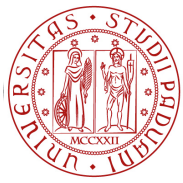


UNIVERSITÀ
DEGLI STUDI
DI PADOVA

Sede Amministrativa: Università degli Studi di Padova

Dipartimento dei Beni Culturali: Archeologia, Storia dell'Arte, del Cinema e della Musica.

SCUOLA DI DOTTORATO DI RICERCA IN: Studio e Conservazione dei Beni Archeologici e Architettonici

CICLO: XXVII

DATING DEPOSITS IN CLASSICAL CITIES: THEORY, METHODS AND CASE STUDIES

Direttore della Scuola: Ch.mo Prof. Giuseppe Salemi

Supervisore: Ch.mo Prof. Jacopo Bonetto

Dottorando: Guido Furlan

❖ Abstract ❖

Focalizzandosi sui centri urbani di età classica, la tesi discute il tema della datazione dei depositi archeologici attraverso lo studio dei manufatti in essi contenuti. Nonostante si tratti di un'attività fondamentale e costantemente svolta nelle attività di post scavo, è altrettanto evidente come sia ancora scarsamente strutturata dal punto di vista teorico e metodologico. La tesi presenta pertanto una revisione dei principali strumenti concettuali impiegati nel campo della datazione dei depositi archeologici e propone una serie di strumenti metodologici, di analisi e di confronto, che possono essere impiegati. Segue una proposta di classificazione dei depositi archeologici in base al loro potenziale informativo in termini di datazione, corredata da casi studio esemplificativi. Infine, la tesi propone un vero e proprio metodo di lavoro da applicare nel corso delle operazioni che vanno dallo scavo all'edizione dei dati.

Focusing on classical urban centres, the thesis discusses the topic of dating archaeological deposits through the study of the embedded assemblages. Although this represents a fundamental activity, routinely carried out after the fieldwork, it is still clearly poorly strucutred both from a theoretical perspective and from a methodological one. Hence, the work proposes a review of the main concepts involved in the issue of dating deposits and proposes analytical and comparative tools to be employed. It follows a taxonomy of archaeological deposits, based on their very informative potential for dating purposes and equipped with case studies. Eventually, the thesis proposes a structured working method, which goes from fieldwork to publishing.

Nothing is more wretched than a man who traverses everything in a round, and pries into the things beneath the earth, as the poet says, and seeks by conjecture what is in the minds of his neighbors, without perceiving that it is sufficient to attend to the daemon within him, and to reverence it sincerely.

Marcus Aurelius, Meditations, 2.13

"Data! data! data!" he cried impatiently. "I can't make bricks without clay."

Sherlock Holmes, The adventure of the copper beeches

❖ PROLOGUE ❖

Between 1974 and 1985 major excavations were carried out by the Royal Ontario Museum at the Maya site of Lamanai, in northern Belize[1]. Right in front of the 16th century Spanish church a mound was cut by several burials; this was provisionally interpreted as the cemetery related to the nearby church. As the building was built on rocky ground, a more ancient Maya mound, embedding materials no older than about 300 AD, was exploited to dig the graves.

Further excavations led to the recovery of two more recent sherds that pushed forward the *terminus post quem* for the formation of the mound at about 1300 AD. No non-Maya objects laid in the mound core.

Eventually, comparisons with the nearby site of Tipu encouraged to reconsider the nature of the mound: this turned out to be the platform of the most ancient church built in the site, which was erected about two and a half centuries later than the diffusion of the two more recent sherds recovered in its foundations.

The excavator admits: " There is no doubt that without the Tipu data the first church would have been recorded as an aberrant Maya structure that saw use as a cemetery in the period of Spanish control"[2].

[1] See in particular PENDERGAST 1981 and PENDERGAST 2005. I wish to thank prof. E. Graham for having let me know this paradigmatic case study from the other end of the world.
[2] PENDERGAST 2005, p. 237

❖ TABLE OF CONTENTS ❖

PART I. *Introduction*

I.1 Introductory remarks p. 3
I.1.1 The subject p. 3
I.1.2 The reasons p. 4
I.1.3 The objectives p. 5
I.1.4 The playing field: what is in, what is out p. 6
I.1.5 Topics connected p. 9
I.1.6 Structure of the thesis p. 9

I.2 Literature review p. 11
I.2.1 The beginnings p. 12
I.2.2 Urban Archaeology p. 15
I.2.3 Behavioural Archaeology: objects p. 23
I.2.4 The study of formation processes in Padova: stratification p. 25
I.2.5 The study of residuals p. 27
I.2.6 Quantitative approaches p. 31
I.2.7 Synthesis and conclusions p. 32

PART II. *Theory*

II.1 Introductory remarks p. 41
II.1.1 Assumptions p. 41
II.1.2 Which theory? p. 44

II.2 Key concepts p. 47
II.2.1 Archaeological context/systemic context/context p. 47
II.2.2 Deposit p. 48
II.2.3 Assemblage p. 51
II.2.4 Primary and secondary p. 53
II.2.5 Residuals and false residuals p. 55
II.2.6 Index fossils/horizons p. 57
II.2.7 'Real time' and 'archaeological time': accuracy p. 57
II.2.8 *Termini post quem, ad quem, ante quem* p. 59
II.2.9 Intrusions and the issue of closed finds/sealed deposits p. 63
II.2.10 *Ex silentio* arguments: evidence of absence or absence of evidence? p. 65
II.2.11 Analogy and its use p. 66
II.2.12 Process p. 67
II.2.13 Model p. 69

PART III. *Method*

III.1 Introductory remarks p. 73

III.2 OSL, TL, mortar dating and direct chronology p. 75
III.3 Dealing with intrusions p. 83

III.4 A quantitative approach p. 91
III.4.1 Introduction p. 91
III.4.2 Minimum number of data and sampling p. 92
III.4.3 Types of artefacts and different dates: the nature of data p. 96
III.4.4 The quantification method p. 104
III.4.5 A formative profile: south formula, aoristic sum, weighted mean sum and Monte Carlo simulation p. 106
III.4.6 Uniform *vs* normal distribution p. 115
III.4.7 A script for R p. 125
III.4.8 The triangular model: an alternative representation of the chronological content p. 128
III.4.9 Conclusions p. 129

III.5 A qualitative approach p. 131
III.5.1 Waste streams, recycling, fragmentation and the dating of deposits p. 131
III.5.2 Other characteristics of the assemblage p. 148
III.5.3 Selection and the intentional addition of materials p. 155
III.5.4 Characteristics of the matrix p. 157

III.6 The contribution of ethnoarchaeology, experimental archaeology and literary sources p. 161
III.6.1 Ethnoarchaeology p. 161
III.6.2 Experimental archaeology p. 191
III.6.3 Literary sources p. 199
III.6.4 Conclusions p. 201

PART IV. *Analysis*

IV.1 The arrangement (a typology for deposits?) p. 205
IV.1.1 Why a typology? p. 205
IV.1.2 What is in and what is out p. 205
IV.1.3 Criteria p. 206
IV.1.4 The scheme proposed p. 209
IV.1.5 Implementability p. 210

IV.2 The main sites p. 211
IV.2.1 Introduction p. 211
IV.2.2 Aquileia p. 212
IV.2.3 Nora p. 219
IV.2.4 Gortyna p. 227

IV.3 Primary deposits with abrupt formation p. 235
IV.3.1 Definition p. 235
IV.3.2 General expectations p. 236
IV.3.3 Dating p. 238
IV.3.4 Formative typology p. 238
IV.3.5 Case study 1: a small hearth within a *taberna* in Aquileia (P.A.2) p. 249
IV.3.6 Case study 2: a drainage with amphorae within an earthwork from Vicenza (P.A.3) p. 256
IV.3.7 Case study 3: a small dump in an ancient *atrium* from Aquileia (P.A.4) p. 262

IV.3.8 Case study 4: *in situ* burnt amphora and content from Aquileia (P.A.5) p. 269
IV.3.9 Case study 5: an *in situ* assemblage beneath collapse debris: the case of the Pythion Theatre in Gortyna(P.A.6) p. 272
IV.3.10 Case study 6: a layer of charcoal from the *domus* of *Titus Macer*, Aquileia (P.A.7) p. 278

IV.4 Primary deposits with continuous formation p. 283
IV.4.1 Definition p. 283
IV.4.2 General expectations p. 284
IV.4.3 Dating p. 285
IV.4.4 Formative typology p. 285
IV.4.5 Case study 1: Mons Claudianus south sebakh (P.C.1) p. 291
IV.4.6 Case study 2: drain culvert fillings from fondi ex-Cossar, Aquileia (P.C.2) p. 300

IV.5 Mixed deposits p. 307
IV.5.1 Definition p. 307
IV.5.2 General expectations p. 308
IV.5.3 Dating p. 309
IV.5.4 Formative typology p. 309
IV.5.5 Case study 1: an earthen and pebbles ploor from the Auditorium Villa (M.B.1) p. 311

IV.6 Secondary deposits p. 319
IV.6.1 Definition p. 319
IV.6.2 General expectations p. 321
IV.6.3 Dating p. 323
IV.6.4 Formative typology p. 323
IV.6.5 Case study 1: a robber trench in the House of Titus Macer, Aquileia (S.1) p. 331
IV.6.6 Case study 2: the backfill of the foundation trenches of the forum temple, Nora (S.2) p. 335
IV.6.7 Case study 3: the construction of the forum basilica of Nora (S.3) p. 341
IV.6.8 Case study 4: the construction of a paved road in Aquileia (S.3) p. 347

IV.7 Other deposits p. 355
IV.7.1 General observations p. 355
IV.7.2 Case study 1: the mortar floor of the Pythion theatre orchestra, Gortyna (O.1) p. 357

PART V. *Synthesis and conclusions*

V.1 Towards a working method p. 363
V.1.1 Introduction p. 363
V.1.2 Before the excavation p. 363
V.1.3 During the excavation p. 364
V.1.4 After the excavation p. 367
V.1.5 Publication p. 373

V.2 Conclusions p. 375
V.2.1 What before? How we currently deal with dating p. 375
V.2.2 What's new? The results p. 378
V.2.3 Five keay ideas p. 383
V.2.4 Critical points and deficiencies p. 384

V.2.5 Perspectives: what's next p. 386
V.2.6 Epilogue p. 387

V.3 Glossary p. 389

V.4 References p. 393

PART I

INTRODUCTION

❖ INTRODUCTORY REMARKS ❖

I.1.1 THE SUBJECT

The subject of the present work may appear, at first sight, both simple and evanescent. One may also ask if the topic really deserves some research as it may seem some obvious; conversely, beacause of its intrinsic vastness, one may also wonder if it is too ambitious or challenging. I can simply reply that it is, whether we like it or not, a necessity.

How do we date strata? The topic of this dissertation can be condensed in this question.

Indeed dating strata is one of the most common activities (if not the most) routinely carried out by archaeologists (and that is why challenging the topic may appear useless or excessively ambitious. - why should someone tell the archaeologists how to do what they already do so often? -); in particular it represents the core of post excavation analyses and it involves the crucial passage from a relative chronology to an absolute one. Dating is, ultimately, a necessary passage for moving (or trying to move) from excavation to history (indeed it is an inescapable factor to be considered also in an anthropological perspective[3]). That is because dating strata means dating the actions and processes by which they have been produced and formed; in other words behind sediments there are actions, whether they are natural or antropic, whether they involve transport or modification, bringing in or removal.

Actually the complexity and vastness of the topic do not long in appearing. The latin expressions *terminus post quem* or *terminu ante quem* immediately remind us that dating does not mean only and simply 'when?', but also 'after which moment?' or 'before which period?'; 'how long did it take?' may as well be added to the list.

Beside this, again, how do we date strata? Apart from some scientific techniques for direct dating, which will be briefly tackled in Chapter III.2, the most common answer which may well be provided by everyone who has to deal with field archaeology would be: 'we date a layer through the materials recovered within it'.

[3] See MUNN 1992 for an overview and for several further references

That is right of course. Today as from the very beginnings of archaeology artefacts (in particular) are the most important mean of dating. Nonetheless it is also obvious that this answer, by itself, is not enough.

Indeed this statement yield a second question, apparently some rarer: 'how did the materials turned out to be embedded within the layer where they have been recovered?'[4].

This is a crucial point and large part of this work will deal with it. I strongly argue that if we do not try to know how the materials we use to date the layer were eventually embedded within it, we cannot truly date the layer itself, besides, possibly, through a mere *terminus post quem*.

So the present work, at the sharp end, concerns primarily time and formation processes.

I.1.2 The reasons

The reasons of the research are both personal and scientific[5]. Before turning to the much more important scientific ones, I would like to briefly sum up the personal ones.

I already tackled the topic of dating deposits, very roughly, in my MA thesis, some 5 years ago. At the beginning, the topic should have been limited to the study residuality, its meaning, limits and potentialities. Anyway soon it was clear that it was almost impossible to fully tackle the issue by itself, as it was inextricably linked with a wide range of other topics. Thus the subject gradually moved to dating as a whole. The idea of dealing with such a prickly matter originated from the countless discussions I had in the field and attending post-ex activities mainly with my tutor prof. J. Bonetto and my co-tutor dott. A. R. Ghiotto. In particular, the excavations carried out at the forum of Nora had just been published and we all had the impression that there was still much more which could have been squeezed out from the data collected. One of the problems was how and that meant issues of theory and methodology.

Here the scientific reasons of the past and present study arise: dealing with materials in post excavation, particularly for dating issues, soon appeared to be all but codified. Methodological issues were tackled in bits and spread over a potentially huge quantity of references. On the other hand, a large part of excavation reports or complete publishings

[4] Fundamental in this sense, particularly for the questions it puts, is Berry 1999

[5] Of course supposing that archaeology was a science. Fundamental considerasions in the classic Popper 1972.

dramatically missed (and unfortunately still miss) in presenting completely the data or the way in which they have been employed in order to provide the dates presented.

So the scientific reasons of such a research can be identified in the incredible lack of coherent and organic theoretical and methodological systematization which should lie behind such an important and common activity such as dating deposits. I do not want to minimize what have already been written on the topic: in my view what is mainly lacking is not contents, but rather some 'shape' (very challenging in any way). I also do not want to suggest that the dates which are commonly provided for so many contexts, deposits, buildings, events and so on are necessarily wrong. What is missing is an explicit and strucutred approach capable of positively answering the simple question 'why?', *i.e.* 'why is this forum dated 50 BC?' or 'why do you think that this building was abandoned at the end of the 5th century AD?' or 'why is this refurbishement phase dated to the age of Tiberius?'. In one word, the issue is 'justifying' properly the dates we propose. What are the key concepts employed? Which tools are available? How can they be employed organically to achieve some date for the deposit being studied? These are the main questions from which this work begins[6].

I.1.3 THE OBJECTIVES

Given the discussion above, it follows that the target of this dissertation is effectively some ambitious: providing a temptative but coherent and structured review of concepts and methodologies for dating deposits, along with a sort of taxonomy and some case studies for comparative purposes. At the very end the target is very practical, as it may be described as the improvement (even a small one!) of the quality of the inferences we make about 'when', during and after the excavation. I also hope that these lines, in their own small way, may help revitalize a debate on the topic which, in my view, has been somehow poor during the last decades. In particular, during the last few years, spatial analyses have arisen as one of the major topics in current theoretical and methodological debate, while time is a key topic of few general works, rarely concerning the dating of deposits and the post excavation analyses. The debate about formation processes has also decreased during the last two decades and however, also within this particular field of discussion, space and function have always been

[6] Maybe the best available and updated synthesis on the issue of dating contexts and deposits is in CARVER 2009 pp. 267-296

the favourite targets. If this work may raise even negative, but prolific critics, a good point would have been made.

I.1.4 THE PLAYING FIELD: WHAT IS IN, WHAT IS OUT

Although the topic of dating deposits, as a whole, surely crosses the chronological and spatial borders of many archaeologies (Prehistoric, Greek, Roman, Medieval and so on), I decided to clearly limit the field in which I will play the game of dating. This is at least for three main reasons:

1. to exhaustively cover all the possible scenarios would have simply taken a lifetime;
2. my personal background of course do not cover all the possible cultural, spatial or temporal aspects of the discipline;
3. every culture (a difficult term, indeed) and depositional environment display its own peculiarities, which deserve specific attention and which make it unique.

Besides the very contingent first two points, the third one takes on scientific importance.

Specific mixtures of phisical, socio-cultural, political and economic factors, which could be considered macro systemic contexts (for a more precise definition and for the specific use of the expression which will be made in the rest of the dissertation, see Chapter II.2.1), define the resulting record in peculiar ways. For instance, although responding to the same phisical laws and to many similar necessities etc., a complex urban society and a hunter gatherers group do produce very different records through very different processes. Thus, for safeguard these peculiarities, a choice has to be made.

Eventually I decided to focus on ancient (more specifically Roman) urban sites. Of course, going back to point 2, among all the possible scenarios, I picked the one I knew better, mainly in reason of several excavation campaigns carried out in the urban sites of Nora, Aquileia and Gortyna.

A classical urban environment display with no doubt a high level of complexity and therefore it represents a great challenge under many points of view. But which are the peculiarities that make a classical (in this specific case Roman) urban site unique, looking at the formation processes involved? I will try to answer schematically, probably with some degree of generalization, focusing on a few crucial points, which are particularly evident in

the field of Roman urban archaeology, but which are to some extent typical of the urban environments in general.

1. the continuity of human life within the same space and for a long time is, obviously, one of the firstly appreciable characteristics of an urban environment. This, by itself, imply a high degree of transformation, complexity and palimpsesticity. This has indeed a positive indirect consequence in relative dating, allowing to create long and sometimes narrow sequences in which actions and proceses can be framed; nonetheless it also presents some disadvantages in terms of absolute dating, because of the higher degree of mobility of artefacts due to redeposition (see point 3).

2. in general, natural formation processes (say processes in which nature plays the major role, although not necessarily exclusive) do not have a massive impact, at least during those periods in which the city and its countryside are well managed and in absence of great catastrophes. The reason of that lies primarily in the fact that Roman cities are in most cases located in comparatively stable plain environments; moreover the Roman care for the maintenance of water courses is almost proverbial[7]. Thus, during periods of 'normal' mangement, episodes of colluvium or alluvium are very rare.

Eventually, the fact that the Roman Empire extended over dry or desertic lands only for a minor part, makes very unlikely that wind played a major depositional role in the cities of the rest of the territories.

The other side of the coin of such an observation consists of the fact that classical urban environments are exquisitely antropic and antropogenic environments, with all the pros and cons implied. Summing up, the human being is the major formative actor in such an environment.

3. particularly if compared to other building traditions, Roman architecture is particularly 'aggressive'. I mean that it commonly involve the movement of substantial volumes of sediments and building materials, along with the use of numerous and differently skilled workers. These massive operations do not concern public buildings and infrastructures only, but can also frequently be observed in private architecture. This means that the urban environment is frequently re-shaped, even substantially. The movement or the excavation of large amounts of sediments for

[7] BROGIOLO *ET ALII* 1988, p. 29

building purposes imply also a major displacement of sherds, with clear impacts on the issue of residuality.

4. although miriads of exceptions may be observed, cities during the Roman period generally benefit of a complex system for the management of waste disposal, of reuse and recycling. The existence of these mechanisms, discussed in Chapter III.5.1, heavily affects the record of a whole city, makes it very different from a small rural settlement and has precise consequences on issues of dating.

5. in general, given the production levels reached during Empire, Roman deposits are usually rich in artefacts, obviously mostly ceramic but often producing also good amounts of numismatic evidence, which in turn, generally speaking, increases the level of accuracy of our chronological inferences. Quantity, as it will be discussed up ahead, counts.

All these aspects typically characterize the playing field in which I chose to play the game of dating deposits. Of course some concepts, methods or observations which will emerge during the dissertation may well be applied to other fields, but in general I think that any mechanical transposition should be avoided; on the contrary, some critical and thoughtful application of some methods or concepts to other fields may eventually turn out to be useful.

It is also worth noting that the borders of the playing field are practically some blur. Sometimes it would be very difficult clearly cut out what is Roman from what is pre or post Roman or to clearly establish if a given settlement display all the requisites of a town or if it should be considered as a big village. This, moreover, would closely depend on the criteria employed. Thus it has to be accounted for some flexibility and uncertainty: some case studies, for instance, will be drawn from periods which would be considered by some as part of the fields of Iron Age archaeology or of Late Antique/Early Medieval archaeology. I think that continuity itself (see point 1), which characterize so evidently the urban environment, allows some chronological flexibility in limiting the field.

Concluding, although the field is limited, I think that the transvers nature of the dissertation still emerges somehow. I personally consider it an extremely positive and stimulating feature, because anyone with some excavation and post excavation experience can feel involved in the topic and can add, propose or correct something; and in some ways it has already happened.

I.1.5 Topics connected

The theme of dating deposits, although very wide by itself, is strictly connected with other topics which are not among the objectives of this dissertation. That means that these topics will not be examined in detail, mostly because they would deserve a dissertation of their own, but they will be touched sometimes in relation to specific issues.

The most important of these 'corollary' topics is the dating of artefacts. This is not a dissertation about dating artefacts, this is a dissertation about how artefacts (and other '-facts') are employed for dating deposits. Besides this, the strict link between the two topics is very clear, as often artefacts are dated thanks to their association to other artefacts in specific deposits, thus creating a sort of circular argument which may be very prickly and which should deserve, in my view, really much more attention. So, I will not tackle directly or indirectly this very important topic, but I trust that some of the considerations which will emerge from this dissertation may turn out to be useful also for it.

Grouping and phasing are also topics linked with this one, along with excavation techniques: these issues will be also touched sometimes, only in reason of specific links with the topic I chose.

The necessity of making some choices and shaping the topic is also evident in the literature review I propose up ahead (see Chapter I.2): indeed large parts of the history of archaeological thought and the development of field techniques are taken for granted, although linked with the main topic. These, of course, would have deserved an independent treatise.

I.1.6 Structure of the thesis

Seeking for some structured working method (being it not available) the structure of the thesis is not traditional. Instead of an usual layout made of collection of data, analysis and synthesis, I chose to start with a theoretical review, moving then to methods and eventually to taxonomy and case studies, thus substantially reversing the traditional order. That is because for moving from data to synthesis (inductively) it is given for granted that the 'way of moving' (through which means, in reason of which theoretical framework etc.) are is already established. In other words we employ an already existing way of managing the matter and making the data speak for the purpose we want (or at least so it should be).

In this case I reputed that starting from a body of data (but which data were important?), without having clear how to make them speak, would have been some pointless. So I started from the basics, moving deductively/inductively and trying to test the expectations formuled. It is important to stress from the very beginning that the case studies employed were deliberately cherry picked in order to show some phenomena in the clearest way. I recognize that this is with no doubt a weak point of the dissertation, but I considered it some necessary. Moreover almost infinite testing may be performed in future and some of the theoretical and methodological tools proposed may consequently turn out to get confirmed, refined or completely rejected. But at least, I think, it has been laid down a basis for further discussions.

According to these principles, the thesis is arranged in five main parts:

1. an introductory part with a review of the state of the art
2. a theoretical discussion of the main key concepts involved in the issue of dating deposits
3. an exposition of the main methodological tools which can be employed for dating deposits, furtherly subdivided in quantitative and qualitative approaches;
4. a taxonomy of deposits along with a selection of case studies
5. a conclusive part with a proposal of flowchart and the synthesis of the working method proposed.

First of all I will examine if and how it can be traced a history of the way in which archaeologists date deposits.

❖ LITERATURE REVIEW ❖

By just taking a quick look at the bulk of archaeological methods and theory literature, one can easily observe that the way assemblages are employed for dating deposits (and particularly in classical urban sites) cannot be considered a topic by itself. Although dating strata is, indeed, one of the most common and historically rooted archaeological activities, literature on the issue is anything but organic and linear. Thus, in writing a literature review on the topic, one must firstly acknowledge that several branches of the discipline have to be investigated, to look for single scattered fragments of theoretical or methodological developments which eventually contributed to define today's tools for dating strata.

Nonetheless, in some way the playing field must be marked before starting. In the following lines, the development of some topics, although closely connected to many issues of interest, will not be taken into account, basically because these topics already benefit from a more structured history and because they would deserve more and independent space. This is the case of the huge topic of finds dating, ranging from typology and cross-dating to modern radiocarbon and thermoluminescence analysis. Of course dating finds and dating deposits are two different but closely related issues; all through this piece of work some of the most important (and difficult) relationships between the two will be touched on, but here I have decided to avoid writing a review of finds dating literature, as it deserves an independent work. Writing an history of excavation techniques will also be avoided, although some important developments will be examined. Similarily, a complete and exhaustive review concerning the way assemblages have been employed for dating deposits in past excavations would be, if not impossible, at least very difficult, even if focusing on classical archaeology only, as it is obviously populated by hundreds of on-going or finished excavations. However, some examples considered particularly illuminating of some developments will be discussed, deliberately opting for a cherry-picking strategy.

The techniques of direct dating (OSL, mortar dating) are so recent that I considered basically useless to trace a review, although I have deferred some notes to Chapter III.2; some notes about tools borrowed from other fields (ethnoarchaeology, experimental archaeology) are included in Chapter III.6, while some important papers concerning the crucial theme of waste disposal are indicated in Chapter III.5.1.

Finally, another general note must be stressed, before starting: most of the review draws on Italian and Anglo-Saxon literature. This is due to many reasons, among which my personal knowledge and background (archaeological, cultural and linguistic) surely have played an important role. Nonetheless, another important reason, besides the obvious attention paid to the Italian literature, is that the focus on the Anglo-Saxon has clear historical reasons. Most of the theoretical and methodological developments concerning modern excavation techniques and post excavation/interpretive issues have seen the light in this context[8], so effectively providing the largest part of those 'scattered fragments' I mentioned above.

I.2.1 The beginnings

I wish to start this review with a brief consideration about the way ancient men perceived the world they lived in, *i.e.* their own 'systemic context' (see Chapter II.2.1). Pausania's 2nd c. A.D. *Ἑλλάδος περιήγησις* is indeed the most striking testimony of the ancients' perception of the palimpsestic nature of their urban environments. Most of the monuments, statues, objects etc. described by the author are effectively 'false residuals' in their own cities. In other words, already 1850 years ago, classical cities were composed of a mixture of structures and artefacts erected or produced in different times and thus displayed a high degree of chronological complexity. It is worth recalling this aspect because, surprisingly, it represents a key point in archaeological analysis often forgotten by archaeologists themselves when dealing with deposits. As I will discuss later, even assemblages embedded in primary sealed-off deposits display this degree of complexity, which must be known and studied in order to fully understand their nature and dating. So, if on the one hand the explicit definitions of residuals and false residuals in archaeology are, after all, quite recent, on the other one their implicit notions are common knowledge now and were common knowledge 2000 years ago. Indeed archaeologists did not create anything really new.

Moving to a much more recent past, we can observe the more or less explicit adoption of some important principles at the very beginning of modern archaeology. C. J. Thomsen is known throughout the world for having first adopted, in his *Guide to Northern*

[8] Leonardi 1982, p. 113

Archaeology, the three ages system (stone, bronze, iron). Less explicit are two other fundamental aspects of his work:

1. the acknowledgement that tombs were privileged contexts for studying artefacts associations, thus grasping their primary status;
2. the dialectic relation between artefact chronology and context chronology (so effectively laying the foundations for seriation and typology techniques).

Thomsen explains the matter in this way:

"Towards determining the exact age of antiquities, or at least the period to which they belong, there is still another guide which hitherto has been but little followed with respect to the antiquities of the North, viz. an investigation of the forms of the objects and of the ornaments with which they were decorated, with a view that by a careful comparison and by accurately noting what sorts are generally found together, we may ascertain the order in which the successive changes took place, and thus determine the periods to which a mere inspection of the ornaments will authorize us to assign the object"[9].

Thus we may conclude that since the very beginning of modern archaeology an idea of what is meant by primary deposit existed, along with the implicit assumption that what makes this deposits very informative consists of displaying *true* associations (see Chapter II.2.3) among the embedded artefacts.

Thomsen's intuitions become more explicit and are largely employed in Flinders Petrie's famous works on Northern Egypt tombs[10]. The primary status of tombs and their assemblages is exploited to provide the basis for a large seriation of artefacts, whose principles were firstly exposed in the *Journal of the Anthropological Institute* in 1899[11] and discussed again in *Diospolis Parva* in 1901[12]. Nonetheless it is *Methods and Aims in Archaeology* that provides new, remarkably fresh considerations concerning the relationship assemblage-context. It is recognised in fact the presence of false residuals in some contexts[13] and infiltrations are evaluated, implicitly acknowledging the the presence and importance of sealed deposits[14]. The primary status of other types of contexts is also recognised, such as

[9] THOMSEN 1848, p. 69
[10] Petrie is considered the father of cross dating. His work will be later developed, among others, by G. Childe (CHILDE 1960, partic. pp. 80-84 and 126-130). See also PATTERSON 1963, p. 391 and the more recent LEE LYMAN, O' BRIEN 1999 pp. 185-215. See also JAMES *ET ALII* 1998 for cross dating and the building of an absolute chronology for the Iron Age central Mediterranean area.
[11] PETRIE 1899
[12] PETRIE 1901, pp. 4-8
[13] PETRIE 1904, p. 145
[14] PETRIE 1904, p. 145

rubbish mounds[15], votive pits[16] and collapse debris[17]. All these considerations are still fundamental for considering the chrono-informative potential of a given deposit. Nonetheless Petrie went even further, realizing the importance of vessels breakage ratios in seriation and in chronological issues in general[18].

I think it is now worth stopping and providing a quick comment on the state of the art of chronological issues at the dawn of the 20th century. Some key ideas, particularly in Petries' work, have been disseminated; in general the existence of index fossils of given periods is obviously widely acknowledged and cross dating is allows the creation of long sequences for dating artefacts from Egypt, Greece and Italy. Roman archaeology on the other hand still relies primarily on the abundance of other sources of dating. However, two points must be stressed:

1. index fossils, a chrono-tool clearly borrowed from geology, are of some help when dealing with very broad periods or in seriating, indeed, tombs or other primary deposits. Otherwise, as every find, they just provide a *terminus post quem*;
2. the main focus is still on tombs and other particular contexts: urban dynamics are known to a certain extent, but proper urban archaeology is far to go.

In fact, the acknowledgment of urban formative complexity can be considered a turning point for a mature development of dating techniques in this field and it does seem to have been achieved not before the 1970s.

Yet, some 20 years before, during the 1950s, M. Wheeler had already introduced rigorous techniques of stratigraphic excavation and recording, but ceramics were still studied as a group[19], while individual studies were devoted to some finds only. Curiously Wheeler's attention was focused on the duration of accretion processes (in any case a matter of great importance) more than on *when* they happened[20]. So at this stage a serious evaluation of the huge problem of residuality was, in fact, impossible, and thus the complexity of urban dating remained substantially untackled. In this period, radiocarbon dating and dendrochronology

[15] PETRIE 1904, p. 147
[16] PETRIE 1904, p. 145
[17] "Let us suppose some old country mansion, where it has been the habit to close permanently any room in which an owner had died, and leave everything in it undisturbed. If we went through such a series of rooms we could not doubt their order of date if we looked at their contents" (PETRIE 1904, pp. 127-128). See also PETRIE 1904, p. 148
[18] PETRIE 1904, pp. 16-17
[19] WHEELER 1954, p. 157
[20] WHEELER 1954, pp. 27-34, 40-49

were in the initial stages of their development and the notion of *terminus post quem* was acknowledged also in case of dated samples[21].

An after all isolated, but forerunner, advocacy of interest in how finds reaches deposits is contained in Pyddoke's 1961 introduction to his work *Stratification for the Archaeologist*: "[...] an excavation report is not complete unless the writer sets out to explain the manner in which the layers were deposited. To understand his site properly the stratigrapher must always ask himself how his finds reached the position in which he discovered them"[22].

The author's statement is certainly right but unfortunately, for some time, no practical consequences followed.

Fortunately, just a few years later, the 1960s announced the New Archaeology and, consequently, quantitative approaches and the early dawn of computer science, finally providing fundamental tools for dealing with large amounts of artefacts (this is a key point which undoubtedly had a huge impact in postponing the development of techniques for dating deposits in urban environment). As S. Roskams has stressed, developments in the archaeological discipline, besides that of individuals' dynamism, were also the products of more general changes. He considers three elements as essential in this development: intellectual framework, available technology and organisation (of fieldwork)[23]. At the turning point of the 1970s, these three elements had made great progress, thus the premises for a major shift from cemeteries to settlements as a target, also for chronological inquiry, had been laid down; starting from this moment, some main streams can be detected, altough, as seen before, a linear evolution in dating strata techniques can not be recognized.

For the sake of simplicity, I will discuss these different branches separately, defering an attempt to provide some synthesis and conclusions to the end of this chapter.

I.2.2 Urban Archaeology

In Italy at least, 'urban archaeology' is usually understood as the archaeology performed in today's urban environments[24]. If archaeologically there is no substantial difference beteween an urban site which stopped existing say 1000 years ago and an urban site which is still living, from many other points of view the difference (organisational,

[21] Wheeler 1954, p. 32
[22] Pyddoke 1961, p. 17
[23] Roskams 2001, p. 9
[24] Brogiolo 2006

economic, legal, political, social etc.) is crucial, thus giving urban archaeology, so understood, its own autonomy and free-standing status. Historically the birth of urban archaeology is closely connected with the birth of contract archaeology and follows the post-war urban renewal of many western towns. This formative moment is thus scattered over many years according to the moment in which in different areas such urban redevelopment took place. The role of urban archaeology in the archaeology of urban sites (it sounds odd, but that is it) has been fundamental as it was pressed by necessities whose answers produced wider benefits. These necessities were:

1. efficient, shared and codified ways of dealing with large amounts of data in shorter periods;
2. the development of planning and sampling strategies;
3. communicational and social impact.

The first necessity led to two major innovations which greatly changed the way archaeology is commonly carried out, namely: the single context recording system and the Harris matrix[25].

From the point of view of dating deposits these two improvements are fundamental for two reasons: the single context recording had a compelling effect, forcing us to look *inside* each context and to evaluate its own nature and meaning, a necessary step in order to evaluate its status. The Harris matrix provided a system to produce reliable relative sequences even when dealing with thousands of contexts, thus making available the basic relative chronology for urban/complex sites and enabling the switch to the absolute dating of deposits.

The second necessity led to evaluation and sampling techniques. On their own these two aspects do not seem to directly affect dating, but the idea lying beneath these two aspects set in motion a wide debate which had some consequences in dating too. The core of the debate may be very roughly summed up by the slogan "total excavation *vs* progressive approach".

The spread of excavation sites in many urban centres took archaeology out of a purely academic perspective and threw it within a world made of budgets, scheduled times, citizens' necessities, construction industries and so on. So one question strongly arised from

[25] HARRIS 1975 and HARRIS 1979. Harris also dedicates part of his work to phasing and to the relationship between materials and strata (although he mainly focuses on the problem of intrusions), drawing in particular from the precious work of D. P. Dymond (DYMOND 1974).

these experiences, *i.e.* is it possible to excavate a whole site with the same level of accuracy and in its whole extent? And if it was possible, would it be ethically correct?

On the one side P. Barker and MOLA (Museum of London Archaeology) pushed towards open area excavations carried on with standardized techniques, with no substantial differences in excavation and recording strategy. On the other side scholars such M. Carver claimed for a more progressive approach, scaling 'intensity' according to the informative potential of deposits and applying sampling techniques when possible[26], depending on specific research questions or agendas. Of course this is a very raw and simplistic description of the issue and does not do justice to several aspects and nuances of the problem. A better and more complete overview can be drawn by two more recent papers published in 1990 by P. Barker[27] and M. Carver[28] in the volume *Lo scavo archeologico: dalla diagnosi all'edizione*.

Here it is not the place to discuss which approach is 'better' (even supposing it would be a useful and meaningful discussion[29]); moreover both approaches (in my personal view they are not antithetical at all) provide fundamental background for approaching dating issues. This is not just a mere compromise position and I will try to demonstrate why.

In a dating perspective, open area excavation with a standardized recording approach, presents two main advantages:

a. sampling problems involving assemblages and deposits are considerably reduced. This issue particularly affects secondary deposits and can lead to dates which are remarkable too old, even just the *terminus post quem*. Dating the construction of a whole building after having examined just part of the backfill of one foundation trench is,to say the least, hazardous. The established *tpq* may be much older than the actual one (see Chapter III.4.2).

b. a minimum standard recording system at context level represents a necessity as it allows in post-excavation analysis at least a raw evaluation of the nature of the context and possible process of formation. The uniformity of the system makes the comparison of two or more contexts easier, thus facilitating the operation of grouping.

On the other hand, a more selective strategy yields a more critical approach to stratification, pushing towards the evaluation of informative potential of contexts and thus

[26] For a later classic application of these principles, see the excavation carried out in via Alberto Mario, Brescia (Italy). BROGIOLO 1985, pp. 71-74, BROGIOLO 1988.
[27] BARKER 1990
[28] CARVER 1990
[29] For some more reasons from an 'open area point of view', see ROSKAMS 2001, pp. 31-34

permitting an early raw distinction between context and context, speeding up some interpretive work. Moreover in this way extra analyses, sampling and data collection can be pushed to the maximum already during the excavation, whenever it seems appropriate.

Apart from some distinctions between the two approaches, both the figures of P. Barker and M. Carver directly and importantly contributed to the development of approaches to dating[30]. Barker's classic excavation manual, based on his experience in Wroxeter and Hen Domen, was first published in 1977 and has, among others, the undeniable merit of having clearly tackled the use of *termini post quem* and *termini ante quem* when dating sequences[31].

Just a couple of years later in Carver's *Notes on some general principles for the analysis of excavated data*[32] some important lines of approach, based on his 1974 experience at Saddler Street, Durham, were set down. The first part of the paper focuses on artefacts seriation, for which contexts status is not taken into account, whereas the second part discusses in more detail contexts and assemblages status. Contexts with primary status are those qualified by "assemblages which have relevance for the activities and culture of the inhabitants"[33], where the association of artefacts is reliable[34]. Carver also warns that "only material from primary contexts may contribute to the absolute chronology"[35] and reminds how much effort has been devoted to sampling and dating secondary deposits. Carver's message is pretty clear and correct and it is just worth noting that actually secondary deposits contribute to absolute chronology, too, although with a mere *terminus post quem* (indeed within a whole sequence, it is the correct combination of all three *termini* which leads to an absolute chronological grid).

These principles had already been at least partially applied in Carver's 1976 excavations in Sidbury, Worcester, which were then published in 1980[36]. The report is extraordinarily important as it provides, albeit in a concise way, an early example of a publication in which the post-excavation process of phasing and dating is somehow made explicit, along with the principles which led the work. Contexts were identified according to their status as primary, secondary or redeposited (although it is not clear how the second and

[30] See also, below, the topic of residuality
[31] BARKER 1977, pp. 193-196. It is astonishing to asciertain how the very simple rules expressed are even now misinterpreted and misused (see Chapter II.2.8)
[32] CARVER 1979
[33] CARVER 1979, p. 8
[34] CARVER 1979, p. 9
[35] CARVER 1979, p. 9
[36] CARVER 1980

the third are understood) and then presented along with some indications about both the embedded materials and their identification ("rubbish pit", "pebble surface" and so on). It is possible to detect a certain split between the stratigraphic sequence and the pottery seriation, which seems to have been carried out quite independently; indeed residuality thresholds were marked not in relation to each deposit, but on an absolute scale, *i.e.* stating after which date a single vessel type could be defined as a residual[37].

Before proceeding, it is worth briefly recalling point 3. (see above), to highlight how the necessity of improving communicational aspects of archaeology, mainly with respect to the great public, also involved important changes in scientific publications. Indeed the need to make the excavation results public (archaeology could not keep on living separated from the surrounding urban society) also responded to more pragmatic commercial demands, allowing the evaluation of if, how and with which results the job had been done. This also generated great scientific benefit, compelling archaeologists to provide detailed data and interpretive syntheses. Carver's report, among others, is also the child of these new necessities.

At the end of the 1970s thus emerged the important topic of contexts/deposits status, *i.e.* their informative potential (spatial, functional, chronological) within urban stratification. In other words the attention shifts also to their own nature. An important fixed point is the 1979 work by P. Crummy and R. Terry (Colchester Archaeological Unit) *Seriation problems in urban archaeology*. This is an extremely important paper as it actually combines the topic of contexts status with that of residuality (see below), of ancient productive outputs and of breakage rates and wear. Some of these prompts will be touched on elsewhere throughout this dissertation. Concerning the status of deposits, Crummy and Terry state:

"In general, we can distinguish two categories of deposit which for the sake of brevity we shall refer to as class I and class II. Class I deposits can be defined as those derived from contexts where all the finds are in their original positions as either lost or discarded whereas class II deposits are those which contain residual material[38].

Provisionally, at the risk of oversimplification, class I deposits can be listed as:

i. occupation layers on floors;

[37] For Carver's great thoretical, methodological and practical activity concerning urban archaeology, see also Carver 1985 and CARVER 1987a and CARVER 1987b. The more recent CARVER 2009 somehow reprents a *summa* of his research.

[38] Note the ambiguous use of two different parameters for defining the two classes, namely a spatial one for class I deposits and a temporal one for class II deposits (see below what is meant by the authors by 'residual'). See Chapter II.2.5

ii. destruction levels (except for the cases such as at Verulamium cited above[39]);

iii. middens (where the soil content is minimal and the original stratification undisturbed);

iv. grave goods;

v. primary deposits in some pits and ditches including cesspits;

vi. coin hoards;

vii. kiln dumps and loaded kilns;

viii. thick tip-lines in pits and ditches which consist of almost exclusively broken pottery and refuse where the soil content is minimal and much of the pottery can be joined together"[40].

The two scholars continue:

"The number of substantial class I deposits encountered on urban sites is probably very low [...]"[41].

Class II deposits are then further split into IIa and IIb, according to a respectively low and high level of residuality and it is then noted that only class I and class IIa deposits can be employed for seriation in order to improve the dating of finds.

An in-depth discussion of this single article would deserve, in my view, a much greater space; it is clearly the child of instances coming directly from urban excavation experiences gradually reached in those years. What emerges is a clear awareness that not every context is suitable for providing the same information and that, from a chronological perspective, the few primary deposits embedded in urban sites are the most important one as they do not contain residuals. The paper also provides a tentative definition of what a primary (class I) deposit is, along with a list of concrete archaeological examples. Implicitly the issue of false residuals (both in case they are vessels of coins) is tackled.

Into the same volume, *Pottery and the Archaeologist*, other papers deserve particular attention. Among them I pick just a few lines from R. Jones introductory paper, as it is a warning that, in my view, should always be kept in mind while dealing with dating:

"[...] perhaps we should be willing to admit that sometimes the pottery sample available from a particular site or deposit is inadequate to fix any date but the most simple

[39] The clarification refers to the presence of residual sherds in brick-earth daub used for wall construction, reported in FRERE 1972, pp. 9-10

[40] CRUMMY, TERRY 1979, pp. 54-55

[41] CRUMMY, TERRY 1979, p. 55

terminus post quem. However, when faced with a report to write, most excavators feel duty-bound to express some opinion even on inadequate grounds[42]".

At the dawn of the 1980s important urban excavations are published throughout Europe and beyond, more or less treasuring the reflections and the improvements achieved mostly in the bosom of British archaeology.

A typical way of presenting the dating evidence for phases, drawn from the Milan 1980s excavations[43] (M-M3 underground lines), is shown below.

SINTESI DEI DATI DI SCAVO — VIA CROCE ROSSA

PERIODO	FASE	PRINCIPALI ATTIVITÀ	MATERIALI DATANTI	CRONOLOGIA
I	a	Lungo la sponda Sud di un corso d'acqua artificiale (Seveso), due tombe (una a cremazione, l'altra a inumazione)	Vernice nera, lucerne, anfore, pareti sottili dai corredi delle tombe (1009, 1204)	Dalla fine del I sec. a.C. alla prima metà del II sec. d.C.
	b	Taglio di due canali perpendicolari al Seveso, buchi di palo, sulla sponda Sud del corso d'acqua	Vernice nera, pareti sottili, anfore da impronta trave e sedimenti Seveso (410, 366)	
	c	Apertura di un altro canale sulla sponda Sud, buchi di palo e impronte di travi orizzontali, battuto e scorie di fusione del rame	Vernice nera, pareti sottili, anfore da piano di calpestio (409)	
	d	Chiusura canali sulla sponda Sud, buchi di palo e impronte di travi orizzontali, battuto e scorie di fusione del rame	Vernice nera, terra sigillata, anfore, pareti sottili da strati di livellamento e impronte travi (399, 421, 435, 487)	
	e=h	Sulla sponda Sud livellamento battuto, buchi di palo, impronte di travi orizzontali (area F); focolare, buchi di palo, impronte di trave orizzontali, scorie di rame (area K)	Lucerne, anfore, pareti sottili, terra sigillata da impronte di trave (116), focolare (459) piani di calpestio (476, 323, 338)	
	f=i	Sulla sponda Sud pavimentazione in ciottoli e strati di discarica (area F); buchi di palo, focolare, impronte di trave orizzontali (area K)	Terra sigillata, anfore da livelli d'uso (295, 125) e buchi di palo (212, 205)	
	g	Sulla sponda Sud battuto con scorie fusione rame, buco di palo	Vernice nera, terra sigillata, anfore da strato di discarica (433)	
	a→i	Sulla sponda Sud, buche e discariche nella area C	Terra sigillata, anfore, vernice nera da buche e strati di discarica (173, 218, 266, etc.)	
II		Frequentazione sporadica dell'area e impaludamento canale laterale 601	Terra sigillata italica dal riempimento canale 601 (533); antoniniano di Gallieno (253-268 d.C.) e sesterzio di Severo Alessandro (227 d.C.) da livelli d'uso (209, 328)	Dalla metà del II sec. alla fine del III sec.
III		Costruzione tratto di mura massimianee (sotto l'Hotel de Milan). Ampliamento dell'alveo del Seveso. Resti di struttura lignea sulla sponda Sud.	Anfore africane da sponda Sud (213, 244, 298)	IV-V sec.
IV	a	Impaludamento progressivo del Seveso	Anfore africane, ceramica invetriata da sedimenti canale Seveso e buche sulla sponda Nord (277, 296, 343, 403, 367, 419, etc.)	Età tardo antica/ alto medioevale
	b	Sulla sponda Nord buche di rifiuti collegabili forse a qualche attività fuori le mura		
V		Costruzione di un condotto interrato per il Seveso e di cantine	Graffita ramina e ferraccia, ingubbiata policroma, maiolica da contesti attinenti al pozzo (1018) e alle cantine (1147, 119)	XV-XVIII sec.
VI		Rettifica e ampliamento della via Croce Rossa, con demolizione delle cantine. Nel 1895 costruzione dell'Hotel de Milan. Nel 1896 costruzione nuovo condotto del Seveso		XIX sec.
VII		Interventi recenti di costruzione e sistemazione di servizi nel sottosuolo		XX sec.

fig. 1 *- Synthesis of phases and chronological apportioning. From* CAPORUSSO *1991*

Although some more details are provided throughout the paper, a complete presentation of contexts, status and material does not always appear. It does not mean of

[42] JONES 1979, p. 3
[43] CAPORUSSO (ED.) 1991

course that the post-excavation analysis did not treasure the achievements of the previous 10-15 years. What seems to emerge, most likely, is a problem with the publishing of the data, a problem which still affects a large part of field archaeology.

Indeed, into the same volume Perring's paper, for instance, is some more detailed, dedicating independent paragraphs to the discussion of dating and presenting recapitulatory charts for each period[44].

Tabella 1.

SINTESI DEGLI ELEMENTI DI DATAZIONE		PIAZZA DUOMO, PERIODO I
PD3 Fase a	Riempimenti (6794 e 6814) di buche di palo	anfora (Lamb. 2), lucerna (Ricci H)
PD3 Fase b	Superficie bruciata (6767) Riempimento (6810) del focolare (6811)	vernice nera (Lamb. 5, aretina) vernice nera (Lamb. 28, locale)
PD3 Fase c	Rialzamento di limo (6783) Riempimento (6787) di un buco di palo	vernice nera (Lamb. 28), lucerna (Ricci H) vernice nera (Lamb. 28), anfora (Dr. Ib), pareti sottili (Ricci 1/15)
PD1	Riempimento (2899) di un buco di palo Suolo naturale disturbato (2781) Riempimento (2551) della buca 2601	anfora (Dr. I) vernice nera (piedi P1) vernice nera (Lamb. 5), anfora (Lamb. 2), lucerna (Dr. 2/3)
PD2	Riempimento (5081) del focolare 5088	vernice nera (Lamb. 6 e 36), anfora (Lamb. 2)

fig. 2 *- Chrono-relevant data for a period. From Perring 1991*

It is also worth noting a certain use of *ex-silentio* arguments (see Chapter II.2.10) along with a certain awareness of providing chronologies from a probabilistic perspective. Dating is indeed 'proposed' more than 'imposed'.

The 90's witness some new interesting theoretical and methodological considerations, which find room in particular into the *Interpreting Stratigraphy* conferences, devoted primarily to post-excavation analyses. A full presentation of each paper would require much space and it would substantially broaden the discussion. Again, it seems better to focus on some areas of significant relevance. Among the papers presented at the conference held in Lincoln in 1992, S. Roskams' article deserves particular attention, as it focuses on the relation between materials and contex status, providing a new temptative classification and a brief review of previous works[45]. Among the papers presented the next year in Edinburgh, K. Matthews paper investigates the formative and chronological aspects of those primary deposits usually named 'occupation layers'[46], while among the papers presented between 1993 and 1997, published in 2000, the articles by M. Morris (ethnoarchaeology of

[44] PERRING 1991
[45] ROSKAMS 1992
[46] MATTHEWS 1993

abandonment debris[47]), J. Gidlow (rubbish, recycling and scavenging[48]), P. Clark (grouping[49]), V. Buteux and R. Jackson (pit backfills dynamics[50]), R. J. Pollard (fragmentation and assemblage formation processes[51]) and P. Rauxloh (relational databases and residuality thresholds[52]) deserve particular attention.

By the end of the 1990s the urban archaeology theorethical and methodological debate seems to diminish. Although obviously important urban excavations were still being published, with even larger *corpora* of data made available, critical discussion within the discipline gets less and less palpable. This state of the art may also be a consequence of the end of large urban development plans in most western cities, but I think it is also affected by a widespread shift in archaeological interests towards new disciplines such as spatial analyses, geo-physics, statistics, building analyses etc. which seems to draw much of the attention in the field of archaeological methods and theory.

I.2.3 Behavioural Archaeology: objects

Behavioural Archaeology took shape in the United States in the early 70's and it developed from the New/Processual Archaeology, within a clearly anthropological framework. Its epicentre was the University of Arizona with some major exponents as J. J. Reid, W. L. Rathje, J. M. Skibo and M. B. Schiffer. Its American origins led to an obvious focus on American history and archaeology, thus delaying its own impact on the archaeology of other cultures and on urban archaeology, which had a typically European characterisation. Indeed, within the current European theoretical debate, still saturated with the opposition Processual - Post Processual Archaeology, this school did not find much room. What makes Behavioural Archaeology extremely interesting within the perspective of dating deposits through assemblages is the explicit focus on the people-artefact relationship at various scales[53]. Of course Behavioural Archaeology has evolved over the last decades, both through internal development and by external impulses, and it now embraces topics ranging from technological change to ritual and religion[54]. Nonetheless the field which is of interest for

[47] Morris 2000
[48] Gidlow 2000
[49] Clark 2000
[50] Buteux, Jackson 2000
[51] Pollard 2000
[52] Rauxloh 2000
[53] Schiffer 2010, p. 14
[54] For a useful collection of articles which well sum up the development of the discipline from the very beginning see Schiffer 1995a. For a recent synthesis see Schiffer 2010, while, perhaps, the most complete

dating approaches is still the very core of Behavioural Archaeology, *i.e.* the understanding of formation processes as a fundamental tool for drawing reliable inferences from the archaeological record. It has to be stressed that, although the existence of two main groups of processes involved in shaping ancient systemic contexts into archaeological contexts, *i.e.* the so called c-transforms and n-transforms (respectively cultural and natural processes of change) was fully recognised, most of the focus has been devoted to c-transforms. This seems to be due to the anthropological approach which so deeply characterizes American archaeology in general and Behavioural Archaeology in particular, with its typical attention to human behaviour. Of course a substantial corpus of literature concerns c-transforms too, but the global theoretical trend stands quite clear and explicit[55]. This tendency presents pros and cons: natural formation processes, geological and micromorphological aspects and post-depositional processes step slightly to the background leaving mainly cultural processes in the foreground which, in turn, are mainly pre-depositional and depositional. Yet, the imbalance of this approach seems also to reflect the imbalance of factors affecting a large part of the archaeological record within the particular playing field chosen, that is the classical urban environment. In this particular field, cultural formation processes indeed play a major role in shaping the record, simply because human activity lasted a long time in the same place. Moreover, as already mentioned, the classical approach to the urban environment, in particular the Roman one, can be particularly incisive in terms of architectural effort, heavily modelling the space above and under the ground. Thus, in general, a behavioural approach seems to suit the playing ground and the target addressed well.

Some main points which are characteristic of this archaeology assume a certain importance according to the aims of the present work:

1. the theoretical shaping and distinction between *systemic context* and *archaeological context* (see Chapter II.2.1);
2. the notion of *formation process* as the link between the two contexts;
3. the distinction between *c-transforms* and *n-transforms*;

and organic work is still represented by SCHIFFER 1996 (first edition in 1987). Each work provides substantial bibliography. Eventually see LAMOTTA, SCHIFFER 2005.

[55] See SCHIFFER 2010, p. 6: "One day in 1972 Reid solved the definitional problem: archaeology, he insisted, was the study of relationships between human behavior and material culture in all times and all spaces". It is curious observing how in 1972 Schiffer himself noted the opposite imbalance: "The branch of archaeological theory which treats these and related questions may be defined as the conceptual system that explains how the archaeological record is formed. As such, it has both cultural and noncultural components. The latter area has received major emphasis to date" (SCHIFFER 1972, p. 156)

4. the notions of *primary refuse*, *secondary refuse*, *de facto refuse*;

5. the aknowledgement of the importance of the processes of *reuse* - *recycling* - *lateral cycling*, *storage*, *transport*, *discard* and *maintenance* (see Chapter III.5.1).

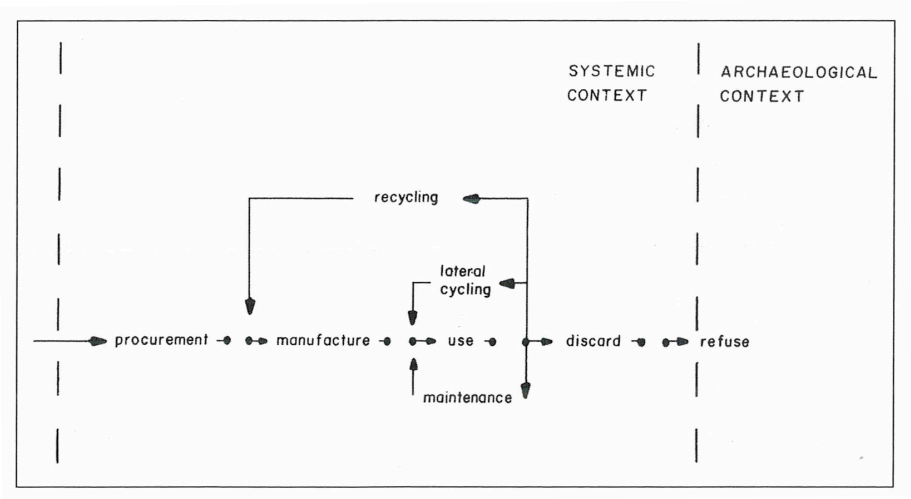


fig. 3 *- The life cycle of durable elements. From Schiffer 1972*

All these aspects have been discussed through the years and developed particularly within American Southwestern archaeology, while a full display of these notions in European archaeology, particularly classical, still has not been achieved to date.

One last aspect of this branch of theoretical and methodological thought needs to be stressed: clearly continuing a tradition born with New/Processual Archaeology, Behavioural Archaeology largely employs ethnoarchaeological and experimental approaches, along with quantitative techniques, in problems of interpretation of the record. The (underestimated) importance of these tools in dating is discussed in Chapter III.6 (ethnoarchaeology and experimental archaeology), below and in Chapter III.4 (quantitative approaches).

Concluding, I think it has to be aknowledged that Behavioural Archaeology, with its pros and cons, still provide more or less explicitly much of the theoretical framework for dealing with the complex relation between people - artefacts - deposit, that is, in turn, the key for using materials for dating.

I.2.4 The study of formation processes in Padova: stratification

If on the one hand Behavioural Archaeology had its main focus on human behaviour, on the other one, between the 1980's and the early 1990's, in Padova another

school brought back under examination formation processes as a whole, this time, maybe, with a slight preference for the natural ones. Theoretically this school, dealing mainly with Italian pre/proto history, can be considered a legitimate heir of the more mature forms of Processual Archaeology, but some legacies from Behavioural approaches are indeed also present. G. Leonardi is to date one of the main contributors to this cause and the proceedings of the international seminar held in 1991 are still the cornerstone of the body of literature produced[56]. Besides the slight shift to n-transforms as a privileged field of investigation (also due, I think, to the different necessities linked to dealing with pre/proto historic sites/deposits), another important point marks the difference from Behavioural Archaeology, that is a great interest in sediments and soils (the matrix) and a close connection with geoarchaeology and micromorphology. This time the shift moves from finds to the deposit as a whole. This jump "back to the basis" has been indeed very healthy, as defining and understanding the single contexts is the first, unavoidable step towards their grouping and then their dating. A knowledge of their general and specific dynamics along with the post depositional processes that occurred is a prerequisite which can never be taken for granted, but which has to be investigated, discussed and eventually evaluated. I think the more the stratigraphic reading is difficult (see particular environments), the more such an approach, markedly geoarchaeological, shows its benefits.

Besides these general traits, one major theoretical contribution provided by the "school of Padova" concerns the topic of basins. Up to now it has been stressed the importance of defining the status of each deposit and the attention has been focused on the primary ones. The shaping of the concept of 'basin' provides the tools for fully tackling the dynamics of secondary deposits, their formation and the way to date/ non date them. G. Leonardi proposes a basic distinction between physical and conceptual basins, with a further split into potential and specific basins and into source basins and depositional basins. Eventually, the concepts of 'local' and 'allochthonous' are then re-discussed and shaped[57]. These pieces of the theoretical framework assume a great importance as they are closely connected in particular with the issue of residuality (see below) and represent an important tessera to answer the question "How did it get here?", *i.e.* the *fil rouge* of dating through assemblages.

Finally, it should be remembered that in Padova, in about the same period, A. De Guio's considerations about the nature of the context itself, acknowledging its dual nature

[56] LEONARDI 1992a
[57] LEONARDI 1992b

(both physical and operational), basically provided the theoretical foundations for grouping (see Chapter II.2.2)[58].

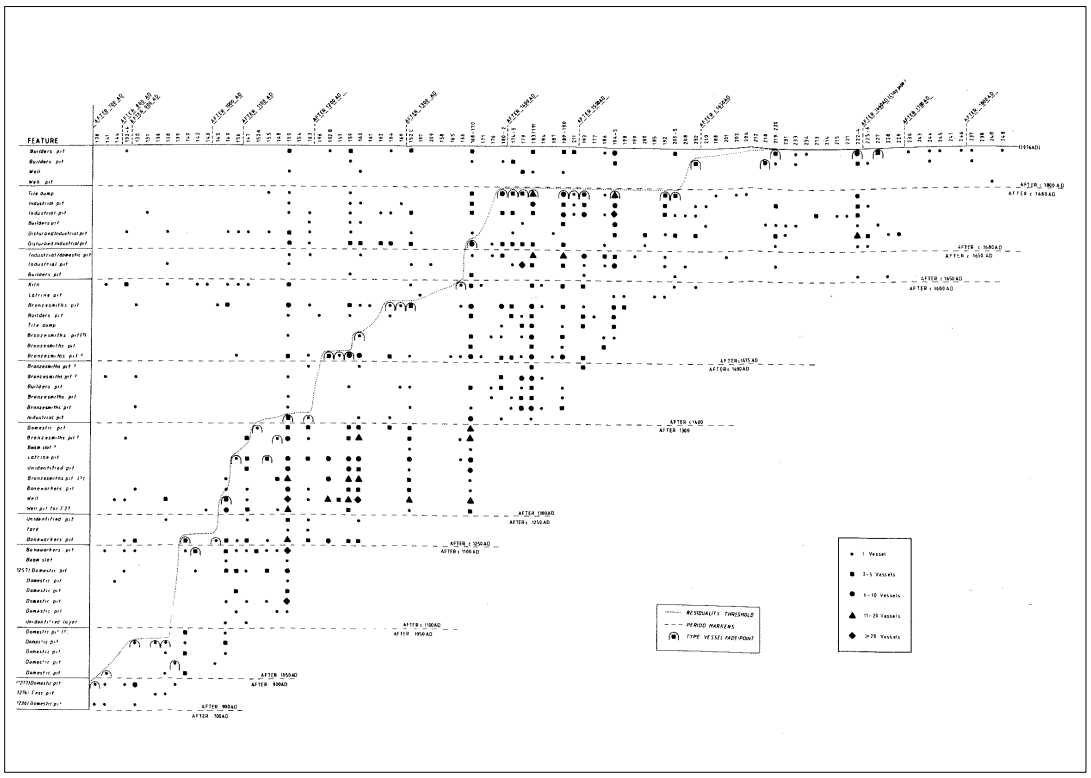
I.2.5 The study of residuals

A topic which plays a fundamental role in the game of dating in urban environments is the one of residuality. The topic arose, obviously, after the basics of archaeological stratigraphy, excavation and recording were established and it is child of both urban archaeology and material culture studies. Although these studies are rooted in the 70s, their main devolpment occurred during the 90s and the topic is still matter of some debate[59]. It should aalso be stressed that residuality represents a phenomenon typical of urban sites, where the redeposition of large amounts of sediments and materials is very common.

A residual is a find definitely discarded in a systemic context predating the systemic context in which the deposit which contained it was formed (see Chapter II.2.5); in the beginning these finds were treated mainly as a problem, while the focus stood on the dating materials, *i.e.* the ones at least broadly contemporary with the formation of the deposit which embedded them. This approach is somehow evident both in Barker's manual and in Carver's first papers; their identification was delegated to a form of empirical seriation of deposits.

[58] De Guio 1988. I guess this role is not exactly worldwide accepted, but yet I think that considering stratigraphic units *also* as operational tools is a key point for "assembling" (and possibly de-assembling) organic groups of units in deposits.
[59] For a brief review of the state of the art, see Bonetto *et alii* n.d.a. See Haselgrove *et alii* 1985 for the use of residuals also in unstratified contexts

Structural Periods	Layers	Pottery Types
Z	1	g + f + e + d + c + b + a
	2	g + f + e + d + c + b + a
	3	g + f + e + d + c + b + a
Y (ACERAMIC)	4	f + e + d + c + b + a
X	5	f + e + d + c + b + a
	6	e + d + c + b + a
W	7	e + d + c + b + a
	8	d + c + b + a
	9	d + c + b + a
V	10	c + b + a
	11	b + a
U	12	b + a
T	13	a
	14	a



figg. 5,6 *- Seriation as a tool for investigating residuality in* BARKER *1977 (above) and* CARVER *1980 (below)*

Ultimately the definition of 'residual' itself was not explicit. Nonetheless already in those years residuality drew the attention of methodological considerations. The already mentioned paper by P. Crummy and R. Terry (see above) also tackles the topic of residuals, defined as "pottery and other finds which derive from occupation earlier than their respective contexts suggests"[60].

The topic was challenged again in the early 1990s by J. Evans and M. Millet: the title of the paper, *Residuality Revisited*[61], is quite self-explanatory and finally the informative potential of these materials was investigated and their nature clarified.

Residuality seems to have been one of those rare methodological issues which caught people's attention also in Italy and even within the field of classical archaeology; in fact the the phenomenon is quite evident in classical and post classical stratigraphies and its importance stands even clearer thanks to the great abbundance of materials (ceramics in particular) produced particularly during the Roman period.

Thus the major recent works on the topic turn out to involve also classical archaeologists and are Italian. That is the case of *I materiali residui nello scavo archeologico*[62], a collection of papers edited in 1998 and completely devoted to various aspects of residuality. How the notion of residual remained fluid for long is demonstrated by the different definitions employed within the same volume. For C. Cecamore a residual is a "manufatto che, prodotto in un dato momento, dopo esaurita la sua funzione, si ritrovi in un contesto posteriore al suo periodo d'uso"[63], while R. Santangeli defines residuals as "quei reperti che, esaurito il loro periodo di utilizzazione e stratificati, sono stati in qualche modo riciclati in contesti posteriori insieme alla loro matrice terrosa" or "che restano in circolazione per un periodo di tempo più lungo dell'usuale"[64]. J. P. Morel, instead, prefers to simply consider residual "un oggetto la cui presenza sorprende per motivi cronologici, o funzionali, in un determinato contesto"[65], while E. Zanini proposes an original and stimulating definition of residuals "come componente antropica della matrice, o meglio come la parte della matrice di cui è più facilmente riconoscibile l'origine antropica"[66]. Finally J. T. Peña considers a residual "any sherd initially discarded before the beginning of the

[60] CRUMMY, TERRY 1979, p. 51
[61] EVANS, MILLET 1992
[62] GUIDOBALDI *ET ALII* (EDS.) 1998
[63] CECAMORE 1998, p. 117
[64] SANTANGELI 1998, p. 268
[65] MOREL 1998, p. 281
[66] ZANINI 1998, p. 293

formation of the context from which it was discovered as a residual"[67]. Furthermore, the paper by Peña is extremely important because he wonders how much time has to pass between the end of the 'systemic life' of an artefact and its last deposition in order that it may be defined a residual. The issue in turn involves the topic of accuracy and the distinction between a continuous and a discrete view of time, both discussed in Chapter II.2.7.

The same volume also contains an important paper by N. Terrenato and G. Ricci concerning a statistical tool which can be emplyed for the study of residuals (and finds in general). This approach is discussed in Chapter III.4.5.

The turn of the 1990s apparently witnessed also the shaping of the concept of "false residual", that is a find which lived an extraordinary long life (heirlooms for instance) and has been subject to forms of curation[68].

After about a decade the topic of residuality is again treated in C. Tronchetti's excavation manual [69] and then, more extensively, in a paper by E. Giannichedda. Giannichedda considers residuals "ciò che non è pertinente al contesto dal punto di vista cronologico"[70], but the approach proposed for their study and identification is more complex and suggests a mixture of functional, contextual and chronological criteria.

	Esempio	Il reperto ha giacitura 'alterata'	Il reperto pone un problema di decorso di tempo	Il reperto ha una funzione nella Us di giacitura	
1	Coccio romano in strato romano	No	No	No	Reperto in fase; giacitura primaria
2	Anello romano in tomba medievale	No	Si	Si	Cimelio
3	Concio romano reimpiegato	Si	Si	Si	Reimpiego
4	Coccio romano in strato medievale	Si	Si	No	Residuo archeologico
5	Anello romano in strato medievale	?	Si	?	Cimelio smarrito o residuo
6	Fr. olla funeraria in livelli di sepolcreto	Si	No	No	Residuo stratigrafico; giacitura secondaria
7	Oggetto in posto	No	No	Si	Reperto in situ
8	Monumento in elevato	No	Si	No	Sopravissuto
9		Si	No	Si	Non determinabile

***fig. 7** - Residuals, false residuals and reuse in GIANNICHEDDA 2007*

[67] PEÑA 1998, p. 296

[68] See RIZZO 1998, pp. 811-812 (partic. footnote 39). Later in RIZZO 2003, p. 21. About the topic see the more recent works of WALLACE 2006, SCHINDLER KAUDELKA, ZABEHLICKY-SCHEFFENEGGER 2007 and ZANINI, COSTA 2011. Coins present peculiarities appreciable in GORINI 1999-2000, GUEST 2007, LOCKYEAR 1999 and LOCKYEAR 2012 (see Chapter III.4.3)

[69] TRONCHETTI 2003, pp. 120-128

[70] GIANNICHEDDA 2007

Up to the present, although theoretical and methodological discussions about residuals seem to have ended, in material culture studies, when assemblages are presented, more and more often residuals, false residuals and in phase materials are recognized and separated[71]. The way in which this is achieved is, of course, a completely different matter.

I.2.6 Quantitative approaches

A much more extensive use of statistics and quantitative approaches in general is perhaps one of the most evident legacies of New Archaeology. This small revolution within the discipline of archaeology was possible also thanks to the more general development of computer science, which provided the essential tools for performing quantitative analysis. Historically the two privileged fields of application of quantitative approaches have been spatial analysis and seriation, but soon also assemblages drew the attention of quantitative analysts.

One of the major figures in this field is certainly C. Orton, whose contribution to the meeting of sherds and numbers is fundamental[72]. More generally quantitative archaeology is also indebted to the figure of S. Shennan[73], thus making the discipline one of the strongpoints of London's UCL Institute of Archaeology.

Unexpectedly methods from the first branch (quantitative studies applied to assemblages) will not be fully drawn for the present work. The reason can be traced back to the very peculiar nature of this field of studies. As stated in Orton et alii 1993, "We use the term 'quantification' in a precise and restricted sense, to mean the measuring of the amount of each type of pottery in an assemblage, with a view to describing the assemblage in terms of proportions of each type present"[74]. Thus, the quantification methods developed over the years (see Chapter III.4.4 for further references) aim primarily to compare different assemblages and to evaluate of the economic impact of some types compared with others. In a few words, they have not been developed for chronological patterning investigation. To perform this kind of analysis I have chosen a simple simulative approach (see Chapter III.4.5): archaeological simulation, as part of quantitative approaches to the record, is itself a branch stretching back to the 1970s but which had an extraordinary development in the last

[71] See for instance the recently published Panella, Saguì 2013
[72] For more references see Chapter III.4.4
[73] See the classic Shennan 1990. See for comparisons also the more recent Fletcher, Lock 2005
[74] Orton *et alii* 1993, p. 21

15 years. An exhaustive and recent literature review, with complete bibliography, is provided in LAKE 2014[75]. Nonetheless, as E. Crema rightly points out, the role of time in quantitative analysis is still somehow neglected[76], and traditionally also simulative approaches have mainly dealt with other issues. This aspect, along with the fundamental topic of uncertainty, has been recently tackled by Crema himself, drawing on the very young body of literature concerning temporal analysis in general. Crema in particular focuses on the global development of prehistoric Jomon pithouses (Japan), but as I will discuss in Chapter III.4.5 (see there for further references), the same quantitative, simulative approach can be employed to model intra-assemblage chronological data. As far as I know, a simulative approach (Monte Carlo simulation) for modelling assemblage chronological data has never been employed before.

Some other forms of quantitative approaches to assemblage chronology, as such as the above mentioned method proposed by N. Terrenato and G. Ricci, are, again, discussed in Chapter III.4.5.

I.2.7 SYNTHESIS AND CONCLUSIONS

As anticipated at the beginning of the chapter, the picture emerging from the review is all but organic. The authors and the works mentioned have been chosen deliberately and presumably, as the topic is so transversal, many other works could add some more details. Nonetheless I think that the backbone of the theoretical and methodological development that has occurred over, say, the last century, has been at least broadly sketched. Moreover, although the overall image is still somewhat incoherent, some important links between the different branches outlined can be traced. One of these is the clear link which can be traced between urban archaeology and the development of the studies concerning residuals, which, in turn, employ some quantitative techniques. What keeps these issues connected is indeed the urban environment, with its high rates of change and redeposition and its abundance of products (ancient) and finds (contemporary). From a more theoretical point of view, processual and behavioural archaeology can provide a good framework, if for no other reason that they traditionally focused on "how". Yet, by the mid of the 1990s, the theoretical and methodological debate about formation processes (both focusing on deposits as a whole or on artefacts) had, if not stopped, at least vigorously slowed down. The more evident

[75] LAKE 2014
[76] CREMA 2012, p. 441

consequence of such a state of the art consists of the fact that we still heavily draw on chunks of theoretical and methodological thought largely from 1970s-1990s literature. This condition of things should drive a strong resume of the debate, which would have surely positive consequences on the issue of dating as well. About the reasons of such a period of substantial inactivity, I think that an important role may have been played by both a global shift in archaeological agendas and by a more subtle conviction that the massive help of scientific techniques by itself would have solved post-excavation interpretive problems, included problems of dating. I strongly claim that the full exploitation of the wide range of techniques available, in particular within the field of dating, can only be achieved if framed and contextualized in a robust and continuously updated and debated theoretical and methodological background concerning the way the archaeological record is formed. Besides the fact it would allowing us to avoid rough misinterpretations, such a framework would be, in my view, the only way for moving, slowly maybe, from the smaller horizons of the field to the possibility of "making history".

Another point which emerges pretty clearly, with few remarkable exceptions, is the deafening silence from classical archaeology in the matters of theory and methodology in general and concerning formation processes in particular. This absence is even more notably because the availability of large bodies of data (with various natures), which qualifies classical archaeology when compared to other archaeologies (prehistoric, early medieval), should have pushed to better and more sophisticated systems for their theoretical management and to articulated and particular methods to extract information from them. Borrowing models from other 'archaeologies' cannot be considered sufficient and implies the underestimation of the peculiarities which are proper of the ancient systemic context studied. The reasons lies in the fact that models, in order to have some practical impact, cannot be general (not only at least), but must be specific. Studying the impact of waste disposal on assemblage formation processes in the Roman world, only and simply borrowing models from ethnographic literature or from prehistoric case studies may obviously lead to wrong conclusions. The specific features of classical archaeology, particularly in urban sites (see the Introduction) should, hopefully, compell the discipline to produce much more independent theoretical and methodological literature. I will refer back to some of these considerations in the final chapter. For the moment, I wish just to emphasise how it is only through a serious tackling of formative problems that a reliable use of assemblages for dating can be reached.

Fortunately some few examples show how the impact of such an approach in classical archaeology can produce invaluable benefits. This is, for instance, the case of the study of

residuals. But it is also the case of some after all recent developments in classical material culture studies, which are devoting more and more attention to the contextualization of ceramic assemblages and to the 'systemic life' of ancient pottery. In this field the work of J. T. Peña, drawing on both the tradition of Roman material culture studies and from a behavioural theoretical framework, has been somehow pioneeering and represents, in my view, a cornerstone of the recent literature on the issue[77]. Both the results of the *Pompeii Artifact Life History Project*[78] and of the *Palatine East Pottery Project*[79] may hopefully provide new interesting inputs.

While the theoretical and methodological debate proceeded, field archaeology kept on producing fresh data and interpretations through excavations and their publication, sometimes taking into account (but more often not doing so) the indications emerging from the debate.

As anticipated, writing a review of every urban excavation involving deposits from the classical period would be a job far too hard and probably it would not produce proportional benefits. Thus, to conclude this review of the state of the art, I will just cite, within the Italian landscape, some recent key publications which, in my view, show some critical evaluation of deposits status and formation for their dating and for chronology building. As I will discuss later, unfortunately they still represent a minor part in a world populated by provisional or partial editions or, worse, by non-editions at all.

Within the framework of Italian Classical Archaeology, A. Carandini's excavations and later excavations led by scholars who matured in the same academic environment, have long been a reference point for many. The Villa dell'Auditorium excavations (which in turn are a child of the Villa di Settefinestre excavations) represent a good attempt to present a full body of data in an organic way, integrating information drawn from the stratigraphic analysis with information drawn from the study of artefacts[80]. Residuality is taken into account and crucial contexts and materials are presented in some detail, along with some quantitative information. Chronology building is somehow explicit and allows for a certain evaluation and discussion, although it is not always clear if *all* the data is presented. Other excavations involved the very centre of the city of Rome: it is worth citing here in particular the Palatine

[77] PEÑA 2007
[78] See PEÑA 2014
[79] See in particular IKÄHEIMO, PEÑA 2009 and PEÑA 2009 (although, in my view, with some controversial considerations)
[80] CARANDINI *ET ALII* (EDS) 2006. It has to be stressed that, although the site is now part of of the periphery of Rome, the *villa* was in ancient a suburban one.

slopes excavations[81], as their publication generated indeed a quite harsh interpretive debate precisely about the date of some of the evidences that emerged.

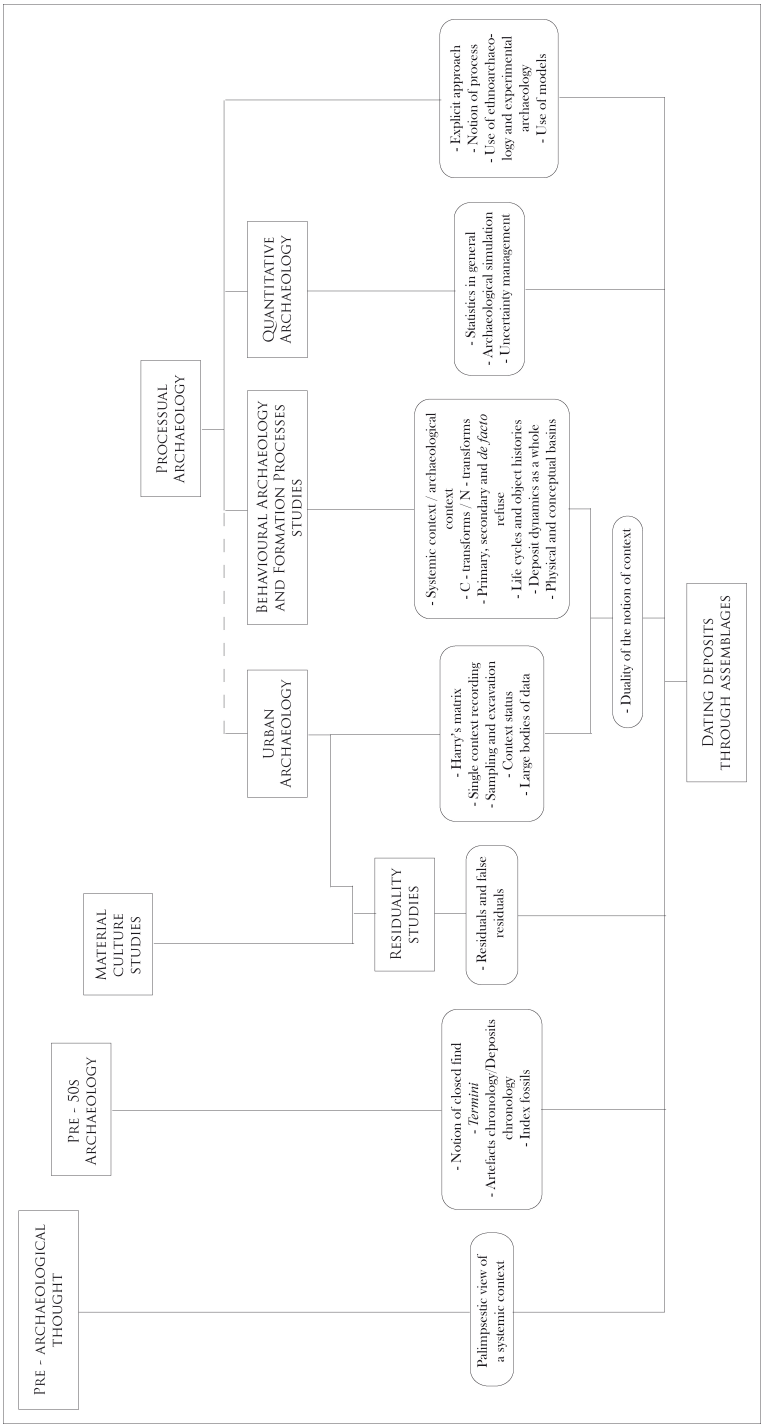


fig. 8 *- Diagram showing the contribution of different branches of archaeology to the use of assemblages for dating deposits (my view)*

[81] CARANDINI, CARAFA (EDS.) 1995, CARANDINI 1995, CARANDINI, PAPI 2006

It must be acknowledged that this was possible thanks to the main edition (were some materials are discussed by context and not by type) and through other papers which allow a critical and wide ranging view of the data collected. Other good examples throughout Italy are unfortunately rare. Large bodies of data from urban excavations lie unpublished and, among the published excavations, too many still do not provide sufficient data in order to allow an evaluation of dating (along with many other conclusions). Far too often the main edition of an excavation consists of a brief summary of the site's history and in a long typological list of finds. The key link between deposits and finds (*i.e.* a contextual approach) is seldom provided or, at most, can only be traced with difficulty. This could be quite easily achieved with simple lists of contexts and embedded materials and, possibly, their dates. A complete matrix, or at least some selected fragments, would also be very welcome, but are indeed very rare. Finally, the status of the deposits is rarely discussed, thus the crucial question "how did these finds find their way into the deposit" remains substantially outstanding, along with any possibility of dealing with the way in which the chronology was built and the single deposits dated. Finally, most dates (which are not raw data, but, at most, interpreted data) have simply to be taken for granted (according to a kind of principle of *auctoritas*), with no actual possibility of re-evaluation.

This pathological aspect of urban archaeology has been already discussed under different lights and a change has been urged. At this time, I just observe how this state of affairs also affects the topic of the evaluation of dates. A complete exposition of data would compell us to use them in a clear and probably more solid way, with great benefits for the quality of the interpretations provided as a whole. This kind of change cannot after all be viewed as a utopia, as other European experiences reveal that more integrated editions of stratigraphic and artefactual data from urban excavations, even involving large numbers of contexts, can be achieved[82]. This is the case of some MOLAS publications which are, at most, somewhat selective and present some difficulties for the reader to get a complete picture.

I would like to end these brief (and sad) considerations about how theoretical and methodological developments are practically employed with a clear flag-waving instance. In 2009 the excavations carried out at the Roman forum of Nora (Sardinia) were published by the working group I had joined as a young student[83]. A great effort was made in order to provide a complete overview of the data collected. Although as a whole the work is

[82] See for instance HILL, ROWSOME (EDS.) 2011 or BATEMAN *ET ALII* (EDS.) 2008
[83] BONETTO *ET ALII* (EDS.) 2009a

traditionally arranged into a part dedicated to the excavation (indeed very detailed) and a part dedicated to the typological presentation of the finds recovered, a conspicuous appendix presents the finds grouped by type, context, period and phase together with a graphic indication of the dating of each specimen. Eventually a complete Harris matrix is also provided. For the reader it is thus rather easily possible to extract the materials associated in each context, together with their nature and chronology and to put the context in the overall stratigraphic sequence. Any conclusion drawn by the excavators can eventually be questioned or elaborated and, even more important for the present work, the link between assemblages and contexts is somehow re-established. After five years on, it can be acknowledged that some more work has to be done in the future to improve the quality of the next editions: in particular a much more explicit and considered evaluation of the status of each context/deposit (or at least of the key ones) is perceived as necessary, along with a methodological and theoretical discussion of the procedures employed for producing and treating the data obtained. Hopefully this will be achieved with the publishing of the excavations recently completed in Aquileia, Fondi ex-Cossar, from which many case studies have been extrapolated for this work.

Part II

Theory

❖ INTRODUCTORY REMARKS ❖

II.1.1 ASSUMPTIONS

The field where the game of dating has to be played lies within a grey, shapeless area which is commonly known as the "post excavation" process. If on the one hand excavation theory, practice and methods have been subjects of many manuals and works, on the other one post excavation seems to be a much less codified field. There are no post excavation manuals and the unwritten rules are also pretty different. I think the explanation of this state of the art is indeed quite simple: excavation is more about getting the data while post excavation is more about interpreting it. Of course this is a very rough distinction and certainly the two fields are closely connected (in fact interpretation begins before and during the excavation, even if sometimes we are not aware of that), but for sure interpreting represents the core of the post excavation process and, at least at first sight, it is much more complicated than retrieving data[84]. How can we codify interpretation? It is even possible to question whether looking for a theory and a method in this field is a good idea.

Of course archaeology is populated by a considerable number of works on theory and methodology dealing with the interpretation of data; nonetheless they often concern more general aspects of the discipline or they employ data which is not exactly raw, but more often already partially interpreted[85]. For instance seriating sites (where sites and their chronology are the data) implies sites have already been dated. This in turn implies materials and other information were employed to date them, as stones and pottery do not speak by themselves. In this broad spectrum of interpretations, excavation interpretation has seen comparatively little attention. There is no doubt there is no organic view of what should happen after the throwel is put back in the drawer and indeed there is no hermeneutics of exacavation. Some aspects of formation processes and spatial analysis are considerable exceptions, but for sure theory and methods of employing artefacts in order to date contexts

[84] BARKER 1986, pp. 141, 147
[85] See SULLIVAN 1978, pp. 188-189 for the difference between data and phenomena in archaeology

and sequences represent a sort of dark hole[86]. The hole is even darker within the field of classical archaeology, where modern excavation techniques arrived quite late[87].

Given this state of the art, I will review some fundamental 'bits' of theory (concepts) and methods (operative tools) and then I will try to combine them in order to formulate models that are helpful in solving problems of dating deposits. However, before starting with theory, some assumptions have to be made.

The first assumption which has to be made is about the excavation itself. The single context, stratigraphic excavation is the basis for any reasoning about dating, simply because otherwise we can not date actions or groups of actions. Collecting pottery with no link to stratigraphy can, at most, allow us to date the occupation span of a whole site, not the construction of its buildings or infrastructures, nor its phases of abandonment or refurbishment. An excavation made by artificial cuts with no attention paid to actual strata would be useless as well.

The excavation must also be well documented; much information is necessary in order to investigate the nature of the excavated deposits and their chronology; among them a complete report of the artefacts and ecofacts embedded, a good description of the matrix, the stratigraphic relations and other data are necessary. Samples for analysis are also fundamental, as they may be used during the post excavation process for getting data which at first, during the excavation, were not considered relevant[88].

The Harris matrix (or its more sophisticated forms) is also considered necessary, especially in urban environments, where hundreds or even thousands of contexts are the norm. It is necessary not only as a tool for ordering and managing small or large numbers of layers, but also because it is "problematic", meaning it obliges the compiler to review what is observed in the field, correct errors and notice anomalies. Indeed, it is a tool for reasoning. Finally, it provides by itself a relative chronology, i.e. the basis for moving towards an absolute one[89].

Single contexts should be at least tentatively grouped[90] together when possible (I will come back to the problem of grouping later) and at least broadly phased. At this stage by

[86] ROSKAMS 1992, p. 27. A considerable exception, in my view still standing almost unchallenged, but too general in its layout to be practically very effective, is representented by the *corpus* of works by M. O. H. Carver, among which here it is worth citing CARVER 1990.
[87] ALTEKAMP 2004
[88] Watson *et alii* defined relevant archaeological data as "anything observable which pertains to the solving of the investigator's particular problem (WATSON *ET ALII* 1971, p. 114)
[89] See GALLINA 2012 for a recent discussion of the use/non use of Harris matrix in architectural analysis
[90] At this stage it seems sufficient to start with defining nodal points and segments See CARANDINI 1990, p. 41, ROSKAMS 2001, pp. 246-254

"phasing" I do not mean incorporating contexts and groups within a precise historical and chronological absolute framework. A phase at this stage should just be a broad container for contexts and groups that are phisically and logically related to common macro events (for instance construction, distruction, refurbishing, abandonement) and shoud be considered just as non definitive working tools.

Of course all these assumptions makes sense only whithin the frame of a general approach[91]: digging up or investigating only one or two contexts alone would make no sense, as one single context can only acquire a full meaning only if placed within a sequence. This is fundamental in order to avoid coarse errors: quantity and seriation count[92].

A serious and complete work on the artefacts and ecofacts recovered must also be assumed. The dates of these materials is necessary too. At this stage only materials whose chronology is well known independently should be used. This is to avoid the obvious problem of circularity. As we use, among other tools, materials in order to understand the nature of a context or group of contexts, and as the nature of the context determines the nature of the association of the embedded materials, using, at this stage, materials whose chronology has been defined, corrected or influenced by the the context itself and by the other materials would introduce a huge problem of circularity, distorting and biasing at the very beginning the data which will be employed then. Chronologically undefined materials should be avoided and safe, broad chronologies should be preferred to closer, tentative ones. Only later, just in case some circumstances occur (for instance in the case of a primary deposit with no or few residuals and responding to certain requisites) a context can be used as a tool to date artefacts of unknown or imprecise dating.

fig. 9 *- The problem of circularity. Photo courtesy of Katerina Kamprani*

[91] BOWKETT *ET ALII* 2001, p. 118
[92] See BARKER 1993, p. 226

Of course a problem of circularity in dating may have also affected chronologies that were taken for granted. This is not the subject of the present paper and careful selection of contexts (usually tombs) and use of other sources have certailnly strongly narrowed the possibility that this phenomenon occurred. For the moment, it is just worth noting that it is an issue which could arise in some cases when clear anomalies are detected[93].

Given all these assumptions I can finally move to examinte the first ingredient which is necessary in order to propose formative models of deposits oriented to dating, that is theory.

II.1.2 Which Theory?

This is certainly not the place to discuss, even in briefly, what theory is and the role it plays in archaeology. I will just try to focus on a few points which seem necessary in order to proceed in a structured way.

Theory has been defined by M. Johnson as "the order we put facts in"[94]; he also underlines that it originates from the necessity of justifying what we do, moving from simple common sense to something more structured and motivated. Indeed common sense is still the main tool employed (often implicitly) when dating contexts and I argue that it deeply pervades classical archaeology in particular.

E. Giannichedda defines theories as "insiemi di idee strutturate in modo coerente al fine di riconoscere, spiegare, interpretare, talvolta anche prevedere, fatti"[95]. He also stresses that theory should not be developed for its own sake, but should be helpful for practice. He sees theory and practice as closely connected and not opposed each other.

I deliberately pick three key features from these two points of view:

- the necessity of moving from common sense to something more structured;
- the definition of theory as a set of ideas;
- a practically oriented conception of theory.

Theory for a practical aim is exactly what I need and common sense is obviously not enough to build a solid model that is useful for comparisons. I will also employ theory as something made up of ideas. I venture to define ideas, in this sphere, as mental tools

[93] In case that evident chronological outliers were detected within an assemblage, and in case no evident mistakes in the excavation procedure were recognised, along with no possibility of intrusions or misundersdanding of the deposit nature, a revision of the outlier chronology should be considered.
[94] Johnson 2010, pp. 2, 216
[95] Giannichedda 2002, p. 9

oriented to a practical aim (dating contexts); of course ideas need to be indicated by terms and terms of course need to be defined. After all defining terms is always part of the theoretical debate[96]. So what follows is a series of theoretical tools which seem to me to be necessary to build the models I am looking for.

It will be immediately clear that some of definitions I present are quite different from the common acceptation of the term discussed. Sometimes the difference may seem to be slight, but indeed substantial if the aim is to get a proper tool. Most of the differences are due to a common factor, that is that many terms (for instance "primary", "secondary" etc.) are commonly employed in a spatial perspective rather than in a temporal one. As I will explain later, one deposit may be primary from a temporal point of view, but secondary from a spatial one. Often these terms are used with a mixture of spatial, functional and temporal meaning. Most of the archaeologists of course have some kind of idea of the meaning of the terms, even if they are not universally codified, so I have decided to employ them giving their meaning a new acceptation or choosing the one which best applies to my target. I considered that using new terms, in this case, would have created more confusion than using new acceptations. Anyway in the future the use of new terms may be well accepted; after all, terms by themselves are just labels.

[96] HODDER 1991, p. 8

❖ KEY CONCEPTS ❖

II.2.1 ARCHAEOLOGICAL CONTEXT/SYSTEMIC CONTEXT/CONTEXT

It is well known that the notion of "systemic context", opposed and related to the notion of "archaeological context", is bond with the studies carried out during the 1970s by M. B. Shiffer and then further developed by other scholars grouped under the label of Behavioural Archaeologists (see the Literature Review). In his first published work on the topic, Schiffer states that the "*Systemic context* labels the condition of an element which is participating in a behavioural system", while "*Archaeological context* describes materials which have passed through a cultural system, and which are now the objects of investigation of archaeologists"[85]. The definitions are then recalled in successive works. What is meant by "systemic context" is basically a living system, made of people, structures, objects, ideas, behaviours, practices. In a chronological perspective, I argue that every single moment represents, theoretically, a different systemic context. Dating a deposit (the part of the archaeological record we are interested in), in this way may, be seen as assigning it to the right systemic context. Of course between the actual ancient life and the record there are cultural or natural processes (see *infra*) which have to be decodified and which make the relations between the two extremes non linear.

One important point needs to be made about the temporal meaning of "systemic context" and its relation with the archaeological one: even excluding a problem of time resolution (cfr. *infra*), a given systemic context is populated not only by contemporary objects or structures. It is also made up of things produced by previous systemic contexts: right now, in my own context, I am writing within a building built in 1937-39 using a six years old laptop. The city itself where I am writing still displays many late medieval buildings. Each one of these elements was produced years ago, but it does not mean that they are not in use now. So, even if the present systemic was perfectly mirrored archaeologically, the result would be a palimpsest[86] (see *infra* the concepts of false residuals and primary deposits).

Finally, it must be underlined that the term "context" by itself is a pretty difficult one. Apart from very broad meanings referring to historical, social, political or more strictly

[85] SCHIFFER 1972, p. 157
[86] BAILEY 2005, p. 269

archaeological circumstances in which a find has to be placed, in Anglo-Saxon archaeology the term context indicates specifically what in Italian is called "unità stratigrafica" which literally means "stratigraphic unit". I will not linger on what a stratigraphic unit is and how its boundaries may or may not be detected; it is just worth underlining its dual nature as a physical and operative/interpretative tool[87].

So, I will use of course the term "context" to also indicate a stratigraphic unit. As the topic of this thesis is dating deposits through the use of artefacts, I will focus on positive stratigraphic units, i.e. layers or strata, and not on negative ones, because evidently these last ones do not contain any material. As I will explain later the Italian word "contesto" assumes different meanings from the Anglo-Saxon one.

II.2.2 DEPOSIT

Besides very general meanings assigned to the term, a general review of what is commonly meant by "deposit" in both geology and archaeology is provided by a paper by J. K. Stein, where the "concept of deposit" itself is nuanced in different ways[88]. In fact what clearly emerges is a lack of consensus about the meaning of the term. Sometimes it is used to indicate a single context (or layer, or stratigraphic unit, usually a positive one[89]) and, more importantly, sometimes it is used to indicate a physical three dimensional unit, at others it is used to indicate a sort of operative-interpretative tool with certain cultural, chronological or formative features.

I think that in this case it is much more useful to start with what I want to name. The point here is what we date. The basic unit which is dated using assemblages is the context (besides interfaces). Nonetheless it may turn out to be necessary to move from one single context to a group of contexts whith similar features. The reason is both "quantitative" and "qualitative"[90]. In the first case dating a single context by the embedded artefacts may mean using an insufficient amount of data. For instance dating the backfill of one single post hole through one or two sherds (see Chapter III.4.2) would be almost useless, besides having a very vague *terminus post quem*, which moreover may be very far from the actual time of

[87] DE GUIO 1988 is still a cornerstone for critically approaching the concept of context (in the paper namend UA, "unità archeostratigrafica")
[88] STEIN 1987. The author draws in particular from the work of H. Gasche and O. Tunca (GASCHE, TUNCA 1983)
[89] In MoLAS Archaeological Site Manual the term "deposit" is used to indicate contexts results of positive actions
[90] See TRONCHETTI 2003, p. 112

deposition. On the other hand dating the whole group of backfills of the post holes pertaining to the same house would allow the use of more data, permitting at least a better definition of the *terminus post quem* and avoiding a problem of sampling. Indeed as most of archaeology is a matter of sampling and data loss I think we should avoid any unnecessary loss.

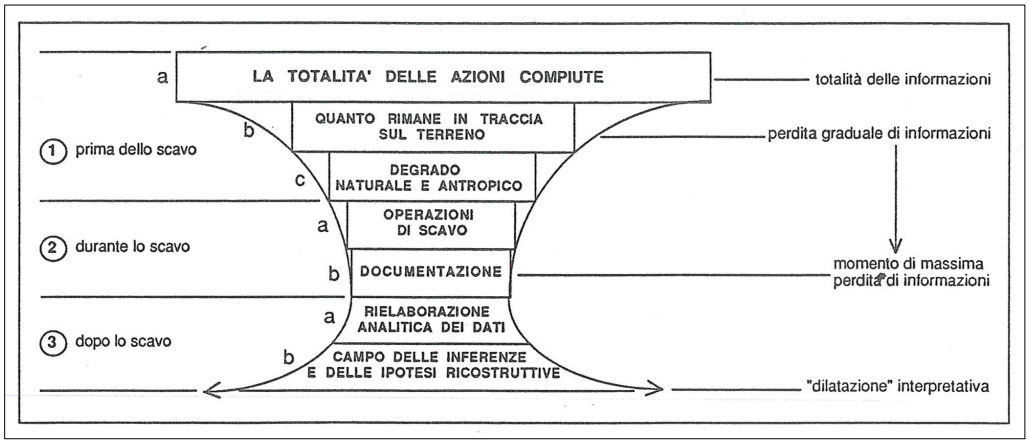


fig. 10 *- A classic model of information loss from* LEONARDI *1992a. This loss can be viewed as a form of progressive sampling*

From a qualitative point of view, it has to be stressed that some processes (or actions or groups of actions) can only be fully understood by applying a global approach. For instance, one single hole is just one single hole and some times it will be very difficult to understand its function. Only by widening the view that we have it is possible to catch if the hole is related to the removal of a post, which in turn was part of a structure. Moreover, when dealing with chronology, there is no theoretical reason for keeping separate two or more contexts related to the same action or group of actions.

The point is how to group contexts, i.e. which criteria I intend to use in order to define what a deposit is. It should be noted that the activity of grouping contexts, which has a very fundamental role in post-excavation interpretation, is again very understudied and uncodified[91].

As contexts are physical volumes defined by specific features, one deposit has, consequently, its own material connotation, given by the sum of each context involved. It means deposits are not only theoretical or operational constructions, but actual, measurable amounts of sediments, artefacts and ecofacts. A deposit consisting of the backfill of the

[91] For a brief dissertation of the issue and further references see ROSKAMS 2001, pp. 257-261

construction trenches of one room has a defined volume, weight and so on, made up of the sum of the volumes and weights of each single backfill involved.

Nonetheless of course what defines the deposits are other features which are not physical. Within a chronological perspective it is fundamental to ensure that the grouped contexts pertain to the same action or group of actions, i.e. that they are the product of the same formative process. This means, for instance, that different parts of the collapse debris discovered in different rooms of the same building with the same stratigraphic position may well be associated in one deposit, while a floor and its covering "occupation layer" should be split in two different contexts. This is maybe one of the most difficult points, not much from a theoretical point of view, but from a methodological/operative perspective; it also seems to involve a good amount of interpretation and discretion. Sometimes it may be almost self evident how to group some contexts (walls built all together, two different contexts which are in fact the same floor cut by a trench through the middle, post holes aligned in a circle and so on), in other cases it may turn to be much more difficult. I think that a cautious approach should be preferred, creating even one context deposits in case of doubts, in order to have a more solid, although less productive, base of data.

One obvious and and very important consequence of such a consideration is that one deposit is equal to one date. One deposit can not have multiple moments of formation. Of course it may have a long history behind, but the "main formation moment" must be one. Of course it can be abrupt or 'punctual' or last for a lenght of time appreciable archaeologically and it can be less or more precise.

In conclusion, a deposit is meant as a group of contexts that are the product of the same positive formative process in the same time; it is both a physical volume and a theoretical/operative tool. From this perspective the assemblage is part of the deposit.

Indeed this use of the term is quite similar to that made by. P. Crummy and R. Terry in their 1979 paper[92], where they also propose a kind of typology based on deposits informative potential (see *infra* and the Literary Review).

Given this definitions, there are some terms that are frequently used with similar meanings: "feature"[93] is often intended as "recurrent patterned arrangements of archaeological contexts forming an interpretative category recorded during an excavation"[94]. In my view, the

[92] CRUMMY, TERRY 1979
[93] BARKER 1986, p. 139, CARVER 1983, fig. 10
[94] DARVILL 2008, p. 154

term and its definition and use are quite ambiguous as the parameters on which the interpretation is based (spatial? temporal? formative?) are not clear.

Another term which is used very similarly to the way I use the term "deposit" is "group". By "group" (or "sub-group", "context series", "block", "text section"[95]) is obviously meant "group of contexts". It is a very neutral, un-connoted and, consequently, flexible term. Of course a group can also be used to indicate a combination of cuts, which of course are the result of negative processes, so they do not involve the presence of datable artefacts. Although, the term "group" (alone) is very generic and the expression "group of contexts" is some too 'long', they both represent, anyhow, convincing alternatives when dealing with a whole sequence, as they allow the progressive grouping of every context, including interfaces.

What I mean by the English term of "deposit" is often indicated in Italian by the term "contesto"[96], while the term "deposito" is employed, often within the field of archaeological risk evaluation, to indicate the stratification of a site as a whole[97]. Sometimes contexts are grouped in "attività" or in "avvenimenti/periodi"[98], which literally mean "activities" and "events/periods": I personally dislike this kind of terminology as it mixes up agents and products; in other words groups of contexts, physical slices of stratigraphy, are named "activities", while in fact these are what produced them. An activity is by definition an action or group of actions and it is not "material". On the other hand "events" and "periods" indicate a chronological (historical) partition, which uses time and not formation processes as a discriminant[99]. These are way of arranging stratigraphic units which have to be made *a posteriori*, once it is known their date, while grouping contexts in deposits has to be done before, right in order to infer their date.

II.2.3 Assemblage

Assemblage can be defined as the set of artefacts (and ecofacts and datable samples) recovered within a given deposit[100]. According to the nature (or status[101]) of the deposit, it may

[95] Roskams 2001. pp. 257-258
[96] Carandini 1991, p. 52
[97] Leonardi 1992a, Leonardi 1982. More ambiguous Leonardi 1992b
[98] Carandini 1991, pp. 140-143. See also Roskams 2001, pp. 259-261
[99] See for instance Bonetto 2009a, p. XXIX
[100] This definition at least is roughly widely accepted (see Jameson 1999, p. 89 and Carver 1990, p. 89, also underlining the point that the assemblage is practically selected by the data acquisition strategy). Of course "assemblage" is also defined the "facts-set" within a single context: I considered substantially unproductive to further split the notion of assemblage naming the context assemblage and the deposit assemblage in two different ways. The insertion of the datable samples recovered within the deposit may seem odd, but they are

reflect the systemic context of the moment in which the deposit formed or it may not. Its composition is thus closely influenced by the processes which contributed to forming the deposit. In this thesis an assemblage is understood as part of a deposit (a subset of a deposit), carrying, among others, chronological information.

A few words have to be dedicated to going a little deeper into an important issue concerning assemblages, that is the kind of relation which links the single artefacts to each other[102]. I distinguish two main different associations, which I call true and false. For "true association", or "systemic association" I mean an association which is substantially the product of a living system: two or more artefacts recovered within the same deposit were truly associated in a certain systemic context and consequently were in use in the same period (and space). Thus a link existed in a certain moment of the past. It is, for instance, the case of deposits sealed by the sudden collapse of a building: in this circumstance, supposing a lamp and a jar were recovered, we can argue they were in use in the same period. In this case the assemblage mirrors one past "systemic context" (see *infra*).

On the contrary for "false association" or "depositional association" I mean an association which is mainly the product of depositional processes: the link between two or more artefacts may not have existed in any past living system, but it is only "archaeological". In other words two artefacts are present within the same deposit because of processes of redeposition or infiltration. This is, for instance, the case of the backfill of a robber trench: as I will examine in more detail later, part or most of the backfill may come from adjacent strata (cut by the trench) which in turn may belong to different periods. Thus, within the backfill, we may find a mixture of artefacts which may have never been in use all together.

The distinction between true and false associations[103] clearly recalls the issue of primary and secondary deposits.

Finally, it must be noted that sometimes among Italian archaeologists the terms "contesto"[104] and "*facies*"[105] are used as equivalent to "assemblage".

---

an invaluable source of chronological information, in the same way as pottery, coins etc. are. Of course, ecofacts are also part of the assemblage, although most of them are usually undated. Obviously a chronological analysis will be carried out only on the "datable part" of the assemblage. Thus, in a more restricted way, when dealing with dating, an assemblage could be defined as "whatever is datable within a deposit".

[101] See CRUMMY, TERRY 1979

[102] The topic is briefly tackled in VINCE 1987, pp. 201-201

[103] See also BARKER 1993, pp. 228-229

[104] TERRENATO 2006, p. 93, GIANNICHEDDA 2006, p. 125

[105] TRONCHETTI 2003, p. 112

II.2.4 PRIMARY AND SECONDARY

The above mentioned definitions of systemic/archaeological context and deposit leads us quite straight to what is meant by primary and secondary deposits. Nonetheless firstly some clarifications are needed.

First: the adjectives "primary" and "secondary" are commonly applied to both artefacts and deposits. M. B. Schiffer himself uses the terms referring to both: stating that "artifacts discarded at their locations of use are termed primary refuse; those discarded elsewhere are known as secondary refuse"[106] the scholar is clearly referring to materials; however he also observes that "primary deposits[107] were formed by cultural deposition at that place, whereas secondary deposits contain materials redeposited by environmental processes, usually flowing water"[108]. J. K. Stein went as far as to heavily criticize the idea itself of talking about primary and secondary deposits, claiming that one deposit (the one we are investigating) was laid down only once[109].

Despite Stein's objection, which seems to me correct from a geological point of view, but not from an archaeological one, I will talk of primary and secondary deposits. This is the basic distinction I will adopt in grouping deposits with different formative models. Nonetheless I also interpret the two terms in a very specific way. If one goes back to Schiffer's above mentioned statements, as well as to a conspicuous body of literature, it can be appreciated that the two terms "primary" and "secondary" (both applied to materials and deposits) are basically meant in a spatial/functional way. At other times a spatial/functional meaning is mixed implicitly or explicitly with a temporal one[110]or it indicates more generally an informative potential, useful in evaluation practices[111].

I think that in order to get a conceptual tool useful for practical purposes it is much better to distinguish between temporal, spatial and functional issues. In dating it is obviously time that counts, so the definition I will apply to the two terms has a clear temporal acceptation.

[106] SCHIFFER 1996 p. 58, recalling SCHIFFER 1972, p. 161
[107] Here apparently meant as the body of archaeological stratification making up a whole site.
[108] SCHIFFER 1996, p. 199. Cultural redeposition seems underestimated, even though the chapter is dedicated to environmental formation processes.
[109] STEIN 1987, pp. 350-351
[110] It is quite difficult to list all the times that such common expressions have been employed. They are also quite common in didactic and unpublished works. For a brief discussion see ROSKAMS 1992, p. 28. For just one example of a mixture of spatial/functional and temporal meaning see OUTRAM *ET ALII* 2010, p. 2826
[111] ROSKAMS 1992, p. 28

Thus, in my view, a primary deposit is a deposit whose assemblage largely belongs to the same systemic context in which the deposit was formed, while a secondary deposit is a deposit whose assemblage largely or completely belongs to a systemic context previous to the one in which the deposit was formed.

In the first case the materials embedded within the deposit reflect part of the materials which were actually in use when deposit was formed. Of course it does not mean that the artefacts were necessarily produced in the same systemic context: they may have been produced previously, within an appreciable time lag or not (see below "real time" and "archaeological time") but for sure they were still in use in some way (see above archaeological context/systemic context/context). We may say they were still under the sun, with whatever function, and had not already been discarded and deposited. Summing up, they were not archaeological objects.

These deposits seem to correspond in some way, to the so called closed finds, to Crummy and Terry's class I deposits[112], and to deposits containing Roskams's Type A finds[113]. Nonetheless at least both the last two entail some degree of spatial relation between the artefacts and the activities which produced them. This is not the case of the definition I use: take for instance the fill of a small rubbish pit located within a Roman house. In the perspective of dating it can be considered a primary deposit (the pit was mostly filled with materials which were circulating). However, in a spatial perspective, the same deposit cannot be considered primary, as the artefacts were displaced some distance from their use area. Indeed they would probably inform the researcher of which activities where carried out in the house as a whole, but not of the activities carried out in the room where the pit was located.

The concept of "closed finds" has a long tradition in seriation and goes back to Flinders Petrie and Thomsen (see the Literay Review) and is used with a meaning close to the one proposed here; it is a definition that is usually applied to burials and shipwrecks (which form no part of the discussion here) while in urban environment its codification seems to be much less clear, apart from the most evident "Pompeii cases". It is meaningful that the term used is "finds" and not "context" or "deposit", thus indicating a clear focus on the pattern displayed by the assemblage. In general the term refers to those groups of artefacts which seem to be linked by a relation of contemporaneity and this seems to generate some misleading conclusions as contemporaneity in use does not imply contemporaneity in

[112] CRUMMY, TERRY 1979, pp. 54-55 . See the Literary Review.
[113] ROSKAMS 1992, p. 28

production at all (see above). Finally, the term sometimes also carries the meaning of "sealed off", which yet refers to the problem of infiltration, something that is something quite different (see below)[114].

Secondary deposits are deposits embedding high percentages (or the total) of materials which reflect systemic contexts previous to the context in which they were finally laid down. It is usually the case of sediments redeposited along with the materials they contained; these artefacts do not inform us of the systemic context in which the deposit was laid down for the last time (before they are dug during the excavation!). In other words they do not inform us of the moment of deposition, they can only inform us of the moment after which it happened. Certainly they carry other important information and are commonly known as residuals (see below).

By using the terms primary and secondary in this dating oriented perspective, it is not necessary to use other expressions, as such as "tertiary deposit", which indicates the number of redepositions more than which kind of link connects the materials and the deposit. Looking at the number of redepositions some primary deposits would turn out to be secondary or even tertiary; ascertaining whether a given context or group was redeposited is of course fundamental in order to model its formation profile and then to date it, but the primary distinction has to be made by looking at the possibility and modality of dating the deposit.

II.2.5 Residuals and false residuals[115]

Given the above mentioned definitions of "primary" and "secondary" and given the concept of "systemic context", definitions of what is commonly known as "residual" and "false residual" follow rather consequently.

A residual is an artefact, ecofact or sample which was discarded in a systemic context previous to the one in which the deposit was formed.

A false residual is an artefact, ecofact or sample which was produced before the systemic context in which the deposit was formed, but which was still in use at that time, belonging in effect to that systemic context.

[114] See for instance the entry "primary context" in DARVILL 2008, p. 365 and compare it to the entry "closed association" in *ibid*, p. 99
[115] See ROVELLI, SAGUÌ 1998

Of course both the definitions require some more explanation[116]. Residuality is primarily an effect of redeposition[117] and implies that materials which had been discarded and deposited (i.e. they had already become archaeological objects, thus stepping out of the systemic context) are relocated and redeposited (more probably along with sediments) in their final "resting place". They can provide precious information about:

1. the formation processes themselves;
2. the original basin(s);
3. trade, economy and activities within a site as a whole;
4. undetected or lost phases;
5. others.

Nonetheless they cannot directly inform us about when the deposit was formed and which was the systemic context which produced it.

On the other hand false residuals were somehow in use when the deposit was formed, even though they were produced some time before (say a time lenght which is archaeologically appreciable). Their persistence in the systemic context may be due to their natural long life on average or to the phenomena of curation, usually because of their value (economic, social or whatever). To be archaeologically appreciable false residuals, two circumstances must occur:

1. the curated artefact life has to be sufficiently long (say fo instance an object passed through two or more generations). The broader the overall dating of the artefacts of the assemblage, the longer its life has to be for being detected; conversely very well dated and shortly lived artefacts within the assemblage will allow to pinpoint even a slightly older object;
2. the examined deposit has to be primary, otherwise obviously any chronological difference may be ascribed to formation processes[118].

[116] For an overview of some of the most popular uses of the term and for a review of the approaches to residuality see the Literary Review

[117] A. Vince witty defined residuals as 'soil-derived sherds' (VINCE 1987, p. 202)

[118] Otherwise it would be easy to run into the mistake suggested in LUCAS 2005, p. 101

II.2.6 INDEX FOSSILS/HORIZONS[119]

I think that the archaeological concept of index fossil, borrowed from geology, is sometimes misleading. Basically an index fossil is something (whatever) that distinguishes something else (a period, a space, a culture, a gender and so on, or the combination of two or more). In other words they are specific traces that can be helpful to detect something. In our case artefacts distinctive of a given period. What is sometimes forgotten, I think, is the fact that they are distinctive of periods and not of deposits: for instance, Italic *sigillata* is distinctive of the early Roman imperial age, but not necessarily of the deposits formed in the early Roman imperial age. At most it can be considered distinctive of some primary deposits of the early Roman imperial age. If one takes the building of a temple under the reign of Augustus, the deposit made up of the backfills of its foundation trenches may or may not contain Italic *sigillata*, according to its formation process. If the backfill consisted mostly of the more ancient sediment excavated by the trench, it is likely to also contain more ancient finds and the Augustan deposit may turn out to be characterized by republican black glazed ware.

Index fossils refer to the continuum of time, to historical time intervals and not to discrete deposits; so do the so called horizons, which are associations of more index fossils which are typical of a given period[120].

I think that both the concepts of index fossils and horizons, though useful in other levels of interpretation, are not useful and possibly misleading in the specific case of dating deposits. Thus I basically will not employ them, apart from dealing with the issue of *ex silentio* arguments (see below). As much as every piece of information we can gather, besides the case of intrusions, they can be employed as *termini post quem*[121].

II.2.7 "REAL TIME" AND "ARCHAEOLOGICAL TIME": ACCURACY

It is not the concern of this thesis to discuss any philosophical or physical implication of the idea of time. Even in archaeology, as a whole, the topic has been discussed according

[119] For an overview of the use of the two terms especially in Americanist archaeology see LEE LYMAN, O'BRIEN 1999

[120] Apparently sometimes the term is also used as synonym of "deposit" as meant here (See MARTIN 2012)

[121] As they are usually well known and recognisable, they can be an effective operative tool in guiding the excavation in its progress; the presence of plastic materials, for instance, quickly points to the contemporary era.

to many different points of view[122]. The point here is primarily that of archaeological time resolution. Given time as a continuum, the contemporaneity of two events depends very much on the accuracy of our measurement: for instance with a common clock, two events happening in the same second can be considered contemporary, but in many sport races one thousandth of a second makes the difference. In archaeology the accuracy of our measurement tools is obviously far lower, therefore even events which happened in different years are considered contemporary. We may say that in this case archaeology looks at history through a very unfocused lens and thus approximation is a necessity closely connected with the nature of archaeology itself. Without this important conceptual tool, the idea itself of primary deposit as described above would not exist (every deposit is subsequent to the events which produced it) and its materials would be at most all false residuals. Eventually it follows that different systemic contexts, understood as time slices (see above), are appreciable only in this discrete view.

The concept of accuracy is closely connected to the concept of time scale[123]: the higher is our chronological accuracy, the bigger is the time scale we can adopt and consequently the shorter are the time intervals in which we can divide time. As accuracy depends mostly on the quality of dating of each single artefact we recovered, we can also claim that the better is the quality of the initial chronological data, the bigger is the scale we can adopt and the smaller are the intervals in which we can divide the time line.

For instance, if we are handling materials broadly dated to one/two century intervals (take amphorae), using a time scale which adopts intervals/boxes of 25 years would be simply useless; on the contrary, using time lapses of 50 years when we dated the single artefacts within boxes of 10 years would lead to a useless loss of information.

If we move from the assemblage-deposit relation to the deposit-deposit relation we obviously have a relative sequence which allows us to order them. The only important issue which has to be pinpointed is indeed quite simple: we know safely that a given context or deposit is *after* or *before* another one. In the activity of grouping contexts in deposits, this is an issue which assumes a certain importance. When we group together layers that lie one above the other, conjecturing that they were laid down for, say, the same building necessity (having well drained foundations for the upper floors), we assume that this activity took place in a time length shorter than the accuracy allowed by our dating tools, even if we can

[122] See BAILEY 2005 for a brief but fundamental overview. See also LEE LYMAN, O'BRIEN 2006, pp. 97-166, LUCAS 2005 and BAILEY 1983

[123] For an original dissertation of the role of scale (both in time and space) in Archaeology and for "the fractal dimension of archaeological patterning", see EDGEWORTH 2013. See also GOSDEN, KIRSANOW 2006.

recognise a sequence of *after* and *before*. On the contrary we do not group together a mosaic floor and a dump laid down on its surface, because the are products of distinct processeses, potentially (if not probably) far each other in time and we do that even though finally the quality of the artefacts dating will not allow us to distinguish them chronologically.

These topics introduce another one, which is the duration of the deposition of a given deposit. In an urban environment, excluding natural strata, most of the deposits are likely to have been formed in short time span. Nonetheless there are remarkable exceptions (large dumps, dark earths -though very particular- and others) which will be treated specifically.

II.2.8 *TERMINI POST QUEM, AD QUEM, ANTE QUEM*

Once defined how and what we date, some notes must be dedicated to what the date means or refers to. It is commonly known that one context or deposit formation can be dated *ad quem*, *post quem* or *ante quem*[124], but it is incredible how these *termini*[125] are still misused or confused.

The most important and most applicable *terminus* is the *terminus post quem* (or *terminus ante quem non*[126]): it is a date, a more or less precise moment within the time continuum, after which a deposit was formed. Whithin a deposit with an assemblage, a *tpq* is provided by the most recent embedded artefact (or ecofact or sample). As most of the artefacts are dated within a time span with a start point and an end point, the start point has to be chosen. For instance if the most recent artefact is a sherd of stamped Samian dated 20-50 AD, the *tpq* is 20 AD, as the artefact may have entered the deposit just after the beginning of its production. Theoretically any deposit is provided with a *terminus post quem*, but particular care has to be devoted to establish if there is any intrusive material (cfr. *infra*), as any intrusion would create a false, more recent, *tpq*. Unfortunately, very often, with insufficient motivations and great ease, *tpq*s are in fact employed for dating straight *ad quem* (cfr. *infra*), i.e. assuming more or less explicitly that the more recent artefact must have been very near to the moment in which the deposit was formed. Of course this is a conclusion which has to be supported, otherwise it may be true or false as well.

[124] See HARRIS 1989, p. 121, 125-126, BARKER 1993, pp. 224-229, SHAW 1999a, SHAW 1999b. Less clear is TERRENATO 2002, pp. 267-268

[125] Literally boundary-marks

[126] In my view, this is theoretically a more correct expression, but I acknowledge that, practically, it seems a pedant complication

The *terminus ante quem* (or *terminus post quem non*) is a date before which a deposit was formed. While the *tpq* is provided by inner data, the *taq* is usually given by external ones, i.e. by information embedded in later contexts, deposits or structures. For instance one layer, covered by debris certainly related to the great fire which devastated Rome in July 64 AD, was formed before or, at the latest, in July 64 AD. To use a *taq* properly, it is extremely important it is unquestioned, a cornerstone of very good reliability: tpqs should be structures or layers or deposits whose formation is placeable in a time frame with a high degree of certainty, possibly through the use of historical or epigraphic sources. Primary deposits (whose nature has been fully studied) can play the same role. If this prerequisite is not met, serious problems may occur in dating a whole sequence. The issue has been clearly engaged with by P. Barker: "[...]we must be careful not to be led into a circular argument. A terminus ante quem cannot be given by a layer which is dated by an object embedded in it which merely gives it a terminus post quem. For example, if a floor in a house contains a coin of AD 267 firmly stratified in it, the floor must have been laid in 267 or after. It does not follow that the layers below the floor were deposited in 267 or earlier. Subsequent excavation of another floor many layers below the first might produce a stratified coin of say, AD 370. In that case all the layers above take a new terminus post quem of 370 or later. The whole complex might ultimately turn out to be tenth century. Unless the limitations of stratified datable objects are fully appreciated there is a danger that serious dating errors will occur in interpretation, to be perpetuated in the literature"[127]. I think there is nothing more to add, but one more example can show how these clear and logical indications are in fact often forgotten. It is the case of a 3rd century BC dump investigated near Cattolica: "La buca venne così completamente obliterata; la superficie non presentava sconnessioni nè avvallamenti, ed anzi a garantire un facile scorrimento agli uomini e ai mezzi era stato superiormente steso un sottile strato di argilla giallognola [...] ; è in questo livelletto, in prossimità dell'angolo nord-ovest, che è stata rinvenuta una moneta, un bronzo coniato della serie di *Ariminum*, perduta in un momento imprecisato, certamente posteriore al riempimento o durante le fasi di stesura dell'argilla, che fornisce un *terminus ante quem* alla datazione della struttura e del suo riempimento"[128].

