INVESTIGATION AND CONSERVATION OF A FRAGMENT OF A ROMAN MOSAIC FLOOR FROM THE GOVERNOR'S PALACE OF AQUINCUM (PANNONIA), HUNGARY

Brigitta Maria Kürtösi

Abstract

The aim of the study of the materials and the structure of this Roman mosaic is to gain thorough information about its technique. The conservation of this fragment made possible the microscopic, chemical and X-ray diffraction examinations, which gave us exact results about the structure and the special technology of the preparation of the support of the mosaic.

Fig. 1. Archive photo of 1941 showing the mosaic before removal, Óbuda, Hajógyári-sziget. It is clear that in the following years some completions were made as confirmed in János Szilágyi's 1945 publication

The mosaic fragment (Fig. 1) comes from the Governor's Palace of Aquincum, which was one of the most representative buildings (Fig. 2) of the Roman province of Pannonia Inferior. The palace is situated on an island of the Danube. Its construction began under the regency of Hadrian in AD 107-108, and the mosaic probably dates to the beginning of the 3rd century AD. According to Havas (2010, 17), it seems that the mosaic pavements of the eastern annexe could not date from an earlier period. During the excavations stamped bricks of the *cohors VII. Breucorum Antoniniana* (COH VII BR AN) and *cohors I.Ulpia Pannoniorum Antoniniana* (198-222 AD) were found under the previously undisturbed, intact mosaic floors of rooms 3 and 5 (Havas 2016, 92). The large-scale construction project took place after this period. A dockyard was later constructed on its ruins.

There were two important excavations between 1941 (Szilágyi 1945) and 1956 (Kaba 1958). During those days and political era it was impossible to establish an archaeological site in situ, and during the rescue excavations the floors were removed. Most pavements are presently in fragments as they were cut into sections and were strengthened with a thick concrete support with an

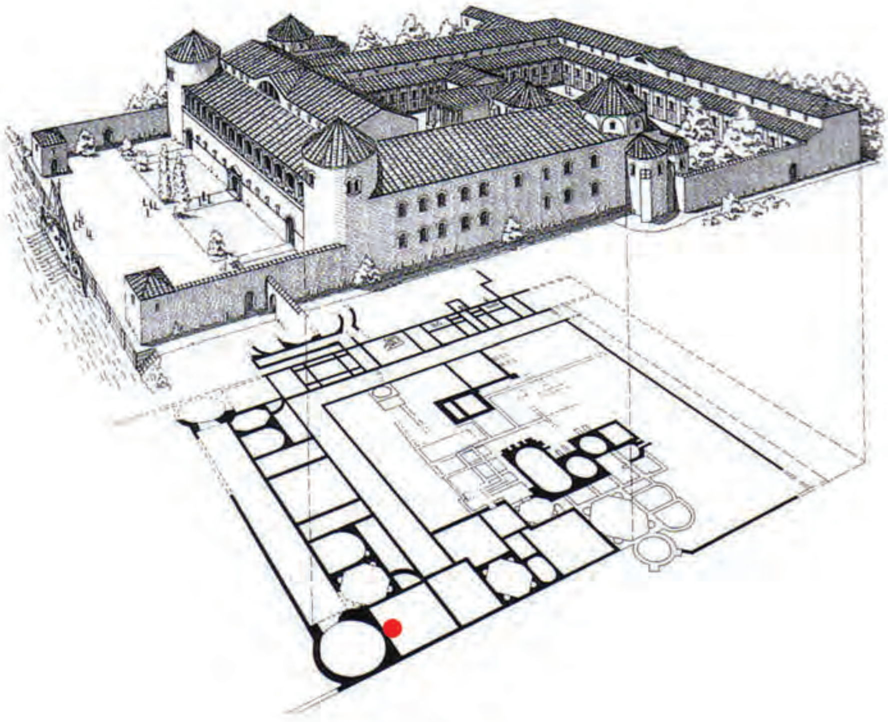
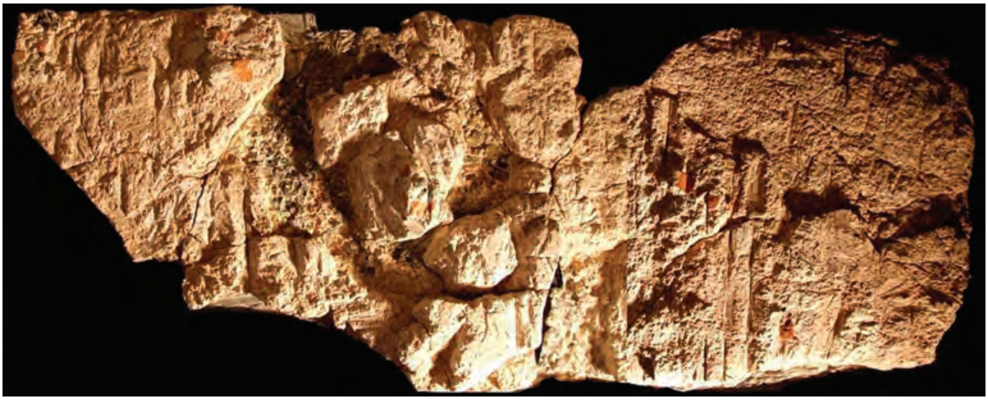


