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études d'égyptologie

Concise Manual for Ceramic Studies

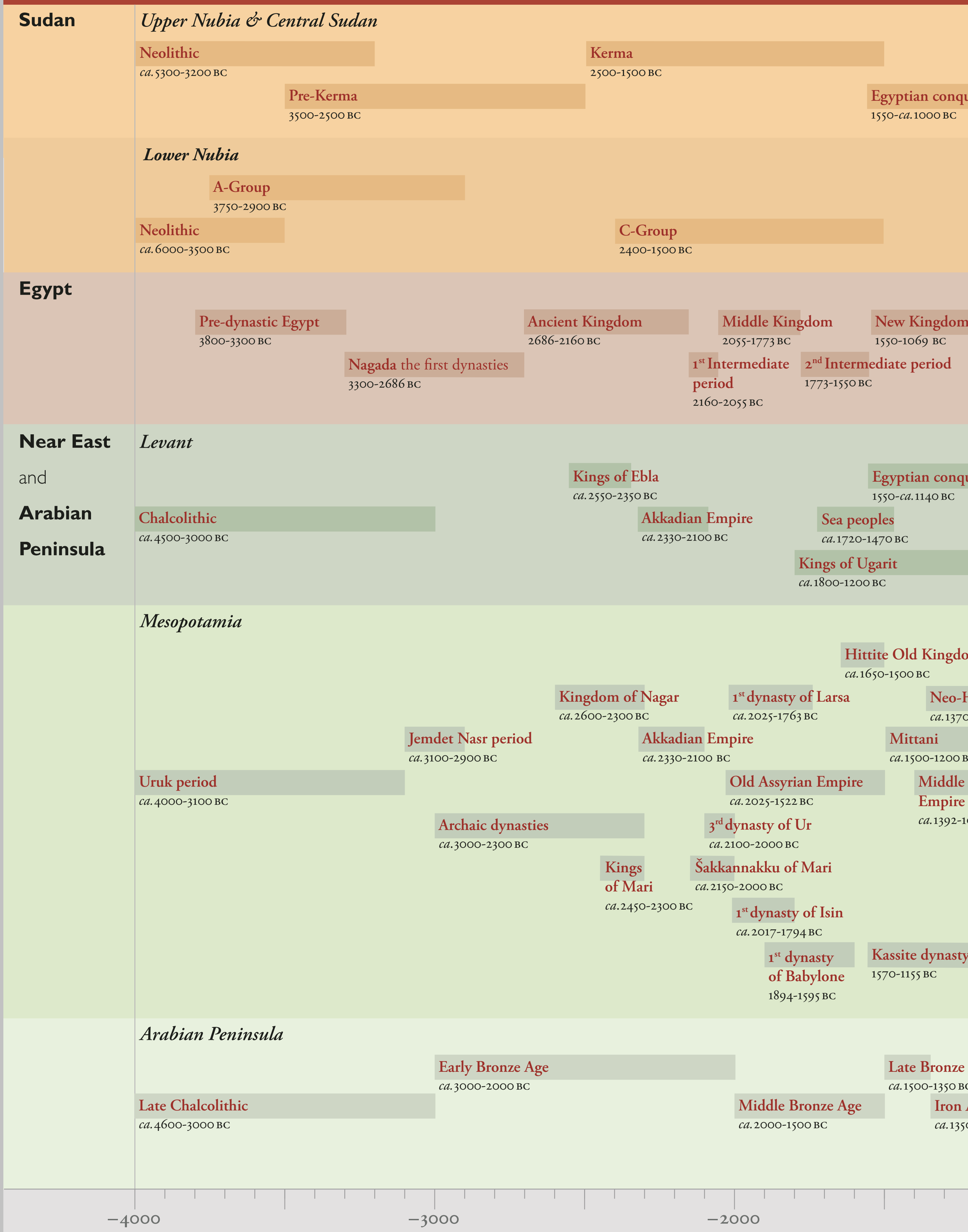
from the Nile Valley to the Middle East

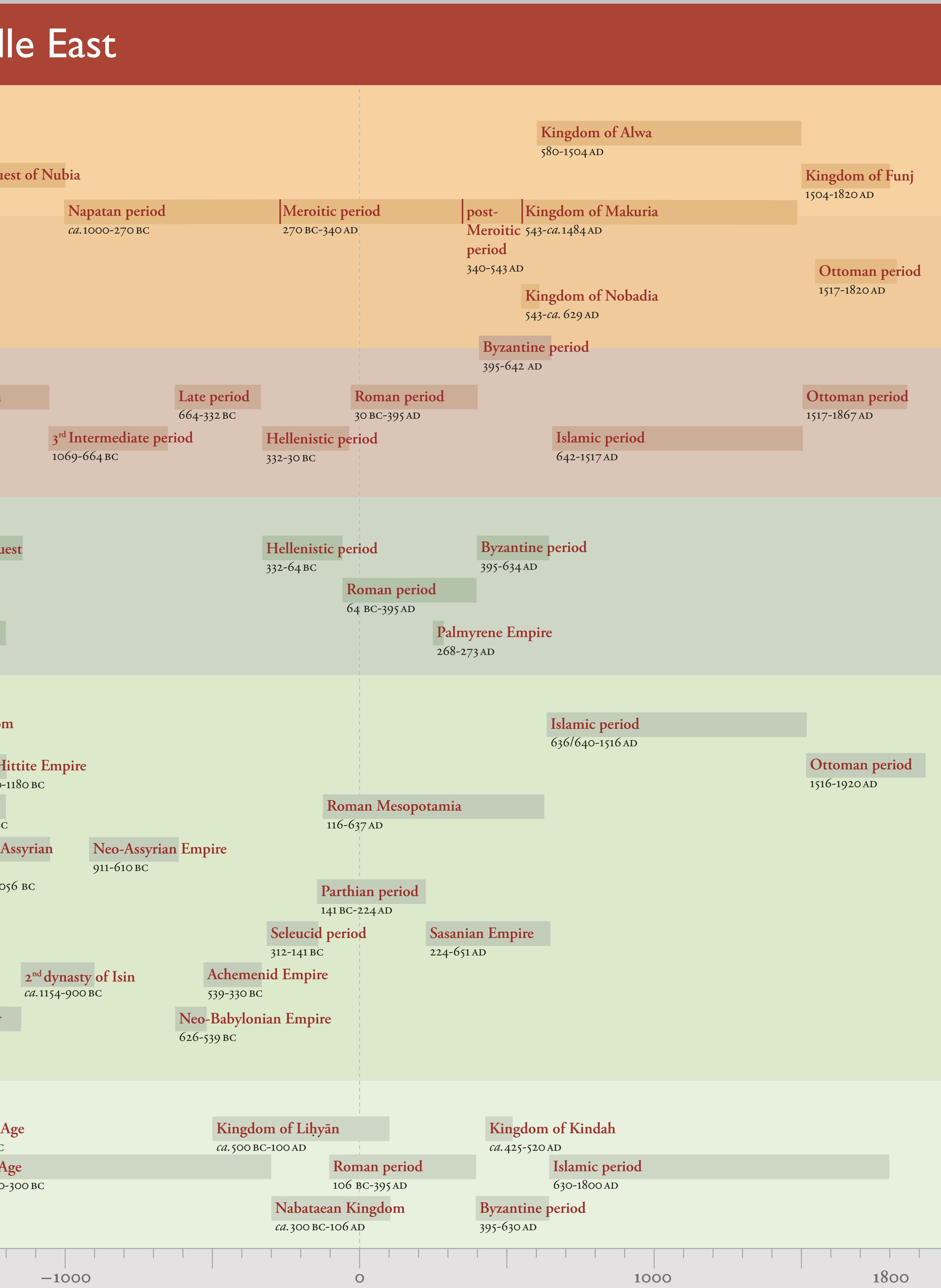
Romain David (dir.)

arabic translation by Mustafa Ahmad

soleb

Comparative chronology of the Nile Valley to the Midd




lle East
Kingdom of Alwa
580-1504 AD
uest of Nubia
Kingdom of Funj
1504-1820 AD
Napatan period
ca. 1000-270 BC
Meroitic period
270 BC-340 AD
post-Meroitic period
340-543 AD
Kingdom of Makuria
543-ca. 1484 AD
Ottoman period
1517-1820 AD
Kingdom of Nobadia
543-ca. 629 AD
Byzantine period
395-642 AD
Late period
664-332 BC
Roman period
30 BC-395 AD
Ottoman period
1517-1867 AD
3rd Intermediate period
1069-664 BC
Hellenistic period
332-30 BC
Islamic period
642-1517 AD
uest
Hellenistic period
332-64 BC
Byzantine period
395-634 AD
Roman period
64 BC-395 AD
Palmyrene Empire
268-273 AD
om
Islamic period
636/640-1516 AD
Hittite Empire
-1180 BC
Ottoman period
1516-1920 AD
Roman Mesopotamia
116-637 AD
Assyrian
056 BC
Neo-Assyrian Empire
911-610 BC
Parthian period
141 BC-224 AD
Seleucid period
312-141 BC
Sasanian Empire
224-651 AD
2nd dynasty of Isin
ca. 1154-900 BC
Achemenid Empire
539-330 BC
Neo-Babylonian Empire
626-539 BC
Age
Kingdom of Liḥyān
ca. 500 BC-100 AD
Kingdom of Kindah
ca. 425-520 AD
Age
-300 BC
Roman period
106 BC-395 AD
Islamic period
630-1800 AD
Nabataean Kingdom
ca. 300 BC-106 AD
Byzantine period
395-630 AD
−1000
0
1000
1800

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Acknowledgements

This manual is based on the observation that to train Arabic-mother tongue ceramic specialists the ability to read books in English, French or German is essential. The language barrier can thus prove to be an obstacle to students interested in ceramic studies and can even curb vocations whilst the lack of specialists is felt worldwide.

In view of this observation, this manual has been prepared primarily for Arabic-speaking undergraduate students thus giving them access to valuable information in their native language. They will discover the rudiments of a discipline in constant progress, regularly enriched with new methods and techniques enabling each and all of us to enhance our knowledge of all daily life aspects of ancient societies. We have, nonetheless, maintained the original English texts to address a wider audience.

A bilingual publication of a book requires concision; we therefore wished to display the voluntarily synthetic nature of the contributions in its title. The aim of the present is not to reproduce the classics of the discipline, from *Ceramics for the Archaeologist* by A. Shepard (1956) to the latest work of V. Roux, *Ceramics and Society* (2019), via *Pottery in Archaeology* by C. Orton, P. Tyers, A. Vince (1993) or *The Oxford Handbook of Archaeological Ceramic Analysis* edited by A.M.W. Hunt (2017), which references remain essential and are mentioned throughout the text, but to encourage readers to take an interest in them in order to perfect their knowledge and sharpen their curiosity by using case studies drawn from work in progress in the Nile valley or in the Near East, to enable them to discover what the examination of ancient sherds actually leads to.

Thanks to close collaboration between researchers from various backgrounds substantial multidisciplinary experience gives substance to the text enriching it with fieldwork and ceramic material that the ceramic specialists encountered. This “practice” of the ceramic material is the primary thread throughout the manual, from the collection on site to the publication of the data.

The different chapters are set out to accompany the reader throughout his or her study. The first chapter thus describes the steps prior to any study, even preceding the fieldwork. The second chapter presents different ceramic processing methods used in the field. The third details the documentary work undertaken once the sorting of the assemblages has been completed. The fourth underlines the role of computers in the organisation and the illustration of the data collected in the field. The fifth illustrates the main issues addressed by the examination of the ceramic material and, finally, the last highlights the work carried out within the various institutional partners of this book.

It is important to remember that all experience is collective. The *Section française de la direction des Antiquités du Soudan* (Sfdas) initiated the present manual and ensured its scientific publication, supported, both scientifically and financially, by the *Institut français d'archéologie orientale* (Ifao), the *Institut français du Proche-Orient* (Ifpo) and the *Centre français de recherche de la péninsule Arabique* (Cefrepa). We address our thanks to Marc Maillot, Laurent Coulon, Michel Mouton and Abbès Zouache, respectively the directors of these institutions, and to three members, namely Sylvie Marchand, Dominique Pieri and Valentina Vezzoli, for their precious role in the very conception of the work. Special thanks to Saskia Buechner-Matthews, the silent architect and the most constant supporter of this work. Secondly, the majority of the sections composing the book were written by a number of contributors working in different geographical areas and these fruitful acquaintances gave birth to a collective reflection on the relevance of the content in order to supply the most useful information possible in the imposed format. I would like to express how happy and honoured I am for all your contributions to this manual. The English texts were proofread and corrected under the guidance of Sandra Jaeggi whose responsiveness and professionalism proved to be a considerable asset. Mustafa Ahmad, the true craftsman of this manual, artistically translated all the texts into Arabic and brought the book to life. These translations were reviewed by Wafa Sharif Dawod Hussein whose comments enabled the necessary adaptations to be made rendering the texts accessible to the diverse readers from the Arab world. Finally, *Soleb* editions and particularly Olivier Cabon have, in addition to their remarkable editorial work, made a very rare gesture for which I warmly thank them, rendering free distribution of both the paper volumes and their digital counterpart possible.

My deepest thanks to all those who made the present manual possible ■

[R.D.]

Archaeological studies focusing on ancient pottery are considered one of the most important branches of archaeology in the modern era, as they shed light on many research aspects relating to the history of the occupation of a site or region, ancient manufacturing techniques and their development throughout history, cultural styles and traditions and their correlation with the ethnicities and peoples who inhabited an area or migrated to or from other areas, as well as many other cultural aspects.

The Arab Library lacks studies relating to the methods of studying archaeological pottery from a scientific and methodological point of view, especially in light of the concentration of scientific research in this field implemented abroad, and therefore the publication of such research and work methodologies in foreign languages, consequently forming a gap in the Arab Library pertaining to this field. Hence the idea of this guide was launched by Romain David, a specialist in pottery of the Nile region in Egypt and Sudan, who worked hard to bring this work to light, with the scientific and financial cooperation from several French research centres in the Arab world (Sfdas, Ifpo, Ifao, and Cefrepa). This work is the result of the efforts of several researchers specialised in pottery, who drew up summaries of the methods they practice in studying archaeological pottery in accordance with the latest scientific methods.

I had the honour of translating this manual into Arabic, and being a pottery specialist myself, I cannot deny the pleasure I felt throughout this work, especially as I am conscious of the need of the Arab library for such specialised scientific publications in the field of methodological studies of pottery, in addition to the demand for students in Arab universities, as well as for pottery specialists. During my work on the manual, I proceeded with an accurate translation transferring the original content to the Arabic version. I tried my utmost to maintain the same spirit in the translation and to strictly respect the original text by preserving the desired meaning without changing the structure or content, taking into account the appropriate linguistic style in the structure of the Arabic language. One of the most challenging difficulties I faced was to find the appropriate scientific vocabulary in the Arabic language, especially that describing pottery in terms of shape, paste or inclusions but also other associated terms from the point of view of a ceramist. Sometimes I indicated the term in its original language (English here) along with the Arabic translation in order to avoid confusion for the reader between the meanings of the selected Arabic terms.

To conclude, I would like to address my sincere thanks to Romain David for choosing me to translate this manual into Arabic, and to Abbès Zouache, Director of the French Centre for Research in the Arabian Peninsula (Cefrepa), for recommending me for this work. Many thanks also to all my colleagues and friends who participated in this manual ■

[M.A.]

Summary

Summary

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The First Steps on the Field

This chapter presents the elements that should be taken into consideration on the arrival of a ceramic specialist on an archaeological fieldwork mission. The specialist may have already defined the general strategy with the field director, but this can nonetheless be adapted in view of the ceramics discovered during the excavation (see Section 1.1). For example, the number of potsherds unearthed per day can vary from a few to a few thousand depending on the context excavated. Moreover, the implementation of a zone devoted to the processing of the ceramic study and its storage is crucial (see Sections 1.2 and 1.3). This zone must be comfortable enough to work in and set up in the best possible conditions (in the shade when possible, with enough space to spread the potsherds out on the same surface) and sustainable for the duration of the excavation ■

Definition of Methodology according to the Archaeological Context I.1

The approaches suggested in this manual are not intended to be final but rather represent common situations encountered in the study of ceramics from archaeological contexts. It is important to remember that every context is unique and those working with ceramics will be challenged by different issues and expected to adapt their methodology to the context being investigated.

The study of ceramic finds is always affected by the kind of investigation being carried out (e.g. survey, test trenches or an excavation, be it a settlement, temple, or cemetery). The aims of the study are typically decided upon by the senior ceramic specialist or finds officer in collaboration with the field or project director before starting (Orton et al. 1993, pp. 39-43). The equipment and the suitable strategy to achieve such aims should be organised prior to the commencement of fieldwork, ensuring that sufficient counting and description sheets, as well as an adequate zone for cleaning, drying and storing, are available.

Ceramics from diverse contexts provide various kinds of information. Their immediate value might be quite specific and directly related to the aims of the project, such as dating a settlement in a surveyed region. However, this should not be reflected in selective handling of material, which should always be consistent and unbiased. Materials may be of use to future researchers and stored accordingly.

Materials may provide information on chronological matters (i.e. dating a specific context or determining the lifespan of a settlement or region), social or economic aspects (i.e. determining settlement use and day-to-day activities), as well as technology, such as skills, knowledge and complexity (i.e. documenting specific techniques, such as the use of the potter's wheel or glazing).

Archaeological Survey

Material collected during field survey commonly originates from the ground surface. Depending on the kind of survey, the assemblage may be from a specific, intensively investigated area or from a much wider geographical region. These differences are likely to have an effect on the methodology of collection. In the first case, it may be preferable to collect diagnostic sherds only, whilst in the second, collection according to a transect may be best (i.e. collecting along a single line, with surveyors spaced at regular intervals from one another). The definition of "diagnostic" sherds should be clearly defined and communicated to those collecting e.g. rims, bases and handles, as well as decorated body fragments.

Assemblages from survey might comprise multi-period finds or differing single-period sites, possibly requiring many specialists or only those with multi-period knowledge for the identification of sherds. This is necessary for the construction of a regional chrono-typology (see Section IV.2). Comparison with assemblages from neighbouring sites or regions is fundamental for the identification of ceramic types. The study of survey material will help determine the lifetime of the investigated area, the localisation of settlements for each period and possibly phases of occupation and abandonment.

Test Trenches

Test trenches are the first glimpse of what to expect from a large-scale excavation and help provide a general overview of the chronology for a site. Here, material can provide preliminary dating for stratigraphy. Material recovered from test trenches should therefore be treated in the same way as that from archaeological excavation (see *infra*).

Archaeological Excavation

If survey or test trenches have already been undertaken, the archaeologist will benefit from initial studies of the pottery and its relationship to the stratigraphic sequence.

Different kinds of contexts will furnish diverse information useful in the interpretation of finds: for example, a collapsed ceiling could offer a homogeneous ceramic assemblage corresponding to a specific phase of a building, whereas the accumulated fill of a building or pit will more likely provide a multi-period assemblage.

All material from an excavated area should be documented and specialists used for further in-depth study and analysis. It is possible to apply selective approaches if a chrono-typology for a site has already been established. However, this does not mean that diagnostic sherds should be discarded. They should be stored for future study. Refitting analysis should include investigations across stratigraphic layers, as these are frequent and help to reconstruct the full morphological repertoire within an assemblage.

Even in the case of mixed layers, ceramics can provide useful estimates of the beginning or end of a deposition event.

In collaboration with field archaeologists, it is possible to observe evolution in decoration, shape, and technology during the lifespan of a building or site within a ceramic assemblage. This helps in the construction of the chrono-typology and provides important guidance for future excavation ■

[V.V. & S.B.-M.]

Management of the Ceramics during Fieldwork 1.2

One of the main objectives of the recording process is to gather as much information as possible with regards to the provenance: correlating the composition and context of the ceramic assemblage. Often archaeologists only return to study materials years later and it is therefore of the utmost importance that the information thereon be stored and archived in the best possible manner.

The first step takes place in the field: ceramics from each layer should be placed in separate buckets/boxes/bags which must be identified using clearly written tags which must include all relevant information: e.g. the site code, the year of excavation, the sector or area, the stratigraphic unit or context of excavation, etc. It is also quite common to add a specific date of excavation. Sunlight can destroy the ink pigments (including markers, ballpoint pens, etc.), rendering the tags useless. The best choice is to use a lead pencil, which does not blur when in contact with moisture.

When the material arrives at the dig house or wherever the ceramic processing is to be carried out, a preliminary assessment should take place. If time is an issue, safe storage of all associated material, including labels, should be undertaken.

Washing should not be undertaken just to clean the material as this could cause loss of valuable information (Orton et al. 1993, pp. 51-52). The material should firstly be thoroughly assessed, and a selection made of material not to be washed. This should include pottery with painted decoration, food residues, plaster or soot. It is preferable to leave the cleaning thereof to an expert.

After careful and delicate washing, it is highly recommended to ensure that all provenance labels are safely secured alongside the relevant pottery, and if the finds are left outside to take extra care to prevent the label from blowing away and thus the pottery getting mixed up with other contexts. Placing tape on the sorting tables, around each individual assemblage, is advised and it also enables additional writing or notes to be added to the tape.

It is quite common to commence the recording, sorting and quantification of an assemblage from a single context as a first step before it has even been inventoried. These actions can include preliminary sorting—including counting rims, handles, bases and body sherds—into defined established groups (see Section III.1). Occasionally, the weight of an assemblage is also used as a quantification factor. Later on, more detailed recording will provide preliminary interpretations of the assemblage, including:

— the function: cooking ware, storage jars, tableware, etc. (see Section II.2);
— the fabric: beige ware, red ware, siliceous or others (see Section II.3);
— the type: a bowl, pot, jar, plate or maybe imports such as amphora, *sigillata* etc. (see Section III.4).

Following the reviewing, selecting, washing, refit assessment and quantification process, some of the material (such as non-informational body sherds) can be discarded.

On completion of the above, the inventory (see Section III.3) can take place, as well as a primary evaluation of where to place vessels within the chrono-typology or form catalogue (see Sections III.2. and V.1).

Another useful reference tool to aid future study of the assemblage is to take photographs of material from the complete context before putting it into storage. The assemblage should then be stored together (e.g. in plastic bags with a more detailed written label (see Section I.3). To avoid any possible loss of provenance, a very useful safety measure is to place a label both inside and outside the container comprising additional information concerning the contents ■

[S.B.-M. & V.V.]

site	season	rec. name	rec. date	sheet no

Context management form

Sector/area/trench	N° Context/Str. Unit/Spit/locus, etc.	Photo Overview photo ☐ Selective ☐

Context

Type Layer ☐ Pit ☐ Fill ☐ Spit ☐ Other ☐

Closed ☐ Accidentally mixed in process ☐
Closed-mixed ☐
Disturbed ☐ Mixed with ....

Context priority
1 2 3 4 5
very high … very low

Priority for
Dating ☐ Samples ☐
Pottery forms ☐ Small finds ☐

Dating

Suggested Dating ....
By material ☐
By C14 ☐
By stratigraphy ☐
Comments ....

Pottery Sampling Strategy
in the field

All ☐ Diagnostics ☐ Selective ☐
Comments ....

Number of Bags
from the Fields

Comments ....

Washing

Unwashed review ☐ To be washed ☐
Washed ☐

Refitting

Comments ....

Professional Conservation

Yes ☐ No ☐
Comments ....

Quantification
cf. Quantification form

Yes ☐ No ☐
Total NR ....
Total MNI ....

Inventoried Vessels

What has been inventoried?
All vessel units ☐
Representative selection ☐
Focus selection ☐
Comments ....

Pottery documentation process (status)
ID ☐
Description ☐
Drawing ☐
Photo ☐
Fabric ☐
Comments ....

Small finds documentation process (status)
ID ☐
Description ☐
Drawing ☐
Photo ☐
Comments ....

Sampling

Samples taken Yes ☐ No ☐

Sample types
Pottery ☐ Animal remains ☐ Other ☐
Soil ☐ Botanical remains ☐ ....
Human remains ☐ Charcoal (C14) ☐ ....

Samples exported
Yes ☐ No ☐

Storage

N° of bags stored/season .... **N° of bags discarded/season** ....
Place of storage .... **Place of discard** ....

Storage and Conservation Strategy 1.3

The safekeeping and storage of objects, especially in respect of their provenance, is a crucial part of all archaeological missions but one often subject to financial constraints (Orton et al. 1993, pp. 98-104). Here we shall address a few of the positive and negative aspects concerning this topic.

Labelling and Ensuring Long-lasting Readability of Tags

The use of a plastic label or the placement of a paper label inside an additional plastic bag to prevent dampness or destruction by insects, rodents or other animals (e.g. termites) is as important as the right choice of a pencil. Using a lead pencil prevents the writing and thus the provenance from fading if exposed to a UV light for instance or from blurring in the case of dampness. Moreover, a record of all stored bags, their contents and their provenance, including non-documented material, should be considered.

Storage Containers

Whilst plastic zip-lock bags are the most common means for storing objects, a long-term option is the use of textile bags. To store larger assemblages, wooden boxes, metal boxes, plastic containers, rubber buckets or even organic baskets can be used. However, it should be clear that almost all container types have disadvantages. For instance, destruction by insects (mainly termites) can affect all containers made of organic material such as baskets and wooden boxes.

Whilst plastic containers or bags suffer damage from heat and, as they age, become brittle resulting in the disintegration thereof. The longest lasting containers are metal boxes, but they can get extremely hot resulting in humidity issues if they are too airtight. The rubber (car tyre) buckets are very sturdy but have no lid. A further option for more complete vessels would be either metal or organic material ring stands (even finished rolls of tape serve the purpose).

Things to Avoid

Thin plastic bags, purchased at supermarkets, are still commonly used due to their availability and low cost; however, they are the worst possible choice for storage as they often age very badly and fall to pieces within a year.

Moreover, sherds often have sharp edges which can easily pierce holes in thin bags letting small sherds and labels fall out, again resulting in the loss of both information and provenance. If no other solution is available, the use of multiple bags inside one another to ensure security of provenance is a must and these should be replaced by better quality bags as soon as possible.

How to Store

It is important to ensure that heavy objects are not placed on top of fragile objects. Large vessels are better stored on the bottom shelve or on the floor using a ring stand.

Humidity

Humidity or dampness can cause major issues to objects. Pottery can suffer from mould/mildew and humidity can cause metal objects to corrode further, turning them into unrecognisable lumps. For smaller objects, anti-condensation pearls made from silica gel are used to absorb moisture. When storing pottery, it is important that the pottery is very dry. Sometimes it can be good idea to leave a small section of the zip-lock open to allow air to circulate and evacuate any excess moisture.

Shelving

Providing shelf units can be a major but vital financial investment. The shelves should be secure and stable and made of metal or wood (again, caution must be taken concerning termites). If the quality of the shelving is poor, they may collapse and not only damage the objects but also mix-up provenances, once again resulting in loss of information.

Sustainability

Seasonal check-ups and necessary adjustments must be made to ensure upholding of the state of preservation of objects as well as their storage containers and, should any problems or damage be witnessed, these should be repaired as soon as possible to avoid any further deterioration ■

[S.B.-M.]

II Ceramic Classification

This chapter addresses an inextricable issue for the ceramic specialist: how to sort the ceramics discovered? Many scholars have already approached the topic either in a theoretical frame (see Section II.1) or in more practical terms (i.e. Shepard 1956, pp. 306-322; Orton et al. 1993, pp. 67-86; Santacreu et al. 2017). Here, we will describe several methods experimented in Sudan or in Egypt, each clearly related to a specific purpose: one can first opt for appropriate field sorting groups to address chronological issues (see Section II.2) and then turn to fabric classification to question the provenance (see Sections II.3 and II.4) or to technological groups to approach the cultural aspects of the ceramic production (see Sections II.5 and II.6). It is important to keep in mind that none are ideal as each method provides specific information complementing the others. A generic form is proposed to illustrate the main attributes considered in each method. Most of them are common to each form but differ in the hierarchical order selected. For instance, the field-sorting groups' classification will favour external visual criteria while the fabric classification will be more concerned by internal characteristics using the support of laboratory analyses. The reader can adopt one of these forms or draw inspiration from them to define a personal file which will probably be better adapted to the ceramics to be studied ■

Classification: the Language of Observation II.1

Introduction

All scientific activities require that we organise the infinite variation of unfamiliar things so that we can make sense of them. The humble pot sherd is no exception to this. The remains of the past must be sorted and organised into archaeological units—which we variously label "type", "class", "series", "group", etc.—so that they can be used for study. This is achieved by means of classification. Its role is therefore central to archaeology. These are also the means by which we communicate our ideas to fellow archaeologists, scientists and members of the public. Classification is our language of observation.

This is an enormously complex subject, and includes not just methodological challenges but matters of philosophy and metaphysics. The intention here is to introduce some basic aspects of the structure of classification (fig. 1) and highlight some of the consequences that result from different approaches and kinds of units. The most important discussion on this subject is Dunnell (1971), as it is the singular review of the form that classification has actually taken in archaeology, which he compared to that used in other sciences. A useful companion for discussion is Adams and Adams (1991), who looked at its practical application in more detail. The study of Dunnell will largely form the basis for the outline of classification described below. Many aspects of this structure may seem unfamiliar, even to experienced ceramic specialists, as most have been content to concern themselves only with practical problems, rather than how or why classification works. We hope that this brief outline will act as a primer and encourage further exploration of these issues in order to develop a better understanding of this important subject.

The Structure of Classification

Terminology

All fields of scientific practice carry the weight of specialised terminology. Sadly, archaeology maintains a terrible history of using quite useful terms in all sorts of inconsistent ways and usually without definition. This is typified by the use of "typology" and "classification" as meaning the same thing, when they do not. As we shall see below, typology is a special kind of classification. The term "type" has also been abused, having been applied to units of different kinds (how they are made), and different sorts (what they comprise), ranging from form to decoration to technology. The kind of unit cannot therefore be determined by its label. Moreover, different regional or period studies in archaeology also tend to employ different terms, as used by the distinct traditions of archaeology in each country. Thus, it is important to be aware of these differences.

Different Kinds of Units

In differentiating between *sort* of unit (what it is made of), the student of pottery must be aware of what it comprises (parts of pots, whole pots, etc.) before comparing it to other units, as well as what *kind* of unit (how it was made) it is. Two of the most important aspects to consider are "rank" and "definition".

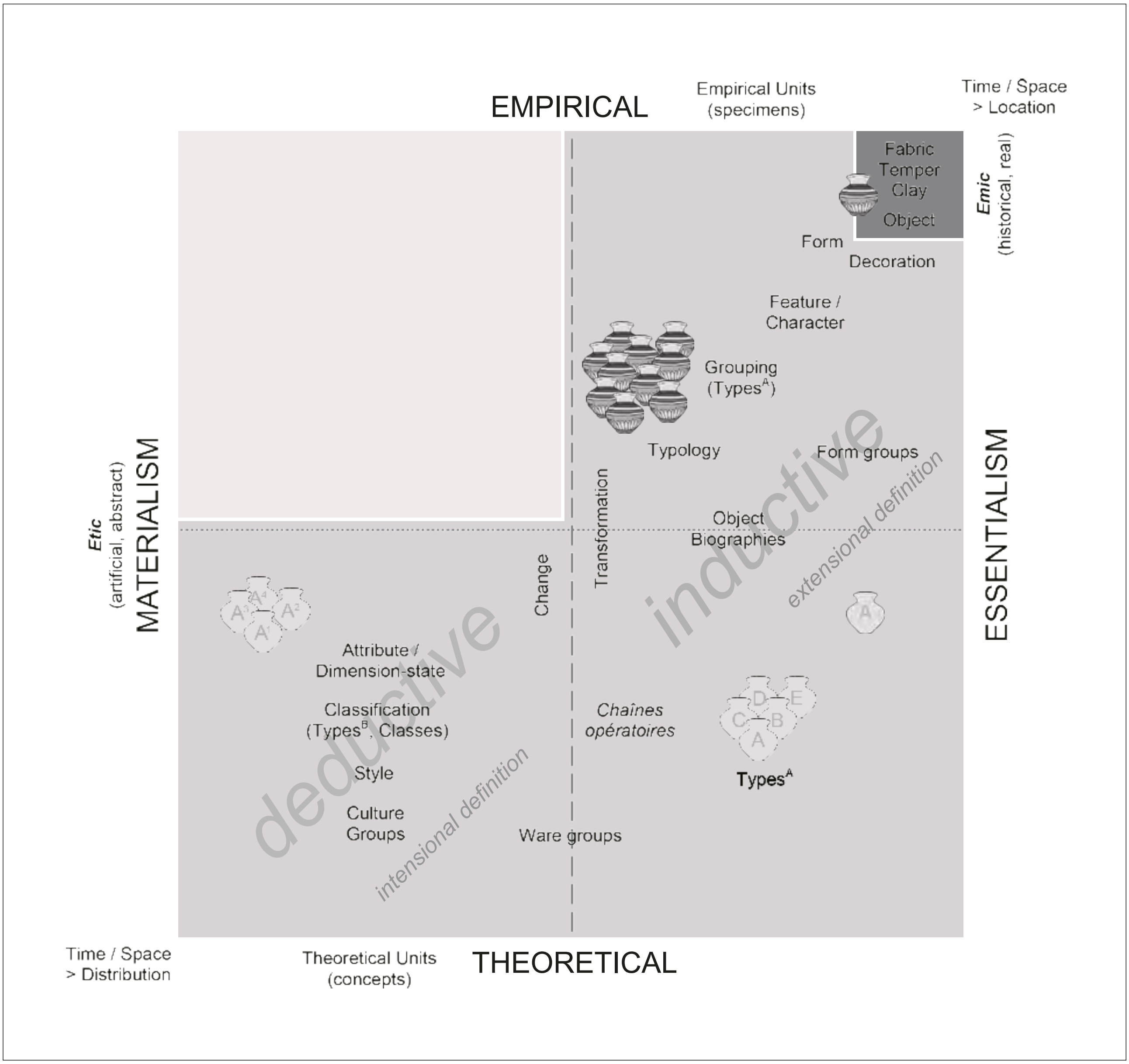


Figure 1. Structure of archaeological classification and the relationship between 1) empirical units (i.e. real things) and theoretical units (i.e. concepts), and 2) the processes of grouping, typology, and classification, and the kind of units that result from these (based on Dunnell 1971; with modifications after: Adams, Adams 1991; O'Brien; Lyman 2000; Rice 1987; Bortolini 2017).

Rank is important for deciding if units are of the same sort or not. This largely depends on their scale, for example if they are based on part of an object (e.g. handles, rim, etc.), a whole object (e.g. shape, volume, etc.), or an assemblage, with each representing different levels of inclusiveness. This can affect such things as temporal or spatial distribution patterns (fig. 2) or the degree to which they measure variation (fig. 3).

The procedure for definition (how it was made) affects the kind of unit. There are two sorts of definition, "extensional" and "intensional". Extensional definition derives criteria for grouping things together from the objects themselves. This results in units that are quite internally homogenous or similar. However, the differences between groupings are not necessarily based on consistent criteria, as they were selected for defining internal similarity rather than external difference. This can be described as an inductive or bottom-up approach. Intensional definition is based instead on specific criteria chosen by the archaeologist to address a particular analytical question. As the units are based only on these criteria, they can be quite internally heterogeneous or varied, as the definition ignores all other variation. This can be thought of as a deductive or top-down approach.

Different Kinds of Classification

These differences provide an important basis for distinguishing further structural differences within classification, to which we apply the terms "typological classification" and "classification".

Typological classification derives from the initial procedure of sorting things into groups by the selection of multiple related criteria (e.g. shape, decoration, attachments, etc.). These provide the basis for the group. Typological classification therefore comprises a particular kind of classification, concerned with—and derived from—these groupings and the classes that result from them. These kinds of classes, called *types*, are extensional units, as described above. Because the process is largely intuitive, with different groups often based on different criteria, definitions for types often take the form of written descriptions. Typological classification therefore derives from the field of *empirical* things: pottery sherds and vessels. As a consequence, the purpose of typology is closely related to the sorting of pottery from excavation or survey, and the production of catalogues. Its empirical basis means it has limitations in the field of analysis and explanation.

Classification, unlike typology, does not deal with empirical things. Here, we must imagine that our sherds and vessels have been packed away. Thus, emphasis is on analysis rather than sorting. Classification is concerned exclusively with concepts or theoretical units, called *classes*. Their criteria are defined by the archaeologist to address a specific problem. If a type is supposed to mimic something real, a class is instead a measuring device, like a centimetre or gram.

Much of the structure of classification and its output is defined by these two distinct (but related) fields: empirical and theoretical. Groupings are empirical units, comprising much of the initial or in-field ordering of archaeological data. Here a unit comprises something real. As we address other concerns, emphasis will shift to theoretical units, where the archaeologist has left the pottery itself behind and begins the critical work of the analyst. Here types, initially based on groupings, can often transition from empirical to theoretical units, or are replaced by more suitable classes. This procedure can be traced in fig. 1, moving from the top-right to bottom-left corner.

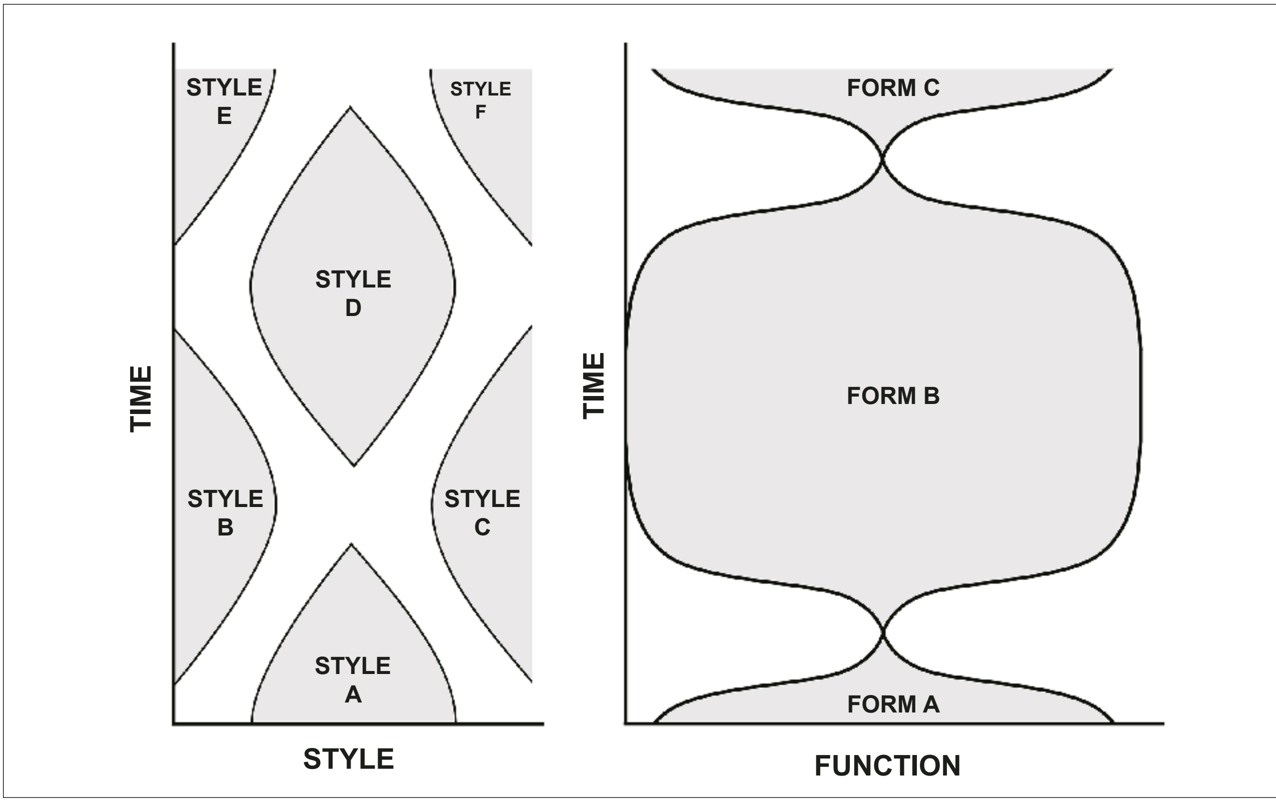


Figure 2. Example of the different distributional patterns in time and space that result from using different criteria in the construction of archaeological units, based on a typical pattern produced by stylistic and functional criteria (after ALLEN 1996, fig. 1).