Dating *ad quem*[129] means determining in which date or within which time frame a

[127] BARKER 1993, p. 226

[128] MALNATI, STOPPIONI 2008, p. 53. Similar errors occur in manuals as well. See for instance DREWETT 1999, p. 113

[129] Sometimes the expression "*terminus ad quem*" is employed as a synonim of "*terminus ante quem*" (*ad quem* has this meaning in juridical language). This seems to be due to the many meanings of the Latin preposition *ad*.

given deposit was formed. In other words it is simply dealing with when (and not "before which date?" or "after which date?"). It may assume the form of either a punctual date or a time span, which is more or less wide, according to the quality of the available data or to the duration of the process involved (for instance the construction operations for erecting an aqueduct may last for years or decades) or a combination of the two. It can be provided internally if the deposit is primary or at least if it is possible to establish a solid chronological relation between some artefacts embedded and the moment in which the deposit was formed; it can also be provided externally, coming from the combination of a *tpq* of a more ancient deposit and the *taq* of a more recent one (it is the case of a layer or structure which does not contain any datable artefact). Finally it can be provided by both internal and external data, by its own *tpq* and the *taq* of a more recent deposit.

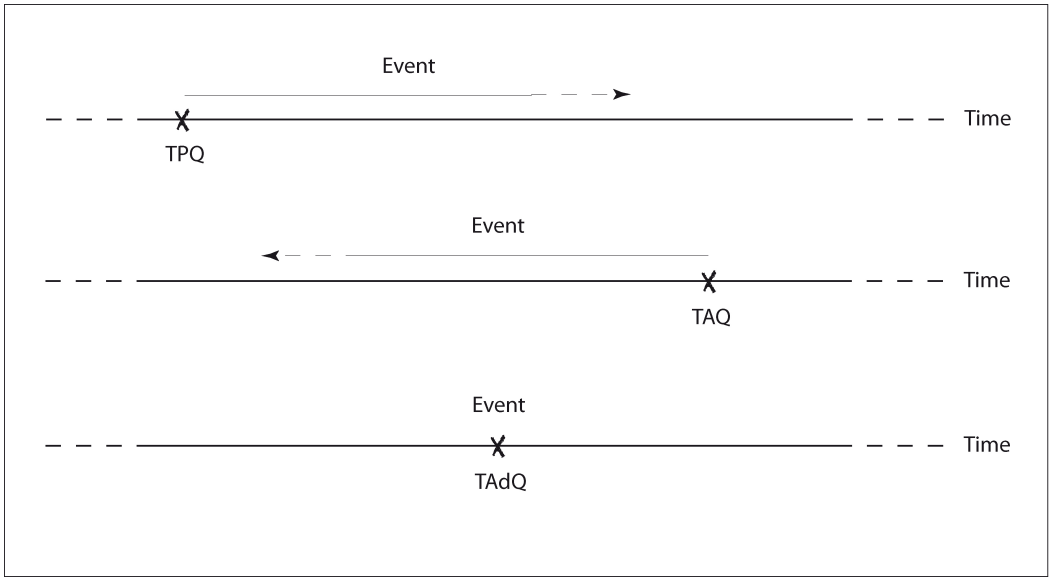


fig. 11 - Terminus post quem, terminus ante quem *and* terminus ad quem

In this case I employ it with meaning "in relation with", "bonded with", "referred to", and not meaning "until". Indeed using two diferrent Latin expressions to indicate the same concept seems to be redundant. Contrary to the two other Latin expressions, which are better codified parts of the common baggage of many archaeologists, this one is less codified and not often employed. Nonetheless the necessity to indicate an element which allows a precise dating would still stand. The existence of the two codified Latin expressions suggested the use of another Latin expression, and instead of formulating a new one, I preferred to clearly codify an existing (even though not common) expression. For an use of the expression *terminus ad quem* equal to the one here proposed see for instance D'AGOSTINO 2006, p. 5. For a similar use see GELICHI 1992, p. 271. If on the one hand the use of the whole expression is uncommon and different shades of meaning can be assumed, on the other one, when it is employed even with the meaning here proposed, the juxtaposition of the word *terminus* (boundary) and the expression *ad quem* does not seem to be a problem. This may give rise to some logical criticisms as "boundary" recalls something where something else begins or ends, more than recalling something where something else "is". In this case thinking of the physical meaning of *terminus*, i.e. the stone itself marking the boundary, may be a way to approach this apparent contradiction (see figures below).

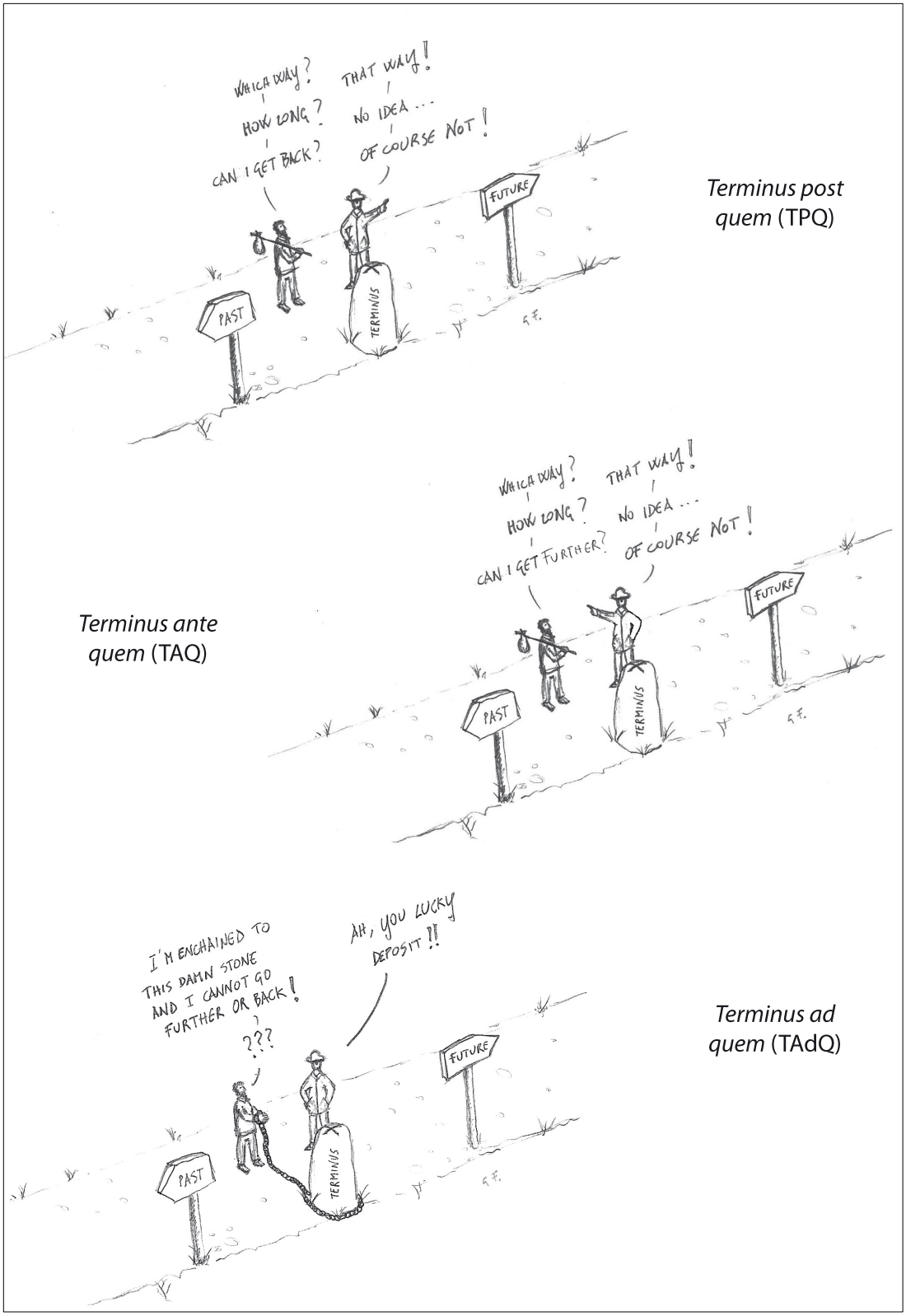


fig. 12 - Termini *as stones*

Concluding, the possibility of dating *ad quem* or merely *post quem* relies on:

1. which type of deposit is under examination;

2. the quality and quantity of the available data;
3. the nature and the data provided by the deposits which are stratigraphically related to the examined deposit.

II.2.9 Intrusions and the issue of closed finds/sealed deposits

The issue of intrusions is surely very prickly and cuts across every consideration concerning dating deposits. They are commonly understood as artefacts or ecofacts deriving from contexts or deposits later than the examined one, somehow infiltrated within the sediment[130]. They may end up within the assemblage of a given deposit through three main streams:

1. the archaeological practice;
2. the post excavation analysis;
3. post-depositional processes.

In the first case the missed identification of contexts boundaries, chaos on the archaeological site or later mistakes in managing the artefacts may lead to mixing up materials from two or more different assemblages. These are all issues than can be practically tackled in order to reduce the risk of these types of infiltrations to the minimum.

In the second case intrusions may derive from wrong grouping, that is associating within a single deposit contexts formed in different periods. False intrusions due to the wrong dating of artefacts can also arise, but this is not a theoretical matter.

In the third case bioturbation in particular my play an important role in mixing deposits up and relocating some artefacts; it may be very hard to catch in the field the effects[131] of these processes and artefac size may play an important role.

Another kind of post-depositional process lies in the middle between practice and theory: it is the case of deposits which are, by nature, very permeable to intrusions expecially by means of simple gravity. This is the case of layers of rubble or building collapse debris, which are basically made up of stones or other building materials; the structure of these kinds of deposits, featured by numerous interstices, allows the entrance of sediments, artefacts and ecofacts from above. The abundance of unoccupied places may also lead

[130] See Carver 1990, p. 104
[131] Tronchetti 2003, p. 113

materials to the top surface of underlying deposits, thus causing even more problems. Theoretically, underlying layers, rubble and infiltrated material are three different deposits connected to three different depositional episodes; however practically it may be extremely difficult to clearly physically distinguish them in the field.

What makes the issue of intrusions (particularly in case of post depositional processes) very harsh, is the fact that they seems to be particularly undetectable *a priori*, while *a posteriori* they are often recalled in order to explain any chronological anomaly, assuming the equation "intrusion = outlier". Of course this is, at least theoretically, a dangerous path, because in absolute terms, the chronological pattern "artefacts embedded during the deposition - intrusions" traces the "residuals - in phase materials" pattern.

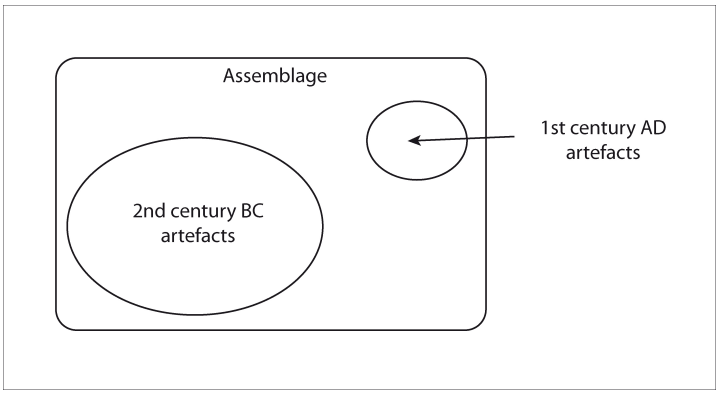


***fig. 13** - Residuals/"in phase" materials or "in phase" materials/intrusions?*

The problem of intrusions is indeed very difficult and no easy solutions seems to be suggested; in Chapter III.3 I will try to suggest at least a way to evaluate and tackle the issue mixing *a priori* and *a posteriori* considerations.

In this perspective, deposits with particularly low permeability (low chances of intrusions) assume a certain importance because of their reliability. Sometimes, as I already mentioned, the expression "closed find", mostly employed to indicate primary deposits (see *infra*), implies also that the deposit is particularly well sealed[132].

Needless to say, the two concepts of primary deposit and of sealed off deposit are pretty different: in the first case what is important is the quality of the information procured, in the second one what is important is its reliability. For example, a secondary deposit may be sealed off by a mortar floor, so producing a reliable assemblage, but not allowing anyway any *ad quem* dating; on the contrary, a tomb may have been heavily disturbed by later

[132] See for instance BIERS 1992, p. 20

activities and post depositional processes, which may compromise the theoretical possibility of dating *ad quem*. The best combination in terms of dating is of course produced by a sealed off primary deposit.

Finally, a terminological problem emerges also with the Italian expression "contesto chiuso", which by itself recalls the idea of a sealed off deposit more than a primary one.

II.2.10 *EX SILENTIO* ARGUMENTS: EVIDENCE OF ABSENCE OR ABSENCE OF EVIDENCE[133]?

The issue of *ex silentio* arguments is certainly another very problematical one. The question may be put in this way: within a given deposit, does the absence of a popular index fossil (see above) suggest that the deposit was formed before the diffusion of the said index fossil? In other words, can the production start date of such a material be used as a *terminus ante quem* for dating the deposit?

Again some distinctions must be made. If we are dealing with a primary deposit, using ex silentio arguments may be unnecessary, as an *ad quem* date should be provided by the existing materials; however it may be useful for narrowing the interval in case:

1. the index fossil was very diffused;
2. the studied assemblage is significantly large;
3. there are no other manifest reasons for the deposit not to contain it.

If the first two points underline a quantitative issue, the last one poses a qualitative problem: before using absence as a chronological tool, other factors should be investigated. A social factor may play an important role. For instance the absence of a given artefact may be due to the fact that the social group supposed to have produced the deposit simply did not use it; it seems unlikely to find, say, military accessories in a production area. Reasons may also be economic: the investigated site may be far from the main routes of diffusion of a given artefact, or the status of the individual (or group) who is likely to have produced the investigated deposit may be too high or too low. A gender explanation could be advanced as well: women's accessories are unlikely to be part of assemblages recovered in an area where males lived. Other factors may be listed; the point is that each one has to be evaluated and weighted before assuming absence as a chronological indicator.

[133] BARKER 1986, p. 108

For secondary deposits the issue is even more prickly, because we basically do not know at which index fossil we have to look at, unless we actually have an idea of when the deposit was formed. I think in this case the use of this kind of *terminus ante quem* should be even more cautious and, besides satisfying the above cited requirements, additional independent sources should be used.

II.2.11 Analogy and its use

Analogy is "the use of information derived from one context, in this case usually the present, to explain data found in another context, in this case the past"[134]. It "implies similarity between the analogues in some respects and dissimilarity in others, since otherwise the analogy would amount to identity"[135].

Analogy is a widespread employed theoretical tool, which is used both for describing and for explaining processes, phenomena etc. The explicit use of analogy in archaeology is with no doubt bound to the years of the New/Processual Archaeology. Binford's Middle-Range Theory is a classical example of the use of analogy for explaining past behaviour and the record[136]. One of the two analogues is usually a past process that we hypothesize may have occurred and produced the archaeological record we are examining. The second analogue is usually picked from ethnoarchaeology or from experimental archaeology, i.e. from the present.

For instance we may suspect a certain pattern in ceramic breakage is due to practices of provisional discard. In this case the observation of practices of discard among present cultures may lead us to observe the record produced and eventually to establish (or not) an analogy between the system observed and the past one. Summing up, we may say that if the records are similar, it is possible to infer that they were produced by the same process.

Of course things are not that easy. Different processes may produce a similar record and, on the contrary, different records may have been produced by the same process; moreover analogy works only if some kind of historical continuity is assumed. The use of analogy in archaeology has thus been even heavily criticized[137].

[134] Johnson 2010, p. 50
[135] Clarke 1972, p. 2
[136] For a detailed account of what Binford mean by "analogy", see Binford 1967
[137] See for instance Allison 1999, for criticism about analogies with both present models and models derived from literary sources.

It should be kept firmly in mind that analogy does not prove or test anything[138]; nonetheless if the use of analogy is not generic, but firmly and formally related to other sources of data within a coherent framework and if analogy shows forms of statistical recurrence[139], then the analogical tool can be employed with excellent reasons.

In this present work I will use analogies in a traditional way, for comparing past evidence with present evidence. Moreover the idea of sketching a sort of draft of catalogue of types of deposits, usable for comparisons, suggests by itself the adoption of a critic analogical procedure in order to compare freshly studied deposits with the already analyzed ones.

Finally, as suggested by M. Vidale, a comparative procedure helps to highlight not only analogies, but also anomalies[140], directing research to new models. Models themselves (see *infra*) are linked by analogy to the modelled process.

II.2.12 Process

I think that the core meaning of the term "process" may be summed up by another one: "how"[141]. It also implies the concept of transformation, indicating something dynamic more than something static. The term is largely used to refer to the term "culture" and it is a strong suit of New/Processual Archaeology and, among others, of the *Annales* Historians. Of course in this case the term refers to deposits[142]. In particular I mean the combination of agents and actions that led to the formation and transformation of a given deposit and its assemblage, with particular focus on how artefacts (the main mean for chronology building) entered a given deposit. In this sense I use the term in a way very close to what behavioural archaeologists call the "formation processes of the archaeological record". The same expression is used by the scholars of pre/proto history of Padua ("processi formativi[143]") and it is commonly widespread. In these cases the term "process" is associated with the term "formation", meaning the investigation of the processes which produced (which "gave birth" or "formed") the record as we recover it in the field.

If, on the one hand, the American school has placed much more emphasis on the human factor in leading these processes (the label "Behavioural Archaeology" is quite

[138] Johnson 2010, p. 62
[139] Vidale 2004, p. 20
[140] Vidale 2004, p. 20
[141] *Contra* Johnson 2010, p. 75. M. Johnson sees process more about "why?". Nonetheless the author deals with processes in cultures more than processes in stratification.
[142] See Leonardi 1992a, p. 15
[143] See Leonardi 2006

explicative by itself), on the other one in Padua research has focused particularly on natural, physical, geological and post depositional factors. Another distinction can be sketched about the targets: behavioural archaeologists worked mostly on the assemblages embedded within the deposits (producing out-and-out object histories or biographies[144]), while the Padua school worked mostly on the matrix of the deposit (the geological component).

In my view both approaches are necessary; nonetheless in urban classical environment human activities had intuitively a much deeper impact, which largely contribute to the formation of the related deposits along with the embedded assemblages. Decoding human activities (with all the risks this entails) seems to be the main challenge in dealing with these kinds of deposits, even though, of course, it can not be sufficient by itself. Moreover, even if dealing mainly with objects/assemblages, I much more prefer to approach the deposit as a whole, because what we want to date is the action(s) connected with its formation and not to the formation of the assemblage alone. For instance, when examining the assemblage embedded in the backfill of the construction trench of the wall of a temple, what we want to date is when the trench was backfilled, i.e. when the temple was built, and not when the assemblage formed. When the assemblage was formed is used as a tool to investigate when the deposit was formed. Moreover sediments and assemblage interact (for instance they may have a common depositional history or not) and their relation is sometimes important in qualifying the deposit.

Here, in particular, are some factors and activities that I think play a major role in formation processes of classical urban deposits and their assemblages:

1. building practice and techniques;
2. maintenance and cleaning;
3. recycling, reuse and disposal of waste;
4. refurbishing;
5. deliberate selection of material and/or sediments (see n°1);
6. economic, political and military factors;

Other factors, for sure present even though difficult to detect, seems to have a minor impact on the bulk of sediments and materials and may contribute to complex mixed patterns. They are, for instance:

[144] Again the title of a recently edited book is self explanatory: *People and things. A Behavioural Approach to Material Culture* (SKIBO, SCHIFFER 2008). See also LEONARDI 1992a, p. 14

1. casual loss;
2. the excavation procedure and post excavation process;
3. significant curation of some artefacts;
4. scavenging;
5. others.

Physical and natural factors are of course omnipresent (before, during and after the deposition, see below "Intrusions and the issue of closed finds/sealed off deposits"), while some cultural and social practices assume a particular importance in a few specific cases (for instance votive depositions or the building of places of worship).

As most of the processes I intend to investigate are substantially concluded, they can not be described, but they can at least be modeled.

II.2.13 MODEL

A model is a simplified representation of something which is more complex[145]. It usually describes only some features, some traits, which are considered to be fundamental in describing the object, phenomenon, process etc. which is studied.

It is possible to consider the relation between the model and the modelled observations as one of analogy[146], i.e. similarity in some features. Which features are to be considered strongly depend on the research aim and, unfortunately, also on the researcher's own knowledge and cultural superstructure. Between the object and the model there is evidently some form of indeterminism or chance.

But what purposes do models serve? Clarke defined them also as "heuristic devices for manipulating observations and hypotheses[147]" and ascribe to them the possibility of playing different roles[148]. Thus they can be:

1. visualizing devices;
2. comparative devices;
3. organizational devices;
4. explanatory devices;
5. devices for the construction and development of theory;

[145] See ORTON 1999
[146] CLARKE 1972, p. 2
[147] CLARKE 1972, p. 2. See also SHANKS 1990, pp. 380-381
[148] CLARKE 1972, p. 2, recalling HARVEY 1969, p. 141

6. predictive devices.

Given all these assumptions, I will try to model formation processes of different type of deposits in order to clarify what we know (or do not know) about their dating. So dating is the research aim and this target will influence the features I will take into account[149]. The models I seek have basically an organizational/explanatory function by themselves, but hopefully they should be, practically, comparative devices. There is, I think, a thin line separating models which are too generic, resulting practically useless, and models which are so specific that they actually fit only one or two case studies. I will try to walk in the middle, starting by a "typology" of deposits which seems to me neither too specific nor too generic, built up around specific but recurrent human activities, such as building a wall or a floor or dumping waste, or around physical/natural occurrences mixed with human activities, such as the collapse of a building.

Each one of these actions, combined with other factors, represents processes which produce different kinds (or types) of deposits which have to be dated.

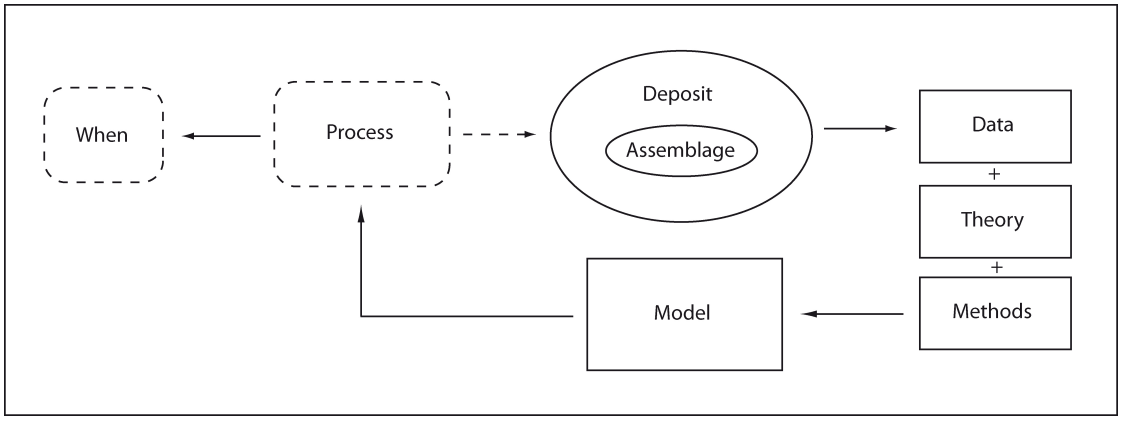


fig. 14 *- Developing models for deposits formation processes and dating. What is unknown is marked with a broken line*

Finally it has to be stressed that a model is something different from a law; a law is indeed a single general statement which has been proved and embeds an absolute value. Far from offering any law, I will be content with formulating just models.

[149] For a typology of contexts based on spatial/functional factors see GARROW 1984

Part III

Method

❖ INTRODUCTORY REMARKS ❖

Once the main conceptual tools have been reviewed, it is necessary to move on the operative tools which can be fielded in the dating game. By 'operative tools' I mean those methods and those source of information which can practically be employed for tackling the issue of dating a given deposit.

The first chapter deals with some scientific techniques which allows for a direct dating of deposits, thus representing a sort of theoretical shortcut, as they do not consider the use of the assemblages embedded (particularly OSL). These techniques are not, up to the present, very diffused in urban excavations, primarily because of the quality of the results they can provide. Nonetheless, in the near future they may represent much more useful tools and become much more routine.

The second chapter tries to tackle the very transversal and prickly topic of intrusions. This time the topic is not discussed from a theoretical perspective, but from a practical one, seeking some useful approaches for both an *a priori* and an *ex post* evaluation.

After the first two more general and transversal chapters, this part focuses on the core of the methods which can be employed; I think that they can be divided into two main categories, one which groups those methods whose target is the deposit itself, and one which groups the external sources which can provide key interpretations.

The first group can be further split in quantitative and qualitative methods, although sometimes the difference between the two becomes certainly somewhat slight. Among the qualitative ones I decided to insert a long paragraph concerning the practices of reuse and recycling in Roman times; its presence may look like a useless digression and moreover this is a huge topic, which, by itself, would deserve a much wider discussion. Nonetheless, I considered fundamental to discuss the topic, because of the major impact it has on the quality (and quantity) of the record, particularly concerning issues such as fragmentation and sherd dimensions. The impact of reuse and recycling practices on the archaeological record produced in ancient cities, in my view, is still by far poorly investigated and discussed. In these lines I will just try to demonstrate its great importance for understanding the quality of the assemblages we handle in urban sites and, ultimately, its importance also for dating.

Among the qualitative traits displayed by a given assemblage, some particular attention is paid to those which indicate that some selection by human agents occurred, thus possibly leading to some *ad quem* dating.

Moving to the second group, that is the one of external sources of information (ethnoarchaeology, experimental archaeology and literary sources), I wish to stress that their contribution in dating a deposit is fundamentally analogical. This means that they do not demonstrate, by themselves, the nature of the studied deposit and the way in which it can be dated; nevertheless they can be used, in accordance with the other methods employed, for building more robust models, as they cast light, in different ways, on some aspects of past behaviours and processes which most likely contributed to the formation of many assemblages and deposits.

According to my personal knowledge, up to the present, ethnoarchaeology, experimental archaeology and the study of literary sources have never been directed to the study of problems in dating; it follows that what is proposed up ahead must be considered a first sketch which, hopefully, will assume a better and deeper shape in the future.

❖ OSL, TL, MORTAR DATING AND DIRECT CHRONOLOGY ❖

For the moment, artefacts are the main means employed for dating deposits. Nonetheless other tools allow the direct dating of the formation/building of deposits/structures. Theoretically, albeit with some caution, these scientific techniques completely bypass the thorny problem of linking artefacts age and their final deposition age, making *de facto* unnecessary any reasoning about residuality, false residuality, assemblage formation processes and so on.

From a theoretical and methodological point of view, the most interesting among these techniques is OSL (optically stimulated luminescence) as it provides a direct date of formation for sediments[150]. In other words this technique allows the direct dating of the deposition of a given deposit, measuring how long ago some minerals (typically quartz or feldspar) were last exposed to daylight[151].

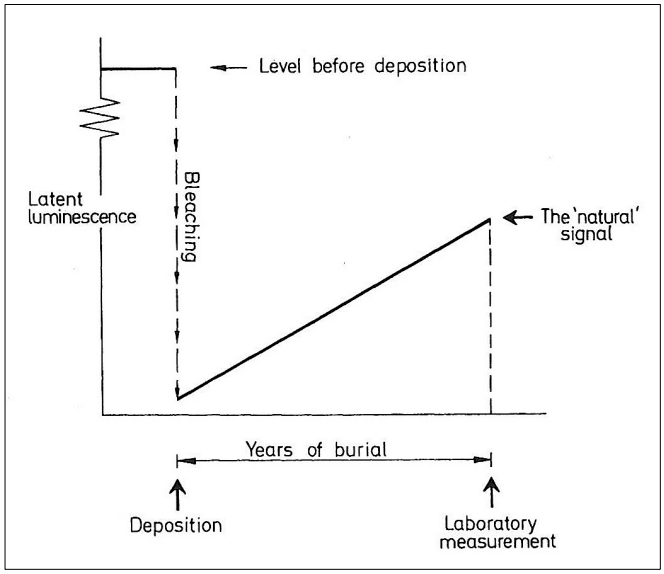


fig. 15 *- The principle of OSL. From Aitken 1998*

If a given sediment is exposed to daylight for sufficient time (bleaching), electron traps within the mineral grains (due to imperfections in the crystal lattice, *i.e.* atom vacancies), once filled, are emptied by solar radiation. It means that electrons remain

[150] FEATHERS 2003, pp. 1493, 1495
[151] Similar to OSL, IRSL, or infrared stimulated luminescence, works with different wavelenghts.

trapped until light provides sufficient energy to the conduction band. When the grains are buried (time 0), the traps start being refilled over time at a rate determined by natural radioactivity (in most cases the saturation point is over 100000 years); a new laboratory irradiation, usually with green light, will empty the traps again, entailing a certain release of energy in form of luminescence. Therefore, the amount of energy released is proportional to the time during which the examined grain has been buried. The older the sample, the more light is emitted[152]. Thus, the luminescence age is proportional to the total radiation absorbed, divided by the annual dose rate: the absorbed dose is estimated from laboratory luminescence measurements, while the dose-rate is determined from radioactivity analysis[153].

This technique, usually employed for dating geological sediments (particularly aeolian sediments, but also water-laid and glacial sediments, peat and so on), is finally finding more and more application in the archaeological field[154]. Its precision, usually ranging between 5% and 10% (and up to 3%[155]), makes it suitable, in perfect conditions, for dating classical contexts and even far more recent ones.

Given the great advantages provided by this technique, one would ask why it is not more widespread among the common archaeological scientific dating methods.

Apart from a general diffidence and delay in handling scientific techniques by archaeologists, some objective shortcomings have distracted attention from OSL; among them the most relevant are:

1. costs. One single analysis costs about double that of a common radiocarbon analysis, but costs rise rapidly as sampling often requires the presence of a specialist[156];
2. sampling. The necessity of maintaining the sample in the dark make this procedures more complicated, even though sampling during the night can be easily avoided using a pvc tube for extracting the sample. Apart from these practical issues, more serious problems arise when dealing with the quality of the sample itself. To ensure good reliability some conditions must be satified:
    a) To avoid excessive γ radiation influence, the sample must be extracted at least 30 cm beneath the surface[157];

[152] For a complete and detailed and overview of the technique, see AITKEN 1998 and for more recent advances DULLER 2004. See also WEINER 2010, pp. 22-23, 252-254
[153] For a quick list of the methods employed for measuring the dose rate, see LIRITZIS 2000, pp. 5-7
[154] FEATHERS 2003, p. 1493
[155] LIRITZIS 2000, p. 4, JACOBS AND ROBERTS 2007, p. 212, OUTRAM *ET ALII* 2010, p. 2825. For modern sediments see also MURRAY, OLLEY 2002
[156] See http://www.arch.ox.ac.uk/luminescence.html

b) Moisture content should be constant or at least measurable (water absorbs radiation to some degree);

c) compaction, leaching and post-depositional disturbances in general should be avoided;

d) on a micro scale, suitable grains must be present in sufficient number (bright grains are ususally 5-10% of the total, although sometimes the percentage is higher[158]).

e) the environment within 30 cm of the sample should be relatively homogeneous as radiations from different strata or large clasts may affect the estimation of the dose rate[159].

f) the required amount of sediment is around one kilogram[160], thus entailing the whole removal of the smallest contexts for such a purpose. Of course it can not always be performed.

These requirements make the application of the technique more difficult in urban environment, where some of the factors enlisted have a sensible impact [particularly b), e), f)];

3. incomplete zeroing, due to insufficient exposure to light, may create some problems, although methodological developments enable effective challenging of the issue;

4. fine grained sediments (such as loess) are more difficult targets[161].

Despite these limitations, application of OSL to anthropogenic deposits, even in urban environment, has started to spread. In most of the cases it is employed along with other techniques in order to check its consistency with other dates, but its value seems to be interesting: anthropogenic infills of cellars in the Iron Age settlement of Herrenbrunnenbuckel (Germany) have been dated through OSL with good consistency with other sources of data[162]. An Iron Age broch at Old Scatness (Shetland) has been dated through a Bayesian approach mixing archaeological and formative data (about which some remarks could be moved), radiocarbon dating and OSL dating, again with good consistency[163]. Similarly, medieval anthropogenic layers in Santiago de Compostela (Spain)

[157] AITKEN 1998, pp. 62-63
[158] FEATHERS 2003, p. 1502
[159] FEATHERS 1996, p. 27
[160] AITKEN 1998, p. 62
[161] See LANG *ET ALII* 1999
[162] LANG *ET ALII* 1999
[163] OUTRAM *ET ALII* 2010

have been dated through OSL with errors ranging from ± 140 to ± 198 years[164]. OSL has also been employed for dating natural deposits linked with artificial structures in urban environments: this is the case of the city walls of the ancient city of Tayma (Saudi Arabia), against which a thick sandy aeolian layer was deposited. OSL dating of this layer permitted the inference that the examined walls already existed in the 2nd half of the 3rd millennium BC[165].

In conclusion, although not currently widespread and despite some factors which can seriously affect its reliability or accuracy, in particular in urban contexts, OSL may develop in the next years to become a useful tool in chronological analysis, above all in virtue of its capability of providing direct dating of archaeological deposits.

Until, hopefully, OSL and other scientific tecniques are part of the common archaeological practice, dating archaeological deposits will still rely on datable artefacts and samples embedded within.

In my view there are also at least three more important reasons for studying assemblage formation processes in a chronological perspective:

1. it is an invaluable tool for the understanding of several other topics of interest (residuality and false residuality, formative dynamics, provenance basins and so on)
2. it is the only available tool for re-examining old/current data and excavations and evaluating the reliability of the chronological inferences proposed;
3. primary deposits can be safely dated through materials in any case, so saving a good amount of money and time and, in common circumstances, allowing a more accurate dating.

OSL can be applied also to ceramics[166] and lithics; of course once applied to movable objects it loses the ability of directly dating deposits, but if it is applied to structures such walls or floors, when they were last exposed to daylight can be determined. OSL has also been employed for determining the age of known classical stone structures, targeting when the single ashlars had been placed side by side, so blocking solar irradiation on the inner surfaces. Accuracy in this cases was quite low for classical archaeology standards, ranging

[164] SANJURJO-SÁNCHEZ, PÉREZ MATO 2013
[165] KLASEN *ET ALII* 2011
[166] A different promising approach to date fired-clay ceramics, based rehydroxylation, is proposed in WILSON *ET ALII* 2009. The first experimental tests showed reasonable standard deviations, well compatible with the necessities of classical archaeology.

from ± 200 years to ± 350 years, with the Temple of Apollo in Delphi (about 550 BC) apparently being the best dated (OSL age 470 ± 200)[167].

Structures in bricks (like pottery) can also rely on termoluminescence dating[168] (TL): once excluding the possibility that the examined bricks were re-employed (see Chapter III.5.1) or, less likely, were stored for an appreciable long time, TL[169] can provide useful insights about the chronology of the studied wall. In this case, indeed, walls should be seen as common deposits embedding datable materials and bricks should be handled as common potsherds. Their primary status should be considered just as slightly more probable and their dating through TL cannot be considered direct, as in the case of OSL applied to sediments.

Nonetheless another dating technique, that is mortar dating, can provide direct dating for masonry structures. It is indeed a quite young technique which has started to develop in the mid '90s in Northern Europe (mainly Finland). The technique, based on ^{14}C principle, was firstly applied in dating the medieval stone churches of the Åland Islands (located between Sweden and Finland) and was fully revised after the introduction of ^{14}C AMS (accelerator mass spectrometry) analysis.

The principle behind the technique, though similar to radiocarbon, presents important differences. Obviously mortar itself is not organic, but carbon dioxide in the atmosphere is fixed in the calcium carbonate ($CaCO_3$) formed during the hardening of lime mortar at the time of construction[170].

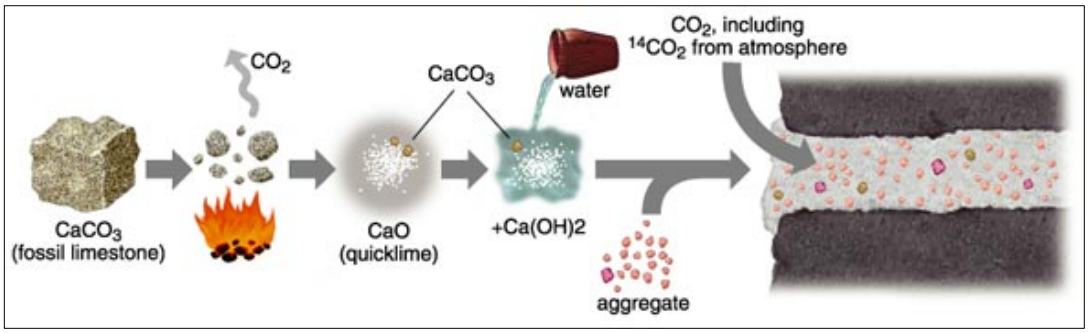


fig. 16 - The principle at the base of the mortar dating techniques. From HALE ET ALII 2003

[167] LIRITZIS, VAFIADOU 2005, pp. 31-35
[168] This technique, generally employed and more widespread than OSL, is based indeed on similar principles, the main difference being that the zeroing event is provided by a high temperature, commonly clay firing or successive heating due to more or less dramatic events.
[169] See CASTELLANO *ET ALII* 2002
[170] RINGBOM *ET ALII* 2011, p. 188

Besides technical problems[171], two main factors strongly affect the reliability of the results achieved:

1. the presence of older limestone, which provides ages that are too old;
2. long lasting hardening in thick walls and phenomena of re-crystallization, which lead to dates that are too young.

Roman pozzolana proved datable with difficulty, along with mortars made hydraulic by the addition of crushed ceramics. Mortars from Pompeii and Herculaneum, buried by ashes, have turned out to be unsuitable for dating, too.

For evaluating the reliability of the results achieved, the mortar dating team has established some criteria, ordered according to the strength of the chronological information provided[172]and based on mutual agreement and/or consistency with other sources of data. The most reliable result is achieved when two or more fractions of the same sample agree in their individual results (Criterion I).

Among the case studies concerning classical/late antique archaeology, the one which has seen the largest employment of mortar dating technique is the Portuguese site of Torre de Palma, up to now the largest Roman villa ever excavated in Iberia[173].

Here mortar dating has been combined with new excavations and with an overall review of the ceramic evidence (particularly *terra sigillata* and African red slip ware). Although careful selection of the contexts and their 'genetic' status does not seem to have been made with great care (along with stratigraphic analysis on standing structures), so leading to some inconsistencies which I think could have been avoided, the technique by itself provided quite interesting results. Sixty-five samples were analyzed, eighteen fulfilling Criterion I requirements. Most of them provided chronologies with common radiocarbon standard deviations. Although some of them show quite wide ranges, Bayesian approaches on coherent groups of dates could help to narrow the intervals making them suitable for classical archaeology chronological standards. At present, dating lime-lumps embedded in the mortar yields the best results, it is cheaper and shows good possibilities for further development.

Concluding, the above mentioned techniques can provide direct dating for sediments deposition (OSL) or for structures construction (OSL, mortar dating), thus bypassing several theoretical problems; nonetheless the chronological ranges provided and a series of

[171] See also BOARETTO 2009, p. 277
[172]RINGBOM *ET ALII* 2011, pp. 193-197
[173] LANGLEY *ET ALII* 2011. Other useful sources about the site are LANCHA, ANDRÉ 2000 and MALONEY, HALE 1996.

limitations make the application of these techniques in classical archaeology, up to now, somewhat difficult. Hopefully in the next few years deficiencies will be corrected, making these techniques more reliable and affordable. In this sense more attention should be paid by archaeologists and more trials are needed. For the moment, integrating the data obtained with other sources seems to be necessary; again, Bayesian approaches can supply a good basis for this integration, leading to some refinement in the chronological framework.

OSL, in particular, may turn out to be particularly appreciable for dating secondary deposits, especially the ones embedding few artefacts; in the case of primary deposits, particularly if containing sufficiently well dated artefacts, the use of assemblages (samples included) presumably will procure more accurate dates for a long time.

❖ DEALING WITH INTRUSIONS[174] ❖

A practical challenge to the issue of intrusions is not easy and apparently it does not fit with the rhythms of a large urban excavation. As anticipated in Chapter II.2.9, the issue is usually tackled *ex post*, that is a problem of intrusions is usually claimed when some sherds do not fit the proposed chronological framework. This approach is theorethically and methodologically somewhat dangerous as it may potentially lead to wrong conclusions about dating. It therefore follows that there is the need, if not to cancel, at least to reduce the impact of intrusions in our inferences *a priori*.

Besides the obvious attention which has to be paid during and after the excavation to handling materials and labels and in keeping the working area as clean as possible, I think that some form of as rapid as possible and explicit evaluation of depositional and post-depositional factors is needed.

Some main factors leading to intrusions and the mixing of assemblages may be listed as follows:

- the texture of the layer;
- its function;
- the nature of the on top layer;
- the duration and nature of the exposition of the layer;
- the impact of post depositional factors.

A very coarse layer, for instance the rubble resulting from the collapse of a structure, cetainly contains many voids which, in turn, may be filled by later sediments and materials[175]. Theoretically the rubble and the percolated sediment (with materials) are in fact two different contexts, with different origins, formation and more or less evident different dates. Nonetheless in field practice it may turn out to be very difficult the distinction between the two and an actual excavation of two different stratigraphic units may eventually be impossible. In this case the texture of the layer itself (its permeability) plays a fundamental role in receiving intrusive materials, which, if on the one hand are theoretically inexistent, on the other one are, in practical terms, a serious issue.

[174] See HARRIS 1989, pp. 120-122 for an early discussion of the topic
[175] These may also mix up with *de facto* refuse and eventually deposit on the surface of the bottom layer.

At the other end of this scale we may find masonry structures, mortar floors and other solid units. In this case, obviously, the risk of intrusions is close to zero.

The function of an anthropic layer also represents a discernible factor: floors and other layers which were supposed from the beginning to be exposed carry higher risk of intrusions than layers which had to be immediately covered. The role of intrusions in earthen floors is discussed in Chapter III.6.2.

The nature of the top layer and the combination with the nature of the bottom one represent another factor to be evaluated; indeed one layer cannot be evaluated alone, but in its context, in this case considering also the nature (function, texture, permeability etc.) of the upper one.

Duration and nature of the exposition are very important too; floors, as mentioned, yield long exposition and use of their surfaces, while construction layers yield a shorter one. But exposition may also be unplanned: truncation due to later cuts, trenches and so on [176]may lead to certain amounts of mixing and thus to intrusions. This factor, combined with the interaction soft or coarse sediments, may potentially have a sensible impact. The nature of exposure is important too: coarse deposits affected by scavenging (dumps) seem to be particularly suitable and exposed to this mean of infiltration, particularly by small artefacts such coins or small sherds[177].

Post depositional factors should indeed deserve a wide digression[178], but again I focus on some points with particular relevance: focusing on the vertical displacement of materials, biological agents seem to play a major role[179]. If roots may yield some displacement of small materials in soils, other agents involve a wider range of deposits (faunalturbation[180]). The impact of these agents depends on the environmental conditions of the investigated site (temperature, moisture, pH, flora) and may range from very low to very high. So a general *a priori* evaluation can be broadly performed. The role of earthworms has been widely discussed in archaeological and geoarchaeological literature, particularly concerning the mixing and uniforming of previously well distinct layers (se the "extreme" case of dark earths). They can play also some role in vertical displacement of small artefacts, but some

[176] I will not discuss the case of erosion, with its peculiar dynamics.
[177] See PEÑA 2009, p. 266 for a very clear instance.
[178] See WOOD, LEE JOHNSON 1978 for a clear overview and further references. Fundamental is indeed BUTZER 1982, particularly pp. 98-122
[179] See the cited references for other physical processes, such sediments cracking, which can lead to other form of intrusions. A possible case of argilliturbation in urban environment is reported in FURLAN 2012, pp. 79-80
[180] SCHIFFER 1996, pp. 207-210 for more references. See also WOOD, LEE JOHNSON 1978, pp. 318-328

important exceptions to their impact, apart from the macro-environmental one[181], can be listed:

- solid floors represent an impenetrable barrier;
- coarse deposits are not very suitable for worm activity, apparently because of attrition and feeding capability[182];
- clay sediments, especially, in regions of high rainfall or poor drainage do not appear very suitable either[183].

Consequently, collapse debris or some clay floors (to cite two common typologies of deposits) or the underlying deposits (if not separated by a great temporal hiatus) should not display substantial problems in this sense, although of course they can yeld other kinds of disturbance (see above).

Moles and their activity are quite common in many European environments. Again a general environmental evaluation can be made *a priori*. In particular, it has been shown that their distribution and abundance is related to the abundance of earthworms and thus to their habitat[184]. Moving to more specific aspects, it has to be stressed that their burrows should leave, theoretically, substantial traces. Thus, again, theoretically, the problem of infiltrations would not exist, as burrows represent different units along with their backfill[185]. But other post depositional factors may seriously mask their existence, thus leading the archaeologist to mix what should be kept separate. Fortunately moles usually dig their burrows at around at 15-25 cm (with a maximum range of 70 cm-1m) beneath the surface (*talpa europaea*), and so their impact should not affect deeper strata.

Considering the biological post depositional agents as a whole, it has to be stressed that until the urban space is maintained, even re-shaped or somehow lived, their impact should be quite low. Instead, sufficiently long breaks in this continuity, definitive abandonment and in general the formation of soil, can produce the environmental requirements for sensible bioturbation which in turn produces some vertical disposal of materials.

Given all the aspects described, I think that there are three main ways to tackle the issue of intrusions *a priori*:

- a general environmental evaluation;

[181] EDWARDS, LOFTY 1977, pp. 149-167
[182] LEE 1985, p. 16. See also EDWARDS, LOFTY 1977, pp. 162-163
[183] LEE 1985, pp. 16, 54-55
[184] FUNMILAYO 1977
[185] These are tubular features commonly known as *krotovina*

– an active use of contexts as operational tools (see Chapters and I.2.4 and II.2.2);

– a context by context evaluation.

A general environmental evaluation can (or should) begin before the excavation even begins and it should consider the basic post depositional agents which are to be expected, in this case with particular focus on those agents producing vertical displacement.

By "active use of contexts as operational tools" I mean mainly the possibility of splitting one context in two or more contexts in case some necessity emerges. One occasion is discussed in Chapter III.6.2 and concerns the peculiar nature and dynamics of earthen floors. Another one emerges with the necessity of tackling intrusions. In a few words, although in the field one unique layer it is "phisically" recognized, if part of the layer is likely to have been affected by one of those factors discussed, this can be divided and another number (or whatever identification method is preferred) can be assigned. A couple of examples drawn from the experience in Aquileia, Fondi ex-Cossar may well illustrate the issue.

The *domus* investigated was provided with a well-structured drainage system, mainly made of masonry drains. Once maintenance stopped, the drains went out of use, filled, more or less rapidly, with sediments, artefacts and ecofacts; then later activities resulted in the removal of substantial parts of the "skeleton" of the house, thus exposing and partially taking away the drains along with their fillings. Given the high informative potential of the fillings in many respects, in some cases they have been split into two or more contexts, thus separating what had lain untouched under the drain cover from what had been affected by the later activities.

A similar procedure was employed when dealing with the robber's trench/foundation trench of a lead *fistula*. The *fistula* was initially laid within a trench which was later backfilled. Still in antiquity, the pipe was then truncated in two points and a certain lenght removed. Apparently, to remove the pipe it was not necessary to dig a trench: two holes[186] were dug where the pipe had to be cut and the resulting portion was then lifted. The removal was probably helped by some movement of the old backfill; this, once the fistula was taken away, was simply redeposited (the volume of the pipe was negligible). The resulting record was basically a trench which was still the old foundation trench, filled with altered sediments and materials and cut at two extremities by two holes. Fortunately the height above sea level at

[186] Only one was detected, being the second one presumably some far from the border of the excavation trench.

which the pipe had been laid down was precisely known, so it was decided to split the uniform backfill of the trench into two different contexts, one for the volume of sediment above the known height and one for the small amount of volume situated beneath that hypothetical line. The aim was to keep separate materials among which there may have been some intrusions and materials potentially unaltered, carrying information (a *tpq*) about when the *fistula* was installed[187].

Although often charged with being too inflexible, single context recording allows (I think) some flexibility which can be profitably employed for dealing with some tricky situations, among which the issue of intrusions can surely be listed.

The third proposed approach should more explicitly concern the "quality" of each context. The factors listed above should be evaluated context by context and then broadly (and quickly) expressed.

Here follows some examples of contexts/deposits that I have tried to broadly group according to the risk of infiltration[188].

HIGH RISK	LOW RISK
Destruction debris made of rubble	Very compact or solid layers (layers linked to construction activities)
Soft sediments affected by later activities of removal and/or sensible alteration	Deposits sealed off by compact or solid layers and likely to have been exposed for a short time
Layers severely affected by bioturbation	Closed structures infillings (drains) if not notched by later activities
Soft sediments exposed for a long time	
Very soft/rubble contexts in contact with very soft/rubble contexts	
Dumps and other strata poor in sediment and rich in coarse materials (rubble, sherds, bones)	

[187] The finds recovered are still being examined
[188] Earthen floors are not mentioned (see Chapter III.6.2)

In the middle, between the two "extremes" of risk, it lies a wide range of contexts or deposits whose risk of infiltrations could be summed up as "middle" and which probably make up the majority of the evidence.

The obvious place which should accommodate this kind of evaluation is the single context sheet. Below there is a proposal for the modification of the standard Italian context sheet (scheda di unità stratigrafica). The risk of infiltrations is just evaluated as "low" (B), "medium" (M) or "high" (A), so that compiling the form is as less time consuming as possible. It has also to be stressed that the same form include an entry named "affidabilità stratigrafica" (which could be grossly translated as "stratigraphic reliability") which apparently would already fit the aim of evaluating infiltrations. Nonetheless our confidence in reading the stratigraphic sequence (unfortunately it is rarely admitted that when "reading" and interpreting strata, their boundaries and relations are not that easy and that substantial doubts sometimes can persist) is something different from the informative reliability of a context in itself, particularly concerning the possibility that later materials entered its body. Thus I think that the two entries should be firmly kept separate.

The aim of the proposed "devices" is, on the one hand, to reduce the impact of infiltration in the post excavation inferential process and, on the other one, to allow some form of *ex post* evaluation in case some doubts arise. In case a well sealed deposit marked with "B" (low risk of intrusions) should display unexpected "too recent" sherds, before claiming for an intrusion, it should be better practice to re evaluate the context status, its supposed date of formation and even the correctness of the dating of that single specimen. On the contrary, severely affected deposits, which may substantially bias later inferences, could be put aside, giving way to other deposits in order to build a solid chronological framework. In my view, still too often many artefacts are addressed as intrusions if they do not fit the provisional chronological framework and it happens without substantial bases. The proposed tools may help distinguish those cases in which some materials are correctly identified as intrusions from those cases in which the decision appears, at most, arbitrary; nonetheless it has to be acknowledged that much more work has to be done, keeping in mind that the issue of intrusions can bias transversely[189] any inference about dating deposits.

In a post excavation perspective I think that an important role should be played by the overall number of the items supposed to be intrusive. As anticipated in Chapter II.2.9, the non intrusive/intrusive chronological pattern mimics in some way the pattern residuals/in

[189] HARRIS 1989, p. 121

phase materials. Once the factors cited above are evaluated, numbers count as well. High rates of "intrusions", particularly if compared to the body of the older specimen, should sound as an alarm bell and lead to a review of the nature of the examined context and/or artefacts.

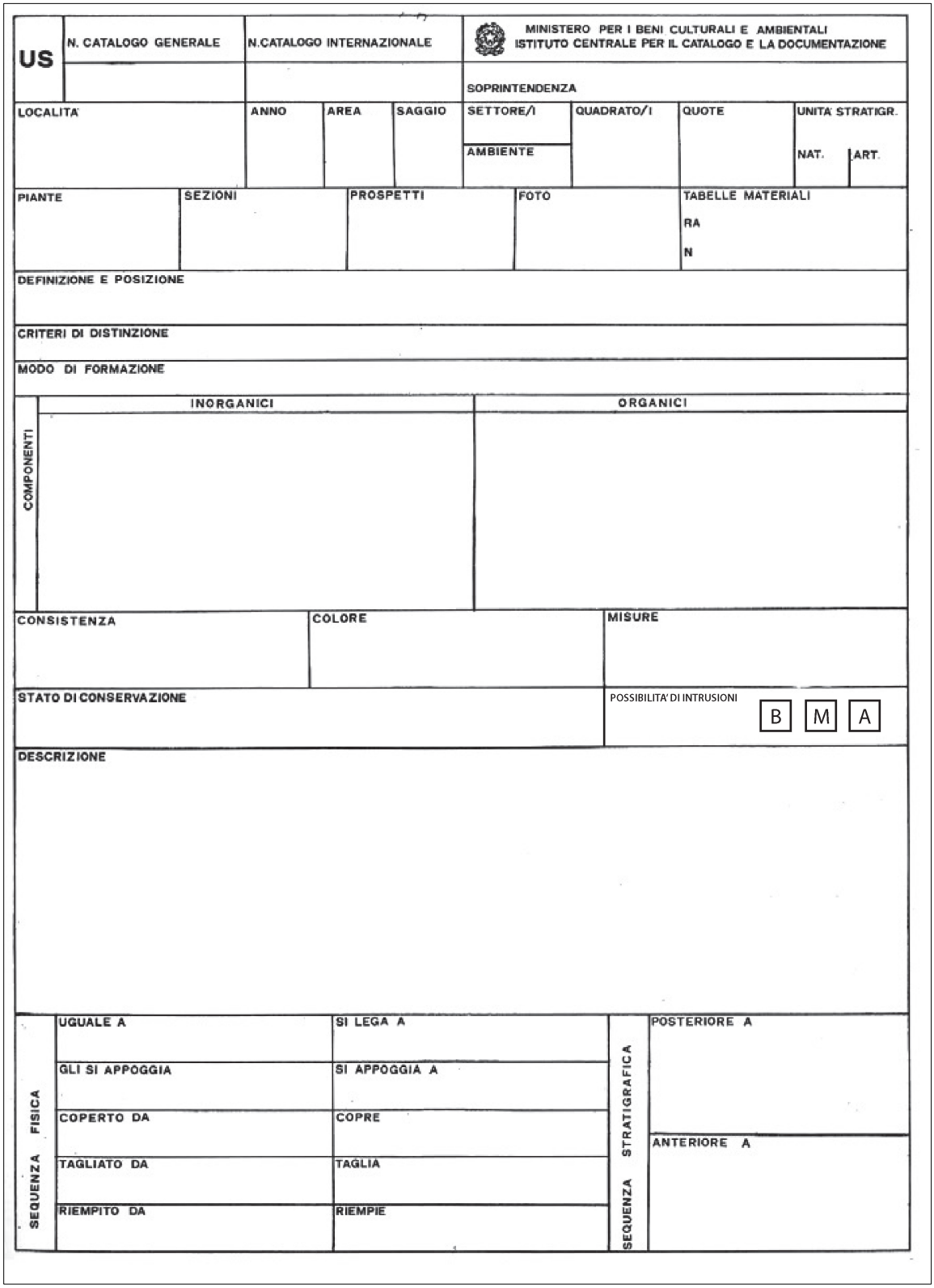


fig. 17 *- A proposal of standard Italian context sheet modified for the evaluation of the risk of intrusions*

❖ A QUANTITATIVE APPROACH ❖

III.4.1 INTRODUCTION

In order to understand the formation process of any archaeological deposit and to gather useful information about its own chronology, it seems necessary to plot in some way the chronological data provided by the embedded artefacts. If we look at the bulk of the excavation reports published every year, we may conclude that it is not a common practice at all. Very often we don't even know exactly which and how many artefacts had been recovered in each context/deposit. The idea itself that the chronology of the artefacts recovered within a given deposit may inform us of its formation processes does not seem to be very popular.

An empirical display of the chronological data provided by the artefacts contained in each context has been proposed in the recent publication of the excavations carried on between 1997 and 2006 in the Forum of the ancient city of Nora (Sardinia)[190] and this approach is now becoming a bit more widespread.

What follows may be seen as a development of this empirical/graphic method and represents one of the ways (not the only one) to formalize it.

One may ask: if the chronology of the artefacts and the chronology of the deposits are two different issues, why should we focus on plotting the data provided by the materials? The answer is: the chronology of the artefacts cannot inform us directly of the date of the deposit (a mistake made too many times), but it can inform us of the processes involved in its formation, so helping to distinguish primary and secondary ones and, finally, make better inferences about the chronology of the deposit itself.

In fact, one of the assumptions made in this work is that the chronological distribution of the artefacts forming an assemblage reflects, more or less clearly, the formation processes which led to the constitution of the archaeological deposit which produced the said assemblage. To be honest, it is both an assumption and a hypothesis, but I trust the case studies analysed in the next part will strengthen, at least partially, this assumption. I can just leave the final word to future testing.

[190] BONETTO *ET ALII* (EDS.) 2009b

Of course plotting chronological data implies a quantitative approach. So, before discussing how to plot the data, it is necessary to examine some preliminary issues, concerning the minimum number of artefacts, the quality of the chronological data we have and the quantification method employed.

III.4.2 Minimum number of data and sampling

A first important distinction must be made between those deposits which have been entirely excavated and those deposits which have been excavated only partially.

I will discuss firstly the case of an entirely excavated deposit. In this case we assume we have removed the totality of the sediments. What about the artefacts? Can we assume they are the whole population or they represent just a non-random sample of the whole, affected in particular by factors such the size and visibility of the artefacts themselves? We have to keep in mind that the aim of the study is the dating of the deposit. So what is really important is the recovery of (good) datable artefacts, and the practical experience teaches that it is very hard to reliably date small body ceramic sherds. It does not mean that we can be less accurate in the practice of the excavation and recovery of materials, but it means that the impact of small, very broadlyor tentatively datable sherds is probably and practically not so strong in dating a deposit. In this case we are interested in what is datable and we assume that, apart from a small percentage of materials unrecovered by chance or by human error, the very great majority of 'what is datable' is recovered. So we assume the artefacts we are handling are a population and not a sample[191].

A few words must be dedicated to a particular class of finds, namely the one of coins. There are two main aspects which make them peculiar: the fact that they are, after all, well datable (I will go back later to the problems concerning the dating of coins) and the fact, obvious of course, that they are generally small. In terms of evaluating the population we are dealing with, it implies that a number of potentially well datable finds may have been unrecovered just because these are small. Apart from the uncommon silver ones and the very rare golden ones, the bulk of ancient coins was minted in copper alloys, which usually deteriorate forming greenish opaque coatings. It implies that the size is not balanced by a particularly striking colour.

[191] One may argue that for sure carbons or bones sampled for ^{14}C analysis represent just one part (a small one) of a hypothetically much larger population. The point is that this population would be impossible to evaluate. So, being more realistic, we can just say that our population includes everything we managed to date.

So the possibility of missing some important pieces of (chronological) information due to the non-recovery of a number of coins should be at least evaluated in every excavation where the metal detector is not extensively employed in the field or where sieving is not a systematic procedure.

For instance in Aquileia, Casa centrale dei Fondi ex Cossar, a broad idea of the percentage of coins unrecovered is given by the ratio of the coins recovered during the excavation and the coins subsequently recovered using the metal detector to screen the mass of sediments generated by the excavation itself. For reasons of time and money sieving had been reserved to few particular contexts and the metal detector was available only occasionally. The bulk of coins has turned out to be made up by small copper alloy specimens, minted mostly between the 3rd and the 5th centuries AD. During the investigations carried out from 2009 to 2012, 594 coins were recovered from secure, identifiable contexts (so, without accounting for those specimens deriving from operations of cleaning, humus etc.). A coin hoard of 561 more specimens was recovered, but, as the coins themselves where all grouped together, it may be counted as one single element. In the same period 76 coins were recovered using a metal detector, which was employed mostly on the surface of the mound of sediments produced by the excavation. Coins recovered with the aid of the metal detector produced 12,77% of the whole coins assemblage. Nevertheless, it has to be stressed that investigations with a metal detector, albeit carried out with great accuracy, were only occasional and could not affect the core of the sediments accumulated. Therefore, it is likely that the number of coins unnoticed during the excavation (but recovered afterwards) may rise substantially. The sample of coins recovered during the excavation seems to be outstanding, but the number of coins recovered later adds a certain degree of uncertainty which has to be considered.

Once it is assumed that we are dealing with a (more or less defined) population, a second question arises: is the number of individuals of the population we are handling sufficient to perform some quantitative analysis? The answer, of course, is 'it depends'[192]. Once excluded the possibility of intrusions, theoretically even one single potsherd, coin, carbon or bone gives a *terminus post quem*. So we may argue that the minimum number of datable artefacts is one. The point is that sometimes the availability of a graph plotting the chronology of the artefacts may be particularly useful in trying to distinguish what kind of deposit we are handling. What can we infer from the plotting of one single sherd? Not a lot,

[192] Recently, with good reasons, C. Orton refused to suggest a specific valor (ORTON 2009, p. 70).

of course. Moreover, if we suspect that we are dealing with a primary deposit, one single sherd cannot confirm our suspect. Finally, if we are dealing with a primary deposit, we may like to date it *ad quem*. But it is unlikely we can do that with any reliability with one sherd only.

So we can affirm that even one single sherd, once excluding the possibility of intrusions, gives a *terminus post quem*, but it is, in practice, useless for creating a graph. So, may it be worth plotting, let us say, 10 sherds? Maybe, particularly if we suspect the deposit to be a primary one. The point is that the more data we have, the more reliable is the graph we obtain. Conversely, the less data, the less reliable the graph. Nevertheless, some estimation of a minimum number of artefacts employable has been attempted, but in this case the aim of the study was different (primarily the comparison of different assemblages): the suggested minimum number of artefacts varies from 30-60 diagnostic individuals to 260[193]. Orton stressed that for these kinds of analysis (which are, I repeat, different from the one I intend to carry out) what really matters is quantity in relation to the proportion of a particular type[194].

There would be another way to approach the problem, in order to get at least a very broad idea of the minimum number of artefacts necessary. We may take a large number of assemblages ('real' ones or more or less randomly generated ones) and, for each of them, pick up randomly a crescent number of dates. When the graph generated from time to time stops changing *significantly*, we can fix the minimum number of artefacts which is necessary to obtain a reliable result. By repeating this mechanism a large number of times, we would obtain an assessment of the minimum number of artefacts that would be, generally, required to create a reliable graph. That would be, indeed, a kind of Monte Carlo simulation (I will come back on it later).

Nevertheless the variability from deposit to deposit (*in primis* between primary and secondary ones) and from assemblage to assemblage is so great, that even this kind of indication would be misleading in many cases.

For the moment, it would be enough if each time a graph is produced, the amount of chronological data employed was indicated, leaving us with the possibility to evaluate the level of reliability which may be expected.

Let us move now to the case in which we are not handling a whole deposit/layer, but just a part of it. This means we are not dealing with a population (the complete assemblage,

[193] SLANE 2003, p. 324
[194] ORTON 1982, pp. 17-18

the full pot of chronological data available) but we are dealing with a sample (just a spoonful of data).

Firstly it would be very helpful to have at least a broad idea of which percentage of the population we are handling. It means that we should estimate the volume of the whole deposit, compare it with the volume of the excavated portion and, assuming artefacts are not clustered within the deposit, use the drawn proportion to have an idea of the numeric consistency of the whole assemblage.

It seems to be a complicated time-wasting business and it may not always be possible to get the necessary data and consequently to have a general knowledge of the population handled; nevertheless, in case one can gather the necessary data, an attempt should be made. It is very important to have an idea of the quantity of data we have if we want to evaluate the quality of the conclusions we draw.

Once we manage to have an idea of the (invisible) population, we may face two main cases. The one in which we suspect we are dealing with a primary deposit and the one we suspect we are dealing with a secondary one. The conclusions we may draw are very different.

If all the data we have (both the qualitative and quantitative data related to the sample) point to the fact that we are handling a primary deposit with abrupt formation (see Chapter IV.3), we may conclude that we can safely employ them to get an *ad quem* date; this will be more or less precise or more or less reliable according to the quality of the data we have and to the size (both absolute and relative) of the sample.

If we are likely to be dealing with a primary deposit with a continuous formation (see Chapter IV.4), that is we have artefacts distributed across a long time span, some problems arise. There is a concrete possibility we are dealing with a dump used for an unknown period. Which 'slice' of this period have we sampled? It would be pretty difficult to determine it. So we can only reliably assume that for sure the deposit we have sampled had formed during the time span suggested by the assemblage we have, but we cannot assume it was not being formed also before and/or later.

If we are facing the concrete possibility that we are handling a secondary deposit, things are different. We must start with the assumption that probably we may obtain only a *terminus post quem*. So the question which arises is: did we catch the *tpq* with our sample? Is it likely that digging the whole deposit we would get a later *terminus post quem*? In other words, what is the probability that the *terminus post quem* for the formation of the deposit is actually later than the one we got?

The issue and the problems that may arise are very well exemplified in a paper by M. T. D'Alessio. Investigating the chronology of the Casa delle Nozze di Ercole, in Pompeii, D'Alessio states: "Più si scava in estensione più dati si hanno a disposizione, quando invece la stratigrafia conservata indagabile è poca, la cronologia sembra risalire". D'Alessio refers mainly to the chronology of the structures pre-dating the great atrium houses of the ancient town; although the difference between primary and secondary deposits is not mentioned, D'Alessio is clearly refering to the second ones. The author suggests that small excavations provided dates which were older than the dates provided by bigger excavations. Nonetheless it has to be stressed that if the dates acquired had been handled correctly, that is as mere *termini post quem*, the problem would not have arised. Instead, a date which should have only fixed in the timeline a point after which the investigated event took place (the construction of the house) was practically used as a *terminus ad quem*. If the termini are employed correctly, more recent dates and older dates are not in contrast, all providing only *termini post quem*. Anyhow even a *terminus post quem* has great utility within a whole sequence: thus, when dealing with deposits which were excavated only partially, the *terminus* can be employed but the possibility it it may shift to more recent periods has to be considered and the actual meaning of *terminus post quem* must be kept in mind even more firmly.

III.4.3 Types of artefacts and different dates: the nature of data

An extremely delicate issue which has to be addressed before turning to the plotting of the profile concerns the nature itself (the quality) of the data we have. We have artefacts or ^{14}C samples and we have their dates. But what do these dates refer to? To the production of the artefact we are handling? To its diffusion? It is a crucial point, because if we want to plot together the dates of the artefacts (or samples) we are studying, the dates must refer to the same 'thing'. We cannot mix data of different intrinsic nature under the same label. That is, we cannot mix under the label 'dates' some dates which refers to the production of specific specimens and other dates which refers to the general distribution of a whole group[195]. Unfortunately, that is exactly the case of the data we usually handle. For instance the chronology of an amphora is commonly related to the presence[196] in the systemic context (*i.e.* among the materials circulating in a precise time-span) of that kind of amphora in a given

[195] The topic is briefly tackled in Giot, Langouet 1984, p. 23
[196] That is what M. Millet defined as 'aggregate lifespan' (Millet 1987, p. 101)

space. Amphorae Dressel 20 were part of the systemic context from the Augustan age to the half of the 3rd century AD. Differently, the date of a coin refers to the minting (production) of that exact specimen. Similarly, the date of a stamped Samian ware usually refers to its production[197]. Radiocarbon dates refer to something still different, that is the death of the examined plant[198] or animal. It is not just an issue of precision but a qualitative problem.

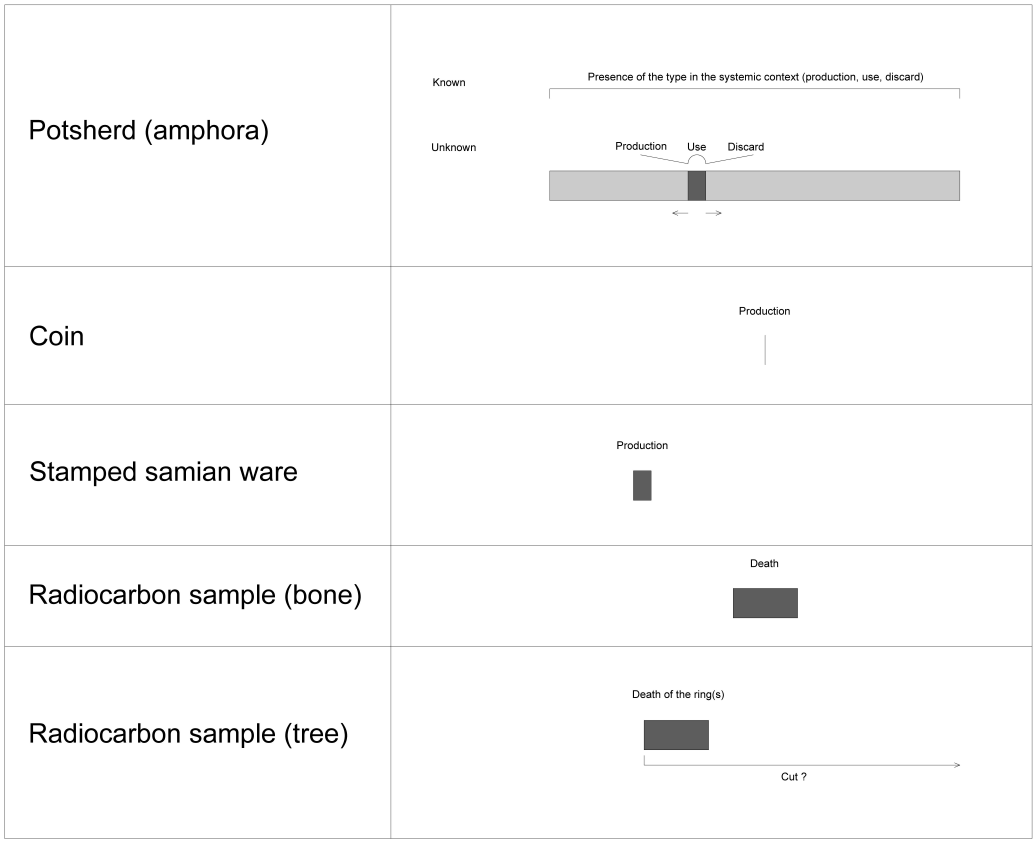


fig. 18 *- Different finds, different dates.*

How can we deal with such a non-homogeneous mass of information? I think there are basically two ways to challenge the issue. The first would consist in plotting separately different classes of data. But this practice would entail some serious disadvantages. Firstly, in order to examine one single context or deposit we would need more than one graph; this is, substantially, a practical disadvantage. Secondly, the basic aim is to get one date (or two in the case of a primary deposit with a continuous formation) for the formation of the deposit.

[197] See HARTLEY DICKINSON 2008, p. 4

[198] The issue, in the case of trees, is even more complicated: if the sample does not come from one of the external, living rings, we are not dealing with the date referring to the cut of the tree, but with the 'death' of that precise ring. I will discuss this topic in more detail later on.

It means that once we produced, let us say, three or four different graphs, we would still face the problem of a unitary explanation and of a unique date.

A second way to challenge the issue of non-homogeneity is, of course, to make the gathered data homogeneous. This is surely the most difficult way and it entails many risks, as some parameters will forcedly be at most best guessed. There is also the risk on the one hand of creating false precision, on the other of diluting precise data into something too vague. It is extremely important that this step involves specialists of each type of artefact or sample.

It would be extremely chancy to transform a date referring to the presence of a type in the systemic context into the date of the production of a precise specimen. That would inevitably lead to the first of the consequences cited above, that is creating false precision, thereby biasing every plotting we may build up.

Inevitably, we can only transform a date related to the production of a specimen, into the date of its hypothetical presence in the systemic context. It means we have to evaluate the length of the artefact's life after its production, 'broadening' the date we have towards a later moment in time. Fortunately, this process involves just the few classes of artefacts whose date of production is known. Nevertheless, some of these artefacts are particularly susceptible to forms of curation, primarily because of their own value[199]. Therefore a major problem arises when fixing a hypothetical date which stands between what can be referred as the most common period of use life and what represents a process of curation.

Coins[200] represent the clearest case: we know, often very precisely, their date of minting. If we want to 'transform' the mint date into a date indicating the presence of the coin within the systemic context, we have to evaluate how long the coin circulated. In general, according to the value of the alloy employed, we can conclude thatthe higher the value the most it is likely the coin circulated (or has been stored) for a long period. This means that gold coins are likely to have a longer use life than the bronze ones. Of course such a general indication is, in practice, useless.

An archaeological indicator of the length of 'a coin's life' seems to be its wear. G. Gorini, referring to the specimens found in *Regio X Venetia et Histria*, has attempted to

[199] See GIANNICHEDDA 2006, p. 119

[200] For coins and excavation see, in general, GORINI 2002, CATALLI 1997 and RIZZI 1985. See also POBLOME 2008, pp. 194-199, for a contextual comparison of numismatic and ceramic data.

quantify, at least broadly, the correspondence between the two phenomena: he has given some useful indications[201]:

Wear	Life
Typological and weight features are maintained	Until 25-30 years after minting
A medium degree of wear: type and legend are recognizable, weight loss around 5-10%	Until 50-60 years after minting
The original type is vague and the coin assumes a lenticular shape	Until 100-120 years after minting

This is of course an empirical evaluation, coming largely from experience. It presents the indubitable advantage of being applicable to every single specimen; in this sense it is not generic, but specific. Nevertheless it is a kind of evaluation deeply biased by the actual incapacity of distinguishing wear due to circulation from wear due to post-depositional factors[202]. Relative wear may be observed in similar specimens buried in similar conditions approximately at the same time. But unless (or until) it is possible to reasonably exclude a large range of factors (including type of alloy, different periods of deposition, physical-chemical features of the context etc.) it seems to be very difficult to concretely apply the evaluation of wear as the main tool in estimating the length of the circulation of a given coin[203].

This difficulty has been addressed as the main reason why we do not know how long in general a coin remained in circulation[204]. Looking at the table above it is also clear that coins which seem to have circulated longer were probably involved in processes of particular curation. But, again, fixing a distinction between common use-life and curation seems to be very difficult.

Nonetheless, besides wear, a more promising tool has been employed to evaluate the use-life of coins: it is the study of coin hoards. K. Lockyear examined the expected coinage pool (the composition of the systemic context of coins) in different periods from the mid-2nd century BC to 2 BC[205]. He used Crawford's method of die-counts and then compared the obtained results to the empirical observation of a number of coin hoards. He plotted the

[201] GORINI 1999-2000, pp. 76-78
[202] DEROSE EVANS 2013, p. 113
[203] Anyhow, the evaluation of coins wear has been practically employed as a chronological refinement tool in BONINI 2004 and it seems to have provided dates consistent with the other available dating sources.
[204] DEROSE EVANS 2013, p. 114
[205] LOCKYEAR 1999

presence of coins minted in a given year in later hoards, so, basically, allowing a broad estimation of the use-life of specimens minted in a given year.

It has also been observed, for instance, that hoards put aside in the early 4th century AD rarely contain coins more than 20-30 years old[206]; this element implicitly gives us an idea of the average use-life of the coins hoarded. A similar approach has also been proposed in 1979 classic paper by P. Crummy and R. Terry (see Chapter I.2.2)[207].

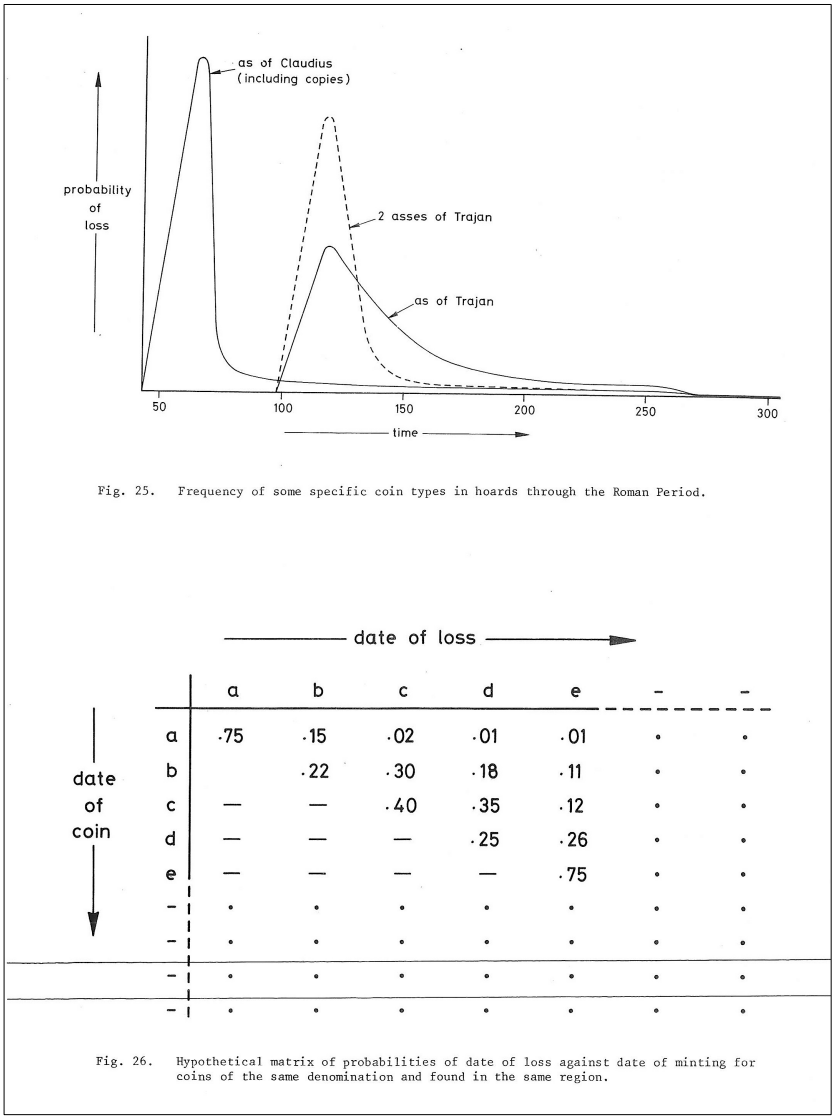


Fig. 25. Frequency of some specific coin types in hoards through the Roman Period.

date of loss

date of coin	a	b	c	d	e	-	-
a	·75	·15	·02	·01	·01	•	•
b		·22	·30	·18	·11	•	•
c	—	—	·40	·35	·12	•	•
d	—	—	—	·25	·26	•	•
e	—	—	—	—	·75	•	•
-	•	•	•	•	•	•	•
-	•	•	•	•	•	•	•
-	•	•	•	•	•	•	•
-	•	•	•	•	•	•	•

Fig. 26. Hypothetical matrix of probabilities of date of loss against date of minting for coins of the same denomination and found in the same region.

fig. 19 *- P. Crummy and R. Terry modeling of coin loss. From* CRUMMY, TERRY *1979*

The cross combination of such information and the careful and contextual observation of wear may hopefully bring a broad estimation of the use-life of the specimens

[206] LOCKYEAR 2012, p. 197. A similar trend is observed in GUEST 2007, p. 298: a significant proportion of the coins lost in *c.* 450 AD had been in circulation for 30-50 years.
[207] CRUMMY, TERRY 1979

recovered during the excavation by numismatists. It is not a very common practice at all and it presents clear risks, but I firmly believe it is a path which has to be followed (in ceramics studies as well) if we want to make better, more substantial and more realistic chronological inferences about the deposits and the assemblages we study.

Suppose we have a group of early 4th century coins, still highly legible and close to the expected weight; I think that adding to the minting date a life-time of about 30 years seems to be reasonable and more realistic and, most importantly, it would allow us to move from the date of the production of a coin to the date of its presence in the coinage pool (*i.e.* the systemic context). Looking back to the purpose of this work, the last point is undoubtedly the most important one. Of course it is an estimation which has to be attempted by the numismatist, who is undoubtedly the only suitable figure to do it, in collaboration with the excavation team.

In this case we assumed that after 30 years the coin, if not discarded, may be have been curated or it became a residual and we consequently fixed an end date to its use-life.

One last thing has to be noted about coins: if the *terminus post quem* for the formation of a given deposit is procured by a coin, and if it is clear that the coin circulated at least for a given period, the *terminus post quem* for the formation of the deposit should be moved forward as well.

Slightly different problems emerge as we turn to examine stamped finewares, such as Samian ware/*terra sigillata*. In this case dating is usually referred to the production of a given group of stamped wares[208], but of course it cannot be as precise as the date of minting of a series of coins: time spans can of course be very narrow, but they refer to a period of some years more than to a single year. For instance we know that the Gallo-Roman Samian ware specimens marked in different ways by the potter *Ambitoutus* were produced between 130 AD and 160 AD[209].

As the date we have refers to production, we are forced to investigate the common use-life of these kind of artefacts; nevertheless, in this case, the starting point is not represented by one single year (as it is very common in dealing with coins), but by a more or less wide period. Of course the additional use-life time span we have to formulate, must be applied starting from the date of the end of the production.

Which information do we have about the use-life of this class of vessels? T. Peña discussed the cycle of production-use-discard-reuse of some different classes of pottery,

[208] HARTLEY, DICKINSON 2008, p. 4, 28
[209] HARTLEY, DICKINSON 2008, pp. 180-181

trying to give the model obtained a chronological perspective[210]. Unfortunately, among the classes discussed, fineware is not mentioned. Fortunately the problem of the life of this class of vessels has been addressed in other works, but it has to be stressed that not much work deals with this topic in current literature.

Interesting suggestions come from a work of C. Wallace dated to 2006[211]. The author examined the presence of Samian ware in a number of Romano-British graves and in other selected contexts in order to highlight the presence of vessels which were commonly dated to a period prior to the burial. This gap may range from 10 years to more than a century or two, and reaching a peak when Samian ware was recovered in early medieval burials. For South-Gaulish examples the 'time drift' varied from 30 to 60 years[212]. Apart from the possibility of multiple depositions[213], the omipresent chance that infiltrations occur[214] and the obvious selection/curation processes involved in such practices, the author raises the larger question of Samian dating, circulation and long life. Indeed, we should not be very surprised if such pottery, surely of some value particularly if compared to other classes of vessels, was commonly preserved with some care[215]; furthermore its own use as fineware did not entail great mechanical stress, reducing the possibility of premature breakage. These aspects alone surely contribute to a use-life longer than the common use-life of amphoras or coarsewares. Even in this case a few more indications may come from wear studies, but at present this is an almost unexplored field.

Summing up, we may say that one of the best chronological tools commonly employed in Roman archaeology, *i.e.* Samian ware, is unfortunately particularly affected by processes of particular care. But when does a reasonably common care stop, making space for practices which can be certainly defined as curation? Again the answer can only be tentative. I suggest that when the dates we have are related to the production of a particular kind of fineware (that is the case of many stamped - and non stamped - Samian wares) we

[210] PEÑA 2007, pp. 322-337. See also the older works DEBOER 1974, DAVID 1972 and FOSTER 1960
[211] WALLACE 2006
[212] WALLACE 2006, p. 260
[213] See for instance VANZETTI 1992. In Roman cemeteries burial reopenings seem to be less attested. This may be due to the actual modesty of diffusion of this kind of ritual or to less careful stratigraphical examinations. Nonetheless some clear examples are available. In Padua, tomb 39 from the cemetery of via Tiepolo - via S. Massimo, dating back to the early-Augustan period, was certainly reopened in order to reunite the family members ROSSI 2014
[214] See two classic examples concerning cremation burials in LEONARDI 1986 and in CUPITÒ, LEONARDI 1999
[215] A similar pattern is suggested in MOGETTA, TERRENATO 2007, p. 118. Although I disagree with the overall methodological structure of the paper, I find the presence of Samian ware, presumed to be long-lived, within a settlement extremely interesting. A use-life for Samian imported in Armorica of about 10-15 years is suggested in GIOT, LANGOUET 1984, p. 23. Finally, common forms of curation for fine wares (10-50 years) are suggested in ZANINI, COSTA 2011, p. 36, p. 40 in SCHINDLER KAUDELKA , ZABEHLICKY-SCHEFFENEGGER 2007 (indeed a wonderful example of ethnoarchaeology) and in SCHINDLER KAUDELKA 2010, partic. p. 475

may safely add about 10-30 years to the proposed time frame, in order to take into account the concrete possibility that these kind of vessels were commonly used for a long time. Again, we have to keep in mind that we are adding a certain percentage of uncertainty to the equation and not some false certainties.

Very difficult issues also arise when dealing with radiocarbon samples[216]. In this case we have to clearly distinguish different types of samples, each one presenting peculiar problems and potentialities in terms of chronological inference. The most common kinds of sample are bones, wood and seeds[217]. In dealing with samples we have to keep in mind that within the record they may be residuals or not, in the same way coins and potsherds are.

Bones. The date we have from the laboratories reveal when the body (human or animal) died. This is the simplest case, as the time frame we have is directly related to a precise event. Indeed bones should be a privileged target; moreover curation processes can be considered very rare. Some attention has to be dedicated to bone objects: in this case we assume that the death of the animal whose bone has been employed and the production of the object we are handling are quite close (a few years at most?).

Wood. This is probably the most complicated case[218]. Apart from episodes of sudden fire and from extraordinary preserved timbers, the most common wood we collect during excavations is brought down in small charred chunks. Two main problems arise in this case:

1. we do not know where the carbon comes from. If it had any structural function, it may have been in place for decades before being burnt and incorporated into the sediments where we finally dug it out. As a piece of furniture the process may have been similar[219]. Moreover, as I will examine in Chapter III.5.1, wood was recycled in antiquity in the same way it is recycled today. Of course wood for fuel was probably young[220], gathered directly from trees or bushes, but we cannot say this was a rule[221]. This issue has to be addressed both by the archaeologist and the archaeobotanic specialist.

---

[216] This seems to be an issue tackled too lightly by both archaeologists and laboratories (AMBERS 1994, p. 7) Some problems also arise when dealing with natural strata (HEDGES 1991, pp. 7-8). The importance of the source context for a good use of radiocarbon samples is discussed in BOARETTO 2009.

[217] Certainly many other kinds of archaeological materials are suitable for radiocarbon analysis; among them shells, textiles, fossiles, hair and lime mortar can be cited. This last type of sample may be of undeniable help in dealing with structures in an urban environment (see Chapter III.2).

[218] GILLESPIE 1986, p. 25, WATERBOLK 1971

[219] See SCHIFFER 1995b, p. 112 for an extremely interesting contemporary comparison, which demonstrates how, also within a society usually assumed to be a "waste maker" as the American one, reuse affects the vast majority of the pieces of furniture. For an exceptional example of reutilization of archaeological wood, see GIOT, LANGOUET 1984, p. 115

[220] WATERBOLK 1971, p. 22

[221] See the extremely interesting reconstruction of Pompeii's economy of wood and charcoal in VEAL 2012

2. we may get the outer rings of the branch/trunk or we may not get them. In the second case the date we can obtain is indeed a *terminus post quem* for the cut of the plant the sample comes from; the sample itself, if coming from a secondary deposit, would give just a *terminus post quem* for the formation of the deposit in which it is embedded. This issue has to be addressed by the archaeobotanic specialist and may be modelled mathematically[222].

The combination of the two factors leads to different degrees of chronological uncertainty: if we have a sample presenting the outer rings and which is not likely to come from a long lived structure, we can use the sample to date a primary deposit *ad quem*. A sample without outer rings, maybe coming from a long lived structure, will procure just a *terminus post quem* even for a primary deposit. The gap separating the *terminus post quem* and the actual moment of formation of the studied deposit may be considerably wide.

Seeds. Seeds are very suitable for radiocarbon dating[223], as they were usually not stored for more than one season/year. If recovered in a primary deposit, they can provide good *ad quem* dating.

In the same way of stamped wares and coins, even in this case plotting together with the other available data the chronological frames returned by the laboratories without any critical evaluation may be seriously misleading, creating false certainty where it actually does not exist. Wood in particular seems to create serious problems in directing us to ages which may be too old, basically unrelated to the moment of deposit formation. As suggested for other classes of data, it seems to be correct to extend (together with the archaeobotanic specialist) the frame procured by the laboratory before plotting it with all the chronological data available.

III.4.4 The quantification method

How to count the data we have may seem to be obvious and discussing it may look like excessively nitpicking. Nonetheless, I think the topic has to be briefly tackled, at because of the existence of a huge body of literature concerning how to quantify ceramics[224], *i.e.* the main *corpus* of data available for chronological inferences. Of course the issue arises

[222] Waterbolk 1971, p. 21
[223] Waterbolk 1971, p. 21
[224] See in particular the huge body of literature produced by C. Orton: Orton 1975, Orton, Orton 1975, Orton 1978, Orton 1980, Orton 1989, Tyers, Orton 1991, Orton, Tyers 1992, Orton *et alii* 1993, Orton 2000, Orton 2005 See also the more recent Cortese 2006 and Millet 1979 Vince 1977.

because of the simple ascertainment that vessels recovered in the archaeological record are usually reduced to fragments. A wide range of factors and phenomena affect breakage rates and modes, so simple sherds count has been questioned as to whether it was the most appropriate tool to estimate ancient economic trends, trade volumes and so on. Furthermore, comparing assemblages and classes within assemblages is complicated because of the different nature and size of the investigated deposits and because of the breakage rates. In response to these problems, many techniques were developed, ranging from the simple sherds weight, to the estimation of the vessel equivalents (EVE) and including the estimation of the minimum and maximum number of vessels, rims and/or bases counts and so on.

These are procedures which unfortunately are still not so widespread in Italian classical archaeology and which should become a much more common practice, in order to enhance many conclusions we draw, for instance, about ancient economy.

Nevertheless, as it has already been outlined, these techniques were developed mainly in order to compare assemblages; it has also been stated that they have little value in breaking down one single assemblage[225]. They were not developed in order to model inferences about formation processes and dating of deposits. What we are handling when plotting the dating of the artefacts embedded within a deposit is 'simple' information. One sherd corresponds to one piece of information. Of course joints must be verified before proceeding, in order to avoid false redundancy. There is also a very practical reason for which it seems to be better to choose the simple sherds count: in this way every piece of information is taken into account, while most of the other quantifying techniques use only rims and/or bases. Finally, other sources of data (coins, radiocarbon samples) are not broken into pieces and weight has no influence on their informative value. One simple, common way of quantification seems to be recommendable. Counting coins and samples and quantifying ceramics by, let us say, minimum number of vessels, does not seem to be correct as it would exclude some potentially useful sources of information such as datable sherds with no rim or handle or base.

Ultimately, I chose to quantify data by simple count.

[225] ORTON 1982, p. 1

III.4.5 A FORMATIVE PROFILE: SOUTH FORMULA, AORISTIC SUM, WEIGHTED MEAN SUM AND MONTE CARLO SIMULATION

Once the quality of the chronological data has been evaluated and uniformed and once the decision has been made how to quantify them, it is possible to express the information they provide in a cumulative and synthetic way.

The starting point is basically a series of values indicating the estimated date of each artefact (or sample) entrance within the systemic context and its exit. We may say that the two dates indicate the extremities of the chronological window (more or less narrow) in which we know the artefact has lived.

This first level of representation has been expressed graphically, for instance, by the tables supplied by the already mentioned publication of the excavations of the Forum of Nora.

				VIII a.C.	VII	VI	V	IV	III	II	I a. C.	I d.C.	II
US	MATERIALE	CLASSE/TIPO	Q.tà										
5275	cer. fp.	mensa	9										
		coppa 1.2	1										
		coppa 4.2	1										
		piatto 2	1										
		anfora 1.1	1										
		cucina/preparaz	10										
		pentola P2	1										
		cer. fatta a mano	2										
		pentola profilo a S	2										
		anfore	76										
		T-2.1.1.2., a	1										
		T-2.1.1.2., c	1										
		T-2.1.1.2./1.2.1.1./1.4.2.1.	1										
		forni/fornelli	3										
		tannur	3										
		di uso diverso	1										
		lucerna L2	1										
	ossi		6										

fig. 20 *- Example of table supplied in* BONETTO ET ALII *2009b*

Within each gap, the related artefact was manufactured, used and discarded and this may have happened throughout the whole period indicated or, much more often, in a narrower, unknown time lapse located within the gap.

This graphical device has the undeniable advantage of being very clear and analytic, providing an excellent overview of the quality and quantity of all the finds recovered within a context/deposit. It is definitely an invaluable tool for publishing, but as an inquiry tool it displays some disadvantages:

- it is graphic and not numerical, so making statistical modelling difficult;

- it is analytic, but not synthetic (which periods are more or less represented by the finds can be observed only roughly, in an "impressionistic" way).

- it is rigid, as it has to employ one fixed measurement unit (in this case time is divided in "boxes" of 25 years), possibly not too small.

A few more words need to be dedicated to the last point: the length of the "boxes" employed determines the accuracy of our final knowledge and it is a direct function of the quality of the available data: the more accurate the initial find dates, the more accurate the sum of the whole body of information will be. Having closely dated finds and using boxes wich are too big would lead to a waste of good information; on the contrary using a narrow grid for broadly dated materials would represent a waste of time. A critical point arises when considering that the quality of dating of different types of artefacts may be very dishomogeneous. So the length of the breaks we use has to be carefully evaluated in advance. I will come back to this point later, because it represents a serious disadvantage of some types of representation which lack of the flexibility needed to fit the available data well.

In order to get a more effective tool, it is possible, of course, to start expressing the same list numerically. For instance, the table below can be easily expressed as follows.

				VIII a.C.	VII	VI	V	IV	III	II	I a. C.	I d.C.
US	MATERIALE	CLASSE/TIPO	Q.tà									
5148	cer. fp.	mensa	243									
		coppa 5.2	1									
		coppa 6.1	1									
		coppa 10	1									
		coppa tripode	1									
		brocca 2	1									
		cucina/preparaz	26									
		pentola P2B	1									
		pentola P7	1									
		cer. fatta a mano	1									
		teglia	1									
		anfore	61									
		T-2.1.1.2., a	1									
		T-1.2.1.1., a	1									
		forni/fornelli	9									
		tannur	9									
	ossi		19									
	conchiglie		1									

fig. 21 *- Another table supplied in* BONETTO ET ALII *2009b*

Entrance	Exit
-650	-575
-650	-550
-650	-550
-700	-600
-650	-500
-625	-550
-300	-100

-750	-600
-650	-600
-625	-575

Nonetheless the main questions to be answered are: how can this body of data be expressed in order to show which periods of time are more (or less) represented? Is it more likely that there are more 7th century materials or 6th century materials? And how many more? How does the chronology of artefacts fluctuate through time? Can we detect any peaks or, conversely, unrepresented periods? As a result we will be able to inquire about the meaning of the detected fluctuations.

In order to answer the mentioned questions, we need to express the information we have gathered in one single plot; in other words we have to move from analysis to synthesis. In these terms, this issue has never been fully tackled (apart from the suggestion of a "triangular model", see below), but some useful tools have been employed in two fields which are extremely close to the one we are examining, *i.e.* the study of residuals and the study of artefacts recovered in surface surveys.

A first approach, initially used by Stanley South for studying the length of periods of site occupations[226], was then applied by Archer Martin to residuals[227]. It is commonly known as the South formula and employs the median date of the "popularity" window of each type (a date in the middle of the known gap) in order to create a global median date of the artefacts studied (I honestly cannot catch the advantage of reducing a time span to a single median date). The approach provides that the median date of each type distribution is multiplied by the number of sherds of that type. The sum of the products is divided by the total number of sherds.

I argue that this approach presents serious disadvantages:

- it takes neither variability nor uncertainty into account, *de facto* canceling the heterogeneity we want to plot and which is the most informative tool we have;

- it assumes a normal distribution of a type through time, with maximum frequency in the middle of time lapse considered. I will discuss later the distorsions this view may introduce in ceramic studies. I just anticipate that cumulative frequency and ancient economy fluctuations are not considered.

[226] SOUTH 1972
[227] MARTIN 1998

These disadvantages make this procedure little helpful for describing the chronological information provided by the artefacts and samples embedded within a given deposit.

An alternative way of elaborating the data has been proposed by Nicola Terrenato and Giovanni Ricci: it is named 'weighted means sum' and it is, basically, a more elaborated form of aoristic sum.

Aoristic sum seems to have been firstly introduced in police investigations, as a means to model the frequency of crimes in the space of a day. The issue arose because often the time span in which a crime (thefts in particular) occurred was known, but the precise moment in which it happened was unknown. Once a full day is divided into convenient time spans (or 'search blocks'. Let us say for instance that one day is divided into 24 blocks lasting one hour each) and once a start point and an end point is conferred onto each event (incidents, *i.e.* thefts), search blocks are weighted accordingly: incidents with longer time spans are less likely to have occurred within a precise search block.

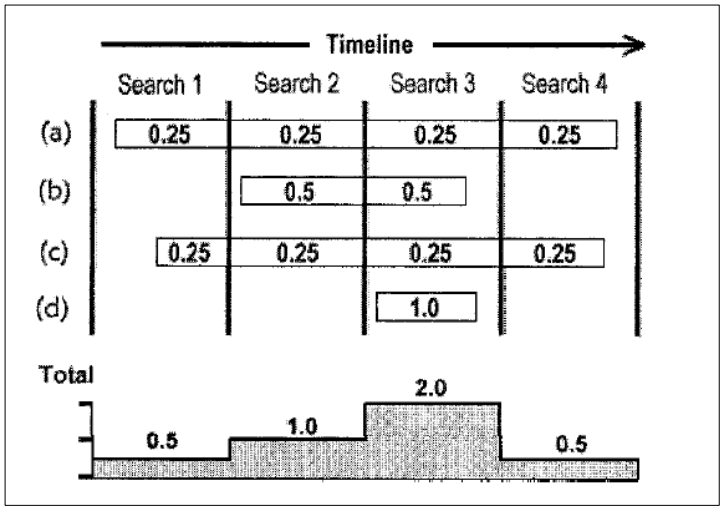


fig. 22 *- Aoristic analysis. From* RATCLIFFE *2000*

The result is an histogram which show accumulated temporal weights (*i.e.* exactly what we are looking for. In other words for each block we have a sum of probabilities, known as aoristic sum), suggesting which periods, over the span of a day, are preferred to commit a crime and can thus be considered more dangerous.

The same procedure is the basis of the method suggested by Terrenato and Ricci and which has been applied to the study of residuality in some contexts of the northern slopes of the Palatine Hill, in Rome[228].

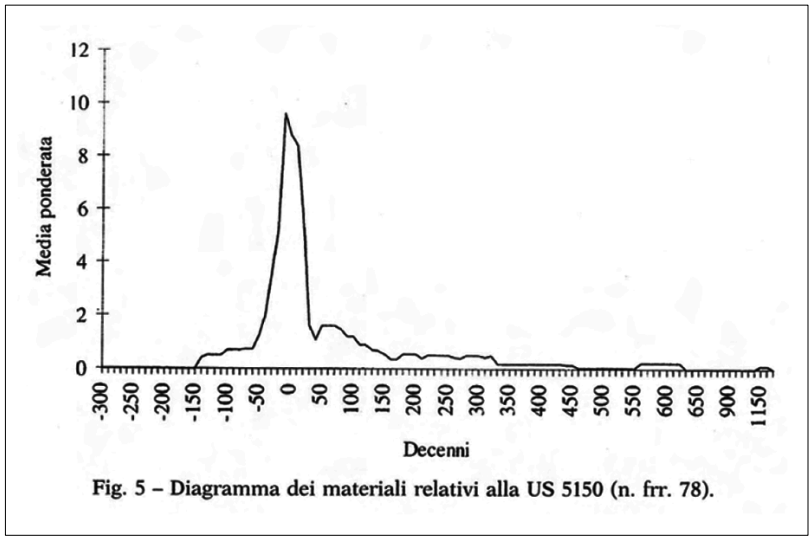


fig. 23 - Weighted means sum. From TERRENATO, RICCI 1998

The main difference from a "straight" aoristic analysis consists of the introduction of a quicker procedure in case we have more sherds (thefts or incidents in the example cited above) with the same start point and end point. The number of sherds is directly divided by the number of boxes covering the time lapse. Suppose that we have 4 sherds dated between 100-225 AD and that we intend to use boxes of 25 years.

sherd 1	0.2	0.2	0.2	0.2	0.2
sherd 2	0.2	0.2	0.2	0.2	0.2
sherd 3	0.2	0.2	0.2	0.2	0.2
sherd 4	0.2	0.2	0.2	0.2	0.2

sum	0.8	0.8	0.8	0.8	0.8

[228] TERRENATO, RICCI 1998. The method has also been employed by other scholars, but surprisingly it seems that the "Italian school" and the "Anglo-Saxon" one did not interact very much. The piece of work by Terrenato and Ricci never appears among the references in aglophone works. Crema (CREMA 2012, p. 447) suggests that aoristic analysis was first introduced in archaeology by I. Johnson (JOHNSON 2004), but the paper by Terrenato and Ricci is far older. On the other hand recent papers by anglophone scholars do not appear among the references of Italian papers, still referring mainly to Terrenato and Ricci. The two Italian scholars in turn apparently draw on older works by G. Marsh and "London School" (see MARSH 1981, p. 181, SYMONDS 2008).

Of course, we just divide the number of sherds (4) by the number of boxes (5) to have the value corresponding to each box (0.8).

Although employed from time to time, this method has never become a common, widespread means for representing the chronological information embedded in strata. Apart from residuals, it has been used for creating "dating profiles" of whole sites in spatial analysis projects[229]or of whole periods in excavation reports[230].

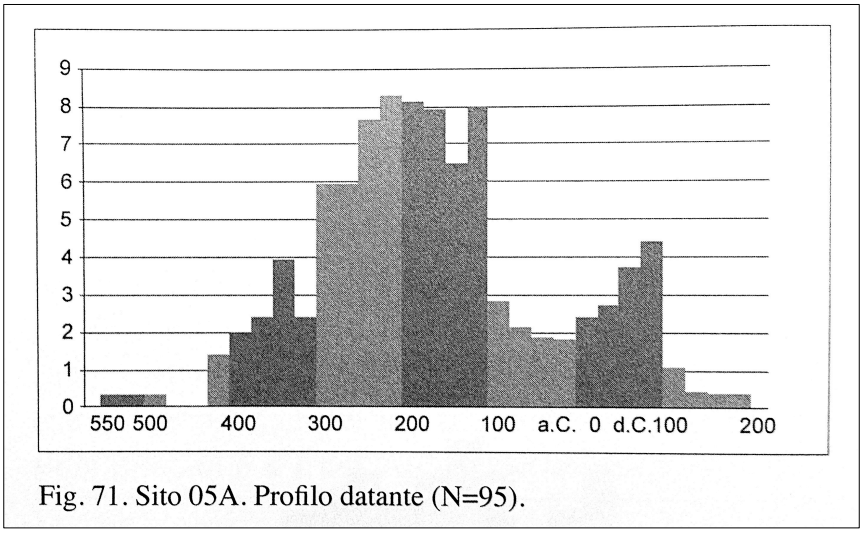


fig. 24 *- Site dating profile. From* ROPPA *2013*

Indeed this method provides a very good way of showing the dating profile of artefacts or samples collected within a context or group of contexts. Informative wealth is mantained and presented in a synthetic way. These profiles can be used, without any doubt, as a useful tool for characterizing deposits according to the chronology of embedded artefacts. Nonetheless, they still present some shortcomings which are due to be corrected:

- they present a value on the y axis which does not correspond to a number of artefacts, but which just indicates a sum of weighted means, *i.e.* a value of probability. This makes it more difficult, for archaeologists in particular, to get a concrete idea of the number of materials circulating in a given period. In a few words, it is simply less comprehensible;

- they transform our preliminary uncertainties about the dating of each artefact into some kind of certainty (but multiplied uncertainties should increase more than decrease the overall uncertainty level).

[229] MILLET 2000. The method has been recently employed by A. Roppa in his survey of urban and rural communities in Hellenistic Sardinia (ROPPA 2013, pp. 104-107)
[230] ARGENTO, DI GIUSEPPE 2006, pp. 34-36

This last point has been discussed by E. Crema and represents the main input for finding different ways of representation: "[...] when the input data are probabilistic, the output data should also be probabilistic. This implies that the aoristic sum could be a misleading approach, as it will obscure possible alternative time series by showing one possible dynamic which is not necessarily the one with the highest chance of occurrence"[231].

In his paper, focusing on variations in the temporal patterns of Jomon pithouses of Japan, Crema challenges the topic from the very basis and then suggests a possible wayout.

Mathematically, a probability calculus, based on the multiplication rule, is the best way to address the problem. We know that the probability that two independent events are occurring at the same time is equal to the product of the probability of each event. Nonetheless the number of permutations that should be performed even for small numbers of blocks and events cannot practically be computed. Fifty events with a time span of just four temporal blocks would have $1.27 * 10^{30}$ permutations.

So, if cumulative probability is misleading, exact probability is practically impossible. The way out suggested by Crema consists of moving to a simulative approach, and here the Monte Carlo method offer a "simple but effective approach"[232].

This method has already been applied in archaeology[233], but it has never been applied to the study of artefacts chronology within a deposit, even if its possible use has been suggested by C. Orton[234].

D. L. Clarke, in the early '70s, defined the Monte Carlo technique as a tool to "suggest solutions to stochastic problems by employing sampling experiments upon a simulated model of the process under investigation[235]". In our case, the basic assumptions are the same as in the case of aoristic sum analysis: we have events (types diffusion) and we have time blocks (5, 10, 25, 50 years); we do not know when the sherds we are handling have actually lived within their range of diffusion. Finally we want to look at the whole information and examine which boxes are more or less represented.

Let us take one single event and divide it in boxes, each one having the same probability of "containing" the actual life of our sherd[236]. We randomly pick up one of the boxes; then we repeat the process for each sherd (event) we have. Basically we have just

[231] CREMA 2012, p. 449
[232] CREMA 2012, p. 451
[233] BUCK *ET ALII* 1996; LAKE, WOODMAN 2003; CREMA *ET ALII* 2010 and finally CREMA 2012.
[234] ORTON 2009, p. 69
[235] CLARKE 1972, p. 24, recalling HAGGETT 1965, pp. 58-60, 97-98. The application of the Monte Carlo techniques was suggested for solving problems in spatial analysis.
[236] I will discuss later uniform and other forms of distribution

simulated a temporal pattern; of course one run of simulation is almost meaningless. But what if we repeat this simulation, let us say, 50, 100 or 1000 times? It acquires an increasingly higher probabilistic value. We can finally stop the analysis "when we start to observe a relatively good degree of convergence [...] or when the standard error of our results becomes minimal"[237].

If, finally, the cumulative result of the simulations run are plotted, having time (divided in more or less dense boxes) on the x axis and the simulated number of artefacts on the y axis, the resulting graph no longer shows a single line with peaks and troughs, but a band which is more or less wide according to the quality of the data we have used. Uncertainty is thus considered and formalized and the final result fits the data more accurately.

The two main problems presented by aoristic sum analysis (uncertainty management and moving from probability to artefacts) are consequently solved. The Monte Carlo method is also flexible and can be improved and modified with more *a priori* knowledge in order to obtain more accurate and realistic simulations. As this method can be modelled and performed automatically using programmes for statistics (for instance "R[238]"), add-ons can also be modelled and automated in order to drastically reduce the time employed.

For instance we may decide to pick up periods of different length according to the known ordinary lifespan of each type (let us say 15 or 25 years for sigillata, 5 years for amphoras, 2 years for common ware and so on...). We can also easily divide time into narrower boxes if the available data are more precise or if the two extremes of the spans are more accurate. For example if we have plenty of red slip ware dated 30 BC - 10 AD we can use 10 years boxes; if have many coins, or if the start/end points of an event are dated *ad annum*, we can even employ 1 year length boxes.

Below, the same assemblage has been plotted using, respectively, an aoristic sum and a Monte Carlo simulation. The first graph has been realized using Microsoft Excel, while the second one has been produced by R.

[237] CREMA 2011, p. 451
[238] See DALGAARD 2008

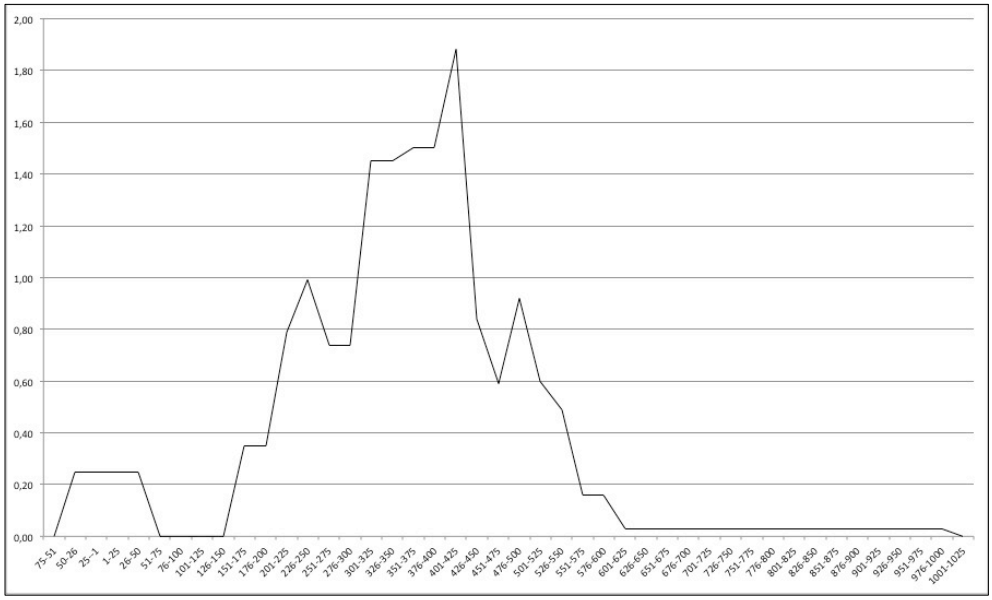


fig. 25 - A plot obtained through aoristic sum

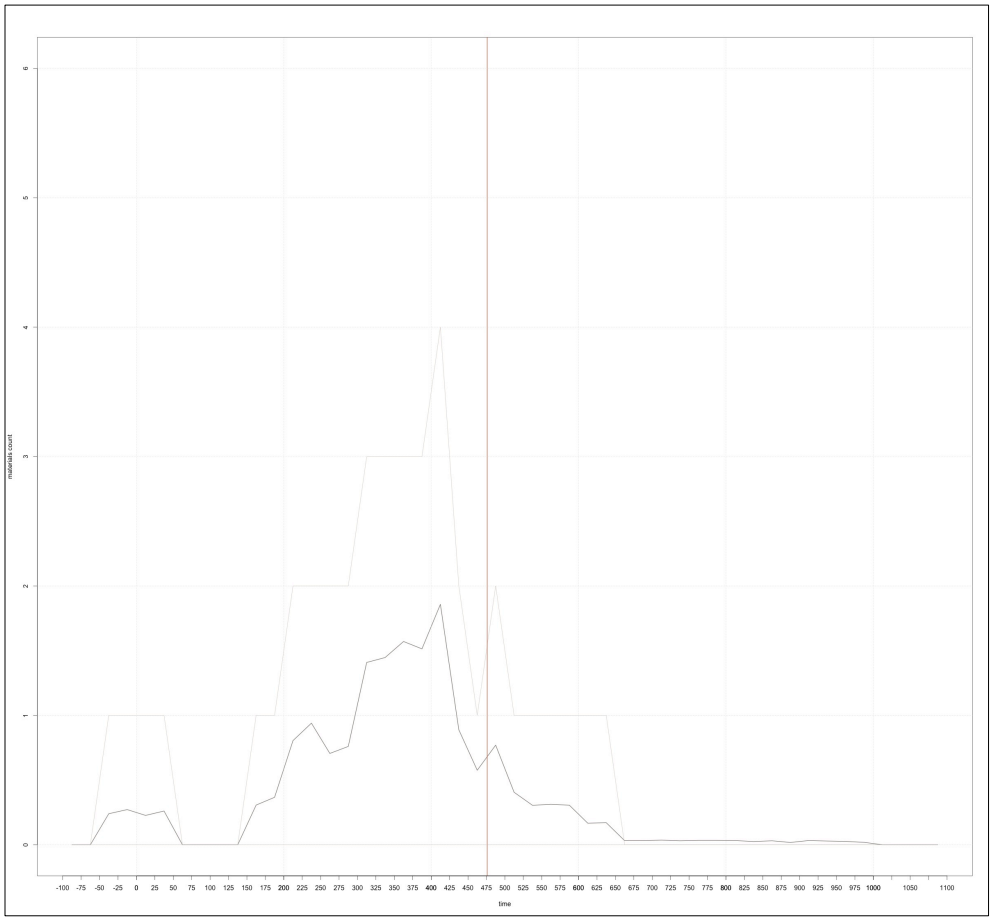


fig. 26 - The sae assemblage plotted above has been plotted using a Monte Carlo simulation

Of course they display the same trend, but the first is produced by a sum of means, while the second (the dark grey line) represents the mean of the values of one thousand

simulations; furthermore the first and the nineth quantiles (light grey lines) are reported, thus showing where the large majority of the performed simulations lie[239]. It is also worth noting that the y axis refers in the first case to a sum of means, while in the second instance it refers to the proposed number of sherds. Eventually it has to be stressed that, in the second case, a different plot with 10 years windows or, say, five years windows, may be performed just replacing one single valor within the script (see below). Theoretically *ad hoc* boxes may also be employed[240]. The red line, automatically generated, indicates the *tpq* provided by the assemblage.

III.4.6 UNIFORM *VS* NORMAL DISTRIBUTION

Both in the case of aoristic analysis and in the Montecarlo simulation, I moved from the assumption that each box within an event had the same chance to be selected. This means that each period within the larger diffusion span of a given artefact has the same possibility of having been the actual period of life of the single specimen studied. In other words I have used a uniform distribution to model the possibility of choosing one single box.

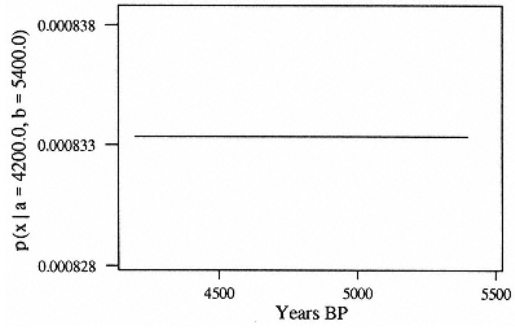


Figure 5.9
Plot of the probability density function of a continuous Uniform random variable on the interval 4200 to 5400 BP.

fig. 27 *- Continuous uniform distribution. From* BUCK *1996*

That means that every outcome of the same length is equally likely to occur.

[239] Each simulation produces a single line. In this case and up ahead in the thesis, for making the graphs more legible, I only provide the mean valors produced by the totality of simulations performed (1000 in this case) and the first and nineth quantiles, indicating the interval in which the large majority of the values fall in.

[240] One of the most widespread series of periods of variable lenghts is the one employed by British numismatists to subdivide time when dealing with coin loss in Roman Britain. In this case the 21 periods in which the time span ranging from 41 AD to 402 AD has been subdivided fit reigns, monetary reforms and other major political events which had a major impact on coin circulation in the province. This articulation of time, proposed by R. Reece, is thus specifically suitable for dealing with numismatic issues. See REECE 1995.

Of course this is a generalization and of course ancient reality must have been different. But how different? The point, I think, is that we do not know. Before reviewing how this question has been answered, it seems to be useful to recall a few issues:

(1) as I discussed above, artefact dates precisely refer to production only in a few cases. In most cases they refer to a more general "presence" within the systemic context of the class/form/type that the single specimen belongs to. In these cases talking about production/use/discard of the single specimen is simply impossible and useless, as the chronological framework available is not so sophisticated;

(2) we do not know very much about the volumes and fluctuations of the ancient ceramic production nor of many other products;

(3) archaeological time resolution is often much lower than "real life time resolution" and consequently it can lead to broad approximations even in case of very rapid processes: this means the quality of the data may lead to collocate within a 25 years box both an event that occurred in a few hours and a process that lasted for five years;

(4) a distinction has to be made between the actual ancient popularity of a form/type and the confidence the specialist has in dealing with that particular form/type. "This amphora was more popular during the 2nd century AD than in the 3rd century AD" and "This amphora is attested during the 2nd century AD, but probably was also used in the 3rd century AD" are two very different statements: the first measures the actual ancient distribution through time of the amphora, the second measures the quality of the data and the confidence displayed in order to date the artefact.

Keeping these issues in mind, we can turn to examine how the distribution of probability has been tackled; the main alternative to a model based on uniform distribution is a model based on normal distribution, that is a distribution modelled according to a Gaussian curve[241]. We say that *x* has a normal distribution if its values follow the pattern of a symmetric, continuous bell shaped curve. Each normal distribution has its own mean and its own standard deviation.

[241] Recently Gaussian curves have been employed to model the data set provided by an assemblage recovered in Pisa, San Rossore (FERRARESE LUPI, LELLA 2013) The approach then involved the use of a mix of weighted means and triangular representations (see below). As I will discuss later I substantially disagree with the use of gaussian curves to model the distribution of a given specimen or type. Gaussian curves are employed also in ROBERTS *ET ALII* 2012

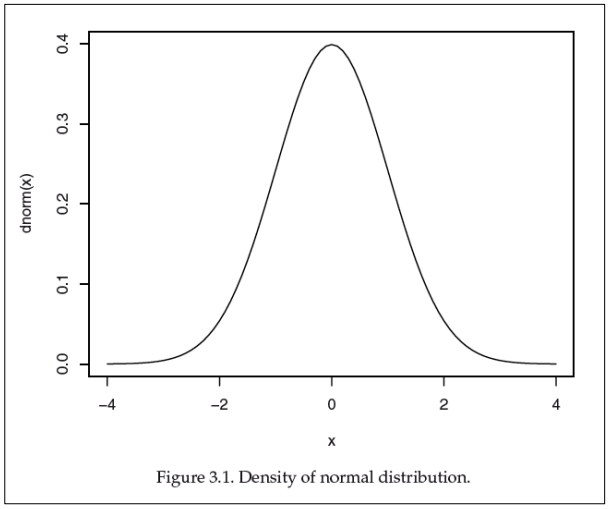


fig. 28 *- Normal distribution. From* DALGAARD *2008*

This unimodal distribution can vary and take the form of a unimodal curve skewed left or right.

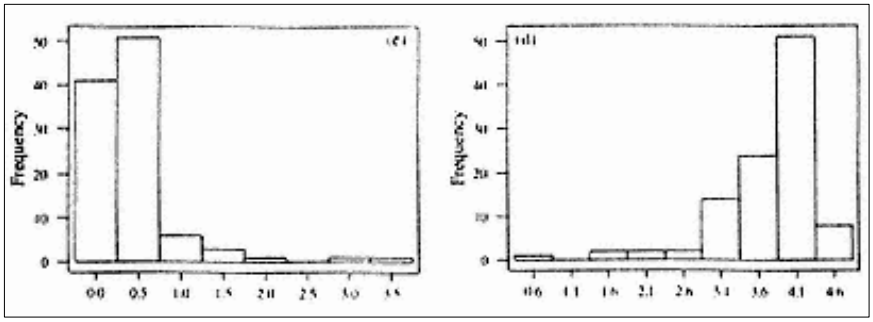


fig. 29 *- Distributions skewed left and right. From* BUCK *1996*

In the first case we get a so called battleship curve, a shape well known in archaeology and with a certain importance in seriation (a field closely connected with the issue of dating deposits, but which I do not deal with in this dissertation).