Fig.2. The findspot of the fragment in the Governor's Palace of Aquincum, chamber no. 8. (illustration by Markus Schaub)

Fig. 3. Condition of the mosaic in 2008 (photo: Brigitta Maria Kürtösi)

Fig. 5. The remnants of the original mortar layers photographed with oblique lighting (photo: Brigitta Maria Kürtösi)

Fig. 4.The removal of the concrete support (photo: Brigitta Maria Kürtösi)



iron armature. The slabs have been stored in the Museum of Aquincum. The part of the mosaic in question could be the threshold from the frame of the pavement of a large room decorated with four-coloured geometric patterns. It comes from the entrance of room 8. All of the floors in the eastern annexe possess a frame with patterns different from those of the central motifs. Our fragment is the only one remaining without the central part and other sections belonging to it. Thus, it was possible to complete the third, fragmentarily preserved motif of the mosaic. The fragment (Fig. 3) represents a complex, repeating geometric pattern; a quadruple Solomon's knot in the centre of a four-pelta swirl (Balmelle *et al.* 1985, pl. 57g: 'tangent and linked swastika-peltae with central [double Solomon] knot, alternately reversed'). The double Solomon knot is rare in the Roman world by comparison to its single form, which is a quite widespread motif, found in many cultures. The Solomon's knot is a symbol of wisdom and is currently interpreted (e.g. Sansoni 1998, 19, 21) as symbolizing eternity, immortality, because of its invisible beginning and end. The whirl is the emblem of cosmic recurrence. The investigation and conservation of the fragment was the author's diploma work in 2010 in the framework of the MA thesis at the Hungarian University of Fine Arts, "Conservation and examination of a mosaic floor fragment from Aquincum. Comparison of floor mosaics from Pannonia. Experiment for exploring technical, structural, material and aesthetic connections" (Supervisor: Bóna, István, DLA habil

Fig. 6. The stratification of the fragment (Reconstruction drawing and photo: Brigitta Maria Kürtösi)

– Painting-Conservator (Hungarian University of Fine Arts); consultants: Kriston, László – Physicist (Hungarian University of Fine Arts), Balázs, Miklós Ernő DLA habil – Mosaicist). I studied the materials and the technology of the substrate of the Roman mosaics from Pannonia, and in this case we tried to find a new, lightweight and compatible support for this fragment, while maintaining the surviving original mortar layers. This is the particularity of this restoration because in most cases, after the detachment of the layer of the mosaic tesserae, the removal of the underlying preparatory mortar layers is the general method. Naturally, the weight is the main reason for dealing with it in this way. In our case, however, the thick concrete support had saved these elements. We had to choose the treatments considering both the materials, the stones and the mortars. Therefore, the challenge was to keep them together. The fragment was severely damaged; the salt coming out of the cement and the corroded armature caused cracks not only in the support but in the original mortars too. The fixed, inflexible support was broken, and this caused loss of tesserae. After the first excavation, it was completed by using concrete on the edges, which often covered the surrounding tesserae. In the central motif, cement was applied to reintegrate losses. Here, not only the tesserae are bigger but also the spaces between the stones are larger and filled with grey cement. In these integrations the original setting aesthetics were not followed. That is why we had to remove these incorrect tesserae fillings. After the systematic removal of the concrete support and the cement fillings, we fortunately found four different fragmentary layers under the mosaic tesserae (Fig. 4 and 5). This offered a good opportunity to examine the technology of the preparation of an 1800-years-old mosaic pavement. It is fortunate that the mortar layers were not destroyed during the rescue excavations like those on the back of the fragments of the other four pavements (Fig. 6). The mortar composition of the layers in question is based on lime. The classical dry lime slaking was employed for the basic mortars. In this case, the dry raw materials are spread and water is poured on them.

