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Analyses of the white barbotine decoration of two Roman pottery groups

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ABSTRACT

White barbotine is a rare decoration form in Roman pottery production. It was applied on three main pottery groups from the 2nd to the 4th century AD: on the Samian ware from Rheinzabern, on the black coated ware from central Gaul and on the motto beakers from Trier. This kind of decoration has not yet been analysed with scientific methods. As a part of a research on the black coated ware in Pannonia some motto beakers from Trier and some samples of Samian ware from Rheinzabern were analysed with XRD, petrographic and EDS-EDX methods to get information about the technique and the material of the white decoration. The results show that the raw material of the white barbotine decoration is white clay. Two types of applications can be distinguished: one method was to fire the barbotine together with the vessel at a temperature of about 950 °C. This method is characteristic for the majority of the barbotine decoration on Samian wares from Rheinzabern. In the second method the raw white clay was first fired at a high temperature (about 1100 °C) and then crushed. Water and perhaps potash-rich materials were added to this mixture to give it the proper consistency and plasticity to draw motifs on the surface of the coated vessels. This technology could be observed on some Samian wares from Rheinzabern and on all of the motto beakers from Trier.

1. Introduction and archaeological background

A special use of the rare white clay in the Roman time was the production of white barbotine decoration on quality pottery with black coat or red slip. This usage was applied on three main pottery groups.

The first group can mainly be found in Central Gaul, in the surroundings of Lezoux. The vessels are generally beakers; the white barbotine decoration is applied on their black coat. The chronology of this group is only roughly known, they were probably made in the second half of the 2nd and in the first half of the 3rd centuries AD (Symonds, 1992).

The second one is a group of the Samian ware from Rheinzabern. The form spectrum of the red slipped vessels with white barbotine decoration is broad: plates, beakers, jugs, etc. The precise chronology of this special group of Samian wares from Rheinzabern is also uncertain. Their production took place maybe at the end of the 2nd and in the first half of the 3rd centuries AD (Thomas, 2001).

The third one is the group of the so called motto beakers from Trier. These were mostly drinking vessels, i.e. beakers, cups, jugs and flagons. This group was also black coated (similarly to the first group from Central Gaul); the white decoration was applied onto this coat. Of the three groups only the chronology of the motto beakers of Trier is known in detail, it was produced from 235/240 till 355 AD. (Harsányi, 2011; Künzl, 1997).

Based on this chronological order it can be supposed, that the technique of the white decoration came first from Central Gaul to Rheinzabern and from there to Trier.

2. Aim

The white barbotine decoration has been not analysed yet with natural scientific methods. A doctoral research on the black coated ware from Trier raised the question of the origin and the technology of the white barbotine decoration of these vessels and offered an opportunity to analyse and compare the white decoration of the motto beakers from Trier and of the Samian ware from Rheinzabern (Harsányi, 2011). The main questions were the following:

1) Of which components is the raw material of the white barbotine decoration composed?
2) How was it applied on the surface of the pottery?
3) At which temperature was it fired?

Based on the comparison of the samples from two of the three pottery groups (motto beakers from Trier, Samian wares from Rheinzabern) we wanted to find out, how uniform the technology of the white barbotine decoration in the various workshops was.

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3. Methods

Two samples from Trier (inv. no. KSZV 2004.I13/H13.103.12 and KSZV 2002.G12.046.98) and 4 samples from Rheinzabern (inv. no. E84/80/297, E82/53/196, E83/84/3 and E92/167) were investigated by petrographic and SEM-EDS analyses. In addition 12 XRD analyses, 3 samples from Trier (inv. no. KSZV 2004.I13/H13.103.12, KSZV 2002.G12.046.98 and BTM 51163) and 9 samples from Rheinzabern (inv. no. E84/80/297, E82/53/196, E82/84/3, E92/167, E84/50/716, E85/41/44, BTM 42295, BTM 55.28.43 and BTM without no.) were made. Macroscopically all the motto beakers from Trier with white barbotine seem to be produced with the same technique. The XRD-analyses of the samples with fast identical results proved this observation, therefore the small number of samples can be considered as representative (Table 1).

SEM examinations and electron microprobe analyses were performed at the Department of Petrology and Geochemistry, Eötvös Loránd University using an AMRAY 1830 scanning electron microscope equipped with an EDAX PV 9800 EDS detector. Conditions of analysis: accelerating voltage 20 kV, beam current 1 nA, measurement time 100 s (livetime), beam diameter ~ 100 nm. Analyses were made on polished surfaces perpendicular to the wall of ceramics.

X-ray powder diffraction scans were taken on a Philips PW 1050 diffractometer with CuKα radiation. Specimens were prepared from a few mg of thoroughly ground sample on a zero background sample holder. Scans were evaluated for quantitative phase composition using full profile fitting methods (Table 2).