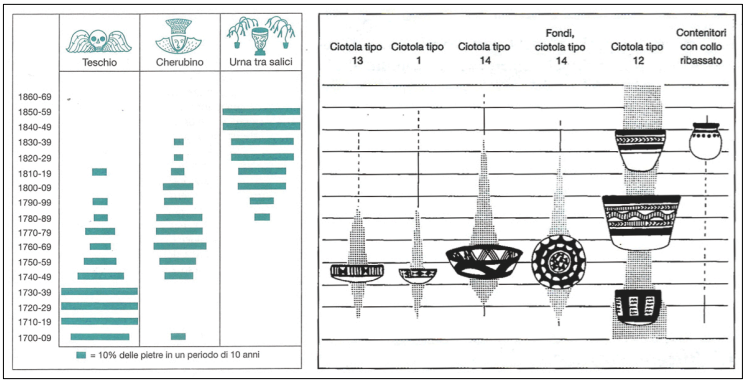


fig. 30 *- Examples of "battleship curves". From* RENFREW, BAHN *2006*

This last kind of distribution has been used by M. Millet in order to model the typical frequency of a pot type through time, assuming it rises steeply to a peak, then declining more gradually (**fig. 31**). Nonetheless the author himself states that "it should be noted that the shape of the frequency curve is a matter of assumption since few stratified sequences have been critically examined to provide empirical validation of the shapes of their curves"[242]. This curve has also been interpreted as the aggregate of a curve of production and a curve "of rubbish". The curve of production has been modelled with normal/Gaussian distribution.

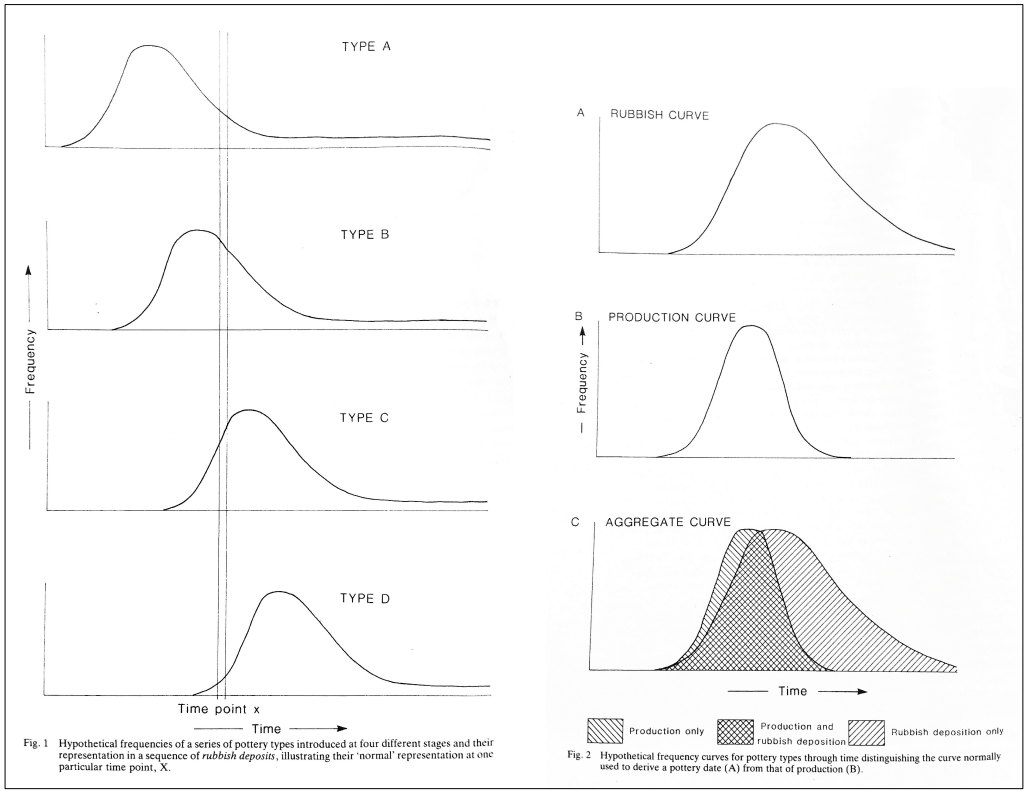


Fig. 1 Hypothetical frequencies of a series of pottery types introduced at four different stages and their representation in a sequence of *rubbish deposits*, illustrating their 'normal' representation at one particular time point, X.

Fig. 2 Hypothetical frequency curves for pottery types through time distinguishing the curve normally used to derive a pottery date (A) from that of production (B).

fig. 31 *- Hypothetical frequency of pottery types (aggregate curves, production curve and "rubbish curve". From* MILLET *1987*

Instead, E. Zanini and S. Costa used both a uniform and a normal distribution to model the production of a type through time[243]; then they created curves shifted to the right to simulate different use-lives for the given type.

[242] MILLET 1987, p. 99
[243] ZANINI, COSTA 2011

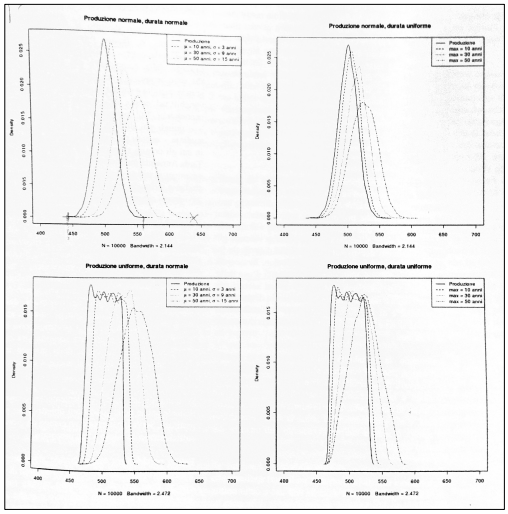


fig. 32 *- Normal and quasi-uniform distribution applied to production and use-life of a given ceramic type. From ZANINI, COSTA 2011*

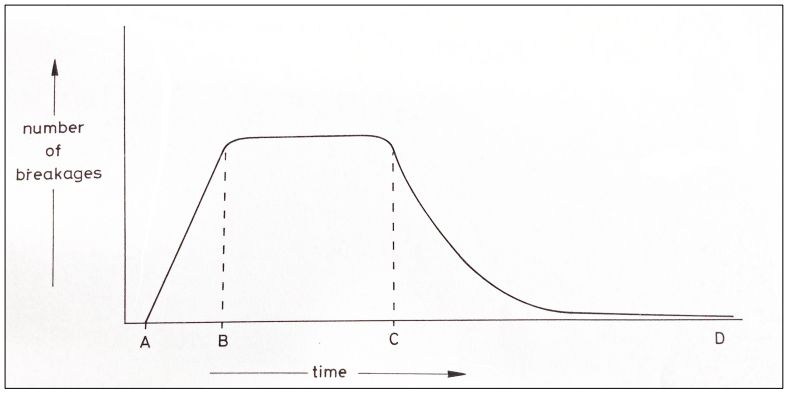


fig. 33 *- One more representation of the distribution of a given type through time (in number of breakages). From CRUMMY, TERRY 1979, p. 50*

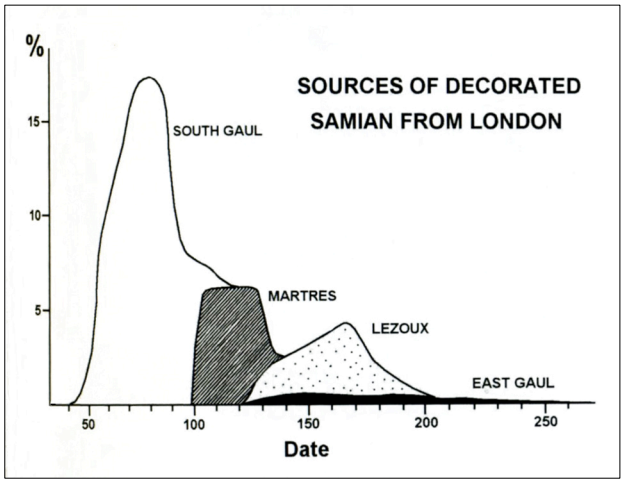


fig. 34 *- Sources of decorated Samian ware from London. See in particular the east Gaulish and Martres (central Gaul) ware. From MARSH 1981, fig. 11.5*

Even though both the papers tackle the major problem of what we date (see above), if we turn back to the remarks previously proposed, we can note that:

- shifted curves simulating use-life should be used to realistically implement the model. Nevertheless this can be done only when the dates we have refer to production, not to the general "diffusion" or "circulation" of a type, as probably these dates already "contain" the whole process of production-use-discard of the single specimen (point (1)).

- as we do not know very much about the fluctuations of the production of ancient pottery (point (2)), simulating it with a curve of normal distribution may be potentially very misleading.

For appreciating this problem, it may be halpful to move to some present case studies. For instance, we can have a look at the current economic crisis occurring on global scale; this heavily affected the production output of many goods.

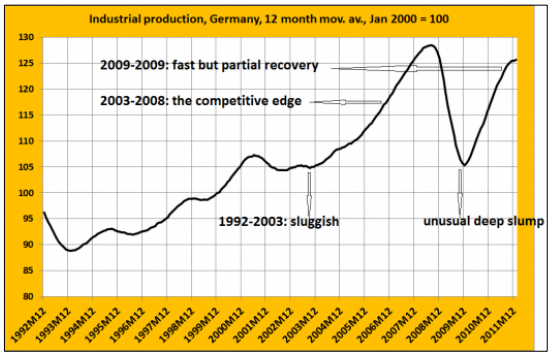


fig. 35 *- The current economic crisis. From quelsi.it*

I think it is very unlikely that goods whose production began, let us say, in 2007, reached a consistent peak a few years later, in the middle of one of the worst crises that Europe and America have faced since 1929. Even one of the most astonishing commercial success of the last 10 years, the iPhone[244], whose global sales has constantly grown, shows, for each type, a sub-uniform distribution, apart from the very end and the very beginning of each curve (about 6 months of increase and six months of decrease).

[244] I acknowledge that it is a very particular item, still I think that the curves provided are somewhat illuminating.

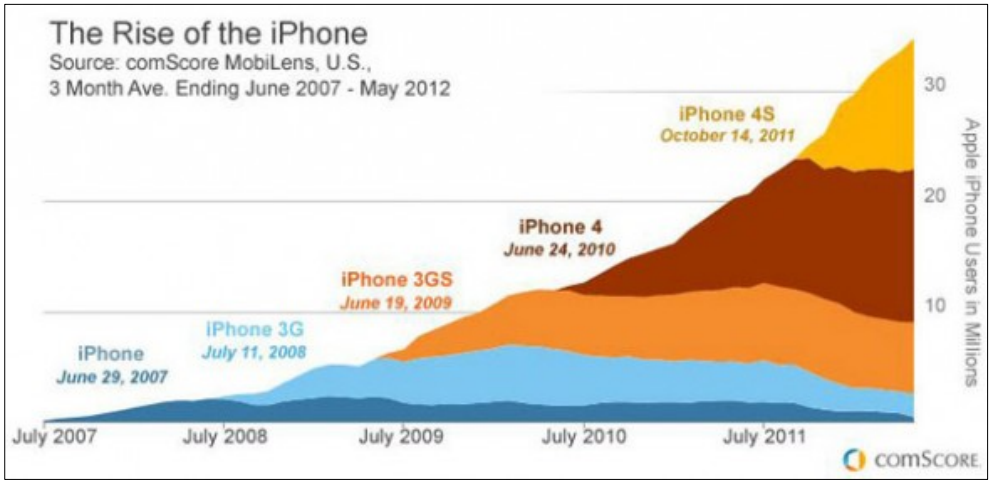


fig. 36 - IPhone sales. From melablog.it

For sure, comparisons between the current and ancient economies are at least dangerous, but if one thinks of the famous 3rd century crisis faced by the Roman empire, it is likely to suppose that at least some of the existing production centres involved in political, military and/or economic crises may have witnessed a sensible reduction in goods production. If one pottery type had a starting point some before the beginning of some kind of crisis, it seems hazardous to model its following distribution with a Gaussian curve. On the contrary it may show a bi-modal distribution specular to a normal one.

The iPhone sales chart stimulate considerations also about the beginning and the ending of production of a given good. Even if one acknowledges that production rises and finally falls gradually, how long do these processes last? If they lasted for months, or even for 2 or 5 years, they would be far shorter than our archaeological perception of time (point (3)). In other words if a given good has been produced, for instance, for 25 years, and it took 2-3 years to reach a full production regime, and if the production declined in 5 years, we may not be able to distinguish variation in such short time lapses. In this case, our approximation of the phenomenon should follow a uniform distribution more than a normal one.

This emerges also by trying to simulate a hypothetical production and the presence of the produced items among the systemic pool according to different replacement ratios. I imagined for instance the production of a given good, began in 55-60 AD and terminated in 110-115 AD. The production, say of a new type of sigillata with particular decorations, is supposed to have gone to full speed in a time span shorter than 5 years.

Year	Produced items	Circulating items (RR=5)	Circulating items(RR=10)	Circulating items (RR=15)	Circulating items (RR=20)
55	0	0	0	0	0
60	300	300	300	300	300
65	300	300	600	600	600
70	300	300	600	900	900
75	290	290	590	890	1190
80	320	320	610	910	1210
85	190	190	510	800	1100
90	250	250	440	760	1050
95	300	300	550	740	1060
100	310	310	610	860	1050
105	290	290	600	900	1150
110	300	300	590	900	1200
115	0	0	300	590	900
120	0	0	0	300	590
125	0	0	0	0	300
130	0	0	0	0	0

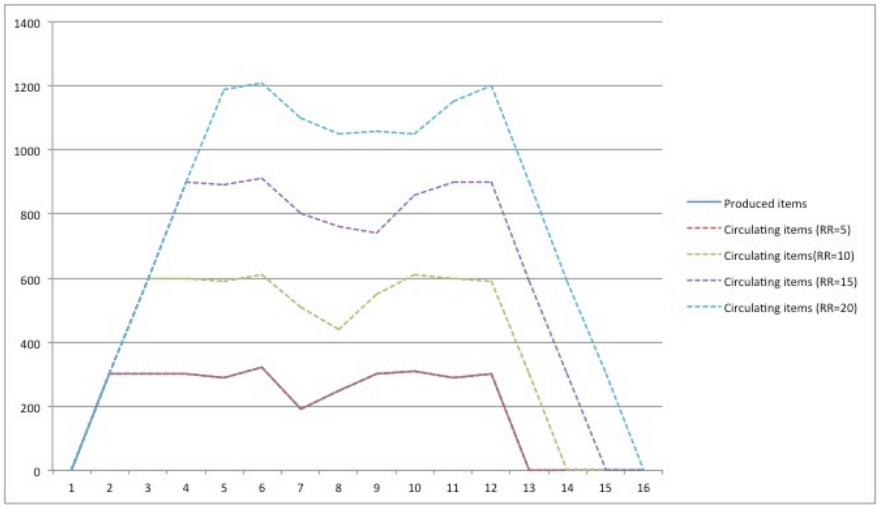


fig. 37 *- The production of an hypothetical good, with different replacement ratios (5, 10, 15 and 20 years)*

It does not mean battleships distributions or normal distributions did not exist or does not exist even today. I suspect that in long periods of time these distributions reflect substantial technological or more global changes, but this issue is not a matter of the dissertation here.

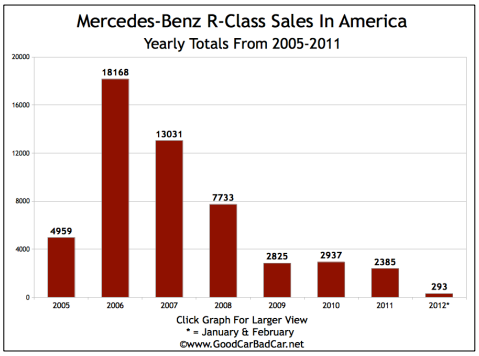


fig. 38 *- Mercedes Benz R class sales in America. From GoodCarBadCar.net*

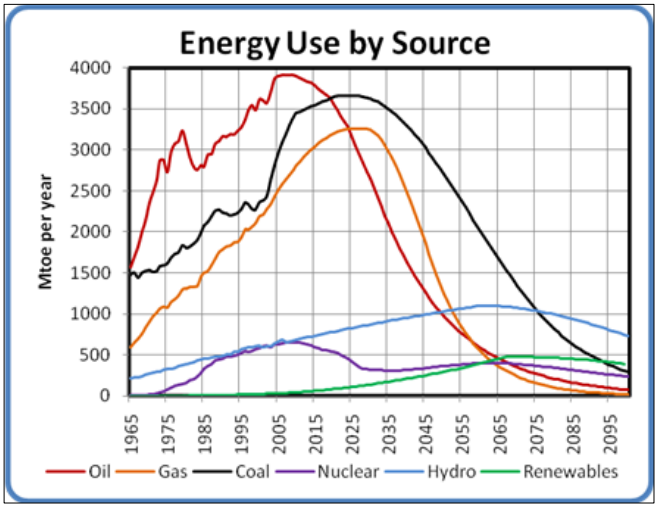


fig. 39 *- Energy use by source (hypothetical from about 2010 on). From courtfool.info*

Moving to archaeological examples, interesting data emerge from the study of well known ceramic types, whose dates are quite precise and consolidated. M. Trivini Bellini has recently studied the presence of african red slip ware in Friuli Venezia-Giulia, Eastern Veneto and Slovenia and plotted the distribution through time of different macro-groups with different fabrics.

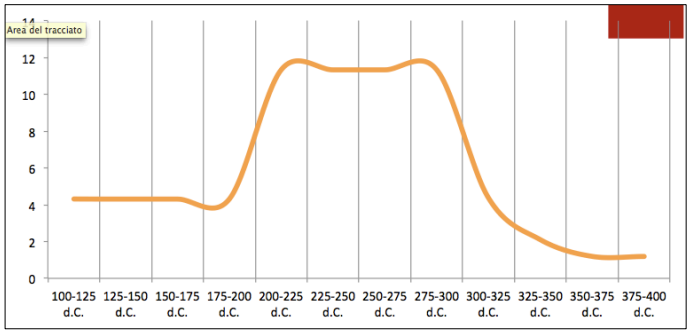


fig. 40 *- African red slip ware. Fabric A. Courtesy of M. T. Bellini*

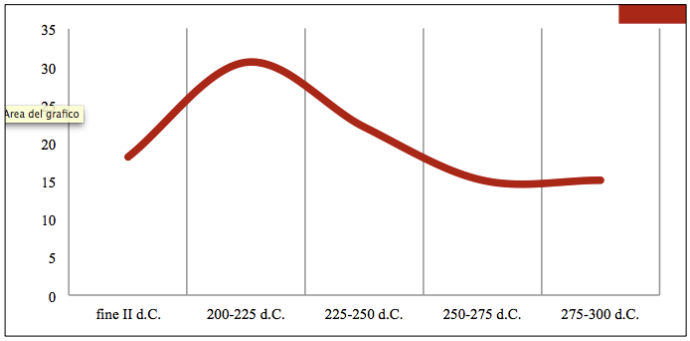


fig. 41 *- African red slip ware. Fabric A/D. Courtesy of M. T. Bellini*

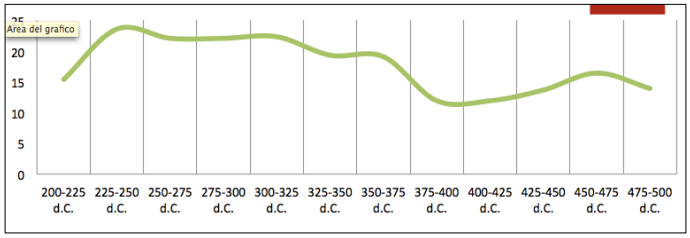


fig. 42 *- African red slip ware. Fabric C. Courtesy of M. T. Bellini*

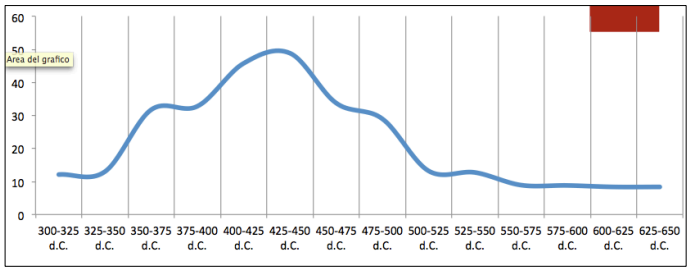


fig. 43 *- African red slip ware. Fabric D. Courtesy of M. T. Bellini*

Indeed, what strikes more is the extreme variability displayed by the four curves.

The aim of all these examples is just to show that normal distribution is not necessarily the most common or probable one in our case. The point is that basically "we do not know".

Indeed, uniform distribution is used as a very approximate model where there are very little or no available data. This seems to be exactly the case of most of the pottery productions that we commonly handle. Of course, it is rarely a good reflection of the actual phenomenon studied, but it is useful, among others things, also for bringing attention to the fact that this is very poorly known.

Hence I decided to employ this simple kind of distribution for Monte Carlo simulation; anyway, if substantial knowledge of a given type/form allowed us to model a precise curve or suggested that a normal, bimodal, battleship etc. distribution curve would be more appropriate to describe the phenomenon, this new curve may be applied to the single simulation, bringing a more accurate global one[245].

Two final remarks have do be made about the issue of coins and the issue of rates of production and discard of a given ceramic type.

As I have already discussed, coins are very particular artefacts and very peculiar chronological markers. Very often we are able to date *ad annum* (or almost *ad annum*) the

[245] *Ad hoc* probabilities for different periods of diffusion of single specimen have been employed by Bevan et alii to extrapolate chronological profiles from the data set produced by the Antikythera survey (BEVAN ET ALII 2013)

production of the single specimen we are studying. Modelling a curve of production would in this case be obviously useless, but we may model a distribution of loss/discard. I am not very sure that the resulting curve would be a Gaussian or a uniform one. A branch of hyperbola may seem to be a good model, but, again, it may be substantially altered by phenomena such us coinage reforms or other political or economic factors. This is of course food for numismatists.

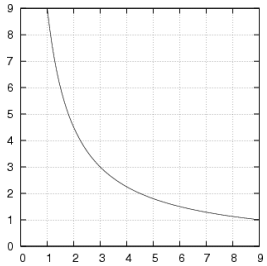


fig. 44 *- Branch of equilateral hyperbola. From people.csail.mit.edu*

III.4.7 A SCRIPT FOR R

Here follows the simple script elaborated for the open access program R. This script in particular was employed to elaborate data of the assemblage of a living room in Crea (Venice), discussed as 'Case 4' in Chapter III.6.1. Of course, being all the items particularly well dated, variability is small and the two light grey lines indicating the first and the nineth quantiles are very close to the median (dark grey).

```
> early<-c(1973, 1973, 1973, 1973, 1973, 1973, 1973, 1973, 1990, 1990, 1990, 1990, 1990, 1990,
1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1975, 1979, 1952, 1952, 2009, 1965, 1965, 1974,
1968, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990,
1990, 1990, 1990, 2000, 2000, 2000, 2000, 2000, 2000, 1962, 1976, 1976, 1976, 1976, 1976,
1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976,
1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976,
1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976, 1976,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949,
1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1949, 2000, 2000, 2000, 2000, 2000, 2000, 2000, 2000, 2000, 2000)
> late<-c(1973, 1973, 1973, 1973, 1973, 1973, 1973, 1973, 1990, 1990, 1990, 1990, 1990, 1990,
1990, 1990, 1990, 1990, 1990, 1990, 1990, 1990, 1975, 1979, 1952, 1952, 2009, 1975, 1975, 1974,
1968, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014,
```

```
2014, 2014, 2014, 2000, 2000, 2000, 2000, 2000, 2000, 1962, 2014, 2014, 2014, 2014, 2014,
2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014,
2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014,
2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949,
1949, 1949, 1949, 1949, 1949, 1949, 1949, 1949, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962, 1962,
1962, 1962, 1949, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014, 2014)
> materials<-c(267)
>
> mat=replicate(1000,runif(materials,early,late))
>
> nsim=1000
>
> breaks=seq(1850, 2100, 25)
> nbreak=length(breaks)-1
> mat2<-matrix(NA,nbreak, nsim)
>
> for (s in 1: nsim)
+ {
+
+     mat2[,s]<-hist(mat[,s],breaks=breaks,plot=FALSE)$counts
+ }
>
> time<-hist(mat[,s],breaks= breaks,plot=FALSE)$mids
>
> mat3<-matrix(NA,nbreak, nsim)
> plot(time,mat3[,1],type="l",col="white",xlab="time",ylab="materials count",ylim=c(0,max(mat2)))
> for (s in 1:nsim)
+ {
+     lines(time,mat2[,s],col="white")
+ }
> mat4<-matrix(NA,1,nbreak)
> for (i in 1:nbreak)
+ {
+     mat4[,i]<-mean(mat2[i,])
+ }
> mat5<-matrix(NA,1,nbreak)
> for (i in 1:nbreak)
+ {
+     mat5[,i]<-quantile(mat2[i,],.1)
+ }
> mat6<-matrix(NA,1,nbreak)
> for (i in 1:nbreak)
+ {
+     mat6[,i]<-quantile(mat2[i,],.9)
+ }
>
> lines(time,mat4,col="seashell4",lwd=2)
> lines(time,mat5,col="seashell3")
> lines(time,mat6,col="seashell3")
> abline(v=max(early), col="salmon3",lwd=2)
> axis(side=1, at=breaks)
```

```
> grid(col="lightgrey")
```

Below follows the graph produced by the script. First and nineth quantiles are shown in light grey, whereas the dark grey line represents the mean of the values of one thousand simulations. The vertical red line indicates the *tpq* of the assemblage, *i.e.* the most recent starting date.

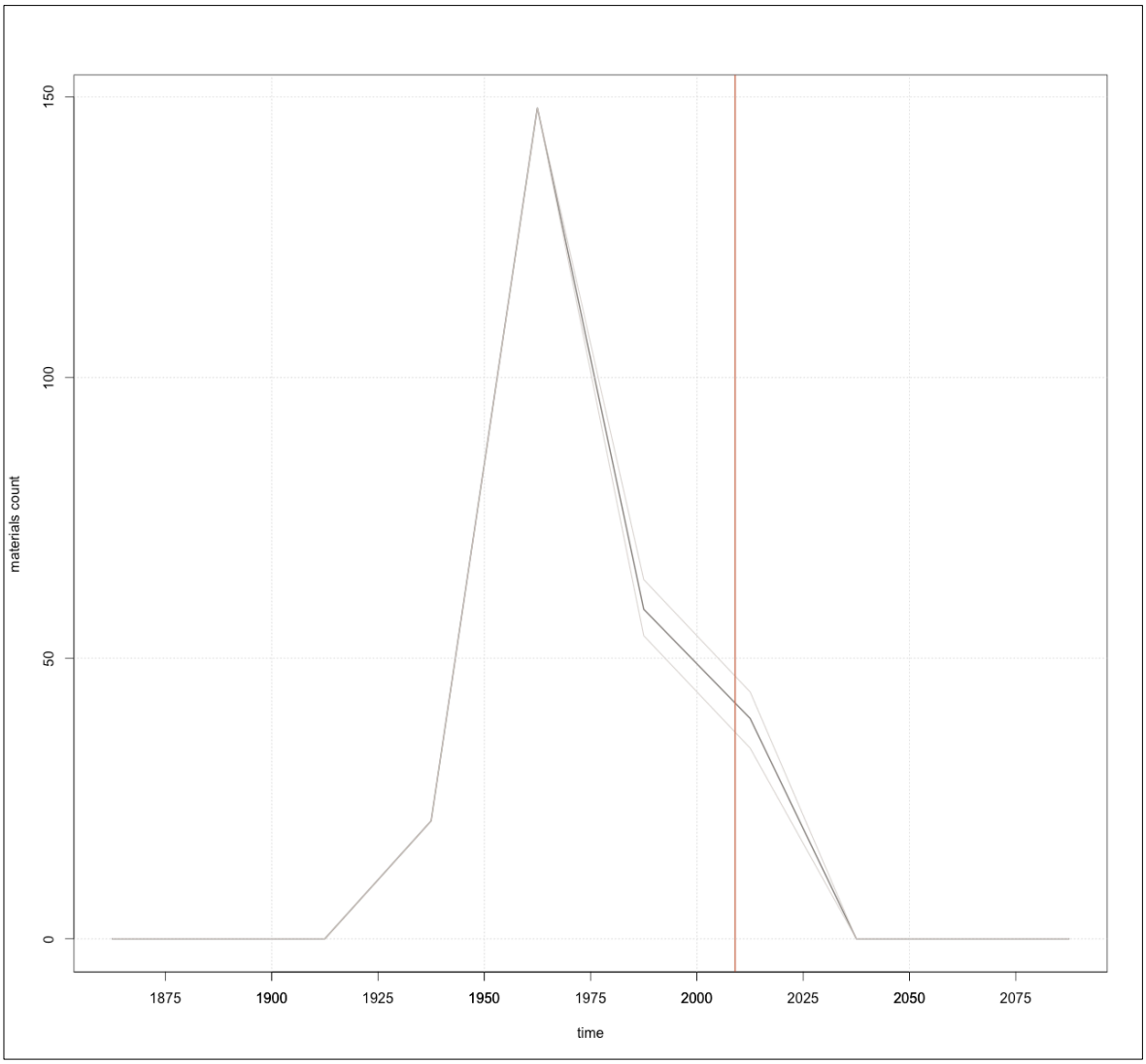


fig. 45 *- The Monte Carlo profile provided by the assemblage examined in 'Case 4', Chapter III.6.1.*

III.4.8 The triangular model: an alternative representation of the chronological content

In 2007 Weghe *et alii*, pushed by the necessities posed by the extremely complex site of Carthage, proposed an alternative method to visualize and analyze residuality[246]. It represents an attempt to go beyond the system proposed by N. Terrenato and G. Ricci and its main point of interest lies in the fact that it does not employ a two dimensional graph, but it employs a three dimensional one. According to the authors, the aim was to allow the visualization of three variables:

- time (phases);
- quantity (percentages);
- quality (fabric types).

Another objective was the reduction of the 'blurring effect' produced by the presence of many specimens badly dated within large forks (one or more centuries).

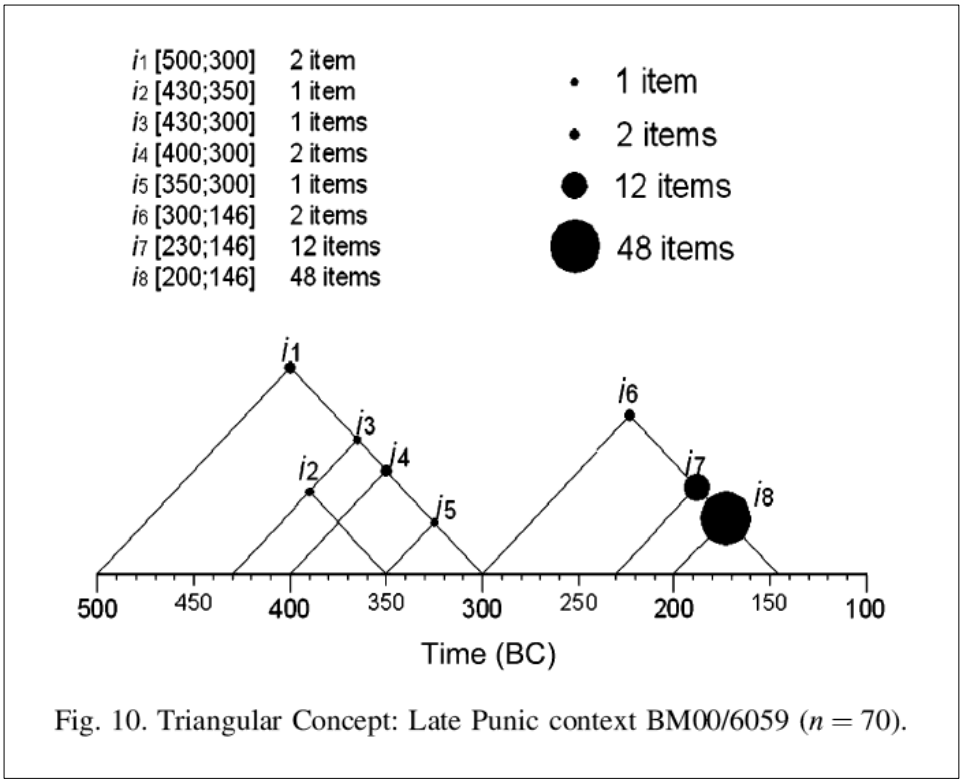


Fig. 10. Triangular Concept: Late Punic context BM00/6059 ($n = 70$).

fig. 46 - An application of the triangular model. From VAN DE WEGHE ET ALII *2007*

[246] VAN DE WEGHE *ET ALII* 2007.

Indeed this visualizing device is very clear and enables an immediate appreciation of the order of magnitude of different productions in different periods. Nonetheless the authors themselves acknowledge that evident problems of visibility arise when multiple temporal intervals are to be represented and, dealing with urban assemblages, this is often the case. I also suggest that the production of these graphs may be somewhat more complicated if compared both to the weighted means mode and to the Monte Carlo simulation. Anyway, compared to the weighted means mode, this latter method allows for an, although empirical, more effective evaluation of uncertainty. One other point in favour of this method is represented by the opportunity to deal with specimens with time intervals whose starting and/or ending points are not sure and thus are, in turn, represented by intervals.

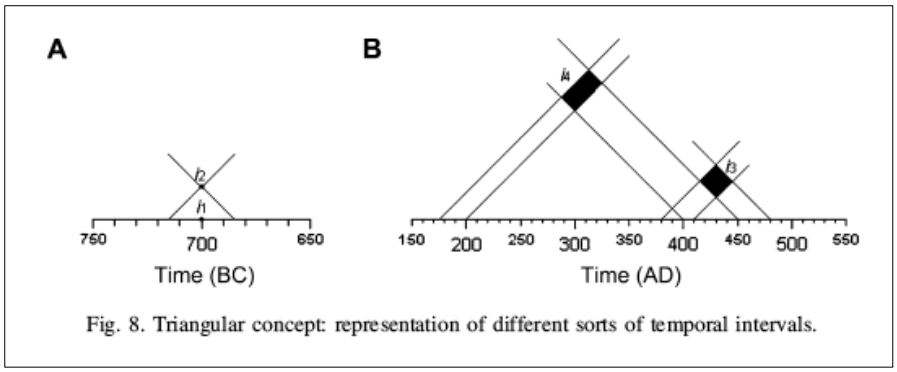


Fig. 8. Triangular concept: representation of different sorts of temporal intervals.

fig. 47 *- Different sorts of temporal intervals. From van de Weghe* et alii *2007*

This flexibility is not enabled by the Monte Carlo simulation proposed, which requires precise dates (numbers) as starting/ending points.

In general, I think that the triangular model presents some very interesting characteristics which make it a potential auxiliary device for showing particular aspects or dealing with small amounts of materials; nonetheless, with larger numbers of items the legibility of these graphs is seriously affected, thus for urban excavations, where large assemblages are usually handled, I suggest that the Monte Carlo simulations represent a more effective and rapid tool.

III.4.9 Conclusions

The necessity of handling large (and often non homogeneous) assemblages in urban excavations has led to the development of some quantitative techniques which take into

account the temporal factor. These, informing us of the overall chronological profile of the assemblage, can be employed for studying the deposits, their genesis and eventually their dating. Of course these kinds of methods cannot be employed without a parallel qualitative approach to the assemblage and the deposit as whole (see the next chapter).

Among the quantitative methods discussed, I suggest that the Monte Carlo simulations perform quite well, particularly in handling uncertainty affecting large amounts of data. It is also a perfectible methodology, which can be further enriched with the future knowledge of production/consumption rates of different typologies of artefacts, particularly ceramics. The less it will be employed a-critically, the better achieved results may be.

Finally it has to be stressed that in this work simulation performs just a descriptive role (not an analytical one), but further analysis (rates of change, model matching?) could be later applied exploiting the developed tool.

❖ A QUALITATIVE APPROACH ❖

III.5.1 WASTE STREAMS, RECYCLING, FRAGMENTATION AND THE DATING OF DEPOSITS

Introduction

As it is well known, the passage of artefacts from the systemic context (past everyday life) to the archaeological context (what we record in the field) is affected by a large number of factors; these have been theoretically ordered and discussed mostly by M. B. Schiffer[247] and other scholars grouped with the label of Behavioural Archaeologists.

Among these processes, recycling and discard affect enormously in particular the record produced by complex societies. We could argue the more complex the society we are dealing with, the more complex the processes of recycling[248] and discard affecting the archaeological record produced[249].

Despite this, the importance of both recycling and discard in the classical world is somewhat underestimated, in particular concerning the way they influence the most important archaeological tool we use to date contexts, *i.e.* ceramics.

In fact, problems linked to the recycling of glass are well known and considered, for instance, when dealing with archaeometric analysis of provenance; in the same way the re-use of timber is often regarded when dealing with dendrochronology and ^{14}C. But the recycling of ceramics is usually regarded only in the most evident cases[250], the most typical of which is the re-use of whole amphoras as building material, in order to lighten the upper part of some structures, or their re-use in drainages.

In this paragraph I will briefly discuss what we know about waste disposal during the Roman period. I will move then to examine evidence of recycling in general and finally

[247] SCHIFFER 1996, pp. 25-35, 47-75

[248] Schiffer uses the term 'reuse' to indicate a process by which there is a 'change in the user or use or form of an artifact'. Different kinds of reuse are named: lateral cycling (the owner changes), recycling (reuse with loss of the original identity of the artefact), secondary use (reuse without substantial modifications) and conservatory processes (collecting). These different shades mean different formation processes, implying different deductions in terms of spatial and functional analyses, but they are much less meaningful in a chronological perspective. In the present work I use sometimes alternatively the terms reuse and recycling, while conservatory processes are discussed separately (see Chapter II.2.5)

[249] Indeed a similar trend is implicitly suggested in MURRAY 1980 and more explicitly stated in VIDALE 2004, p. 49

[250] RODRÍGUEZ-ALMEYDA 2000, pp.125-126, PEÑA 2007, pp. 119-192

evidence of re-use of ceramics. Finally, once I have built a model of Roman re-use of pottery, I will investigate how this affects the archaeological record and the way we date contexts and groups of contexts.

In dealing with rubbish disposal in the Roman period, I will focus on solid waste in towns. Of course cities produced large amounts of liquid waste too, but even when this left any direct archaeological trace, it does not carry any piece of chronological information. I will not discuss rural rubbish disposal, as fortunately it is less challenging in terms of complexity, but some key that emerge from investigating the urban environment may be applied to the rural one as well.

Waste disposal in Roman towns[251]

Known structured systems of waste disposal in Italian towns go back as far as the Republican period[252]. Complex drain grids guaranteed efficient disposal of the liquid waste, together with rain water, in new colonies and in existing *municipia*.

If, thanks to drains, it is easy to detect the route followed by the liquid waste, the solid waste stream seems to be more indistinct and difficult to track; it started in most cases with the rubbish thrown directly out of the window, as suggested by a number of literary sources[253], while other dwellings may have been provided by pits for temporary disposal. In both cases rubbish was then periodically removed[254].

The existence of a local management of solid waste, indeed, is proved by both archaeological data and literary sources; even if scholars disagree on the administrative organization of this management, in particular although it was up to private landowners or to the local authority to physically provide for the removal of waste[255], written sources clearly indicate the existence of forms of periodical *purgatio* (cleaning) of public spaces. In the same way *stercorarii* had the task of cleaning the drains, other figures (maybe the *stercorarii* themselves[256]) were in charge of keeping the streets clean, using carts named *plostra*; we know

[251] For an overview on the management of rubbish from the Middle Ages to the dawn of the industrial society, see SORI 2001 AND MANACORDA 2000. For ancient Greece see LINDENLAUF 2004, partic. pp. 92-98, and LINDENLAUF n.d. For the Roman period, in general, see JANSEN 2000, RAVENTÓS, REMOLÀ 2000 and REMOLÀ 2000. For the Bronze Age see the extraordinary case of Runnimede Bridge, Egham (Surrey) and the thoughtful investigations carried on refuse patterns (NEEDHAM, SØRENSEN 1989).

[252] GELICHI 2000, p. 15

[253] See PANCIERA 2000, pp. 96-98

[254] In kitchens considerable amounts of ash and carbons may have been provisionally disposed before final discard. See PEÑA 2007, p. 312 and DE CARO 1994.

[255] For the hypothesis of private management see LIEBESCHUETZ 2000, p. 54. *Contra* PANCIERA 2000, pp. 98-99, pp. 102-105. See also NIN, LEGUILLOUX 2003, pp. 160-161

[256] PANCIERA 2000, p. 105

that in Rome these carts were allowed to circulate even during the night. In this case, fortunately, literary sources and graffiti inform us of a process which does not leave any direct trace in the archaeological record.

Instead, archaeological data enlighten us to where the waste collected in this way was disposed: several public dumps have been excavated in sites located all over the Roman world (some interesting case-studies in Pompeii[257], *Mons Claudianus*[258], *Augustodunum*[259], *Lugdunum*[260], *Londinium*[261]along with many cases in Roman *Hispania*[262]); dumps were located preferably outside the city walls (*extra muros*) or in proximity to the rivers[263], that is, often, on the boundary of the city.

We do not know how often public spaces were cleaned and waste brought to the main communal dumps, but for sure literary and legal sources show that Roman cities, compared to modern standards, were pretty grim[264]. In Rome, cleaning activity must have been more accurate when the *aediles* checked the state of the roads, *i.e.* four times a year[265]. The street levels may well have risen[266], but the accumulated waste was then periodically removed.

The mechanism described represents one of the main reasons why what is usually called "the living phase" of an archaeological site is almost unrepresented in the archaeological record of many Roman towns: operations of continuous cleaning and

[257] PEÑA 2007, pp. 279-282, MAIURI 2002, pp. 174-175, CHIARAMONTE TRERÉ 1986, pp. 21-54, ROMANAZZI, VOLONTÉ 1986, pp. 21-54

[258] MAXFIELD, PEACOCK 2001, pp. 421-455

[259] KASPRZYCK, LABAUNNE 2003, pp. 103-104

[260] DESBAT 2003

[261] MILLER *ET ALII* 1986

[262] For a general overview see REMOLÀ VALLVERDÚ, ACERO PÉREZ 2011

[263] A famous case-study is represented by the Walbrook stream, in London. It this case both rituality (MERRIFIELD 1995) and simple dumping (WILMOTT 1991) have been addressed in the interpretation of the refuse artefacts. Another example in Tours (DUBANT 2003)

[264] The case of dead bodies abandoned in public spaces recurs frequently in literary sources: the most famous episode is reported by Suetonius, describing the scene of a stray dog bringing a human hand to the imperial dining room while Vespasian was dining (*Suet., Vesp.* 5.4). Suetonius himself reports the episode of Nero's horse prancing *ex odore abiecti in via cadaveris* (*Suet., Nero 48*). Other cases of dead bodies left in the streets are attested in Martial (*Mart., 10, 5, 11* and following), Cassius Dio (*Dio, 65, 1*), Petronius (*Satyricon, 134, 1*) and Ausonius (*Auson., Epigr., 24, 1*).
But the general neglect of public roads is suggested by many other sources: muddy and bumpy streets are mentioned by Martial and Seneca (*Mart., 7, 61, 6, Sen., De ira, 3, 35, 5*), while *cacatores* are mentioned, among others, by a number of Pompeian graffiti (see CIL, IV 3782, 3832, 4586, 5438). These widespread practices were persecuted, more or less effectively, by law, as suggested by the *Lex libitinariorum* of Puteoli and the *Lex tabulae Heracleensis*. Other sources are mentioned in PANCIERA, 2000.

[265] LIEBESCHUETZ 2000, p. 55. See also SALIOU 2003

[266] LIEBESCHUETZ 2000, p. 55

maintenance di not allow the formation of conspicuous deposits within the city[267]. We may say that everyday life, when cities were well administrated and did not suffer any effective external reason for crisis, is far unrepresented in the archaeological record within the city itself[268].

The public system of waste disposal worked throughout the imperial age and we do not have evidence of widespread collapse till Late Antiquity and the Early Middle Ages; archaeological excavations show that in this period drainage systems were often filled with rubbish and organic layers accumulated in public areas, leading to the formation of dark earths. So, substantial amounts of rubbish entered again the borders of the towns, where now more unmanaged or abandoned spaces were available.

Alongside the main public "waste stream", another mechanism of disposal seems having existed during the Roman period: smaller dumps related to workshops[269] or private dwellings are attested in some Roman towns (mostly in peripheral neighbourhoods) during the initial periods of their lives[270], in phases of general decline or local crisis, but also in times when no evidence of falling off are documented[271]: in all these cases abandoned/collapsed buildings/areas represented an immediate and irresistible opportunity for quick dumping, even within an intensively occupied urban context[272].

Evidence for recycling in Roman towns

Looking briefly at the highlighted evidence, we can formulate a sufficiently sophisticated model of discard, transport and disposal of rubbish in a common Roman town. But the *chaîne opératoire* described still lacks of a fundamental 'ring': that of lateral cycling and recycling. Lateral cycling is defined by Schiffer as the simple 'change in an artifact's user'[273] and may not leave any trace within the archaeological record.

[267] SCHIFFER 1996, pp. 59, 64-72, LAMOTTA, SCHIFFER 1999, p. 21, PUTZEYS 2007, p. 49, FURLAN 2012, p. 81. The topic is also discussed in MATTHEWS 1993, whereas, more generally, the topic of negative evidence in archaeology in discussed in an extremely interesting paper by G. D. Stone (STONE 1981)
[268] CARVER 1987a, p.34
[269] KASPRZYCK, LABAUNNE 2003, pp. 101-102, NIN, LEGUILLOUX 2003, pp. 152-160, BALLET 2003, pp. 224-226, DIEUDONNÉ-GLAD, RODET-BELLARBI 2003
[270] KASPRZYCK, LABAUNNE 2003, pp. 99-100
[271] MONTEIL *ET ALII* 2003
[272] JACOBS 2013, pp. 606-610. See the cases of *Mons Claudianus* (MAXFIELD, PEACOCK (EDS) 2001, MAXFIELD, PEACOCK (EDS) 2006), Nora (ALBANESE 2013) and Gortina (BONETTO 2004). The case of *Crypta Balbi* is also particularly famous (see SAGUÌ 1998 for more more references)
[273] SCHIFFER 1996, 29

On the contrary, as we will see, the process of recycling deeply affects the archaeological record and had an extremely important role in ancient economy and social practices.

It may have occurred in different stages of the waste stream, from the very beginning to the very end. As we will examine, evidence for the recycling of some materials must have been so considerable, that it is more reasonable to assume the existence of a systematic and well organized collection, than an occasional one[274]. Unfortunately the available sources cast little light on the structure of this phenomenon; but to underestimate it, just because the data available is scarce, would be misleading. It is part of the archaeological process dealing with absence together with presence; but it is well know that the absence of some data does not always mean that the process which may have produced those data did not occur.

Nevertheless, along with more organized forms of recycling, scavengers (*scrutarii*) may have played a consistent role, at different steps of this chain, in removing from the waste stream whatever could have been reused[275]. Ethnographic studies attest very clearly to this kind of practices also in modern and contemporary urban environments[276]. Recycling carried out within workshops themselves may have been consistent too.

Recycled materials were different in type and quantity and affected the archaeological record in different ways: for instance wood is relatively rare in most archaeological sites and it is usually only well preserved in waterlogged environments or in extremely dry ones, along with exceptional cases such as the Vesuvian ones. Carbonised wood is common within most archaeological deposits, but it is rarely preserved in big chunks.

Nevertheless, there is strong evidence of wood, particularly timber, recycling. Ancient sources mention the reuse of big seized timbers: that is the case of Nero's wooden amphitheatre, in which an extraordinary long beam had been salvaged from a Tiberian *naumachia*[277]. Also shingles were removed from demolished buildings and reused, as attested by archaeological evidence in Vindolanda[278]. The extraordinary well preserved evidence from this site also suggests a more complete form of recycling of timber structures, carried out by what has been defined as a "demolition gang" once the fort had been temporarily abandoned: major beams and spars from the roofs and planks from the floors were

[274] See NIN, LEGUILLOUX 2003, pp. 151-152
[275] LIEBESCHUETZ 2000, p. 55
[276] GIDLOW 2000, pp. 39-40, fig. 5.3, RATHJE, MURPHY 1992, pp. 40, 43, 191-196, fig. 9-A, PEÑA 2007, pp. 317-318
[277] *HN 16.200.1*
[278] BIRLEY 1994, p. 90, ULRICH 2007, p. 123

systematically salvaged[279]. But even when the fort was occupied wooden structures were commonly reused[280].

Archaeological analysis, combined with dendrochronological data, attests other episodes of recycling of wood: this is the case of another amphitheatre, that is the one of London. The first timber building (AD 75-125) used second-hand posts and post-pads[281] and again wooden planks were reused for the building of the drain of the masonry amphitheatre after AD 125[282].

Moving more decisively into the field of archaeometry, the well-known "old wood" problem, or "old wood" effect, is often due, apart from the age of the wood itself and its formation by the tree[283], to scavenging and reuse of timber[284].

Timber was not the only building material suitable for recycling. Building materials in general (bricks, tiles, stones, marbles, whole architectural elements etc.) are attested by archaeological evidence to have been reused often in both Medieval and Roman times[285].

For the Roman period, literary sources mention this practice as something ruled by municipal laws and it seemed to be far from uncommon. In fact there may be little doubt that the building rubble from Antioch cited by Libanius in his Oration L[286], which had to be disposed just out of the city walls, was expected to be at least partly reused. Other juridical sources confirm the existence of similar patterns: a law dating to 397 AD ordered that material from demolished temples was to be employed for the maintenance of public routes[287], while another source states that if the owner of a collapsed building didn't provide for the removal of the debris, everyone could claim the ownership of the resulting material[288].

The economic advantage of using second hand material is self-evident[289]: some elements were no doubt more suitable for reuse (tiles from the roofs, ashlar walls, complete

[279] BIRLEY 1994, p. 90
[280] BIRLEY 1994, plate IV, fig. 2
[281] BATEMAN *ET ALII* 2008, p. 19, 30, 37
[282] BATEMAN *ET ALII* 2008, p. 56, 82. In general see TYERS 2008, p. 220
[283] WEINER 2010, p. 21
[284] SCHIFFER 1986
[285] The re-use of Roman architectural elements in post-antique times is widely recognised and it is often linked to economic crisis or to particular cultural and ideological mechanisms of self-representation and use of the past. But re-use of building materials in Roman times is far less investigated (less obvious?). This disproportion is a clear trait of the literature concerning re-use in architecture and it can be appreciated by just taking a quick look to the list of contents of a recent work on the topic: among about fifty papers, only three or four deals with re-employment of building materials in Antiquity. [BERNARD *ET ALII* (EDS.) 2008].
[286] *Libanius, Or. L.* See also LIEBESCHUETZ 2000, pp. 51-52
[287] *CT, XV.1.40*, see also LIEBESCHUETZ 2000, p. 54
[288] *Gaius, 381.38*, see also LIEBESCHUETZ 2000, p. 54. For an overview of Roman legislation about building materials re-use, see MARANO 2012.
[289] An extremely vivid overview and a more detailed quantification of the impact of reuse of building material by Roman builders is proposed in BARKER 2010

columns and capitals), while others may have required a greater effort (*crustae*, *sectilia*, bricks)[290], but in any case the economic benefit was consistent. It has been estimated that second-hand ashlar blocks, reused on site, costed about 20% of the price of freshly made blocks[291]. There is also evidence that second-hand building material was employed by both public and private builders[292], for new constructions on site as well as in new buildings located elsewhere. Concluding, it emerges clearly that the use of second-hand material has to be taken into account when dealing with Roman buildings, with particular attention devoted to the impact it has on our way of dating the buildings themselves.

Turning to materials employed in the manufacture of movable objects, we know that glass was also widely reused[293]. This practice is attested by literary sources and by archaeological and archaeometric evidence.

The collecting of cullet is attested in Martial[294], who describes a door to door collection, and in Petronius' *Satyricon*[295]. A similar practice is attested in Statius[296], while Pliny's work seems to be more controversial[297].

We also have archaeological evidence that strongly suggests the recycling of glass: substantial volumes of glass vessel fragments, which were likely to have been stored for future melting, are attested in Nijimegen[298], Agen[299], Amiens[300], Reze[301], Lyons[302], Saintes[303], Aoste[304], the London amphitheatre[305] and London-Basinghall Street[306]. Cullet stored in a barrel within the shipwreck discovered near Grado seems to have had the same function[307], therefore attesting to the trade of cullet itself.

[290] Among others, many case studies concerning Aquileia are proposed in CUSCITO (ED.) 2012
[291] BARKER 2010, p. 135
[292] A painted sign in Insula 7, Regio III in Pompeii seems to attest the sale of second-hand roof tiles (CIL IV, 7124)
[293] See STERN 1999, pp. 450-456, See also STERN 1995
[294] *Mart., I. 41.3-5*
[295] *Satyricon, 10.1*
[296] *Silvae, I.6.74*
[297] In one passage of his Natural History the author seems to suggest that pieces of broken glass could only be stuck together (*HN 36.199*), but earlier it is stated they could be fused (*HN 36.193*). See PEREZ-SALA, SHEPHERD 2008, p.143
[298] ISINGS, BLOEMERS 1980, pp. 281, 341-344
[299] CNAU 1999, p.21
[300] BAYARD, MASSY 1983, DILLY, MAHEO 1997, p. 17
[301] FOY, NENNA 2001, p. 50
[302] MONIN, BECKER 2000
[303] NICOLINI 1977, p. 377-379, HOCHULI-GYSEL 1993
[304] VEYRAT-CHARVILLON 1999
[305] PEREZ-SALA, SHEPHERD 2008
[306] SHEPHERD, WARDLE 2009, KEILY, SHEPHERD 2005
[307] SILVESTRI ET ALII 2008, p. 331, DELL'AMICO 2001, FOY, NENNA 2001, p. 111

Finally, through chemical analyses, archaeometry has provided evidence of glass re-melting spanning from Britain[308] to Asia[309].

Also metals have been so systematically collected and re-melted throughout history, that it would be an incredible challenge to list all the evidences we have, which go from proto-historical[310] metal hoards to the demolition of ancient buildings in post-classical times in order to collect iron and bronze clamps[311].

Even though ancient sources mentioning the re-melting of metals are rare[312], we may be sure that during the Roman period it was a common practice, as it is indirectly suggested, also, by the cyclic practice, attempted by the central authority, of removing old coins from circulation, in order to mint new coins with a lower percentage of precious metal[313] (a phenomenon well known to numismatists as the main cause of the Gresham's Law).

Bone and organic matter were collected as well: the first was used by workshops or in smaller scale domestic productions (appliques, dice, tokens, small boxes etc.), while the second[314] played an important role in both crafts (urine[315] was used to process leather) and agriculture[316].

Looking at the evidence provided, we can observe that the process of recycling involved almost every kind of material and it was so common[317] and permeated Roman society and urban life so deeply, that E. Rodríguez-Almeida provocatively defined classical Rome as a 'self-cleaning[318]' city.

This is the framework in which the process of the re-use/recycling of ceramics has to be placed; however, although pottery is probably the most common artefact recovered in classical excavations and despite its value as a powerful archaeological tool, which allows inferences about chronology, economy, social and functional patterns etc., studies about its recycling in antiquity are comparatively few.

---

[308] See FOSTER, JACKSON 2009, pp. 193, 195-196
[309] For the case of Sagalassos see DEGRYSE *EY ALII* 2006
[310] Metals could be recycled a long time span after the mining of the original raw material. An example is given in BRAY, POLLARD 2012, p. 862, mentioning prehistoric evidence of objects produced with metal smelted about 500 years earlier.
[311] See for instance BERNARD 2008
[312] RODRÍGUEZ-ALMEIDA 2000, p. 124
[313] This process seems to have left out *orichalcum* coins (DUNGWORTH 1996, BAYLEY *ET ALII* 2008, p. 49)
[314] CORDIER 2003b
[315] It is attested that it was collected in amphoras located at crossroads. See PANCIERA 2000, p. 101, in partic. footnote 41, PEÑA 2007, pp. 200-202, CORDIER 2003b, p. 55. Ancient mentions in *Mart. 6, 93 and Macrob., Sat. 3, 16, 15.* An extremely interesting case-study in BRISSAUD 2003
[316] RODRÍGUEZ-ALMEIDA 2000, p. 127
[317] NIN, LEGUILLOUX 2003, pp. 151-152
[318] RODRÍGUEZ-ALMEIDA 2000

Evidence for recycling of pottery

Particular attention has been devoted to the most evident cases of reuse, usually involving amphoras[319]. The best known features in which amphoras were recycled (usually complete or almost complete) are drainages and walls. In the first case, vessels that were no longer suitable for containing liquids or foodstuffs were re-employed in large numbers in wetlands, in order to guarantee stable and drained topsoil[320]. In the second case vessels were re-employed in particular circumstances, *i.e.* when part of walls or vaults[321], for static reasons (or more likely for economic ones[322]), were due to be lightened[323]. Amphoras were fixed with mortar in this way and allowed the building of robust but light structures, both in public and private buildings.

Apart from these most striking (and comparatively rare) cases, I argue that pottery was involved in much more widespread and consistent processes of recycling.

Two main flows can be detected: firstly a chain of activities leading to the production of mortar and *cocciopesto* and secondly a flow connected to the use of grog temper (*chamotte*) for the production of new pottery or building material.

The use of primary and even secondary grog[324] for the production of new vessels is well attested in proto-historical societies[325] as well as in ethnographic literature and in different geographic contexts[326]; nonetheless it seems to have been far less common in the Roman world. In the handbook of fabrics of Roman pottery in Britain[327], compiled by the Museum of London Archaeology Service, less than 3% of the fabrics contain grog as a regular temper[328].

If, on the one hand the use of grog as temper for producing new vessels may have played a small role, on the other the use of grog as temper for ceramic building materials may have been far more consistent[329]: if one looks at the section of a common Roman brick

[319] For a general discussion of the reuse of amphoras see PEÑA 2007, 119-192. See also MARTIN-KILCHER 2003
[320] See Chapters IV.3.4 and IV.3.6 . For a general overview see PEÑA 2007, pp. 181-192
[321] For a recent review of the use of amphoras in vaults see LANCASTER 2005, pp. 68-85
[322] LANCASTER 2005, pp. 77-78
[323] PEÑA 2007, pp. 174-178
[324] QUINN 2013, p. 58, p. 59, fig. 3.30, QUINN 2009, p. 284, fig. 8c
[325] In the Eneolithic – Bronze Age site of Moncín (Spain) the amount of discarded pottery reused as grog has been estimated in around 25% of the original systemic population (HARRISON *ET ALII* 1994, pp. 287, 529)
[326] For instance see QUINN 2009
[327] TOMBER, DORE 1998
[328] Cfr. PEÑA 2007, pp. 269-270
[329] PEÑA 2007, p. 270

or tile[330] and compares it with a chart used for the characterization of fabrics, a much wider spread presence of grog is easily appreciable, quantifiable in around 25% of the fabric.

In fact at first sight recycled pottery seems to have played an important role in the production of fresh building material; nevertheless, unfortunately, fabric analysis carried on building materials rarely distinguishes between grog originating from pottery and grog originating from other building materials[331]. This is without doubt a field which should be investigated much more, as a distinction of the two kinds of grog may allow us to finally evaluate the importance of the role played by recycled pottery in the production of bricks and tiles.

We can conclude that evaluating the importance of the recycling of pottery for the production of grog is, at present, problematic. Fortunately the role played by ceramic materials, in the form of fragments, in the production chain of mortar, *cocciopesto* and floor beddings, is much clearer: often, thanks to the bigger dimensions of the single sherds, it is much easier to detect the ones originating from pottery.

Cocciopesto is by definition produced with *testae tunsae*[332]and it was widely employed for constructing pavements, hydraulic infrastructures, and also wall plaster (for instance in the amphitheatre of El Djem[333] or in the Insula of the Menander in Pompeii[334]). It was so widespread that it would be impossible to compile a list of every case in which it was employed. In many occasions, when aggregates are big enough, it is quite easy to detect potsherds included in the mortar, excluding in this way the reuse of architectural materials. In the case of *cocciopesto* or hydraulic plaster and mortar, crushed ceramics play the same role as that of *pozzolana* as a reagent with the lime in the mortar, leading to the production of an impermeable compound.

If we turn to cement pavements, using both literary and archaeological sources, the amount of pottery employed in these features can be broadly estimated as about one third of

[330] See for instance the brick illustrated in CUOMO DI CAPRIO 2007, p. 89. Fig. 12

[331] There seem to be two main ways to identify grog obtained from vessels: the first consists in the identification of relic surfaces, slips or glazes (QUINN 2013, p. 58, p. 59, fig. 3.29, QUINN 2009, p. 284, fig. 8b) while the second involves the observation of alignments in the inclusions indicating the use of a potter's wheel (PEÑA 2007, p. 268, CHIARI *ET ALII* 1992, p. 129). A sentence by Vitruvius (*Vitr., 2, 8, 19*) of unclear interpretation has to be quoted too: "*Quare maxime ex veteribus tegulis testa structa parietes firmitatem poterunt habere.*" has been interpreted both as evidence for the use of crushed tiles for making new bricks as *chamotte* (see the translation by Antonio Corso) and as evidence for a more direct reuse of tiles fragments in wall construction (BACCHETTA 2003, p. 147).

[332] *Vitr., 7, 1, 3*

[333] PEÑA 2007, p. 263, fig. 9.5

[334] Many examples in ARTHUR 1997

the whole volume[335], giving the idea of the consistence of the stream of recycled vessels involved in the process[336].

Potsherds were also inserted, more or less systematically, directly in the mortar binding of masonry structures: I will discuss a case study in Chapter IV.7.2: here it is worth noting that the practice of adding crushed pottery to mortar may not have been very systematic, but at least we can assume it was not a rare exception[337]. The important cases of the intentional addition of potsherds in mudbricks/pisé structures or in groundworks is discussed respectively in Chapter III.6.1 and in Chapter IV.5.4, but crushed vessels were employed also in an uncountable variety of minor cases, spanning from the coating of basins to the repair of cracks or gaps in masonry structures[338]. Finally, some extreme cases of large scale recycling of vessels in smaller or bigger chunks and with different functions have been observed in proto-Byzantine hermitages in Egypt[339].

At this point, I believe that the data collected is sufficient to assume that recycling was a common practice in the Roman world and that it involved ceramic vessels too. It is still difficult to quantify this phenomenon, but I argue the clues we have indicate that it was not occasional, in particular if we look at the recycling of potsherds as fill/reagent for coverings and pavements. More data may come from the analysis of grog in ceramic building material: the distinction between grog originating from other building materials and grog originating from vessels may allow us to clarify and possibly quantify also this aspect of recycling, which may turn out to be pretty consistent.

The impact of ancient recycling of pottery on the archaeological record and on its dating

Once the existence of a more or less structured mechanism of pottery recycling[340]has been assumed, the next step is to examine how this process affects the archaeological record and in particular the means we use to date archaeological deposits.

Indeed, the effects of recycling on assemblages[341] and the way they affect the tools we use to distinguish primary and secondary deposits (whatever definition we give of the two)

[335] PEÑA 2007, pp. 265-267

[336] Analysis conducted in some mortar-based building materials from temple of Venus in Pompeii may suggest an overall ratio of 1:1 between aggregates and binder (PIOVESAN *ET ALII* 2009, pp. 71-73, 75). In this case part of the ceramic aggregate resulted allochthonous (PIOVESAN *ET ALII* 2009, pp. 76-77), suggesting the possibility that it derived from vessels. See also WEINER 2010, pp. 189-190

[337] For the case of a wall almost totally made up of pottery, see ADAM 1994, pp. 153-154

[338] Respectively PEÑA 2007, p. 261, fig. 9.3 and ADAM 1994, pp. 152-154

[339] For an overview and for further references see BALLET 2003, pp. 226-227

[340] It has already been discussed how Roman practices of discard affect the record, in particular by creating "patterns of absence" within the city

and so, consequently, the way of dating the sequences we dig, are almost completely unexplored.

Firstly, I argue that the systemic process of recycling may seriously affect the fragmentation index of the pottery recovered in the archaeological record; it may seem to be at least unusual to link each other the two processes of recycling and fragmentation, but I'll try to demonstrate that the link is consistent and prolific of consequences.

An index of fragmentation has often been used as tool for recognizing primary and secondary deposits[342]: in other words high ratios of breakage are usually ascribed to re-deposition[343], rather than processes which took place between primary use and final discard (*i.e.* recycling). The effectiveness of this method has already been questioned[344]; in particular it has been noticed that both archaeological and ethnoarchaeological evidence does not always (but we may say very rarely) match the expected fragmentation variability.

It is worth noting that recycling (in particular for grog temper) has already been claimed to be one of the possible causes of incomplete vessel re-fitting in contexts considered primary[345] (see Chapters IV.3 and IV.4); incomplete re-fitting itself implies an increase in the fragmentation of the record, therefore in this case we may relate recycling and fragmentation.

Turning to specific case-studies, ethnographic research carried out in the Kalinga Province in the Philippines[346] has shown that domestic dumps (*i.e.* one kind of deposit archaeologically considered primary) did not receive freshly broken vessels. About one third of the vessels were first provisionally discarded for possible re-use, implying that domestic dumps/discard areas were filled with material damaged from the very beginning; in fact an average of 74% of the midden sherds was under 5cm^2.

Communal dumps, on the contrary, received both more intact vessels and heavily damaged ones, coming from domestic dumps/middens.

Moving to archaeological data, an interesting investigation of breakage rates has been carried out in Leicester[347]: two methods (total weight/number of sherds and number of sherds/EVEs –rims-) were employed to evaluate fragmentation, but both failed to differentiate different kinds of features or primary and secondary contexts, apart from some

[341] SHOTT 1996, p. 464
[342] For a more genral use of indications derived from sherd size alayses see BRADLEY, FULFORD 1980
[343] PUSCHNIGG 2006, pp. 107-108. *Contra* the fundamental HALSTEAD *ET ALII* 1978
[344] DUBANT 2003, p. 167
[345] CHAPMAN 2000, p. 54
[346] BECK 2006, pp. 42-44
[347] POLLARD 2000

extreme cases. In particular pits filled with contemporary rubbish did not show a markedly different pattern compared to re-deposited old rubbish.

I argue that practices of recycling previous to final discard may have played a substantial role in affecting the breakage rates of the studied assemblages.

Given this data, breakage rates cannot be considered decisive in detecting primary or secondary deposits, apart from the most obvious and extreme cases involving complete (or almost complete) vessels. In particular it does not seem to be an appropriate tool in assessing that a deposit is secondary: even highly fragmented assemblages may turn out to be primary.

Summing up, we may conclude that, assuming the existence of different consistent practices of recycling, we do not expect primary deposits necessarily to show low breakage rates.

Finally, I also argue that the moving of amounts of sediments along with the potsherds within them (eventually generating secondary deposits) may not entail a sensible increase of the breakage ratio of the sherds themselves; potsherds, embedded in the matrix, should suffer a consistent mechanical shock to be cracked again. This phenomenon may affect only few sherds in the 'periphery', while the bulk would not change its characteristics that much.

It has been possible to provisionally test this model experimentally: during the excavations carried out in Aquileia in September 2013, 50 potsherds of different sizes and types, gathered from the modern topsoil (which had been removed by the bulldozer during the campaigns carried out in 2010-2012), were marked (**fig. 48**, a) and then mixed with sediment. Both the matrix and the sherds were then loaded into two (metal) wheelbarrows (**fig. 48**, b) with a common shovel, transported for 100 m, and finally unloaded (**fig. 48**, c).

fig. 48 *- Fragmentation and transport*

Of 50 sherds, just 3 were cracked, bringing the total amount of fragments to 55. It was also possible to observe that the damages were caused during the processes of loading and unloading, while the distance covered was substantially non influential.

Therefore, given an higher ratio of breakage for primary deposits and a lower ratio for the secondary ones (compared to the ratios one would have expected in advance), we observe a much more homogeneous pattern in the overall fragmentation of archaeological

deposits, i.e. the pattern emerged in the case study from Leicester. As I will examine in Chapter xxx, a similar pattern may be observed when dealing with wear.

I think we can still assume that a high preservation of vessels implies a low frequency of re-deposition, but we cannot assume that low preservation of vessels necessarily implies a high frequency of re-deposition.

The mechanism examined may be well illustrated by the case of some medieval rubbish pits excavated in Worcester (Deansway, Site 2) during the late 1980s[348]. I will discuss the case in more detail in Chapter xxx, so here I will focus only on the aspects concerning fragmentation.

A large number of pits, dated from the mid-11th century to the 13th century AD[349], were provisionally interpreted as cesspits, workshops pits or rubbish pits and consequently considered as primary deposits[350]. Nevertheless later, during the post excavation analysis, it emerged that the characteristics of the fills did not match the expected ones. In particular ceramic materials within such features were expected to:

- include large parts of vessels;
- be of large size and not very abraded;
- be largely contemporary apart from a small amount of residuals;
- be consistent in number.

It is also worth to note that these assemblages were compared with others coming from dumps, which turned out to show a similar pattern.

In both cases ceramics were generally small, abraded, and not so consistent in number. Finally residuals (i.e. Roman or early medieval sherds[351]) were certainly present. Moreover, in this period there were almost non cross-context joins and very few reconstructable vessels[352].

[348] BUTEUX, JACKSON 2000. The discussion below is largely indebted to this short piece of work. Even if I differ in some conclusions, the data provided and the issues raised are invaluable and extremely stimulating. For further data see JACKSON 2004, pp. 139-150. See also DALWOOD 2004, pp. 61-67, DALWOOD, BRYANT 2004, pp. 84-88, BRYANT, TAYLOR 2004, pp.174-182, TAYLOR 2004, pp. 202-204, DALWOOD, EDWARDS 2004, pp. 225-228 and BRYANT 2004, pp. 331-334

[349] Indicated as Period 8

[350] Of course we have to keep in mind that the term 'primary' was intended in that mix of special and temporal meaning already discussed in Chapter II.2.4.

[351] Less than 15% of Roman pottery (by count) and minimal amounts of Late Saxon/early medieval pottery

[352] BRYANT 2004, p. 333

In this case the state of the ceramic record has been regarded as an evidence suggesting that the infillings of the pits were not primary[353], and consequently unreliable as chronological markers[354]. However, I argue that in this case the infillings were actually primary[355], at least in a chronological perspective, and I think that the state of the ceramic record has to be largely related to practices of provisional discard and recycling which took place before the final discard into a midden or into the pit themselves.

Along with recycling, transport may for sure influence the breakage rate of pottery before it is thrown into communal dumps; in particular I think that the procedures of loading and downloading refused pottery may be significant (see *supra*). Loading may have comported the intentional breakage of the most bulky vessels in order to reduce their volume and fill the carts properly (or whatever mean of transportation) used to transfer the waste. On the contrary I don't think the distance of the journey would deeply affect the final record, as during the way, apart maybe from the quality of the road, there are no other factors which could play a significant role (see *supra*).

Again the issue can be well explained by a case study: the short carry distance has been claimed to be the main reason of the good condition and completeness of the pottery recovered in pre-Boudican refuse in Walbrook valley, London[356]. Potsherds, along with other materials, seem to have come from the central area of the newly established town. I think that the condition of the ceramic assemblage may be more realistically ascribed to the absence, during the first stages of the life of the settlement, of any form of organized recycling. Moreover I think that for sure transportation may have affected the resulting record, but I do not think that a longer journey would have sensibly increased the breakage rate.

Other factors surely contribute to create the fragmentation patterns we observe in ceramic assemblages: the most important seems to be the different breakage ratio of different vessels, due to the technology of manufacturing, the thickness of the body and the size of the whole vessel.

Nevertheless we may consider this aspect to be very influential if we are dealing, for instance, with the percentage of different classes of pottery within an assemblage; but if we are considering whole assemblages, we may argue this process affects our ability to define primary and secondary deposits only slightly.

[353] Note, again, the ambiguity of the term 'primary'
[354] BUTEUX, JACKSON 2000, p. 194
[355] See Chapter IV.3.4
[356] HILL, ROWSOME 2011, p. 439. See also HILL, ROWSOME 2011, pp. 24-26

Apart from fragmentation, a second important consequence of ancient practices of recycling on the archaeological record consists of the introduction of 'freshly made' potsherds in sealed archaeological contexts which, consequently, may be considered primary in a chronological perspective[357].

This is the case of mortar floor beddings or cocciopesto: from a functional or spatial point of view they may be considered secondary contexts, as the potsherds embedded were not used and discarded in the same location where they are recovered: in fact they have passed through a chain of different transformations and disposals.

Nevertheless, in a chronological and formative perspective, the same sherds may have a much higher value. Considering the fact that it is unlikely sherds have been obtained from once buried vessels, there are two main channels by which they may have entered the mortar as fill/reagent: one is through the reuse of more ancient building materials coming from dismantled structures or whole buildings. A second way is through recycling of vessels as soon as they had been discarded.

The last one seems to be the most reasonable way by which potsherds were embedded in mortar, even if the two other processes may have occurred. As I will examine in this chapter and in Chapter IV.7, there are some means by which we can differentiate the three different processes; if we are dealing with freshly recycled sherds, we are also substantially dealing with a primary deposit, suitable for *ad quem* datation[358].

In fact, even though we do not know exactly which was the duration of the process which brought the discarded sherds into their final context, we can safely assume it was not relevant, given the approximate level of our chronological inferences. For instance, if we are dealing with an assemblage of amphora sherds, broadly dated to the 1st century AD, it makes little difference if it took even five years, after the amphorae were discarded, before they got incorporated into the structure where they were finally recovered.

A third important consequence of the practice of recycling (in general) in antiquity, concern the formation of dumps of different quality. We may recover dumps made up of:

- materials unworthy to be recycled[359];
- both recyclable and un-recyclable materials;
- recyclable materials which were never recovered[360].

[357] See the fundamental considerations of R. Ling in LING 1997, p. 19
[358] A direct connection with potters has been advanced too (GRECO 2011, p. 62)
[359] For instance see ADAM 1994, p. 153 and NIN, LEGUILLOUX 2003, p. 156

This consequence does not affect how the dumps are dated themselves, but it influences the quality of the artefacts recovered within such deposits: so, when dealing with the interpretation of a deposit as a dump, we have to keep in mind that it can show these different features.

Concluding, we can state that recycling affects the way to deal with the chronology of archaeological deposits in two main ways: firstly, by affecting, along with transport, the breakage rate of pottery and consequently one of the tools employed in distinguishing primary and secondary deposits; secondly, by allowing us to infer that some deposits (basically mortar built features), which may be considered secondary from a spatial/functional point of view, may turn out to be primary from in a chronological perspective. Finally, a third consequence, *i.e.* the quality of the artefacts recovered in dumps, may be considered of secondary importance when dealing with chronological issues.

III.5.2 Other characteristics of the assemblage

The role of fragmentation as a more or less reliable tool for investigating the status of one deposit, and thus making inferences about its date of formation, has already been discussed. Nonetheless, other physical and possibly chemical characteristics of the assemblage may also provide useful insights about the flows which brought the single materials to where they were eventually recovered.

Ceramics

Concerning ceramics, the basic idea behind the assumption mentioned above is that every single sherd represents a micro-basin carrying a variety of information[361], from its manufacture to its diagenesis: of course it is the last part of its life which is of much interest in this case.

Related to the issue of fragmentation is that of conjoinable pieces. The topic has been discussed in many ways[362], and it represents an issue well known in every excavation; it is worth focusing on how it may affect the way of dating. Conjoinable pieces within the same

[360] Among other instances, a typical case is represented by marbles collected presumably to be reduced in lime and evidently never recovered. See Nin, Leguilloux 2003, p. 151. Another possible case study in Bonetto *et alii* 2005

[361] Vidale 2007, p. 72. See also Mannoni, Giannichedda 2003

[362] Chapman 2008, Chapman, Gaydarska 2007, Chapman 2000. See Schindler Kaudelka 2010 for conjoinable sherds which were most probably separated (they were recovered at distances of 50 meters or more) by colluvium activity.

context or even deposit may represent at most a ceramological or spatial issue or yield a problem in counting. Sometimes conjoinable pieces recovered close each others are claimed to be *in situ*. This may well be true if they compose a whole vessel or at least a specimen which can be largely restored, but in case they form just a larger piece this conclusion is not straightforward at all, as large sherds may have fractured just during/after deposition/redeposition because of the weight of the upper sediments.

More complicated is the issue of joins between different assemblages. One first interesting way of employing conjoinable pieces from superimposed strata is represented by assessing that vertical displacement and thus infiltrations occurred (see Chapters II.2.9 and III.3). This tool has been employed in prehistoric sites also to assess the formative homogeneity of levels which had been at first kept divided[363]. In urban classical environment, using conjoinable pieces to assess the presence of infiltrated materials in the lower levels can surely be performed, but great attention has to be paid to other possible causes. Generally speaking, the high rates of fragmentation and continuous redeposition typical of such an environment can much more easily bring different sherds of the same vessel into different contexts, without producing contamination or wrong stratigraphic readings by the excavator. The simplest example may be represented by the case of a robber trench.

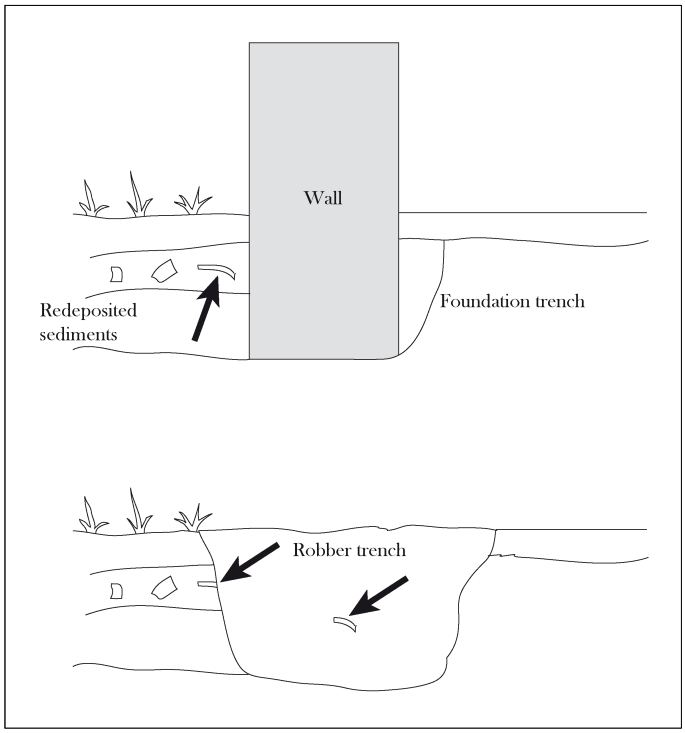


***fig. 49** - Conjoinable sherds in different contexts: the case of a robber trench*

[363] VILLA 1982

In this case destructive activity may crush some sherds embedded within the layers affected and some of the resulting pieces may get embedded in the backfill of the trench. In this case, the "freshly made sherds" will be possible residual materials in the backfill assemblage. Similarly, much more complex and even repeated processes are after all quite common in cities.

Indeed, besides infiltration, conjoinable pieces may simply indicate that redeposition occurred, but how long it took is another matter. Sometimes the presence of conjoinable pieces in different backfills is used to postulate a unitary and contemporaneous combination of actions, and/or a common source or basin[364].

Few interesting conclusions can be drawn also through the examination of deterioration/wear[365]. Given the fact that it is a characteristic affected by many factors (manufacturing technique, typology and use of the specimen, depositional environment etc.) some key features can suggest the informative potential of the whole asssemblage or of the single sherd. In fact it has to be stressed that large parte of the available studies focus on use alteration (thus pre depositional) while diagenetic processes are still neglected to some extent[366]. Use wear can be a helpful tool only in some particular cases, that is when we are handling the most recent material of an assemblage and when it is well dated. In this case we can try to refine the *tpq* or the *tadq* that this provides (see below. For coins see Chapter III.4.3). When dealing with post depositional alteration, fractures assume a particular importance, as what happened to them must have occurred much more probably after the sherd was deposited, or at most after the vessel had lost its primary function. Another important key point is represented by the relationship characteristics of the artefact-characteristics of the deposit: that is discrepancies between the two may raise the doubt that redeposition, possibly after perceivable time, occurred.

Looking at the assemblage as a whole, it is sometimes assumed that visibly worn sherds must have been redeposited, while primary deposits (in any sense) should, generally speaking, display materials with little post depositional wear. Apart from general considerations about the burial environment, which can play a fundamental role, some other observations, similar to those made about fragmentation, can be advanced. If on the one hand severely abraded sherds are likely to have had a particularly intense "afterlife" and thus

[364] See the case of Drain 1971 - 1 from Corinth (MC PHEE, PEMBERTON 2012, pp. 1-17)
[365] Skibo and Schiffer define deterioration as "breakdown by non-cultural processes" and wear as "artifact modifications resulting from human use" (SKIBO, SCHIFFER 1987, p. 83)
[366] WEINER 2010, p. 198. For use alteration see in particular SKIBO 1992 and ARTHUR 2002

redeposition is likely to have occurred[367], the contrary cannot be taken for granted. Indeed, once buried the sherd meets relatively stable conditions[368] (moisture, temperature etc.) and the mechanical stress which is necessary to produce abrasion[369] is very low. Thus even sherds redeposited more than once, along with their matrix, may display little abrasion, thus being similar to "untouched" sherds.

Nonetheless, within the same assemblage, global and transversal dishomogeneity in roundness may represent a clue about the status of the deposit, in this case suggesting that we are handling a secondary one. In this case it is likely that more than one source basin has been notched, thus some upstream redeposition must have occurred, probably after a sensible period time (for the more worn materials).

Abrasion and roundness produced by flowing water found in sherds recovered in a more or less dry context, if not produced by environmental changes, suggest redeposition (it is even more evident when just some of the sherds present these characteristics). This case has been discussed by A. R. Ghiotto in the analysis of the Roman forum of Nora and allowed him to track the potential source basins of some sherds (coastal deposits)[370].

If this characteristic involves the more recent specimens, these must be assumed to provide only a *terminus post quem* for the deposit formation, which, furthermore, must have occurred much later. Post depositional processes (post last deposition) in this case must also be evaluated in order to detect any localized disturbance which may have affected the wear rate just in part of the assemblage.

An even closer examination, for dating purpose, may target only the most recent items included in the assemblage under examination. If this is the case of particularly well dated finds, an evaluation of both pre and post depositional wear/deterioration could provide useful insights in order to refine the *tpq*/*tadq*. One sherd showing markedly different degrees of abrasion on different fractures is likely to have been redeposited, thus the date provided should be handled as a generic *tpq*.

Blackening (through sooting or charring) is a physical/chemical characteristic which can be observed by the naked eye productively. Again it is an issue which has been well studied in regard to vessels use, but much less attention has been devoted to what happens

[367] Also ploughing may play an important role in case of superficial materials in open areas. In this case, more than redeposition *stricto sensu*, wear points to mixing and re-elaboration.
[368] LEGA *ET ALII* 1997, p. 88
[369] SCHIFFER, SKIBO 1989, p. 103
[370] GHIOTTO 2009, pp. 265-267 and BONETTO *ET ALII* n.d.

after the deposition[371]. In this sense the blackening of sherds pertaining to vessels whose primary function was not cooking may represent an interesting clue.

Together with other parameters, post-depositional blackening of pottery is a key feature in order to recognize a layer which was the product of an episode of fire (thus potentially a primary one): in Aquileia a long tradition attributes "black layers" to the destruction brought by Attila and his Huns in A.D. 452. During and after the excavation of the central *domus* located at the Fondi ex-Cossar, some late antique dark layers, which were liable to be attributed to that episode, according to the materials physical status (in particular no blackening was observed) were instead interpreted as the dumping of various items together with substantial amounts of ash and charcoal, possibly produced by domestic activities. Although on the one hand in any case the deposit could have been claimed as a primary one, on the other one the global interpretation of the evidence resulted very different and a precise dating to A.D. 452 could no longer be sustained.

Concerning blackening it has to be stressed that free carbon can be wiped off a ceramic surface very easily, thus this physical aspect of the assemblage has to be described and investigated before the ceramics are washed[372].

Blackening of a different kind, made of manganese and iron, may also be produced in particular conditions by micro-biological activity[373], while the blackening of glazes or lead rich enamels is produced by anaerobic bacteria which flourish in the presence of decomposing organic material[374] (see dumps), thus pointing to the original context of burial.

Indeed, the burial context does not only affect the physical characteristics of ceramics, but also their chemical status. By now the literature has largely acknowledged that the burial environment affects the chemical profile of ceramics[375] (particularly the more superficial layers of sherds) with particular consequences in provenance and use analysis. Less attention has been devoted to the compatibility/accordance of the characteristics of the alteration with those of the environment in which the sherd was recovered, leading in case to postulate redeposition after some time. Again efforts could just focus on some key sherds, such as the most recent ones.

Certainly in this field archaeometry may play, in the future, an important role, although up to now research has not pointed in this direction.

---

[371] See BANDUCCI 2014 for a recent overview
[372] BANDUCCI 2014, p. 808
[373] LEGA *ET ALII* 1997, p. 88 with further references
[374] LEGA *ET ALII* 1997, p. 93
[375] FREESTONE 2001, SCHWEDT ET ALII 2004, MARITAN, MAZZOLI 2004, MARITAN *ET ALII* 2007. See HALLY 1983 for alteration due to use. More in general see the classic RICE 1987

Coins

See Chapter III.4.3

Bone

The weathering of bone[376] also poses some problems in dating; it is indeed a very suitable source for radiocarbon dating, but if weathered, it has to be assumed that for a certain period (more or less long according to the severity of turbation) the find was abandoned on the surface of the ground. Indeed, apart from aggressive (acid) conditions, most of the weathering of bone occurs on the surface[377] (among many factors, sunlight probably plays an important role, along with gnawing) and it causes typical longitudinal cracks[378]. The length of such period may well be archaeologically irrelevant, but this fact may help indicate that redeposition occurred. *In situ* weathered bone may also be used to infer that a given surface had been exposed for a long period. Nonetheless, given the multitude of factors involved, the quantification of the time which the bone remained unburied is far from easy, making this aspect of the record quite difficult to handle for fruitful inferences in dating. In this sense much more work is needed and for the moment it has to be considered as a clue which has to be integrated with other observations.

On the other hand, articulated bones within a given deposit indicate that they were discarded when some flesh or was still holding them together, thus it is very unlikely that redeposition occurred. This make these bones particularly suitable for radiocarbon dating and should allow for a good *ad quem* dating of a primary deposit.

Finally, unlike ceramics, chemical weathering of bone[379] does not seem to produce substantial consequences to the issue of of dating.

Suggestions for recording the assemblage physical status

Given all the potential helpful information which can be drawn from the physico/chemical status of the assemblage, it is worth thinking about how these should be collected. As already mentioned, urban excavations require effective and quick methods of recording; moreover it has to be acknowledged that, at present, the overall weight of the infomation available from these observations, when compared with other sources, is after all

[376] BEHRENSMEYER 1978
[377] WIENER 2010, pp. 115-116
[378] See SCHIFFER 1996, also for further references
[379] WHITE, HANNUS 1983

quite low. I think that a good compromise between the necessity of good recording and its actual practicability may be achieved with a high resolution picture of the whole assemblage. Two pictures, one taken before washing and the other after it, possibly with conjoinable pieces placed close together and provided with a metric scale, would be even better. This simple and quick procedure would enable at least a rough but effective and speedy visual evaluation of fragmentation, wear, blackening etc., whereas other pictures may be dedicated to particularly informative pieces, showing some peculiarities. If this procedure was part of of ceramists standard procedure, excavators would also draw great benefits and at the end of the excavation a visual collection of assemblages would also be available for quick comparative observations. Some more precise indications about wear may be obtained later through the comparison with sphericity roundness charts.

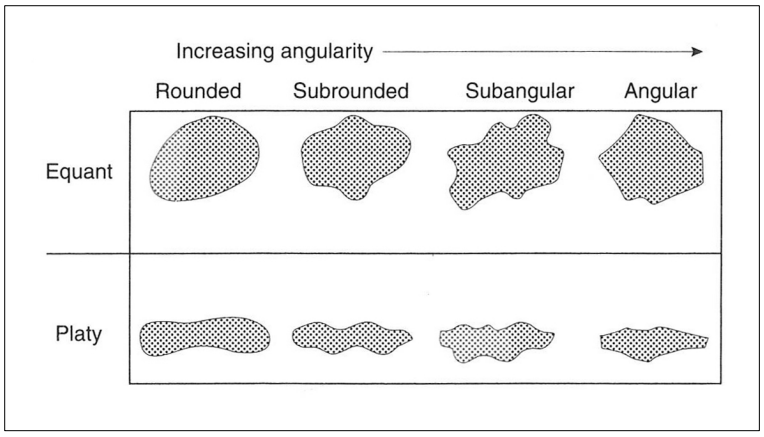


fig. 50 *- Angularity (from GOLDBERG, MACPHAIL 2006)*

More detailed information could be later collected using other techniques, even quantitative ones[380]. Anyhow greater attention already during the excavation would be very welcome and some more information, from the excavator's point of view, should be given space on the standard single context sheet. In general it has to be acknowledged that these aspects of the record are quite neglected in the field of classical archaeology, while some useful data could be collected even with relatively low costs in terms of both time and money. I hope that these few lines will help push research in this direction.

[380] ALLEN 1989

III.5.3 Selection and the intentional addition of materials

When dealing with recycling, particularly concerning pottery, it has been observed how some "freshly made" sherds eventually become part of masonry structures, plaster etc. The intentional addition of these materials is self evident and it has been demonstrated that they can be used, if other requisites are observed, for tempting *ad quem* dating. The intentional addition of both sherds and charcoal is also discussed when dealing with literary sources (see Chapter III.6.3). Other cases may be much less obvious, but similar conclusions may be drawn. Thus, given this general knowledge provided by literary sources as well as by the knowledge of recycling processes, it is necessary to examine which other aspects of the record may suggest the intentional addition of materials. I will discuss later that intentionality does not always imply *ad quem* dating, but quite often it seems to be the case.

Intentional deposition may be suggested *in primis* by the spatial arrangement of finds: regularity, iso-orientation and any non caotic and non natural feature may represent important clues in this sense. Even though depositsion was not intentional, sometimes it may be possible to asciertain if the sherds were redeposited together with their matrix or not by observing their spatial arrangement, *i.e.* observing if their three dimensional position is due simply to gravity or also to the presence of a matrix compelling their movements.

Another key criterion for assessing intentionality is the one of (human) selection[381]. If the materials within a given anthropogenic deposit have been somehow sorted, it is unlikely that they got redeposited together with the sediments which form the deposit, whereas it is probable that they have been removed from the circulating stream and added to the deposit. Selection does not necessarily occur if intentional addition occurs, but if selection occurs, then intentional addition must have occurred too.

The assemblage may display selection, for instance, according to type and/or size[382]. Take for instance one deposit containing high proportions of decimetric amphora body sherds or only amphora stoppers: casuality in this sorting seems to be unlikely, as does natural sorting. Human sorting, and thus intentional addition seem much more probable.

In this case another kind of sorting must also have occurred, *i.e.* a chronological one: the vast majority of the assemblage should display dates in reciprocal accordance, although some false residuality may be observed.

[381] Clearly I am not dealing with the natural selection of particles or materials by water, wind or weight.
[382] Another possible clue may be a clearly artificial spatial arrangement.

Finally, the example introduces also another important criterion that is the global amount of the materials involved. It is unlikely that just a few pieces were intentionally included within a given deposit (to make what difference?) while to play any role they must be present in a consistent number. These conclusions recall, in turn, another fundamental criterion, which is that of the function (the reason) of the embedded assemblage. The intentional addition must respond to some necessity and thus the inserted assemblage must play some function within the deposit. This seem to be much more probable in deposits linked with building activity, where the added materials can have, for instance, a mechanical or draining function.

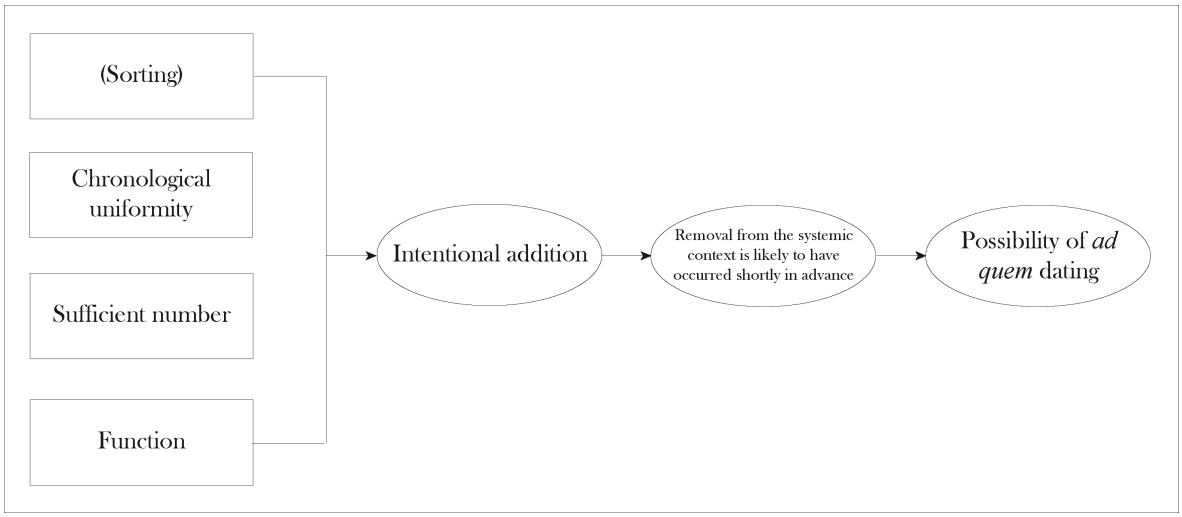


fig. 51 *- Clues of intentional addition*

Drainages can be considered a matrix-less extreme case of deposit made of selected items, picked among the freshly discarded ones, deposited in large numbers and fulfilling a specific function[383] (see Chapters IV.3.4 and IV.3.6).

A similar case, still quite explicit, is provided by the excavations carried out in 1990 in Concordia (VE)[384]. Here the partial removal of a floor brought to light its bedding layers, one of which was almost completely made up of amphora stoppers. These were certainly laid down to prevent ground water from damaging the top floor and had been most probably collected at the nearby fluvial port, thus picked from the systemic context in which they were probably playing the role of stored or provisionally discarded items.

[383] Monte Testaccio, in Rome, may also be seen as the product of an extreme process of selection. See BLÁZQUES MARTÍNEZ *ET ALII* 1994 and RODRIGUEZ-ALMEIDA 1984

[384] GOBBO 1998, RINALDI *ET ALII* 2014. Similar cases reported in OMARI 2010-2011

It has to be stressed that other materials, already embedded within the redeposited matrix, may substantially mask the pattern displayed by the intentionally added materials and that great care must be taken anyway before attempting some *ad quem* dating. Another useful example, in this sense, comes from the ex-Cossar area[385]. In this case one layer was made up almost entirely of fragments of wall plaster (selection, global amount) which had the function of bedding a floor made of bricks (function). Although the single fragments displayed two different superimposed plasterworks, they were likely to come from the same room, thus being phase by phase contemporary (chronological uniformity). Summing up, all the previously listed requisites were fulfilled. Nonetheless, quite obviously, the plaster fragments (even if they could have ever been precisely dated) do not allow any *ad quem* dating of the layer but provide a mere and very generic *terminus post quem*. Indeed they had been obtained, most probably, through the demolition of the decorative apparatus of the very room where they were finally laid down, after having lived a presumably long systemic life. In this case the plaster fragments were not the more recent finds recovered, and this immediately suggested that they had nothing to do with the moment in which the deposit was formed. Again qualitative and quantitative approaches cannot run separately, but must support each other. Moreover, this example shows clearly how the indications provided should be used as a guide, not as a rule, and how important is the class of materials employed. In general, building materials have to be treated very carefully, considering that they normally have a long life, *i.e.* commonly they are false residuals. Asking how materials entered the record is, again, the key point.

III.5.4 Charachteristics of the matrix

Besides the case of OSL, discussed in Chapter III.2, sediments, by themselves, cannot provide an excavation with direct dates. Indeed among the major aims of this work is to elucidate how assemblages can be employed to date when they and the sediments in which they are embedded were deposited.

Nonetheless, apart from the obvious role played during the excavation[386], some characteristics of the matrix can play an indirect role in dating and the disciplines which

[385] Furlan 2012, pp. 76-77

[386] It is almost worthless to remeber that usually rubbish layers contain soft dark sediments, rich in organic matter, that construction fills may display evident selection of matrix (see for instance Previato 2012), that robber trench backfills are often incoherent, that sediments filtered through rubble are usually soft etc. It is

specifically study sediments and their formation (say micromorphology, geoarchaeology, sedimentology, pedology) can profitably (must) contribute to the understanding, and thus to the dating, of deposits, particularly in some more difficult cases.

I suggest that there are three main ways in which these disciplines can contribute to the correct dating of deposits:

1. helping avoid mistakes in stratigraphic reading and grouping;
2. clarifying how a given deposit was formed;
3. providing information about the duration of the process of deposition;

The three aspects are of course linked together and involve a lot of other information which can be drawn on. The first one refers to the obvious risk, in particularly difficult cases, of misreading a sequence, for instance keeping together what should have been kept separate, thus yielding substantial problems in dating. Matthews *et alii* have noticed that "The only difference between observations and interpretations in the field and in thin section is the greater visible resolution provided by microscopic analysis. Micromorphology could be used much more widely by archaeologists[387]". Indeed these disciplines can provide archaeologists with high resolution observations, thus helping avoid misreadings at least in the more difficult cases. Maybe this is also one of the reasons which explain why they are employed on a much wider scale in prehistoric archaeology (indeed the the following examples are drawn from middle east pre/protohistory and from late antique/early medieval European scenarios).

The second piont is possibly the more interesting. A wrong interpretation of a single context or of a whole deposit can change the way in which materials are employed to date it.

Geoarchaeological analyses have been employed in the urban Phoenician site of Tel Dor (Israel) in order to recognize floors and to distinguish constructional deposits from deposits accumulated through continuous *in situ* habitation[388]. Concerning floors, the typical ones were made of tiny fragments of local carbonaceous sandstone, similar to throughgoing lime; analyses enabled the detection of one "false floor", which was actually made of phytoliths, thus indicating that it was not the product of human activity, but of natural processes. It has to be stressed that initially it had been interpreted as a floor because to the naked eye it looked identical to the other "real" floors. Important information was also gained

taken for granted that these coarse observations of the matrix are common ground of all field archaeologists for sketching the first *in fieri* interpretations of the deposits already when the excavation is still in progress.

[387] MATTHEWS *ET ALII* 1997, p. 285

[388] SHAHACK-GROSS *ET ALII* 2005

about the use of the floors, enlightening dynamics similar to those discussed in Chapter III.6.2 about earthen floors. Consequences for dating and for the overall interpretation of the sequence are, in this case, obvious. Even more cogent conclusions, from a chronological point of view, were drawn dealing with "fill" deposits. As anticipated above, in this case microstratigraphic analyses allowed archaeologiststo distinguish constructional deposits from deposits accumulated through continuous accretion. In terms of dating, the difference is substantial, as constructional deposits are redeposited (after an unknown time lapse) and will probably be dated by a mere *tpq*, whereas accretion deposits are formed *in situ* with circulating materials, thus enabling some *ad quem* dating. In our case the two types of deposits were difficult to discernn with the naked eye, but were clearly characterized microscopically, with backfills containing a random orientation of components, while accretion layers presented micro-laminated structures[389].

The work at Tel Dor also took advantage of some previous work carried out at Çatalhöyük and Tell Brak[390]; a wide typology of deposits was investigated and each one was characterized micromorphologically, thus providing a very useful reference for comparison in further studies. Deposits ranged from floors, middens and stable areas to unroofed trampled surfaces, streets and so on. This high resolution strategy allowed archaeologists to relate artefacts and microartefacts to discrete single episodes/actions of deposition or use, together with the postdepositional activity which affected each one.

Extremely interesting data, with important fallouts in dating, were collected in particular concerning the issue of redeposition: in streets and courtyards deposits it was possible to assess that some aggregates were coated in sediments differing from the surrounding matrix, thus suggesting that they had been redeposited[391] and, consequently, that they were in a secondary context from a spatial/functional point of view and probably also from a temporal one. This achievement sounds quite interesting in perspective and may go hand in hand with chemical analyses conducted on ceramics and other artefacts.

Another big issue where geoarchaeology plays a fundamental role concerning the way in which urban deposits are formed is the one of dark earths. The relationship between the formation of these deposits and their dating is controversial and seems to depend on a case by case interpretation which, in turn, cannot be done without the assistance of micromorphology. The debate about the formation of this type of deposits, which markedly

[389] SHAHACK-GROSS *ET ALII* 2005, p. 1429
[390] MATTHEWS *ET ALII* 1997
[391] MATTHEWS *ET ALII* 1997, p. 287

characterizes the late antique/early medieval sequences of many European towns, has lasted for about 30 years[392]. Their formation has been linked to:

- rubbish disposal (particularly charcoal);
- timber structures decay;
- cultivation in urban environment[393];

Of course several phenomena may have occurred together and for sure heavy bioturbation seems to play a key homogenization role. As anticipated their formation has to be evaluated case by case; concerning chronolgy, it has to be stressed that sometimes high rates of residuality have been observed[394]; this collides with the hypotesis that dark earths were produced mainly by rubbish disposal, which, in turn, has been demonstrated through micromorphology in other cases[395]. I suggest that some of the tools proposed in this work (particularly a quantitative approach on artefacts) may be employed in reverse, exactly to support or contest one of the formative hypotheses proposed.

It has also been acknowledged that dark earths formations did not happen *abrupto*, but was, on the contrary, the product of prolonged deposition and reworking. This leads to the third of the above mentioned topics for which geoarchaeological sciences can provide useful insights, that is the one of the duration of the processes of deposition. Laminae and beddings are well known in geological (natural) strata[396] and, as observed above for the cases of Tel Dor and Çatalhöyük - Tell Brak, can also be observed in urban anthropogenic strata. In this case, although macroscopically one single layer is observed, micromorphology, increasing the resolution of our observations, enables the detection of single episodes of deposition, thus allowing to distinguish contexts which were the product of quick single deposition from those contexts formed in longer time spans.

This brief overview, with its cherry picked examples, just slightly scratch the surface of the topic of the relation between geoarchaeology, formation processes and chronology, but I think that some prompts for future, further considerations are evident. Again, as whole, it is a topic that classical urban archaeology needs to take up energetically.

[392] BROGIOLO, GELICHI 2005, pp. 90-95. For a recent example and updated references see NICOSIA *ET ALII* 2012. See also GOLDBERG, MACPHAIL 2006, pp. 271-273 and MACPHAIL 1994
[393] BROGIOLO, GELICHI 2005, pp. 92-93
[394] BROGIOLO, GELICHI 2005, p. 91
[395] NICOSIA *ET ALII* 2012, pp. 117-120
[396] See REINECK, SINGH 1980

❖ THE CONTRIBUTION OF ETHNOARCHAEOLOGY, EXPERIMENTAL ARCHAEOLOGY AND LITERARY SOURCES ❖

These lines are not devoted to provide a complete overview of the applications of ethnoarchaeology and experimental archaeology in post excavation analysis; of course the topic is wide and deserves a much more detailed dissertation. I will focus just on a few points closely linked with assemblage formation processes and dating which have some impact within the field of classical archaeology. Indeed both the disciplines have been somehow neglected by most classical archaeologists for a long time[397]. I argue that the main explanation of this state of the art is the realtive abundance of other sources, *in primis* literary and historical, which can provide similar information in a much more direct way.

Nonetheless, within the particular field of formation processes and dating, I will try to demonstrate that the two discipines can provide valuable and unique information. Thus, this brief chapter also aims to stimulate more attention about, at least, this specific topic, in the hope that in the future more studies may be dedicated to it. The last part touches also some general aspects concerning the use of literary sources in this field.

III.6.1 ETHNOARCHAEOLOGY

I have already discussed the meaning and validity of the use of analogy (see Chapter II.2.11), which is indeed the theorethical link between what we observe in the present and what we recover in the field. When approaching ethnoarchaeology, to make the analogy a good one, among other things, I think it is important to select a living systemic context sharing as many traits as possible with the systemic context which produced the archaeological record being investigated.

I mean that, for instance, for investigating dynamics of assemblage formation processes within an abandoned Roman *domus*, it seems more fruitful knowing abandonement formation processes of buildings erected with similar building techniques, with similar functions etc., more than knowing abandonement processes of, say, a small

[397] In a recent overview about different ethonarchaeological traditions in different countries, Italian ethnoarchaeological school is explicitly linked only with pre/proto history scholars (LUGLI 2013). For a rare ethnoarchaeological approach to pottery in classical antiquity, see PEACOCK 1982.

wooden hut with both domestic and productive functions. Given the complexity of the classical world in terms of production, trades, technology, social structures, building practices etc., examples drawn even from present common daylife, even within the "western society", can help enlight some processes which may have played a key role in antiquity.

In terms of usefulness in dating classical urban deposits, I think that there are two main streams where ethnoarchaeology can provide interesting data:

1. how assemblages and deposits are formed and patterned;
2. how artefacts use-life affects the chronological patterns detected within assemblages.

About deposits and assemblages formation, one very evident case study is given, for instance, by ancient and modern mudbricks/pisé structures[398]. These structures were widespread in antiquity[399] and present clear use-continuity until present. In Nora (Sardinia) excavations below the Roman *forum* brought to light the structures of a previous punic quarter: the lower part of the walls was made up of cobblestones and orthostats binded with silt and clay, while the upper part was built using the pisé technique. Although when the new *forum* was built the upper part of the walls was demolished and employed for backfilling the resulting grid of structures, it was possible to postulate the nature of the deposit so generated drawing from a large archaeological and ethnoarchaeological series of case-studies, among which also the present town of Pula, just few kilometers away from the archaeological site.

***fig. 52 (left)** - Present day mudbricks wall in Sarroch (Sardinia). From Bonetto 2009.* ***fig. 53 (right)** - Present day mud wall in Dagpazari (Turkey), embedding straw, lithics and ceramics. Courtesy of G. Rossi*

[398] Indeed there a vast bibliography about the topic. Here are presented just a few works considered necessary to specific points and/or embedding further references

[399] See ADAM 1988, pp. 62-65. More references in BONETTO 2009, footnote 175, p. 119. See also the recent DE CHAZELLES *ET ALII* (EDS.) 2011 for a wide overview

Indeed earthen structures are still in use in many present towns in Sardinia as well as in many other sites[400]. Apart from a general help in defining the nature of the excavated deposit, knowledge of this building technique allows one explanation of the presence of many potsherds: the introduction of sherds as aggregate may in fact have been intentional, for making the mudbricks stronger, more suitable to receive plasters and, if sherds were employed into the face, for protection from falling water. This use of aggregates has been studied in contemporary systems and seems to provide a coherent explanation[401]. Deliberate introduction of artefacts within structures and, consequently, deposits, is a key factor in establishing wether an assemblage is suitable for dating *ad quem* or not. If it is likely that the artefacts were not recovered in earlier deposits, but were circulating somehow within the time lapse of the systemic context in which the structure was built, they can be used for direct dating. Of course this issue has to be fully investigated and other tools are necessary. In tha case of Nora, it has been demonstrated, for instance, that some sherds were already residuals when they turned out to be embedded within the walls. Furthermore, intentional addition does not mean by itself dating *ad quem*, as it is quickly demonstrated by another ethnoarchaeological example.

fig. 54 *- Today's wall in Villa Asiola (Villa Vicentina, near Aquileia). Photo by the author*

Villa Asiola, an old mansion just 4 km far from the centre of the ancient Aquileia, was completely refurbished and converted into a B&B in recent times. Some of the

[400] See for instance SCHIFFER 1996, p. 112, fig. 5.4
[401] See MACINTOSH 1974, p. 159, MACINTOSH 1977 and COOKE 2010, p. 13 for further references

refurbished walls still display a mixture of modern bricks and Roman tiles, potsherds and bricks. These artefacts were obviously intentionaly added, possibly for aesthetic reasons, but they are also clearly residuals. Continuous reincorporation of older pottery within mud walls has also been observed and studied in some contemporary structures in West Africa, a clear "warning to those hoping to use the incorporated pottery to date a wall"[402].

Thus, even when intentionality is suspected as a factor behind the presence of some artefacts in a given deposit, it has to be combined with other sources of data in order to try to employ the assemblage for *ad quem* dating. In the case of the punic walls below the *forum* of Nora, other factors which may support an attempt of *ad quem* dating may be the coherent (gaussian or pseudo gaussian) chronology of the materials employed (see below) and the abundance of freshly discarded vessels and the shortage of previous stratified sherds when the walls were erected.

The case of Nora arises also another chronological issue, which, again, can be tackled (mainly) through the use of ethnoarchaeological analogy, that is how long earthen structures can stand without significant reconstructions. MacIntosh work in contemporary West Africa provide interesting insights into decay rates of these kinds of structures, clearly showing how these studies should be improved. Ethnoarchaeological evidence showed that walls directly built on the ground needed some repair after 2/3 years if uncovered and after up to 7 years if covered with plaster. The punic walls below the *forum* of Nora, erected on a lithic base and probably covered, are likely to have stood unaltered even longer. Moreover, apart from the needed repairs[403], the core of the structure may have been unchanged for a substantially long time, thus confirming the excavators' hypotesis that the same structures remained in use for a very long time, up to the *forum* construction[404]. Ethnoarchaeological evidence from many other contemporary sites, for instance, clearly points in the same way.

Concluding, it is clear in the case of earthen structures how ethnoarchaeological analogies can contribute to strenghten our models of formation processes and dating and to elight some aspects about the duration of some activities. A similar analogy can be advanced for wooden structures, with clear fallouts in evaluating radiocarbon dates and the duration of some processes. The lifespan of woodworking proposed by J. P. Adam is indeed borrowed from present day knowledge and observations, thus involving a form of ethnoarchaeology[405].

[402] MACINTOSH 1977, p. 195. See also MACINTOSH 1974, p. 159
[403] See COOKE 2010, Sketch 1, p. 39 and pp. 36-45 for further well updated references
[404] BONETTO 2009, pp. 139-141
[405] ADAM 1988, pp. 91-92. Of course scientific data seem having been employed too

Another clear circumstance in which etnoarchaeological comparison is fruitful occurs when dealing with deposits likely to be the product of abandonement/collapse/reuse processes or rubbish disposal. Some interesting studies in regard to abandoned buildings have been carried out in the Irish Midlands: M. Morris studied what is commonly known as occupation debris at an early stage in the site formation process[406].

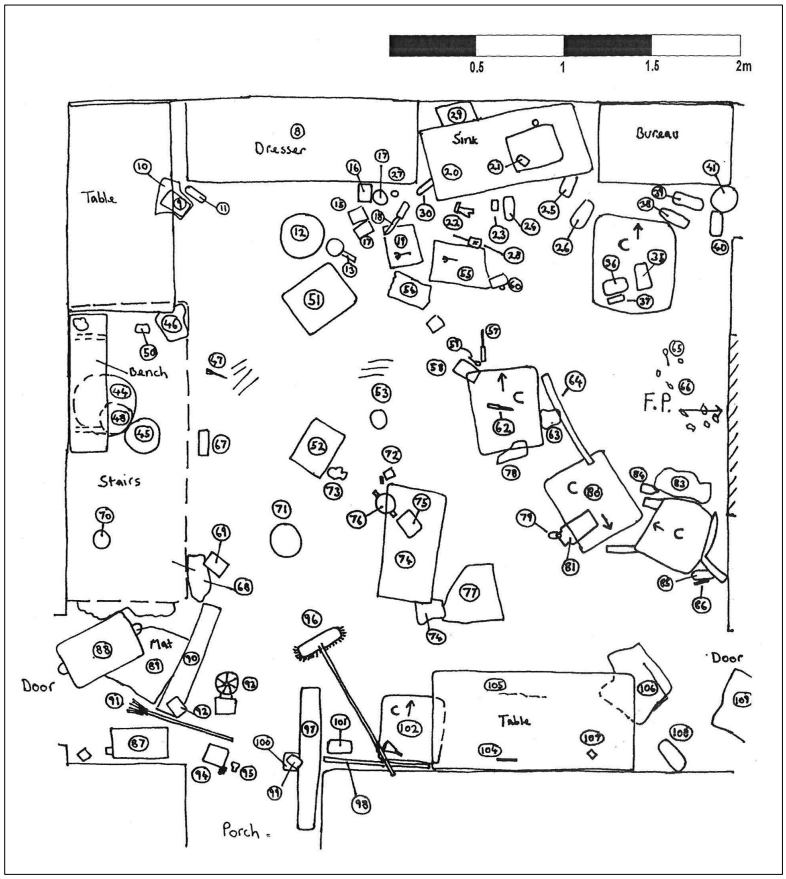


fig. 55 - Sketch of assemblage arrangement within a kitchen in a present day abandoned rural dwelling. From MORRIS 2000

In this case attention was focused on spatial patterning and functional analysis, but, as I will observe later, more specific chronological patterning can be addressed too, with very promising results. Nonetheless also a coarse qualitative study can contribute to understand some formation processes which have a certain impact on the rate of confidence of our chronological inferences. In particuar the entrance within the deposit of anomalous elements has been tracked in one interesting case study drawn from the excavations carried out in Aquileia, Fondi ex-Cossar (context 4046, **fig.** 56)

[406] MORRIS 2000

Materiale	Cronologia	Classe	Totale reperti	528
terrecotte	tardo romana	africana da cucina		1
metalli	tardo romana	bronzo		14
terrecotte	non determinata	comune depurata		1
terrecotte	non determinata	comune grezza		7
terrecotte	romana	comune orientale		4
terrecotte	tardo romana	contenitori da trasporto		165
metalli	non determinata	ferro		9
leganti	non determinata	intonaco		39
terrecotte	non determinata	laterizi		5
materiali organici	non determinata	malacofauna		63
materiali organici	non determinata	ossa animali		56
terrecotte	romana	pareti sottili		2
materiali vitrei	non determinata	pasta vitrea		4
manufatti litici	non determinata	pietra		33
metalli	non determinata	piombo		1
leganti	non determinata	preparazione parietale		7
terrecotte	non determinata	sigillata africana		11
terrecotte	non determinata	suppellettile da illumin.		2
materiali vitrei	non determinata	vetro		104

fig. 56 *- Materials recovered in context 4046. Plaster fragments are in yellow*

The deposit was interpreted as a small dump activated when the building, still standing, was presumably at least partially abandoned. Given the small amount of debris, the dump seemed to have been used for a short time. Artefacts chronology, their physical state, the abundance of bones, shells, charcoal and ash seemed to support the interpretation of the deposit as a dump, thus a primary deposit. Some lithic *tesserae* clearly originated from the break of an underlying floor, being indeed residuals/false residuals. Nonetheless the presence of several fragments of plaster arised the hypothesis the deposit could have actually derived from demolition activities, therefore invalidating the initial hypothesis. In this case, however, it would have been quite difficult to explain the copious presence of bones and shells. Observing today's abandoned buildings provided a possible explanation for the presence of a significant amount of plaster within the deposit.

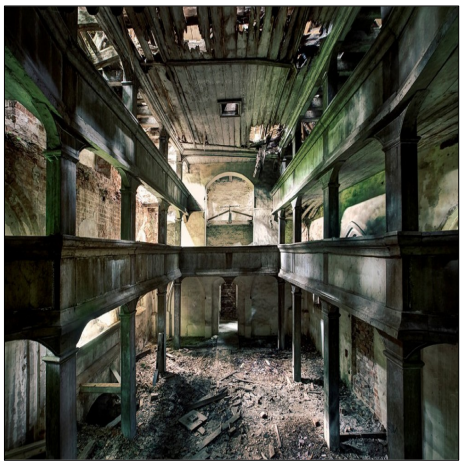


fig. 57 (left) - *Crooked Cottage, abandoned in 1956. Most of the debris is made of plaster fragments. Photo courtesy of HotSpot Media.* ***fig. 58 (right)*** *- Mildew Church, Poland, 2013. Again plaster and mortar populate the floor debris. Photo courtesy of Rebecca Litchfield*

Basically, plaster could have simply come from decaying walls and ceilings just nearby the small dump. This explanation seems to be, up to now, as simple as realistic and the primary status of the context (along with the possibility of *ad quem* dating) has been exploited.

Moving to point 2, *i.e.* how artefacts use-life affects the chronological patterns detected within assemblages, even more interesting conclusions can be drawn from ethnoarchaeological observations. A series of extremely illuminating observations can be drawn starting from the very simple question: what if my house would be abandoned or collapsed right now? Archaeologically this process would be translated into the simplest and perhaps most informative case study, a primary deposit with 'Pompeii premise' features without any curate behaviour occurred. Of course here I am not interested in social of economic patterns (which surely would emerge) and I focus on the chronological ones.

Shown below is a sample of forms which have been handed out (I hope just to start) to friends and colleagues (of course the sample cannot be considered completely random, as the proportion of archaeologists is abnormally high). The starting point was provided by a paper published by E. Schindler Kaudelka and S. Zabehlicky-Scheffenegger in which the two authors suggested some archaeological conclusions (particularly about false residuals) moving also from their own personal "assemblages"[407].

The table below is very simple. On the upper part some basic data are required: location, type of building, type of room, date of occupancy, proportion of the objects analysed compared to the total.

[407] SCHINDLER KAUDELKA, ZABEHLICKY-SCHEFFENEGGER 2007

Località:.....
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro):.....
Stanza/ambiente (cucina, salotto, studio etc.):.....
Occupato dal:.....
Campione analizzato (se volete contate anche i mobili):

- o tutti o quasi tutti gli oggetti
- o circa tre quarti
- o circa metà
- o circa un quarto
- o meno di un quarto

Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note

fig. 59 - Ourselves archaeology form

The lover part has to be filled with the type of objects being present within the studied room, their quantity, the material they are made of and their purchase date. It has also to be specified if the object was presumed to have been produced substantially earlier than the purchase date (say a vintage object) and if the puchase was linked with some special event (marriage, move, birthday etc.).

For each case a series of three graphs has been produced, using a Monte Carlo simulation, according to what exposed in Chapter III.4.5. The top graph shows chronological patterning with 'standard' 25 years intervals, the second one uses 10 years intervals and the bottom one displays 50 years intervals. The simulations were run 1000 times each and 0.1 and 0.9 percentiles are shown. It is also provided a sketch summing up the lenght of the time spans occurring between the deposition date and the *terminus post quem*, between the *terminus post quem* and the main peak of counts and between the main peak and the date of the oldest object.