Fig. 7. 'Kalkspatzen'- detail of the first layer of *nucleus* (Photo: Brigitta Maria Kürtösi)

The slaking of the quicklime happens on the premises. The presence of chalk-like kernels in the lime, called 'Kalkspatzen' in German, is quite extensive. These kernels are reserves of binder and can be activated by moisture. The binder obtained from them migrates and can bind the micro-cracks all over the matrix of the preparatory mortar layers (Fig. 7). The traditional division of the preparatory layers can be found in this mosaic:

S*upra nucleus* – This is thin, white bedding mortar. Powder of limestone is present in the lime binder matrix. Based on the microscopic analyses and the X-ray diffraction examination, the sample taken from this layer does not contain any hydraulic additives.
Nucleus – There are two layers made 'wet in wet'. The 5 cm thick lower one is richer in lime than the upper 1 cm thick part, where the quantity of powdered brick is significant. That is why this stratum has a pinkish hue. The crushed brick was used as filler. The use of a quantity of brick dust in a mortar can be one of the causes leading to low density and high effective porosity. It behaves like an artificial pozzolanic additive, and here reacted with the calcium hydroxide Ca $(OH)_2$. As a hydraulic component, it increases the solidity of the mortar. The average porosity value of the samples taken from the *nucleus* of the mosaic in question is approximately 30%, and its density is about 1.5 g/cm^3. The other mortar sample comes from the Roman Villa of Serena, in the present-day municipality of Nagyharsány. The characteristic porosity is between 45-50%, and the density is about 0.6 g/cm^3.
Rudus – Only traces remained of this stratum. It is a rough layer with 4-5 cm large limestone and brick pieces embedded in lime. The materials and the colours of these parts are the same as those of the tesserae.
We do not have any information on either the dimensions or the compositions of the deeper, preparatory layers.

During conservation, we had to save the original preparatory mortar, so we were dealing with quite a heavy object. After the cleaning of the reverse side, we had to fill in and level the mortar surface. It was necessary to work out a lightweight and easily removable support, instead of the previous concrete one, and a lightweight lime-based mortar to fill in the losses. Instead of the quartz sand and crushed gravel, a mixture of ground glass foam (a Hungarian product by Geofil) and glass foam-beads (Poraver by Dennert) were used as filler (Fig. 8). The diverse grain-size dispersion ensures a properly stable mortar. The pH value of Poraver is about 9-12. The cause of this high pH value is the presence of a water soluble salt called Trona ($Na_3H(CO_3)_2 \cdot 2H_2O$) measured by XRD. It was necessary to re-

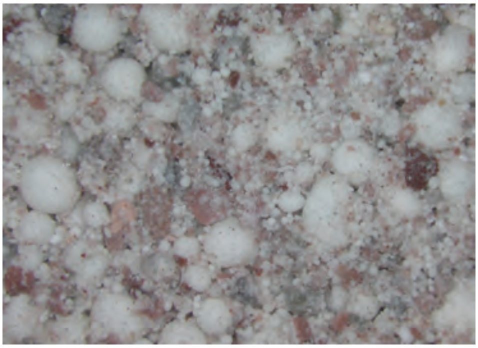


Fig. 8. The new lime-based mortar with lightweight aggregates (glass foam products) (Photo: Brigitta Maria Kürtösi)

