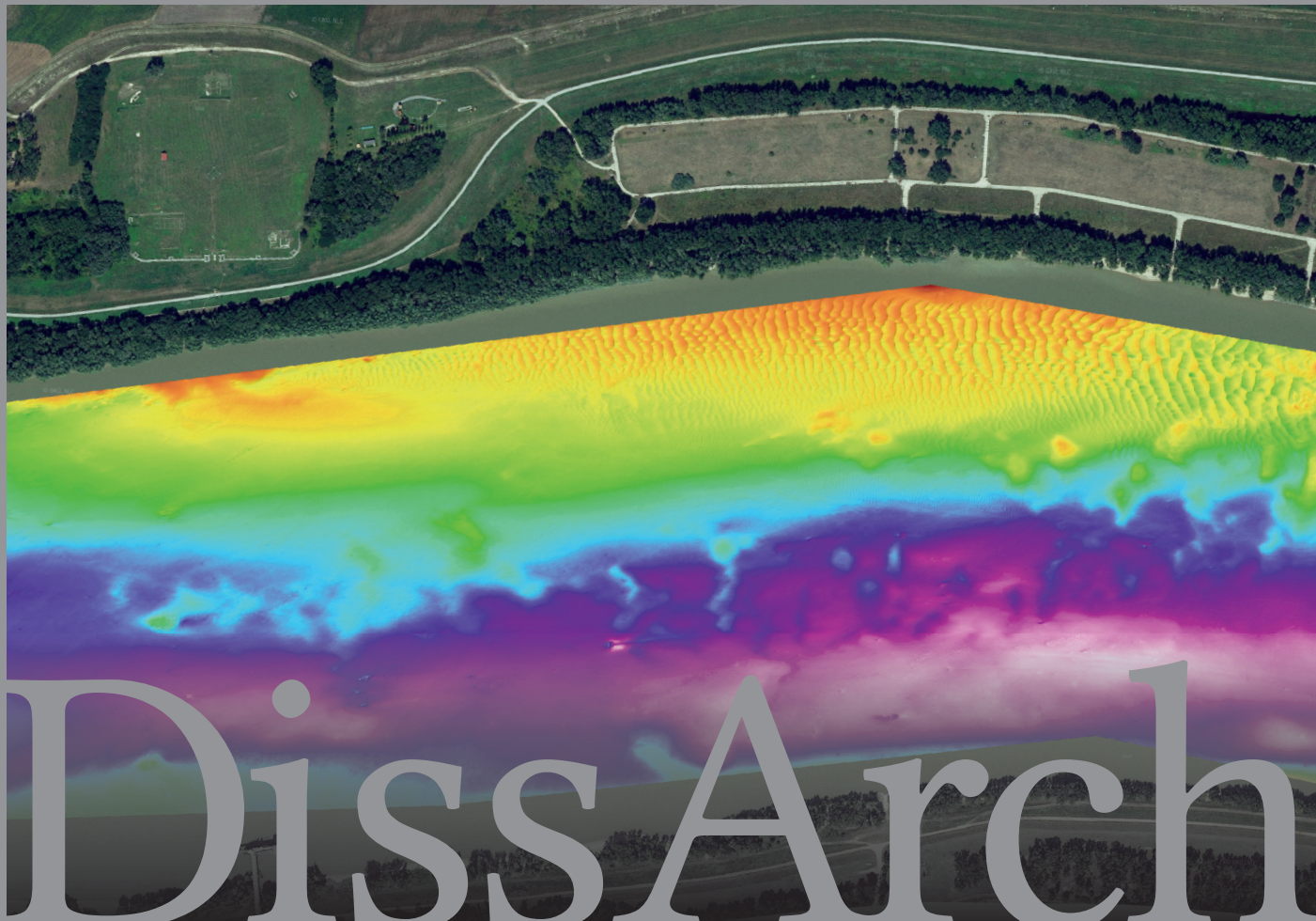


DISSERTATIONES ARCHAEOLOGICAE

ex Instituto Archaeologico

Universitatis de Rolando Eötvös nominatae



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Dissertationes Archaeologicae
ex Instituto Archaeologico
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On the functionality of *vasa diatreta*

The case of the cage cup fragments from Gorsium

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Abstract: This study re-evaluates the functionality and production context of Roman cage cups (*vasa diatreta*) through recently analysed fragments from Gorsium (Tác, Hungary), found in the apsidal audience hall of a Late Roman palace. The architectural setting, with clear administrative-imperial connotations, confirms the ceremonial use of these luxury vessels by high-ranking officials. The presence of multiple cage cup fragments in a single representative room is particularly notable, indicating that such elite objects were not isolated rarities but could also be used in official receptions, thus redefining their social function.

Archaeometric analysis has confirmed that their composition reveals unusually low levels of iron, magnesium, and potassium, suggesting the use of exceptionally pure, low-impurity sand—a possible indicator of deliberate material selection in elite production contexts.

Evidence from Gorsium provides rare insights into the interplay of luxury, recycling, and imperial display in the Late Roman provinces. It challenges traditional distinctions between high craftsmanship and reused materials, and affirms the adaptive sophistication of Roman glass economy.

Keywords: cage cups, *vasa diatreta*, Roman colourless glass, recycled glass, Pannonia

Function and meaning of cage cups: an archaeological perspective

Cage cups, also known as *vasa diatreta*, were doubtless one of the most sophisticated glass products, both artistically and technologically, of the Roman period. The catalogue to the most comprehensive overview of cage cups written by Whitehouse lists 69 pieces, with an additional 13 specimens in the appendices.¹ The book was published posthumously due to the author's untimely death, and some portions of the text were revised or written by his colleagues.² The first classification of cage cups was proposed by Harden and Toynbee.³ *Diatreta* can be divided into six different forms: dishes or skillets (*paterae*), bowls, beakers, bottles, amphoras or pitchers, and buckets (*situlae*).⁴ While

1 WHITEHOUSE 2015.

2 FÜNFSCILLING 2020, 931–937.

3 HARDEN – TOYNBEE 1959, 179–212.

4 FÜNFSCILLING 2020, 931–937.

there is a lively ongoing debate over how these objects were manufactured,⁵ far less is known about their chemical composition. Although the fragments presented here are already known to archaeological scholarship and also appear in Whitehouse's catalogue, some minor details call for additional clarification.⁶ We recently had the opportunity to study the chemical composition of these fragments in order to determine whether the three fragments came from the same or from two different cage cups as hypothesized by Harden,⁷ to check whether the chemical composition of these fragments shares any similarities with other cage cups, and to gain an insight into the technology of their production.

Besides distribution, dating, and the much debated production technology, another intriguing issue is the function of these vessels and how they were used. Being highly expensive luxury items whose production called for exceptional skills, they were presumably produced in a few major centres—most likely in major imperial seats and administrative centres—where the appropriate raw materials and specialised craftsmen were available, alongside a demand for luxury items. A glance at the distribution of the currently known roughly 80 pieces (Fig. 1) reveals that, although they have been found throughout the Roman Empire (from Britain to Africa and from Spain to Asia and Syria), there is no one single region with a strikingly high concentration, suggesting the movement of these prestigious vessels along with officials whose duties may have taken them from one end of the empire to the other, or that they graced the homes of wealthy patrons in their *villae*.⁸