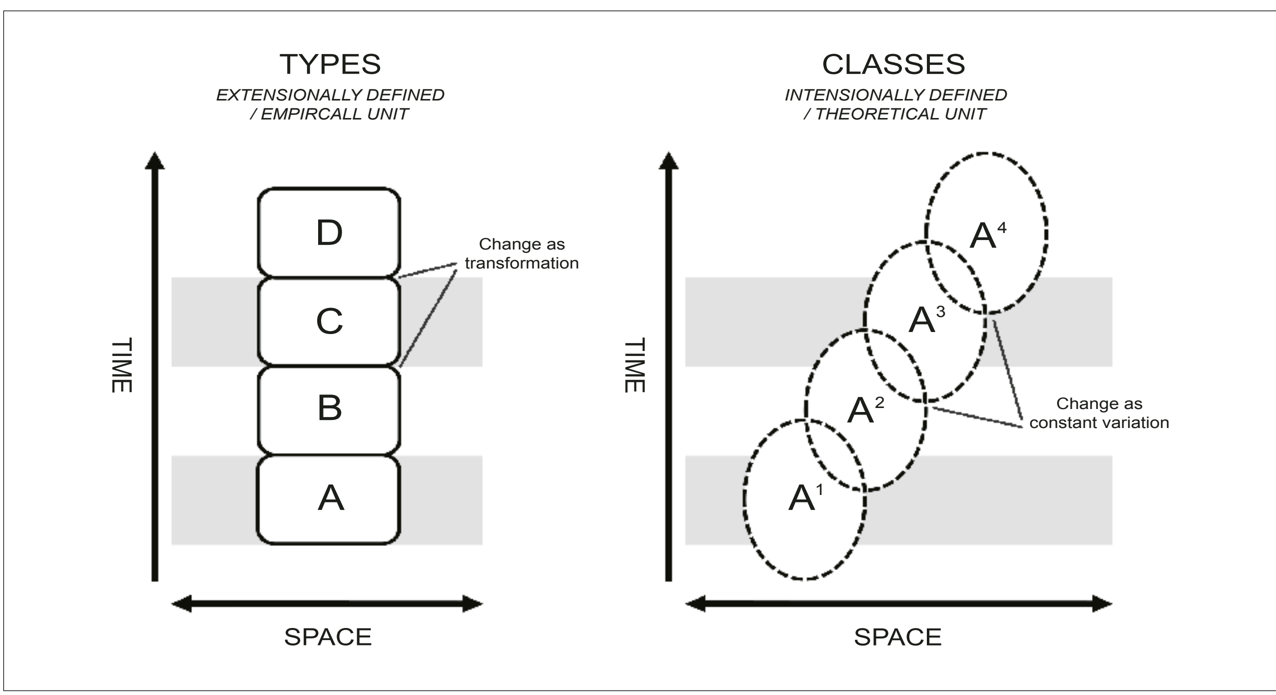


Figure 3. The different distributional and relational patterns typically produced by type units and class units in time and space. Types, based on "extensional" definitions, result in patterns where time is discontinuous and change between units is transformational, whilst classes, based on "intensional" definitions, results in patterns where time is continuous and change measures variation (representing the differences between essentialist (change as transformation) and materialist (change as constant variation) perspectives respectively (after O'BRIEN, LYMAN 2000).

Pragmatic and Analytical Approaches

The above structure is embodied in all forms of ceramic analysis, with the differences between 1) levels and rank, 2) extensional and intensional, 3) grouping, typology and classification, and 4) empirical and theoretical, having tangible effects on everything from the comparison of medieval ceramic industries, the reconstruction of style complexes, to *chaîne opératoire* for pottery production.

These differences should not be thought of as mutually exclusive. Selecting between them is a matter of purpose. If you are in the field, faced with sorting pottery resulting from an excavation, or museum, confronted with an unsorted collection, you are likely to employ extensional grouping methods to create units. Faced with a specific research question, you are more likely to employ well-designed intensional classes. Types, for example, are remarkably useful for dividing up time and space, and have traditionally provided the basis for constructing chronologies and delineating spatial divisions, such as archaeological cultures, exchange patterns or ceramic industries. Intensional units are better for defining variation (fig. 3). As a consequence, types are good for defining limits or borders between distributions, whereas classes are good for studying transmission and innovation. Such units are complimentary, serving different problems. No particular approach, kind or scale of unit, is necessarily better or worse in their own right. The tasks with which we are faced and the use to which we will put them is what determines which is right and which is wrong ■

[S.Mat.]

Field Sorting Pottery Groups II.2

Purpose of a Field Sorting

A ceramic pot is a manufactured container used for diverse activities. These include, for instance, storing products in small or large quantities, the transformation of products from one condition to another through cooking for example, or for serving and eating such as containers.

Besides its practical utility, a pottery vessel also reflects a state of technological development represented by techniques of shaping the vessel, the thickness and hardness of the material, the chosen surface finish, and the decoration (see Section II.5). This includes traditions concerning style and fashion. Like any other manufactured object, it is not only "just" a technical product but also embodies social and cultural meanings.

In order to study these aspects, the classification of pottery into a useful analytical corpus during the fieldwork is therefore a major task, representing an essential first step in characterising an ancient society via its material culture.

The initial sorting of a pottery ensemble into groups is the primary part of the classificatory process and usually takes place in the field where the volume of pottery is the most abundant. Thus, the sorting work needs to be simple and fast and does not usually involve the use of magnification tools or other specialised scientific equipment. Often, primary sorting of a pottery ensemble is undertaken as a practical means of organising the huge, sometimes daunting, range of variation typically exhibited by newly excavated material. Once completed, it allows easier comparison with pottery forms and groups from other archaeological sites and assists the discussion with colleagues about the possible dating and origin of the vessels represented by the potsherds.

Creation of "Field sorting pottery" groups

The core step is the initial creation of groups into which the material can be sorted. For example, a simple grouping method, based on one or more limited criteria (manufacturing techniques; type of production; supposed function; etc.), can be established as a base. Each group can be defined by a group code such as "Pottery group 1" which, when applied consistently, can be developed further according to the variations in the pottery identified necessitating further groups or sub-groups.

Examples for such groups could be:

"Pottery group 1": wheel-made pottery, which can contain open and closed shapes of small to medium sized vessels, such as smaller bowls, cups, dishes or small bottles and jugs, categorised as fine ware used mainly for serving food and/or maybe the preparation thereof, thin-walled with a hard matrix structure using mineral temper, oxidised/reduced and well fired.

Additionally, or subsequently, a sub-group *might be added:*

"Pottery group 1.1": wheel-made pottery, fine ware, including "only" open shapes of small to medium sized vessels such as bowls, cups, small dishes etc.

Another example for a group could be:

"Pottery group 2": wheel-made pottery, closed shapes (e.g. jars), coarse ware, used for storage and maybe food preparation, with wall thicknesses from medium to thick, a medium hard to crumbly matrix structure with organic temper inclusions and often an oxidised firing, ranging from well to uneven firing.

A further example could be:

"Pottery group 3": hand-made pottery, open shapes such as open pots, deep bowls or large plates, coarse ware, used for cooking and possibly preparation with medium sized wall thickness, rarely thick, crumbly to medium hard structure with organic and mineral temper, and an oxidised uneven firing.

Often this process is highly influenced by experience, detail, and pragmatism—including the expected volume of material to be classified, the scope and longevity of the project, and even the subject of pre-planned research publications—guiding the ceramic specialists as they create and divide groups and sub-groups during the field season. An average number of 10 to 60 groups is not uncommon, and it happens during the process that the number of groups is either reduced or expanded as initial major groups are defined and later sub-groups required depending on diversity of the pottery ensemble, time restrictions, etc. The fewer and more easily identifiable criteria (or attributes) applied in the beginning as the basis for groups, the faster a large ensemble can be sorted for first results.

The following attribute hierarchy provides a useful example:

In the form sheet, the fields for "Dating and occurrence", "Sample reference" (e.g. ID numbers, context numbers or specific areas of the excavation site), "Equivalence with other groups" (internal with personally developed groups or even groups from other excavations), will often be filled in later when a greater amount of data has been processed and major groups formed, as well as the sub-groups expanded or reduced and the acquisition of more clarity relating to certain patterns.

It is beneficial, if not crucial, to understand manufacturing techniques and the shape of a pottery fragment (a necessary technical aspect required when drawing a conclusion of the vessel's complete shape from one or several sherds). One should be able to classify, for example, a rim fragment as e.g. a bowl (open vessel) or a bottle (closed vessel).

The first attribute chosen could be based on observations about possible techniques used by the ancient potters, characterised by the two major traditions of wheel-made pottery, and hand-made pottery. Obviously, allowances must be made for uncertain or hybrid examples, representing composite techniques (See Section **II**.5).

The next step might concern vessel shapes, which can be divided into closed or open forms. The first have relatively small mouth openings, are meant to protect the contents, and include, for instance, large, medium and small jars, bottles, jugs, flasks, etc. Whereas "open vessels", with a maximum diameter placed near or at the opening, allow easy access to the inside of the container, these include large basins, small and large bowls, cups, beakers and goblets, plates, or platters. Besides these shapes, further pottery forms with a specific function can be noted such as lids, pipes, drains, braziers and libation tables, lamps, miniature vessels, etc.

Helpful consideration for speeding up the process of the initial classification of an ensemble should be given to the sorting of single sherds into fine wares, utility wares, common wares and coarse wares could be:

— Small vessels: those likely to have been used individually, rather than as part of a set or composite vessel. Mainly employed for serving at the table but also for individual activities, thus implying small contents.

— Medium sized vessels: those easily carried using one hand, but which content could be shared by several individuals. These vessels were used for multiple purposes, such as storing and transforming products, sharing products during a meal or a meeting, etc.

— Large vessels: those which size or weight (especially when full) would have made them difficult to carry using one hand. These vessels were often devoted to storage or to domestic activities on a collective scale, such as cooking for several people, transforming a large quantity of content in the frame of a hand-craft activity.

This split helps to determine in which group a vessel should be placed based on the ware's attributes (fine, utility, common and coarse) which can be related to the possible function of a vessel (service, preparation, cooking, storage, etc.). However, combined with information on the paste and structure (e.g. wall thickness, matrix structure and hardness, the use of organic or mineral temper, as well as firing) of the vessel's ware group, can be a much more defining set of attributes for some ceramic specialists, and given precedence in the hierarchy above size, shape and assumed function. With specific regards to the field sorting process, a pragmatic approach is typically worthwhile, and therefore the order of such attributes within any hierarchy is interchangeable.

Having defined a certain group, such as our "Pottery group 1" described above, and arranged the relevant sherds accordingly, we are now in a position to sub-divide the group further. Besides the size and function of a pottery vessel, the surface finish and decoration are further attributes of importance.

Two important categories can be distinguished: those on which a surface finish has been applied and those with a rough or plain surface. The application of a surface finish is often connected to the necessity of waterproofing a vessel or serves a representational, symbolic, or decorative purpose. It can include smoothing, polishing or burnishing, and

site	season	rec. name	rec. date	sheet no

Field sorting groups description form

Group code

Dating and occurence
Chronological appraisal; main contexts of appearance; frequency

Sample reference

Equivalence with other groups

Manufacture
(See technological description form)

Hand-made ☐ Wheel-made ☐ Uncertain ☐

Vessel Shapes

Open ☐ Closed ☐ Comments & Types

Type of Production

Fine ☐ Common ☐ Utility ☐ Coarse ☐

Comments

Function

Service ☐ Preparation ☐ Cooking ☐ Storage ☐

Other ☐

Unknown ☐

Wall Thickness

Thin 2-4 mm ☐ Medium 5-9 mm ☐

Thick 10-19 mm ☐ > 19 mm ☐

Structure / Hardness

Crumbly ☐ Medium hard ☐

Hard ☐

Firing

Oxidised ☐ Reduced ☐

Well fired ☐ Uneven firing ☐

Temper

Organic ☐ Mineral ☐

Unknown ☐

Colour of the section

Associated fabrics/comments
See Fabric description form

Surface Treatment - Finishing

Inside		*Outside*	
None ☐		None ☐	
Smooth ☐		Smooth ☐	
Slip ☐	Colour	Slip ☐	Colour
Wash ☐	Colour	Wash ☐	Colour
Glazed ☐	Colour	Glazed ☐	Colour
Burnished ☐		Burnished ☐	
Other ☐		Other ☐	

Decoration

Inside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐
Outside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐

Comments (position e.g. rim, body; colour and motif)

References

(e.g. comparisons to other groups, sites, publications, and/or referencing of sampling and analyses)

Additional comments and observations:
Problems; relationship to other groups; distinctive properties

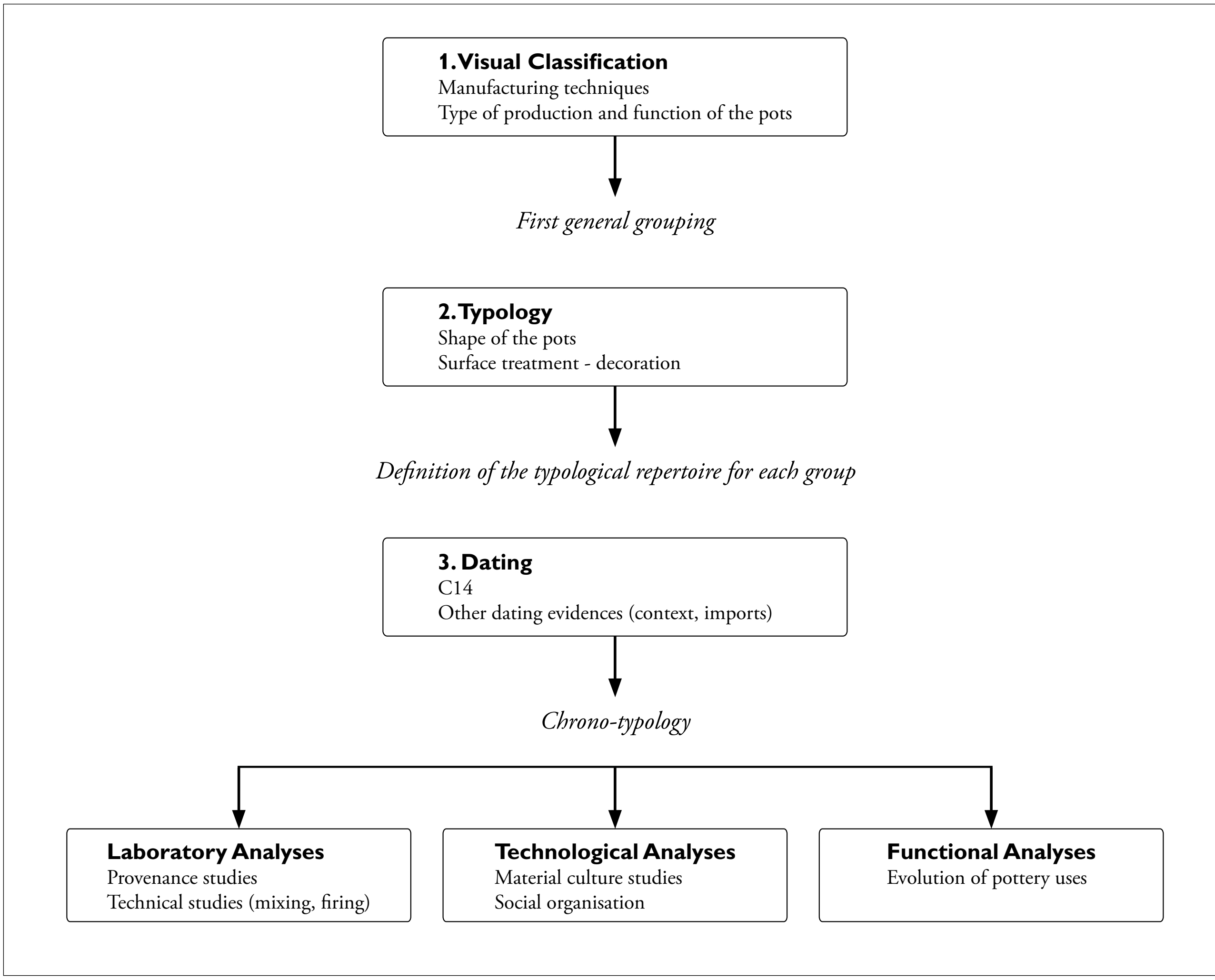


Figure 4. The various stages of the "field-sorting groups" process.

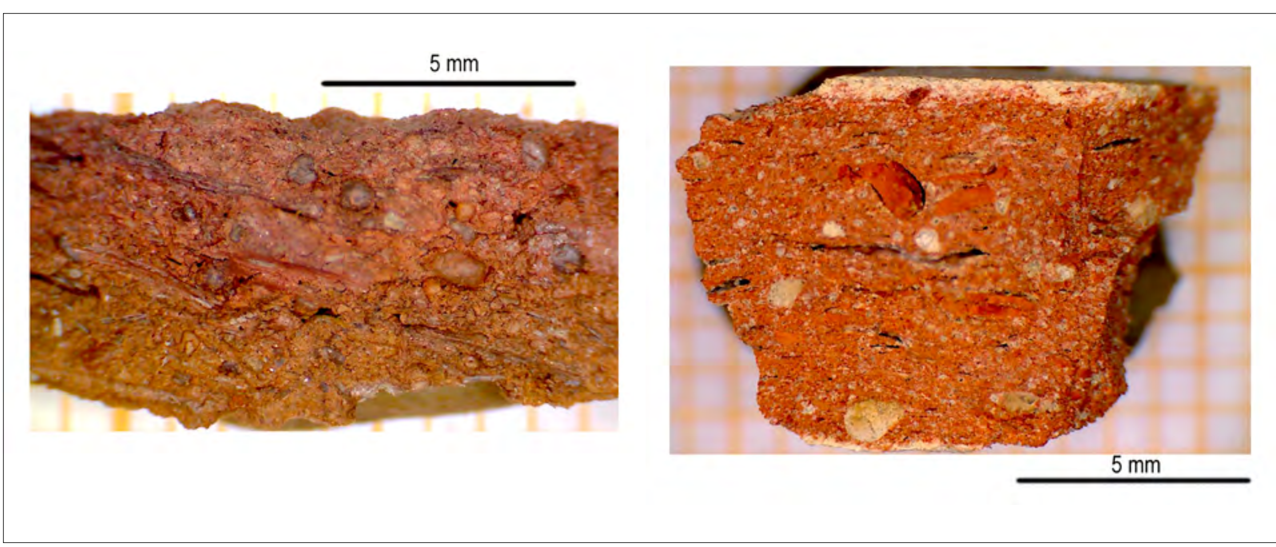


Figure 5.

a) A section of a Nile C2 fabric fragment of a closed vessel from the late Middle Kingdom found at Tell el-Daba. © B. Bader.

b) Section of a Marl C1 fabric vessel of closed shape from the late Middle Kingdom found at Tell el-Daba. © B. Bader.

the application of a slip or wash. Various kinds of decoration, such as incisions, impressions, stamps, or painting, are often incorporated into the finish and can provide further societal, technological, or chronological detail in a classification.

"References", "Equivalence with other groups", "Dating" and "Occurrence" form the framework for the groups. Within that framework the groups themselves can be classified (rather than the individual sherds). For instance, it may become much clearer that some pottery groups occur more frequently in a specific chronological period and within a certain part of the archaeological site, such as graves or kitchens. The interpretation drawn from that information can again reflect a state of technological development, and additionally might provide an important relative dating tool to date other ensembles.

Through further study of the material, the focus will inevitably begin to shift from the macroscopic determination of these pottery groups in the field to more detailed and specific analysis. The latter are usually undertaken by specialists, typically concerned with a selected sub-group or "sample" of the total ensemble, providing further details, a more comprehensive analysis of certain components and techniques used to produce the ceramics, and solidify these established field sorted pottery groups (fig. 4).

Additionally, in the creation of these groups, and in providing a comparable and manageable dataset, it is often beneficial to use the created groups for the field counting process as it provides for both a reliable quantification of the ensemble (see Section III.1) and means to create initial comparable datasets upon which further analyses can be built ■

[**S.B.-M.** & **A. Ben.**]

The Pottery Fabrics II.3

In pottery studies one of the major points of departure is the classification of the raw material. The raw material is the fired clay with its intentional or natural additions (inclusions), such as mineral grains and organic remains, etc. depending on the geological conditions of the area (here the Nile valley and the neighbouring desert areas). This fired clay is called "fabric". A classification system is necessary to divide the ceramic material into groups for better understanding of the distribution of pottery throughout the regions and to pinpoint the places where pottery was made and where it was used. Thus, production and exchange of pottery vessels can be studied. This also enables an understanding of technological processes and the intentional uses of specific raw materials.

The Vienna System

The Vienna system is a local classification aid devoted to the pottery of the Nile valley. It was formulated by excavators and pottery specialists to enable comparisons of raw materials between sites. The group included Dorothea Arnold, Manfred Bietak, Janine Bourriau, Helen and Jean Jacquet and Hans-Åke Nordström and the system was named after their final meeting of establishment in Vienna in the 1980s (Nordström, Bourriau 1993).

The major division of the Egyptian raw clays is between the alluvial sediment from the river Nile (and ancient deposits) and raw calcareous marls mined in various desert wadis along the Nile. This distinction is visible in the physical properties of Nile alluvium and Marl clay fabrics even after firing. Nile clay fabrics were fired quite briefly at lower temperatures (600-800 °C), while Marl clay fabrics were fired for longer at 800-1050°C (Nordström, Bourriau 1993). Differences can be seen in the colouring of the pottery (to be measured with a soil colour chart): Nile clay fabrics fire red, reddish brown, light brown and brown, while Marl clay fabrics may be dark red, pink, light red, yellow, green or whitish, both in oxidising conditions; Nile clay fabrics are softer and easier to break than the harder Marl clay fabrics; the sections/sherd breaks differ in terms of porosity and often show zoning: Nile clay fabrics often show a dark core and several oxidation zones in red, purple, reddish yellow and light brown depending on the temperature and duration of the firing process (the oxidation may also be complete in which case the colour is uniform, cf. fig. 8), while Marl clay fabrics are often uniformly coloured and more rarely zoned (cf. Bader 2001). Marl clay vessels appear frequently with a white layer on the surfaces exposed to the kiln gases (exterior in closed vessels (fig. 5b), both interior and exterior in open vessels), which is not a colour slip but probably a chemical reaction of the elements contained in the clay developing this "scum" as the vessel dries and/or fires (Ownby, Griffiths 2009).

Following this major division, the two Egyptian fabric groups are further sub-divided by the nature of their inclusions and their frequency (fig. 5). For Nile clay fabrics these depend on the presence of organic inclusions (dung, straw) and their fineness (Nile A, B1, B2, C) as well as on limestone particles (Nile D) and a high number of more or less rounded mineral inclusions (Nile E). In Nile C the visible inclusions are various mineral grains of rounded to sub rounded shape in sand size. Also visible are the impressions of organic inclusions, probably straw with some white remains left in the section. They tend to look like desiccated grass (fig. 5a). For the Marl clay fabrics, the division includes porosity and the inclusions (intentional and unintentional) at various frequencies, such as mineral grains, limestone and argillaceous inclusions ("unmixed marl", "shale") and sometimes black grits. Mica is present in most fabrics. Marl C1 is dominated by limestone inclusions that are numerous in this section in variable size. The burnt out limestone inclusions are visible as small holes with white rims. The larger limestone particles are filled with a white or yellowish substance. Most typical of Marl C are the argillaceous inclusions of red-brown colour sometimes with a slate-like texture. These inclusions may be very large and even break through the surface of vessels. Also note the thick white layer on top of the section, which is derived from chemical reactions in the material during drying/firing and not from adding paint (fig. 5b). In addition, the system covers imports from the Levant, the Oases and Sudan. Those are further sub-divided according to their components. The section can best be observed in the field with a 10 × hand lens, when the vessel wall had been freshly broken parallel to the rim, because when turned on a turning device the organic inclusions are arranged parallel to the vessel wall by the rotary kinetic energy and thus are best visible. For fabric description a geological microscope with 30 × magnification is necessary (figs. 7-8).

The Vienna system can be considered as a skeleton that may be fleshed out individually as each site and each period may yield different material. Space needs to be devoted to site-specific and chronological variants. This classification system was not intended to "replace" local systems but to provide a vehicle for easy comparison across ancient Egypt and Sudan. This fabric classification system cannot be employed for other geographic areas without amendment as it depends on the material available in the region considered (See Section **vi**.2).

The Vienna system is better adapted to certain periods of Egyptian history because the actual pottery used as its basis was derived from the Middle Kingdom to the mid New Kingdom (*ca.* 2000-1400 BC). As does technology, firing changes over time and this results in Nile B2 of the Middle Kingdom "differing" in several aspects from that of the New Kingdom or the Late Period (cf. Aston 1999), e.g. in density and colouring.

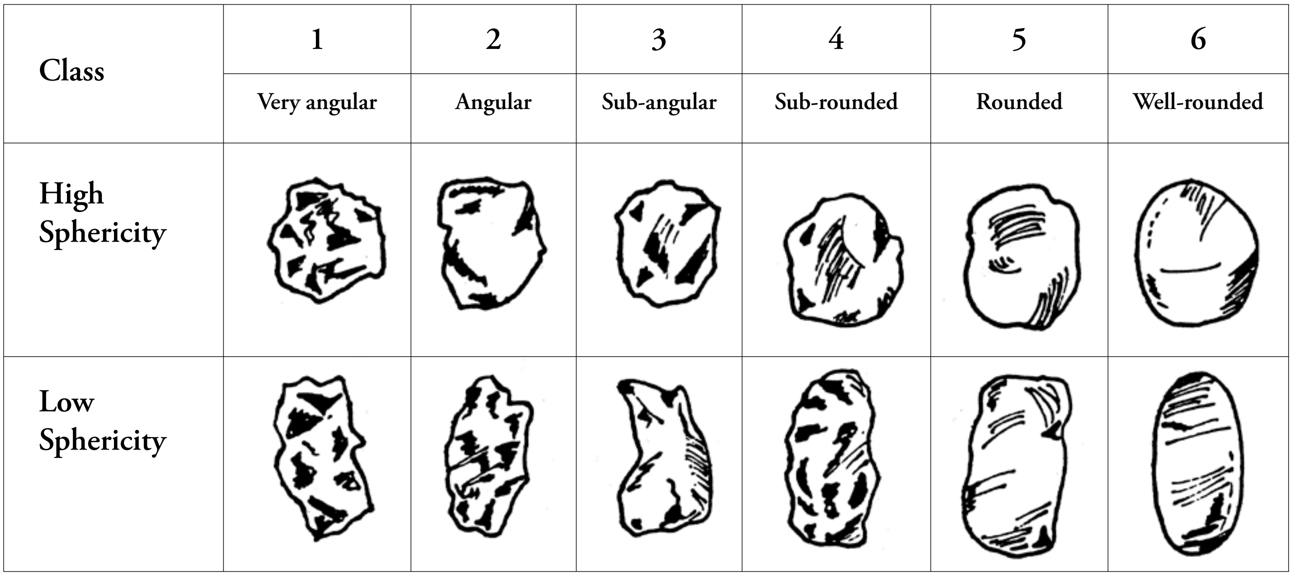


Figure 6. Chart of Roundness versus Angularity, from Barraclough 1992.

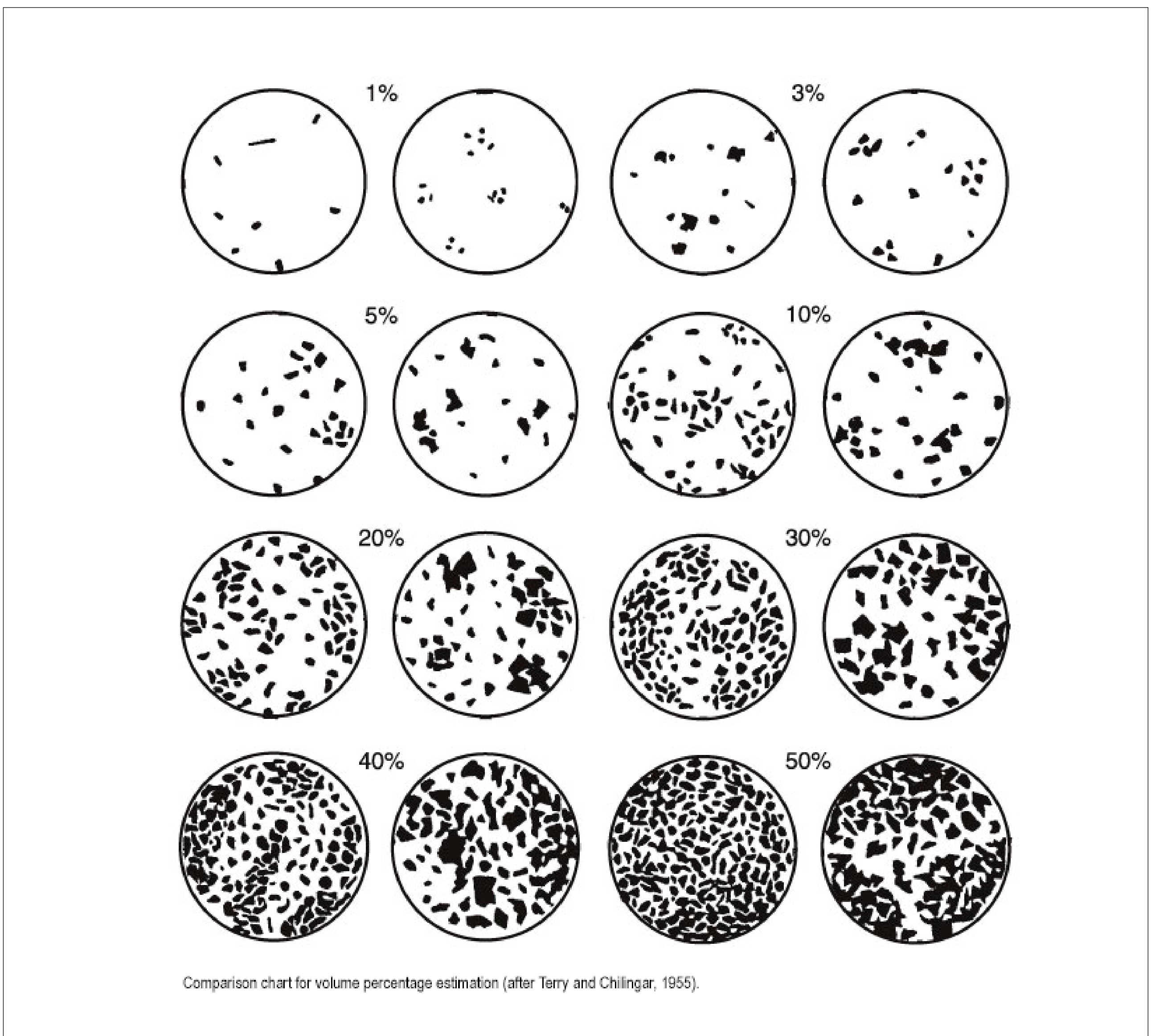


Figure 7. Density of inclusions, from Terry, Chilingar 1955.

The study of pottery in the Second Intermediate Period shows that numerous local recipes for pottery-making exist, most apparent in the "Nile B2" fabric at a number of sites, which unfortunately has not included the aid of petrographic analyses so far. While the general classification of Nile B2 is undisputed, in the Nile delta mineral grains dominate, while in the Theban area it is often limestone. At Aswan, the southern limit of Egypt, abundant mica is observed on the surfaces of the pottery. Thus, the raw material of the alluvial pottery in this period attests to several production places throughout the regions that were not centralised.

Petrographic Characterisation of Ceramic Fabrics

As noted, the Vienna System is a broad classificatory method for inter-site comparison, but most excavations create their own fabric groupings based on the studied ceramic corpus. In order to clarify these groupings and relate the material to the Vienna System, petrographic analysis is performed. This technique employs a geological microscope to examine a thin slice of pottery placed on a glass slide. The characteristics of the minerals and rock fragments under crossed polarising and plane polarising light identifies them. Features of the clay, though the particles themselves are too small to see, can be described. Collectively, the petrographically defined inclusions and clay appearance are classified as a petrofabric with individual samples being assigned to particular petrofabric groups. This method is ideal for relating fabric to raw material source and comparing amongst samples (see Ownby, Brand 2019 for an overview of petrographic work in Egypt; see Ownby 2016 for petrographic analysis of Vienna System fabrics). It is worth noting that chemical analyses via neutron activation analysis have been performed on a fair number of sherds representing the Vienna System Fabric groups (Al-Dayel 1995 and Bourriau et al. 2006).

Petrographic analysis of the Nile A fabric of the Vienna System typically confirms that it is composed of fine Nile clay without the addition of sand, plant remains, or grog (i.e. crushed pottery). Such clay can be acquired from naturally levigated sources in canals or from intentionally created settling pools that allow coarse material to fall to the bottom leaving finer clay at the top. Nile B1, as seen in thin section, comprises Nile clay with some medium to coarse mineral inclusions, usually quartz and feldspars. These often appear natural to the clay and suggest the selection of coarser Nile clay along the river or canals. Rare fine plant remains may occur. Nile B2 is similar though can have increased medium to coarse mineral inclusions and plant remains. For some fabrics the addition of sand and plant remains as temper can be suggested, but other analysed fabrics that would be classified as Nile B2 appear also to have natural coarse inclusions. Rare limestone may be present in both Nile B1 and Nile B2, and the fabrics are probably a continuum of naturally or artificially made clay paste recipes. Nile C is notable macroscopically and microscopically for the addition of common, coarse plant remains and was often used for bread moulds and beer jars (fig. 5a). The Nile clay itself is similar in texture to that employed for Nile B1 and Nile B2. Likewise, Nile D is composed of Nile clay with a similar texture to the other fabrics, but clearly added numerous coarse limestone pieces. In some cases, this fabric can be confused with Nile and Marl clay mixed fabrics (*infra*). Finally, Nile E is distinguished based on the common sand that was probably added and appears as medium to coarse-sized rounded quartz, feldspar and quartzite grains (cf. fig. 6). However, many fabrics fall somewhere in between a Nile E and a Nile B, Nile C or Nile D.

The Marl clay fabrics are difficult to define macroscopically and petrographically. Marl A1 fabrics have a fine, dense clay with few inclusions but common limestone. This could be an intentional addition or natural to the clay. Marl A2 is probably natural clay

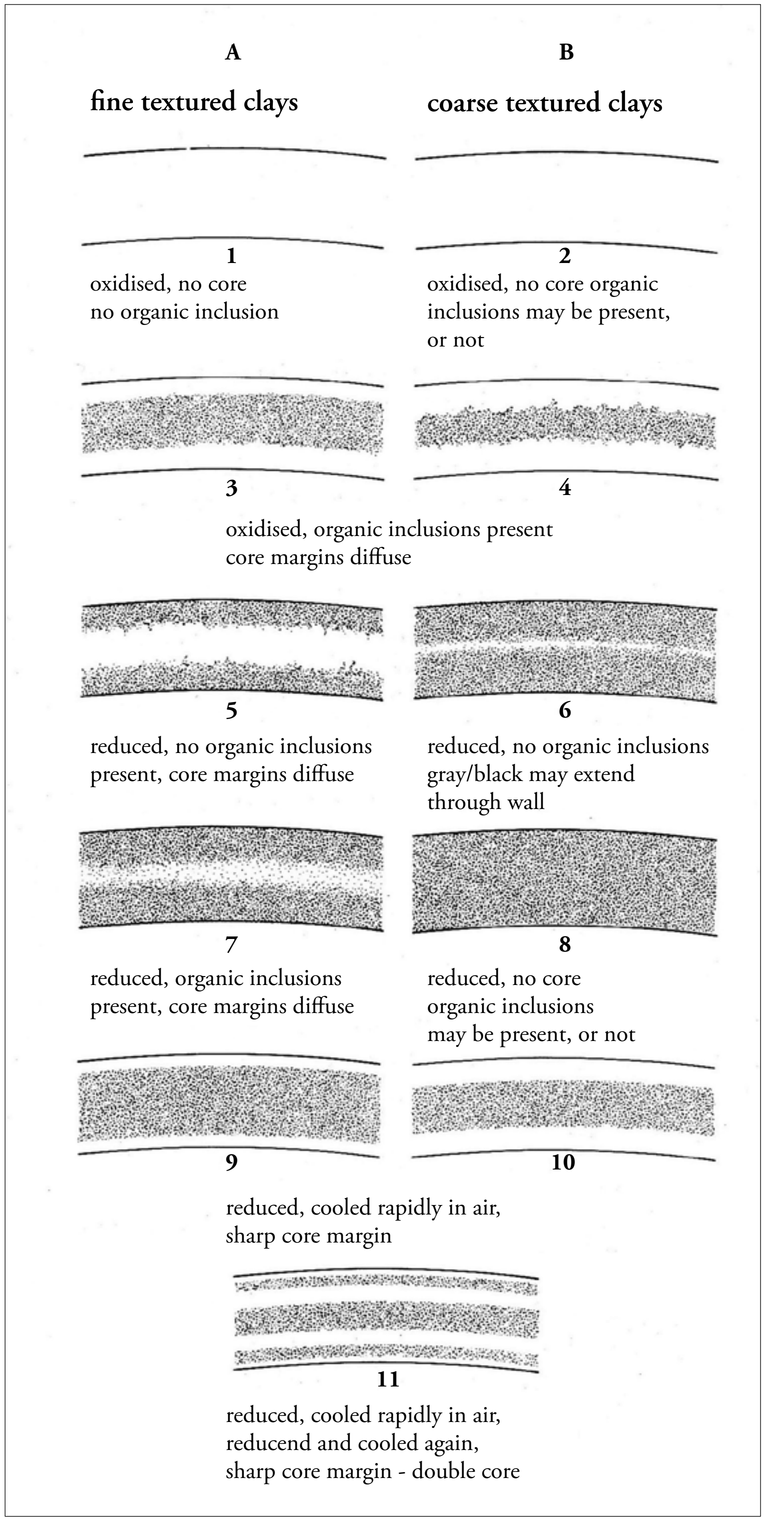


Figure 8. Schematic patterns of sections, after Rye 1981, fig. 104.

site	season	rec. name	rec. date	sheet no

Fabric description form

Group code

Dating and occurence
Chronological appraisal; main contexts of appearance; frequency

Sample reference
Reference to pot used for description

Equivalence with other groups

Photographs ☐ Thin sections ☐ Naked eye ☐ Magnification ☐ Microscope ☐

Colour
cf. Munsell Soil color Chart

Surface	Section

Wall Thickness	Structure / Hardness	Sorting	Porosity
Thin 2-4 mm ☐ Medium 5-9 mm ☐	Crumbly ☐ Medium hard ☐	Very poor ☐ Poor ☐ Fair ☐	Open ☐ Medium ☐
Thick 10-19 mm ☐ > 19 mm ☐	Hard ☐	Good ☐ Very good ☐	Dense ☐ Incipient vitrification ☐

Inclusions	Coarseness			Frequency	Shape
	Fine < 2mm	Medium 2-5mm	Coarse > 5mm	Cf. the density of inclusions chart	Cf. the chart of roundness
Plant Remains					
	Fine 60-250mi	Medium 250-500mi	Coarse > 500mi		
Sand (quartz / felspar)					
Limestone					
Elongated pores					
Decomposed limestone					
Grey-white particles					
Red-brown particles, soft					
Red-brown rock particles					
Mica					
Shell: strips					
Microfossils					
Rounded sand-grains					
Grog					
Black rock particles					
Other					

Additional comments and observations
Problems; relationship to other fabrics; distinctive properties

with some inherent mineral grains and limestone, but notable pieces of unmixed clay. In this case, the clay itself was more likely from a shale deposit rather than carbonate formations that produce true Marl clay. Shale clays often occur below carbonate layers, and the weathering of both can produce a secondary clay deposit of mixed shale and calcareous material. Marl A3 is also a dense fabric with some natural inclusions. It is distinct due to its light greenish colour. Marl A4 is notable due to the likely addition of sand producing a sandy and coarse fabric. In some cases, this sand may derive from the presence of Nile clay, either added intentionally or from a clay deposit where Nile flood plain material has mixed with calcareous clay at the outlet of a wadi. These are termed "mixed clays" fabrics and are often subsumed under the Marl clay fabric groups. They are identified by more common mica, volcanic rock fragments, and clay pellets. The Marl B fabric is also sandy, possibly representing added temper, and has visible limestone like Marl A4. Marl C is probably the most petrographically studied of all the Marl fabrics and such analyses suggest the source is shale clay rather than true calcareous Marl clay. Shale fragments are readily seen in the fabric with Marl C1 having added limestone, while Marl C2 is dominated by sand temper. Marl D also features common limestone that could be temper unlike the natural limestone present in most Marl A and Marl B fabrics. Marl E has rarely been studied but is notable for the plant remains in the fabric. Finally, Marl F has been defined for late Second Intermediate/early New Kingdom ceramics in the Delta but is a variable fabric ranging from more or less calcareous with some having added sand and/or limestone.

