

Chemical characterization via pXRF of Late Roman pottery from Sicily: new data from the excavations at the Catacombs of St. Lucy at Siracusa (2011-2015)

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Abstract: The excavations carried out at the Catacombs of St. Lucy at Siracusa by the University of Catania (2011-2012) and Arcadia University (2013-2105) in partnership with the Pontifical Commission for Sacred Archaeology have produced a remarkable amount of ceramic material ranging from fine wares related to Late Hellenistic and Early Roman contexts, and Late Roman coarse wares, cooking wares and amphorae from contexts dated between the 4th and the late 7th centuries AD. Since Siracusa was the capital of the province of Sicily during the Roman and Byzantine Empires, this evidence consists of a representative case study for the region. Ceramic artifacts from different areas of Region C of the Catacombs of St. Lucy, including Sector F, the Oratory C and Crypt VI, were tested non-destructively with a portable X-ray fluorescence spectrometer to study production and circulation of fine and coarse wares in Sicily during the Late Roman and Early Medieval periods. Analyses using a Bruker III-SD were conducted on 71 ceramic samples, selected from the most common ceramic classes. Samples were analyzed on broken edges, focusing on trace elements Rb, Sr, Y, Zr, and Nb. Quantitative values were produced using widely shared calibration software for these elements, and the principal components analysis of the data show that the ceramics fall into distinguishable groups, with most of the artifacts tested most likely coming from clay sources near the site. Further investigation will assess whether there are patterns based on object type and decoration, and the advantages and disadvantages of using this method.

Keywords: SICILY, SYRACUSE, CATACOMBS, ROMAN POTTERY, NORTH AFRICA, PXRF

Introduction

The Catacombs of St. Lucy represent one of the oldest and most important monuments related to the Christian communities of Syracuse and Sicily in the Late Roman and Byzantine periods. The name of the complex derives from the tradition that Saint Lucy, martyred during the reign of Diocletian in the early 4th century AD, was buried there.

Despite the fact that pottery represents the principal evidence of extant material culture, a long tradition of studies has preferred to focus on the architecture of the catacombs. Only the pioneering archaeologist Paolo Orsi extensively published pottery in his work dedicated to Christian cemeteries (Orsi 1896, 1897) in order to infer chronology.

In the last decade, several publications have focused on Sicilian catacomb pottery assemblages (Ancona 1998; Bonacasa Carra 1995; Fallico 1971; Marchese 2012; Sgarlata 2003 99-104; Vitale 2012). However, attempts at understanding the nature and the function of the group of artifacts are often limited to lamps and fine ware imports. The presence in this volume of two papers dedicated, in a different way, to Late Roman coarse wares from important Sicilian Christian contexts as Agrigento and Syracuse may represent the start of a new phase of studies.

The catacombs of St. Lucy are an extremely complex archaeological site, interested by multiple phases of occupation through the centuries and major changes in the use of some areas. The Akradina district and the area surrounding the St. Lucy complex are host to a series of monumental features such as cisterns, aqueducts, craft shops, dated between Hellenistic and Roman times; recently, a team directed by D. Malfitana rekindled scientific interest in the area (Malfitana and Cacciaguerra 2014, 2015), focusing on previously discovered production areas (Agnello 1957; Lagona 1972). For this reason, a huge amount of the ceramic material found inside the St. Lucy catacombs is related to Hellenistic and Roman phases. The Late Roman cemeterial phase is paradoxically the least documented period.

In this contribution we shall exclude detailed descriptions of all of the artifacts, and rather reserve that task for a future publication concerning the excavations. We shall focus here on pottery groups and discuss the results of our pXRF analyses.

The context

The Catacombs of St. Lucy represent one of the oldest and most important monuments related to the Christian communities of Syracuse and Sicily in the Late Roman period. Beneath the homonymous square, there is a large underground cemetery that was developed throughout

the 3rd, 4th and 5th centuries AD, incorporating previous structures used for funerary, 'cultural' and industrial purposes that were transformed into monumental burial chambers. The presence of the tomb of St. Lucy guaranteed the popularity of the complex even after the end of its use as a cemetery in the 6th century AD. In fact, in at least two regions of the catacombs (A and C) new oratories were built, probably relating to the activity of nearby monastic groups. These groups substantially modified the layout of the catacombs in order to create spaces required for their cult practices. Frescoes and devotional graffiti testify to a consistent exploitation of the oratories until the second half of the 13th century AD.

