

The beginning of glazed ware production in late medieval Cyprus

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Highlights

- Early Cypriot glaze technology followed broad eastern Mediterranean traditions.
- Raw materials procured from local sources were used to make glaze and ceramic body.
- Potters possessed a certain level of skill when glaze production began.
- The Franks provided the labour and created the market to stimulate production.

Abstract

This study presents the first characterisation of the early glaze technology that emerged in Cyprus during the 13th century AD, with the glazed ware assemblage recovered from the theatre site at Nea Paphos as the main focus. By framing the results of the technological study using SEM-EDS and thin-section petrography within the historical context, we are able to establish the link between local production and broader technological and socio-historical developments. The early glaze technology in Cyprus appears to have followed the established traditions characteristic of the eastern Mediterranean region during the late medieval period. This is reflected in the use of high lead glaze, the addition of iron and copper oxide as colourants, and the use of painting and sgraffito as principal decorative technique. Although the introduction of glaze production in Cyprus coincided with the time when the island fell under the Frankish rule, there is no evidence indicating that the Frankish rulers directly controlled the production or the Franks were involved in the actual production process. However, we argue that the establishment of the Frankish influence had indirectly stimulated the beginning of glazed ware production in Cyprus by facilitating the movement of labour and creating the market and demand required for such production through its link to the Crusaders' campaigns in the wider Levantine region.

Keywords: Glaze technology; SEM-EDS; thin-section petrography; late medieval; Crusaders; Cyprus

1. Introduction

Previous research has shown that glaze technology, especially the one used to produce ware types of the highest quality or associated with the elites, is highly susceptible to and thus reflective of the occurrence of socio-cultural interactions. This is evident in the case of the use of tin-oxide as an opacifying agent, lustre-painting, and stonepaste throughout the Mediterranean during the late medieval period (George, 2015: 26-27; Jenkins-Madina, 2006; Mason, 1997; Marin et al., 2018; Pradell et al., 2008; Salinas et al., 2019; Tite et al., 2011; Tite et al., 2015; Watson, 2014). The development and spread of these innovations of glaze technology are said to have been the result of contacts among different political powers representing the East and West. In contrast, the effectiveness of the technology that was used to produce the glazed ware for local consumption or for circulation within a limited geographic extent in reflecting socio-cultural interactions remains largely unexplored. This is partly rooted in the belief that the technology of ‘non-elite’ glazed ware was static, largely unaffected by socio-political changes through time (Mason, 1997: 171-72). Was this really the case? Or, are we assuming that this was the case because we know very little about the technology used to produce the ‘non-elite’ ware types?

With this question in mind, this study calls for a reconsideration of the technology of ‘non-elite’ glazed ware by using the beginning of glazed ware production in Cyprus and its link to the fate of the so-called Crusader states during the 13th century AD as an example. The focus of this study is the glazed ware assemblage, coupled with other direct evidence of production such as wasters, kiln furniture, and raw clay material, recovered from the theatre site at Nea Paphos. Scanning electron microscopy energy dispersive spectrometry (SEM-EDS) and thin-section petrography were used to investigate the composition of the glaze and associated ceramic body, the type of colourant used, the source of raw materials, and the method of glaze application of Cypriot glazed ware. The data generated are not only useful in establishing the early glaze technology or tradition, but also serve as a proxy for assessing how the production of glazed ware was organised. A reconstruction of the craft organisation provides us with an insight into the role played by the Franks in glazed ware production in Cyprus, which in turn links up the local processes with regional developments.

1.1. The case of glazed ware production in late medieval Cyprus

The production of glazed ware does not seem to have begun in Cyprus until the 13th century AD, with the earliest evidence indicating the occurrence of production activities recovered from the Paphos-Lemba area (Cook, 2014; Cook and Green, 2002; Papanikola-Bakirtzi, 2012; von Wartburg, 1997). With the start date being placed in the 13th century AD, which was considerably later than its neighbours in the eastern Mediterranean or even pan-Mediterranean region, two fundamental questions arise regarding the beginning of glazed ware production in Cyprus. First, what triggered the early glaze technology to develop in Cyprus? With glazed ware production already firmly established in different parts of the Mediterranean, each with their own distinctive tradition (e.g. Armstrong et al., 1997; Molera et al., 2001; Palamara et al., 2016; Tite, 2009; Waksman and François, 2004; Waksman and von Wartburg, 2006), did the potters in Cyprus adopt any of these regional trends in glaze production? Or did the local glaze technology deviate from the contemporaneous ones and can be considered as an independent variation?

Second, what were the factors or conditions in the 13th century AD that might have contributed to encouraging the production to take place? What we know, based on the historical sources, is that it was a time when fundamental changes occurred to the socio-political order in Cyprus. The island was no longer under Byzantine rule and was handed over to Guy de Lusignan (c.1150-1194; reign in Cyprus 1193-1194), the dethroned King of Jerusalem, which then marked the beginning of almost three hundred years of Frankish rule on the island until the Venetians took over (Hunt, 2012). However, the written record is silent with regard to the role played by the Franks, if any, in stimulating the production of glazed ware in Cyprus. Were the Frankish rulers involved at all in setting up the production, such as by selecting a specific region or imposing certain technology, considering that the first major centre for production of glazed wares was identified at Paphos in western Cyprus?

The answers to these two questions, despite being key to understanding the beginning of glazed ware production in Cyprus, remain to be largely unexplored. This is because the vast majority of previous research was dedicated to examining the art-historical or iconographic aspects of the late medieval Cypriot glazed ware (Dikigoropoulos and Megaw, 1957; du Plat Taylor and Megaw, 1951; François and Vallauri, 2001; Papanikola-Bakirtzi, 1996, 1999, 2012; Vallauri, 2004; von Wartburg, 1997; Vroom, 2014). Very few technological studies are available, but even so, these studies focused on characterising the composition of the ceramic body and establishing the provenance of glazed ware rather than identifying the glaze technology (Megaw and Jones, 1983; Waksman, 2014). An exception to this was the work carried out by Charalambous and colleagues (2010) on two assemblages of glazed ware dating to the 12th to 15th century AD from the Limassol area. This pioneering work serves to provide some general observations of the glaze technologies over a broad period, although little attempt was made to connect the beginning of glazed ware production with the historical context within which such technology took form.