Recent petrographic studies have now clarified the kaolinitic clays used in the Aswan area and their variability. As with Marl clay, the Aswan clay fabrics can have a Nile clay component, but it is similarly difficult to specify if such mixes occur naturally or were created by the potter. Several oases fabrics are now more clearly defined, especially those from Kharga, Dakhla and Bahariya. Such work has enabled the identification of these vessels in the Nile Valley and ascribed them to a specific oasis. This information clarifies the movement of pottery from the Nile Valley to the oases, and petrographic research as a whole has highlighted the movement of pottery along the Nile over long periods of time. It has become clear that though much pottery production takes place locally with local fabrics, some productions are meant to be traded far and wide ■

[**B.B.** & **M.O.**]

Ceramic Laboratory Analyses II.4

The archaeometric study of ancient ceramic materials is often based on the use of different analytical techniques, typical of hard science (e.g. Maritan 2019). Methods that are normally selected depend on both the type of ceramic itself (coarse—versus fine-grained body), and the archaeological issues to be solved (Gliozzo 2020). Results from various types of analysis are often integrated within the same research to reconstruct the specific stages of the ceramic "life", from the raw materials' selection, to the production recipes, to its firing, use and alteration during burial (e.g. Ballirano et al. 2014; Bajeot et al. 2020; Botticelli et al. 2020; Maritan et al. 2005; Maritan et al. 2017; Medeghini, Nigro 2017; Medeghini et al. 2019; Russo et al. 2018). Among the numerous works describing the analytical techniques for ancient ceramic analysis, we suggest the detailed and comprehensive Oxford handbook of archaeological ceramics analysis edited by Hunt (2017), and a very recent

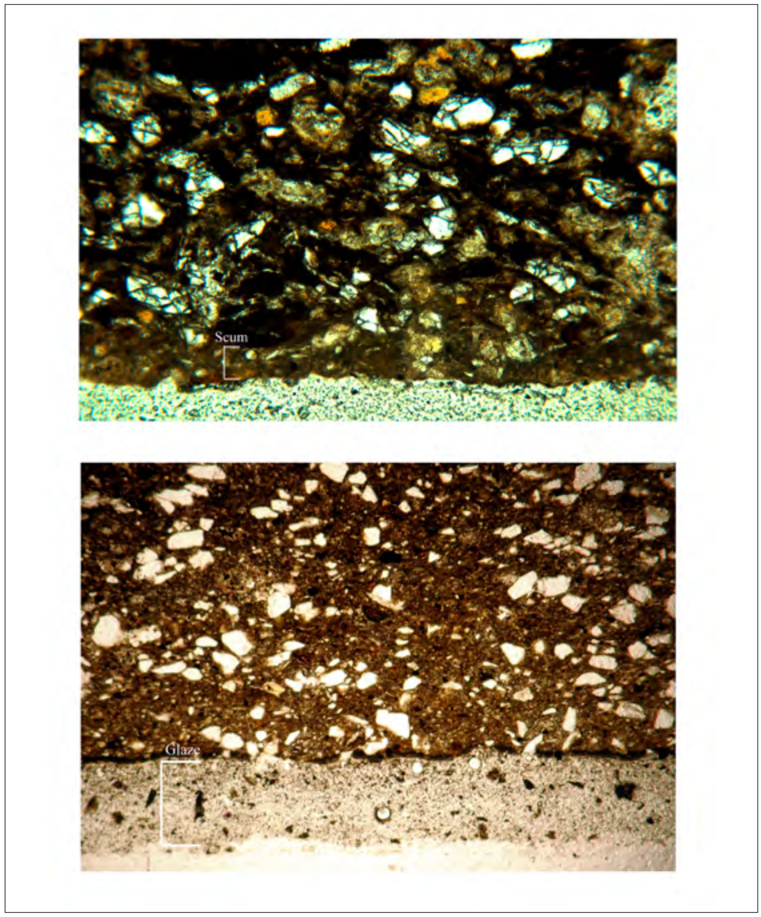


Figure 9. Petrographic images of a Marl C sherd showing paste and scum surface (plane-polarized light, image width is 5 mm), and a glaze ware sherd showing paste and glazed surface (plane-polarised light, image width is 5 mm). Photomicrographs taken by M. Ownby (see Ownby and Griffiths 2009, fig. 1; Ownby et al. 2017, fig. 4).

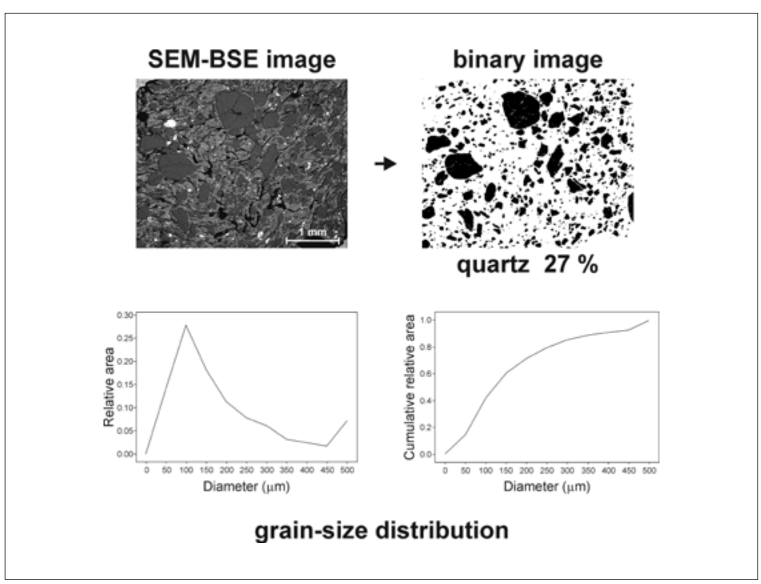


Figure 10. Example of a scanning electron microscope, back scattered electron (Sem-Bse) image of a ceramic body and of the binary image obtained from the segmentation of its quartz inclusions. Quantity (expressed in % area) and grain-size distribution, as relative area and cumulative area as a function of grain diameter, are also reported.

topical collection of review papers on "Ceramics: Research questions and answers".[1] In this section we will focus on the description of the main analytical techniques (optical microscopy, scanning electron microscopy, X-ray diffraction, chemical analysis and statistical treatment of data) to investigate different aspects of ancient ceramic materials, such as the provenance of the raw material used and production technology.

Optical Microscopy

Often examination of ceramics begins with a hand-lens (20× magnification) or a small binocular microscope (up to 100× magnification). This enables the basic components and appearance of the sherd to be described. For more specific details, a petrographic microscope is employed that examines a thin slice of a sherd on a slide (fig. 9). This provides important information on the mineralogy of the inclusions in the paste, be they natural or added, and clay characteristics (see section II.3; Ownby, Brand 2019). Such data can be related to geological formations for provenance purposes. Petrography also clarifies technological features such as paste recipe, general firing temperatures, and surface features.

Scanning Electron Microscopy (SEM)

For questions of firing temperatures, the chemical composition of glazes or particular inclusions, and other features requiring very high magnification, scanning electron microscopy (SEM) is used. This enables both great magnification and also chemical data to characterise features that often relate to particular workshops creating vessels from specific recipes at certain times. Understanding the technology of production at this level increases knowledge on the organisation of ceramic manufacture and distribution. SEM was used to clarify the white surfaces of Marl C pottery from Egypt highlighting the technological reasons these surfaces are present and the deep knowledge potters had of their raw materials (Ownby, Griffiths 2009). Samples for SEM are often prepared by imbedding them in a resin block and finely polishing them, nonetheless whole specimens can also be examined.

SEM secondary electron imaging (SEM-SEI) is normally performed on freshly-broken pieces of ceramic body to study their microstructure, especially the degree of vitrification to constrain their firing temperature, according to the method proposed by Tite and Maniatis (1975).

The development of accessible and fast-processing software (information technology) favoured the possibility of processing digital images to quantitatively describe the abundance, grain-size distribution, and shape of textural features (inclusions and voids) of the ceramic materials (fig. 10). This quantitative approach can be performed on photomicrographs, scanning electron microscope images in back-scattered mode, or even on multi-spectral images such as the chemical maps acquired by SEM-EDS, using open access software (Maritan et al. 2020). Possible differences in the quantity of inclusions and/or their grain-size distribution, can be related to different production recipes in diachronic or ceramic function/provenance terms (Dal Sasso et al. 2014; Baklouti et al. 2016).

1 Please find the various contributions at the following link: https://link.springer.com/journal/12520/topicalCollection/AC_90a72dd401e9b98aeee536c566e18d98

X-ray Powder Diffraction

X-ray powder diffraction (XRPD) is an analytical technique widely used to determine the mineralogical composition of crystalline materials (Maritan et al. 2015). The interaction between the crystalline lattice of the mineral-phases composing the analysed material and the X-ray beam produces (when the Bragg law is satisfied) a diffraction pattern (fig. 11). These peaks can be directly linked, through comparative mineralogical databases (such as the PDF—Powder Diffraction File—produced by the International Centre for Diffraction Data), to specific mineral phases. In order to obtain the mineralogical composition of a ceramic material with such a technique, a representative fragment of the body of a potsherd, after the mechanical removal of possible coatings and altered/dirty external surfaces, needs to be finely grinded (possibly in an agate mortar).

The mineralogical composition of a ceramic body depends on the mineralogical composition of the raw materials used (of both clay and possibly added temper) and their grain-size, as well as the firing conditions, and in particular, on the maximum temperature reached and firing atmosphere (oxidising versus reducing). Therefore, the mineral associations recognised in a ceramic can be used to characterise its firing conditions, based on comparison to the results of firing experiments on similar raw materials (Daszkiewicz, Maritan 2017). The original mineralogical composition of the ceramic body and its possible coating (slip or glaze) can undergo important changes (precipitation of secondary minerals, transformation of pristine phases into new products, or dissolution of mineral phases) during the post-depositional processes (Maritan 2020 and quoted literature), that can be determined by XRPD analysis as well.

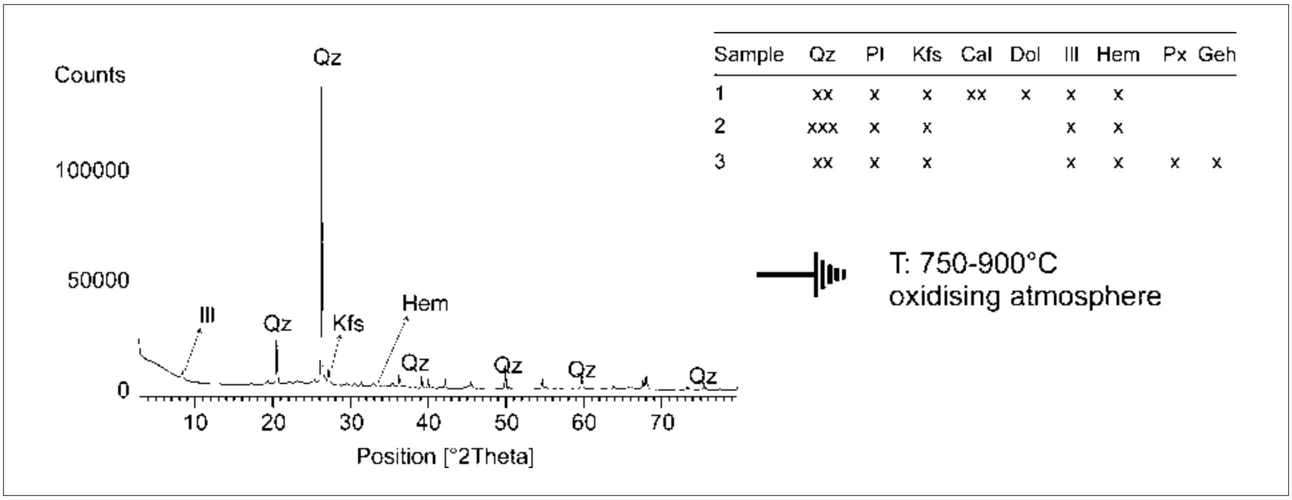
Other methods can be used to determine the mineralogical composition of ceramic materials, such as micro-diffraction, synchrotron light diffraction, the electron back-scattered diffraction, micro-Raman spectroscopy and infra-red spectroscopy (see Maritan 2019 and quoted literature). Each technique has advantages, such as the possibility of preforming the analysis in a non-destructive way, or requiring very little material, or making the analysis on very restricted areas of the ceramic such as painted decorations or certain specific portions of the body.

Chemical Analyses and Statistical Treatment of Data

One of the most common analytical methods employed for studying ceramics is to acquire chemical data, typically the full set of elements and their quantity in a powdered sherd. These data are used to assess those ceramics made from similar raw materials and pastes. Often this relates to a common production source enabling the distribution of such pottery to be revealed and those economic factors involved to be understood. Thus, while many vessels can appear similar in form and paste, chemical data will identify those likely to have been produced in the same workshop and/or area. Such research has revealed the organised workshop production of marl pottery in Egypt and clarified fabric groupings (and their relation to each other) for ceramic specialists (Bourriau et al. 2006).

Chemical analysis is normally performed on fine-grained ceramics, the provenance of which cannot be inferred by petrographic analysis due to the very fine inclusions.

A number of different instruments can acquire such data. In the past, neutron activation analysis employing a nuclear reactor was a common method for precise and highly sensitive (parts per billion) data acquisition. As reactors are less readily available, other methods have become more popular. Inductively coupled plasma mass spectrometry



Sample	Qz	Pl	Kfs	Cal	Dol	Ill	Hem	Px	Geh
1	xx	x	x	xx	x	x	x		
2	xxx	x	x			x	x		
3	xx	x	x			x	x	x	x

Figure 11. Example of a XRPD pattern (diffactogram) of a ceramic material, with indication of the relative firing temperature, and a table reporting mineral associations as determined by XRPD data. Mineral abbreviations: Qz: quartz, Pl: plagioclase, Kfs: K-feldspar, Cal: calcite, Dol: dolomite; Ill: illite, Hem: hematite, Px: pyroxene, Geh: gehlenite.

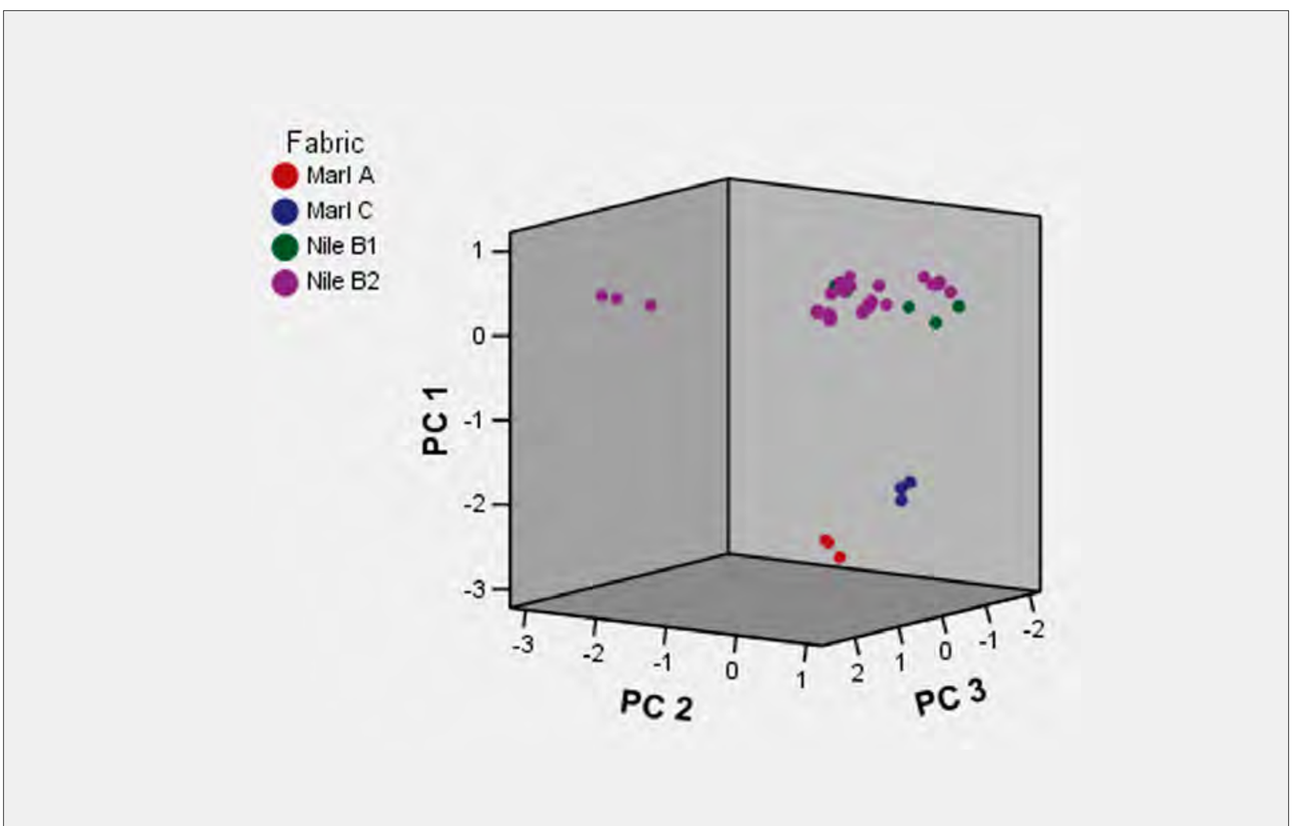


Figure 12. Principal components graph of XRF data from Giza samples.
Created by M. Ownby (see Ownby 2009, fig. 5).

or atomic emission spectrometry (ICP-MS, ICP-AS), proton induced X-rays (PIXE) and gamma rays (PIGME), and X-ray fluorescence spectrometry (XRF) have also been used (For a case study of the latter method see Ownby 2009). Portable XRF has also become more commonly employed for non-destructive chemical analysis, however, for ceramics the method is less accurate due to material heterogeneity.

All of these methods produce tables of elements and their values that must be examined statistically. The data are usually normalised first (by base 10 logarithms or other equations) so the variances between common and rare elements do not overly influence the data. Then several statistical methods are used to explore the data and discover those samples with similar compositions (fig. **12**). Principal components analysis, correspondence analysis, hierarchical cluster analysis, and discriminant analysis are the most frequently employed (Baxter 2003; Shennan 1997). Use of multiple statistical tests to verify groups of chemically similar pottery is the best practice.

Overall, these scientific methods have greatly improved our understanding of pottery manufacture, distribution, and use. Such information is vital for clarifying the role of pottery in past societies and providing information on the economic, religious, and social systems of those groups ■

[**L.M.** & **M.O.**]

The Concept of "*Chaîne Opératoire*" II.5

A Theoretical Framework from the Anthropology of the Techniques

The concept of *chaîne opératoire*, theorised by French anthropologists (A. Leroi-Gourhan first, then R. Creswell and others), considers the manufacturing process as an organised sequence of technical gestures that transform a raw material into a usable product. Thus the technological analysis of ceramics involves the reconstruction of all the stages of the process of fabrication of the vessels, from the supply of raw materials to the finished product, passing through the stages of preparation of the paste, manufacturing, finishing, surface treatment, decorating and firing (Shepard 1956; Rye 1981; Binder, Courtin 1994; Livingstone Smith et al. 2005; Roux, Courty 2019). Ethnographic and archaeological studies have shown that the same shape or the same type of decoration can be made with the use of different techniques, which indicates several producers (Gosselain 2002). For the potter, the choice of one technique rather than another is related to a cultural heritage and to his identity, that can be ethnic, ethno-linguistic, religious, family, socio-professional, etc. (see among others: Binder, Courtin 1994; Gosselain 2002; Livingstone Smith et al. 2005). Manufacturing techniques involve specialised gestures that are more stable than finishing and decoration techniques—although they are not always visible in the finished products—, so they have a great identity meaning (Gosselain 2002). The technological analysis enables the demonstration of the artisans' skills and the tools used. In recognising gestures and actions on the paste, the study restores all the stages of the production and thereby this anthropological approach of the ceramic reaches the socio-cultural dimension of this activity. Thus, the *chaînes opératoires* allow to differentiate social groups and to characterise the socio-economic organisation of the production, which can then be related to the socio-cultural history of the human groups.

The Technological Analysis of the Ceramics from Muweis (Sudan)

In the Island of Meroe (Sudan), the excavation of the site of Muweis conducted by M. Millet (Louvre Museum) has uncovered large amounts of ceramics. This city—with various temples, a palace, a residential area, and craft zones—intensively occupied throughout the Meroitic (*ca.* 270 BC-340 AD) and post-Meroitic (*ca.* 340-550 AD) periods remained so until the modern period (Baud 2008; David, Evina 2016). One of the objectives of the ceramic study is to understand the technical variability of the pottery production to approach the socio-cultural diversity of the populations of Muweis. The assemblage has been recently analysed by R. David and E. Jadot according to the concept of *chaîne opératoire*; a synthesis of the results is presented below.

Methodology

According to the methodology of V. Roux and M.-A. Courty (Roux, Courty 2019), the technological analysis of a ceramic corpus focuses on three successive studies for the sorting, the description, and the exploitation of data: 1) the examination of technical entities (features of manufacturing, finishing and surface treatments) and their variants called technical groups; 2) the petrographic analysis to determine the origin of raw materials, the preparation of the paste and the type of firing; and 3) the morpho-stylistic study (fig. **13**). Consequently, it is possible to evaluate the range of shapes obtained according to the different *chaînes opératoires* identified and thereby evaluate whether the variability is linked to functional or cultural factors.

Sorting and Reconstituting the Technical Groups

The identification of manufacturing techniques is possible through the observation of the diagnostic surface features present on the inner and the outer walls of the pots as well as in section (see notably Roux, Courty 2019). The macro-traces describe the topography (morphology of walls, micro-relief), the surfaces (striations, grooves, rills, texture, appearance and coating) and the type of fractures (orientation and shape) of the sherds (fig. **14**).

Within the ceramic assemblage of Muweis, the identification of the manufacturing techniques and methods used distinguishes 6 main technical entities: 1) combination of coiling and wheel-shaping techniques (coils are formed by discontinuous pressures and then are joined and thinned to fashion the body with the use of the rotational kinetic energy of the wheel; see Roux, Courty 2019, pp. 84-87); 2) wheel-throwing; 3) coiling; 4) combination of hammering (for the body) and coiling (for the neck); 5) moulding; and 6) modelling. The varieties of finishing techniques and surface treatments constitute 14 technical groups distinguished by the application or not of a slip and by an operation of burnishing or not after smoothing (fig. **15**).

Studying the Paste Preparation

This second stage differentiates the petrographic groups within each technical group already defined. The petrographic classification considers the matrix (petrofabric, texture, colour and mineralogy), the inclusions (type, form, size, and quantity), and the porosity (see Section II.3; Shepard 1956; Rye 1981). Thereby we can determine the origin of raw materials and provide data on the scale of production. Furthermore, the petrographic characterisation gives not only indications relating to the choice of raw materials depending on their properties and the environment, but also the technical preparation for transforming

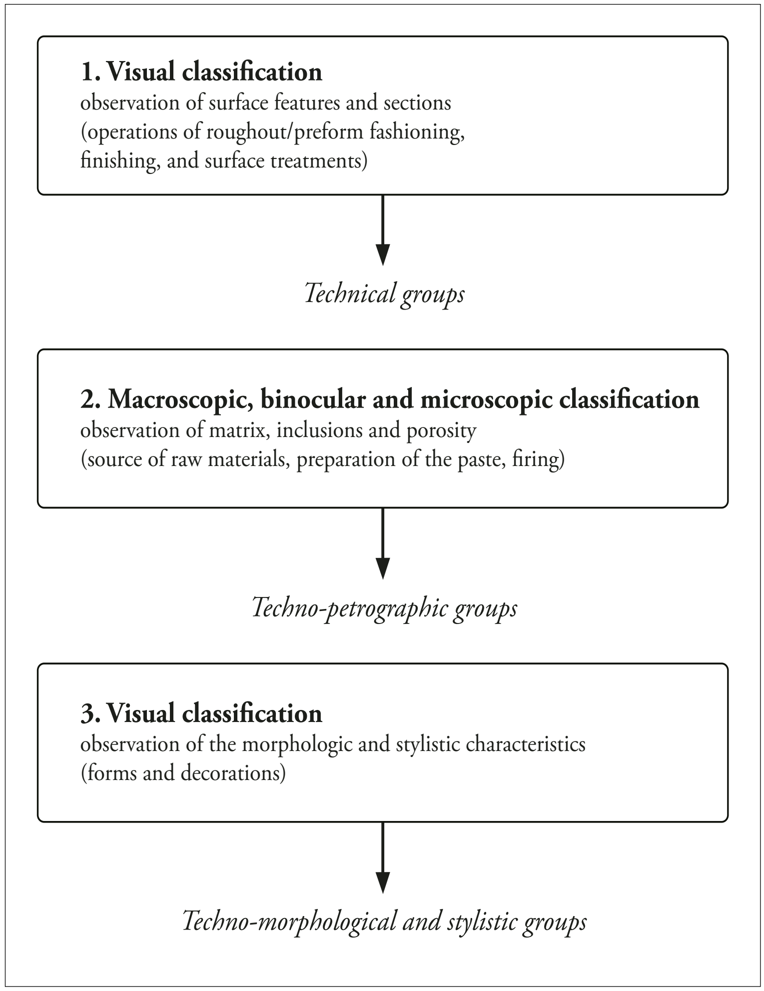


Figure 13. Stages of the technological analysis of a ceramic assemblage according to the concept of *chaîne opératoire* (adapted from Roux, Courty 2019, fig. 4.1).

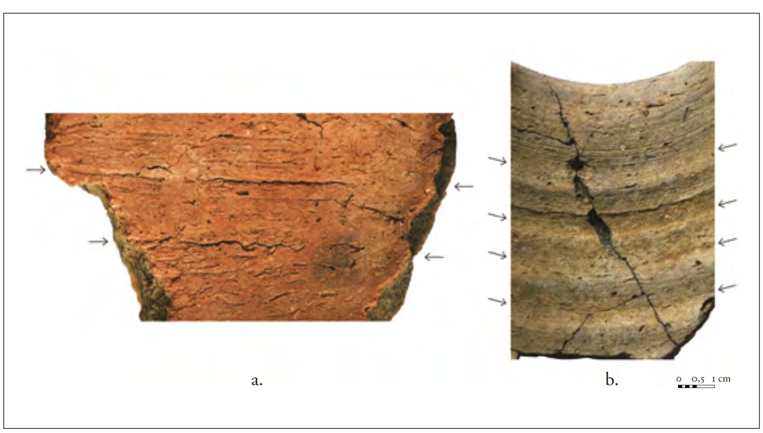


Figure 14. Examples of manufacturing techniques using coils observed on the inner wall of ceramics of Muweis.

a) Coiling: parallel rills and horizontal grooves due to joints between coils, undulation of the surface.

b) Coiling and wheel-shaping: coils joined and thinned through rotation on a wheel (and parallel striations of smoothing made on wet paste with rotation on a wheel).

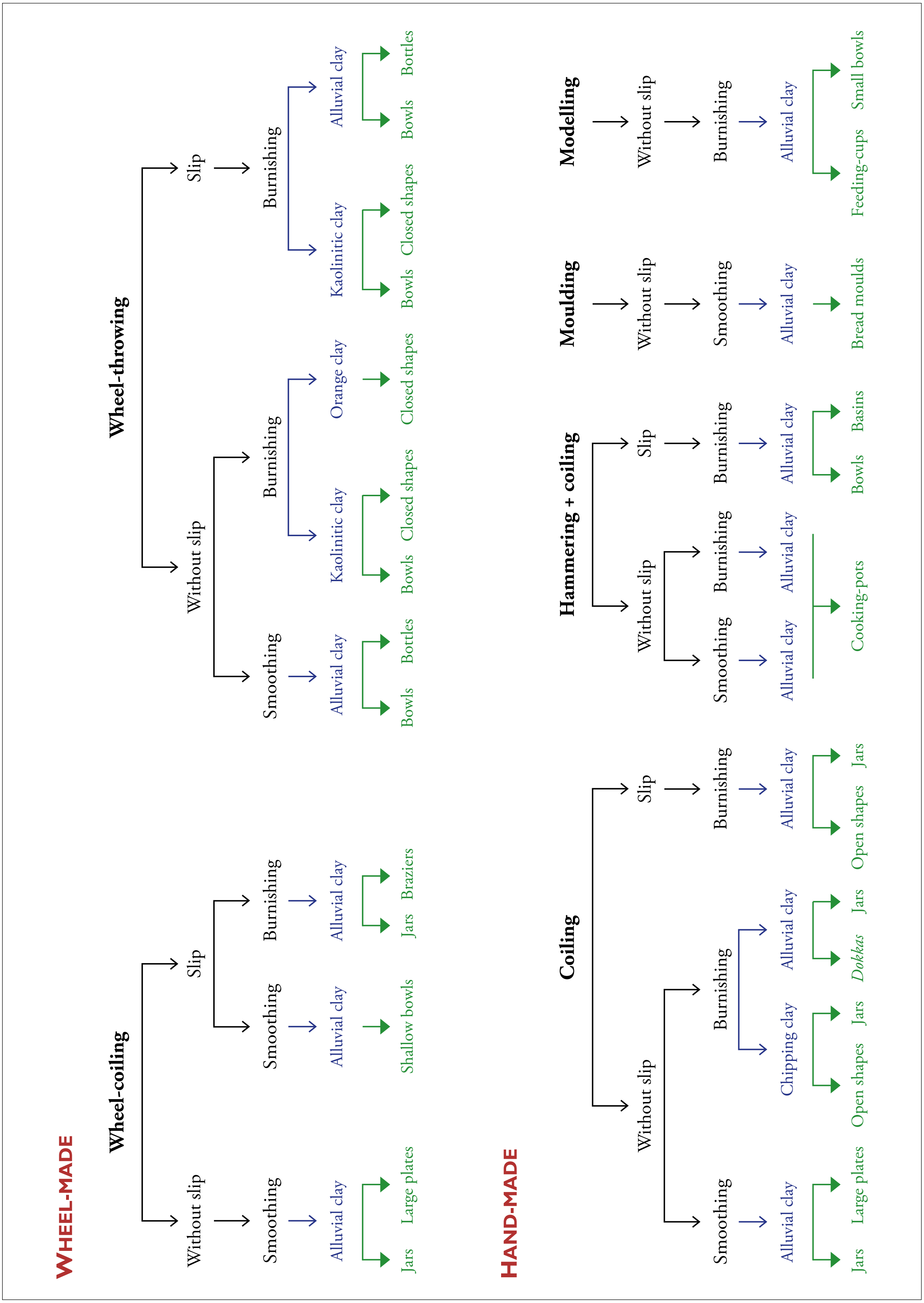


Figure 15. Technological tree of the ceramic of Muweis.

site	season	rec. name	rec. date	sheet no

Technological description form

Group code

Dating and occurence
Chronological appraisal; main contexts of appearance; frequency

Sample reference
Reference to pot used for description

Equivalence with other groups

Shape

Function

Manufacturing Technique

Hand-made ☐ Modelling ☐ Hammering ☐ Coiling ☐
Moulding ☐ Other ☐

Wheel-made ☐ Wheel-throwing ☐ Wheel-coiling ☐

If coiling
Size of coils
Method of coiling

Finishing

Gestures/Tools

	Inner wall	Outer wall
Gestures/Tools	Smoothing ☐ Brushing ☐ Shaving ☐	Smoothing ☐ Brushing ☐ Shaving ☐

Surface Treatment - Finishing

Inside		*Outside*	
None ☐		None ☐	
Smooth ☐		Smooth ☐	
Slip ☐	Colour	Slip ☐	Colour
Wash ☐	Colour	Wash ☐	Colour
Glazed ☐	Colour	Glazed ☐	Colour
Burnished ☐		Burnished ☐	
Other ☐		Other ☐	

Decoration

Inside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐
Outside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐

Comments (position e.g. rim, body; colour and motif)

Gestures/Tools

Wall Thickness

Thin 2-4 mm ☐ Medium 5-9 mm ☐
Thick 10-19 mm ☐ > 19 mm ☐

Structure / Hardness

Crumbly ☐ Medium hard ☐
Hard ☐

Firing

Oxidised ☐ Reduced ☐
Well fired ☐ Uneven firing ☐

Temper

Organic ☐ Mineral ☐
Unknown ☐

Colour of the section

Associated fabrics/comments
See Fabric description form

Additional comments and observations
Problems; relationship to other groups; distinctive properties

them into suitable clay such as removing coarse elements, sieving, decanting, adding temper, wedging, kneading, etc. The techno-petrographic groups correspond to the production units and reflect the diversity of the artisan groups, so the variations help to understand the organisation of production (Roux, Courty 2019).

In Muweis, there is a great variability in the raw materials used and in the preparation of the pastes. A majority is made with Nile clay (fine to coarse), with vegetal or mineral tempers. Some over fired samples found in the craft area of the city suggest a local production for some of the ceramics uncovered. It is interesting to point out that these ceramics locally made with alluvial clay are linked to various manufacturing techniques, indicating distinct craft groups producing according to different technical traditions, thus revealing distinct cultural lineage of transmission within the same area. Nevertheless, nowadays these types of alluvial clays still appear similar all along the Nile Valley and it is therefore still impossible to locate the sources. In such case, the analysis of the manufacturing techniques is especially important to complete the study and to emphasise data on the variability of the production groups. Other clays are present in smaller quantities: "gratinitic" clay, white kaolinitic clay (very fine or fine, with fine vegetal temper) and orange clay (fine, from the *wadis*). Petrographic and chemical analyses are still on-going to characterise, in more detail, the preparation of the paste.

Linking *Chaînes Opératoires* with Shape and Decoration of the Vessels

Finally, the techno-petrographic groups are related to the shape of the pots and to their iconography. Technological studies propose to further analyse the ceramics beyond their aesthetic classification and to delve into the decorative techniques: identification of the raw material used for the decoration, degree of drying of the paste during these operations, method used, type of tool and its mode of use (see, in particular, the website of the Working Group on African Impressed Ceramics "CerAfIm"). In addition, the structure and the organisation of the motifs are studied to understand the "decorative language" according to the structural approach (Shepard 1956). These techno-morpho-stylistic groups emphasise the type of vessels (shape and function) produced according to the different technical processes, thus allowing to interpret technical variability as the manifestation of several functional categories of vessels or as the expression of social factors corresponding to human groups (Roux, Courty 2019).

In Muweis, only the cases of moulding and modelling techniques are associated with one type of clay material and one unique functional category, so they depend on the function of the potteries. In other parts, most of the other *chaînes opératoires* include various categories of pots (fig. 15): the technical variability is not correlated with the function of the vessels but can be explained by the presence of several cultural traditions and social boundaries.

Socio-cultural Interpretation of the *Chaînes Opératoires*

Technological data can be interpreted from various levels relative to the contexts of discovery in archaeological sites (spatial and temporal distribution), and according to the scientific problematic. On a synchronic axis, similar pottery techniques can indicate an identical apprenticeship network that can be interpreted as groups with a common cultural affiliation, while differences would correspond to different communities (Roux, Courty 2019). In diachrony, technical changes reflect socio-cultural transformations and then authorise to characterise technical evolution as an endogenous or exogenous process. Thus, the technological analysis leads to interpretations of chronological, economic, and socio-cultural order.

In the example of Muweis, the large technical variability observed in synchrony (6 technical entities for manufacturing, for a total of 14 technical groups: fig. 15) indicates that this site brought several social groups together. This would suggest that this city gathered populations from different regions of Sudan. The discovery of ceramic workshops in Muweis indisputably proves the craft specialisation—meaning that it exceeds the personal need of the potters—of a part of the production at least. Today, the question of the status of these artisans (independent or attached) remains unanswered; as does the context of manufacture of the hand-made ceramics (coiling, hammering/coiling, moulding, modelling), the production rates and the functions of the vessels differing from the wheel-made ones. The study is still in progress concerning the understanding of the organisation of the production and to connect its evolution to the history of the population of Muweis.

Hence, the *chaîne opératoire* concept does not only lead to determine the techniques of fabrication of a finished product but—as the expression of identity choices from the potters—is the starting point to historical and socio-cultural interpretations ■

[E.J.]