The first archaeological explorations were carried out in 1916-1919 by Paolo Orsi, who focused in particular on the topography of Region A, where the so-called Byzantine Oratory of the Forty Martyrs of Sebaste was discovered. The division of the cemetery into four regions (A, B, C, D) was made at the beginning of the 20th century by J. Führer (Cugno and Garro 2016), and does not correspond to the original plan of the catacombs but rather to the layout that resulted from the construction of the Mausoleum of St. Lucy, built by Giovanni Vermexio in 1630. This destroyed a significant part of the cemetery in order to isolate and incorporate the revered tomb of the martyr into the monument. The plan of the catacombs was further modified in the course of the 1940s, when they were used as bomb shelters by the local people endangered by Allied bombing raids during the Second World War. During the war, the National Authority for Anti-Aircraft Protection ordered the excavation of wide connecting tunnels that reached Regions B and C, which were still unexplored at the time.

The systematic exploration of Region C was carried out in the early 1950's by S.L. Agnello on behalf of the Vatican Committee for Sacred Archaeology. He emptied the tunnels of Region C, revealing the backbone of the entire area represented by the double North-South axes of Galleries A and B which form the largest district of the entire complex. In the southern part of Region C are several earlier structures related to the Greek and Roman periods that were buried by a catastrophic cave-in that probably occurred at the end of the Early Roman Empire (Agnello 1996): these include the so-called 'pagan shrine', a cult place dedicated to Zeus Peloros and dated to the 2nd-1st century BC, a columbarium with cinerary urns dating to the 1st-2nd century AD, and several rooms related to a large pottery workshop. Furthermore, a second 'pagan shrine' with features similar to the other one, but in much poorer condition, has been identified in Sector F of Region C.

The so-called 'second pagan shrine' and the 'Pagan Shrine of Zeus Peloros', located in the South-West corner of Region C, belong to the pre-existing structures of the late Hellenistic and Roman periods, later incorporated in the cemetery. change with: gnello (1955) determined

that the room had a religious purpose prior to its use as a cemetery, by comparing an extant pillar that preserves a trapezoidal plan with traces of a niche to the similarly built Shrine of Zeus Peloros, as well as terracotta figurines of sailors that were found in two pits, which were interpreted as ex-votos. Unlike the Shrine of Zeus Peloros, which remained intact in its perimeter and was exploited by the Christian cemetery simply by opening burial niches along the walls, this second room presents much more complex phases of use, which have radically altered its original appearance. In the archaeological campaigns 2011-2013 several graves in the floor level were investigated, identifying the pre-cemeterial phases of the room.

Located along the Gallery B, Crypt VI comprises a group of cubacula set on different levels, accessible from a single monumental entrance with a sequence of three framed arches. In a further phase, a lower level connected to the rest of the complex by a staircase was excavated. Portions of frescoes, related to the last phase of use are still visible on the walls. In one room, there are some massive sarcophagi carved into the bedrock, indicating the high rank of the commissioner of this complex. The excavation of the crypt in the early 1950s produced a large amount of architectural and plaster elements, and coloured marble testifying that this funerary space was destined for an elite group. Oratory C, located at the northern end of the region, is one of the most significant examples of modifications of the cemeterial space in order to create a monumental Byzantine cult site that, in this case, was still active in the Norman period. It shows an articulated plan with several intercommunicating rooms, some built and others carved into the rock, dating to different phases.

The central area shows a palimpsest of frescoes with portraits of saints and a floor level covered by graves with varying orientations, the majority of which were plundered a long time ago.

