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# THE ITALIAN TERRA SIGILLATA FROM S. GIOVANNI DI RUOTI: A COMPOSITIONAL STUDY



BY

BARBARA G. SIMPSON

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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Barbara G Simpson

8912 - 116 Street

Edmonton, Alberta

Date: October, 1986

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The undersigned certify that they have read, and recommend to the faculty of Graduate Studies and Research for acceptance, a thesis entitled THE ITALIAN TERRA SIGILLATA FROM SAN GIOVANNI DI RUOTI: A COMPOSITIONAL STUDY submitted by BARBARA GAIL SIMPSON in partial fulfilment of the requirements for the degree of Master of Arts in Classics.

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Supervisor

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Date: 5 August 1986

TO MY MOTHER

## Abstract

A sample of Italian terra sigillata pottery was recovered from the Roman site of S. Giovanni di Ruoti, Italy, during several seasons of excavation from 1977 to 1984. This pottery, a monochrome red gloss fine ware, was used throughout the Roman world in early Imperial times, from around 30 B.C. to the last quarter of the first century after Christ and later. As a class of material, this pottery has been the subject of intense study and has been classified by successive scholars who have investigated its ranges of form and decoration.

In this study, approximately 150 representative sherds of Italian terra sigillata plain ware were examined. There were three main objectives. First, an attempt was made to determine the provenience of the sherds by comparing results obtained through Neutron Activation Analysis and petrographic analysis with published profiles. The second objective was to ascertain the extent to which visual differention of fabric is valid using a standard colour chart readily available to archaeologists in Europe and North America. The third objective was to provide a detailed catalogue of representative Italian terra sigillata from S. Giovanni di Ruoti.

The Neutron Activation Analysis did not provide by itself positive attribution of sherds to a source region. Limited by a lack of sherds from known proveniences as comparanda, analysis of the NAA data indicated that some sherds very probably came from Arezzo and some sherds very probably

did not. The petrographic analysis yielded additional information consistent with the NAA data. In sum, three homogeneous groups of sherds were identified according to the composition of their fabric. The first was most likely produced at Arezzo, the second group was very probably of local South Italian manufacture. The third group of sherds was found to derive from a volcanic area, possibly but not certainly Pozzuoli.

Visual differentiation of fabric according to standard descriptions of colour was found not to be valid.

The detailed catalogue of representative Italian terra sigillata from S. Giovanni di Ruoti makes up the Appendix to this thesis.

## Acknowledgements

I would like to acknowledge the assistance of all those who made this study possible. In particular, I am grateful to Drs. R.J. Buck and A.M. Small of the University of Alberta, who as leaders of the Canadian team at S. Giovanni di Ruoti, encouraged me to engage in this study. To Dr. Small, my adviser, I owe an additional debt of gratitude.

This work would not have been possible without the assistance and guidance of scientific colleagues at the University of Alberta. I would like to express my special gratitude to M.J.M. Duke, Research Associate for the University's SLOWPOKE nuclear laboratory in the Faculty of Pharmacy and Pharmaceutical Sciences, and the SLOWPOKE Committee. For advice and assistance in the petrographic analysis of the sherds, I am deeply grateful to P. Metcalfe, in the Department of Geology.

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## Abbreviations

| | |
|---|---|
| AJA | American Journal of Archaeology |
| BAR | British Archaeological Reports |
| Bonner Jb. | Bonner Jahrbücher |
| CVA | Corpus Vasorum Antiquorum |
| RCRF Acta | Rei Cretariae Romanae Fautorum Acta |
| MEFR | Mélanges d'Ecole française de Rome |
| JRS | Journal of Roman Studies |
| NSc | Notizie degli Scavi (Accademia dei Lincei) |
| PBSR | Papers of the British School at Rome |

## Introduction

The subject of this thesis is the Italian terra sigillata from S. Giovanni di Ruoti, a Roman rural villa in an isolated area of South Italy. The site is located in Basilicata near the watershed of the Lucanian Apennines. A Canadian archaeological group, funded by the Social Sciences and Humanities Research Council of Canada (SSHRCC) and directed by faculty members of the Department of Classics at the University of Alberta, has undertaken systematic investigation of the site since 1977. (1)

The Roman occupation at S. Giovanni di Ruoti lasted for about five centuries. Three apparent occupation periods have been identified from structural remains and associated finds. The pottery from Period I, which has been dated from the last quarter of the first century before Christ through the second century after Christ, demonstrates conformity to the cultural koinē with thin-walled glazed beakers and cups, Pompeian red ware and Italian terra sigillata.

Italian terra sigillata is a monochrome red gloss fine ware which was used throughout the Roman world in early Imperial times. The pottery was made in a variety of standard shapes, some plain, some decorated. The date range of the ware is from c. 30 B.C. to 70 A.D or later. There is evidence of a large scale industry at Arretium (modern Arezzo) from which the term "Arretine" ware is derived. Other production centres in Italy have been identified and now the ware is generally known as "Italian terra

sigillata". Factories were established in France and Germany as offshoots of the Arezzo industry and competition from these provincial equivalents, known as "samian wares", rapidly eroded the Arretine market. In Arezzo, production of decorated ware seems to have ended sometime in the fourth decade, although new plain ware forms of consistently high quality continued to be produced. South Gaulish samian relief ware rapidly took over the Arretine market throughout the Empire and was even exported to Italy. The Arretine tradition continued in a debased and derivative form with Late Italian sigillata, a decorated ware produced by local Italian workshops. After the decline of the terra sigillata industry, it seems that no fine wares were produced in Italy.

Most of of the terra sigillata from S. Giovanni di Ruoti is Italian terra sigillata plain ware dating to the post-Augustan period of production. Few sherds decorated in relief were discovered and no Late Italian sigillata or South Gaulish Samian ware has been identified. Identification of the proveniences of the samples analyzed is of particular interest, since the fabric colour and/or texture of a significant portion of the sherds is different from that of the type site of Arezzo and the source regions for Lucania are unknown.

Approximately 1,000 Italian terra sigillata sherds were recovered during excavation. Of these, 150 were initially selected for further study on the basis of "diagnostic" form and/or presence of decoration and potters' stamps. In 1984, during a study session in the deposits of the Soprintendenza Archeologica della Basilicata, this sample was examined in greater detail according to fabric colour and texture. Through the kind

offices of Dr. A. Bottini, then Soprintendente reggente, a representative sample of sherds from the S. Giovanni di Ruoti assemblage was released for compositional analysis in Edmonton. Since no kiln material or sherds with a secure provenience were available for comparison, the project was based on comparison with published data.

The value of neutron activation analysis in provenience studies has been well demonstrated. (2) This method of analysis has a number of advantages: it requires no chemical processing of materials, very little of the substance is required, and data are generated for a large number of elements. It has been utilized in archaeological studies for almost three decades but has yet to be widely accepted as an analytical method in classical archaeology—witness a paper recently presented at a seminar on ceramics as archaeological material at the Smithsonian Institute entitled "Why is Archaeometry So Boring for Archaeologists?". (3) In the field of Italian terra sigillata, Picon and others have used X-ray fluorescence spectrometry (XRF) and neutron activation analysis (NAA) to demonstrate that the chemical composition of terra sigillata sherds from known production centres such as Arezzo, Lyon and Lezoux may readily be distinguished. Thus they have been able to attribute sherds found elsewhere to one or other of these sources. (4)

Until recently, scientific analysis of Arretine and other Italian terra sigillata was confined to the chemical composition of the clay by X-ray fluorescence and neutron activation analysis. Since the clay used in terra

sigillata production is so fine grained and well levigated, it was thought that petrographic analysis would yield little useful information. However, Williams has shown that fine grained wares can be usefully characterized by thin section analysis and he has published thin section profiles of sherds from Arezzo, Pozzuoli, and some Gaulish centres. (5)

A comprehensive sourcing study is of obvious value to the archaeologist and to the historian. (6) The identification of trade wares and their local imitations is of value for understanding the economy. The identification of products from various workshops affords considerable scope for economic studies as they relate to trade in the Roman world. If the sources of a pottery sample can be determined, commercial connections may be established from the resulting distribution patterns. To some extent, characterization of the local economy is possible. For example, identification of the proportion of imported fine wares to locally produced imitations will have a direct bearing on the assumed wealth of the occupants of any individual site or region. Even when specific production centres cannot be identified, the discrimination of multiple sources of raw materials can be valuable for understanding the economy of a site or region.

There are three main objectives in this study. The first objective is to attempt determination of the provenience of the sample by comparing results obtained through NAA and petrographic analysis with published profiles for known production centres (see Picon and Williams, above, p. 3). The second objective is to ascertain to what extent visual

differentiation of fabric using Munsell Soil Colour Charts is valid. (7) Thin section petrography results of representative sherds and the results of the NAA were used to test the actual homogeneity of the visually defined groups. (8) The third objective is to provide a detailed catalogue of representative Italian terra sigillata from S. Giovanni di Ruoti.

The format of the thesis is as follows. Chapter 1 reviews the pertinent literature on Italian terra sigillata and provenience studies related to the ware. In Chapter 2, the pottery processing scheme and the assemblage of Italian terra sigillata at S. Giovanni di Ruoti are described. Chapter 3 is devoted to the methods of analysis employed. Chapter 4 details the results of the neutron activation and the petrographic analyses. A summary of this work and conclusions to be drawn from the study are presented in Chapter 5. The catalogue of pots studied is presented in the Appendix.

## Chapter 1: Review of the Literature

### Introduction

The production of red gloss tablewares (Italian terra sigillata and its provincial equivalents) was an important part of the Roman ceramic industry. Red gloss fine wares were used throughout the Roman empire and were widely exported and used as items of trade. The industry itself was highly organized and potteries grew up in different areas of the Empire for increased market supply. The movement from Italy to South Gaul and then to Central and East Gaul, together with the establishment of local manufacture in outlying areas where possible, reflects the growth of the Empire in the first and second centuries after Christ and the attempt by suppliers to keep within reasonable distance of the market.

### History of Study

The scholarship devoted to Italian terra sigillata has outlined sufficiently well its typological and artistic development to the extent that it has become a valuable dating tool for the archaeologist. The high artistic quality of Arretine decorated ware and the potters' stamps attracted attention long before a real, scholarly interest in Italian terra sigillata developed. (1) Epigraphic and typological studies began in the nineteenth century, with the first sound archaeological treatment by H. Dragendorff in 1896. (2) Dragendorff laid the foundation for systematic study of the ware by developing a typology and chronology of Hellenistic and red gloss wares. His typology of 55 forms included 14 "Arretine

forms" of which 8 were undecorated/plain ware. A number of stylistic analyses of decorated Arretine terra sigillata from museum collections followed. (3) The importance of relating epigraphic evidence to typological and stylistic analyses to study the activity of individual potters and workshops was recognized. The first epigraphical treatment of Arretine terra sigillata stamps was published in 1899 by F. Dressel and M. Ihm in CIL XV. The definitive catalogue of potters' stamps, the Corpus Vasorum Arretinorum, compiled by A. Oxé and edited by H. Comfort, was published in 1968. (4)

Goudineau provides a comprehensive review of the scholarship devoted to Italian terra sigillata plain ware to 1968. (5) Before Goudineau's publication of the Italian terra sigillta at Bolsena, Italy, the typological and chronological development of plain ware was based on its discoveries at German mid-Augustan and early Tiberian sites, a span which excludes both its origin and later development. The traditional typology of Italian terra sigillata plain ware was developed by Loeschcke and was based on the assemblage from the legionary base at Haltern in Lower Germany (see below, p. 10). (6) Goudineau's publication of the Bolsena terra sigillata and a typology based on it advanced the typological study of post-Augustan plain ware forms. His typology replaces Loeschcke's 16 forms and four "Services" with a much broader range of 43 types. This has since been supplemented by Hayes' study of the pottery from the South Stoa at Corinth. Hayes deduced his chronology from the South Stoa (closed c. 50/70 A.D.) and from dated contexts at Tipasa (Algeria), Pompeii, Bolsena, Locarno, Haltern, Oberaden and Camulodunum (Colchester, England). Hayes'

typology includes forms not represented in the Bolsena assemblage. (7)

## The Workshops

In the last twenty years or so, scholarship devoted to Italian terra sigillata has drastically altered the picture of the industry. Previously, it was thought that red gloss fine ware production in Italy was essentially confined to a single, unified industry situated at Arezzo. This led to the assumption that, for the Augustan period at least, the "Arretine" series represented a precise chronological evolution.

That the terra sigillata industry encompassed a diversity of production centres and that there was no uniform pattern of distribution, even within a single enterprise, has now been made clear. An important kiln site has been identified at Pisa; unfortunately it remains unpublished. Kilns used to produce terra sigillata have recently been discovered in the area of Rome and in the Chiana Valley (central Etruria). (8) Publication of the numerous kilns discovered between Orte and Viterbo in a survey conducted between 1973 and 1977 will certainly shed light on Italian terra sigillata production in the peninsula and also on the economy of central Italy during the Imperial period. (9) Preliminary study by Gazzetti of a kiln near the area of Vasanello suggests a period of distribution from c. 15 to 60 A.D. (placing it among the "middle" Italian potteries) with major distribution to central and southern Italy and small scale export to the Rhenish Limes. (10) Publication of Penna's compositional analysis of survey material from Tiberine Etruria (from Veii and Falerii to Prima Porta) should contribute greatly to this developing picture of the terra

sigillata industry in Italy. (11)

Research conducted by Picon and others has advanced our understanding of the development of the Italian and Gaulish industries and the complex distribution patterns of some workshops. As part of their programme, a number of Ateius-stamped "Arretine" sherds found in Gaul were studied. Among the large firms of Arezzo, the Ateius firm is particularly interesting because of its prominence in Gaul and the Germanic frontier garrisons. The Ateius workshop in Arezzo was discovered in 1959 but the possibility that some Ateius pottery was manufactured in Gaul remained and was eventually demonstrated by chemical analysis undertaken by Widemann, Picon et. al. (12) Analysis of a number of Ateius-stamped "Arretine" sherds found in Gaul shows the same chemical composition pattern as wasters from the complex of workshops of Montée de la Muette in Lyon. The authors suggest that the Ateius firm in Arezzo had a branch workshop in Lyon around 10 B.C., which was probably opened with experienced potters from Arezzo to shorten the distance to the markets of eastern Gaul and the Rhineland. Analysis so far suggests that the majority of Ateius products at Haltern came from Lyon and Pisa. (13) The Arezzo workshop appears to have had a market that was largely inland, accounting for almost all Ateius-stamped pottery at Bolsena. (14) The Ateius workshop at Pisa was apparently established to develop sea-borne exports; it also supplied Gaul. (15) Pisan sigillata is common in sherds analyzed from Campania and has also been identified in samples from Conimbriga (Portugal). (16)

Although the existence of production centres other than Arezzo is no longer in doubt, the general assumption that typological developments

occurred in the same order and at the same rate in all centres of production has lingered. This assumption is derived mainly from Loeschcke's interpretation of the Haltern assemblage. Haltern has been a key site for the typology and chronology of terra sigillata; its fixed date of destruction, now set at 9 A.D., provides a terminus ante quem for the manufacture of the pottery found at the site. (17) Loeschcke assumed that virtually all sigillata found at Haltern came from Arezzo and he classified the plain ware forms into four "Services" which represented chronological phases. It must be stressed that Loeschcke's chronology was based on an inferred typological evolution and not on stratigraphy. Von Schnurbein's re-examination of the Haltern material, published in 1982, has established that there are no stratigraphic grounds for dividing the Haltern pottery into "earlier" and "later" phases and that the majority of the Haltern sigillata does not come from Arezzo. (18) X-ray fluorescence analysis by Picon and Lasfargues of 243 Haltern stamps resulted in an attribution of 117 stamps to Pisa, 69 to Lyon, 12 to Arezzo, 1 to Campania, and 43 to Italy in general (1 could not be classified).

Von Schnurbein's contribution to terra sigillata studies extends beyond matters of chronology to provenience and place of manufacture. It is now more or less recognized that the only sound approach for establishing a chronology for Italian terra sigillata, and delineating the extent of the industry, is to identify the products of individual production centres and their distribution patterns. Precise chronologies cannot be applied with any accuracy to Arretine and Italian terra sigillata plain ware until our knowledge of the extent of the industry is more fully developed.

Further study is needed, especially in identifying the full extent of the terra sigillata industries in Pisa, Pozzuoli, the area of Rome and central Etruria.

## Chronology

The origin, development and decline of the Arretine industry and Italian terra sigillata as a whole are even more speculative. Certainly the glossy black Campanian ware, produced in Italy from the fourth to the first centuries B.C., influenced Italian terra sigillata plain ware forms. There is evidence to suggest that workshops in Arezzo were producing black gloss ware by the first century B.C. (19) The change to red gloss ware seems to have occurred quite suddenly around 30 B.C. The reason for the change to red gloss manufacture is not clear. It has been suggested that the impetus came from the East, where the tradition of red-gloss manufacture originated. Pucci suggests that a trade in eastern slaves trained in ceramic manufacture may have occurred following the "fall" of Alexandria. (20) Goudineau, in contrast, has argued that Arretine ware developed from Italian Etrusco-Campanian into an experimental "pre-Arretine" red gloss ware about 50/45 B.C. and that the classic forms evolved from this around 30 B.C. Goudineau further suggested that Italian terra sigillata replaced black gloss as the favoured fine ware between 20 and 10 B.C. and that potters with Greek names became involved in the industry about 15 B.C. The evidence is inconclusive.

Arretine terra sigillata continued until the middle of the first century A.D. or later but the Italian industry was crippled by competition from provincial production centres. South Gaulish factories (La Graufesenque,

Montans, Banassac, etc.) took over the market and their wares replaced Arretine throughout the Empire around 30 to 40 A.D. South Gaulish samian ware was even exported to Italy itself; a crate of South Gaulish samian was found at Pompeii. (21) The Arretine tradition continued in a debased and derivative fashion with Late Italian sigillata, which was itself influenced by South Gaulish styles of decoration. Until recently, Late Italian sigillata was considered an impoverished survival of Arretine ware that dated to the second half of the first century A.D. Marabini Moevs' recent publication of a small fragment of decorated Late Italian sigillata with the impression of the obverse of a bronze coin of Sabina dateable to 128-137 A.D. has considerably altered the previous chronologies. (22) She assigns the sherd to a late phase of production, and notes the possibility that plain sigillata could have been produced in Italy during the third quarter of the first century after Christ.

## Organization

The industrial organization of the Arezzo industry is inferred from the study of potters' stamps. The stamps refer to the potter himself or to the owner of the workshop. The earliest large platters have multiple radial stamps, while smaller vessels have a single centrally placed stamp. It appears that about 15-10 B.C. multiple stamps were replaced by a single rectangular stamp. About 15 A.D. or later, there was a shift to in planta pedis stamps (a stamp in the form of an outline of a foot--usually the right--containing the potter's "signature", quite often in an abbreviated form). (23) Goudineau suggested that the elimination of multiple stamps

was merely a simplification, but that in planta pedis stamps may have originated as a "made in Arretium" label to combat competition from other centres. (24) In planta pedis stamps, however, were not specific to Arezzo. They appear to have been widely used in central and southern Italy. (25) In large workshops, at any rate, potters' stamps might have been used as a check on the output of individual workers, which would have been necessary where several potters were making vessels of the same shape. The early stamps bear the name of the works' owner followed by one of his workers. The stamps indicate that slaves were used in the ceramic industry and sometimes the servile status is directly mentioned in the stamp.