1.2. The assemblage from the theatre site at Nea Paphos

The glazed ware assemblage, coupled with other direct evidence of production, recovered from the theatre site at Nea Paphos is the focus of this study. Situated on the southern slope of the Fabrika hill in the northeastern quarter of Nea Paphos (Fig. 1), the site has been excavated by the University of Sydney's Paphos Theatre Archaeological Project under the auspices of the Department of Antiquities of Cyprus since 1995. The southern slope of Fabrika was initially chosen as the location of the theatre, which was in use during the Hellenistic and Roman periods, with evidence of significant accompanying infrastructure (Green et al., 2011; Green et al., 2014). The theatre was eventually destroyed in the late 4th century AD as a result of earthquakes, but there is considerable evidence of production activities over the ruins of the former theatre well into Late Antiquity. The entire region south of Fabrika was reoccupied during the medieval period (Barker, 2016), during which the production of glazed ceramics is believed to have commenced on, or near, the site, as revealed by the excavation of a sealed deposit (Trench 16C, 3097), filled with fragments of glazed ware stylistically dated to the 13th century AD (Cook, 2004; Cook and Green, 2002).

Four different styles of glazed ware can be identified among the assemblage: slip-painted, plain glazed, sgraffito, and sgraffito with slip-painted decoration. The majority of glazed ware fragments are open vessel forms (e.g. bowls), with a few fragments being closed vessel forms (e.g. jugs). The glazed ware fragments were found together with biscuit-fired ceramic fragments, tripod stilts, lumps of clay (both raw and fired), and possible fragments of a kiln; all of which are considered to be direct evidence of production (Costin, 1991:18). Given the context, quantity, and variety of evidence recovered, it is sufficient to suggest that production activities took place at or in the area adjacent to the site, even though the exact location of the kiln is yet to be found to date. Thus, this assemblage is particularly well-suited to address the technological and organisational issues of early glazed ware production in Cyprus. In total, 21 glazed ware samples, five biscuit-fired ceramic samples, two tripod stilts, one clay lump, and one possible kiln fragment are submitted for analyses. The glazed ware samples selected are representative of the range of styles and vessel forms observed in the assemblage (Fig. 2; Table 1).

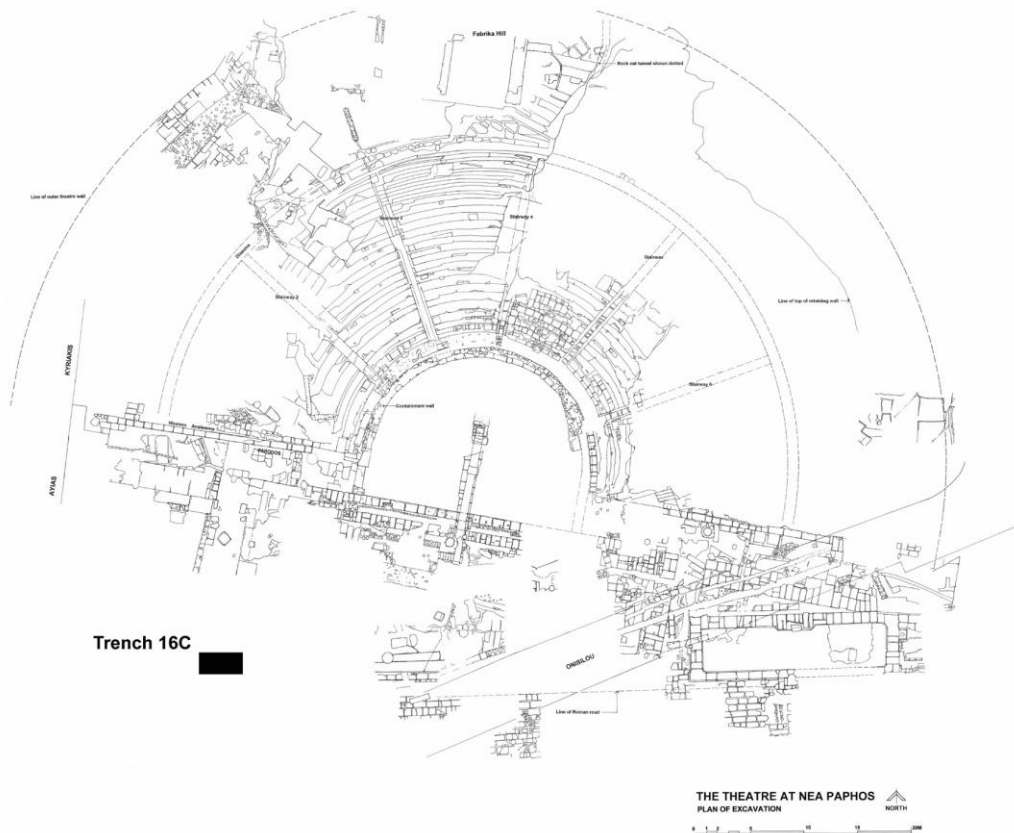


Figure 1. Plan of the theatre site at Nea Paphos showing the location of Trench 16C (marked in black) against the extant architectural remains of the rest of the ancient theatre. Plan by Geoff Stennett.