Ethnoarchaeology and Experimental Archaeology II.6

Introduction and Methods

Ethnoarchaeology and experimental archaeology are considered as an aid in the interpretation of archaeological remains. The aim of ethnoarchaeology is to observe living societies and their behaviour in order to question and explain archaeological records (Binford 1981, p. 32) while experimental archaeology has been defined as "the fabrication of materials, behaviours, or both in order to observe one or more processes involved in the production, use, discard, deterioration, or recovery of material culture" (Skibo 1992, p. 18). Experimental archaeology leads to test hypothesis by reproducing archaeological objects and their process of manufacture using laboratory and actualistic methodologies. In practice, the *chaîne opératoire* approach includes aspects of ceramic production such as techniques, methods, tools, and social context (Roux 1994). In other words, ethnoarchaeology and experimental archaeology might yield insightful information on the material culture and on the behaviour of the societies which produced and used it.

Ethnoarchaeology and Experimental Archaeology in Practice

Both ethnoarchaeology and experimental archaeology follow a dedicated research methodology and regard the interpretation of archaeological data as their primary goal. It is worth while noting that the use of both research techniques in archaeological investigation poses methodological problems and sets traps of which researchers should be aware. Concerning

Figure 16 ▲ Pottery workshop in Jabarūna village with a detailed view of the potter's equipment (top, middle) and a quern with stone pestle for preparing grog (bottom). Photos by B. Franczyk.

Figure 17 ▶ Selected stages of the shaping process: preparing the base of a water jar *azyār* (top) and scraping and smoothing the external surface of the vessel with a plastic scraper (bottom). Photos by B. Franczyk (top) and K. Danys (bottom).

Figure 18 ▲ Process of drying in the courtyard of the potter's house (top) and vessels with a yellow burnishing surface ready for firing (bottom). Photos by K. Danys (top) and B. Franczyk (bottom).

Figure 19 ▲◀ Pottery kilns in Jabarūna village in the form of a pit with metal shreds and plates at the top as isolation to protect vessels from the flames and different stages of the firing preparation. Photos by B. Franczyk.

ceramic studies, these research tools are able to determine which aspects of ceramic production can be possibly reconstructed and how. Ethnoarchaeology and experimental archaeology complement each other therefore combined investigation would definitely be the most beneficial approach.

Ethnoarchaeology is considered more a research approach than a theory or method and has a lot to offer for ceramic specialists. Here we are using ethnoarchaeological research carried out in Sudan as a representative sample.

Fowler's division of ethnoarchaeologists focused on pottery studies isolating two main approaches (Fowler 2017). The "positivist approach" basically contains everything that could be described as a technological aspect of ceramic production. The central role of the object to characterise the production system is emphasised. The major part of ethnoarchaeological research in Sudan, focusing on the analysis of contemporary pottery workshops, is included within this school of thought. One of the earliest studies of this type was conducted in Darfur, where the focus was mainly on the firing process and the preparation of ceramic mass (Tobert 1984). Subsequent research focused essentially on the recording of the *chaîne opératoire* within local pottery workshops in the Nile Valley.

The second approach is qualified as "humanistic/symbolic". This approach assumes that the creation of vessels is both a technological and social process, and simply questions "how society influences making things". This school is mainly followed by researchers involved in projects implemented in West Africa. So far this approach has not been fully explored in Sudanese ethnoarchaeology, although more recent contributions have taken a small step in this direction by using ethnographic methods to record closed down pottery workshops in the Ad-Dabba region. Ethnographic interviews have proved that the social memory of former customers has given light to deserted places of pottery production.

Focus on the technological aspects has been chosen as the starting point for more detailed research. Ethnographical investigations carried out in the village of Jabarūna (*ca.* 30km upstream from Ad-Dabba) by the authors are turning to a "humanistic/symbolic approach". Observation of the pottery production *chaîne opératoire* (figs. **16**-**19**) aided in the interpretation of the Funj period ceramics found in Old Dongola. Research is mainly focused on the problems of apprenticeships in a potter's society and abandonment of objects in deserted areas such as the Abandoned Village in Old Dongola (fig. **20**). Full understanding of the local *chaîne opératoire* will enable the identification of the social dimension of the contemporary pottery production (Mayor 2010).

The main goal of experimental archaeology in ceramic studies is to reconstruct the various phases of the *chaîne opératoire* using single-segment experiments (concerning, for instance, raw materials: their resources, collecting strategy and fabric preparation) or combined segment experiments where all actions related to the ceramic production are included. Research of the properties of ceramic vessels and their use could also be one of the aims of experimental archaeology. A single-segment experiment was applied in research relating to forming techniques in order to test the hypothesis whether the relative density of sherds correlates with the technique used to form the vessel. During the experiment, vessels were formed using different techniques and pores in the ceramic paste were analysed using laboratory methods. The structure and texture of the paste were correlated with the forming technique, and the obtained results were compared with data derived from laboratory analysis of ancient pottery. The ability to reconstruct shaping techniques can therefore be considered an achievement subsequent to the implementation of experimental archaeology. A single-segment experiment on the impressions of mats on vessels was conducted on material from the Fourth Cataract (Phillips 2010) and on the Funj pottery

Figure 20. Storage vessels (top), pigeon vessels made of cooking pots placed in the wall of the house (middle) in the Abandoned Village in Dongola called *Hilla* Dongola and a ceramic bowl by a Muslim grave in Old Dongola (bottom) placed as a bird feeder according to informants. Photos by K. Danys (top) and B. Franczyk (middle and bottom).

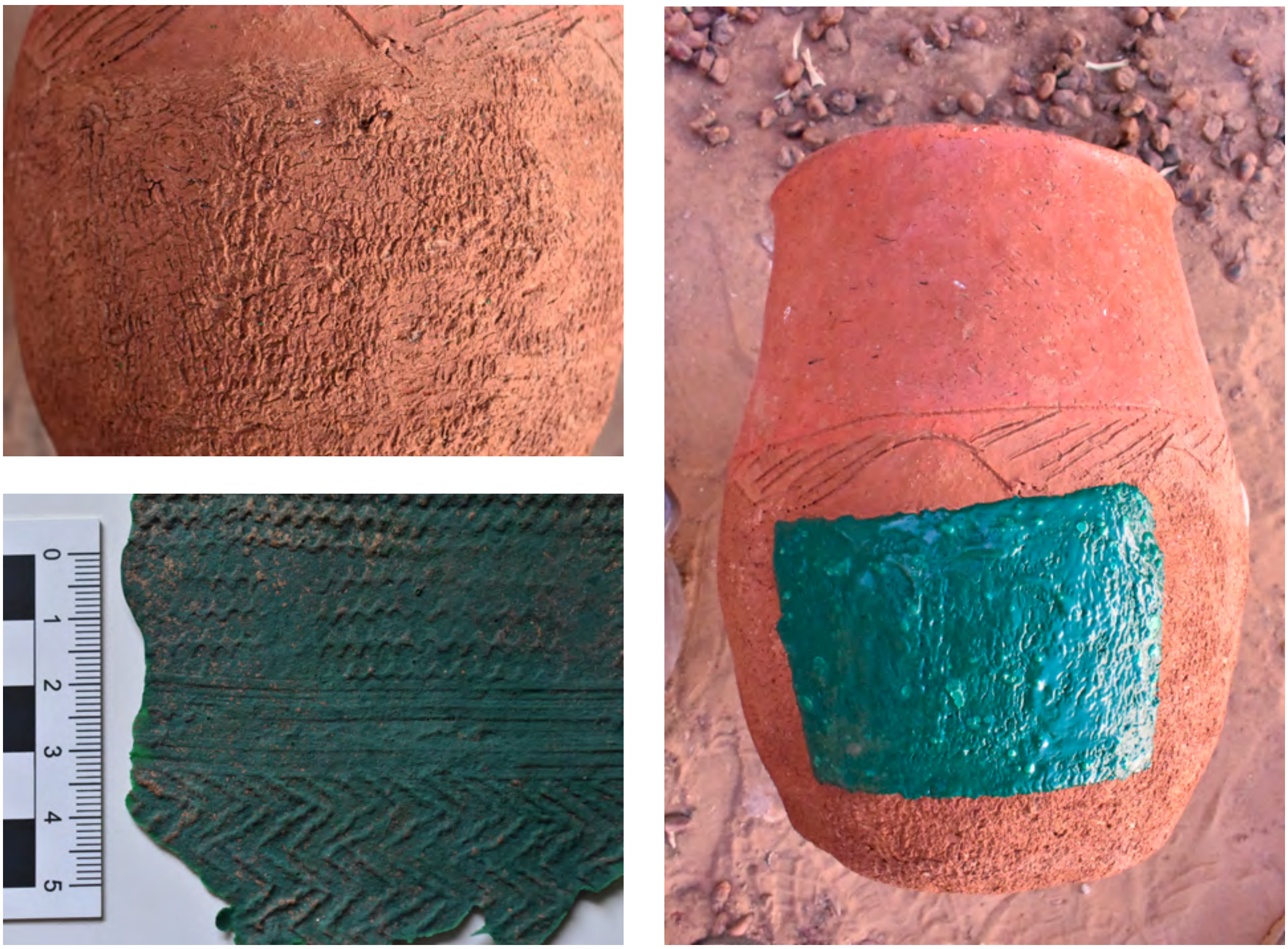


Figure 21. Process of silicone casting of the surface with corncob impression (top left and right), and silicone cast (bottom left) with an impressed decoration on the surface of a vessel. Photos by B. Franczyk.

in Old Dongola (fig. **21**). Silicone castings made from the surfaces of pots were compared with remains of mats and basketry found in contemporary archaeological material. Clearly, the applied method needed improvement, as some of the impressions were too shallow to leave traces in the silicone paste. While research of the sources of the impressions is still on-going, one action of the *chaîne opératoire* has been tested using an experiment, investigating other archaeological resources, and comparing them in order to reconstruct one of the aspects of the Funj pottery production. A combined-segment experiment of the firing technology of Meroitic pottery consisted of a multi-levelled process which encompassed resourcing and preparation of clay, shaping of the vessels and firing. Laboratory analysis of the experimental pottery was carried out and the results aid to reconstruct the actions of the *chaîne opératoire* in the case of Meroitic pottery (Daszkiewicz, Wetendorf 2017).

Discussion

Although ethnoarchaeological sources are useful in the reconstruction of past human activities, researchers should be aware of possible misinterpretations of so-called cautionary tales. Conclusions based on investigation of ethnoarchaeology and experimental archaeology should be careful of misuse of the analogy, which is the most common research tool in archaeological interpretation. Obviously, the idea that local communities are the most suitable for ethnoarchaeological reasoning is far too optimistic (London 2000, p. 3). Nevertheless, the application of a "direct historical approach" in investigating ancient pottery techniques and their social dimension can provide further information that has been lost between the living society and the archaeological context (Stahl 1993, pp. 242-243).

Ethnographic research carried out in Old Dongola allowed the use of acquired data as analogy for 17th-18th century pottery from the Funj settlement on the site. Members of the local community share the same environment with their predecessors who used to occupy the area under archaeological investigation. The short time span separating archaeological and ethnographic data enabled the use of the latter as analogy in the research. The application of ethnoarchaeology in places with on-going archaeological activity should be included along with a program of community engagement. Collaboration between researchers implementing ethnographic studies and members of local community should be beneficial to both groups ■

[**K.D.** & **B.F.**]

Documentation of the Assemblages

This chapter chronologically describes the process of documentation implemented on the field after the sorting of an assemblage. Once the ceramics are grouped according to the chosen classification, firstly they need to be counted (see Section III.1). The forms to be fully documented are then selected, tagged, and described (see Sections III.2 to III.5). These steps are crucial as the selection procedure will determine what will be used for the study as well as for the publication thereof. Selection also means discarding the unselected potsherds and, in many cases, the discarded pottery will be cast aside to a devoted area and mixed with the bulk of already discarded pottery. Only one rule needs to be kept in mind: the more documentation there is, the easier it will be to choose the most relevant afterwards ■

Quantification III.1

Why Counting Sherds?

Counting or the quantification of sherds is considered a self-evident part of the documentation process of ceramic material. It allows an overall comparison between different types of archaeological contexts, trenches, or sites (Arcelin, Tuffreau-Libre 1998; Orton et al. 1993, pp. 166-181; Verdan 2011; Rice 1987, pp. 288-293). However, as "counting sherds" is a time-consuming activity, the suitability of each quantification deserves to be questioned. The quantification of something must have a precise purpose which can either be general (e.g. the relative proportion of isolated groups of production) or accurate (e.g. the number of vessels or the storage capacity, etc.). A quantitative approach is above all related to the chronological and economic issues raised by the archaeological material.

A Check-list before Counting

Before performing the quantification of a ceramic assemblage, the following questions should be answered:

Is the classification of the pottery in use valid?

Quantification is fundamentally linked to the development of a classification system. Counting sherds without a clearly defined and established classification scheme may lead to invalid results. The comparison between two quantifications using different classification methods would be unproductive. Therefore the use of the same method to compare material is recommended.

Is the type of the archaeological site well-known?

The nature of an archaeological site can have a valid impact on the method used for counting but also on the questions to which answers are sought. For example, some amphorae in a shipwreck do not yield the same information as a pottery dump in a town. Comparison between different types of archaeological sites should be approached with caution.

Are the archaeological contexts (stratigraphic units, chronological horizons, contexts, etc.) well-defined?

A ceramic assemblage consists of complete and broken pots which are found within isolated archaeological units. The homogeneity or mixed nature of each unit must be discussed, and the specialist may introduce accordingly a qualitative sampling to ensure the validity of his counting (for instance, if the excavation had time constrictions such as rescue excavations or materials that got mixed up).

Is a count of a selection of an assemblage necessary? If yes, on which criteria?

A selection of material from the most relevant contexts is usually undertaken to address certain topics such as a particular question to which a specialist would like to obtain a clear answer or when a time constraint is set (e.g. test trenches and dating results). For example, surface finds are usually not ideal whilst closed contexts are favoured.

Are the selected ceramic assemblages representative and valid?

Statistical exploitation of the counts is successful when the sampling is representative from both a qualitative (considering all categories and forms in a homogeneous manner) and a quantitative point of view. For instance, an assemblage that is too small might not necessarily lead to a general overview of each defined pottery production. Primarily, quantification of material is applied to facilitate comparison which supports the larger historical picture; hence the use of the same counting method for each assemblage is crucial.

The various Methods

Once the preliminary questions answered and a sorting process set up, two broad types of quantification can be distinguished:

Quantification before Refitting

Sherd count or the Number of Remains (NR) considers ideally all the fragments belonging to one given context. It allows an immediate overview of the composition of an assemblage. However, this method tends to overestimate the individual vessel or form count within the categories with a higher broken sherd count (e.g. amphorae, jars) and to underestimate other groups such as fine wares.

Weighing the pottery presents similar advantages and imperfections as the sherd count (NR) but additionally provides more representation to weighty and larger-sized vessel productions. However, this method is sometimes recommended, for instance in the case of a homogeneous assemblage of amphorae the original weight of which is already known.

These two methods offer a general assessment of the composition of an assemblage, but their analytical value is rather limited. A more elaborated approach to quantification might produce more reliable results.

Quantification after Refitting

The determination of the "Minimum Number of Individuals" (MNI) is obtained after sorting each category or group and respectively counting rims, bases, handles and body sherds (diagnostic sherds) before and after refitting (fig. 22). This provides information about the *degree of fragmentation* of the pottery assemblage within an isolated context. The actual MNI can be calculated after the refitting process with the highest numbers of rims or bases per each category. The accuracy of the MNI is related to the time spent in matching and joining sherds. It can be balanced in counting 1 for a category represented by body sherds only.

The "Estimated Vessels Equivalent" (EVE) follows a similar pattern: it measures the preserved arc of a rim sherd as a percentage of a whole rim (bearing in mind that a complete rim equates to the 360° of a circle). For this approach all the rims (or the bases, which is a less practiced option) must be measured per category using a *rim chart* with degrees/preserved percentages. The total amount of all degrees/preserved percentages is calculated and then divided by 360°. These results are better presented in fractions than in degrees or percentages.

These methods usually provide comparable results but do not have the same limitations. Whilst the MNI tends to facilitate an overestimation of the number of pieces of pottery (one pot can be counted several times if scattered over more than one context), the EVE, which is more focused on individual vessels, can underestimate a category if only represented by body sherds and additionally requires that all necessary sherds be measured.

site Mouweis	season 2020	rec. name RD	rec. date 27/10/2020	sheet no 4

Counting form

Sector/area/trench	N° Context/Str. Unit/Spit/locus, etc.	Comments
1	1012	Few material, mainly eroded. Supposed date 2nd c. AD. Only a few drawings

Group	Rim	Base	Handle	Body	**NR**	**MNI**	Associated shapes/remarks
W 1	1	-	-	8	9	1 [1]	1 carinated bowl
W 3	10	-	-	11	21	9 [2]	see 1012-01 to 1012-06
W 4	4	2	1	88	95	3 [3]	see 1012-07 to 1012-08
W 6	-	1	1	6	8	1 [4]	1 ringed base of a jar
W 8	2	3	-	12	17	3 [5]	see 1012-09 to 1012-08
W 12	-	-	-	4	4	1 [6]	sherds from the same jar

Comments

1 The MNI is calculated on the single rim observed.
2 Two rims were joined or refitted so the MNI equals the total of rims minus 1.
3 As in 2, two rims were refitted. The number of bases and handles is inferior to the number of the rims.
4 As there are no rims, the MNI is calculated on the number of the base.
5 The number of the bases being higher than the number of rims, the latter is the one taken into account for the MNI.
6 As there are only sherds to represent this category, the MNI is weighed to equate 1.

Figure 22. Example of counting form using quantification of NR and MNI.

Presentation of the Results

Favour is given to a combined quantification method of the MNI and NR in our counting sheet, as it appears to be the most practiced and practical one (fig. 22). Each context is counted separately, and groups can be named and isolated according to the category they belong to (fine wares, common wares, amphorae, etc.). A box allows referral to shapes which will undergo a full documentation process on an additional chart provided. To conclude, there is no perfect method of quantification, it is up to the specialist to define the best strategy according to the context of the excavations and to the issues the specialist needs to answer, but it is essential that the strategy is consistently and comparably applied ■

[R.D. & S.B.-M.]

site	season	rec. name	rec. date	sheet no

Counting form

Sector/area/trench	N° Context/Str. Unit/Spit/locus, etc.	Comments

Group	Rim	Base	Handle	Body	**NR**	**MNI**	Associated shapes/remarks
Total							

Selection of Forms to be Recorded III.2

Selecting pottery forms is an orderly approach to classify large amounts of objects in "time and space" including their variations and production, and respectively the changes thereof. It contributes to the understanding of the function of the objects and therefore also contributes to the interpretation of the archaeological contexts and the evolution throughout the occupation of the site or of the region (Orton et al. 1993, pp. 57-61).

Different Types of Contextualised Collections

During survey investigations the collection and selection of pottery depends essentially on in-field preselected diagnostic sherds from the surface of the investigated area. Archaeologists face a very deceptive and fragmentary picture which does not render the formation of a typology easy. Rims, bases, and handles (diagnostic sherds) are common, but there are hardly any complete profiles. Stratigraphic sequences are rarely available and consequently the reconstruction of an evolution of forms is challenging, unless comparisons already exist, or other well-dated material can be associated with certitude to the unknown forms.

Test trench excavations containing a larger number of sherds present a different situation and although chances are greater for refitting and thus the evaluation of complete shapes, the fragmentation degree is also higher and, due to the restricted size of a test trench, the collection of material often results in a knowledge of certain rim shapes, but not which base certain variations might belong to.

The selection of pottery forms from archaeological excavations, especially from graves and cemeteries, often furnishes the best-preserved material. Fragmentation of material tends to be lower making the identification of complete forms easier for archaeologists and rendering a higher percentage of refit success. Moreover, high refitting success is often found in closed contexts providing single chronological points in time. This allows for a refined chronological typology. Settlement excavations tend to be the most challenging as the quantity of material can be overwhelming. These give the possibility of finding complete vessels but also small, fragmented pottery dumps which provide a glimpse of a large variety of material.

The amount of work depends on whether a typology of the site or the region is already known or if it still needs to be established and researched.

A Practical Guide to a Form Typology in the Field

One of the main contributions of an archaeological excavation for the building of a chrono-typology (see Section v.1) is the provided stratigraphic sequence. This sequence allows to pinpoint certain pottery types to certain time periods and therefore to reconstruct the changes and evolutions within the ceramic morphological repertoire throughout the lifespan of the site.

If the chrono-typology is already known for a certain site or region, the study of the material will evolve to a more comparable method whereas the assemblage is matched, for instance, to already available literature and is thus verified accordingly. Additionally, it permits to identify which vessel forms were locally produced or might be regional or imported from far away.

Step 1

Assuming a new chrono-typology needs to be built, the challenges and strategies are complex. In this case, one must create the typology by documenting the pottery first and classifying categories of ceramic such as the field sorting pottery groups (see Section II.2: cooking ware; fine ware; common ware; etc.); the shapes (bowls, cups, jugs, jars, etc.); and the surface treatment (slip, burnishing, glaze, etc.).
Useful classifications and tools to start with are:

The use of the quantification categories and field sorting pottery groups (see Section III.1)
The use of an "internal" code of detected shapes; here a few examples shall be given:

For instance, the cooking ware from the medieval period in Apamea, Syria was classified as follows (Vezzoli 2016):

Category: Cooking Ware
Rim 1: everted rim
Rim 2: folded rim
Rim 3: grooved rim
Handle 1: grip handle
Handle 2: basket handle
Handle 3: vertical handle
Base: rounded base (B1)

In a further stage the codes or classifications can be combined if more complete shapes are discovered during the excavation. It allows associating a rim (or a handle) to a complete form and the typology could be enriched as follows (fig. 23):

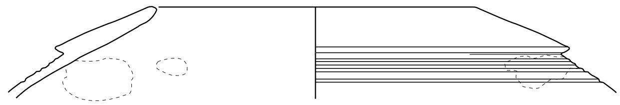
CP01: Cooking pot: Globular holed mouth cooking pot, with folded rim (Rim 2), basket handles (Handle 2), and rounded base (B1). The folded rim can be broader or smaller (variant CP01b).
CP08: Cooking pot: Globular holed mouth cooking pot with grooved rim (Rim 3), vertical (Handle 3) or basket handles (Handle 2), and rounded base (B1).
CP09: Cooking pot: Globular cooking pot with short neck and everted rim (Rim 1) with grip handles (Handle 1), and rounded base (B1).

Step 2

The next step follows when the excavations stratigraphic sequence, chronological evolutions and changes can be traced further: for instance, the pot CP09 appears in Phase 3 and continues until Phase 6 (dating to late 12th-late 13th century AD); while CP01b was distributed during the entire medieval occupation of the site (Phase 3 to Phase 7, the CP01 variant is attested later, from Phase 5 to 7, the period for which it is the most representative shape (dating to 13th-14th century AD). Finally, CP08 is also attested during the same period as CP01 but is less common (fig. 24).

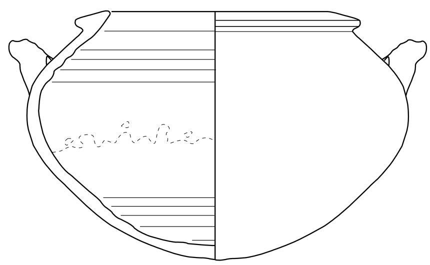
Possible research questions would be: Was this evolution in shapes related to specific functional purposes or due to different suppliers, or are even other socio-economic aspects involved?

CP01: globular holed mouth cooking pot (diam. 10-23 cm) with wide folded rim (2,5-4,5 cm), basket handles on the shoulders and rounded base.
Associated with: Type BW (Brittle Ware)



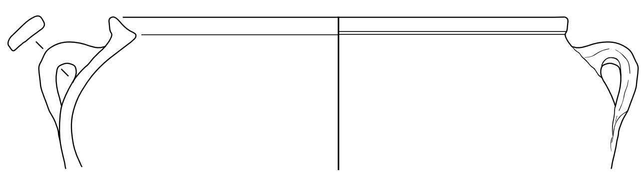
AP.05.I.64.38

CP01b: globular holed mouth cooking pot (diam. 10-21 cm) with folded rim (1,5-2,5 cm), basket handles on the shoulders and rounded base. The width of the folded rim distinguishes it from the previous pot (CP01).
Associated with: Type BW (Brittle Ware)



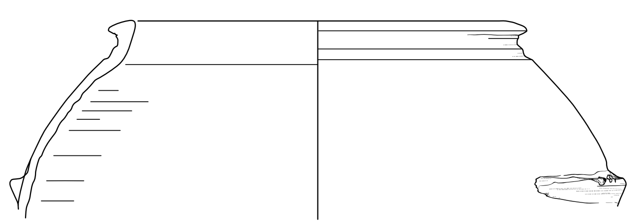
AP.05.I.129.2

CP08: globular holed mouth cooking pot with grooved rim and vertical handles or basket handles. The grooved rim was probably used to place a lid (diam. 18-15,5 cm). Shoulders can be decorated with a band of fine incisions.
Associated with: Type BW (Brittle Ware)



AP.04.IV.119.5

CP09: globular cooking pot with short neck and everted rim (diam. 13-19,5 cm). Grip handles can be detected.
Associated with: Type BW (Brittle Ware)



AP.05.I.30.17

Figure 23. Example based on the study of the ceramic assemblage from Apamea (Syria) on how to create an "internal" coding system for detected shapes (Vezzoli 2016).

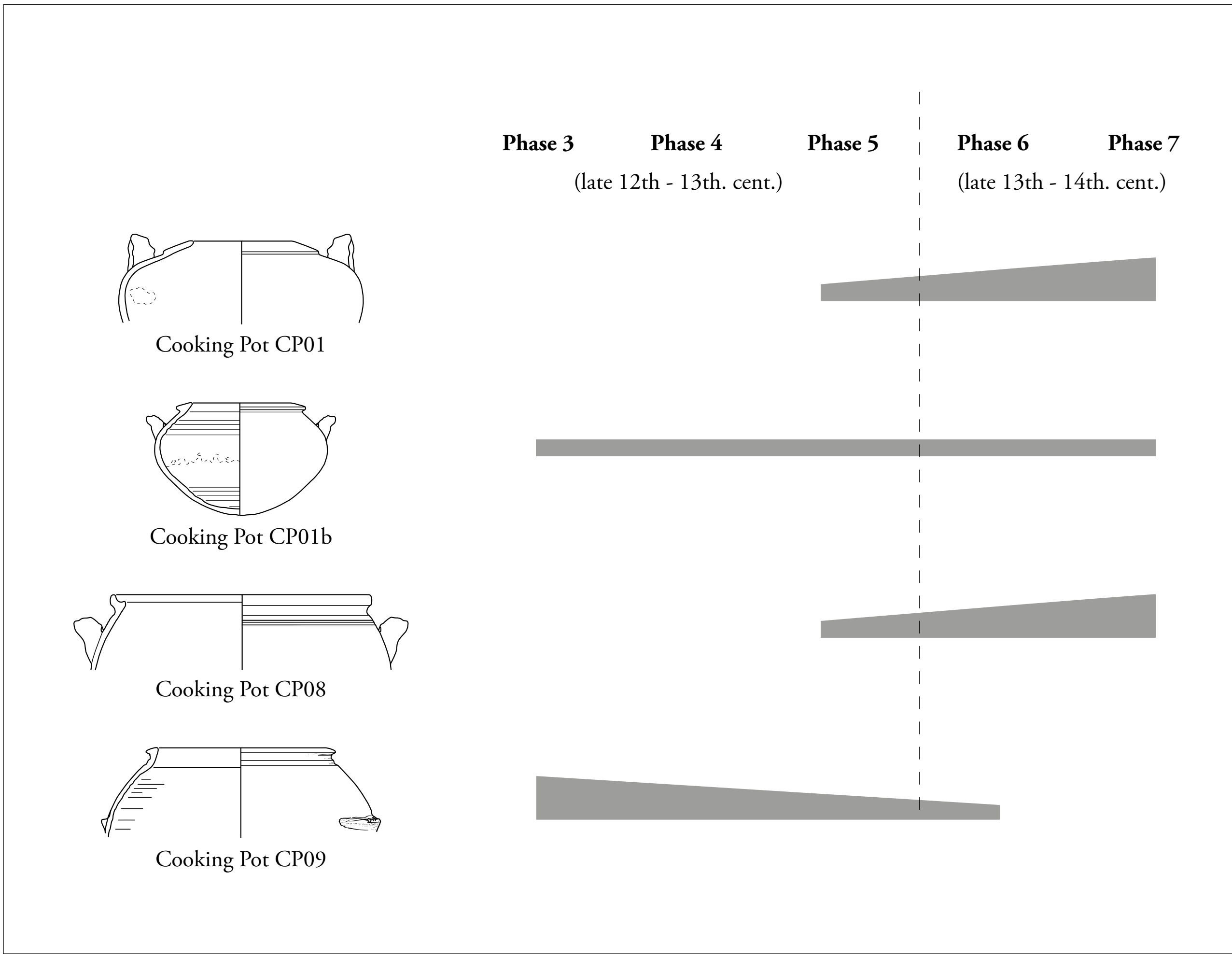


Figure 24. Example based on the study of the ceramic assemblage from Apamea (Syria) on how the evolvement of pottery forms throughout different time phases can be traced (Vezzoli 2016).

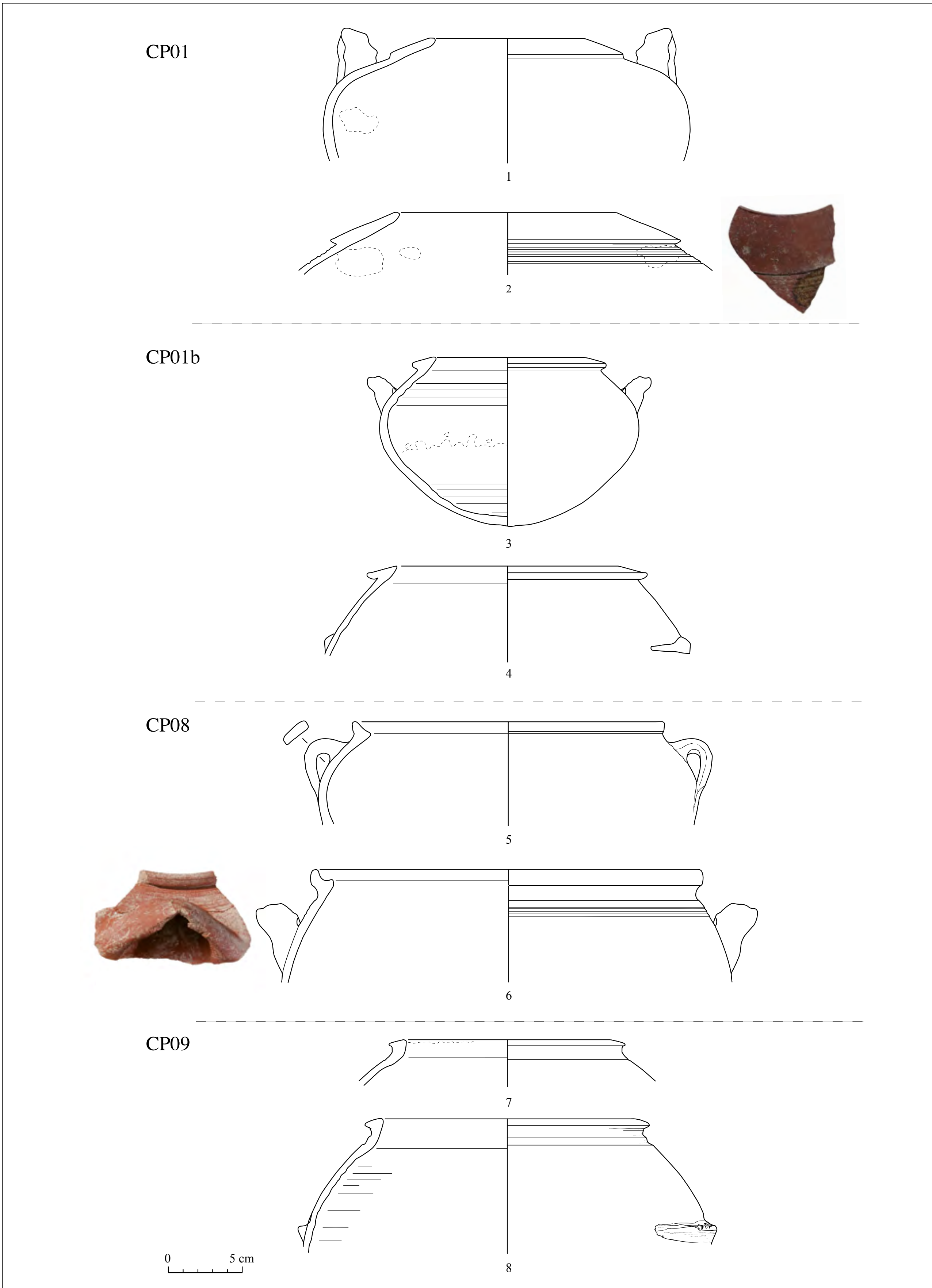


Figure 25. Example based on the study of the ceramic assemblage from Apamea (Syria) on how a possible display of associated forms from specific pottery type categories could be created (Vezzoli 2016).

Pottery forms do change and evolve for different reasons and the understanding and interpretation thereof is the main objective. For example, some cooking pots could have ceased to be attested on the site due to the supplying production centre having stopped their production or increased the price bringing their users to choose another workshop. Some forms may no longer be attested due to changes in culinary habits, which could reflect on the selection of the ware.

The practical step here is to create plates from the technical drawings of the material displaying all forms associated to a specific category or type. These assists to visually detect how changes in the different stratigraphic units or archaeological phases occur and allow re-grouping or separating certain forms whilst developing the chrono-typology (fig. 25).

Step 3

When the form typology is built (or a larger majority thereof), chronological plates of the identified forms should be created (see again fig. 24). This offers a picture of how a form evolved in different time phases of the site or when it stops to be attested and when it was maybe replaced by another form, etc.

The same methodology can be applied when creating a chrono-typology for survey or trench material (see Section v.1). However, consideration must be given to the fact that the assemblage alone would be insufficient to reconstruct such a complete repertoire, due to the above-mentioned dimensional limitations when working with sequenced material ■

[V.V. & S.B.-M.]

Numbering the Objects III.3

The numbering or "ID-ing" process of pottery is a coding structure which requires a clear and well-defined systematic and it ties in perfectly with the respective excavation records (Orton et al. 1993, pp. 52-54). These coherent and consistently applied number codes in combination with the provenances form the base for successful research, storage (short and long) and management thereof as well as accessibility for further studies or researchers. Traditionally, a large variety of numbering systems are used by archaeological missions working in Sudan or elsewhere, the majority of which are very reliable if understood / decoded.

Variances between the numbering of all sherds versus vessel units should be well thought out beforehand. Whilst the first would number each sherd from an excavation as a single item the second approach numbers all sherds belonging to one vessel as a single ID. Differences in numbering (that is, which sherd receives a number?) are often related to the method of pottery processing and should be systematically recorded either in a site manual or in the methodology section of the publication.

Essentially, the finds number, vessel unit number, ID or code of ceramics (or other objects!) follows a certain interchangeable schematic (fig. 26) but can also vary slightly according to where the preference of the project is set and spaced, however the most common are:

— Initials / diminutive of the archaeological site / project—year of excavation / or process—continuous number for the object, often starting with 001 for each year, as at Hamadab (see fig. 26 HVU-15-0058).

— Initials / diminutive of the archaeological site—year of excavation / or process—sector of the site—context—continuous number for the object, as at Dongola (see fig. 26 D.19.1.1.1200).

— Initials / diminutive of the archaeological site—continuous number, such as D001 although nowadays the latter is not recommended.

The key reason for this process is to provide a unique ID to an object linked to a record of its provenance enabling location, tracking and reference thereto thus ensuring that it is not an anonymous item within a heap of sherds. Loss of such code numbers on sherds usually results in the loss of provenance and contextualisation, hence the use of the object for research purposes reduces it to a simply "pretty" or "interesting" item, but useless for further scientific analyses.

As a final word, remember that:

— Its provenance and contextualisation will be irremediably lost.

— The most successful for the provision of the initial information is clearly the use of the provenance but this can result in long numbers which may cause practical issues in the field (e.g. the sherd is too small for number etc.) ■

[K.D. & S.B.-M.]

Ceramic Description III.4

After executing the first steps in ceramic management (collecting, washing, refitting, sorting, quantifying, and selecting), the ceramic material needs to be inventoried and described.

The Purpose of a Ceramic Description

The main purpose of ceramic description is to provide a valuable dataset about the individual object itself and to contribute and enhance broader research studies, as well as to create an archival record. The objectives of the research may range from building a chrono-typology, questions concerning ancient technological approaches, to carrying out statistical analysis for certain or all aspects of the archaeological area, etc.

The person in charge of the assemblage or a specialist of a specific period, a specific production, etc., will be able to consult this data whenever it is needed using the hard copies or by checking the database (see Section IV.3). It will be possible to exploit the data at any given time in the future, independent of location. The information gathered thanks to these descriptions is thus available for study even once the fieldwork is finished.

Different strategies can be adopted for the selection of material to be described. As a selected approach is required by many archaeologists, not all preserved material is described in detail, for instance, undecorated body sherds do not all have a description (ID) form. The choice of what needs to be described in detailed records depends on the objectives of the study, financial restrictions, time restrictions, the type of archaeological context, and very often the overall project aims (see Section III.2).

Generally, a ceramic description consists of detailed observations concerning the physical aspects of the collected object, its state of preservation, administrative elements such as the provenance, recorder, drawing number etc., shape, ware—or functional group,

Archaeological missions	Code numbers (e. g.)	Code decrypt for site
Banganarti	BA-18-1529	**Ban**ganarti, season 20**18**, continuous number **1529**
Damboya	DAM20-E-001-Cer. 054	**Dam**boya, season 20**20**, sector **E**, context **001**, continuous number **054**
Dongola	D20.1.1.1200	**D**ongola, season 20**20**, sector **1**, context **1**, continuous number **1200**
Early Makuria	Z4/79	**Z**uma tumulus **4**, continuous number **79**
Research Project	D2/4	El-**D**etti, tumulus **2**, continuous number **4**
	Tnq47/15	**Tanq**asi, tumulus **47**, continuous number **15**
Gazahli	P.14.077	**P**ottery, season 20**14**, continuous number **077**
Hamadab	HVU-15-0058	**H**amadab **v**essel **u**nit, season 20**15**, continuous number **0058**
Sedeinga	II T 165 Cd 01	Sedeinga, sector **II**, **T**omb **165**, **C**eramic **d**escenderie number **01**
Qasr el-Wizz	KEW 65-11-6-405	**K**asr **e**l-**W**iz, season 19**65**, **November**, date **6**th, continuous number **405**
QMPS Pyramids Meroe	QVU-16-003	**Q**MPS **v**essel **u**nit, season 20**16**, continuous number **003**
UCL/BIEA-Iron production	VU-901-MIS 3-3-14-152	**V**essel **u**nit, continuous number **901**, **M**eroe **I**ron **S**lag heap **3**, trench **3**, season 20**14**, context **152**

Initials/diminutive of the archaeological site: Depending on the country specific archaeological traditions often between one and three characters relating to the archaeological site or the project name e. g. D = Dongola, Q = QMPS, HMD = Hamadab, MWS = Muweis, TNQ = Tanqasi, DAM = Damboya.