In planta pedis stamps with meaningless characters are not uncommon. These marks would have been adequate for identifying a particular man's work; they could also have been intended to deceive the consumer into believing that the pots were produced at a well-known workshop.

The evidence collected in the Corpus Vasorum Arretinorum suggests the existence of numerous separate workshops in Arezzo. Goudineau suggested that there was some form of central office controlling the output of the various workshops, and that organized cooperation in mining, purifying and firing accounted for the standardized forms and fabrics. (26) As Pucci has stressed, however, there is no literary or epigraphic evidence to suggest a collegium of clay workers in Arretium nor do the stamps suggest such cooperation between firms. Standardization of form and fabric need not imply cooperation; Pucci has adduced the example of African terra sigillata, which shows a similar standardization despite widely separated

production centres where cooperation would have been unlikely. (27) Until there is further evidence, both suggestions remain possible.

## Distribution

The distribution mechanisms for both major firms and smaller workshops remain a matter of speculation. It is not yet possible, nor may it ever be possible, to associate individual production centres with particular markets—witness the variety of supply sources for Haltern (above, p.10). The possibilities range from comprehensive distribution networks attached to large firms, like the Ateius workshop, to independent middlemen, to local marketing mechanisms (such as daily or periodic markets or fairs).

Negotiatores cretarii, presumably traders in fine pottery, are mentioned in inscriptions but their role is unclear. Wells has suggested that the army supply was most likely organized through contracts let to publicani who operated at the local level, since he believes a centralized system of supply for the army (with purchasing agents commissioning or buying wholesale from the producer) is unlikely in the Augustan period. (28) Until a sound knowledge of the distribution of products of individual production centres can be gained, the question must remain open. (29)

## Chapter 2: The Site and the Pottery

### The Site

The villa at S. Giovanni di Ruoti is located in an isolated area in the province of Basilicata, Italy, near the watershed of the Lucanian Apennines. Its position is roughly equidistant from the Tyrrhenian and Adriatic seas and from the Gulf of Taranto. The site is located some 27 km. northwest of Potenza and about two km. north of the village of Ruoti. It lies on the slopes north of the Fiumara di Avigliano, facing south at an altitude of about 670 m. Until modern times, communications with the Adriatic were better than with the Tyrrhenian sea by way of the pass of San Cataldo and the Ofanto Valley. Fig. 1 shows the location of the site in relation to the principal production centres of Italian terra sigillata.

Excavation has revealed a succession of partially superimposed building complexes, the earliest of which is in the western half of the site. The earliest occupation, Period I, dates to the beginning of the first century after Christ and lasts to the early part of the third century after Christ. At this point, the site was temporarily abandoned. There are remains of contemporary structures immediately to the east. The buildings in the western part of the site have been related to the "U villa plan", in which the buildings are grouped around three sides of a courtyard. (1)

The Period I contexts were disturbed in building during Periods II and III; less than twenty-five percent of the Italian terra sigillata was found in stratified Period I contexts. The remaining sherds were found in

topsoil or stratified contexts defined as build-up for the later periods. This is consistent with the percentages for the other early wares (Pompeian red ware, thin walled glazed beakers and cups, flat bottomed low coarse ware bowls and globular coarse ware cooking pots). (2) The early stratified contexts demonstrate a continuous occupation over approximately two centuries, and therefore are of little value in refining chronologies for the early wares.

Period I artifacts suggest that the villa establishment was rather modest. (3) The Period I pottery shows that, despite its isolated location, S. Giovanni di Ruoti belonged to the cultural koinē. The appearance of African Red Slip ware (terra sigillata chiara A) in the second century shows that S. Giovanni di Ruoti, like the rest of the Italian peninsula, imported fine wares and some coarse wares from North Africa. (4)

More specifically, however, no published site in South Italy has provided a comparable assemblage of terra sigillata--a fact that makes this study of particular importance to future investigators. (5)

## The Pottery Processing Scheme

A total examination of the pottery material was considered necessary. All pottery recovered during excavation was recorded on "Final Layer Records" and sherd counts were recorded for all wares. Pieces with features subject to classification--rims, bases, stamps, decoration, etc.--were selected for further study. These pieces were recorded on a standard form using the following criteria: dimensions, fabric colour, slip colour, relative

hardness of the paste suggesting differences in firing temperature, presence of inclusions, and other observations. Representative sherds were then selected for drawing. After drawing, the sherds were subjected to library research, scientific study, and laboratory description to establish the chronology and origin as best as possible.

## The Italian Terra Sigillata

The sample of Italian terra sigillata from S. Giovanni di Ruoti is composed of approximately 1,000 wall sherds and a further 150 "diagnostic" sherds selected for further study. A complete description of the forms is presented in the Appendix. Most of the Italian terra sigillata is plain ware dating to the post-Augustan period of production. No "pre-sigillata", as defined by Goudineau was observed. (6) Interestingly, no South Gaulish samian ware or Late Italian sigillata was identified. This could indicate a gap in fine ware importation at S. Giovanni di Ruoti, given the suggested date range for Italian terra sigillata and African red slip ware. (7)

Of major interest was the fact that a significant number of sherds were different in fabric colour and texture than sherds from the type site of Arezzo (see p. 21). This is not uncommon in excavated assemblages of terra sigillata sherds and has been reported at Posto, Francolise; Conimbriga; Benghazi; and other sites. (8) At Ordona, the combination of three distinct techniques of manufacture and unfamiliar forms led Vanderhoeven to suggest that the Ordona assemblage confirmed the

existence of a large typology in which local and regional influences were combined with oriental influences. (9) It must be noted that Vanderhoeven adduces no evidence to support this assumption; local coarse ware forms in the area of Ordona would have to be studied to investigate this possibility.

As noted previously, without the benefit of compositional analysis differences in fabric colour are not particularly good indices of attribution to production centres.

The relief ware is not discussed in this thesis, although it will be published in the final report of the S. Giovanni di Ruoti excavation. It is, however, worth noting that three examples of Augustan relief ware were identified, one of which belongs to the Perennius workshop at Arezzo.

Plain Ware Forms

Most of the Italian terra sigillata recovered from S. Giovanni di Ruoti is plain ware: vessels decorated in relief and stamps are not common. Most of the plain ware forms are post-Augustan. The distribution of Italian terra sigillata across the site reveals no significant differentiation between Augustan and later forms, though later forms are more widely dispersed.

The presence of two uncommon cup/bowl forms (Hayes Form 20, Dragendorff Type 4) is interesting, as is the relatively large number of hemispherical bowls, a form said to be common in "Italian regional ware". (10) It is worth noting that different sites yield different forms and differing proportions of forms. Current study is not sufficiently advanced to

explain these differences. It could be that such differences are due to specific production in local workshops or variations in consumer taste or use. These problems may be resolved when assemblages from other sites are more adequately published. In the S. Giovanni di Ruoti sample, four unfamiliar forms were isolated (see Appendix). The presence of unfamiliar forms should not be surprising; evidence from Corinth and Ordona indicates that the repertoire of forms in Italian terra sigillata may be larger than previously suspected. (11)

Stamps

Ten stamps in varying degrees of preservation were recovered. Only three stamps can be attributed to known potters, and one of the readings is somewhat doubtful. They provide little information as to provenience: two stamps, one rectangular and one in planta pedis, are of potters attested at Arezzo. Another rectangular stamp belongs to an Italian potter whose workshop has not been located (see the Appendix, 15a - 16f).

## Chapter 3: Methods of Analysis

### Visual Examination

Visual examination of surface colour, applied slip or paint and fabric colour and quality is the first step in defining and classifying a group of sherds. This type of description is quite subjective and sometimes unreliable, as there are variables that can affect fabric colour after firing, such as the conditions of deposition. The composition of the soil and circulating fluids—including air—are important factors. Sherds deposited in dry conditions approximating the mineral and chemical composition of the sherd itself will show little change in fabric colour over time. Sherds deposited in wet soil with a high pH level (midden soil, for example) will be subject to greater change in fabric colour; the extent of change will be a logarithmic function of time.

Then, too, perception of colour is subjective and can be affected by many variables. Conditions of examination (natural light or fluorescent light, for example) will affect perception of colour. The cleanness and age of the fabric break being examined are other variables. The colour aptitude of the recorder plays a significant role.

In recent years colour charts have sometimes been used to help in the discrimination of groups and to "standardize" slip and fabric descriptions. The Munsell Soil Colour Charts (hereafter "Munsell") have been used in several publications of terra sigillata to describe fabric and slip colour. (1)

Most of the Italian terra sigillata selected for further study and all

the pieces selected for laboratory analysis were visually examined with the aid of Munsell. Three main groups and one sub-group were defined according to fabric colour--exterior surface colour was quite uniform, in the range Munsell 2.5YR 5/6-4/8. Group 1 consists of sherds with a rosy pink fine fabric (Munsell 2.5YR 6/4-6/6). Group 1a consists of sherds with with a pink buff fine fabric (Munsell 5YR 8/4-7/4). Group 2 sherds are characterized by a micaceous orange fabric with sparse, fine black and white inclusions (Munsell 5YR 7/6-6/6). Group 3 consists of sherds with a soft, pale micaceous orange buff fabric with sparse black or white inclusions (Munsell 7.5YR 8/6-7/6).

A provisional classification of the four groups was made according to on site examination. Group 1 was identified as "typical" Arretine/Arezzo ware. Group 1a was classified as Arretine ware fired at a slightly higher temperature, producing the lighter colour fabric. Group 2 was not identified with any known centre of terra sigillata production and was tentatively associated with "local production terra sigillata" on the basis of the quality and colour of the paste. (2) Group 3 was associated with Group 2 as possible local production sigillata because of the quality of the paste; a separate grouping was made for these sherds because of the pronounced colour difference. The results of the petrographic and neutron activation analyses were used to test the validity of the visually defined groups.

## Compositional Analysis

### Neutron Activation Analysis

Instrumental neutron activation analysis (NAA) is a technique in which radio-isotopes are produced by bombarding elements within a sample with neutrons. A nuclear reactor is commonly the source of the neutrons. The sample is not chemically treated before or after irradiation. It is ground to a fine powder and sealed in a plastic vial prior to irradiation. The vials are transferred to the nuclear reactor via pneumatic tubes. The number of neutrons passing through a square centimetre each second (the neutron flux) in this area can be controlled by the operator. The nuclei of some elements of the sample absorb some of the neutrons, producing radioactive isotopes. The process of decay begins immediately since the isotopes are unstable. The time required for a particular isotope to decay to half its initial activity is called the half-life. Upon decay, many isotopes emit energy in the form of gamma-rays. The gamma-rays are detected and the rate of production of gamma rays of a particular energy are measured using a Ge(Li) or Ge detector with a multichannel analyzer (MCA). Following bombardment, samples are left to decay for given periods of time before being placed in front of the gamma-ray detector for the counting process. Data regarding the number and energy of the gamma-rays emitted are accumulated by the MCA and displayed graphically in the form of a spectrum. Upon computer analysis, essential data regarding the kinds and amounts of elements are generated.

This process is available at the University of Alberta because the University has a SLOWPOKE (Safe LOW POwer Kritical Experiment) Nuclear

Reactor. (3)

Neutron activation analysis was selected in preference to X-ray fluorescence spectrometry (XRF) because it combines accuracy and sensitivity for a wide array of elements. Moreover, NAA is comparatively insensitive to changes in the matrix of the element studied. NAA seems to be becoming the preferred method of analysis in pottery provenience studies. (4) On the other hand, profiles for some of the likely source regions for S. Giovanni di Ruoti, such as Pisa and Pozzuoli, have been obtained by XRF. My preliminary attempt to compare XRF values with NAA values was unsuccessful. (5)

Experimental procedure

The samples were processed in the SLOWPOKE facility. A sample was removed from each sherd with a diamond-tipped rock saw. The gloss and 1 to 2 mm of the sherd's surface were also removed using the diamond-tipped saw to remove any potential contamination. Initially, to avoid contamination, the sherds were broken down by crushing them in individual polyethylene vials with pliers. The resulting sherd fragments were then ground by hand to a fine powder using an agate mortar and pestle. Agate is a major constituent of clay and is unlikely to cause any significant contamination. After a sample was crushed, the mortar and pestle were cleaned with acetone to prevent contamination. The samples were placed in polyethylene vials and were weighed and heat sealed. The short irradiation produced radio-isotopes of elements with short half-lives. The long irradiation produced isotopes of elements with

half-lives greater than 10 hours. To test the calibration, a Cody Shale Rock standard and four aliquots of one sherd were analyzed.

Table 1 outlines the conditions used for the analysis of each element determined in this study. In addition to the elements listed, a number of elements (Titanium, Dysprosium, etc.) were detected but are not represented because of large uncertainties and/or duplication of information derived from the rare earth elements.

NAA values for Arezzo, Lyon and Loyasse published by Widemann et. al. were used as a comparative standard. (6)

Petrographic analysis

Sixteen samples of representative sherds from the visually defined groups were examined in thin section under a petrological microscope to identify the mineral inclusions in each sherd. (7) Thin sections were cut from each of the sherds and ground to standard 0.03 mm thickness. At this thickness, the majority of non-plastic inclusions present in the clay are transparent and can be identified by their optical properties under polarized light. When unique minerals or rock fragments are present, it is possible, with appropriate clay sourcing studies, to determine the geographical regions where these are likely to occur and the identification of a production area may be made. In the absence of distinctive mineralogy, characterization of the type, size, shape and relative frequency of inclusions in the clay fabric can provide evidence for or against a common source for a sample of sherds. Petrographic descriptions of Arretine and other terra sigillata sherds published by Williams were used as a comparative standard. (8)

Table 1: Summary of Conditions Used for Elements Determined by NAA

| Element | Radio-isotope Measured | Half-life | Gamma-ray Energy Counted[a] | Analysis Scheme[b] |
|---|---|---|---|---|
| Al | $^{28}Al$ | 2.24 min | 1779 | A |
| V | $^{52}V$ | 3.76 min | 1434 | A |
| Mn | $^{56}Mn$ | 2.58 h | 1811 | B |
| Ca | $^{49}Ca$ | 8.72 min | 3083 | B |
| La | $^{140}La$ | 40.28 h | 487 | C |
| Sm | $^{153}Sm$ | 46.70 h | 103 | C |
| As | $^{76}As$ | 26.32 h | 559 | C |
| Sb | $^{122}Sb$ | 2.80 d | 564 | C |
| Na | $^{24}Na$ | 14.96 h | 1369 | B,C |
| Sc | $^{46}Sc$ | 83.83 d | 889 | D |
| Cr | $^{51}Cr$ | 27.70 d | 320 | D |
| Fe | $^{59}Fe$ | 45.50 d | 1099 | D |
| Co | $^{60}Co$ | 5.27 y | 1173 | D |
| Rb | $^{86}Rb$ | 18.65 d | 1077 | D |
| Ba | $^{131}Ba$ | 12.0 d | 496 | D |
| Cs | $^{134}Cs$ | 2.06 y | 605 | D |
| Eu | $^{152}Eu$ | 12.7 y | 1408 | D |
| Hf | $^{181}Hf$ | 42.5 d | 482 | D |
| Th | $^{233}Pa$ | 27.0 d | 311 | D |

[a]Lederer, C. M.; Hollander, J.M; Perlman, I. "Table of the Isotopes", 6th ed.; Wiley: New York, 1967. Values are in kiloelectronvolts. [b] Times of irradiation, decay and counting for the analysis schemes were as follows: (A) 4 min - 12 min - 5 min (irradiation at flux of $1 \times 10^{11}$ n $cm^{-2}$ $s^{-1}$, counting geometry 10 cm from detector (open); (B) 4 min - 30 min - 10 min (irradiation flux as in A, counting geometry 3 cm from detector in 10 cm Pb cave); (C) 2 hr - 6 d - 30 min (irradiation at flux of $1 \times 10^{12}$ n $cm^{-2}$ $s^{-1}$, counting geometry 1 cm from detector in 10 cm Pb cave); (D) 2 hr - 21 d - 2 hr (irradiation flux and counting geometry as in C).

## Chapter 4: Data Manipulation

No kiln material or sherds of secure provenience were available for analysis and as a result this study was designed for comparison with published results. Initially it was thought that a sufficient data base had been accumulated and published to serve as a "reference group" for the petrographic and neutron activation analyses. All published provenience studies have been based on sherds of known provenience; this is the first study to attempt to substitute published data for kiln material. Thus, there were no established guidelines for data manipulation. The inconsistency of the reporting standard proved to be a significant drawback. (1) The current practice of reporting chemical abundances in average abundance and root mean square deviation or standard deviation complicated the process of comparison.

Similarly, comparison with the petrographic profiles published by Williams proved difficult. (2) A complete petrographic description should include the size and range, shape and range, and grain to grain relationship of each mineral. Where possible, the composition of each mineral should be noted, as should a summary description of rock fragments, if any are present. Williams' published description is confined to the size and range of selected minerals, which has made satisfactory comparison with the sherds from S. Giovanni di Ruoti impossible.

Neutron activation analysis and petrographic analyses were initiated at different stages of this project and were not intended as complementary techniques. Coincidentally, some sherds were subjected to both types of

analysis. On analyzing the data, it became clear that information derived from one technique can be valuable in assessing data from the other. Future research in this area will take this into account.

## Data Manipulation of NAA Results

The raw data derived from neutron activation analysis (the percent or parts per million of selected elements for each sherd, see Table 2) were entered in an MTS computer file. The MIDAS system (Michigan Interactive Data Analysis System) was used for data manipulation and statistical analysis. (3) It has been noted in several publications that statistical cluster analyses clarify NAA results. (4) A correlation cluster analysis in the form of a hierarchical tree (see Documentation for MIDAS [1976]: 71: A2:131,C3:331,S4:214) was obtained using the NAA profiles for each sherd. Simply, this type of cluster analysis involves starting with all samples (sherds) in clusters of one sample (sherd) and merging the most similar.