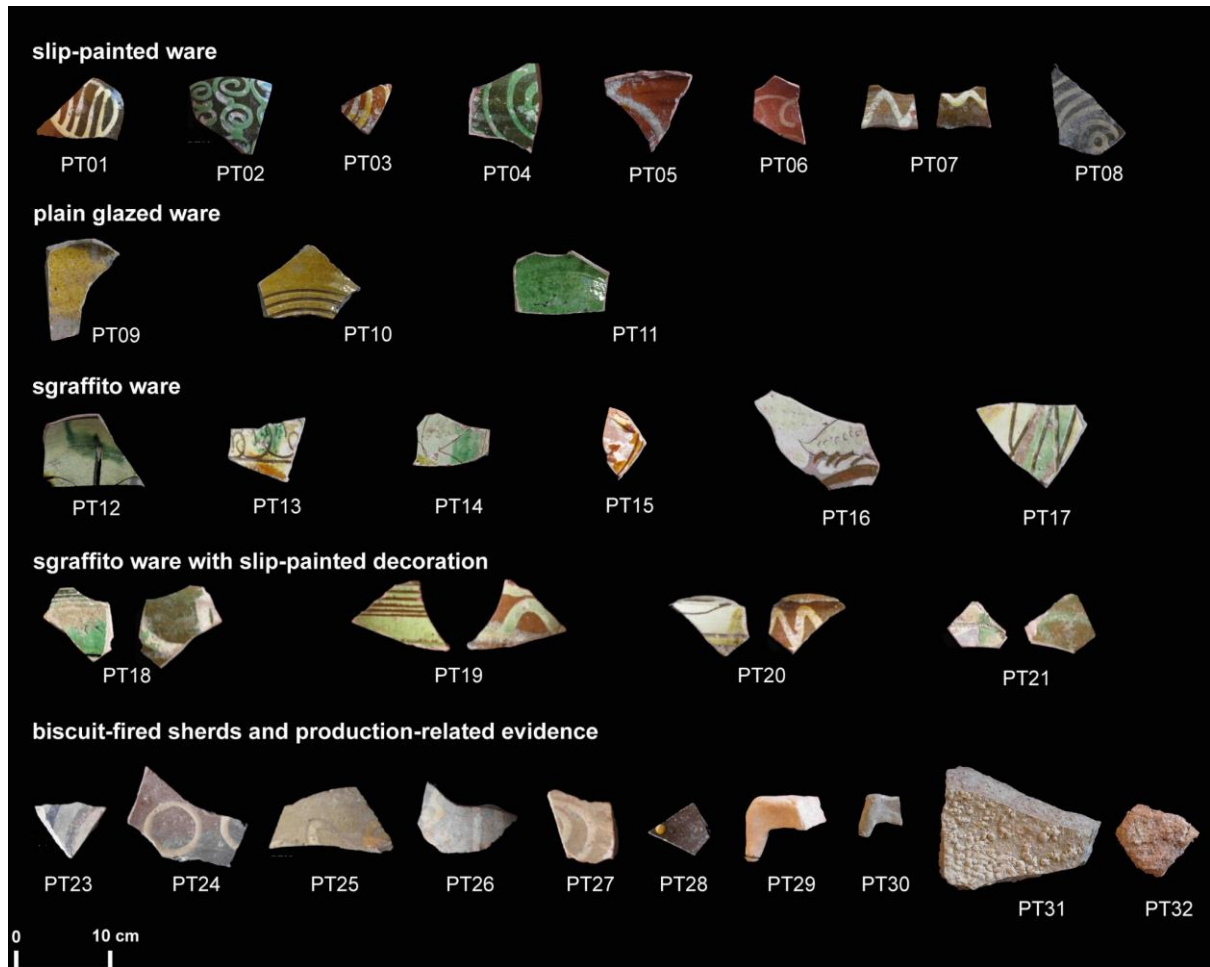


Figure 2. All glazed ware samples and production-related evidence from the theatre site at Nea Paphos that are included in this study.

2. Analytical methods

All samples were analysed using scanning electron microscopy energy dispersive spectrometry (SEM-EDS) and thin-section petrography.

2.1. SEM-EDS

The ability of this analytical technique to focus on a specific area of the sample, in this case the glaze, ceramic body, and paint or slip, has allowed us to characterise different aspects of glaze technology. These aspects of glaze technology include the composition of the glaze and associated ceramic body, the type of colourant used, and the method of glaze application, and the source of raw materials. Since

most samples have glaze on both surfaces, a distinction is made here to differentiate the surface that was intended to be decorated and the one that was not, which will facilitate the discussion of results below. For the slip-painted, plain glazed, and sgraffito ware, the surface that was intended for decoration refers to the interior surface of a bowl and the exterior surface of a jug, both of which are painted or incised with geometric and iconographic patterns. Since the sgraffito with slip-painted decoration has decoration on both surfaces of the vessel (sgraffito on the interior and painted decoration the exterior), the glazes on both surfaces are considered to be intended for decoration. The remnant of glaze seen on the surface of the biscuit-fired sherds (PT24, PT25, PT28) is viewed as not intended for decoration, as they were probably caused by dripping from other glazed wares fired in the same kiln.

The samples were prepared in polished blocks and carbon-coated for analysis using two SEM suites, owing to the accessibility and availability of the instruments. The first suite is the JEOL JSM 6610 low vacuum scanning electron microscope at UCL Qatar Archaeological Materials Science Laboratories, and the second suite is the CARL-ZEISS EVO25 at the UCL Wolfson Archaeological Sciences Laboratories. Both suites are fitted with the Oxford Instruments AZtec energy dispersive spectrometer analysis system. The system was set to 20.0kV accelerating voltage and take about 22 to 25s total per measurement. The data presented below is an average of three analyses. The area of analysis for the paint, slip and glaze is around 25x50 μm for the matrix and 50x100 μm for the bulk, whereas the area analysis for the ceramic bulk composition measures around 200x300 μm . In all cases, the measurements were converted to oxides by stoichiometry and normalised to 100 wt% to account for the fluctuations in beam intensity and sample porosity. Corning Glass C was analysed as the reference material at the beginning of each analytical session to evaluate the accuracy and precision of measurements and to ensure the compatibility of the data generated by the two instruments (Table 2). A cobalt standard was analysed at regular intervals to monitor the beam current stability.

A fixed set of oxides – Na₂O, MgO, Al₂O₃, SiO₂, P₂O₅, K₂O, CaO, TiO₂, Fe₂O₃, CuO and PbO – was measured for the ceramic body, paint and slip, and glaze of the samples. SnO₂ and Sb₂O₅ were also

measured owing to the identification of some lead-tin and lead-antimony rich particles in a few glaze samples, but these oxides in the ceramic body and paint and slip layers are not reported here as they are consistently below 0.1 wt%, which is below the limits of detection of the SEM-EDS.

2.2. Thin-section petrography

Thin-section petrography was used to identify the types of inclusions and their associated texture – abundance, grain size, shape and sorting of inclusions – in the ceramic body of the vessels and other ceramic products, to confirm and refine the groupings based on the elemental composition determined by the SEM-EDS. The petrographic data further complements the SEM-EDS analysis by establishing the potential provenance of the raw materials used to make the vessels and other ceramic products, by comparing the mineralogical composition of the samples with the information provided by the geological map. Also, by characterising the texture of the samples, we were able to comment on certain technical practices, particularly on how the potters prepared the clay for the ceramic body and slip. All samples were prepared at the UCL Wolfson Archaeological Sciences Laboratories and analysed using the LEICA DM EP Polarisation Microscope. For the description of the petrographic data, the percentage charts developed by Matthews and colleagues (1991) were used to estimate the relative abundance of inclusions.

3. Results

3.1. Ceramic body

Petrographic analysis shows that all ware types share a single fabric. This fabric is very fine-grained, characterised by the presence of the following inclusions: c. 20-30% of quartz, 5-15% of serpentine and mudstone fragment, 5-15% of amphibole, <5-10% of plagioclase feldspar, pyroxene, biotite and limestone fragments, and <5% of apatite in a non-calcareous clay matrix (Fig. 3a). All inclusions but the mudstone and limestone fragments display a strong mode in grain size that measures 0.20mm, whereas the mudstone and limestone fragments vary in grain size, ranging from 0.16mm to 0.80mm. The mudstone fragments appear to be coarser-grained and more frequent in some samples (PT02, PT03,

PT04, PT06, PT07, PT08, PT14, PT15, PT16). Possible evidence of clay mixing can be observed in PT07 and PT16. The same fabric was also used to make the biscuit-fired ceramic fragments and tripod stilts. The inclusions of the tripod stilts are notably less homogenous in grain size compared to those in the glazed ware and biscuit-fired samples, measuring between 0.08mm and 0.68mm (Fig. 3b). The mineralogical constituent of the fabric displays striking similarity with that of the clay lump (PT32) that was found together with the glazed ware fragments, even though the inclusions of the clay lump are coarser-grained (Fig. 3c). The only exception is the fabric of the possible kiln fragment, in which carbonate sand was identified (Fig. 3d).