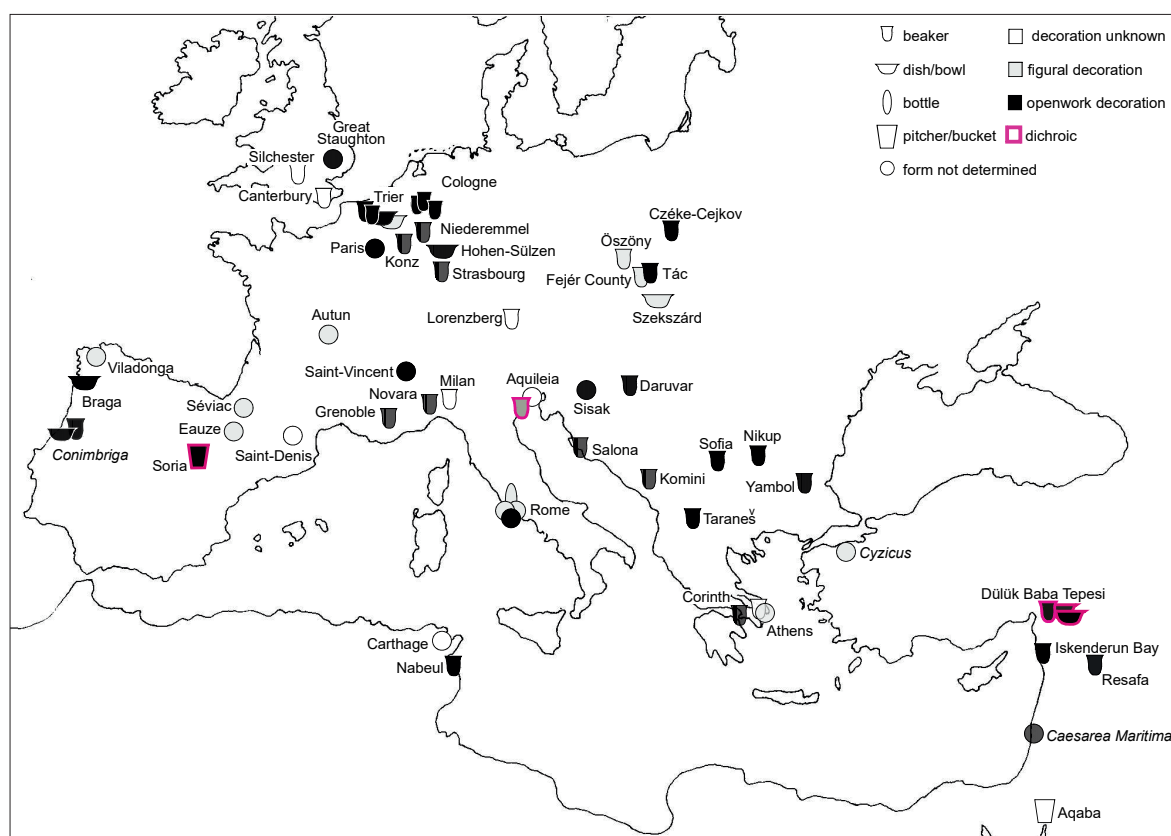


Fig. 1. Distribution of cage cups, including the fragments from Gorsium (TÁC) (after HÖPKEN 2014; WHITEHOUSE 2015, updated).

5 SCOTT 1991; SCOTT 1993; LIERKE 1993; LIERKE 1995a; LIERKE 1995b; WELZEL 1998; LIERKE 2001; LIERKE 2004; LIERKE 2012; LIERKE 2013; CARNEVALE 2015; WHITEHOUSE 2015; FÜNFSCILLING 2020.

6 WHITEHOUSE 2015.

7 HARDEN 1963, 8–17.

8 WHITEHOUSE 2015.

Two possible uses have been proposed for cage cups: as lamps, or as drinking vessels (cups or bowls). The possible function of other *diatreta* vessel types, such as bottles, jugs, and buckets, is even more uncertain. One of the hemispherical cage cups in the collection of the Corning Museum of Glass has a metal collar around the neck, indicating that it was suspended, which would support the lamp hypothesis.⁹ Some of these cups were in all likelihood used as drinking vessels, a function suggested by the inscriptions on the cups themselves; for example, the Trivulzio and Cologne cups bear mottos with an identical or roughly similar meaning, “Drink and live long!”¹⁰ Whitehouse reviewed and analysed the references to dichroic cage cups in the textual sources.¹¹ A passage in Vopiscus’s life of Syracusius in the *Historia Augusta* recounts that the Emperor Hadrian sent his brother-in-law Severianus an unusual gift from Egypt. It is noteworthy that Vopiscus, living in the fourth century, described a cup that changed its colour and was an imperial gift to be used at banquets on special occasions. It seems likely that in his capacity as a historian, Vopiscus, the scion of a noble family, whose grandfather and father had found favour with the emperor, described a custom that was fashionable in his own days in the early 4th century: the use of dichroic glass vessels at banquets.¹² Another passage comes from the novel *Leukippe and Cleitophon* by Achilles Tatius, who is believed to have lived in the 2nd century.

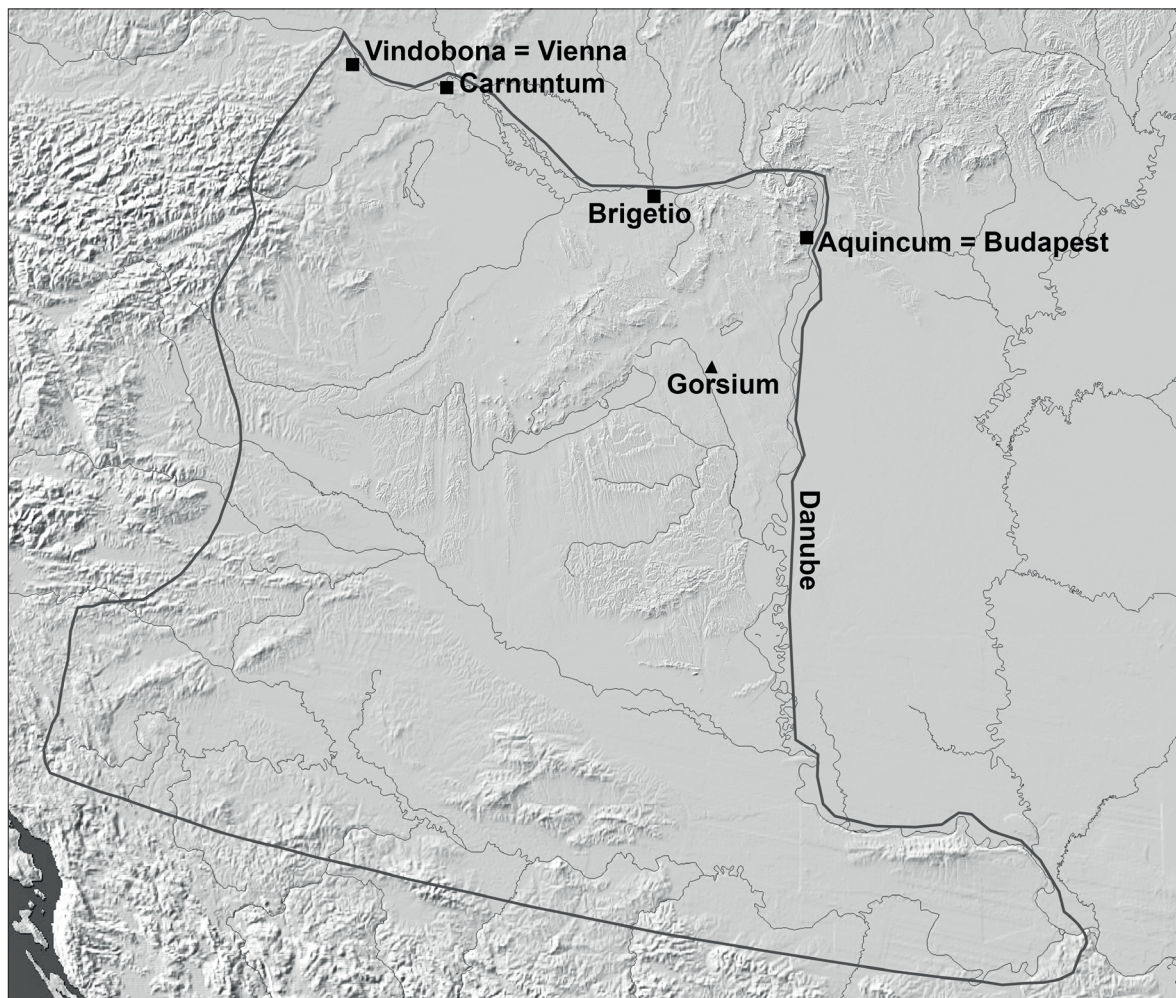


Fig. 2. Pannonia and the main settlement with the location of Gorsium.