Three groups of compositionally similar sherds can be identified by cluster analysis. Given the absence of a reference group (i.e., sherds of known provenience which could be placed in the cluster), the cluster could only be used to test the validity of the visually defined groups. The results are shown in Figure 2. The Group 1 sherds (visually defined as Arezzo ware) all fall in the middle cluster, along with sherds from all the other groups. There is a clump of Group 1a sherds (possibly high-fired Arezzo ware) in the cluster to the right, which also includes sherds from Groups 2 and 3 (visually identified as "local production" terra sigillata). The cluster to the left is composed of sherds from Groups 2 and 3, with

Table 2: NAA Chemical Abundances

| Sherd | Al% | V | Mn | Ca% | La | Sm | As | Sb | Na% | Sc |
|---|---|---|---|---|---|---|---|---|---|---|
| P0701 | 9.04 | 98.4 | 803. | 7.75 | 36.4 | 6.36 | 6.47 | .648 | .544 | 15.7 |
| P0881a | 8.14 | 119. | 751 | 8.62 | 36.3 | 5.91 | 8.85 | .895 | .555 | 15.0 |
| P3384 | 8.26 | 102 | 1020 | 7.35 | 34.9 | 6.29 | 11.3 | .991 | .621 | 14.3 |
| P3582 | 8.15 | 85.2 | 871 | 6.81 | 35.0 | 6.34 | 9.87 | .683 | .737 | 14.1 |
| P3628 | 8.05 | 90.9 | 931. | 6.93 | 44.3 | 8.11 | 11.1 | 1.53 | .816 | 14.6 |
| P3676a | 9.16 | 102. | 1200. | 6.77 | 37.8 | 6.67 | 3.40 | .875 | .730 | 17.3 |
| P3676c | 8.93 | 106. | 1140. | 6.77 | 35.2 | 6.40 | 4.14 | .787 | .698 | 16.7 |
| P5097 | 9.74 | 118. | 1010 | 6.23 | 40.0 | 6.90 | 11.0 | .871 | .684 | 16.4 |
| P5098 | 8.98 | 136 | 723 | 8.57 | 37.8 | 6.20 | 5.87 | .783 | .530 | 15.6 |
| P5180 | 9.63 | 106 | 925 | 4.90 | 45.7 | 7.82 | 8.54 | 1.33 | .834 | 17.3 |
| P5229 | 8.84 | 111. | 708. | 8.20 | 38.8 | 6.30 | 6.19 | .800 | .566 | 15.5 |
| P6408 | 8.73 | 143. | 744. | 9.72 | 35.1 | 6.50 | 11.3 | 1.09 | .674 | 14.5 |
| P6472 | 9.13 | 114. | 819. | 7.17 | 36.6 | 6.37 | 7.32 | .833 | .529 | 16.5 |
| P6668 | 9.38 | 120. | 632. | 8.14 | 39.8 | 6.39 | 7.03 | .969 | .555 | 15.8 |
| P7066 | 8.26 | 89.4 | 852 | 6.78 | 36.5 | 6.48 | 8.05 | .768 | .680 | 14.4 |
| P7140 | 9.02 | 134. | 1190. | 8.15 | 39.1 | 6.96 | 6.50 | .898 | .584 | 17.8 |
| P7165 | 9.53 | 98.9 | 1123. | 7.78 | 37.5 | 6.60 | 2.90 | .769 | .702 | 16.8 |
| P7205 | 8.27 | 108. | 862. | 9.15 | 35.0 | 5.92 | 6.44 | .753 | .539 | 14.6 |
| P9001 | 8.73 | 90.9 | 824. | 6.65 | 34.3 | 6.37 | 12.4 | .877 | .680 | 13.5 |
| P9002 | 8.15 | 82.7 | 850. | 5.39 | 37.7 | 6.82 | 9.39 | .886 | .768 | 15.1 |
| P9007 | 9.31 | 126. | 745. | 9.15 | 40.9 | 6.80 | 8.36 | 1.23 | .474 | 16.1 |
| P9015 | 8.73 | 113. | 1276 | 6.25 | 34.8 | 6.81 | 4.85 | .627 | .796 | 16.8 |
| P9018 | 8.97 | 139. | 1050. | 8.31 | 37.1 | 6.20 | 8.96 | .852 | .580 | 15.5 |
| P9020 | 8.73 | 114. | 1070. | 8.91 | 37.9 | 6.33 | 5.71 | .936 | .614 | 15.6 |
| P9021 | 8.68 | 117. | 838. | 9.08 | 36.0 | 6.47 | 6.83 | .831 | .716 | 13.7 |
| P9023 | 8.75 | 113. | 1000. | 6.97 | 40.8 | 7.88 | 14.9 | 1.13 | .846 | 15.8 |
| P9027 | 9.48 | 125. | 700. | 7.34 | 40.2 | 6.62 | 4.74 | .603 | .513 | 15.8 |

Table 2, cont'd: NAA Chemical Abundances

| Sherd | Cr | Fe% | Co | Rb | Ba | Cs | Eu | Hf | Th |
|---|---|---|---|---|---|---|---|---|---|
| P0701 | 124. | 4.36 | 15.2 | 124. | 335. | 7.14 | 1.26 | 3.90 | 11.9 |
| P0881a | 121. | 4.33 | 19.8 | 126. | 360. | 6.95 | 1.36 | 3.82 | 11.5 |
| P3384 | 108. | 4.10 | 14.0 | 123. | 573. | 5.97 | 1.35 | 4.12 | 11.5 |
| P3582 | 99.5 | 4.02 | 14.3 | 140. | 413. | 6.53 | 1.35 | 4.69 | 12.4 |
| P3628 | 110. | 4.20 | 14.7 | 107. | 581. | 5.98 | 1.64 | 4.51 | 12.5 |
| P3676a | 124. | 5.00 | 22.7 | 133. | -00. | 6.92 | 1.45 | 4.37 | 11.7 |
| P3676c | 120. | 4.84 | 22.2 | 126. | 473. | 7.17 | 1.63 | 3.76 | 11.3 |
| P5097 | 119. | 4.61 | 17.7 | 144. | 666. | 7.72 | 1.73 | 5.02 | 13.7 |
| P5098 | 116. | 4.40 | 14.3 | 135. | 343. | 7.27 | 1.34 | 3.81 | 11.4 |
| P5180 | 132. | 5.02 | 19.0 | 170. | 474. | 9.08 | 1.61 | 5.66 | 16.1 |
| P5229 | 127. | 4.32 | 14.6 | 122. | 368. | 7.67 | 1.28 | 3.60 | 11.8 |
| P6408 | 113. | 4.07 | 15.5 | 128. | 370. | 6.41 | 1.27 | 4.26 | 11.7 |
| P6472 | 140. | 4.74 | 16.1 | 135. | 349. | 7.40 | 1.59 | 4.02 | 12.6 |
| P6668 | 131. | 4.64 | 15.2 | 139. | 364. | 8.40 | 2.17 | 3.84 | 12.9 |
| P7066 | 110. | 4.20 | 15.3 | 131 | 536. | 6.70 | 1.31 | 4.25 | 12.3 |
| P7140 | 166. | 4.97 | 22.5 | 122 | -00. | 8.07 | 1.50 | 3.55 | 13.0 |
| P7165 | 128. | 4.82 | 22.4 | 134. | 363. | 8.06 | 1.32 | 3.94 | 12.4 |
| P7205 | 110. | 3.94 | 14.4 | 124. | 415. | 7.06 | 1.45 | 3.52 | 10.8 |
| P9001 | 95.4 | 4.05 | 14.5 | 125. | 560. | 6.20 | 1.12 | 4.48 | 11.7 |
| P9002 | 93.9 | 3.78 | 14.3 | 111. | 745 | 5.90 | 1.22 | 4.46 | 11.3 |
| P9007 | 132. | 4.62 | 17.1 | 146. | 452. | 9.22 | 1.30 | 3.91 | 12.3 |
| P9015 | 124. | 4.95 | 23.7 | 130. | 341. | 6.98 | 1.40 | 4.04 | 12.3 |
| P9018 | 133. | 4.67 | 15.6 | 120. | 285. | 7.01 | 1.28 | 3.40 | 11.9 |
| P9020 | 127. | 4.47 | 15.4 | 141. | 352. | 7.83 | 1.41 | 3.93 | 12.1 |
| P9021 | 100. | 3.82 | 14.4 | 124. | 379. | 6.37 | 1.21 | 4.18 | 11.7 |
| P9023 | 123. | 4.89 | 17.3 | 142. | 499. | 7.34 | 1.47 | 5.32 | 13.6 |
| P9027 | 131. | 4.45 | 16.7 | 159. | 537. | 9.04 | 1.30 | 3.47 | 12.8 |

one sherd from Group 1a. Basically, all the cluster analysis shows is that the visual differentiation of distinct groups was not accurate. This is consistent with results from other analyses, notably Conimbriga. (5)

Provenience Determination

Profiles for Arezzo, Lyon and Loyasse published by Widemann et. al. were selected for comparison with the NAA data. (6) The comparison was based on fifteen elements (Al,Ca,Mn,Na,Sm,La,Co,Sc,Fe,Hf,Cs,Cr,Th,Eu,and Rb). The NAA abundances were published in the form of the average abundance and root-mean-square deviation. To compare the two data sets, it was necessary to alter the data set for the S. Giovanni di Ruoti sherds. This was done by creating analytical variables in the data set using transformations (mathematical functions) of variables that already existed in the data set (see MIDAS [1976]: 166--TRANS command, keyword ranks). The mean value of each of the selected elements from the comparison group (the published results) was subtracted from the raw score for each element from the test group (S. Giovanni sherds) to get the mean deviation; the mean deviation was then divided by the standard deviation for the comparison group to get a standard score for each element. The standard score was squared and then all the squares were summed. The sum was divided by 4 to obtain the Z score; the square root of the Z score was the value used. The rank of each value was computed with smallest rank corresponding to the smallest value (the highest probability).

A ranked probability for each sherd was obtained for comparison with the values published for Arezzo, Lyon and Loyasse. The results are shown in

Table 3. It is interesting to note that sherds P7140 and P7165, repectively ranked 1 and 2 in the probability for an Arezzo source, compare well petrographically with the profile for "Arretine" ware and were visually identified as such. The scores for Lyon are comparatively very high, suggesting that none of the terra sigillata from S. Giovanni di Ruoti was produced in that region. Seven of the twenty-seven sherds show a greater correlation with Loyasse. Since the comparison relates only to these three groups, this does not mean that the sherds were produced at Loyasse, but rather that these sherds are the least chemically similar to an Arezzo clay source. As may be noted from Table 3, these sherds, in descending order of probability, are [redacted]21, P7205, P9001, P9002, P3384, P3582 and P6408; they were all classified as "local production sigillata" on the basis of visual examination, except for P7205, which was identified as high-fired Arezzo ware.

Three of these sherds were examined petrographically. Sherds P3582 and P3384 have a similar mineralogy consistent with the close NAA ranked probability for Loyasse (respectively, 5 and 6). These sherds may be related to the somewhat coarser terra sigillata ware identified petrographically (see below, p. 33). Sherd P7205, visually identified as high-fired Arezzo ware, has a slightly coarser mineralogy than Arezzo ware. Petrographic analysis of the remaining four sherds might yield additional information.

It is of interest that neither sherd P9027 nor P5229 shows a good correlation with any of the three production centres; petrographic analysis indicates that these sherds derive from a volcanic region (see below, p. 34).

Table 3: NAA Ranked Probabilities

| Sherd | Arezzo(Score) | Rank | Lyon(Score) | Rank | Loyasse(Score) | Rank |
|---|---|---|---|---|---|---|
| P0701 | 305.00 | 11 | 1775.0 | 8 | 634.85 | 12 |
| P0881a | 391.25 | 17 | 1049.2 | 2 | 532.73 | 8 |
| P3384 | 413.38 | 19 | 1300.1 | 3 | 442.52 | 5 |
| P3582 | 520.07 | 25 | 1859.8 | 10 | 453.72 | 6 |
| P3628 | 453.60 | 22 | 6047.6 | 23 | 832.89 | 16 |
| P3767a | 161.67 | 3 | 5674.2 | 22 | 1276.6 | 25 |
| P3767c | 182.10 | 4 | 4532.2 | 20 | 1145.7 | 20 |
| P5097 | 277.11 | 10 | 4386.1 | 19 | 1082.3 | 19 |
| P5098 | 390.46 | 16 | 1514.0 | 4 | 618.84 | 10 |
| P5180 | 480.66 | 23 | 9382.5 | 27 | 1592.8 | 27 |
| P5229 | 354.45 | 14 | 1754.1 | 6 | 625.33 | 11 |
| P6408 | 421.30 | 20 | 1912.5 | 11 | 486.18 | 7 |
| P6472 | 205.47 | 5 | 2391.5 | 14 | 971.98 | 18 |
| P6668 | 336.33 | 13 | 2534.9 | 16 | 1199.4 | 23 |
| P7066 | 383.43 | 15 | 2025.9 | 12 | 532.97 | 9 |
| P7140 | 32.232 | 1 | 6119.5 | 24 | 1449.6 | 26 |
| P7165 | 124.4 | 2 | 5281.8 | 21 | 1153.3 | 21 |
| P7205 | 446.48 | 21 | 809.44 | 1 | 403.26 | 2 |
| P9001 | 544.01 | 26 | 1574.1 | 5 | 412.19 | 3 |
| P9002 | 548.07 | 27 | 2496.1 | 15 | 434.42 | 4 |
| P9007 | 264.61 | 9 | 3272.0 | 18 | 892.54 | 17 |
| P9015 | 207.85 | 6 | 6438.1 | 25 | 1275.4 | 24 |
| P9018 | 219.06 | 8 | 1848.1 | 9 | 777.76 | 14 |
| P9020 | 213.36 | 7 | 2066.7 | 13 | 764.11 | 13 |
| P9021 | 506.70 | 24 | 1767.1 | 7 | 377.50 | 1 |
| P9023 | 392.60 | 18 | 6733.2 | 26 | 1179.2 | 22 |
| P9027 | 309.45 | 12 | 2910.1 | 17 | 824.34 | 15 |

## Petrographic Analysis

Thin sections were cut from a total of sixteen sherds; three sherds from Groups 1 and 2 and five sherds from Groups 1a and 3 were examined. Preliminary examination indicated that the sherds fell into three main types or groups. Twelve representative samples were analyzed in detail.

### Type 1, 1a: Arezzo Ware

All the sherds visually defined as Arretine (Group 1) compare well with the general petrographic description of Arretine terra sigillata given by Williams. The sherds (P5945, P7140, P7165) are characterized by a finer matrix grain size, a low content of coarse material and a more monotonous modal mineralogy, consistent with source material from an alluvial environment. Three sherds visually identified as "high fired Arezzo-ware" are included in this group (P7205, P6178, P9044, Petrographic Type 1a). The matrix is comparable to the Arezzo ware but there is evidence of recrystallization. This is due to either a higher firing temperature or a longer firing time.

### Type 2: Possible Local Terra Sigllata

The second group of sherds (P9013, P9000) consists of sherds visually identified as "local production" (Group 2). They have a much coarser grain size with a higher proportion of quartz and feldspar, together with a significant percentage of rock fragments. Rock fragments were not observed in the Arretine terra sigillata. The rock fragments were tentatively identified as angular fragments of granodiorite and rounded

fragments of a fine grained rock, possibly siltstone. The mineralogy of the sherds suggests a source region with a granite terrain with siltstone and possibly fine grained limestone.

A sub-group consisting of three sherds (P3582, P3384, P7066) was identified. These were visually defined as Group 3 "local production". They are similar in the percentage of coarse material but have a slightly different matrix and a variable amount of carbonate. This could be attributed to different firing times, different firing temperatures or, less likely, a different source. Generally these sherds were not as well fired as the Arretine sherds.

Type 3: Sherds from a Volcanic Region

The third group of sherds consists of sherds visually defined as Group 1a, Group 2 and Group 3 (P9027, P5229, P881, P6668, P6742). This group of sherds has a matrix finer than the second group. However, in grain size and firing, they are of poorer quality than the Arretine ware. Sherd P9027 is particularly interesting because of explicitly volcanogenic material, such as augite, basaltic hornblende and Types 1 and 2 igneous rock fragments. The amount of volcanogenic material is less than 1 percent. The other sherds, while texturally consistent with P9027, lack specific volcanogenic material. This is no doubt due to random sampling; the presence or absence of explicitly volcanogenic material in any given section through a sherd will be a statistical problem. Williams' profile of a sherd from Pozzuoli shows volcanic material, but the brevity of his description makes it impossible to attribute positively this group of sherds to Pozzuoli.

## Chapter 5: Summary and Conclusions

Three methods of analysis were applied to representative sherds of the Italian terra sigillata from S. Giovanni di Ruoti: visual examination with the aid of Munsell Soil Colour Charts, neutron activation analysis, and petrographic characterization. These last two methods of analysis were used to test the validity of visual examination and to try to determine the proveniences of the sherds.

Compositional analysis demonstrated that the differentiation of groups according to fabric colour was not accurate for the visually defined Groups 1a, 2 and 3. Interestingly, Group 1 sherds were consistent chemically and mineralogically. Three distinct groups can be defined by cluster analysis based on NAA data and by petrographic analysis. That three groups were also defined visually seems to have been fortuitous.

The neutron activation analysis did not provide by itself positive attribution of sherds to a source region. The study, limited by a lack of sherds from a known provenience, yielded results which indicate that some sherds very probably came from Arezzo and some sherds very probably did not. In this regard, the petrographic analysis yielded additional information that was consistent with the NAA data.

Petrographic analysis demonstrates that the representative sherds selected for analysis derive from at least three distinct sources. One source (Petrographic Type 1) was certainly Arezzo. The fact that stamps from known Arretine potters were found at S. Giovanni di Ruoti, combined with a positive visual identification, a ranked probability from NAA and a

reasonably assured petrographic attribution, is sufficient proof for Arezzo as a source.

A second group of sherds with a coarser matrix and which were not as well fired as Type 1 was defined as "Petrographic Type 2". The higher proportion of coarse material certainly shows levigation practices below the Arezzo standard. The uniform, fine texture of sherds from Arezzo is almost certainly due to the sophistication of levigation that was possible in a large factory or factories. (1) Perhaps small workshops could have benefitted from this as well (see above p. 13). This degree of refinement would be less likely in a "local" pottery for several reasons. Reproduction of high quality levigation practices and firing techniques is less likely in a pottery with a local distribution, if only because of expense and the availability of skilled artisans. Certainly, it is less likely that experienced potters capable of producing high quality pots would be located in areas with restricted facilities, distribution and, consequently, a restricted opportunity for profit. Petrographic Type 2 sherds may well be local production terra sigillata.

The third group of sherds (Petrographic Type 3) derives from a volcanic area. Pozzuoli is a possible source region but a secure attribution could not be made, given the brevity of Williams' description. (2) A more secure attribution of provenience requires that kiln material or sherds of secure provenience be used as a comparative standard.

This study has demonstrated that published results cannot yet be substituted for such material. Evaluation of the data indicates that

results obtained from neutron activation and petrographic analysis can be complementary techniques.

The comparison of fabric grouping to defined form has yielded some interesting results (see Table 4). Two sherds (P3384, P7066) of the "local production terra sigillata" (Petrographic Type 2) were from the hemispherical cup form. This may provide some evidence for Hayes' suggestion that the form is common in "Italian regional ware" (P3384 and P7066). Two sherds of Goudineau Type 43 were analyzed (P0881, P3676); one has a high probability for an Arezzo origin, and another is Petrographic Type 3. This is consistent with the popularity and longevity of the form, which is quite common at S. Giovanni di Ruoti. It is interesting to note that Goudineau Type 36 appears in the "local terra sigillata" (Petrographic Type 2). Also, for what it is worth, Hayes 20, an uncommon form, occurs in Petrographic Type 3 (P5229).

Few sherds with diagnostic forms were analyzed. Analysis of forms known to be rare or common at a site might yield more information about the bias of local production. Survival of earlier forms in later dateable contexts could indicate a conservatism of taste or even perhaps a relative isolation from the "current" koine; it might even suggest an extended production period for local Italian terra sigillata workshops as opposed to late Italian sigillata.

There are many other questions that come to mind, such as the marketing mechanisms for local workshops and the probable extent of distribution. I hope to address these problems in further studies.