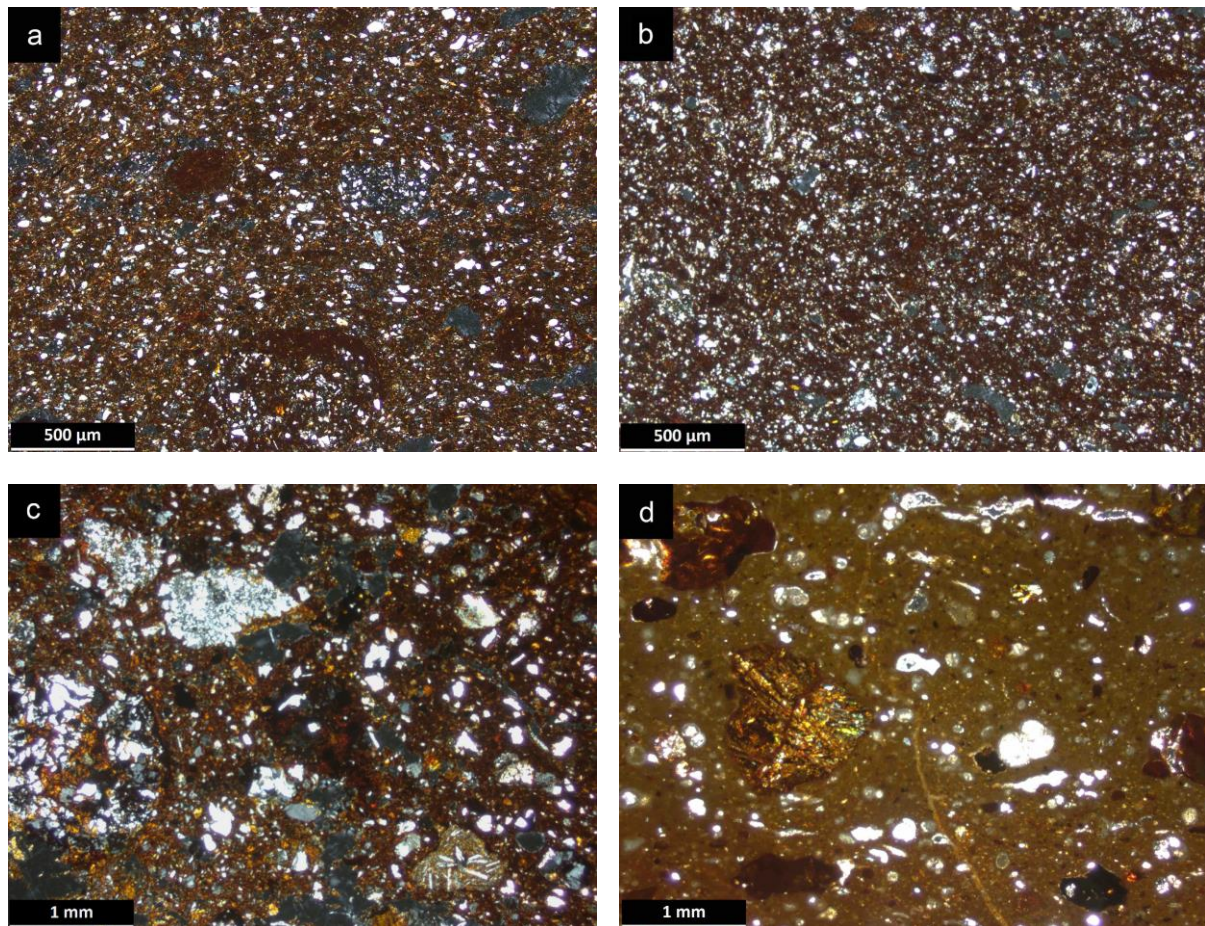


Figure 3. Photomicrographs showing the fabric of (a) the glazed ware samples (PT07) in which patches of clay with pale grey matrix is found to have mixed with the fine-grained reddish-brown matrix, (b) tripod stilt (PT29), (c) the clay lump (PT32) with coarse-grained inclusions, and (d) possible kiln

fragment (PT31) with carbonate sand. All photomicrographs were taken in crossed polarisation and at x50 magnification for (a) and (b) and at x25 magnification for (c) and (d).

SEM-EDS analysis reveals that the ceramic body of all samples but the kiln fragment has similar bulk composition. The ceramic body is typically characterised by 62.1 to 69.2 wt% SiO₂, 11.3 to 18.2 wt% Al₂O₃, 1.70 to 2.84 wt% MgO and 1.10 to 4.21 wt% K₂O (Table 3). The CaO concentration varies from 2.82 to 8.96 wt%, although its concentration does not exceed 6 wt% in most samples and can be broadly categorised as non-calcareous (Maniatis and Tite 1981). The Fe₂O₃ concentration measures between 5.15 and 7.13 wt%, which contributes to its characteristic red fabric colour (5YR 5/8 yellowish red). The kiln fragment is marked by an exceptionally high Fe₂O₃ concentration (10.1 wt%). This, coupled with its different mineralogical composition, makes the kiln fragment an outlier and was not included in the following biplot. A strong correlation is exhibited among all samples, especially in terms of their Al₂O₃ and Fe₂O₃ concentration (Fig. 4). This supports our observation of the presence of a single fabric, and further implies that the clays from similar sources were likely used to make the ceramic body of the glazed, biscuit-fired and tripod samples.

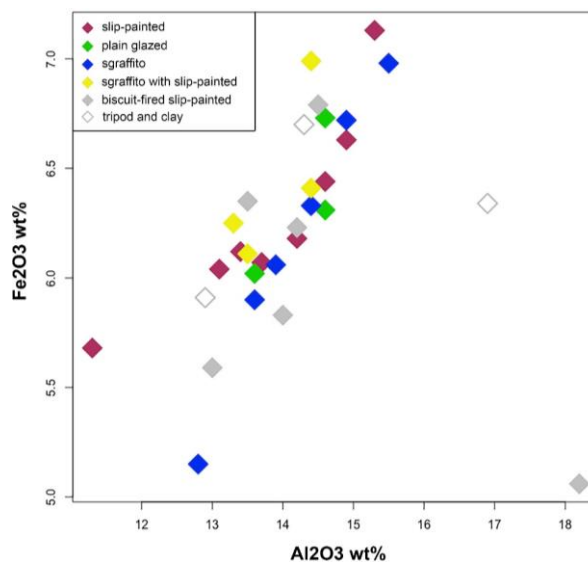


Figure 4. Biplot showing a positive correlation between the Al₂O₃ and Fe₂O₃ concentration, which suggests that similar clay sources were used to make the ceramic body of all samples.