Località: CADONEGHE (PD)
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SALOTTO
Occupato dal: 2009
Campione analizzato (se volete contate anche i mobili):

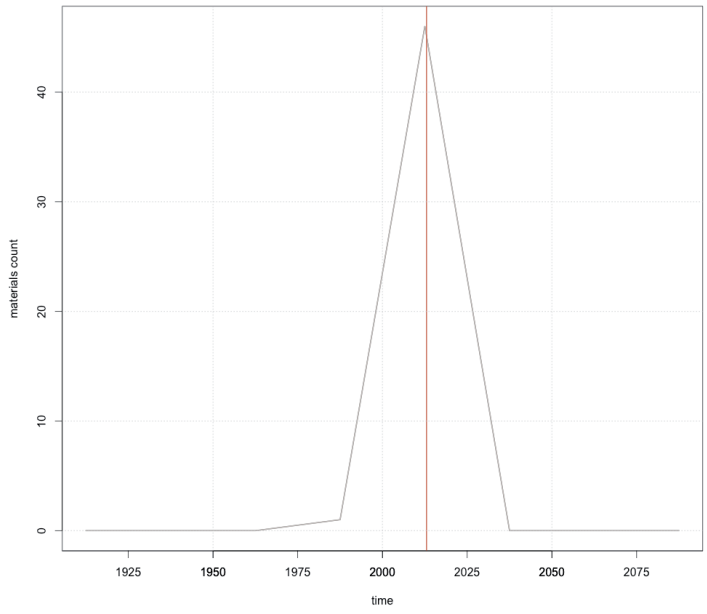
- ○ tutti o quasi tutti gli oggetti
- ○ circa tre quarti
- ● circa metà
- ○ circa un quarto
- ○ meno di un quarto

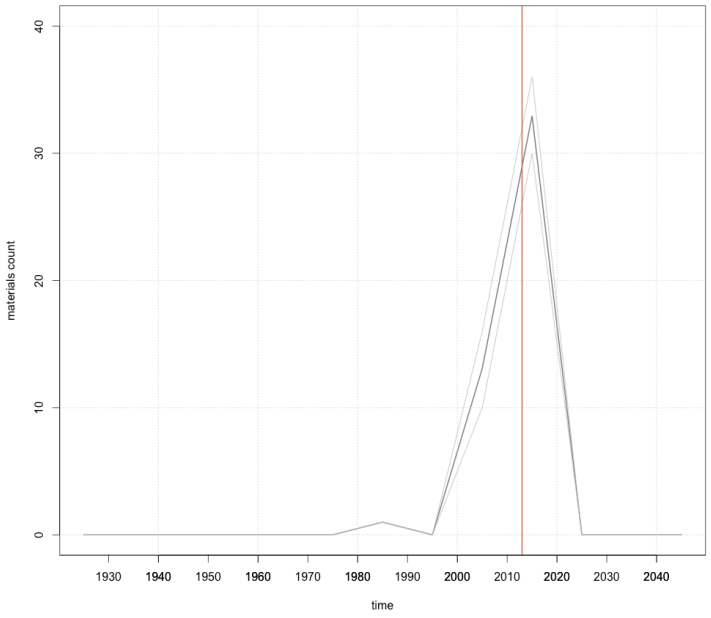
Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
TAPPETI	7	LANA	TRA IL 2009 E IL 2014		TRASLOCO	SONO TAPPETI ORIENTALI
LAMPADE	8		TRA IL 2009 E IL 2014		TRASLOCO	
VASI DI CERAMICA	7	ARGILLA				REALIZZATI A MANO
DIVANO	1	STRUTTURA IN ACCIAIO + CUSCINI	2009		TRASLOCO	
CREDENZA	1	LEGNO	?		EREDITÀ	
LIBRERIA	1	LEGNO	?			
STATUETTE	25	LEGNO	TRA IL 2009 E IL 2014			SONO STATUETTE AFRICANE E BUDDHA
POLTRONA A SACCO	1	INVOLUCRO DI TESSUTO CHE CONTIENE PALLINE DI POLISTIROLO	2010		TRASLOCO	
SPECCHI	3	SPECCHIO + CORNICI DI LEGNO	?		EREDITÀ e TRASLOCO	
QUADRO	1	CORNICE IN LEGNO + TELA DIPINTA	1989		EREDITÀ	REALIZZATO DA GILBERTO SARTORI
TAVOLI	2	CRISTALLO e ALLUMINIO	?			
SEDIE	6	METALLO	?			
POLTRONE	2	PELLE e ACCIAIO	?			
VASI	7	VETRO	?			
TELEVISIONE	1		2009		TRASLOCO	
VASI	2	CERA	2009		TRASLOCO	

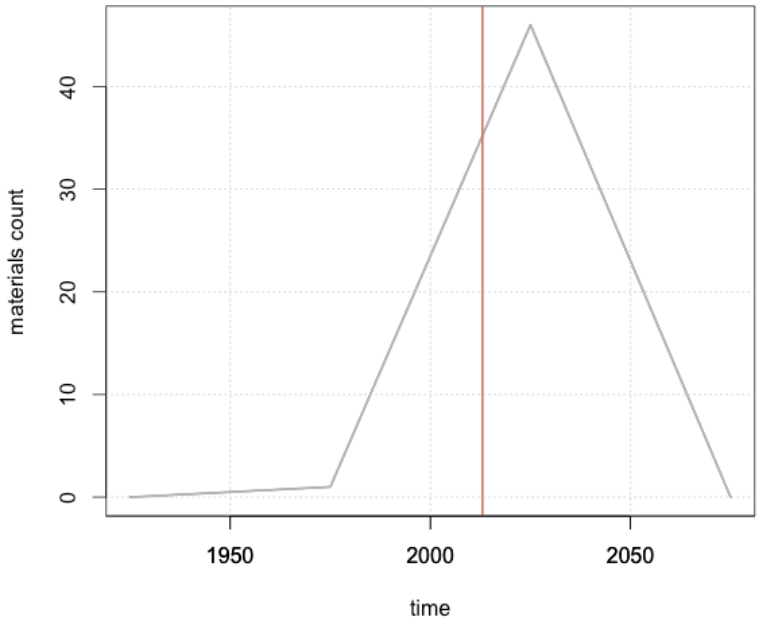
PIATTO	1	PIATTO IN CERAMICA DECORATO	?		REGALO	
SEGGIOLINO PER BAMBINI	1	LEGNO	2013			È AFRICANO

Osservazioni:

Case 1



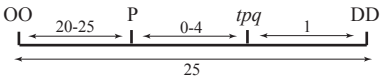




Comment

The total number of computed items is 47 (the only dated objects) and a large amount is made of perishable material (whool and wax would not even leave any datable sample). Besides only one item, which is slightly older, the others are all grouped within the gap 2009 (room occupation) and 2014 (hypothetical collapse and deposit date of formation). The whole chronological span is indeed very short.

The *tpq* predates the hypothetical formation of just one year and substantially lies in correspondance of the peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

Località: SAN PIETRO DI STRA
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SALA GIORNO (PRANZO + SALOTTO)
Occupato dal: 2014
Campione analizzato (se volete contate anche i mobili):

- [x] tutti o quasi tutti gli oggetti
- [ ] circa tre quarti
- [ ] circa metà
- [ ] circa un quarto
- [ ] meno di un quarto

Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
TV	1	MATERIALE ELETTRONICO	2007		ACQUISTO CASA	+ TELECOMANDO + CAVI
IMPIANTO DOLBY 5+1	1	"	2007		"	5 DIFFUSORI + 1 SUBWOOFER + CASSA CENTRALE + 2 ANTENNE WIFI + TELECOMANDO + CAVI
DECODER ELETTRICE TORINO	1	"	2007		"	+ TELECOMANDO + CAVI
MOBILE TV	1	VETRO + METALLO	2007		"	
CIABATTA A 3 PRESE	1	MAT. ELETTR	2007		"	
DIVANO	1+1	LEGNO + TELA + METALLO + GOMMAPIUMA	2014		TRASLOCO	4 POSTI + PUFF SEPARATO
QUADRI	2	LEGNO + CARTA/CARTONE	2014		"	APPESI CON 3 CHIODI DI PLASTICA
PENDOLO	1	LEGNO + METALLO	INIZI XX SEC.	PROBABILMENTE AVEVA GIÀ ~ 10 ANNI	EREDITÀ	DOTATO DI CHIAVE X CARICA + PENDOLO RIMOVIBILE
LAMPADA	1	LEGNO + PLASTICA + MAT. ELETTR.	ANNI 20 XX SEC.		EREDITÀ	RESA ELETTRICA NEGLI ANNI
CUSCINI	2	TELA + GOMMAPIUMA	ANNI 50 XX SEC.		"	FATTI DA MIA MAMMA CON GOMMAPIUMA DEL 2014
BRACIERE	1	METALLO	ANNI 30 XX SEC.		"	USATO COME PORTA PIANTE (2 ELEMENTI)
VASO CON FELCE	1	TERRACOTTA + VEGETALE	2014		TRASLOCO	
TAVOLINO BASSO	1	LEGNO + METALLO	ANNI 90 XX SEC		PRESENTE IN CASA ALL'ACQUISTO	
TAVOLO X 8 PERSONE	1	LEGNO + VETRO + METALLO	"		"	
SEDIE	4	TELA + LEGNO + GOMMAPIUMA + METALLO	"		"	
CENTRINI	10	TESSUTO	ANNI 70 XX SEC		EREDITÀ	CUCITI IN FAMIGLIA

COPPA PORTAPIORI	VETRO METALLO	1	ANNI '60 XX SEC		EREDITÀ	COSTITUITA DA 2 ELEMENTI
FIORI FINTI	9	CARTONE FIL DI FERRO TESSUTO	ANNI '90 XX SEC			
TROTTOLE	3	LEGNO	ANNI '90 XX SEC ~~ANNI 10 XXI SEC~~		COLLEZIONE/REGALO	
ROUTER	1	MAT. ELETTR	ANNI 10 XX SEC			
PENNE BIRO	3	PLASTICA	ANNI 10 XX SEC			
PORTA POSTIT + POSTIT	1	PLASTICA + CARTA	0			
VASSOIO METALLO	1	METALLO	1981		REGALO NOZZE GENITORI	
PORTA BOTTIGLIE	1	PLASTICA	2014		~~DONO X TRASLOCO~~ ACQUISTO	
TELEFONO CORDLESS	1	MAT. ELET.	2007		ACQUISTO CASA	BASE + TELEFONO
BOTTIGLIE SUPERALCOLICI	4	VETRO + LIQUIDI	2014			
BOTTIGLIE VINO	~~4~~ 15	VETRO + LIQUIDI	2014			
PIATTI FONDI RICCO DERUTA	10	CERAMICA	ANNI '60 XX SEC		EREDITÀ	ORIGINARIAMENTE SERVIZIO DA 12
PIATTI PIANI RICCO DERUTA	11	"	"		"	"
PIATTI DOLCE RICCO DERUTA	12	"	"		"	"
PIATTI PANE RICCO DERUTA	6	"	"		"	
PIATTI PORTATA RICCO DERUTA	5	"	"		"	
CIOTOLA GRANDE RICCO DERUTA	1	"	"		"	
BOCCALE ~~RICCO~~ DERUTA	1	"	"		"	
CIOTOLA PICCOLA ~~RICCO~~ DERUTA	1	"	2014		DONO X TRASLOCO	
BICCHIERI RICCO DERUTA	9	"	ANNI '60 XX SEC		EREDITÀ	ORIGINARIAMENTE SERVIZIO DA 12

Osservazioni:
"Ricco Deruta" è una maiolica che rivela pedissequamente le maioliche umbre Tardo-medievali/rinascimentali. La casa di produzione è la "GRAZIA - DERUTA".

Case 2

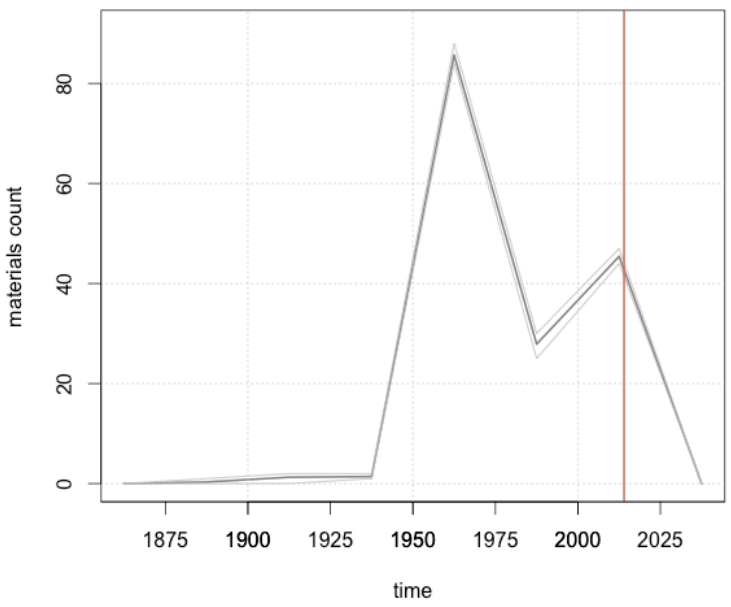
Località:.....
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro):.....
Stanza/ambiente (cucina, salotto, studio etc.):.....
Occupato dal:.....
Campione analizzato (se volete contate anche i mobili):

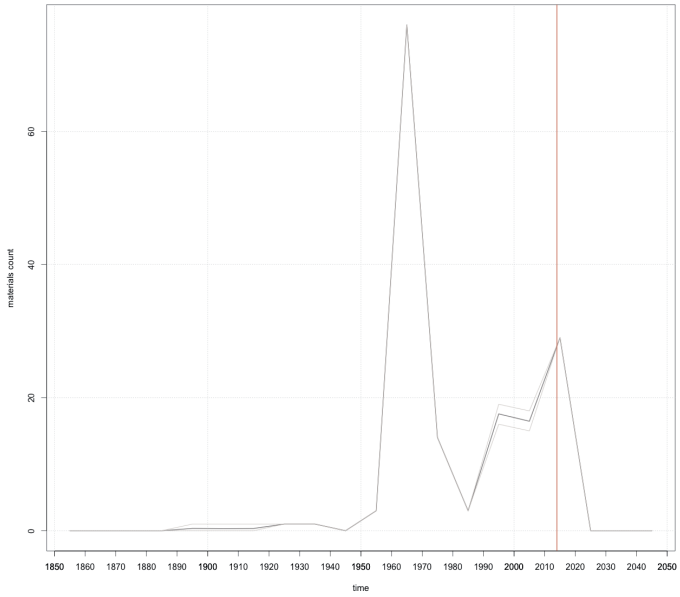
- tutti o quasi tutti gli oggetti
- circa tre quarti
- circa metà
- circa un quarto
- meno di un quarto

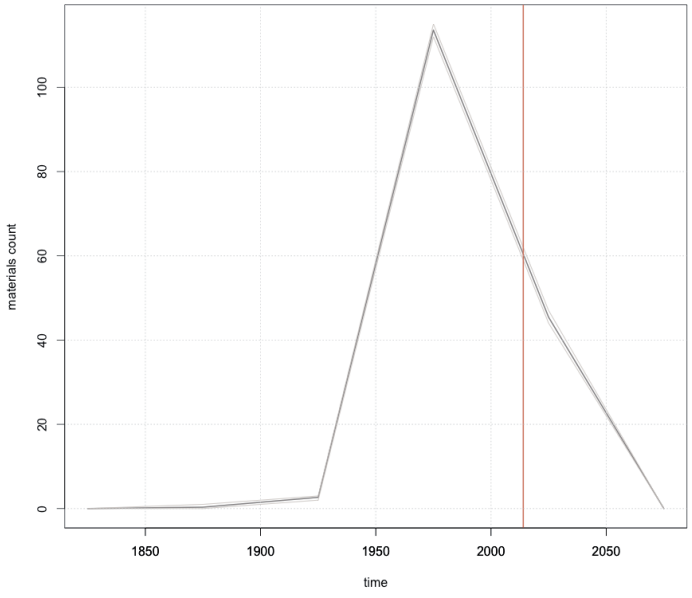
Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
FORMAGGIERA RICCO DERUTA	1	CERAMICA	ANNI '60 DEL XX SEC		EREDITÀ	
BROCCA DERUTA	1	〃	〃		〃	
BRICCHETTO LATTE RICCO DERUTA	1	〃	〃		〃	
BOCCALI BIRRA RICCO DERUTA	2	〃	〃		〃	
CIOTOLINE DOLCE RICCO DERUTA	8	〃	〃		〃	
PORTA GRISSINI RICCO DERUTA	1	〃	〃		〃	
PIATTO PORTATA RICCO DERUTA	1	〃	2012		SOSTITUZIONE DOPO ROTTURA	
FRUTTIERA	1	〃	2014		〃	ROTTO 2 VOLTE E 2 VOLTE RICOMPRATO IDENTICO
COPPA CENTROTAVOLA RAFFAELLO DERUTA	1	〃	ANNI '60 DEL XX SEC		EREDITÀ	
PORTACANDELA	5	〃	〃		〃	2 A 3 BRACCI 3 A 1 BRACCIO
PIATTO PORTATA ROSA DERUTA	1	〃	ANNI '50 XX SEC		〃	
PORTA OMBRELLI RICCO DERUTA	1	〃	ANNI '60 XX SEC.		DONO	
TOVAGLIA +TOVAGLIOLI	1	TELA	ANNI '70		EREDITÀ	8 TOVAGLIOLI
TOVAGLIA +TOVAGLIOLI	1	TELA	〃		〃	8 TOVAGLIOLI
TOVAGLIA	1	TELA	ANNI '80		〃	TOVAGLIE UNITE UNENDO 6 TOVAGLIOLI
CESTO	1	VIMINI	〃		DONO	CESTO DI VIMINI CENTROTAVOLA

CANDELE	20	CERA	RECENTE		ACQUISTO RECENTE	ALCUNE IN PARTE USATE
LUMINI	24	〃	〃		〃	〃
CHIAVI	8	METALLO				CHIAVI DI PORTE INTERNE DELLA CASA
CONTENITORE	1	PLASTICA			PRESENTE IN CASA ALL'ACQUISTO	VASCHETTA PER LE CHIAVI
TOVAGLIE	2	~~TELA~~ TESSUTO				TOVAGLIE SENZA TOVAGLIOLI ABBINATI
MAZZO CARTE	2	CARTA	ANNI '80		IN FAMIGLIA	BRISCOLA NAPOLETANE + SCALA
NASTRI ADESIVI	6	CARTA + TAVOLA PLASTICA	RECENTE			
LAMPADINE	7	VETRO PLASTICA METALLO	〃			
LAMPADARIO	1	VETRO e METALLO			PRESENTE IN CASA ALL'ACQUISTO	
MULTIPLE/ RIDUTTORI	4	PLASTICA + METALLO	ANNI 2000			
STARTER	1	METALLO PLASTICA	2014			
BATTERIE	22	METALLO + MATERIA PLASTICA	RECENTE			VARI FORMATI

Osservazioni:





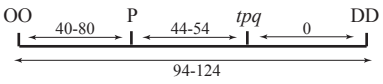


Comment

The 162 computed items represent about the whole assemblage provided by a living room (only few objects of uncertain date were not computed). Most of the materials are not perishable: the bulk is provided by mid 60s ware whereas another important contribution comes from the more recent items (1990-2014) and it is made up mainly by electrical ware and plastic/glass objects. The amount of objects older than 60/70 years is certainly negligible.

It is worth noting the abundance of inherited materials (mid 60s), substantially predating the occupation of the room.

The *tpq* corresponds to the date of formation, it is about 50 years later than the main peak and substantially corresponds to the second peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

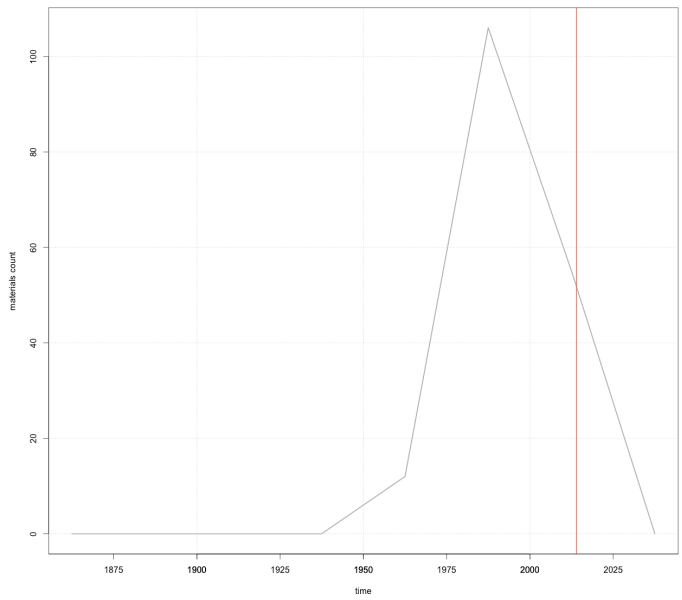
Case 3

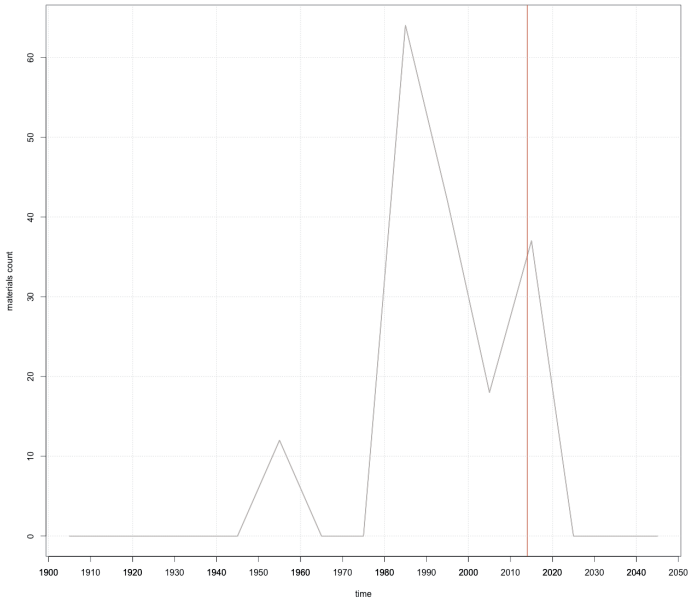
Località: MASI (PADOVA)
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SALOTTO
Occupato dal: 1991
Campione analizzato (se volete contate anche i mobili):

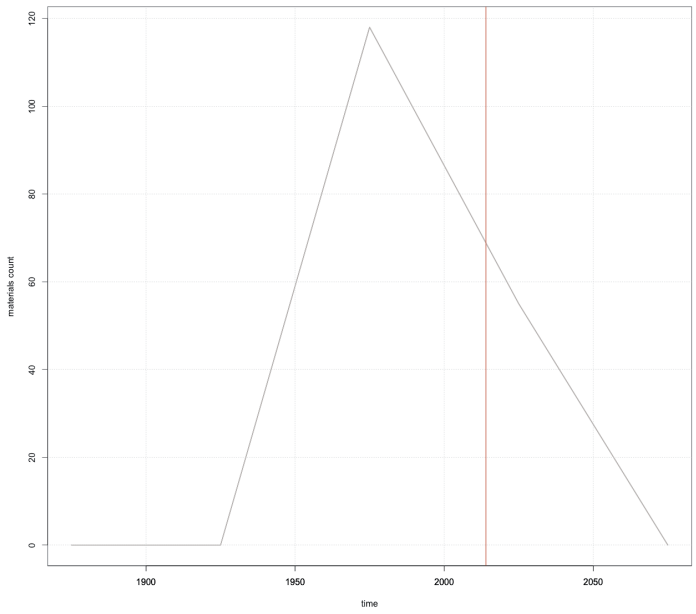
- o tutti o quasi tutti gli oggetti
- ☒ circa tre quarti
- o circa metà
- o circa un quarto
- o meno di un quarto

Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
PIATTO	18	CERAMICA	1987		REGALO MATRIMONIO	
BICCHIERI	18	VETRO	1987		REGALO MATRIMONIO	
TAZZINE DA CAFFÈ	6	CERAMICA	2000		REGALO	
PIATTO	12	CERAMICA	1960		REGALO/ EREDITÀ	
ZUCCHERIERA	1	CERAMICA	2004		ACQUISTO	
SERVIZIO DA THE	8	CERAMICA	1991		ACQUISTO	
BICCHIERI	18	VETRO	1992		ACQUISTO	
BICCHIERI	9	VETRO	2013		ACQUISTO	
DECANTER	1	VETRO	2005		REGALO	
CORNICE	1	ARGENTO	2003		ACQUISTO	
BICCHIERI	24	VETRO	1987		REGALO MATRIMONIO	
TAZZINE CAFFÈ	6	CERAMCA	2010		ACQUISTO	
VASO FIORI	1	VETRO	2007		ACQUISTO	
BOTTIGLIA	3	VETRO	2006		REGALO	
PORTA CARAMELLE	1	CRISTALLO DI BOEMIA	1990		REGALO DOPO LA CADUTA DEL MURO DI BERLINO	
TAVOLINO	1	VETRO	1991		ACQUISTO	
VASO FIORI	1	CERAMCA	2001		ACQUISTO	
CENTRO TAVOLA	1	CERAMICA	1991		ACQUISTO	
VASO FIORI	1	CERAMCA	1987		REGALO MATRIMONIO	
VASSOIO	1	VETRO	2009		REGALO	
PIATTI	24	CERAMICA	2011		ACQUISTO	
CORNICI x QUADRI	8	LEGNO o VETRO	dal 1991 al 1997			
STAMPE CINESI	2	LEGNO, VETRO	1987		REGALO MATRIMONIO	
VASI PER PIANTE	4	CERAMICA	2014		ACQUISTO	
NINNOLI GANFRUSAGLIE	VARIE	VARIO				

Osservazioni:



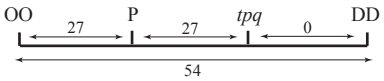




Comment

All the 173 items listed were computed. Most of them are unperishable (mostly ceramics and glass) and represent about of 3/4 of the assemblage which would be provided in case of collapse of the living room. There are no objects older than 60 years, but the vast majority concentrates within the decades 1980-2000. In particular 1987 (marriage) contributes with a set of dishes, glasses and cutlery (60 objects). Another important amount is provided by the most recent items (2010-2014).

The *tpq*, which corresponds with the date of hypothetical collapse, is about 30 years later than the main peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

Località: CREA - Fraciona di Spinea
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SOGGIORNO
Occupato dal: 1949
Campione analizzato (se volete contate anche i mobili):

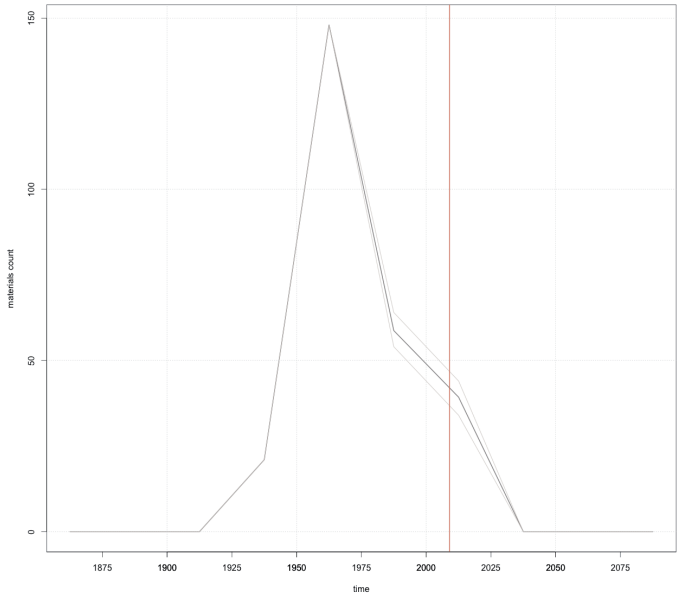
- [x] tutti o quasi tutti gli oggetti
- [ ] circa tre quarti
- [ ] circa metà
- [ ] circa un quarto
- [ ] meno di un quarto

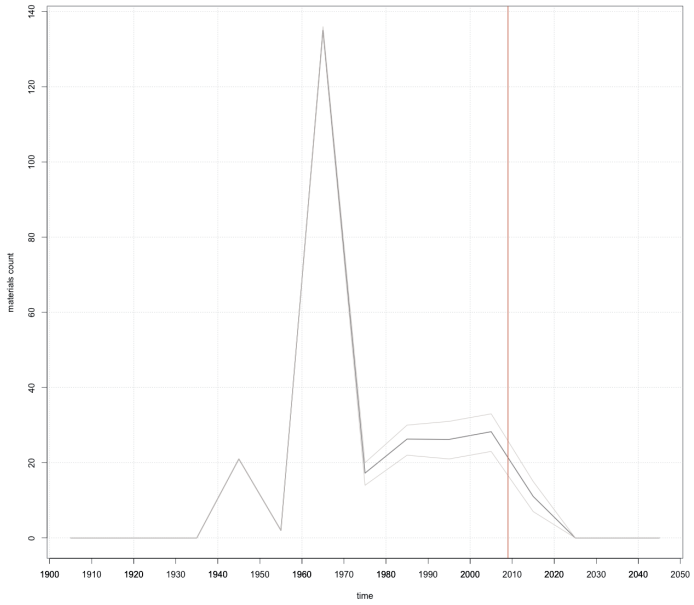
Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
TAVOLO	1	LEGNO	1973			
SEDIE	6	LEGNO, PAGLIA	1973			
CREDENZA	1	LEGNO	1973			
DIVANO	1	LEGNO, TESSUTO, GOMMAPIUMA	1990			
CUSCINI	12	TESSUTO, PIUMA	1990			
MACCHINA DA CUCIRE	1	LEGNO, METALLO	1975			
CESTO DI VIMINI	1	VIMINI	1979			
MOBILE	1	LEGNO, VETRO	1952			
RADIO	1		1952			
TELEVISORE	1		2009			
RADIATORI	2	METALLO	circa 1970			
LAMPADARIO	1	METALLO, VETRO	1974			
TERMOMETRO/ BAROMETRO	1	PLASTICA, METALLO	1968			
QUADRI	17	LEGNO/ VETRO, TESSUTO	1990 - 2014			
TENDE	6	TESSUTO	2000			
CROCIFISSO	1	LEGNO, PLASTICA	1962		X	PRIMA COMUNIONE DI MIO PAPA'

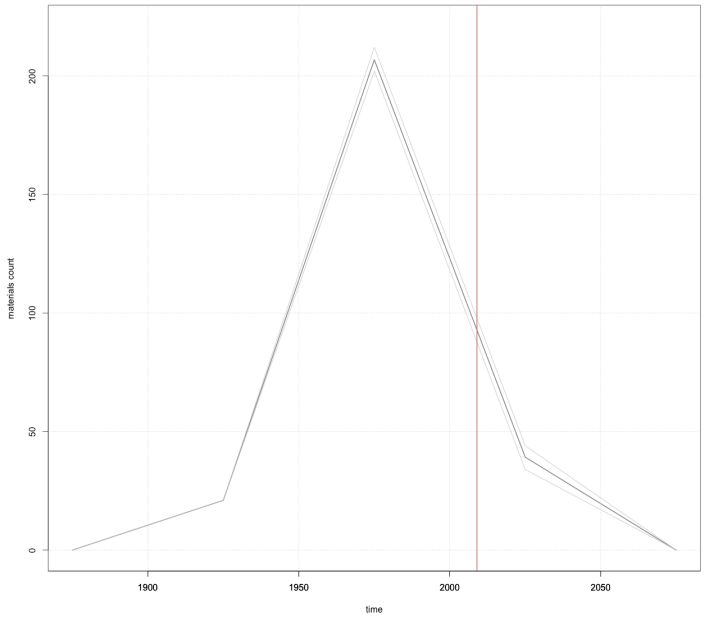
VASI E SOPRAMMOBILI	50 circa	CERAMICA, METALLO, VETRO	1976 - 2014			MOLTI SONO DI PROVENIENZA GARDA (MIA ZIA E' SARDA) O SONO SOUVENIR DALL'ESTERO
BICCHIERI	48	VETRO	1962			
TAZZE E TAZZINE	20	CERAMICA	1949		X MATRIMONIO	
PIATTI	36	CERAMICA	1962			
POSATE	48	METALLO	1962			
CONFEZIONI DI CIBO	...	CARTA, CARTONE, PLASTICA	2014			
FRUTTIERA	1	VETRO	1949		X MATRIMONIO	
STRACCI E STOFFE	...	TESSUTO	??			
CARTE E DOCUMENTI	...	CARTA	?? - 2014			
GIOCATTOLI	10 circa	PLASTICA	2000 - 2014			

Osservazioni:

Case 4

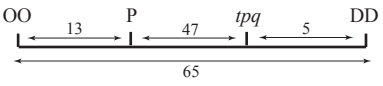






Comment

In this case 267 items where computed (uncounted papers, rags and food contaniners were not taken into account) and they are almost the whole assemblage produced by a living room occupied since 1949. The bulk is made up of 1962's glasses, dishes and cutlery (132 items). From the 70's to present a continuous supply of smaller amounts of objects contributed to the accretion of the assemblage. The amount of old objects is quite low, with the oldest one purchased right in 1949. The whole assemblage spans less than 70 years. It is interesting to note that some replacement (or different disposal) of old items must have occurred, as, for instance, no dishes of glasses predate 1962. The *tpq* (the television. As mentioned uncounted food containers - 2014 - were not computed) predates the 'actual' formation of the deposit by 5 years and lies almost 50 years after the peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

Località: PADOVA
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SALOTTO
Occupato dal: 2002
Campione analizzato (se volete contate anche i mobili):

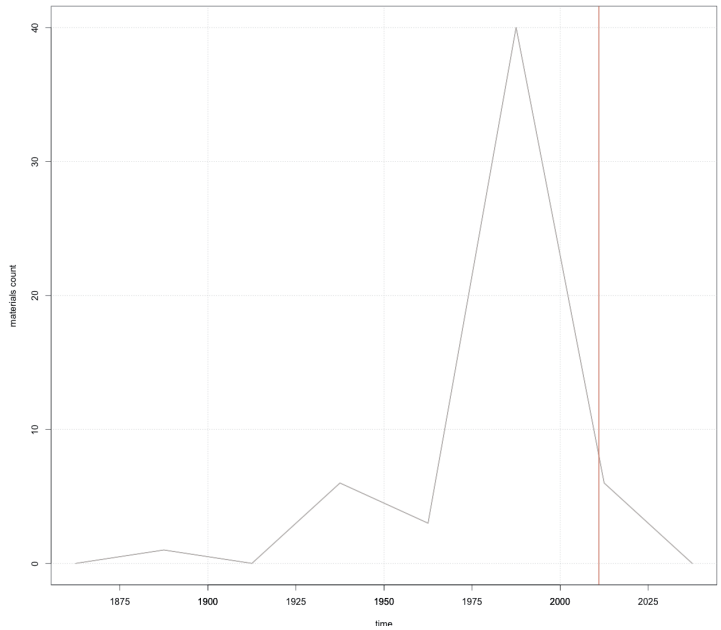
- ○ tutti o quasi tutti gli oggetti
- ○ circa tre quarti
- ⊗ circa metà
- ○ circa un quarto
- ○ meno di un quarto

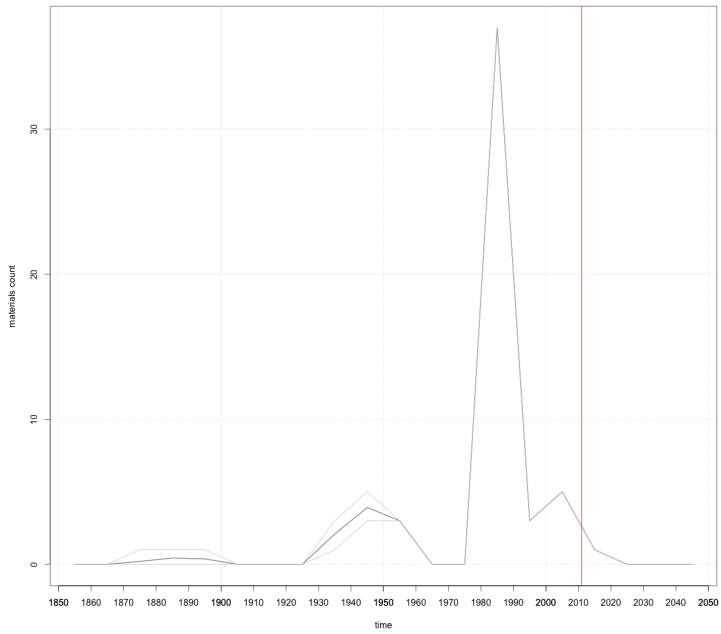
Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
TAVOLO	1	LEGNO	2000	FINE 800	ACQUISTO	E' STATO RESTAURATO
CREDENZA	1	LEGNO	1997	ANNI 30/40	ACQUISTO	
QUADRO	2			1946	EREDITA'	DI FAMIGLIA
DIVANO	2	PELLE	2003	2003	ACQUISTO TRASLOCO	
LIBRERIA	1	LEGNO	2003	2003	ACQUISTO	
ZUCCHE RIERE	2	ARGENTO		ANNI 50	EREDITA'	DI FAMIGLIA
PORACCA	1	ARGENTO		2000	REGALO	
VASSOIO	1	ARGENTO		1999	REGALO	
VASO	1	~~TERRACOTTA~~ DIPINTA		1930/40	EREDITA'	
VASO	1	VETRO	2012	2011	ACQUISTO	
QUADRO	1			1983	REGALO MATRIMONIO	CORNICE (NUOVA) DEL 2000
VASO	1	CERAMICA FIRENZE		2002	REGALO	
TAVOLINO	1	NOCE	2005	1930/40	ACQUISTO	
TAVOLINO	1	NOCE	2013	1930/40	"	
LAMPADA	1	VETRO E ALLUMINIO	2002	2001	ACQUISTO PER TRASLOCO	
PORTAGHIE	1	VETRO		1952	NASCITA (BATTESIMO)	EREDITA'

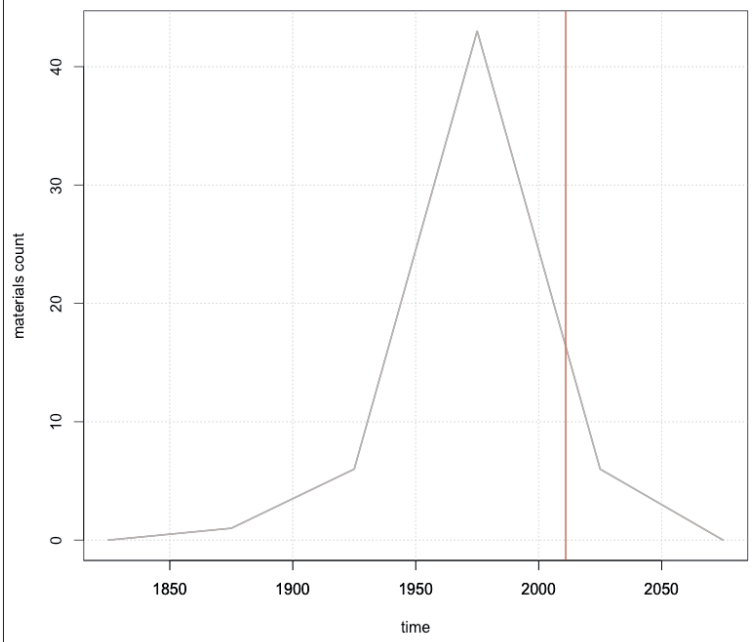
BICCHIERI	1	STOFFA E ACCIAIO	2000	2000	ACQUISTO	
PIATTI	36	CERAMICA O PORCELLANA	1983	1982	REGALO MATRIMONIO	

Osservazioni:

Case 5



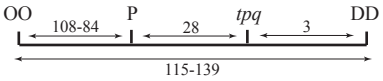




Comment

About 2/3 of the 56 materials listed (which in turn are about 1/2 of the total assemblage), consist in a set of dishes given as a marriage present in 1983. A mix of inherited and vintage items, dated to the dacades 1930-40, represents the majority of the older objects. It is also worth noting that they are pieces of furniture made of wood, thus perishable. Other items cover the period 2000-2014. The latest piece dates to 2011 and the oldest one (wooden piece of furniture) to the end of the 19th century, bringing the total time span to more than a century.

The *tpq* is 3 years earlier than the hypothetical formation date and almost 30 years later than the peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

Località: MASI (PADOVA)
Tipo di edificio (abitazione, luogo di lavoro, magazzino, altro): ABITAZIONE
Stanza/ambiente (cucina, salotto, studio etc.): SALA DA PRANZO
Occupato dal: 1967 / 1967 MATRIMONIO
Campione analizzato (se volete contate anche i mobili):

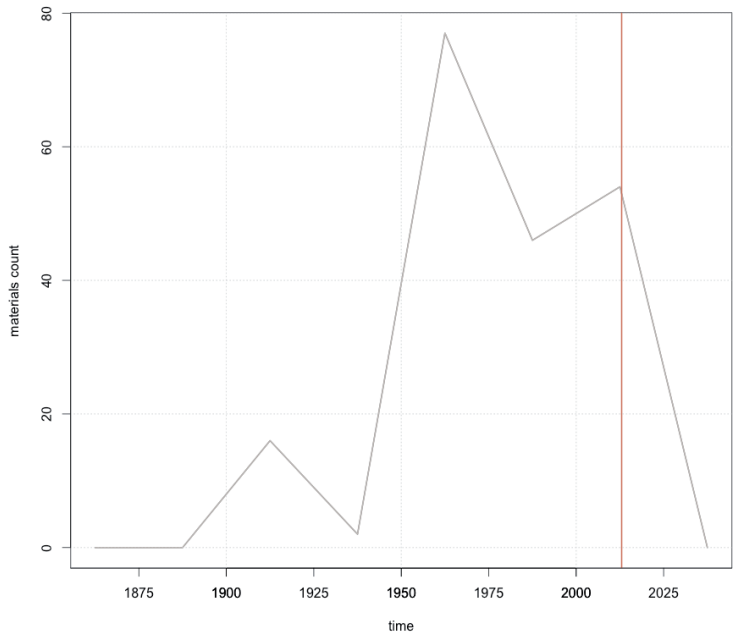
- o tutti o quasi tutti gli oggetti
- x circa tre quarti
- o circa metà
- o circa un quarto
- o meno di un quarto

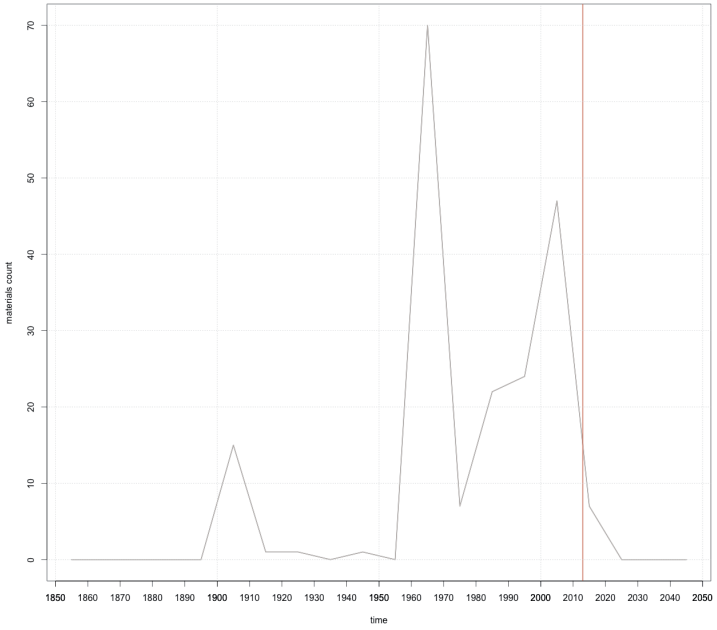
Oggetto	Quantità	Materiale	Data di acquisto	Data di produzione presumibilmente molto precedente rispetto alla data di acquisto (barrare se è il caso)	L'acquisto/regalo è legato ad un episodio particolare (trasloco, matrimonio, eredità etc.)?	Note
CENTRO TAVOLA	1	CERAMICA	1950		REGALO AMICHE NONNA	
SVUOTA TASCHE	2	VETRO	2002			
CORNICE	10	ARGENTO	2009			
VASO DI FIORI	2	CERAMICA	1996		REGALO	
PORTA GIORNALI	1	VETRO e ACCIAIO	1987			
ZUCCHERIERA	1	ARGENTO	1967		REGALO MATRIMONIO	
LATTIERA	1	ARGENTO	1967		REGALO MATRIMONIO	
VASETTI	2	CERAMICA	1999			
VASO DI FIORI	1	VETRO	1988			
OROLOGIO A MURO	1	ACCIAIO	2015			
LUME / LAMPADA A PETROLIO	1	VETRO e CERAMICA	1930			
BICCHIERI	15	CRISTALLO	1957	X (1910)	EREDITA' DA NONNO	
SERVIZIO DA THE	8	CERAMICA	1962			
SERVIZIO DA CAFFE'	10	CERAMICA	2005			
BICCHIERI	20	VETRO	1990			
VASSOIO	2	ARGENTO	1967			

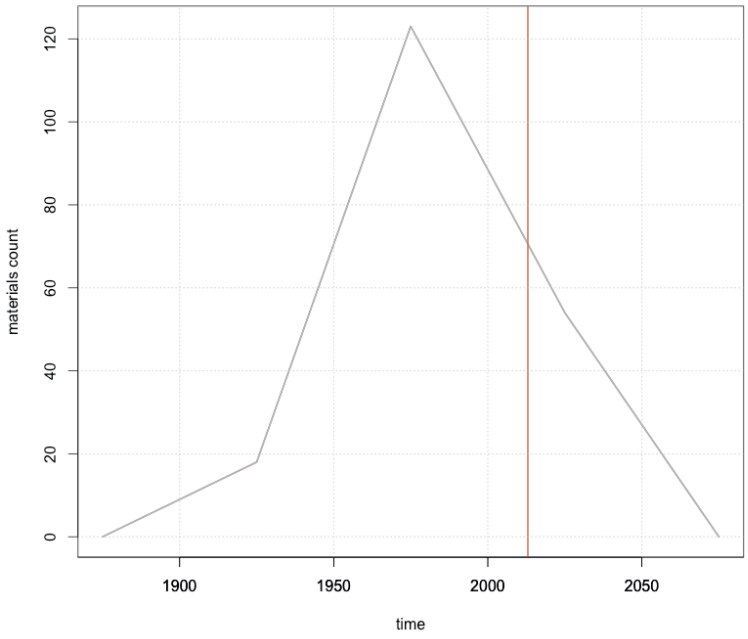
SERVIZIO DA CAFFE'	6	CERAMICA	2011			
SERVIZIO MACEDONIA	6	VETRO	1997			
BICCHIERI DA LIQUORE	6	VETRO	1970			
BICCHIERI	6	VETRO	2003			
CARAFFA	1	VETRO	1970			
SOPRAMOBILI	12	CERAMICA	1995-2000			
PENTOLE	4	ACCIAIO	1975			
ZUCCHERIERA	1	ARGENTO	1967		REGALO MATRIMONIO	
PIATTI	24	CERAMICA	1965			
PIATTI	24	CERAMICA	1970			
SCODELLE	6	CERAMICA	2004			
PIROFILA	2	VETRO	1970			
PIATTI	12	CERAMICA	2004			
TERRINA	3	CERAMICA	1972			
FERRO DA STIRO	1	GHISA	1920			
CENTRO TAVOLA	1	CERAMICA	2001			
SECCHIELLO PER IL GHIACCIO	2	VETRO	1996			

Osservazioni:

Case 6



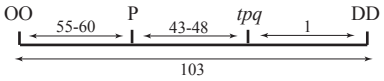




Comment

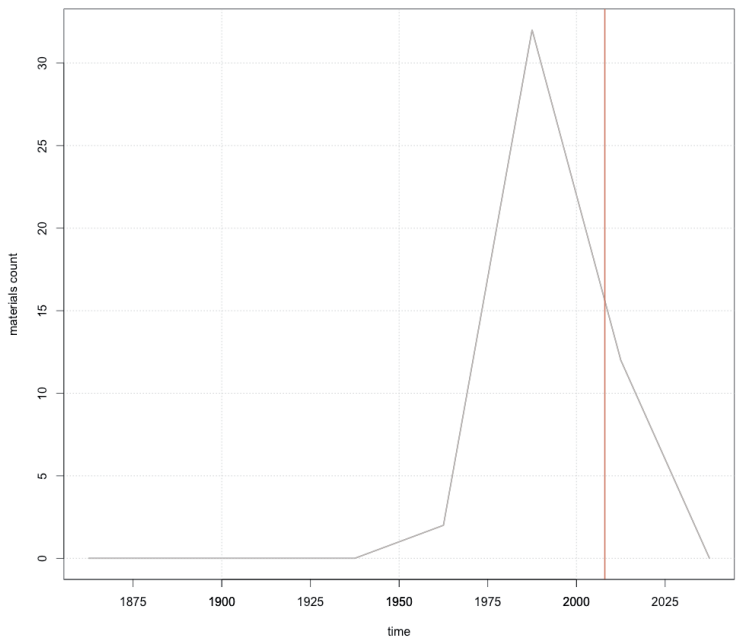
The 195 unperishable items listed and computed belong to a living room occupied since 1947 and represent about 3/4 of the total assemblage. The oldest items date back to 1910, the newest one to 2013, thus bringing the gap to 103 years. The most important group is dated to the late 60s (dishes, cups and some silverware), but considerable amounts of objects belong to the following decades, with a slight peak in the period 2000-2014.

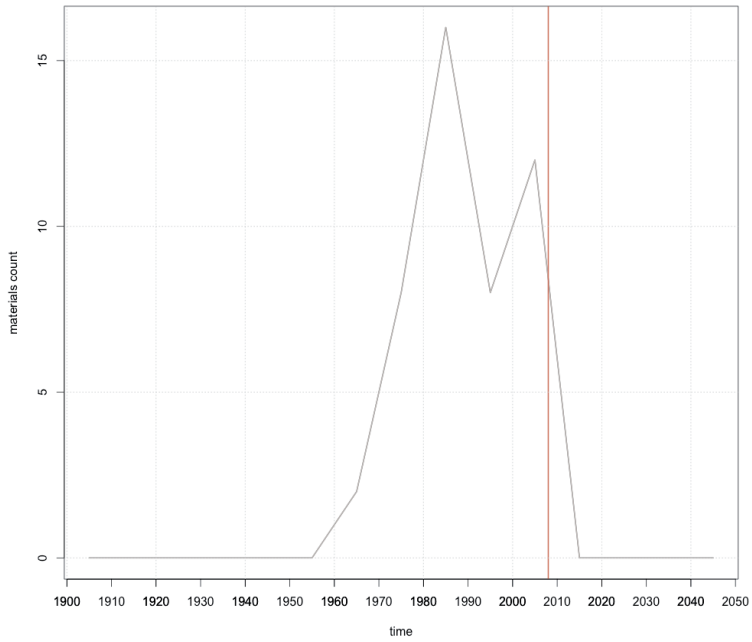
The tpq is just 1 year earlier than the supposed date of collapse and about 40-50 years later than the main peak.

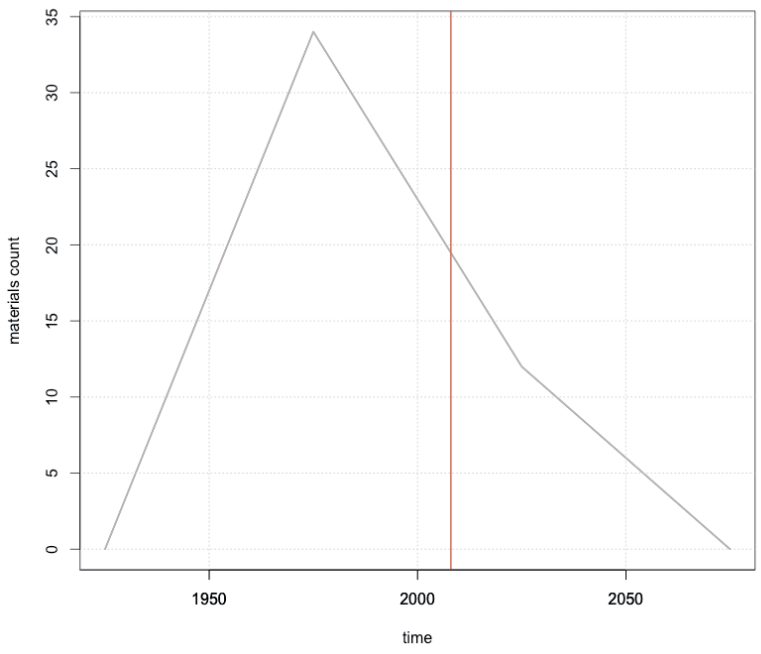


DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

Quantità	Tipo	Anni b.p. (26-06-09)	Anni d.C.
1	Piastra per bistecche	30	1979
1	Pentola alta	30	1979
1	Pentola bassa	30	1979
1	Pentola alta	30	1979
3	Pentole antiaderenti	4	2005
1	Padella in rame e alluminio	3 o 4	2005-2006
1	Pentolino in acciaio	3	2006
1	Pentola a pressione	3	2006
1	Pentola a pressione casseruola	20	1989
1	Scolapasta in acciaio	25	1984
1	Pentola alta	25	1984
2	Pentole basse	25	1984
3	Padelle in acciaio	25	1984
1	Paiolo in rame per polenta	20	1989
1	Padella in ferro per frittura	1	2008
2	Teglie in alluminio	40	1969
2	Teglie piccole in acciaio	15	1994
1	Teglia piccola antiaderente	1	2008
1	Colino in acciaio	4 o 5	2004-2005
1	Colino in acciaio	25	1984
1	Pentola bassa in acciaio	10	1999
1	Bollitore	25	1984
1	Pentola alta in acciaio	10	1999
1	Cestello per cottura al vapore	10	1999
3	Vassoi in acciaio	30	1979
1	Batticarne in acciao	30	1979
1	Passalegumi in alluminio	10	1999
1	Bollitore piccolo	20	1989
1	Bollitore medio	4 o 5	2004-2005
1	Padellone antiaderente	10	1999
1	Affettaverdure in plastica e acciaio	10	1999
1	Schiacciapatate	4 o 5	2004-2005
4	Stampi per budini in acciaio	25	1984
1	Casseruola ovale in alluminio	8	2001



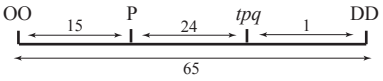




Comment

The 46 items listed and computed belong to a kitchen examined in 2009 and occupied since 2002. They represented the whole set of pots and pans and about 1/4 of the total assemblage. It is indeed all metalware spanning about 40 years, but substantially concentrated between the late 70s and the early 2000s. Among them, ware purchased or received in the mid 80's form a peak and it is ascribable to marriage and related activities.

The *tpq* is one year earlier than the supposed abandonement/collapse of the kitchen and about 20 years later than the main peak.



DD = deposition date
tpq = terminus post quem
P = peak
OO = oldest object

General observations

Some initial notes have to be devoted to the sample as a whole. One first thing has to be stressed from the beginning, that is the sample is not statistically representative of anything. It just represents a small group of case studies, picked up for the sake of semplicity mainly among friends. Although not statistically relevant, it highlights some tendencies and suggests some explanations which appear consistent with archaeological observations and models. It also seems to provide at least a minimum basis to draw some conclusions of chronological relevance. Summing up, much more investigation in this field is required to make such studies definitely relevant, but one has to start somewhere. A second issue affects the validity of the analogy with the archaeological data, that is the *quality* of the sample. I have already briefly touched the topic in the introductory part, but it is worth spending a few more words. The question is: does the systemic context employed fit in some way with the systemic contexts which are likely to have produced the archaeological contexts we are interested in? Is the distance between the Roman society and our society, in this particular field, too far or it can be bridged somehow, recognizing similar phenomena, behaviours and patterns? Indeed trying to answer these questions probably a whole book would not be enough. Nonetheless, given a very long list of differences, some crucial affinities can be listed:

1. the existence of mass products available for everyday life;
2. the (self evident) existence of breakage rates;
3. the existence of common necessities (cooking, storing, cleaning, furnishing) within the household;
4. the existence (for long periods, in urban sites) of articulate systems of rubbish disposal (see Chapter III.5.1);
5. domestic spaces with functional patterning (more or less articulate);
6. processes of curation and inheritance;
7. sudden or slow abandonement of buildings (often with clear continuity in building techniques till present) or sites in similar forms.

Among the differences, the scale of production of goods and different replacement rates seem to be the most substantial.

As a whole I think that some analogies can be attempted. Living societies with more traits in common with the Roman one (with particular focus on pratices of assemblage formation) may exist, but I must confess they are far out of my personal knowledge. Again this could be a field for further interesting investigations.

Moving to more particular issues, inside the sample, it is worth noting that most of the dates provided by the interviewees are very precise and are usually expressed by one single calendar year. This seems to be clearly a forcing due probably to the desire of providing precise data, but some more uncertainty should be taken into account. Indeed 0.1 and 0.9 percentiles are rarely discernible, thus variation is almost not existing. Though less realistic, at least the resulting pattern is clearer, but of course the level of precision reached is much higher than in a common archaeological sample. It has also to be kept in mind that dates refer to the presumed production (or purchase) of the item. To 'soften' this high precision problem, as mentioned above, the timeline has been subdivided in boxes of 25, 10 or 50 years (and not in boxes of 1 single year)[408].

The size of each assemblage presented ranges from 46 to 267 objects, thus providing a number comparable to many archaeological samples. Most of the rooms are living/dining rooms (choice of the interviewees), thus I decided also to add the last case study (my mother's kitchen, examined in 2009) to show some more functional variability. Of course it would be interesting to extend the study to bathrooms, utility rooms, warehouses etc.

Let us examine the single cases some closer.

Case 1 presents a very narrow profile. The flat has been occupied very recently and it has been furnished with modern items. False residuality is almost non existing and the shape of each curve (particularly with 25 and 50 years intervals) could easily approach a normal distribution, with the *tpq* very close to the mean.

Case 2 shows a much larger and articulate assemblage, whose chronological structure is slightly appreciable even employing 25 years intervals. The most consistent group of items (main peak) belongs to the mid '60 and is made of inherited objects. The second largest group is made of items purchased from the 90s until present day. The third group, the smaller, is made of very few old inherited objects. The three peaks are more appreciable with 10 years intervals, whereas with 50 years windows, the curve gets unimodal and approaches a normal one. The *tpq* substantially corresponds with the second peak observed.

Case 3, the assemblage of a living room occupied since 1991, shows a unimodal distribution with a 25 years intervals graph, while three close peaks can be observed with 10 years breaks. The main peak consists in marriage presents of the late 80s, the second highest peak is provided by very recent items and the smaller peak is made of 1960 inherited

[408] Note that obviously wider breaks imply less variability.

ceramics. The third graph (50 years breaks) displays a unimodal distribution approaching a normal one. The *tpq* lies in proximity of the second peak.

The fourth case is indeed very similar to the third one, displaying three clear peaks using 10 years intervals, with the second peak some wider (distributed along a longer time span) and less evident. The main peak is more distant from the *tpq*.

The fifth case shows a three modal distribution with 25 years breaks, but in this case the three peaks are the main one (some older than the *tpq*) and to two older peaks (the oldest almost indiscernible) of false residuals. The 10 years graph shows four peaks, displaying also the one related to the more recent items, a bit earlier than the *tpq*.

Case 6 shows three peaks with both 25 and 10 years breaks, again with a central main peak, a second peak of recent items, close to the *tpq*, and a third small peak of curated objects. Again the graph with 50 years breaks shows a sub-normal distribution.

The last case presented shows unimodal distributions with 25 and 50 years breaks, whereas with 10 years intervals the curve gets bimodal, with a main peak on the left and a slightly smaller peak on the right (more recent items). In this case false residuality is very low (note this is a kitchen).

The maximum time span covered by the examined assemblages is 139 years and the minimum is 25 years, with most of them ranging between 40 and 100 years. The *tpq*, in the presented cases, is never earlier than 5 years in relation to the deposit formation moment.

General conclusions

From what observed some provisional conclusions can be drawn.

1. When plotted in 50 years breaks graphs, these hypothetical primary deposits assemblages display a unimodal distribution approaching a normal one;
2. The main peak of evidence usually predate the *terminus post quem* (25-50 years)[409];
3. The terminus *post quem* is very close to the 'actual' date of deposit formation;
4. Some patterning seems to emerge, according to the sketch outlined below.

[409] In 6 cases out of 7. The only case in which they correspond is Case 1 (it is noteworthy that only 47 items where available for computing and that the room had been recently occupied).

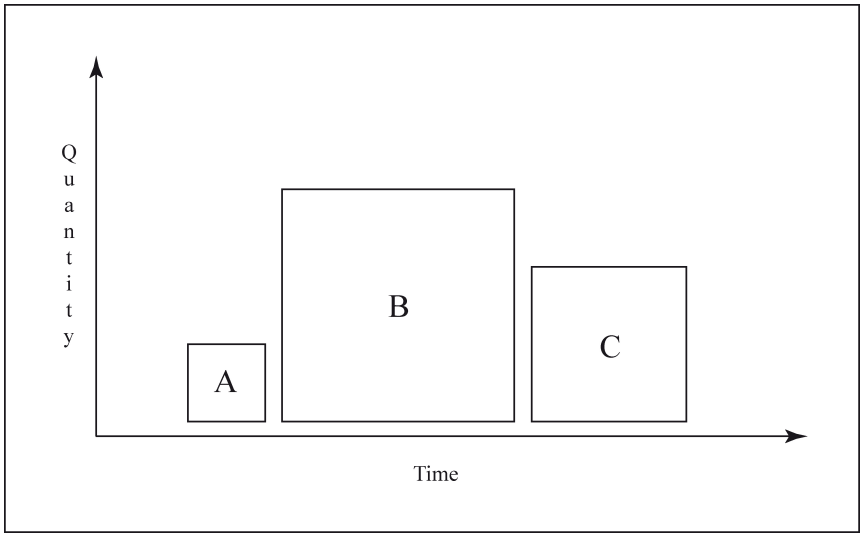


fig. 60 *- Sketch of the chronological patterning of a living assemblage according to the observations made.*

The three groups highlighted lead back to three main sources:

A: inherited/family objects (heirlooms), possibly moved from one generation to another. Also collected 'vintage' items find the same place;

B: main body of evidence, often linked to marriage, move, inheritance or important events in the household life;

C: items with higher replacement rate, possibly of daily use.

Discussion: archaeological relevance

Although the sample is still far from being sufficient, at least some improvable tools have been established for understanding the chronological patterning in primary deposits assemblages.

For drawing solid dating evidence, the number of materials recovered has to be sufficient and a minimum number of 50-60 finds, at first sight, seem to be recommendable. It has also to be stressed that a higher degree of fragility for ancient items may have led to narrower profiles. The quality of the data is important too: to get a clear appreciacion of some patterning, the presence of several finds dated within 25 years or less seems necessary (and everyone knows how hard it is).

Given this premise, some useful indications seem to emerge:

1. primary deposits assemblages, when plotted in 50 years breaks graphs, should display a unimodal distribution approaching a normal one. Of course some forms of residuality of anomalous false residuality may occurr;

2. the *tpq* should postdate the main peak or, at most, be consistent with it;

3. when dating primary deposits, a date very close to the *tpq* seems to be very likely, say within the span of the find providing the *tpq* or slighly later;

4. dating within the main peak, thus considering, for instance, a later *tpq* due to intrusions, may lead to too old dates. On the contrary finds too younger than the main peak, say more than 50 years, should be handled with suspicion or the nature of the deposit itself should be re-discussed;

5. in case the quality of the data was high and the 'three groups pattern' was detected, similar explanations may be advanced. Samian ware for instance may well play the role of group B, while coarse ware (unfortunately the most broadly dated) may play the role of group C. Particularly valuable items may be expected in group A.

Concluding it is worth repeating that what observed is some tendencies in a small sample of today's case studies and the indications proposed are far from being laws. What they are meant for are interpretive tools which must be consistent, first of all, with the archaeological evidence.

III.6.2 Experimental archaeology

Experimental archaeology represents a wide and independent field within the brader limits of archaeology. Again, as in the case of ethnoarchaeology, a complete approach to the matter is impossible in this work, so I will focus on some peculiar points which appear more closely connected with the practice of dating.

As a whole, the discipline has manufacturing as its preferential target[410] and pre-proto history as its more common temporal reference area. Again, Classical archaeology displayed, unfortunately, insufficient attention to this branch.

At least five main types of experiments are usually carried out[411]:

1. construction (constructing -and destroying- buildings)[412];

2. processes and function experiments (for instance which was one tool or building function and how it was employed);

[410] Bell 1996b, pp. 244-245
[411] Reynolds 1999. Summed up in Outram 2008, p. 3
[412] See Coles 2008, pp. 49-62

3. simulation (of formation processes, included post depositional ones);

4. eventuality trial (complex experiments with more variables combined each other, for instance land productivity);

5. technological innovation (for instance the testing of non invasive techniques over a simulated archaeological site).

I will focus on the third aspect, but it has to be stressed that point 1 experiments, *i.e.* dealing with construction/destruction, are often carried out for Bronze/Iron Age and Medieval buildings, but much more rarely for Classical ones. These experiments, if properly oriented, could provide useful fresh data also in the field of deposits recognition, patterning and dating.

As said, point 3 includes those experiments which seem more promising for studying formation processes and dating; within this group I focus on three main contributions that experimental archaeology brings to the practice of dating deposits:

1. the effects of trampling[413] and its implications in chronological patterning;

2. the effect of (post)depositional processes in the dispersal of materials, thus influencing residuality and dating;

3. the effects of transport and building activities over ceramics breakage rates.

Point 1, at first sight, may appear after all quite marginal. Moreover, although tackled experimentally, practical conclusions for field and post excavation activity do not seem to have been drawn. Nonetheless it is an aspect which can have important fallouts in dating one of the most controversial and at the same time one of the most important types of deposits commonly present within an urban classical (and obviously non classical) stratification, that is an earthen floor. Of course trampling, as a more or less substantial mean of artefacts displacement, may play an important role not just in chronological patterning, but also in functional/spatial analyses.

An earthen floor basically consitsts in a more or less thick layer of sediment, laid down in a certain space, on whose top some human activity occurs[414]. It is, in itself, a secondary deposit from every point of view, as the finds possibly embedded in the sediment

[413] For a general overview and additional references see SCHIFFER 1996, pp. 126-129

[414] For a geoarchaeological approach and for more references see GOLDBERG, MACPHAIL 2006, pp. 258-264. Curiously behavioural archaeologists did not pay much attention on what is *inside* floors, focusing more on what happens on their surfaces. A typical structure life history is indeed usually seen as a sum of abitation, abandonement and post-abandonement processes, thus laying aside the construction process (LAMOTTA, SCHIFFER 1999, p. 20), *i.e.* the ones which bring most of the materials *within* the structures.

do not inform us neither of the activities carried out on its top, nor of when these activities took place. Nonetheless two other main streams can bring materials into the floor:

a) the intentional addition of some artefacts or ecofacts (say sherds or charcoal), in order to improve some physical characteristics of the layer, such as its drainage property or its compactness;

b) the unintentional insertion of finds, usually small, due to trampling and its interaction with clearance activities.

These factors lead to a mix of materials of different origins and carrying different information, more or less valuable. For instance artefacts intentionally added may eventually suggest *ad quem* dating for the construction of the floor and trampled artefacts may inform us of the activities carried out on the surface and of their dating. The critical point consits, of course, in recognizing the three groups (supposed it is possible).

Focusing on trampling, it is obvious that it implies the insertion of artefacts or ecofacts within the underlying floor only if the last one has some penetrability, thus, worthless saying, other kinds of floors (concrete, mosaics etc.) do not suffer any impact. Instead, the consequences of trampling on sediments have been tested experimentally with very interesting results.

Different kind of sediments, with different textures and both in dry and wet conditions, have been tested. If on the one hand horizontal displacement does not seem to affect our dating practices, on the other one vertical displacement can play an important role, bringing artefacts from being on the surface to being embedded within the sediment.

It has been clearly demonstrated that vertical displacement affects only the upper part of the sediment, a loose top sediment formed by trampling, and does not affect the hard-packed bottom one. The top layer indeed embeds the vast majority of the trampled artefacts and according to its texture it is not thicker than 3 cm, usually measuring just 1.5 cm in thickness. In hard packed surfaces (it may well be the case of clay layers) vertical displacement does not exceed 1.5-2 cm[415].

Which helpful practical conclusions can we draw from these data? Given the general mixed nature of this kind of layers and given that, in the field, it may not always be possible to clearly distinguish the top loose sediment from the core (and geoarchaeological or micromorfological support may not always be available), it seem to be reasonable, in any case, to split the observed layer into two different contexts, a first one for the top 2-3 cm of

[415] NIELSEN 1991 (see also for further references). See GIFFORD-GONZALEZ *ET ALII* 1985 for soft sediments. See also FONTANA, BAGOLAN 1992, p. 326

sediment and a second one for the bottom layer. This makes sense from a formative perspective (different agents involved) and from a chronological one as well, as it may lead to an easier and safer distinction between the possibly present primary refuse and the materials carried with the sediment. More or less slight differences in the chronological patterns observed for the two contexts may eventually corroborate the model proposed.

Finally, although probably very close, a more solid *tpq* may be proposed for the layer construction, while some *ad quem* dating may be supposed for the activities which took place on the layer surface and, thus some *terminus ante quem* for the layout of the floor.

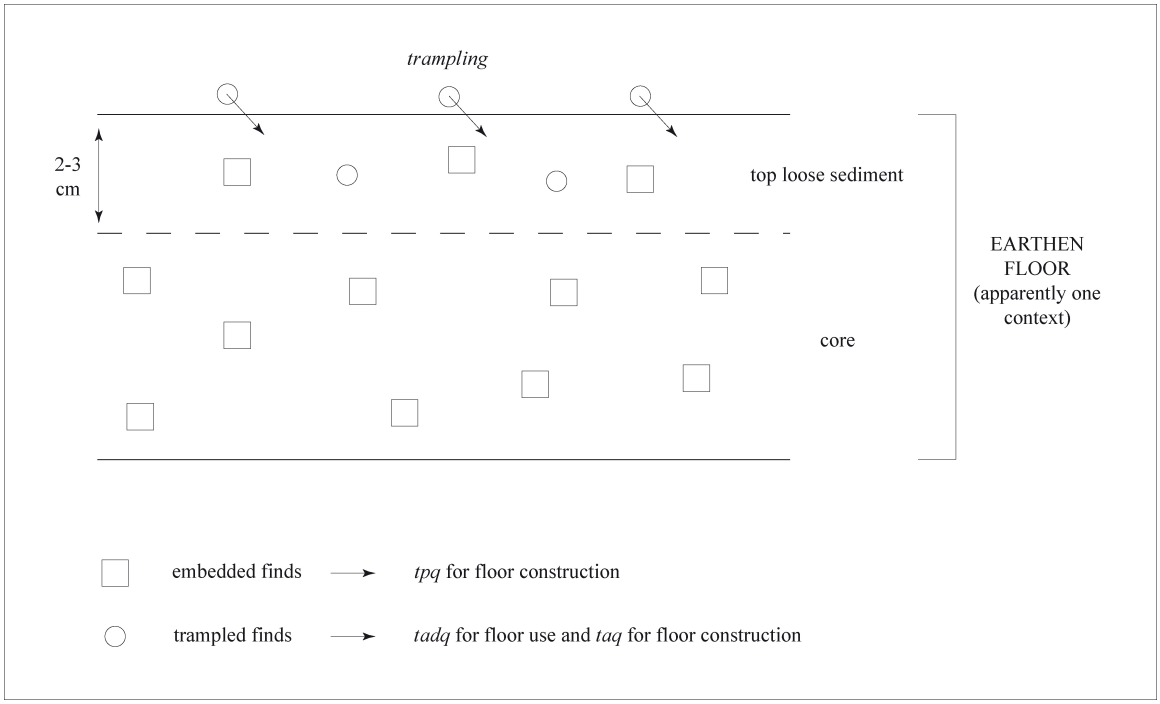


fig. 61 *- Trampling and earthen floors*

Of course this very articulated and subtle patterning may be detected only if the findes embedded within the sediment employed for the earthen floor are substantially older than the trampled finds.

Four variations to this scheme may also occurr. In one case we may suppose that the original sediment was well selected and findsless. In this case most finds should be concentrated within the top context, thus the partition proposed may turn out to be helpful again, also allowing the employment of the upper finds for *ad quem* dating of the activity carried on in the space investigated and providing a *terminus ante quem* for the floor construction (presumably quite close to the actual moment of construction).

In another case no clear distinctions in artefacts patterning may be due to the absence of trampled material. This case may be verified only in case of extremely well dated (and globally examined) materials and it seems to me to be unlikely. Nonetheless, for being verified, this case requires the partition too.

A third case arises if the earthen floor is thinner than 3(/4) cm. In this event, finds origin may be speculated only through a clear chronological patterning.

A last case (sadly, I guess, the most common) may show no evident chronological or vertical patterning, probably due to insufficient dating precision of the single finds. Again, in this case, some suggestions may come from the observation of the global chronological spectrum. Nonetheless no clear indications may come by this means or by the observation of the physical state of the finds, thus the whole assemblage or just one part may intdicate a *tpq*, a *taq* or a *tadq*. For sure in this case any spatial/functional analyses should be put aside and the final dating should be left to the overall chronological framework, and, of course, particularly to the contexts stratigraphically closer.

One second field in which experimental archaeology can provide some very interesting insights is the one of depositional and post-depositional processes, involving both sediments and materials (point 2). These can, obviously, have important repercussions on dating.

One of the most ambitious and fruitful works in this sense is doubtless the Experimental earthwork project[416], which provided data for many fields of investigation, particularly concerning materials deterioration and micromorphological aspects. Two main earthworks were built in 1960 at Overton Down and in 1963 at Wareham, both made of a bank and a ditch in which different types of artefacts and ecofacts were buried. Many excavations were scheduled during the following years (the last are yet to come), in order to check the transformations occurred. I will focus on a few aspects of main interest.

[416] BELL ET ALII 1996

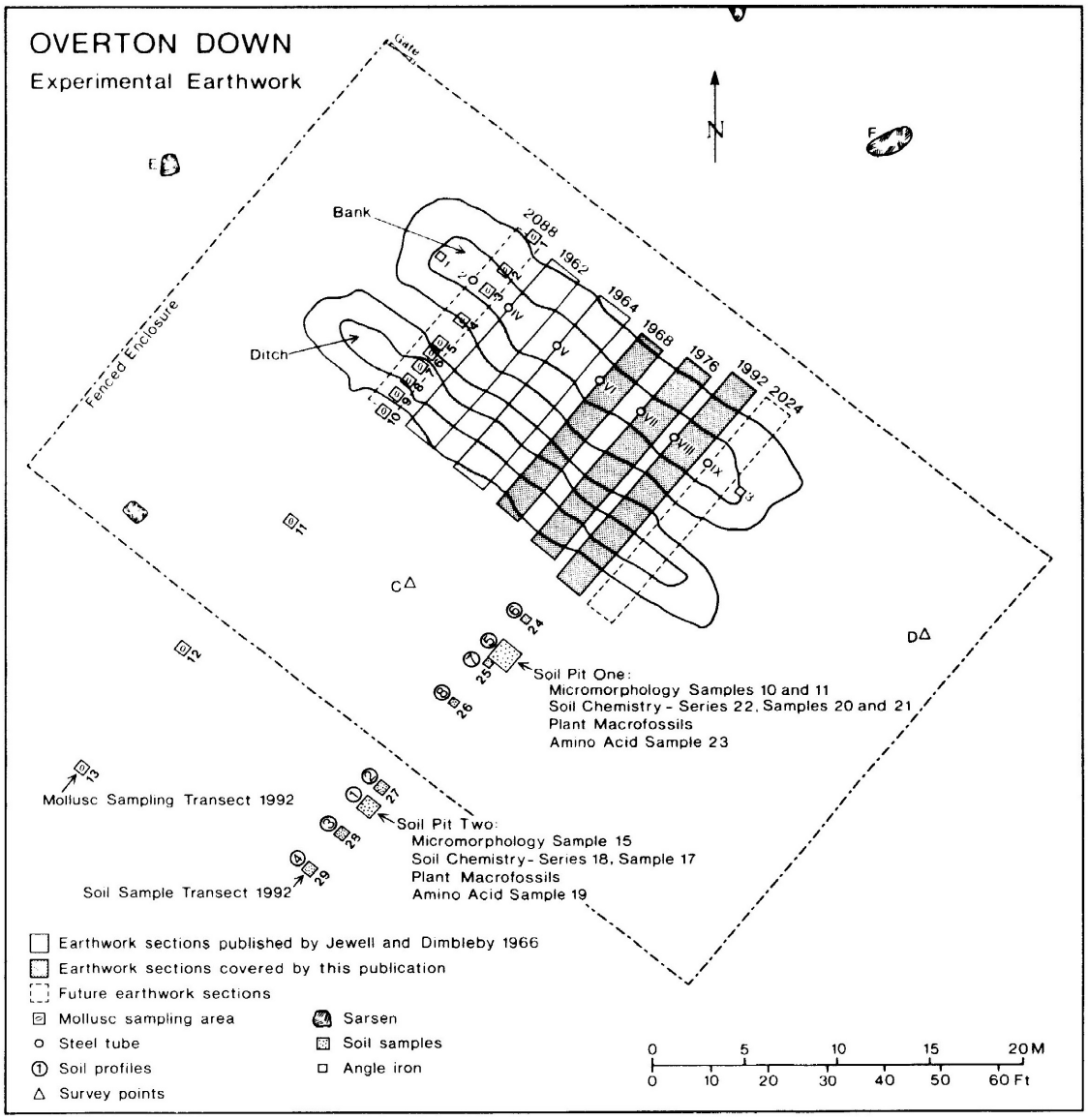


fig. 62 - The Overton Down earthwork. From BELL ET ALII *1996*

One first important body of data concerns the movement of sediments and materials[417] and the formation of the so called "primary fills", *i.e.* a particular class of deposits, usually the first to accumulate in the bottom of a ditch or pit once it has been dug.

These deposits are produced mainly by natural agents (water, wind, gravity) which, of course, may in turn have scratched both anthropogenig or natural deposits, thus moving the materials possibly buried. These deposits should of course be considered as secondary ones, nonetheless "archaeologically it is generally accepted that any artefacts in the primary fill of a feature date to approximately the time of its construction or earlier[418]".

[417] FOWLER *ET ALII* 1996, pp. 45-50
[418] DARVILL 2008, p. 365

The earthwork experiment showed clearly how these fills are formed and how materials may get embedded within the sediment. Most of the materials may well be residuals coming from the bank or from the eroded sides of the ditch, while the possibility of later intrusions seems to be considerable, thus meaning that the actual informative dating potential of these kind of deposits is quite low[419].

Another aspect of interest concerns the *duration* of the process of filling and of the simultaneous process of erosion involving the sides of the ditch (and the bank)[420], thus helping detect abrupto backfills and allowing at least a rough evaluation of how long a given negative feature has been exposed. Although these data are not closely connected with dating, an evaluation of the duration of the processes studied surely contribute to the global chronological framework.

[419] BELL 1996a, p. 79, BELL 1996b, p. 234
[420] BELL 1996b, pp. 230-237

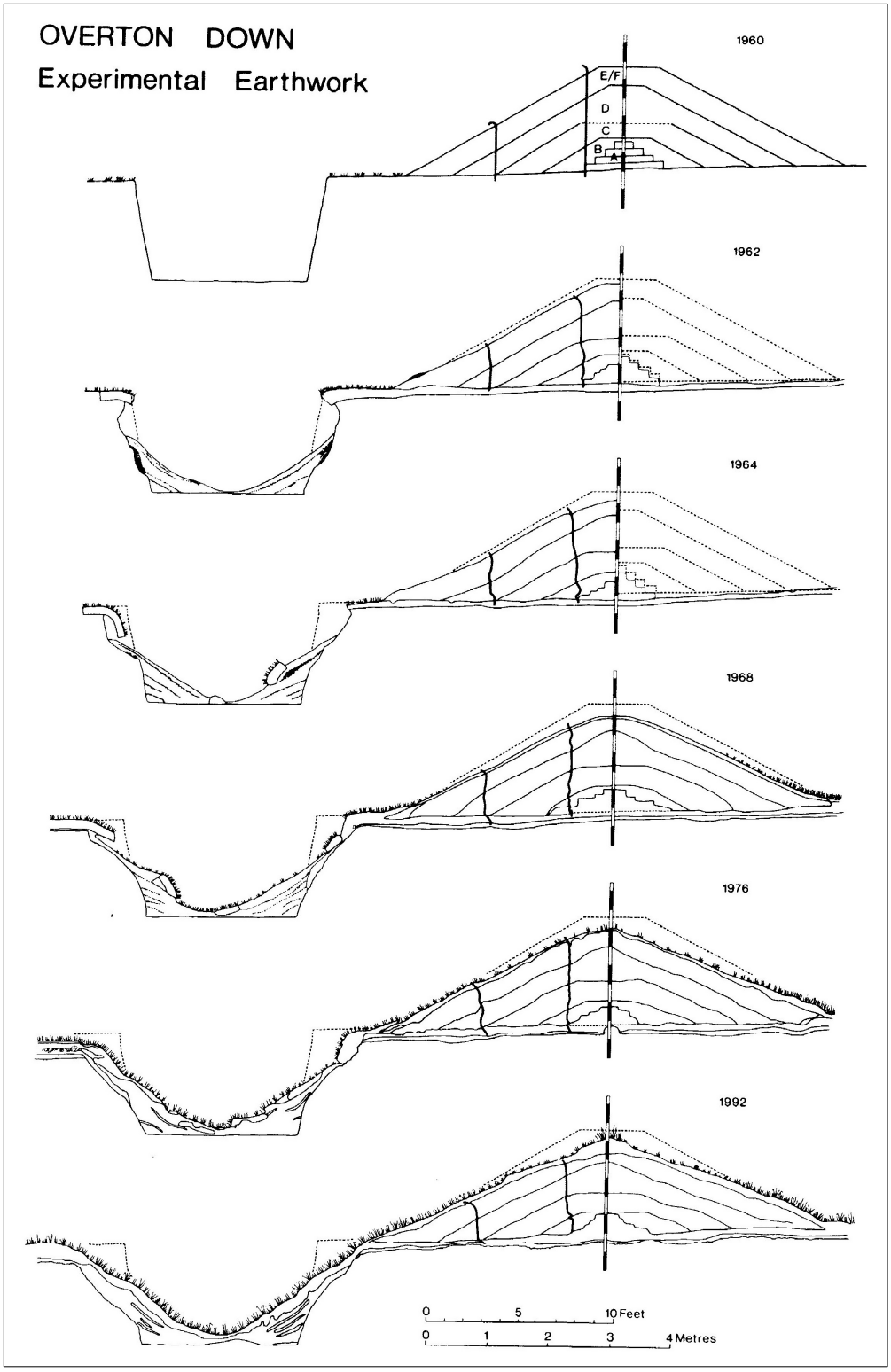


fig. 63 - The Overton Down earthwork. Section showing its changing profile between 1960 and 1992. From BELL ET ALII 1996

One last interesting body of data concerns post depositional activities (mainly biological) and their impact on the movement of artefacts. The topic of intrusions crosses the whole practice of dating (see Chapters II.2.9 and III.3) and in has to be tackled also a

priori, through a general environmental evaluation and a more specific archaeological one. Moles and earthworms activity in particular has a very different impact according to the environment, with effects ranging from negligible to substantial[421] for artefacts disposal.

The earthwork project provided also some data on wear and weathering, affecting mainly surface materials; nonetheless the topic of the physical state of materials can be tackled also through other experimental approaches. This is the case of ceramics breakage rates (point 3). This example is discussed in Chapter III.5.1, (recycling and fragmentation) therefore it has not to be fully explained here. It is just worth repeating that fragmentation is usually employed as a co-tool for labelling primary or secondary deposits, then directly affecting archaeological dating techniques of deposits. It is therefore important to fully understand breakage dynamics and experimental archaeology in this field may represent a good means of investigation. Experiments much more sophisticated than the attempted one could be set for checking the impact of redeposition and transport over ceramic breakage, providing a useful comparative body of data. For instance, recording chrono-profiles of *ad hoc* laid deposits may represent one useful approach, as much as veryfing the actual consequences of the intentional addition of some materials (ceramics, carbons) to sediments in order to enhance their physical features. Construction and destruction of structures could also provide interesting insights about abandonement deposits.

Concluding, in this brief paragraph I tried to sketch some contributions that experimental archaeology, maybe the discipline more neglected by classical archaeology, can bring to the cause of dating deposits. It is also clear that there is potential for this field of investigation to be heightened and sharpened, thus better contributing to dating and to formation processes studies in general.

III.6.3 Literary sources

A good availability of literary sources represents one the main strenghts of classical archaeology and it sensibily discriminate it from the archaeology of other periods. It is worthless adding that literary sources have been employed in several ways for interpreting, supporting or rejecting archaeological data *stricto sensu*. They represent, together with epigraphic sources, an obvious and largely employed tool for direct dating. They are useful for dating the construction of many public buildings and often even deposits linked with

[421] Fowler, Swanton 1996, p. 10, Fowler *et alii* 1996, p. 47, Bell 1996b, pp. 236-237

episodes of destruction, earthquakes, fire and so on can be quite easily attributed to a precise date thanks to this kind of data. Nonetheless, again, they have been rarely used as a tool for interpreting some formation processes (mainly depositional and pre-depositional) and least of all for drawing chronological conclusions.

Besides this general tendency, some fruitful indications can be picked up, although, again, the topic should be much more developed in the future.

One important use of literature data has been presented in Chapter III.5.1, were references are provided; in this case literary and juridical sources have been employed to model the (pre)depositional processes of reuse, recycling and disposal which affect the characteristics of the record in Roman urban sites.

Sometimes literary sources can corroborate ethnoarchaeological observations: that is the case of the earthen structures examined above. Their extraordinary longevity is stated also by Pliny the Elder ("*Quid? Non in Africa Hispaniaque e terra parietes, quos appellant formaceos, quoniam in forma circumdatis utrimque tabulis inferciuntur verius quam struuntur, aevis durant, incorrupti imbribus, ventis, ignibus omnique caemento firmiores? Spectat etiam nunc speculas Hannibalis Hispania terrenasque turres iugis montium impositas.*[422]") who also suggests the existence of standing structures more than 200 years old.

Another field in which literary sources can provide interesting insights is the use of some materials in construction practices[423]. Besides the case of *testae*, already mentioned when dealing with recycling and mentioned also in Cato[424], Varro[425], Columella[426], Pliny[427] and Palladius[428], the case of carbons can be addressed too. Their intentional insertion in some particular contexts can make them indeed very informative. This practice is mentioned in particular by Vitruvius, who prescribes their use when the soil is especially moist and soft[429]. He also mentions a particular type of floor, the so called *graecanicum*, in which a certain amount of carbons and ashes is added in order to improve its ability to absorb liquids[430]. Although archaeological attestations of such a kind of floor are, in Italy at least, quite poor, the intentional use of carbons for floor beddings[431] and also in mortars[432] is well known.

[422] *NH, 35, 48*
[423] See GRECO 2011
[424] *De agric., 18, 7*
[425] *De re rust., 3, 11, 2*
[426] *Ars Agriculturae, 1, 6, 13*
[427] *NH, 35, 165, NH, 36, 175-176, 186*
[428] *Opus Agriculturae, 1, 10, 3* e *1, 40, 1*
[429] *Vitr., 3, 4, 2* e *5, 12, 6*
[430] *Vitr., 7, 4, 5.* Similarly *NH, 36, 63.*
[431] See for instance Chapter IV.3.10 and the case study therein presented

This intentional insertion of materials has great importance in dating some contexts or deposits which may be defined as mixed, that is with possibly both a primary and a secondary component (see Chapter IV.5), and in determining the primary status of other particular deposits (see Chapter IV.7). The insertion of freshly crushed pottery is discussed in Chapter III.5.3; in the matter of carbons a similar model can be proposed, but some peculiarities emerge.

Intentional insertion implies the use of systemic wood (whatever the function carried on) much more likely than archaeological wood, thus leading to the possibility of gaining some *ad quem* dating. Intentionality nevertheless has to be somehow motivated, not just by a generic use of classical literature, but also through a serious challenge of the archaeological record, especially using criteria of quantity and selection of finds (see again Chapter III.5.3). A chrono-profile can provide a useful aid for investigating intentionality and also for tackling the next step, that is dealing with the old wood effect caused by the use of false residual wood or by having sampled internal rings. Homogeneity in radiocarbon dates would suggest a low old wood effect while scattered dates would suggest a more patterned and complex scenario, thus imposing a very cautious approach to any *ad quem* dating. Archaeobotanical observations in this case are also fundamental: the presence of small well recognisable logs dramatically lower the effect produced by both the sampling of internal rings and the use of old wood, leading evantually to the craved *ad quem* dating.

In this case the combination of knowlege drawn from literary sources and from archaeological, archaeometric and quantitative analyses is fundamental and can eventually provide very strong indications.

III.6.4 Conclusions

What emerges clearly from this brief review of other sources of information for dating, besides their single value, is indeed the clear necessity of combining them with other sources of data in order to compose a model as much as possible organic and reliable for explaining how finds entered the studied deposit and how to date it. The usefulness of this approach has been demonstrated for some type of deposits:

- earthen walls and deposits generated from their demolition;
- masonry walls;

[432] See for instance Bonetto, Novello 2000, pp. 186-187 and Martinelli 2009

- deposits produced by episodes of abandonement/reuse within standing buildings;
- "pompeii premise" deposits;
- earthen floors;
- ditch "primary" infillings (actually secondary);
- some types of "solid" floors;
- deposits intentionally made up completely or partially of carbons.

Other more transverse information concern:

- the exposure duration of some interfaces;
- the usefullness or not of fragmentation as a marker between primary and secondary deposits.

Just quickly browsing the list, it is easy to appreciate how the contribute of the sources of data cited is substantial and it is possible to perceive how it could be even greater.

Part IV

Analysis

❖ The arrangement ❖
(a typology for deposits?)

IV.1.1 Why a typology?

One first question which may arise when reading this paper is "why is it necessary to create a sort of typology of archaeological deposits for dating them?". That of course is not just because typology is one of archaeologists' favourite sports. The reason lies in the fact that according to the nature of the deposit investigated the way of dating it changes. Thus, it seems convenient to group the deposits according to the way we can date them, *i.e.*, just to begin, according to a first coarse distinction between deposits that can be dated *ad quem* and deposits which can be dated merely through a *terminus post quem*. This is a very practical necessity for every field archaeologist.

Creating a typology is fundamental not only for practical reasons, but (more importantly) also because, by compelling to insert the handled case study within a precise frame, it forces to discuss the nature of the deposit itself and the way it can be dated, hopefully avoiding any mechanical approach.

The typology created can be used then as a sort of comparative device, which can also be used to help explain some phenomena observed in a precise case study. Of course every single deposit has its own peculiarities and its own story, but through coherent analogy (see Chapter II.2.11) it can be approached to one of the proposed sub-categories and consequently it can be more effectively understood and dated.

IV.1.2 What is in and what is out

As observed in the introductory chapter, the field in which the game of dating is played, in this work, is the field of classical towns. Thus the typology proposed concerns the most common urban classical deposits. Of course it does not comprehend every kind of deposit and it may well be expanded in the future (see below).

Some types of deposits are not taken into accout by deliberate choice, because of their peculiarities or because, within the panorama offered by an ancient urban environment, they can be considered quite exceptional: the main exceptions are tombs, votive offerings,

shipwreks and coin hoards among the primary deposits and every deposit clearly predominantly produced by natural agents (alluvium, colluvium etc.) among the secondary ones. Indeed, soils (and re-deposited soils) , are also not taken into account, due to their very peculiar formation processes, which would with no doubt deserve a much detailed comprehension, certainly out of the range of the present work. Dark earths are still the object of some debate concerning their formation processes and their nature seems to vary from case to case (see Chapter III.5.4). Moreover it has been ascertained that bioturbation plays an important role in their formation, thus, again, I decided to keep them out of the arrangement proposed.

Conversely, I decided to deal with another very peculiar type of deposit in which the main agent of deposition, *stricto sensu*, is natural, but which is very common and characteristic of urban environments, that is the filling of a drain. As I will examine later, except the case of deliberate backfilling, these deposits are a peculiar type of primary ones.

Besides these exceptions, the deposits arranged in the sort of typology proposed are the most common results of the actions of building, destruction or everyday life which populate an ancient urban environment. Of course many specific case studies handled everyday in any given excavation may turn out impossible to be labeled and precisely placed within the framework proposed, I think mainly because their specific nature is detectable with difficulty and/or because they have witnessed heavy post depositional changes. These will deserve a case by case evaluation, in order to decide if they can provide at least a reliable *terminus post quem* or if it is even better to discard the data they provide for not biasing the overall chronological framework.

IV.1.3 Criteria

The crucial point in ordering a set of things is represented by the criteria employed. The aim of this sort of typology is grouping deposits according to the possibility of dating them in a way or in another one. Time is of course the key point. If one would like to group deposits according to their possibility of providing spatial or functional information, the resulting grid would be obviously different. Of course time, although being the prevalent criterion, is not the only one: the typology that is proposed is arranged around three main successive filters, the first being theoretical, while the second may be defined as qualitative and the third may well be called formative. In the first two filters, time plays of course the major role in defining categories. But in the third one more components are taken into

account in order to answer the basic question linked with dating deposits through assemblages, i.e. 'how did the materials entered the deposit?'.

The path can then be followed starting from the more general filter of from the more specific one, according respectively to a deductive or to an inductive approach.

The theoretical filter

One first coarse distinction has to be made between what can be dated *ad quem* and what can be dated only with a *terminus post quem*, that is a distinction between primary and secondary deposits operated according to what has been exposed in the first part (see Chapter II.2.4). It is worth recalling briefly the two definitions proposed:

- primary deposit: a deposit whose assemblage largely belongs to the same systemic context in which the deposit was formed;
- secondary deposit: a deposit whose assemblage largely or completely belongs to a systemic context previous to the one in which the deposit was formed.

One of the clear consequences of what stated consist of the fact that the former can be dated more or less precisely *ad quem*, while the latter can be dated merely by a *tpq*.

Between the two extremes it turned out useful the insertion of a third type of deposits which I called mixed and that cannot considered primary but may lead to some *ad quem* dating: I label with this term those deposits which contain conspicuous amounts of residuals but which also clearly contain systemic materials, which were deliberately (see Chapter III.5.3) or incidentaly embedded within the deposit. It is worth anticipating a quick example in order to make this point clear. Mixed deposits may be considered, for instance, those sediments which were redeposited, along with the materials embedded, for building activities and which were intentionally mixed with freshly discarded sherds for increasing the resulting hydraulic/mechanical characteristics. It may also be the case of redeposited materials in which some systemic items were accidentally embedded (obviously the casual loss of such an item has to be, if not proved, at least be the most probable event).

Finally I considered useful adding a sort of box for containing all those deposits which require a case by case evaluation, and which may turn out to be primary or secondary only once properly investigated.

One may ask where it should be placed the use of the *terminus ante quem* (see Chapter II.2.8). Besides the use of historical or epigraphic data, which are not strictly matter of discussion, a *terminus ante quem* for more ancient layers can be provided only by those

deposits whose primary nature has been firmly established; thus the use of this chronological indicator, when dealing with assemblages, can be considered a second step, following the necessary distinction between what is primary and what is not. It is worth recall that a terminus ante quem for an underlying deposit should be provided by the more recent possible date of deposition of the upper primary deposit: for instance a primary deposit firmly dated AD 140-190, provides the *terminus ante quem* (or *terminus post quem non*) of AD 190 for the underlying deposits. That is because it is assumed that whithin the range AD 140-190 the primary deposit could effectively have formed in AD 190 , being the previous layers, say, dated to AD 150.

The qualitative filter

The first distinctions proposed are still too vague for allowing to label a given deposit in a way or another; nonetheless, before moving to the filter I called formative, another step is necessary.

The deposit could have formed in lapse of time more or less long which, according to the accuracy of our ability of measuring time (see Chapter II.2.7), may be considered abrupt or continuous. That means that we may be able to distinguish the date in which deposition began and the date in which the deposition ended or, conversely, we may not. For instance, a rubbish pit, filled probably in a month or a year, could be dated *ad quem* AD 230-300 (its assemblage mirrors what was circulating in the period in which it was filled); conversely a big urban dump, which remained in use for long, may be dated AD 200-250 / AD 370-390 or, should the materials embedded particularly well dated and/or the overall chronological framework particularly favourable, say AD 232 / AD 371. In this the embedded materials mirror a longer systemic context or, in other words, the materials circulating over a longer time span, which is the same in which the dump was formed.

Thus, before proceeding to the formative filter, I considered useful to introduce this further subdivision which, of course can be applied ot primary deposits only. This does not mean that, theoretically, secondary deposits could not have formed in long time windows; the point is that we cannot know as their own nature allow us to date them merely through a *tpq*, because their assemblage mirrors one or more systemic contexts which predated the formation of the deposit itself.

The formative filter

This is probably the most important one, as it should allow the insertion of a given deposit within one precise category. In this case, time is not he only parameter taken into account as what is important is how the assemblage was formed and how it got embedded within the deposit. In order to attribute the specific case study to one type or to another, at this level, all the tools described in Part III (method) make the scene.

It is worth to quickly recall them; besides the information gainable from the general archaeological background, summing up they are:

- the possible application of scientific techniques;
- the evaluation of the presence of intrusions;
- a quantitative approach to the assemblage;
- a qualitative approach to the assemblage and the evaluation of intentional insertions;
- a qualitative approach to the deposit as a whole;
- the use of analogy with ethnoarchaeological or experimental cases;
- the use of information obtained from every useful source, particularly literary.

Each type represents the archaeological result, with its own characteristics, of a coherent group of actions which distinguish it from the other types and correspond to a precise formative model (see Chapter II.2.13).

The actions producing each type of deposit are specific but recurrent in human life, such as building, dumping, removing something valuable or lighting up a fire.

If on the one hand the way in which they are distinguished from each other is formative, the way in which they are grouped responds to th criteria adopted for the first and second filter according mainly to a temporal parameter.

IV.1.4 The scheme proposed

Below it is proposed the scheme resulting from the proposed arrangement of deposits. On the first row, (theoretical filter) macro-types are arranged from the more informative to the less, in terms of dating.

For the sake of simplicity a code was given to each type of deposit, just in order to make it easier to be located and/or identified.

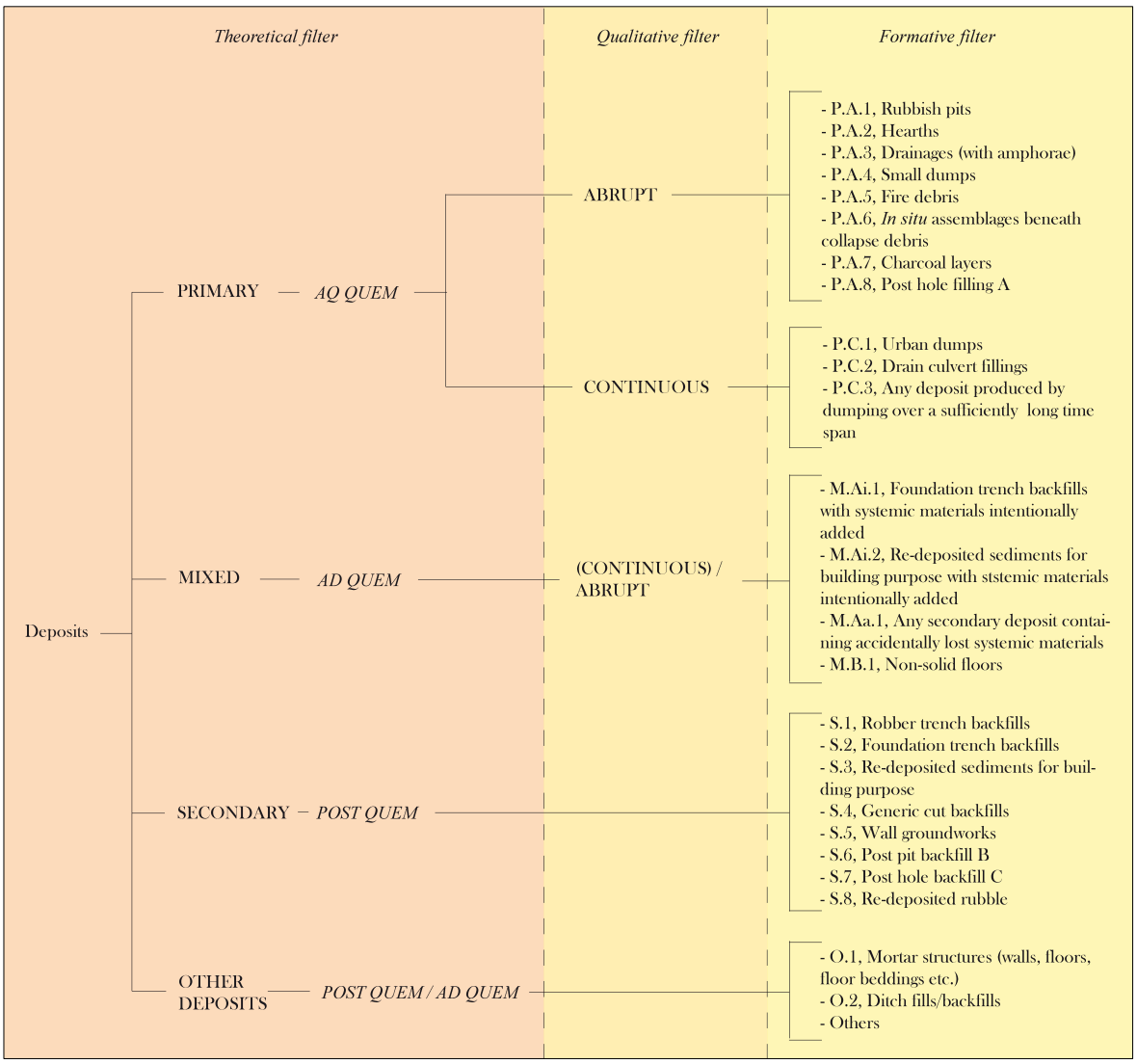


***fig. 64** - A typology for deposits*

IV.1.5 Implementability

Certainly the types proposed do not cover any kind of deposit which could be ever investigated and the arrangement focuses on the most common deposits in every excavation. It follows that the list proposed could be quite easily widened or types could be further split in more specific sub-types. Nonetheless creating too specific types may easily turn out to be quite unproductive or could fit just a very small number of deposits. Thus, the eventual implementation of the typology should be, I think, more vertical than horizontal. Hopefully in the next future it will be possible to further develop the typology and to provide a much larger number of specific case studies for useful comparisons.

❖ THE MAIN SITES ❖

IV.2.1 INTRODUCTION

For the sake of simplicity, it is below presented a brief introductory overview of the three main sites which provide the major part of the case studies discussed up ahead. The choice of these three sites responds primarily to the necessity of accessing as directly as possible to the body of data required and, if necessary, to quickly gain further information. In the light of that, I focused on sites in which me and the research team I am part of had carried out researches and excavations in the last few years. In this sense, the choice has somehow also been forced by the shortage of fully published excavations discussed in Chapter I.2.7. Finally, in each case I had already gained much more confidence with the general archaeological and historical background, thus I could start from solid bases.

Of course the cases provided by the three sites do not cover any possible type of deposit in which I decided to branch the huge and heterogeneous galaxy of urban stratigraphies. Thus, for the main exceptions, and when it seemed appropriate, I also drew upon literature examples. It has to be aknowledged that although I picked up sites for which I may access large part of the post excavation documents, some data remain substantially unavailable simply because they were not gathered. This has not to be judged too severely, as what we did not record years ago is routinely recorded today, thus I prefer to stress the positive evolution towards better methods that is possible to observe now.

It has also to be stressed that the three selected sites correspond to three ancient cities, but nowadays they cannot be considered cities. Nora (Sardinia) has been almost entirely abandoned during the early Medieval Age and is now included within an archaeological park. Gortyna (Crete) has witnessed a similar fate, but it is now largely buried beneath olive groves, while just a small part of the ancient city is occupied by the contemporary villages of Mitropolis and Aghioi Deka. Aquileia, one of the largest cities of the Roman Empire, although not completely abandoned, continued its life in smaller forms and it is nowadays a small town with a population of about 3400 people. Among the three sites, only Aquileia displays some of the problems and features which are typical of urban archaeology understood as the archaeology in today's cities.

IV.2.2 AQUILEIA[433]

The place in which the future colony of Aquileia will be founded is strategically located at the bottom of the Adriatic Gulf, where the ethnic groups of *Veneti* and *Histri* border on. Few archaeological data attest the presence, approximately where the colony will be established, of a late Iron Age settlement[434], but its nature and extention are, to date, unknown.

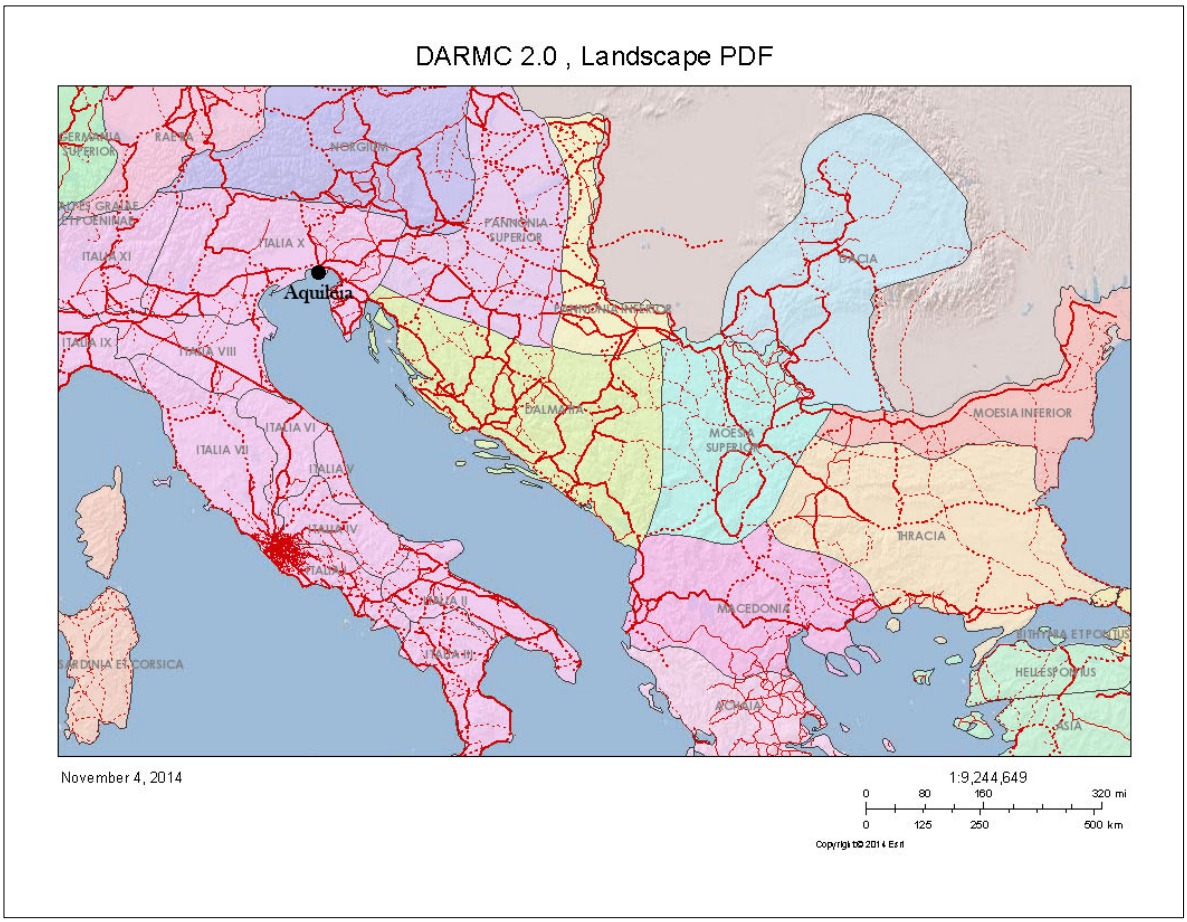


fig. 65 *- Aquileia within the context of the Roman Empire (c. 117 AD). From the Digital Atlas of Roman and Medieval Civilizations. Modified by the author.*

[433] The most recent and complete historical and archaeological overview of Aquileia is with no doubt GHEDINI *ET ALII* (EDS.) 2009

[434] MASELLI SCOTTI 2009, CHIABÀ 2009, p. 10

Historically, the birth of Aquileia follows the great Roman expansion towards the Po plain, which took place at the turn of the period which Pierre Grimal has named "le siècle des Scipions"[435], just after the end of the second punic war.

The main political and military events of those years, related to the Roman expansion northwards, may be listed as it follows:

– 197 BC: campaigns of the consuls *Q. Minucius Rufus* and *C. Cornelius Cetego* against *Insubres*, *Boii* and *Cenomani*;

– 196 BC: consul *M. Claudius Marcellus* defeats Gallic people near *Comum*;

– 194 BC: consul *L. Valerius Flaccus* defeats *Insubres* and *Boii* near *Mediolanum*;

– 191 BC: consul *P. Cornelius Scipio Nasica* defeats the *Boii*;

– 189 BC: foundation of the Latin colony of *Bononia* and beginning of the realization of the *via Aemilia*, eventually completed in 187 BC;

– 183 BC: constitution of the two Roman colonies of *Parma* and *Placentia*;

– 181 BC: defeath of the people of Liguri.

Within this framework, in 186 BC a Celtic tribe, probably coming from today's Slovenia, crossed the Alps and established an *oppidum* in the Lower Friuli Plain. The people of *Veneti*, traditionally allied with Rome, called for help and the senate sent an embassy which, nonetheles, did not reach any result.

Three years later the consul *M. Claudius Marcellus* was appointed to substantially eliminate the Gallic presence down the Alps and the senate resolved to found a new colony. This was eventually established in 181 BC[436].

The location selected for laying out the settlement was the western bank of a modest meander of the river *Natiso*; the location has indeed important consequences on the geomorphological and hydraulic structure of the city.

The area nowadays reaches a maximum height of about just 4 meters on the sea level, but large parts of the city lies below the sea level; moreover this territory is affected by both bradyseism and eustasy (respectively the lowering of the ground level and the raising of the sea level) with the first one alone yielding a lowering of 0.8-1.4 cm every 10 years[437].

[435] GRIMAL 1953. See also BANDELLI 2001 and BANDELLI 2003 for Rome and the Adriatic in the previous decades.
[436] See BANDELLI 1987, pp. 63-67 for a complete overview of the events which led to the colony foundation
[437] Consorzio di Bonifica Bassa Friulana

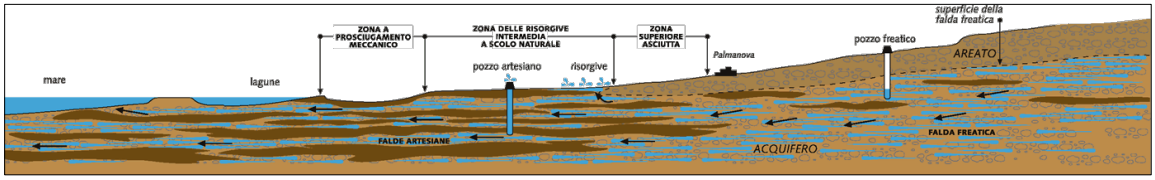


fig. 66 *- Typical cross section of the Lower Friuli Plain (Consorzio di Bonifica Bassa Friulana)*

The ground water table is pretty high, thus making water supply quite easy, but also yielding drainage problems, which, in turn, heavily affect the groundworks necessary for building.

Moving from east to west, thus from the river bank to the lower areas, hydraulic problems are even more pressing and pressing (the western area of the ancient city today is called 'Marignane', a term which evokes the presence of marshes)

The initial layout of the colony is not well known, apart from the possible subdivision of the *intra moenia* space in regular *insulae*, which has been object of many different studies[438]. For some years, life in the city must have been somehow precarious; this pushed the civic authorities to ask for more settlers and a *supplementum* of 1500 families was eventually granted by the senate in 169 BC.

Historically we do not know much of the following years besides the fact that during the *bellum sociale* Aquileia affirmed his alliance with Rome, thus gaining the status of a *municipium optimo iure* in 90 BC.

From the last years of the 1st century BC, the available archaeological data gets more and more substantial, providentially integrating what is known through historical sources. The city, with its forum, markets, theatre and amphitheatre is now a mediterranean metropolis whereas its important river port makes it a cornerstone of the east-west and north-south (iron from *Noricum*) trades of the Empire. Its strategical location makes also the city involved in many political and military events. A Weisenau helmet displayed at the National Museum of Aquileia bears witness of the transit of Vitellio's troops in 69 AD[439], while during the reign of Lucius Verus and Marcus Aurelius Aquileia experiences its first siege, by means of the tribes of Quadi and Marcomanni, and the plague brought by the Roman soldiers.

Nonetheless, the most famous military episode which involved the city is with no doubt the siege of 238 AD, well known mostly thanks to the testimony of Herodianus. In

[438] STRAZZULLA 1989, MEDRI 2000, MEDRI 2004, MUZZIOLI 2004, GHIOTTO n.d
[439] BERTACCHI 1968, columns 39-41, BERTACCHI 1982, pp. 88-89

this occasion, Roman troops loyal to the emperor Maximinus tried to capture the city, which was loyal to the senate; however the strong and the lenght of the defence lead Maximinus' own troops to mutiny and eventually to kill him and his son. Herodianus' lines describe a city (a real market for the goods entering Italy) with a copius population and a farmland with large scale viticulture[440].

With the tetrarchy Aquileia gains an official political endorsement, being the headquarters of the *Venetia et Histria*[441] governor; whereas from 294 AD its own mint start producing its coinage. The fourth century witnesses the raise of christianity, which quickly finds in Aquileia a major focus (see the famous halls built under the aegis of the bishop Theodore). In 340 AD Costanitnus II and Constans confront each other for the supremacy over the *pars occidentis* in the city territory; the town itself is involved in another dinastic issue about 20 years later, when Julian siege the newly built city walls (361 AD). This time the city surrenders only after having learnt of the death of the legitimate emperor.

In general, although the fourth century witnesses the raise of the city of Ravenna, the prestige of Aquileia is still very high; indeed in this century archaeological data testify a widespread restoration of public and private buildings, along with new constructions.

Nonetheless, the fifth century has substantially different hues: in 425 AD Aquileia is involved in another dinastic conflict, which culminates in the decapitation of Joannes Primicerius in the circus. But the most dramatic event of the city takes place about 30 years later; in 452 AD the city faces for the upteenth time a siege: this time, after three months of resistance, the city is eventually seized by Attila's Huns. This episode still produces an active archaeological and historical debate about its consequences: for a long time the event has been connected with the end of urban life in Aquileia. More recent excavations and the re-examination of previous data led to a more balanced view: if on the one hand it is aknowledged the destructive and destabilising impact of Attila's passage, on the other one traces of continuity of urban life are also tracked in both the archaeological and historical record.

In any way Aquileia slowly disappears from the written records of the following years: the Rise of Ravenna and the fragmentation of the Empire itself surely contributed to the crisis of a town which had made Mediterranean trades its strenght. Land routes also seem to have changed, with the northern ones now preferred to the low ones. The bizantine presence seems to be marked by a new circuit of walls characterized by deep salients, but the

[440] *Herodianus*, 8.2.3
[441] Former *X Regio*. See ZACCARIA 1986, p. 74

new circuit surrounds only the southern half of the ancient city, with its famous basilica and episcopium.

The end of the ancient Aquileia is usually linked to the 568 AD invasion of the Lombards, when patriarch Paul seek refuge in Grado[442].

After a long period wich left scarce monumental and historical traces, some renovation took place in the 11th century, when the patriarchs returned to the town. The patriarchal state lasted until the 15th century, when large parte of Friuli became part of the Serenissima Republic and Aquileia became subject to Austrian jurisdiction. In this period the town minted its own coins and re-established some of the political and cultural centrality that it had experienced in the past. Eventually, new walls were erected too. Nonetheless the image of the centre was now that of a small town more than that of a proper city. This aspect remained substantially unchanged during the following centuries. After the events of the Great War, Aquileia became part of Italy, while after the Second World War the town witnessed some urban expansion, which indeed provoked those political and social contrasts and dynamics which typically involve urban archaeology. Archaeological researches in Aquileia go back at least to the second half of the 19th century, but it is during the post war period that the necessities of urban development and those of archaeological excavations and cultural heritage safeguard began to collide. Nowadays in Aquileia large archaeological areas live side by side with the town and the full integration of the two is still yet to come.

The Fondi ex-Cossar area

The area named Fondi ex-Cossar is located just few meters north of the famous Basilica and it is encircled by the most ancient (republican) city walls. It occupies the south-eastern corner of the most ancient city and it is some meters close to the river Natissa (ancient *Natiso*).

[442] MARANO 2009, p. 33

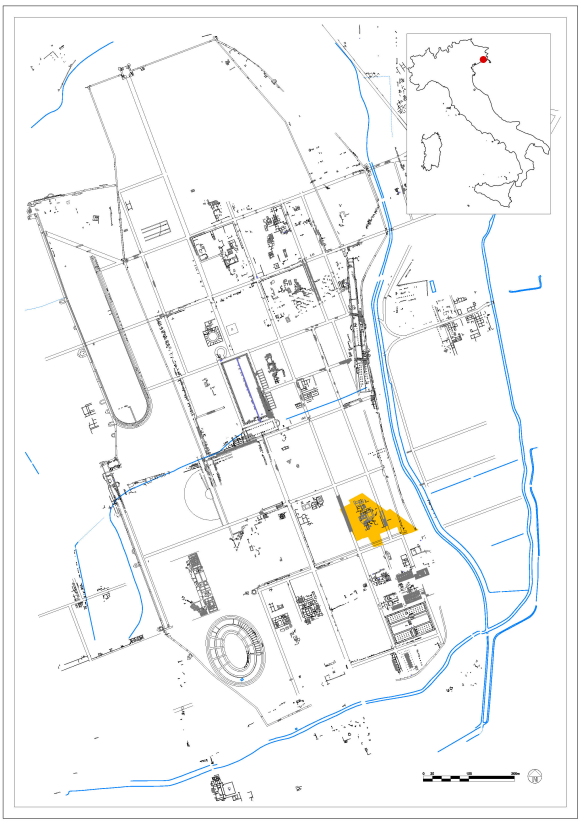


fig. 67 *- The Fondi ex-Cossar area (in orange) within the archaeological framework of the ancient Aquileia.*

The area witnessed several archaeological campaigns in the last 150 years[443]. In 1859 or 1860 two important mosaics were recovered, the famous *asarotos oikos* and the one portraying Europa; moreover at the turn of the century it was discovered the ancient road which defines on the west the ancient *insula* extending throughout the area. Nonetheless, most of the archaeological activity concentrates on the decades from the 20s to the 60s of the 20th century. Within this time interval G. B. Brusin and L. Bertacchi brought to light large parts of at least three different rich *domus* and the eastern road which encloses the *insula*. Extensive restoration of mosaics and structures took place in the following decade[444], heavily affecting the possibility of new archaeological investigations in many points. Both the past investigations and protection practices produced an important consequence on the record. The eastern part of the insula was exposed to the depth of the majority of the recovered floors, it was affected by restoration works and was then left visible. This, in turn, entailed that biological activity of the last 40 years directly affected also deeper archaeological strata and features.

[443] For a complete review of the state of the art of the area, see BONETTO *ET ALII* 2012, pp. 138-140, CENTOLA *ET ALII* 2012, pp. 110-113.
[444] MADRIGALI 2012

The western part of the area, only partially affected by past excavations and then returned to a private ownership, witnessed ploughing and biological activity which notched only the upper strata and left the bottom ones relatively untouched. Indeed, beneath the soil profile, a thick layer of rubble (most likely produced by post-ancient destructions, removals and levelling practices) shielded the lower stratification from the activity of moles (see Chapter III.3), roots, worms etc.