Table 4: Sherds Analyzed

| Sherd | Form | Visual | NAA(Arezzo Rank) | Petro |
|---|---|---|---|---|
| P0701 | Base sherd | Group 2 | 11 | No |
| P0881 | Goudineau 43 | Group 1a | 17 | Type 3 |
| P3384 | Hemispherical Bowl | Group 3 | 19 | Type 2 |
| P3582 | Goudineau 36 | Group 3 | 25 | Type 2 |
| P3628 | Platter base | Group 2 | 22 | No |
| P3676a | Goudineau 43 | Group 1 | 3 | No |
| P3676c | Goudineau 43 | Group 2 | 4 | No |
| P5097 | Relief ware, poor | Group 2? | 10 | No |
| P5098 | Goudineau 38 | Group 2 | 16 | No |
| P5180 | Goudineau 30, base | Group 2 | 23 | No |
| P5229 | Hayes 20 | Group 1a | 14 | Type 3 |
| P5945 | Goudineau 39 | Group 1 | No | Type 1 |
| P6178 | Base sherd | Group 1a | No | Type Ia |
| P6408 | Goudineau 36 | Group 2 | 20 | No |
| P6472 | Goudineau 30 | Group 1a | 5 | Type 3 |
| P6668 | Ring base | Group 3 | 13 | Type 3 |
| P7066 | Ring base | Group 3 | 15 | Type 2 |
| P7140 | Platter base | Group 1 | 1 | Type 1 |
| P7165 | Goudineau 39 | Group 1 | 2 | Type 1 |
| P7205 | Dragendorff 8 | Group 1a | 21 | Type 1a |
| P9000 | ?Hemispherical Bowl | Group 2 | No | Type 2 |
| P9001 | Goudineau 36 | Group 2 | 26 | No |
| P9002 | Wall sherd | Group 2 | 27 | No |
| P9007 | Wall sherd | Group 2 | 9 | No |
| P9013 | Platter base sherd | Group 2 | No | Type 2 |
| P9015 | Base sherd | Group 1 | 6 | No |
| P9018 | Wall sherd | Group 2 | 8 | No |
| P9020 | ?Goudineau 30 | Group 1a | 7 | No |
| P9021 | Base sherd | Group 2 | 24 | No |
| P9023 | Base sherd | Group 2 | 18 | No |
| P9027 | Wall sherd | Group 2 | 12 | Type 3 |
| P9044 | Wall sherd | Group 1a | No | Type 1a |

## Notes to the Introduction

1. M. Gualtieri, M. Salvatore, A. Small. Lo scavo di S. Giovanni di Ruoti ed il periodo tardantico in Basilicata. Atti della Tavola Rotunda, Roma, 4 luglio 1981, Bari (1983). See also A.M. Small and R.J. Buck, "S. Giovanni di Ruoti 1977", Classical News and Views 22 (1978): 5-8; A.M. Small, "San Giovanni di Ruoti: some problems in the interpretation of the structures", Roman Villas in Italy, Recent Excavations and Research, London (1980): 91-109.

2. V.M. Emeleus and G. Simpson, "Neutron activation analysis of ancient Roman potsherds", Nature 185 (1960): 196ff.; I. Perlman and F. Asaro, "Pottery Analysis by Neutron Activation Analysis", Archaeometry 11 (1969): 21ff.; G. Banterla, A. Stenico, M. Terrani and S. Villani, "Characterization of Samian ware shards by means of neutron activation analysis", Archaeometry 15 (1973): 209-220.

3. F. Widemann, "Why is Archaeometry So Boring for Archaeologists" in Archaeological Ceramics (eds. J. S. Olin & A.D. Franklin), Smithsonian Institution Press, Washington (1982): 29-36. Widemann emphasizes that correct application of archaeometric techniques to historical problems requires close cooperation between archaeologists with a classical training and scientists nurtured on mathematics, physics or chemistry. However, Widemann does not

mention that the expense and availability of laboratory analysis are important factors. Moreover, in a small study directed by a single researcher, time can be an important factor. The procedures in NAA I performed (sample preparation, counting and peak searching) were found to be extremely time consuming.

4. M. Picon, M. Vichy and E. Meille, "Composition of the Lezoux, Lyon and Arezzo Samian ware", Archaeometry 13 (1971): 191-208; F. Widemann, M. Picon, F. Asaro, H.V. Michel and I. Perlman, "A Lyons Branch of the Pottery-Making Firm of Ateius of Arezzo", Archaeometry 17 (1975): 45-59.

5. D. F. Williams, "Petrological Analysis of Arretine and Early Samian: A Preliminary Report", Early Roman Fine-Wares in Roman Britain (eds. P. Arthur and G. Marsh), BAR 57 (1978): 5-13.

6. For an overview of recent provenience analyses, see P.M. Rice and M.E. Saffer, "Cluster Analysis of Mixed-level Data: Pottery Provenience as an Example," Journal of Archaeological Science 9 (1982): 395-409.

7. The difficulty of distinguishing the products of different workshops or production centres on the basis of visual differentiation of fabric is well known: see P.M. Kenrick, "Arretine Pottery—A Changing Scene",

Papers in Italian Archaeology, Vol.I, BAR 41 (1978): 237-241; see also M. Delgado in J. Alarçao and R. Etienne (eds.), Fouilles de Conimbriga, iv, Les Sigillées, Paris (1975): 3, n. 2.

8. For the possibly complementary nature of the two techniques in data interpretat[illegible], see K. Kilmurray, "The manufacture of Stamford ware: an applic[illegible]of thin sectioning and neutron activation analysis" in I. Fre[illegible]C. Johns and T. Potter (eds.) Current Research in Ceramics: Thin-section studies, British Museum Occasional Paper No. 32 (1980): 105-111.

## Notes to Chapter 1

1. For an historical overview of interest in "Arretine" ware, see see G. H. Chase, Catalogue of Arretine Pottery, Boston (1916).

2. H. Dragendorff, "Terra-Sigillata", Bonner Jb. 96/97 (1895): 18-155.

3. G. H. Chase, The Loeb Collection of Arretine Pottery, New York (1908); G. H. Chase, Catalogue of Arretine Pottery, Boston (1916); A. Oxe, Arretinische Reliefgefasse vom Rhein, Frankfurt (1933); C. Alexander, C.V.A., USA 9, Metropolitan Museum i: Arretine Relief Ware, Cambridge, Mass. (1943); H. Dragendorff (ed. C. Watzinger), Arretinische Reliefkeramik mit Beschreibung der Sammlung in Tübingen, Reutlingen (1948); A. C. Brown, Catalogue of Italian Terra Sigillata in the Ashmolean Museum, Oxford (1968). Unfortunately, the findspots are rarely recorded in museum collections assembled at the turn of the century.

4. A. Oxe & H. Comfort, Corpus Vasorum Arretinorum, Bonn (1968).

5. C. Goudineau, Fouilles de l'Ecole française de Rome à Bolsena (Poggio Moscini), Tome IV, La Ceramique aretine lisse, Ecole Française de Rome Mélanges d'Archéologie et d'Histoire 6 Paris (1968): 13-63.

6. S. Loeschcke, "Keramische Funde in Haltern", Mitteilungen der Altertümskommission für Westfalen 5 (1909): 101-322.

7. J. W. Hayes, "Roman Pottery from the South Stoa at Corinth", Hesperia 42 (1973): 416-470.

8. In conversation with M. Torelli, University of Perugia, March, 1986; cf. G. Pucci, "A sigillata kiln recently discovered in the Chiana Valley", forthcoming, RCRF XV International Congress, Worms, September 1986.

9. Gazzetti (see note 10) notes that "Le recognizioni svolte del G.A.R. negli anni 1973-1977 hanno portato all'individuazione di numerose fornaci di ceramica romana, nella zona compresa tra Orte e Viterbo interessata al passaggio della antica Via Amerina e gravitante attorno al porto fluviale sul Tevere, scoperto di recente presso Penna in Teverina." Hopefully publication will not be delayed much longer.

10. G. Gazzetti, "Una fornace di Sigillata Italica scoperta a Vasanello", Archeologia Romanistica 1 (1979): 29-33.

11. Personal communication from T. Penna; forthcoming, Memoirs of the American Academy at Rome.

12. F. Widemann, M. Picon, F. Asaro, H. V. Michel & I. Perlman, "A Lyons Branch of the Pottery-Making Firm of Ateius of Arezzo", Archaeometry 17 (1975): 45-59. For the discovery of the Ateius workshop at Arezzo, see G. Maetzke, "Notizie sulla esplorazione della fornace di Cn Ateius in Arezzo", RCRF Acta 2 (1959): 25-8.

13. S. Von Schnurbein, Die Unverzierte Terra Sigillata Aus Haltern (mit einem beitrrag von J. Lasfargues und M. Picon), Bodenaltertümer Westfalens 19, Munster (1982): 140-142.

14. M. Picon, M. Vichy and E. Meille, "Composition of the Lezoux, Lyon and Arezzo Samian Ware", Archaeometry 13 (1971): 191-208.

15. S. Von Schnurbein, above n. 13.

16. See Introduction, note 7.

17. For the controversy surrounding the date of destruction at Haltern and other sites on the northern frontier, see C. M. Wells, The German Policy of Augustus; an Examination of the Archaeological Evidence, Oxford (1972): 177-192 (Haltern).

18. S. Von Schnurbein, above n. 13.

19. See J.P. Morel, "Notes sur la ceramique Etruscocampanienne. Vases a vernis noir de Saraigne et d'Arezzo", MEFR 75 (1963): 7-58. See also H. Comfort, "Terra Sigillata" in T. Frank, Economic Survey of Ancient Rome, Vol. V, Baltimore (1940): 188-94.

20. G. Pucci, "La Produzione della ceramica aretina. Note sull'industria nella prima età imperiale", Dialoghi di Archeologia 7 (1973): 255-93

21. D. Atkinson, "A Hoard of Samian Ware from Pompeii", JRS 4 (1914): 27-64.

22. M. Marabini Moevs, "New Evidence for an Absolute Chronology of Decorated Late Italian Terra Sigillata", AJA 84 (1980): 319-327.

23. It is uncertain exactly when in planta pedis stamps replaced rectangular stamps. Goudineau suggests that the shift occurred quite suddenly, about 15 A.D. (1968: 244). Hayes notes that the in planta pedis stamp is a late stamp form which scarcely occurs on the Augustan sites of Oberaden and Haltern; he suggests that the shift to in planta pedis stamps took place in the later years of the principate of Tiberius and was complete by c. 40 A.D. (1973: 439).

24. Goudineau (1968): 354

25. Pucci (1973): 274

26. Goudineau (1968): 350

27. Pucci (1973): 272-273

28. C. Wells, "Manufacture, Distribution and Date: Some Methodological Considerations on the Dating of Augustan Terra Sigillata", RCRF Acta 5/6 (1977): 139-140.

29. The historical evidence (literary and epigraphic) has not been examined in sufficient detail; this line of enquiry may provide a sounder basis for reconstructing marketing methods. For a brief examination of possible local marketing methods, see R. MacMullen, "Market Days in the Roman Empire", Phoenix 24 (1970): 33-341.

## Notes to Chapter 2

1. Final report in preparation, eds. A.M. Small and R.J. Buck.

2. J. Freed, in Small and Buck, above.

3. See above,n. 1.

4. See above, n. 1.

5. Published sites in the general area of S. Giovanni include Grumento (L. Giardino, ed. Grumentum: La Ricerca Archeologica in un Centro Antico. Soprintendenza Archeologica della Basilicata [1981]) and Monte Irsi (A.M. Small, ed. Monte Irsi, Southern Italy, BAR Supplementary Series 20 (1977)). The assemblage of Italian terra sigillata plain ware forms at Monte Irsi is not large (28 plain ware sherds published) and is generally early but it is interesting to note the presence of 1 sherd of Robinson's "Samian A Ware" (p. 193). In addition, several sites lie on the fringes of the date range of Italian terra sigillata, such as Gravina di Puglia (final report in preparation, ed. A.M. Small). It is unfortunate that the "red glaze ware" from Buccino was not well published; it is of interest that a red glaze ware stamp attributed to La Graufesenque was discovered at the Vittimose villa. (S.L. Dyson, The Roman Villas of Buccino,

BAR International Series 187, Oxford (1983): 44; for a scathing review, see M.H. Crawford, JRS 74 (1984): 225).

6. C. Goudineau (1968): 57-63

7. The date range for Italian terra sigillata is c. 30 B.C. to 70 A.D. or somewhat later. African red-slip ware (terra sigillata chiara A, C and D) was manufactured between the second and seventh centuries. According to J. Freed, the earliest dateable piece of African red slip ware at S. Giovanni is from the middle of the second century A.D.

8. M.A. Cotton, The Late Republican Villa at Posto, Francolise, PBSR Supplementary Vol. London (1979), "The Terra Sigillata Wares": 187-190. See also M.A. Cotton and G.P.R. Metraux, The San Rocco Villa at Francolise, PBSR Supplementary Vol. (1985). At Posto, seven "Arretine" fabrics and three "Late Italian" fabrics were distinguished on the basis of the colour and quality of the slip and fabric. A "local imitation terra sigillata ware" was also identified. At Conimbriga, de Alarçao distinguished twelve distinct groups of terra sigillata on the basis of fabric and slip colour and purity (see Introduction, note 7). For Benghazi, see P.M. Kenrick, Excavations at Sidi Khrebish Benghazi (Berenice), Vol. III, Part I, The Fine Pottery (1985).

9. M. Vanderhoeven, "La Terre Sigillée Lisse" in Ordona V (ed. J. Mertens), Etudes de Philologie, d'Archéologie et d'Histoire Anciennes, Tome 16 (1976): 84.

10. For discussion, see Appendix A, Cat. 14. Hayes (pers. comm., 1984) claims the form is common in "Italian regional ware".

11. J.W. Hayes (1973): 416-470; see also Ordona V, note 9, above.

## Notes to Chapter 3

1. Munsell Soil Colour Charts, Munsell Products, Baltimore (1973). The Munsell Charts are not ideal for describing pottery fabrics. In the first place, the charts were designed for the determination of soil colours and not for pottery fabric colour discrimination. The system is time consuming and rather complex. Since the notation is decimal and capable of expressing any degree of refinement desired, there is a temptation to be over-precise. Depending on the colour aptitude of the recorder, colour chart notations may be just as subjective as non standardized colour descriptions. Von Schnurbein recounts that he and a colleague examined twelve terra sigillata sherds under identical conditions; they agreed on group designation in two cases out of twelve: "Offensichtlich nimmt jedes Auge die Farben so individuell wahr, dass auch mit Hilfe von Farbtabellen unterschiedliche Bestimmungen erfolgen." (Von Schnurbein, above Chapter 1, n. 13: 5) Furthermore, to appreciate the use of Munsell notations in published reports, the reader must have access to the Soil Charts. These are quite expensive, currently about $100.00 CAN.

2. The term "local production terra sigillata" is misleading since there is no evidence at the moment to suggest that terra sigillata was produced in the area of S. Giovanni di Ruoti. The term is used in preference to "imitation terra sigillata" or "local imitation terra

sigillata" which are completely misleading, in my opinion. Wells has argued against the validity of the concept of "imitation sigillata": "Let us not speak of 'imitation' (terra sigillata). Potters moved to set up workshops where a market seemed to offer, and tried to make sigillata, such as there was a demand for. Where their products were of the highest quality, we may not be able to distinguish them from those of the main centres of production. Where they were less good, they often still found a market in an outlying area...." C. Wells, "Manufacture, Distribution and Date: Some Methodological Considerations on the Dating of Augustan Terra Sigillata", RCRF Acta 17 (1977): 135.

3. I am grateful to the University of Alberta SLOWPOKE Committee for approving the experiment and to M.J.M. Duke, SLOWPOKE Research Associate, for irradiating the samples and showing me how to prepare the samples for irradiation, use the Ge(Li) detector and Nuclear Data (ND) 660 multichannal analyzer, etc. See M.J.M.Duke, B.G. Ackroyd, A.M. Small, "INAA of Terra Sigillata Pottery", SLOWPOKE Annual Report, University of Alberta, Edmonton (1984): R14 and (1985) R19.

4. This is due to the accuracy and precision of the technique. Widemann (1975: 46) notes "Besides the major elements found in pottery, there are many more which occur only in minute traces

often in just a few parts-per-million (ppm). The potential importance of these trace elements for determining provenience of pottery by chemical fingerprinting lies in the breadth of chemical properties which are included in such a large array of elements. Clays arise from the weathering of certain rocks which might be quite similar in composition. Chemical fractionations take place in forming the clays, and environmental conditions will no doubt effect various elements differently. If one examines elements which exhibit a diversity of chemical properties, there will be more chance for detecting the consequences of subtle environmental differences between one place and another."

5. The ranked probability for different sources of production was extremely inconsistent: the ranked probability for Arezzo based on NAA data and for Arezzo based on XRF data for the S. Giovanni sherds did not coincide and varied significantly. I attribute this to the fact that only four elements could be compared (Na, Fe, Mn, and Ca). Widemann (1975: 57) compared NAA and XRF measurements and found that "For a number of samples definite discrepancies were observed between the XRF and NAA measurements, but these could almost all be attributed to differences in the sample preparation procedure. For those sherds with little or no volatile material, the agreements

between the XRF and NAA determinations of the same elements were excellent."

6. F. Widemann et. al. (1975): 52, Table 3.

7. I am grateful to Paul Metcalfe, University of Alberta (Department of Geology) for supplying a complete petrographic description. This will be published in the final report on the S. Giovanni excavation (in preparation, eds. A.M. Small and R.J. Buck

8. D. F. Williams (1978): 5-13.

## Notes to Chapter 4

1. This problem has been acknowledged by other researchers. Widemann (1975: 55) reports that the NAA published by Banterla et. al. on a number of terra sigillata sherds from Italy could not be used for comparison because they did not give actual chemical abundances but rather gamma ray counting rates for different elements. (G. Banterla, A. Stanico, M. Terrani and S. Villani, "Characterization of Samian Ware Sherds by Means of Neutron Activation Analysis". Archaeometry 13 (1973): 209-220). A common reporting standard would facilitate comparison between laboratories and possibly obviate the duplication of results. Kiln material or sherds of secure provenience can be difficult to obtain, once published data can be substituted, the method may be more widely employed in terra sigillata studies.

2. D. F. Williams (1978): 5-13.

3. D.J. Fix and K.E. Guire, Documentation for MIDAS. University of Michigan (1976).

4. Most recently, S. Wissemann in a paper delivered to the Archaeological Institute of America, December, 1985. I am grateful to her for for the as yet unpublished results of the NAA of

terra sigillata sherds from the Olcott collection at the University of Illinois.

5. J. Alarcao and R. Etienne (eds.) (1975).

6. F. Widemann et al., above Chapter 3, n. 6.

## Notes to Chapter 5

1. For the sophistication of the Arezzo industry, See Pucci (1973) and D. Peacock, Pottery in the Roman World: An Ethnoarchaeological Approach, London (1984). The levigation tanks excavated at Arezzo are quite spectacular; one belonging to the Perennius establishment had a capacity of 10,000 gallons (U. Pasqui, "Nuove scoperte di antiche figuline della fornace di M. Perennio", NSc (1896): 453-66, quoted in Peacock (1984): 54.

