman Domus-Type in Gaul*. British Archaeological Reports – International Series 2206. Oxford. doi: 10.30861/9781407307640

Ulrich, R. B. 2007: *Roman Woodworking*. New Haven–London.

Vassal, V. 2006*: Les pavements d'opus signinum. Technique, décor, fonction architecturale*. British Archaeological Reports – International Series 1472. Oxford. doi: 10.30861/9781841719085

Vipard, P. 2003: Les portiques fenêtrés dans les domus du Haut-Empire romain. *Bulletin archéologique du Comité des travaux historiques et scientifiques: Antiquité, Archéologie Classique* 30. Paris, 99–134.

Vipard, P. 2009: L'usage du verre à vitre dans l'architecture romaine du Haut Empire. In: Lagabrielle, S. – Philippe, M. (dir.): *Verre et fenêtre de l'Antiquité au XVIIIe siècle. Actes du premier colloque international de l'association Verre et Histoire, Paris-La Défense/Versailles, 13–15 octobre 2005*. Paris, 3–10.

Zsidi, P. 2008: Wohnhaustypen und Stadtstruktur in der Zivilstadt von Aquincum. In: Scherrer, P. (Hrsg.): *DOMUS. Das Haus in den Städten der römischen Donauprovinzen. Akten des 3. Internationalen Symposiums über römische Städte in Noricum und Pannonien*. Vienna, 251–270.