9 WHITEHOUSE 1988, 28–33.

10 HARDEN 1987, 239.

11 WHITEHOUSE 1989, 119–121.

12 WHITEHOUSE 1989, 120.

The protagonist, Cleitophon, attends a banquet in honour of Dionysus, where a most unusual bowl was used for offering libation.¹³ As Carnevale points out, the inscriptions should not necessarily be taken literally: the fact that the mottos would imply that one was encouraged to drink makes it a reasonable assumption that the cup was used for that. Yet, the motto alone does not necessarily mean that the vessel was actually drunk from but rather that it was used in the context of ‘drinking’.¹⁴ In practice, it would have been quite difficult to drink from cage cups because of their design and fragility, and it is therefore possible that the inscriptions should not be taken literally, and the cups were not meant to be drunk from but were used as lighting devices adorning the walls of the dining halls where banquets and libations were held. Assuming that cage cups were important part of the paraphernalia of the *cena*, the *convivum*, and the *libatio*, it seems worth to examine whether the archaeological record confirms that by studying the find contexts of these vessels. In what architectural spaces have *vasa diatrete* been found? Can their presence be archaeologically proven in elegant dining rooms and banquet halls? Looking at *vasa diatrete* from this perspective, we find that a very few come from archaeological contexts with a precise dating. Whitehouse’s book includes a useful compilation of well-dated specimens, providing a rough idea of the time frame within which they were used.¹⁵ However, it seems that a closer look at the contexts from which *diatrete* have been recovered—if they can be identified architecturally—can shed light not only on their dating but also on their possible former use. Cage cups have been found as grave goods from burials and they have also been recovered from settlements and buildings.

A total of five exemplars have been recovered from burials. The Strasbourg cage cup (Argentoratum in the Roman province of Germania Superior, later Germania Prima, in France), recovered from a sarcophagus, bears a datable inscription (Tab. 1).¹⁶ Two cage cups accompanied by a coin were found in Cologne (Colonia Claudia Ara Agrippinensium in the Roman province of Germania Inferior, later Germania Secunda, in Germany),¹⁷ and a cage cup was found together with an inscribed gold brooch in a grave at Taraneš (western Macedonia),¹⁸ whose inscription dated the assemblage to the reign of Licinius I (r. 309–324). In these cases, the funerary context allows dating. *Diatrete* fragments were found in a richly furnished grave, also dating from the Late Roman period, in the Barbaricum near the border of Pannonia at Cejkov in today’s south-eastern Slovakia.¹⁹

One intriguing question is the possible function of these luxurious glasses as grave goods is, were they simply prestige objects at funerals of the elite, were they perhaps used for libation offerings, or were they tools of social display? Unfortunately, the analysis of the grave finds reveals little about the one-time use of the vessels.²⁰

Fourteen more fragments come from datable archaeological contexts (based on the information in Whitehouse’s catalogue and appendices), among them three different pieces from Dülük Baba Tepesi (Doliche in the Roman province of Syria, later Syria Euphratensis, in today’s Turkey),²¹ while

13 WHITEHOUSE 1989, 121.

14 CARNEVALE 2015, 478–487.

15 WHITEHOUSE 2015.

16 SAUZAY 1868, 21–22; SAUZAY 1870, 15–19; HARDEN – TOYNBEE 1959, 210; WELZEL 1994, 34, Fig. 54C; WHITEHOUSE 2015, 100–101.

17 URLICHS 1844; KISA 1899, 21; HARDEN – TOYNBEE 1959, 208; WELZEL 1994, 6, Fig. 1; WHITEHOUSE 2015, 109.

18 IVANOVSKI 1984, 219–226; IVANOVSKI 1987, 81–90; CERMANOVIĆ-KUZMANOVIČ 1995, 24–27; WHITEHOUSE 2015, 110–111.

19 BENINGER 1937; KRASKOVSKÁ 1981, 11–17; HRNČIARIK 2021, 33–44.

20 FÜNFSCILLING 2020, 931–937.

21 WHITEHOUSE 2015, 80, 86.

Britannia Prima; the modern Caerwent, Wales, United Kingdom).²⁶ Finally, fragments of a figural vessel depicting a songbird were found among the remains of a house during the excavation of the Athenian Agora (Greece), Athenae in the province of Achaia in today's Greece).²⁷

Three fragments of a cage cup were recovered from a layer containing finds from the 3rd to 7th centuries AD during the excavation of a sanctuary of Jupiter Dolichenus at Dülük Baba Tepesi (ancient Doli-che). The first fragment does not provide any additional information on the function or the chronological position of the object. However, three further *diatrete* fragments came to light during the 2011 excavations. Two of these were found among baking vessels near an oven and a structure that was perhaps a storeroom, suggesting that the building was the bakery of the monastery. The fourth fragment was found on the southwestern central plateau, in the area of the Iron Age and Hellenistic temple, where it may have been transported with the building material. Accordingly, these fragments were recovered from secondary contexts and provide no additional information on their one-time use.²⁸ The Trivulzio cage cup fragment in Milan (Mediolanum in the province of Italia, later Italia Annonaria, in today's Italy) came to light in a context dated between the 4th and 6th centuries AD; however, no information is available on its former function.²⁹ The cage cup from Corinth (Corinthus in the province of Achaia in today's Greece), found together with coins of Constantius II, can perhaps be associated with a Roman building, possibly a *villa*,

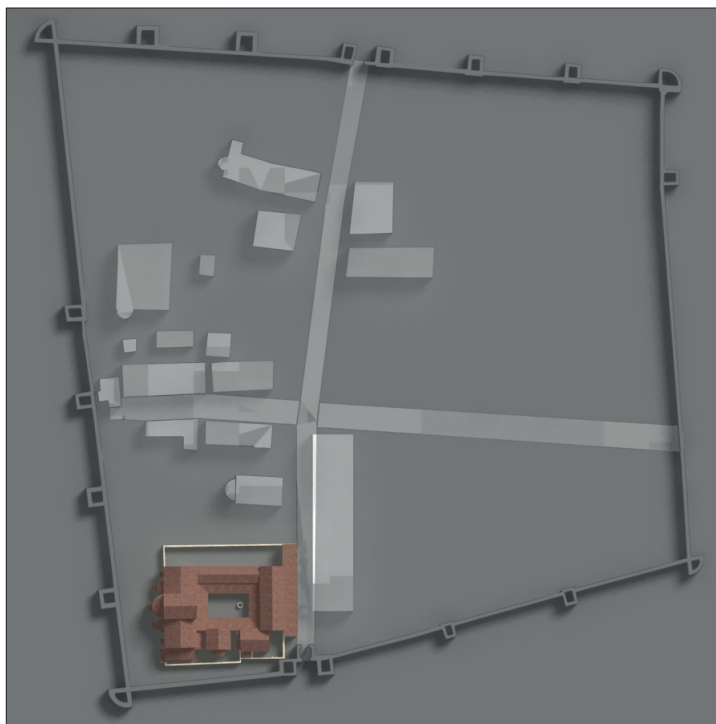


Fig. 4. Reconstruction of the settlement of Gorsium in the 4th century AD. Szent István Király Museum, Archaeological Park Gorsium (graphics by Zoltán Zsiga).