Figure 26. Examples of coding systems used at archaeological sites in the Middle Nile Valley.

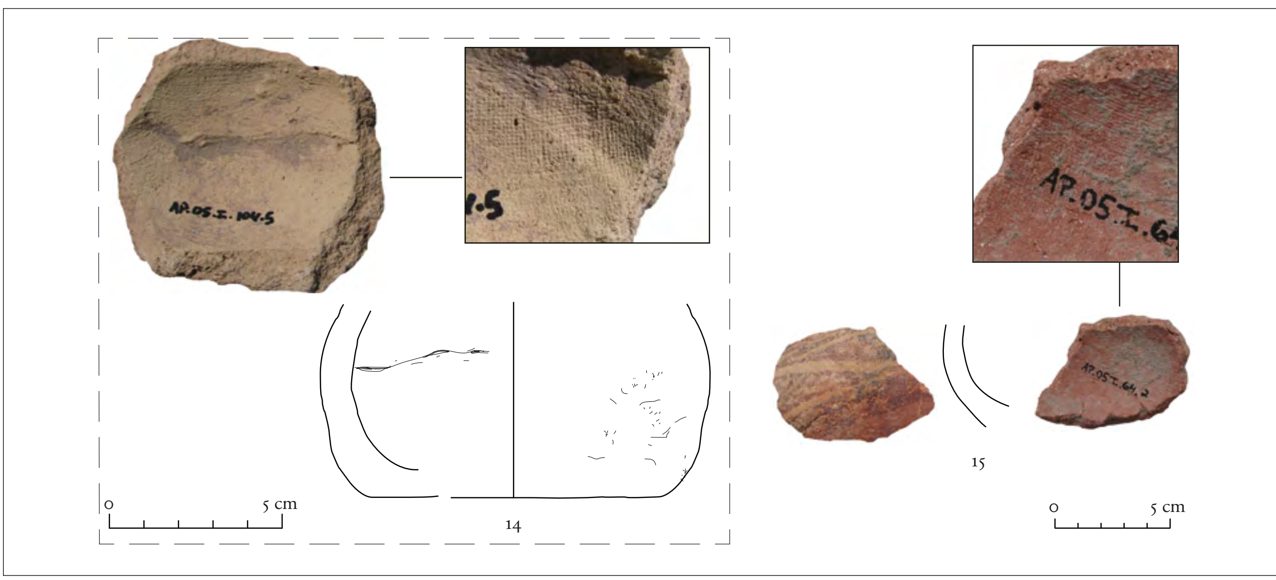


Figure 27. Traces of manufacturing techniques on the inside. Use of textiles to shape the vessel; on the left, also trace of coils. From Apamea, Syria (Vezzoli 2016, pl. 40, nos. 14-15).

Figure 28. Section of a common ware body sherd from Apamea, Syria (AP.04.IV.46.26) (Vezzoli 2016).

technology of manufacture, measurements, fabric features and codes, surface treatment and decoration (see Chapter II). Often it includes decisions for the next steps, such as the sampling for further laboratory-based analyses and possible storage location.

The Various Steps of the Description

Data regarding the provenance, stratigraphic unit, and year of campaign should be repeated to avoid loss. Each object described will be recorded with a consecutive ID-number (see Section III.3). The recorded form sheet per individual ID vessel unit number should be (later) entered into a database (see Section IV.3) to enable comprehensive analysis and the remote accessibility.

As the analysis remains influenced by the observations of the individual, it is useful to let the most specialised person fill in the description sheets. The first dataset to be added to the ceramic description form is that relating to the provenance of the object, such as the *ID number*; *sector/area/trench*; *context number/stratigraphic unit/locus*, etc. This first dataset provides the most essential elements of information for a chronological interpretation of the context of origin, identifying the evolution of ceramic production within the stratigraphic sequence, archiving, as well as the nature and functional use of the area under investigation.

A section regarding *preservation* and *vessel form* comes next. These records indicate which part of the vessel was collected; whether it is the rim, the base or the handle, as well as the number of sherds belonging to each vessel unit. It allows the recording of measurements, such as the diameter of the openings, the bases, and the thickness of the individual sherd. More detailed information on specific features can also be included.

It can be useful to make a sketch of the object which serves as a visual aid to easily sort forms when working on the typology. However, it is important to note whether a scaled drawing was made. The notes on the preserved percentage of rim and base enable statistical analyses of the whole collection and should be recorded (see Sections III.1 and IV.2). Analogies within the same site or in published papers should also be quoted.

The following part of the description form is dedicated to technology and use, which includes *manufacturing techniques*, *paste features, surface treatment* and *decoration*. All these aspects will provide further information to be incorporated into the typology, providing more detailed information on the base of wares and their features, as well as on information concerning clays and provenances, specific productions, firing conditions and possibilities, raw materials collection choices and potters' skills.

One of the first steps is to understand which *manufacturing techniques* may have been employed: hand-made or wheel-made would be the first major indicator. From there on even finer categories can be selected, such as: pinch-stretch, slabs, moulds, coils, wheel-coiling, wheel-throwing, textiles shaping such as "mat-impressed" (fig. **27**), etc. (see Section II.5). All of these techniques are often visible on the sherds themselves, as traces of joints between different coils, fingerprints for pinching or moulding (on the inside of the sherd), and/or regular concentric circles from wheel marks.

When possible, data regarding the type of firing—which can be determined based on the colour of the surfaces, the section, and the compactness of the fabric—should be recorded: 1) oxidisation, where there is circulation of oxygen during firing, or 2) reduction, with a low presence of oxygen during firing or semi-oxidizing or semi-reducing (see Section II.3). It could be interesting to note whether the object appears to have been evenly or unevenly fired, by observing the homogeneity of the surface colour, as well as if they had a secondary fire/heat exposure. The latter could provide important information on the use of the object. Additional observations of the residues on the sherd and sampling thereof for further analyses also prove to be particularly useful.

Regarding the description of *paste*, a specific series of information is required. Fabric observations can be made by using a microscope, magnifying glass, or the naked eye (see Section II.3). Colour characteristics must be recorded for inner and outer parts of the cross section. Archaeologists often employ the "Munsell Soil Colour Charts" to ensure comparability when identifying colours, but a well-defined simple colour notation system can also be effective (such as: R= red, Br= brown, Bl= black or rBr= reddish brown, etc.) as long as it is consistent. Developing fabric codes are advised and will ease the process. Most ceramic specialists even prefer a much more detailed description of the section's inclusions within the matrix, their nature (vegetal/organic or mineral/non-organic), dimensions, colour, and frequency (fig. **28**) for the individual object. A general interpretation of the fabric's quality (fine, semi-fine, medium, medium-coarse, or coarse) will produce an additional layer of detail in the classification of wares (see Section II.3 and Fabric description form).

Very often an additional *treatment of the surface* of a vessel performed by the potter to make it smoother or to decorate the pottery can be observed. This varies from plain surfaces to burnished ones (e.g. stripe burnished with a stone tool to seal the surface), polished (the more elaborated "fancy" type of smoothing using stone tools or textile cloth so the surface is sealed completely and is shiny), to a thin layer of wash (with use of clay and maybe pigments and water, making it "see through"), or a slip coat, using clay and pigments (so it is "not see through" but rather a thick layer of "paint"). A further treatment can be a layer of transparent or opaque coloured glaze which also serves the function of rendering a vessel waterproof. These types of treatment could have been applied to cover all or only parts of the surface and can be located on the inside, outside and/or around the rim, depending on the shape, function, and use of the vessel (i.e., open, or closed vessel, or respectively the use as a bowl or a jug). Surface treatments are often related to decoration but also served a functional use such as its waterproofing capacity or aiding heat distribution (e.g. water jars or cooking pots).

A vast variety of *decorations* and decorative techniques can be recorded on the external surface, internal surface, and rim of vessels (figs. **29-30**): incisions, excisions, grooves, combed patterns, stamps, and applications with the use of a large quantity and variation of different tools. These can be organised into patterns, applied as relief (applied or moulded), or stamped. Slip painting can be applied to the entire surface or can create specific designs and schemes, a glaze can cover the whole surface or only parts of it and can be applied above a layer of slip (which brings out the colour of the glaze or creates underglaze patterns). The glaze can also be opaque and then decorated with pigments.

When possible, the person in charge of the pottery should aim to provide a chrono-typology or preliminary chrono-typology of the described objects. This enables speedier determination of the specific type of object recovered. However, body sherds of all sorts, and especially undecorated common wares, can be challenging in terms of quantity and type determination.

Finally, it is important to keep track of everything studied (see Section I.2), such as if an object has undergone special restorations or if it has been sampled for further analyses, and where it is currently stored ■

[**V.V.** & **S.B.-M.**]

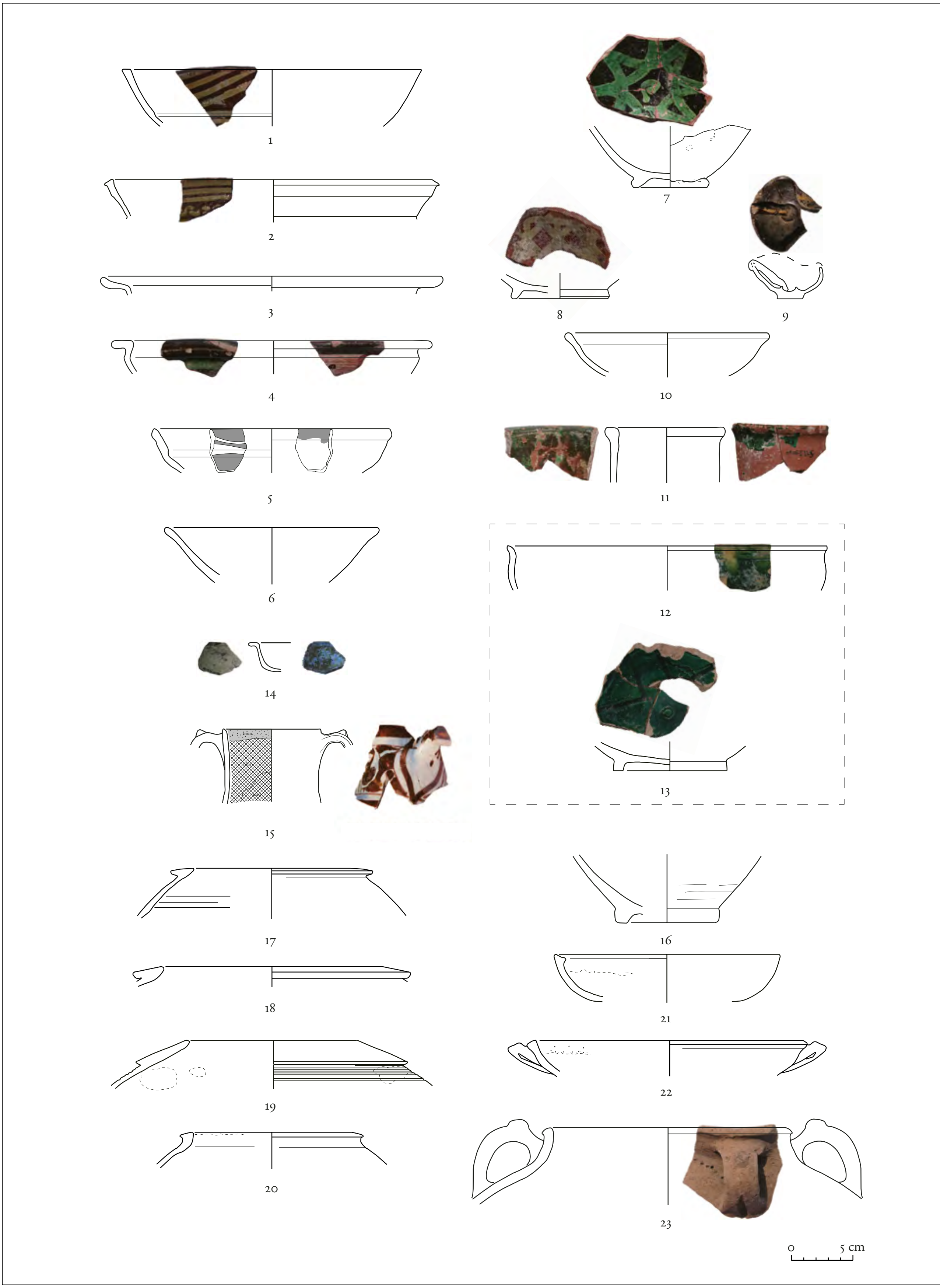


Figure 29. Plate with different examples of glazed surfacing (nos. 1-9: slip painted decoration under transparent coloured glaze; no. 11: monochrome glaze; no. 13: incised decoration under coloured transparent glaze; n. 15: lustre decoration on opaque white glaze). From Apamea, Syria (Vezzoli 2016, pl. 5).

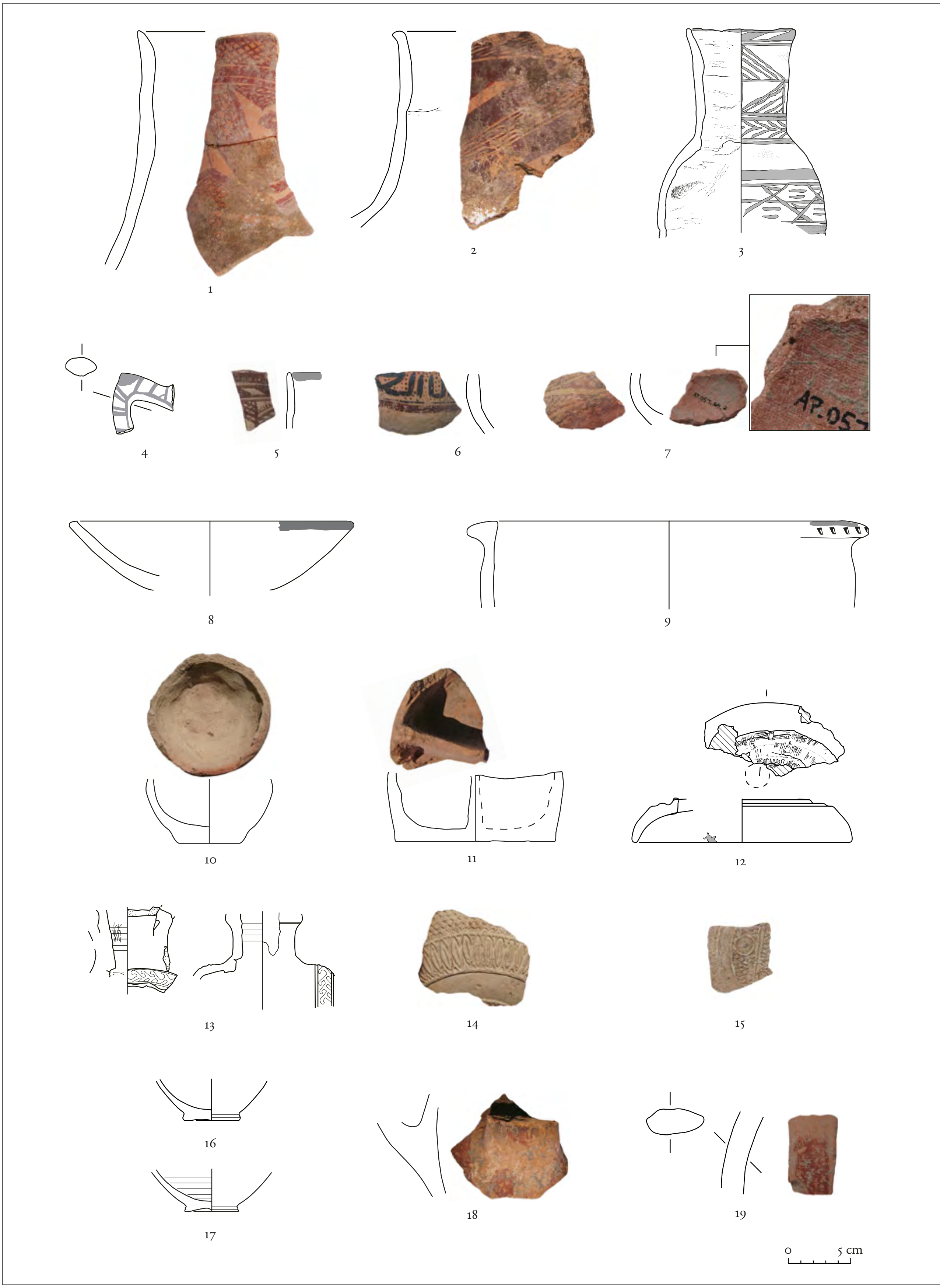


Figure 30. Plate with different examples of surface decoration (nos. 1-7, 18-19: painted decoration; nos. 14-15: moulded decoration). From Apamea, Syria (Vezzoli 2016, pl. 6).

site	season	rec. name	rec. date	sheet no

Ceramic description form

Sector/area/trench	N° Context/Str. Unit/Spit/locus, etc.	ID Number	Group number (according to classification system) and/or Technological Group (refering to technological description form) and/or Fabric code (refering to fabric description form)

Preservation

Whole vessel ☐ Fragmentary ☐ Complete section ☐

Number of sherds ....

Rim ☐ Bodysherd ☐ Base ☐ Handle ☐ Spout ☐ Other ☐

Vessel Form

Open ☐ Close ☐ Uncertain ☐ Type ....

Measurement

% preserved Rim .... Base ....

Preserved height ....

Opening (Rim) Diameter .... Base Diameter ....

Thickness (Min. and Max.) ....

Sketch

Analogies

....

....

Manufacture

Hand-made ☐ Wheel-made ☐

Comments ....

Firing

Oxidised ☐ Reduced ☐ Well fired ☐

Comments .... Uneven firing ☐

Paste

Colour of the section ....

Comments ....

....

Traces of Use

Content ☐ Erosion ☐ Soot ☐

Other ☐ ....

Temper

Organic ☐ Mineral ☐

Uncertain ☐ ....

Surface Treatment - Finishing

Inside		*Outside*	
None ☐		None ☐	
Smooth ☐		Smooth ☐	
Slip ☐	Colour	Slip ☐	Colour ....
Wash ☐	Colour	Wash ☐	Colour ....
Glazed ☐	Colour	Glazed ☐	Colour ....
Burnished ☐		Burnished ☐	
Other ☐	....	Other ☐	....

Decoration

Inside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐
Outside	Incised ☐	Impressed ☐	Combed ☐
	Moulded ☐	Applied ☐	Grooved ☐
	Stamped ☐	Painted ☐	Other ☐

Comments (position e.g. rim, body; colour and motif) ....

....

....

Other Information

season/year/storage location

Restoration	yes ☐	no ☐	....
Sample	yes ☐	no ☐	....
Drawing	yes ☐	no ☐	Drawing sheet number
Photo	yes ☐	no ☐	

Dating

by context ☐ ....

by object ☐ ....

Comments ....

....

Drawing and Photography III.5

Technical drawings and photography provide selected attributes of pottery useful for comparison and sharing among the scientific community. Technical drawings act as a reconstructed visualisation of an object, most often beginning with a single sherd, which allows to present manufacturing techniques, dimensions, surface treatments or decorations in combination with a reconstructed comparable shape.

Photography forms a second layer of information expressing the present state of the object. Both techniques respect certain standards to which academics are subject, even though the method and specifics thereof can vary from one person to another according to their experience and to the publication specifications (for more details see Olin, Dillon 1987; Griffiths et al. 1990; Aston 1998, pp. 13-25; Banning 2000, pp. 282-287; Collett 2012).

Technical Drawing

Technical drawing of sherds is a matter of experience and practice. What can take half an hour or more at the beginning can be achieved in much less with a little practice. It is important to understand that technical drawing follows defined rules and has nothing in common with artistic drawing (see Section IV.1). The most important aspect is the accuracy of the drawing which reproduces the external characteristics of the sherd to be drawn precisely. The purpose of technical drawings is to illustrate the profile of the sherd—a view of its vertical cross-section, that is as if we were looking through it from the outside—and therefore to produce a comparable and shareable dataset (fig. 31). However, it should be noted that there are several ways of proceeding with the technical drawing of a pottery vessel. The faithful result is what counts, and any helpful tools are welcome.

Equipment for Drawing

The minimum set of equipment required by the technical draughtsman includes: Tracing paper, Graph paper, sharpened pencils or technical pens (0.5 to 0.3 mm with hard leads 2H to 4H), a rubber, one or two set squares with measurements beginning at the edge, vernier callipers, a diameter/rim chart and most importantly a profile gauge (comb). The latter is more expensive and sometimes difficult to find. The 15 cm metallic profile gauge with fine metallic teeth is preferable to replicate the profile (vertical section) of the pots with precision but it should be used with great caution on fragile or painted pottery.

Drawing Sherds with a Profile Gauge

The first step of a drawing is to obtain the external vertical profile of the sherd (fig. 32). It can be easily taken with a profile gauge by holding it in one hand and applying it vertically to the sherd. A small wooden stick or your finger can be used to gently push the small metallic teeth of the profile gauge so that they follow any subtle changes on the external vertical section of the sherd (fig. 33 a). Then the profile gauge is placed flat down onto the tracing paper and, with the aid of a pen, the obtained profile can be drawn (fig. 33 b).

The second step is to measure the thickness of the sherd with the calliper tool (fig. 33 c) at various points: at least one at the top edge, one at the bottom edge and one in the middle in the case of a simple shape and as many points as required in the case of a complex one with more extensive variability of thickness within the section.

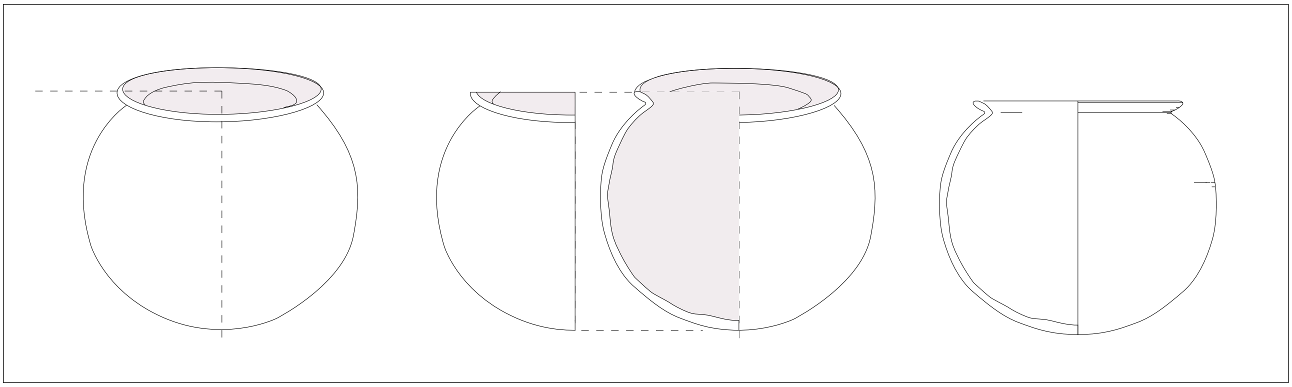


Figure 31. From a ceramic to its technical drawing (adapted from Banning 2000, fig. 16.8).

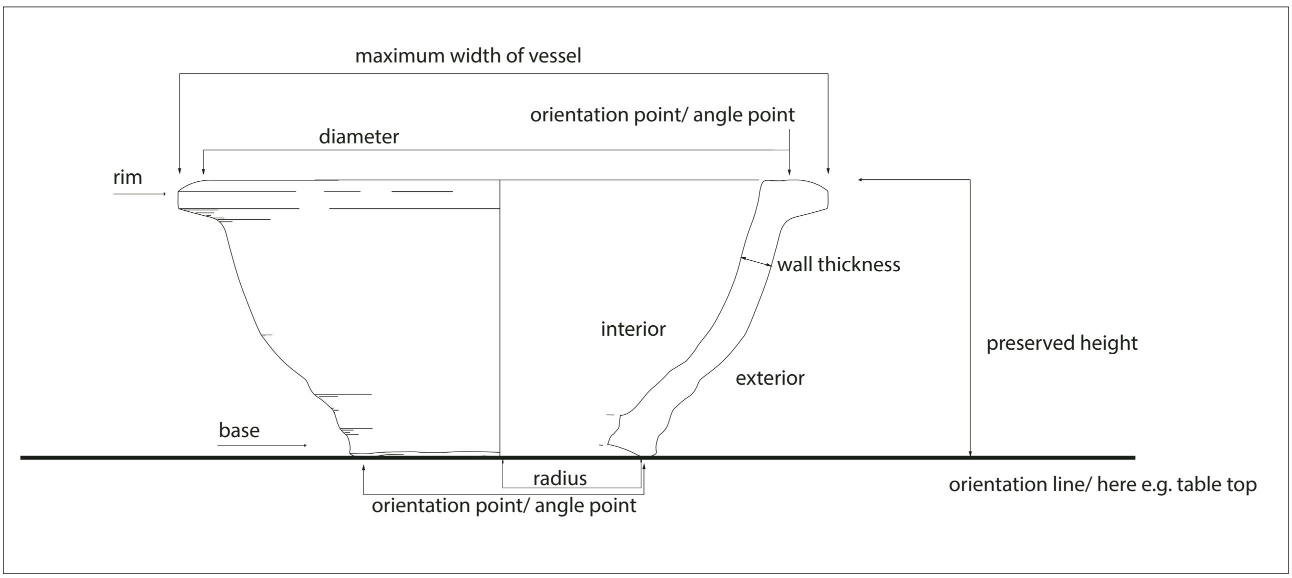


Figure 32. The various parts of a vessel.

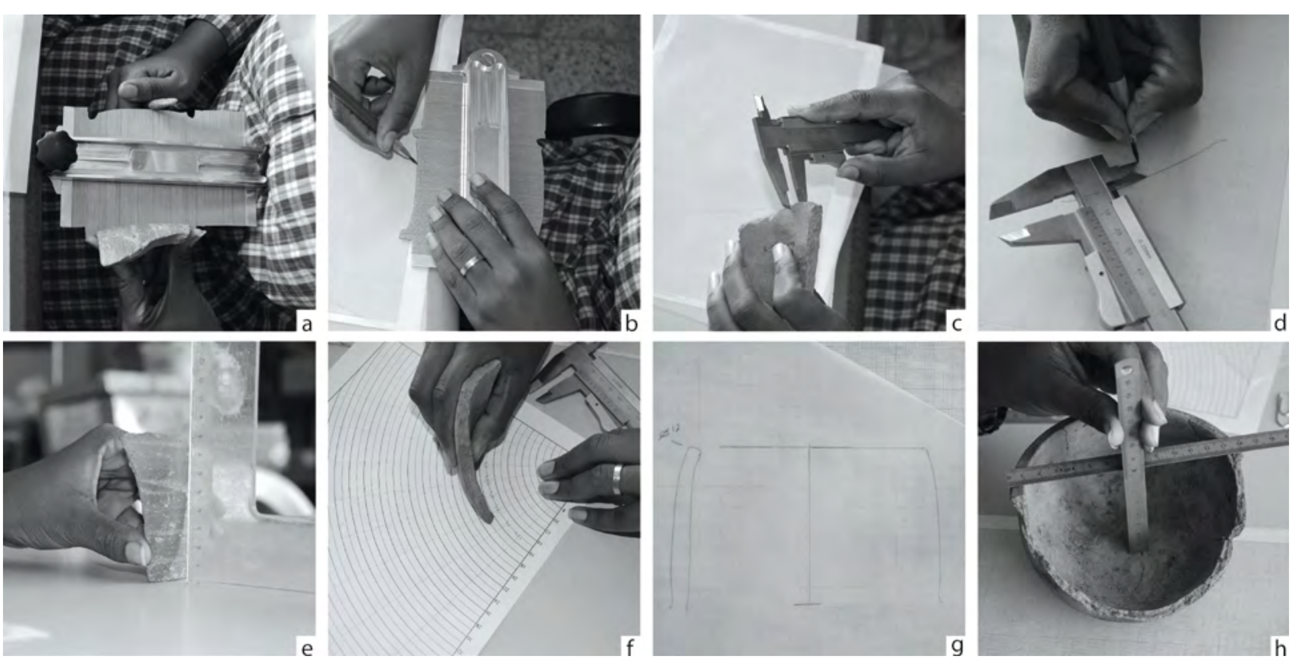


Figure 33. The different steps of the technical drawing.

The measurements must be transferred onto the drawing with precision; it is recommended to use small dots drawn with the pen or by creating little marks with the sharp points of the callipers (fig. 33 d).

The inner profile can now be obtained following the same procedure as for the external one. It can be drawn on a separate sheet of tracing paper as a draft and then copied in cleaner lines onto the final sheet after being aligned with the measured thickness landmarks or it can be directly included in the same drawing as the external profile. This last option entails supplementary manipulation of both the profile gauge and the tracing paper.

Drawing Sherds or Complete Pots without a Profile Gauge

In the case of a complete pot or in the absence of a profile gauge, the drawing can be achieved with a triangle and a ruler only. First, the object must be correctly positioned (on its rim edge) against the triangle (figs. 33 e and 34). Once in the right position, measurements of each major point or each centimetre if the shape is quite regular can be taken. The calliper is used to draw the internal profile in the case of a sherd. For a complete pot, another ruler placed on the rim serves as the basis to define the lowest point of the inner profile (fig. 33 h). Without a profile gauge, the skill, measurement accuracy and the eyes of the draughtsman are put to more demand.

Orientation

The orientation of the sherd is the next key element as it allows, when done correctly, to define the type of vessel (open or closed) and its group of reference (plate, bowl, etc.). Generally within a technical drawing, we are assuming that the rim is circular and that the pots have been placed upside-down whilst drying. In this latter process the whole diameter (horizontal of the rim area) is in contact with the ground, floor or a flat surface on which the pot has been left (fig. 34). This contact point of the vessel with a flat surface line forms what is called the orientation line (fig. 33 e). Consequently, no light is visible between the rim of a sherd and the flat surface if the rim is correctly oriented. The orientation should be checked several times in case of uncertainty.

To record the measurements for the orientation, the actual orientated sherd is placed against a triangle and measures of its height and of the distance between some identified points (rim edge or bottom edge) and the triangle can be taken and transferred onto the drawing (as described for the thickness measurements). With all these collected measurements, the pre-prepared but still non-orientated section drawing acts as a one to one and the orientation line can then be established.

Determination of the Diameter

In the following step the diameter will be determined. For this, a rim sherd is placed with the rim edge (again up-side down) orientated (as before for the determination of the orientation on the "flat surface") on a so-called rim or radius chart (fig. 33 f). With the use of a rim chart a vessel's rim or base radius or diameter, as well as their preserved proportions can be determined.

The diameter or radius information will be added to the drawing where the orientation line acts as the virtual diameter. Now the external section can be mirrored to the other site and factually displays the so-called "reconstruction part" of the technical drawing (fig. 33 g).

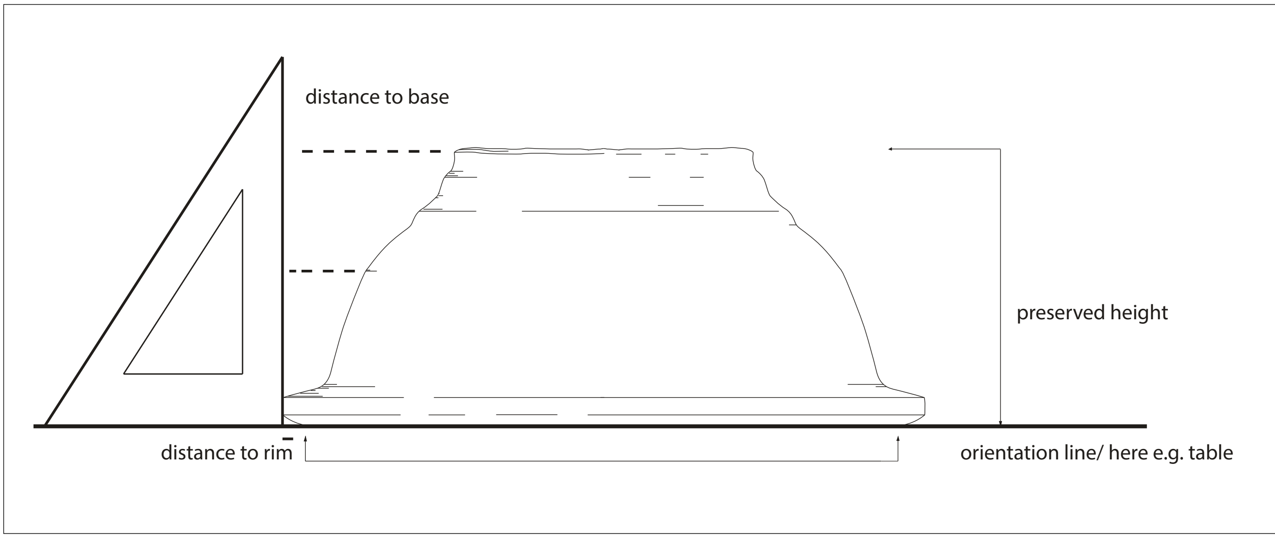
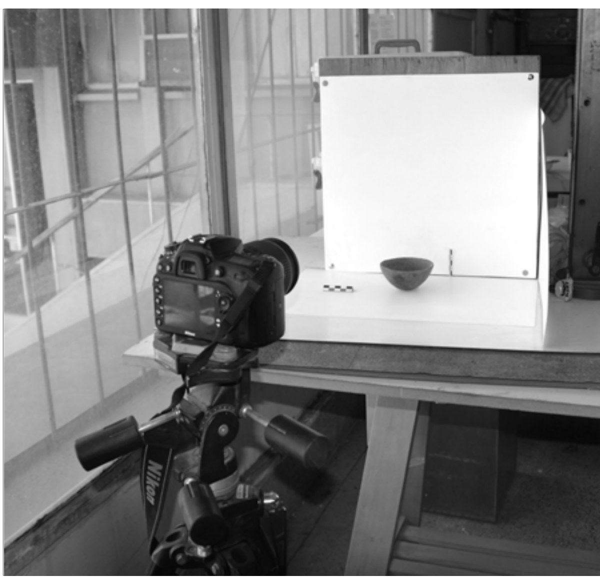


Figure 34. The technical drawing with a triangle.



Figures 35. A "photolab" installed at the Sfdas; 36. Example of ceramic viewed from profile.

Figure 37. Examples of a ceramic sherd.

Internal Lines and Shadow

The internal lines reflect the vertical changes of the section and highlight the details that the draughtsman finds relevant for the illustration of the sherd. They provide the viewer with a sort of 3D effect and allow for easier comparison. Further pencil illustrations also act as representations of certain surface treatments and decorative elements etc.

Advice

Careful verification should be carried out to ensure that all individual drawings include their ID number written clearly as well as the name of the draughtsman. Care must also be taken in numbering each drawing sheet and preparing a list of which objects are drawn on which sheet; this will make the later process of digitisation and publication easier.

File Format and Archiving

The scan of the drawing sheets must be done thoroughly, as it forms the base for the catalogue and presents the actual framework of the pottery (or finds) analyses. It is advised to scan using 600dpi Tiff in greyscale. This permits an optimal "one to one" digital picture without any loss of pixels, maintaining measurements, and should be archived as such.

The Photography of Ceramics

The ceramic specialist is rarely a professional photographer even if some of his pictures are usually published in academic papers. In this section, some recommendations are given to take suitable photographs without entering into the considerations a professional would take into account with his specific material. These aspects are developed in other dedicated manuals (See e.g. Dorrell 1994; Foster, Barker 1996; Riviera 2014; Verhoeven 2016).

Equipment for Photographing

The minimum set required to take suitable photographs for publication would include: various scales of different shapes (5 cm, 10 cm, flat and right angle ones), an obligatorily matt background whether it be white, black, grey or even blue, a camera and, if possible, a tripod.

Setting up a Photo Lab

A photo lab can be installed wherever suitable as long as the light conditions can be controlled. Natural sunlight usually gives good results but only during a few hours per day depending on the spot chosen (close to a window for example). Artificial lamps can be used at all times but require electricity or regular charging. Ideally, the camera is installed on a tripod to avoid any movement while shooting.

Two light sources are placed at a 45-degree angle on each side and close enough to the object to minimise shading. In the absence of a lamp, a reflector (or a white paper) can be used to reflect the sunlight on the opposite side of the light source. The main source must always come from the top left-hand edge (as for technical drawings): this practice makes it possible to juxtapose images on a plate without the eye confusing the grooves and the ridges (fig. 35).

A clean background is placed on the flat surface and equally behind the object in the case of horizontal view. A dark background can be favoured in the case of light-coloured/pale objects.

The scale, adapted to the size of the object, is placed close to it, just below the object in the case of photographs from above or to the side when pictured horizontally.

The photographs must not be too dark or overexposed. The automatic mode on recent cameras is generally good enough to optimize the photographs.

What Kind of Shot for What Kind of Ceramics

The photographer defines the view, details, quality, and quantity of pictures he wants to record so as to correctly adapt the adjustments and the position of the camera.

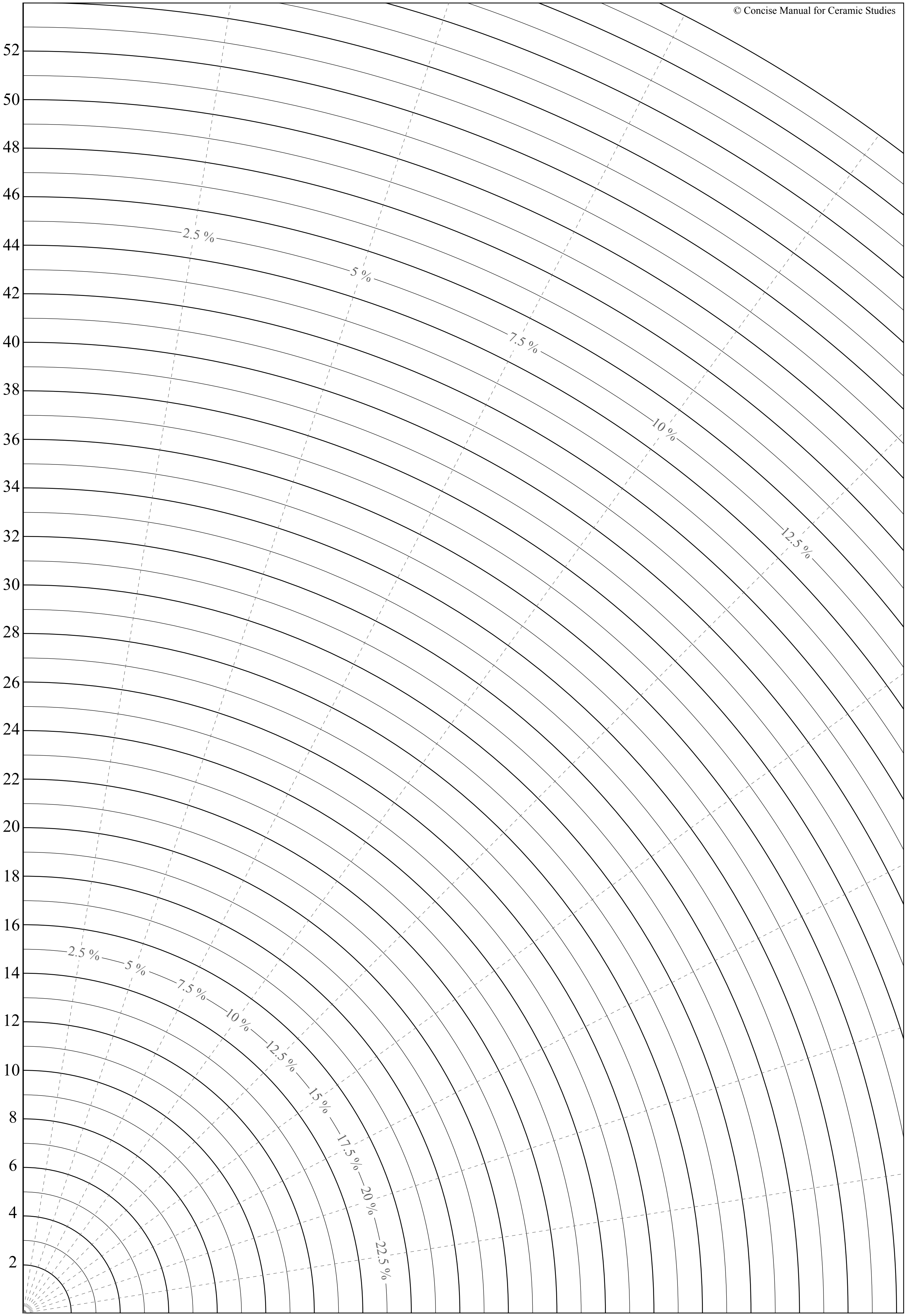
Ceramics, either complete or broken, must be pictured in correctly orientated with their opening on top (fig. **37**). Equal space should be left on each side above and beneath the composition (object with scale).