The archaeological excavations resumed in 2011-2012 by the joint effort of the University of Catania and the Pontifical Commission for Sacred Archaeology with a series of intervention in Region C, in particular the Oratory C and the area of the Second Pagan Shrine. Between 2013 and 2015 further excavations were undertaken by Arcadia University and the Pontifical Commission for Sacred Archaeology again in Region C, with Oratory C and the area of the Second Pagan Shrine and Crypt VI as areas of interest (Gradante and Tanasi 2017). Since 2016, University of South Florida assumed the scientific direction of the post-excavation studies related with the Arcadia University's explorations of 2013-2015.

A late Roman site without late Roman pottery

During the campaign of 2013-2015, 882 diagnostic pottery sherds were identified, mostly belonging to the pre- or



FIGURE 1. A) 'A ROSARIO' LAMP, SL13/173 (SPECIAL FIND #70), FROM ROOM ALPHA OF THE PAGAN SHRINE FROM TOMB 1001 A, US 1114; B) 'A ROSARIO' LAMP SL13/71 (SPECIAL FIND #59) FROM ROOM ALPHA OF THE PAGAN SHRINE, TOMB 1006, US 1128; C) GEOMETRIC MOTIF AND A PALM ON A LAMP FROM THE BETA ROOM OF ORATORY C (EXCAVATIONS 2011-2012); D) LAMP WITH ONE ROW OF GLOBULES, A CONCAVE AND PLAIN DISCUS FROM THE BETA ROOM OF ORATORY C (EXCAVATIONS 2011-2012).

post-cemeterial phases. While the study of the pottery is still ongoing, a brief presentation of some examples of Late Roman and Early Medieval coarse and cooking wares and amphorae can be beneficial to better appreciate the site of St. Lucy.

Lamps were one of the most common type of finds. During the excavations, twenty-five lamps or lamp sherds were found in differing states of preservation. Moreover, some of the authors have detected a significant balance between African imports and local products. Among the recognizable lamps, as might be expected, the best documented category of lamps is the 'a rosario' type. This category includes small and medium-sized carinated lamps, with an ovoid discus, a border around the hole and a solid handle (Provost type 10A).

Two samples from floor graves in the Pagan Shrine's room *alpha* (T. 1001a, T. 1006) show the distinctive 'a rosario' decoration: small pearls and four little rings (Figures 1a-b).

Another example (Figure 1c) from a grave in the *beta* room of Oratory C (T. 1023) displays a schematic geometrical ornament ('a nervature') that converts into a stylized palm twig on the discus-canal. Based on this relatively rare geometrical theme the lamp can be placed in a transitional phase between two different lamp categories, the 'a rosario' and the 'a ciabatta', as the simplified ribbing represents a stand-alone motif in the latter.

Overall, the decoration appear to be inspired by Christian iconography (crosses, twigs, fishes), even though none of our samples display any commemorative inscriptions or signatures, which are often present on this type of lamps. The issue of identification of one or more production centers and the chronology of 'a rosario' lamps has been central in many studies since Paolo Orsi (1896: 343-

350, 1897: 486-487). Orsi proposed to identify the place of origin in eastern Sicily (Syracuse?) because of the many finds from the catacombs in Syracuse. In addition, he suggested a date between the 5th and 7th centuries for their production. The theory formulated by Paolo Orsi, even though it was not fully embraced by some researchers (Anselmino 1986: 234; Bailey 1980: 387-388; Villedieu 1984: 257), has been generally accepted by most scholars (e.g. Fraeigari 2008: 8-10). Examples of 'italicized rosario' lamps have been found in many Italian (Rome, Naples, Ostia) and other Mediterranean (Greece, Spain, North Africa and Malta) contexts. Yet, from room *beta* comes an almost complete lamp with some peculiarities related to the shape and the ornaments compared to other examples (Figure 1d). It has a solid handle, circular shape, a concave disk without any decoration, one row of globules on the rim and a cross on the circular base.

Even though the use of rows of globules or pearls represents a highly common decorative theme employed in lamps produced both in Sicily and elsewhere, the lack of a decoration on the discus combined with the presence of little globes along a single row are infrequent elements among the many examples discovered in the catacombs, not only in Syracuse but more generally in Sicily. A striking comparison of the shape and decoration comes from Argos where few examples are dated between the 4th and 5th centuries (Koutoussaki 2008: 254).