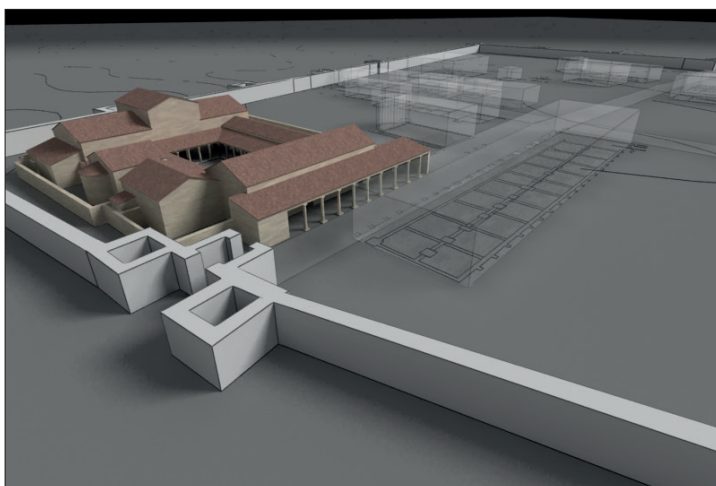


Fig. 5. 3D reconstruction of the Palatium (Building I). Szent István Király Museum, Archaeological Park Gorsium (graphics by Zoltán Zsiga).

26 WHITEHOUSE 2015, 181.

27 HARDEN 1963, 16; WEINBERG 1964, 47–51; WELZEL 1994, 17, Fig. 26D; WHITEHOUSE 2015, 94–95.

28 HÖPKEN 2008; HÖPKEN 2014; HÖPKEN 2015; WHITEHOUSE 2015, 80, 86.

29 UBOLDI 1991; PAOLUCCI 1997, 186–189; WHITEHOUSE 2015, 106–107.

some 500 metres from the Odeon.³⁰ The exemplars from Abodiacum (modern Epfach, Germany, province of Raetia) can be dated to the end of the 4th century AD; however, nothing indicates their function.³¹ One fragment was recovered from a late Saxon pit excavated at Roman Durovernum Cantiacorum (modern Canterbury, United Kingdom, province of Britannia).³² The piece from ancient Neapolis (Naples, Italy, province of Italia/Campania) is dated to the 4th century AD, while the fragment from Roman Nicopolis ad Istrum (province of Moesia Inferior in today's Bulgaria) was recovered from the fill of the foundation of an early

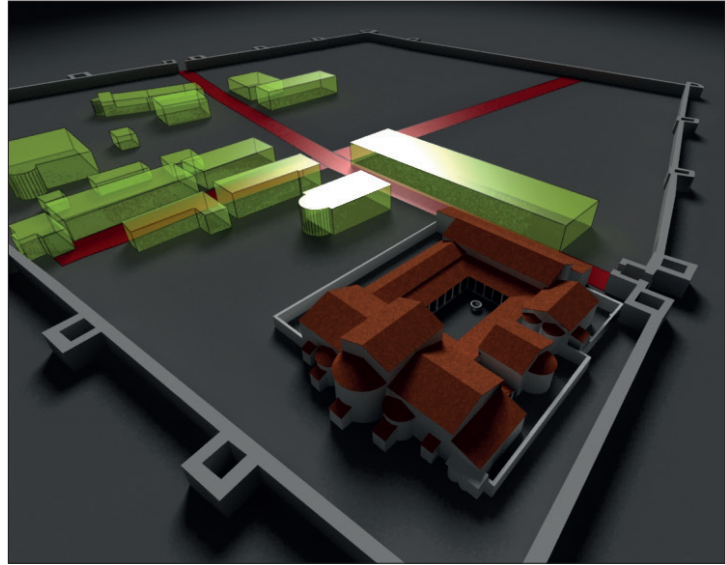


Fig. 6. 3D reconstruction of the Palatium (Building I). Szent István Király Museum, Archaeological Park Gorsium (graphics by Zoltán Zsiga).

Byzantine tower.³³ Another piece came to light at 'Aqaba (Aela in the province of Arabia Petraea in today's Jordan) among the ruins of what may have been a church.³⁴ Excavations at Great Staughton (United Kingdom, area of the province of Britannia) have uncovered part of a large complex consisting of a *villa* and a bath house.³⁵ Finally, some dated fragments were found in Carthage (Carthago in the province of Africa Proconsularis in today's Tunisia), Nabeul (Neapolis in the province of Africa Proconsularis in today's Tunisia) and Lorenzberg (Empfach, Germany, province of Raetia). However, neither of these pieces sheds any light on the use of cage cups.³⁶

The cage cup found in Roman Contionacum (Konz, Germany, province of Gallia Belgica) is relevant in terms of the function of these vessels since the related *villa* was the country residence of the Emperor Valentinian, who had his headquarters in Trier.³⁷ In this case, the find context fits in with literary evidence on *diatreta* and available data on their production, both pointing towards their use in the banqueting halls of imperial officials and in imperial centres.³⁸

The Gorsium (Tác, Hungary, province of Pannonia) specimen can also be assigned to the pieces with a well-dated archaeological context; the function of the associated building can also be determined.³⁹ Quite remarkably, both the building itself and the room it was found in indicate its former use.

30 HARDEN 1963, 17; WEINBERG 1964, 51–54; RISTOW 1988, 14; WELZEL 1994, 33, Fig. 53B; WHITEHOUSE 2015, 119.

31 HARDEN 1963, 16–17; RISTOW 1988, 11; WELZEL 1994, 33; PAOLUCCI 1997, 190–191.

32 CHARLESWORTH – PRICE 1987, 222, Fig. 88; WHITEHOUSE 2015, 129.

33 SEPHERD 1999, 318–319; WHITEHOUSE 2015, 134–135.

34 PARKER 2000, 373–394; JONES 2003, 180–182; WHITEHOUSE 2015, 144–145.

35 HARDEN – TOYNBEE 1959, 212; HARDEN 1963, 16; WELZEL 1994, 28, Fig. 40C; WHITEHOUSE 2015, 158.

36 WHITEHOUSE 2015.

37 GOETHERT-POLASCHEK 1977, 63; GERICK 2010, 123–125; WHITEHOUSE 2015, 131.

38 HARDEN 1963; WELZEL 1994; WHITEHOUSE 2015.

39 MAROSI 1934, 66, Fig. 6; HARDEN 1963, 17, no. B17; THOMAS 1964, 322 and Pl. 198.1; BARKÓCZI 1988, 219, Kat. no. 553; RISTOW 1988, 24, Fig. 30; WHITEHOUSE 2015, 126.