The complete record of a ceramic requires various views. It is important to take several photographs of the same object from different angles to enable understanding of the object as a whole. The angle of view must be adapted to the type of object. Sherds can be shot flat (camera above) while complete ceramics can be pictured from a lower angle to show their profile (fig. **36**). Also, additional pictures of decorative details or fabrics should be considered.

File Format and Archiving

The JPEG format is the most commonly used nevertheless TIFF or RAW offer much better quality and enable for later light/colour and size manipulation without any loss of pixels. As for the drawings, each photograph should be labelled immediately after the session according to the labelling set up for the mission ■

[S.B.-M. & **R.D.]**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IV

Computerisation of the Documentation

This chapter focuses on the process of documentation that can be completed, during or after the fieldwork, using dedicated IT software, most of which are common licensed software which include programs suitable for the treatment of archaeological data. These can be a valuable aid for digitalisation of drawings (see Section IV.1), statistical purposes (see Section IV.2), as well as for arranging and sorting of the documentation (see Section IV.3). The increasing role of computerisation in the processing of the archaeological data (see e.g. Lock 2003) makes it essential for the ceramic specialist to master such software ■

Vector Drawing Programs and Publication of Archaeological Drawings IV.1

The drawings produced on the fields are usually reworked with specific software when selected for publication. This section approaches the basic requirements and standards usually applied to the publication of the ceramic drawings.

What is a Vector Drawing and What is it Used for?

A vector drawing is a digital image which is based on lines, curves, and other shapes within a "vector path" which is fundamentally different from a so-called "raster drawing" which is a picture/photo program with a pre-set set of pixels in which the pixels are manipulated. The vector drawing implies the creation of a digital drawing accurately resuming the drawing done on the tracing paper by using the various tools of dedicated software. A vector program allows the user to scale an image up and down, to blend in and out and change certain aspects without losing any resolution. Moreover, the line size and, if chosen, colours can be constantly manipulated to thicker, thinner and diverse colour schemes depending on what is necessary for the publication or print.

Formats of Vector Drawings

Vector graphic files are often found with the endings AI, ESP, SVG (see Costa 2020) but can also be done as PDF. In comparison we would find raster program endings such as JPEG, GIF or PNG.

Various Software and their Manuals

Any design software proposing a toolkit able to draw lines and curves is suitable for ceramic vector drawing. For the digitalisation of their archaeological drawings, most of the ceramic specialists are using Adobe Illustrator but it can also be mentioned CorelDRAW which offers similar results, or Inkscape, a free and open-source vector graphic editor using SVG format. As all software, their manipulation requires some basic knowledge that can easily be acquired via devoted tutorials or literature (e.g. Woelfel 2014). Whichever software chosen, the publication of a ceramic drawing meets standards that are commonly adopted and others that the ceramic specialist can personally define.

The General Standards for Publication

As many standards exist as there are ceramic specialists; nonetheless common agreement exists on a few points (e.g. Arcelin, Rigoir 1979). As mentioned in a previous section (see Section III.5), a ceramic technical drawing considers the profile of the pot and its internal features on one side of a half diameter vertical line and its external features on the other side (fig. 38).

The section of the ceramic can be placed either to the left (mainly Latin schools) or to the right (mainly Anglo-Saxon schools), either in solid black or outlined. Additionally, profiles can be drawn closed or left open. Adjacent to the section, the view of the interior part, if not decorated, is usually left blank or with a few lines only to highlight the main inflections of the inner wall of the pot. The lines should not touch the section thus heightening the readability of the drawing, but they can reach the vertical line. On the opposite

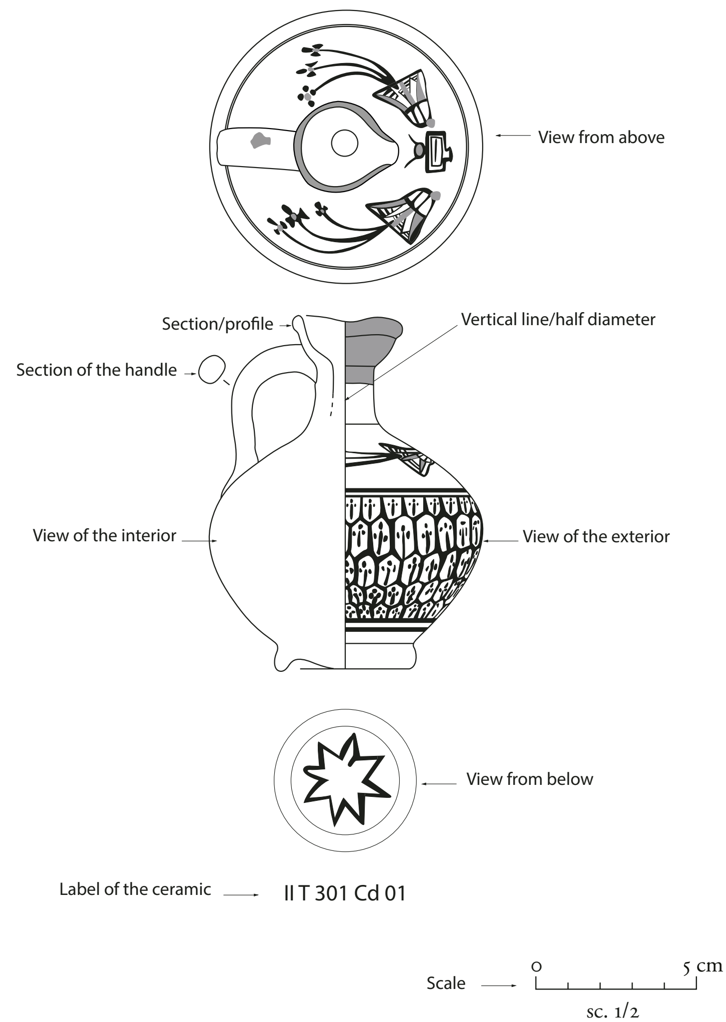


Figure 38. General standards for a technical drawing.

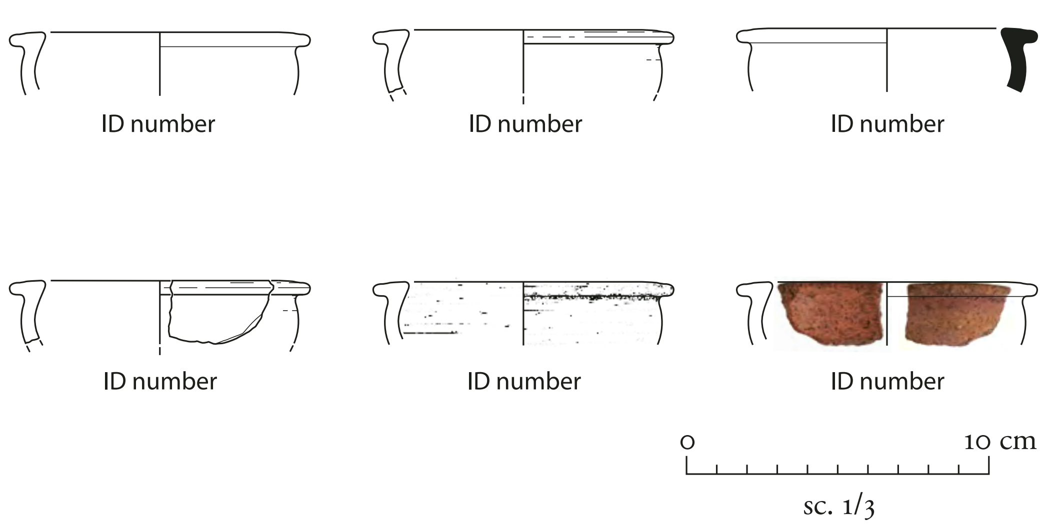


Figure 39. The different ways to illustrate the same shape according to the type of publication and the choice of the ceramic specialist.

side and separated by the vertical centre line, the view of the exterior shows all the details observed when looking at the outside wall of the pot. The lines picturing the inflections connect both to the vertical centre line and to the exterior profile.

Details which can only be seen from above (decoration on the rim for instance) are represented at the top of the drawing and the details figuring underneath (decoration on the base) are placed below. The cross section of a handle is placed next to the profile, with a line showing the exact location of where the measurement was taken. A scale is placed under each drawing or at the bottom right corner of a plate gathering ceramics all drawn on the same scale.

For the rest, the ceramic specialist can define his own standards according to the habits in his area of research and to the standards of the publication, it being noted that once the standards are defined they must to be strictly followed throughout the entire publication.

Specific Standards and Details

The outlines are commonly drawn with a thicker stroke than the internal and external details (for instance 0.5pt for the outlines and 0.25pt for the additional lines of the internal and external features). Drawing can be simplified to focus on the typology or with a lot a detail to reproduce the surface treatment (fig. **39**).

It is preferable to use various grey tones following a chart (e.g. very light grey for white, strong grey for red, etc.) rather than a synthetic colour proposed by the software to provide information about slip and decoration. The slip is, however, more frequently described than pictured as a wide flat tint of colour could render the drawing more difficult to read. Moreover, grey tones are better adapted to all publication formatting even though colour plates are now very widespread in academic periodicals. Since the development of digital photography, detailed drawings are gradually being replaced by a design mixing vectors and pictures (fig. **39**). What we gain in the precision given to the surface treatment and decoration is counterbalanced by the time spent on cleaning photographs to incorporate them into the drawings. It also greatly influences the frame of the publication that would be on a large size and in colour. Indeed, such drawings lose their relevancy if they are reduced too much.

Finally, each published drawing must be labelled immediately below the drawing according to its number of excavation. This will assist readers in reconstructing the assemblages, and linking them to the archaeological context if published separately on various papers.

Archiving

As for the drawings and photographs, each vector drawing should be labelled according to the labelling scheme implemented for the mission ■

[S.B.-M. & R.D.]

Quantitative Analysis with Excel IV.2

The huge number of pottery sherds in any excavation or survey project necessitates specific software to compile all the pottery data and analyse it in order to obtain selective results (for more details see VanPool, Leonard 2011; Bishop 2017). Numerous software are used in this domain which vary from simple to complex tools. Using spreadsheets through tables is the most practical way to store the pottery-related data and to later analyse it. Excel, namely Microsoft Excel, is the most frequently used software in this sector for pottery studies. Using Excel does not conflict with other database software such as Access or Filemaker, but deals with basic levels of data management and calculations.

Excel is a grid of cell-based spreadsheet programs which consist of rows and columns where entries of numerical values or data are inserted. These data are entered in the spreadsheet and are subject to calculations, displayed in graphs and statistical analyses.

Excel can be used for many different purposes relating to pottery study management. The most commonly used approaches are pottery counting (see Section III.1), graphical diagrams and seriations. Excel can also be used for other approaches, but these are the most common and essential ones.

Excel as a Recording and a Count Tool

Counting with Excel is based on defined determinants relating to pottery that need to be recorded and analysed. The data determinants are defined in the spreadsheet according to the purposes of the desired documentation level and analyses' operations. This is carried out on two levels: on lots (batches) of pottery sherds and on individual pottery recording.

Counting the Lots of Pottery

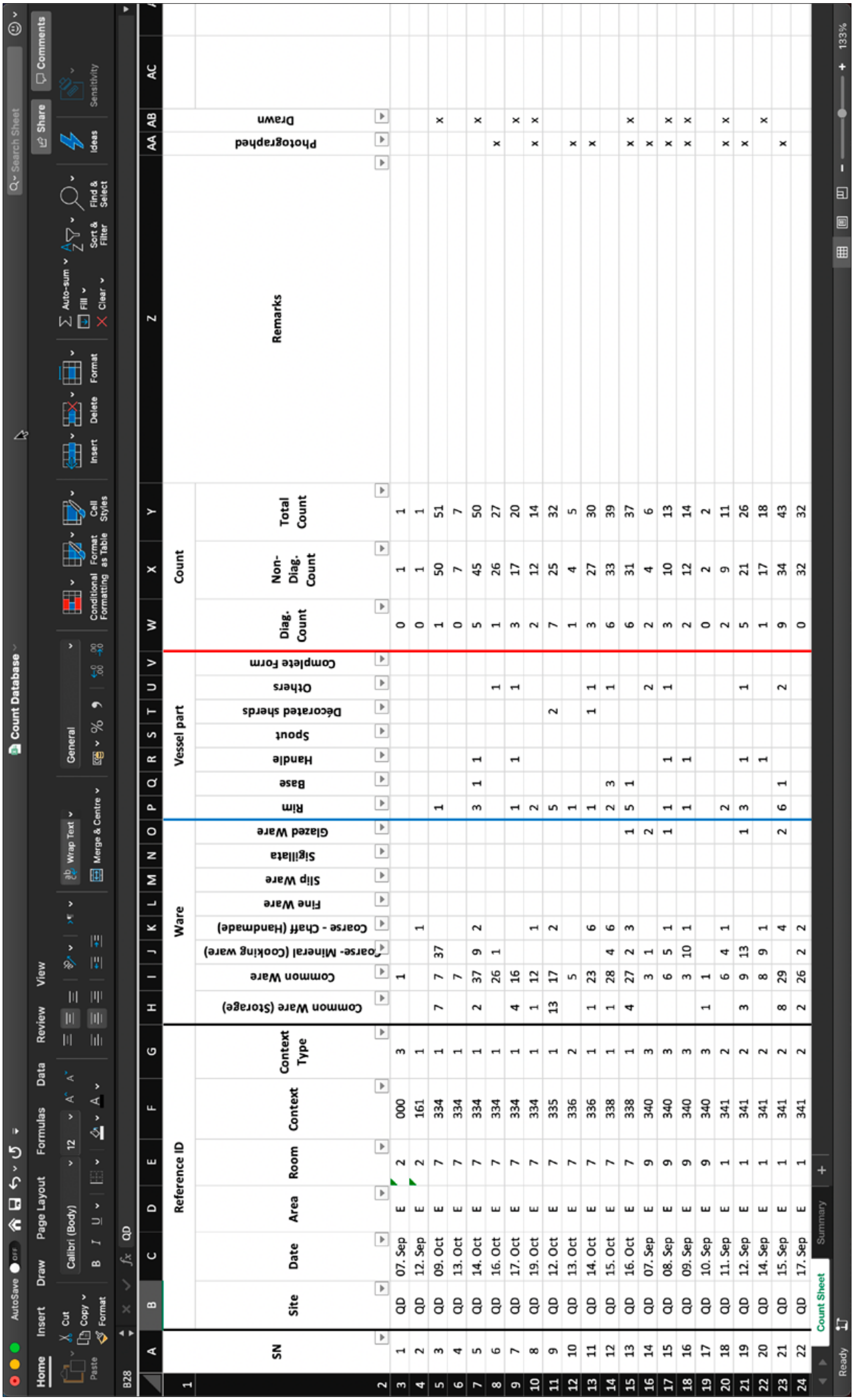
Basic determinants for counting pottery sherds are essential for any pottery documentation and study whether for excavation or survey projects. Here, counting is based on the count of lots derived from different contexts/loci in the case of excavation or areas/sites in the case of surveys. The determinants can include different information (fig. 40) such as:

Reference information, which includes the basic information forming an ID, e.g. a) for excavations: Site name, excavation date, area, room, context, context type; b) for surveys: Province, district, sub-district, zone, site name, survey date, site nature.

Ceramic ware, which refers to the count of the pottery sherds of each ceramic ware found. This can be main information (e.g. common ware, glazed ware, etc.) or detailed information (e.g. red painted ware, green glazed ware, etc.). It can be represented by names or codes.

Vessel part, which refers to the different main parts of the vessel (rim, base, handle, spout, etc.). These sherds are called "Diagnostic" sherds so as to differentiate them from the "Non-diagnostic" sherds represented by common body sherds.

Main sherds count, which includes both the diagnostic and non-diagnostic sherds. The counting for these fields can be automated by using formulas or functions to count and sum the sherds from the "Ware" columns (Total count) and "Vessel part" columns (Diagnostic sherds count).



SN	Site	Date	Area	Room	Context	Context Type	Common Ware (Storage)	Common Ware	Coarse- Mineral (Cooking ware)	Coarse - Chaff (Handmade)	Fine Ware	Slip Ware	Sigillata	Glazed Ware	Rim	Base	Handle	Spout	Decorated sherds	Others	Complete form	Diag. Count	Non-Diag. Count	Total Count	Remarks	Photographed	Drawn
1	QD	07. Sep	E	2	000	3		1														0	1	1			
2	QD	12. Sep	E	2	161	1				1												0	1	1			
3	QD	09. Oct	E	7	334	1	7	7	37						1							1	50	51			x
4	QD	13. Oct	E	7	334	1		7														0	7	7			
5	QD	14. Oct	E	7	334	1	2	37	9	2					3	1	1					5	45	50			x
6	QD	16. Oct	E	7	334	1		26	1											1		1	26	27		x	
7	QD	17. Oct	E	7	334	1	4	16							1		1			1		3	17	20			x
8	QD	19. Oct	E	7	334	1	1	12		1					2							2	12	14		x	x
9	QD	12. Oct	E	7	335	1	13	17		2					5				2			7	25	32			
10	QD	13. Oct	E	7	336	2		5							1							1	4	5		x	
11	QD	14. Oct	E	7	336	1	1	23		6					1				1	1		3	27	30		x	
12	QD	15. Oct	E	7	338	1	1	28	4	6					2	3				1		6	33	39			
13	QD	16. Oct	E	7	338	1	4	27	2	3				1	5	1						6	31	37		x	x
14	QD	07. Sep	E	9	340	3		3	1					2						2		2	4	6		x	
15	QD	08. Sep	E	9	340	3		6	5	1				1	1		1			1		3	10	13		x	x
16	QD	09. Sep	E	9	340	3		3	10	1					1		1					2	12	14		x	x
17	QD	10. Sep	E	9	340	3	1	1														0	2	2			
18	QD	11. Sep	E	1	341	2		6	4	1					2							2	9	11		x	x
19	QD	12. Sep	E	1	341	2	3	9	13					1	3		1			1		5	21	26		x	
20	QD	14. Sep	E	1	341	2		8	9	1							1					1	17	18			x
21	QD	15. Sep	E	1	341	2	8	29		4				2	6	1				2		9	34	43		x	
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Figure 40. A spreadsheet showing an example of counting lots of pottery (© M. Ahmad, British Museum project in Iraqi Kurdistan).

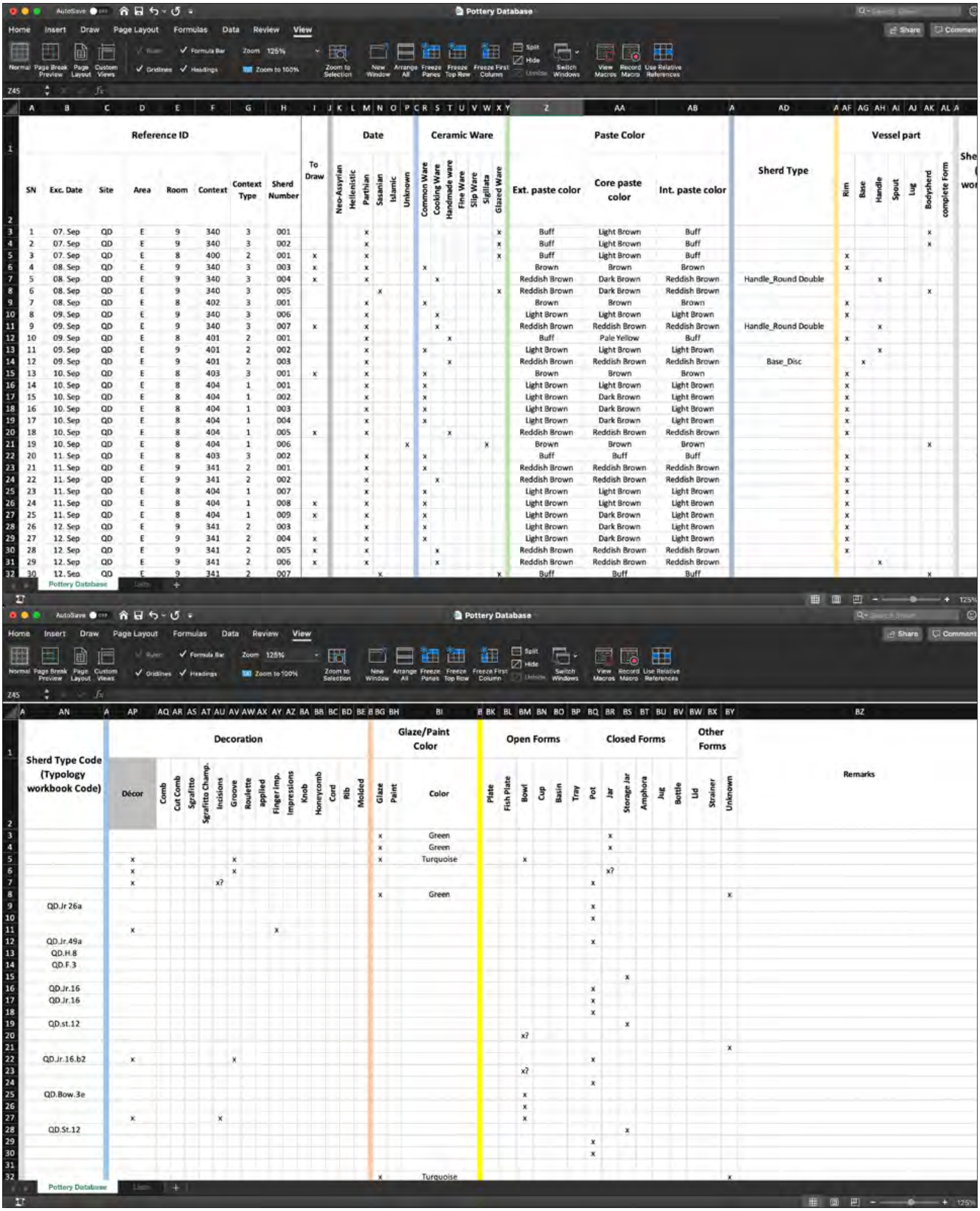

Figure 41. A spreadsheet showing an example of sherd-based level recording (© M. Ahmad, British Museum project in Iraqi Kurdistan).

Individual Counting

This is a sherd-based level recording, where each sherd is defined, and related detailed information is entered (fig. 41). The determinants of the pottery sherd information vary from basic to more complex levels. It depends on the purposes of the recording and the expected results. As examples of these determinants:

Reference ID of the sherd, which refers to the identity of each sherd
Proposed Dating
Ceramic wares
Inclusions
Manufacture
Paste colours
Vessel part
Typology
Decoration
Paint/Glaze colours
Forms (Open/Closed)

All the aforementioned related data can be freely entered or be restricted to pre-defined entries. The latter can be achieved through a "Data Validation" process.

Data Analysis

After completion of the spreadsheet, different analysis can be operated in order to obtain the desired results. These operations are carried out through various tools such as:

Sort: The data can be sorted per column or per multiple columns based on the required results. The sort can be in an ascending or descending order.

Filter: The entered data can be filtered in order to display records that meet certain criteria. This is useful when searching for a specific or multiple entry within a huge amount of data by selecting the criteria to be filtered and displayed.

Pivot tables: Pivot tables are one of Excel's most powerful features. They enable the extraction of significance from a large, detailed data set. In other words, they provide a summary of the data, packaged within a table or a chart yielding a report and permitting the exploration of trends based on the processed information.

Diagrams and Charts

The data in an Excel sheet can be displayed not only in a table view but also in a graphical view. This can be obtained in two main forms: Diagrams and Charts. Diagrams and charts are important because they present information visually. Thus, instead of seeing numbers and codes of pottery information in a table, diagrams and charts visualise these data. A diagram is a symbolic representation of information according to visualisation techniques. It can resemble a plan, a drawing, a sketch or even an outline showing how something works

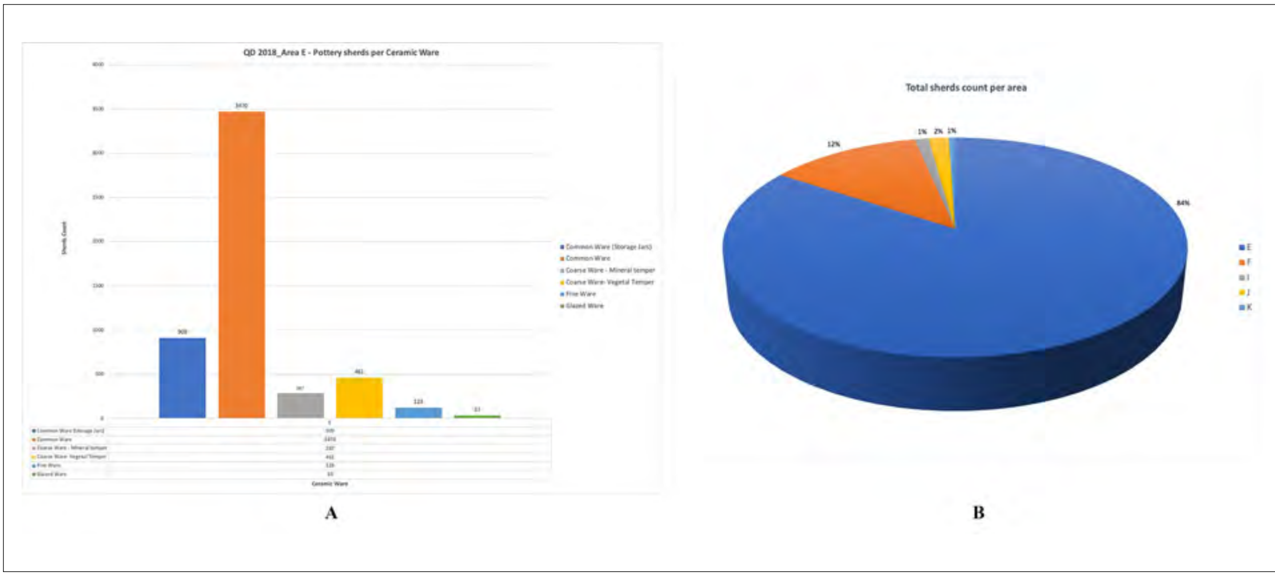

Figure 42. Two examples of excel charts A) Histogram “Bar chart” B) Pie chart.

or the relationships between the parts of a global data. While a chart is a graphical representation of data, in which “the data is represented by symbols, such as bars in a bar chart, lines in a line chart, or slices in a pie chart”, it can also represent tabular numeric data, functions or other kinds of qualitative structure and provide different information (fig. 42).

Formerly, diagrams and charts were used for seriations to display the relative sequence of frequency and occurrence of different determinants of pottery (Ceramic wares, forms, types, etc.) but recently, new software automatically carry out this process ■

[M.A.]

Management of the Documentation through Databases IV.3

Aims of the Use of Databases

Analysis on collected ceramics during archaeological excavations aims at bringing forth numerous questions for research, including the production of pottery and its technology, its contextual and functional aspects as well as the dating thereof. An appropriate database and its management are essential for the organisation and analysis of the collected data. Thanks to advanced computer technologies and software, it is possible to create a database dedicated to the specific requirements of the material and scope of research questions. They also enable comparative studies and statistical analyses to be undertaken and permit the results to be shared via digital media. In other words, databases allow digitalising, organising, querying and analysing ceramic assemblages collected in different regions and periods.

Data Modelling

The creation of a database for ceramics should be based strictly on the methodology adopted for an investigated material or site. Easily accessible depositories include FileMaker and Access included in the MS Office package. FileMaker is a data storage tool with the ability to add illustrations such as photos and drawings. The cards created for individual vessels can also be easily used to create catalogues. Access contributes to pottery studies by enabling researchers to conduct complex queries and statistical analyses, which can be published along with diagram charts. Consequently, these two depositories significantly improve data management.

Database Interface, Function and Results

The interfaces and functions of the two aforementioned databases differ. The structure of FileMaker is based on related cards, which can be presented as forms, lists or tables. Access is presented in the form of datasheets. In both cases the properties of each value can be set manually and both check boxes and drop-down menus are available. The sample FileMaker database was constructed from the *Main Card* (see also section III.4 and Ceramic description form), which contains basic information about the archaeological context of the find and the vessel itself such as its form, the technique of shaping employed, the state of preservation and dating. This chart also includes fields in which any pertaining information and notes can be added, as well as a preview of a subpage including photos and drawings (fig. **43**, top). The *Technical Card* subpage contains detailed information relating to the fabric and dimensions of the vessel (fig. **43**, bottom). The following subpages provide detailed descriptions of decorations and inscriptions, and inserted pottery photos and drawings (fig. **44**). These cards permit the addition of more detailed data such as the decoration, where it is situated, the technique of execution and the character of motifs as well as that concerning any inscriptions found on the vessels. Any information can be added e.g. type of inscription, colour of the ink, transcription, and when it was placed on the vessel (before or after firing).

The interface of a database created in Access is based on tables containing information about the pottery in context, a register of all diagnostic vessels and those containing distinguished types of fabrics, vessels and decorations (fig. **46**). It follows the methodology used for ceramics of the Funj period in Dongola in Sudan (Wodzińska, forthcoming). Table *Pottery_BagForm* includes all data obtained from a pottery bag containing a single archaeological context and is related to the first stage of pottery processing at the site such as general and categorised counting and weighing (fig. **46**, top). Table *Pottery* is devoted to further processing of pottery finds and includes detailed information about each vessel, for instance the class, type, technique of manufacture, fabric, surface treatment and decoration (fig. **46**, centre). The properties of fields are defined in the same way for all tables (fig. **46**, bottom) which allows preparing simple and advanced queries within one several tables (fig. **45**). The results are presented in a table form. All records can be sorted and filtered within criteria such as "equals", "contains" or "begins with". It is also possible to count percentage shares of groups of vessels by using formula in the process of creating queries. Access also includes a function permitting the creation of reports containing data presented in a table form that can be easily used in publication. Both tools function as a depository of data with possibilities of queries and analysis which can be transformed by computer specialists into digital media. Creating digital depositories requires cooperation and dialogue between ceramic and computer specialists so as to obtain the best result.

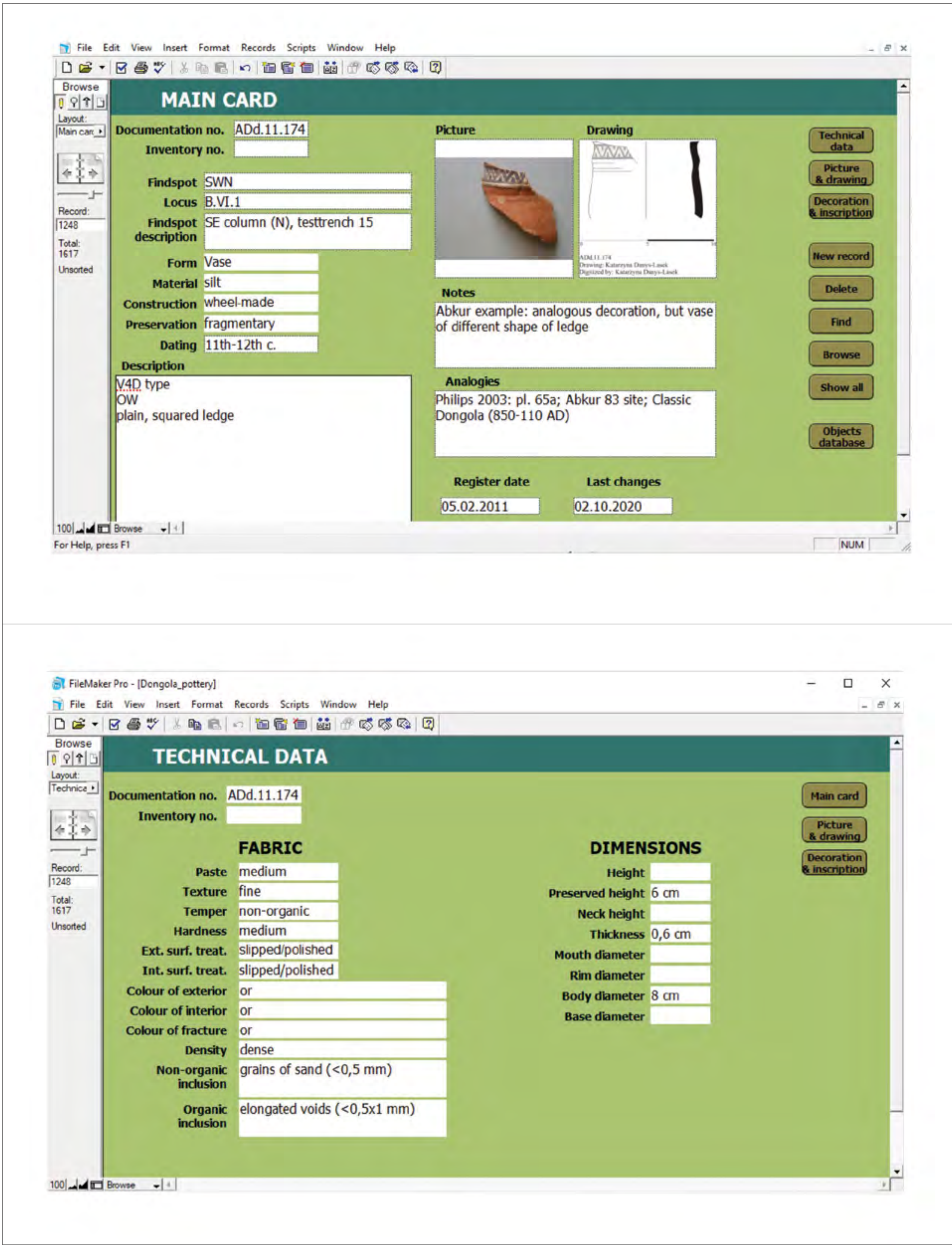

Figure 43. Sample view of pottery database in FileMaker.

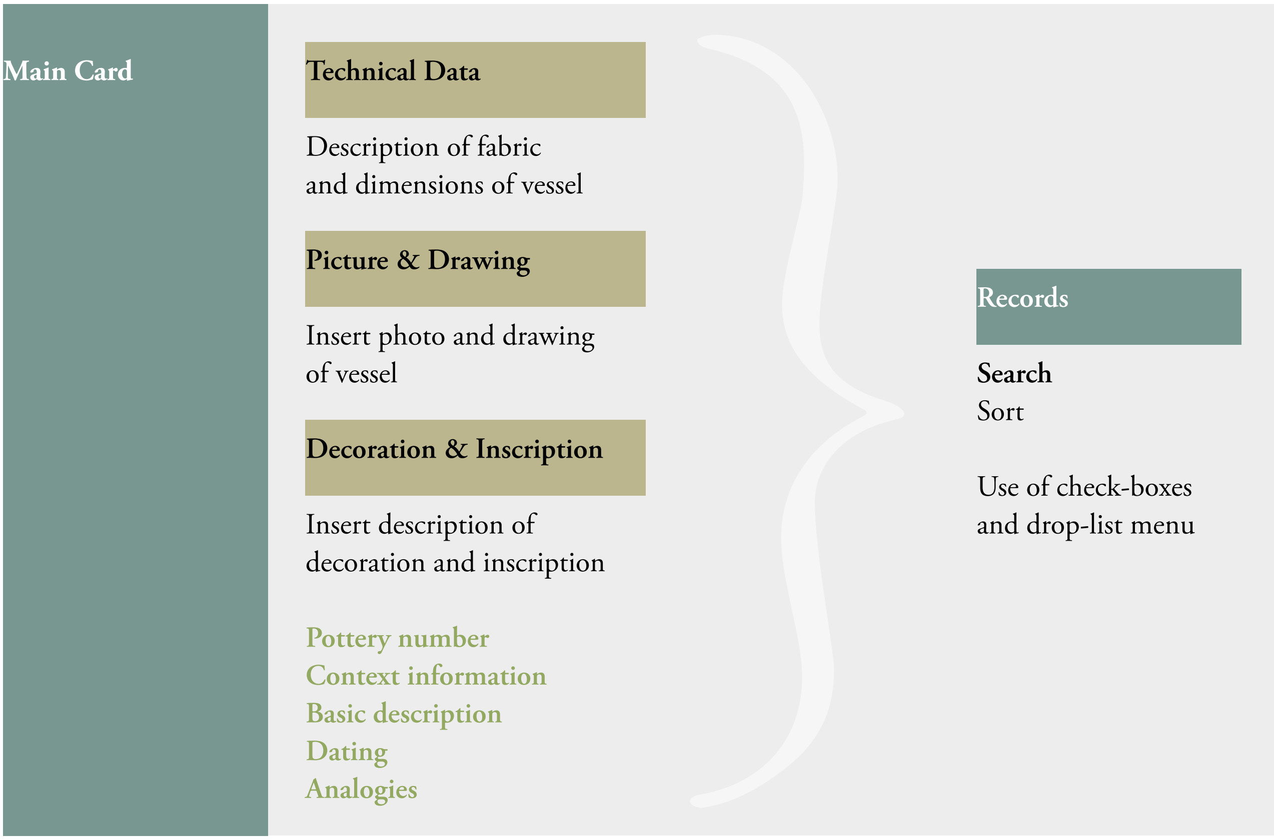

Figure 44. Flowchart detailing organization of the example of pottery database in FileMaker.