***fig. 68** - Moles activity in the Fondi ex-Cossar area*

Recent excavations began in 2009 and were carried out by Università di Padova until 2013[445]; the new investigations involved the central part of the *insula*, which was brought to light and re-examined 'from street to street'. The area investigated was largely occupied by a great *domus* arranged around an *atrium* (west) and a *cryptoporticus* (east), whereas a row of shops fronted the eastern road[446].

[445] Up to now, the published reports are BONETTO ET ALII 2012, CENTOLA ET ALII 2012, BONETTO *ET ALII* 2009, BONETTO, GHIOTTO (EDS.) 2011, BONETTO, GHIOTTO (EDS.) 2012, BONETTO, GHIOTTO (EDS.) 2013

[446] The architectural layout of the *domus* is discussed in FURLAN 2011, BONETTO, GHEDINI n.d., BONETTO, FURLAN n.d. and CENTOLA *ET ALII* n.d.

fig. 69 *- The Fondi ex-Cossar central area approximately in the Early Imperial Age.*

Three different part of this strip presented some peculiarities: the western part (*atrium* house) laid beneath the thick layer of rubble cited above, thus it was possible to fully investigate it, starting with the most recent layers. The central part of the house was basically left untouched, because of the precence of widespread restoration works made of concrete and thus preventing any excavation. The eastern part, although affected by previous work of excavation and restoration, was lacking preserved mosaic floors, enabling the investigation of the strata which had not been removed in the 20th century campaigns.

The new investigations produced an articulated structural and stratigraphic sequence which is now being studied along with the finds recovered; up to now, it seems that the core of the sequence last from the Late Republican Age (*domus* building) to the age of the Renaissance (robbers trenches). The complete publishing of the excavation is now being edited. Unfortunately, althought the post excavation process proceeds fast, the study of materials is still not complete (as it was initially expected to be). This implies that some of the data discussed in this part are unhappily only partial. I will go back to this point in the concluding part.

IV.2.3 NORA[447]

In contrast with Aquileia, historical and epigraphic sources concerning the ancient city of Nora (Sardinia) are much rarer. Indeed the ancient town never reached the size and

[447] In general, see TRONCHETTI 2001, PESCE 1957 and PESCE 1972

the economic and political importance of the north adriatic colony. Consequently the history of the site is is much more indebted to the archaeological data which were gathered through time.

The origins of the town are still matter of a debate which, in turn, has to be placed within the much wider framework of the status itself of the first western phoenician settlements[448]. Both nuragic[449] and early phoenician[450] traces (8th-7th centuries BC) in the area of the peninsula of Nora are extremely ephemeral and seem to suggest precarious forms of settlement, probably in relationship with the trade of goods.

In fact, the location where the future town will develop responds quite clearly to a sort of 'phoenician prototype' for marketplaces/emporia which is not uncommon in Sicily[451] and in Sardinia itself (Tharros, S. Antioco): phoenician settlers/traders indeed seem to show particular favour for peninsulas or small islands located near the mainland, well positioned along strategic naval routes, easily defendable and provided with natural anchorages. Nora clearly responds to all these requisites: it is located in a small peninsula in the western part of the Cagliari Gulf and it is connected to the mainland with a narrow isthmus. It also displays three main bays, one of which (the western one) particularly protected and suitable for hosting a port. Finally, freshwater is available at reasonable depth throughout the area.

[448] See BONDÌ 2012 and BERNARDINI, PERRA (eds.) 2012
[449] However a nuraghe is attested not far from the peninsula, located on the top of a modest elevation named Sa Guardia Mongiasa.
[450] See BONETTO 2009, BONETTO n.d.a and BONETTO n.d.b
[451] *Thucydides, Ιστορίαι, 6, 2*

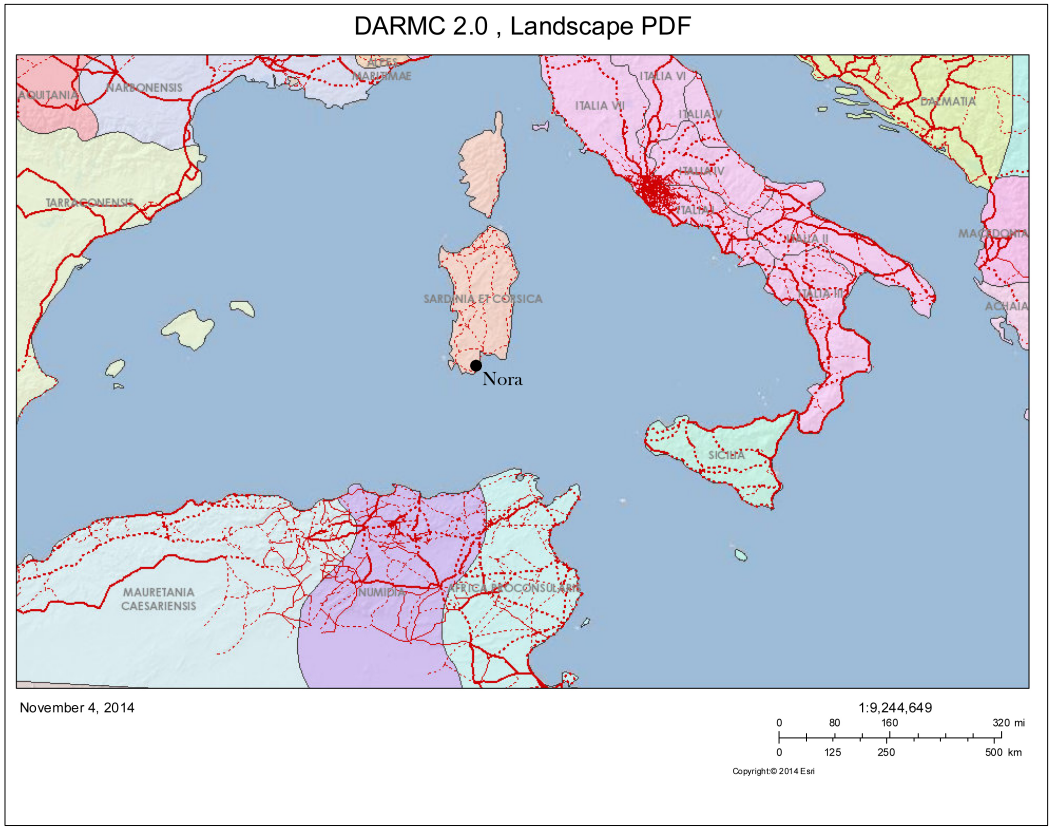


fig. 70 *- Nora within the context of the Roman Empire (c. 117 AD). From the Digital Atlas of Roman and Medieval Civilizations. Modified by the author.*

Recent studies of the sea level of the ancient Mediterranean Sea and concerning Nora in particular have demonstrated that the peninsula was sensibly wider during the archaic period and, later, also during the Roman one[452]; however the maritime vocation of the site has not been brought into question.

The change of the sea level and the maritime erosion entail important archaeological consequences, as they have indeed truncated large portions of ancient stratifications and represent today a serious danger for the presevation of the site[453]. It is also worth to anticipate that the coastline plays the same role of rivers or town walls in urban waste disposal (see Chapter III.5.1), thus potentially attracting the presence of small or big dumps and, in general, the discard of any non recycled item.

[452] ROPPA 2009

[453] DI GREGORIO *ET ALII* 2009. See also BONETTO *ET ALII* 2008 and BONETTO *ET ALII* n.d.b

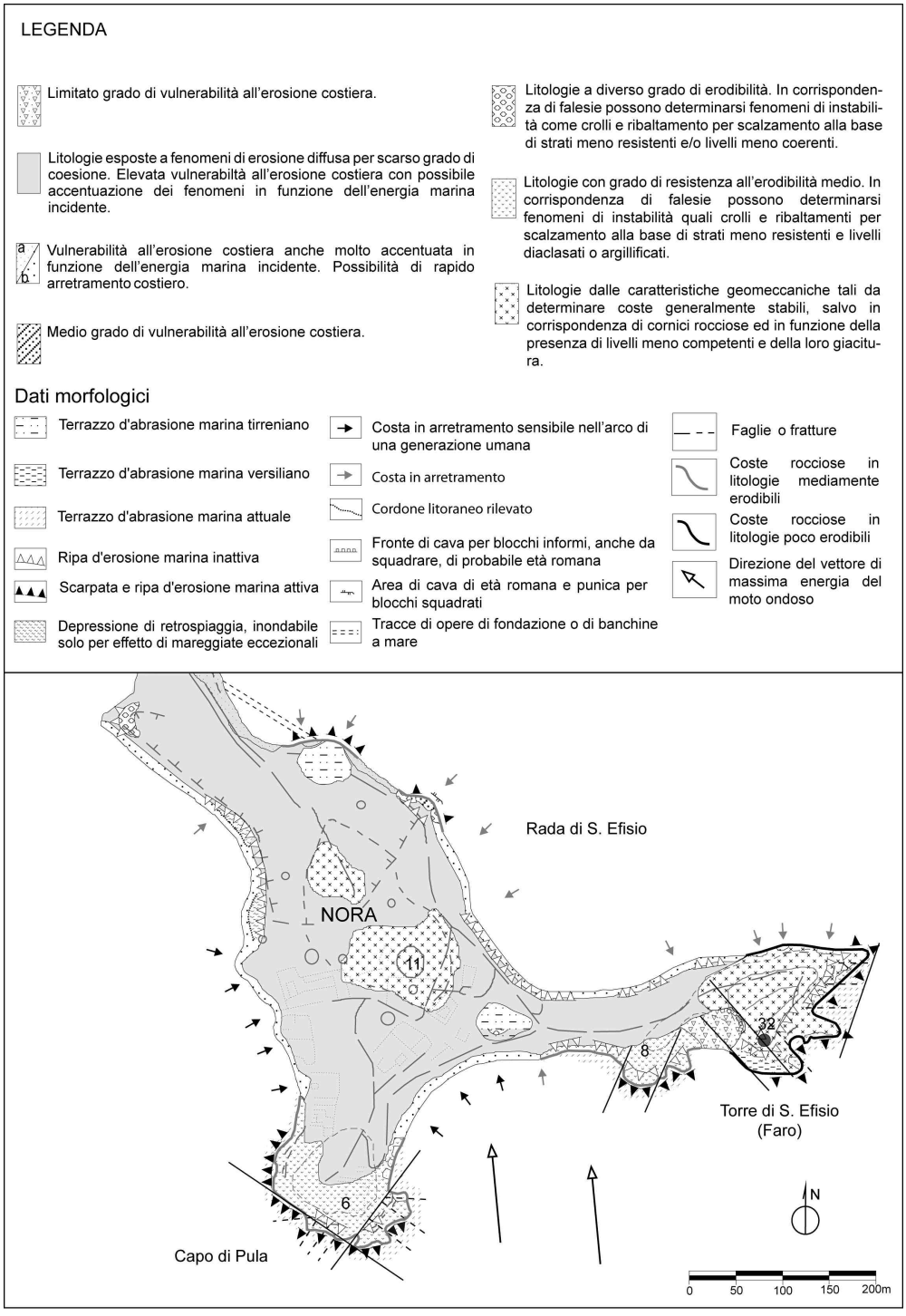


fig. 71 *- Geomorphological map of the Nora peninsula, with indication of major vulnerability areas (from* DI GREGORIO ET ALII *2009)*

It has to be stressed that the hinterland of the city displays anyway some territories suitable for large scale agriculture, which seem to have been fully exploited from the punic period.

As anticipated, although some artefacts and possibly a few tombs suggest an earlier inhabitation, structures in perishable materials are attested in Nora not before the 6th

century BC. At this time some worship places seem to have existed, along with the cemetery and the *tofet*.

During the punic period Nora take the form of a proper urban centre and seems to have flourished during the 5th and the 4th centuries BC.

In 238 BC punic mercenaries in Sardinia mutiny and call Rome for help. *Consul T. Sempronius Gracchus* quickly occupies the main cities and in 227 BC Sardinia becomes with Corsica a new provincia. Politically this date sanction the beginning of the Roman period, but the punic culture will remain visible in major material expressions for a long time[454].

It has been suggested that in these first years of Roman government Nora itself hosted the governor's headquarters, before Karalis (Cagliari) became the provincial capital. The architectural and infrastructural arrangement of the city do not seem to witness substantial changes in the next century, while important urban developments take place during the periods of Caesar and Octavianus, probably in conjunction with the achievement of the status of Municipium[455]. The city, now provided with a forum, is enriched by a theatre during the early imperial age, whereas it is not possible to ascertain when the suburban amphitheatre was realized.

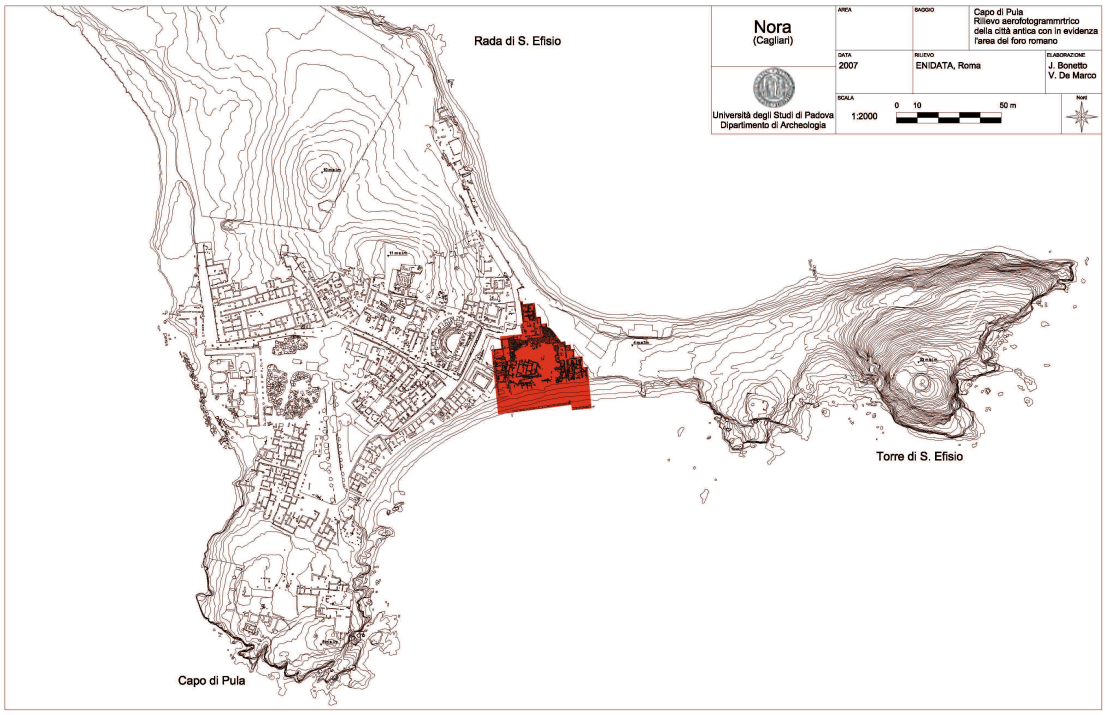


fig. 72 *- Nora: the city with the Roman* forum *(from* BONETTO *2009a)*

[454] See BONETTO, FALEZZA 2009
[455] BONETTO 2002. See also BEJOR 1992 and BEJOR 1994

A period of noteworthy monumental development is attested during the Severan period[456] (193 - 235 AD), when the road system was completely refurbished and three new baths, served by an aqueduct, were realized. Moreover, the so called Tempio Romano gained its definitive aspect, the forum was modified and private architecture witnessed also some important renewals.

Artefacts and epigraphic data attest continuity at least until the half of the 5th century AD. The arrival of the Vandals does not seem to leave particular traces in the archaeological record and the trade routes with North Africa are apparently still active (see the African red slip ware). In 534 AD Sardinia is retaken by Justinian, thus getting off the Byzantine control over the island. Anyhow, the status of the settlement seems to decline and the Ravenna Cosmography names Nora as a *praesidium*, suggesting that the settlement had already lost its urban status[457]. The beginning of the Arab raids in the western Mediterranean probably sanctioned the end of a city which had made of sea trades its peculiar vocation. Indeed the more recent artefects recovered in the urban area date back to the 8th century AD.

Life in the area somehow continued focusing arond the suburban church dedicated to the christian martyr *Ephysius*, who probably had been killed in Nora in 303 AD; the first architectural phases of the church date back at least to the 10th century AD: at this time the ancient city was probably reduced to a mere quarry for the extraction of reusable building materials.

The area of the peninsula remained substantially abandoned until the16th century, when pirate raids forced the Spanish authorities to provide the coast of the island with garrisons and towers: a tower was eventually built in 1607 on the eastern promontory of the peninsula of Nora (Torre del Coltellazzo) and it was guarded until the 19th century. Instead, the rest of the peninsula witnessed some agricultural activity, which is documented by the first photograps took in the area.

The first archaeological investigations took place at the turn of the 19th century, but involved mostly the isthmus and the ancient cemeteries, whereas the core of the ancient town remained substantially undistubed. Some remains of military structures attest the presence of Italian soldiers in the forum area during the Second World War, but it was during the 50s, with the activity of G. Pesce, that most of the ancient city was brought to light through extensive diggings. These large excavations were carried out with no stratigraphic

[456] GHIOTTO 2004, pp. 185-186
[457] *Ravennatis anonymi Cosmographia et Guidonis Geographica*, 412-3 and G500-14.

methodology and were never fully published: if on the one hand they exposed large parts of the ancient city in a relatively short time, on the other one they entailed the destruction of large parts of the evidence concerning the latest phases of the city life. Minor works of refurbishement were also carried out employing concrete structures, thus further compromising the possibility of future stratigraphic recording in some points. Summing up, this activity produced a sort of areal truncation which had to be taken into account when new investigations began. These were eventually resumed starting from the 90s and are now carried on by a joint mission of the Universities of Genova, Padova, Milano and Viterbo. As anticipated, most of the city is nowadays part of an archaeological area, which attracts about 55000 visitors per year[458].

The forum area[459]

Together with large part of the ancient city, the forum had already been investigated during the campaigns carried out in the 50s. In that occasion the fundamental structures of the public place had already emerged: a building wich was most probably a temple defined the northern side of the square and was flanked by two arches which permitted the entry to the paved square. Two porticoes limited the space on the eastern and western sides of the complex and were flanked by two rows of small rooms, whereas the southern side of the forum had not been preserved because of the sea erosion.

The new excavations were carried out from 1997 to 2006 and targeted both the Roman structures and a large central sector in which the square paving was not preserved, thus enabling to gain evidence of the pre-foum Nora.

[458] Ministero dei Beni e delle Attività Culturali e del Turismo
[459] BONETTO *ET ALII* (EDS.) 2009

fig. 73 *- The Roman* forum *and the more ancient punic warehouses (from* BONETTO *2009a)*

The sequence emerged by the excavations turned out to cover a time period lasting from the late 7th/early 6th century BC to Late Antiquity, with also later spots of evidence reaching the period of Second World War and eventually the previous archaeological

activities. Phisically, the two extremes of the sequence are represented by the first anthropic traces (directly on the topsoil) and by the above mentioned areal truncation.

In particular, the new investigations:

– brought to light a series of timber structures (documented by post holes and thin shreds of strata) which attest the first forms of occupation in the area during the archaic period;

– unearthed a cospicuous part of a Punic and later Roman Republican district, occupied by private dwellings and/or warehouses;

– attested the presence, underneath the Roman temple, of a previous punic worship place;

– documented the destruction of the district and the way in which the forum was built;

– gained important data for dating the forum construction (40-20 BC) and for sketching its own arrangement (in particular it was possible to recognize the most probable location of the *basilica*);

– documented the main architectural evolution of the forum;

– although large bodies of stratification got lost with the 50s excavations, it documented shreds of later activities.

The results of the excavations were eventually fully published in 2009, thus providing scholars with new fresh data for present and future considerations.

IV.2.4 GORTYNA[460]

The ancient city of Gortyna is located in central Crete, close to the slopes that encirle north the very fertile plain named Messarà. Although human presence is attested since the Neolithic age, the synecistic process which eventually led to the birth of the city took place most probably in the middle of the 7th century BC and lasted for some decades.

[460] A large synthesis is provided in DI VITA 2010

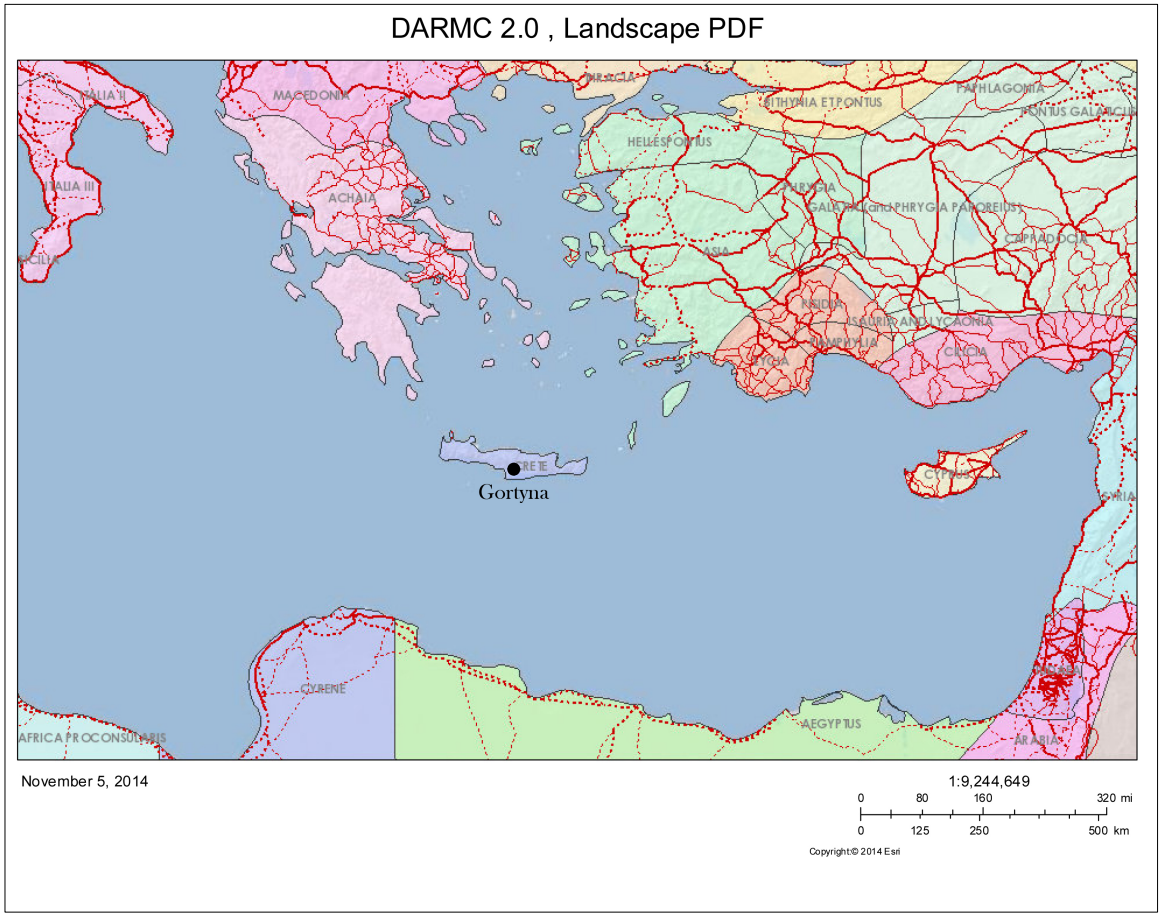


fig. 74 *- Gortyna within the context of the Roman Empire (c. 117 AD). From the Digital Atlas of Roman and Medieval Civilizations. Modified by the author.*

The process entailed that the older villages located on the hilltops right north of the plain joint with each other into a new community occupying the southern plain. The new born city mantained a presence on the hilltop of Hagios Ioannis, which became the acropolis, but mostly extended south, from the river Mitropolianos (west) to a modest stream (east) which was later covered during the Roman Age. The western part of the city was subject to the floods of the river, whereas the area in general presents high seismicity and, as I will discuss later, many seismic episodes are indeed attested in antiquity and played un undeniable important role in the story of the local community[461].

[461] DI VITA 1995

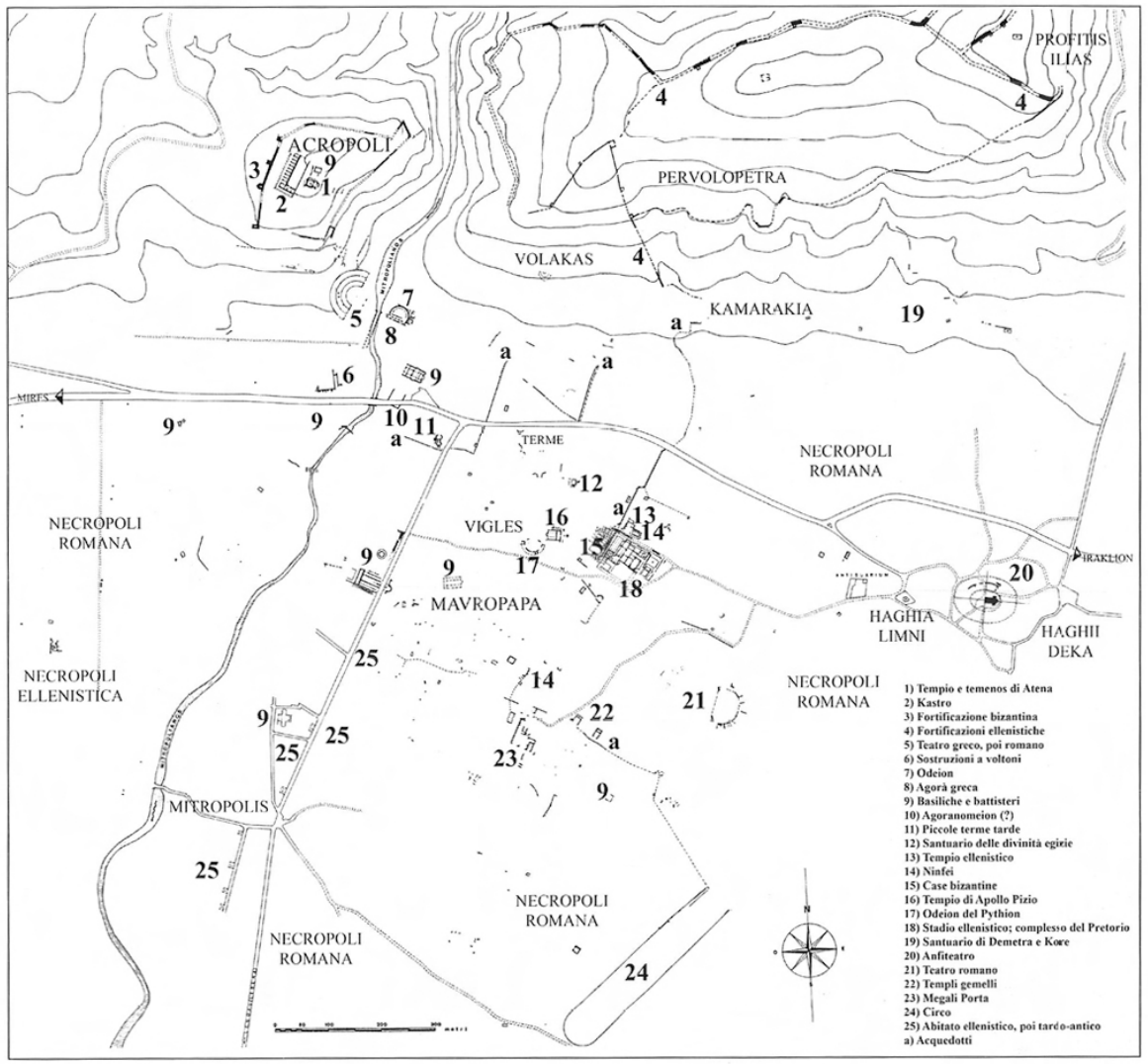


fig. 75 *- Plan of the monumental evidence of the ancient Gortyna (from* DI VITA *2010)*

The first stages of the city life as well as its monumental and infrastructural arrangement are not well known. The agorà must have been located on the eastern bank of the Mitropolianos river, in the very north-western corner of the lower city, but the Temple of Apollo, located in the middle of the settlement, seems to have played an important political role, too.

The most important juridical and political source for the archaic Gortyna is a substantial *corpus* of epigraphic data, among which the Great Inscription represents with no doubt the most important single document. This was recovered as a series of blocks re-employed within the Roman Odeion and it is the longest known juridical epigraph in ancient Greece; it contains articles concerning mainly individuals' rights, goods bequeathals and the relationship between individuals and properties.

From the end of the 6th century BC Gortyna widens its trades with the Aegean *poleis* and strenghten its own position in the Messarà plain: this entails an inevitable crush with the other main power in Crete, that is Knossos. It follows a period of dicontinuous but persistent local wars which will end only with the presence of Rome.

The major Hellenistic archaeological evidence, together with the stadium, are indeed the city walls located on the northern slopes, which bear witness of such a troubled period. When Octavian in 27 BC establishes the arrangement of the newly born Empire, Gortyna is eventually chosen as the capital city of the senate province of Crete and Cyrenaica. Indeed, most of the visible monuments of Gortyna belong to the Roman period. In particular, besides the above mentioned Odeion, located near the agorà, the Romans provide the capital with two more theatres (a previous one was located on the southern slopes of Hagios Ioannis), an amphitheatre, a circus and the Megali Porta baths. In this period the city expands mainly southwards and eastwards, but the residential districts of the city are very poorly known. In general, in the same way observed for Nora, Gortyna benefits of an important monumental development during the age of the Severii; later, after the edict of Milan, the christian community choose, as it is frequently attested, a peripheric district of the city to focus its activity: in this case it is chosen the western part of the town, where, in a short time, at least five churches are built, being the two main worship centres the church dedicated to S. Titus, near the agorà, and the metropolitan basilica in today's Mitropolis, then rebuilt by Justinian and later by Heraclius.

In 365 AD a great earthquake destroys large parts of the city: the recovery is supported economically by the emperors who follow one another in the next years, but it seems to have been some slow. During the years 382-383 AD one last significant effort is attested by the construction of a new justice hall by the *praeses* of the province, Oikoumenios Asklepiodotos Dositheos, but a new series of earthquakes heavily damage the city once again: this seismic activity is attested in the middle of the 5th century AD, just after the middle of the 6th century AD, between 618 AD and 621 AD and finally between 668 AD and 670 AD. In the middle, some minor building activity is attested, particularly under the reign of Heraclius, but after 670 AD the central authority in Costantinople cannot provide the necessary resources anymore and the city life eventually breaks into smaller areas apparently surruonded by ruins. Some more organized activities survive on the ancient acropolis, but the lower city substantially goes to an end. Life continues in smaller forms also during the 7th century AD and probably, close to the acropolis, until the 8th century AD. In this period the area of the ancient site gets more and more rural.

During the 9th century AD Crete witnessed the Arab conquest, which lasted until the the second half of the next century, when the island was reconquered by Costantinople. Officially, it remained a Bizantine possession until 1204, when it became part of the territories of Venice. Starting from this period, we have the first, precious reports and drawings of the standing ruins of the ancient Gortyna. The drawings in particular attest the state of the major monuments before further robbings and the earthquake of 1856. Meanwhile two small villages devoloped on the two far extremes of the ancient city, Mitropolis (west) and Aghioi Deka (east).

At the turn of the 19th century Federico Halbherr starts the first archaeological investigations in the area of the ancient city, bringing to light the Great Inscription and generating a wide interest in the town. Halbherr himself carried out excavations in the areas of the agorà, of the Odeion and of temple of Apollo. In 1909 it was founded the Scuola Archeologica Italiana in Atene, which carried on the investigations in Gortyna in the next years, particularly on the acropolis hilltop, at the *Praetorium* (justice hall) and in the Temple of Egyptian deities. From 2001 some Italian universities are also involved in the excations.

Until present the archaeological investigations in the city have produced a situation which is somehow peculiar: a small central area of the lower settlement, with the Temple of Apollo and the Praetorium, has been unearthed, it is enclosed and visible and it is managed by the SAIA. The northwestern part of the city, with the standing church of S. Titus and the agorà, has been partially excavated and it is fully visitable, directly managed by the local Ephoria. Some evidences emerged near Mitropolis (the christian basilica) are still visible, whereas the older core of the village of Aghioi Deka, which developed in the area of the ancient amphitheatre, still recalls with its shape the presence of the ancient building. Among these spots lies a large cultivated, non excavated area, characterized by some standing remains and by hundreds of olive trees. Most part of the ancient site indeed has never been brought to light, thus the knowledge we have of the urban layout is hypothetical to a large extent. In particular, private architecture is poorly known, with the considerable exception of the Bizantine district located between the Praetorium and the Temple of Apollo.

The Pythion theatre[462]

The Pythion theatre is named after the district which is occupied by the temple of Apollo Pythius, which is located just east of the theatre and which was investigated by F. Halbherr between 1885 and 1887. The two buildings may have been functionally related, as theatrical representations were an important part of the deity celebrations.

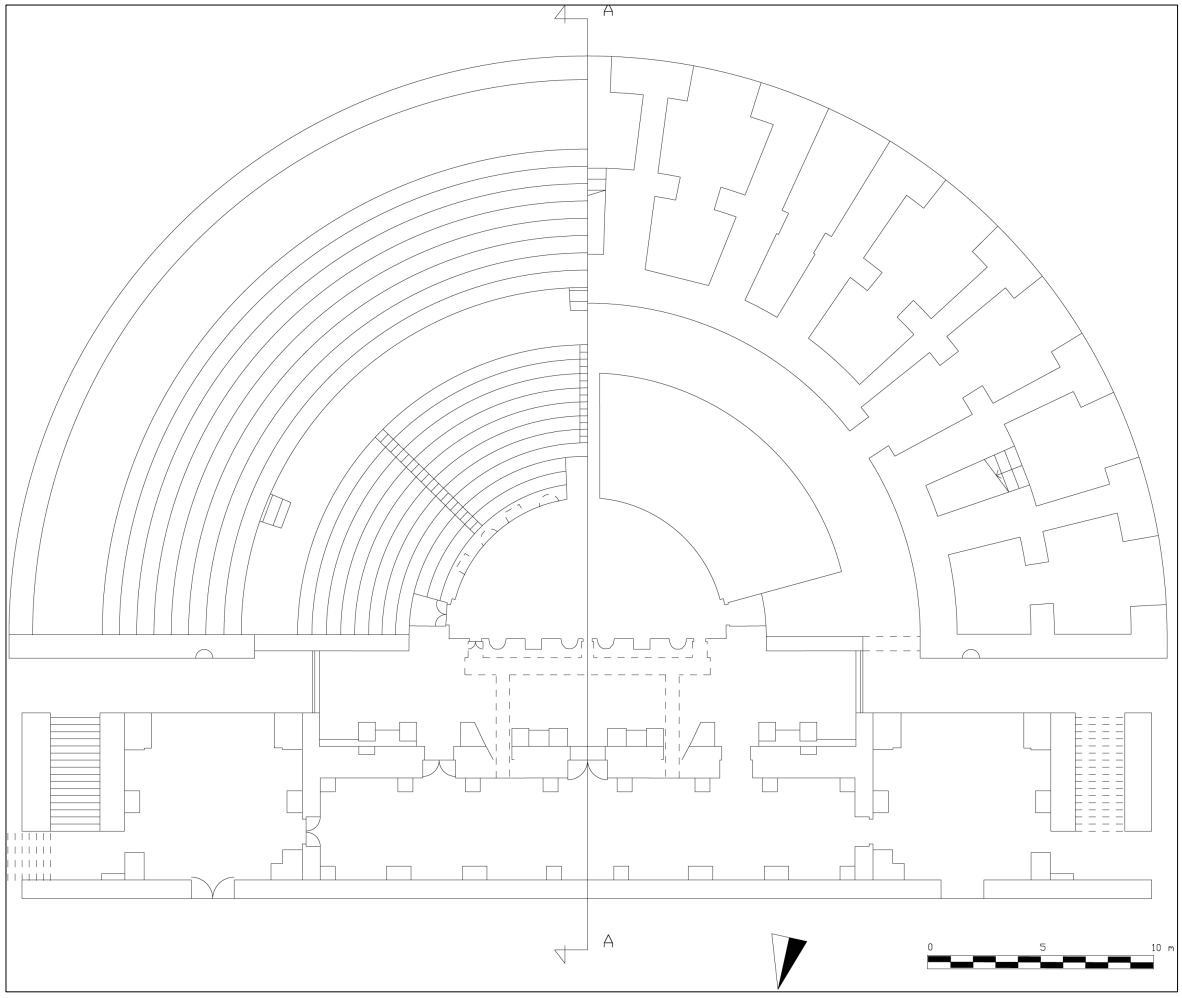


***fig. 76** - Reconstructive plan of the theatre after the last campaign in 2013*

The upper structures of the theatre already emerged from the ground before the new investigations began and its presence is reported also in many old travellers drawings. According to the building technique, the structure had already been provisionally ascribed to the 2nd century AD, most probably to the antonine period[463].

[462] Up to present, preliminary reports on the activity carried out at the Pythion theatre are in BONETTO 2001, BONETTO *ET ALII* 2002, BONETTO *ET ALII* 2005, BONETTO (ED.) 2006, BONETTO *ET ALII* 2008, BONETTO, FRANCISCI 2008, BONETTO *ET ALII* 2009, BONETTO FRANCISCI n.d.

[463] LIVIADIOTTI 2004, p. 746

The new excavations, began in 2001 and carried on by Padua University until 2013, concerned the eastern half of the structures an sketched the following sequence:

- theatre construction, whose related deposits were investigated in small spots, due to the presence of the well preserved structures of the theatre itself. Up to now, the date previously proposed seems to be substantially confirmed;
- architectural modifications (elevation of the orchestra and cladding of the *frons pulpiti* niches);
- theatre early disuse, probably due to the decline of pagan cults in the early 4th century AD. Removal of some marble decorations;
- theatre new function as stable and *officina* for the reuse of marble elements (production of lime?);
- sudden collapse of the strucutre, most probably due to the 365 AD earthquake. A coin hoard and the skeletal remains of two horses lodged in the stable were recovered;
- transformation of the *cavea* in a huge dump;
- soil formation.

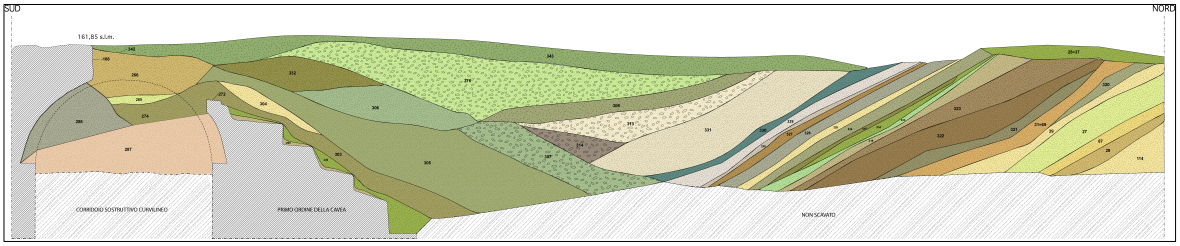


fig. 77 *- The cavea backfill, originated from progressive dumping activity.*

The excavations at the theatre ended in 2013; most of the stratigraphic sequence has already been analyzed and single contexts were eventually grouped in deposits and phases. The vast majority of the materials has also been studied and the full edition of the excavation is about to be published.

❖ PRIMARY DEPOSITS WITH ABRUPT FORMATION ❖

IV.3.1 DEFINITION

In Chapter II.2.4, I already defined a primary deposit as a deposit whose assemblage largely belongs to the same systemic context in which the deposit was formed. It is also worth recalling the temporal nature of this definition, by which spatial relocation is not taken into account. In Chapter IV.1 I also explained that a combination of the accuracy of our observations and of past duration of the depositional process make useful a further distinction between those deposits whose formation can be dated as a whole (in a 'punctual' way) and those depositis whose formation can be dated through a starting date and an end date.

Given the fact that the quality of the date of single artefacts does not change in fuction of the quality of the deposits (lamps are not better dated in urban dumps and worse dated if they were recovered within the backfill of a foundation trench), large part of the difference between the two sub-types of deposits lies in the lenght of their formation.

It follows that a primary deposit with abrupt formation may be defined as a deposit whose assemblage largely belongs to the same systemic context in which the deposit was formed and whose formation lasted for a short time (where by short is meant 'not sufficiently long for being appreciable through the means currently available).

Somehow the information which can be drawn from these deposits may be seen as quick flashes on past systemic contexts. For dating purposes they are indeed the best suited as they allow more or less precise ad quem dating of the actions or processes which produced the deposit. Whithin a whole relative sequence, which is commonly schematized through a Harris matrix, these depsosits and their dates assume a particularly relevant importance, as they can fix a grid of absolute dates for the whole sequence itself.

Unfortunately the common field experience suggest that these kind of deposits, particularly whithin an urban environment (with all the peculiarities discussed - see Chapter I.1.4), are usually a tiny fraction of the whole. This, along with their high informative potential, should lead to focus resources and attention on them, even though they are apparently not directly related to critical or particularly important features such as structures or infrastructures (the construction of a Temple, of a street etc.). The reading of the

sequence as whole, along with the most important features, will in fact benefit of this anyhow, being framed within an absolute grid whose points can be used in turn as *termini post quem* or *termini ante quem* for other deposits.

Taken for granted any problems of false residuality, these deposits, or at least the most reliable among them (no intrusions or interpretive doubts, clear formation processes and dating etc.) may also be used for performing possible corrections, adjustements or refinement of existing dates of artefacts, also through seriation.

IV.3.2 General expectations

What is expected from these deposits? In other words, what kind of answer do we expect from the application of the tools discussed in Part three?

Besides the issue of intrusions, which has to be evaluated for every deposit and which can dramatically lower the reliability also of a primary deposit, and besides the fact that OSL may be theoretically applied to every deposit (precisely on the surface of the underlying one), it is worth starting with some quantitative expectations. In general the profile expected from these deposits (generated by a Monte Carlo simulation or whatever other useful tool) should be quite narrow, in reason of their primary status and short formation. This should lead to a normal/sub-normal distribution of the chrono-formative profile.

Of course some residuality and some false residuality have to be realistically be accounted for, thus some 'tails' may be present in the profile, but their absolute weight should be sensibly lower.

Our expectations can be somehow refined having in mind the tentative and provisional 'ethnoarchaeological experiment' proposed in Chapter III.6.1 and the conclusions drawn from it. Besides an approximation to a normal distribution, particularly evident using brackets of 50 years, it is worth recalling here some of the other conclusions:

- the *tpq* generally post date the main peak or at most it is consistent with it;
- a date very close to the *tpq* seems to be very likely, say within the span of the find providing the *tpq* or slighly later
- dating within the main peak, thus considering, for instance, a later *tpq* due to intrusions, may lead to too old dates. On the contrary finds too younger than the main peak should be handled with suspicion or the nature of the deposit itself should be re-discussed

- in case the quality of the data was high and the 'three groups pattern' was detected, similar explanations may be advanced.

It has to be considered that the proposed ethnoarchaeological cases substantially simulated *in situ* assemblages which may be recovered beneath collapse debris (type P.A.6, see below), thus a particular type among the primary deposits with a abrupt formation. In general, it has to be rembered that even primary deposits with abrupt formation are palimpsestic, embedding assemblages which in turn may have been made up of objects all truly systemic, but produced in different periods, curated or stored for some time.

The qualitative characteristics of this kind of deposits will be examined in some more detail case by case. Nonetheless it is here worth recalling some of the observations made in Chapter III.5:

- high rates of breakage may well be compatible with this kind of deposits (reuse, recycling, scavenging);
- low rates of breakage strenghten their interpretation as primary;
- selection (functional, qualitative, dimensional etc.) represent another element making suspect a primary status;
- post depositional wear shold be homogeneous (taken for granted the different characteristics of different vessels) and compatible with the depositional environment;
- the presence of articulated bones also strenghten the suspect of primary deposition.

The largest combination of both the quantitative and qualitative traits described should strenghten the interpretation of the tackled deposit as a primary one.

One final observation can be made about their abrupt formation: given the fact that the duration of the process of deposition should be short, the volumes of these kind of deposits should be generally low. A rubbish pit or a small dump, if produced in a short time, should not produce incredibly high volumes of debris. A useful comparison is provided by the southern sebakh of *Mons Claudianus*, which, although produced by a comparatively small settlement, measured some 60x20 m and reached an height of 1.80 m. It was produced mostly in a decade, but the whole dumping activity lasted for about 30 years[464].

[464] MAXFIELD, BINGEN 2001, pp. 109-125

For primary deposits with abrupt formation we must seek for much shorter periods of deposition and lower volumes. We will see up ahead how *in situ* assemblages preserved beneath collapse debris represent an extreme case of matrix-less deposits.

IV.3.3 Dating

This 'taxon' of deposits can be dated *ad quem*, using a window reasonably extending from the *tpq* to the point in which the profile reaches a low point after the last peak. Using the brakets provided by artefact which provided the tpq seems also to be a reasonable solution; anyhow dates closer to the tpq (usually when the curve is higher) seem to be the more probable.

IV.3.4 Formative typology

What is the archaeological translation of primary deposits producing a narrow profile? And how is the formative taphonomy which can be proposed for these deposits? As anticipated in Chapter IV.1, the taphonomy proposed is with no doubt partial and could be widened. Moreover some deposits were deliberately not taken into account: among the primary ones with a abrupt formation there are tombs, shipwreks and hoards (although up ahead I will use the evidence provided by a coin hoard as part of the chronological information drawn from an *in situ* assemblage).

Here follows the typology proposed, which will be then examined in more detail.

- P.A.1, Rubbish pits
- P.A.2, Hearths
- P.A.3, Drainages
- P.A.4, Small dumps
- P.A.5, Fire debris
- P.A.6, *In situ* assemblages beneath collapse debris
- P.A.7, Charcoal layers
- P.A.8, Post hole filling A

P.A.1, Rubbish pits

Some expectations on what should be found in a 'typical' rubbish pit are expressed in BUTEUX, JACKSON 2000[465]:

– large parts of individual vessels;

– sherds should be large and not very abraded;

– apart from a small amount of residuals, the majority of sherds should be contemporary.

In this case the authors explicitly refer to Medieval rubbish pits. For the Roman era (and whenever a complex and structured system of waste management exists) I argue that the first expectations may not be necessary, as the pit may well contain only what avoided in some ways different filters which existed and which removed substantial amounts of materials from the 'direct line' use-dump for recycling or reuse. For similar reason the second expectation is not necessary as well; finally I have already noticed how abrasion represent, by itself, a very prickly index (see Chapter III.5.2).

The last point on the contrary is, in my view, fully sharable; this should bring to a chrono-profile similar to the one suggested above. Let us now try to understand more precisely how the materials recovered may have entered the deposit.

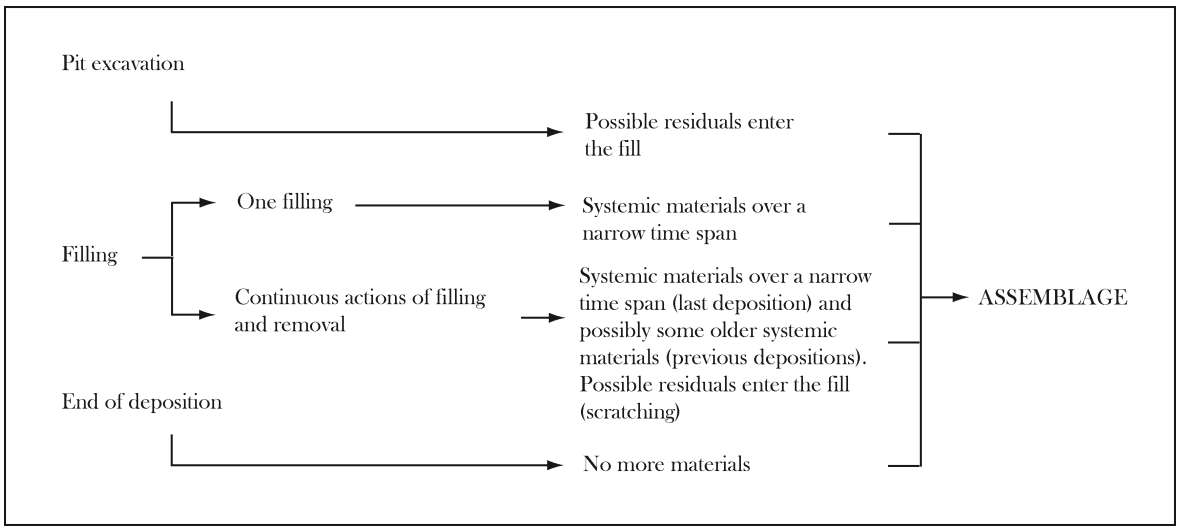


fig. 78 *- A model for the formation of the assemblage of a rubbish pit*

The bulk of materials should refer to the last deposition in case the pit was used more than once, that is that they were deposited and later the pit was never emptied again.

[465] BUTEUX, JACKSON 2000, p. 193

These materials should be largely systemic. What about some more ancient materials? They may have entered the deposit through three main streams:

1. they are residuals, most likely redeposited with other dumped materials or scratched from the pit walls or or bottom during routine emptying;
2. they are false residuals, *i.e.* they are systemic and entered the deposit along with the bulk of materials, but were produced some before and curated/stored for a perceivable time;
3. they are systemic materials but not false residuals, *i.e.* they entered the deposit during a deposition prior to the last one, which produced the bulk of materials.

Once roughly modeled the meaning of the probable chronological profile of these deposits, it is worth observing which other characteristics they should display: besides particular deposits with selected items or linked with workshops activities, domestic refuse should display products of daily activities among which cooking seems to be the most frequent and unavoidable one. Thus good amounts of charcoal and bones should be represented; moreover the dacaying of organic material should produce soft, dark sediments. Occasionally loss small items may also be part of the assemblage along with, of course, any potsherd which did not enter the reuse/recyle circle. Certainly, although not necessarily (see above), complete or (more likely) sub-complete vessels may also turn out to get buried.

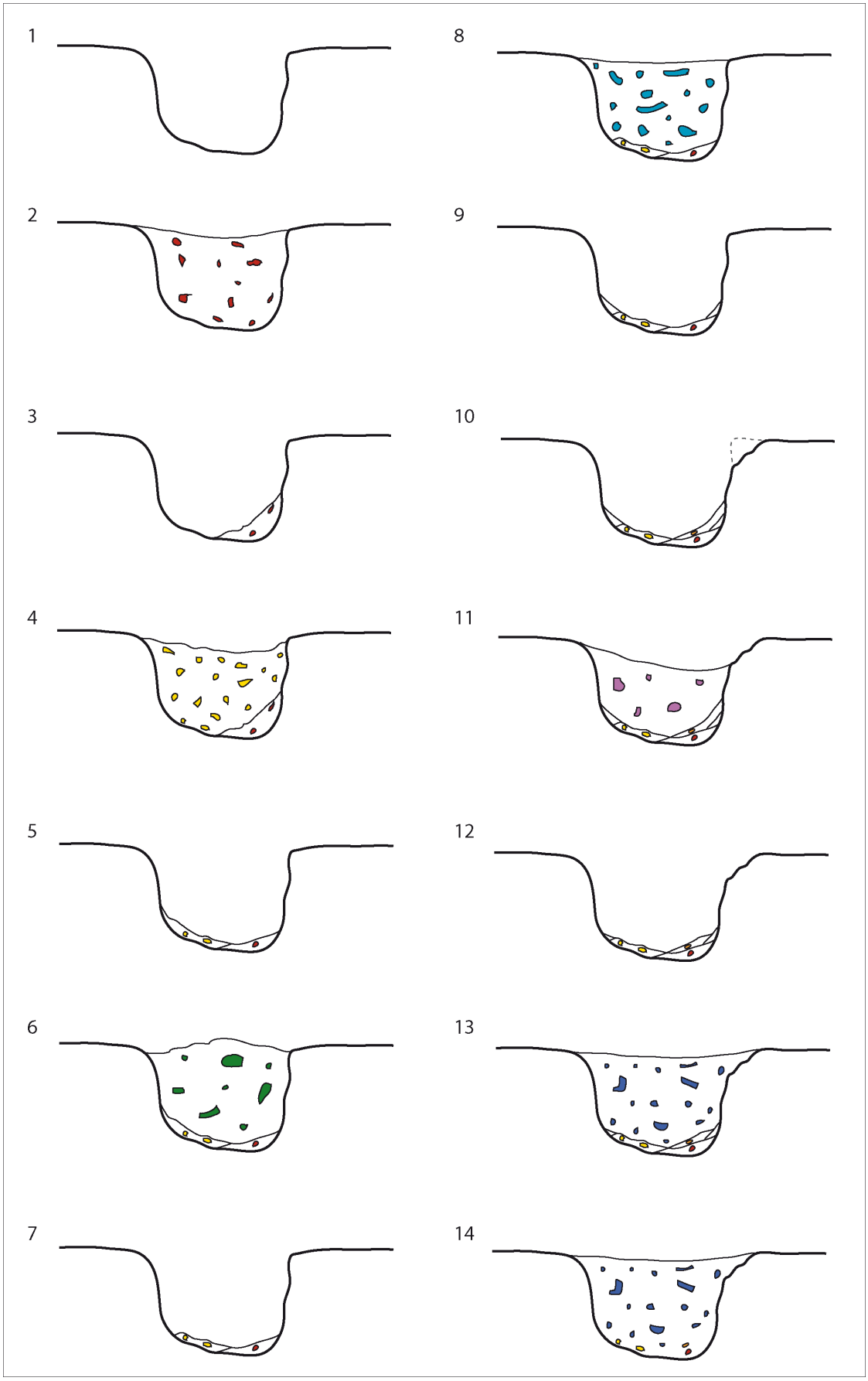


fig. 79 *- A sketch of the formation of the assemblage of a rubbish pit*

Finally, it has to be stressed that post depositional agents, which may play ai important role, given the high presence of organic material, may severely affect the possibility of reading any clear internal lamination or stratification. Cappings or final backfillings, would probably reduce these phenomena; of course they have to be considered as something different from the primary fill and their status has most probably to be considered as secondary.

As a whole, when recognized as rubbish pits, these deposit may be well dated in the way suggested above. They of course represent excellent windows for getting other precious information, for instance about diet or concerning the activities carried out in the more or less close proximity of the pit. Cesspits, which are not treated here, may for many aspects be assimilated to rubbish pits.

P.A.2, Hearths

Hearths are usually made of a fireplace, like a simple pit, some clay plastering or a more structured feature (a solid surface or even a masonry counter) and the product of combustion. If more that one combustion occurred (*i.e.* a fire was lighted repeatedly in the same place), the bulk of what is recovered should refer to the last combustion or to the last few combustions, because of the ordinary activities of clearance and maintenance.

The outcome of combustion activities should be a layer substantially made of ash and carbons, while the the fireplace should display signs of exposure to heat.

Below it is sketched a possible and very simple model for the formation of the assemblage produced by a hearth made of clayish plaster and the outcome of some burning activity.

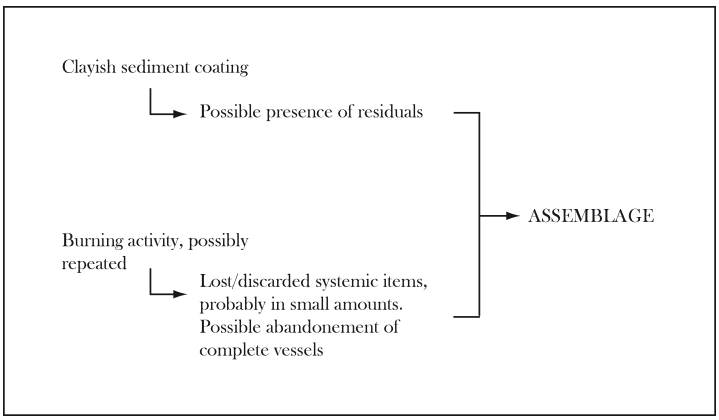


***fig. 80** - A model for the formation of the assemblage of a hearth*

Seeking for primary deposits I focus mainly on the layer(s) resulted from combustion. Any redeposited sediment used for plastering a given suface is in fact a secondary deposit, providing at most a *tpq* for the layout of the fireplace. A masonry structure should be treated as something different in turn. What draws the attention in this case is the layer resulted from combustion. Apart from ash and charcoal, it may also contain a few materials which are very likely to be systemic, although some attention should be paid for the case of redeposited layers produced of combustion. These materials may be accidentally lost small items, some discarded items or simply bones and other remains connected with cooking. In case the fire was used for activities other than cooking, artefacts connected with the activity carried out may be recovered.

They may display or not traces of blackening, as they may have been lost or discarded previously or after the last combustion. Occasionally whole vessels or other artefacts may also be recovered in association with the hearth and they may also be taken into account in evaluating when the (last) burning activity took place.

In general, anyhow, these layers are not expected to produce large amounts artefacts, thus the resulting assemblage should be relatively small, rising a problem of representativeness for the sample collected. The sample may in this case get strenghtened through radiocarbon analyses carried out on the bones and carbons recovered, which are very likely to be systemic[466]. Of course, in case of charcoal, old wood effect and connected issues are to be evaluated (see Chapters III.4.3 and III.5.1).

Concluding, looking at the layers product of direct combustion, the artefacts recovered should be chronologically consistent with each other, thus pruducing a typical primary profile with a more or less narrow width according to the quality of artefacts dates. Again, some issue of residuality may arise, but should be exceptional. Same false residuality, conversely, should be taken in some major account, although the bulk of materials should be consistent in date. On the other hand, as anticipated above, much more residuality may concern any sediment employed for plastering the fireplace.

P.A.3, Drainages (with amphorae)

More or less extensive drainages, usually made of reused amphorae, are something very peculiar of Roman management of water and soil; they are a common presence all over

[466] Radiocarbon dating of ash is very problematic (see WEINER 2010, p. 177)

the Empire, whenever particular hydrologic and morphologic characteristics require some intervention. In particular they are widespread in northern Italy, were they have been studied in many different lights. Indeed amphorae, thanks to their large availability and to their peculiar shape, provided a perfect mean for this kind of works; they were employed in two main ways, extensively, for drying a whole area preventing the raising upward of the groundwater, or forming a sort of pipes for mawking the water flow away from the targeted area. Of course sediments had then to be redeposited for reaching the desired height, but here I focus on the amphorae themseves. They are usually laid down complete or at most sub-complete (for draining reasons a hole was often opened on their walls or bottoms) and it seems very unlikely they were chosen among buried materials. When they were selected for being employed, they were most likely systemic, picked up among the circulating or provisionally stored specimens; of course they may have been previously used more than once and they could have been stored for some time, but they were effectively part of the systemic context in which the drainage was made. Moreover, they were not particularly affected by curation and J. T. Peña estimated their average life expectancy (primary use) in 5 years[467], thus, in general, far beyond the common accuracy of archaeological time observations. Of course, as I have highlighted many times, the overall chronological profile of such an assemblage, has to be seen in a palimpsestic view. Nonetheless the systemic nature of the assemblage makes it suitable for *ad quem* dating and should produce a normal or sub-normal distribution. Unfortunately, among the wide range of Roman ceramic species, amphorae do generally provide quite wide ranges, thus, although the deposit itself is primary and abrupt, the overall profile may turn out to be pretty wide. For narrowing it and for providing a closer *tpq*, stamped specimens or vessels displaying *tituli picti* play an important role.

Other cases of clear selection of vessels among the circulating or provisionally stored items for structural reuse or similar (whole vessels reemployed in walls or vaults, as *sarcofagi*, as pipes etc.) may be modelled in the same way.

P.A.4, Small dumps

Formation and dating of small dumps can be roughly assimilated to those of rubbish pits, the main difference being the depositional basin. Two slight differencences may occurr:

[467] PEÑA 2007, p. 325-327

– the presence of residuals due to the notching of existing nearby strata should be lower;

– in case the depositional basin was open, a higher risk of intrusions should be taken into account.

Intrusions in some cases my produce the paradoxical presence of a sort of residuals: this case is well illustrated in Chapter III.6.1, where old fragments of wall plaster are suggested to have been embedded within a small dump after having detached from the still standing walls and ceilings of the room itself in which the dump was formed. It is worth reminding that disused, abandoned buildings are often targeted, even within still well mantained settlements, as favourite locations for dumping (see Chapter III.5.1).

P.A.5, Fire debris

In this case I clearly refer to *in situ* fire debris, as it may be redeposited in the same way as any sediment could.

A sudden episode of fire, accidentally or intentionally originated, leads to the 'sealing' of an existing situation. Of course the layer formed may later be subject to reworking, scavenging or other 'disturbance' processes. Anyhow, whenever and wherever undisturbed, such a deposit represente a source of information extremely valuable, obviously not only in a chronological perspective. Along with the next type of deposits, that is *in situ* assemblages preserved beneath a collapse debris, this is the case which can be considered most similar to the Pompeii premise so often cited in the Binforf-Schiffer debate [468] . The 'ethnoarchaeological' case studies presented in Chapter III.6.1 may be considered a good simulation of this occurrence too and similar chronological palimpsests may be detected. From a chronological point of view some differences may arise in the form of an higher percentage of false residuals in case structural timbers were sampled for radiocarbon dating. Charred bones and seeds would represent on the contrary excellent targets allowing to avoid substantial old wood effects.

Charred and decomposed materials are likely to provide large part of the matrix, which may also turn out to contain large quantities of building materials, which, in turn, may contain some residuals.

[468] At least from a dating perspective

The *in situ* assemblage, which may be treated as an independent context or deposit, should display blackening and a large percentage of complete or sub-complete vessels, although reduced in fragments.

It worth recalling that sometimes it is possible to relate major episodes of fire to specific historical events, such as Rome's great fire dating back to 64 AD or London's destruction in 60-61 AD. In both cases the two deposits reprent a familiar feature of their respective sequences and are often used also as reliable *termini ante quem* for the previous activities occurred.

P.A.6, In situ *assemblages beneath collapse debris*

This is a form of 'Pompeii case' which may have been produced by simple abandonement and deteriortion of a standing structure or by more sudden episodes, typically earthquakes. The major difference between the two consists in the fact that the first occurrence implies a much higher risk, in sequence, of selection of items to be removed, scavenging, space reuse (typically for dumping) and eventually intrusions. Thus, the first case should be handled with great care, as buildings untouched and undisturbed until their final collapse represent a rarity.

Here I will focus on the second case, that is the one of *in situ* assemblages beneath debris produced by sudden collapse. In this case the major interpretive risk connected with dating is the presence of more recent materials filtered through the debris itself, due to the most probable presence of empty spaces (see ChaptersII.2.9 and III.3). The deposit of interest is thus substantially matrixless and is completely made of the assemblage. Recently a very accurate attempt to distinguish the status of different artefacts associated in this kind of debris has been attempted for the so called Earthquake House at Kourion, Cyprus, which collapsed at the end of the 4th century AD and which were excavated by the University of Pennsylvania Museum in 1934-35 and by the University of Arizona in 1984-87[469]. Unfortunately the work focuses primarily of functional and spatial aspects, yielding that artefacts dates are not readily available. Nonetheless from a qualitative point of view it represents a case study quite explicative of the expectations we should have of this type of deposits:

1. vessels should be, although in pieces, complete or sub-complete (high conjoinability);

[469] COSTELLO IV 2014

2. complete articulated skeletons could be present;
3. other complete items may be present.

Some problems may arise for small items such as coins, in case their belonging to the main assemblage or to the group intrusions was in doubt. Single small sherds not connected with dumping activity or not reliably ascribable to the activities carried on before the sudden collapse took place shoud be discarded.

Given all what has been observed, residuality should be almost non existing, making in turn false residuality more easily detectable if present. Given the possible high risk of intrusions, the *ad quem* dating of the deposit should be based primarily on those materials whose status is sure, that is basically those listed above.

P.A. 7, Charcoal layers

This particular type of deposit has been suggested by my personal experience in Aquileia, where a layer of clean charcoal was laid down, probably with some drying function, as part of the bedding for an upper floor. The case, which may seem quite unique, is discussed in detail up ahead; indeed this typology, although rare, is not unknown: the intentional insertion of charcoal in some tipes of floors has been discussed in Chapter III.6.3 and they are also often intentionally added to cocciopesto and mortar.

In this case freshly burnt wood is intentionally laid down in the building site for a precise function: it is thus likely to provide good *ad quem* dating, although affected by some old wood effect according to the age of the wood employed. For assessing a primary status it is important that the sampled lumps of charcoal provide consistent dates. Then, statistical approaches could also be employed for narrowing the obtained results.

P.A.8, Post hole filling A

Post holes/pipes and post pits are one of the most common features of any archaeological site; they are usually thought to be characteristic of wooden architecture but it is worth reminding that timber structures, more or less provisional, play an important role also in the process of constructing masonry buildings; finally posts can play a wide variety of functions (not strictly structural) such as limiting a space[470] or for light structures such as devices for drying and so on. Formative dynamics and excsvation of post holes and post pits

[470] See CARVER 2009, p. 21

have been already discussed by some literature[471]: what is of interest here is the chronological information they provide. To tackle the issue more easily, I highlighted four main possibilities, which are sketched below. Of course what is important in this scheme is how we can date the different types of deposits emerging, not the structural/functional characterisitics of hole, pite and their respective fills. This kind of typology would be indeed much larger.

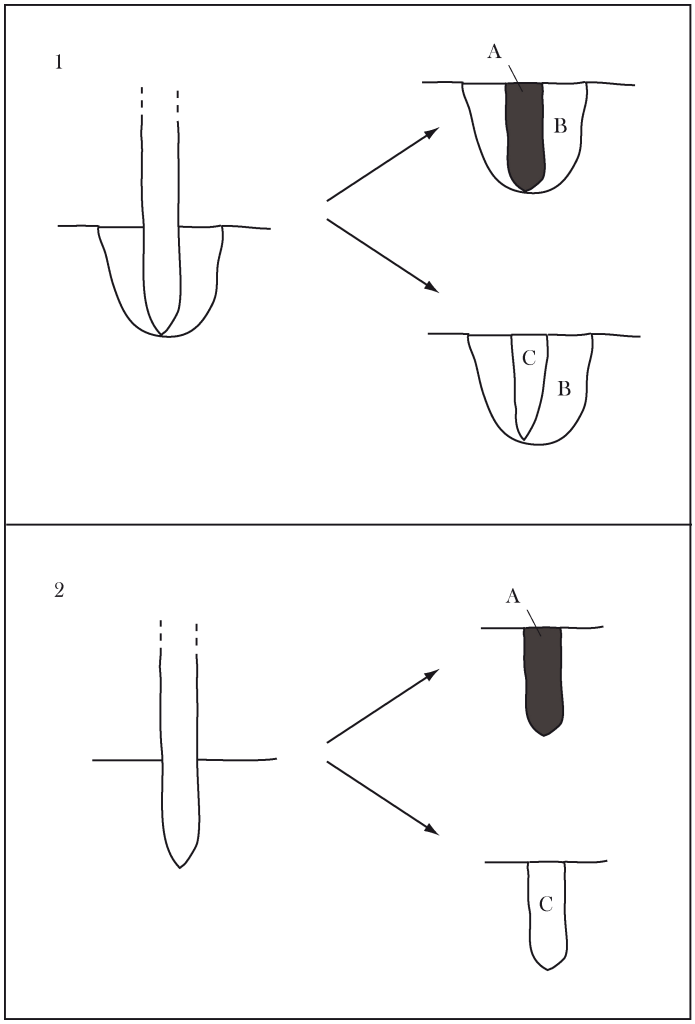


fig. 81 *- Different fillings of post holes and post pits*

The four mainpossibilities described procuce in turn three 'types' of contexts/deposits which carry different chronological information; the first of them can be interpreted as primary, the other as secondary:

A. context formed by in situ decay of the post itself (*i.e.* the post was never removed);

[471] Among them, see in particular BARKER 1969, BARKER 1977, pp. 83-90, VALENTI, FRONZA 2001

B. backfill of the post pit, formed when the post was installed;

C. backfill of the post hole, formed once the post was removed.

In this case I refer to the first type (A). This kind of fill should be recognizable by its high organic, dark matrix, made of the decomposed post itself. In this case what is to be dated is the installation of the post itself. Among the primary deposits, this is maybe the most thorny one as it seems very difficult to distinguish a genuine fill produced by post decay from a backfill made with organic sediment. Moreover, given the very rare case of a post still recognizable (charred or not), what is expected for dating are at most small lumps of charcoal or wood, thus making very difficult to select possible external rings.

It follows that the main problems concern the interpretation of the deposit itself, the lack of conspicuous dating materials and the possibility that old wood effect may seriously affect the sampled lumps. Eventually the quality of the obtainable date closely depends on the quality of the record and on the quantity of samples which may be afforded. If the interpretation of the deposit as *in situ* decomposed post was confirmed, even in absence of large samples of well identifiable wood/charcoal, a *terminus post quem* not very far from the actual date may be obtained for the post installation. In case large chuncks of wood were recovered, with outher rings identifiable, the death of the tree which provided the post may be dated *ad quem*. Assuming that a brief time (from an archaeological view) passed between the cut of the tree and the installation of the post, this last, in turn, can be also dated substantially *ad quem*.

IV.3.5 Case study 1: a small hearth within a *taberna* in Aquileia (P.A.2)

Topographic and archaeological background

The hearth considered in this discussion was recovered within one of the rooms, probably *tabernae*, located on the eastern side of the *domus* excavated. This part of the area had already been investigated during the campaigns carried out during the 20th century; this entailed the loss of the upper part of the sequence (see Chapter IV.2.2).

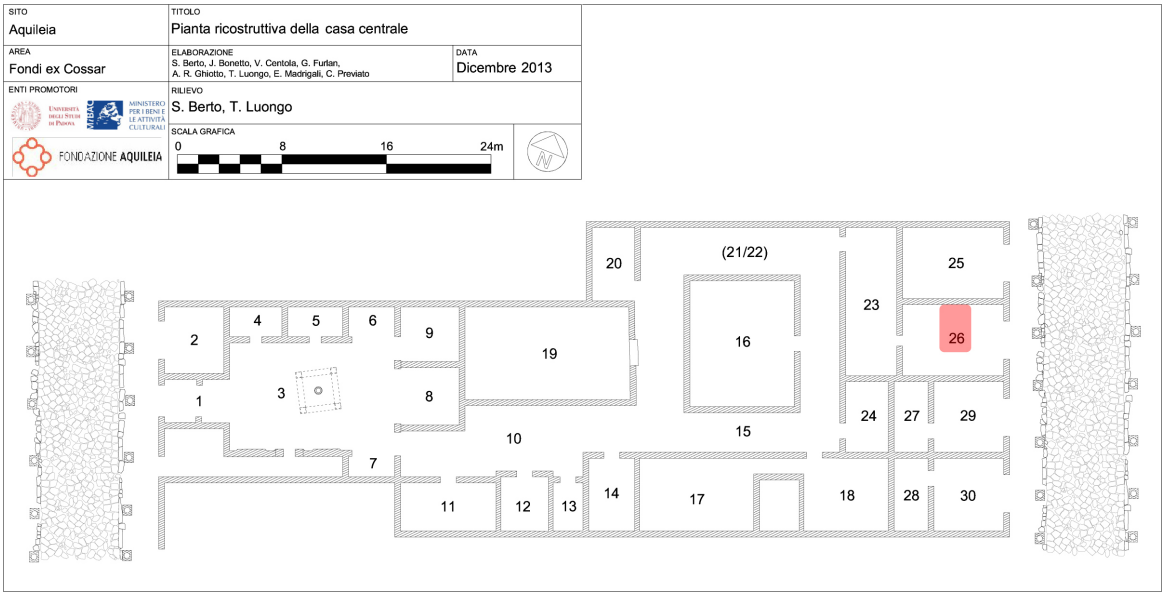


***fig. 82** - Location of the discussed deposit. Aquileia,* domus *of Titus Macer and* tabernae

The period in which this part of the *insula* was laid out is still matter of study and the main body of the excavated strata refer to the later activities which were carried out in these spaces, along their evolution and transformation before their final abandonment.

The hearth was located on the northern side of room 26 (see above); the fireplace was set up when the *taberna* tessellated floor (made with tile tesserae) had already been very damaged and cut by several post holes: it was made of a layer of brickearth (which was then renovated a few times) as a basis and by a small wall forming a corner with the northern wall of the room. Here several burning activities occurred and, although it is still not clear their function, the presence of some animal bones and of two net weights, one in the upper level and one in a deeper one (thus confirming the substantial unity of the sequence), seems to suggest food processing as a credible hypothesis.

Deposit description

The deposit was made of layers of combustion products alternating to layers of burnt clay. The two groups should theoretically be kept separated, being the outcome of different processes and having furthermore a different status. In this case I put together the whole sequence for practical and 'didactic' purposes; it has to be stressed anyhow that the clayish layers provided a few artefacts, which turned out to be residuals, exactly as it was expected to be likely.

fig. 83 *- The hearth seen from the north-east*

Below the whole sequence is summed up: in red are the brickearth layers, in grey the layers produced by combustion and in beige the small wall (73) and a few fragments of bricks laid down for creating a flat surface (79).

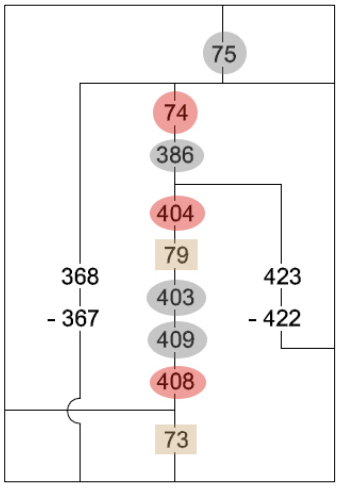


fig. 84 *- Extract of the Harry's matrix of the* domus *of Titus Macer representing the investigated sequence*

Focusing on the layers produced by combustion, the two lower ones (403 and 409) were made almost entirely of white ash, 386 had a matrix rich of greyish ash and lumps of charcoal, while the upper level (75) was almost black in colour and extremely rich of charcoal lumps.

Assemblage physical state

The general assemblage physical state was not recorded in detail; it can just be noted that all the materials recovered were relatively small.

The finds

Unfortunately the available dates are still scarce, as some half of the datable assemblage is still being studied. This is indeed the major deficiency in presenting this case study. The total amount of dated finds is, up to now, only 15. Fortunately, among them, a high percentage of coins allows some accuracy.

Here follows a list with the dated finds available, divided by context:

- 75
    - coin, 268-270 AD
    - coin, 270-300 AD
    - coin, 260-268 AD
    - coin, 244-249 AD
    - coin, 236-238 AD
    - coin, 251-253 AD
    - glass, 200-500 AD
    - coarseware, 200-700 AD
- 386
    - african sigillata, 200-500 AD
    - black glazed pottery, 150-50 BC
    - coin, 145-176 AD
    - coin, 1-300 AD
- 408
    - glazed coarseware, 200-600 AD
    - thin walled ware, 25-75 AD
    - thin walled ware, 25-75 AD

Besides the high percentage of coins, three specimen appear clearly residual: two of them (thin walled ware) are embedded in one of the clayish layers, while a third (black glazed pottery) is a residual within a primary context. The *tpq* is provided by the coin dated 270-300 AD.

Monte Carlo chrono-profile

Below are proposed the Monte Carlo simulations applied to the studied assemblage. Coins life has been extended of 30 years in order to account of their possible circulation for some time (see Chapter III.4.3). The first graph uses brackets of 25 years, while the second one employs brackets of 50 years. The third one, with time windows of 10 years, is applied to the assemblage without taking into account the three residuals detected.

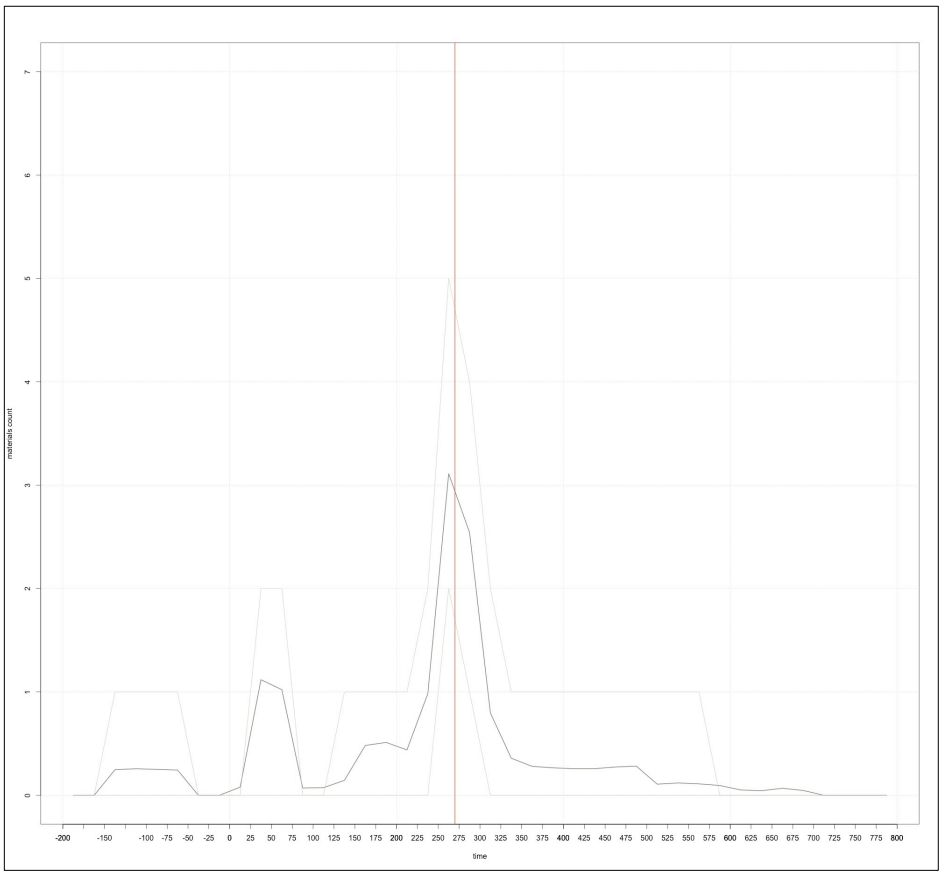


fig. 85 *- The small hearth. Profile with 25 years brackets*

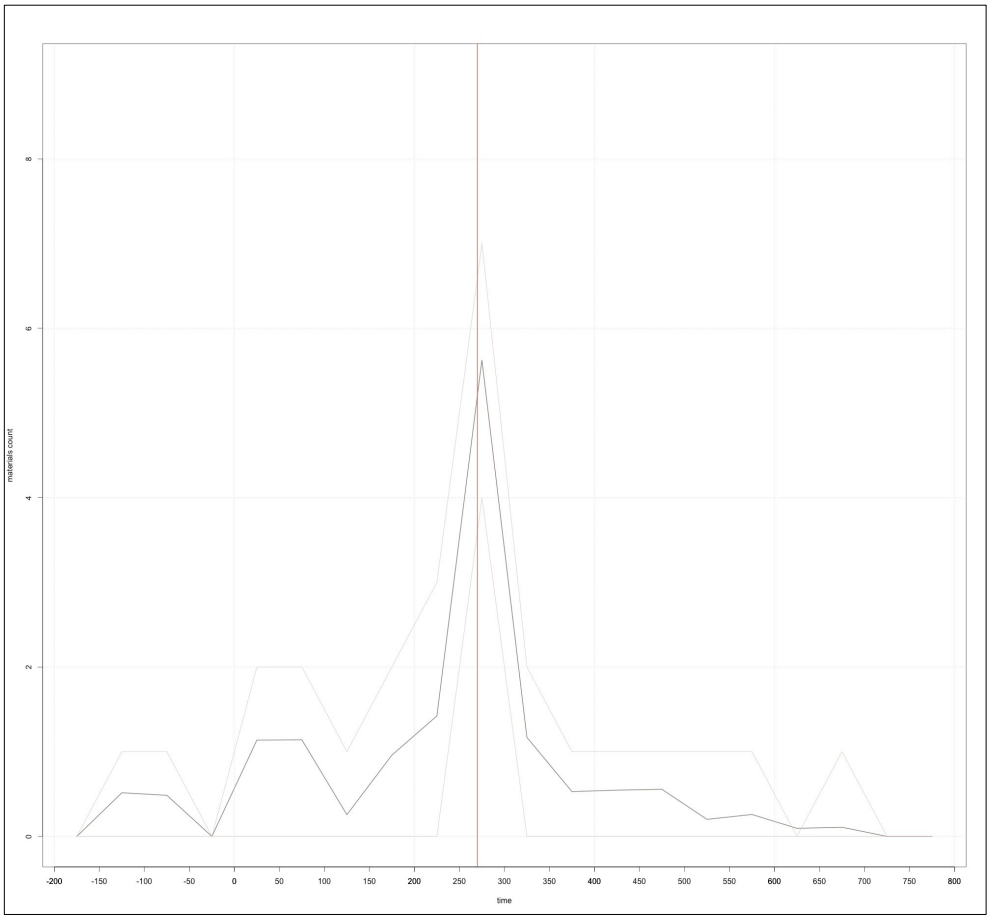


fig. 86 - *The small hearth. Profile with 50 years brackets*

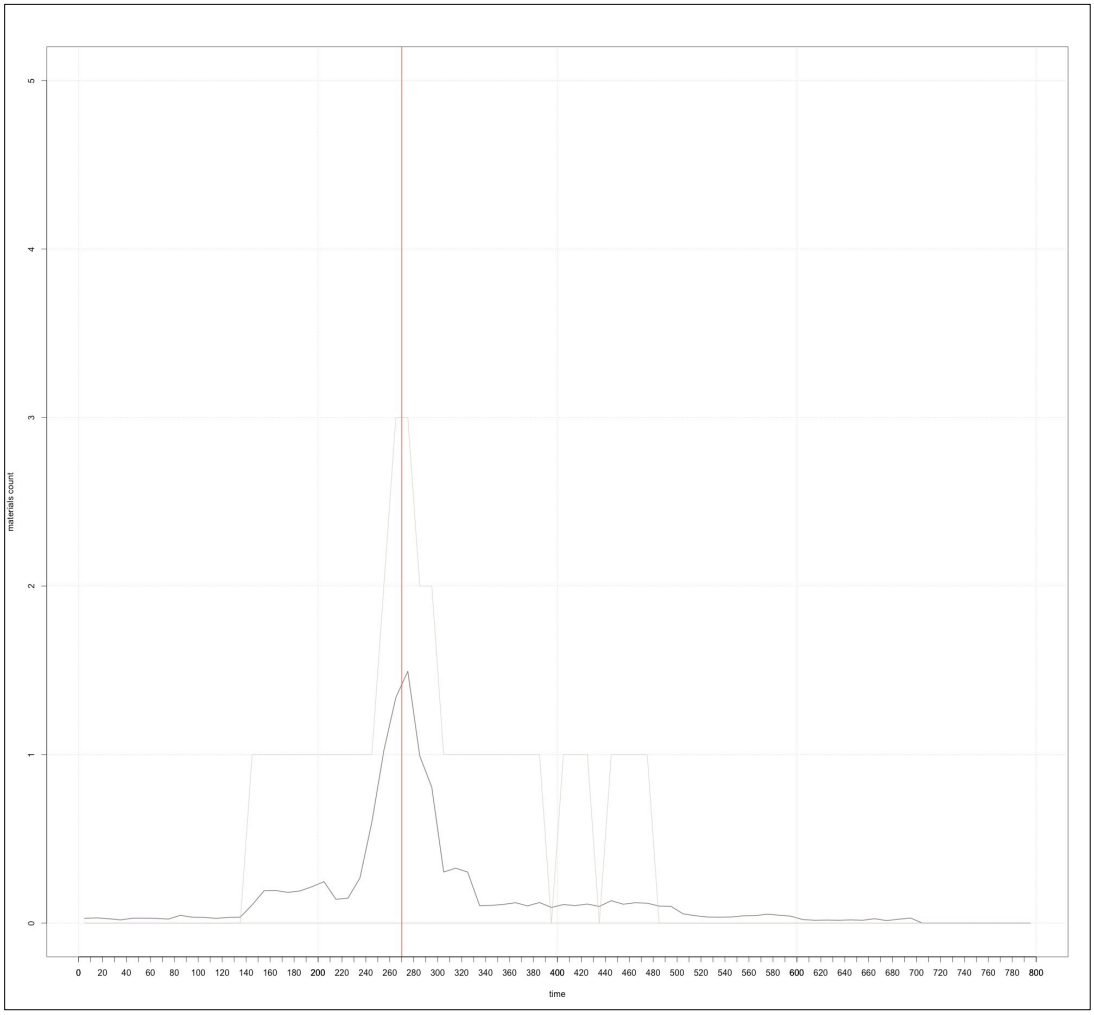


fig. 87 *- The small hearth. Profile with 10 years brackets*

Discussion

The major pike of the graph is clearly produced by the coins recovered in the upper level, but in general the other finds (besides the three residuals detected) are consistent with them, produing a unimodal, narrow distribution. The coin dated to the period of Antoninus Pius or Marcus Aurelius may well be a false residual, curated for a long time. As observed at the beginning, the dated sample is very small, thus the conclusion drawn are far from conclusive. For the moment it is possible to observe that the case study, as a whole, well answer the expectations advanced.

Date proposed

Ad quem: 270-340 AD (provisional). For now, there are no evident inconsistencies with the site general chronological grid or with any historical or logical expectation.

Duration

As a whole, the fireplace has been in use more than once, but the timespan of the overall activities (although not clearly computable and although some maintenance may have occurred, removing some layers) seems relatively short, far below the accuracy threshold which would allow to distinguish an inital date and an end date.

Notes and references

It is desirable that in the next months the complete study of the artefacts recovered was completed, making the sample sufficiently representative; some corrections may then be necessary. Radiocarbon samples from the recovered charcoal may provide some more dates for strenghtening the inferences drawn. The data employed are substantially unpublished. A general overview of the area is in CENTOLA *ET ALII* 2012.

IV.3.6 CASE STUDY 2: A DRAINAGE WITH AMPHORAE WITHIN AN EARTHWORK FROM VICENZA (P.A.3)

Topographic and archaeological background

Vicenza is located in north-eastern Italy, in the Veneto region. The foundation of the urban centre is commonly dated to the 6th century BC, during the so called 'second phase of urbanization' of the region.

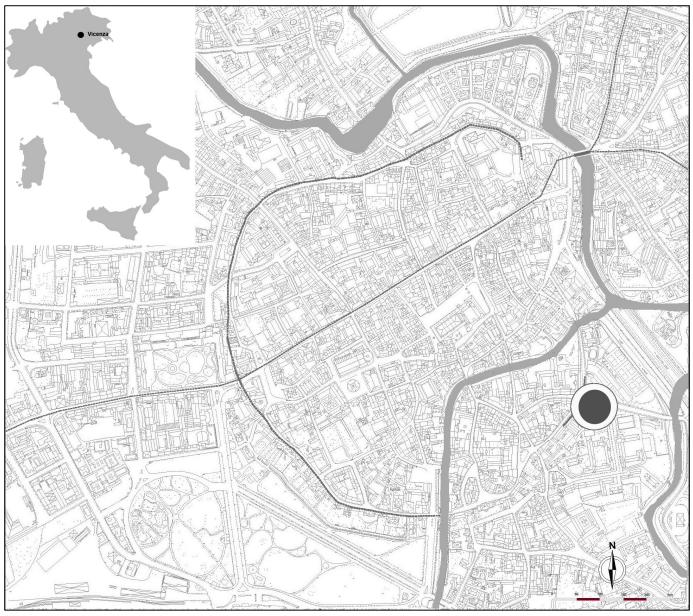


***fig. 88** - Location of the earthwork*

The area in which the town developed is located near the confluence of two rivers, on a slightly higher ground surrounded by marshlands; this peculiar hydraulic and geomorphological situation made some water management works necessary.

The infrastructure examined below is indeed part of the Roman city defences which were laid out against floods.

In the early '90s some excavations were carried out between Contrà della Piarda and Contrà Mure S: Michele, in the south-eastern suburbs of the ancient city. Here emerged part of a considerable earthwork, most probably an embankment dividing the urban center from the marshlands and protecting it against river floods. The bank was realized with successive layers for a total height of at least 4 meters. Among them, here are examined the lowest ones, particularly contexts 145 and 155, which consisted of complete or sub complete amphorae, laid down for clear draining and stability purposes.

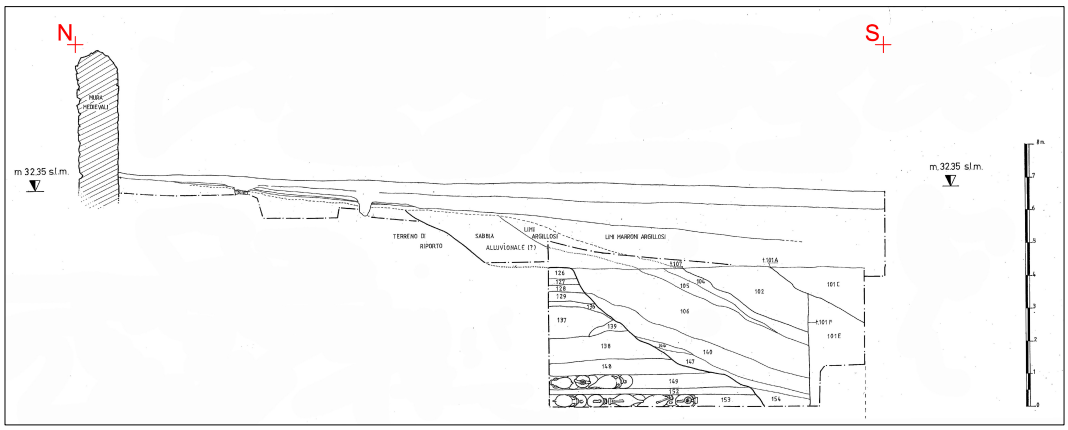


fig. 89 - Cross section of the earthwork

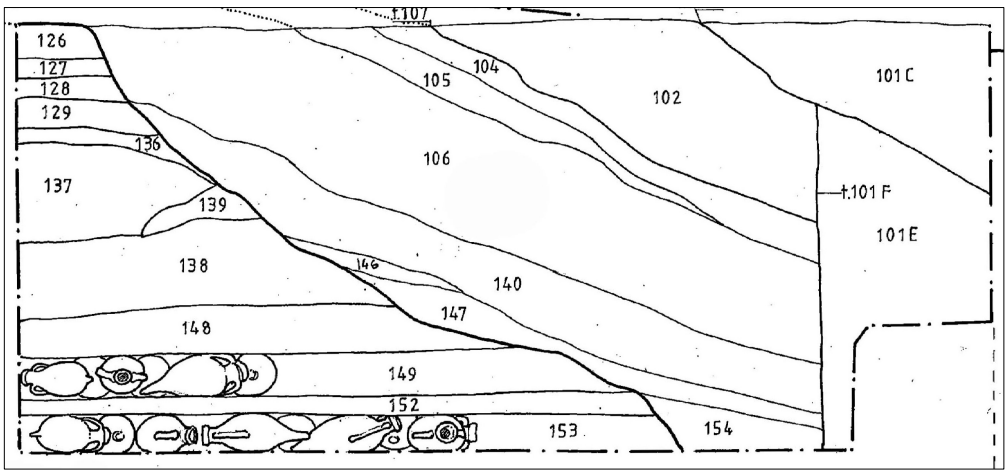


fig. 90 - Detail of the cross section of the earthwork

Deposit description

As anticipated, here are discussed only the two layers of amphorae employed for draining and stabilize the earthwork (contexts 145 and 155). These have indeed a history quite different from the sherds embedded within the sediments which were redeposited for filling the empty spaces left and for the elevation of the *agger* (contexts 153, 152, 149), although it has been possible to demonstrate that, besides, amphorae, other vessels were intentionally redeposited, particularly in the upper layer (made apparently of 'second choice' materials), for draining the embankment foundation[472]. The data provided by this materials are consistent with the data provided by the amphorae alone but here they have been kept separate anyhow.

fig. 91 *- The lower drainage during the excavation*

Assemblage physical state

Most of the vessels are complete or sub-complete, with the top layer displaying a higher rate of fragmentation.

The finds

In this case it was possible to process 275 items, being all of them complete or sub-complete amphorae. They include the types Lamboglia2, Dressel 6A, Dressel 6B, Fondo

[472] MAZZOCCHIN, FURLAN n.d.

piatto, Troncoconica da olive, Dressel 1, Dressel 2-4, Dressel 7-11, Tardo Rodie, Dressel 25, AC3, AC4 and Tripolitana I. The vast majority of the specimens consists in Dressel 6A and Dressel 6B. Some of the vessels were stamped, thus carrying more accurate dates. A complete list of finds is available in MAZZOCCHIN 2013, pp. 42-43. No finds other than amphorae were processed. The *tpq* is provided by 5 stamped amphorae dated to the age of Claudius (41- 54 AD).

Monte Carlo chrono-profile

Below are plotted the profiles with windows, in order, of 25, 50 and 10 years. No corrections were applied to the dates provided in MAZZOCCHIN 2013; these were simply "translated" in numbers.

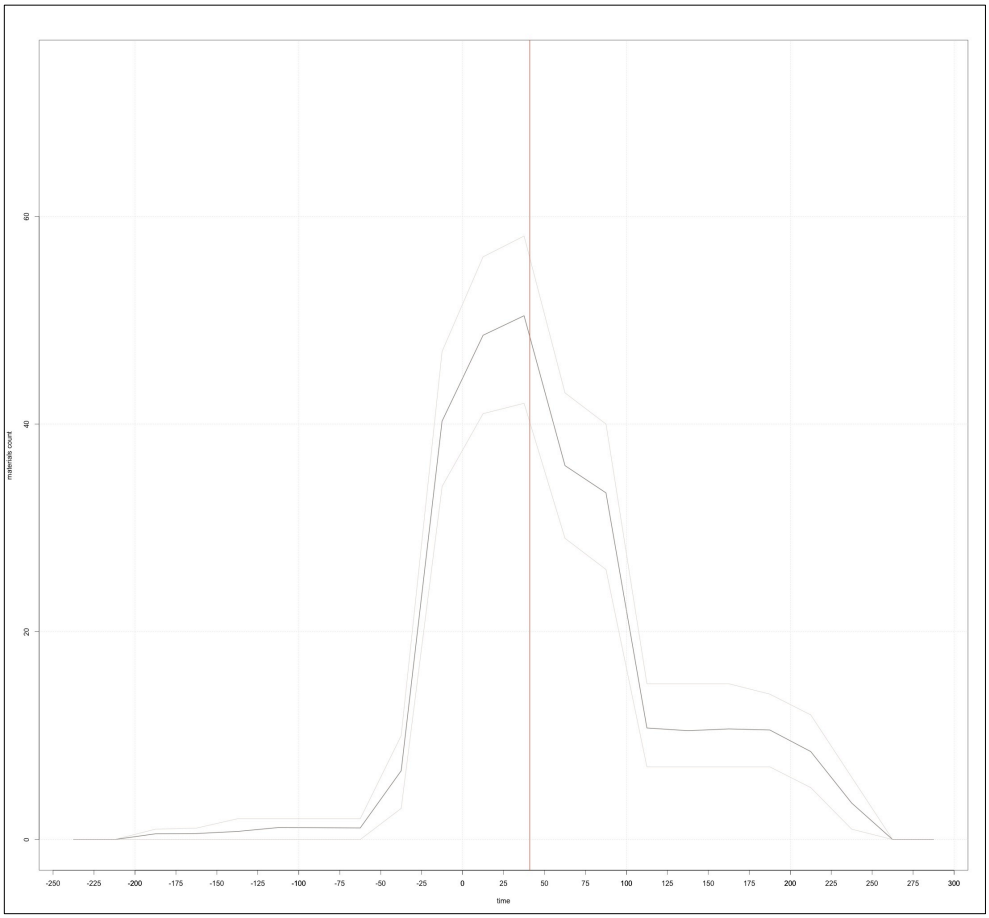


fig. 92 *- The drainage. Profile with 25 years brackets*

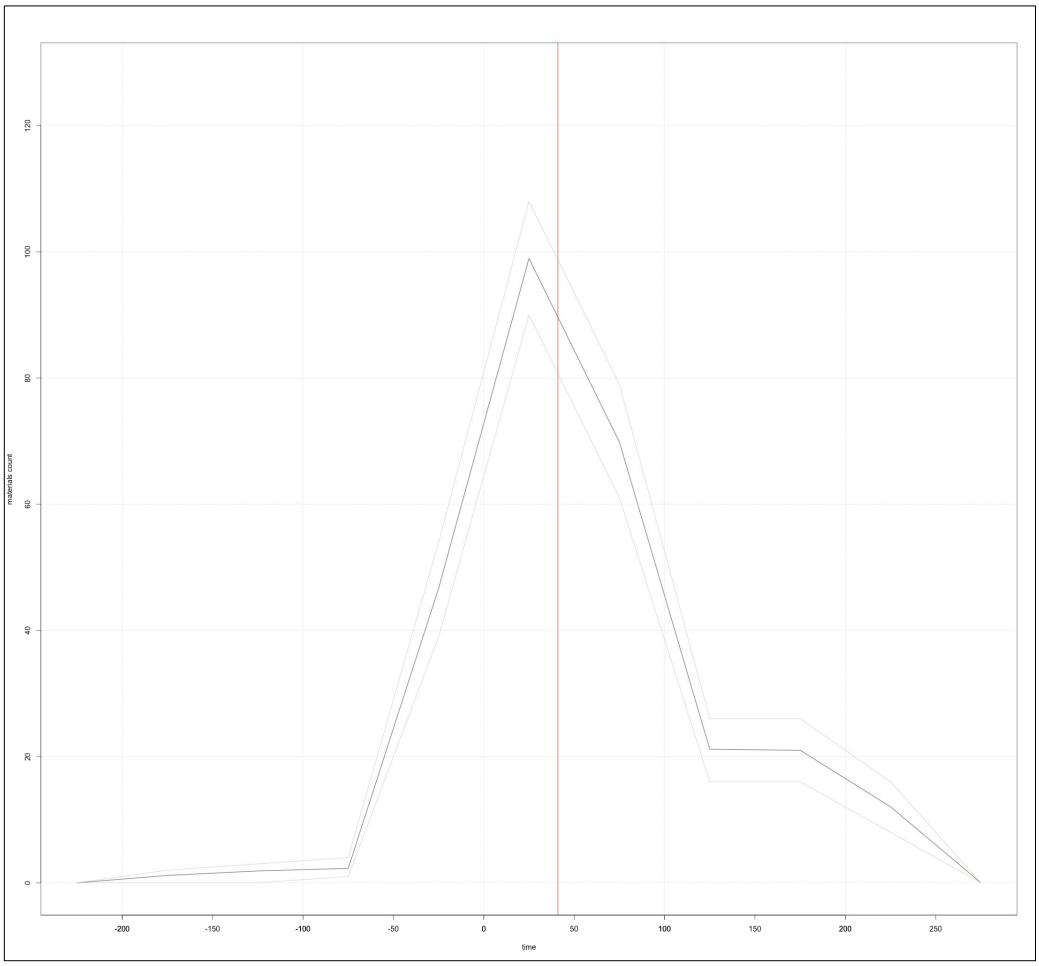


fig. 93 - *The drainage. Profile with 50 years brackets*

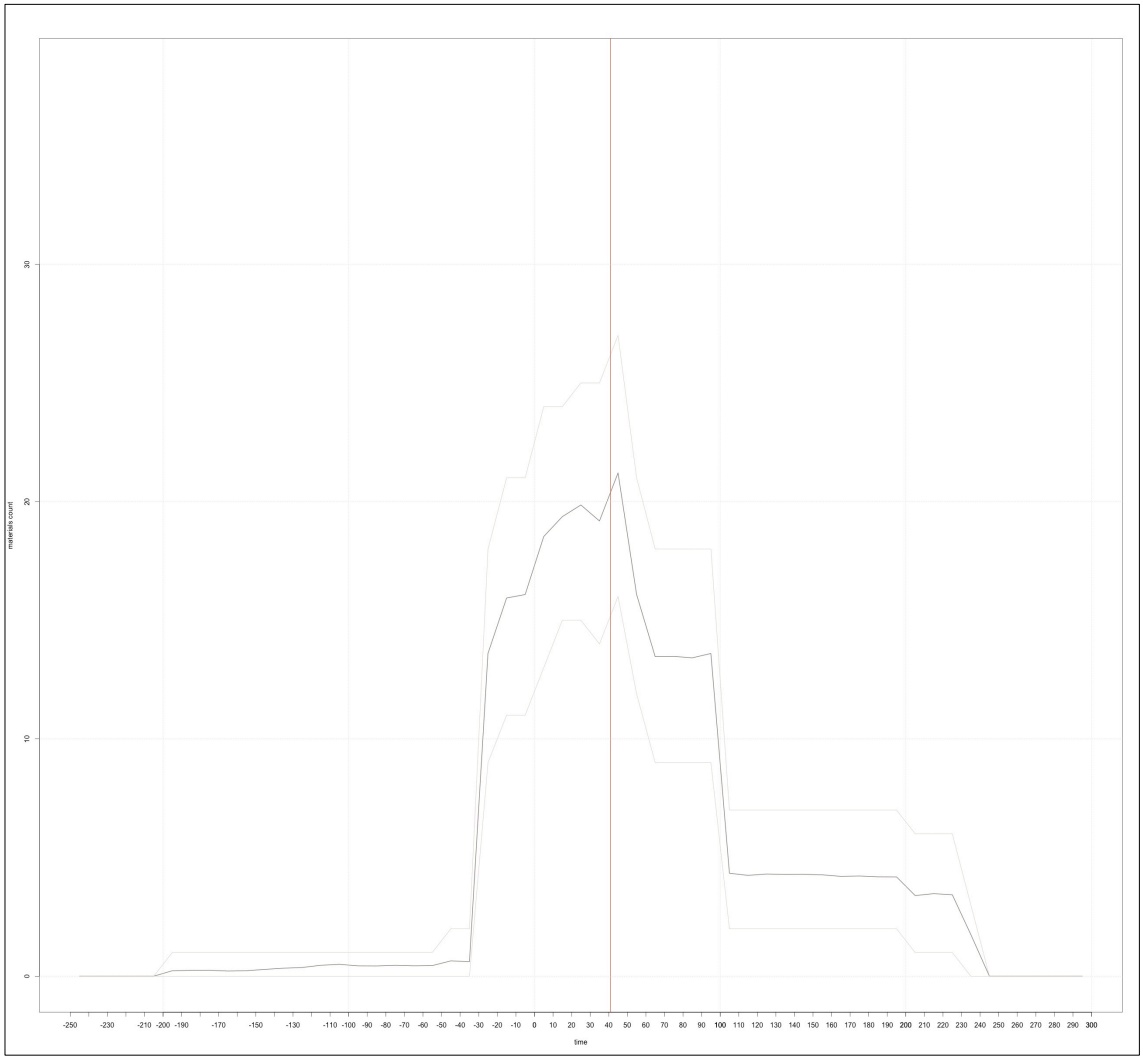


fig. 94 *- The drainage. Profile with 10 years brackets*

Discussion

The chronological profiles obtained perfectly meet the expectations for a primary deposit with abrupt formation, although the curve is some wide because of the poor dating of many specimens (one or more centuries). The peak is consistent with the *tpq* and residuality is null. This is clearly due to the fact that the vessels employed were picked directly from the systemic ones, were they circulating or provisionally stored. Eventually, intrusions do not seem to have played any substantial role, because of the short exposition of the deposit, of its depth and of the absence of any recorded later 'disturbance' activity.

Date proposed

Ad quem: 41-100 AD. Within this window, given the normal life expectancy of a common amphora, the satus of the deposit and the overall chronological profile, the period

41-60 AD seems the best option. It has to be stressed that this date is consistent with the data provided by the other materials recovered within the earthwork section excavated and with the overall historical and monumental background, in particular with the documented exapansion of the city towards south-east in the middle of the 1st century AD.

Duration

The duration of the process which led to the construction of earthwork as a whole is unknown; the building of the small section excavated may have been a matter of days or weeks at most, according to the oganization of the construction site and to the abundance of manpower. In any case the window seems to be far narrower than the accuracy of our observations.

Notes and references

The assemblage is presented in full detail in MAZZOCCHIN 2013, while MAZZOCCHIN, FURLAN n.d., along with a summary of the recovered items, presents a discussion of the formation and dating of the agger.

IV.3.7 CASE STUDY 3: A SMALL DUMP IN AN ANCIENT *ATRIUM* FROM AQUILEIA (P.A.4)

Topographic and archaeological background

The deposit is located in the western part of the house of Titus Macer, the one arranged with a typical *atrium* scheme.

fig. 95 - Location of the small dumping area. Domus *of* Titus Macer

In particular the examined dumped material was accumulated in the eastern part of the *atrium* and in the northern *ala*. Although the excavation of the southern corridor was suspended and in spite of the very poor preservation of the north and west ones, it is probable that the whole open area was involved in dumping activities.

It is worth recalling that here the stratification had been left substantially untouched by the excavations carried out during the 20th century and, although the deposit considered was one of the top ones, it was comparatively well sealed by the upper thick rubble debris which was preserved right below the ploghsoil.

It is also worth considering schematically the extremely rich and interesting sequence which forms the framework in which the deposit has to be placed.

The deeper strata excavated in the area refer to the construction of the house and may be dated to a quite ancient phase (see up ahead), say at most at the very beginning of the 1st century BC. The *domus* did not witness substantial structural changes for long, besides the reflooring of at least one room (9), more probably two (8, 9). Routine maintenance and cleaning activities apparently prevented some record from forming, besides some traces of wear which can be observed on the mosaics surface. Major re-arrangements took place much later, probably at the end of the 4th century AD or at the very beginning of the next one: they entailed the widening and re-paving of the central open space, the re-flooring of the corridors with bricks and the walling up of some passages. This situation apparently did not last for long: a great number of small post holes and some traces of fire are documented soon after the brick floor was built, until the dumping activity took place. The deposit examined represents the upper layers produced by this activity, which probably witnessed some attempts of provisional reflooring through clay layers.

After the deposit was formed or contemporarily a significal coin hoard was hidden and never recovered. This is being examined by prof. M. Asolati and seems to be datable to the second half of the 5th century AD. This episode does not represent the end of this rich sequence: later a new bricks floor was probably laid down. Here an amphora containing lentils was set down close to the north-eastern corner of the northern *ala*. Again its content was never recovered (before the recent excavations), in this case because of a fire which involved this part of the house (see up ahead). This episode marked the end of a substantial continuity of occupation in the house. Later activities are not attested until the remaining structures of the building were eventually robbed, most probably in post medieval times. On the rubble ammassed a soil profile finally developed.

Deposit description

As anticipated the deposit described is made by the upper layers produced by dumping activity in the area (contexts 4071 and 3016). It may turn out that even the lower layers, directly deposited on the surface of the brick floor, may be associated with the upper ones, but for the moment, the existence, in the middle, of layers possibly attributable to tentative repaving imposes some caution. It is also still not clear if the coin hoard recovered was buried alond with the other dumped materials or after the dump was formed, as it was recovered in the upper part of context 4071, with no evident signs of cut. Nonetheless the removal of matter for burying it may have been minimal, thus leaving no substantial traces. It follows that the hoard is here not treated. The possibility that some coins got dispersed around also suggested to keep out of this discussion the numismatic evidence as a whole, although it is worth noting that the evidence emerged, until now, does not seem to be in contrast with the conclusions drawn by the rest of the assemblage alone.

The deposit had the appearance of a ≈10 cm thick, dark, brown-greyish, sub-tabular layer, quite soft and with a sandy-loamy texture. It was rich in ash, charcoal lumps and small bones, thus in general, its identification as a small dump seemed to be reasonable.

Assemblage physical state

Concerning the pottery and glass recovered, their fragmentation is quite high and they do not display any sign of blackening or burning. Their wear seems to be in general low and homogeneous.

The absence of blackening and the absence of any whole vessel, in particular, exclude the hypothesis that the deposit was the result of an episode of fire *in situ*, strenghtening its interpretation as a dump. Charcoal and ash are likely to have been produced by cooking (most probably, given the amounts of bones and shells - see below) or craft activities.

Some of the bones recovered displayed clear cuts probably due to butchering, but no signs of long exposition on the surface.

fig. 96 *- The assemblage recovered in context 4071.*

The finds

The materials recovered included substantial amounts of bones and shells, insignificant amounts of fragments of mortar and wall plaster a good number of posherds, glass fragments and iron items. Among them, it was possible to process 22 items, *i.e.* 8 potsherds, 1 metal knife and 13 fragments of glass. Among the unprocessed artefacts, the most represented are unidentified amphorae body sherds and glass fragments, followed by iron items.

A few more artefacts may be dated after their study has been completed. Again, the total number of finds is, unfortunately, some poor.

Among the finds, it is somehow surprising the high amount of iron objects, which could have been profitably reused or recycled.

The knife, dated to the first century AD (but some review of the date may be required), and one black glased potsherd are clearly residuals, while the other dated items are substantially consistent with each others. A tpq at the middle of the 5th century AD is provided by an african sigillata sherd and by a glass fragment.

Monte Carlo chrono-profile

Here follow, in order, a standard profile with 25 years brackets, a profile with 50 years brackets and a profile with 10 years brackets accounting for all the dated finds but the residuals.

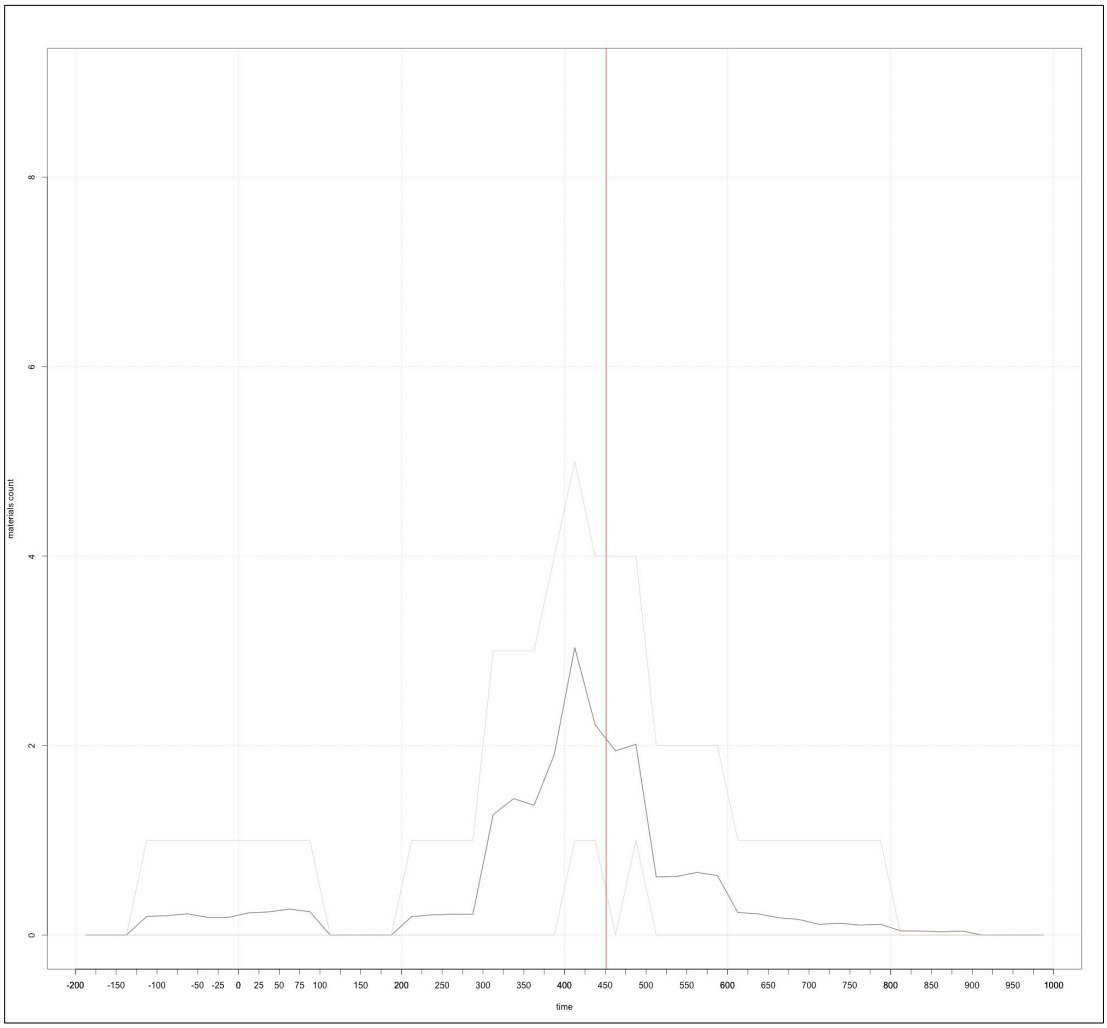


fig. 97 *- The small dump. Profile with 25 years brackets*

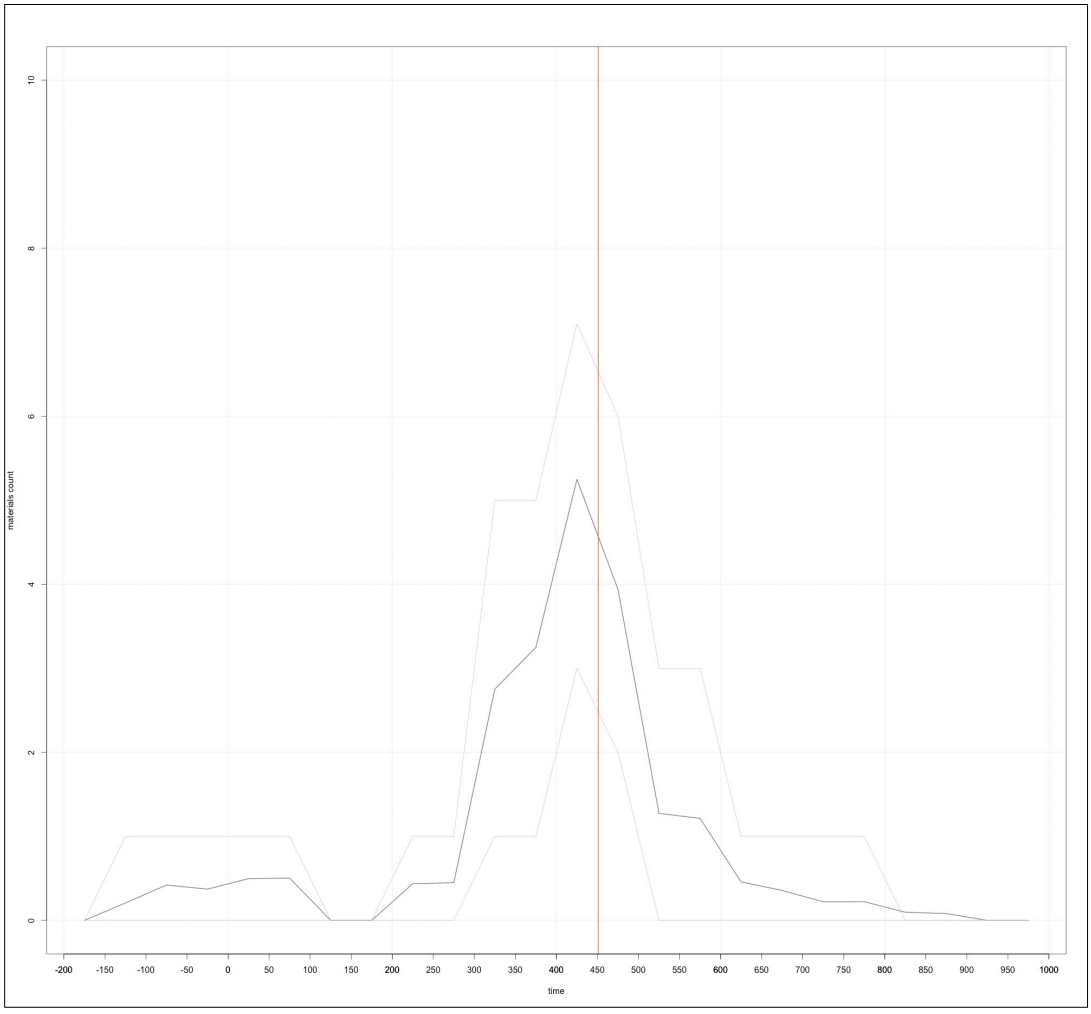


fig. 98 - The small dump. Profile with 50 years brackets

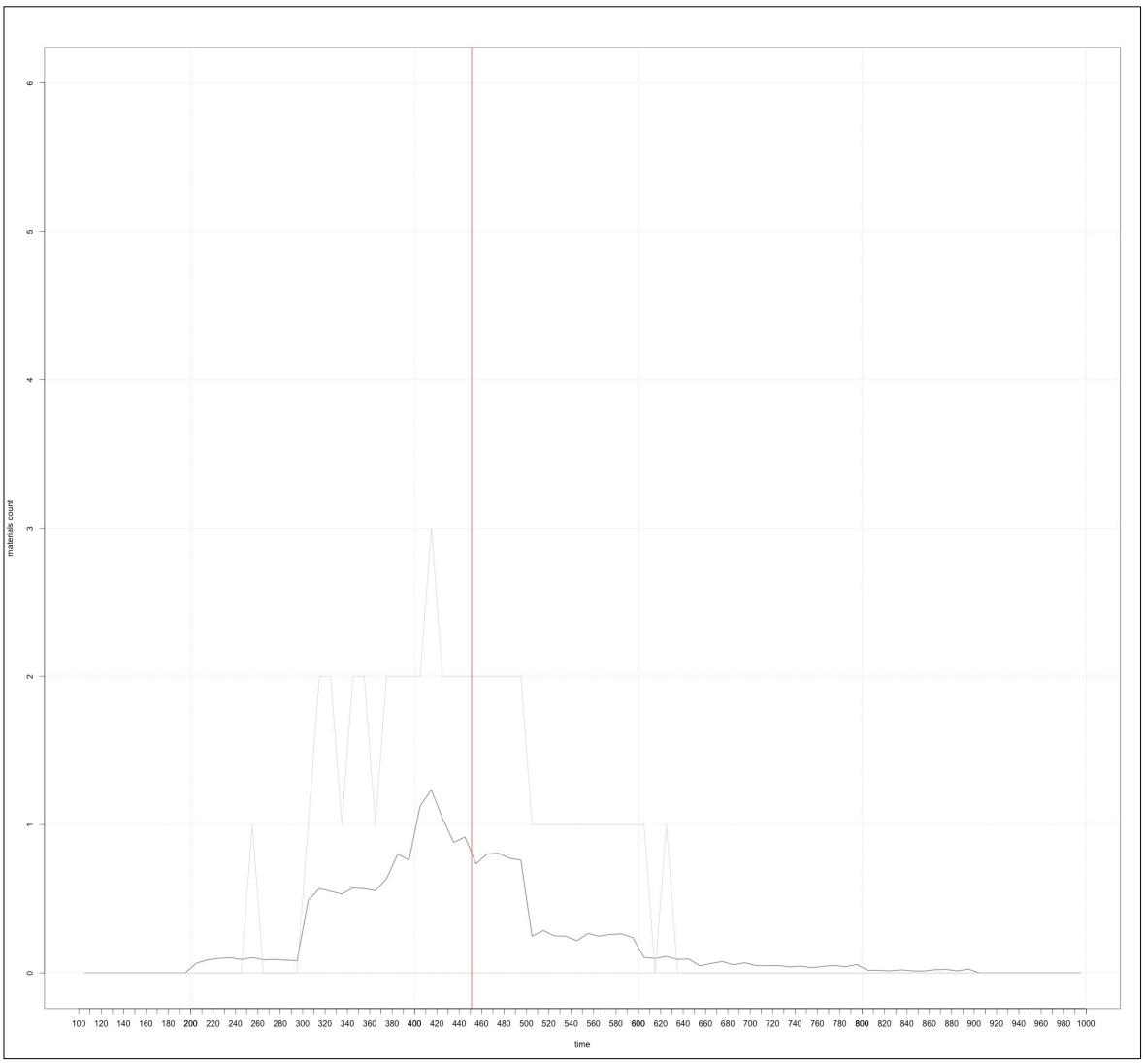


fig. 99 *- The small dump. Profile with 10 years brackets*

Discussion

The profile display a main peak, very evident using brackets of 25 and 50 years, and a neat tail of residuality, produced by the two items cited above. With 10 years brackets the main peak appears some wide, mostly because of the presence of finds (coarseware in particular) dated with very broadly. These items also produce a profile stretching onwards, but the bulk of the materials is plotted between 300 AD and 500 AD.