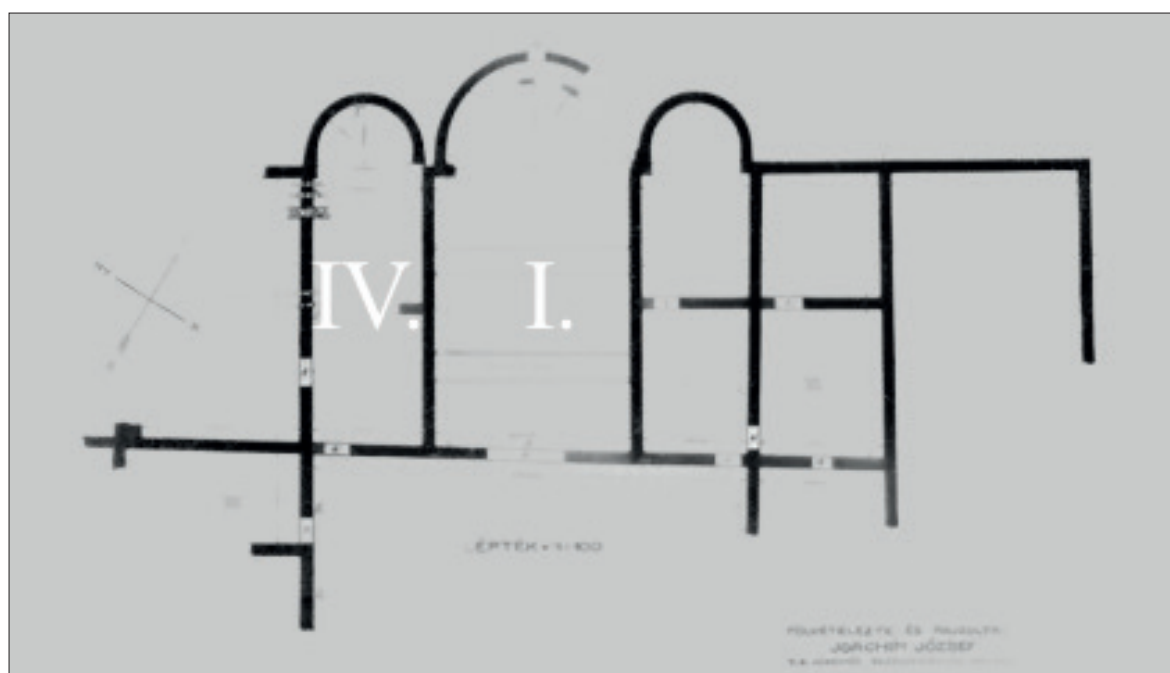


Fig. 7. Plan of the Palatium (graphics by Zoltán Zsiga). Szent István Király Museum, Archaeological Park Gorsium (after FITZ 2003, 32).

Apparently, five of the well-dated examples come from burials, although it is difficult to determine what function they served in grave. Whitehouse mentions four burials with *diatrete* glass; another piece was also found in a Vandal princely burial in the Barbaricum near the Pannonian limes. Whitehouse's appendix lists 14 exemplars from dated archaeological contexts, but this list is not complete and includes pieces from fill layers or refuse pits which do not yield conclusive evidence on the character of the one-time building.⁴⁰ The inclusion of the 10th–11th-century AD refuse pit from Canterbury in the list is disputable from a chronological perspective since the fragment in question was obviously redeposited and, thus, offers no information on the date of its use.

Seven more cage cups which do not appear in Whitehouse's catalogue are known from buildings; all of which may carry relevant information on how these vessels were used. The exact function of eleven buildings in which *diatrete* vessels were found can be identified. The list includes baths (Trier), a presumed church ('Aqaba), formal, representative buildings such as palaces, official buildings, and basilicas (Gorsium, Trier, Caerwent, and Resafa), and private luxury villas and the residences of wealthy, influential aristocrats, perhaps former officials and emperors (Séviac, Konz, Corinth, Athenian Agora and Great Staughton). Whether used for drinking or lighting, cage cups are often, although not exclusively, associated with buildings in centres of imperial administration. In regions where the army played a significant role, for example along the *limes*, a significant and affluent office-holding aristocracy in the service and defence of the empire was also present. These officials were always on the move, which may account for the concentrations of *diatrete* glass along the Rhine and in Pannonia. In many cases, wealthy, ambitious landowners travelled to the administrative centres and significant military areas to take up office and, at the end of their term, returned to their country *villae* with status objects such as cage cups. A group of Hispanic *diatrete* vessels comes from a region that is more of a *villa* district than an imperial administrative centre; besides, some exemplars that appear to reflect economic status rather than a position in official bureaucracy are known from major cities, suggesting that these vessels were not used solely by the aristocracy with an active role in imperial administration.

40 WHITEHOUSE 2015, 191–223.

Archaeological background

The Roman settlement of Gorsium (modern TÁC, Hungary, [Figs 1–2](#)) was established as a military camp of the *ala Scubulorum* in the province of Pannonia around the AD 40s. The next important period in the history of Gorsium began with reorganisations in the wake of the Dacian wars, when Gorsium became the seat of the *concilium provinciae* and the town had a sacred precinct with a temple for the cult of the emperor during the reign of Trajan. Sarmatian incursions destroyed the settlement again in the AD 260s, and life in the ransacked city restarted only at the close of the 3rd century AD.⁴¹ This period saw the construction of the large peristyle building (Building I) and the Early Christian basilicas (Buildings III and V), as well as of the colonnaded main street (*decumanus maximus*). The town's name was changed to Herculia according to the *Itinerarium Antonini*.⁴² The third period began with the foundation of a new city by the Emperor Diocletian, which he named Herculia after his co-emperor Maximian Herculus. Building I was converted into a spacious palace for the governor of the new province of Valeria and defensive walls were built around the settlement. The construction of Building I began in the AD 290s ([Fig. 3](#)).⁴³