It seems clear that Greek and Sicilian examples derive from type Deneuve VIII/4 and its ARS sub-types. Indeed, the type shows the combination between the presence of little globes on the shoulder (2 or 3 rows) and a concave and plain discus. The evolutionary pattern recently proposed by M. Bonifay goes from the 3rd until the end of the 5th century (Bonifay 2004: 315) and includes also a gradual reduction in dimensions. Therefore, the small size can be considered a later feature and a lamp of this

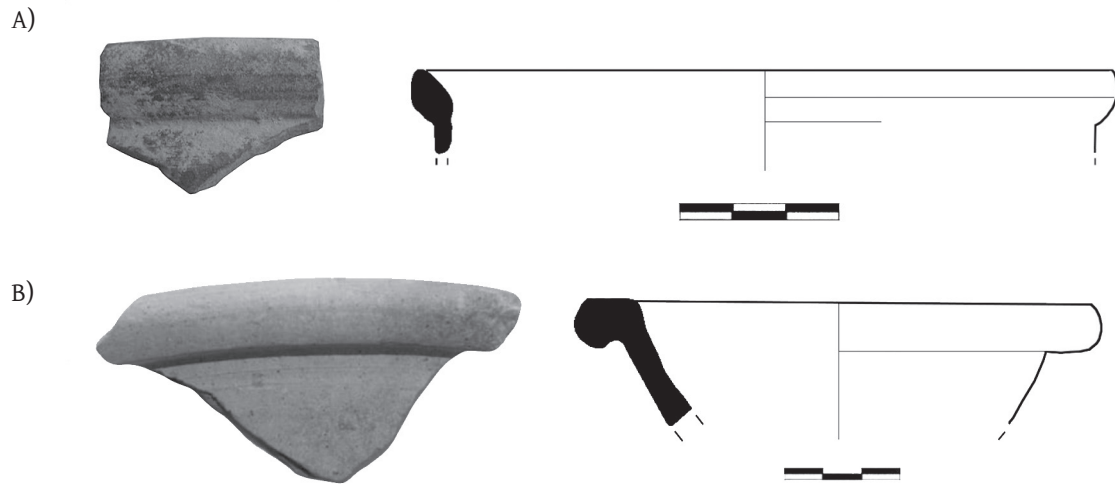


FIGURE 2. A) COARSE WARE BASIN SL14/289 FROM THE TOPSOIL OF ROOM ALPHA; B) COARSE WARE BASIN SL13/80 FROM ROOM ALPHA TOMB 1008, US 1105.

type would date to a later phase, possibly around the end of the 5th century. The colour of the clay suggests a local origin.

The Late Roman Coarse Ware is scantily documented; there are only a few sherds that permit the identification of types with precision. Just a few examples of Pantellerian Ware have been reported, small non-diagnostic fragments that are probably casseroles. The presence of cooking ware of the ‘*Santa Caterina*’ type is scattered also. This ware, which was recently identified (Cacciaguerra 2008), was created to fill the gap left in the market by Pantellerian Ware. The single fragment certainly attributable to the ‘*Santa Caterina 1*’ type comes from grave 1009/1010, inside the Pagan Shrine: it is a casserole with a very thick rim, a handle attached right down the rim and burnished surface. The fabric is hard, not very purified and with many volcanic inclusions that seem to connect the production to the Mt. Etna region. The production of the ‘*Santa Caterina*’ type could be datable between the half of the 5th century and the 8th century. Several basins of local production with everted rim, comparable with the Carra type 93.492 (Bonacasa Carra 2007) were found in Agrigento, and they represent the coarse wares there (Figures 2a-b). Aegean cooking wares were not discovered in the Catacombs of St. Lucy or elsewhere in Syracuse, even if they were first identified not far from Syracuse, at Akrai (Wiceniak 2015: 270-272).