It is interesting that, although roughly, the 10 brackets profile seems to evocate the three groups scheme observed in Chapter xxxx. A detailed selection of the coins embedded may strenghten the overall picture and allow in future some more accuracy.

Date proposed

Ad quem: 450(1)-500

Duration

Given the relatively poor thickness of the deposit (even accounting for a volume decrease typical of layers containing high percentages of organic material) it is likely to have formed in time span much narrower than our chronological accuracy, thus it can be considered having a 'punctual', abrupt formation. The deposition of the whole dumping sequence (thus including the lower levels) may have taken some more, but probably not enough for allowing the detection of a starting date and of an ending date.

Notes and references

This deposit is substantially unpublished, but some notes are available in FURLAN 2011. A complete list of the finds recovered is available in the same report (DOBREVA 2011).

IV.3.8 CASE STUDY 4: *IN SITU* BURNT AMPHORA AND CONTENT FROM AQUILEIA (P.A.5)

Topographic and archaeological background

The deposit represents the product of the last actions of the long life sequence discussed for the previous case study. After this, a long occupational hiatus seems to occur until post medieval times.

Deposit description

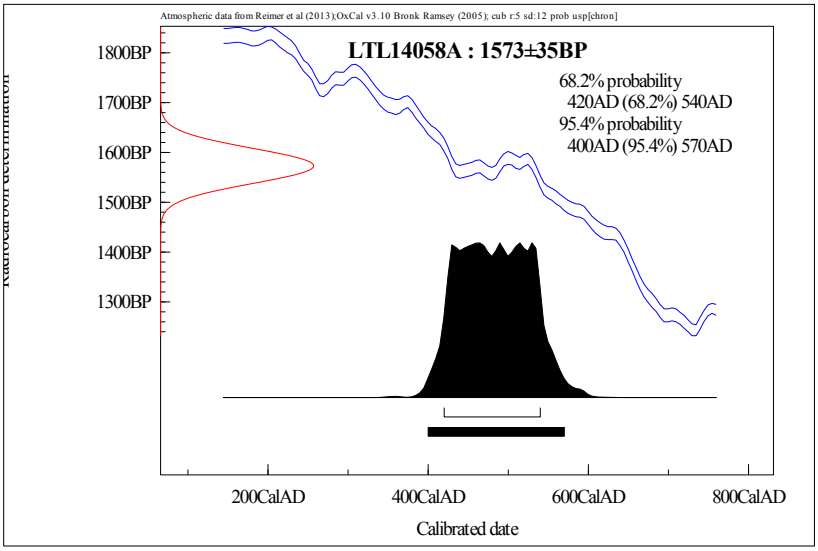
Compared to other case studies, looks with no doubt very clear and 'easy'. Anyhow I thinnk it is worth briefly discussing it, at least for underlining a crucial operative key point, that is exploiting scientific techniques at the height where the status of the deposit is particularly clear and where the huge amount of process which interfere with dating is reduced to the minimum. The deposit in itself is made only by an amphora (reused for storing food) and its content of lentices; these were charred and the vessel itself displayed traces of blackening due to fire. That is quite difficult to say whether the fire was accidental or intentional and how far it spreaded, but indeed the issue has scarce interest from an exquisitely chronological point of view. Ash and unidentified charcoal lumps completed this

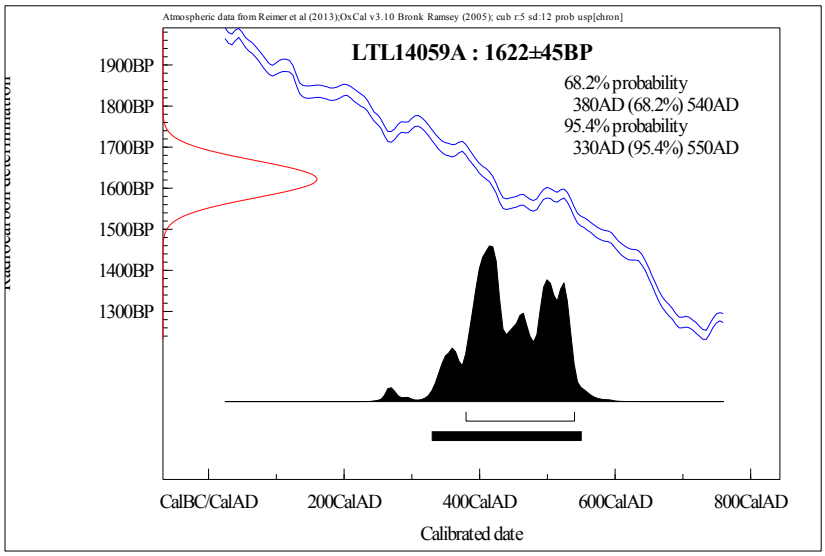
almost matrix-less deposit. The primary status of the deposit is unquestionable from both a spatial and temporal point of view.

fig. 100 *- The burnt amphora ant its content*

The finds

The amphora containing the seeds has been provisionally dated to the 4th-6th century AD, but what draws the attention in this case is the content made of charred seeds. Seeds offer indeed an invaluable opportunity for dating, as they are not affected by old wood effect and they were likely to get stored for no more than one season (see Chapter xxxx). They represent, along with primary bones, an invaluable mean of dating. In this case two samples were selected for radiocarbon datings, which were eventually performed by CEDAD (LE, Italy); the resulting curves are provided below.





figg. 101, 102 - *Radiocarbon curves of the two collected samples*

Profile

The solid primary status of the deposit, along with the almost certain contemporaneity of the seeds, allowed to combine the two dates for trying to narrow the chronological window provided. This necessity was even more cogent because of the plateu which characterize the calibration curve in the late Roman/ early medieval times, entailing wide forks in the dates of single samples. Moreover a sure *terminus post quem* was offered by the hoard preseved in the lower strata (see above). This *terminus* was fixed very cautiously at 450 AD (but in the future it may be pushed forward to 460/70 AD) and combined with the radiocarbon dates. The resulting plot, obtained with the on line program Oxcal, is provided below.

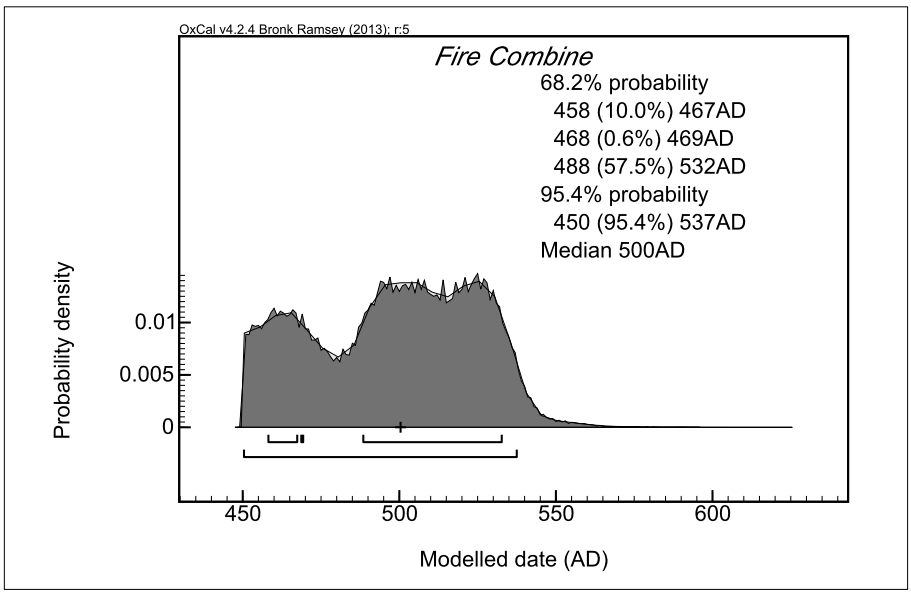


fig. 103 *- Oxcal combine of the two radiocarbon dates*

Date proposed

Ad quem: 450-537 AD, with a slight preference for the later period, say after 480 AD.

Duration

The formation of the deposit seems to have been a matter of minutes/hours.

Notes and references

The discovery is (paradoxically) reported in VILLA 2012, while the later analyses are unpublished.

IV.3.9 CASE STUDY 5: AN *IN SITU* ASSEMBLAGE BENEATH COLLAPSE DEBRIS: THE CASE OF THE PYTHION THEATRE IN GORTYNA (P.A.6)

Topographic and archaeological background

The case discussed represents another 'extreme', matrix-less and lucky case, which neatly shows the kind of dynamics which should be expected by this type of deposits. After the primary function of the theatre was lost, probably in relation to the abandonment of the cult of Apollo at the beginning of the 4th century AD, the structure was reused for some time for activities such as stabling and marble reuse and calcination. This occupation lasted

until a sudden event led to the collapse of the structure, literally burying whatever was located at the structure feet.

Here we focus on the southern part of the ancient *scaena*, lately reused as a stable: literally between the earthen floor and the debris collapsed from the upper structures some *in situ* materials were preserved.

Deposit description

The stable has been investigated only partially, entailing that some more materials may be preserved just some meters far from the excavated area. Two main goups of evidence were recovered: a coin hoard abandoned on the surface of a niche and two articulated donkey skeletons. Their primary status, from both a spatial and a chronological point of view, is unquestionable.

Assemblage physical state

As anticipated the remains of the two donkeys recovered were articulated and their death is certainly due to the collapse of the structure.

fig. 104 *- One of the two donkeys discovered*

The coins were also in recovered in close spatial association and one of them displayed traces of the fabric container in which they had been grouped.

fig. 105 *- Coin with traces of the fabric container of the hoard*

The finds

It follows a schematic list of the 34 coins forming the hoard:

1) Sons of Constantine I for Divus Constantine I, follis, 347-348 AD, Antioch

2) Constantius II, AE4, 355-361 AD, Cyzicus

3) Julian III, AE3, 361-363 AD, Thessaloniki

4) Julian III, AE3, 361-363 AD, Thessaloniki

5) Julian III, AE3, 361-363 AD, Thessaloniki

6) Julian III, AE3, 361-363 AD, Thessaloniki

7) Julian III, AE3, 361-363 AD, Thessaloniki

8) Julian III, AE3, 361-363 AD, Thessaloniki

9) Julian III, AE3, 361-363 AD, Thessaloniki

10) Julian III, AE3, 361-363 AD, Thessaloniki

11) Julian III, AE3, 361-363 AD, Thessaloniki

12) Julian III, AE3, 361-363 AD, Thessaloniki

13) Julian III, AE3, 361-363 AD, Thessaloniki

14) Julian III, AE3, 361-363 AD, Thessaloniki

15) Julian III, AE3, 361-363 AD, Thessaloniki

16) Julian III, AE3, 361-363 AD, Constantinopole

17) Julian III, AE3, 361-363 AD, Cyzicus

18) Jovian, AE3, 363-364 AD, Heraclea

19) Valentinian I, AE3, 364-367 AD, Thessaloniki

20) Valens, AE3, 364-367 AD, Thessaloniki

21) Valens, AE3, 364-367 AD, Thessaloniki

22) Valens, AE3, 364-367 AD, Thessaloniki

23) Valens, AE3, 364-367 AD, Thessaloniki

24) Valens, AE3, 364-367 AD, Thessaloniki

25) Valens, AE3, 364-367 AD, Thessaloniki
26) Valens, AE3, 364-367 AD, Thessaloniki
27) Valens, AE3, 364-367 AD, Thessaloniki
28) Valens, AE3, 364-367 AD, Thessaloniki
29) Valens, AE3, 364-367 AD, Thessaloniki
30) Valens, AE3, 364-367 AD, Thessaloniki
31) Valens, AE3, 364-367 AD, Thessaloniki
32) Valens, AE3, 364-367 AD, Thessaloniki
33) Valens, AE3, 364-367 AD, Thessaloniki
34) Valens, AE3, 364-367 AD, Thessaloniki (?)

The consistence of the dates provided is indeed astonishing; this, along with the great predominance of specimens from one single mint suggests that the coins circulated for a very short time[473]. Sixteen specimens provide as *terminus ante quem non* the year 364 AD.

Turning to the two donkeys, three samples were dated with the radiocarbon technique and then summed and combined. Here are the results[474].

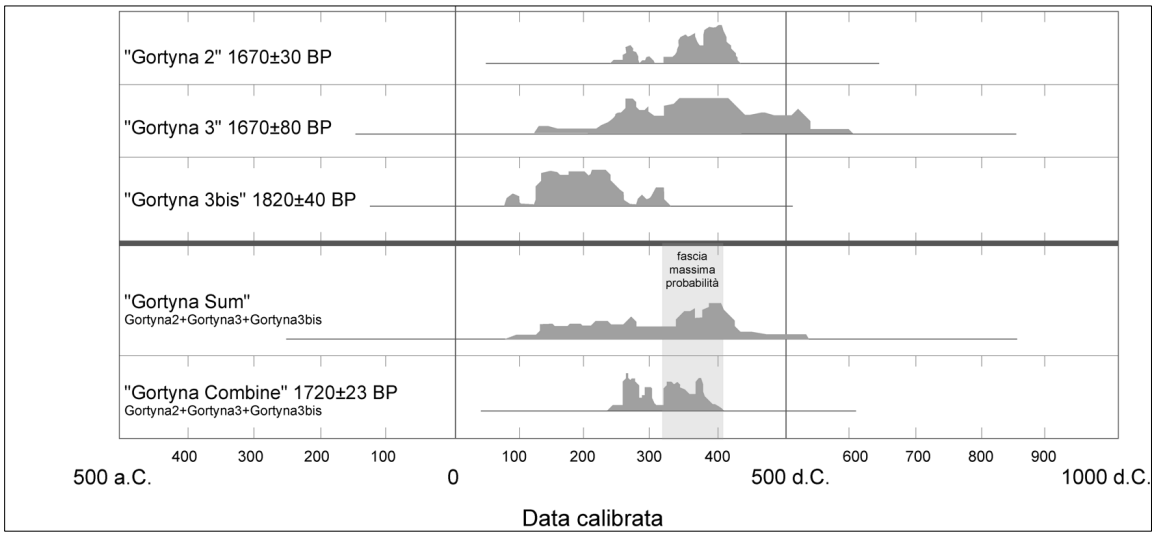


fig. 106 *- The radiocarbon profiles provided by the collected samples*

Monte Carlo chrono-profile

Given the accuracy provided by the coins forming the hoard, particularly compared with the radiocarbon combine date, in this case any quantitative profile is some excessive.

[473] ASOLATI n.d.
[474] BONETTO ET ALII 2006, p. 735

Only the 25 years brackets and the 10 years brackets profiles are plotted. Coins life has been extended of 10 years, although it was clearly unnecessary.

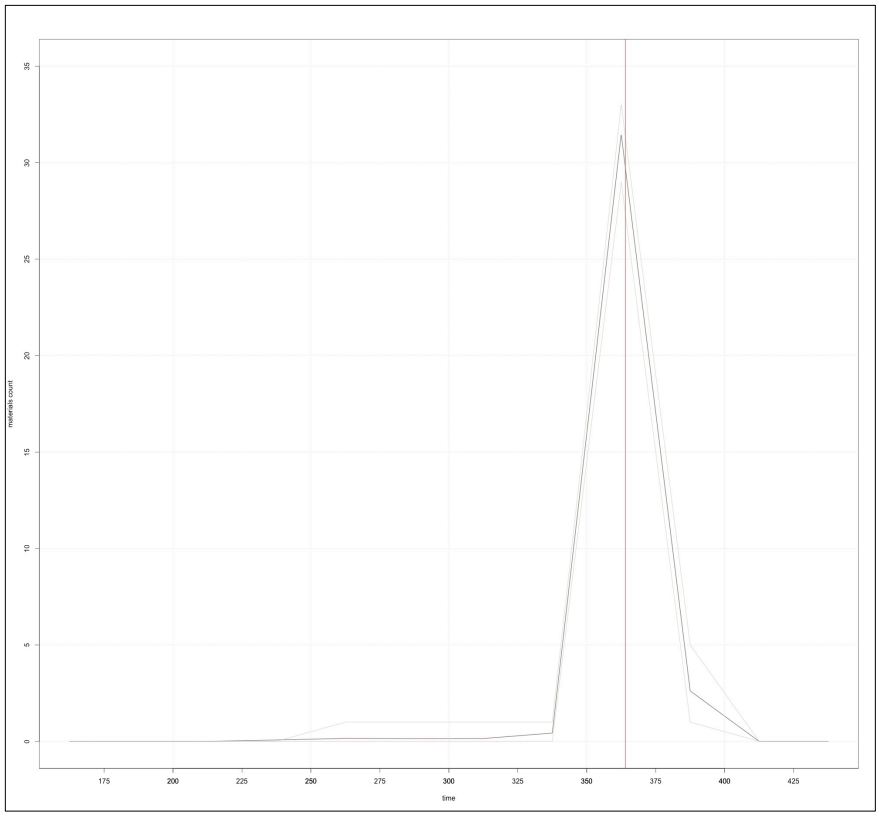


fig. 107 - *The* in situ *assemblage. Profile with 25 years brackets*

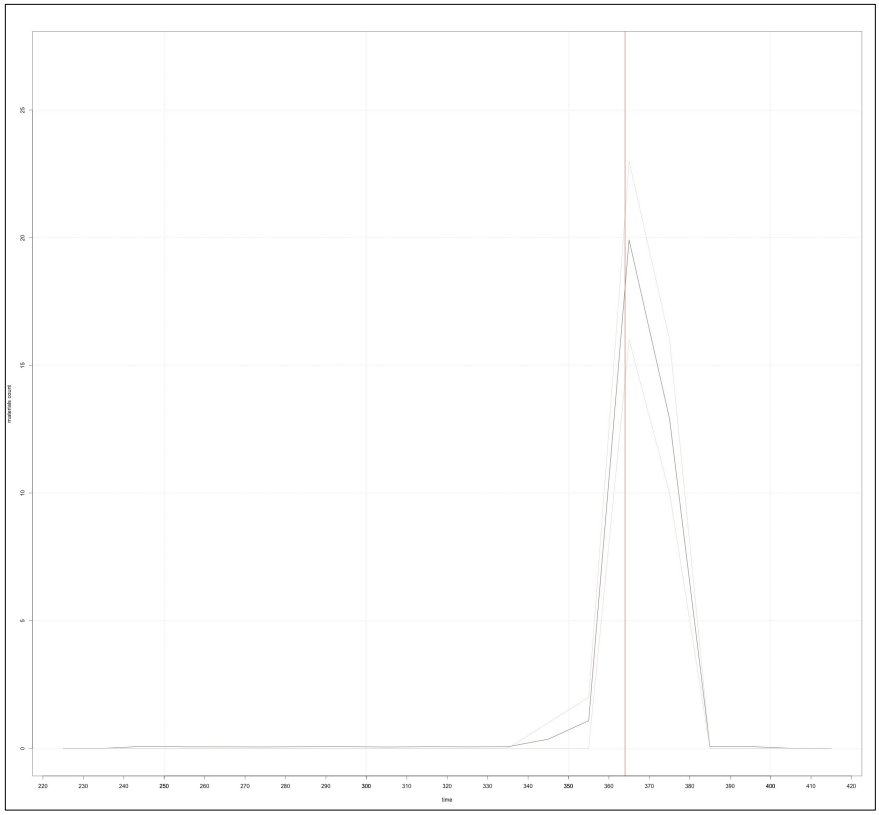


fig. 108 *- The* in situ *assemblage. Profile with 10 years brackets*

Discussion

As anticipated the use of any simulation in this case is almost unnecessary, although quite explicative. The hoard structure suggests a date quite close to terminus post quem provided. We know by historical sources that a major earthquake took place in July 365 AD

Date proposed

Ad quem: 364-380 AD. Of course we are almost certain that the collapse occurred during the earthquake which took place on the 21st of July, 365 AD. Indeed the assemblage formation is almost surely related to this episode; in this case historical sources substantially confirm the picture emerged by the archaeological evidence.

Notes and references

See Chapter IV.2.2 for the references concerning the excavation as a whole and BONETTO *ET ALII* 2006 for this area in particular. See also ASOLATI n.d. the detailed numismatic examination of the hoard.

IV.3.10 Case study 6: a layer of charcoal from the *domus* of *Titus Macer*, Aquileia (P.A.7)

Topographic and archaeological background

The deposit discussed is part of the sequence of strata connected with the construction of the *atrium* house. It has been noticed on the south wall of the robbing trench which marks the northern border of the dwelling. The surface of the layer has been exposed in a minimal area, but it is likely to extend all over the surface of room 9. It is made of a single context (US 4474) which lies directly on the surface of a silty bedding which, in turn, covers a layer made of brick fragments. It is covered by another loamy layer holding a second layer of brick chips; eventually, on the top of this one, the mortar bedding for the more ancient mosaic of the room was laid down. Given all this, its relation with the construction of the house can be taken for granted. It has to be stressed that all the other layers which are part of the sequence are basically secondary ones, thus redeposited and most probably containing residuals.

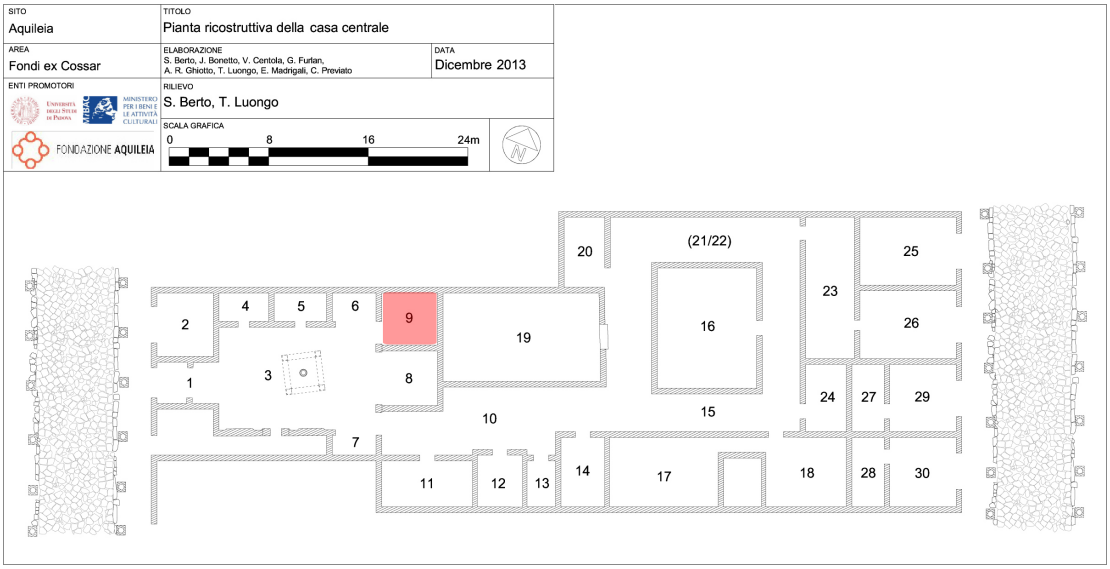


fig. 109 *- Location of the charcoal layer recovered in the* domus *of* Titus Macer

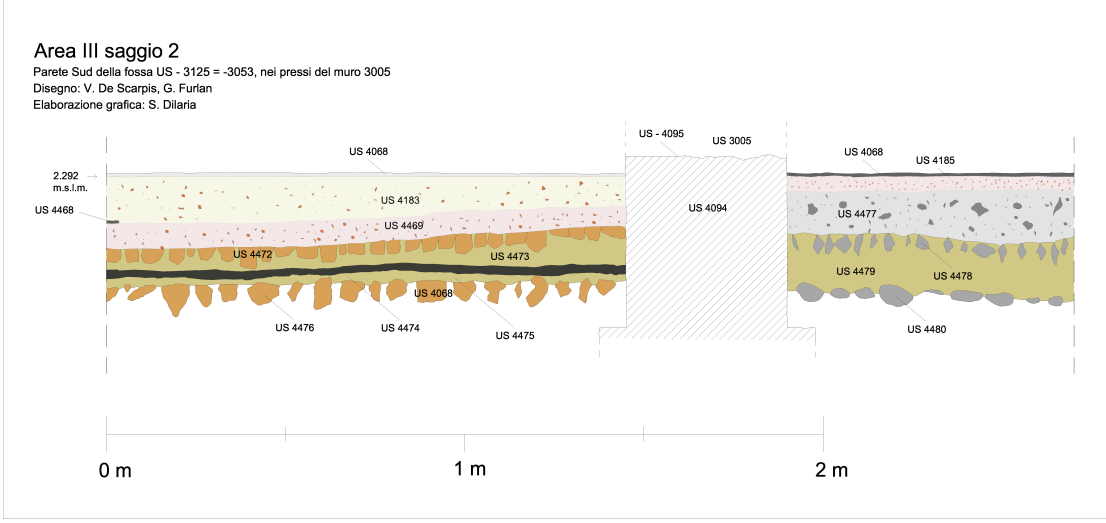


fig. 110 *- Cross section of the sequence observed beneath the floor of rooms 9 (left) and 6 (right)*

Deposit description

The layer is made exclusively of chunks of charred twigs. It is easily recognisable and it does not appear being mixed with sediment of containing artefacts of materials other than charcoal. It seems most probable that the layer was laid down intentionally, possibly for hygroscopic reasons; some selection of the wood seems also to have occurred and the chunks, although not *in situ*, are likely to have been burnt for this specific purpose a few time before being deposited. The primary status of the deposit seems consequently by far the most probable.

Assemblage physical state

The chunks of charred wood are well preserved and belong, apparently for the vast majority, to small twigs.

The finds

During the end of the last excavation campaign, some samples were collected; these were then examined by the archaeobotanist N. Martinelli and three of them were selected. These are particularly well preserved and the external rings are, if not present, at least quite close to the sampled ones. The old wood effect should then be reduced. The three radiocarbon dates provided by CEDAD laboratories were the following (years BP):

2168 ± 45
2091 ± 30
2154 ± 35

Profile

The three dates were combined with Oxcal for reducing time window (the three twigs originally were most likely cut in the same period). A solid terminus post quem was also introduced for further trying to reduce the gap: this was provided by the foundation of the colony itself, in 181 BC. Below is the resulting plot.

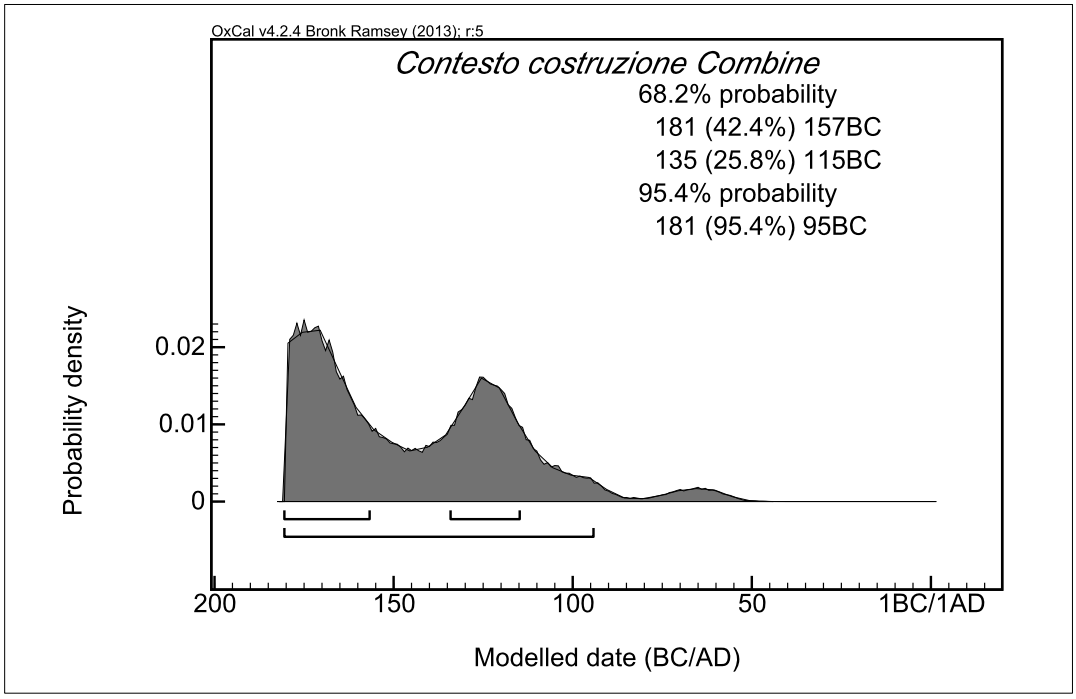


fig. 111 *- Oxcal combine of the three radiocarbon dates*

Discussion

The three dates provided by CEDAD are by themselves very consistent, further suggesting of being scarcerly affected by old wood effect, wood reuse or storage for long time. It is also possible to advance that, for the moment, besides two single pieces whose date is some uncertain and may be reviewed, the materials recovered within the other layers referred to the construction of the building do not contrast with the evidence suggested by the radiocarbon analysis.

Date proposed

Ad quem: 181-90 BC. Five years more were added to the window for taking into account the possible storage of the sampled twigs for a brief period (it seems unlikely that they were stored for more than one or two seasons and they may well have been collected

exactly for the purpose of being used in the construction site just before they were eventually burnt) and for minimal old wood effect.

Duration

Per se the process of depositing the layer of charcoal was a matter of minutes or hours at most.

Notes and references

The analyses carried out are still unpublished, while the sequence examined is briefly discussed in BERTO *ET ALII* 2013, p. 58

❖ PRIMARY DEPOSITS WITH CONTINUOUS FORMATION ❖

IV.4.1 DEFINITION

What is a primary deposit has been already discussed in Chapters II.2.4 and IV.3. It is here worth focusing on the the differences between a primary deposit with puctual formation and a primary one with continuous formation. The difference is basically quantitative and it is relative, more than absolute. It means that according to the accuracy of our observations we can put the formation of a given deposit on an imaginary timeline as a whole or we may be able to discern the beginning and the end of its formation. This is a matter of formation span and of quality of data. As anticipated, being the quality of dates substantially independent from the deposit status, the chance of recognising a primary deposit with continuous formation lies primarily in the temporal lenght of its own formation. It can be advanced that this lenght is, to this day, generally quite long; primary deposits whose continuous formation can be ascertained are indeed very large ones, which formed over 30, 50 or a hundred years. Nonetheless a general improvement in finds dating may, in the future, make possible to move some deposits from the status of primary abrupt to the status of primary continuous.

It follows that a primary deposit with continuous formation may be defined as a deposit whose assemblage largely belongs to the same systemic context in which the deposit was formed and whose formation lasted for a long time (where with 'long' is meant 'sufficiently long for being appreciable through the means currently available).

These deposits are, summing up, the product of processes and actions which lasted for some time; it entails that their assemblages mirror a more or less long sequence of systemic contexts, eventually providing precious information about a time span longer than the one provided by a primary deposit with abrupt formation. This makes them, particularly those with longer 'life', precious tools for reconstructing ancien economic trends and dynamics.

Unfortunately, although their single volume should be high, their overall number in an urban excavation is not high at all and their presence is usually pent into precise topographic areas (see below).

Grouping in this case represents an important issue; as I will disscuss later, if one thinks of one typical deposit of this taxon, *i.e.* an urban dump, it suddenly emerges how, in fact, it is made up of contexts (when recognizable) each one, in itself, is a primary deposit with an abrupt formation. The point here is which *modus operandi* assure more results: considering each context by itself would not be wrong, meaning it would not lead to mistakes, but it would prove to be poorly valuable, providing many correct dates of single scarcely significant episodes and moreover preventing a global view of the economics of, say, the site which produced the whole deposit. Wider groups, in this sense, although more difficult to handle, carry a much more interesting informative potential.

IV.4.2 General expectations

A quantitative analysis of these deposits impose much more attention if compared to the previous ones, at least for two reasons:

- apart from the 'tail' and the 'head' of any profile, in the middle any trend may be likely, according to the specific economic dynamics which produced the deposit;
- the potential longer exposition of these deposits make them inherently more susceptible to mixing and to phenomena of residuality (internal and or external) and intrusions.

These points make drafting any general expectation much more difficult and are worth being discussed in more detail.

These deposits should display, theoretically, a continuous profile, besides the case of some sensibly older residuals. Within this interval, it is almost impossible to guess how the shape of the profile will appear, as it may depend on a wide range of factors, among which economy, demography, and quality and quantity of activities are just few. This is because these deposits, in general, are also expected to be the product of larger communities.

In case they are 'open air' deposits, their longer time of formation, as a whole, make also much more probable activities such as scavenging, which produces mixing and removal of reusable items; furthermore bioturbation in general have much more chances to play a important role. Thus, besides the presence of residuals and later intrusions, internal residuality and intrusions may also occurr, meaning that some mixing within the deposit may

bring some materials literally up or down, thus without changing the global profile, but changing the profile of the single contexts which makes up the whole deposit.

Concluding, the general expectations we can have concerning the chronological profiles of this type of deposits are possibly larger profiles with various shapes. Markedly younger or older groups of finds may well be interpreted, respectively, as intrusions or residuals, but their presence may be much more undetectable.

As the reading of the chrono profiles in these cases is anything but resolving, the interpretation of these deposits lies primarily on their specific identification, which will be examined up ahead case by case along with the specific characteristics they may display.

IV.4.3 Dating

These deposits can theoretically be dated *ad quem*, using a 'double fork', one for the starting date of deposition and one for the closing date. In general it has to be observed that dating these deposits is some more prickly and interpretive if compared to the previous type.

IV.4.4 Formative typology

For the moment, I highlighted two main kinds of primary deposits with a continuous formation:

- urban dumps;
- drain culvert fillings.

P.C.1, Urban dumps

An urban dump is generally the final product of the waste stream of a whole urban community or of a large part of it. The global amount of materials which can form the assemblage of these deposits is thus potentially very high. Moreover, being dumping a necessary activity, deposition within the same basin may last for considerable time, probably somehow under the aegis of the civic public authority. The topographic canonic distribution of these deposits and the various filters through which any discarded item goes before entering the dumps have already been discussed in Chapter III.5.1. It is worth recalling that usually the distribution of these dumps involves the periphery of the settlement, along with

river banks and any open non used space; the more common topographic features which are suitable basins for receiving these deposits can eventually be listed as:

- the zone surrounding the city walls, particularly near the gates and the main routes; existing cemeteries may represent a mild stop for dumping;
- the ditch which may surround the walls;
- the riverbanks, also *intra moenia*;
- abandoned or undeveloped parcels.

Once highlighted the main probable location of dumps, it is worth reminding that the other side of the coin represented by the existence of these deposits is the very important phenomenon of the substantial absence of accretion and thus of archaeological record *intra moenia* when the waste streams are well managed and regular maintenance is assured.

Moving to the various filters, connected with reuse and recycling, which affect the life of any item before its final deposition in dumps, they act removing the large proportion of what has some value, is necessary or can be recycled. The efficiency of these mechanisms can vary, but in general within the dumps assemblages, at least in periods of 'normal' management are to be expected low rates of glass, metals and valuable items. The last filter operating, *i.e.* scavenging, may also produce some mixing (see above).

Besides systemic items, it has to be reminded the possibility, undoubtedly higher in comparison to smaller dumps, that some residuals turned out to be redeposited in dumps; these may well be the product of building demolitions of the removal of some volumes of sediments, again probably for building purpose, within the city area.

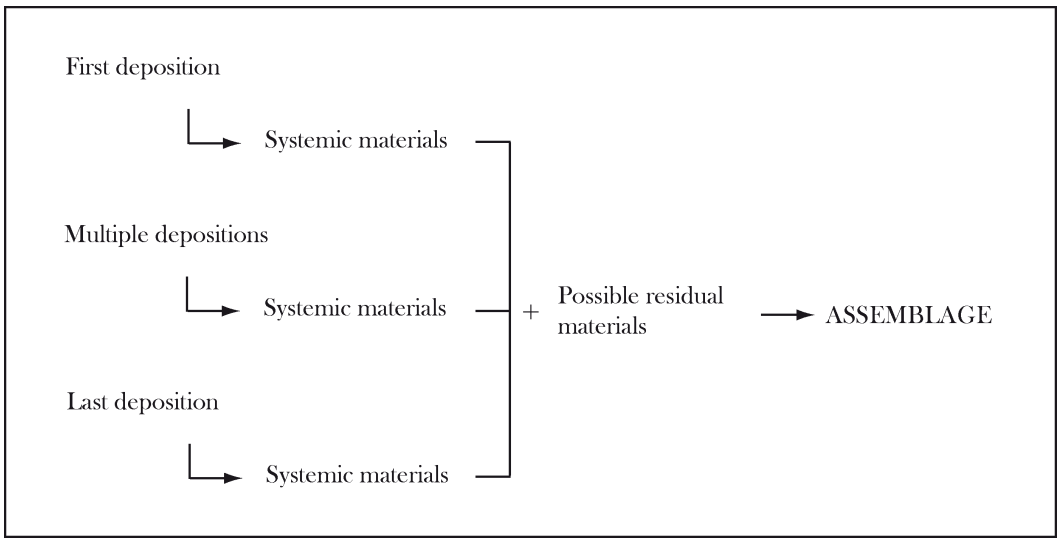


fig. 112 *- The formation of assemblages in urban dumps*

Another source of some residuality may be the longer time span which may exist between provisional dumping in some intermediate smaller dumps and the final discharge within the civic dumps.

The phisical state of these assemblages, particularly concerning fragmentation, has also been discussed in Chapters III.5.1, III.5.2 and IV.3.2: high rates of fragmentation should not surprise, but the presence of some complete or sub complete items should be probable, together with some conjoinability of sherds. Wear should be generally homogeneous, but if some redeposition with residuals occurred, some differences may be detectable. The presence of some articulated bone may also strenghten the interpretation of these deposits. In general, it seems likely to expect high rates of bones, chacoal, ash and other products of the decay of organic materials.

Turning to the matrix, besides the case of some redeposited sediments, these deposits are expected to be poor in matrix: in case, this should be quite organic (dark) and soft. Originally these deposits should also have displayed many empty spaces: this, combined with their long exposition, contribute to their vulnerability to internal and external intrusions, particularly concerning small items. The progressive decay of the organic matter, along with a volume loss, may also contribute to this phenomenon (see Chapter III.3). Eventually empty spaces also allow for the presence of 'intrusive' matrix

In case no clear internal stratification was detectable (high contents of organic matter make bioturbation, for instance by worms, likely to occurr, thus masking previously existing boundaries) beddings and *laminae* may suggest the various depositional episodes occurred. Conversely, in case some stratification was still observable, clusters of particular finds, concentrations of ash or charcoal or levels of lime (or whatever suitable for some form of sanification) may well characterise the sequence recorded.

A few lines, besides the issue of dating, are to be devoted to the importance of these deposits for the great informative potential that they carry. Reconstructing the economic history of a settlement, besides with a presence/absence scheme, is theoretically anything but easy. If artefacts, in themselves, are good markers, their context of deposition may severely affect any conclusion. Drawing inferences on the economic history of a whole site basing our deductions on a single (or two or three) small excavation means handling a serious problem of sampling. The sample itself may be seriuosly biased, affected by residuality, selection and by the phenomenon cited above, that is the low rate of deposition *intra moenia* when the city is well managed. One way of tackling this problem may be the execution of many different excavations, well distributed over the settlement area; this would indeed lower local

depostional biases, but may not solve the problem of *intra moenia* low deposition in some periods, leading to the underestimation of their economic consistency. The investigation of a considerable proportion the urban dumps would be conversely, at least theoretically, a good means for tackling also this issue.

Up to now the ancient cities whose main dumps have been well excavated and are well known are not many, the main being cited in Chapter III.5.1. With no doubt much more attention and research should be devoted to these precious deposits, being, furthermore, relatively easy to predict their location. Their importance for economic history may be invaluable.

P.C.2, Drain culvert fillings

The filling which forms within drain culverts, a typical feature of classic domestic and public achitecture, represent the product of very particular processes in a very particular environment; they are, anyhow, a quite common deposit type in urban environments and the information which can be drawn by these deposits are particularly precious. It follows that, although it represents with no doubt a difficult case, it is worth discussing it and try at least to propose a draft of formative model and way of dating it.

First of all, it seems appropriate to specify which structures and which filling are the precise subject of the following discussion. I do not refer to drains as a whole, but to drain culverts in particular, because open air drains (see the ones which are typical of the farmland) are affected by different dynamics and, in general, can be assimilated to any ditch or linear negative evidence. Drain culverts are not open air features, and this is a peculiarity which greatly affect the deposition of sediments and materials within the basin they constitute. They are usually masonry or timber linear features, made of a slightly inclined bottom, two parallel walls creating a *specus*, and some roofing on the top. They usually run well beneath the floors and represent the branches of the drainage system of a settlement.

Turning to the filling, I do not refer to the deliberate backfill of the structure, for any reason, but to the progressive infilling which occurs by means of occasional dumping of artefacts in the sewer covers and by their transportation and deposition, together with big or small amounts of sediments, thanks to the pesence of flowing water.

This introduces the very peculiar formative process of these deposits, in which both human and natural agents play an important role. In this case we have no vertical deposition, by means of gravity, as it would happen in any common non fluvial environment; in this case the primary depositional agent is water, which plays its role almost horizontally, because of

the structure of the culverts. If the drain is regularly mantained, within a given section no substantial amounts of deposit should form, thanks to the more or less occasional water flow. Major sedimentation and materials deposition should begin once the normal waterflow is somehow prevented by the downstream presence of obstacles, blockages or damages; if regular maintenance does not provide for their removal (the existence of *stercorarii*, whose task, among others, was to provide periodic cleaning of the sewers, is cited in Chapter III.5.1), some deposition start taking place. It follows that the end of culverts maintenance and the starting date of these deposits formation are closely connected.

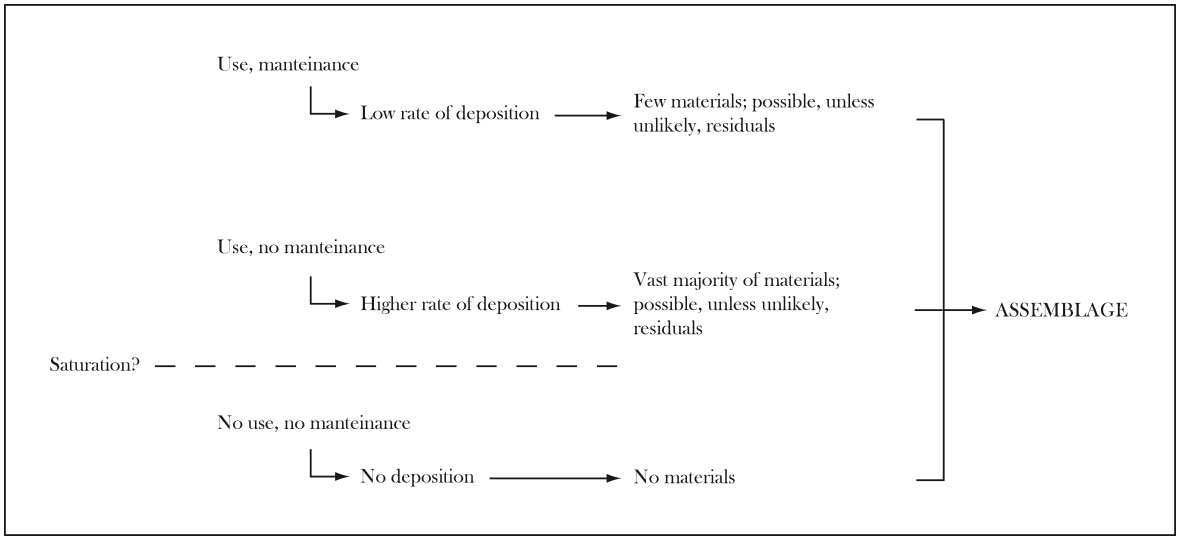


fig. 113 *- A model for the formation of the assemblages returned by drain culvert fillings*

Deposition is likely to occurr even though the regular maintenance of the drain is not assured anymore, thus forming the bulk of what is later recovered. When the deposition of material within the drain stops, the formation of the deposit may be considered concluded.

Certainly the daposition may witness some breaks, which would hopefully appear in the deposit profile. Beddings and *laminae* may also be visible, but, in general, it should be taken into account that the water flow may produce a substantial mixing of both sediments and materials.

In general, in these deposits large size materials are not expected, while some water abrasion may be detectable; wear, once taken for granted the different physical and mechanical charcteristics of the material involved, should be quite uniform.

From a quantitative point of view, we may expect a major peak of evidence, corresponding to the main dumping activity: its starting date suggests, besides the beginning of deposition, also the end of some effective maintenace of the infrastructure. The end of

the peak should correspond to the end of the depositional process. No later peaks should appear, as, besides the occurrence of later trenching activities or damages, the content of the culvert is substantially sealed off. On the contrary, some tails of earlier materials may be present, being residual or the result of some dumping which 'survived' to the later maintenance an water flow.

Concluding, as a whole, these deposits, although formed in a very peculiar way, are very similar to a sort of dump, including the possibility of internal mixing. The fact they are substantially well sealed, nonetheless, make them better targets for pushing at the height other analyses, such as botanical and pollen ones. It has to be born in mind that, unless one precise entrance point for the materials recovered was located (say a basin or a sewer cover) and other possible sources were excluded, it is quite difficult to associate the materials to any precise area or activity.

One last peculiarity involves these deposits: unless they are cut by later activities and they have been excavated simply pulling up the culvert covering, it is quite difficult to correctly position them within the framework of an Harry's matrix (they fill the culvert, but they are not covered by anything); in these cases their dating cannot rely on an upper relative sequence and is based almost exclusively on internal data, *i.e.* the absolute dates provided by the materials embedded.

Other cases

Other deposits, although different under many lights, from a dating point of view, may be substantially assimilated to a large urban dump. That is the case of dumps exploiting the presence of abandoned buildings or open areas and used for a sufficiently long time span. Disused public buildings can provide large basins, as in the case of the Pythion theatre in Gortyna, whose cavea was perfectly suitable for receiving large amounts of rubbish. Some ditch fillings may also turn out to be simply the result of episodes of dumping prolonged for some time. Eventually, some even large dumps may have received only specific items, produced by specific craft or trade activities: the most famous case is with no doubt represented by Monte Testaccio, but many others are documented, particularly in relation with craft activities such as pottery manufacturing.

Concluding any deposit produced by dumping over a long time can be treated, for dating, as a large urban dump. Drain culvert fillings represent a very peculiar case, but if a similar case should occurr, similar conclusions may well be drawn. Besides the products of dumping (P.P.1, P.P.4), the other primary deposits with abrupt formation (P.P.2, P.P.3,

P.P.5, P.P.6, P.P.7, P.P.8) are not likely to have an equivalent type of deposit with continuous formation.

IV.4.5 Case study 1: Mons Claudianus south sebakh (P.C.1)

Topographic and archaeological background

The site of Mons Claudianus is located in The Eastern Desert of Egipt, in a rocky region not far from the Red Sea and about 500 km south of Cairo.

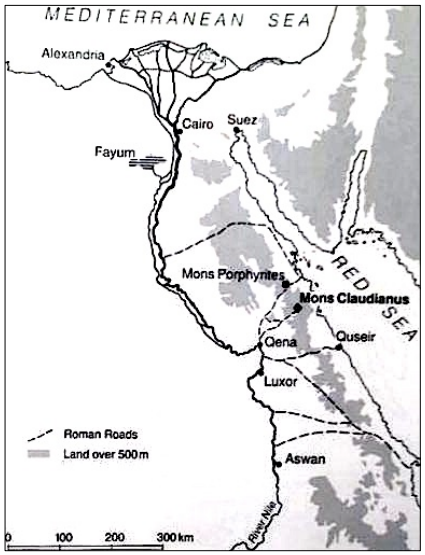


fig. 114 *- The location of Mons Claudianus in the Eastern Desert of Egypt. From MAXFIELD, PEACOCK (EDS.) 2001*

The site consists of a quarry field, which extends over 750 ha., and of a main fortified residential and administrative settlement, located in the Wadi Umm Hussein. The quarries, consisting in 130 individual quarry sites, produced the famous granodiorite which has been employed, among others, in the Colosseum, in Trajan's Baths, Markets and Basilica and in temple of Venus and Rome. The settlement, during its main occupation phase, was substantially made of a fort and some external annexes, among which a big granary and a temple dedicated to Serapis are the main ones. It has to be stressed from the very beginning that certainly it is not an urban site *stricto sensu*, although it display some charachteristics (among which, the waste management) which are typical of urban sites. Nonetheless it presents the advantage of being one of the few sites whose main dump has been well studied and published, together with the materials recovered within it. Furthermore the accuracy

provided by the dated artefacts, as we will see, is very high, thus allowing detailed considerations.

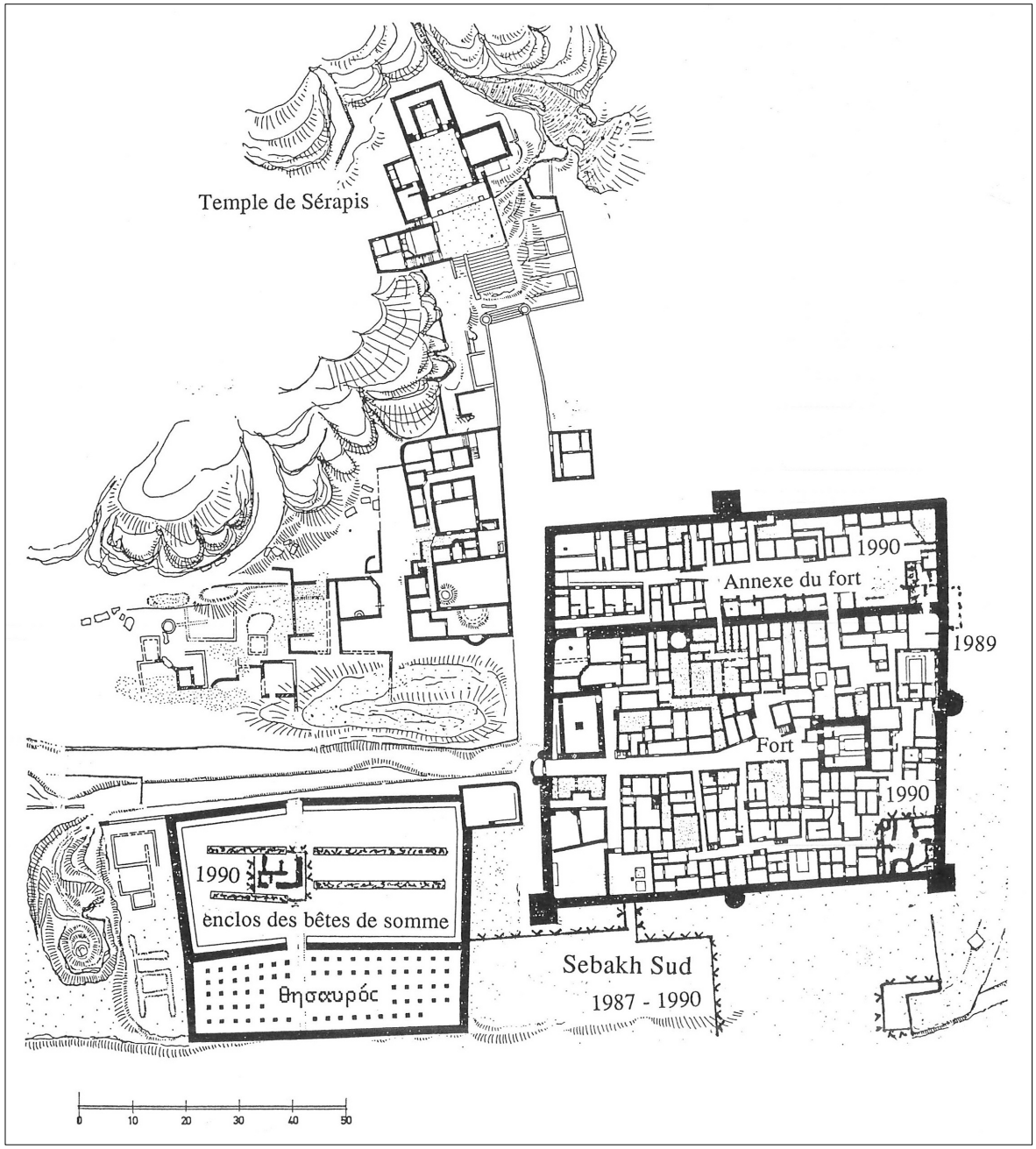


fig. 115 *- Plan of the main site. From* BINGEN J. *ET ALII* 1992

The site was occupied, in a rarefied way, since about the reign of Domitian, but its major period of occupation, coinciding with the heaviest exploitation of the quarries, occurred between the reigns of Trajan and Antoninus Pius. Occupation continued on a

reduced scale until the Severan period; after this period and until the early 5th century AD the site was visited only intermittently[475].

The studied deposit consists of the dump located just south-east of the fort and it is known as South Sebakh (the term 'sebakh' in Egypt generally refers to humic, organic waste). It was formed after a previous building, known as 'east building', was abandoned.

Deposit description

The dump consists of a mound measuring about 60x20 m and it is has maximum height of 1.80 m.

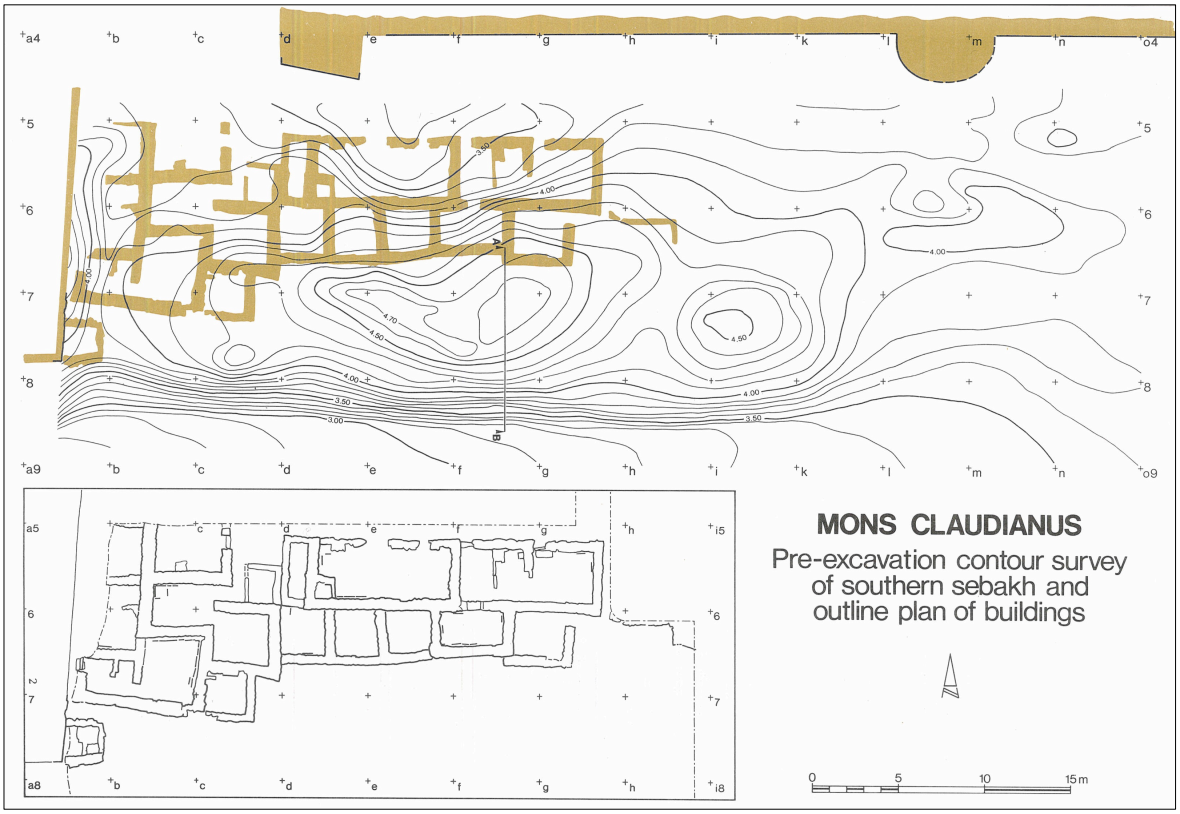


fig. 116 - *The south sebakh. From* BINGEN J. *ET ALII* 1992

It presents an higly stratified profile, with single contexts ascribable to specific dumping episodes; layers particularly rich in charcoal and ash alternate with layers particularly rich in organic fibres or potsherds. Layers of sand, possibly suggesting some pauses in the depositional process, layers of lime, probably deposited for sanification

[475] MAXFIELD, PEACOCK 2001, p. 423

purposes, and some rubble, probably deriving from the dismantlement of some buildings, were also observed.

The excavators noticed that internal mixing and residuality occurred; nonetheless, although the deposit laid exposed for a long time, thus being particularly susceptible to intrusions, no clear inconsistencies were noticed in the assemblage as a whole.

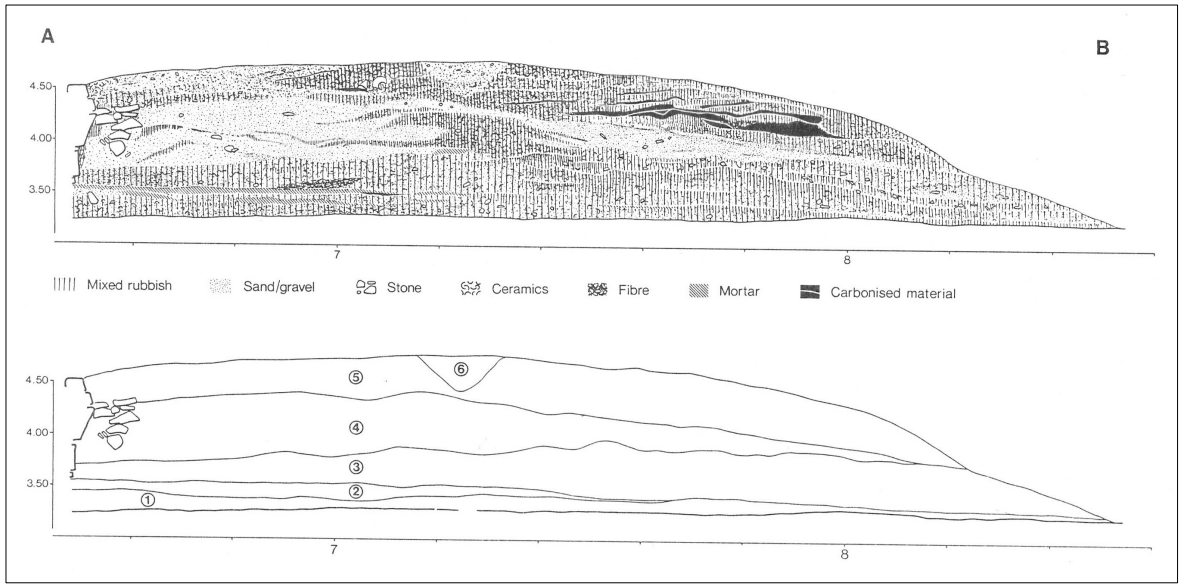


fig. 117 *- Cross section of the south sebakh. From MAXFIELD, PEACOCK (EDS.) 2001*

Assemblage physical state

The climatic conditions in the site allowed for an incredible good preservation of organic matter, thus returning a panorama of finds which is much richer than the common ones. Some bones were still fleshed and others were still articulated. Eventually, leather was preserved as well.

fig. 118 - Fleshed donkey bones from the south sebakh. From MAXFIELD, PEACOCK (EDS.) 2001

Moving to ceramics, which were recovered literally in tonnes, they ranged from almost complete vessels to small sherds, thus confirming the general expectations discussed for this kind of deposits.

fig. 119 - Complete and sub-complete amphorae from the south sebakh. From MAXFIELD, PEACOCK (EDS.) 2006

The finds

The time whih actually took the formation of the deposit is fully appreciable through the high chronological accuracy provided by the recovered materials. In particular, what makes this deposit exceptional, is the presence of a great number of *ostraka*, many of which can be dated *ad annum*. These *ostraka* reported precious information about the administrative and military organization of the site, about the cultural and social traits of its inhabitants, about its economy and much more, thus being an invaluable tool for many kind of investigations. In this case we are merely interested in their dates.

The *ostraka* recovered in Mons Claudianus excavations, up to the present, have been published in 4 volumes, the first of which is entirely dedicated to the South sebakh. I processed all the *ostraka* published in this volume, apart from *ostraka* 79-82, for which no clear date was provided. To the specimens which were dated *ad annum* or within a range narrower than 5 years, 1 year was added to the date, in order to account for some time before their discard occurred. The range of *ostrakon* 83 was widened of ± 5 years as its date was marked with a '?'. A few more *ostraka* were published in volume 2, while the third one did not present any *ostrakon* from South sebakh apart from the republishing of *ostrakon* 13, already presented in volume 1. Specimens from volume 4 were not taken into account, as it was clear that their dates derived by the deposis date itself; in this way I avoided a problem of circularity. Ultimately, 222 *ostraka* were processed.

Among all the other materials recovered and published, a large part of the dates had been derived from the deposit date, thus, also in this case, I chose not to plot them. Anyhow I processed some more items independently dated, namely 8 coins, published in the volume concerning the excavation of the site, and 4 fragments of imported sigillata. To the date of coins 30 years were added by default to their range. Finally I chose not to process imported amphoras as their vague dates uselessly widened the global range displayed; anyhow it is worth stressing that they do not provide any date inconsistent with the ones which were processed.

Eventually, 234 items were processed. The *tpq* for the end of the deposition is provided by an ostrakon dated to 148 AD.

Monte Carlo chrono-profile

Below are provided the Monte Carlo simuations with breaks of 25, 5 and 2 years. This example shows the flexibility of the simulation employed, as breaks can easily varied according to the accuracy of the dates provided by the assemblage.

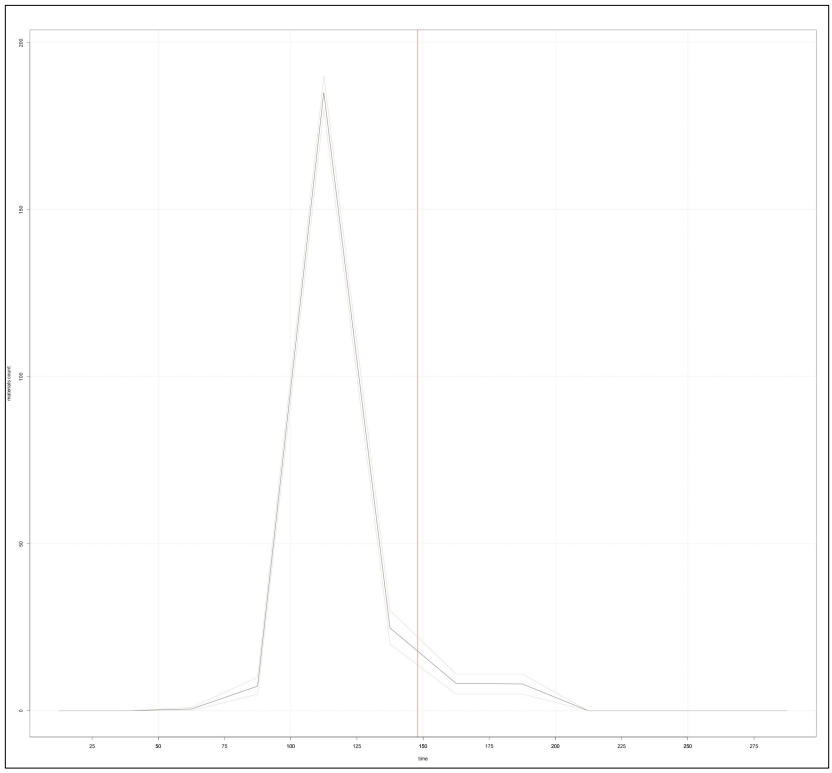


fig. 120 - *The* south sebakh assemblage*. Profile with 25 years brackets*

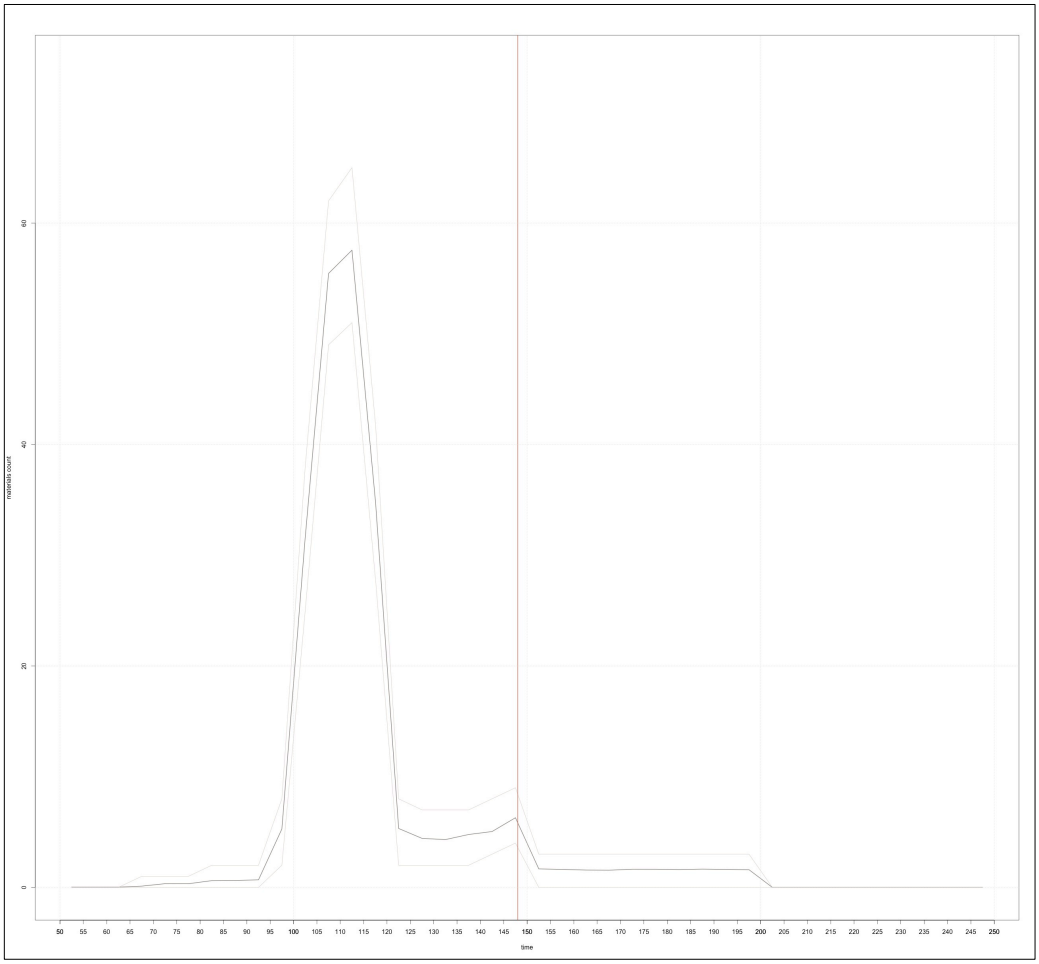


fig. 121 *- The* south sebakh assemblage*. Profile with 5 years brackets*

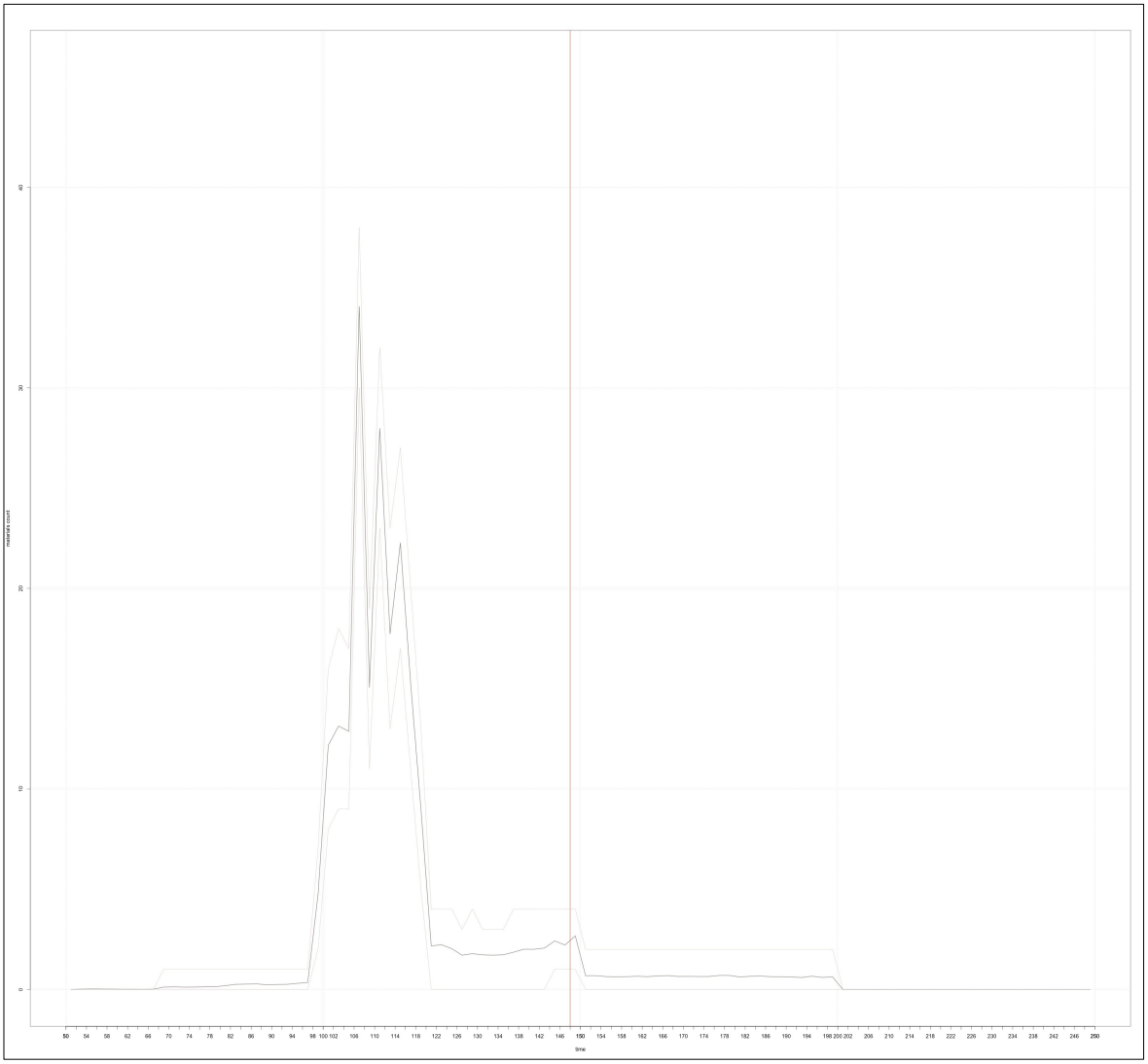


fig. 122 *- The* south sebakh assemblage. *Profile with 2 years brackets*

Discussion

With 25 years breaks and also with 5 years breaks the assemblage profile would be basically identical to the one displayed by a primary deposit with an abrupt formation (apart from a *tpq* sensibly more recent than the main pike). Nonetheless with 2 years breaks the complexity of the assemblage is fully appreciable. A main group of materials is dated in a span of 20 years, from about 100 AD to 120 AD. Within this span some periods are more represented, while others display substantial decrease.

Later dumping activity, although with much lower intensity, is then documented until the half of the century. The more recent specimens (three ostraka and one coin) were not considered intrusions because their location within the deposit was considered safe by the excavators. In any case they seems to suggest that some dumping, more or less occasional,

continued for some time and considering these materials as intrusions or as later systemic materials is in fact just a matter of point of view.

Date proposed

Main dumping activity, *ad quem*: from 100-102 AD to 118-120 AD

Occasional dumping/accidental loss, *ad quem*: from 118-120 AD to 148-150 AD

Duration

Main dumping activity: about 20 years

Occasional dumping/accidental loss: about 30 years

A long formation is indeed consistent with the volume and complex internal stratification of the deposit.

Notes and references

A description of the site, its excavation and some classes of finds is provided in MAXFIELD, PEACOCK (EDS.) 2001. Ceramics are the main subject of MAXFIELD, PEACOCK (EDS.) 2006 whereas the ostraka are published in BINGEN *ET ALII* 1992, BINGEN *ET ALII* 1997, CUVIGNY 2000, BÜLOW-JACOBSEN 2009.

IV.4.6 CASE STUDY 2: DRAIN CULVERT FILLINGS FROM FONDI EX-COSSAR, AQUILEIA (P.C.2)

Topographic and archaeological background

The area recently excavated in the Fondi ex-Cossar area, in Aquileia, is crossed by a web of many drain culverts, direct to the major urban drains located below the street grid. Some of them were certainly built for the central *domus* necessities, but for many their origin is still unclear and may be located out of the excavated area. They are typically built with a bottom made of tiles, two walls built with brick fragments, usually poorly binded with mortar or clay, and a cover made of whole bricks (the so called Lydian ones, measuring about 30x45 cm). The drainage system was rearranged and repaired through time, thus the culverts do not belong to the same phase. In general, during the excavation, it was not possible to investigate the drains content for substantial lenghts, thus each context, *per se*, usually did not procure large assemblages. In this case I selected two contexts which were dug within two culverts which were most probably built (after the partial dismantlement of

two previous drains) and 'abandoned' in the same period. The sections excavated are located in the area occupied by the eastern portico, just close to the first and third *tabernae* beginning from the north (25, 29); they are just a few meters far from the main drain lying beneath the eastern *cardo*.

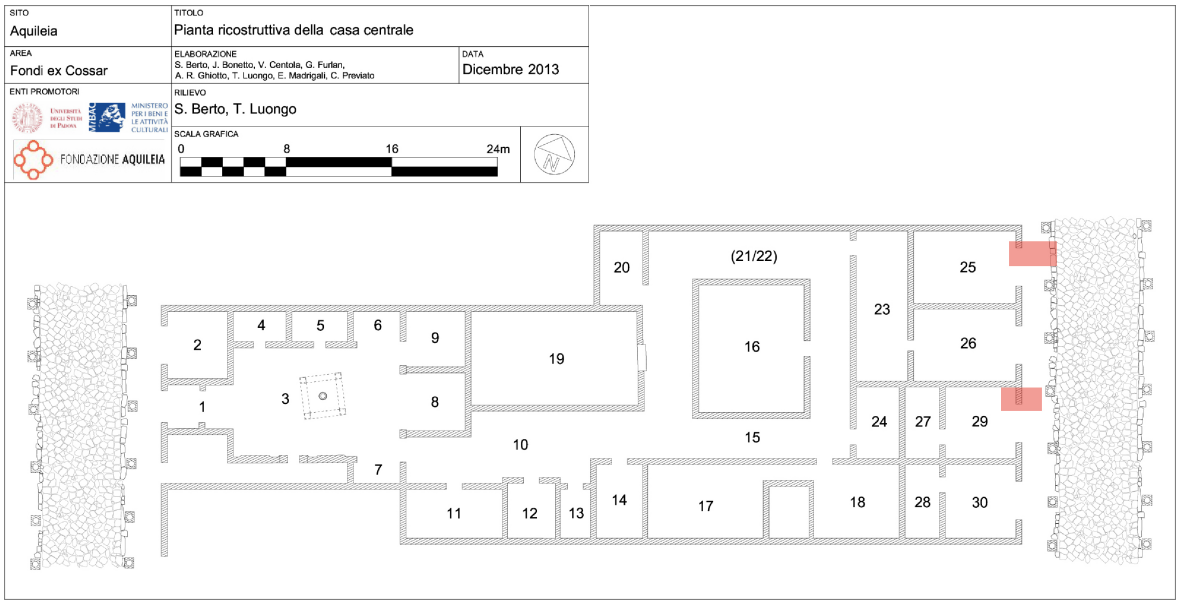


fig. 123 - *The location of the two examined drain culverts*

It is also worth advancing that, up to present, the whole drainage system in the investigated area, besides the presence of some culverts deliberately abandoned in a previous period, got filled and disused broadly in the same period.

Deposit description

The deposit is formed by three contexts. One is the fill (US 289) of the northern culvert (US 120), which was recovered untouched and was excavated once part of the covering bricks were recovered. Some samples for botanical analises were also collected. The other two contexts are the infilling (US 632 e 635) of the southern drain (US 634); this had been partially destroyed by later activities and the fill was labelled with two different numbers, one for the best preserved part, still lying in the untouched part of the culvert, and one for the part which may have been affected by later intrusions. Eventually, an examination of the assemblage and a review of the data recovered in the field suggest that no significant mixing occurred in neither of the two contexts.

fig. 124 *- Context 652 (the fill preserved where the southern culvert was untouched)*

The fills of the two culverts appear quite similar, with greyish colour, soft consistence and loamy texture. No visible stratification was recorded, nor any laminae were visible. Both the culverts contained abundant charcoal lumps and fragments of bones and shells, together with some small pebbles and very small fragments of mortar and plaster. The north fill is also characterized by the presence of several stone mosaic *tesserae*, suggesting that somewhere upstream some refurbishing or demolition of floors occurred when the culvert was filled.

Assemblage physical state

No substantial data are available; in general all the finds display small dimensions.

The finds

Unfortunately, also in this case, the partial progress of the post excavation processing does not allow to provide definitive data and again, although three contexts were grouped, the assemblage examined is quite small. Furthermore, a significative amount of the finds recovered (mainly coarseware), in spite of having been examined, could not provide any chronological indication. A total of 17 items were processed, whose complete list is provided

below. A *tpq* (for the end of the depositional process) is provided by a sherd of african sigillata, whose distribution began in the last quarter of the 5th century AD.

- 289
  - coin, 200-400 AD
  - coin, 200-400 AD
  - glass, 400-500 AD
  - glass, 300-425 AD
  - glass, 200-425 AD
  - glass, 200-425 AD
  - coarseware, 150-1000 AD
  - coarseware, 50 BC - 50 AD
  - african sigillata, 475-650 AD
  - african sigillata, 230-360 AD
  - african sigillata, 150-250 AD
- 652
  - coin, 300-400 AD
  - glass, 400-600 AD
  - glass, 300-425 AD
  - african sigillata, 350-450 AD
- 635
  - coin, 300-500 AD
  - african amphora, 150-500 AD

Monte Carlo chrono-profile

Given the quality of the artefact dates, below are provided only the profiles obtained with 25 and 50 years brackets. Coins final dates were pushed forward of 30 years by default, for taking into some account their circulation.

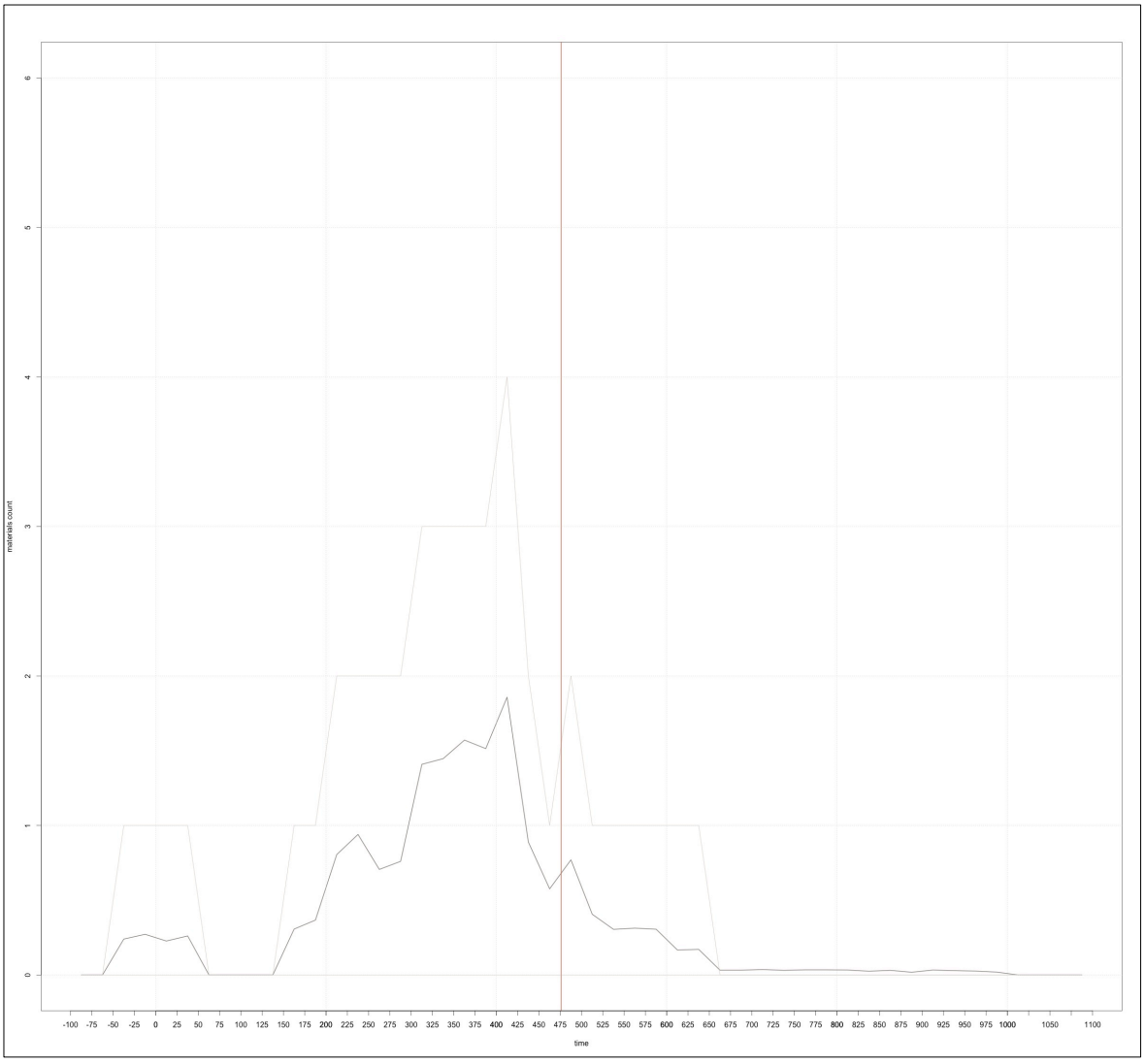


fig. 125 *- The examined assemblage. Profile with 25 years brackets*

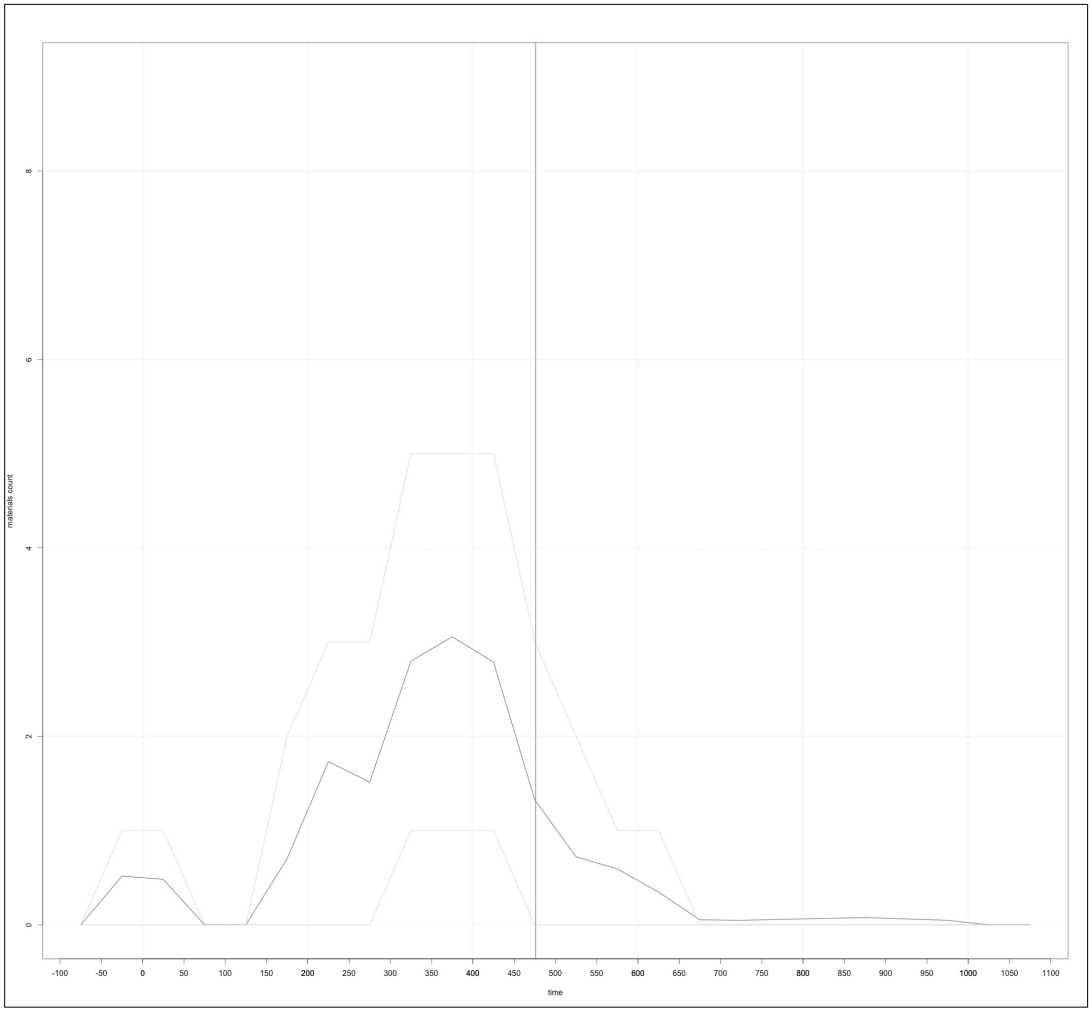


fig. 126 *- The examined assemblage. Profile with 50 years brackets*

Discussion

The low number of processed sherds imposes some caution and any conclusion has to be taken as provisional. Nonetheless the overall picture emerging is after all quite clear. A *terminus post quem* of 475 AD provides a date close to the end of any deposition within the drains. After 550 AD some more depositional episodes are to be regarded as highly unlikely, thus a window 475-550 AD may well be advanced for the 'closure' of the deposit.

The bulk of the deposition seems to have occurred between 200 AD and 400 AD, but a slight pause may have occurred betweem 250 AD and 300 AD. Thus is seems more cautious to fix a provisional date for the end of some effective maintenance at the period 300-325 AD.

The 'tail' visible on the left is prodced by one single sherd of coarseware; given the quality and the poor quantity of the data, three possibilities seems reasonable in order to explain its presence:

- it is a residual;
- it is a systemic item, which survived the maintenance processes and the water flow when the culvert was in use. In this case the sherd would also provide an *terminus ante quem*, cautiously to pinpoint in 50 AD, for the construction of the culvert;
- the item date needs some review.

Given the state of the art, none of these options can now be picked with sufficient confidence and any further consideration should wait for a greater number of data.

Date proposed

End of effective maintenance, *ad quem*: 300-325 AD (and possibly some before)
End of deposition within the culverts, *ad quem*: 475 (6)-550 AD

Duration

The bulk of depositional events took place in about two centuries (200-400 AD), with a consistent pike in the last 75 years of this period.

Notes and references

The two examined contexts are substantially unpublished. The present of the two culverts is reported in CENTOLA *ET ALII* 2012, p. 114, fig. 6.

❖ MIXED DEPOSITS ❖

IV.5.1 DEFINITION

With mixed deposits are meant those deposits in which it is possible detect both the residual and the systemic part of the assemblage, both having some consistence. They cannot be considered as primary deposits, as their assemblage usually does largely represent the systemic context in which the deposit itself was formed. It seems much better to define them as secondary deposits with a demonstrated (or at least most probable) presence of systemic material. Thus, recalling what has been advanced in Chapter II.2.4, mixed deposits are those whose assemblage belongs both to a systemic context previous to the one in which the deposit was formed and to the same systemic context in which the deposit was formed or used.

The point of course is establishing if systemic materials actually exist, which they are and what they inform us of. Residuals are not much troublesome, as they were most probably embedded within any sediment that was redeposited. Concerning the systemic materials two main distinctions are to be discussed. The first concerns what they inform us of: they may inform us of the formation of the deposit, here intended as the redeposition of the bulk of sediments along with the materials embedded, or they may inform us of its use, having been incorporated within the deposit after it was formed and being substantially intrusions.

The first group clearly allows a kind of dating, while for the second one we date different episodes in different ways. In the first case, the presence of materials consistent with the deposit formation should allow an *ad quem* dating of this episode, thus we should know when the bulk of sediments and the possibly embedded materials have been redeposited. It is the case, for instance, of sediments redeposited in a building site and mixed with freshly discarded materials (see Chapter III.5.3), say amphora sherds. In the second case we should technically have a *terminus post quem* for the redeposition of the bulk of sediments and the possibly embedded materials, provided by the most recent residual, and *a terminus ad quem* for the use of the deposit surface, or for part of this period of use (this could have been longer, but in some periods any materials may not have turned out to get embedded). It is the case of an earthen floor trampled for some time (see Chapter III.6.2). Certainly it is a

tiny distinction and it is somehow more theorical than practical. But it has to be kept in mind that in the two cases (say mixed deposits A and mixed deposits B) the more recent artefacts carry much different information.

Systemic materials of the first group (A) has to be further divided in:

- materials intentionally added within the deposit;
- materials accidentally lost or discarded;

If the first instance is somehow possible to engage (see Chapter xxxx), the second type of materials are much more dificcult to detect and may be very low in number. Indeed they may be easily interpreted as intrusions, sharing with them the same chronological pattern. Nonetheless I suspect that the number of deposits of this kind should be relatively small and i wonder what are effectively the chances that in a building site some contemporary sherds turn out to get embedded within the sediments being deposited and what are the effective chances of bumping into them.

Concluding, these deposits may be further detailed in the following sub-categories:

- subtype A: deposits with systemic materials entered during the formation
  - i, with materials intentionally embedded
  - a, with materials accidentally embedded
- subtype B: deposits with systemic materials entered during the use.

IV.5.2 General expectations

Given the extreme difficulty of tracing and dealing with the subtype Aa deposits, i.e. those containing systemic materials accidentally embedded during their formation, i will focus on subtypes Ai and B.

From a quantitative point of view, both are expected to display one or more peaks of residuality and a small group of more recent finds. In lucky occasions the main groups of residuals and systemic materials may be clearly distinct, but more often the situation may be much more confused and blur, thus requiring a higher interpretive contribution.

For ascribing to the materials belonging to the more recent group the status of systemic finds, some factors must be taken into account. For Mixed Ai deposits these aspects are discussed in Chapter III.5.3, which deals with the issues of intentionality and selection. It is worth summarize that selection is indeed a strong clue suggesting the intentional addition of materials and it is in turn, sussegested by the following aspects:

- sufficient number;
- chronological homogeneity;
- sorting by class or size.

Eventually the added finds has to play some evident role (hydraulic, mechanical, even aesthetic) which convincingly explains their presence within the deposit.

Turning to Mixed B deposits, the most typical case, that of an earthen floor, is discussed in much more detail Chapter III.6.2, as important clues on dealing with this kind of deposits come from the field of experimental archaeology. Systemic materials related to the surface use, besides their more recent dates, should display the following characteristics:

- being small in size;
- being concentrated in the upper part of the deposit (2-3 cm), which could be considered a context *per se*;
- possibly they should display wear and scratches compatible with trampling.

IV.5.3 Dating

As anticipated the way of dating these deposits vary according to their more specific nature.

- Mixed Ai: *terminus ad quem* for the deposit formation
- Mixed B*: terminus post quem* for the deposit formation and *terminus ad quem* for part of its use. Given that it is most likely that the surface of the deposit start being used just after its construction, with good approximation, the deposit formation may substantially be dated *ad quem*.

IV.5.4 Formative typology

The types proposed may be summed up as follows:

- M.Ai.1, Foundation trench backfills with systemic materials intentionally added
- M.Ai.2, Redeposited sediments for building purpose with systemic materials intentionally added
- M.Aa.1, Any secondary deposit containing accidentally lost systemic materials
- M.B.1, Non-solid floors

M.Ai.1, Foundation trench backfills with systemic materials intentionally added

To my knowledge no cases of foundation trenches backfilled also with selected systemic items are known. Anyhow, being the principle the same which rules the addition of materials to sediments for other building purposes, some cases may turn out to get recorded (or have already been recorded, but they are not known to me).

M.Ai.2, Redeposited sediments for building purpose with systemic materials intentionally added

As mentioned above, the intentional insertion of systemic materials has already been discussed in Chapter III.5.3 and the main aspects suggesting selection and consequently intentionality and eventually the presence of systemic materials have already been cited. Below it is provided a sketch of the whole process of deposition for this kind of deposits.

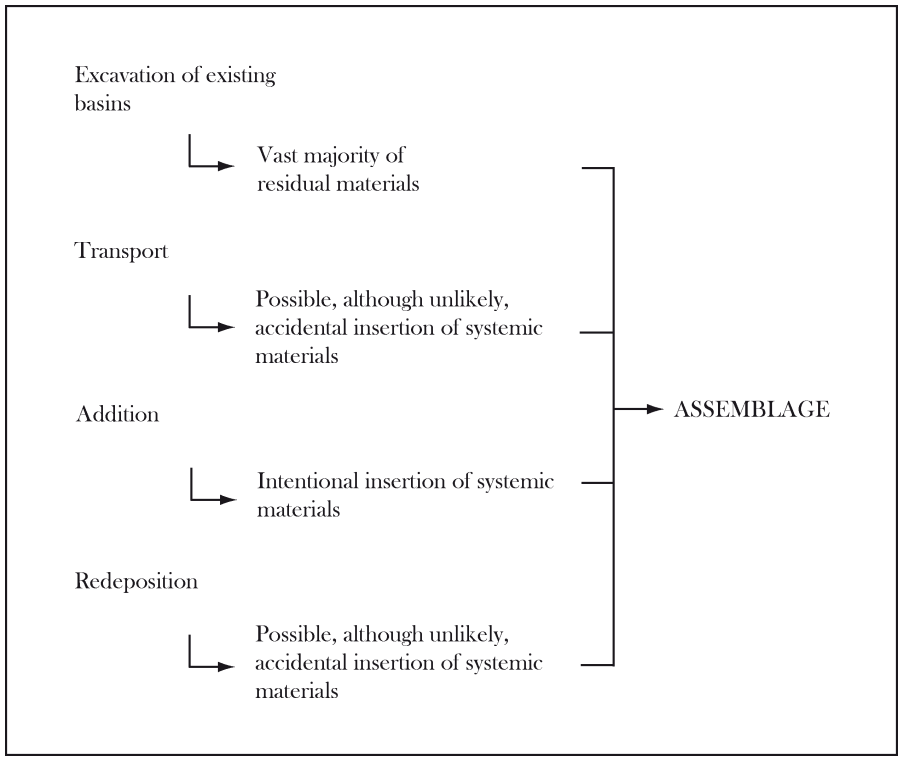


fig. 127 *- A model for M.Ai.2 assemblages*

These deposits are not unknown; deposits made only of freshly discarded items (for instance made of amphora stoppers or body sherds), mortar structures with systemic sherds embedded and even charcoal layers (see P.A.7 in Chapter IV.3.10) can be seen as extreme

cases of this kind of deposits. In the other cases, when residuals are present, the may display also differences in terms of sherd size and conjoinability.

M.Aa.1, Any secondary deposit containing accidentally lost systemic materials

As anticipated, these deposits are very difficult, if not impossible, to label and to handle. In general, for distinguishing with some plausibility a possible systemic item from an intrusion, or for a residual itself, apart from being it more recent than the other sherds, some other circumstances should occurr:

- the possibility of intrusions should be minimal;
- the item(s) should display one of those characteristics suggesting they have been freshly discarded (larger size, high conjoinability etch.).

Conversely, demonstrating that a given item was not systemic seems almost impossible. Anyhow, once excluded the possibility of some intrusions, the use of the more recent item(s) for providing a more cautious *terminus post quem* seems to me by far the best option.

M.B.1, Non-solid floors

As advanced, the case of non solid floors has been already largely discussed in Chapter III.6.2.

IV.5.5 Case study 1: an earthen and pebbles floor from the Auditorium Villa (M.B.1)

Topographic and archaeological background

The Auditorium Villa in ancient times was located in the suburbs of Rome, thus it does not represent, technically, a case picked from an ancient urban environment. Nonetheless the excavation was carefully carried out and well published in 2006, providing explicit bodies of data (a rarity) and many interesting sparks. Moreover the whole sequence investigated spans some seven centuries and the site is indeed nowadays located in an urban area (the name of the villa derives from the building which was effectively built in its proximity once the excavation was concluded), thus the site shares many of the traits which characterize an ancient urban environment.

The site was occasionally frequented during until the half of the 6th century BC, when a first farm was built; it lasted for about 50 years, when a *villa* was built. The life of this second dwelling was much longer, lasting until 350/300 BC, when it is heavily refurbished (in this new phase the villa is called the Acheloo Villa, for a terracotta protome which was recovered in deposits afferent to this phase). This building stood substantially untouched until 225 BC, when a new one, a typical *atrium villa*, took its place. This new building, which witnessed substantial refurbishments in the mid 2nd century BC, is further modified 80 BC and is occupied until the beginning of the third century AD. In this period the area is used as a cemetery.

The deposit discussed below belongs to the so called Villa di Acheloo phase, dated to the period 300-225 BC.

fig. 128 *- The so called Villa dell'Acheloo, reconstructive plan.* CARANDINI ET ALII *(EDS.) 2006.*

Deposit description

The floor examined was made of fluvial pebbels mixed with sand and paved the southern yard (ambiente 18); the choice of using a mixture of sand and pebbles was probably made to make the floor permeable to rain water. It survived to later activities in three small

parts located just south-east of the basin: each part was recorded as a differnt context (US 904, 945, 946). The layers thickness is not reported.

It has to be stressed that its function and its exposition to later activities make this deposit susceptible to potential intrusions.

No distinction was made between the upper part and the bottom of the deposit, thus this important tool cannot be employed for dividing systemic and residual materials. This has then to be tempted using *ex post* arguments (see below)

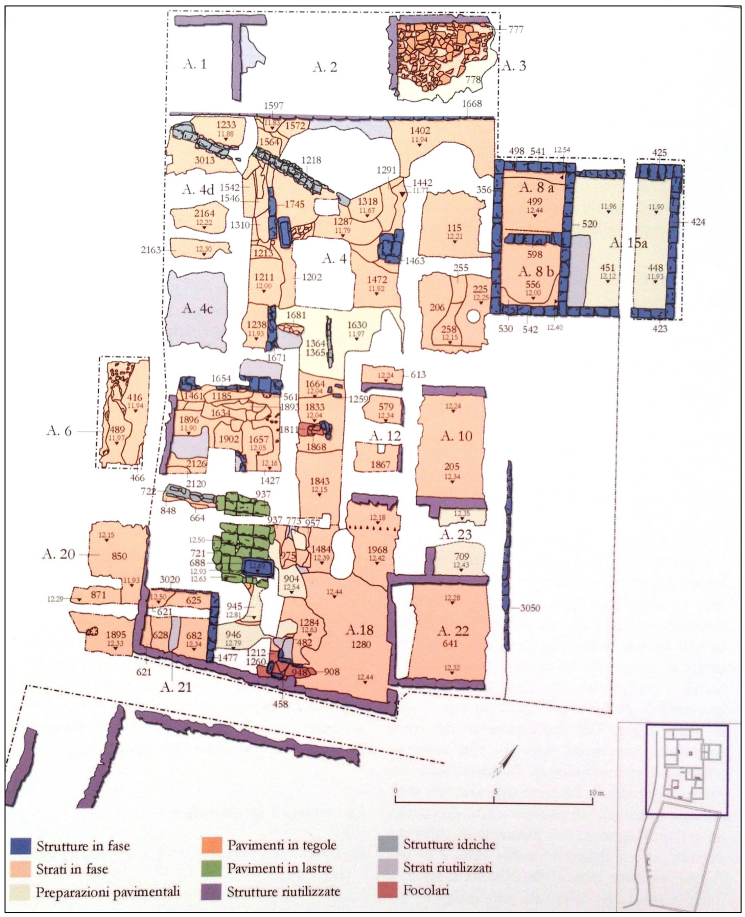


fig. 129 *- The so called Villa dell'Acheloo. In the southern yard, numbered 904, 945 and 946, the remains of the floor are visible.* CARANDINI ET ALII *(EDS.) 2006.*

Assemblage physical state

Unfortunately no information concerning the physical state of the assemblage are reported. This make more difficult assesing the status of the recovered finds. This will be tempted primarily using *ex post* information (see below).

The finds

A complete list of finds is provided in DI GIUSEPPE 2006, pp. 209-210. The published list includes all the materials recovered in the strata related to the same activity groups. Among them i picked only the finds recovered in 'ambiente 18', that is the yard. I sed the nuber of vases and not the numberof fragments, referring the number of vases, in this case, simply to the fragments after conjoinability had been checked. When the same type was recorded in more than a room, included room 18, it was not possible to understand how many pieces belonged to each room. In these cases I counted only one piece for room 18.

Eventually a total amount of 29 pieces was processed; among them a *tpq* is provided by four sherds whose distribution began at the beginning of the 3rd century BC.

Monte Carlo chrono-profile

Three canonical profiles are proposed, the first with 25 years brackets, the second with 50 years brackets and the third with 10 years windows. No modifications were applied to the find dates proposed. One sherd of uncertain status, dated to 300 BC circa, has been processed with a window 310-290 BC, thus accounting for some more variability.

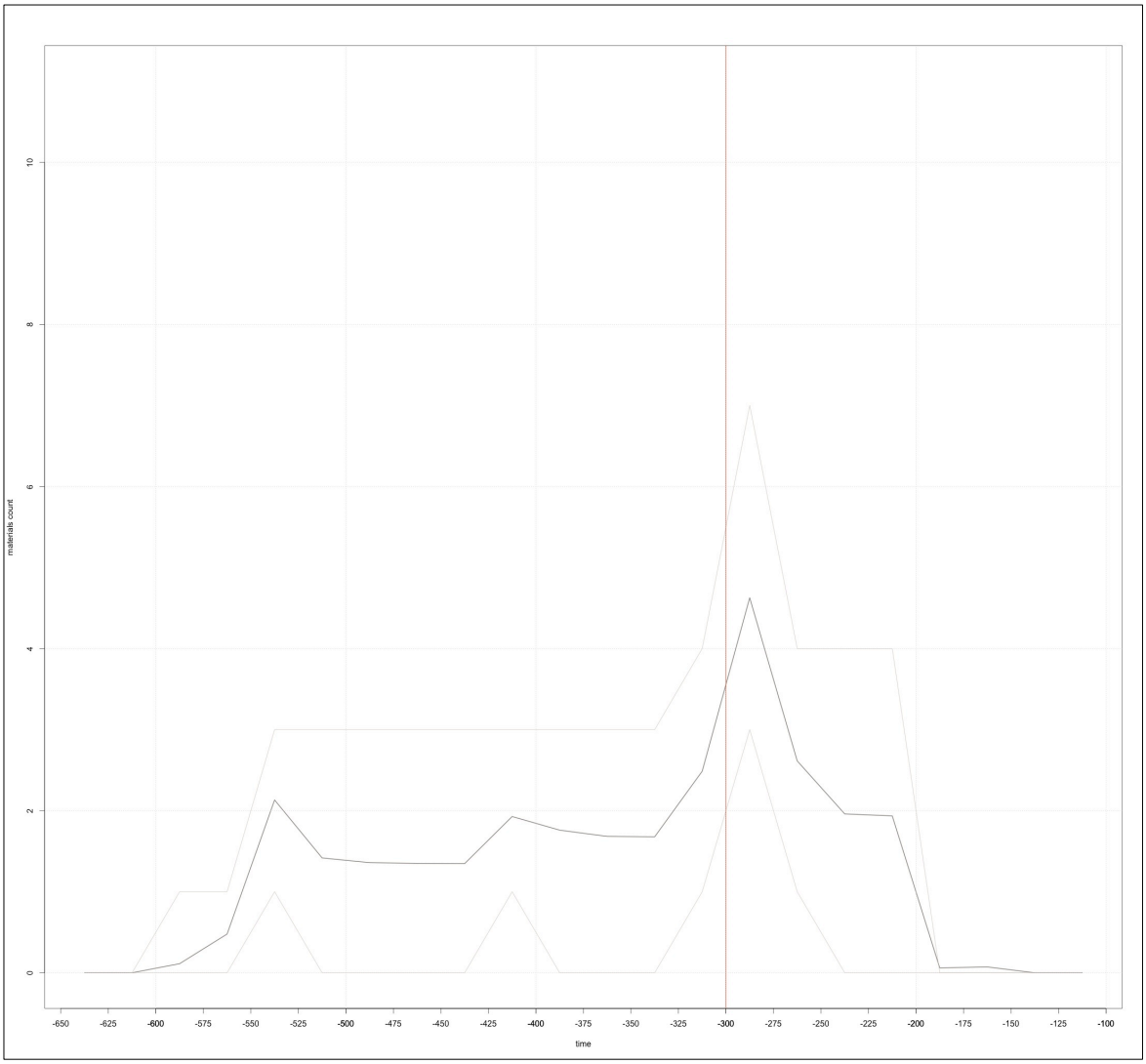


fig. 130 *- The floor assemblage. Profile with 25 years brackets*

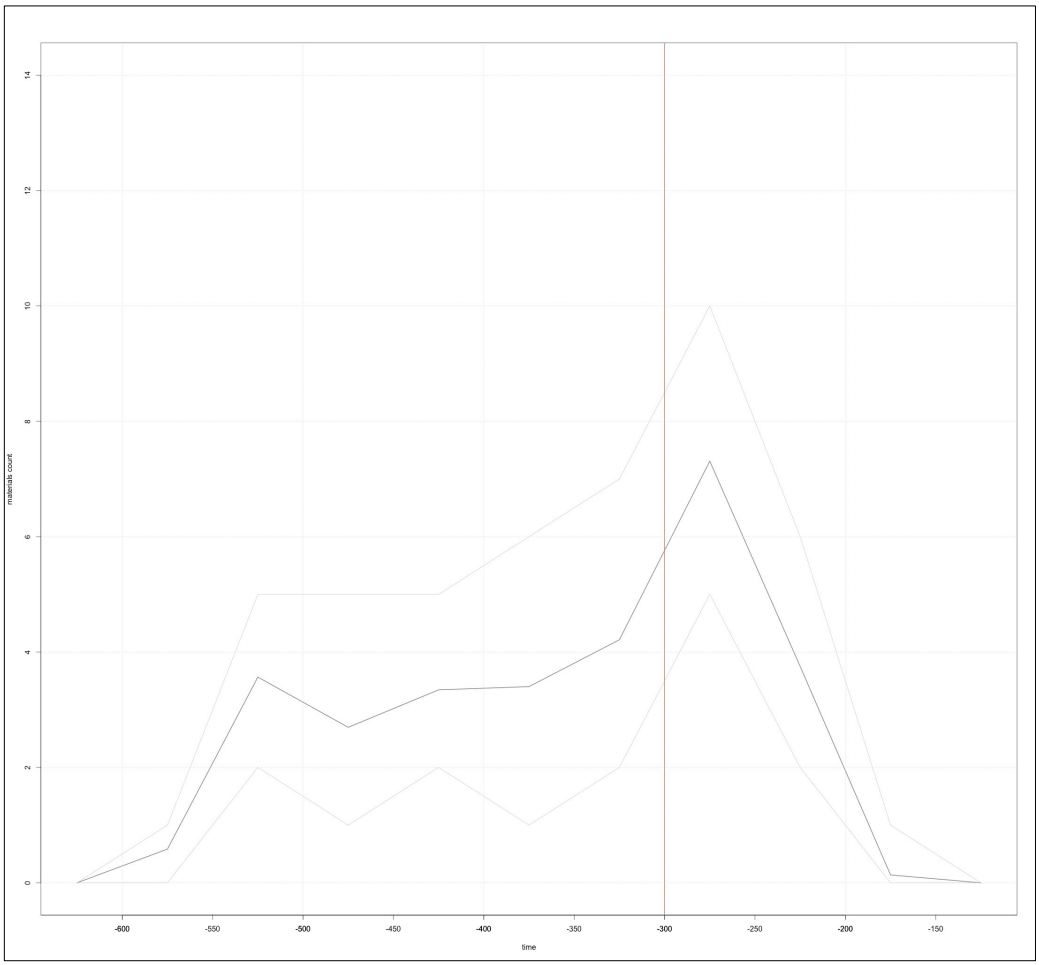


fig. 131 - *The floor assemblage. Profile with 50 years brackets*

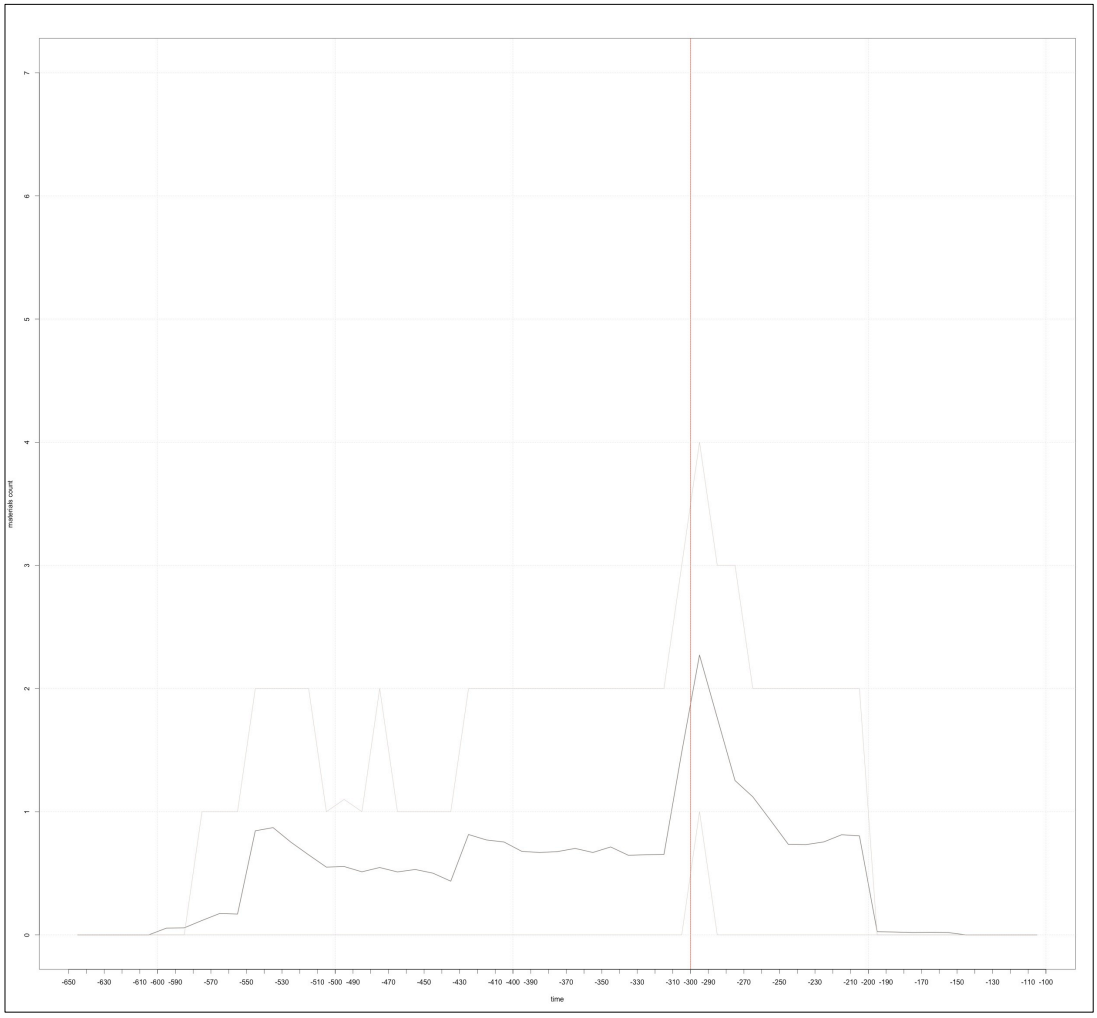


fig. 132 *- The floor assemblage. Profile with 10 years brackets*

Discussion

As advanced before, missing some fundamentals data such as the physical state of the assemblage and the depht at which they were recovered, the following observations are made ex post, *i.e.* taking for granted the site global chronological framework and the date proposed by the authors for the phase this deposit belongs. This phase is dated 300-225 BC and it is in perfect accordance with the assemblage displayed by the examined deposit. The deposit assemblage, indeed, provides a *tpq* of 300 BC, in accordance with the date proposed for its construction. Although the presence of intrusions is difficult to evaluate, the accordance between the overall chronological propose and the peculiar situation of the deposit is striking. All the more ancient finds can well be considered residuals, and are distributed along a wide time span which covers the whole previous occupation of the area, since 550 BC, when the first farm was built. Two slight peaks of residuals are located in this first period and in the period 430-400 BC.

It is even more striking observing how the proposed lenght of this phase of occupationn substantially coincide with the deposit surface use lenght which may have been advanced studying the profile: if the whole phase is dated 300-225 BC, the deposit use, according to the graph, may be dated 300-210/200 BC, that is with an after all slight difference of about 15-25 years.

Date proposed

- Construction: 300 BC
- Use: 300-225 (or 210/200) BC

Notes and references

The whole excavation is published in CARANDINI *ET ALII* (EDS.) 2006. The sequence is described is RICCI 2006, partic. p. 198. The materials employed are in DI GIUSEPPE 2006, pp. 209-210.

❖ SECONDARY DEPOSITS ❖

IV.6.1 DEFINITION

In Chapter II.2.4 I defined a secondary deposit as a deposit whose assemblage largely or completely belongs to a systemic context previous to the one in which the deposit was formed. This means that the recovered assemblage most probably have nothing to do with the formation of the deposit and even less with any activity which was carried on, for instance, on its surface (in one word, with its function). One of the simplest and clearest examples is represented by the building of a typical ditch and rampart earthwork (this example is usually picked to explain what is the meaning of "reverse stratigraphy"): the layers which form the rampart have most probably been obtained through the excavation of the nearby ditch, together with any material possibly embedded. These materials do not inform us of anything about when the rampart was built, what was its function or which were the activities carried on it. The only chronological information we can gain from the assemblage is a *terminus post quem*, a moment after which the rampart was built; indeed, according only to the data obtained through the excavation and the examination of the assemblage, the construction of the rampart may have taken place 5, 10, 100 or even 1000 years later than the *tpq*. If no systemic materials were intentionally of accidentally added to the assemblage, all the materials recovered are probably residuals.

May the assemblage be so close in time to the formation of the deposit for being considered, according to the accuracy of our observations, contemporary, thus allowing any *ad quem* date? Of course it could be[476]. The point is that we do not know.

It follows that this category groups all those deposits, probably the vast majority, which cannot be safely dated *ad quem*, because we do not recognise with some confidency the presence of any systemic material, which may well have never been part of the deposit. In other words we cannot establish a solid link between the date provided by the assemblage and the date of formation of the deposit. In these cases, we must be satified of a *terminus post quem*.

[476] BIGLIATI, COLETTI 1998

Once screened out the presence of intrusions, we may also postulate that the more a given material is ancient in respect to the *terminus post quem*, the more it is probable that it is a residual. The more we get close to the *tpq*, the more the chances that a given material was a false residual or a contemporary material rise, but, again, we do not know if it was the case and that precise artefact, bone or sample may also have been a residual.

It emerges that two main factors are important to define these deposits: redeposition and time. Redeposition is the main factor which causes the entry of older materials in more recently formed deposits. Time is the second key factor; we must establish how long the time span that occurred between the first deposition of a single material or of a whole assemblage and its redeposition is. Three circumstances can occur:

- the time lenght is short (according to the accuracy and scale of our observations);
- the time lenght is long;
- we cannot estimate this time lenght.

When the first requisite is satisfied the deposit can be labelled as primary; if the second case or the third one occur, the deposit should be considered secondary.

One of the typical traits of these deposits is the presence of residuals. Although they do not provide any direct information about the date of formation of the deposit, they can cast some light on other issues, which have been listed in Chapter II.2.5 as follows:

1. the formation processes themselves;
2. the original basin(s);
3. trade, economy and activities within a site as a whole;
4. undetected or lost phases;

Among these topics, the first two ones assume some importance in strenghtening our formative models, which are in any case a necessary step in the game of dating.

For instance the presence of residuals of different ages may suggest that different basins were notched (intentionally, say for catching sediments of a given quality, or not) or that superimposed strata, belonging to different occupational phases, were cut and redeposited (see for instance the typical case of a foundation trench). Peculiar physical characteristics of these materials may even suggest the spatial location of the original basins (say the case of water abraded sherds recovered in dry environments).

IV.6.2 General expectations

As usual, it is much convenient to keep separate quantitative and qualitative characteristics of the assemblage. Looking at the quantitative characteristics which should be displayed by the assemblages contained in these deposits, it can be noticed that basically any kind of profile is likely to occurr, according to the basins cut. Some of these profiles are surely typical of this category of deposits, while others are shared by other categories. Let's try to examinate the different possibilities.

Secondary deposits may display a profile that is similar to those of primary ones, namely a unimodal distribution. This may be the case of re-deposited primary deposits. This is in fact a case which is quite difficult to detect, as every original characteristic may have remained unchanged. I guess that this occurrence is not very frequent, but sometimes it may occur. Secondary deposits may display a unimodal and even narrow profile also for other reasons; for instance only one more ancient basin, both primary or secondary, may have been cut to provide the needed sediments, which were eventually redeposited in new forms. In Aquileia, House of Titus Macer, most of the robbers trenches (see below) located in the western part of the dwelling cut the deposits which were related to the construction of the house and those related to the last phase of occupation. Being the first deposits not very rich in artefacts and having the regular clearance, maintenance and cleaning activities prevented, during the following centuries, the formation of any deposit, the last period of occupation is by far the most represented, thus entailing the formation of curves imitating those produced by primary deposits with some "tails" of residuality (see below).

In these cases the comprehension of the nature and function of the deposit is fundamental for avoiding any mistake.

Similar considerations arise in case secondary deposits mimic the shape of a primary deposit with a wide profile (*i.e.* with a continuous formation); indeed the two may be identical and, again, understanding what we are excavating is essential and keeping in mind that usually primary deposits with continuous formation (dumps) are most likely located in certain places may be of some help.

Eventually, there are also more legible cases, in which neat, well separated pikes define a multimodal curve which in turn strongly suggests that we are dealing with a secondary deposit which originated from different basins, each one containing different assemblages. This may be more frequent in case deep trenches are cut in long lived settlements and in case the resulting sediments are employed for backfilling the trench itself,

say a foundation trench. In these cases the 'new' assemblage should be the sum of the older assemblages notched by the excavation of the trench and they may be representative of the main occupation phases witnessed by the site.