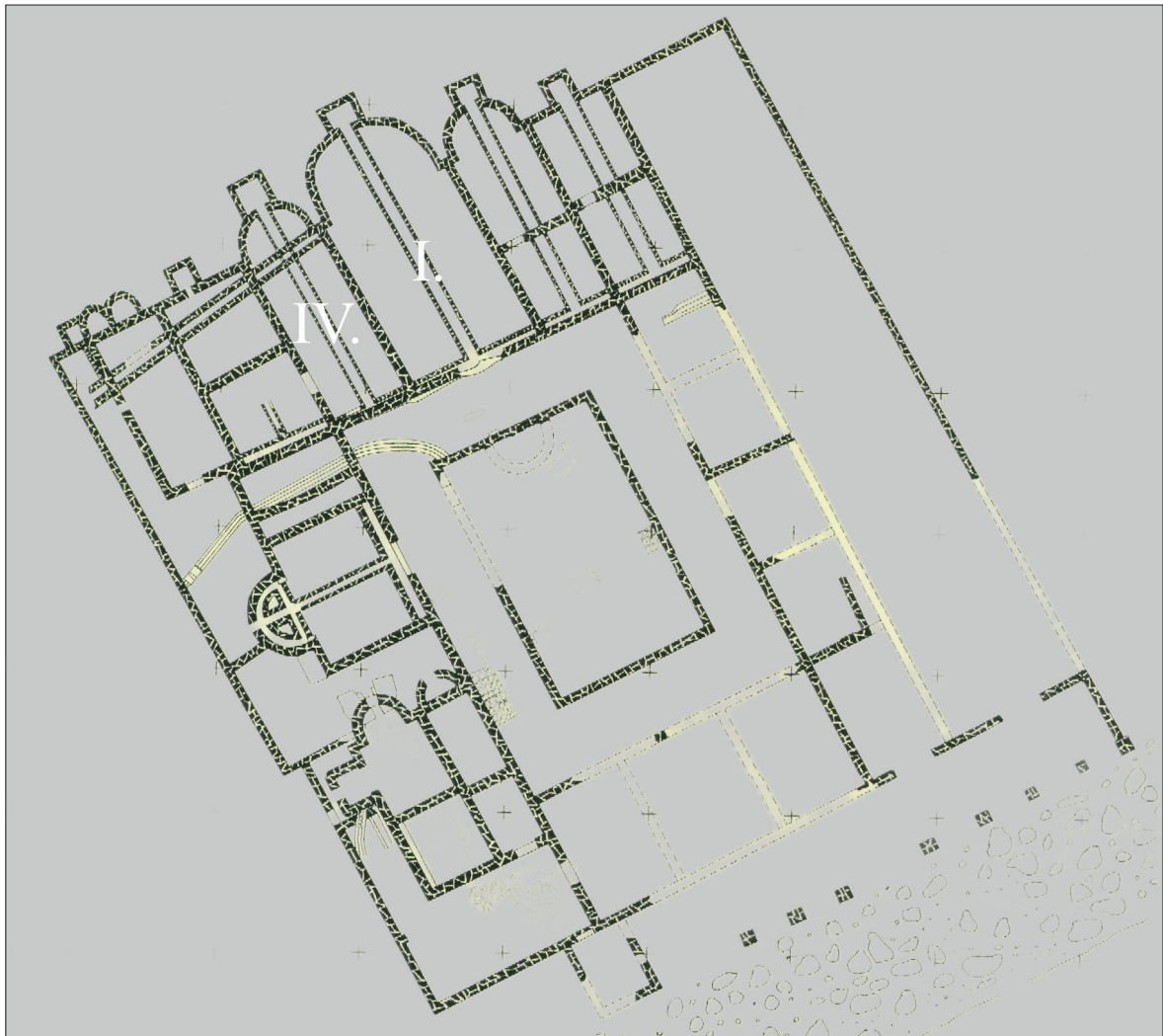


Fig. 8. Plan of the Palatium (Building I) with Rooms I and IV (after [MAROSI 1934](#), 60).

41 [FITZ 2003](#), 15.

42 [FITZ 2003](#), 19.

43 [FITZ 2003](#), 19–21.

Palatium (Building I)

A huge palace complex built by Diocletian in the 4th century AD stood on the northern side of the *decumanus maximus* in the north-western part of the walled town (Figs 4–6). The building remained in use as the governor's palace, an administrative building, as long as the province of Valeria existed. The 65 × 50 m building had a *porticus* onto the main street (Figs 5–6). Passing through the main entrance, aligned with the building's axis, visitors entered the *peristylum* through the *vestibule*, from where the others rooms opened. The palace also housed a bath. The palace's most prestigious spaces were the apsidal rooms on the northern side. The cage cup fragments discussed here came to light in Room IV of the palace, one of the apsidal rooms (at least according to the description by Whitehouse)⁴⁴ (Figs 7–8). However, it must be noted that the original brief excavation report written by Arnold Marosi merely states that all *vasa diatreta* fragments came to light in the reception hall of the palace building. This central apsidal hall was designated Room I, and not Room IV, of the palace building (Fig. 7).⁴⁵ It seems certain that the cage cup fragments were found in this central apsidal hall, which in our opinion functioned as the main reception room, and not in Room IV. This large apsidal hall was doubtless the most prestigious space that was in all likelihood used for official receptions, as well as for the ceremonial banquets hosted by the governor. One major question, however, is the exact duration of the building's use as a representative building that was quite certainly commissioned by the central administrative power and its subsequent fate during the turbulent decades of the late 4th and early 5th centuries AD. The excavation documentation dates from the early twentieth century, and the finds themselves outline a rather eclectic picture. No high-quality mosaics or wall paintings have been recovered from the building, and the finds suggest that it may have been a site of everyday life and activities in the late 4th to 5th centuries AD. However, the palace's layout and design certainly suggest that it was in all likelihood an imposing, representative building, even if this function only spanned a short period. The *diatreta* fragments can probably be associated with this period.

Fragments from Gorsium

The fragments (Fig. 9.1–3) were found during the 1934 excavation in Room 1, one of the palace's apsidal rooms. Arnold Marosi reported eight fragments, but only described five in detail.⁴⁶ These five pieces are also described by Thomas.⁴⁷ At present, three fragments are in the Gorsium Archaeological Park, while the two smaller fragments with an ovolo frieze segments are missing. The rim and wall fragments come from one or more bell-shaped cage cups. Marosi mentioned that all pieces were found in the building's main room, although not at the same time and not in the same area. Harden raised the possibility that the pieces did not all belong to the same cage cup.⁴⁸ The largest fragment comes from the rim and upper part of a bell-shaped beaker with an overhanging ovolo frieze, measuring roughly 38 × 37 mm (Fig. 9.1). The height of the frieze is 7 mm. The rim is out-splayed and has a horizontal ridge near the bottom. There is a small bridge 3.4 mm below the ovolo frieze—these bridges connected the openwork cage adorning the vessel under the ovolo frieze to the cup's body (Fig. 10).

The ovolo frieze bears traces of engraving and its base is polished into a regular rectangular shape through which it is attached to the vessel wall. The fragment of an openwork cage decoration was found together with this fragment. The third, only 0.3 mm thick, curved fragment with two stumps

⁴⁴ WHITEHOUSE 2015, 126.

⁴⁵ MAROSI 1934, 53–60.

⁴⁶ MAROSI 1934, 66.

⁴⁷ THOMAS 1964, 322.

⁴⁸ HARDEN 1963, 17.

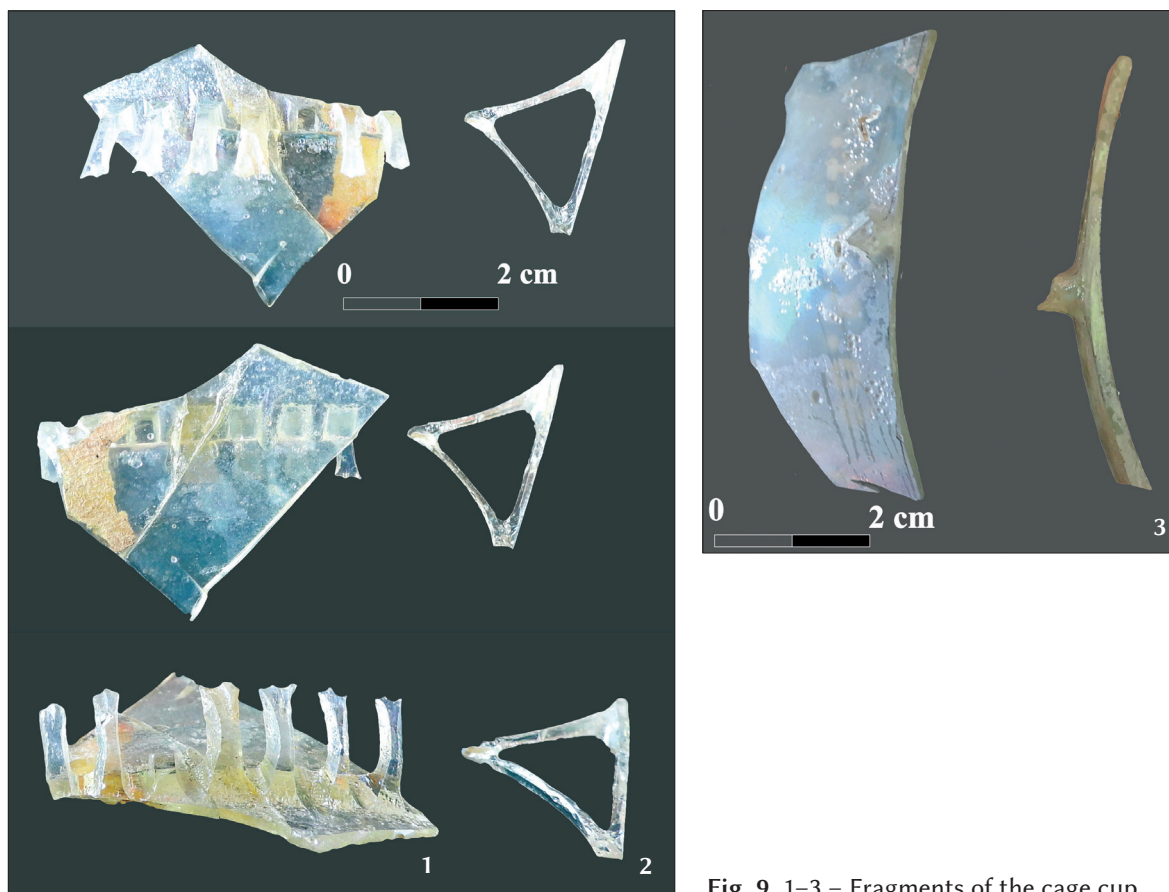


Fig. 9. 1–3 – Fragments of the cage cup.