2. Venosa may be an even more likely source. Torelli (University of Perugia, pers. comm.) is convinced that Venosa and Canosa had terra sigillata workshops with artisans hired from Campania, if not further north. In Roman times it was certainly much cheaper to move the potter than it was to move the pot—the Lucanian market might well have justified a local pottery that produced tableware. For the high cost of transport in the Roman world, see Trade in the Ancient Economy (eds. P. Garnsey, K. Hopkins, C. Whittaker) London [1983]); see also R. Duncan-Jones, The Economy of the Roman Empire, London (1983).

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## Italian Terra Sigillata at S. Giovanni di Ruoti: Selected Samples

No single typology includes all the forms represented at San Giovanni; the type series published by Goudineau and Hayes were used as the basis for classification and Haltern equivalents are included for convenient reference. Following Hayes, the term gloss is used to denote the shiny Arretine "glanztonfilm" and slip is used to denote a matte finish. The first number of each entry refers to the Catalogue number; the second number, prefaced by a "P", is the S. Giovanni inventory number. The following abbreviations are used: RD (rim diameter); PH (preserved height); Th (wall thickness): BD (base diameter). All dates given are approximate. All drawings are by Rosemary Haldenby.

### Haltern Type 1; Hayes Form 1; Goudineau Type 15,17

A plate/dish form characterized by moulding on the interior of the wall and a hanging lip. The lip of the rim may be rounded or angular; the foot profile can be rectangular with a broad resting surface or triangular with a small resting surface. Goudineau Type 15 appears at Bolsena c. 15 B.C. or later and Type 17 appears c. 12 B.C. Suggested date: 20 B.C.-15 A.D. Two examples.

1a. (P0224) RD: 15.3 cm PH: 1.9 cm Th: 0.55-0.7 cm

Rounded, heavy rim of a small plate or dish. Only 0.7 cm of the wall remains, making secure identification of the form impossible; probably a clumsy variant of Haltern 1. Orange, very micaceous fabric with some inclusions; worn, red-brown gloss. Group 2 fabric. (Fig. 3)

1b. (P1986) RD: 18.0 cm PH: 2.3 cm Th: 0.2-0.3 cm

Rim of a plate, Hayes 1/Goudineau 15. Orange, soft micaceous fabric with sparse inclusions; red-brown gloss, very worn interior. The rim is triangular; there is an interior groove just below the rim and a slight ridge on the outer wall. For a similar version of the form, see Monte Irsi (Fig. 34, no. 277). Group 2 fabric. (Fig. 3)

## Haltern Type 2; Hayes Form 4

A plate/dish form characterized by a curving exterior profile with grooves delineating the rim and base of the wall. The form is common among the later groups at Haltern and rare at Oberaden. It is well represented at Camulodunum, which dates from c. 10 B.C. onwards. At Camulodunum, the form appears in Arretine in the early phases and later appears in South Gaulish ware. The basic type had a long life span and underwent a number of changes to correspond to the fashion of the time; variants are common. Early variants may have a moulded exterior and lack grooves. For the intermediate stage and final stages of development (Hayes Form 7, 12, Goudineau Type 39), see below. Suggested date: c. 10 B.C. - 30 A.D. Seven examples.

2a. (P8002); RD: 24.0 cm; PH: 2.6 cm; Th: 0.3-0.7 cm
Rim and wall and part of the base moulding, Haltern Type 2. Dark orange fabric; good red-brown gloss. This is a classic example of the form. Group 2 fabric. (Fig. 3)

2b. (P6619); RD: 14.0 cm; PH: 2.6 cm; Th: 0.3-0.6 cm
Rim, wall and part of the base moulding, Haltern Type 2. Light orange fine buff fabric with minute black and white inclusions; thick red-brown slip. The wall is vertical. See Hayes (Pl. 82,7). Group 3 fabric. (Not illustrated)

2c. (P3532); RD: 35.0 cm; PH: 2.2 cm; Th: 0.35-0.45 cm
Rim and wall of a platter, a large version of Haltern Type 2. Rosy tan fine fabric; worn red-brown gloss. The exterior wall profile is curved and there is an interior groove below the rim. Group 1 fabric. (Not illustrated)

2d. (P6541); RD: 14.0 cm; PH: 2.4 cm; Th: 0.3-0.5 cm; BD: 13.0 cm
Rim and wall of a plate, Haltern Type 2. Light orange fine fabric; worn red-brown gloss. There is an exterior groove below the rim. Group 3 fabric. (Not illustrated)

2e. (P3572); RD: 24.0 cm; PH: 2.6 cm; Th: 0.45-0.5 cm
Rim and wall of a plate, Haltern Type 2. Rosy tan fine fabric; very shiny red-brown gloss. Group 1 fabric. (Not illustrated)

2f. (P1576); RD: ?; PH: 2.6 cm; Th: 0.4-0.8 cm; BD: 29.6 cm
Base and part of the wall of a plate, probably Haltern Type 2. Light buff orange fabric, very fine sparse inclusions; good red-brown slip. There are two sets of double grooves on the interior of the floor. Group 3 fabric. (Not illustrated)

2g. (P6014); RD: 14.0 cm; PH: 1.5 cm; Th: 0.3 cm
Rim and wall of a plate, Haltern Type 2. Light buff orange fabric with minute black and white inclusions; good red-brown gloss. Group 3 fabric. (Not illustrated)

Hayes Form 7, 12; Goudineau Type 39

Hayes Form 7, equivalent to Goudineau Type 39a, is an offshoot of Haltern Type 2. It is characterized by a vertical wall, simpler mouldings, and occasional applique decoration, which foreshadows the final development of the form. An example from Corinth has an in planta pedis stamp, causing Hayes to suggest a date range of 20-40 A.D. or slightly later. The final stage of development (Hayes Form 12, Goudineau Type 39b,c) is characterized by a vertical wall, small mouldings at the rim and base and applique decoration. The form is common at Pompeii. Suggested date for Form 12: c. 35/45-65 A.D. and later. Fifteen examples.

3a. (P5945); RD: 23.0 cm; PH: 3.4 cm; Th: 0.4-0.5 cm
Rim, wall and part of the base moulding, Hayes Form 7. Rosy pink fine fabric; good red-brown gloss. There is an interior groove below the rim. Group 1 fabric. (Fig. 3)

3b. (P3515); RD: 23.0 cm; PH: 3.4 cm; Th: 0.6 cm
Rim and wall, Hayes Form 7. Soft orange fabric; good red-brown gloss. The mouldings are simplified, but the wall profile is slightly curved. There is no trace of applique decoration. Group 2 fabric. (Not illustrated)

3c. (P1281); RD: 30-35 cm; PH: 3.4 cm; Th: 0.45 cm
Rim and wall, Goudineau 39b. Soft orange fabric; shiny red-brown gloss. Applique decoration in the form of a poorly modelled rosette with twelve petals. Group 2 fabric. (Fig. 3)

3d. (P7165); RD: 15.5 cm; PH: 4.5 cm; Th: 0.35-0.5 cm; BD: 8.0 cm
Rim, wall, and base, Hayes Form 12, Goudineau Type 39c. Light pink fabric; thick red-brown gloss. The high, narrow foot is obviously late. There is an applique rosette and a poorly modelled half circle, probably a garland. Group 1a fabric. (Fig. 4)

3e. (P3431); RD: 21.0 cm; PH: 2.8 cm; Th: 0.4-0.5cm
Rim and wall, Hayes Form 12. Rosy pink fine fabric; good red-brown gloss. Applique decoration in the form of the head of a donkey, mule, or possibly a goat. Group 1 fabric. (Not illustrated)

3f. (P7105); RD: 14.2 cm; PH: 2.9 cm; Th: 0.45-0.5cm
Rim, wall, and base moulding, Hayes Form 12, Goudineau 39c. Orange fabric with sparse inclusions; matte red-brown slip. The mouldings are simplified; there is an interior groove below the rim. Applique decoration in the form of a fleur-de-lys. Group 2 fabric. (Not illustrated)

3g. (P3693); RD: 20.0 cm; PH: 3.0 cm; Th: 0.5-0.55 cm

Rim, wall and base moulding, Hayes Form 12, Goudineau 39c. Orange, micaceous soft fabric; good red-brown gloss, very worn, chipped exterior. No trace of applique decoration preserved. Group 2 fabric. (Not illustrated)

3h. (P6140); RD: 14.0 cm; PH: 2.1 cm; Th: 0.3-0.4cm

Rim, wall and base moulding, Hayes Form 12, Goudineau 39c. Fine light orange fabric with very sparse, fine white inclusions; worn mottled red-brown gloss. No trace of applique decoration preserved. Group 3 fabric. (Not illustrated)

3i. (P3693); RD: 20.0 cm; PH: 3.0 cm; Th: 0.4-0.55 cm

Rim and wall, Hayes Form 12, Goudineau 39c. Soft orange micaceous fabric; red-brown gloss, very worn exterior. The wall is vertical, the mouldings simplified. There is no trace of applique decoration. Group 2 fabric. (Not illustrated)

3j. (P5978); RD: 23.0 cm; PH: 3.0 cm; Th: 0.3-0.4 cm

Rim and wall, Hayes Form 12, Goudineau 39c. Rosy pink fine fabric with fine sparse white inclusions; red-brown slip. Applique decoration in the form of a fish head, partially preserved. Group 1 fabric. (Not illustrated)

3k. (P3705); RD: ?; PH: 2.2 cm; Th: 0.35-0.5 cm

Wall sherd and base moulding, probably Hayes Form 12, Goudineau Type 39c. Pink buff fine fabric, shiny red-brown gloss. On the wall there are traces of a circular applique form, not preserved. Group 1a fabric. (Not illustrated)

3l. (P0044); RD: 20.0 cm; PH: 2.3 cm; Th: 0.3 cm

Rim and wall, Hayes Form 12. Rosy pink fine fabric; red-brown slip. An applique in the form of a knot (3 bands bound together by three lines) is preserved. Group 1 fabric. (Not illustrated)

3m. (P3868); RD: 12.0 cm (?); PH: 1.2 cm; Th: 0.3 cm

Rim and wall, Goudineau 39. For the rim, see Goudineau, (p. 211, C-2B-103). Pale orange fine fabric; good red-brown gloss. Two exterior grooves below the rim, tiny interior groove below the rim. Group 3 fabric. (Not illustrated)

3n. (P3652); RD: ?; PH: 1.8 cm; Th: 0.6-0.75 cm

Wall sherd, possibly from a Goudineau 39/Hayes 7-12 plate. Dark rose fabric; good red-brown gloss. An applique in the form of a boukranion is preserved. Group 1 fabric. (Not illustrated)

3o. (P1144); RD: 15.8 cm; PH: 1.4 cm; Th: 0.3-0.4 cm

Rim of a plate/dish, Goudineau 39. For the rim, see Goudineau (p. 211, C-2B-100). Orange fabric with very fine, sparse inclusions; good red-brown gloss. Group 2 fabric. (Fig. 4)

Goudineau Type 29b; Hayes Form 15; Haltern Type 10, with variants

A cup/bowl form characterized by a tripartite division of the exterior wall with rouletted decoration. It appears at Bolsena around 5 B.C. Suggested date: 10 B.C.- 5 A.D. One example.

4a. (P3771); RD: 15.0 cm; PH: 2.7 cm; Th: 0.45-0.5cm

Rim of a bowl, a simplified version of Goudineau Type 29b. Light pink fine fabric, no obvious inclusions; very shiny red-brown gloss with rouletting on upper exterior of wall. Group 1a fabric. (Fig. 5)

Haltern 3, Goudineau Type 28, Hayes Form 11

A plate/dish form characterized by an external bulge or renflement and a quarter round moulding interior between the wall and the floor; occasional applique decoration or roulgtting. It appears at Bolsena in the first decade B.C. Hayes Form 11 dates from 10 A.D. to 60 A.D. One example.

5a. (P0496); RD: ?; PH: ?; Th: 0.45cm

Wall and base sherd, Haltern Type 3. Rosy pink fine fabric; very shiny red-brown gloss. Without the rim it is impossible to tell whether it is an early or late version of the form. Group 1 fabric. (Fig. 5)

Haltern Type 4; Goudineau Type 30; Hayes Form 6

A plate/platter form characterized by a curving exterior wall and an offset at the base of the floor. This is a rare form at Bolsena; according to Goudineau, only the shape of the foot helps to date it. He notes that an example at Haltern ought to be early and an example at Oberaden should be late, see Goudineau (p. 301). He does not assign a date. Examples from Corinth include two sherds, stamped in planta pedis. Decorative lines or ridges on the interior of the floor can occur and one example has spectacle spiral applique decoration. The rim diameter varies from 16.8 cm to 33 cm. In later examples, the internal offset may be omitted. Suggested date: c. 5/15-65 A.D. and later. Six examples.

6a. (P6560); RD: 14.5 cm; PH: 2.5 cm; Th: 0.35-0.8 cm; BD: 7.3 cm. Rim, wall and base, Haltern 4. Light pink buff fabric, quite fine; worn red-brown matte slip, mottled. The wall profile is curved and there is an offset at the interior edge of the floor. Group 1a fabric. (Fig. 5)

6b. (P3541); RD: 12.7 cm; PH: 1.9 cm; Th: 0.45 cm

Rim, wall and base, Haltern 4. Rosy pink fine fabric; good red-brown gloss, missing on outer wall, possibly reserved. Group 1 fabric. (Not illustrated)

6c. (P8011); RD: ?; PH: 1.1 cm; Th: 0.6 cm; BD: 10.0 cm

Base shard with offset, Haltern 4. Light orange buff micaceous fabric with sparse fine inclusions; worn red-orange gloss. Group 3 fabric. (Not illustrated)

6d. (P0882); RD: ?; PH: 2.0 cm; Th: 0.7cm; BD: 10.0 cm

Base shard and wall, Haltern 4. Rosy pink fine fabric; red-brown gloss. There are three sets of decorative ridges on the interior of the floor. Group 1 fabric. (Not illustrated)

6e. (P1084); RD: ?; PH: 2.5 cm; Th: 0.4-0.5 cm; BD: ?

Base shard with offset, Haltern 4. Orange fabric with very sparse white inclusions; thick red-brown slip. Group 2 fabric. (Not illustrated)

6f. (P6525); RD: ?; PH: 2.0 cm; Th: 0.4-0.7 cm; BD: ?

Base shard with offset preserved, Haltern 4. Light orange buff fabric with sparse inclusions; mottled red-brown slip. Group 3 fabric. (Not illustrated)

## Haltern Type 11:Goudineau Type 32b

A cup form with a rounded exterior wall divided in two parts by a groove; the upper wall is usually rouletted. It appears at Bolsena around 5-10 A.D. An example at Ordona (pl. L, 251) lacks rouletting. Suggested date: c. 0-25 A.D. One example.

7a. (P3664); RD: 12.0 cm; PH: 2.8 cm; Th: 0.2-0.3 cm

Rim and wall, Haltern 11. Soft orange slightly micaeceous fabric; red-brown gloss. There is an interior groove below the rim; the exterior groove is sharply articulated. There is no interior rouletting. Group 2 fabric. (Fig. 5)

Haltern Type 5; Goudineau Type 36

A platter form with an interior wall rising at an oblique angle; the exterior wall is more or less vertical. Hayes Form 5 is related to Haltern Type 5 and examples from Corinth are decorated with applied spirals. The form appears at Bolsena around 12-16 A.D. Suggested date: 0-25 A.D. Three examples.

8a. (P1588); RD: 14.5 cm; PH: 2.4 cm; Th: 0.3-0.6 cm

Rim, wall and base, Haltern 5. Soft orange fabric with sparse inclusions; red-brown matte slip of poor quality. The angle of the interior wall is only slightly oblique; no trace of decoration. There is an internal groove at the join of the base and wall. Group 2 fabric. (Fig. 5)

8b. (P3582); RD: 16.0 cm; PH: 1.8 cm; Th: 0.4-0.55 cm

Rim and wall, Haltern 5. Orange fabric with small, sparse white inclusions; red-brown slip. Group 2 fabric. (Not illustrated)

8c. (P6498); RD: 14.0 cm; PH: 1.8 cm; Th: 0.3-0.4 cm

Rim and wall, Haltern 5. Rosy pink fine fabric; red-brown gloss, worn over rim. Group 1 fabric. (Not illustrated)

Haltern Type 12; Goudineau Type 38a,b; Hayes Form 21, 24

A hemispherical bowl characterized by a flange on the exterior wall, usually decorated with incised spectacle spirals or applique decoration. The form was popular and it seems to have been one of the two cup forms that continued to be produced in the latest stages of Italian terra sigillata production (Hayes, p. 445). Earl[illegible] versions of the form (Hayes Form 21, Goudineau Type 38a) are characterized [illegible] spectacle spiral decoration and may have a zone of rouletting. In later versions of the form, applique decoration in the form of rosettes, theatre masks, etc. replace the spiral decoration and the flange is sometimes extended at an angle, as in Goudineau Type 38b and Hayes Form 24. Goudineau Type 38a appears at Bolsena around 12-16 A.D. and 38b appears after 20. Hayes dates Form 21 to between 25 and 50 A.D. and Form 24 to c. 45/50-65 A.D. and later. The form is common at Ordona, both with rouletting and without decoration. Twelve examples.