4. Results

4.1. Macroscopic petrography

The pattern of the white decoration of the motto beakers from Trier is generally composed of a short motto and plant motifs underneath (Figs. 1A and D, 2A, 3A, 4A). The details of the compositional structure of the Samian wares with white decoration from Rheinzabern have not been published yet. It is known that a motto on the vessels is not as frequent as on the motto beakers from Trier, plant motifs rather dominate in different compositions.

The barbotine on the motto beakers from Trier and on some Samian wares from Rheinzabern is snow-white, compact, but relatively soft; it can be easily detached from the surface. In the case of many motto beakers from Trier it even flakes off by itself. On another group of the Samian ware from Rheinzabern the barbotine is yellowish, its consistence is hard and it looks similar to the slip on the surface of the pottery. The barbotine can only be removed from these vessels together with the slip.

4.2. Microscopic petrography and SEM-EDS

The composition and appearance of the studied barbotines are very similar to each other, however, there are differences in texture and stucture.

Generally there is a large amount of clasts in a variously vitrified clayey matrix in all the samples.

The size of the clasts are variable, the dominant range of them is 1-50 μm, except for the all Trier and one Rheinzabern (E83/84/3) samples in which the clasts are 20–200 μm (Figs. 3B, C, D, 4B, C, D). Among the clasts quartz is predominant, there is less K-feldspar and very rarely relicts of 10 Å-phases can be found. Quartz and K-feldspar are initially resorbed in samples coming from Rheinzabern, while they are angular in samples from Trier. There is quite a large amount of rutile (1–5 μm angular clasts) accompanied by other accessories such as zircon and monazite. The amount of glass present varies, generally the highest amount is in the interface of the slip and the barbotine, however in some cases even the barbotine is completely glassy.

Between the barbotine and the ceramic body a 10–20 μm thick slip can be observed, containing a considerable amount of submicron scale Fe-rich phase. Generally the slip and the barbotine are tightly connected due to a shallow deep fusion on the border of the barbotine and the slip.

Except for the above mentioned features there are huge differences among the samples. Barbotine of the sample E84/80/297 is strongly and almost completely vitrified (Fig. 1B and C), while barbotine in sample E82/53/196 consists of two layers, the inner being less glassy than the outer part. The differences between the two layers manifest only in their composition, the transition zone is thin, but continuous. The strongly glassy outer part is richer in potassium than the inner layer probably producing completely glassy phases (K_2O content are 5% and 13–17% respectively) (Fig. 1E). Sample E92/167 is the least glassy among the studied samples. Even the relicts of micas also can be recognized (Fig. 2C). In this sample the slip is ragged (Fig. 2B and D), probably because the barbotine was applied on not a completely consolidated surface.

In sample E83/84/3 clasts are less well sorted and there are considerably coarser than in the other studied Rheinzabern samples and similar to that of the barbotine of the Trier samples (20–200 μm). In samples from Trier not only the size, but also their shape is different being more angular (Fig. 4C and D).

In the barbotine of Trier pottery very fine (5–10 × 1 μm) needles can be seen, which are too thin to be analysed by SEM-EDS, but were identified as mullite by XRD analysis.

4.3. XRD

Based on their X-ray powder diffraction patterns, all the investigated barbotine samples are characterized by high amount of quartz

Table 1
List of the analysed samples.

Inv. no.	Pottery type	Colour of the coat	XRD	Petrographic and SEM-EDS analyses	XRD barbotine-type	Technological group
KSZV 2004.I13/H13.103.12	motto beaker from Trier	black	yes	yes	type 3	group b
KSZV 2002.G12.046.98	motto beaker from Trier	black	yes	yes	type 3	group b
BTM 51163	motto beaker from Trier	black	yes	no	type 3	
E84/80/297	Samian ware from Rheinzabern	red	yes	yes	type 1	group b
E82/53/196	Samian ware from Rheinzabern	red	yes	yes	?	group b
E83/84/3	Samian ware from Rheinzabern	red	yes	yes	type 2	group b
E92/167	Samian ware from Rheinzabern	red	yes	yes	type 2	group a
E84/50/716	Samian ware from Rheinzabern	red	yes	no	type 1	not determined
E85/41/44	Samian ware from Rheinzabern	red	yes	no	type 2	not determined
BTM 42295	Samian ware from Rheinzabern	red	yes	no	type 2	not determined
BTM 55.28.43	Samian ware from Rheinzabern	red	yes	no	type 2? (poor XRD)	not determined
BTM without no.	Samian ware from Rheinzabern	red	yes	no	type 2	not determined