3.2. Paint and slip

Microscopically, the paint and slip layers have different microstructure, as expressed in their thickness and texture. The paint of the slip-painted wares is generally thinner, measuring between 40 μm and 90 μm in thickness. It contains very little to no inclusion, which is particularly evident in the paint of the biscuit-fired slip-painted samples (Fig. 5a). The slip of the plain glazed ware, sgraffito, and sgraffito with slip-painted decoration measures between 160 μm and 200 μm , and is marked by the presence of a few quartz inclusions (Fig. 5b). These features also apply to the paint found on the exterior surface of the sgraffito with slip-painted decoration, which was different from the fineness of the paint used to decorate the slip-painted ware.

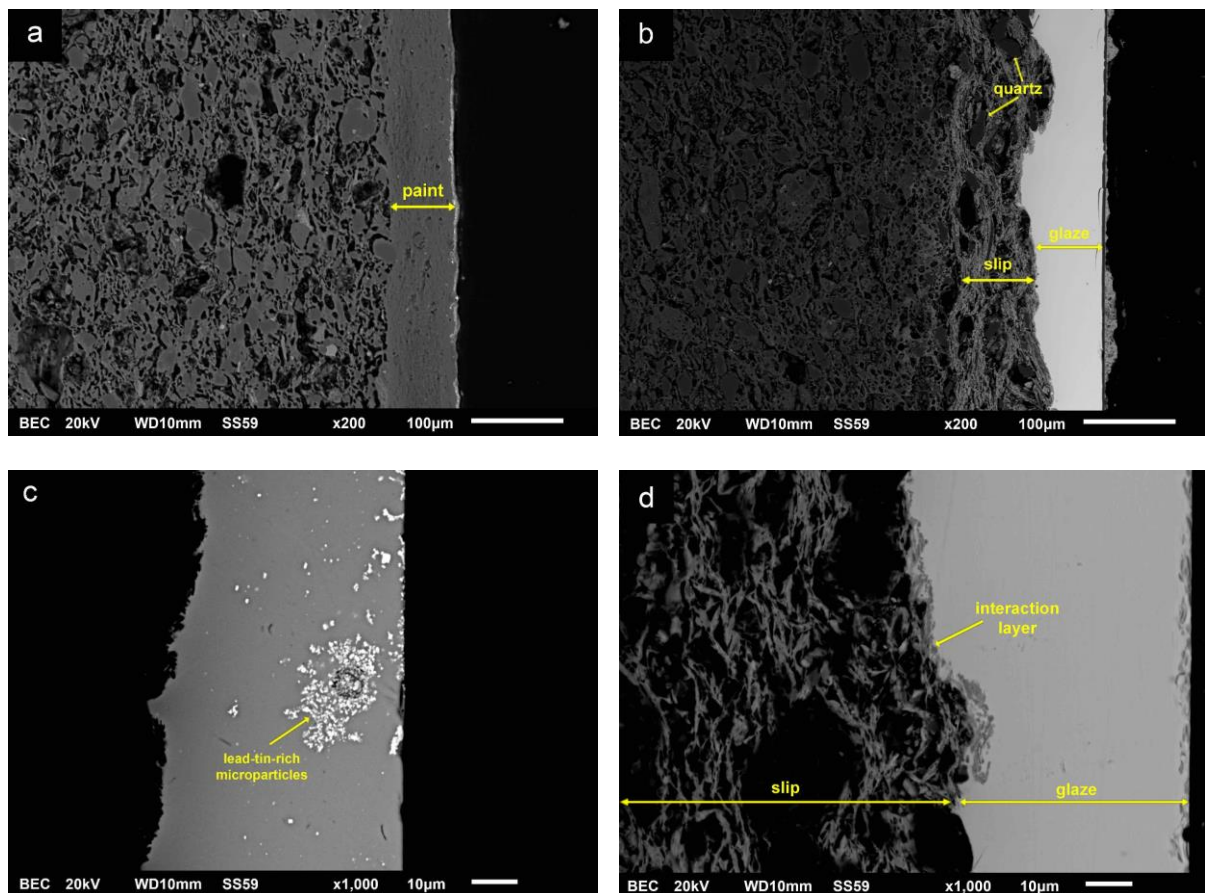


Figure 5. BSE images showing (a) the paint with very little inclusions on the interior surface of the biscuit-fired sherd of the slip-painted ware (PT23), (b) the slip with frequent occurrence of quartz inclusions of the sgraffito ware (PT17), (c) clusters of tiny lead-tin-rich-particles in the glaze of the slip-painted ware (PT04), and (d) thin interaction layer between the glaze and underlying slip layer (PT10).

Noteworthy is that the following discussion of the paint and slip composition is based on the analysis of the clay matrix of paint and slip. The quartz inclusions in the slip of the plain-glazed, sgraffito and sgraffito with slip-painted decoration only result in an elevated SiO_2 concentration of the bulk composition of their slip, and the variation in other elements between the clay matrix (area clear of quartz inclusions) and the bulk (area with quartz inclusions) is slight and systematic (Table 4). Also, all oxides were renormalised after removing the PbO concentration, since the difference in the PbO concentration of the slip is not a feature of its original composition.

All paint and slip layers are characterised by lower CaO and Fe_2O_3 concentration and an elevated Al_2O_3 concentration than the associated ceramic body (Table 4). The paint of the biscuit-fired slip-painted samples stands out for having higher Al_2O_3 concentration than their glazed counterparts and the slip of other ware types (Fig. 6). The higher Al_2O_3 concentration in the slip of these unglazed samples might reflect the lack of dissolution of clay from the paint to the glaze. As for the paint and slip of the glazed samples, their composition is far from homogeneous, notably in terms of their CaO and Fe_2O_3 concentration (Fig. 6). The samples with higher CaO and Fe_2O_3 concentration in the paint and slip are mostly the slip-painted ware and the painted side of the sgraffito with slip-painted decoration. The slip of some plain glazed and sgraffito samples also has higher Fe_2O_3 concentration, and it is usually associated with the samples with yellow glaze. Such variation in paint and slip composition seems to have caused by an interaction with the glaze, which will be elaborated below.