The transport amphorae are documented by a large number of small sherds, predominantly of vessel walls, the majority of which are non-diagnostic. Setting aside the forms related to the peak of the Imperial period, parts of the neck and the rim have been discovered of a Tripolitanian 2 amphora (Bonifay 2004: 89-92) datable to the Late Roman Imperial period (Figure 3a), recalling, in particular, the types found at Ganzirri of Messina (Borelli

et al. 2016: 70-76). The find SL13/320 is particularly noteworthy, as it can certainly be interpreted as a Late Roman Amphora 4 subtype A2 (Figure 3b), dating to 5th century AD (Pieri 2005: fig. 68; Sazanov 2017: 635-637, fig. 4). However, despite its wide diffusion and its distribution throughout the Mediterranean Sea and beyond, this amphora type is not well testified in Syracuse. They are only documented from a coastal maritime/underwater context from which came three examples, a restricted number, especially when compared to the quantity of LRA 1 and LRA 2 amphorae (44) recovered from the same site (Malfitana and Franco 2008: 196). So, this example consists of the first (published) evidence of a LRA 4 from an urban context in Syracuse and it follows the examples of LRA 4 finds previously known from the excavations at Sant’Agata al Carcere at Catania (Arcifa 2010b, 376). The other eastern *sigillata* and amphorae, LRA 1 and LRA 2 above all, have been already largely documented in eastern Sicilian coastal sites. One of the main reasons that explain this significant absence is that Late Antique and Early Medieval contexts often remain unpublished; in the absence of further data, it seems risky to hypothesize the existence of specific circulation patterns of amphorae that exclude Syracuse, the then capital of the Byzantine Empire under Emperor Constans II. We hope that the situation presented will change shortly thanks to the publication of new contexts and new data becoming available.

Despite the limited number of sherds, the emerging evidence about these late products is quite interesting. As regards the cooking ware, an example of ‘*a stuoia*’ ware has been considered a proper archaeological marker related to Early Medieval period (Figure 4).

This specific ware has lately been the focal point of many studies (Arcifa 2004: 390-395, 2008: 303-304; Cacciaguerra

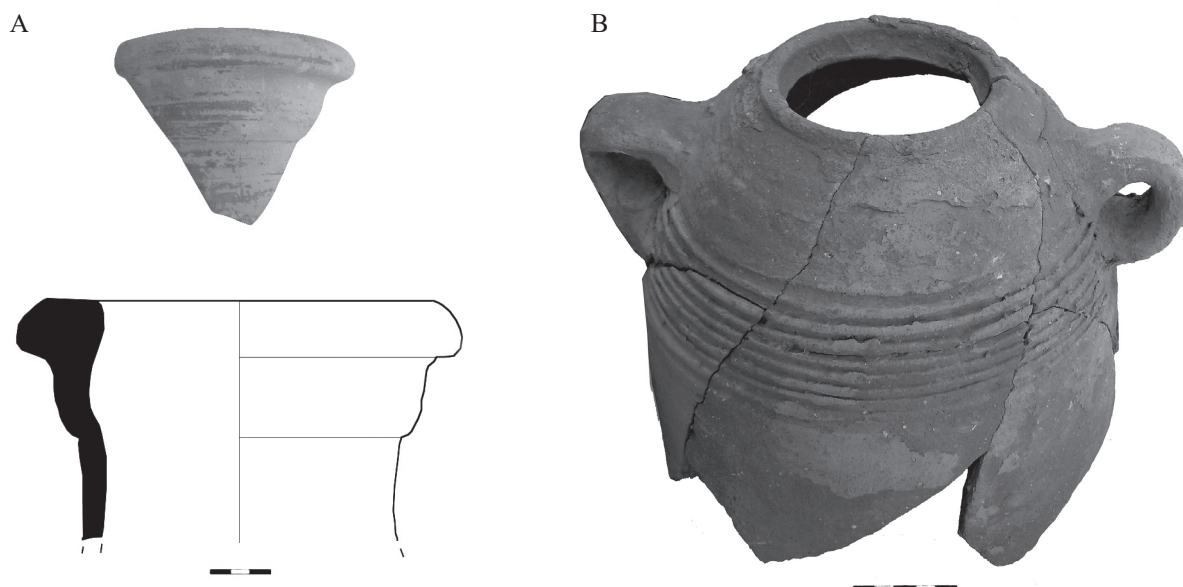


FIGURE 3. A) LATE ROMAN IMPERIAL AMPHORA SL14/148 OF TRIPOLITANIA TYPE 2 FROM TOMB 1005, US 1153; B) LATE ROMAN AMPHORA 4 SL13/320 FROM TOMB 1001 A, US 1110.