move the salts before using the glass foam-beads as filler in the new mortar. For the backing we tried to use clear, inorganic materials. The mortar supplement had to be easily removable; and had to fit in with the original materials and their physical properties. At the same time, it is not supposed to be stronger than the ancient mortar. It is desirable that the effective porosity of the two touching layers be similar. In this case, the measured values were about 30%. The difference was between the density values as the used fillers halved the density of the new mortar (Table 1). In this case, the filling mortar has a mainly supporting role; thus, it must be lightweight and stable. Its stability increases with the process of carbonation. The new support is a composite plate made of a foam glass board (by the German Huber-Kunststoff) covered with 3P SP2 resin (by the Hungarian Polinvent Ltd.) and woven carbon fibre on both sides (Fig. 9-12). These materials were developed for industrial use. That is why it was necessary to understand their physical properties before introducing them into conservation. The artwork was fixed onto the foam glass board with acetate-free silicone rubber. As bedding mortar, a Czech grouting mortar was used (VAPO inject 01), because its composition and properties resemble those of the original. The mixture consists of white, hydraulic and volumetrically stable lime-hydrate, mixed with latently working hydraulic fired clay – alumino-silicate component. The filling in of the pattern was made with tesserae from a geologically similar limestone. The original and the completed parts show a mild difference in their hue. The extent of the completion does not exceed the provable original state of the mosaic (Fig. 13, 14 and 15). There are many types of completion methods, and the choice of materials and treatment is most often based on the personal preferences of the conservator, and on the owner's decision.

The re-restored mosaic fragment was displayed first at the Exhibition of Diploma Works, entitled *Preserved Art Treasures 2010* in the Hungarian National Muse-

Mortar samples	Effective porosity (%)	Density (g/cm3)
The mortar (from nucleus) of the examined Roman mosaic of Aquineum	30,33	1,48
The new mortar with glass foam fillers	30,00	0,69

Table 1. The measured values of the mortar samples

Fig. 9. The preparation of the new support with woven carbon fibre and 3PSP2 resin (Photo: Brigitta Maria Kürtösi)

Fig. 10. The preparation of the new support with woven carbon fibre and 3PSP2 resin (Photo: Brigitta Maria Kürtösi)

Fig. 11. The leveling of the backside of the mosaic was made by the lightweight lime-based mortar (Photo: Brigitta Maria Kürtösi)

Fig. 12. The leveling of the backside of the mosaic was made by the lightweight lime-based mortar (Photo: Brigitta Maria Kürtösi)

Fig. 13.The place of the missing parts (Photo: Brigitta Maria Kürtösi)

Fig. 14. The preparation of the new tesserae supplements (Photo: István Bóna)

Fig. 15. The material of the new tesserae supplements was a geologically similar massive limestone. The lime-based VAPO inject 01 was used as bedding mortar (Photo: Brigitta Maria Kürtösi)

um, and then at the temporary exhibition of the Museum of Aquincum entitled *There is something new under the ground, old sites – new results 2011* (Fig. 16).

Brigitta Maria Kürtösi, Hungarian University of Fine Arts, Association of Hungarian Restorers

Bibliography

Balmelle, C., M. Blancard-Lemée, J. Christophe, J.P. Darmon, A-M. Guimier-Sorbets, H. Lavagne, R. Prudhomme and H. Stern, 1985, *Le décor géométrique de la mosaïque romain*, Paris.

Havas, Z., 2010, *Az aquincumi helytartó székhely tégla építészete*, Typescript of an unpublished PhD thesis, ELTE BTK, Budapest.

Havas, Z. 2016, "Der Statthalterpalast von Aquincum – Forschungsstand 2015", in J. Beszédes (ed.), *Legionary fortress and canabae legionis in Pannonia, International Archaeological Conference, 16-17 November, 2015*, in *Aquincum Nostrum* II.7, 81-102.

Kaba, M. 1958, "Az aquincumi Helytartói Palota mozaikpadozatai", *Budapest Régiségei* 18, 79-101.

Sansoni, U., 1998*, Il Nodo di Salomone – Simbolo e Archetipo d'Alleanza*, Milano.

Szilágyi, J., 1945, "Az aquincumi Helytartói Palota", *Budapest Régiségei* 14, 42-108.

Fig. 16. The state of the threshold mosaic after conservation in 2010 (Photo: Brigitta Maria Kürtösi)