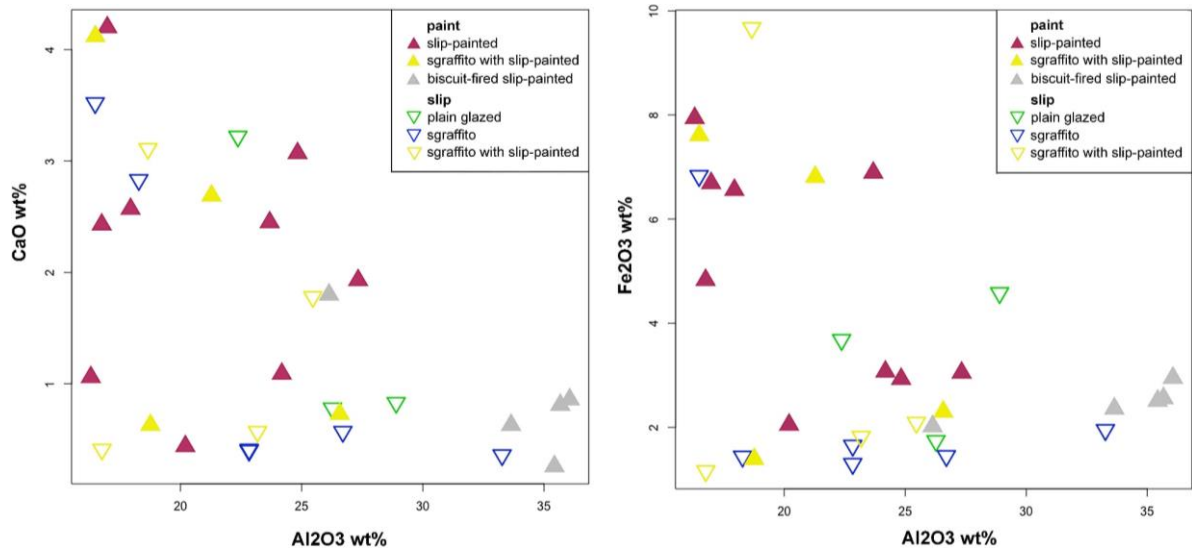


Figure 6. Biplots showing that the biscuit-fired slip-painted samples have higher Al_2O_3 concentration, and that the paint and slip of the slip-painted samples and painted side of the sgraffito with slip-painted decoration tend to have higher CaO and Fe_2O_3 concentration than the slip of other ware types.

3.3. Glaze

All glaze has high PbO concentration, which measures between 48.3 and 68.9 wt% for the surface that was intended for decoration, and between 27.0 and 66.3 wt% for the surface that was not intended for decoration (Table 5). Particles or clusters of particles (c. $2\mu\text{m}$ in grain size) rich in lead-tin and lead-antimony concentration are found to be present in the glaze of some samples (PT04, PT11, PT14, PT21) (Fig. 5c). The analysis of the glass matrix and bulk area of the glaze that contains the lead-tin and lead-antimony particles shows that there is no significant variation in the composition between the two; thus the following discussion is based on the composition of the glass matrix. Given the low SnO_2 and Sb_2O_5 concentration in the glaze of these samples (less than 1 wt%), as well as their rare occurrence and fine grain size, it is likely that the lead-tin and lead-antimony particles are newly formed crystals (Molera et al., 1999) rather than added deliberately as an opacifying agent (Matin et al., 2018; Molera et al., 2001; Tite et al., 2008, 2015).

For the surface that was intended for decoration, the glaze of the slip-painted samples and painted side of sgraffito with slip-painted decoration tends to have higher CaO and Fe_2O_3 concentration (Table 5,

Fig. 7). In these samples, since the paint only covers the surface partially, the glaze reacted with both paint and ceramic body. This might have resulted in the transferral of the constituents of the ceramic body – which is rich in CaO and Fe₂O₃ as revealed above – to the glaze. At the same time, the glaze with enhanced CaO and Fe₂O₃ concentration interacted with the underlying paint or slip, leading to the higher CaO and Fe₂O₃ concentration of the paint or slip. The Fe₂O₃ concentration of some glazes is further enhanced by the addition of iron oxide as colourant (see below).

Turning to the colourant, copper oxide was used to make green glaze. The CuO concentration measures between 1.16 and 2.40 wt% in the glaze of PT02, PT04 and PT11, and the splash decoration by green glaze of PT12, PT13, PT14, PT17, PT18, PT19 and PT21 (Table 5). As mentioned above, iron oxide was used to make yellow glaze. Higher Fe₂O₃ concentration – which ranges from 0.96 to 4.06 wt% – is measured in the glaze of PT03, PT05, PT07, PT08, PT09 and PT10 and the splash decoration of PT12, PT13, PT14, PT15, PT17, PT20 and PT21 (Table 5).

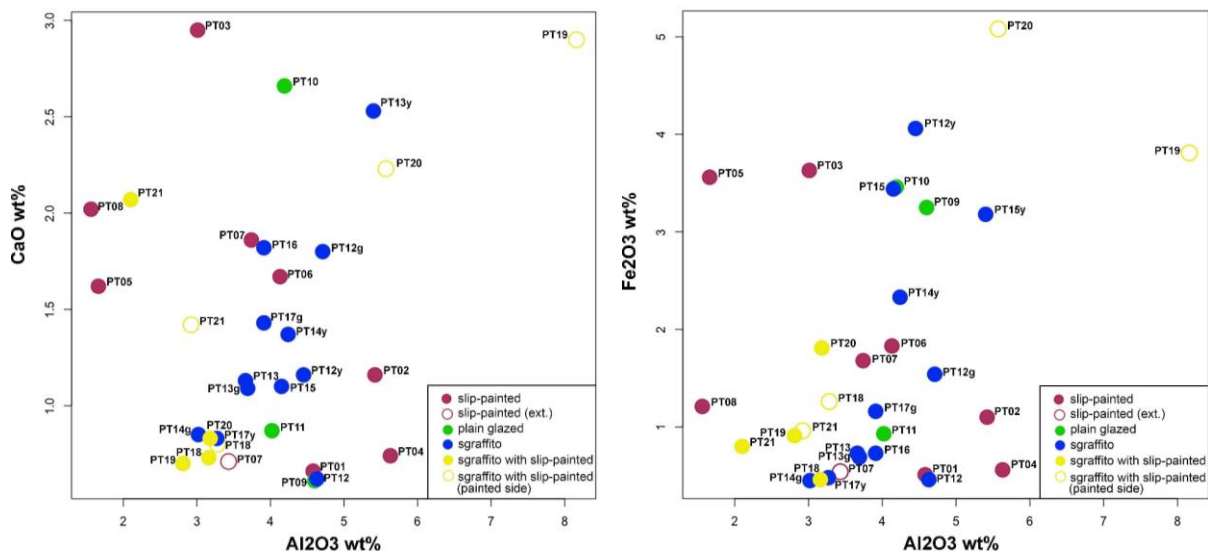


Figure 7. Biplots showing the glaze of slip-painted samples and painted side of sgraffito with slip-painted decoration has higher CaO and Fe₂O₃ concentration. Some samples are represented by more than one set of glaze analyses because of multiple glaze colours (y=yellow and g=green).

The Fe₂O₃ concentration of the glaze on the surface that was not intended for decoration is also high, measuring between 0.54 and 5.59 wt%. This, coupled with higher CaO concentration of these glazes, leads to the postulation that it was caused by greater interaction between the ceramic body and glaze owing to the lack of slip to act as a buffer between the two on the undecorated surface. In addition to higher Fe₂O₃ and CaO concentration, the composition of the glaze on the undecorated surface is generally more varied than the glaze on the decorated surface (Table 5). We suggest that the potters might have used whatever raw materials that were leftover to make the glaze on the undecorated surface. This hypothesis is supported by the samples with only green glaze on the decorated surface (PT02 and PT04), which have low CuO₂ concentration of the glaze of the undecorated surface; thus pointing to the use of different glaze on different surfaces.