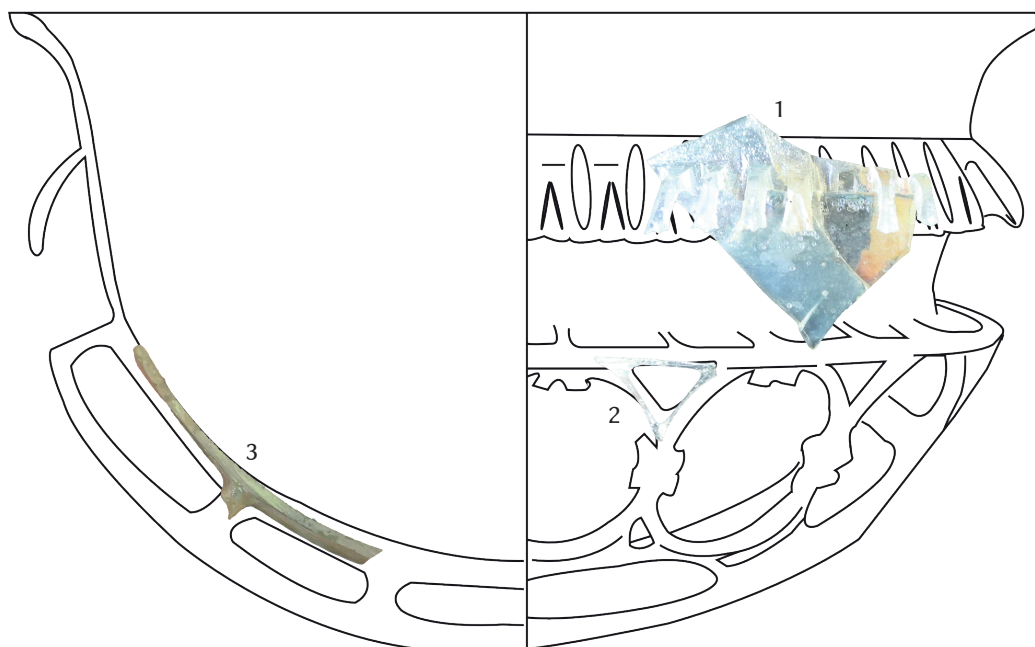


Fig. 10. Reconstruction with the existing fragments (1–3) of the cage cup found in Gorsium.

of the bridge possibly comes from the vessel's lower part. In addition to the above-mentioned fragments, two smaller fragments with sections of an ovolo frieze came to light by the western wall of the building's main room. The coins of Constantinus Gallus and Valens found together with the latter pieces date them to the later 4th century AD.

Given that all fragments were found in the building's main room, although not at the same time and not in the same area, one important issue to be clarified by means of archaeometric studies was whether these fragments came from the same vessel or whether several cage cups had perhaps been used in the palace.

Issues in archaeometry

'What can realistically be expected from archaeometric research' is always an intriguing question from an archaeological perspective. Do we have any plausible and relevant questions to which the analysis of material composition can provide answers—ideally by linking and complementing the results of both disciplines?

It is essential in interdisciplinary research that results do not merely exist side by side but archaeological questions are meaningfully integrated with the outcomes of scientific analyses. But what kind of archaeological question can we meaningfully pose in the case of a colourless, high-quality glass fragment, whose material is so uniform across the Roman world that distinguishing differences becomes extremely difficult?

As archaeologists, we held in our hands a fragment of a unique luxury glass vessel—one of only around 80 known examples—from a period in which glass as a raw material was otherwise common and widely used in everyday contexts.

Our primary question, then, was whether cage cups, as exceptional luxury glass vessels whose production by the *diatretarii* required a high level of craftsmanship, possessed any specific material characteristics essential to their manufacture. While it is clear that the production of the external cage decoration demanded considerable technical expertise, was it also necessary for the base glass to be of particularly high purity? Or could these prestigious objects have been made from entirely ordinary, everyday glass?

According to written sources, the base glass from which cage cups were made had to be valuable, as the *diatretarii* were held responsible for any breakage during production.

Even Pliny the Elder notes that the finest quality glass is completely transparent, colourless, and "clear as crystal" (*clarum et pellucidum*).⁴⁹ Even more intriguing is a Late Roman source that indirectly refers to the base material used for *vasa diatreta* and the high expectations regarding its quality. In *Digest (Ulpianus, ad edictum)*,⁵⁰ it is stated that if a client entrusted a blank to a craftsman for the purpose of manufacturing a *diatretum* vessel and the artisan broke it due to ignorance or lack of skill, he would be held liable. This passage is significant because it refers specifically to the commission of a cage cup and the particulars of such an order—indicating that such vessels were produced on an individual basis and that the *diatretarii* bore financial responsibility.

Notably, the raw material was supplied by the patron, which implies that it had to meet especially high standards to be suitable for the production of a *vas diatretum*. If any ordinary glass were sufficient, such legal provisions would not have been necessary; glass, after all, was relatively inexpensive and widely available. The fact that the artisan—who, according to multiple sources, occupied a privileged and specialised position—was held liable for damage strongly suggests that the blank itself was of exceptional value.

It is therefore likely that the superior quality of the glass blank was what enabled the vessel to withstand the extreme demands of the *cage-work* technique—the cutting of intricate, freestanding mesh

49 Plin., *Nat. Hist.* 36.66–67.

50 Iust., *Dig.*, 9.2.27.29.

patterns—without compromising the structural integrity of the vessel. This legal excerpt, albeit indirectly, implies that the base glass for *vasa diatreta* was purpose-made to meet these stringent criteria.

But in what way did the base glass's uniqueness manifest itself from a chemical composition perspective? It can be assumed that due to the intricate decoration, the base glass required exceptional purity and had to be free from impurities, bubbles, and strains that could cause cracks during production. Therefore, the glass substrate likely needed to be specially made to ensure it contained no internal stresses or tensions that might lead to fracture during manufacturing.

The decoration stands out best in exceptionally clear, perfectly decolourised glass. But what kind of decolouriser and in what proportion was used in the case of cage cups? During the Roman period, glass was commonly decolourised using either antimony or manganese.⁵¹ Drawing on a comprehensive dataset, Gliozzo *et al.* analysed hundreds of Roman glass samples and calculated the average chemical compositions of glasses decolourised with antimony (Sb), manganese (Mn), and a combination of both (Sb–Mn). Their study highlights distinct compositional differences between these groups, reflecting variations in raw materials and production technologies employed across the Roman Empire.⁵²

Our other archaeological question was whether the multiple fragments found within the same apsidal, representative building definitely belonged to a single vessel, or if, thanks to material composition analyses, it could be demonstrated that several identical cage cups were used simultaneously in the same room.

A detailed publication of the compositional analysis results is currently in progress, but we have reached the following preliminary conclusions.

Conclusions

Cage cup fragments were found in the main apsidal hall of a Roman palace in Gorsium, a building with an obviously imperial-administrative function, which thus add to the number of cage cups recovered from closed archaeological contexts and confirm that the *vasa diatreta* found in representative buildings can be associated with high-ranking persons. Eight fragments were originally unearthed during the first excavations in 1934, but only three of them have survived in the museum collection. The fragments came to light in a *palatium* building, the governor's palace erected in the north-western corner of the 4th-century AD city, on the northern side of the *decumanus maximus*. The building in which the luxury vessel was used can thus be directly linked to the imperial administration; the building functioned as an elite residence and administrative centre; and the cage cup fragments were found in the apsidal banqueting hall, thus their stratigraphic context also sheds light on their former function. It would appear that several *vasa diatreta* were in use simultaneously within the walls of an elegant banqueting hall.