9a. (P3531); RD: 9.0 cm; PH: 3.5 cm; Th: 0.25-0.3 cm

Rim and wall, Goudineau 38a/Hayes 21. Fine light buff orange fabric; unusual shiny mottled red orange gloss. Spectacle spiral decoration and a field of fine rouletting are preserved on the exterior wall. The flange is low on the exterior wall and not extended. Group 3 fabric. (Fig. 6)

9b. (P7134); RD: ?; PH: 4.5 cm; Th: 0.35-0.50 cm; BD: 6.0 cm
Base and wall, Goudineau 38a/Hayes 21. Orange micaceous fabric; unusual mottled red-orange gloss. There is a zone of fine, shallow rouletting above the flange. Group 2 fabric. (Not illustrated)

9c. (P6229); RD: 7.0 cm; PH: 2.3 cm; Th: 0.2-0.3 cm
Rim and wall of a flanged bowl with applique decoration, Goudineau 38b/Hayes 24. Rosy pink fine fabric; shiny red-brown gloss. The applique is a theatre mask, rather worn. Group 1 fabric. (Fig. 6)

9d. (P6442); RD: 8.0 cm; PH: 2.2 cm; Th: 0.5 cm
Rim, wall and flange of a bowl with applique decoration, Goudineau 38b/Hayes 24. Buff orange fine fabric; worn red-brown slip. The applique is in the form of a rosette just above the flange; traces of another rosette just above it are preserved. Group 3 fabric. (Not illustrated)

9e. (P8015); RD: 8.0 cm; PH: 2.1 cm; Th: 0.4-0.9cm
Rim and wall of a flanged bowl with applique decoration, Goudineau 38b, Hayes 24. Light buff orange micaceous fabric; red-brown slip mottled to light red. There is a deep groove below the rim and the flange is extended. Traces of a very worn rosette are preserved above the flange. Group 3 fabric. (Not illustrated)

9f. (P0113); RD: 9.7 cm; PH: 1.9 cm; Th: 0.3-0.7 cm
Rim and wall of a flanged bowl with applique decoration, Goudineau 38b/Hayes 24. Rosy pink fine fabric; good red-brown gloss. A rosette applique above the flange is preserved. Group 1 fabric. (Not illustrated)

9g. (P0502); RD: 12.0 cm; PH: 3.1 cm; Th: 0.4-0.9 cm
Rim, wall, and flange, Goudineau 38b/Hayes 24, without rouletting or applique decoration. Rosy pink fine fabric; red-brown gloss. Group 1 fabric. (Fig. 6)

9h. (P3591); RD: 11.0 cm; PH: 2.9 cm; Th: 0.25-0.4 cm
Rim, wall and flange, Goudineau 38b/Hayes 24. Without rouletting or applique decoration. Light orange buff pale fabric; very thin red-brown gloss, Group 3 fabric. (Not illustrated)

9i. (P6540); RD: 12.5 cm; PH: 2.2 cm; Th: 0.3-0.4 cm
Rim and wall of a bowl, flange partially preserved. Goudineau 38b/Hayes 24. No trace of decoration is preserved. Pink buff fine fabric with fine, sparse inclusions; red-brown slip, worn over flange. Group 1a fabric. (Not illustrated)

9j. (P6646); RD: 8.0 cm; PH: 2.4 cm; Th: 0.3-0.4 cm
Rim, wall and flange, Goudineau 38b/Hayes 24. Without applique decoration. Rosy tan fine fabric; mottled red-brown slip. There is a very marked groove under the flange. Group 1 fabric. (Not illustrated)

9k. (P3626); RD: ?; PH: 2.5 cm; Th: 0.35-0.5 cm; BD: 6.0 cm
Base, wall and flange of a bowl. Orange fabric with sparse fine inclusions; good red-brown slip. The foot is small and rather rounded, unlike the canonical high, narrow, triangular foot profile of Goudineau 38/Hayes 24; possibly a local variant. Group 2 fabric. (Not illustrated)

91. (P1240); RD: ?; PH: 2.1 cm; Th: 0.3-0.6 cm
Wall sherd with flange, probably Goudineau 38b/Hayes 24. Light orange fine fabric; good red-brown gloss. Group 1a fabric.

Goudineau Type 41b; Hayes Form 22

A large bowl form characterized by a carination on the exterior wall; vertical wall above carination and a flat everted angular rim. The form is common in Gaulish terra sigillata (Ritterling Form 9). It appears at Bolsena around around 15-20 A.D. Hayes dates the form to ca. 20 A.D. to 65 or later. One example.

10a. (P3594); RD: ?; PH: 3.1 cm; Th: 0.4-0.5 cm; BD: 5.0 cm
Base, carination and part of wall, Goudineau 41b. Light orange fine fabric; good, thick red-brown gloss. There is fine oblique rouletting above and below the carination. Group 1a fabric. (Not illustrated)

Goudineau Type 43; Hayes Form 13

A dish characterized by a high sloping wall; the form of the rim may vary (see Ordona IV, pl. LIV, 331-334) Goudineau Form 43/Hayes 13 is equivalent

to Barocelli Type 6 and the counterpart of Dragendorff Type 18 in Gaulish terra sigillata. The form does not appear at Haltern, Oberhausen or Vindonissa. Examples from Ordona, Corinth and Bolsena have in planta pedis stamps. The form is among the latest forms at Bolsena, dated no earlier than the last quarter of the first century B.C. Hayes (Hayes, 1973) dates the life span of the form to the third quarter of the first century A.D. and later and notes that it, along with Form 24, continued to be produced in the latest stages of the Itali[illegible] sigillata production. Twelve examples.

11a. (P0325); RD: 23.0 cm; PH: 2.1 cm; Th: 0.5 cm
Rim and wall, Goudineau 43. Soft, orange, micaceous fabric; worn red brown-gloss. This is a steep-walled version of the form. Group 2 fabric. (Fig. 7)

11b. (P7042); RD: 24.0 cm; PH: 4.0 cm; Th: 0.4-0.45 cm
Rim and wall, Goudineau 43. Pale orange micaceous fabric with sparse inclusions; good red-brown slip. The rim is flared and there is a groove at the upper edge of the rim. This is a rather elegant version of the form. Group 3II fabric. (Fig. 7)

11c. (P0504); RD: 35.0 cm; PH: 3.5 cm; Th: 0.6 cm
Rim and wall of a large version of Goudineau 43. Rosy pink fine fabric; red-brown gloss, chipped. The rim is flared, as above. Group 1 fabric. (Fig. 7)

11d. (P6205); RD: 14.0 cm; PH: 1.2 cm; Th: 0.3 cm
Rim and wall of a small version of Goudineau 43. Light orange buff fine fabric; red-brown gloss. The rim is flared and there are two grooves below the outer rim. Group 1a fabric. (Not illustrated)

11e. (P1581); RD: 18.0 cm; PH: 4.5 cm; Th: 0.4 cm
Rim and wall, Goudineau 43. Micaceous orange fabric; red-brown gloss. The rim is rounded; there is a poorly drawn interior groove below the rim. Group 2 fabric. (Not illustrated)

11f. (P1593); RD: 20.0 cm; PH: 1.5 cm; Th: 0.4 cm
Rim and wall, Goudineau 43. Micaceous orange fabric; red-brown gloss. The rim is rounded, as above. Group 2 fabric. (Not illustrated)

11g. (P1595); RD: ?; PH: 3.3 cm; Th: 0.5-0.6 cm
Rim and wall, Goudineau 43. Orange fabric; red-brown slip. The rim is rounded; there is an exterior groove under the edge of the rim. Group 2 fabric. (Not illustrated)

11h. (P2082); RD: 17.0 cm; PH: 2.6 cm; Th: 0.5 cm
Rim and wall, Goudineau 43. Orange fabric with sparse, fine white inclusions; red-brown slip. There is a groove interior below the rim and a fine ridge on the wall just above the break. Group 2 fabric. (Not illustrated)

111. (P3573); RD: 17.0 cm; PH: 1.5 cm; Th: 0.4-0.45 cm
Rim and wall, Goudineau 43. Fine pink buff fabric; good red-brown gloss. There is a groove exterior under the rim. Group 1a fabric. (Not illustrated)

111. (P3676); RD: 18.0 cm; PH: 3.4 cm; Th: 0.35-0.4 cm
Rim and wall, Goudineau 43. Rosy pink fine fabric; good red-brown slip. The wall is rather steep. Below the rim there are interior and exterior grooves. Group 1 fabric. (Not illustrated)

111k. (P3706); RD: 19.0 cm; PH: 2.0 cm; TH: 0.3-0.4 cm
Rim and wall, Goudineau 43. Pink buff fine fabric; good red-brown gloss. Below the rim there are interior and exterior grooves. Group 1a fabric. (Not illustrated)

111. (P6513); RD: 15.0 cm; PH: 2.5 cm; Th: 0.4-0.5 cm
Rim and wall, Goudineau 43. Rosy pink fine fabric with very sparse minute inclusions; very worn red-brown gloss. The rim is slightly triangular. Group 1 fabric. (Not illustrated)

## Hayes Form 20

An uncommon cup/bowl form, related to Haltern Type 15, characterized by a convex moulding bounded by grooves half way up the wall. There is a single example from Haltern (Haltern II, pl. IV, 10 and XII, 5). See also Goudineau, p. 226, C2-A-60. The form is not represented at Ordona or

Pompeii; there are two examples of Haltern Type 15 from Monte Irsi. Hayes suggests a date of c. 10-45 A.D. Two examples.

12a. (P5229); RD: 10.0 cm; PH: 3.9 cm; Th: 0.2-0.4 cm
Rim and wall, Hayes 20. Light orange buff fabric with sparse white inclusions; red-brown slip. Group 3 fabric. (Fig. 8)

12b. (P8012); RD: 7.9 cm; PH: 2.3 cm; Th: 0.3 cm
Rim and wall, Hayes form 20. Orange, micaceous fabric; red-brown slip, worn at rim. Group 2 fabric. (Not illustrated)

Dragendorff Type 4

Cup with a vertical wall with exterior grooves about half way down the wall; the lip may be rounded or everted; a rounded moulding is used instead of a footstand. This is the forerunner of Dragendorff Types 22 and 23 in Gaulish sigillata. For the form, see also Oswald and Pryce (p. 188, pl. L, 1). The form occurs in the Tiberian period at Aislingen with an in planta pedis stamp ("GELI") and also at Colchester. The form is not common in central or southern Italy; there are three examples of Dragendorff Type 22 at Pompeii. A similar form, with only rim and wall preserved, occurs at Posto, Francolise, in presumed Arretine fabric (p. 123, fig. 33, 20) and is dated to the Claudian-Neronian period. See also a similar example, with only rim and part of the wall preserved, at Ordona (pl. LX, 458). Suggested date: Tiberian and later. Four examples.

13a. (P8000); RD: 7.2 cm; PH: 2.8 cm; Th: 0.2-0.4 cm; BD: 5.9 cm
Rim, wall and base, Dragendorff Type 4. Light yellow buff fabric; thin orange red slip with sepia black thicker patches. The end of an in planta pedis stamp is visible on the floor. Group 3 fabric. (Fig. 8)

13b. (P6599); RD: 8.5 cm; PH: 3.0 cm; Th: 0.3 cm; BD: 7.5 cm
Rim, wall and base, Dragendorff Type 4. Rosy pink fine fabric; red-brown slip, somewhat mottled. There is a well defined groove at the base floor and tiny steps/ridges at the outer edge of the rim. Group 1 fabric. (Not illustrated)

13c. (P6596); RD: 8.0 cm; PH: 2.2 cm; Th: 0.3 cm
Rim and wall, Dragendorff Type 4. Rosy pink fine fabric; good red-brown gloss. Group 1 fabric. (Not illustrated)

13d. (P7205) RD: 8.0 cm; PH: 1.8 cm; Th: 0.25-0.30 cm
Rim and wall, Dragendorff Type 4. Pink buff fine fabric; worn red-brown slip. Group 1a fabric. (Not illustrated)

## Hemispherical Cup

A small hemispherical cup with a lipped or everted rim. Pucci identified the form in Pompeii (Tav. 11, 8) and equated it with two cups/bowls from the Antiquarium Communale di Roma described by Comfort (Antioch IV [p. 70, pl. XII, 26-27]). A related example from Bolsena (Goudineau, p. 212, C-2B-111) has a sharper triangular rim and is probably from a bowl with a

steeper wall. There are examples of small, hemispherical bowls from Ordona with similar rim forms (pl. LIX, 427-435) dated to the first half of the first century and later. Variations of the form appear at Monte Irsi (Fig. 35, 293-295; not Haltern 11, as described). The form is represented at Carthage in "Imitation terra sigillata", Hayes Form 10. Suggested date: Tiberian and later. Twelve examples.

14a. (P3538); RD: 9.0 cm; PH: 4.2 cm; Th: 0.25-0.4 cm; BD: 4.0 cm
Rim to foot of a small bowl, form as above with a triangular lipped rim. Fine light orange fabric; unusual orange slip which is mottled toward the base. There is a miniature in planta pedis stamp form on the floor. Group 3 fabric. (Fig. 9)

14b. (P7164); RD: 7.2 cm; PH: 3.5 cm; Th: 0.3-0.35 cm; BD: 3.5 cm
Rim to foot of a small hemispherical bowl, form as above; the rounded rim is not defined. Light orange fine fabric with sparse inclusions; mottled red-brown slip. There is a groove around the the interior of the lower wall. There is an in planta pedis stamp in the form of a sandal preserved on the floor, which may be read as V VE or possibly C V V. The reading is not convincing; Oxe-Comfort 2166 is not a close parallel. Group 2 fabric. (Fig. 10)

14c. (P0590); RD: 7.0 cm; PH: 1.6 cm; Th: 0.2-0.25 cm
Rim and wall of a cup, form as above; horizontal rounded rim. Micaceous orange fabric; very worn red-brown gloss. Group 2 fabric. (Not illustrated)

14d. (P1645); RD: 10.0 cm; PH: 1.2 cm; Th: 0.4 cm
Rim and wall of a cup, form as above; triangular rim. Orange fabric; red-brown gloss. Group 2 fabric. (Not illustrated)

14e. (P3013); RD: 9.0 cm; PH: 1.5 cm; Th: 0.25-0.3 cm
Rim and wall of a cup, form as above; triangular rim. Micaceous orange fabric with sparse fine inclusions; red-brown slip. Group 2 fabric. (Not illustrated)

14f. (P3384); RD: 12.0 cm; PH: 2.8 cm; Th: 0.3 cm
Rim and wall of a cup, form as above, triangular rim. Dark orange fabric with sparse inclusions; red-brown slip, slightly worn. Group 2 fabric. (Not illustrated)

14g. (P3790); RD: 10.0 cm; PH: 2.4 cm; Th: 0.2 cm
Rim and wall of a cup, form as above, with a horizontal flared rim. Micaceous orange fabric; exterior surface very worn, trace of red gloss visible under the rim. Group 2 fabric. (Not illustrated)

14h. (P3792); RD: 8.0 cm; PH: 1.7 cm; Th: 0.25-0.3 cm
Rim and wall of a cup, form as above, rounded rim. Orange micaceous fabric with sparse white inclusions; unusual red-orange slip, worn over rim. Group 2 fabric. (Not illustrated)

14i. (P3865); RD: ?; PH: 0.9 cm; Th: 0.2 cm

Triangular rim of a small hemispherical cup. Micaceous orange fabric; thin, worn red-brown gloss. Group 2 fabric. (Not illustrated)

14j. (P6360); RD: 8.0 cm; PH: 2.0 cm; Th: 0.2-0.3 cm

Rim and wall of a hemispherical cup. Orange fabric; good red-brown slip. The rim is horizontal. Group 2 fabric. (Not illustrated)

14k. (P6469); RD: 9.0 cm; PH: 2.3 cm; Th: 0.2-0.25 cm

Rim and wall of a hemispherical cup. Fine orange fabric; red-brown slip. The rim is triangular. Group 2 fabric. (Not illustrated)

14l. (P7252); RD: 9.0 cm; PH: 1.3 cm; Th: 0.2-0.3 cm

Rim and wall of a hemisherical cup. Soft orange, micaceous fabric; red-brown gloss. The rim is slightly rounded and flared. Group 2 fabric. (Not illustrated)

## Rectangular Stamps

15a. (P0600); Th: 0.5 cm

Small fragment of a base sherd with a partially preserved rectangular stamp surrounded by an incised circle. Rosy tan fine fabric; shiny red-brown gloss. The stamp reads T.R/RV IO. This is a stamp of T. Rufrenus Rufio of Arezzo; see Oxe-Comfort, 1599-1606. The CVAr records a radial stamp, 1601 (k) and several in planta pedis stamps, 1599, 1603, 1604, suggesting a long period of activity. Stamps of this potter are

attested in Italy, France, Spain and Germany. There are two examples from Bolsena (192: no. 69 and 159: no. 38), one of which occurs on a Goudineau Type 24. This cup form appears c. 12-10 B.C. at Bolsena. The example from San Giovanni can be dated c. 10 B.C.-10 A.D. Group 1 fabric. (Fig. 10)

15b. (P3133); Th: 0.6 cm

Small fragment of a base sherd with a rectangular stamp, almost fully preserved. Rosy tan fine fabric; shiny dark red-brwon gloss. The stamp reads —TTI/OPTATI. This is a stamp of Vettius Optatus, Oxe-Comfort 2270. Oxe-Comfort 2270(b) is almost identical, except the dividing shaft is reversed. Stamp 2270(b) was on a platter with a square foot profile, possibly a Haltern Form 3. Stamps of this potter are represented in collections at Fiesole, Rome, Lanuvio, Tortona and Aquileia. The lettering is very elegant, as in good Imperial inscriptions, suggesting an Augustan date. Group 1 fabric. (Figure 10)

15c. (P8014); Th: 0.4 cm

Base sherd with the trace of a rectangular stamp preserved. Rosy fine fabric; good red-brown gloss, very worn exterior. Group 1 fabric. (Not illustrated)

15d. (P6600); PH: 1.2 cm; TH: 0.15-0.25 cm; BD: 6.0 cm

Foot and base of a small cup with the trace of a rectangular stamp preserved. Dark rose fabric; worn red-brown slip. Group 1 fabric. (Not illustrated)

Stamps in planta pedis

16a. (P0167); Th:0.5 cm

Base sherd with a partially preserved in planta pedis stamp. Rosy tan fine fabric; good red-brown gloss interior, exterior reserved. The letters ME, ligatured, are preserved in the heel of the stamp. This is probably a stamp of Memmius, Oxe-Comfort 984. The stamp is particularly interesting because of the in planta pedis form. Comfort (1943: 320) notes that Memmius' stamps are usually in quadrato and that the in planta pedis examples regularly include his praenominal C. Comfort concludes that Memmius was essentially an Augustan potter and that the example from Minturnae in planta pedis (320: 27, -EM) should be dated to early in the principate of Tiberius. There is one example of an in planta pedis stamp, probably M(EM), from Bolsena (Goudineau, p. 193, 83). This example can probably be dated to c. 15-20 A.D. Group 1 fabric. (Fig 10)

16b. (P3791); Th: 0.35-0.4 cm

Fragment of a base sherd with a meaningless in planta pedis stamp preserved. Rather fine orange fabric; worn red-brown slip. Oxe-Comfort records several meaningless in planta pedis stamps (2595, 2596, 2597). Group 2 fabric. (Fig. 11)

16c. (P1250); Th: 0.4-0.5 cm

Fragment of a base with a partially preserved in planta pedis stamp. Light orange buff fabric; red-brown slip. Characters illegible, probably meaningless. Group 3 fabric. (Fig. 11)

16d. (P3643); Th: 0.5 cm; BD: 6.0 cm

Foot ring base of a small cup with a meaningless in planta pedis stamp. Rosy pink fine fabric; red-brown slip, slightly mottled. There is a groove on the interior wall of the cup, similar to P7164, Cat. 13b. Group 1 fabric. (Fig. 11)

16e. (P3099); Th: 0.35-0.4 cm; BD: c. 6.0 cm

Base sherd with an in planta pedis stamp. Light orange fabric with sparse fine inclusions; red-brown slip. Only the toes of the stamp are preserved. There are two sets of grooves on the interior floor. Group 2 fabric. (Not illustrated)

16f. (P6654); PH: 1.2 cm; Th: 0.25-0.4 cm; BD: 5.5 cm

Foot and base sherd of a small cup with the toes of an in planta pedis stamp preserved. Pink buff fine fabric; thin red-brown slip, slightly mottled. Group 1a fabric. (Not illustrated)

## Graffiti

17a. (P6111); PH: 1.3 cm; Th: 0.2-0.3 cm; BD: 3.5 cm

Base of a small cup with the heel of an in planta pedis stamp preserved. A graffito is scratched on the bottom of the base. Dull rose fine fabric; good red-brown slip. Group 1 fabric. (Fig. 11)

Unfamiliar Forms

18a. (P0651); RD: 9.0 cm; PH: 1.8 cm; Th: 0.3 cm

Rim and wall of a small cup with a hori[illegible]niced" rim, toothed at the top of the rim. The wall is vertical. Soft orange fabric; red brown gloss. Group 2 fabric. (Fig 12)

19a. (P3469); RD: 7.0 cm; PH: 1.1 cm; Th: 0.2-0.3 cm

Rim and wall of a small cup with rouletting on the exterior wall. Rim slightly everted. This form may be related to Haltern Type 8. Pale buff fabric; very shiny red-brown gloss. Group 3 fabric. (Fig. 12)

20a. (P1036); RD: 19.0 cm; PH: 1.3 cm; Th: 0.4 cm

Rim and wall of a plate/dish with a slightly flared rim; beneath, a deeply incised groove; a field of fine rouletting below. Light orange buff fabric; good red-brown gloss. Group 3 fabric. (Fig. 13)

21a. (P8010); RD: 18.5 cm; PH: 2.1 cm; Th: 0.4 cm

Rim and wall of a plate/dish; bevelled, everted rim; vertical wall. The wall is insufficiently preserved to allow a secure identification; it may be a variant of Goudineau Type 43. Soft orange micaceous fabric; unusual red-orange slip. Group 2 fabric. (Fig. 13)

Bases

In addition to the pieces outlined above, seventeen bases of platters and cups of indeterminate form were recovered. Eight belong to large plates/platters, four to small plates and five to cups or bowls.