4. Discussion

4.1. Reconstruction of the glaze ware technology of the Paphos production

The clays that were used to make the ceramic body of all glazed wares were likely derived from local sources. The mineralogical composition of the fabric is consistent with the local geology of the Paphos region, which is partially underlain by the sedimentary and igneous rocks of the Mamonia Group (Hadjistavrinou and Afrodisis, 1977: 8-9; Robertson and Woodcock, 1979). Serpentine is described as being one of the main lithologies of the Mamonia Complex, which is further distinguished by their porphyritic character consisting of feldspar and pyroxene phenocrysts, less altered appearance (compared to the Troodos Igneous Complex), and the presence of minerals such as biotite and apatite (Bear, 1963: 17). The clayey alluvium of the Athalassa Formation can be found along the coastal area, which might have provided the clay for making the ceramic body of the samples (Hadjistavrinou and Afrodisis, 1977: 13). The similarity between the composition of the glazed wares samples and clay lump and the local geology suggests that the potters not only procured the raw materials from the local source, while the difference in inclusion size and distribution indicates that they processed and refined the raw materials to prepare the fabric for the ceramic body.

Once the ceramic body was formed, a layer of paint or slip was applied to the surface of the vessel to create a 'white' background for highlighting the design and accentuating the colour of the glaze. The paint and slip were prepared in different ways, with quartz inclusions being added to the slip but not to the paint. The paint was applied onto the surface of the slip-painted ware in form of the desired design, whereas the slip covered the entire surface of the plain glazed and sgraffito ware, although the slip was partly scraped off to expose the red ceramic body underneath for the sgraffito. A combination of both decorative techniques can be found on the sgraffito with slip-painted decoration. The composition of the paint and slip layers, coupled with their white colour, suggest that some sort of kaolinitic clay was used. The composition of the paint and slip of all glazed ware samples is largely consistent with Type A white slip categorised by Aloupi and colleagues (2001: 22) in their study of Late Bronze Age Cypriot Monochrome White Slip pottery. Although the provenance of Type A white slip and thus the slip of glazed ware samples under studied is yet to be established, it is unlikely that the clay was extracted from Troodos Massif, which is argued to have been used to make some Late Bronze Age White Slip II wares, based on the difference in chemical and mineralogical composition (Gomez and Doherty, 2000).

The decorated ceramic body underwent first firing before the glaze application, as evident in the recovery of biscuit-fired sherds and the thin interaction layer between the glaze and underlying paint, slip or ceramic body (Fig. 5d). The examination of the ceramic body of the biscuit-fired slip-painted sherds by the SEM highlights the presence of glassy surface and small bloated pores. These features can be interpreted as the signs of extensive vitrification (Maniatis and Tite, 1981), suggesting that the vessels were fired at around 850 to 950°C during the first firing. Although the vessels were fired twice, the unglazed and glazed vessels were likely fired together. This is highlighted in the identification of the remnant of glaze on the exterior surface some biscuit-fired sherds. This further implies that the temperatures of the second firing were more or less within the same range as the temperatures of the first firing, which would have been sufficient for the glaze to form (Tite et al. 1998, 252-53).

The glaze was made by a mixture of lead oxide and silica rather than the direct application of lead oxide to the surface of the ceramic body. This is confirmed by the observation that the samples do not fall on

the unity slope line by plotting the composition of the glaze and underlying paint/slip and ceramic body, after removing PbO concentration and renormalising the glaze composition to 100 wt% (Fig. A1) (Hurst and Freestone, 1996; Walton and Tite, 2010). We further suggest that the unexpected presence of tin and antimony in some glazes reflects the use of Roman lead pipes and solders – which contain trace amount of tin and antimony as indicated by previous research (Gomes, 2016; Segal, 2015; Wyttenbach and Schubiger, 1973) – as flux for the glaze. This hypothesis is based on the fact that the ceramic body, paint and slip contain little to no SnO₂ and Sb₂O₅ concentration, and that lead is not a common element on Cyprus, even the rich copper ores of the Troodos foothills have an unusually low PbO concentration (Bear, 1963: 48; Constantinou, 1982).

4.2. The role of the establishment of the Frankish rule in beginning of glaze production in Cyprus

Based on the results of the analyses, it appears that the technology used to produce the glazed ware in Cyprus during the 13th century AD was in line with the contemporaneous technological trends of glaze production in the broader eastern Mediterranean region. The use of lead glaze, as well as the use of iron and copper oxide as colourants, was a common technical practice not only among the Byzantine (e.g. Armstrong et al., 1997; Palamara et al., 2016), but also known to the local productions of Islamic glazed earthenware in the eastern Mediterranean and Middle East region (e.g. Mason, 2004; Ting et al., 2019; Tite, 2011; Tite et al., 1998). The preference for sgraffito, in particular, further suggests that the potters were following the decorative technique that was fashioned by the production in the Byzantine provinces, the Aegean Latin-dominated regions and the Levant alike (Lane, 1938; Morgan, 1942; Papanikola-Bakirtzi, 1999; Tonghini and Henderson, 1998). Judging from the similarity between these two aspects of glazed ware production in Cyprus and its contemporaries, we argue that the potters were not only already familiar with glaze production when they began making glazed ware in Cyprus, but they also possessed certain level of skills and technical knowledge. The potters seem to know how to obtain the flux for glaze in a situation where a natural source was not readily available, how to make use of the contrast of white slip and red clay to create certain visual effect, and how to use different glazes for different surfaces and that the glaze on the decorated surface – the side that was supposed to be seen by the consumers – should have more standardised quality and colour. Thus, we postulate that

the early production of glazed wares in Cyprus involved the adoption of pre-existing, well-established traditions by local potters, or perhaps the production was executed by others than the local potters.

Our data do not provide any indication that the Franks were involved in the actual production process as potters or the Frankish rulers controlled or monopolised the production. That being said, we suggest that the establishment of the Frankish influence on the island had certainly stimulated the glazed ware production in the two main ways. First, it might have provided the labour and skills required for glaze production. We know from historical records that there was a mass influx of people from Latin Syria to Famagusta following the fall of Acre and the Kingdom of Jerusalem in 1291 (Coureas, 2005). Although no parallel records can be found about the movement of people during the initial years of the Frankish rule on the island, it is logical to assume that there was also movement of people to Cyprus from areas that were affected by the constant conflicts among different powers that represented the Christian West and Islamic East, and that some of these people might have possessed the skills to execute or pass on the knowledge to local potters. This would be supported by our argument that the potters adopted technologies that were common to the eastern Mediterranean region in the early glazed ware production in Cyprus.