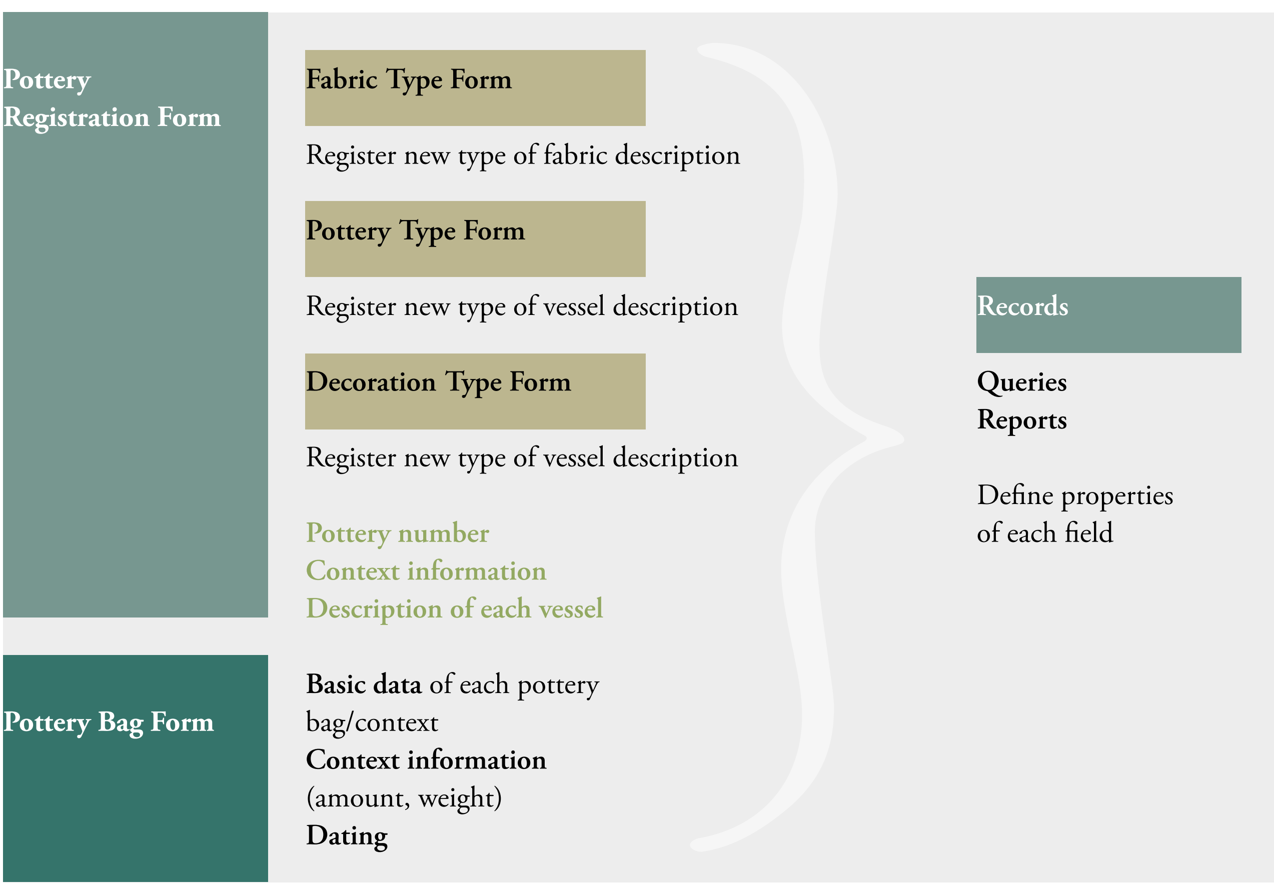

Figure 45. Flowchart detailing organization of the example of pottery database in Access.

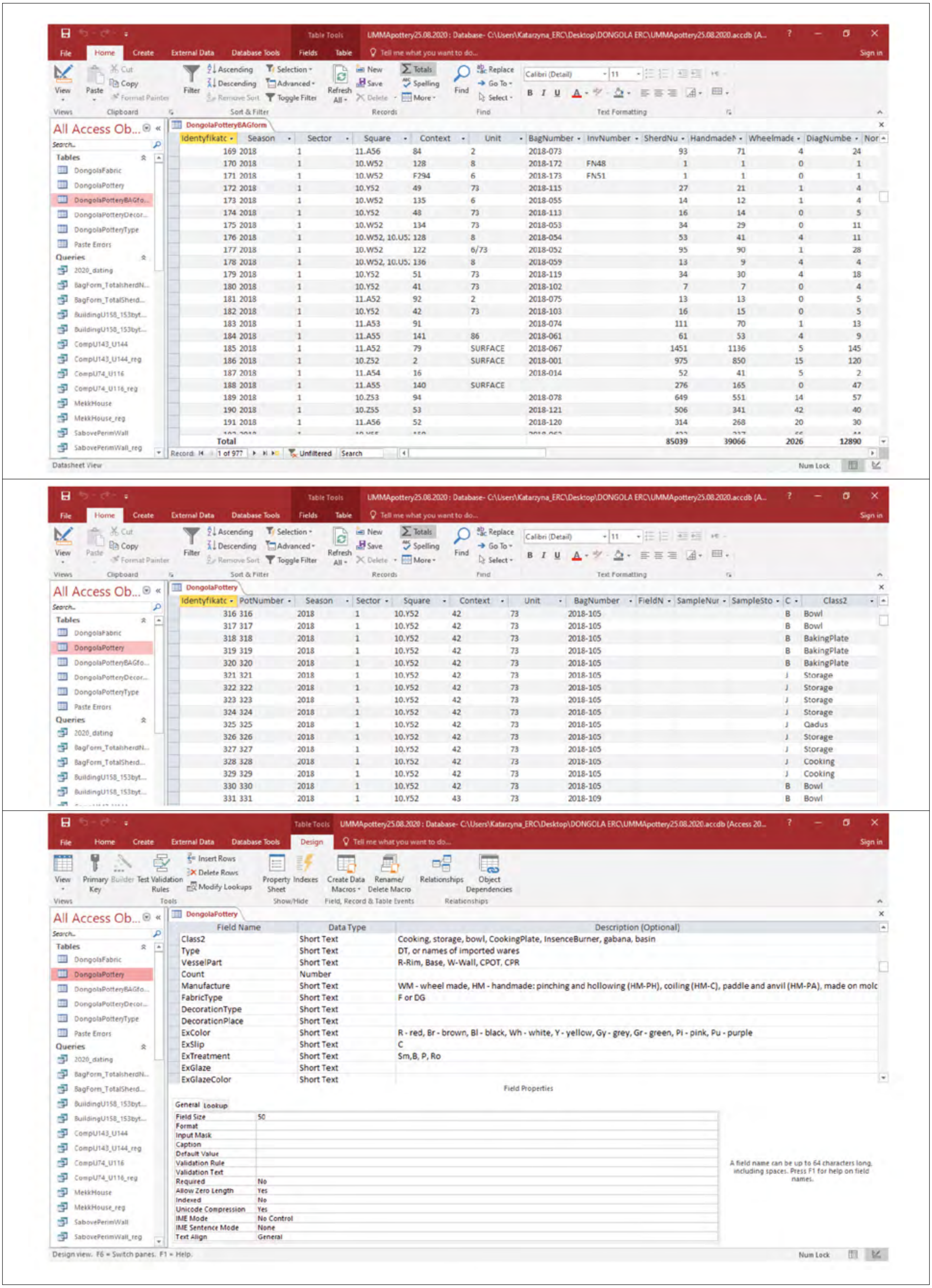

Figure 46. Sample view of pottery database in Access.

Sharing Data

Sharing databases has two functionalities depending on the data-entry level. If the data-entry is still on-going, people can use the share function to enter data simultaneously whether they are in the same place or situated in different distant places. If the data-entry has been performed and finished, databases can be shared, thus providing access to the data contained in the database.

Ceramic data repositories can be shared locally or online during or following the data-entry level. Databases can be shared locally through a W-Lan network. Accordingly, anyone with access to the network can access the database. On the other hand, databases can be shared online through database servers (this is applicable for both FileMaker and MS Access). Additionally, databases can be shared and stored online on a dedicated website, using either a password access to the database or free access.

Discussion

Management of the pottery documentation through databases allows digitalisation, storing and organisation of data collected during the pottery studies. It is a very useful tool for analysing and sharing results. Software, such as FileMaker, is equally very helpful when creating catalogues of finds which include illustrations. Access also provides reporting and querying functions which are essential in the process of exploration of obtained data. Consequently, management of the pottery database leads to collaborative research and makes on-line availability much easier ■

[**K.D.** & **M.A.**]

The Levantine Ceramics Project

Every pot has numerous aspects—shape, fabric, decoration, distribution—and each can answer different questions. This makes pottery perfect for digital, data-based applications. The Levantine Ceramics Project (LCP; www.levantineceramics.org) is one such application: a free, open access project for ceramics produced anywhere in the greater Levant, meaning Egypt, Israel and the Palestinian Authority, Jordan, Lebanon, Cyprus, Syria, and Turkey, from Neolithic times (*ca.* 5500 BC) until the end of the Ottoman era (*ca.* 1920 AD).

How does it work?

Anybody can consult the LCP; and anybody can register and submit information, whether newly studied or long published. The LCP includes information on ceramic wares and petrofabrics, individual vessels and illustrations, petrographic analyses, and kilns/workshops. Contributors can edit their own entries at any time, keeping the LCP—and its users—fully up-to-date. Entries can be marked public, meaning fully visible to anybody who consults the site; restricted; or private (choices can be changed). Finally, all data is attributed to its contributor(s), to maintain intellectual property. Every page has a "get citation" button, which makes each entry a digital publication.

The LCP and Ceramic Research

The LCP is also a research tool. One example: maps! From any display or browse page, click "View on map" to see other vessels of that shape, ware, or date, where kilns producing specific wares are, etc.

The LCP is also a partner for publications. Including LCP links in print or digital publications means that future readers can click directly to the LCP page, see updates, search for related data, etc. LCP links enhance a publication's long-term utility.

Eventually the LCP will allow us to address questions for which pottery offers basic evidence. Examples: what is the relationship between an imperial economy and local prosperity? Are certain clay types used for certain production modes across long periods of time? Right now it is difficult to collect the data necessary to answer such queries. Together we can build a tool to help advance this field of research by enhancing the addition of data to the LCP's storehouse.

As archaeologists, we are *always* in a mode of discovery: finding new sites, re-thinking earlier theories. The LCP supplies us with a way to remain up-to-date, to connect new data with older material, to share with and to learn from each other ■

[A.Ber.]

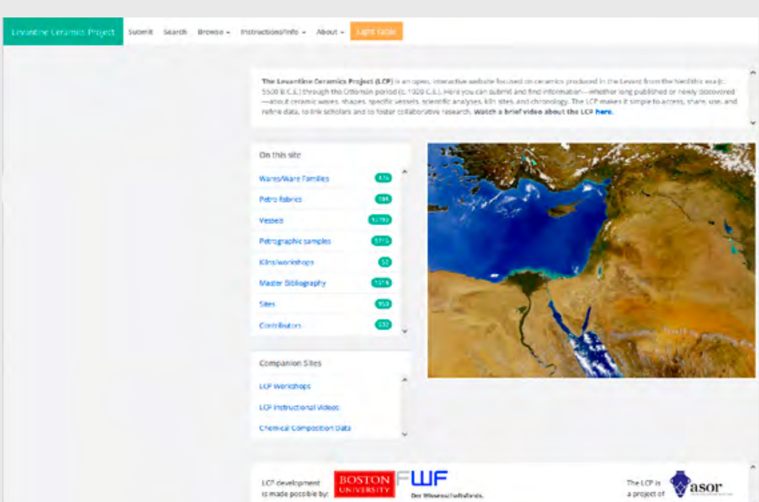

Figure 47. Screenshot of the home page of the Levantine Ceramics Project.

V

Various Approaches of the Ceramic Documentation

This chapter presents various research highlighting the different topics frequently addressed through ceramic studies. Chrono-typology is probably the most frequently addressed topic as it represents the early stage of every study (see Section v.1). The other aspects of the ceramic studies, whether economic, cultural, or functional, are dependent on this first chronological appraisal.

Once the evolution of the productions is understood, these results can be put into perspective to insert the pottery studied within a larger frame to highlight cultural exchanges (see Section v.2), to draw the outline of the organisation of the production and internal economy (see Section v.3) or to analyse the functions and use of the ceramic through content analyses (see Sections v.4 and v.5) ■

The Chrono-typology: a Case Study from Karnak (Egypt) V.1

A chrono-typology is an essential tool to approach other issues raised by the ceramic material. This first result mainly depends on the good preservation of the archaeological contexts—which is finally quite rare—and on careful documentation of the stratigraphic layers as well as the associated pottery. A case study from Karnak (Egypt) provides a good example to address this topic.

The Ptolemaic Levels of the Treasure of Shabaqo

The evolution of the Ptolemaic ceramics in the Theban region was the subject of a 2-year research programme at Karnak between 2013 and 2015. Numerous researchers were involved in studying the ceramic material from archaeological sites in the region (David 2016). The archaeological exploration of the Treasure of Shabaqo at Karnak has considerably enriched our knowledge about the chronology of the productions thanks to the discovery of a succession of dwellings installed on the monument dated to the Late Period (Licitra, David 2016). Nadia Licitra managed to isolate different stratigraphic phases of occupation and abandonment from the beginning of the Ptolemaic period to the beginning of the Roman period (end of 4th century BC-1st century AD) that can be summarised as follow:

1. the level prior to the installation of the house III-01
2. the construction and use of the house III-01
3. the destruction of the house III-01
4. the construction and use of the house II-01
5. the destruction of the house II-01

The stratigraphy of the excavation guides the presentation of the ceramic material and allows highlighting of the appearance of certain forms or even certain productions and thus serves as a comparison with the material from regions where the evolution of production is better known. The classification of the ceramic production in the Theban region adopted during a workshop held in Karnak in 2014 serves as a reference for the presentation of ceramics (David et al. 2016). It distinguishes the local productions made in a calcareous clay for which at least one of the production centres is known (Barahona-Mendieta 2016), and many other productions made in Nile clay according to easily identifiable groups (see Section II.2). The results enable to approach the economic dynamics affecting the productions uncovered at Karnak as well as the progressive influence of the Hellenistic tradition on the local facies.

The Evolution of the Ceramic Production

Phase 1: The Regional Facies at the End of the Egyptian Late Period

The first phase, dated to the very beginning of the Ptolemaic period, is illustrated by ceramics mainly following the models inherited from the Late Period. The typology is indeed in line with what we know of Saite and Persian assemblages with some markers such as bowls, the rims of which are underlined by a groove and painted black or jars with a triangular rim (fig. **48** a-b). This phase, however, marks the advent of new amphora shapes inspired by Greek models (fig. **48** c), more particularly from the Aegean islands from which Egypt receives a quantity of wine (Defernez, Marchand 2016).

Phase 2: Between Hellenisation and Creation of a Local Facies

In the second phase (*ca.* mid-3rd century BC-*ca.* mid-2nd century BC), the Hellenistic influence was particularly strong on the typology of tableware, cooking wares and those associated with the storage function. The shapes are based on contemporary prototypes observed in the Greek world, such as the "echinus" bowls, "fish dishes", *caccabai* and *chytra* (fig. **48** d-g). However, local amphoras moved away from the Greek models to adopt a form that lasted until the Roman period (fig. **50**). At Karnak, the same types of amphorae produced from alluvial clay also appeared, the proportion of which increased during the following phases.

Phase 3: Continuity of the Hellenistic Facies

The ceramic material of phase 3 (*ca.* mid-2nd century BC-*ca.* mid-1st century BC) is basically the same as the one observed during phase 2. The calcareous local productions remain for the most part unchanged. However, some of them are covered with a red slip, which was not observed in the previous phases. The shape of the cooking wares seems to be more varied, with types derived from *caccabai* and *lopades* (fig. **49** a-b) following an evolution already noticed in Alexandria (Harlaut, Hayes 2018). Amphorae in alluvial paste, one of the production centres of which could be located in Coptos (Dixneuf 2011, p. 95), are more widespread.

Phase 4: The Late Hellenistic Facies

The repertoire of shapes associated with phase 4 (*ca.* 1st century BC) shows notable changes compared to the previous phase. While the continuity of certain categories can be seen, particularly among tableware and amphorae, the introduction of new types is well documented. Within the category of the cooking ware, we note the disappearance of the *caccabai* and the appearance of "flanged" pots (fig. **49** c). On the other hand, the influence of *Eastern Sigillata* A types on local productions can be observed (fig. **49** d).

Phase 5: Early Roman Ceramics

Unfortunately, the small quantity of the ceramic material dated to this phase does not enable further discussion on the general evolution of the facies of the ceramic from Karnak. However, it can be noted that most of the forms observed in the last level of abandonment of the site follow on from the facies of phase 4. The introduction of new forms of AE3-5 amphorae, probably originating from Coptos, marks the transition from the Ptolemaic to the Roman period (Dixneuf 2011, p. 128).

Concluding Remarks

The evolution of the productions illustrated by the ceramic material from the Treasure of Shabaqo provides important clues to approach the phenomenon of the Hellenisation of the Egyptian culture. We can thus note the permanence of the pottery tradition of the Late Period during phase 1 and then, from phase 2 onwards, a marked influence of Greek

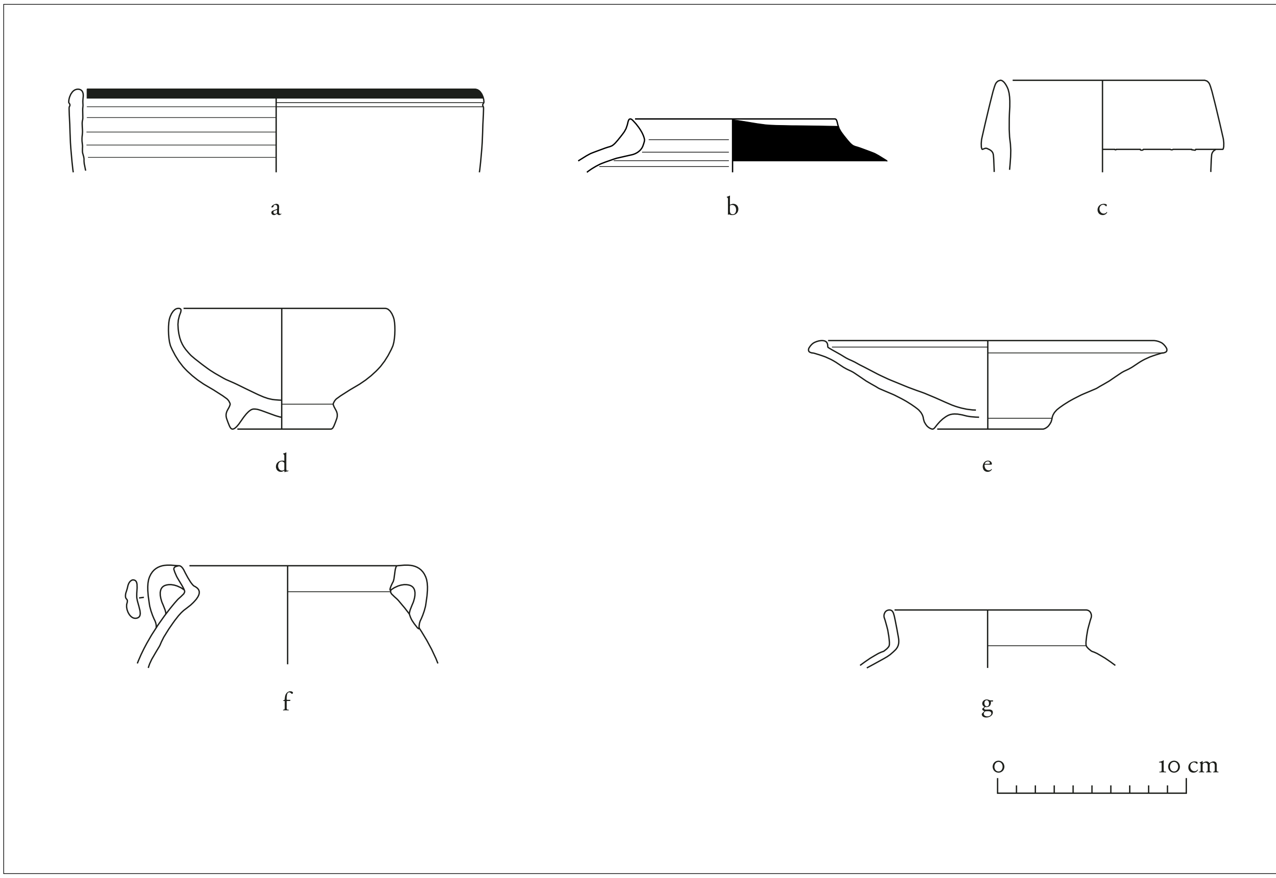

Figure 48. Ceramic material typical of Ptolemaic phases 1 and 2 at Karnak (© N. Licitra/R. David/Cfeetk).

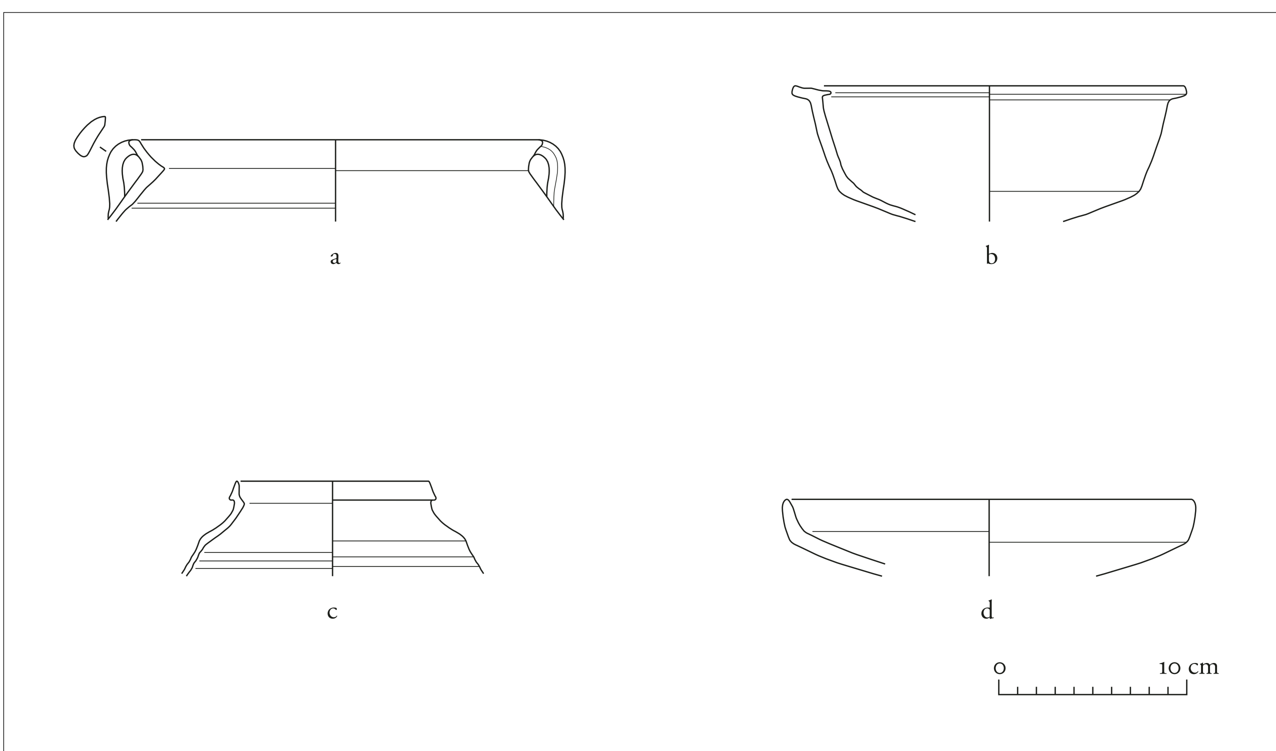

Figure 49. Ceramic material typical of Ptolemaic phases 3 and 4 at Karnak (© N. Licitra/R. David/Cfeetk).

Figure 50. Complete amphora from the Treasure of Shabako
(© J. Maucor/CFEETK).

models that accompanies the diversification of the local repertoire. It is likely that this facies remains unchanged in phase 3, apart from a variety of shapes observed among the category of the cooking wares. Phase 4 marks a slight break from this point of view since, with the renewal of the typology the local calcareous productions under the influence of the *Eastern Sigillata* A and the disappearance of many forms maintained from earlier periods, the facies of the Treasure of Shabaqo loses its specificity. Our documentation allows us to follow this process up to early Roman times (phase 5), when the ceramic repertoire becomes very similar to that of many sites in Egypt ■

[R.D.]

Highlighting Economic and Cultural Exchanges V.2

The potential of the analysis of ceramics for reconstructing economic and cultural exchanges and the close links between aspects of cultural identity and technological features of the pottery manufacture are well known in archaeology. The following presents a case study from the Nile Valley.

The AcrossBorders Project as a Case Study

Sai Island is located in the river Nile between the Second and Third Cataracts in Upper Nubia (Sudan). The town on the island is one of the urban centres erected during the Egyptian "colonisation" in the New Kingdom (*ca.* 1450 BC). Prior to the New Kingdom, Sai was an important stronghold of the Nubian Kerma Kingdom.

The Egyptian town and its contemporaneous cemetery on Sai were the focus of the European Research Council project AcrossBorders from 2013 to 2017 (Budka 2020). The project aimed to provide new insight into the lifestyle and living conditions in New Kingdom Nubia based on new fieldwork and multi-layered research on the island. In this respect, pottery played a major role.

In order to reconstruct life on Sai, all archaeological material was considered from pottery to small finds, tools and other various equipment; each item was assessed in detail and in relation to associated finds, architecture and past human actions.

Economic Significance and Production

The functional, economic and social significance of ceramics were discussed by the AcrossBorders project in order to answer questions relating to Nubian vs. Egyptian lifestyles. Scientific analyses of materials, and especially petrography in the present case, contributed to the archaeological interpretation of pottery from Sai.

A site-specific fabric corpus was established for the New Kingdom town of Sai, which closely resembles ceramics from other New Kingdom towns, but also includes local fabrics for Egyptian vessels as well as for Nubian wares. This fabric corpus comprises six large groups: 1) imported Nile clays from Egypt, 2) locally produced Nile clays from Sai/Upper

Nubia, 3) Nubian clays from Upper Nubia, 4) imported Marl clays from Egypt, 5) other imported wares (Oases, Levant, Cyprus) and 6) imported Mixed clays from Egypt. Thus, it was clear that many imports from Egypt and beyond landed on Sai, including not only amphorae and storage vessels but also painted wares, which were considered as luxury wares (fig. 51). The local production of ceramics on the island comprised wheel-thrown Egyptian-style Nile clay vessels (fig. 52) as well as hand-made Nubian vessels. Nubian cooking pots (fig. 53) and storage vessels are regular finds and attest to Nubian presence in the Egyptian town or maybe to Nubian cooks or persons otherwise involved in food production.

Other than the analysis of fabrics, important evidence of local pottery production comes from wasters and unfired sherds and should therefore be treated with priority in the archaeological record.

Sai can be used as a case study of local pottery workshops and traditions in New Kingdom Nubia. Regional style was mostly expressed by surface treatment and decoration. The main difference to pottery corpora from sites located on main-land Egypt is the predominance of Nile clay wares, even for shapes usually produced in Marl clay. This is, of course, related to the accessibility of raw materials, which always needs to be considered.

Cultural Encounters and Material Entanglement

In order to assess a pottery corpus regarding information on potential cultural encounters, the material must be checked for comparisons and specific features. In the case of Sai, the rich ceramic material from the town found ready parallels not only in other Egyptian foundations in Nubia (e.g. Rose 2018), but also at various New Kingdom sites in Egypt. However, a local component of site-specific features was also noted. Besides local decoration patterns (fig. 52), these are especially hybrid types of ceramics which illustrate two-way influences of the Nubian and Egyptian pottery traditions at the site (fig. 54). Some locally produced Nile clay pottery vessels were modelled on Egyptian types, but with a "Nubian" influence regarding the surface treatment, production technique or decoration. Such vessels can be considered as evidence of "material entanglement" (Stockhammer 2013) indicating a complex mixture of lifestyles during the New Kingdom on Sai.

What can we Learn from the AcrossBorders Project?

Sai and the results of the AcrossBorders project illustrate the dynamic and situational characters of past societies. Other than drawing artificial border lines between cultural groups, in this case Egyptians and Nubians, the aim of modern archaeology should be to reconstruct social, economic and cultural identities at the local level of sites (see e.g. Spencer et al. 2017). Such identities can change, interact and merge with each other. On Sai, the ceramics indicate that there was a complex intermingling of the Egyptian and Kerma traditions, resulting in a great variability and in hybrid forms that display both Egyptian and Nubian features.

The most pressing questions about the pottery from Sai were the identity of the potters and of the users of the vessels. The answers must derive from respecting a very dynamic microcosm with fuzzy boundaries between cultural identities at the site. For Middle Kingdom Nubia, episodic work of Egyptian potters as itinerant craftsmen travelling from site to site could be reconstructed (Reshetnikova, Williams 2016). At major sites industrial workshops showing local features produced ceramics on a large scale, whereas

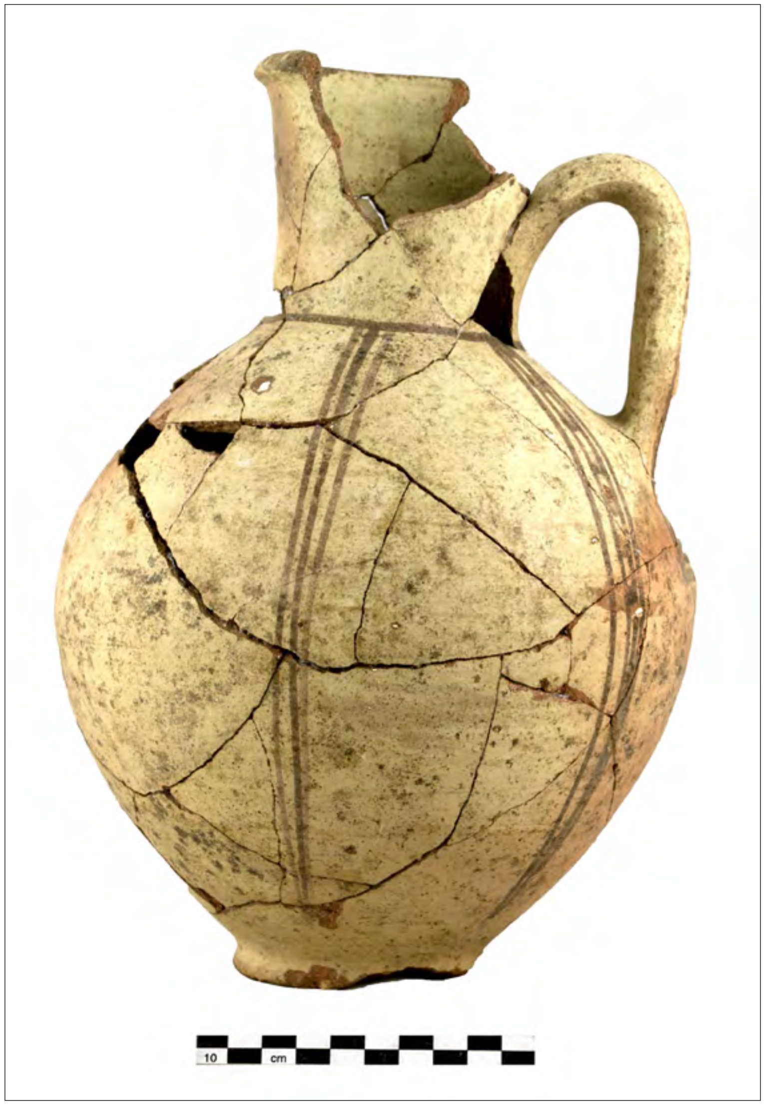

Figure 51. Painted Marl clay jar from Egypt,
found in the Egyptian town of Sai (SAV1E 874/2017).

Figure 52. Rim sherd of painted dish, local style,
from the Egyptian town of Sai (SAV1W P016).

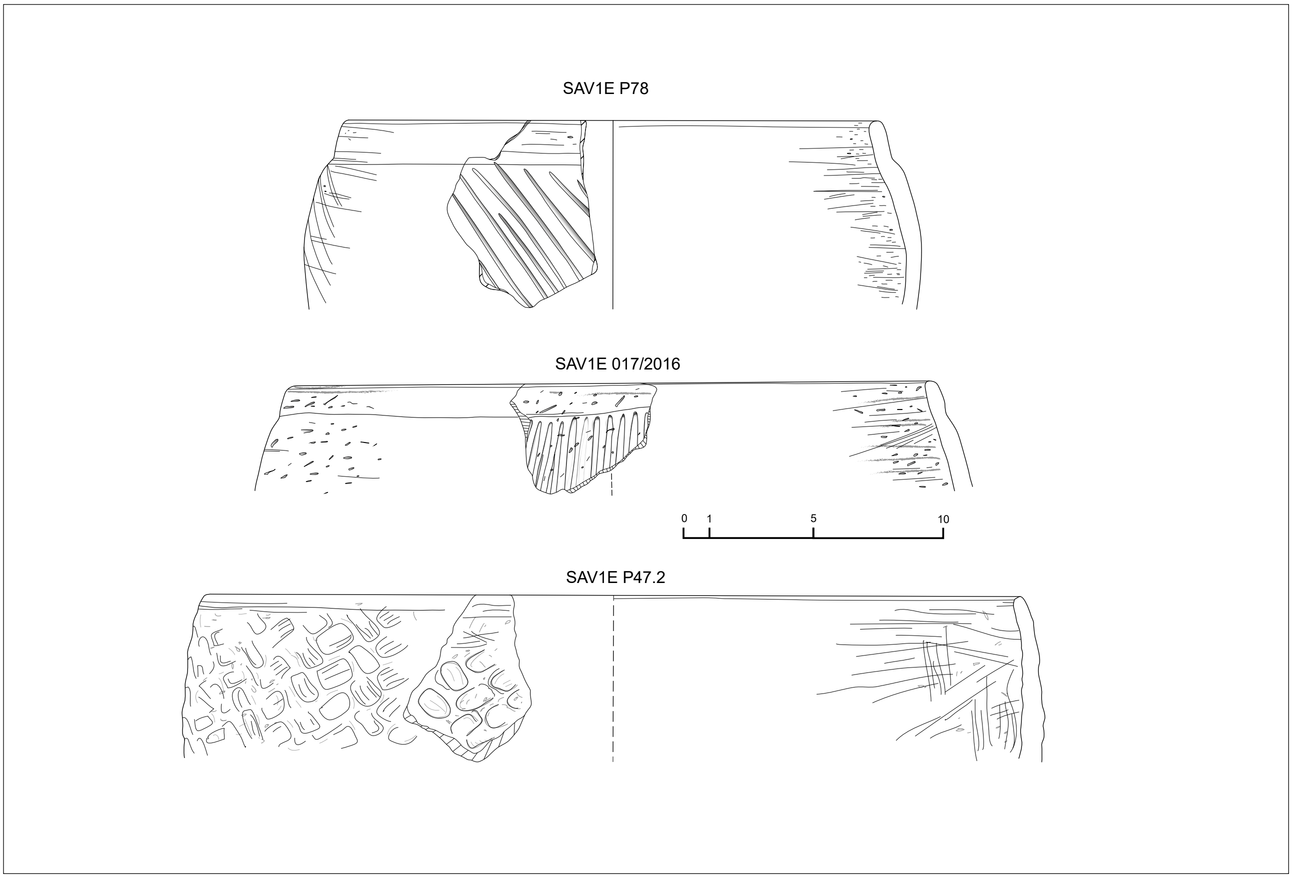

Figure 53. Nubian cooking pots from the Egyptian town of Sai.

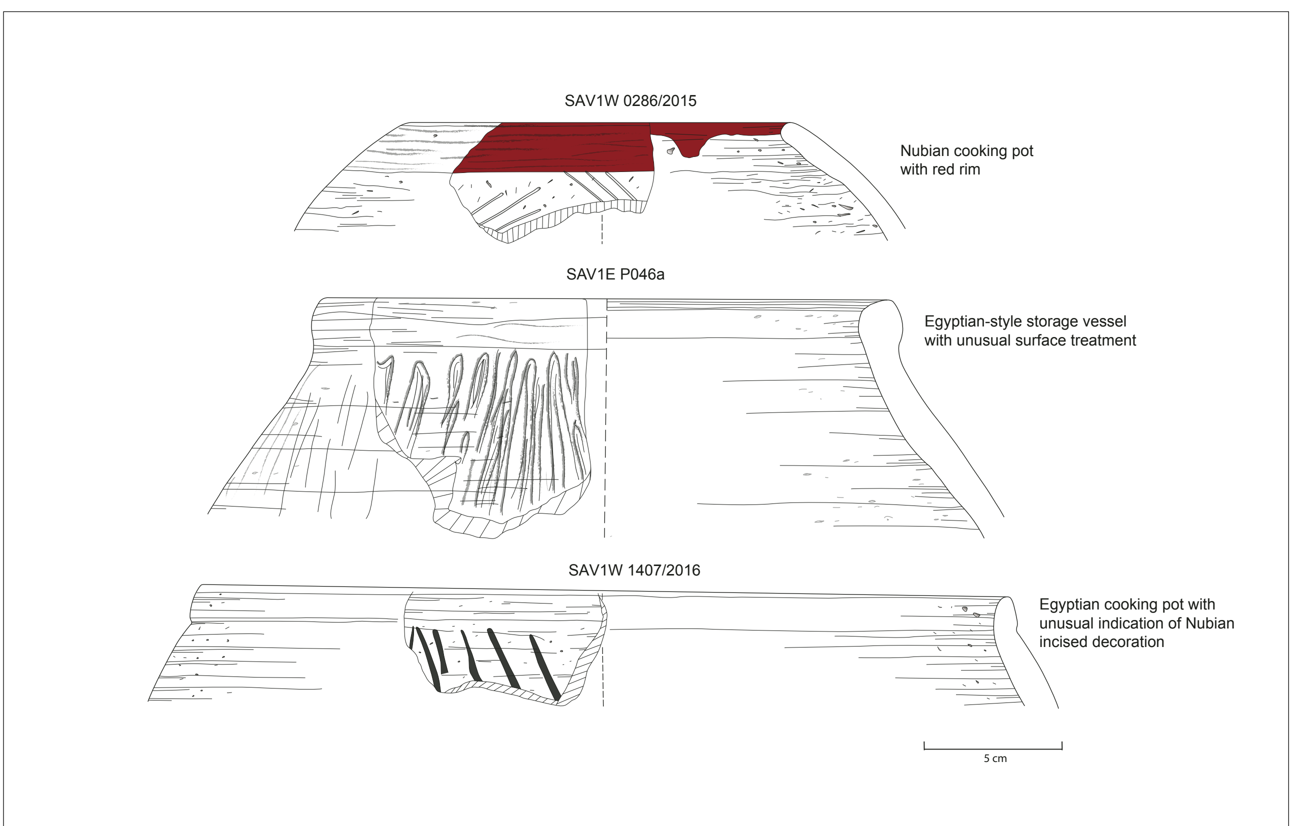

Figure 54. Hybrid vessels from the Egyptian town of Sai.

the production at other sites was for much smaller demands. On Sai, an industrial workshop for the Egyptian-style pottery seems likely, but details relating to the ceramic production remain unclear. Close interconnections between Egyptians and Nubians are evident and it seems most likely that Nubian potters were trained in the wheel-made production by Egyptians. Thus, production patterns and the identity of the potters changed during the life of the town of Sai.