## Summary of Forms

| Date | Form | Arretine | Other | Total |
|---|---|---|---|---|
| 20 B.C.-15 A.D. | Haltern 1 | | 2 | 2 |
| 10 B.C.-30 A.D. | Haltern 2 | 2 | 5 | 7 |
| 20-40 A.D. | Hayes 7 | 1 | 1 | 2 |
| 35 A.D. + | Hayes 12/Goudineau 39b,c | 7 | 8 | 15 |
| 10 B.C.-5 A.D. | Goudineau 29b | 1 | | 1 |
| 10-60 A.D. | Haltern 3 | 1 | | 1 |
| 5/15-65 A.D. + | Goudineau 30 | 3 | 3 | 6 |
| First 1/2 I A.D. | Goudineau 32b | | 1 | 1 |
| First 1/4 I A.D. | Goudineau 36 | 1 | 2 | 3 |
| Second 1/4 I A.D. | Hayes 21/Goudineau 38a | | 2 | 2 |
| Mid I A.D. + | Hayes 24/Goudineau 38b | 6 | 4 | 10 |
| 20 A.D. + | Goudineau 41b | 1 | | 1 |
| 25 A.D. + | Goudineau 43 | 6 | 6 | 12 |
| 10-45 A.D. + | Hayes 20 | | 2 | 2 |
| Tiberian + | Dragendorff 4 | 3 | 1 | 4 |
| Tiberian + | Hemispherical Cup | | 12 | 12 |
| Augustan | Rectangular Stamp | 4 | | 4 |
| Tiberian + | In planta pedis stamp | 3 | 3 | 6 |
| | Unfamiliar | | 4 | 4 |
| | Bases | 8 | 9 | 17 |
| | | 47 | 65 | 112 |

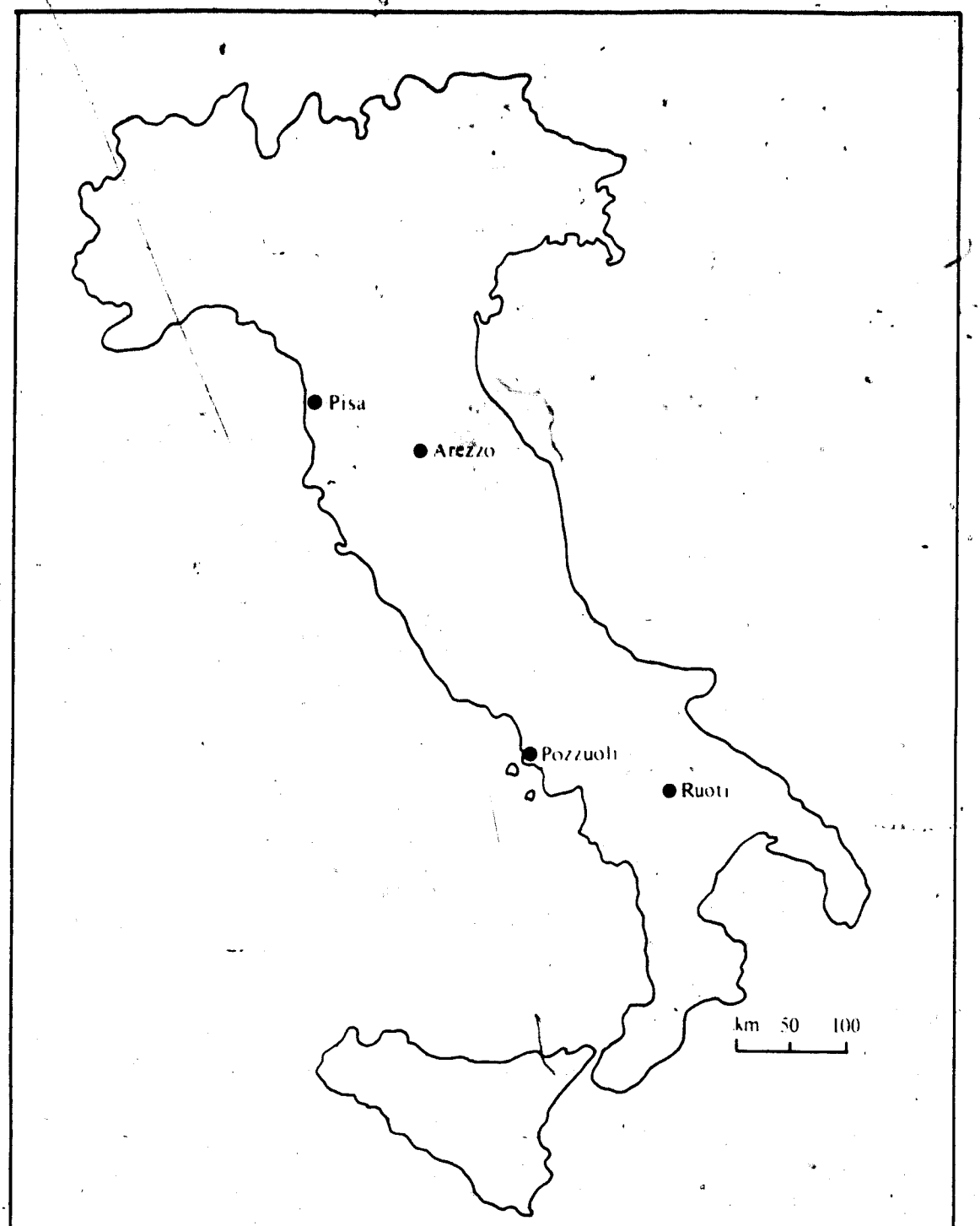



Figure 1. San Giovanni di Ruoti in relation to major centres of Italian Terra Sigillata production.

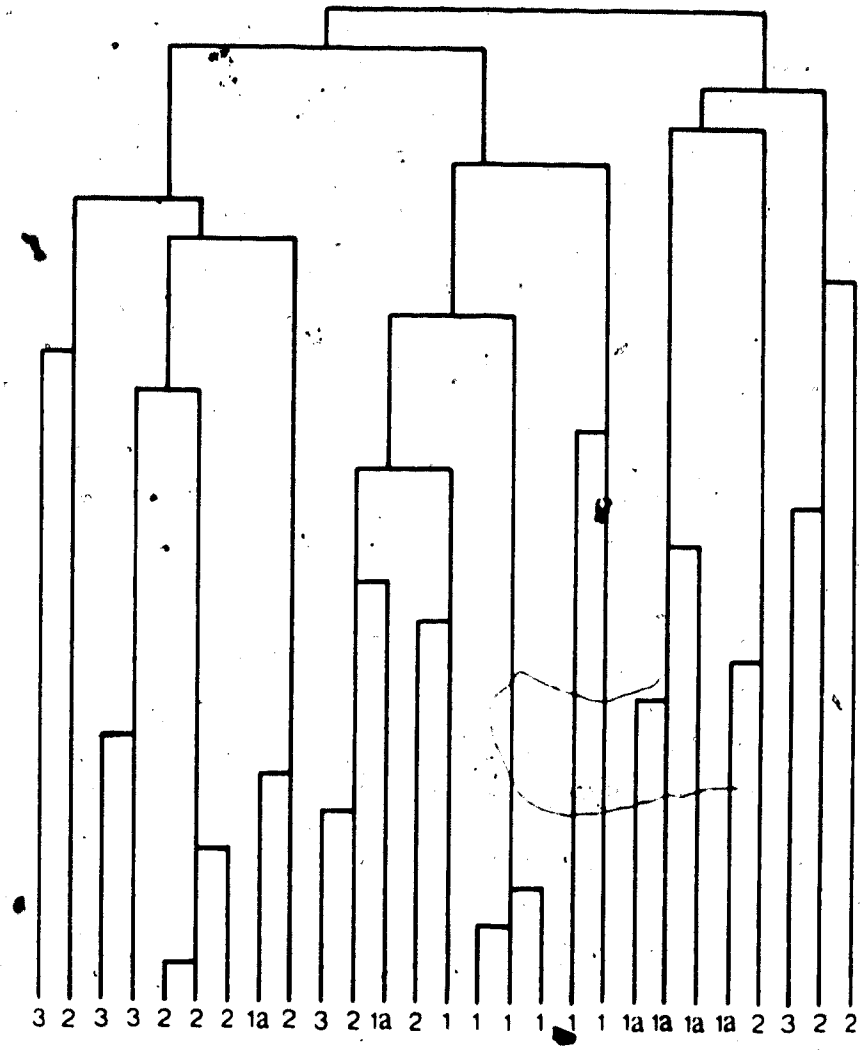



Figure 2. Hierarchical cluster of visually defined groups.

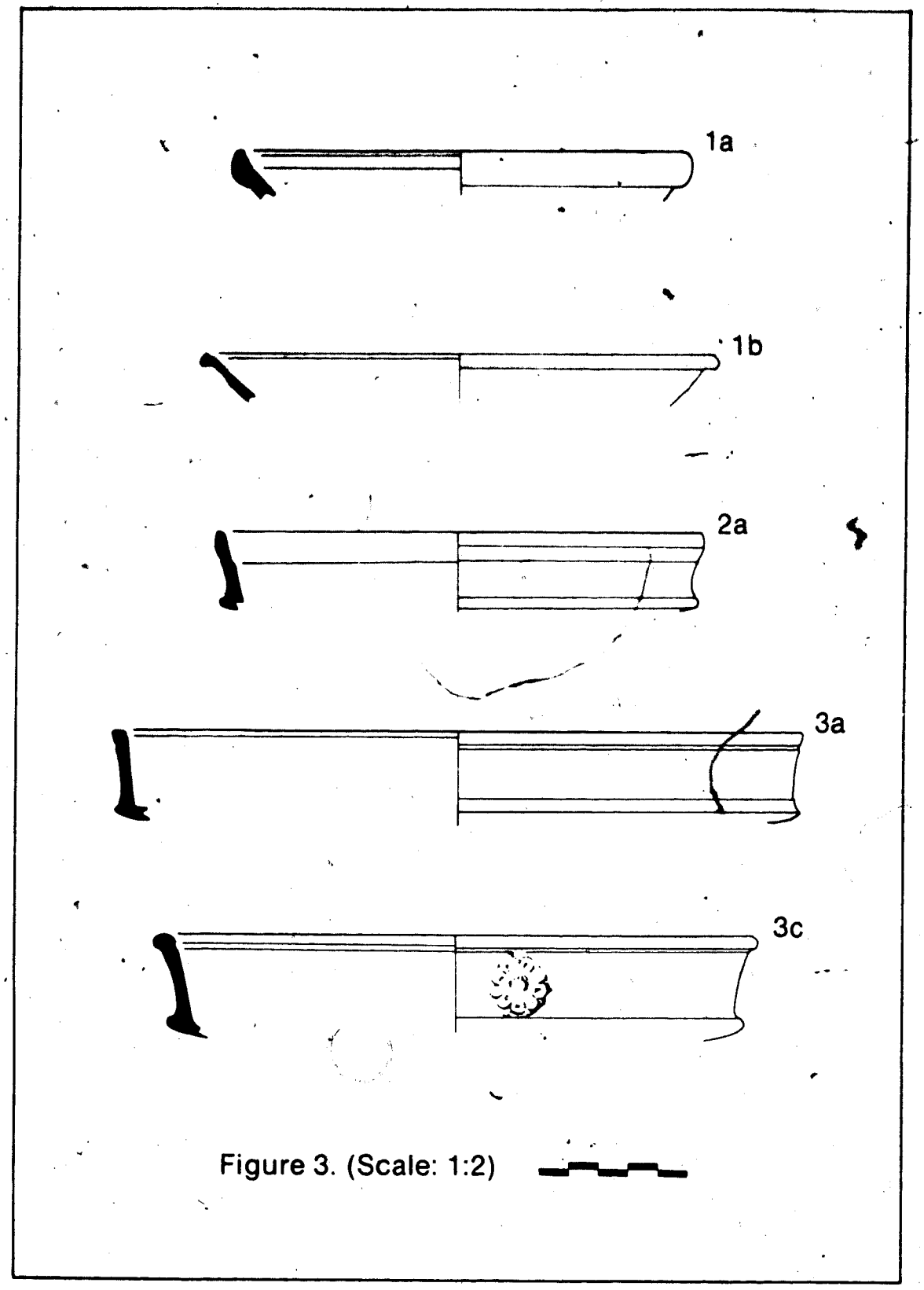
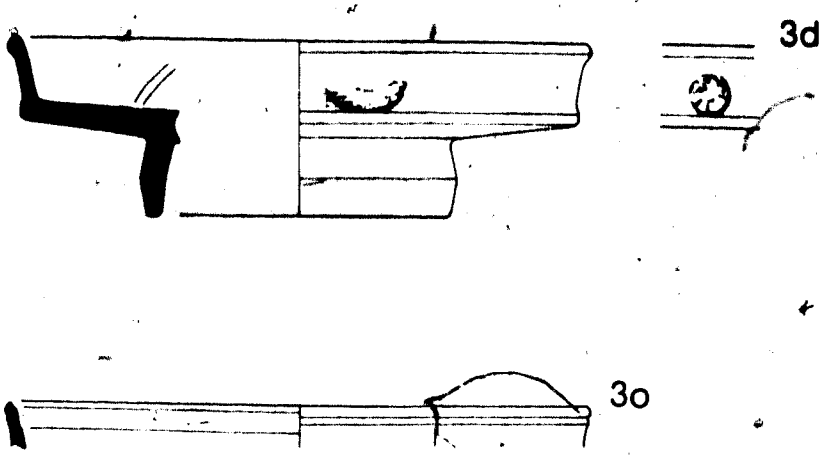



Figure 3. (Scale: 1:2)

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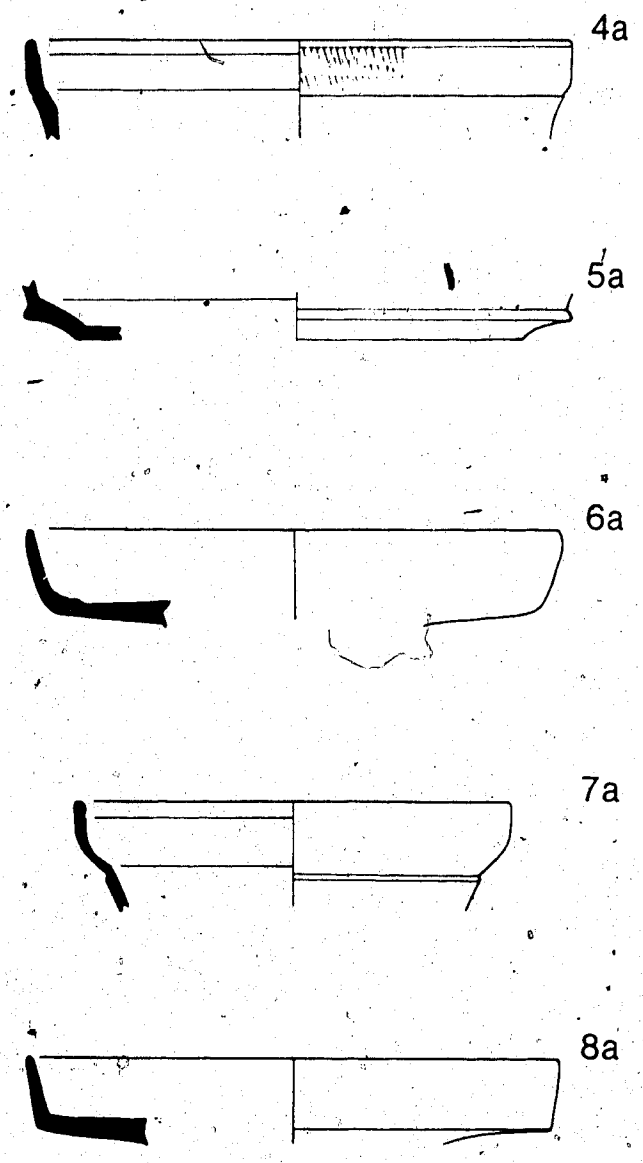
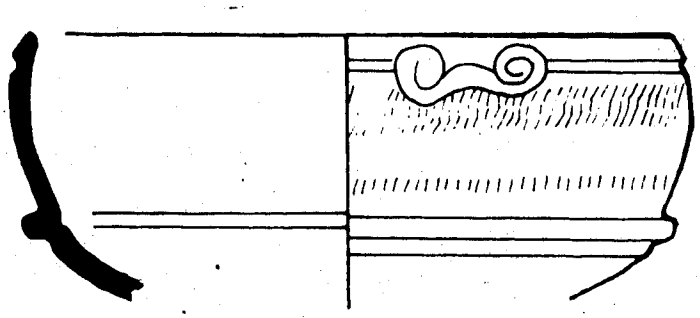
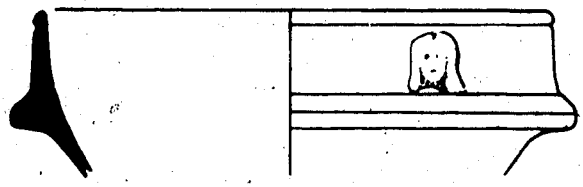



Figure 5. (Scale: 1:2)



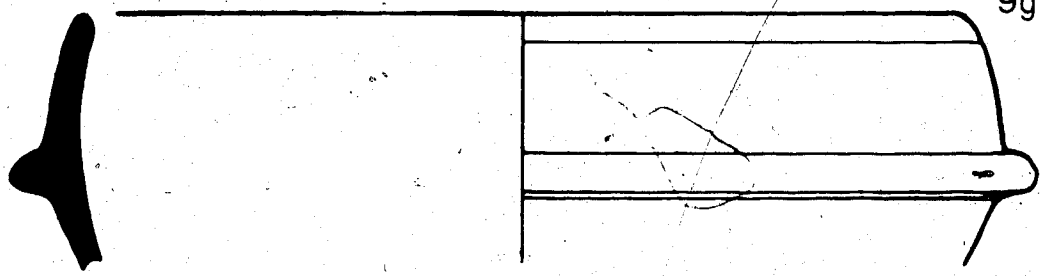




Figure 6. (Scale: 1:1)