2015: 241-242), aiming to improve the chronology, the distribution and the typology. The chronological range suggested by the scientific literature, between the end of the 8th century and the 9th century, is supported also by our finds from Oratory C. Furthermore, a recent review of the pictorial research from the same space (Arcidiacono 2017) allowed us to identify an early-medieval phase, clearly coeval with 'a *stuoia*' vessels. Regarding their distribution, casseroles and 'a *stuoia*' pots are being identified in different sites from Sicily and Malta (Arcifa 2010a: 32-36). At the beginning, this specific type was identified first in eastern Sicilian contexts, but later it was traced to central-western Sicily as well. Some fragments with 'a *stuoia*' decoration have been identified from the area of the *Foro Siracusano*, in Syracuse (Guzzardi *et al.* 2020). Lastly, some pottery sherds with dark stripes on light ground are not easily identifiable (though they are definitely closed forms), and may belong to an even later context. A similar decorative motif has been documented from the same context of the *Foro Siracusano*.

Preliminary data suggest that the production workshops were destroyed during the Arab invasion. Regarding our sherd, it bears stripes much thinner than the example from Syracuse and, more generally, it can be attributed to the production from the 8th to 9th centuries. Indeed, since studies on decorative patterns show the trend of the stripe becoming thinner in later times (Ardizzone and Arcifa 2009: 180), this vessel should be attributed to the peak of the Medieval period.

Archaeometric analyses

An important part of the post-excavation studies is represented by the archaeometric analyses for the chemical characterization of fine and coarse wares



FIGURE 4. WALL FRAGMENT SL14/347 OF BYZANTINE 'A *STUOIA*' WARE FROM ORATORY C, ROOM ALPHA, TOMB 2041, US 125.

collected during the excavations of 2013, 2014 and 2015 at the Catacombs of St. Lucy, using a portable handheld Bruker Tracer III-SD X-ray fluorescence (pXRF) spectrometer, a non-destructive and non-invasive analytical technique which has already proved to be as effective as the traditional X-ray fluorescence spectrometer with certain classes of materials such as obsidian and metals (Tykot 2016).

The research project aims to provide information about the chemical characterization of the fine and coarse wares found in the pre-cemeterial, cemeterial and post-cemeterial phase of the site. The analytical plan was therefore articulated in three main phases, starting with the fine wares related to the pre-cemeterial phase