Second, the Frankish link to and involvement in the Crusaders' campaigns had created the market, and thus demands, that fuelled the production of glazed ware. Again, we learn from historical records that the ports in Cyprus, especially those located along the south and southwest coast, functioned as stopovers for Crusaders to refill their supplies before continuing their journey to the Levant (Cook, 2014; Coureas, 2005), although the exact nature of these supplies was not listed in the written sources. This, coupled with the recovery of glazed ware with styles similar to the ones under study here mostly in areas within the realm of the Crusader states (Boaz, 1999; Stern, 2014), suggests that the early glazed ware production in Cyprus was intended to accommodate the demands of Crusaders. This hypothesis is further supported by the fact that there was a decline in glazed ware production activities in the Paphos-Lemba area during the mid-14th century AD, which corresponded with the time following the dissolution of the Kingdom of Jerusalem and the Crusaders states (Cook, 2014; von Wartburg, 1997).

It is noteworthy that the bulk of the Paphos glazed products (especially the coloured sgraffito ware, dated between the early 13th and early 14th centuries) must have been exported to other places abroad (e.g. the Crusader Kingdom of Jerusalem). Very few products seem to have reached markets in Cyprus itself (with the exception of big urban centres, such as Nicosia), while only a handful of fragments of glazed pottery from Paphos, dated to the 13th century, are usually identified by systematic surface survey projects in the rural countryside of Cyprus. Once the biggest market for the Paphos sgraffito ware in the Levant falls to the Mamluks, the Paphos production slowly dies with it.

5. Conclusion

The results of the technological characterisation reveals that the early glaze technology in Cyprus was marked by the following features: the use of high lead glaze, the addition of iron and copper oxide as colourants, the application of painting and incision as the principal decorative techniques, and the use of locally available raw materials for the glaze and ceramic body. Judging from such characterisation, it seems that the early glaze technology in Cyprus was just another case of using high lead glaze, which is expected for most local productions in the region during the late medieval period. However, by framing the results of the technological study within its historical context, which we have devised in this study, we begin to see the connection between the local glaze production and contemporaneous technological traditions, as well as the connection between the beginning of glazed ware production and the fate of the Crusader states. In this sense, this study has also highlighted the potential of using ‘non-elite’ glazed ware to establish the missing link between local processes and the broader technological and historical developments. If we begin to reconsider the ‘non-elite’ glazed ware in such a way, we will be able to unlock a whole host of new data to create an alternative narration – especially the ones that are often neglected in written records or underrepresented in existing research framework – in understanding the dynamics of socio-cultural interactions among different players in the eastern Mediterranean during this period.

Appendix

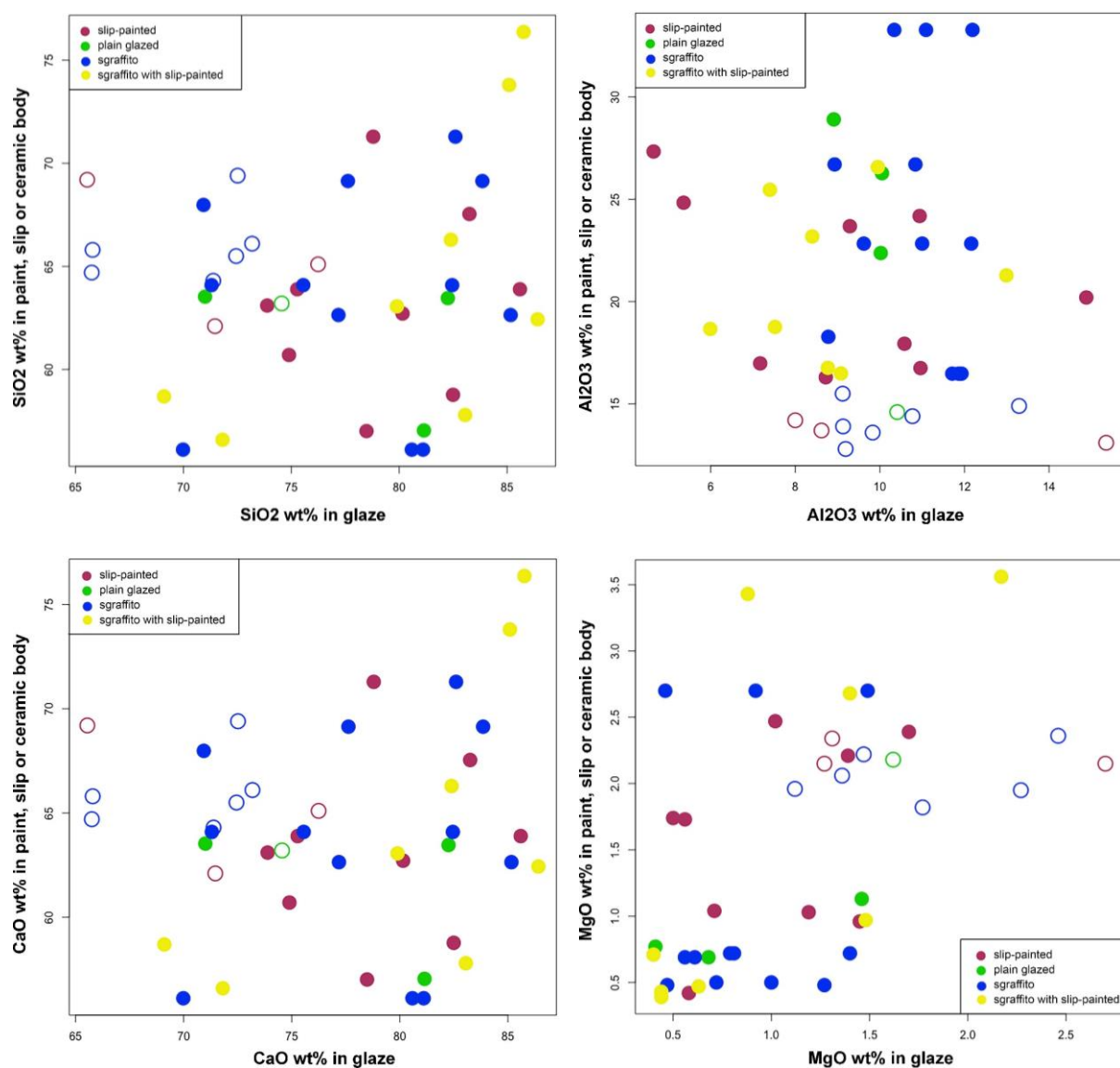


Figure A1. Biplots showing the samples do not fall into the unity slope line by comparing the same oxides in glaze and associated paint, slip or ceramic body. Solid dots represent the glaze on the decorated surface and hollow dots represent the glaze on undecorated surface.

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