If on the one hand the shape of the profiles obtained through a Monte Carlo simulation or through other medhods are somehow difficult to handle, on the other one there are two other quantitative parameters which may be particularly helpful in detecting the secondary nature of a given deposit:

1. a significantly long time span covered by the assemblage, particularly in case of deposits whose volume is after all quite small;
2. a substantial temporal distance between the main peak displayed by the assemblage and the *terminus post quem*.

In both cases intrusions and the intentional or accidental addition of materials should have been reasonably excluded.

Moving to the qualitative characteristics of the assemblage, it has been already discussed how some parameters such as fragmentation, conjoinability and wear cannot be considered as solid discriminants. High rates of fragmentation and low conjoinability, in particular, may also characterize primary deposits. Dishomogeneity in wear, with particular focus on fractures in case of potsherds, may represent a substantial clue to suggest that some redeposition occurred after substantial time, but, on the contrary, homogeneity does not necessarily imply that redeposition after long time did not occur. Finally it has to be stressed that wear is heavily affected by the materials on which it is observed and, among others, by factors such as manufactoring technique and use.

Concluding, as it has been observed in Chapter III.5.1, the information provided by these parameters can strenghten our suspects that we are dealing with a secondary deposit, but cannot be used, alone, to reject this hypothesis.

If we turn to the characteristics of the deposit as a whole, we can notice that in general secondary deposits entail the redeposition of sediment or rubble; this, in urban environment often happens for building purpose or simply to restore a plain surface. In the first case in particular we may expect the use of specifically selected sediments or at least of sediments with sufficient mechanical characteristics; in any case, it seems quite unlikely the use of highly organic sediments, as the degradation of organic matter entails a volume loss which definitely works against stability. This very simple observation is, by itself, some useful, as most part of the primary deposits is, on the contrary, matrixless (P.P.3, P.P.6) or connected with dumping activity and thus characterized by organig matrix (P.P.1, P.P.4,

P.P.8, P.C.1). Others (P.P.2, P.P.5, P.P.7, P.C.2) are very peculiar and easily recognizable. Redeposition of 'pure' rubbish after a substantial period seems somewhat unlikely, but of course it may occur.

Some problems may arise in the case of redeposited rubble, which may remotely have the appearance of *in situ* collapse debris, although in any case, what is primary and what draws the attention, in case of collapse, is what is preserved beneath the debris. Both in case it is *in situ* or it has been redeposited, it is worth repeating that it is particularly affected by intrusions, for being characterized by empty spaces which may be have been easily filled by upper sediments.

Of course in all these cases the matrix is not very helpful to distinguish a secondary deposit from a mixed deposit with systemic materials accidentally or intentionally added. Some indications for playing this difficult game are expressed in Chapters III.5.3 and IV.5. In case none of the proposed parameters was satisfied, the studied deposit should be considered a secondary one.

IV.6.3 Dating

These deposits can be dated, through the embedded assemblage, with a mere *terminus post quem*. Any attempt to close "the other side of window" basically relies on other external sources, such as historical considerations, general cultural or archaeological knowledge, the presence (up in the sequence) of *termini ante quem* or simply personal confidence. Anyhow, I strongly claim that the two issues should be kept separated and that it should be explicitly stated what the assemblage says and what is provided by other sources.

IV.6.4 Formative typology

A formative typology of secondary deposits may be certainly extremely large, as they usually represent the vast majority of the excavated deposits. Among the main categories in which I have decided to "taxonomize" the totality of deposits, this is the one which may get most enriched with new types. What follows has then to be considered as a first coarse and provisional subdivision, which is not expected to contain every possible case. The types listed below are just some of the more common ones, which are part of the record produced by almost every classical (and non-classical) urban environment. They can be listed as follows:

- S.1, Robber trench backfills
- S.2, Foundation trench backfills
- S.3, Re-deposited sediments for building purpose
- S.4, Generic cut backfills
- S.5, Wall groundworks
- S.6, Post pit backfill B
- S.7, Post hole backfill C
- S.8, Re-deposited rubble

S.1, Robber trench backfills

Robber trenches are one of the most common features in any urban environment and they are particularly, although not exclusively, typical of post classical activities. They are usually related to the removal of structures, particularly walls, but they can also be dug to remove other reusable or recyclable things, such as lead water pipes. In case walls, thresholds, floors or pavings were dismantled, the aim of the process usually consisted of the re-employment of the building materials or of their calcination (in case of limestone). The excavation of a trench allowed for recovering the lower part of the walls, mostly their socles; when removing these, also part of the nearby sediments were notched. Trenches may then have been left open or, more often, they were backfilled in order to recreate a plain surface, able to be traversed. The easiest way to backfill the empty spaces resulting consisted of re-employing the notched sediments and the unusable part of the rubble removed. In this case the quality of what was used to backfill the trench was not particularly important as usually no immediate statical role was required. It follows that the intentional addition of some materials can be considered unlikely to have occurred. On the contrary accidental loss of systemic materials, particularly when the operations of dismantlement were lasting long, may have occurred more likely[477].

The assemblage physical state is expected to be quite heterogeneous (sherd size, wear, blackened and non blackened pottery etc) while the matrix is expected to be soft. If different original basins turned out to be mixed, the matrix texture seems likely to be loamy, otherwise internal stratification may be observed.

[477] Certainly the scheme proposed may be much more complicated. For a mixture of human and natural agents producing the backfill of a robbers trench see ARNOLDUS HUYZENVELD A., MAETZKE G. 1988, PP. 155-159

Eventually, the bulk of the recovered materials should roughly reflect, chronologically, the previous settlement occupational trends.

Of course what sketched is just a simplicistic descritpion of the main processes involved and actual ancient processes may have been much more complicated. Other materials may have turned out to get buried and more substantial space displacement may have occurred, together with more mixing.

One important issue concerns in particular these deposits: they seem to be quite susceptible to intrusions, because they were most probably left exposed and because of their internal structure, which is likely to have displayed some empty spaces. Occasional loss of items may also have occurred during their formation. To distinguish between the two cases seems very difficult. Recording during the excavation the precise position and recovery context of those materials which, at least at first sight, are likely to be the more recent may be somewhat helpful (in classical archaeology obviously it is not common practice the precise spatial recording of each single material). Anyhow, in case no safe distinction could be made between the two cases, I think that, theoretically, the most correct strategy would consist of attributing an earlier *terminus post quem*, *i.e.* a *terminus* provided by more ancient materials, which are less likely to be intrusions in turn.

The case of backfills made of allochtonous materials and/or sediments should be quite easily recognizable.

S.2, Foundation trench backfills

Foundation trenches are another very common feature in built areas. These trenches are excavated in soils or in existing sediments in order to lay down the foundations of the walls which will define a building. This is not the case to discuss all the different building techniques employed in classical times to lay foundations. In this case I refer to the very simple case represented by a trench in which some foundations were laid down and whose resulting empty space was then backfilled with sediments. These last may in turn have been selected according to their mechanical and/or hydraulic properties or being simply the same sediments produced by the excavation of the trench.

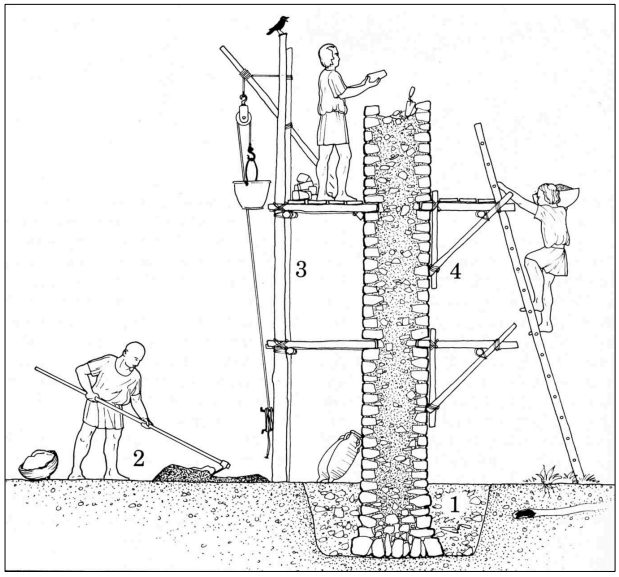


fig. 133 - A foundation trench and its backfill (1). From ADAM 1994

In both cases any sherd, bone or charcoal lump recovered within the deposit was most likely already embedded in the sediments. The case of materials intentionally added is briefly discussed in Chapter III.5.3, while, as usual, the accidental loss of systemic material seems at the same time unlikely and difficult to demonstrate.

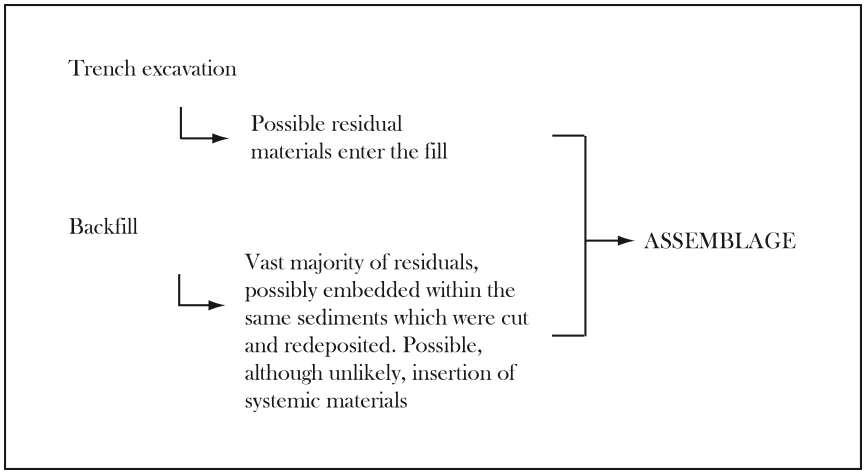


fig. 134 - The backfill of a foundation trench and its assemblage

Contrary to robbers trenches, foundation trenches were usually not left exposed for long time (most of the times they were then covered by a floor or its beddings in case of a roofed space or by other sediments in case of external spaces). This make them less susceptible to intrusions, apart of course from the case in which later 'disturbance' occurred.

Variability in assemblage physical state and quantitative profile as well as in matrix characteristics seems to be very high, according to the original basins.

S.3, Re-deposited sediments for building purpose

As in every secondary deposit happens, also in this case redeposition is involved. In this case sediments are redeposited on a given area (basin) to perform further building activity. Some of the most common reasons for which it may happen are the necessity of obtaining a flat, plain surface, the necessity of raising the ground level or a combination of the two. Also in this case sediments may have been selected according to their mechanical and/or hydraulic properties or being simply the most easily available.

Heterogeneity also in this case may be characteristic of both the qualitative and quantitative traits of the assemblage.

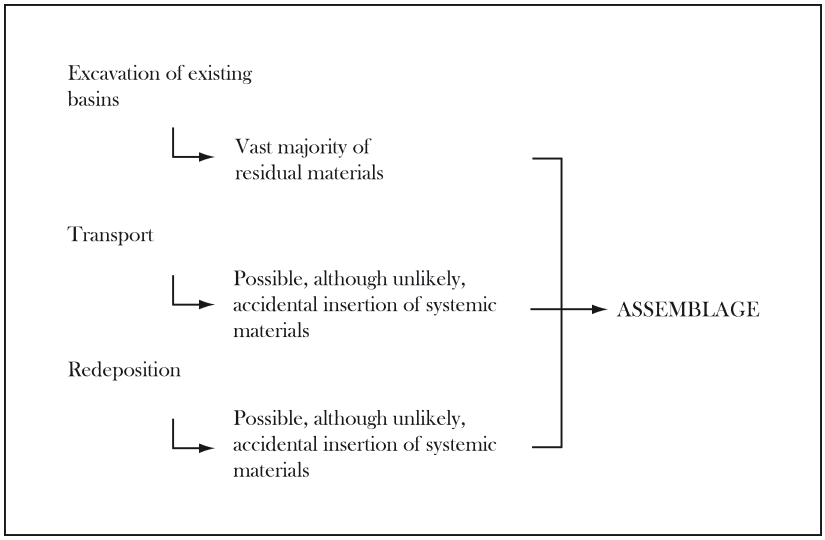


***fig. 135** - Redeposition of sediments and materials*

S.4, Generic cut backfills

Almost any cut, whatever its purpose was, imply its own backfilling, at least for restoring a flat surface. In any excavation many interfaces are detected and part of them may elude any precise interpretation, together with their backfills. This may be the cases of pits which may have been dug to procure, say, clayish sediments for other buildings or it may be the case of small or large cuts performed to carry away something which we cannot know. It may also be the case of simple holes which we cannot safely connect to the presence of posts or any other feature. In all these cases, in which the very interpretation of both cut and backfill is unclear, once evaluated the issue of intrusions, only a *terminus post quem* can be

provided by the assemblages recovered. In any case, with no doubt, these deposits should not be the key elements for building the overall chronological framework of the excavation. Conversely they will eventually benefit from information provided by the global framework which they are part of.

S.5, Wall groundworks

Wall groundworks are just a sub group among the wide range of sediments which have been redeposited for building purpose. In this case, anyhow, their specific function is quite clear and the use of selected sediments is much more probable. These deposits are quite well known in the field of Roman archaeology, particularly thanks to the growing interest in Roman building techniques and architecture. From a formative point of view they can be treated as any other secondary deposits, but the possibility that some materials were intentionally added to improve the mechanical or hydraulic characteristics of the sediments seems somewhat higher (see M.Ai.2, Chapter IV.5.4). These sediments may have been laid down directly on the ground surface or within a more or less large trench, but for dating purposes this does not make any difference.

S.6, Post pit backfill B

The very rough subdivision in which features connected with the presence of a post can be classified has already been proposed in Chapter IV.3.4 (partic. see **fig. 81**). In this case a focus on what I named post pit backfill B. It is the sediment which was used to fill a post pit once the post had been put into place. The process is indeed the same involved in the construction of any foundation trench, but in this case it may be much less visible and neat (particularly in case the cut sediments are soft, thus facilitating the walls collapse and substantial mixing) and particular care must be devoted in the field to detect it. Along with sediments, the insertion of stones or pebbels in the pit, for packing the space and making the structure firmer, is a quite common practice.

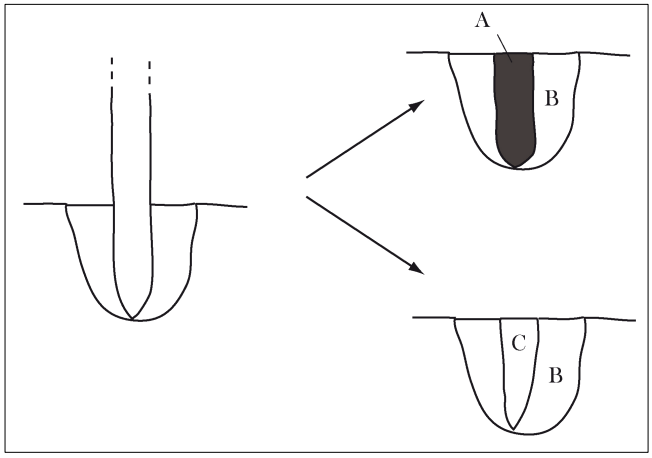


fig. 136 *- Post pit and post hole*

The assemblage contained in this kind of backfill *de facto* provides a *terminus post quem* for the installation of the post, as the empty space of the pit is supposed to have been filled right after the post was installed. As usual, the simplest and most effective way to backfill the hole consists of redepositing the sediments excavated for the pit, but other sources may be employed and sediments may also have been selected according to specific properties; in any case the materials possibly embedded within the redeposited sediments are most likely residuals.

S.7, Post hole backfill C

This is the last of the three main categories in which I subdivided the features linked with the presence of a post. In this case I examine the backfill of the post hole. This entails that the post was removed after its use; it follows that the basic process behind the formation of these deposits is the same that lies behind the formation of the backfill of a robbers trench. Anyhow some important differences are detectable. Firstly the post may have been simply removed, thus no actual excavation was made. Moreover, once it was done, some substantial mixing may have occurred according to the consistency of the walls exposed. If the post was small and the post pit backfill was soft, backfilling the post hole may not have been necessary, thus making this case very difficult to detect, particularly compared to the case discussed above (S.6). Again, the major problem is a problem of field legibility; in case this kind of backfill was detected with some confidence, the assemblage possibly recovered suggests a *terminus post quem* for the dismantlement of the post, thus in case providing a precious piece of information about the abandonment or refurbishment of a timber structure.

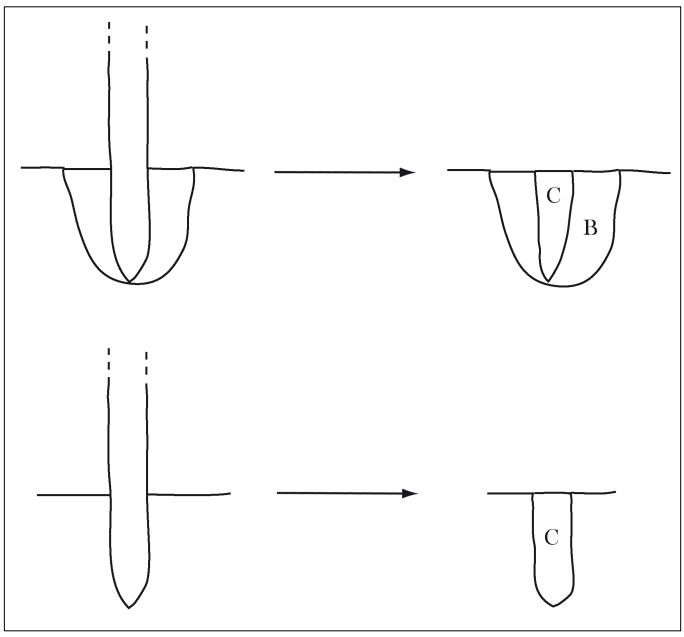


fig. 137 *- Post hole backfill C*

S.8, Re-deposited rubble (and loose stone foundations)

Rubble derived from building dismantlements or other demolition activities is something quite common in urban environments. Demolitions may occurr in connection with major episodes of destruction due to military episodes or to natural phenomena or they may occur on the occasion of small or great refurbishment activities. They can be left untouched or they can be relocated for new building activities, whereas the single materials can easily enter reuse and recycling mechanisms (see Chapter III.5.1).

Rubble redeposited *en bloc*, say to raise the ground level in a boggy area or to terrace a certain slope, should be discernible from *in situ* debris at least because beneath it no *in situ* compatible structures should be recovered. Moreover its internal arrangement should be chaotic and no preferential alignements should be detected. The assemblages recovered within these deposits, which may consist of large amounts of building materials, some of which may be datable, can provide at most a *terminus post quem* for their final deposition.

Nonetheless it has to be stressed that these deposits may contain many empty spaces and few sediments, particularly in case masonry structures were dismantled, and this make them very susceptible to the presence of intrusions; indeed the chronological palimpsests displayed by the materials possibly recovered within the volumes occupied by these deposits may be highly complex, produced by an inextricable combination of original basins. The safest approach seems to consist in keeping in separate contexts what is certainly pertinent to

the rubble and what may have been infiltrated from upper deposits. Anyhow these deposits cannot be considered very reliable for dating purposes and I think that they should be put aside until the general chronological framework of the excavation has been structured. They should be examined in close relation to the upper deposits and also to the underlying ones.

Loose stone foundations are phisically similar; they may display the same problems in dating, but they are likely to consist of very few datable materials (if any are apresent).

IV.6.5 Case study 1: a robber trench in the House of Titus Macer, Aquileia (S.1)

Topographic and archaeological background

The deposit is located in the western part if the investigated area, *i.e.* the one which had never been excavated before. It was directly covered by a layer rubble (see Chapter IV.2.2) which, in turn was lying directly beneath the topsoil. It represented the backfill of a little deep, large areal cut, which was most probably performed to remove an existing paving made of stone slabs and reused bricks and which survived in two small chunks. The shape of the cut was irregular but roughly rectangular, thus suggesting the shape of the paving.

This last one had been laid down between the very end of the 4th century AD and the half of the 5th century AD (most probably in the first decades of this time span) and it was the product of larger activities of refurbishment which involved the ancient *atrium* house as a whole. In particular the new floor transformed the open space of the *atrium* in a larger courtyard.

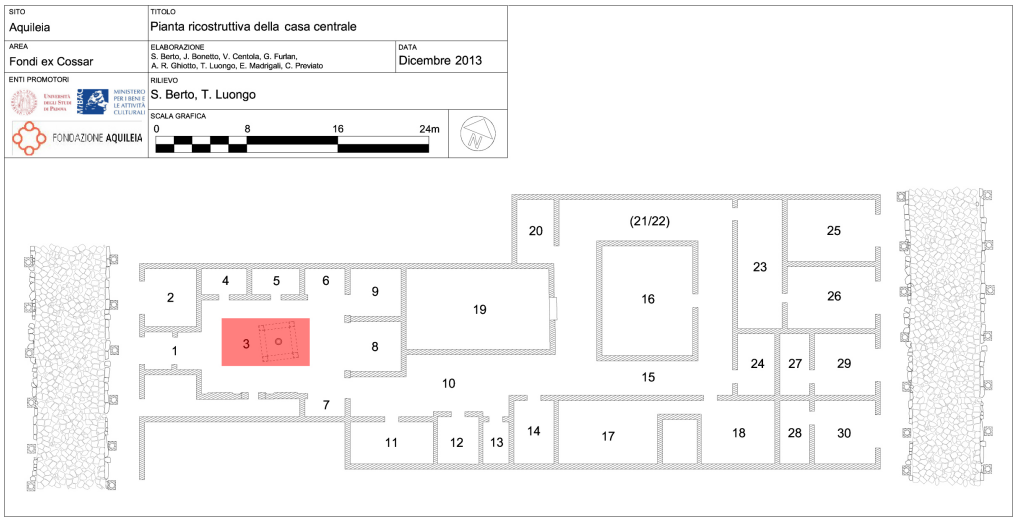


fig. 138 *- The location of the discussed deposit*

Deposit description

The considered deposit is made of a single context (namely US 3151); this displayed loamy/sandy dark brown matrix, with soft consistency. No internal stratification was observed, nor laminae or beddings. Given its consistency and its location, the context may have been susceptible to some intrusions.

Apart from the dated finds, many fragments of bricks and clay *tesserae* were recovered, together with bones and shells. Bricks and *tesserae* may have originated from the partial destruction of surrounding floors, while some bones and shells may derive from the notching of nearby small dumps.

Eventually part of a marble column was also recovered.

Assemblage physical state

The assemblage was quite heterogeneous in terms of sherds size. No other peculiarities were recorded.

The finds

Among the finds, amphoras body sherd are particularly numerous, thus in general the dates provided are somewhat broad. Nine coins and some fragments of african red slip ware provide some narrower windows. In all, 203 items were plotted. It has to be stressed that the overall time span covered by the finds is very wide, ranging the bulk of them from about the 2nd century BC to the late 5th century AD. A *tpq* for the formation of the deposit is provided by the spike of an amphora Keay 62Q, dated to the last quarter of the 5th century AD.

Monte Carlo chrono-profile

Below are provided two graphs, one with 25 years brakets and one with 50 years brakets. Given the quality of the find dates, a further graph with 10 years brakets was considered to be useless.

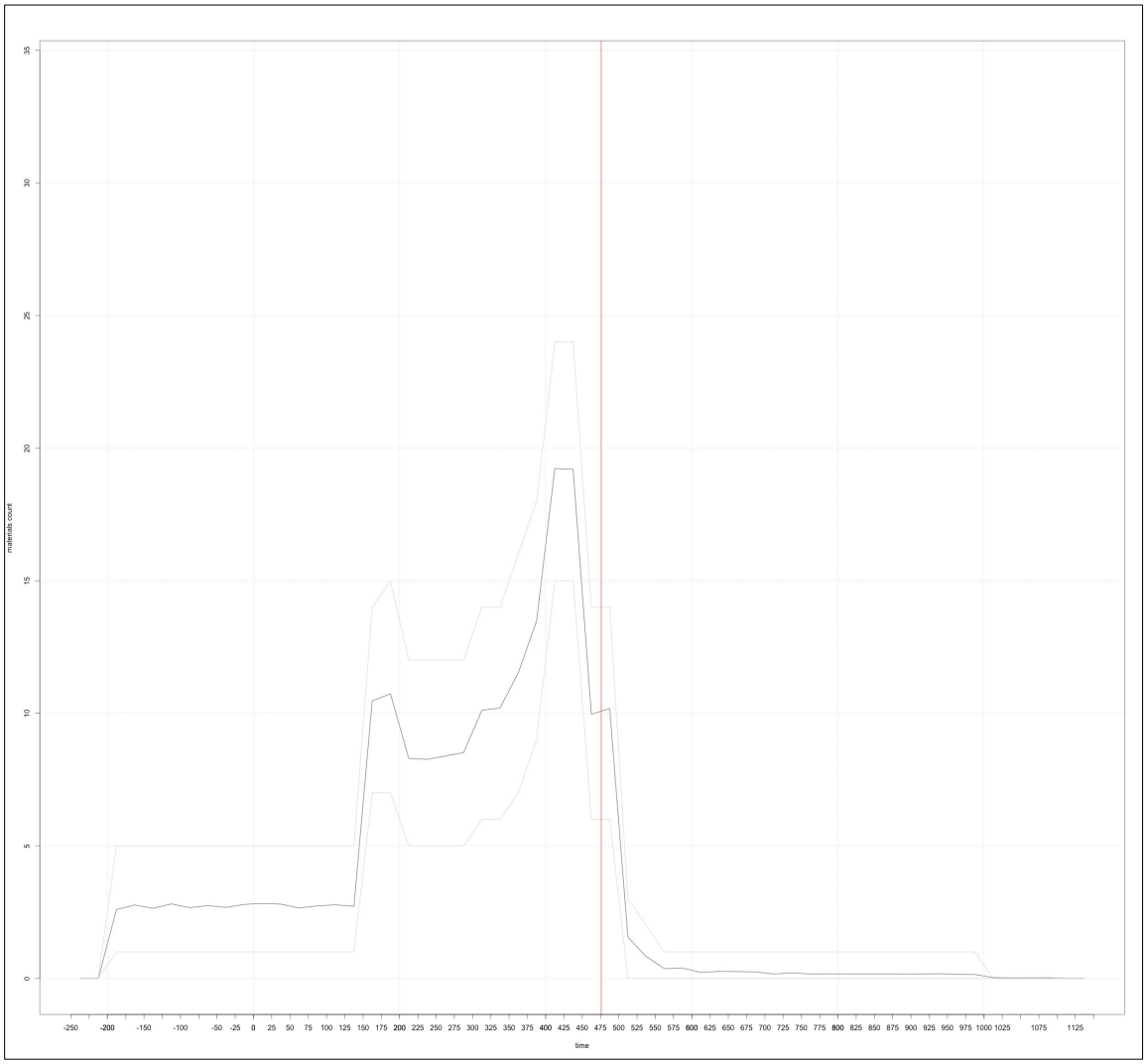


fig. 139 - The discussed assemblage. Profile with 25 years brackets

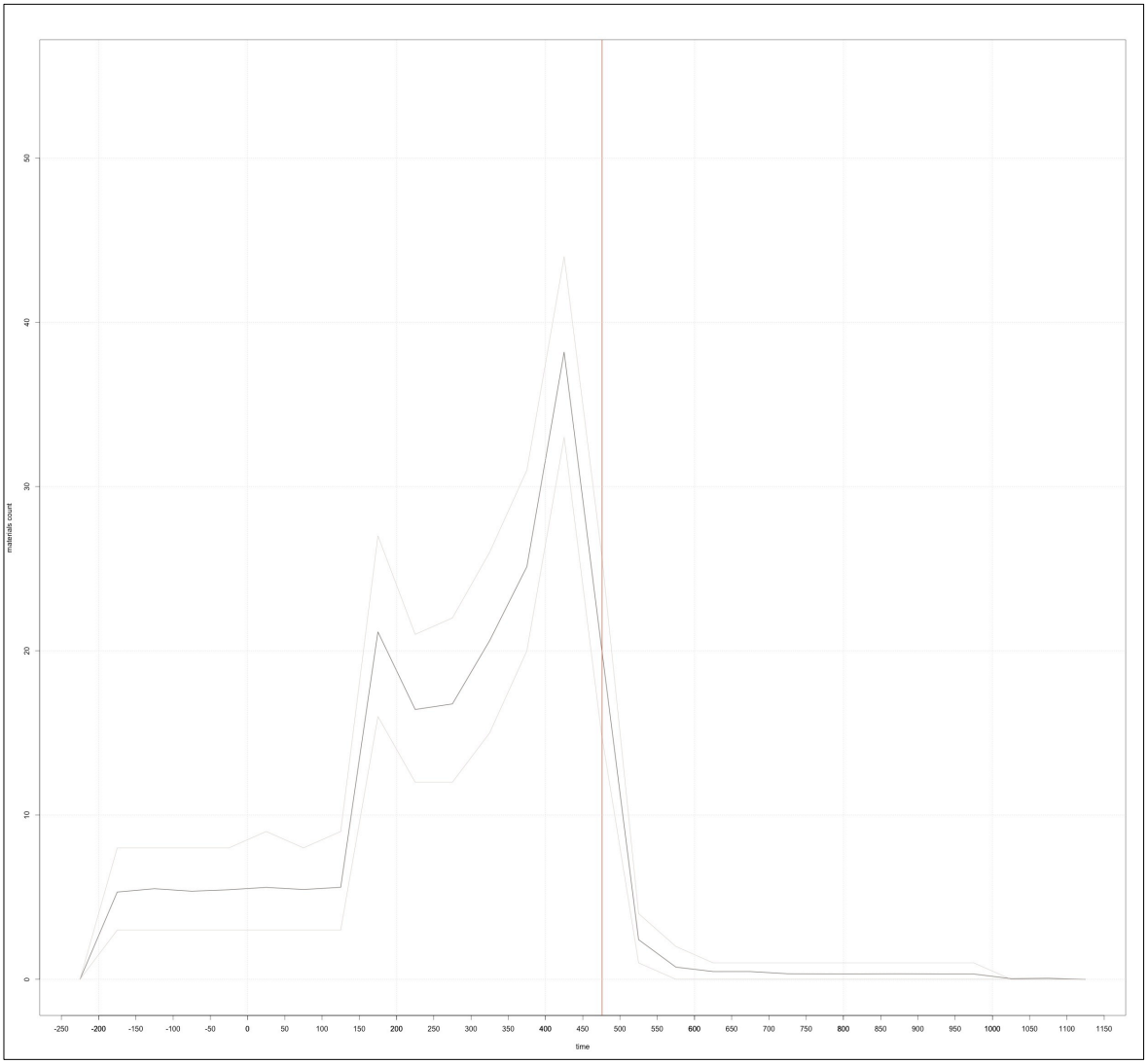


fig. 140 *- The discussed assemblage. Profile with 50 years brackets*

Discussion

The shape of the curve is somehow irregular, presenting a main pike about 50 years before the tpq and another minor pike at the end of the 2nd century AD. A long substantial 'tail' extends the profile back to the 2nd century BC. Being the main pike some close to the *tpq*, it seems unlikely it is the product of intrusions. Conversely, it seems more plausible that it is the product of the trenching of the deposits connected to last substantial earlier occupation of the area. In this case we know that the *atrium* house witnessed some dumping activities during the last stages of its life, broadly datable to the period included between the 5th century AD and the half of the next century. Moreover the beginning of the 5th century AD had just previosly witnessed a major activity of refurbishment, whose strate were most probable cut.

The presence of less materials dated to the previous periods does not strike too much, as the common activities of cleaning and maintenance most likely kept the surfaces quite clean. Given this, it seems much more reasonable to ascribe these materials to more ancient episodes of refurbishment and, for the most ancient ones, to the very construction of the house.

Date proposed

Terminus post quem: 475 AD. The overall chronological framework and the relation of this deposit with others containg later materials, suggest that it was formed much later than the *tpq*, possibly even a thousand years later.

Duration

The backfill of the cut may have been a matter of hours or days at most.

Notes and references

The deposit, excavated in 2011, is still substantially unpublished. Its recovery is reported in FURLAN 2011, while a list of finds is provided in DOBREVA 2011.

IV.6.6 CASE STUDY 2: THE BACKFILL OF THE FOUNDATION TRENCHES OF THE FORUM TEMPLE, NORA (S.2)

Topographic and archaeological background

As discussed in Chapter IV.2.3, the area of the forum of Nora was settled by far before the construction of the Forum complex. This of course is valid also for the area which was later occupied by the forum temple, which is thought to have accommodated a more ancient worship place.

The new temple was laid down through the excavation of remarkable foundation trenches, where massive sandstone blocks were positioned in order to bear the weight of the upper structures. Some thin layers were laid down on the bottom of the trenches were it was necessary to perfectly flatten the surface and to bring the blocks to the exact height. The trenches were just a little larger than the blocks, but the empty space left was anyhow due to be backfilled.

The backfill was most probably left untouched for long, until the structure was abandoned and almost completely dismantled. In this occasion some of the foundation blocks were also removed and the foundation backfill was partially exposed and cut.

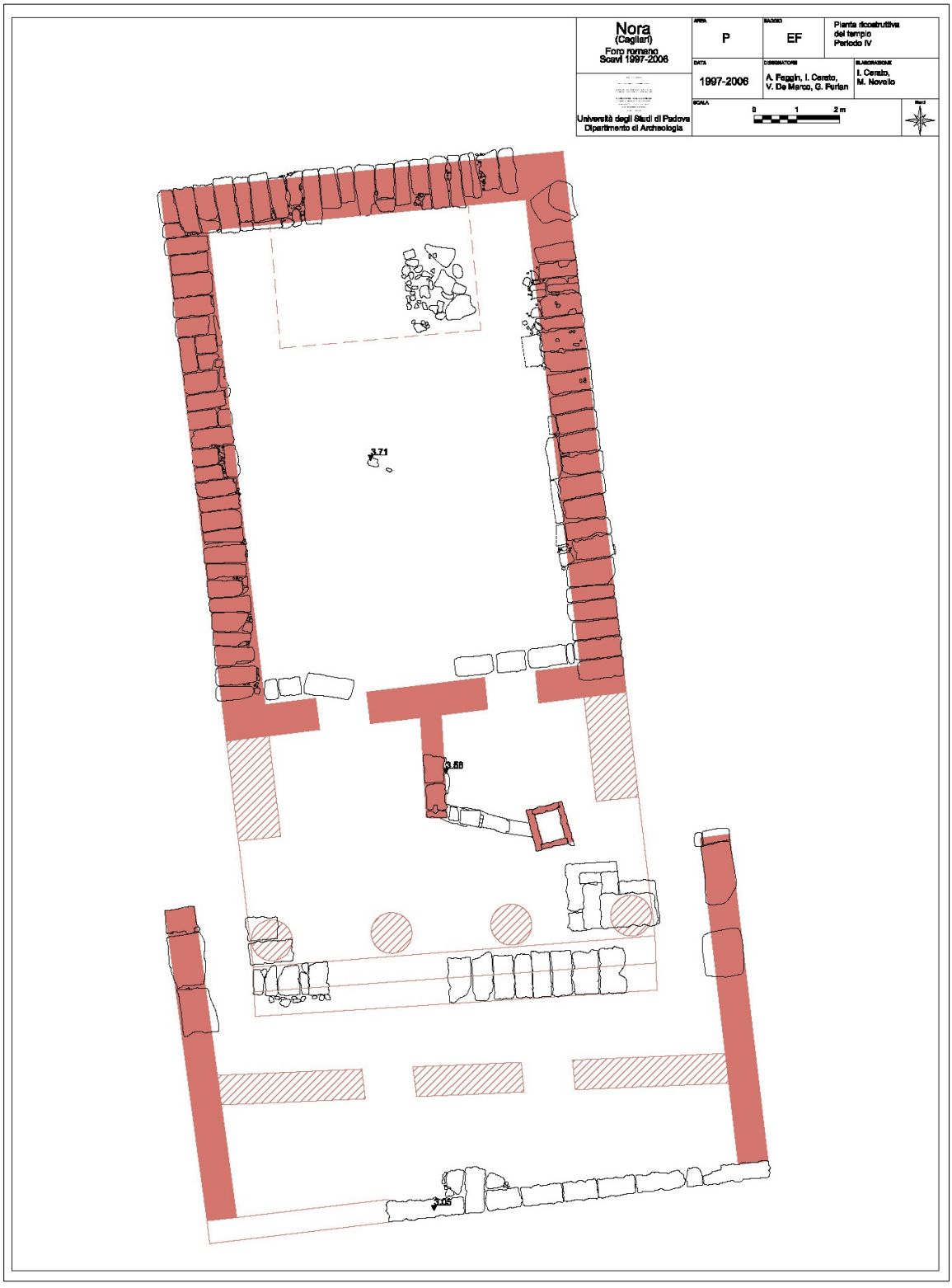


fig. 141 - *The forum temple of Nora, Sardinia. From Novello 2009*

Deposit description

The examined deposit consists of all the trench backfills which produced any datable material; they include both the thin layers laid on the bottom of the trenches and the backfills deposited once the blocks had been laid down. These last are described as 'non homogeneous material', but no other information are provided. The contexts examined are US 5400, 5622, 5747=5694=5705, 5858, 5975, 11519=11518 and 11521.

Assemblage physical state

Unfortunately no information is easily available, although all the diagnostic finds have been presented in BONETTO *ET ALII* (EDS.) 2009c and BONETTO *ET ALII* (EDS.) 2009d.

The finds

The group of contexts returned 36 datable finds. Many others were recovered, but no precise date was gained. Anyhow the presence of numerous sherds catalogued simply as "Phoenician/Punic" suggests that the overall residuality displayed by the assemblage is actually even higher. Among the 36 dated finds, two were considered by the author as intrusions, mainly because of the overall chronological framework and because they were recovered in contexts which were later exposed and notched, thus they were possibly subjected to some mixing.

Among the Roman dated materials, thin walled ware and and black glazed pottery (both local and imported) are the most represented classes; among the pre-Roman specimens, kitchen and dining ware are the most popular. Very few bones (undated) and no coins were recovered.

It has to be stressed that the overall period covered by the dated finds is very wide, ranging about from the 7th century BC to the Roman imperial age.

Monte Carlo chrono-profile

The first graph, plotted with 25 years brackets, shows the profile produced taking into account the two pieces considered intrusions; it is followed by a 25 years graph and a 50 years graph which do not consider the two possible intrusions. This determines that the first graph display a later *terminus post quem* (red line).

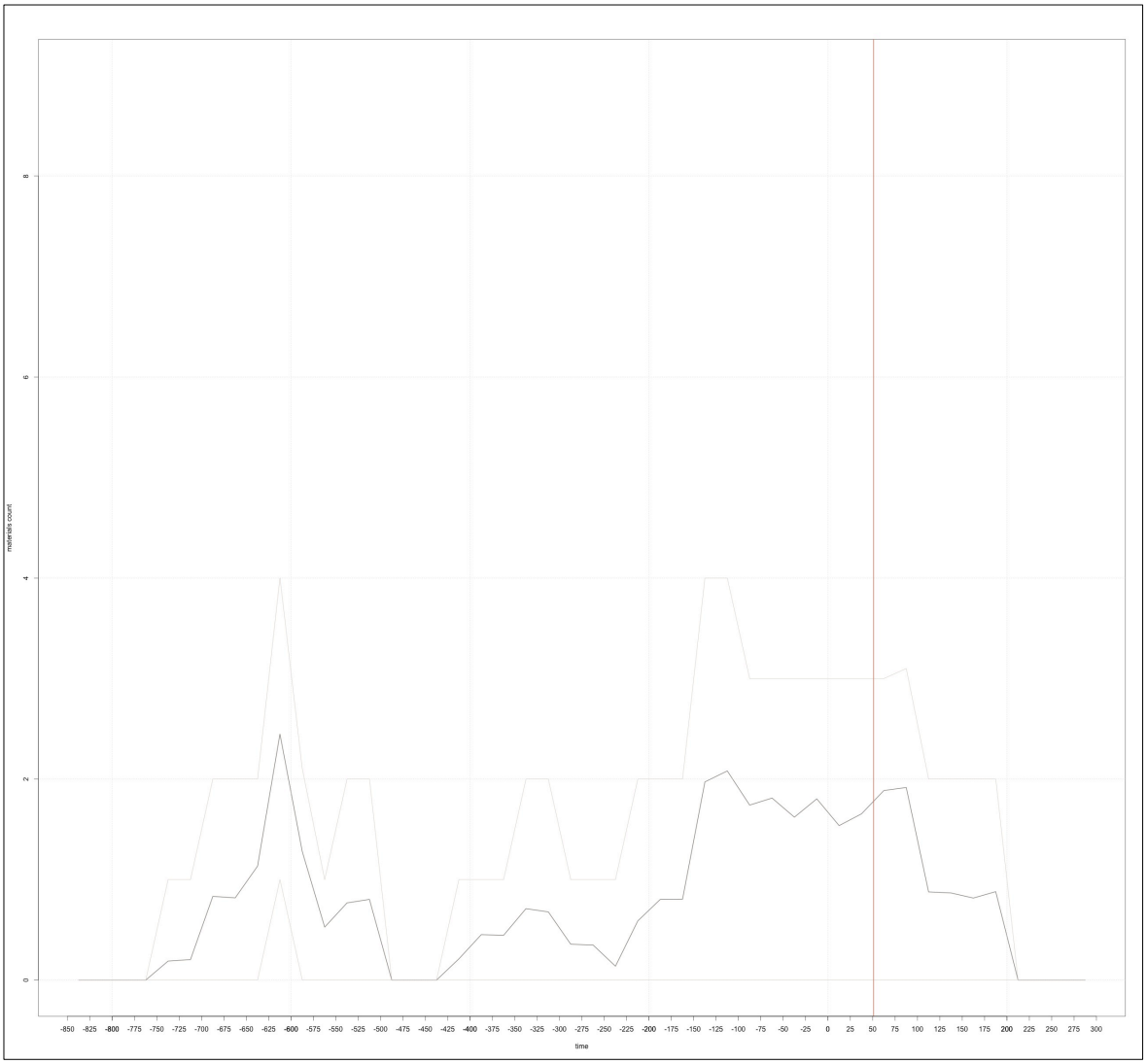


fig. 142 *- The discussed assemblage. Profile with 25 years brackets. Materials considered as intrusions are included*

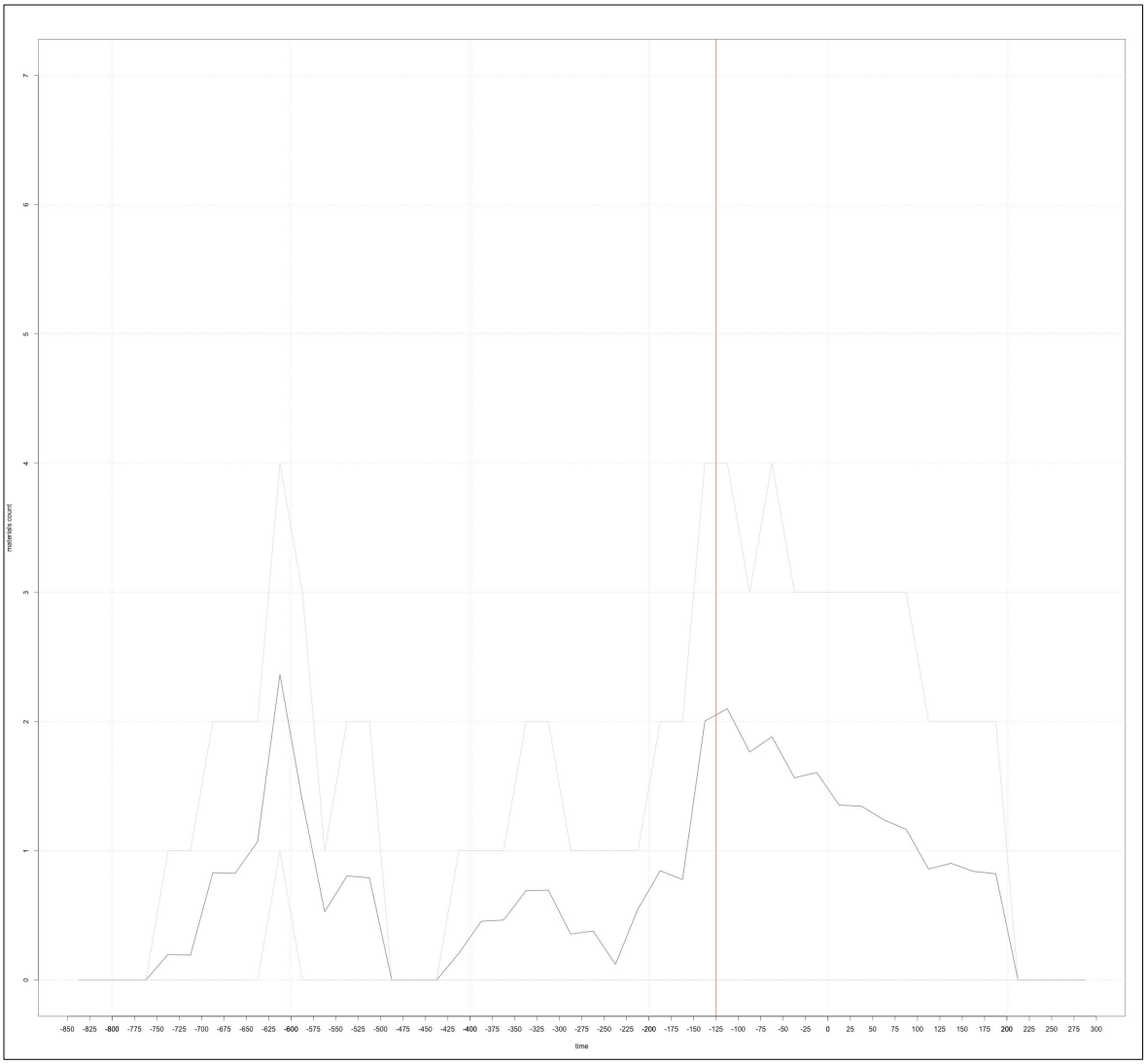


fig. 143 - *The discussed assemblage. Profile with 25 years brackets. Materials considered as intrusions are excluded (note that the* tpq *red line has moved back to 125 BC)*

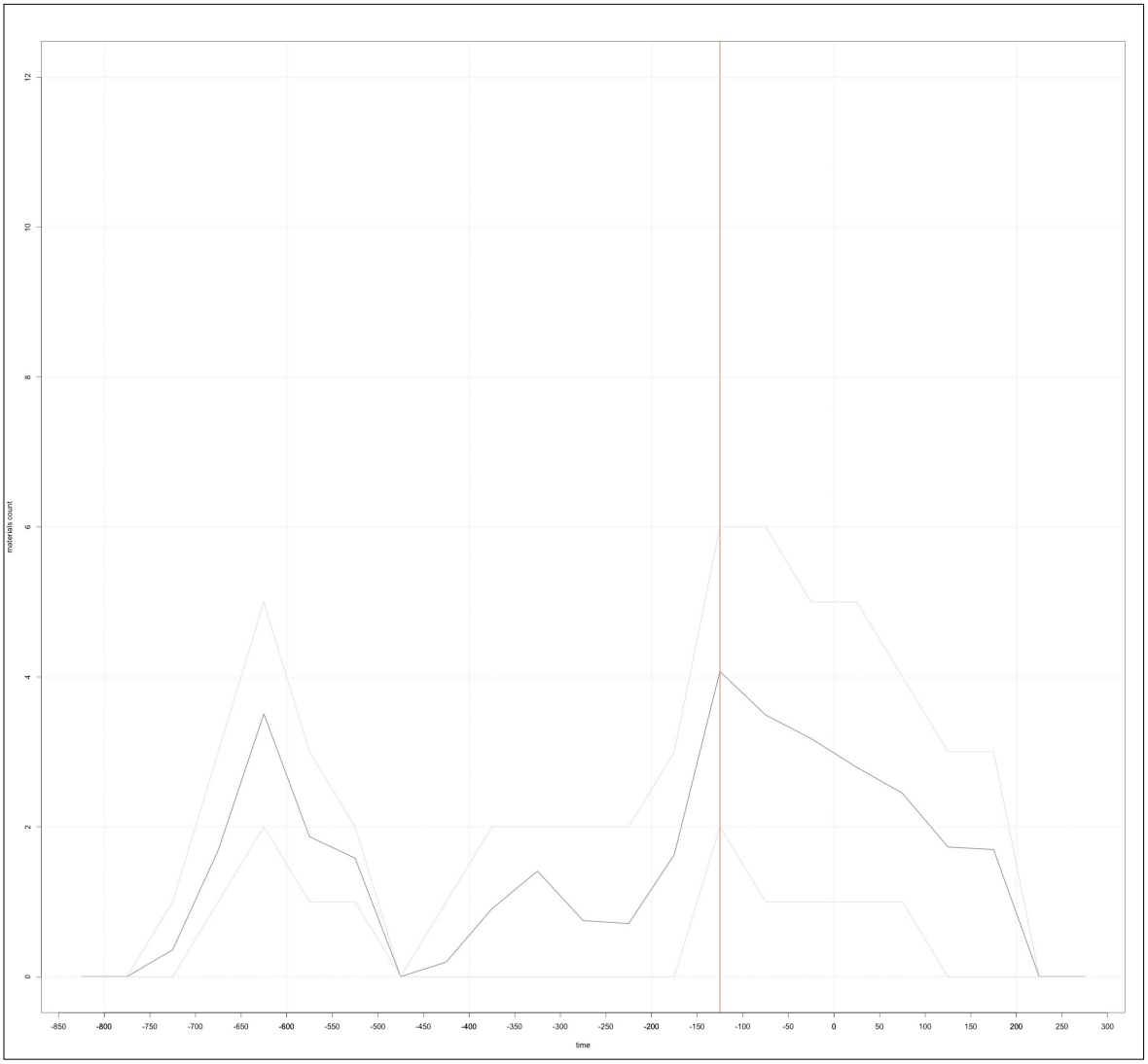


fig. 144 *- The discussed assemblage. Profile with 50 years brackets and no intrusions*

Discussion

The curve displayed by the assemblage dates can be considered somehow typical of a secondary deposit whose materials come from different original basins. Indeed the presence of three neat, clear pikes, together with the formative model of this kind of deposits, suggests that three basins were notched. Of course we do not know almost anything of the spatial location of these basins; they may have been physically separated but it seems more probable that they were simply superimposed, made of the layers that were cut by the foundation trench and thus mirroring the previous activities carried out in the very area of the temple. The first circumstance (phisically separated original basins) may be asciertained through a spatial analysis of the deposit, say context by context; if spatial patterning was observed in the

investigated deposit and if it matched the chronological patterning observed in the graphs above, we may suspect that the three original basins were distinct[478].

A first substantial pike indicates that strata with materials dated to the 7th-6th centuries BC were cut, while a second smaller pike suggests that also mid 4th century materials were involved. Anyhow the bulk of materials recovered seems to be Late Republican Roman and may be linked to the last substantial activities performed in the area before the construction of the temple.

Date proposed

Terminus post quem: circa 125 BC. Indeed the author's proposal of dating the deposits to the early Augustan age strongly relies on external sources, primarily on the consistence of such a date with the date proposed for the building of the forum square and porticoes.

Duration

The whole process of trenches backfilling may have lasted for a few hours or have been spread over a much longer time, according to the construction site arrangement.

Notes and references

The constuction of the temple is discussed in detail in NOVELLO 2009. See in particular pp. 383-390 and 397-399. A list of the processed contexts is reported in footnotes 25, 26 and 38. A complete list of finds is available in BONETTO *ET ALII* (EDS.) 2009a, pp. 125-137

IV.6.7 CASE STUDY 3: THE CONSTRUCTION OF THE FORUM BASILICA OF NORA (S.3)

Topographic and archaeological background

The forum basilica of the city of Nora is located in the southeastern corner of the public complex. Large part of the building has been eroded by maritime erosion and nowadays only the very northern part of the structure still survives. Its construction was much probably contemporary with the realization of the whole forum and in fact the building shares its western wall with the eastern portico of the central square. At most the building

[478] A similar procedure has been employed by A. R. Ghiotto in BONETTO *ET ALII* n.d.

may have been completed a little later than the forum, given also the fact that the whole project may have taken several years to be completed.

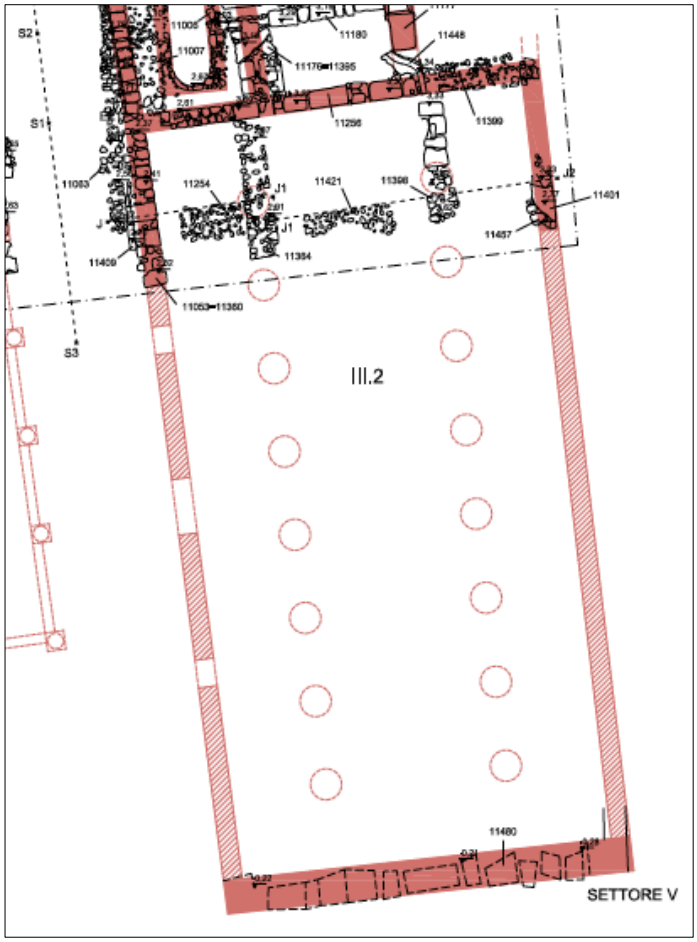


fig. 145 - The forum basilica of Nora, Sardinia

In general, the presence of previous punic structures in the area is well known, but the more ancient layout of the space occupied by the building is unknown. When the new building was erected, different techniques were employed: the foundations of the eastern nave were realized excavating two trenches which then accommodated the necessary masonry structures and were eventually backfilled. Differently, the western nave (the one nearer to the square) was located on lower ground, thus the masonry foundations were raised to the prefixed height and the resulting empty space was backfilled, little by little, with a 1,40 m thick deposit. The sediments were then covered by a layer of pebbles which accommodated the upper floor beddings.

In antiquity and later for some time the layers connected with the western nave foundation most likely remained well sealed; when the southern wall of the basilica (the one

closer to the water edge) collapsed, erosion started notching the strata beneath the floors and large part of the building was dismantled. The upper structures of the building, along with the rest of the forum, were most probably pillaged and then reused or recycled.

Deposit description

The deposit which is examined consists of the tabular and sub-tabular layers which were redeposited for the construction of the western nave, namely (from top to bottom) contexts 11373 = 11255, 11374, 11377, 11380, 11383 and 11397[479].

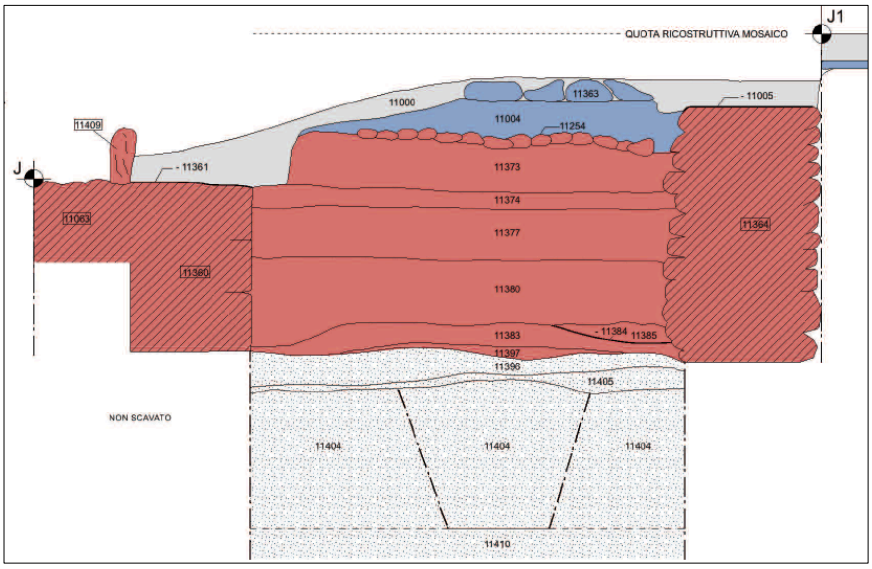


fig. 146 *- A cross section of the discussed sequence*

Among them, only contexts 11373 = 11255, 11377, 11380, 11383 provided some datable materials. In general these layers are quite similar to each other, with soft heterogeneous matrixes, charachterized by silty clusters and lumps of charcoal. No original basin can be easily detected for these sediments.

Given the general development of the area, the deposit is not likely to have suffered intrusions until the basilica was abandoned; intrusions from above seem to have affected the upper strata only very marginally. Conversely, sea erosion continuously exposed the southern edge of the deposit; nonetheless the undisturbed part of the deposit was easily detectable and well cleaned. As a whole, the possibility that intrusions affected the

[479] The sequence is interrupted by a small hearth (US -11384 and 11385) located on the top of context 11383; this was interpreted as the result of activities which were necessarily performed in the building site. This is with no doubt a primary deposit, thus I decided to not consider it. Anyhow its date substantially confirms the general chronological framework and the date proposed for the construction of the basilica (and the whole forum complex) and it is absolutely consistent with the data emerged by the deposit here examined.

assemblage can be considered quie low. Eventually, no inconsistencies with the global chronological framework are noticed.

Assemblage physical state

Unfortunately no information is easily available, although theoretically some information may be obtained from BONETTO *ET ALII* (EDS.) 2009c and BONETTO *ET ALII* (EDS.) 2009d (see the previous case study).

The finds

The examined assemblage is made of 53 datable finds. Again the presence of substantial amounts of undated Phoenician/Punic pottery would rise the impact of residuality on the whole assemblage. Among the processed finds, Punic kitchen ware and Roman thin walled ware and black glazed pottery make the bulk of the total amount. Some datable amphora sherds, both Roman and Punic, and few very old materials ascribable to Phoenician times complete the picture.

A *terminus post quem* is provided by a single sherd of thin walled ware (type Vegas 29) dated from the beginning of the Augustan age. It was recovered in context 11377, that is a well sealed one. A sherd of the same type has been considered by the author as an intrusion in the case of the foundation trenches of the forum temple. In this case, anyhow, there are no solid reasons which should lead us to reject the belonging of the sherd to the context in which it was recovered. Eventually it has to be stressed that the date provided by the sherd is not inconsistent with the date proposed for the construction of the forum complex (40-20 BC). Thus, concluding, I decided to process it. Conversely a *tpq* would have been fixed to the beginning of the 1st century BC.

The global time span covered by the assemblage covers about eight centuries.

Monte Carlo chrono-profile

Below are provided two profiles, one with 25 years brackets and one with 50 years ones. Given the arrangement of the chart from which the data were extracted (the table displays 25 years boxes) it was worthless to employ narrower windows.

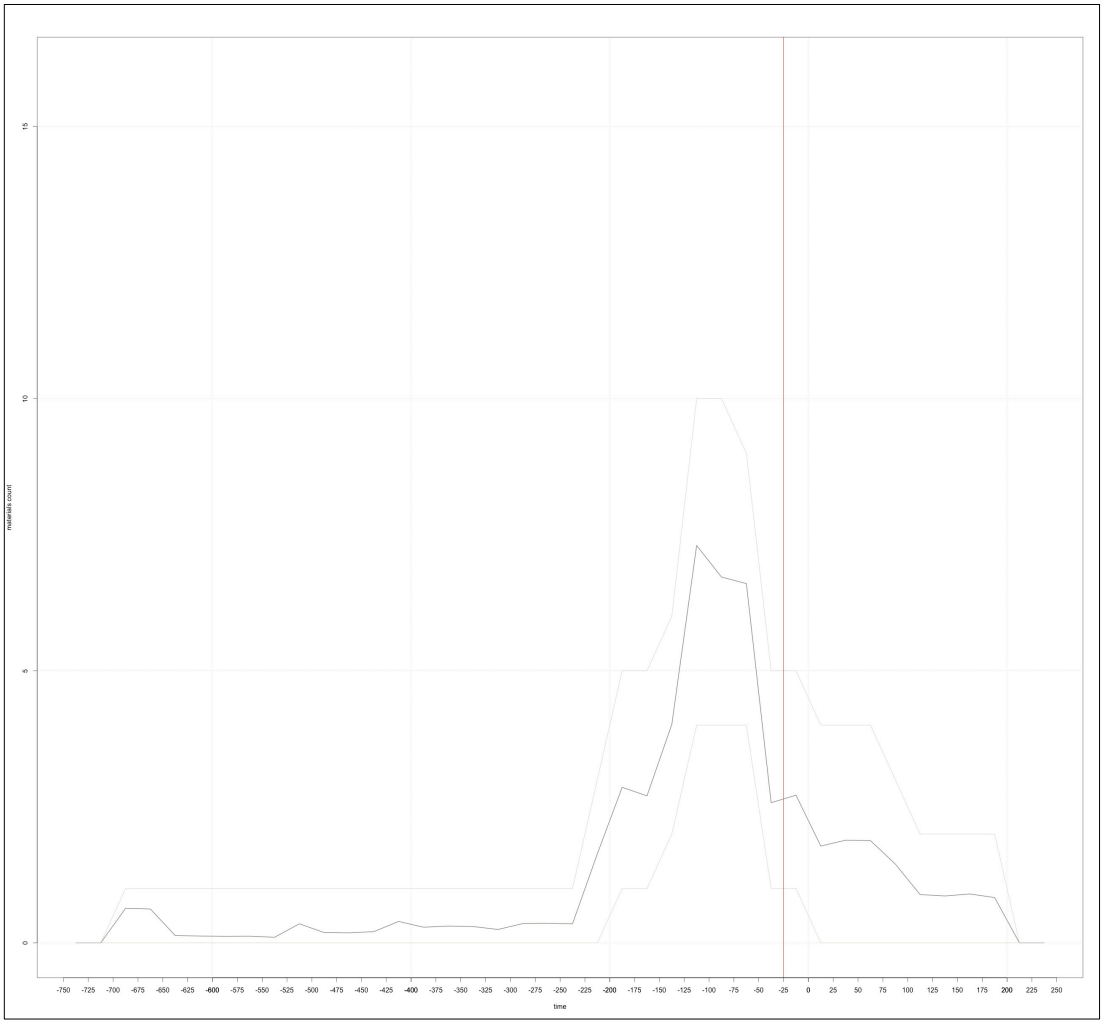


fig. 147 *- The assemblage provided by the discussed deposit. Profile with 25 years brackets*

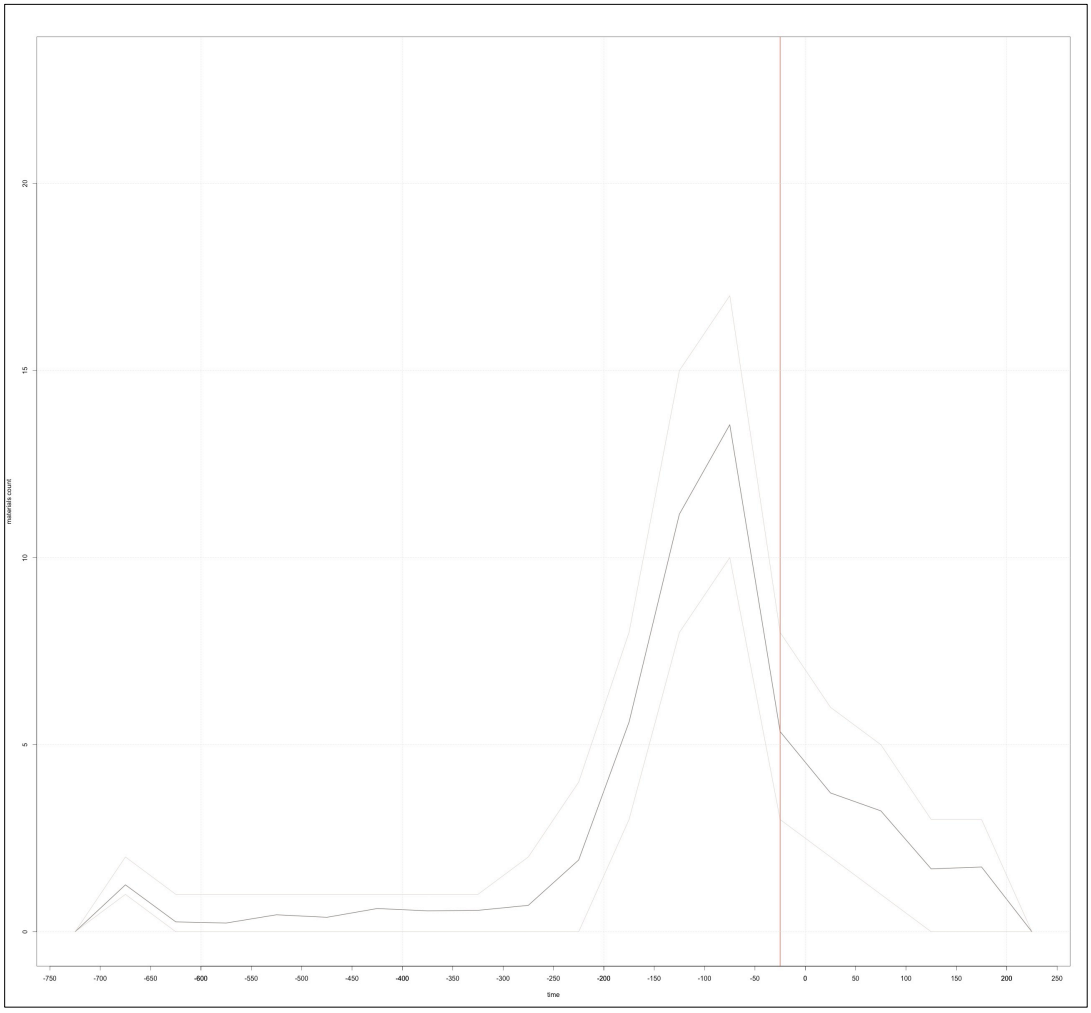


fig. 148 *- The assemblage provided by the discussed deposit. Profile with 50 years brackets*

Discussion

This case is particularly interesting because the plotted profile closely mimics the profile provided by a primary deposit with a 'tail' of residuals. But considering the curve more in detail, it can be noticed that the main peak is about one century earlier than the *tpq* (although it has to be acknowledged that if the more recent sherd was considered an intrusion, the main peak and the *tpq* would be almost consistent). Moreover it has to be stressed that the 'residuality tail', albeit low, is clear and well visible.

Anyhow, in this case it has to be stressed that the profile, alone, is by far insufficient for suggesting the nature of the deposit. The lesson which can be drawn, again, is that quantitative and qualitative approaches are both important and that the interpretation of the very nature of the deposit is fundamental for its dating.

Although, *ex post*, we do know, from the overall chronological framework, that the more recent sherds recovered may be very close to the moment in which the basilica was

actually built (accidental loss?), we should anyhow evaluate that the deposit related to the building construction was excavated only partially, and the the possibility that more recent tpqs would have emerged should have been considered.

Date proposed

Terminus post quem: beginning of the Augustan age, say after 30 BC

Duration

The construction of the building may have lasted for some years, but the backfilling of the west nave, alone, may have lasted for some weeks or months.

Notes and references

The sequence is described in GHIOTTO 2009, particularly pp. 272-275 and 305-307. The materials which were recovered are presented in BONETTO *ET ALII* (EDS.) 2009a, pp. 143-145.

IV.6.8 CASE STUDY 4: THE CONSTRUCTION OF A PAVED ROAD IN AQUILEIA (S.3)

Topographic and archaeological background

During the very beginning of the new campaigns carried out in the Fondi ex-Cossar area, a small, deep trench was excavated were the paving of the eastern road was not preserved, in order to try to provide materials useful to date the construction of the infrastructure. The ancient stratification had been heavily notched by the early 20th century excavations carried out in the middle of the road seeking the underlying drain. Nonetheless part of the strata was preserved and allowed the recovery of some materials.

When the more recent excavations began, the road surface was still exposed.

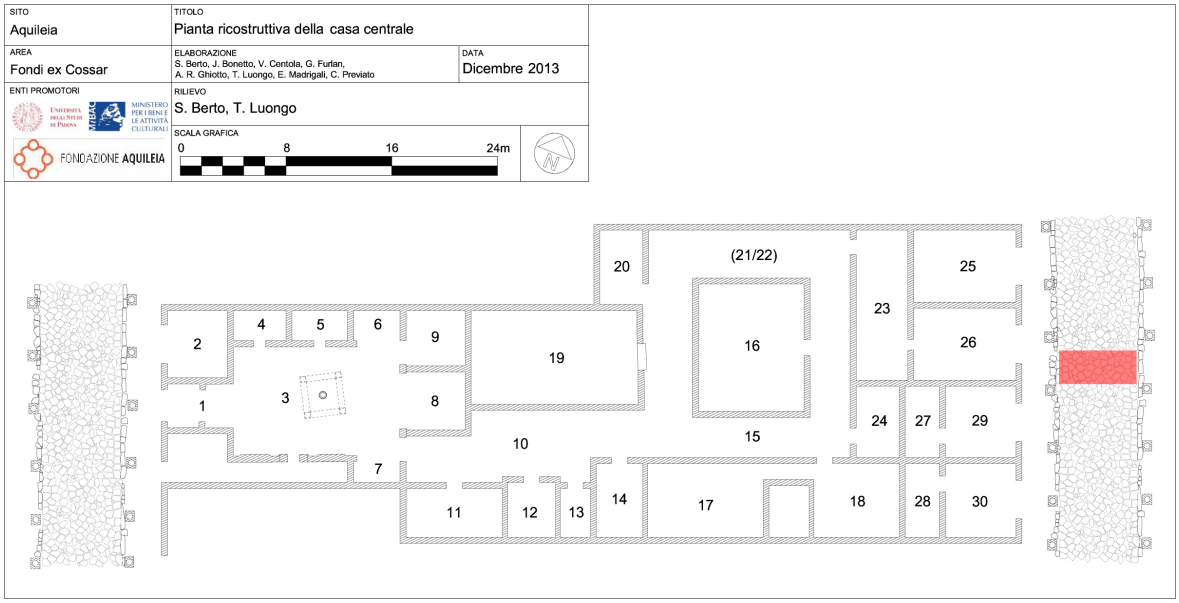


fig. 149 - *The location of the 2009 excavation trench*

Deposit description

The sequence observed beneath the road, starting from the top, consisted of a thick layer of gravel (US 18, which accommodated the surviving paving stones), a layer rich in stone chips (US 151, possibly connected with the rough-hewing of the paving stones), a silty layer with pebbles and ceramics (US 111), a clayish layer (US 19), a sandy and clayish sediment with few materials (US 110), a clean sandy layer (US 108) and eventually a layer characterized by the presence of some amphora sherds (US 109). Below this level the excavation had to stop because of the presence of ground water. All the layers are sub tabular and some selection of the sediments which were to be employed seems to have occurred.

Among the strata described, contexts 18, 151 and 108 did not return any artefact. Among the others, contexts 19 and 109 provided the vast majority of the materials.

It has to be stressed that the whole block of strata can be considered as the product of a unitary work connected with the construction of the drain/road system. The single layers (apart from the upper one, which anyhow did not return any material) were most likely left exposed for a short time and they were then sealed by the upper ones. The chance that infiltration occurred seems thus quite low. Moreover, the strata have been undisturbed until the 20th century excavations; fortunately the cut produced by this recent activity was very clear and ancient strata were distinguished by the backfill of the excavation very clearly. Thus, again, infiltrations are not likely to have occurred.

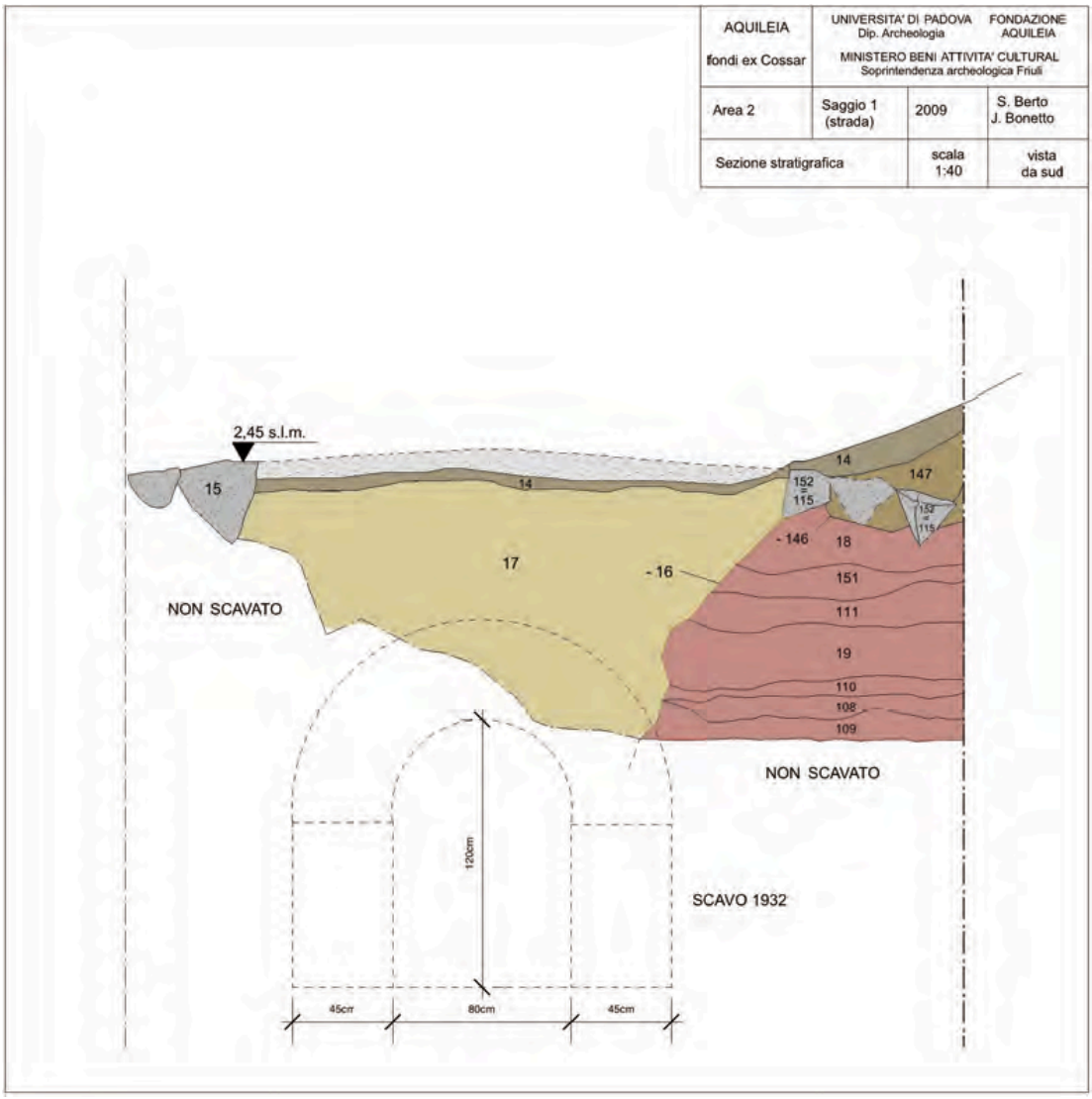


fig. 150 - *Cross section representing the discussed sequence*

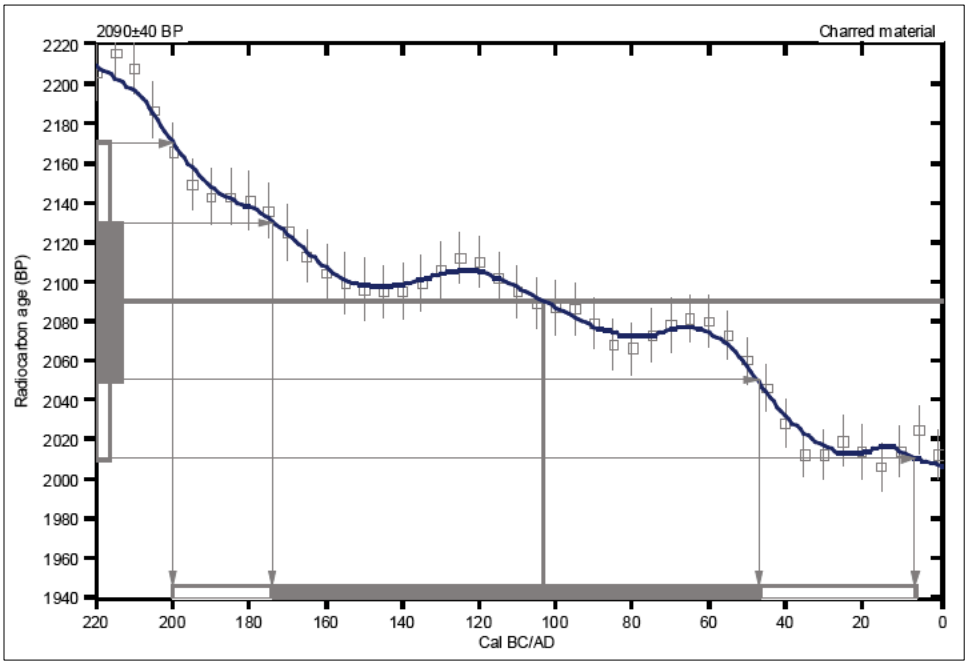
Assemblage physical state

No peculiarities are reported. The presence of a good number of amphora stoppers may suggest the selection and intentional addition of some materials, but their overall number and percentage is not so high for being considered, alone, decisive. Further investigations in this sense, anyhow, seem to be due in the next future. For the moment, it is just worth noting that their dates are pretty broad.

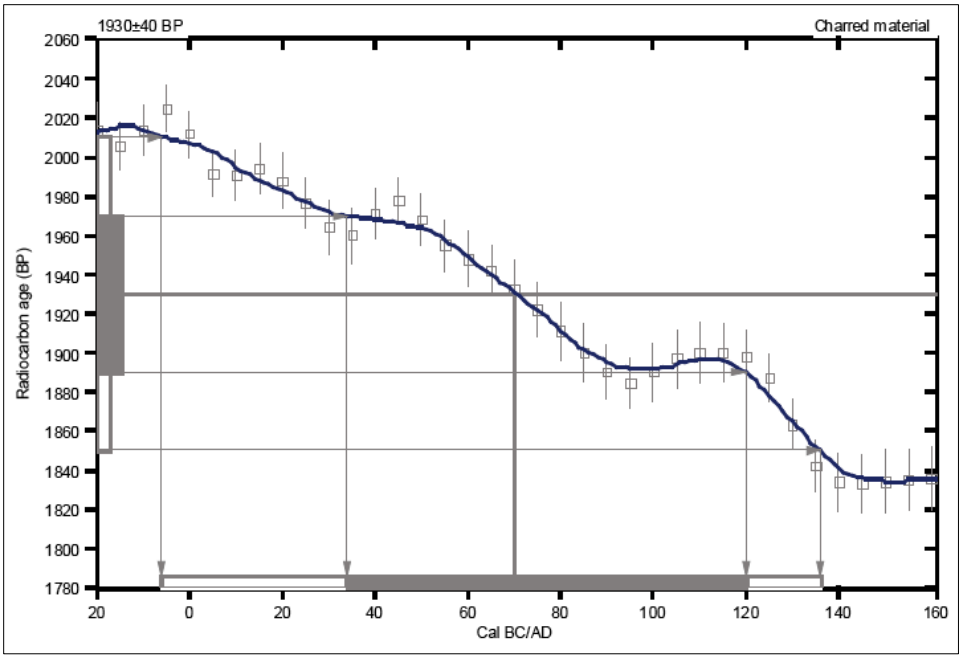
The finds

A group of 30 artefacts was processed. Among them, amphora fragments and stoppers represent the vast majority. Two samples of charcoal from contexts 19 and 108 were also collected for radiocarbon dating. The results, are provided below.

Context 19: 2σ, 200 BC-10 BC



Context 108: 2σ, 10 BC-140 AD



figg. 151, 152 - *The calibrated radiocarbon ages of the two samples which have been collected*

The overall *terminus post quem* produced by the assemblage is provided by a glass item whose diffusion dates from the beginning of the 1st century AD recovered in context 19. It is worth noting that it is well consistent with the *terminus* provided by the second charcoal lump.

Monte Carlo chrono-profile

Below are provided graphs with 25, 50 and 10 years brakets.

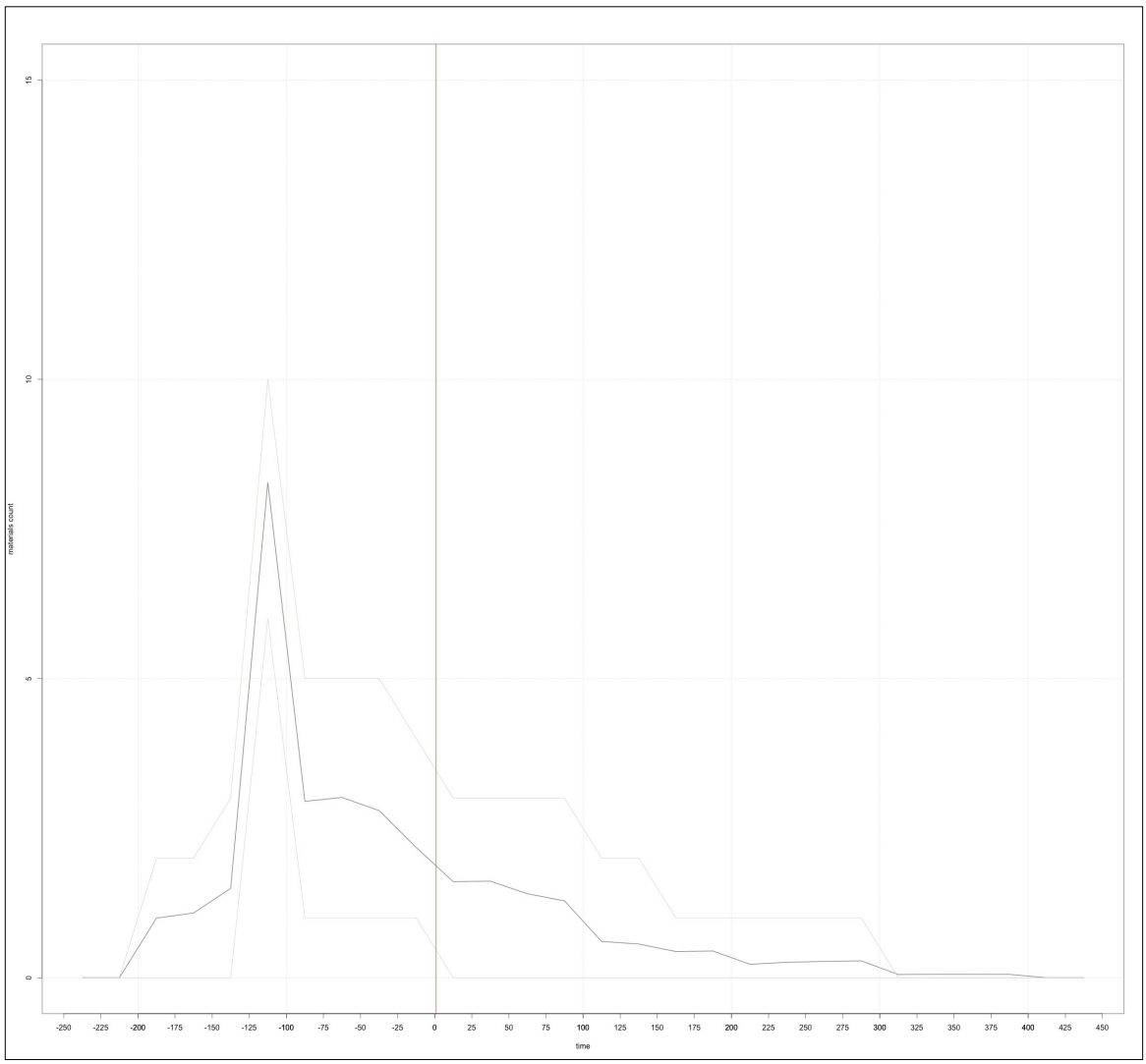


fig. 153 *- The assemblage provided by the discussed deposit. Profile with 25 years brackets*

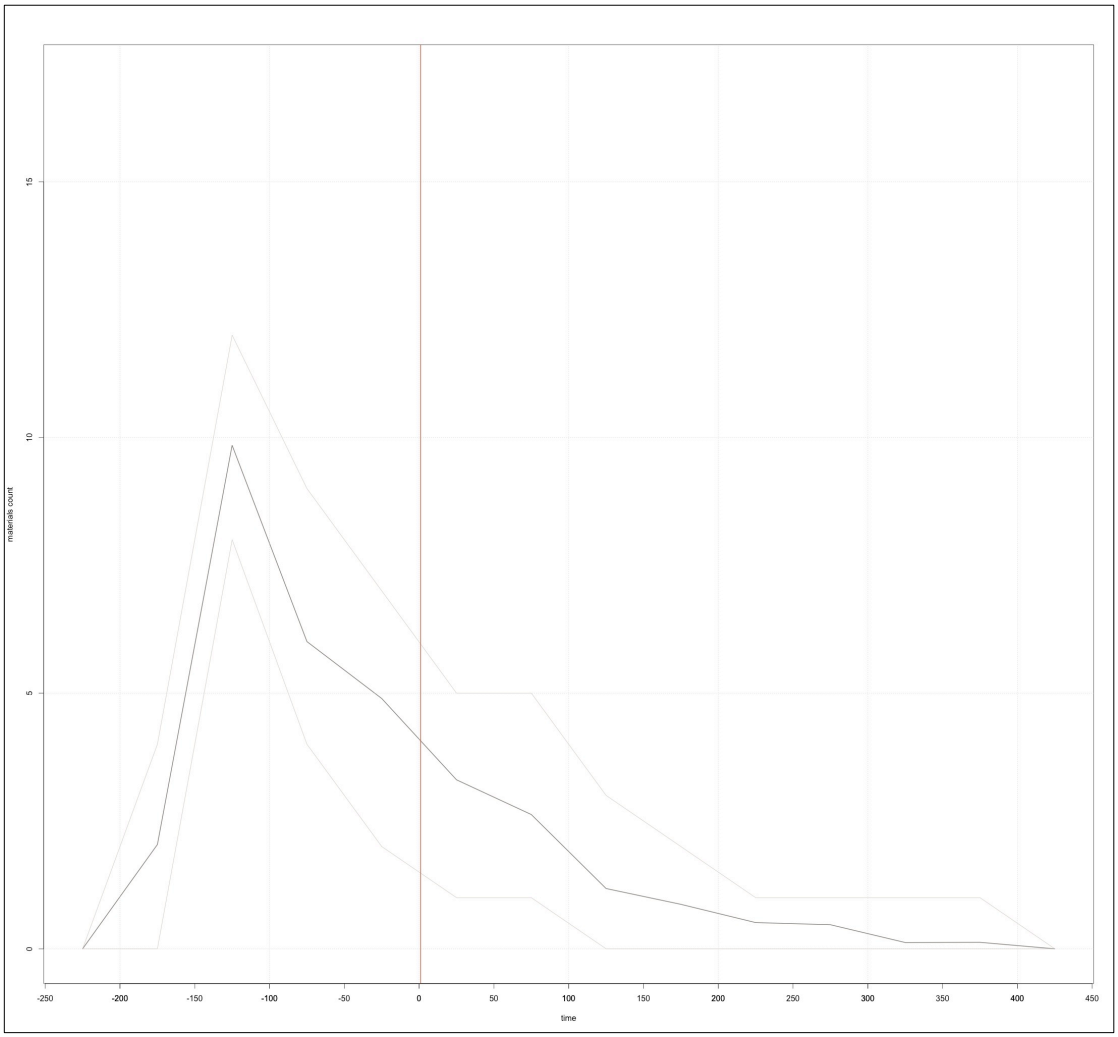


fig. 154 *- The assemblage provided by the discussed deposit. Profile with 50 years brackets*

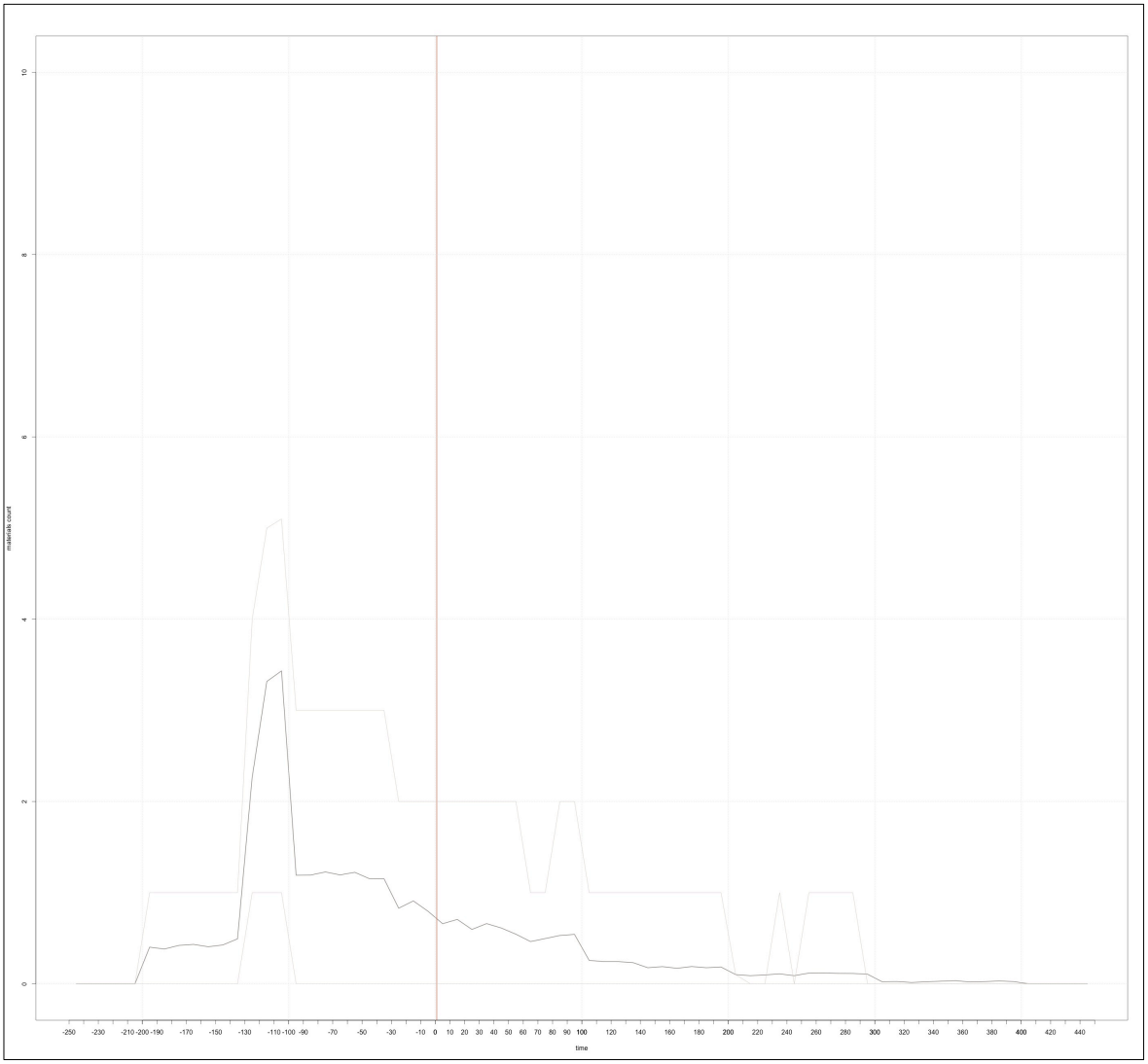


fig. 155 *- The assemblage provided by the discussed deposit. Profile with 10 years brackets*

Discussion

The plotted curve displays a markedly unimodal distribution, but it is substantially skewed to the left of the *tpq*; the time lapse occurring between the main peak, located in the last quarter of the 2nd century BC, and the *tpq* covers about one century. This suggests that for catching the necessary sediments were notched sediments rich in these materials. These sediments may have derived from the same volumes of matter which were removed for allowing the construction of the drain or they may have been allochtonous, particularly in case some selected sediments were required. Eventually, both the cases may have occurred.

It is worth noting that the secondary status of the deposit seems to be confirmed by the inconsistency of the two radiocarbon dates obtained, with the one coming from a deeper layer being more recent. Anyhow, given that the two sampled chunks were quite small, this may also depend on a problem of sampling (internal tree rings).

In the same way it can be observed in the previous case study, also in this case a problem of sample representativeness emerges clearly; indeed it was possible to investigate only a minimum part of the whole deposit linked to the construction of the paved road, even if we would consider only a small section. Although estimating the volume of the deposit is somewhat difficult (we do not know if diferent sections - of different lenghts? - were build in different periods) the possibility that more recent tpqs would emerge through further excavations seems probable.

Date proposed

Terminus post quem: beginning of the 1st century AD.

Duration

The time elapsed for the construction of the infrastructure as a whole is unknown. Building a section of the same lenght, say, of the investigated *insula*, may have taken several weeks, months or even more than one year, according primarily to the manpower which was possible to employ.

Notes and references

A complete report of the excavation is provided in BONETTO *ET ALII* 2009, pp. 17-21

❖ Other deposits ❖

IV.7.1 General observations

In this provisional category I decided to group all those deposits whose nature as to be evaluated much more case by case or for which there is still no sufficient knowledge. In any case, they may be each time primary or secondary, according to their specific characteristics. In this sense no expectations can be expressed in advance, but each specific case, once studied, may then be moved to one of the other main categories and in case new types or sub-types may be created.

For the moment I pinpoint two main cases which may occur, the one of (lime) mortar structures and the one of ditch fillings. In the first case specific knowledge is still somewhat inadequate, while in the second case extreme variability seems to be the key aspect.

Mortar structures

The most probable recycling of freshly discarded vessels or sherds to obtain aggregate for mortars has been discussed in Chapter III.5.1. Nonetheless studies in this sense are still quite poor (we know almost everything of Roman building techniques but up to the present, according to my personal knowledge, nobody asked himself if the sherds employed were residuals or systemic materials, apart from a few very unmistakeble cases, in which complete or sub-complete vessels were employed) and variability from case to case may be very high.

In case freshly discarded materials were crushed to get the needed aggregate, structures could be considered as primary deposits (or mixed at most), in case residual pottery was employed structures should be considered as secondary deposits, because there is no safe link between the date(s) provided by the assemblage recovered and the construction of the structure.

In order to demonstrate that the employed sherds were substantially systemic, the considerations exposed in Chapter III.5.1 about reuse and recycling are not sufficient, and the tools suggested to detect selection and the intentional addition of materials (Chapter III.5.3) can be employed.

Eventually, the chronological profile emerging by the examination of the assemblage, should be compatible with the one produced by a primary deposit.

In case all these requisites were satisfied, we could safely conclude that the structure examined can be dated *ad quem* through the use of the embedded assemblage (and we may get dates even more precise than those produced by employing scientific techniques such as the dating of lime lumps - see Chapter III.2 -).

In case sufficient observations confirmed this point, mortar structures could, in the next future, be moved to the the category of primary deposits, although, obviously, a particularly careful examination of each case should be performed anyhow.

Clearly the factor which prevents from a fast confirmation of the picture proposed is the shortage of case studies (particularly of case studies which provide good amounts of datable materials) and this, in turn, depends on the obvious fact that dismantling parts of archaeological structures may be legally and ethically questionable, besides hard working and possibly poorly profitable. Poorly preserved structures, with no valuable decorations preserved and particularly rich in sherds of sufficient dimensions, may represent the ideal target.

Charcoal lumps contained in mortar structures present similar problems; in order to assess their systemic nature, we should have a sufficient number of dated samples. Their consistency would pinpoint a primary status, but old wood effect may create palimpsestic results, which would be much more difficult to read. A sufficiently global and uniform amount of lumps within the mortar structure is also an important clue for determining their intentional addition; a few dispersed carbons may be turned out to get embedded simply accidentally and they may well be residuals.

The ideal case in order to assess the primary nature of a given mortar structure through radiocarbon analysis seems to be the one displaying numerous and well distributed carbons, with some well identifiable chunks among which it is possible to select those samples which are likely to be closer to the external rings. If the dates provided were consistent, they may well provide good *ad quem* dates.

Ditch fills

A ditch, by itself, is simply a cut same as many other interfaces which are detected in every excavation. Nonetheless ditches have assumed through time some independent relevance, primarily because, along with ramparts, are a key feature of bronze age and iron age settlements. The presence of ditches sometimes also defines the borders of classical

settlements, wherever the city walls were not a mere propaganda tool but conversely played an effective defensive role. Eventually they are a typical feature of innumerable Roman forts.

Compared to other interfaces, they are linear features particularly deep and wide, thus represnting ideal depositional basins for the products of many natural and anthropic activities.

I try to list below some of the most common ways by which they can be filled or backfilled and of course a combination of two or more of the processes listed is likely to occur:

- a ditch wich turned out to be an obstacle to the development of a given area may have been simply backfilled with allochtonous material in order to restore a flat surface;
- a ditch undergoes commonly to natural processes such as its progressive filling due to the action of gravity and water or as the formation of soil on its surface; this is due mainly to its usually long exposition and to its own shape;
- ditches are ideal *loci* for dumping activities, which in turn may be occasional or well organised;
- ditches may be the finish line of urban sewer systems and may thus accommodate the discarded products of the city activities.

All these processes and many others, once combined, may produce very different palimpsests which must be studied case by case and eventually attributed entirely or partially to one of the categories or types proposed[480].

IV.7.2 Case study 1: the mortar floor of the Pythion theatre orchestra, Gortyna (O.1)

Topographic and archaeological background

During the campaign of excavations carried out in 2013 it was possible to asciertain that the visible floor of the orchestra of the Pythion theatre, made of marble slabs laid on a layer of cocciopesto, represented a late refurbishment. The more ancient floor, related to the very construction of the building, was eventually detected, thanks to a small trench, at a lower level, covered by the massive loose stone foundations of the upper one.

[480] See Martens 2007

Eventually it was also possible to investigate the bedding of the more ancient floor, which was partially removed after accurate recording.

Deposit description

The most ancient floor (US 610) was made of a layer of coarse cocciopesto, slightly inclined towards the centre of the theatre to allow the rain water to gradually flow off. The layer presented a smooth surface and it was not possible to establish if it was originally covered with slabs or not; it was not very thick (about 2-4 cm) but it was tough and made of good lime. A bulk sample having the volume of about half a basket of material was collected in the field for further analyses; later it was possible to mechanically separate the aggregate from the binder in order to examine the embedded sherds.

Five other sherds had already been recovered during the excavation.

The assemblage

After the sample was crushed, it was possible to retrieve 89 sherds, all obtained from broken pottery. In addition to them, only two pieces of recycled wall plaster and two brick fragments were recovered, thus suggesting that their presence was accidental.

Focusing on the potsherds (whose total amount is 94 pieces, including the fragments recovered during the excavation) many interesting traits emerge:

- they seem to have been sorted by size, as the vast majority of them presents a maximum lenght included between 2 cm and 4 cm;
- they all present clear, neat fractures. This clue and the other one seems to suggest that intentional breakage occurred;
- only two small feet and two small rims (out of 94 sherds) were present (4,25%);
- only three small fragments of glazed pottery were present (3,19%). The other pieces display fabrics and other features which are typical of tableware.

Among the 94 finds, unfortunately, only 2 fragments were more specifically recognizable, namely two small pieces of eastern sigillata, one of which, still being studied, may provide a more accurate date.

fig. 156 *- The discussed assemblage. Note the evident traces of mortar*

Discussion

All the clues point to the fact that the sherds employed for building the cocciopesto floor were selected by class and by form and then intentionally crushed in order to obtain regular sizes. This last point may be explained by the need for an homogeneous mixture, while the discard of feet, rims and glazed pottery may have occurred because they bind with the mortar in a worse way, thus threatening the quality of the floor.

In any case, all the operations carried out would have been much easier with materials recently discarded, more than seeking materials which had already been buried. Unfortunately, among the materials recovered, only one piece is somehow well datable; anyhow it is interesting to note that the two recognizable pieces belong to the same class and that the only well datable one seems to provide a date which is consistent with the period in which the theatre seems to have been built.

Concluding, all the collected clues suggest that the materials forming the assemblage could be used to provide some *ad quem* dating; unfortunately the shortage of well datable

finds (which usually are exactly those items which apparently were deliberately discarded!) do not allow to reach a definitive and safe conclusion. The collection of one or more further samples may lead, more luckily, to recover other datable pieces which could provide a better support to the model which, for the moment, can only be supposed.

As advanced above, some more (and luckier) examples like this one are required in order to get a better comprehension of these deposits and of the way in which we can date them.

Notes and references

This context is still unpublished.

PART V

SYNTHESIS AND CONCLUSIONS

❖ TOWARDS A WORKING METHOD ❖

V.1.1 INTRODUCTION

After the long examination of the theoretical and methodological tools which are available to date archaeological deposits, once conveniently 'taxonomized' the infinite galaxy of the products of stratification and eventually after having shown how the available tools can be employed for dealing with single deposits, it seems convenient to try to shape a sort of global approach, a working method, in which all these fragments can be organically inserted. Which is the work flow which pulls out of the excavation an organic sequence made of actions, episodes and processes which are more or less accurately dated? How do we move from excavation to absolute dates? I will try to sketch my proposal, starting from what can be done before the excavation even begins and concluding with what is to be published. Some steps which are well known, common practice, albeit fundamental, will be touched briefly, while I will focus some more on the most critical points and on what I consider useful, new tools or approaches provided by this work. Of course, discussing this method, what I keep in mind is mainly the procedures I have been used to apply during the past years, thus I think that the ideal target of this working method consists of the excavations of classical urban sites carried on by Padua University itself; nonetheless, if not already in use, many procedures can certainly get adopted in whatever excavation project for which they will be considered somehow helpful.

V.1.2 BEFORE THE EXCAVATION

Although before an excavation begins there is nothing to date, there are a few expedients that can be put into practice and which can help to strenghten the successive conclusions eventually drawn.

Firstly, a general explicit evaluation of the major local biological and non biological factors which can affect the issue of intrusions should be performed. Rodents and worms activity, the impact of roots, the depth at which the main archaeological deposits lie benath the topsoil, the impact of heat and freezing on the cracking of clayish sediments, the occurrence of recent excavations, truncations or ploughing, etc. should be taken into account

and explicitly reported, in order to provide a basic framework for the context by context evaluation of intrusions which will be later performed.

Another thing which should be taken into account before the excavation starts is merely an economic one; it is my opinion (but I might be wrong) that in Italty quite often both academic and commercial excavations are not planned in detail, particularly economically, before the beginning of the field activity. Focusing on the topic of dating, some resources should be put aside to perform later analyses: the scientific dating at least of the most of crucial samples should be taken into account from the very beginning, together with other excavation and post-excavation analyses; for instance it has been already discussed how micromorphology, albeit not directly involved in dating, can provide fundamental clues on the formation of many prickly deposits, thus consequently allowing for better understanding also of the way to date them (see Chapter III.5.4).

Finally, any other information (historical, epigraphical etc.) which may turn out to be useful for specific dating or, more generally, to collocate the global chronological framework of the excavation, should be obviously collected and evaluated.

V.1.3 During the excavation

Much more expedients can be fielded when the excavation begins. I will try to list them:

1. a context by context evaluation of intrusions;
2. an assesment of the global volume of a given deposit, when possible, in case we can dig it only partially;
3. in case structures are excavated, particularly with mortar, when possible samples should be collected in order to extract sherds potentially useful for dating;
4. in case earthen floors are excavated, the top layer (2-3 cm) should be kept separate from the bottom;
5. a broad evaluation of the key contexts and the collection of more samples in these cases; documentation could also be pushed to the maximum;
6. particular attention devoted to the presence of articulated bones, particularly in case we suspect we are dealing with a primary deposit. Samples of bones should be collected together with charcoal for radiocarbon dating;

7. during the excavation laboratory activity, collective photos of the assemblages recovered should be taken, possibly both before and after washing.

Let us examine them more specifically.

(1). Specific, context by context evaluation of intrusions could be performed in the field, evaluating those parameters suggested in Chapters II.2.9 and III.3 and eventually filling the very speditive entry which has been hypothesized for the standard Italian context sheet.

(2). When excavating only partially some deposits, particularly in case of secondary deposits with great volume (say, for instance, the sediments which were redeposited for building the floors of a given house), at least a rough evaluation of the proportion between the volume excavated and the global volume of the deposit should be performed, in order to explicitly quantify and evaluate the problem of sampling which may arise when dealing with an assemblage which represents a small part of the actual one.

(3). It is usually quite difficult to obtain any authorization for collecting large samples of archaeological structures; anyhow badly preserved floor beddings, walls or similar, which at first sight seems to include good amounts of potsherds of sufficient size may represent good targets and some sampling may be authorized. It is an attempt which seems worth to be made, as these deposits, which are no susceptible to intrusions, may turn out to be primary and thus they may provide extremely useful indications for building the global chronological framework of the excavation. Furthermore, their own dating usually represents and important goal in classical excavations; eventually mortar dating or carbon sampling may also be performed on this peculiar kind of deposits.

(4). In case non solid floors were detected, the top loose layer should be kept separate from the bottom one, in order to have the chance (sure not the certainty) to distinguish any systemic materials (in relation to the activities carried out on the surface of the floor) which possibly turned out to get included into the deposit. Sewing the top layer may also turn out to be useful.

(5). Building theories and then forcing data to fit them is never a good idea, but excavation does not talk by himself. Making provisional models and expectations during the practice of excavation, on condition that we are flexible and ready to change them, is somehow unavoidable and can be useful for directing the research. In case we suspect that some deposits are particularly informative, also from a chronological perspective, we can push at the height the accuracy of our investigation through *ad hoc* documentation and more sampling. Of course it does not mean that we should not have a minimum standard of digging, recording and sampling for all the other deposits. We would just be sure that in the

following stage of analysis we have all the data we need and also some extra ones to deal with the more promising deposits.

(6). Major attention should be devoted, at least according to my personal experience, to deal with bones. The presence of articulated ones should be recorded and they should be collected not just for archaeozoological investigations; they are primary targets for radiocardon dating (no old wood effect), thus some of them should be sampled separately. Fragmented bones, which would unlikely provide useful archaeozoological data, would represent excellent samples.

(7). Recording the assemblage physical state piece by piece would be for sure too time consuming in any urban excavation, either classical or not. Nonetheless some useful information can be drawn by this aspect in later post-excavation analyses in order to strenghten (or modify) our assumptions on the nature of a given deposit, and thus on the way we can date it. A photograph of the whole assemblage provided by each context, possibly taken before and after washing and with the presence of a metric scale, represents a speditive and effective way for having an immediate idea of the physical state of the materials recoverd. This could be useful also during the later, delicate operation of grouping: for instance, in case we suspect two contexts represent two different chunk of the same deposit, similar assemblages are also expected. Markedly different assemblages, on the contrary, would suggest more caution and eventually we may decide to safely keep the two contexts separated.

I wish to add to this list some more general considerations about the practice of excavation and its relation with dating. Of course, it is not here the case to discuss in detail excavation techniques and approaches, which fortunately benefit of many detailed manuals and probably thousands of case studies; I focus only on a few relevant points. One peculiar consideration about the relation between the practice of excavation and the practice of dating can be advanced about the 'old', common sense, unwritten rule which suggests that in case of doubt, when dealing with the interface between two strata, it is safer to collect the ambiguous sherds as part of the upper context, without risking the 'contamination' of the underlying layer. I honestly agree with this unwritten rule, because, from a chronological perspective, it is much easier to deal with a few 'false' residuals than with a few 'false' intrusions. Of course perfect and clear separation of two different contexts along with their assemblages is the best option, but it should be acknowledged as well that things are not always so easy. An elastic approach is anyhow possible using actively contexts as operational tools; this means that in case of doubt we can anyhow create 'new, intermediate contexts' to deal with unclear,

nuanced situations. Somehow provocatively, I also advance that, in a micro-cosmos marked by sampling at so many levels like the excavation, even the discard of a few pieces may be acceptable, as I would honestly prefer fewer, safe data than more numerous, but possibily biased ones.

In general, anyhow, I feel that some more attention, in the field, should be devoted to the implications of our practice for dating and for the overall chronological framework of the excavation. In this sense a key point is with no doubt represented by a constructive and mutual collaboration between find specialists and field supervisors.

V.1.4 After the excavation

The core of the game of dating is with no doubt played during the post excavation activities and analyses. Here the variability in the approaches which are employed is the biggest. I will try to sketch a coherent proposal moving from the very end of the excavation towards the excavation final report.

When the excavation ends, two main branches of work usually proceed somewhat parallel: the one carried out by the find specialists, *i.e.* the slow processing of the recovered finds (drawing, photographing, identification, dating), and the one carried out by those who followed the excavation in the field, that is usually made of the completion and revision of the Harris' matrix produced and of the crucial activity of grouping contexts (see Chapter II.2.2). Each of them presents particular a critical points.

Concerning finds processing, I strongly claim that, at this stage, the dating of materials should not be influenced by the information derived from the excavation. Using contexts relative chronology for dating artefacts which then should provide and absolute date for the same contexts leads to a clear circular argument. One example may clarify the issue: say we are handling a sherd which, by itself, can only be dated very broadly, say over a time span of some centuries, ranging from the Early Imperial Age to Late Antiquity. In case this sherd has been recovered in one of the latest contexts (the ones in the upper part of the matrix), we are not authorized to narrow its date to late antiquity, because the specimen may well be a residual; moreover 'late' in relative chronology does not mean 'Late' in an absolute one. In this case the contexts 'located' in the upper part of the matrix, which are later than the ones on the bottom, may be early or mid imperial (in fact we do not know yet). Similar considertions may be advanced in case the sherd is recovered in a bottom layer. The point is

that we cannot mix absolute and relative chronology, contexts and finds. The integration of the various data must wait.

Another form of strong influence which may affect the dating of finds is internal to single contexts and consists of the association of finds recovered within them. Being influenced, at this stage, by the finds association in order to 'model' the date of one specimen is theoretically and methodologically wrong and may lead to coarse mistakes or lead the interpretation of the excavated data to wrong directions. The point is that at this stage we do not know anything about the nature of the contexts and we do not know if the association of the materials embedded can be considered true/systemic, or false/depositional (see Chapter II.2.3). Even in case it was considered true, the phenomenon of false residuality should be evaluated very carefully. Another example may be useful: say we are handling a sherd broadly dated to the Roman Imperial Age, which has been recovered with some finds dated to the early 3rd century AD. Can we conclude that the sherd we are handling can be dated to the same period? Of course we can not, as the association between the artefacts may be false and the specimen we are handling may be a residual or may be dated to the 4th century AD, thus making the other sherds residuals. It follows that its original, wide date should not be narrowed, but, if safe, should be used as it is.

Concluding I consider much better to date, at this stage, only those materials whose date is already well known through previous literature and studies and which does not need the information provided by the excavation to be estimated. Eventually, broad, safe dates should be preferred to narrower but temptative windows, possibly advanced considering the relative status of the context and the association of the finds recovered within it. The point may be summed up in this way: there are materials which date strata and materials which are dated by strata. At this stage we need materials which date strata, because strata are what we want to date. Refining poorly known dates of some types or classes of materials is a game which can be played later, once contexts are dated and their nature is clear, for instance through seriation techniques.

It follows that, at this stage and for dating purposes, the main role must be played by artefacts such as coins, fineware, amphorae, small finds and whatever can be independently well dated (including samples dated through scientific techniques). Eventually at this stage some specific evaluations about the systemic life of those specimens whose production is dated (namely coins and stamped sigillata) can be performed and the single windows can be widened according to the judgment of each finds specialist (see Chapter III.4.3).

I move now to the other 'operative branch', namely the activity of grouping contexts; it is an activity by far uncodified and it is as prickly and crucial as the dating of finds is. I think that a progresive approach and the use of groups of different levels may be helpful. It has to be stressed that what we are interested in, here, are groups which still have to be dated; macrogroups or phases created to group contexts or subgroups with the same date or with similar dates are something successive, as they already take for granted the single contexts or subgroups dates (*ad quem* or not) and may result also from the use of some *termini ante quem*.

Here we talk of contexts with the same formative history, whose date refers to the same thing and is consequently one. In a few words I refer to what I defined deposit in Chapter II.2.2. One deposit means substantially one main activity and one date. For instance a mortar floor and what has been dumped on its surface should be kept separate, while three superimposed layers of redeposited sediments for building purpose (say they are the bedding for a mosaic) can be grouped together. What is important is that we can safely date the same event or process.

This means that probably at this stage groups of contexts may result quite small and many of them may consist of a single context. Anyhow bigger groups, based on different and wider criteria, may be created later. For the moment we must be satisfied of handling numerous small groups, which is with no doubt something somehow annoying, but which has to be considered necessary. It has to be reminded that pictures of the assemblages could also be employed at this stage as a further tool for assessing the equivalence of two of more contexts (see above). Some contexts may turn out to be put aside also at this very early stage, as their nature and reliability may result unclear and heavy biased from the beginning.

Once contexts have been grouped in deposits and the dates of materials are available, they can finally be evaluated together and the status of each deposit can be assessed, using both the information gained by the excavation and by the assemblages. At this stage all the tools proposed can be fielded in order to label each deposit into one of those taxa suggested in this work and to move then to their dating. Comparison with other cases already studied in detail, such as the ones presented in Part IV, may also turn out to be helpful.

In particular quantitative and qualitative/formative approaches must proceed shoulder to shoulder and sustain each other, as only a global examination of all the aspects to be evaluated can lead to strong interpretive models and dates. How did the materials turned out to be embedded within the layer where they have been recovered? This is still the main question which has to guide our enquiry.

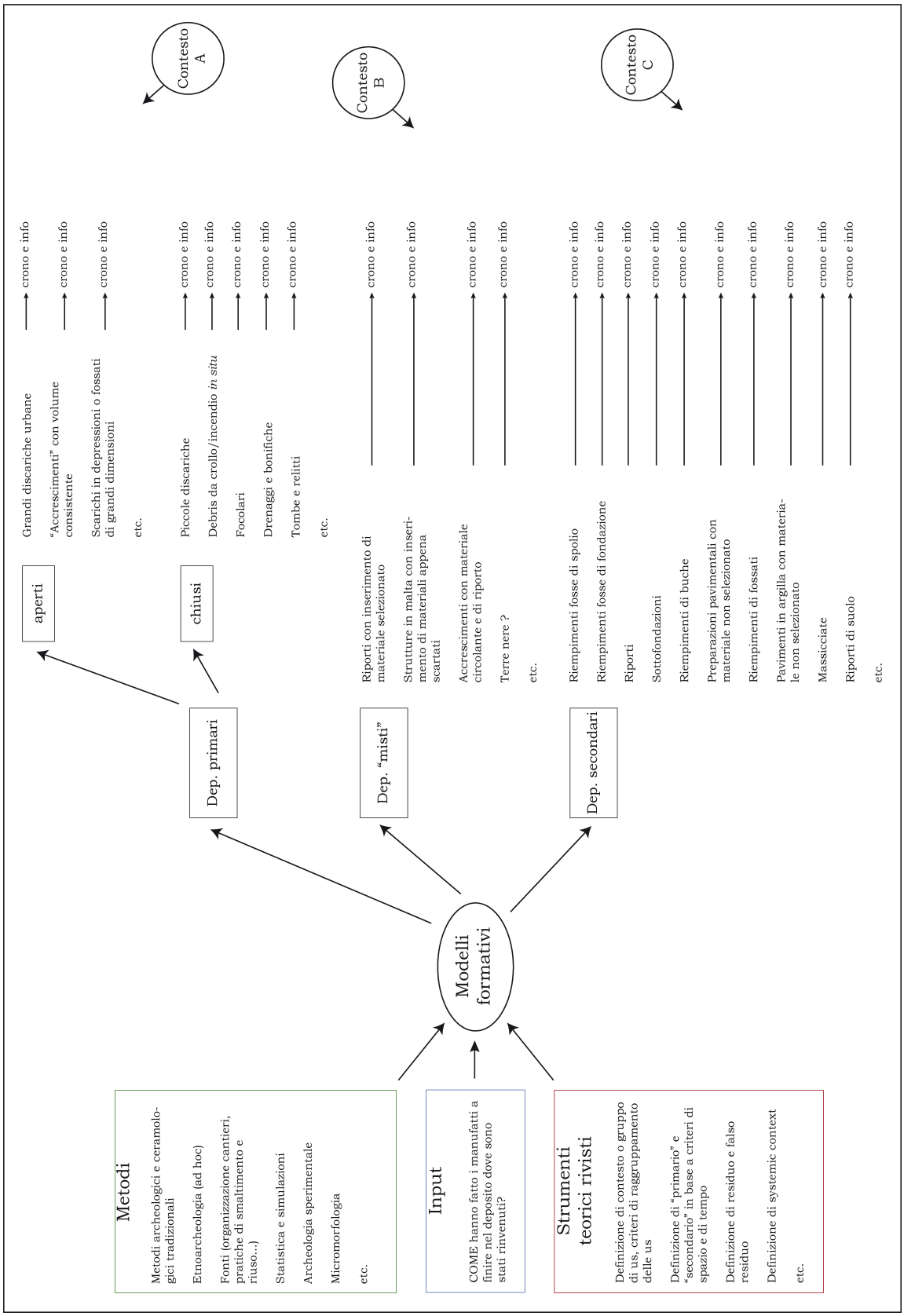


fig. 157 *- Scheme proposed in 2014 to explain the links between theory, methods, models, taxonomy and specific case studies*

In a seminar held in march 2014 I proposed a first draft of the typology for deposits here presented in Chapter IV.1.4 and I tried to sketch the way of dealing with the deposits which are to be dated (**fig. 157**).

Although some differences in the typology proposed and in the list of conceptual and operative tools employed can be observed[481], as a whole the scheme well shows the core of the interpretive process which should lead to date the deposits we have excavated. It has to be stressed, nonetheless, that the same conceptual and operative tools and inputs which has been created to give shape to the models proposed, are the same ones which have to be employed to tackle the single case study, the very deposit we are studying.

Moving to a higher level of detail, for assessing the affinity of a given deposit to one of the types proposed (or to a new '*taxon*' created *ad hoc*), some tools are particularly necessary:

1. a chrono-profile. A Monte Carlo one could be automatically produced, for instance, if the common output of the database Adam (the one which is commonly employed in excavations of classical sites by Padua University) was numerical; much better results would be achieved if also the date of non-inventory numbered materials could be loaded. This in turn could be performed automatically, applying by default dates to whole classes (say 'african amphoras'). These dates are usually very broad but could turn out to be decisive in some cases;
2. a collective picture of the assemblage investigated (see above);
3. a complete excavation record (a well filled context sheet and an Harris' matrix) of the deposit, together with every topographical or archaeological observation which could suggest its status. The context sheet should also report in some form the risk that intrusions occurred.

Together with these internal tools, other external sources should be employed in order to assess the what the deposit is, how it was formed and how the materials entered it: they are other archaeological notions in general (which range from building techniques to waste management) and the comparison with ethnoarchaeological, experimental and literary sources.