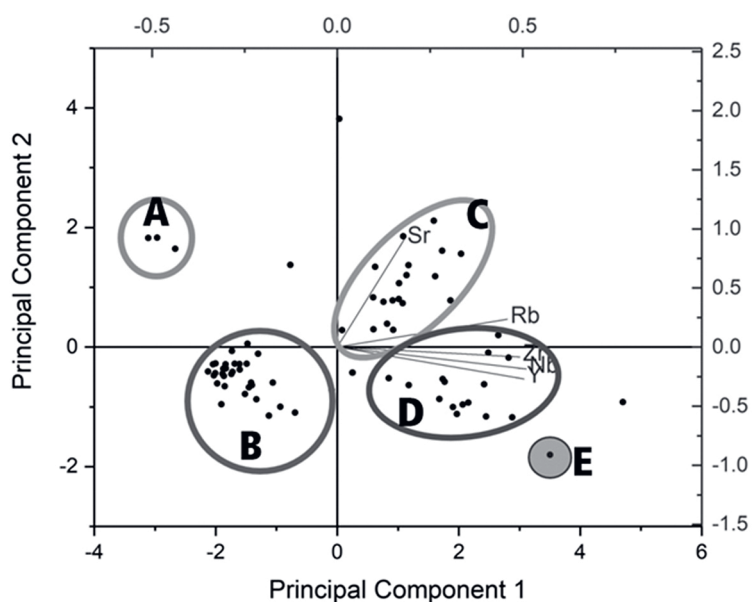


FIGURE 5. PRINCIPAL COMPONENT ANALYSIS IDENTIFYING LOCAL RAW CLAYS (CLUSTER A), PROBABLE LOCAL WARES (B), TWO ADDITIONAL CHEMICALLY DISTINGUISHABLE CLUSTERS (C AND D), AND A FEW OUTLIERS, AMONG WHICH SL13/172 (E). STRONTIUM (SR) HAS THE HIGHEST STANDARD DEVIATION (170).

traditionally associated with a pottery workshop active between the 1st century BC and 1st century AD. Seventy-one samples including Arretine ware, Campanian C ware and San Giuliano Ware collected in the 2013-2015 excavations were analyzed together with three samples of raw clay found *in situ* in an archaeological deposit in the area related to the pottery workshop in the so-called Second Pagan Shrine in the Region C. This initial part of the research was also used to establish protocols and to test the reliability of the technique, before moving forward with the analysis of the Late Roman coarse and cooking wares and amphorae.

Namely, out of the 71 samples analyzed, 42 were sherds of Arretine ware, 24 were Campanian C fragments of plates and bowls and 5 were fragments of San Giuliano ware. The three samples of raw clay were collected in three different locations of Region C, in which it was possible to identify large archaeological deposits of this material, possibly related with the production activity of the pottery workshop.

For lack of space in the present contribution it is not possible to present the full data with the results, which will be instead published in the final version of this study on both fine and coarse wares. The data obtained with the pXRF were subsequently statistically treated with Principal Components Analysis. The first two principal components were extracted considering the Eigenvalues of the Correlation Matrix should be >1 , and these amount to 86.97% of total variance.

As a result, three useful clusters can be distinguished for the sherds using strontium, rubidium, zirconium, niobium and yttrium to discriminate them (Figure 5). The first cluster in the graph (A) shows a set of local raw clays and does not include any artifacts, but it suggests a use of local clays (variance in most pottery is in the

norm when accounting for different tempers) for the nearest cluster(s). Cluster B includes Campanian C ware and San Giuliano ware; cluster C comprises Arretine ware and few pieces of Campanian C ware; cluster D includes just Arretine ware. The ceramics in the C and D clusters were made with different clay sources or with mixtures of different clays. Clusters A and B (local wares) are recognizable by similar values of strontium, which is a chemical element known to vary by geological sources and therefore when one main source of clays has been used, it is often consistent as it is in this case. Cluster C is chemically identifiable by values of strontium, while cluster D is chemically fingerprinted by values of zirconium, niobium and yttrium.

It is also noteworthy to highlight that one sample, SL13/172, typologically identifiable as an African Red Slip Ware Hayes 61B decorated with a toothed ring stamp (Hayes type 41b) falls outside of all the clusters (E in the graph). In this case, it is not just an outlier but may be chemically certified as an import.

The promising results obtained by the pXRF survey on the fine wares prompted us to schedule a similar campaign of analysis on the group of coarse wares found in the excavation of 2013-2015, as the first item in our research agenda.

Conclusion

Although not conclusive, this study has focused on an extremely complex archaeological site, occupied for several centuries through multiple phases of occupation and several changes in use. The preliminary data on Late Roman coarse and cooking wares and amphorae are meant to add the site to a growing list of places where such wares have been found in Sicily. The encouraging results obtained with the pXRF have demonstrated the

reliability of this non-destructive analytical technique to discriminate chemical groups and identify potential imports, encouraging us to continue with a second sampling campaign for further pXRF analyses on Late Roman coarse and cooking wares, amphorae and other Byzantine wares. The study of all the artifacts found during the 2011-2012 and 2013-2015 excavation campaigns is currently under finalization.

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