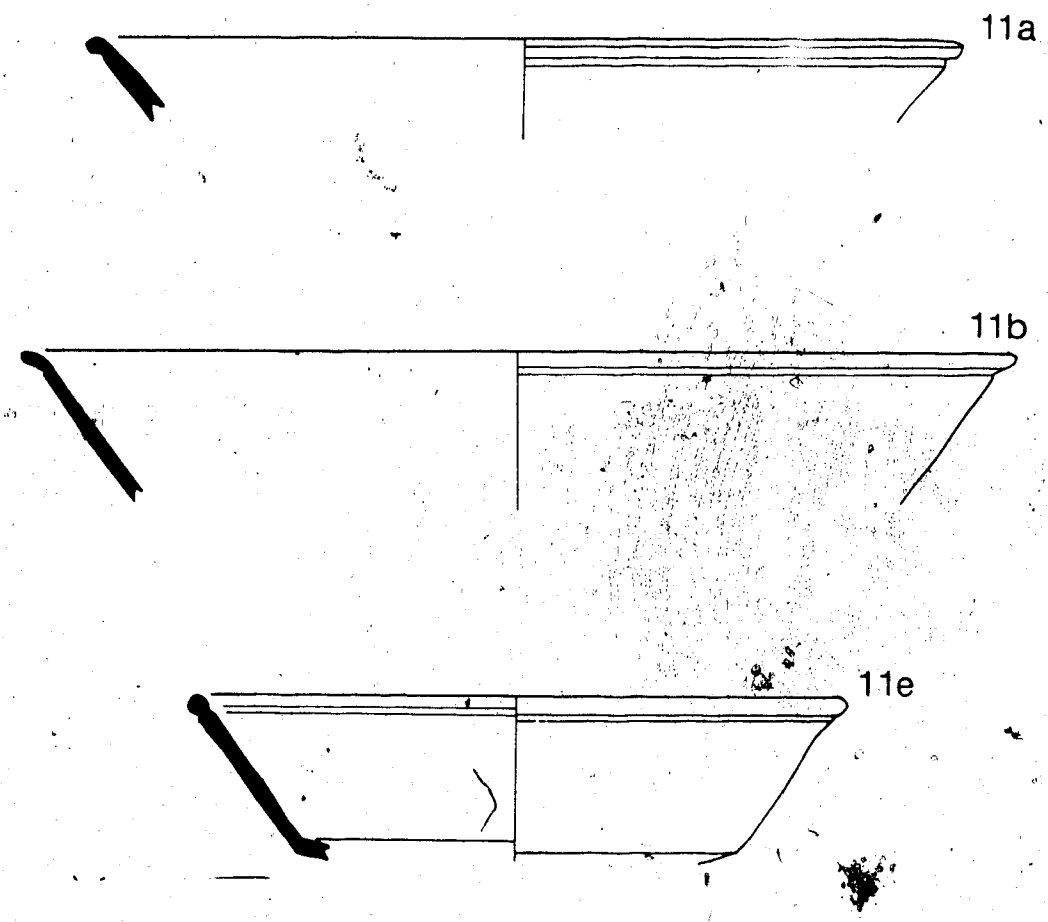
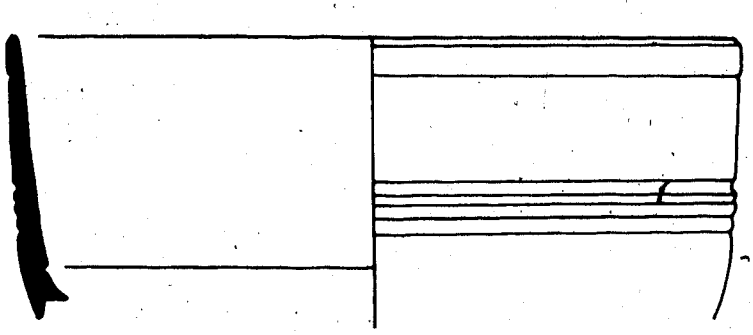
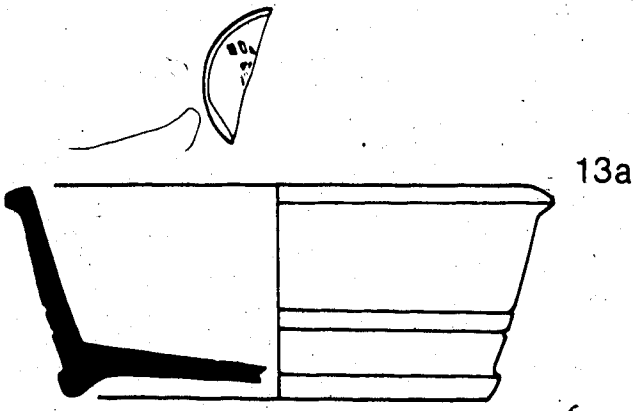



Figure 7. (Scale: 1:2)

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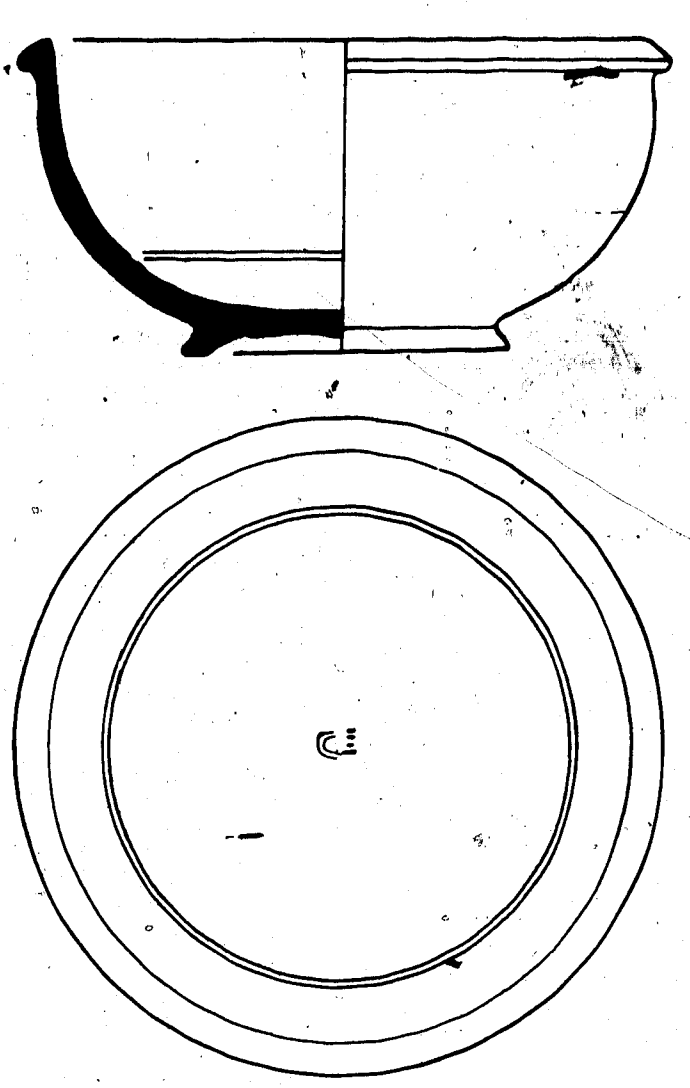



Figure 9. (Scale: 1:1)

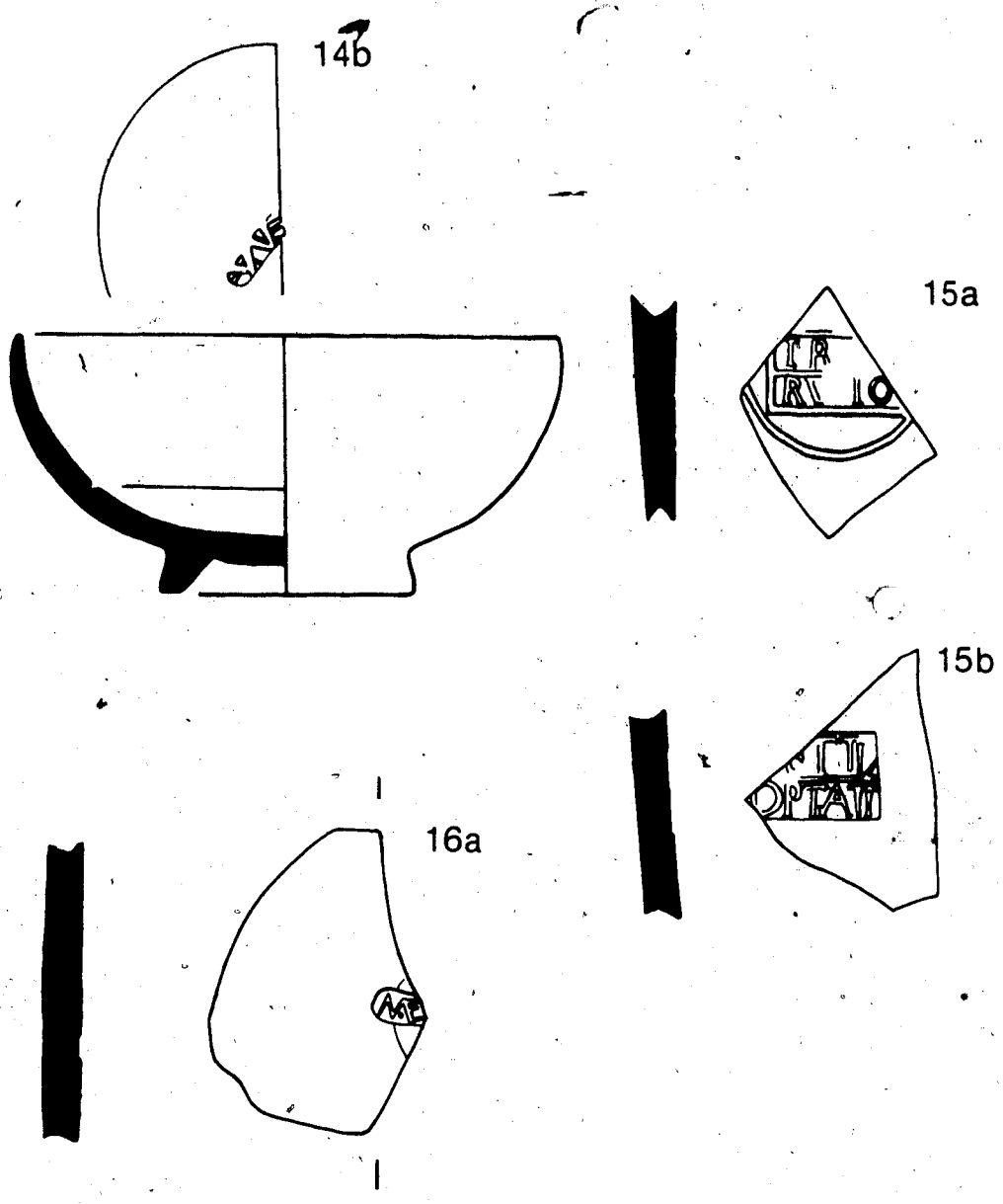
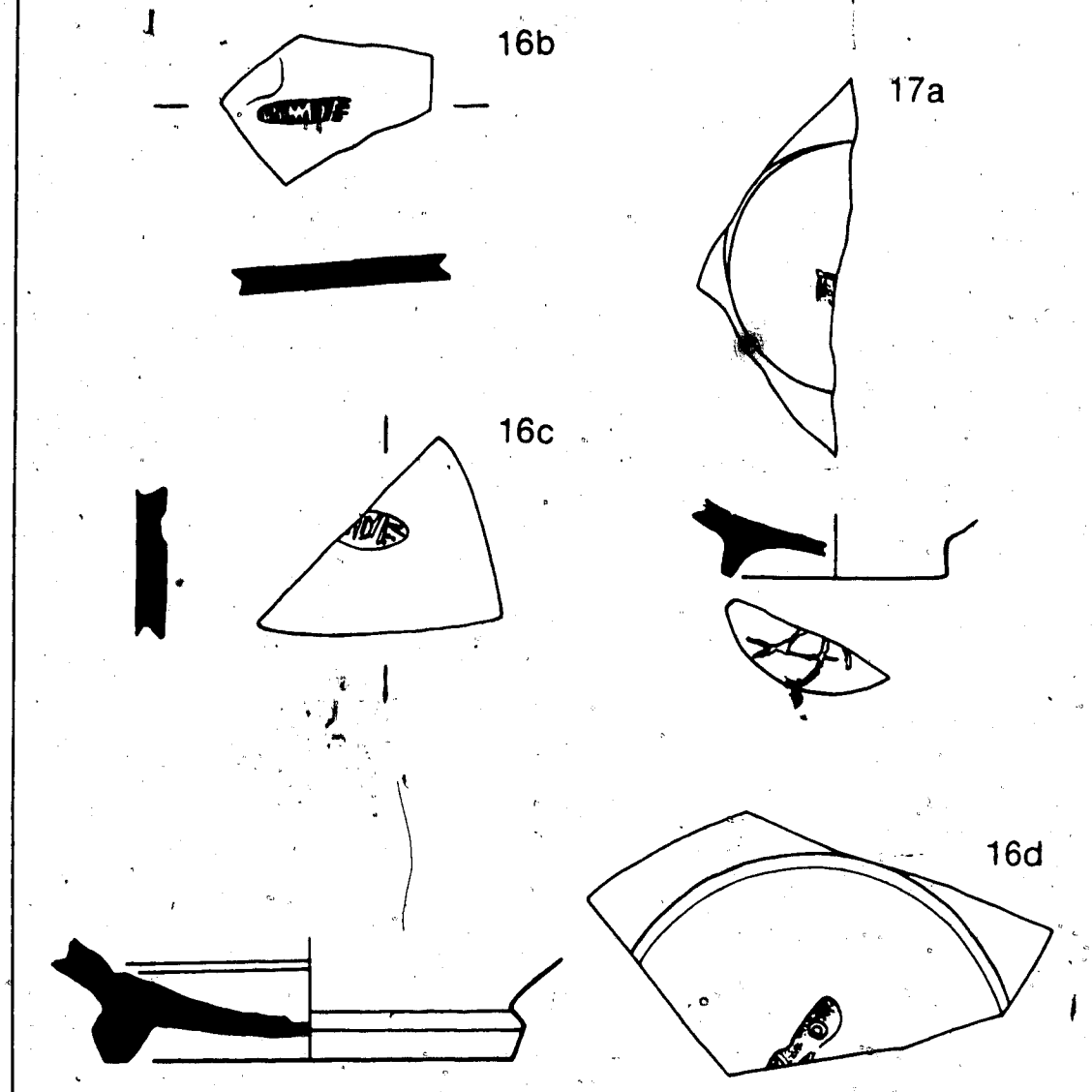



Figure 10. (Scale: 1:1)

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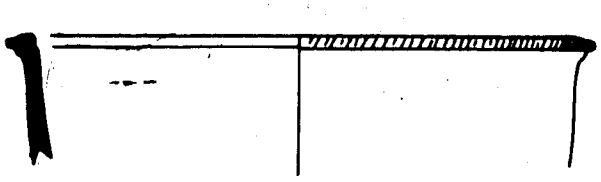
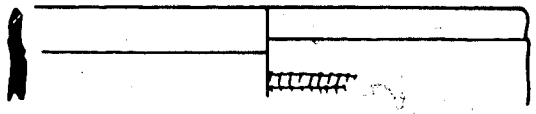


18a



19a

Figure 12. (Scale: 1:1)

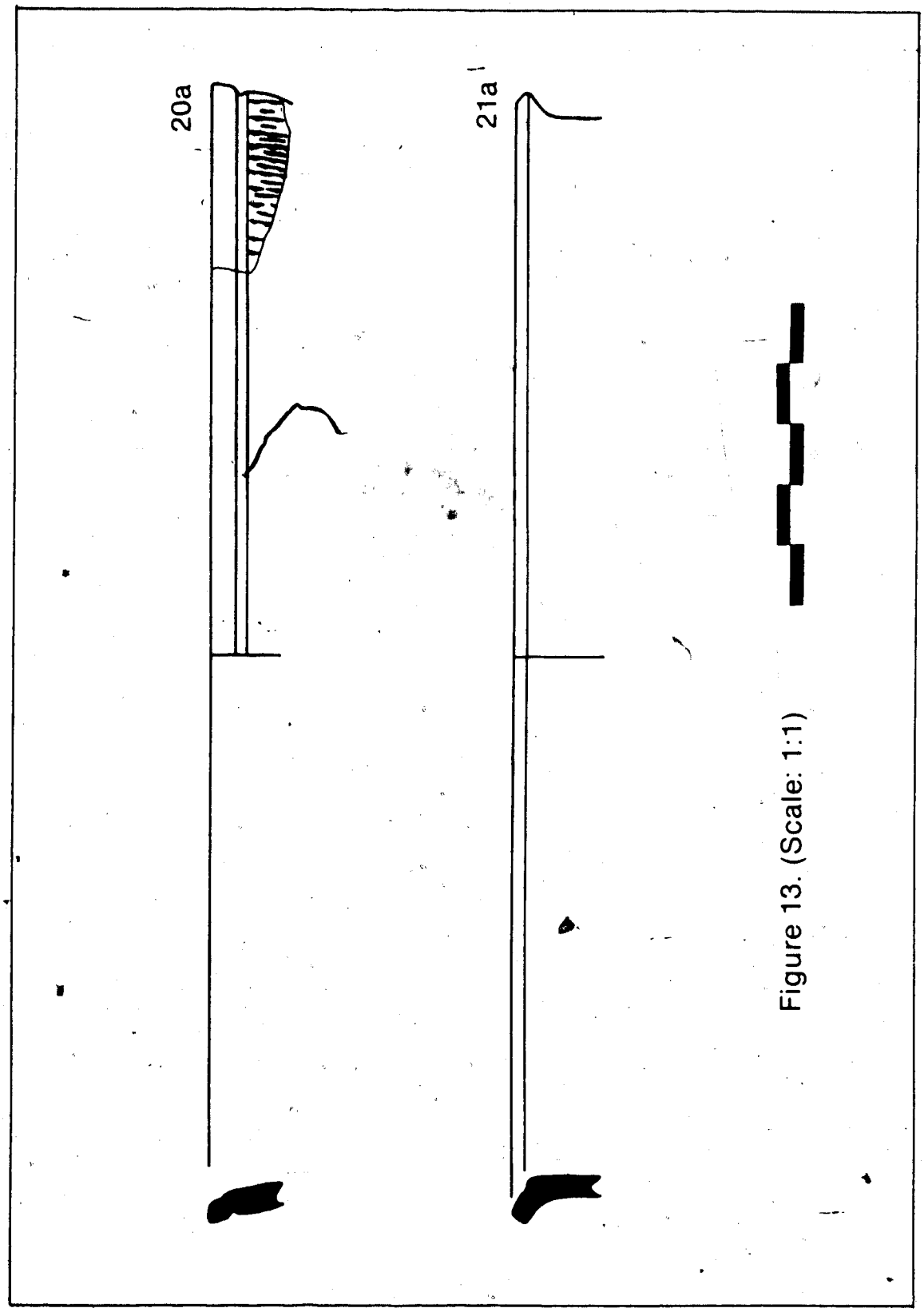



Figure 13. (Scale: 1:1)