Eventually, the comparison of the characteristics displayed by the studied deposit with the specific expectations of each type proposed in the taxonomy (and the more general

[481] Note that the English term 'deposit' is translated with the Italian term 'contesto'.

expectations described for the macro categories - primary abrupt, primary continuous, mixed, secondary, others-) should lead to label the deposit and consequently to date it.

Once this main activity has been carried out, we would finally have available a series of *termini post quem* or of *termini ad quem*, one for each deposit which was possible to examine some safely. Indeed, again, deposits which display a high possibility that consistent intrusions occurred and deposits whose interpretation is very unclear should be put aside. They may be checked later and eventually they will benefit of the overall chronological framework built.

Once this operation has been concluded two main consistency checks should be performed, an internal one and an external one. In the first case we should check the internal consistency of the chronological grid, particularly verifying the existence of inconsistencies between the absolute grid and the relative sequence. Any other anomaly should also be examined and, in case, the previous passages should be re-discussed (grouping, artefact dates, deposits status, possiblity that infiltrations occurred etc.).

Another check should be external, meaning that the chronological framework emerged should be compared with other external available sources; the information gained from historical or epigraphic data may well fit with the framework and even allowing for more accuracy or they may be inconsistent with the grid emerged from the excavation. Also in this case a step by step re-examination should be performed and the external sources may be questioned too. General archaeological knowledge may also be employed at this stage, but it is important that all the considerations derived from these sources are kept explicitly separated from those which derive from the excavation and the study of its deposits and assemblages.

If the picture emerged from this double check is consistent, additional investigations can be pushed to the height whenever it is considered useful for narrowing some chronological windows. For instance primary deposits may be targeted for additional scientific dating or even secondary deposits of particular importance (say, connected to the construction of important structures or infrastructures) may be targeted seeking a more recent *tpq*.

At this stage those deposits which were dated *ad quem* (namely the most recent date provided by their window) can finally play the role of *termini ante quem* for the previous deposits.

Eventually, deposits can be pushed up and down in the matrix and macrogroups and chronological phases can be formed; this can be considered the last step of the long game

which consists of moving from the relative chronology provided by the excavated sequence to absolute dates, which are provided by a combined study of both deposits and assemblages. The excavation, at last, becomes itself a tool for further archaeological, historical or anthropological research.

Once the cycle is closed, the careful evaluation of the assemblages recovered in primary deposits, together with the clear awareness of the issue of false residuality and of the palimpsestic nature of every systemic context, may lead to review those materials which are still in need of secure narrow datings. The seriation of a good number of this kind of deposits seems to be particularly recommended, but of course this is not the topic of the present work.

Secondary deposits can also provide useful information once they have been collocated within the absolute chronological grid which has emerged. Say that one vessel type, whose date is considered uncertain, was not employed for dating purposes. Its presence in a well sealed secondary deposit (whose date is the result of the whole work carried out) suggests that the given type was diffused at least (but not exclusively) before that date.

V.1.5 PUBLICATION[482]

A complete publication of the excavation is fundamental. If an excavation is not published, in some ways, it is as if it was never carried out, because the scientific community will not be able to fully know and evaluate it. In this sense brief reports cannot be considered sufficient, because they do not allow for sufficient display of data and interpretive structure.

Massive urban excavations, in particular, represent an invaluable source for archaeologists, anthropologists and historians for further and wider considerations in infinite ways. The lack of complete, exaustive publications, particularly in the field of classical urban sites and with particular focus on the Italian panorama, has indeed been highlighted in the literature review (see Chapter I.2.7).

From a chronological perspective, in order to allow a full evaluation of the grid of dates which has been proposed and to give the possibility to perform further investigations, two points seems fundamental:

1. a complete data display;

[482] The topic is indeed rarely discussed . Interesting prompts about the publication of finds catalogues are discussed in ALLISON 1997

2. an explicit description of the criteria employed and of the workflow which has been followed for moving from relative to absolute chronology.

In both cases, particularly in the second one, a full publication of these aspects seems to be quite rare. Let us examine them.

(1). What is needed is 'simply' a complete list of finds, together with their dates, arranged context by context. An Harris' matrix with the indication of deposits, macrogroups and phases is also needed. Certainly the full publication of these data represents a noteworthy effort, particularly in terms of time, editorial space and money. In this sense an on line publication may well represent a good and cheaper alternative to a printed volume. Moreover the production of lists of finds, ordered by context and provided with other data, can be produced almost automatically by most of the databases employed for managing the post excavation activity.

(2). The workflow which has been followed during the excavation and post excavation analysis, whatever it was, should be explicitly discussed, from grouping to phasing, along with the criteria employed. How contexts were grouped, for instance is far from being obvious. Some choices in some critical deposits should also be explained. Eventually, I think that the publishing of chrono profiles, at least for some key deposits, but even for whole phases, would represent a useful device for assessing chronological patterns.

Concluding, it has to be strongly underlined that publishing is still part of the activities linked with the excavation, and thus it should be planned (also economically) and managed from the very beginning.

❖ Conclusions ❖

V.2.1 What before? How we currently deal with dating

The more I got into the topic of this dissertation and the more I felt familiar with the bibliography, the more it was possible for me to have a better appreciation of the state of the art of dating deposits. Together with fundamental pieces of work, tackling more or less specific issues (I think of the considerable efforts which have been made in the fields of residuality, of scientific techniques, of rubbish disposal, of contexts managing etc.), the panorama of dating deposits was populated by only few attempts to organically build up a working method to tackle the issue; also handbooks usually treat it in a very general (and sometimes generic) way. Sadly, I consider that this state of the art produced also very poor practical consequences. It is my opinion that the equation 'a lot of materials of a given period = the deposit was formed in that period' is still all too common; but even this impression is somewhat difficult to asciertain, as the complete editions of excavation projects, particularly in Italy, are by far insufficient if compared to the fieldworks which are actually carried out; and even among the complete editions, just a tiny part of the whole explicitly provides the data which are necessary in order to make possible to evaluate the quality of the dates which have been proposed, the way in which they were achieved and, ultimately to criticize or to agree with them.

From a theoretical point of view I consider that the main 'original sin' consisted of having not created *ad hoc* conceptual tools, preferring to borrow them from pieces of theoretical debate which were not aimed to dating. This is the case of the use of the concepts of 'primary' and 'secondary', which were developed to tackle spatial and functional issues, but whose use has been 'imported' to deal with chronological issues without any serious revision.

Anyhow, in general, a lack of codification and condivision seems to be the most striking trait which emerged from the theoretical review. It is my opinion that, among many other factors, a too deep detachment between the branch of material studies and the branch of studies revolving around the interpetation of stratigraphy may represent one the main reasons for this state of the art.

Turning to methodological issues (how? with wich operative tools?), I must confess that, in my personal view, the overall panorama is even darker. The homogeneity of the

dates provided by a given assemblage, rarely quantified[483] or made somehow explicit (so, how can these data be evaluated?), seems to be the only criterion for assessing the primary status of a given deposit, while for deposits which are clearly secondary, the *terminus post quem* offered by the most recent artefact is used by far too often to date *ad quem*. Fragmentation, sometimes, is employed as a tool to distinguish primary and secondary deposits (but primary and secondary in which sense?), but how it was produced is rarely evaluated and the study of rubbish disposal in classical times, although well developed, is conversely rarely considered in its impact on the record we dig. The use of micromorphology is also still underestimated in classical archaeology, even if it could well answer specific questions about the formation of single contexts or whole deposits.

Eventually the presence of intrusions is usually claimed only *ex post*, whenever some specimens provide dates which disagree with expectations and chronological frameworks which are quite often the product of considerations deriving from general (or, again, generic) archaeological or historical considerations. This means that too often, in my view, the data emerged from the analysis of the excavated assemblages are stretched, with no or few theoretical and methodological attention, to fit chronological conclusions which we have already explicitly or implicitly formed in our minds.

More in general, a formative and qualitative approach (what is this stratum? how was it formed? How did the materials got embedded within it?) is very rarely combined with quantitative observations on the chronology provided by the recovered finds (are the dates consistent or they are clustered in different periods? which is the period - or the periods - more represented? is there consistency or not between the main peak of evidence and the terminus post quem?).

Analogical and comparative devices seem also to be by far underestimated; the use of ethnoarchaeological and experimental analogy is rarely employed in classical archaeology and is almost unknown in the field of dating.

During the same seminar which has been cited in the previous chapter, I presented a picture, realized through transforming a famous picture already edited by M. Johnson[484], in which I expressed the necessity for classical archaeologist to make much more use of these

[483] It has already been stressed that a considerable body of literature exists about quantitative techniques to deal with ceramics, but large part of this literature targets economic issues or the comparison between two or more assemblages. A few considerable exceptions are cited in Chapter III.4.

[484] Johnson's picture also well summarize the way in which classical archaeologist are seen 'on the outside', by those who are more currently involved within the theoretical and methodological debate. A similar picture was proposed years later, in order to show how the theoretical debate had changed during the following years. The way in which classical archaeology was considered remained unchanged.

instruments (and of other 'ancillary' disciplines) in the future. Up to the present it has to be (sadly) acknowledged that the situation is still much more similar to that depicted in Johnson's picture.

Literary sources are traditionally taken into some more account, but rarely their potential is exploited to investigate formation processes and dating.

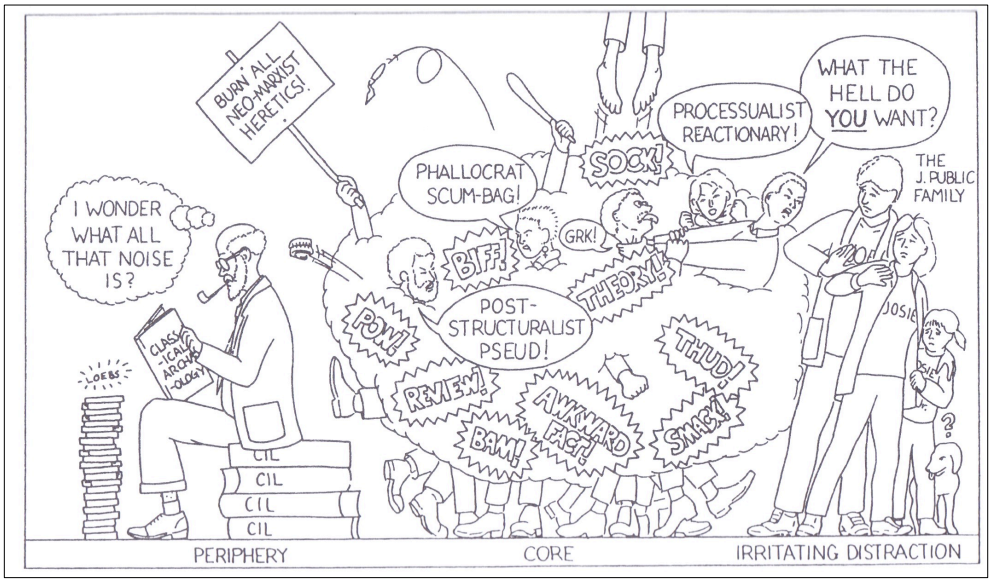


fig. 158 - The theoretical debate at the end of the 1980s according to Johnson. From Johnson 2010

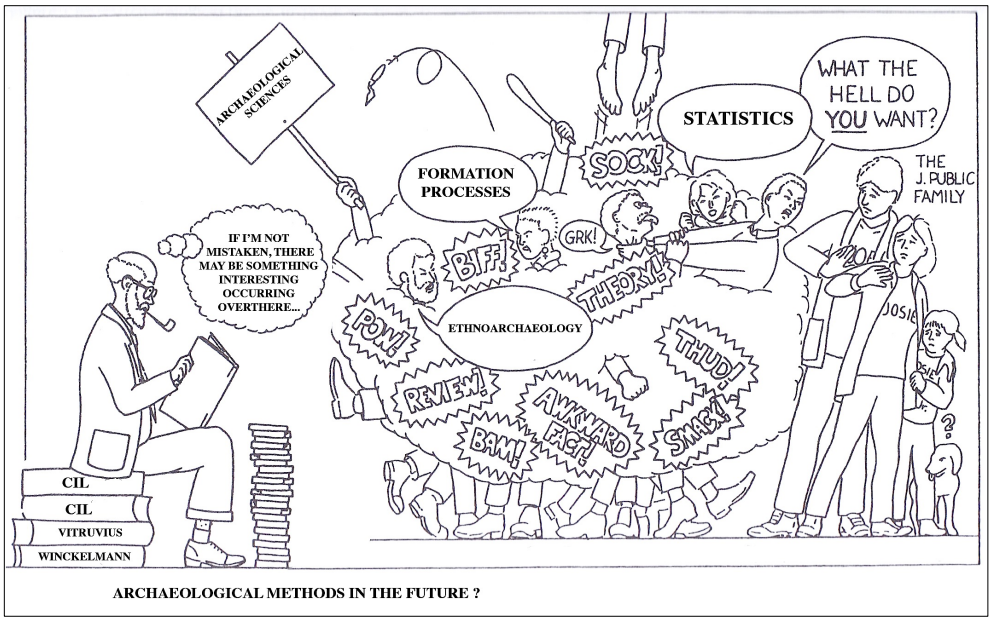


fig. 159 - Archaeological methods in the future?

Eventually, the last comparative device which could be employed to date deposits, namely the existing case studies, is greatly biased by the very lack of complete editions of excavations, contexts and deposits which has been cited above.

As anticipated in the introduction to this work (Chapter I.1) and in the literature review (Chapter I.2), the picture emerging from an examination of the state of the art is anything but organic, with specific topics tackled by considerable works and other issues which still remains almost unexplored.

V.2.2 What's new? The results

Given this state of the art and once reached the end of this work, it is necessary to ask if and how this thesis answers to the critical points which have been highlighted.

In the introduction (Chapter I.1.3) I expressed the aim to improve, even a little bit, the quality of the way in which we date deposits. For doing this, I reviewed both the theoretical and methodological tools and I tried to give shape to a taxonomy of deposits and to a working method. I will try to sketch, point by point, the elements which I consider more innovative and which may represent a small headway in the way of dating deposits on more solid bases.

Theory

In Part II, dedicated to theory, I examinated which are the main concepts involved in dating deposits. In order to label the selected key concepts, I chose not to adopt new terms (there are already too many), but conversely I produced new definitions, which better fit to the field of study selected. In particular I moved from a spatial/functional (or simply ambiguous) perspective (see the terms 'primary' and 'secondary', as well as 'residual' or 'systemic context') to a more markedly temporal point of view, which represents a prerequisite when dealing with dating. I also tried to link many of the advanced definitions with the main issue of accuracy/uncertainty, which represents, in my view, the key point in order to fully understand and define phenomena such as residuality and false residuality, or to distinguish what is primary and what is secondary.

Eventually, I tried to be very explicit also about other concepts which, albeit not closely confined to the topic of dating, I often used throughout the work, such as 'analogy', 'model' or 'process'.

This necessity to define the concepts employed originated from the will to be very clear and explicit from the very beginning, particularly in a field which is poorly codified.

Methods

I think that among the methods proposed, it may be possible to detect some innovative points, the most important of which, in my view, is represented by the use of Monte Carlo simulations in order to produce profiles which represent the 'chronological content' of each deposit, *i.e.* to show which periods are more or less represented by the finds which have been recovered. This method allows for a good management of uncertainty and it is quick and easy to read, thus having some advantages if compared to other methods such as the wieghted mean sum. It has also to be stressed that even this last methodology, albeit it has been used for dealing with assemblages, has never been employed as a tool to investigate the way in which a given deposit was formed and eventually to establish its status and date it.

I also think that some useful prompts are represented by the reflections made on the finds which provide the dates which are used for the simulations. Far too often we handle dates in a somewhat semplicistic way, as if they all referred to the same thing, while they actually may regard the production of a given item, its diffusion, the diffusion of its typology etc.; even more complicated issues concern carbons. Given the necessity of handling the entirety of the chronological information available, it follows the necessity of uniforming the quality of the dates we have. I think this is an important point which has to be stressed and which adds additional variability to the palimpsets offered by the assemblages we study. In particular it emerges quite clearly that, somehow paradoxically, the more precisely dated items we usually have in a classical urban environment (coins and finewares) are reasonably affected by phenomena of curation much more than other items (coarseware above all) which, on the contrary, usually live a short life, but are also very poorly dated. Given the impossiblity of asciertaining when many items were produced, suggesting to extend the typical systemic life of coins and fineware whose dates refers to the production, I basically imply to replace a forme of false certainty with a higher degree of 'true' uncertainty.

The observations made about the tendencies in ancient items production and diffusion are obviously based on the current state of the art and thus may be substantially reviewed if future studies in this field will provide new fresh data. For the moment, what emerges is a panorama made of considerable variability or of substantial lack of data, thus I think that the use of uniform distributions still has to be preferred to the use of normal ones.

Eventually, I also stressed the importance of handling the assemblages as populations or as samples, according to the percentage of a given deposit which has been investigated; it has also been demonstrated that the representativeness of the sample also depends on the quality, or status, of the deposit itself.

Moving to the evaluation of the physical characteristics of the assemblage, it has to be advanced that, in this particular field, a much larger body of literature exists, ranging from the evaluation of wear to the study of fragmentation, conjoinability, blackening etc. The point is how to interpret these data in order to gain information about the formation of the deposit and its dating. This still remain a controversial point, which I think has to be evaluated case by case; I restricted myself to proposing a quick way to record large part of the date which are needed, namely a simple photo of the assemblage as a whole, possibly before and after it has been washed. I considered that, given the speed which is required by an urban excavation, the adoption of different ways to record piece by piece different qualities was both time consuming and difficult to handle in order to reconstruct a global picture of the state of the assemblage. Through a simple picture we can have a quick, global, visual impression of the characteristics of a whole assemblage and we can easily build up a large collection, useful for comparative studies. Of course this approach does not allow any form of quantification, but it seems to me to display a good degree of effectiveness, practicity and speed. Usually some notes about the dimensions (rarely about other characteristics) of the recovered finds are reported in the context sheets, but they are often too vague or incomplete and are more time consuming; indeed, pictures of whole assemblages are also taken sometimes, but it is not a systematic practice; I suggest that this practice should become part of the routine excavation laboratory activity and that it should be employed in particular for assessing the nature of the deposit which returned the assemblage.

I also wish to stress the emphasis which has been posed to the role of reuse, recycle and discard practices in shaping the assemblages that we recover, not only in terms of physical state, or in terms of presence/absence of artefacts, but also in circulating freshly discarded items which can potentially provide good *ad quem* dates.

Eventually it has been reminded the crucial role which can be played by micromorphology and, more in general, by the investigation of the matrix of the deposit, to gain information on its formation and status.

Other methods which are helpful to assess the status of a given deposit and to understand how to employ the embedded materials in order to propose a date of formation are not 'internal' or analytic, but comparative. In this case analogy has to be used as the main

conceptual link between what we observe and the terms for comparison that have been chosen. I cited four main comparative tools which can be employed, namely ethnological, experimental, literary and archaeological. Archaeological comparisons would be guaranteed by large bodies of fully published data and their lack represents a topic that I have already discussed. Literary sources have been examined somewhat briefly; they are a branch from which classical archaeology draws a great body of information, but they are rarely empoyed in connection with the study deposits formation processes. I sketched just a few examples which show how this powerful tool could be employed more effectively in this way, but, as a whole, this is a huge field of studies and should deserve much wider and more detailed studies in the future. Ethnoarchaeology and experimental archaeology, as reminded above, are still somehow too neglected by classical archaeologists. I think I managed to demonstrate that both can be quite helpful in strenghtening some models that we have develop about the formation of some deposits according to what we have observed in the field. Even these topics have been tackled only partially, but I think that I managed to provide a couple of useful, practical indications about earthen floors and about the dynamics of *in situ* assemblages beneath collapse debris. In these fields, as well as in the fields of direct dating of mortar and sediments, there is still much work to do.

Among the wide range of issues which must be tackled to deal with dating, the issue of intrusions is in my view by far the most transversal and critical. I tried to list which are the main cause of intrusions and 'false' intrusions (wrong grouping, for instance). This seems to be a problem quite difficult to solve once and for all, so I tried to suggest some instruments to limit it. Apart from the necessary care to be taken in the field and after, I focused mainly on instruments to evaluate the issue *a priori*, in order to limit its indiscriminate use ex post (see above). A general environmental evaluation seems to represent a necessary basis to start, but it must follows a form of more specific context by context evaluation. In this sense I proposed to slightly modify the common context sheets adopted. The point is that the presence of some finds can well be explained resorting to the issue of intrusions if we are dealing with a context with sot matrix which has been exposed for long and have been later cut or truncated, or which seems to have suffered heavy bioturbation. But we cannot claim that intrusions occurred if we are dealing with the beddings of a mortar floor which have laid untouched after their construction. In this case we'd better to find other ways to explain why a given find was recovered and maybe we should reconsider some chronological assumptions made too hastily.

Taxonomy/typology

Classifications of archaeological contexts or deposits have already been proposed in the past (see the subdiviosion in class I and class II deposits proposed by Crummy and Terry in 1979 (see the literature review, Chapter I.2.2). The one proposed here is explicitly oriented to dating. The aim of the sort of typology proposed consists not only of a way to give shape, according to some criteria, to the galaxy of archaeological deposits; it also represents an instrument to attribute a given deposit to a specific formative model and then to lead to its own way of dating. As a classifying device, the taxonomy proposed can be read from the most general categories (primary, mixed, secondary) to the more specific types (rubbish pit, robbers trench backfills etc.); as an operative and comparative tool the same taxonomy can be read in the opposite way, from the specific formative model to which our specific case can be assimilated, to the more general categories, which lead to a way of dating the deposit.

In doing this, I tried to be explicit about the criteria (filters) that I have employed to group deposits: at the bottom the filter is formative (what is the deposit I am dealing with and how was it formed?), while at the top the filter is theoretical as it answers a specific enquiry question, which is given by the archaeologists and in this case it is represented by the question 'when'?. In this case the answer depends on the relation between artefacts and deposits. In the middle, I chose to set one more filter which allowed to distinguish those deposits whose date of formation was possible to split in a start date and in an ending date and those deposits whose formation was datable only as a whole (abrupt and continuous). This filter, that I defined qualitative, depends on the length of the formative process and on the quality of the dates of the single artefacts embedded.

This typology may well be extended and modified in the future, but I think it may represent a good starting point. The case studies presented, which represent just a small selection, may also get infinitely extended, in order to create an actual data base, useful for future comparisons.

Working method

At the very end of this work, I tried to sketch a proposal of working method, to deal explicitly with dating from the early stages of a field project to its publication. Of course it is just a personal proposal, which does not to claim to be dogmatic, and it is structured mainly keeping in mind the procedures I am most used to. It avails itself of the tools proposed and

discussed and put them in the wider framework of excavation practice and post excavation analysis.

Among the critical points debated, two have been stressed with particular emphasis, namely the one of grouping and the necessing of avoiding the dangerous circular procedure which employs of contextual data in order to date materials which are in turn used to date contexts. I guess that these two key points may be the less 'digestible', on the one side by field archaeologists and on the other one by finds specialists. I can just stress that I tried to keep myself in the perspective of dating and that I think that the arguments proposed are after all quite strong.

Conclusive remarks

Given what observed above, I consider that the objective of this research has been achieved. To what extent it has been achieved, I guess it is a matter of point of view, but I think that more than one interesting and original prompt emerged for future research. As for me, I just hope that this dissertation may lead to some practical and effective consequences in our way of dealing with the game of dating.

V.2.3 Five key ideas

From work as a whole some key ideas emerge, a few of them quite clearly and others more implicitly; I think that they are worth to be summed up and clarified.

(1). Archaeological research can have different targets. The one discussed here and which has to be kept in mind is dating deposits. Here, what we want to do is dating deposits. It is somewhat obvious, but when dealing with such a transversal issue it has to often recalled, as mixing tools, concepts or models with different objectives (say detecting functional, spatial or economic patterns) is by far too easy. I already stressed that mixing different perspectives has led to unclear and uncodified conceptual tools, which are often misleading or useless.

(2). For investigating when a deposit was formed using the finds recovered within it, it is unavoidable to understand how the deposit was formed and how the materials got embedded into it. This is surely something I would never stop to repeat[485].

[485] It seems to me that quite often this crucial question is somewhat forgotten, particularly when deposits are seriated seeking more chronological accuracy (see Bellanger *et alii* 2006). Other times, in my view, the question addresses the wrong target: this should be the deposit, which displays formative and chronological uniformity (see Chapter II.2.2), while broader groups or 'feature categories' may include deposits of different formative nature and different dates (See for instance Martin 2007).

(3). Dates are not raw data. They are something which displays an high interpretive content. It follows that we must employ a workflow as much as possible structured and explicit to achieve them and this workflow has to be made explicit also to other scholar, to allow them to evaluate the reliability of the dates proposed.

(4). Quantitative approach and qualitatitive/formative study must proceed shoulder to shoulder. No solid conclusion can be drawn about dating if we proceed on one branch only.

(5). There is a direct relationship between quantity and quality of the available data and quantity and quality of the conclusions which can be drawn from those same data. This counts also in the field of dating. If we have available a few, poorly dated artefacts, we cannot think of dating the deposit which contains them *ad annum*. If narrow chronological windows are needed or wanted, their definition will have to rely on sources of data others than the artefacts.

I think that this thesis can provide some useful means to translate these concepts into practice.

V.2.4 Critical points and deficiencies

After having examined those points which I consider the key strenghts of this thesis, I consider it is also fair to have a look at those critical points and deficiencies that emerged. Two of them seem to me quite evident, one concerning the case studies discussed and one concerning the overall layout of the thesis.

Starting with the case studies, one first objection may concern the way in which they have been chosen. They have been deliberately cherry picked among those deposits I best know (those whose exacavation I had been involved in) for their clarity. So one may say that they obviously fit the framework I built, as they were chosen exactly to do that. What about other cases? What about other case which do not fit the expectations I had? This is a right question that, for the moment, I can answer in this way: the role of the presented case studies is explicative and does not have any statistical value. Indeed, some 'types' of deposits are not provided with a case study (see rubbish pits) just because those examples I studied turned out to be somewhat little explicative (and poor in materials - see below -). Of course there may be infinite exceptions and case studies which does not fit the framework proposed. I think that a wide collection of case studies (see below) may represent in future both a useful comparative device and a way to strenghten or to reject the theoretical and methodological framework proposed. But somewhere I had to start.

Another main issue which emerges through the examination of the case studies proposed concerns the thata employed. Some of the case studies presented display a poor number of dated artefacts. This is basically due to the fact that when this project began I was quite confident that the Aquileia, house of Titus Macer, post excavation data would have been fully available. Unfortunately, albeit great work has been done, some dates concerning some classes of finds are still missing and will be available only in the next months, when the processing of the huge number of finds recovered will be over. This lack of evidence is entirely due to my own underestimation.

Eventually, it will be possible to observe that qualitative data of the examined assemblages are in general quite poor. The main tool I proposed to record the physical state of the assemblages (a simple picture) is indeed something whose utility became clear after the three main excavations I used for picking the case studies I needed (Aquileia, Titus Macer; Gortyna, Pythion theatre; Nora, forum) were over. I hope that this practice may be put to use in the very next excavations which will be carried on.

Moving to the second critical point, that is the overall structure of the thesis, some objections may rise. I already explained in the introductory part why I decided to choose a non traditional layout of my work, starting from theory and not from data. One may say that although I start with theory, that theory clearly draws on past experience and uses data at the very least to explain and to demonstrate some concepts. My answer is simply 'yes, of course'. Theory does not grow up in an empty environment. Even theory and methods elaborated to categorize and analyze data moving from general principles and research aims, do actually draws from a certain knowledge of the data we are handling and of the general problems they raise[486]. Deductive and inductive methods should not be seen as antithetical, separated approaches, but they are part of a circle of continuous elaboration and test. Many approaches proposed in this thesis still need to be fully tested (see what I discussed above about the case studies). Empirical and statistical future investigations will allow to accept or to reject the models proposed, to raise new questions and to lead research in new directions. In a few words, what presented here is just one part of a deductive/inductive cycle which I hope may continue its development in the future.

[486] The relationship between inductive reasoning and theory has been tackled during the 20th century by the two major philosophers Bertrand Russell and Karl Popper. Popper in particular, developing thoughts rooting in Kant's philosophy, stressed that observations are always soaked with theory. See partic. POPPER 1972, pp. 76-105 and 312-313.

V.2.5 Perspectives: what's next

Some future lines of research which could grow from the present work have already been suggested, while others remained some more implicit: it follows a random list of future researches which, in my view, way be worth to be approached to continue the path began with this dissertation. I avoided to cite general topics whose development will surely contribute, in the next future, also to the improvement of our ways of dating deposits. Here is the list:

1. substantial extension of the case studies examined, possibly until the body of data collected and processed have also some statistical weight; this collection would represent also an invaluable comparative tool. I also think that, once that the main ways of proceedings have been laid down, the collection of a good amount of new fresh data may proceed relatively fast; somehow reversing the approach, deposits which are already firmly dated could be investigated seeking recurrent patterns;
2. *ad hoc* ethnoarchaeological studies of historical archaeology studies to investigate the internal patterning of both primary and secondary deposits; abandoned dwellings and infrastructures whose date of construction is known may represent excellent targets;
3. experimental studies, particularly concerning ceramic breakage patterns or the replica of ancient practices involved in the formation of common archaeological deposits;
4. studies concerning reuse and recycling in the Classical world;
5. analyses of mortar structure assemblages to verify some of the models proposed;
6. extensive radiocarbon analyses of wooden finds (furniture, small finds and even architectural timber) in contexts of known dates, in order to understand how patterns of old wood effect, curation, reuse and recycling affect the dates of samples collected in primary deposits; Herculaneum assemblages may be a perfect target;
7. improvenment of our chronotypologies for those classes of finds which are more common and which are less likely to have suffered episodes of curation or whose systemic life is simply usually short (see coarseware); in this sense the application of absolute dating techniques together with Bayesian approaches could turn out to be very helpful. Finally, in my view, a more general, explicit review of the ways in which materials are currently dated, from both a theoretical and a methodological perspective, would also be of great benefit;

8. archaeometry of ceramics and burial environments, to assess if redeposition occurred;
9. improvement of absolute dating techniques such as mortar dating and OSL.

V.2.6 EPILOGUE

Apart from the final, global appraisal of what has been achieved by this thesis and what has not been, I think that, at the very least, the revitalization of the current debate about the crucial topic of dating deposits, which is somehow languishing, would be a great achievement.

I truly hope that this work may represent good food for thought in this sense.

❖ GLOSSARY ❖

abrupt formation, *formazione puntuale nel tempo*

The terms refer to those deposits whose main formative process was so brief that we cannot split the date of its beginning and the date of its end. The quality of the dates of the artefacts recovered also play an important role: sometimes the dates we handle are so broad, that we are forced to treat deposits whose formation was long as if their formation was abrupt.

accuracy, *accuratezza*

It this work the term refers primarily to chronological accuracy, that is our ability to distinguish two or more events in a time scale. When dealing with the date of formation of a given deposit, the accuracy of this date is proportional to the accuracy of the dates of the finds forming the assemblage produced by the deposit itself.

analogy, *analogia*

It expresses a relation of similarity between two or more things. An analogy does not prove anything, but it can be employed for comparisons, thus strenghtening some hypotheses we formulate. Its indiscriminate use has been heavily criticized.

archaeological context, *contesto archeologico*

In SCHIFFER 1972 it is given the following definition of archaeological context: '*Archaeological context* describes materials which have passed through a cultural system, and which are now the objects of investigation of archaeologists'. This definition closely refers to objects. In a wider sense the term applies to the conditions of the object of an archaeologist's investigation in the moment in which it is recovered.

assemblage, *contesto o insieme di materiali*

The term indicates the set of finds returned by a given chunk of stratification. In this work I employ the term to indicate whatever is datable within a deposit. Often the term is employed referring only to ceramics or, more in general, to artefacts.

backfill, *riempimento con materiale di riporto*

The term indicates a volume of allochtonous sediments, together with its content, which has been used to fill, usually abruptly, a given interface (say a pit or a trench).

closed find, *complesso chiuso* or *contesto chiuso*

The term is usually employed somewhat ambiguously to indicate well sealed deposits, primary deposits (usually with abrupt formation) or a combination of the two. This ambiguity made me choose not to employ it.

continuous formation, *formazione che perdura nel tempo*

The terms refer to those deposits whose main formative process was long enough to allow us to detect the date of its beginning and the date of its end. The quality of the dates of the artefacts recovered also play an important role: sometimes the dates we handle are so broad, that we are forced to treat deposits whose formation was long as if their formation was abrupt. If the formation was long enough and the accuracy of the dated provided by the embedded assemblage is sufficient, we may be able to distinguish the two moments.

deposit, *contesto o deposito*

This term usually assumes different meanings. In this work I use it to indicate a group of contexts that are the product of the same positive formative process in the same time. In Italian the term 'deposito' often refers to stratification as a whole, while the English term deposit, with the meaning indicated above, is often translated by the word 'contesto'.

false residual, *falso residuo*

A false residual is an artefact, ecofact or sample which was produced before the systemic context in which the deposit was formed, but which was still in use at that time. Heirlooms, particularly valuable coins and finewares are typically curated for some time and are likely to become false residuals.

horizon, *orizzonte* or *facies*

In this work, the terms refer to a group of materials or to an association of materials which is typical of a given historical period in a given area.

index fossil, *fossile guida*

In this work, the terms refer to a material which is typical of a given historical period.

intrusion, *intruso* or *infiltrazione*

Intrusions are artefacts or ecofacts deriving from contexts or deposits later than the examined one. The main factors which can lead to the presence of intrusions in a given deposit, apart from human error in excavation and storing, are later activities which led to the exposition of the surface of the deposit, natural turbation and wrong grouping.

model, *modello*

A model is a simplified representation of something which is more complex, in our case the formative process which led to the formation of a given assemblage and deposit.

phase, *fase*

It is a broad group of contexts which is usually based on a chronological criterion; this means that phases usually groups contexts formed in the same period; this, in turn, implies that contexts grouped have already been dated.

post pit, *buca per palo*

This is the cut which is carried out to install a post. This is usually larger than the post and needs to be backfilled.

post hole, *buca di palo*

This is the hole which remains in the ground once a given post is removed. Alternatively, if the post decays *in situ*, the post hole is directly filled with the products of the deterioration.

primary, *primario*

Together with secondary, this is an adjective which is often employed in archaeology, with different tones of meaning (spatial, functional, temporal). It may refer to objects or to contexts or whole deposits. In this work I choose to employ this term with a purely temporal meaning and to apply it to those deposits whose assemblage largely belongs to the same systemic context in which they were formed.

process, *processo*

By this term I mean the combination of agents and actions that led to the formation and transformation of a given deposit and its assemblage, with particular focus on how artefacts entered a given deposit

residual, *residuale* or *materiale residuo*

A residual is an artefact, ecofact or sample which was discarded in a systemic context previous to the one in which the deposit was formed. This means that redeposition occurred after a detactable period of time.

secondary, *secondario*

This term is the counterpart of the term primary (see above); I apply it to those deposits whose assemblage largely or completely belongs to a systemic context previous to the one in which they were formed.

systemic context, *contesto sistemico*

In SCHIFFER 1972 the following definition is provided: '*Systemic context* labels the condition of an element which is participating in a behavioural system'. In this work I employ it with a markedly temporal connotation, meaning a living system (with palimpsestic nature) in a given time slice.

urban archaeology, *archeologia urbana*

These terms may indicate the archaeology which studies ancient cities, the archaeology which is practiced in modern cities or a combination of the two (particularly in Italy). In this work I choose to employ this expression with the first meaning.

❖ References ❖

- Adam J. P., *Roman Building. Materials and Techniques*, London, 1994
- Aitken M. J., *An Introduction to Optical Dating. The Dating of Quaternary Sediments by the Use of Photon-Stimulated Luminescence*, Oxford, 1998
- Albanese L., *Nora. Area C. Vano A32. Un immondezzaio urbano in un contesto abitativo romano*, Genova, 2013
- Allen J. R. L., *A quantitative technique for assessing the roundness of pottery sherds in water contexts*, in *Geoarchaeology* 4, 2 1989, pp. 143-155
- Allison P. M., *Labels for ladles: Interpreting the material culture of Roman households*, in *The Archaeology of Household Activities*, ed. by P. Allison, London and New York, 199, pp. 57-77
- Allison P. M., *Why do excavation reports have find's catalogues?*, in *Not so much a pot, more a way of life. Current approaches to artefact analysis in archaeology*, ed. by C. G. Cumberpatch and P. W. Blikhorn , Oxford, 1997, pp. 77-84
- Altekamp S., *The Resistance of Classical Archaeology against Stratigraphic Excavation*, in *Digging in the Dirt. Excavation in a New Millennium*, ed. by G. Carver, BAR International Series 1256, Oxford, 2004, pp. 141-149
- Ambers J., *Radiocarbon and calendar chronologies: some practical difficulties in the use of 14C in archaeology*, in *Radiocarbon Dating and Italian Prehistory*, ed. by R. Skeates, R. Whitehouse, London, 1994, pp. 7-14
- Argento A., Di Giuseppe H., *La classificazione del materiale ceramico*, in *La fattoria e la villa dell'Auditorium*, ed. by A. Carandini *et alii* Rome, 2006, pp. 33-40
- Arnoldus Huyzenveld A., Maetzke G., *L'influenza dei processi naturali nella formazione delle stratificazioni archeologiche: l'esempio di uno scavo al Foro Romano,* in *Archeologia Medievale*, 15, 1988, pp. 125-175
- Arthur J. W., *Pottery Use-Alteration as an Indicator of Socioeconomic Status: An Ethnoarchaeological Study of the Gamo of Ethiopia*, in *Journal of Archaeological Method and Theory,* 9, 4, 2002, pp.331-355
- Arthur P., *Appendix B. Pottery in Structural Contexts*, in *The Insula of the Menander at Pompeii. Volume I: the Structures*, ed. by R. Ling, Oxford, 1997, pp. 325-331

- ASOLATI M., *Le monete. Il gruzzolo di Gortyna 2011 e il terremoto del 365 d.C.*, n.d.
- BACCHETTA A., *Edilizia rurale romana: materiali e tecniche costruttive nella pianura padana (II sec. a.C.-IV sec. d. C.)*, Firenze, 2003
- BAILEY G., *Concepts of Time*, in *Archaeology. The Key Concepts*, ed. by C. Renfrew, London and New York, 2005, pp. 268-273
- BAILEY G., *Concepts of Time in Quaternary Prehistory*, in *Annual Review of Anthropology*, vol. 12, 1983, pp. 165-192
- BALLET P., *Dépotoirs cultuels, domestiques et "industriels" dans la* chora *égyptienne à l'époque romaine*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 219-230
- BANDELLI G., *Aquileia colonia latina dal* senatus consultum *del 183 a.C. al* supplementum *del 169 a.C.*, in *AAAd*, 54, 2003, pp. 49-78
- BANDELLI G., *Roma e l'Adriatico fra III e II secolo a.C.*, in *AAAd*, 46, 2001, pp. 17-41
- BANDELLI G., *Politica romana e colonizzazione cisalpina: i triumvirati di Aquileia (181 e 169 a.C.)*, in *AAAd*, 30, 1987, pp. 63-76
- BANDUCCI L., *Function and Use of Roman Pottery: A Quantitative Method for Assessing Use-Wear*, in *Journal of Mediterranean Archaeology*, 27, 2, 2014, pp. 187-210
- BARKER P., *Open area excavation, illustrated by the excavation of the Baths Basilica at Wroxeter Roman City, Shropshire, England*, in *Lo scavo Archeologico: dalla Diagnosi all'Edizione*, ed. by R. Francovich, D. Manacorda, Firenze, 1990, pp. 205-234
- BARKER P., *Understanding Archaeological Excavation*, London, 1986
- BARKER P., *Techniques of Archaeological excavation*, London - New York, 2002. First edition: 1977, third edition: 1993
- BARKER S., *Roman Builders – Pillagers or Salvagers? The Economics of Deconstruction and Reuse*, in *Arqueología da la construccíon II. Los procesos constructivos en el mundo romano: Italia y provincias orienteles (Certosa di Pontignano, Siena, 13-15 de Noviembre de 2008)*, ed. by S. Camporeale *et alii,* Madrid – Mérida, 2010, pp. 127-142
- BATEMAN N. *ET ALII, London's Roman amphitheatre: Guildhall Yard, City of London*, London, 2008
- BAYARD D., MASSY J. L., *Amiens Romain:* Samarobriva Ambianorum, in *Revue archéologique de Picardie*, Amiens, 1983

- BAYLEY J. *ET ALII*, *Metals and Metalworking. A research framework for archaeometallurgy*, Wakefield, 2008
- BECK M. E., *Midden Ceramic Assemblage Formation: a Case Study from Kalinga, Philippines*, in *American Antiquity*, 71(1), 2006, pp. 27-51
- BEHRENSMEYER A. K., *Taphonomic and ecologic information from bone weathering*, in *Paleobiology,* 4 (2), 1978, pp. 150-162
- BEJOR G., *Nora I. L'abitato romano: distribuzione, cronologie, sviluppi*, in *Quaderni della Soprintendenza Archeologica per le Provincie di Cagliari e Oristano*, 9, 1992, pp. 125-132
- BEJOR G., *Romanizzazione ed evoluzione dello spazio urbano in una città punica: il caso di Nora*, in *L'Africa Romana*, 10, 2, 1994, pp. 843-856
- BELL M., *Overton Down 1992 excavation (32nd year)*, in *The Experimental Earthwork Project 1960-1992*, *CBA Research Report 100*, ed. by M. Bell, P. J. Fowler, S. W. Hillson, York, 1996a, pp. 66-89
- BELL M., *Discussion and Conclusions*, in *The Experimental Earthwork Project 1960-1992*, *CBA Research Report 100*, ed. by M. Bell, P. J. Fowler, S. W. Hillson, York, 1996b, pp. 228-246
- BELL M. *ET ALII*, *The Experimental Earthwork Project 1960-1992*, *CBA Research Report 100*, York, 1996
- BELLANGER L. *ET ALII*, *Statistical Aspects of Pottery Quantification for the Dating of some Archaeological Contexts*, in *Archaeometry*, 48, 1, 2006, pp. 169-183
- BERNARD J. F., *À propos de l'architecture antique comme source d'approvisionnement en métaux*, in *Il reimpiego* in *architettura. Recupero, trasformazione, uso*, ed. by J. F. BERNARD *ET ALII,* Rome, 2008, pp. 41-50
- BERNARD J. F. *ET ALII* (EDS.), *Il reimpiego in architettura. Recupero, trasformazione, uso*, Rome, 2008
- BERNARDINI P., PERRA M. (EDS.), *I nuragici, i fenici e gli altri. Sardegna e Mediterraneo tra Bronzo Finale e Prima Età del Ferro*, Sassari 2012
- BERRY M., *Finds, Deposits, and Assigned Status: New Approaches to Defined Relationships*, in *Crossing Paths or Sharing Tracks? Future directions in the archaeological study of post-1550 Britain and Ireland*, ed. by A. Horning, M. Palmer, Woodbridge, 2009, pp. 149-165

- BERTACCHI L., *Cisterna romana (Scavo 1968)*, in *Ritrovamenti archeologici recenti e recentissimi nel Friuli-Venezia Giulia, Catalogo della mostra (Trieste, 1982)*, Trieste, 1982, pp. 85-97
- BERTACCHI L., *Aquileia - Relazione preliminare sugli scavi del 1968*, in *AquilNost*, 39, 1968, coll. 29-48
- BERTO *ET ALII*, *Area III, saggio 2*, in *Aquileia – Fondi ex Cossar. Missione archeologica 2013*, ed. by J. Bonetto, A. R. Ghiotto, Padua, 2013, pp. 53-60
- BEVAN A. *ET ALII*, *Measuring Chronological Uncertainty in Intensive Survey Finds: a Case Study from Antikythera, Greece*, in *Archaeometry*, 55, 2, 2013, pp. 312-328
- BIERS W. R., *Art, Artefacts and Chronology in Classical Archaeology*, London, 1992
- BIGLIATI A., COLETTI M. C., *Santa Maria Antiqua*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 105-115
- BINFORD L. R., *Smudge Pits and Hide Smoking: the Use of Analogy in Archaeological Reasoning*, in *American Antiquity*, 32, 1, 1967, pp. 1-12
- BINGEN J. *ET ALII*, Mons Claudianus. Ostraca Graeca et Latina I *(O. Claud 1 à 190)*, Cairo, 1992
- BINGEN J. *ET ALII*, Mons Claudianus. Ostraca Graeca et Latina II *(O. Claud 191 à 416)*, Cairo, 1997
- BIRLEY R., *Vindolanda. Research reports, New Series. Volume I. The Early Wooden Forts. The Excavations of 1973-76 and 1985-89, with some additional details from excavations of 1991-93*, Hexham, 1994
- BLÁZQUES MARTÍNEZ J. M. *ET ALII*, Excavaciones arqueologícas en el Monte Testaccio (Roma), Madrid, 1994
- BOARETTO E., *Dating Materials in Good Archaeological Contexts: the Next Challenge for Radiocarbon Analysis*, in *Radiocarbon*, 51, 1, 2009, pp. 275-281
- BONDÌ S. F., *Nora, da insediamento fenicio a città cartaginese*, in *Archeologia e Memoria Storica. Atti delle Giornate di Studio (Viterbo 25-26 marzo 2009)*, ed. by G. M. Di Nocera *et alii*, Viterbo, 2012, pp. 81-94
- BONETTO J, *Ricognizione e prospezioni geofisiche presso il teatro del Pythion di Gortina*, in *ASAtene,* 79, 2001, pp. 377-379
- BONETTO J. *Nora municipio romano*, in *L'Africa Romana*, 14, 2, 2002, pp. 1201-1220

- BONETTO J., Gortyna. *Lo scavo 2004 presso il teatro del* Pythion, in *Annuario della scuola archeologica italiana di Atene e delle missioni italiane in Oriente,* 82, 2004, pp. 713-750
- BONETTO J., *L'insediamento di età fenicia, punica e romana repubblicana nell'area del foro*, in *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006*, ed. by J. Bonetto *et aiil.*, Padua, 2009
- BONETTO J., *L'insediamento fenicio di Nora e le comunità nuragiche: contatti e distanze*, in *Atti del Convegno Materiali e contesti nell'età del Ferro sarda (S. Vero Milis, 26 maggio 2012)*, *Rivista di studi fenici*, 41, n.d.a
- BONETTO J., *Nora nel V secolo: da emporio a colonia*, in *Atti del Convegno internazionale La Sardegna nel V secolo (Santadi, 30 maggio-.1 giugno 2013)*, Babesch supplementum, ed. by M. Botto *et alii*, n.d.b
- BONETTO J. *ET ALII*, *Aquileia - Fondi ex-Cossar. Missione archeologica 2009*, Padova, 2009
- BONETTO *ET ALII* (EDS.), *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006*, Padua, 2009a
- BONETTO *ET ALII* (EDS.), *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006. Volume III - Le unità stratigrafiche e i loro reperti*, Padua, 2009b
- BONETTO *ET ALII* (EDS.), *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006. Volume II.1 - I materiali preromani*, Padua, 2009c
- BONETTO *ET ALII* (EDS.), *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006. Volume II.2 - I materiali romani e gli altri reperti*, Padua, 2009d
- BONETTO J. *ET ALII*, *Le variazioni della linea di costa e l'assetto insediativo nell'area del foro di Nora tra età fenicia ed età romana*, in *L'Africa romana XVII, Atti del Convegno internazionale (Siviglia, 2006)*, Roma, 2008, pp. 1591-1616
- BONETTO *ET ALII*, *Gortyna di Creta, teatro del Pythion. Ricerche e scavi 2007-2010*, in *Annuario della scuola archeologica italiana di Atene e delle missioni italiane in Oriente,* 87, 2009, pp. 1087-1098
- BONETTO J. *ET ALII*, *Aquileia (UD). Fondi ex Cossar. Relazione delle ricerche 2009*, in *Notiziario della Soprintendenza per i Beni Archeologici del Friuli Venezia Giulia*, 4/2009, 2012, pp. 134-168

- BONETTO J. *ET ALII*, *Lo scavo 2005 presso il Teatro del Pythion*, in *ASAtene*, 83, serie 3, 5, Tomo 2, 2005, pp. 649-672
- BONETTO J. *ET ALII*, *Problematiche e potenzialità informative dei materiali residui in contesti archeologici urbani. I depositi pluristratificati dell'area del foro di Nora*, n.d.a
- BONETTO J. *ET ALII*, *Nora e il mare. Ricerche e tutela attorno agli spazi costieri della città antica*, in *L'Africa romana. Momenti di continuità e rottura: bilancio di 30 anni di convegni de l'Africa romana, XX Convegno internazionale di studi*, n.d.b
- BONETTO J., FALEZZA G., *Scenari di romanizzazione a Nora: un deposito di fondazione e un deposito votivo per la costituzione della provincia Sardinia et Corsica*, in Sardinia, Corsica et Baleares antiquae, 7, 2009, pp. 81-100
- BONETTO J., FRANCISCI D., *Il teatro del Pythion di Gortina: storia di un teatro romano a Creta*, in *Centro y periferia en el Mundo Clásico / Centre and periphery in the ancient world*, Merida, n.d.
- BONETTO J., FURLAN G., *Architettura privata ad Aquileia e in Cisalpina: modelli e architetti italici*, in *Les Modèles Italiques dans l'Architecture des IIe-Ier siècles avant J.C. en Gaule et dans les régions voisines, Actes du congress, Toulouse, 2-4 octobre 2013*, n.d.
- BONETTO J., GHEDINI E. F., *Vitruvio ad Aquileia. La casa ad atrio dei fondi ex Cossar,* in *Vitruvio e l'Archeologia. Tra Norma e Prassi, Atti del III Symposium di Studi vitruviani (Fano, 8-11 novembre 2012)*, n.d.
- BONETTO J., GHIOTTO A. R. (EDS.), *Aquileia - Fondi ex-Cossar. Missione archeologica 2011*, Padova, 2011
- BONETTO J., GHIOTTO A. R. (EDS.), *Aquileia - Fondi ex-Cossar. Missione archeologica 2012*, Padova, 2012
- BONETTO J., GHIOTTO A. R. (EDS.), *Aquileia - Fondi ex-Cossar. Missione archeologica 2013*, Padova, 2013
- BONETTO J., NOVELLO M., *Il Foro romano (Area "P")*, in *Ricerche su Nora - I. Anni 1990-1998*, ed. by C. Tronchetti, Cagliari, 2000, pp. 183-195
- BONINI P., *Le monete*, in *Montegrotto Terme - via neroniana. Gli scavi 1989-2002*, ed. by P. Zanovello, P. Basso, Padua, 2004, pp. 177-179
- BOWKETT L. *ET ALII*, *Classical Archaeology in the Field: Approaches*, Bristol, 2001
- BRADLEY R., FULFORD M. G., *Sherd size in the analysis of occupation debris*, in *Bullettin University of London Institute of Archaeology*, 17, London, 1980, pp. 85-94

- BRAY P. J., POLLARD A. M., *A new interpretative approach to the chemistry of copper-alloy objects: source, recycling and technology*, in *Antiquity*, 86, 2012, pp. 853-867
- BROGIOLO G. P., *Urbana, archeologia*, in Francovich R., Manacorda D. (eds.), *Dizionario di Archeologia*, Rome-Bari, 2006, pp. 350-355
- BROGIOLO G. P., *Archeologia urbana a Brescia*, in *Restauro e città*, 1, 2, 1985, pp. 69-78
- BROGIOLO G. P., *Parte Prima: Lo scavo. Premessa*, in *Ricerche su Brescia altomedievale vol. 1. Gli studi fino al 1978. Lo scavo di via Alberto Mario*, Brescia, ed. by G. Panazza, G. P. B. Brogiolo, 1988, pp. 39-42
- BROGIOLO G. P., GELICHI S., *La città nell'alto medioevo italiano. Archeologia e storia*, Rome-Bari, 2005
- BROGIOLO G. P., *ET ALII*, *Processi di stratificazione in centri urbani (dalla stratificazione «naturale» alla stratificazione «archeologica»)*, in *Archeologia stratigrafica dell'Italia settentrionale* 1, Como, 1988, pp. 23-30
- BRYANT V., *Medieval and early post-medieval pottery*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 281-339
- BRYANT V., TAYLOR G., *Deansway Site 1: Powick Lane south*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 163-196
- BUCK C. E., *ET ALII*, *Bayesian Approach to Interpreting Archaeological Data*, Chichester, 1996
- BÜLOW-JACOBSEN A., Mons Claudianus. Ostraca Graeca et Latina IV, *The quarry-Texts. O. Claud. 632-896*, Cairo, 2009
- BUTEUX V., JACKSON R., *Rethinking the 'Rubbish Pit' in Medieval Worchester*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams , Oxford, 2000, pp. 193-196
- BUTZER K. W., *Archaeology as human ecology*, Cambridge, 1982
- CAPORUSSO D. (ED.), *Scavi MM3: ricerche di archeologia urbana a Milano durante la costruzione della linea 3 della metropolitana: 1982-1990*, Milan, 1991.
- CAPORUSSO D., *Lo scavo di via Croce Rossa*, in *Scavi MM3: ricerche di archeologia urbana a Milano durante la costruzione della linea 3 della metropolitana: 1982-1990*, D. Caporusso, Milan, 1991, pp. 51-74

- CARANDINI A., *Palatium e Sacra Via I. Prima delle mura, l'età delle mura e l'età delle case arcaiche. Racconto breve dello scavo con disegni*, *Bollettino di Archeologia*, 34, 1995
- CARANDINI A., *Storie dalla terra*, Torino, 1991
- CARANDINI A., *Nuove riflessioni su "Storie dalla terra"*, in *Lo scavo archeologico: dalla diagnosi all'edizione*, ed. by R. Francovich, D. Manacorda, Florence, 1990, pp. 31-42
- CARANDINI A. *ET ALII* (EDS.), *La fattoria e la villa dell'Auditorium*, Rome, 2006
- CARANDINI A., CARAFA P. (EDS.), *Palatium e Sacra Via I. Prima delle mura, l'età delle mura e l'età delle case arcaiche*, *Bollettino di Archeologia*, 31-33, 1995
- CARANDINI A., PAPI E. (EDS.), *Palatium e Sacra Via II. L'età tardo-repubblicana e la prima età imperiale (fine del III secolo a.C.-64 d.C.*, *Bollettino di Archeologia*, 59-60, 2006
- CARVER M. O. H., *Notes on some general principles for the analysis of excavated data*, in *Science and Archaeology*, 21, 1979, pp. 3-14
- CARVER M. O. H., *The Excavation of Three Medieval Craftmen's Tenements in Sidbury Worcester, 1976*, in *Medieval Worcester. An Archaeological Framework. Transactions of the Worcestershire Archaeological Society*, ed. by M. O. H. Carver, 3, 7, 1980, pp. 154-219
- CARVER M. O. H., *Valutazione, strategia ed analisi nei siti pluristratificati*, in *Archeologia Medievale* 10, Florence, 1983, pp. 49-71
- CARVER M. O. H., *Theory and practice in urban pottery seriation*, in *Journal of Archaeological Science,* 12, 1985, pp. 353-366
- CARVER M. O. H., *Archaeological investigation*, London - New York, 2009
- CARVER M. O. H., *Digging for data: archaeological approaches to data definition, acquisition and analysis*, in *Lo scavo archeologico: dalla diagnosi all'edizione*, ed. by R. Francovich, D. Manacorda, Florence, 1990, pp.45-120
- CARVER M. O. H., *Underneath English Towns. Interpreting Urban Archaeology*, London, 1987a
- CARVER M. O. H., *The nature of Urban Deposits*, in *Urban Archaeology in Britain. CBA Research Report n°61*, ed. by J. Schofield and R. Leech, London, 1987b, pp. 9-26
- CASTELLANO A. *ET ALII*, *Elementi di archeometria: metodi fisici per i beni culturali*, Milan, 2002
- CATALLI F., *Monete e stratigrafia. Considerazioni generali*, in *Caput Africae* II, Rome 1997, pp. 103-105

- CECAMORE C., *I residui nello scavo archeologico. Esperienze sui materiali residui nello scavo stratigrafico e loro utilizzazione ed interpretazione in siti dell'area romana: il caso del Foro di Nerva*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 117-123
- CENTOLA V. *ET ALII*, *La casa centrale dei fondi ex Cossar ad Aquileia: nuovi scavi e prospettive di ricerca*, in *L'architettura privata ad Aquileia in età romana, Atti del Convegno di studio (Padova, 21-22 febbraio 2011)*, ed. by J. Bonetto, M. Salvadori, Padua, 2012, pp. 105-129
- CENTOLA V. *ET ALII*, *La domus dei Fondi ex-Cossar ad Aquileia: tradizione architettonica e innovazione tecnica*, in CIAC, 18, Mérida, n.d.
- CHAPMAN J., *Object fragmentation and Past Landscapes*, in *Handbook of Landscape Archaeology*, ed. by B. David, J. Thomas, Walnut Creek, 2008, pp. 187-201
- CHAPMAN J., *Fragmentation in Archaeology*, London and New York, 2000
- CHAPMAN J., GAYDARSKA B., *Parts and Wholes. Fragmentation in Prehistoric Context*, Oxford, 2007
- CHIABÀ M., *Dalla fondazione all'età tetrarchica*, in Moenibus et purtu celeberrima. *Aquileia: storia di una città*, ed. by E. F. Ghedini *et alii*, Rome, 2009, pp. 7-22
- CHIARI, G. *ET ALII, Caratterizzazione delle malte antiche mediante l'analisi di campioni non frazionati*, in *Materiali e Strutture* 2.3, 1992, pp. 111–37
- CHILDE V. G., *Piecing Together the Past; the Interpretation of Archaeological Data*, New York, 1956. Italian edition: *I frammenti del passato. Archeologia della preistoria*, Milan, 1960
- CHIARAMONTE TRERÈ C. (ED.), *Nuovi contributi sulle fortificazioni pompeiane*, Milan, 1986
- CLARK P., *Post-Excavation Analysis: moving from the context to the phase*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams, Oxford, 2000, pp. 157-159
- CLARKE D. L., *Models and paradigms in contemporary archaeology*, in *Models in Archaeology*, ed. by D. L. Clarke, London, 1972
- CNAU*, Annuaire des opérations de terrain en milieu urbain 1998*, Tours, 1999
- COLES J., *Archeologia sperimentale*, Milan, 2008 (translation by D. Manconi)

- COOKE L., *Conservation Approaches to Earthen Architecture* in *Archaeological Contexts.* BAR International Series 2147, Oxford, 2010
- CORDIER P., *Le destin urbain du* stercus *et de l'urine*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003b, pp. 51-52
- CORTESE C., *Quantificazione e analisi statistica degli insiemi ceramici*, in *Quaderni Friulani di Archeologia* XVI, Trieste, 2006, pp. 47-59
- COSTELLO IV B., *Architecture and Material Culture from the Earthquake House at Kourion, Cyprus*, Oxford, 2014
- CREMA E., *Modelling Temporal Uncertainty in Archaeological Analysis*, in *Journal of Archaeological Method and Theory*, 19(3), 2012, pp. 440-461
- CREMA E. *ET ALII*, *A probabilistic framework for assessing spatio temporal point patterns in the archaeological record*, in *Journal of Archaeological Science*, 37, pp. 1118-1130
- CRUMMY P., TERRY R., *Seriation problems in urban archaeology*, in *Pottery and the archaeologist*, ed. by M. Millet, London, 1979, pp. 49-60
- CUOMO DI CAPRIO N., *Ceramica in Archeologia 2. Antiche tecniche di lavorazione e moderni metodi di indagine*, Rome, 2007
- CUPITÒ M., LEONARDI G., *Potenzialità informativa del record archeologico. Microstratigrafia e interpretazione gentico-processuale: uno studio di caso funerario*, in *Padusa*, 34/35, 1999, pp. 177-208
- CUSCITO G. (ED.), *Riuso di monumenti e reimpiego di materiali antichi in età postclassica: il caso della* Venetia, AAAd, 74, 2012
- CUVIGNY H., Mons Claudianus. Ostraca Graeca et Latina III. *Les reçus pour avances à la* familia. *O. Claud. 417 à 631*, Cairo, 2000
- D'AGOSTINO B., *Premessa*, in *Cuma. Le fortificazioni. 2. I materiali dai terrapieni arcaici*, ed. by M. Cuozzo *et alii* Naples, 2006, pp. 5-13
- DALGAARD P., *Introductory Statistics with R*, New York, 2008
- DALWOOD H., *Chronological synthesis*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 36-76
- DALWOOD H., BRYANT V., *Rubbish disposal*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 84-88

- DALWOOD H., EDWARDS R., *Deansway Sites 4 and 5: Powick Lane north*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 207-234
- DARVILL T. (ED.), *The Concise Oxford Dictionary of Archaeology*, Oxford, 2008
- DAVID N., *On the lifespan of pottery type frequencies and archaeological inference*, in *American Antiquity,* 37, 1972, pp. 141-142
- DEBOER W. R., *Ceramic Longevity and Archaeological Interpretations: an Example from the Upper Ucayali, Peru*, in *American Antiquity,* 39, 1974, pp. 235-242
- DE CARO S., *La villa rustica in località Villa Regina a Boscoreale*, Rome, 1994
- DE CHAZELLES C. A. *ET ALII* (EDS), *Les cultures constructives de la brique crue. Troisièmes Échanges transdisciplinaires sur les constructions en terre crue placés sous la présidence du Professeur Olivier Aurenche. Actes du colloque international de Tolouse 16 et 17 mai 2008*, Toulouse, 2011
- DEGRYSE P. *ET ALII*, *Evidence for glass 'recycling' using Pb and Sr isotopic ratios and Sr-mixing lines: the case of early Byzantine Sagalassos*, in *Journal of Archaeological Science*, 33, 2006, pp. 494-501
- DE GUIO A., *Unità Archeostratigrafiche come Unità Operazionali: verso le Archeologie Possibili degli anni '90*, in *Archeologia Stratigrafica dell'Italia Settentrionale* I, Como,1988, pp. 9-22
- DELL'AMICO, P., *La nave romana di Grado,* in *Navis*, 2, 2001, pp. 36-65
- DEROSE EVANS J., *Coins and the Archaeology of the Roman Republic*, in *A Companion to the Archaeology of the Roman Republic*, ed. by J. DeRose Evans, Oxford???, 2013, pp. 110-122
- DESBAT A., *La gestion de déchets en milieu urbain: l'exemple de Lyon à la période romaine*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 117-120
- DIEUDONNÉ-GLAD N., RODET-BELLARBI I., *La gestion des déchets artisanaux et domestiques: actions individuelles ou concertées? L'exemple d'une agglomération secondaire de Gaule romaine*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 181-196.

- DI GIUSEPPE H., *I reperti*, in *La fattoria e la villa dell'Auditorium*, ed. by A. Carandini *et alii*, Rome, 2006, pp. 201-211
- DI GREGORIO F. *ET ALII*, *Il quadro ambientale*, in *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006, vol. 1. Lo scavo*, Padua, 2009, pp.11-38
- DILLY G., MAHEO N., *Verreries antiques de musée de Picardie*, Paris, 1997
- DI VITA A., *Gortina di Creta: quindici secoli di vita urbana*, Rome, 2010
- DI VITA A., *Archaeologists and Earthquakes: the case of 365 AD*, in *Annali di geofisica*, 38, 5-6, 1995, pp. 971-976
- DOBREVA D., *I materiali archeologici*, in *Aquileia - Fondi ex Cossar. Missione archeologica 2011*, ed. by J. Bonetto, A. R. Ghiotto, pp. 96-106
- DREWETT P. L., *Field Archaeology. An Introduction*, London and New York, 1999
- DUBANT D., *Une décharge publique gallo-romaine (fin I^r^-début IIe s. ap. J. C.) à Tours (Indre-et-Loire, France)*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, 165-180
- DULLER G. A. T., *Luminescence dating of Quaternary sediments: recent advances*, in *Journal of Quaternary Science*, 19, 2, 2004, pp. 183-192
- DUNGWORTH D., *Caley's 'zinc decline' reconsidered*, in *The Numismatic Chronicle*, vol. 156, 1996, pp. 228-234
- DYMOND D. P., *Archaeology and History, a Plea for Reconciliation*, London, 1974
- EDGEWORTH M., *Scale*, in *The Oxford Handbook of the Archaeology of the Contemporary World*, Oxford, 2013, pp. 379-391
- EDWARDS C. A., LOFTY J. R., *Biology of Earthworms*, London, 1977
- EVANS J., MILLET M., *Residuality Revisited*, in *Oxford Journal of Archaeology,* 11, Oxford, 1992, pp. 225-240
- FEATHERS J. K., *Use of luminescence dating in archaeology*, in *Measurements Science and Technology*, 14, 2003, pp. 1493-1509
- FEATHERS J. K., *Luminescence Dating and Modern Human Origins*, in *Evolutionary Anthropology*, 5, 1, 1996, p. 25
- FERRARESE LUPI A., LELLA P., *Gaussian Curves for Visualizing Chronological Patterns of Ceramic Finds and Residuality*, in *Archaeometry*, 55, 2, pp. 296-311
- FLETCHER M., LOCK G. R., *Digging numbers*, Oxford, 2005

- FONTANA V., BAGOLAN M., *Frammenti ceramici e stratigrafia abitativa: due studi di caso*, in *Processi formativi della stratificazione archeologica – Atti del seminario internazionale Formation processes and excavation methods in archaeology: perspectives*, ed. by G. Leonardi, Padua, 1992, pp 323-347
- FOSTER G. M., *Life-expectancy of utilitarian pottery in Tzintzuntzn, Michoacan, Mexico*, in *American Antiquity*, 25, 1960, pp. 606-609
- FOSTER H. E., JACKSON C. M., *The composition of 'naturally coloured' late Roman vessel glass from Britain and the implications for models of glass production and supply*, in Journal of Archaeological Science, 36, 2009, pp. 189-204
- FOWLER P. *ET ALII*, *Artefacts and buried materials, 1968 and 1976*, in *The Experimental Earthwork Project 1960-1992*, *CBA Research Report 100*, ed. by M. Bell, P. J. Fowler, S. W. Hillson, York, 1996, pp. 43-65
- FOWLER P., SWANTON G., *Background, Overton*, in *The Experimental Earthwork Project 1960-1992*, *CBA Research Report 100*, ed. by M. Bell, P. J. Fowler, S. W. Hillson, York, 1996, pp. 8-12
- FOY D., NENNA M. D., *Tout feu, tout sable – mille ans de verre antique dans le Midi de la France*, Marseilles, 2001
- FREESTONE I. C., *Post depositional changes in archaeological ceramics and glasses*, in *Handbook of Archaeological Sciences*, ed. by D. R. Brothwell, A. M. Pollard, Chichester - New York, 2001, pp. 615-625
- FRERE, S. S., *Verulamium Excavations Volume I*, in *Rep. Res. Comm. Soc. Antiq. Lon.*, 28, Oxford, 1972
- FUNMILAYO O., *Distribution and Abundance of Moles (*Talpa europaea L.*) in Relation to Physical Habitat and Food Supply*, in *Oecologia*, 30, 1977, pp. 277-283
- FURLAN G., *Area III, saggio 2*, in *Aquileia – Fondi ex Cossar. Missione archeologica 2012*, ed. by J. Bonetto, A. R. Ghiotto, Padua, 2012, pp. 71-92
- FURLAN G., *La ricostruzione del sistema di copertura della* domus *centrale dei Fondi ex-Cossar ad Aquileia*, Scuola di Specializzazione thesis, Università degli Studi di Padova, 2011
- GALLINA D., *Sillogismo deduttivo o abduzione? Alcune proposte per l'abbandono/superamento del matrix di Harris nell'analisi dell'architettura*, in *VI Congresso Nazionale di Archeologia Medievale, L'Aquila, 12-15 settembre 2012*, ed. by F. Redi, A. Forgione, Florence, 2012, pp. 75-81

- GARROW P. H., *The identification and use of context types in urban archaeology*, in *Southeastern Archaeology*, 3, 2, 1984, pp. 91-96
- GASCHE H., TUNCA O., *Guide to archaeostratigraphic classification and terminology: definition and principles*, in *Journal of Field Archaeology*, 10, pp. 325-335
- GELICHI S., *L'eliminazione dei rifiuti nelle città romane del nord Italia tra antichità ed alto medioevo*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 13-23
- GELICHI S., *Una discarica di scarti di fornace e la graffita ferrarese del XV secolo*, in *Ferrara prima e dopo il castello. Testimonianze archeologiche per la storia della città*, ed. by S. Gelichi, Ferrara, 1992, pp. 260-296
- GHEDINI *ET ALII* (EDS.), Moenibus et purtu celeberrima. *Aquileia: storia di una città*, Rome, 2009
- GHIOTTO A. R., *Nuovi dati e nuove ipotesi sulla pianificazione urbana di Aquileia*, in *Rivista di Archeologia*, 37, n.d.
- GHIOTTO A. R., *Il complesso monumentale del foro*, in *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006*, ed. by J. Bonetto *et al.*, Padua, 2009, pp. 245-373
- GHIOTTO A. R., *L'Architettura Romana nelle Città della Sardegna*, Rome, 2004
- GIANNICHEDDA E., *Lo Scavo, i residui, l'affidabilità stratigrafica*, in Facta 1, Pisa-Rome, 2007, pp. 51-64
- GIANNICHEDDA E., *Uomini e cose*, Bari, 2006
- GIANNICHEDDA E., *Archeologia teorica*, Rome, 2002
- GIDLOW J., *Arguing the Case for Rubbish*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams, Oxford, 2000, pp. 35-41
- GIFFORD-GONZALEZ D. P. *ET ALII*, *The Third Dimension in Site Structure: an Experiment in Trampling and Vertical Dispersal*, in *American Antiquity*, 50, 4, 1985, pp. 803-818
- GILLESPIE R., *Radiocarbon User's Handbook*, Oxford, 1986
- GIOT P. R., LANGOUET L., *La datation du passe. La Mesure du Temps en Archéologie*, Rennes, 1984

- GOBBO V., Iulia Concordia: *un drenaggio con tappi d'anfora*, in *Bonifiche e drenaggi con anfore in epoca romana: aspetti tecnici e topografici. Atti del seminario di studi (Padova, 19-20 ottobre 1995)*, ed. by S. Pesavento Mattioli, Modena, 1998, pp. 283-286
- GOLDBERG P., MACPHAIL R. I., *Practical and Theoretical Geoarchaeology*, Oxford, 2006
- GORINI G., *Monete e ritrovamenti archeologici nella X regio*, in *Atti e Memorie dell' Accademia Galileiana di Scienze, Lettere ed Arti,* 112, Padua, 1999-2000, pp. 69-78
- GORINI G. (ED.), *Ritrovamenti monetali nel mondo antico: problemi e metodi*, Padua, 2002
- GOSDEN C., KIRSANOW K., *Timescales*, in *Confronting scale in Archaeology*, ed. by. G. Lock, B. L. Molyneaux, New York, 2006, pp. 27-37
- GRECO A. V., *Virtutes materiae. Il contributo delle fonti latine nello studio di malte, intonaci e rivestimenti nel mondo romano*, Ortacesus, 2011
- GRIMAL P., *Le siècle des Scipions. Rome et l'hellénisme au temps des guerres puniques*, Paris, 1953
- GUEST P., *Coin Circulation in the Balkans in Late Antiquity*, in *The Transition to Late Antiquity on the Danube and Beyond*, ed. by A. G. Poulter, Oxford, 2007, pp. 295-308
- GUIDOBALDI F., *ET ALII* (EDS), *I materiali residui nello scavo archeologico*, Rome, 1998
- HAGGETT P., *Location Analysis in Human Geography*, London, 1965
- HALLY D. J., *Use Alteration of Pottery Vessel Surfaces: an Important Source of Evidence for the Identification of Vessel Function*, in *North American Archaeologist, 4*, 1, 1983, pp. 3-26
- HALSTEAD P. *ET ALII*, *Behavioural Archaeology and Refuse Patterns*, in *Nowegian Archaeological Review,* 11, 2, 1978, pp. 118-131
- HARRIS E. C., *The Stratigraphic Sequence: a Question of Time*, in *World Archaeology*, 7, 1, 1975, pp. 109-121
- HARRIS E. C., *Principles of archaeological stratigraphy*, New York, 1979. Italian edition: *Principi di stratigrafia archeologica*, Rome, 1983
- HARRIS E. C., *Principles of archaeological stratigraphy (2nd edition)*, London, 1989
- HARRISON R. J. *ET ALII*, *Moncín: un poblado de la edad del bronce (Borja, Zaragoza)*, Zaragoza, 1994
- HARTLEY B. R., DICKINSON B. M., *Names on* Terra Sigillata. *An Index of Makers'Stamps & Signatures on Gallo-Roman* Terra Sigillata *(Samian Ware). Volume 1 (A to AXO)*, London, 2008

- HARVEY D., *Explanation in Geography*, London, 1969
- HASELGROVE C. C., *ET ALII* , *Archaeology from the Ploughsoil*, Sheffield, 1985
- HILL J., ROWSOME P., *Settlement and development up to the Boudican fire and its aftermath,* c *AD 45-65 (period 2)*, in *Roman London and the Walbrook stream crossing. Excavations at 1 Poultry and vicinity, City of London*, Part I, ed. by J. Hill, P. Rowsome, London, 2011, pp. 21-82
- HILL J., ROWSOME P., *Conclusions – the development of Roman London*, in *Roman London and the Walbrook stream crossing. Excavations at 1 Poultry and vicinity, City of London*, Part 2, ed. by J. Hill, P. Rowsome, London, 2011, pp. 438-451
- HOCHULI-GYSEL A., *Römisches Glas aus dem Süd-western von Frankreich*, in *Annales de l'Association International pour L'Histoire du Verre*, 12, 1993
- HODDER J., *Interpretive Archaeology and its Role*, in *American Antiquity*, 56, 1, 1991, pp. 7-18
- IKÄHEIMO J., PEÑA J. T., *The Palatine East Pottery Project: a Holistic Approach to the Study and Publication of an Excavated Pottery Assemblage from Rome*, in *Proceedings of the European Meeting on Ancient Ceramics 2007 (Hungarian National Museum)*, ed. by K.T. Biro, Budapest, 2009, pp. 37-42
- ISINGS C., BLOEMERS J. H. F., *Glass from the* Canabae Legionis *at Nijmegen, in Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek Jaargang*, 30, 1980, pp. 281-346
- JACKSON R., *Deansway Site 2: Bull Entry*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 115-163
- JACOBS I., *Aesthetic Maintenance of Civic Space. The 'Classical' City from the 4th to the 7th c. AD*, Leuven, 2013
- JACOBS Z., ROBERTS R. G., *Advances in Optically Stimulated Luminescence Dating of Individual Grains of Quartz from Archaeological Deposits*, in *Evolutionary Anthropology*, 16, 2007, pp. 210-223
- JAMES P. *ET ALII*, *Mediterranean Chronology in Crisis*, in *Sardinian and Aegean Chronology*, ed. by Balmuth M. S., Tykot R. H., Oxford, 1998, pp. 29-43
- JAMESON R., *'assemblage'*, in *A Dictionary of Archaeology*, ed. by I. Shaw, R. Jameson, Oxford, 1999

- JANSEN G. C. M., *Systems for the disposal of waste and excreta in Roman cities. The situation in Pompeii, Herculaneum and Ostia*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 37-49
- JOHNSON I., *Aoristic Analysis: Seeds of a New Approach to Mapping Archaeological Distributions through Time*, in *Enter the Past. The E-way into the Four Dimensions of Cultural Heritage. CAA 2003. Computer Applications and Quantitative Methods in Archaeology. Proceedings of the 31st Conference, Vienna, Austria, April 2003*, ed. by Magistrat der Stadt Wien - Referat Kulturelles Erbe - Stadtarchäologie Wien, Oxford, 2004, pp. 448-452
- JOHNSON M., *Archaeological Theory. An Introduction*, Chichester, 2010
- JONES R. F. J., *Why pottery?*, in *Pottery and the Archaeologist*, ed. by M. Millet, London 1979, pp. 1-5
- KASPRZYK M., LABAUNE Y., *La gestion des déchets à* Augustodunum *(Autun, Saône-et-Loire) durant l'epoque romaine: les données archéologiques*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 99-116
- KEILY J., SHEPHERD J., *Glass*, in, *Roman pottery production in the Walbrook valley: Excavations at 20-28 Moorgate, City of London, 1998-2000*, ed. by F. Seeley, J. Drummond-Murray, London, 2005, pp. 178-185
- KLASEN N. *ET ALII*, *Optically stimulated luminescence dating of the city wall system of ancient Tayma (NW Saudi Arabia)*, in *Journal of Archaeological Science*, 38, 2011, pp. 1818-1826
- LAKE M. W., *Trends in Archaeological Simulation*, in *Journal of Archaeological Method and Theory*, 21, 2014, pp. 258-287
- LAKE M. W., WOODMAN P. E., *Visibility studies in archaeology: a review and a case study*, in *Environment and Planning B: Planning and Design*, 30, pp. 689-707
- LAMOTTA V. M., SCHIFFER M. B., *Archaeological formation processes*, in *Archaeology: the Key Concepts*, ed. by C. Renfrew, P. Bahn, London - New York, 2005, pp. 121-127
- LAMOTTA V. M., SCHIFFER M. B., *Formation Processes of House Floor Assemblages*, in *The Archaeology of Households Activities*, ed. by P. Allison, London - New York, 1999, pp. 19-29

- LANCASTER L. C., *Concrete vaulted construction in Imperial Rome: innovations in context*, Cambridge, 2005
- LANCHA J., ANDRÉ P., *Corpus dos Mosaicos Romanos de Portugal. II . Conventus Pacensis.1. A* villa *de Torre de Parma*, Lisboa, 2000
- LANG A. *ET ALII*, *Optical Dating of Anthropogenic Sediments at the Archaeological Site of Herrenbrunnenbuckel, Bretten-Bauerbach (Germany)*, in *Archaeometry*, 41, 2, 1999, pp. 397-411
- LANGLEY M. M. *ET ALII*, *A Comparison of Dating Techniques at Torre de Palma, Portugal: Mortars and Ceramics*, in *Building* Roma Eaterna*. Current research on Roman Mortar and Concrete. Proceedings of the conference March 27-29 2008. Commentationes Humanarum Litterarum 128*, ed. by Å. Ringbom, R. L. Hohlfelder, Helsinki, 2011, pp. 242-256
- LEE K. E., *Earthworms. Their Ecology and Relationships with Soils and Land Use*, North Ryde, 1985
- LEE LYMAN R., O'BRIEN M. J., *Seriation, stratigraphy and index fossils. The backbone ofarchaeological dating*, Columbia 1999
- LEE LYMAN R., O'BRIEN M. J., *Measuring Time with Artifacts*, Lincoln and London, 2006
- LEGA A. M. *ET ALII*, *Le alterazioni e i degradi più frequenti dei prodotti ceramici: casistica e principali cause*, in *Faenza, III giornata di studio v. 83, n° 1-3*, 1997, pp. 86-95
- LEONARDI G., *Processi formativi*, in *Dizionario di Archeologia*, ed. by R. Francovich, D. Manacorda, Rome-Bari, 2006, pp. 228-231
- LEONARDI G. (ED.), *Processi formativi della stratificazione archeologica. Atti del seminario internazionale Formation processes and excavation methods in archaeology: perspectives. Padova 15/27 luglio 1991.* Preliminar edition, Padua, 1992a
- LEONARDI G., *Il deposito archeologico: bacini, processi formativi e trasformativi*, in *Processi formativi della stratificazione archeologica. Atti del seminario internazionale Formation processes and excavation methods in archaeology: perspectives. Padova 15/27 luglio 1991.* Preliminar edition, Padua, 1992b, pp. 13-47
- LEONARDI G., *Procedure di stratigrafia processuale. La necropoli paleoveneta del Piovego a Padova*, in *Aquileia Nostra*, 57, 1986, cc. 209-236
- LEONARDI G., *"Lo scavo archeologico: appunti e immagini per un approccio alla stratificazione". Corso di propedeutica archeologica*, Correzzola, 1982

- LIEBESCHUETZ W., *Rubbish disposal in Greek and Roman cities*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 51-61
- LINDENLAUF A., *Dirt, CLeanliness, and Social Structure in Ancient Greece*, in *Agency Uncovered. Archaeological Perspectives on Social Agency, Power, and Being Human*, ed. by A. Gardner, Walnut Creek, 2007, pp. 81-105
- LINDENLAUF A., *Waste Management in the Ancient Greek World*, n.d.
- LING R. (ED.), *The Insula of the Menander at Pompeii. Volume I: the Structures*, Oxford, 1997, pp.17-20
- LIRITZIS I., *Advances in Thermo- and Opto-Luminescence Dating of Environmental Materials (Sedimentary Deposits). Part I: Techniques*, in *Global Nest Journal*, 2, 1, 2000, pp. 3-27
- LIRITZIS I., VAFIADOU A., *Dating by Luminescence of Ancient Megalithic Masonry*, in *Mediterranean Archaeology and Archaeometry*, 5, 1, 2005, pp. 25-38
- LIVIADIOTTI M., *Criteri di datazione delle murature di età romana a Gortina: confronti con altre aree di Creta*, in *Creta Romana e Protobizantina*, Padua, 2004, pp. 739-749
- LOCKYEAR K., *Hoard Structure and Coin Production in Antiquity: an Empirical Investigation*, in *Numismatic Chronicle*, 159, 1999, pp. 215-243
- LOCKYEAR K., *Dating Coins, Dating with Coins*, in *Oxford Journal of Archaeology*, 31, 2012, pp. 191-211
- LUCAS G., *The Archaeology of Time*, New York, 2005
- LUGLI F., *Ethnoarchaeology in Italy*, in *Contesting Ethnoarchaeologies. Tradition, Theories, Prospects*, ed. by A. Marciniak, N. Yalman, New York, 2013, pp. 35-59
- MACINTOSH R. J., *Archaeology and Mud Wall Decay in a West African Village*, in *World Archaeology*, 6, 2, 1974, pp. 154-171
- MACINTOSH R. J., *The Excavation of Mud Structures: an Experiment from West Africa*, in *World Archaeology*, 9, 2, 1977, pp. 185-199
- MACPHAIL R. I., *The Reworking of Urban Stratigraphy by Human and Natural Processes*, in *Urban-Rural Connexions: Perspectives from Environmental Archaeology*, ed. by A. R. Hall and H. K. Kenward, Oxford, 1994, pp. 13-43
- MAIURI A., *L'ultima fase edilizia di Pompei*, Naples, 2002, pp. 174-175

- MADRIGALI E., *Esperienze di restauro e valorizzazione di Aquileia: l'esempio dei Fondi ex-Cossar,* in *L'architettura privata ad Aquileia in età romana, Atti del Convegno di studio (Padova, 21-22 febbraio 2011)*, ed. by J. Bonetto, M. Salvadori, Padua, 2012, pp. 685-697
- MALNATI L., STOPPIONI M. L., *Una discarica di III sec. a. C.: caratteristiche strutturali e funzionali, in Vetus Litus. Archeologia della foce. Una discarica di materiali ceramici del III secolo a. C. alla darsena di Cattolica lungo il Tavollo - Quaderni di archeologia dell'Emilia Romagna,* 23, 2008, pp. 51-57
- MALONEY S. J., HALE J. R., *The* villa *of Torre de Palma (Alto Alentejo)*, in *Journal of Roman Archaeology*, 9, 1996, pp. 275-294
- MANACORDA D., *Sui "mondezzari" di Roma tra antichità ed età moderna*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 63-73
- MANNONI T., GIANNICHEDDA E., *Archeologia della produzione*, Torino, 2003
- MARANO Y. A., *Fonti giuridiche di età romana (I secolo a.C. - VI secolo d.C.) per lo studio del reimpiego*, in *Riuso di monumenti e reimpiego di materiali antichi in età postclassica: il caso della* Venetia, ed. by G. Cuscito, AAAd, 74, 2012, pp. 63-84
- MARANO Y. A., *La città tardoantica*, in *Moenibus et purtu celeberrima. Aquileia: storia di una città*, ed. by E. F. Ghedini *et alii*, Roma, 2009, pp. 23-33
- MARITAN L., MAZZOLI C., *Phosphates in archaeological finds: implications for environmental conditions of burial*, in *Archaeometry*, 46, 4, 2004, pp. 673-683
- MARITAN L. *ET ALII*, *Analisi dei processi post-deposizionali in ceramiche: il caso di Pontecchio Polesine, Frattesina e Adria*, in *Padusa*, 2007, pp.209-216
- MARSH G., *London's samian supply and its relationship to the development of the Gallic samian industry*, in *Roman Pottery Research in Britain and North-West Europe. Papers Presented to G. Webster,* ed. by A. C. Anderson, A. S. Anderson, Oxford, 1981, pp. 173-238
- MARTENS M., *Creating Order in Waste: Structured Deposits in Roman Tienen*, in *Roman Finds: Context and Theory. Proceedings of a conference held at the University of Durham*, ed. by R. Hingley and S. Willis, Southampton, 2007, pp. 150-155
- MARTIN A., *Residualità, La formula di South per il calcolo della data media della ceramica applicata a contesti romani*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini e P. Pergola, Rome, 1998, pp. 197-234

- MARTIN A., *Composition by functional groups of contexts at Pompeii*, in RCRF, 42, Bonn 2012, pp. 225-228
- MARTIN T. S., *Techniques for Exploring Context, Deposition and Chronology*, in *Roman Finds: Context and Theory. Proceedings of a conference held at the University of Durham*, ed. by R. Hingley and S. Willis, Southampton, 2007, pp. 86-99
- MARTINELLI N., *Le datazioni radiometriche col ^{14}C dei carboni nelle preparazioni pavimentali e nel rivestimento idraulico*, in *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006*, vol. 2.2, ed. by J. Bonetto *et al.*, Padua, 2009, pp. 921-923
- MARTIN-KILCHER S., *Dépots en milieu urbain et amphores: évacuation organisée - réutilisation - déchets*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 231-242
- MASELLI SCOTTI F., *Le fasi preromane*, in Moenibus et purtu celeberrima. *Aquileia: storia di una città*, ed. by E. F. Ghedini *et alii*, Roma, 2009, pp. 3-6
- MATTHEWS K., *A futile occupation? Archaeological meanings and occupation, in Interpreting Stratigraphy 1992*, ed. by J. Barber, Edinburgh, 1993, pp. 55-61
- MATTHEWS W. *ET ALII*, *Microstratigraphic Traces of Site Formation Processes and Human Activities*, in *World Archaeology*, Vol. 29, No. 2, 1997, pp. 281-308
- MAXFIELD V. A., BINGEN J., *Chapter 5. The southern sebakh*, in Mons Claudianus. *Survey and Excavation. 1987-1993, Volume II, Excavations, Part 1*, ed. by V. A. Maxfield, D. P. S. Peacock, Cairo, 2001, pp. 89-125
- MAXFIELD V. A., PEACOCK D. P. S. (EDS.), Mons Claudianus. *Survey and Excavation. 1987-1993, Volume II, Excavations, Part 1*, Cairo, 2001
- MAXFIELD V. A., PEACOCK D. P. S. (EDS.), Mons Claudianus. *Survey and Excavation. 1987-1993, Volume III, Ceramic Vessels and Related Objects*, Cairo, 2006
- MAYOR A., *Use of ethnoarchaeology for a better understanding of ceramic production, diffusion and consumption modalities: the Mali example*, in *Ceramic in the Society. Proceedings of the 6th European Meeting on Ancient Ceramics. Fribourg, Switzerland, 3-6 October 2001*, Fribourg, 2003, pp. 217-229
- MAZZOCCHIN S., *Vicenza. Traffici commerciali in epoca romana: i dati delle anfore*, Trieste, 2013

- MAZZOCCHIN S., FURLAN G., *A peculiar Roman context in Vicenza. A new approach on pottery and amphorae*, n.d.
- MC PHEE I, PEMBERTON E. G., *Corinth VII.6. Late Classical Pottery from Ancient Corinth: Drain 1971-1 in the Forum Southwest*, Athens, 2012
- MEDRI M., *Scavo di due* insulae *dei quartieri nord di Aquileia. Campagne 1995-2000. Rapporto preliminare*, in *Aquil-Nost*, 71, 2000, columns 257-334
- MEDRI M, *Aquileia, scavo dei quartieri nord: alcune ipotesi di ricostruzione*, in *Archeologia e territorio. Metodi, materiali, preospettive. Mejerda e Adige: due territori a confronto*, ed. by M. De Vos, Trento, 2004, pp. 559-579
- MERRIFIELD R., *Roman Metalwork from the Walbrook – Rubbish, Ritual or Redundancy?*, in *Transactions of the London and Middlesex Archaeological Society*, 46, 1995, pp. 27-44
- MILLER L. *ET ALII*, *The Roman quay at St. Magnus House, London : excavations at New French Wharf, Lower Thames Street, London 1974-78*, London, 1986
- MILLET M., *How much pottery?*, in *Pottery and the archaeologist*, ed. by M. Millet, London, 1979, pp. 77-80
- MILLET M., *Dating, quantifying and utilizing pottery assemblages from surface survey*, in *Extracting Meaning from Ploughsoil Asdsemblages*, ed. by R. Francovich, H. Patterson, G. Barker, Oxford, 2000, pp. 53-59
- MILLS B. J., *Integrating Functional Analyses of Vessels and Sherds through Models of Ceramic Assemblage Formation*, in *World Archaeology*, Vol. 21, No. 1, 1989, pp. 133-147
- MILNE G., WARDLE A., *Early Roman development at Leadenhall Court, London and related research*, in *Transactions of London and Middlesex Archaeological Society*, 44, 1993, pp. 23-169
- MOGETTA M., TERRENATO N., *Architecture and Economy in an Early Imperial Settlement in Northern Etruria*, in *Facta*, 1, 2007, pp. 107-124
- MONIN M., BECKER C., *Les fours des verriers des subsistances, 8 bis quai St-Vincent, Lyon 1er*, in *Bulletin d'association Français pour l'archéologie du verre*, 6-7, 2000
- MONTEIL M. *ET ALII*, *Dépotoirs domestiques et déchets artisanaux: l'exemple de Nîmes (Gard) au Haut Empire*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 121-132

- MOREL J. P., *Tavola Rotonda*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 281-286
- MORRIS M., *Occupation Debris and Abandonment Events and Processes*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams, Oxford, 2000, pp. 25-34
- MUNN N. D., *The Cultural Anthropology of Time: a Critical Essay*, in *Annual Review of Anthropology*, 21, 1992, pp. 93-123
- MURRAY P., *Discard location: the ethnographic data*, in *American Antiquity*, 45, 3, 1980, pp. 490-502
- MURRAY A. S., OLLEY J. M., *Precision and accuracy in the optically stimulated luminescence dating of sedimentary quartz: a status review*, in *Geochronometria*, 21, 2002, pp. 1-16
- MUZZIOLI M. P., *Aspetti della pianificazione della colonia di Aquileia*, in *AAAd*, 59, 2004, pp. 121-150
- NEEDHAM S. P., SØRENSEN M. L. S., *Runnymede refuse tip – a consideration of midden deposits and their formation*, in *The archaeology of context: recent research on the Neolithic and Bronze Age in Britain*, ed. by J. C. Barrett and I. A. Kinnes, Sheffield, 1989, pp. 113-120
- NICOLINI G., *Circonscription du Poitier-Charente*, in *Gallia*, 35, 1977, pp. 377-379
- NICOSIA C. *ET ALII*, *Medieval Dark Earth in an Active Alluvial Setting from the Uffizi Gallery Complex in Florence*, Italy, in *Geoarchaeology*, 27, 2012, pp. 105-122
- NIELSEN A. E., *Trampling the Archaeological Record: an Experiment Study*, in *American Antiquity*, 56, 3, 1991, pp. 483-503
- NIN N., LEGUILLOUX M., *La gestion des déchets à Aix-en-Provence dans l'Antiquité*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, pp. 133-164
- NOVELLO M., *Il tempio del foro*, in *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006*, ed. by J. Bonetto *et al.*, Padua, 2009, pp. 375-453
- OMARI E., *Esempi di rivestimenti pavimentali con il reimpiego della ceramica nell'area egeo-adriatica*, in *Anales de Arqueología Cordobesa*, 21-22, 2010-2011, pp. 81-91

- ORTON C. R., *«Four pots good, two pots bad»: exploring the limits of quantification in the study of archaeological ceramics*, in *Facta*, 3, 2009, pp. 65-74
- ORTON C.R., *Handling large urban assemblages and their statistics*, in *The Pottery from Medieval Novgorod and its Region*, ed. by C. R. Orton, London, 2005, pp. 117-126
- ORTON C. R. Sampling in Archaeology, Cambridge, 2000
- ORTON C. R., *Model (mathematical)*, in *A Dictionary of Archaeology*, ed. by I. Shaw, R. Jameson, Oxford, 1999, p. 403
- ORTON C. R., *How many pots make five? - an historical review of pottery quantification*, in *Archaeometry*, 35, 2, 1993, pp. 169-184
- ORTON C. R., *Computer Simulation Experiments to Assess the Performance of Measures of Quantity of Pottery*, in *World Archaeology*, 14, 1, 1982, pp. 1-20
- ORTON C. R., *Mathematics in Archaeology*, London, 1980
- ORTON C. R., *Statistical dating of the sequence from trench 2*, in *Southwark excavation 2*, ed. by J. Bird, London, 1978, pp. 460-461
- ORTON C. R., *Quantitative Pottery Studies. Some progress problems and prospects*, in *Science and Archaeology* , 16, 1975, pp. 30-35
- ORTON C. R. *ET ALII*, *Pottery in Archaeology*, Cambridge, 1993
- ORTON C. R., ORTON J., *It's older than you think: a statistical look at an archaeological problem*, in *London Archaeologist 2*, London, 1975, pp.285-287
- ORTON C. R., TYERS P. A., *Counting broken objects: the statistics of ceramic assemblages*, in *Proceedings of the British Academy*, 77, 1991, pp. 163-184
- OUTRAM A. K., *Introduction to Experimental Archaeology*, in *World Archaeology*, 40, 1, 2008, pp. 1-6
- OUTRAM Z. *ET ALII*, *The integration of chronological and archaeological information to date building construction: an example from Shetland, Scotland, UK*, in *Journal of Archaeological Science*, 37, 2010, pp. 2821-2830
- PANCIERA S., *Nettezza urbana a Roma. Organizzazione e responsabili*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 95-105
- PANELLA C., SAGUÌ L. (EDS.)., *Materiali e contesti 2. Valle del Colosseo e pendici nord-orientali del Palatino*, Rome, 2013
- PATTERSON T. C., *Contemporaneity and Cross Dating in Archaeological Interpretation*, in *American Antiquity* , 28, 3, 1963, pp. 389-392

- PEACOCK D. P. S., *Pottery in the Roman World: an ethnoarchaeological approach*, London and New York, 1982
- PEÑA J. T., *Aspects of residuality in the Palatine east pottery assemblage*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 5-19
- PEÑA J. T., *Roman Pottery in the Archaeological Record*, Cambridge, 2007
- PEÑA J.T., *Use of ceramic and numismatic evidence in site chronology* in *The Palatine East Excavations. Vol 1: Stratigraphy and Architecture*, ed. by E. Hostetter, J.R. Brandt, Rome, 2009, pp. 264-267
- PEÑA J.T., *The Pompeii Artifact Life History Project*, in RCRF Acta, 43, 2014, pp. 467-474
- PENDERGAST D. M., *The Lessons of History: Perspectives from Spanish Period Lamanai, Belize, on the Interpretation of Stratigraphy, Core Content and Midden Associations*, in *Onward and Upward! Papers in Honor of Clement W. Meighan*, ed. by K. L. Johnson, Chico, 2005
- PENDERGAST D. M., *Lamanai, Belize: Summary of Excavation Results, 1974-1980*, in *Journal of Field Archaeology*, 8, 1, 1981, pp. 29-53
- PEREZ-SALA M., SHEPHERD J., *The cullet dump and evidence of glass working*, in *London's Roman amphitheatre: Guildhall Yard, City of London*, ed. by N. Bateman et alii, London, 2008, pp. 142-146
- PERRING D., *Lo scavo di Piazza Duomo: età romana e altomedioevale*, in *Scavi MM3: ricerche di archeologia urbana a Milano durante la costruzione della linea 3 della metropolitana: 1982-1990*, ed. by D. Caporusso, Milan, 1991, pp. 105-161
- PESCE G., *Nora. Guida agli scavi*, Cagliari, 1957
- PESCE G., *Nora. Guida agli scavi*, Cagliari, 1972
- PETRIE, W. M. F., *Methods and Aims in Archaeology*, London-New York, 1904
- PETRIE, W. M. F., Diospolis Parva. *The Cemeteries of Abadiyeh And Hu. 1898-9*, London 1901
- PETRIE W. M. F., *Sequences in Prehistoric Remains*, in *The Journal of the Anthropological Institute of Great Britain and Ireland*, 29, 3/4, 1899, pp. 295-301
- PIOVESAN R. *ET ALII*, *Petrographic & Microstratigraphic Analysis of Mortar-Based Building Materials from the Temple of Venus, Pompeii*, in *Interpreting Silent Artefacts.*

Petrographic Approaches to Archaeological Ceramics, ed. by S. P. Quinn, Oxford, 2009, pp. 65-79

- POBLOME J., *Sherds and Coins from a Place under the Sun. Further Thoughts from Sagalassos*, in *Facta*, 2, Pisa-Rome, 2008, pp. 193-213
- POLLARD R. J., *Assemblage Formation Processes: a case study from Leicester*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams, Oxford, 2000, pp. 207-211
- POPPER K. R., *Congetture e confutazioni*, Bologna, 1972. Orig. edition: *Conjectures and Refutations*, London, 1969
- PREVIATO C., *Tecniche costruttive utilizzate nelle case di Aquileia: le sottofondazioni pluristratificate*, in *L'architettura privata ad Aquileia in età romana. Atti del convegno di studio (Padova, 21-22 febbraio 2011)*, ed. by J. Bonetto, M. Salvadori, Padua, 2012, pp. 165-180
- PUSCHNIGG G., *Ceramics of the Merv Oasis. Recycling the city*, Walnut Creek, 2006
- PUTZEYS T., *Domestic Space in Late Antiquity*, in *Objects in Context, Objects in Use Material Spatiality in Late Antiquity*, ed. by L. Lavan et alii, Leiden-Boston, 2007, pp. 49-62
- PYDDOKE E., *Stratification for the Archaeologist*, London, 1961
- QUINN P. S., *Ceramic Petrography*, Oxford, 2013
- QUINN P. S., BURTON M., *Ceramic Petrography & the Reconstruction of Hunter-Gatherer Craft Technology in Late Prehistoric Southern California*, in *Interpreting Silent Artefacts. Petrographic Approaches to Archaeological Ceramics*, ed. by S. P. Quinn, Oxford, 2009, pp. 267-295
- RATCLIFFE J. H., *Aoristic analysis: the spatial interpretation of unspecific temporal events*, in *International Journal of Geographical Information Science*, 14(17), 2000, pp. 669-679
- RATHJE W., MURPHY C., *Rubbish!: the archaeology of garbage*, New York, 1992
- RAUXLOH P., *Stratigraphy, Residuality and a Realational Database*, in *Interpreting Stratigraphy. Site evaluation, recording procedures and stratigraphic analysis. Papers presented to the Interpreting Stratigraphy Conferences 1993-1997*, ed. by S. Roskams, Oxford, 2000, pp. 213-216

- RAVENTÓS X. D., REMOLÀ J. A., *Sordes Urbis, per concludere...*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 139-145
- REINECK H. E., SINGH I. B., *Depositional Sedimentary Environments. With Reference to Terrigenous Clastics*, Heidelberg, 1980
- REMOLÀ, J. A., *Sobre le interpretación arqueológica de los vertederos*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 107-121
- REMOLÀ VALLVERDÚ J. A., ACERO PÉREZ J. (eds.), *La gestión de los residuos urbanos en Hispania. Xavier Dupré Raventós (1956-2006),* in *Memoriam*, Mérida, 2011
- RENFREW C., BAHN P., *Archaeology. Theories, Methods and Practice*, London, 2004. Italian edition: *Archeologia. Teoria, metodi, pratiche*, Bologna, 2006
- REYNOLDS P. J., *The nature of experiment in archaeology*, in *Experiment and Design: Archaeological Studies in Honour of John Coles*, ed. by A. F. Harding, Oxford, 1999, pp. 156-162
- RICE P. M., *Pottery Analysis: a sourcebook*, Chicago, 1987, pp. 226-236, 301-306
- RICCI G., *La sequenza stratigrafica*, in *La fattoria e la villa dell'Auditorium*, ed. by A. Carandini *et alii*, Rome, 2006, pp. 191-201
- RINALDI F. *ET ALII*, *Tappi d'anfora da un intervento di archeologia urbana* apud horrea *a* Iulia Concordia, in *Quaderni Friulani di Archeologia 12/13-2012/2013*, 2014, pp. 65-73
- RINGBOM Å. *ET ALII*, *Mortar dating and Roman pozzolana, results and interpretations*, in *Building* Roma Eaterna*. Current research on Roman Mortar and Concrete. Proceedings of the conference March 27-29 2008. Commentationes Humanarum Litterarum 128*, ed. by Å. Ringbom, R. L. Hohlfelder, Helsinki, 2011, pp. 187-208
- RIZZI G., *Considerazioni sul prolungato uso di moneta romana in relazione alle fasi stratigrafiche e cronologiche di una casa di età tardo romana di Sebatum*, in *Rivista italiana di numismatica e scienze affini,* 87, Milan, 1985, pp. 143-193
- RIZZO G., Instrumenta Urbis. *I, Ceramiche fini da mensa, lucerne ed anfore a Roma nei primi due secoli dell'Impero*, Roma, 2003
- RIZZO G., Samia etiamnunc in esculentis laudantur *(Pl., N.H. XXXV, 160-161). I vasi «aretini» a Roma*, in MEFRA, 110, 2, 1998, pp. 799-848
- ROBERTS JR. J. M. *ET ALII*, *A method for chronological apportioning of ceramic assemblages*, in *Journal of Archaeological Science*, 39, 2012, pp. 1513-1520

- RODRÍGUEZ-ALMEIDA E., *Il monte Testaccio: ambiente, storia, materiali*, Rome, 1984
- RODRÍGUEZ-ALMEIDA E., *Roma, una città self-cleaning?*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 123-127
- ROMANAZZI L., VOLONTÈ A. M., *Gli scarichi tra Porta Nola e la Torre*, in *Nuovi contributi sulle fortificazioni pompeiane*, ed. by C. Chiaramonte Treré, Milan, 1986, pp. 55-113
- ROPPA A., *Il foro: storia delle ricerche*, in Bonetto et alii (eds), *Nora. Il foro romano. Storia di un'area urbana dall'età fenicia alla tarda antichità. 1997-2006, vol.1. Lo scavo,* Padua, 2009, pp. 1-10
- ROPPA A., *Comunità urbane e rurali nella Sardegna punica di età ellenistica*, València, 2013
- ROSKAMS S., *Finds context and Deposit Status*, in *Interpretation of Stratigraphy: a Review of the Art. Proceedings of a Conference held on 18th June, 1992 at the City of Lincoln Archaeology Unit*, Lincoln, 1992, pp. 27-29
- ROSKAMS S., *Excavation*, Cambridge, 2001
- ROSSI C., *Le necropoli urbane di Padova romana*, Padova, c.s.
- ROVELLI A., SAGUÌ L., *Residualità, non residualità, continuità di circolazione*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 173-195
- SAGUÌ L., *Crypta Balbi*, in *Scavi e ricerche dell'Università di Roma La Sapienza*, Rome, 1998, pp. 55-61
- SALIOU C., *Le nettoyage des rues dans l'Antiquité: fragments de discours normatifs*, in *La ville et ses déchets dans le monde romain: rebuts et recyclages. Actes du Colloque de Poitiers (19-21 Septembre 2002)*, ed. by P. Ballet, P. Cordier, N. Dieudonné-Glad, Montagnac, 2003, 37-52
- SANJURJO-SÁNCHEZ J., PÉREZ MATO M., *Delimiting Urban Growth of Santiago de Compostela (NW Spain) by OSL Dating of Medieval Anthropogenic Sediments*, in *Mediterranean Archaeology and Archaeometry*, 13, 3, pp. 163-173
- SANTANGELI R., *Tavola Rotonda*, in *I materiali residui nello scavo archeologico*, a cura di Guidobaldi F., Pavolini C. and Pergola P., Rome, 1998, pp. 268-269
- SCHIFFER M. B. (ED.), *Behavioral Archaeology: principles and practice*, London, 2010
- SCHIFFER M. B., *Formation processes of the archaeological record*, Salt Lake City, 1996

- SCHIFFER M. B., *Behavioural Archaeology: First Principles*, Salt Lake City, 1995a
- SCHIFFER M. B., *Waste not, want not: reuse processes in Tucson*, in *Behavioural Archaeology: First Principles*, Salt Lake City, 1995b, pp. 107-120
- SCHIFFER M. B., *Radiocarbon Dating and the "Old Wood" Problem: the Case of the Hohokam Chronology*, in *Journal of Archaeological Science*, 13, 1986, pp. 13-30
- SCHIFFER M. B., *Archaeological context and systemic context*, in *American Antiquity*, 37, 2, 1972, pp. 156-165
- SCHIFFER M. B., SKIBO J. M., *A provisional theory of ceramic abrasion*, in *American Anthropologist,* 91, n. 1, 1989, pp.101-115
- SCHWEDT A. *ET ALII*, *Post-depositional elemental alterations in pottery: neutron activation analyses of surface and core samples*, in *Archaeometry*, 46, 1, 2004, pp. 85-101.
- SCHINDLER KAUDELKA E., *Magdalensberg. Ceramica e contesti di epoca augustea*, in *Contextos ceràmics i cultura material d'època augustal a l'occident romà. Actes de la reunió celebrada a la Universitat de Barcelona els dies 15 i 16 d'abril de 2007*, ed. by V. Revilla, M. Roca, Barcelona, 2010, pp. 462-488.
- SCHINDLER KAUDELKA E., ZABEHLICKY-SCHEFFENEGGER S., *Céramiques et chronologie: réflexions critiques sur nos façons de dater*, in *SFECAG, Actes du congrès de Langres*, Marseille, 2007, pp.37-48
- SHAHACK-GROSS R. *ET ALII*, *Geoarchaeology in an urban context: the uses of space in a Phoenician monumental building at Tel Dor (Israel)*, in *Journal of Archaeological Science*, 32, 2005, pp. 1417-1431
- SHANKS M., *Approaches to Interpretation in Archaeology*, in *Lo scavo archeologico: dalla diagnosi all'edizione*, ed. by R. Francovich, D. Manacorda, Florence, 1990, pp. 379-399
- SHAW I., Terminus ante quem, in *A dictionary of Archaeology*, ed. by I. Shaw, R. Jameson, Oxford, 1999, p. 570
- SHAW I., Terminus post quem, in *A dictionary of Archaeology*, ed. by I. Shaw, R. Jameson, Oxford, 1999, p. 570
- SHENNAN S., *Quatifying Archaeology*, Edimburgo, 1990
- SHEPHERD J. WARDLE A., *The glass workers of Roman London*, London, 2009
- SHOTT M. J., *Mortal Pots: on Use Life and Vessel Size in the Formation of Ceramic Assemblages*, in *American Antiquity*, 61(3), 1996, pp. 463-482
- SILVERSTRI A. *ET ALII*, *The colourless glass of* Iulia Felix, in *Journal of Archaeological Science*, 35, 2008, pp. 331-341

- SKIBO J., *Pottery Function: a Use-Alteration Perspective*, New York, 1992
- SKIBO J. M., SCHIFFER M. J., *The Effects of Water on Processes of Ceramic Abrasion*, in *Journal of Archaeological Science,* 14, 1987, pp. 83-96
- SKIBO J. M., SCHIFFER M. J., *People and Things. A Behavioural Approach to Material Culture*, New York, 2008
- SLANE K. W., *Corinth's Roman Pottery. Quantification and Meaning*, in *Corinth XX*, ed. by C. K. Williams II and N. Bookidis, Athens, 2003, pp. 321-335.
- SORI E., *La città e i rifiuti. Ecologia urbana dal Medioevo al primo Novecento*, Bologna, 2001
- SOUTH S., *Evolution and Horizon as Revealed in Ceramic Analysis in Historical Archaeology*, in *The Conference on Historic Site Archaeology Papers 1971*, 6, Columbia, 1972, pp. 71-116
- STEIN J. K., *Deposits for archaeologists*, in *Advances in archaeological method and theory*, 11, 1987, pp. 337-395
- STERN E. M., *Roman Mold-blown Glass. The First through Sixth Centuries*, Rome, 1995
- STERN E. M., *Roman Glassblowing in a Cultural Context*, in *American Journal of Archaeology*, 103/3, 1999, pp. 441-484
- STIROS S. C., *The AD 365 Crete earthquake and possible seismic clustering during the fourth to sixth centuries AD in the Eastern Mediterranean: a review of historical and archaeological data*, in *Journal of Structural Geology* , 23, 2001, pp. 545-562
- STONE G. D., *The interpretation of negative evidence in archaeology*, in *University of Arizona, Department of Anthropology Occasional Papers*, 2, 41, 1981, pp. 41-53
- STRAZZULLA M. J., In paludibus moenia constituta*: problemi urbanistici di Aquileia in età repubblicana alla luce della documentazione archeologica e delle fonti scritte*, in *AAAd*, 35, 1989, pp. 187-228
- SULLIVAN III A. P., *Ethnoarchaeological and Archaeological Perspectives on Ceramic Vessels and Annual Accumulation Rates of Sherds*, in *American Antiquity*, Vol. 73, No. 1, 2008, pp.121-135
- SULLIVAN A. P., *Inference and Evidence in Archaeology: a Discussion of the Conceptual Problems*, in *Advances in Archaeological Method and Theory*, 1, 1978, pp. 183-221
- SYMONDS R. P., *Terminus post quem. Datation systématique et représentation numérique et graphique de la chronologie des céramiques*, in *SFECAG, Actes du Congrès de L'Escala-Empùries*, 2008, pp. 607-616

- TARRATS F., *Tárraco, topografía urbana y arqueología de los vertederos*, in *Sordes Urbis: la eliminación de resduos en la ciudad romana*, ed. by X. D. Raventós, J. A. Remolà, Rome, 2000, pp. 129-137
- TAYLOR G., *Deansway Site 3: Ambulance station*, in *Excavations at Deansway, Worcester, 1988-89: Romano-British small town to late medieval city*, ed. by H. Dalwood, R. Edwards, York, 2004, pp. 197-207
- TERRENATO N, *Contesto*, in *Dizionario di Archeologia*, Rome-Bari, 2006, pp. 90-92
- TERRENATO N., *Residuo*, in *Dizionario di Archeologia*, Rome-Bari, 2006, pp. 241-242
- TERRENATO N., *I metodi storico-archeologici*, in *Enciclopedia archeologica, Il mondo dell'archeologia*, vol 1, Rome, 2002, pp. 266-269
- TERRENATO N., RICCI G., *I residui nella stratificazione urbana. Metodi di quantificazione e implicazioni per l'interpretazione delle sequenze: un caso di studio dalle pendici settentrionali del Palatino*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 89-104
- THOMSEN C. J., *Guide to Northern Archaeology*, London, 1848 (English translation of *Ledetraad til Nordisk Oldkyndighed*, København, 1836, by the Earl of Ellesmere)
- TOMBER R., DORE J., *The National Roman Fabric Reference Collection: a handbook*, London, 1998
- TONIOLO A., *Uso e commercio di oggetti da riutilizzare nell'antichità*, in Archeologia Veneta, 25-26, 2002-2003, pp. 109-142
- TRONCHETTI C., *Metodo e Strategie dello Scavo Archeologico*, Rome, 2003, pp. 120-128
- TRONCHETTI C., *Nora*, Sassari, 2001
- TYERS I., *Tree-ring analysis of Roman timbers*, in *London's Roman amphitheatre: Guildhall Yard, City of London*, ed. by N. Bateman *et alii*, London, 2008, pp. 219-220
- TYERS P. A., ORTON C. R., *Statistical analysis of ceramic assemblages,* in *Computer Applications and Quantitative Methods in Archaeology 1990*, ed. by K. Lockyear, S. P. Q. Rahtz, 1991, Oxford, pp. 117-120
- ULRICH R. B., *Roman Woodworking*, New Haven and London, 2007
- VALENTI M., FRONZA V., Lo scavo di strutture in materiale deperibile. Griglie di riferimento per l'interpretazione di buche e di edifici, on-line ed. , 2001
- VAN DE MOORTEL A., *The Area around the Kiln, and the Pottery from the Kiln and the Kiln Dump*, in *Hesperia Supplements*, Vol. 30, 2001, pp. 25-110

- VAN DE WEGHE N. ET ALII, *The triangular model as an instrument for visualising and analysing residuality*, in *Journal of Archaeological Science*, 34, 4, 2007, pp. 649-655
- VANZETTI A., *Le sepolture a incinerazione a più deposizioni nella protostoria dell'Italia nord-orientale*, in *Rivista di Scienze Preistoriche*, 44, 1992, pp. 115-209
- VEAL R., *From context to economy: charcoal as an archaeological interpretative tool. A case studi from Pompeii (3rd c. B.C.-A.D: 79)*, in *More than just Numbers? The Role of Science in Roman Archaeology, JRA Supplementary Series Number 91*, ed. by I. Schrüfer-Kolb, Porthsmouth, 2012, pp. 19-51
- VEYRAT-CHARVILLON A., *Aspects de la verrerie gallo-romaine au Musée d'Aoste (Isère)*, in *Bulletin d'Association français pour l'archéologie du verre*, 1999, pp. 7-12
- VIDALE M., *Che cos'è l'etnoarcheologia*, Rome, 2004
- VIDALE M., *Ceramica e Archeologia*, Rome, 2007
- VILLA L., *Modelli di evoluzione dell'edilizia abitativa in Aquileia tra l'antichità e il medioevo*, in *L'architettura privata ad Aquileia in età romana, Atti del Convegno di studio (Padova, 21-22 febbraio 2011)*, ed. by J. Bonetto, M. Salvadori, Padua, 2012, pp. 591-618
- VILLA P., *Conjoinable Pieces and Site Formation Processes*, in *American Antiquity, 47*, 1982, pp. 276-290
- VINCE A. G., *Some aspects of Pottery Quantification*, in *Medieval Ceramics, 1*, 1977, pp. 63-74
- VINCE A., *The study of Pottery from Urban Excavations*, in *Urban Archaeology in Britain. CBA Research Report n°61*, ed. by J. Schofield and R. Leech, London, 1987, pp. 201-213
- WALLACE C., *Long-lived Samian?*, in *Britannia, 37*, 2006, pp. 259-272
- WATERBOLK H. T., *Working with Radiocarbon Dates*, in *Proceedings of the Prehistoric Society*, 37, 2, 1971, pp. 15-33
- WATSON P. J. *ET ALII*, *Explanation in Archaeology. An Explicitly Scientific Approach*, New York and London, 1971
- WEINER S., *Microarchaeology. Beyond the Visible Archaeological Record*, New York, 2010
- WHEELER R. E. M., *Archaeology from the Earth*, Oxford, 1954
- WHITE E. M., HANNUS L. A., *Chemical Weathering of Bone in Archaeological Soils*, in *American Antiquity*, 48, 2, 1983, pp. 316-322

- WILLIS S., HINGLEY R., *Roman Finds: Context and Theory*, in *Roman Finds: Context and Theory. Proceedings of a conference held at the University of Durham*, ed. by R. Hingley and S. Willis, Southampton, 2007, pp. 2-17
- WILMOTT T., *Excavations in the Middle Walbrook Valley: City of London, 1927-1960*, London, 1991
- WILSON M. A. *ET ALII*, *Dating fired-clay ceramics using long-term power law rehydroxylation kinetics*, in *Preoceedings of the Royal Society A*, 465, 2108
- WOOD W. R., LEE JOHNSON D., *A Survey of Disturbance Processes in Archaeological Site Formation*, in *Advances in Archaeological Method and Theory*, 1, 1978, pp. 315-381
- ZACCARIA C., *Il governo romano nella* Regio X *e nella Provincia* Venetia et Histria, in *AAAd*, 28, 1986, pp. 65-103
- ZANINI E., *Tavola Rotonda*, in *I materiali residui nello scavo archeologico*, ed. by F. Guidobaldi, C. Pavolini and P. Pergola, Rome, 1998, pp. 293-295
- ZANINI E., COSTA S., *Ceramica e contesti nel Quartiere Bizantino de Pythion di Gortina (Creta): alla ricerca della "complessità" nella datazione*, in *LRFW*, 1, 2011, pp. 33-44

Greek and Latin Literary Sources

- *Ausonius, Epigrammata*
- *Cassius Dio, Historia romana*
- *Cato, De agricultura*
- *Columella, Ars agriculturae*
- *Gaius, Institutiones*
- *Herodianus, τῆς μετὰ Μάρκον βασιλείας ἱστορία*
- *Libanius, Or. 50*
- *Macrobius, Saturnalia*
- *Martialis, Epigrammata*
- *Palladius, Opus agriculturae*
- *Petronius, Satyricon*
- *Plinius Senior, Historia naturalis*
- *Ravennatis Anonymi, Cosmographia*
- *Seneca, De ira*
- *Statius, Silvae*
- *Suetonius, Vitae cesarum*
- *Thucydides, Ἱστορίαι*
- *Varro, De re rustica*
- *Vitruvius, De architectura*

❖ Acknowledgements ❖

It is said that every man is an island. I guess that even if it was right, for sure, at the very least, there would be many ships landing and leaving from that island.

Firstly, I wish to gratefully thank my PhD tutor, prof. J. Bonetto, for about ten years of advices, long discussions and field experience, which represent the very origins of this thesis. I also wish to thank my co-tutor, prof. A. R. Ghiotto, for his rigorous and constructive approach to the topic of this work, prof. A. Bevan, for having accepted to supervise me during the semester I spent at UCL, Institute of Archaeology, and for having reviewed this thesis, prof. R. Docter (Universiteit Gent) for having also accept to review this work and prof. D. Perring (UCL) for joining the commission as foreign member.

I also would like to extend my thanks to dott. S. Mazzocchin, dott. D. Dobreva and dott. A. Stella for the precious advices provided in the field of ceramics and numismatics; dott. E. Crema, dott. D. Francisci and dott. F. Da Re provided me with fundamental help in statistical processing and approaches; the staff of the library 'Tito Livio' gently provided me apparently unobtainable papers and I am particularly grateful to P. Cristofoletti and A. Muffato. I am also grateful to J. Hayne, who managed to partially perform a linguistic review of this work and to the students who attended the Aquileia post-excavation seminars held in 2013-14; they helped me to form some ideas which played an important role in this work.

This thesis began life as a Ma dissertation, so I also wish to thank prof. A. De Guio, who was my co-tutor at the time and who provided me with a very good advice when suggested me to spend a period at UCL.

I am grateful to all the friends who shared with me so many hours under the sweltering sun of Aquileia and Gortyna; I wish to cite in particular Emanuele, Caterina, Vanessa, Simone, Giulia, Mattia, Michele, Marianna, Erika, Martina and Valeria.

The PhD project has been funded through a grant of Università degli Studi di Padova, which for me is not just a whatever institution, by my hometown university.

Finally, I would like to thank my colleagues, for having shared the experience of a PhD programme with me, my friends, for the past and the future pints, Vanessa, for having heroically helped me during the last stages of the drafting of this thesis, and, of course, my family, for unconditionally supporting me in every occasion.

All errors are my own.