The significance of the cage cup fragments from Gorsium lies primarily in their well-documented archaeological context, namely the apsidal reception hall (Room I) of the Diocletianic palace complex. This precise provenance directly supports what the luxurious character of such vessels has long suggested—that they were associated with high-ranking officials, likely connected to the imperial administration, and were used during elite banquets or ceremonial receptions held in official settings.

The archaeometric question was whether the fragments came from one or more vessels of the same type used in the same building at the same time? Furthermore, does the material of these luxury

51 SAYRE 1963

52 GLIOZZO 2017; GLIOZZO *et al.* 2017.

items, whose manufacture called for specialised skills and technical expertise, have any unusual traits, assuming that the chemical composition of the expensive cage cups would be special, too?⁵³

The results of the archaeometric study of the fragments can be summarised as follows. Archaeometric analyses revealed that the fragments came from at least two distinct cage cups, confirming previous hypotheses. Both vessels were made wholly or partly from recycled glass, indicated by mixed antimony–manganese decolourisation and elevated lead traces. The glass composition showed elevated sodium and lower calcium levels, characteristic of high-quality antimony decoloured Roman glass. Notably, the Gorsium cage cups were crafted from very pure, low-impurity sand, reflected in significantly lower iron, magnesium, and potassium contents compared to other cage cups. While sharing many features with other published samples, their exact composition was unique, likely due to selective remelting of highly transparent glass shards to maintain clarity. We hypothesize that the transparency of the glass not only satisfied aesthetic requirements but also provided a way to check whether the blank glass was really free of any bubbles or other inclusions. The absence of bubbles was an important prerequisite of glass cutting. Other important expectations regarding the properties of the glass blank included that it should have minimum internal tension to prevent cracking during the crafting of the outer cage. Internal tension or stress does not depend on the chemical composition of glass but rather on the speed of cooling. These requirements also apply to the blanks of facet-cut vessels;⁵⁴ however, the lack of tension is especially important in the case of the very intricate cage cups. Roman artisans knew that slow cooling minimises internal tension, so an experienced glassworker in any secondary workshop could make a purpose-made cage cup blank if sufficiently transparent glass (raw glass or cullet) was available.

Recycling indicates that the blanks of the Gorsium cage cups were made in a secondary workshop, thereby supporting the above-mentioned hypothesis. The idea that luxury cage cups were made in a central glass workshop in the Roman Empire probably does not hold as such vessels could also be made in secondary workshops provided it had a craftsman with the necessary special know-how.

Taken all together, the Gorsium fragments not only provide rare proof of cage cup use in a provincial yet imperially governed palace but also broaden our understanding of Roman glass economy, showing that recycling was compatible with elite craftsmanship. The presence of multiple identical luxury glasses used simultaneously in official imperial contexts illustrates the high status of such spaces and objects.

Recycling and reuse were widespread in antiquity,⁵⁵ especially in the case of Roman glass, often called the ‘plastic of antiquity.’ While expected for common items, recycling in the case of luxury vessels challenges assumptions about production and resource use in the Roman world.

Founding

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53 The detailed results are currently in preparation for publication.

54 DÉVAI *et al.* 2021, 123–133.

55 DUCKWORTH – WILSON 2020.

Tab. 1. Archaeological contexts of cage cups published by various authors.

Findspot	Date	Context	Literature
Aqaba (HKJ)	Turn of the 5th century	Ruins of a church	JONES 2003; PARKER 2000; WHITEHOUSE 2015
Athenian Agora (GR)	Late 3rd century	South House, Room 12	HARDEN 1963; WEINBERG 1964; WELZEL 1994
Caerwent (UK)	4th century	Excavation of the Roman Forum Basilica	WHITEHOUSE 2015
Canterbury (UK)	9th–11th centuries	Late Saxon refuse pit	CHARLESWORTH – PRICE 1987; WHITEHOUSE 2015
Carthage (TN)	6th–7th centuries	Fill of a vat in Area C-I of the excavations at Carthage	HARDEN 1963; WEINBERG 1964; RISTOW 1988; WELZEL 1994; WHITEHOUSE 2015
Cejkov (SK)	3rd–4th centuries	Princely grave from the Barbaricum	BENINGER 1937; KRASKOVSKÁ 1981; HRNČIARIK 2021
Cologne 1-Benesisstrasse (D)	4th century	Stone sarcophagus	URLICH 1844; KISA 1908; HARDEN – TOYNBEE 1959; FREMERSDORF 1967; RISTOW 1988; WELZEL 1994; WHITEHOUSE 2015; FÜNFSCILLING 2020
Cologne 2-Benesisstrasse (D)	4th century	Stone sarcophagus	URLICH 1844; KISA 1908; HARDEN – TOYNBEE 1959; FREMERSDORF 1967; RISTOW 1988; WELZEL 1994; WHITEHOUSE 2015; LIERKE 1995c; LIERKE 2004
Corinth (GR)	4th century	House from the Late Roman period	WHITEHOUSE 2015
Dülük Baba Tepesi (TR)	3rd–7th centuries	Building from Late Antiquity	HÖPKEN 2008; HÖPKEN 2014; HÖPKEN 2015; WHITEHOUSE 2015
Great Staughton (UK)	4th century	Site of a Romano-British villa and bath house	HARDEN 1963; HARDEN – TOYNBEE 1959; WELZEL 1994; WHITEHOUSE 2015
Gorsium (H)	Late 4th century	Apsidal room of a palace building	MAROSI 1934; THOMAS 1964; WHITEHOUSE 2015
Konz (D)	Late 4th century	Villa complex of Emperor Valentinian I (r. 364–375)	GERICK 2010; GOETHERT-POLASCHEK 1977; WHITEHOUSE 2015
Lorenzberg (D)	Late 4th century	—	HARDEN 1963; RISTOW 1988; WELZEL 1994; PAOLUCCI 1997; WHITEHOUSE 2015
Milan (I)	3rd–6th centuries	Building from Late Antiquity	UBOLDI 1991; PAOLUCCI 1997; WHITEHOUSE 2015
Nabeul (TN)	Second half of 4th century	—	SLIM <i>et al.</i> 1999; FOY 2000; WHITEHOUSE 2015
Nikup (BG)	Late 4th–early 5th centuries	Fill of the foundation of an early Byzantine tower	SEPPHERD 1999; WHITEHOUSE 2015
Resafa (SYR)	4th century	Area of Basilica C	ANON. NMV 2005; WHITEHOUSE 2015 ►

► Findspot	Date	Context	Literature
Séviac (F)	4th–5th centuries	Area of a luxurious villa	HOCHULI-GYSEL 1993; GUGOLE 1998; WHITEHOUSE 2015
Strasbourg (F)	4th century	Stone sarcophagus	SAUZAY 1868; SAUZAY 1870; HARDEN – TOYNBEE 1959; WELZEL 1994; WHITEHOUSE 2015; FÜNFSCILLING 2020
Taraneš (MKD)	4th century	Richly furnished male burial	IVANOVSKI 1984; IVANOVSKI 1987; CERMANOVIĆ-KUZMANOVIĆ 1995; WHITEHOUSE 2015
Trier (D)	4th century	Trier, Imperial Baths	REUSCH 1969; GOETHERT-POLASCHEK 1977; WELZEL 1994; GERICK 2010; WHITEHOUSE 2015
Trier-Basilica–Mustor Street (D)	4th century	North-east of the Roman Basilica	GOETHERT 1989; WELZEL 1998; GERICK 2010; WHITEHOUSE 2015

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