In summary, Nubian pots, representing the minority in the pottery corpus, confirm the character of Sai as an Egyptian-style town. As for other groups of the material culture, the pottery corpus attests to people primarily identifying themselves as Egyptian officials but who may nonetheless have had Nubian family ties. As such, they were part of a local group with a specific cultural identity that was never completely abandoned but greatly adapted to an Egyptian appearance—including the production of Egyptian-style pottery with local features ■

[J.B.]

Identifying Patterns of Production V.3

Patterns of production: from Anthropology to Archaeology

The organisation of pottery production is a topic that has been much studied in ethnography since the various components characterising it (location and size of the production unit, workforce, labour division and specialisation, artisan identity and gender, work output or scale of distribution) provide an insight into multiple cultural, organisational and economic aspects of a society (Costin 2000; Roux 2003; Duistermaat 2016). To summarise broadly, workshop organisation has often been defined by opposing "workshop"/specialised production to domestic/unspecialised production; the first involving the production of items used by individuals other than the producers (notion of surplus). To go beyond this division which can be somewhat simplistic, a list of other attributes is also often associated with the concept of a specialised workshop (see Costin 2020 for a recent synthesis on the subject and for further references):

the presence of equipment and facilities set in a non-residential, formally structured space;
the presence of several (as opposed to a single potter) trained artisans which may not be related by kinship;
full-time workers with an internal division of labour;
work unit focused on the production of a limited range of standardised (with few mechanical variations) items;
high scale of production;
location in urban (or sub-urban) areas.

If some of the listed elements may indeed characterise specialised archaeological production contexts for the Mediterranean and the Near-East, ethnographic and archaeological studies also bring some nuances, as specialised production with a fairly high output can take place in a domestic context or does not specifically imply a limited range of products.

Furthermore, it has been noted that the number of artisans needed to supply a given population is often overestimated by archaeologists and that most craft productions in the preindustrial world were probably part-time, seasonal activities.

The determination of these different parameters may also prove difficult in archaeology, for aspects such as the economic specialisation (part-time or full-time labour), the scale of the production, the social identity or gender of the producer and his social relation to his environment are generally not accessible in the archaeological record. Direct archaeological evidence is given when the physical location of a place of production is known. In most cases, it is materialised by the presence of firing structures (often kilns in the Levant). It can sometimes be associated with other permanent structures as clay tanks, or misfired pottery (wasters), raw material (clay or temper), unfired vessels or tools. Such evidence may allow to determine the size of the workshop, to study the spatial organisation of production activities within the workshop or in relation with its broader environment. One may even assess the approximate number of artisans in case specific installations such as a potter's wheel can be associated with a worker station. When misfired or unfired pottery is present, it is also possible determine the degree of standardisation of the production, as for instance in Tell Leilan.

Most often however, archaeologists have to deal with indirect evidence: the pottery found on consumption sites. In this instance, one may attempt to characterise the organisation of the production through a comprehensive study combining the reconstruction of the *chaîne opératoire* (see Section II.5), archaeometric analyses of the clay fabrics (see Section II.3), chrono-typology (see Section V.1) as well as the distribution and use of the pottery. One of the main evidence generally brought forward to identify specialised production is standardisation. Similar raw material, shaping and decoration techniques can be an argument to consider that a group of ceramics was produced in the same place. Caution is nevertheless necessary as similar raw material can be used by several production units or potters and inversely several clay recipes can be used in one production unit. Morphological standardisation of the vessels is also a key-element, although one must bear in mind that the assessment of metrical standardisation is a relative concept that becomes meaningful when comparing several assemblages. It is generally considered that little metrical variation, when observed on a large quantity of vessels, is an index for a small amount of full-time or at least trained potters. However, in the case of long chronologies and therefore many production events, one should take into account the cumulative effect that would increase the degree of variations.

The Patterns of Production of Syrian Cooking Ware (Brittle Ware)

From the Hellenistic period onwards, Levantine cooking wares share a common recipe using iron-rich clay with quartz and a common repertoire—a cooking set—composed by a cooking pot, a shallow casserole, a lid, and sometimes a kettle. Despite these common features, several large regional *facies* can be distinguished. Northern Syria and the Euphrates region share a similar cooking ware tradition, usually called Brittle Ware, while Asia Minor, Cyprus, southern Syria and northern Palestine or southern Palestine have their own morphological repertoire and presumed or known production centres. In Syria, the Brittle Ware production centres seem to have held a complete monopoly of the market as no major competing cooking ware is attested until the Middle-Islamic period (Vokaer 2011). The worshops producing Brittle Ware are so far unlocated. However, fabric analyses (combining binocular, petrographic and XRF analyses) allowed to determine the existence of several

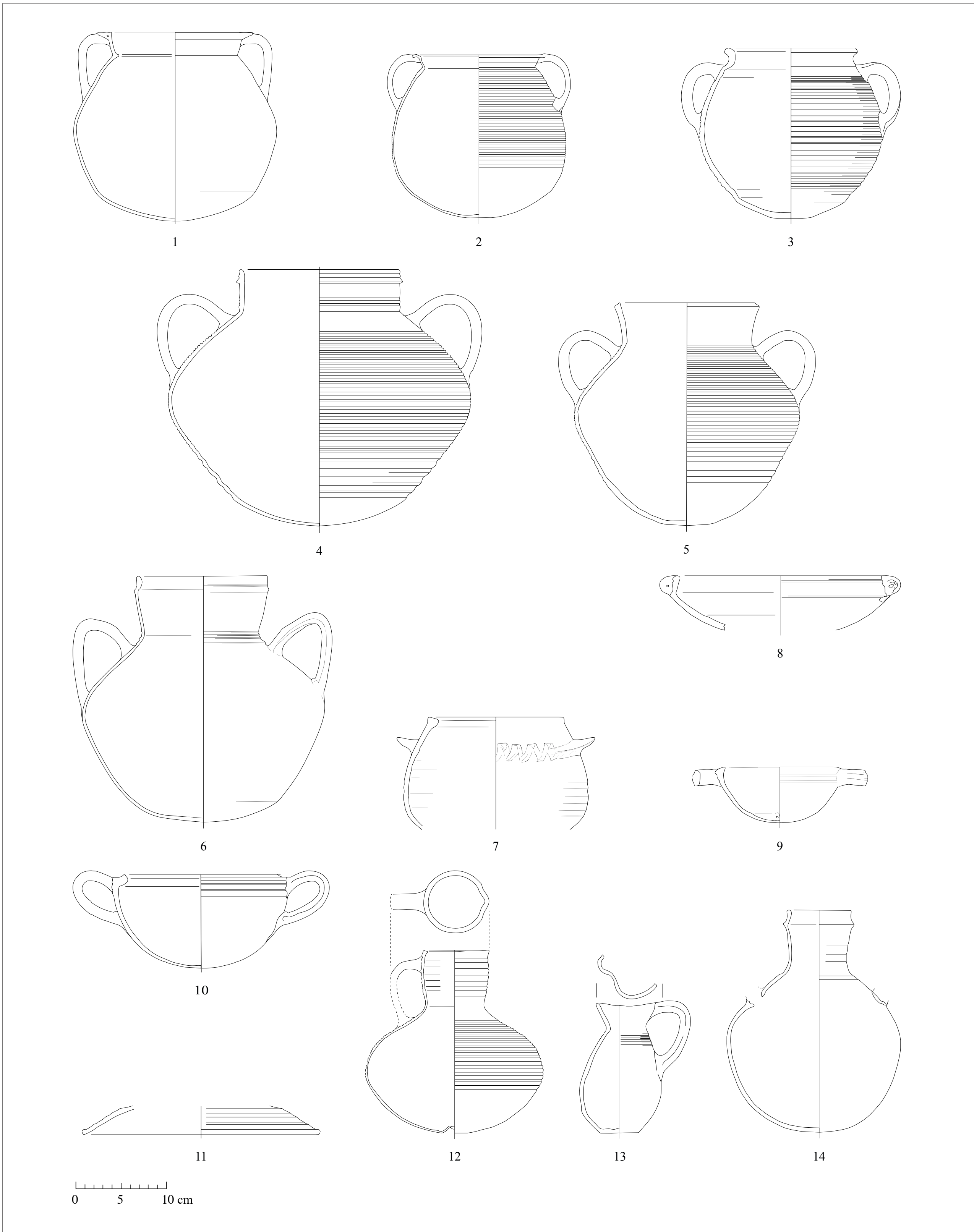

Figure 55. Main shapes of Brittle Ware (unless mentioned, drawing: A. Vokaer and CAD: A. Stoll).
1: Dibsi Faraj, 1st-2nd c. AD; 2: Ain Sinu (from OATES 1959, pl. LVIII) 2nd-4th c.;
3: Apamea, 4th-5th c.; 4: Apamea, 6th-8th c.; 5: Apamea, 6th-8th c.; 6. Dibsi Faraj, 7th-9th c.;
7: Dibsi Faraj, 8th-10th c.; 8: Dibsi Faraj, 3rd-5th c.; 9: Apamea, 6th-8th c.; 10: Dibsi Faraj, 7th-9th c.;
11: Dibsi Faraj, Roman and Byzantine; 12: Ain Sinu (from OATES 1959, pl. LVIII), 3rd-4th c.;
13: Apamea, 6th-9th c. and 14: Apamea, 6th-8th c.

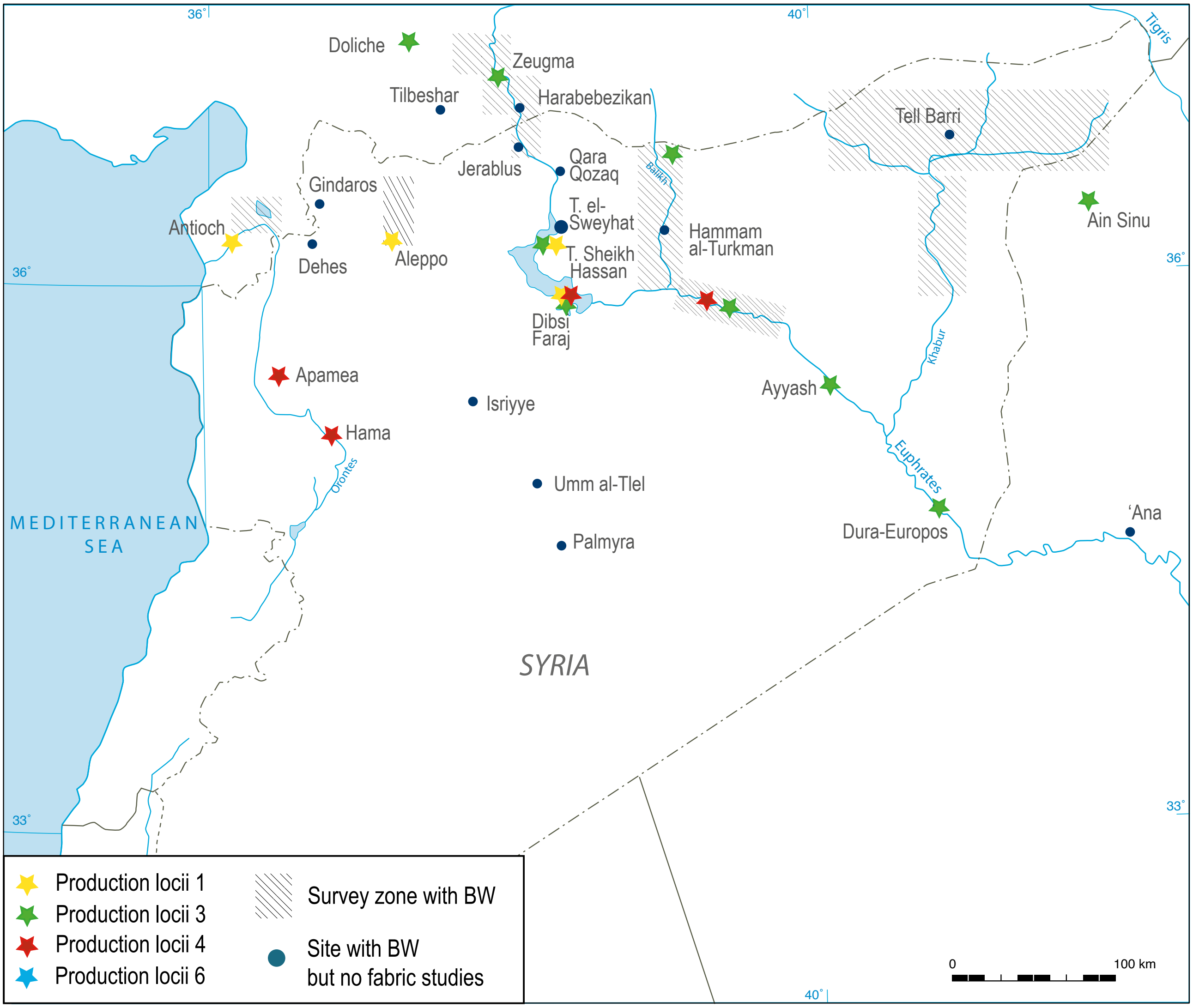

Figure 56. Brittle Ware distribution in the Roman period (drawing A. Vokaer and N. Bloch).

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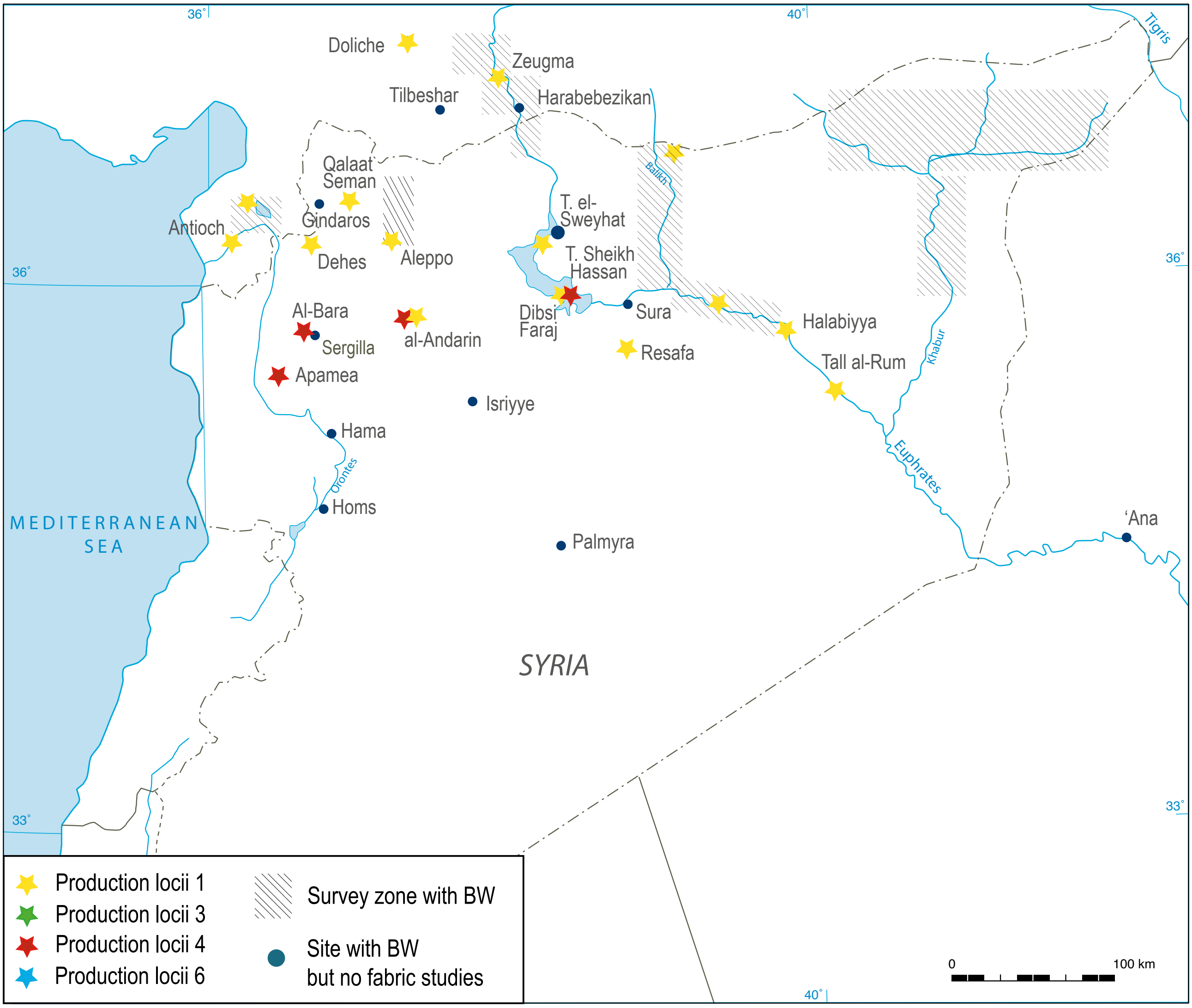


Figure 57. Brittle Ware distribution in the Byzantine period (drawing A. Vokaer and N. Bloch).

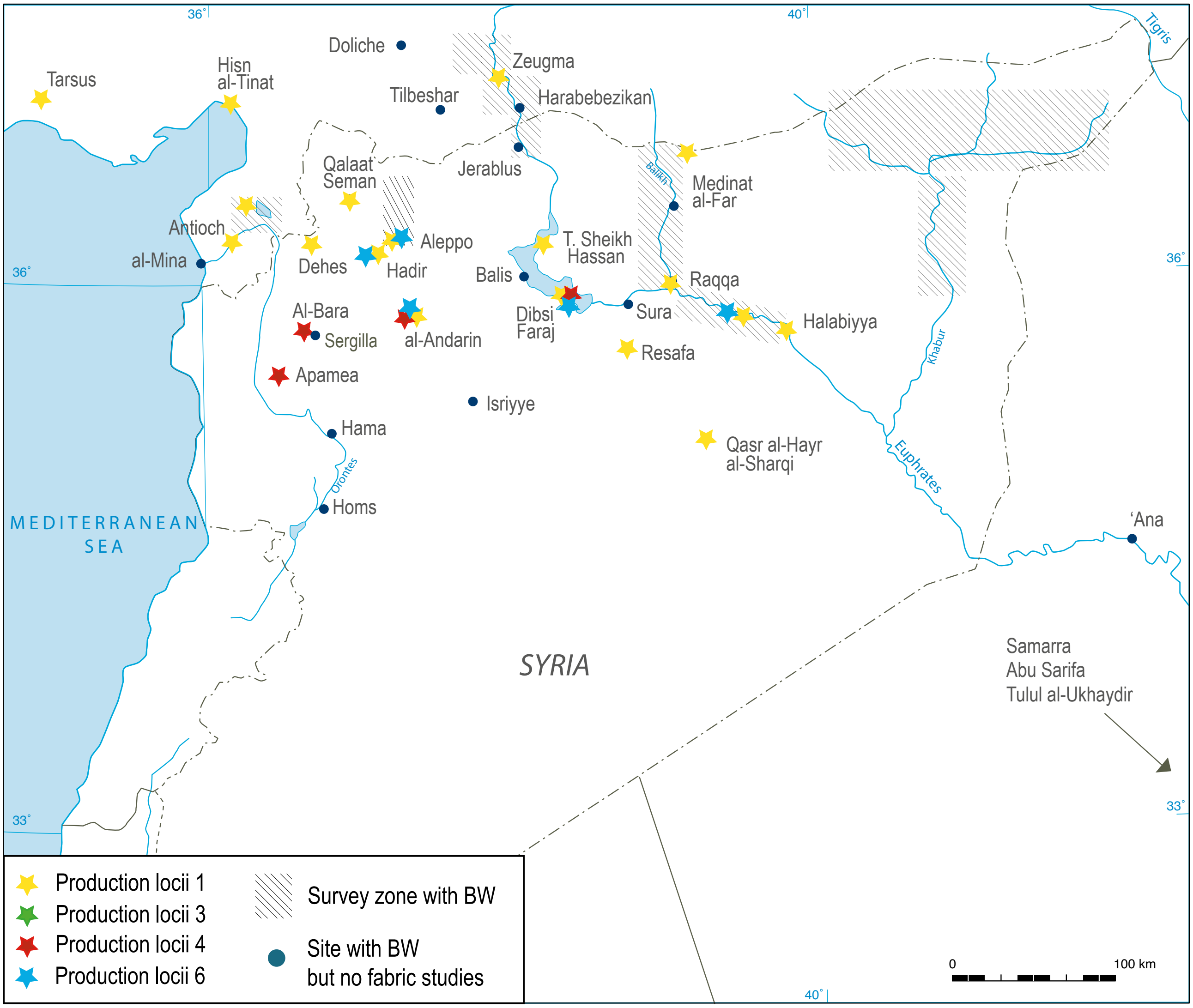


Figure 58. Brittle Ware distribution in the Early-Islamic period (drawing A. Vokaer and N. Bloch).

distinct groups corresponding to "workshops" or rather "production locus" as the number of production units and their precise location remain unknown. Three of them are located in north-western Syria, one around Apamea ("Production locus" 4) and two probably in the surroundings of Antioch ("Production locii" 1 and 6). A fourth one was situated in Euphrates region ("Production locus" 3). Information on the chronology of the production centres and their distribution profile was obtained by studying the distribution of shapes and fabrics through time and space. "Production locus" 1 was active from the Roman to the Abbasid period or later. "Production locus" 4 has the longest lifespan so far: from the Roman to the Mamluk period. "Production locus" 3 seems to operate from the 1st to the 5th century AD, while "Production locus" 6 is active during the Early Islamic period only. During their respective periods of production, the different "workshops" shared a common morphological repertoire and a relatively similar paste recipe (at least for "Production locii" 1, 4 and 6, with a quartz-rich fabric) so that, from the consumer's point of view, it was not possible to differentiate the vessels of the various production centres (fig. **55**). Their distribution profile shows that they supplied the large cities located close to them but were also oriented towards an extra-regional market. For instance, "Production locus" 4 supplied Apamea for more than a millennium as well as neighbouring and further sites, as far as Dibsi Faraj (figs. **56**-**58**). "Production locus" 1, presumed to be in the region of Antioch, supplied the city and the whole northern Syria, especially after the 5th century AD when it replaced the Euphratean "Production locus" 3 that was previously active in this region (figs. **56**-**58**). During the Abbasid period, when the Brittle Ware distribution reached its largest scale (from Cilicia to the Persian Gulf), fabric analyses allowed to identify finds belonging to "Production locus" 1 from Tarsus to the Euphrates, covering a distance greater than 400 km (fig. **58**). Brittle Ware from "Production locus" 6 is so far less frequent but still relatively largely distributed (fig. **58**).

The scale of distribution and the limited range of variations appearing in the clay recipe and in the morphological repertoire point towards specialised workshops. But in the absence of the physical sites, one cannot determine the internal organisation of the production units, their size or number, or whether these were specialised in the production of cooking ware only. An interesting point of comparison is the rather exceptional example of Kefar Hananya in ancient Palestine (see Adan-Bayewitz 1993; Adan-Bayewitz et al. 2009). The village was specialised in the production of cooking ware during the Roman period and was so renowned that mentions of its products appear in the rabbinic literature. In comparison with Brittle Ware, Kefar Hananya vessels were nevertheless distributed on a relatively moderate scale, that of Galilee. One could thus imagine a similar mode of production for at least Brittle Ware "Production locii" 1 and 4, located near two important cities they supplied but distributing eastwards along important economic axes. Even if the size and relationship of the workshops cannot be determined, one can estimate that these were operated by trained artisans and were organised production centres, either located in one region or even on one site as in Kefar Hananya. Moreover, the combined study of the typology, fabrics and of their geographical distribution clearly indicates that this type of cooking ware was the subject of an intensive production and of large-scaled trade ■

[A.V.]

Vessel Contents as Revealed by Organic Residue Analysis V.4

The Scorpion I Tomb as a Case Study

The Scorpion I tomb (U-j) at Abydos in Egypt, dated to *ca.* 3150 BC, which was excavated by an archaeological team from the German Institute of Archaeology in Cairo in 1988 (Dreyer 1999), provides an excellent example of how a well-provenienced, well-dated, well-excavated, and well-preserved archaeological context holds out good prospects for the recovery of ancient organic materials. The tomb, laid out as a model funerary house (for a scale floor plan, see McGovern et al. 1997, fig. 4; see fig. 59), is one of the earliest and most important tombs of an ancient predynastic Egyptian king, probably named Scorpion (I). The presumed ruler's identity is based on large, well-drawn images of the desert animal painted on many wavy-handled pottery jars, which likely contained oils or fats (as yet, unanalysed); these "pictographs" may represent some of the earliest known hieroglyphic characters. The king himself (represented by a few bones only, due to robbery in antiquity) had been laid out on a wooden shrine, traces of which were recovered in the largest chamber (fig. 59) of the tomb in its northwest corner, with his ivory *hq3* (Egyptian, "ruler") sceptre at his side. Other chambers of the tomb contained beer jars, bread moulds, and fragments of cedar boxes, perhaps once having held clothes, etc., for his journey into the afterlife.

From the perspective of an ancient grape/wine hypothesis, the most important excavated finds were 207 pottery jars of non-Egyptian types, nearly all of which were intact, in the south-eastern two-thirds of chamber 7 and the entirety of chamber 10 on the north-eastern side of the tomb (Hartung 2001). They were stacked in three or four layers from the sand floor to about mid-wall height, one layer above another (McGovern et al. 1997, fig. 5). Depressions in the sand floor of chamber 12 on the south-eastern corner of the structure, together with numerous jar sherds of the same types as those in chambers 7 and 10, show that at least another 150 vessels once covered the floor of this chamber but had been stolen in antiquity. On the assumption that more vessels once existed in the north-western third of chamber 7 and additional jars were piled on top of one another in chamber 12, the three rooms can be estimated to have originally contained as many as 700 jars (fig. 60). Since each jar had a capacity of about 7-8 litres, the jars would have held up to 4500 litres of liquid if full. The question was: What was the liquid that the vessels originally contained?

The jars in chambers 7 and 10 were found intact beneath half a metre of sand. Each chamber was surrounded by 0.5 to 1-metre-thick mudbrick walls, approximately 1.5 metre high, and covered by a roof of wooden beams, plastered mudbrick and reed mats, still partly preserved. The tomb had also been buried under a mound of sand. When the roof collapsed into the chambers, sand poured into the latter, creating depressions in the desert.

The Western Saharan Desert of Upper Egypt, where the Scorpion I tomb is located, receives about 1 millimetre of annual rainfall and has a relative humidity ranging between 30-60%. Today, rain only penetrates several millimetres into the fine sand, well above the depth at which the well-sealed jars are set, and any moisture quickly evaporates in what is considered to be one of the sunniest spots on Earth. Similar environmental conditions have likely prevailed in this region for the past 5000 years. During the excavation, no moisture or elevated humidity was observed in chambers 7 and 10, and it is unlikely that rain or the water-table ever seeped in. In short, the presumed insulation provided by the sand, mudbrick walls, roof, and mound would have kept the jars relatively cool and dry for millennia and helped to preserve organic materials.

Figure 59. Scorpion I's tomb at Abydos, showing one of the chambers filled with wine jars before excavation (Photograph © DAI Cairo; see DREYER 1999, pl. 3b.).

Figure 60. A "wine cellar for eternity": peering down at some of the 700 wine jars buried with Scorpion I (Photograph © DAI Cairo).

Figure 61. The interior of wine jar no. 7/50 from Scorpion I's tomb (HARTUNG 2001, cat. no. 389, 189, pl. 58 and 94).
Note that the surface residue formed a circle and was slanted off from the horizontal, because the jar with its liquid was tilted in antiquity. Ht. of sherd 33.5 cm (Photograph © DAI Cairo).

Yet, as was to be expected, the contents of the jars had evaporated and been replaced by sand over the millennia. Slanted rings of a yellowish crusty residue were revealed on the interiors of many jars, once the sand was poured out (fig. **61**). The rings are best explained as "tide-lines" that mark the surface of a liquid. As the presumed liquid inside gradually evaporated, it left behind solids which had been floating on the surface. If a jar had moved, its ring was slanted from the horizontal. Residue had also accumulated on the bases where other solids in the liquid had settled. The argument that the vessels were liquid containers was further substantiated by their narrow mouths and a scattering of small clay sealings around the jars, which had jar rim and string impressions on their backs. It is hypothesised that the jars had once had "lids" made of an organic material, such as leather, that were tied over the jar mouths with string and secured with the sealings. The strings and covers later disintegrated, and the sealings fell to the floor.

An indication of the original contents of jars as having been fermented grape juice (i.e. wine) was already suggested by the recovery of numerous raisins from many of them, together with grape seeds and skins. However, the number of raisins per jar was low, suggesting that the liquid contents had been filtered but not finely, perhaps to further extract the aromatic and bittering compounds of the grapes.

Several jars contained a single desiccated fig, which had been sliced horizontally into sections was centrally perforated which, in some examples, contained remnants of preserved string. If the wine hypothesis were to be sustained by our analyses, this finding would be the only instance of a chemically confirmed fig-flavoured wine from antiquity. It appears possible that the figs might have been hung from the mouth of the vessel into the liquid. By slicing them up to create a larger surface area, they might have served better as sweetening agents, for special flavouring, or to provide additional yeast for fermentation. A less pragmatic, but perhaps no less compelling, reason for such a wine was a 3rd millennium BC Old Kingdom Pyramid Text (§112c-d) that reads: "The king shall make his meal from figs and wine which are in the garden of the god." By having a wine laced with figs, Scorpion I would have been assured of a fully sanctified meal in the afterlife.

The inferences of the jars having once contained a grape wine, based on archaeological observations, archaeobotanical finds, and textual sources, were further corroborated by our chemical analyses of the tide-line residues inside three jars (nos. 7/18, 10/22 and 10/115) excavated from undisturbed areas of chambers 7 and 10. We began by testing the yellowish residues inside three jars using our standard, albeit at the time, low-level battery of analyses viz., Fourier-transform infrared spectrometry (FT-IR), HPLC (high-performance liquid chromatography), and a Feigl spot test in search of biomarkers for possible natural products. We demanded that the results of all three independent methods agreed with one another, otherwise our hypothetical identification(s) would be disproven (McGovern 2019a; McGovern et al. 1997; McGovern et al. 2001). The tests uniformly showed the presence of tartaric acid/tartrate, further corroborating the initial hypothesis that the vessels had indeed contained a grape product, most likely wine. This result was subsequently confirmed by state-of-the-art liquid chromatography with tandem mass spectrometry (LC-MS/MS) (McGovern et al. 2009).

Since tartaric acid/tartrate only occurs in large amounts in the Eurasian grape (*Vitis vinifera*) in the Middle East, it is the fingerprint compound for a grape product there. When expressed as a liquid, as was clearly indicated by the narrow mouths of the jars and where the residues had collected on their interiors, grapes readily ferment to wine in a warm climate. Numerous clay sealings found in the vicinity of the jars showed that the mouths of the jars had once been covered, probably by leather that since disintegrated, to keep out oxygen and prevent the wine from oxidising to vinegar. Our inferences were borne out by the addition of a tree sap preservative, and the archaeobotanical recovery of grape remains from inside many of the jars (*infra*).

The combined evidence left little doubt that the 700 jars in the Scorpion I had once contained grape wine. One could argue that some of the jars might have been filled with other contents, especially since only a very small percentage of jars in the corpus had been chemically tested. The archaeological context in which all the jars were found together with their interiors showing little or no variations in material content (e.g. comparable tide-lines and archaeobotanical findings), however, suggested otherwise.

Yet, other questions remained pertaining to whether the jars had once contained what would be the earliest chemically attested wine for Egypt to date. Most troublesome was the fact that the royal Egyptian winemaking industry was not established in the Nile Delta until several hundred years after Scorpion I, around 3000 BC. Moreover, wild grapevine (*V. vinifera sylvestris*) never grew in the arid climate of Egypt. Thus, if the wine contained in the jars was indeed wild grape wine, then it had been imported from elsewhere.

A clue to the jars' contents—a deductive test of the grape/wine hypothesis—was their unusual shapes, decorations, and manufacturing details, which were foreign to Egypt. The best parallels were from sites in the Jordan Valley, near the Dead Sea, and in the vicinity of Gaza along the Mediterranean, the closest settled area in the southern Levant to Egypt where, at that time, a wine industry already existed and had for half a millennium or more (McGovern 2019a). This inference was confirmed by neutron activation analysis (NAA) (McGovern et al. 2001).

Many other analyses were carried out on the residues, including identifying ancient DNA of the ancestor wine yeast responsible for the fermentation of the grape juice into wine (Cavalieri et al. 2003) and herbal additives of Levantine origin (McGovern et al. 2009). The botanicals, which go readily into solution in an alcoholic medium such as wine that can be readily applied to the skin or be drunk, likely provide the earliest chemical evidence for a medicinal preparation from ancient Egypt (McGovern et al. 2010; McGovern 2019b).

Our chemical analyses also showed that Scorpion I's wine had been resinated with pine and probably terebinth tree saps, based on characteristic diterpenoid and triterpenoid compounds (unsaturated and cyclic hydrocarbons). In our experience, almost without exception, a tree sap was added to ancient wine throughout the Near East and elsewhere, most likely because they have antioxidant properties that prevent wine from turning to vinegar, or failing that, they cover up off-aromas and off-tastes.

The case study of Scorpion I's grape wine illustrates how organic residue analyses are best performed to achieve the most meaningful results (see McGovern, Hall 2015, for specifics and recommendations). Working hypotheses (in this instance, a "wine hypothesis"), drawing upon as many relevant disciplines as possible to derive the maximum information from a very limited database, are key to this highly interdisciplinary field, which is a branch of biomolecular archaeology.

Archaeological, chemical, and archaeobotanical analytical techniques and data are most important for effectively developing and testing such hypotheses, but zoological, geological and other natural science approaches, as well as ancient textual, artistic and more recent ethnohistorical and ethnographic evidence, also need to be taken into account. Thus, documentary sources and artistic depictions, especially those which are contemporaneous with the mute, non-textual archaeological data, can help to "flesh out" what is otherwise equivocal from the latter scientific data alone. Because alcoholic beverages are central to nearly every culture on the planet, they can be highly conservative through time.

Archaeologically, the goal is to obtain as many relevant samples for the proposed hypothesis as possible from the best preserved and dated contexts, which have been subjected to the least degradation and disturbance by later natural processes and human handling, including washing and conservation treatment. Chemically, molecular biomarkers of natural products need to be defined and identified by the best and most appropriate techniques, together with bioinformatics searches and assessment of degradation. With ever-improving techniques and new data, previously analysed samples need to be retested and hypotheses possibly reformulated.

A corollary of a highly probabilistic discipline is that *absolute* certainty or refutation of a posited working hypothesis of archaeological significance at least one that is at a higher level of abstraction, such as a social activity, technology or ideology, as opposed to the chemical or physical identification of a specific material or chemical compound is unattainable. Unlike the hard sciences, past archaeological events cannot be fully replicated by experiments in the present. So-called "experimental archaeology", a branch of ethnoarchaeology, in which various possible ancient scenarios are tested for their viability is of explanatory value but is often quite limited.

It should be noted that earthenware pottery and other porous ceramic materials are the ideal for absorbing and preserving ancient organics, especially liquids with polar compounds like grape wine. The ionic forces of aluminosilicate clays, for example, can retain the ancient compounds intact, depending upon their stability and susceptibility to possible displacement by extraneous ground water, until they are extracted by modern solvents. Acid baths to remove carbonates, which has been a common practice in archaeology, is also detrimental to the preservation of ancient organics.

Reconstructing ancient viniculture's history and technology is a single example of how ancient organic residue analysis, when buttressed by as solid a methodological, theoretical and experimental foundation as possible, promises to shed new light on a host of biocultural developments that have made humans the organisms and cultures that we are today. With that knowledge, we can move more confidently into the future. Most of what we are as humans is organic—our houses, our clothes, our bodies, etc.—and we now have the analytical tools to recover and identify and interpret ancient organic remains.

We stand at the beginning of a process of discovery in which we can find out much more about ourselves and our past world, including our bodies and brains, the microbiomes that surround and inhabit us, our languages and social systems, diets and economies, trade routes which brought peoples and their organic commodities and ideologies together, how we domesticated plants and animals, developed medicines, innovated in music, dance, theatre, and the arts generally—the possibilities are endless. This knowledge may well lead to new taste sensations, alternative medicines, a better understanding of our shared biological and cultural heritages, and much else. But such advances will require chemistry, archaeology, and ancillary natural, historical, and social sciences working together in a joint appreciation and application of rigorous theory, methodology, and data collection. Optimistically, we might envision a "new history of humankind" eventually being written.

A guide to the practical considerations that one should keep in mind in carrying out an organic residue study is posted on my homepage: https://www.penn.museum/sites/biomoleculararchaeology/.

The proposed approach is generally applicable to archaeological sites, artifacts and ecofacts, and residues world-wide for any time period. It is particularly applicable to humankind's homeland—Africa and specifically to Egypt in its northeast corner, which lies at the gateway to the eastern Mediterranean and the continent of Asia.

[P.E.McG.]

From Sherds to Food Traditions: Determining Ancient Vessel Function V.5

The study of vessel use or "function" plays an important role in the investigation of ancient ceramics, helping to understand how pottery vessels were used in day-to-day activities. Increasingly, archaeologists use these functional aspects to investigate ceramic use in food preparation, cooking, and consumption. These activities were integral parts of the social and cultural life of past societies, complimenting traditional studies of subsistence and production. The preparation and consumption of food serves not only fundamental human needs in terms of nutrition but also reflects cultural, social, economic and personal circumstances. Pottery is an ideal medium to investigate these foodways, given their archaeological ubiquity and durability that make them one of the best surviving bodies of evidence for past culinary traditions.

Here we will review some of the approaches and techniques used in the study of these ancient food practices by the project "Connecting Foodways: Cultural Entanglement and Technological Transmission between the Middle Nile valley and central and eastern Africa during the Early Iron Age" (Matthews, Nowotnick 2019).[1] This project uses ceramics to study the culinary traditions of sub-Saharan Africa, combining archaeological and laboratory analyses, ethnoarchaeological observations and the study of associated food remains. The main focus, however, is the pottery vessels used in preparing, cooking and serving meals.

Artefact Analysis

When studying ceramics used in past foodways particular attention is paid to the functional characteristics of pottery vessels, such as morphology and technological aspects, being those attributes which would most likely have had a direct effect on their daily performance.

Vessel Morphology

The shape and size of a pot often serves an intended function. For example, storage vessels typically have large dimensions and a restricted opening to protect contents against spillage. Pots used in cooking are usually round-based globular vessels, a form which minimises thermal stress and helps distribute heat from the fire (fig. 62). Thus, vessel shape, proportions and capacity are often adapted to suit particular kinds of foodstuffs and cooking practices (cf. Orton et al. 1993, p. 220; Rice 1987, pp. 207-241; Skibo 2013).

Materials Analysis of Ceramics

Laboratory analyses of pottery sherds are a further means to determine function, especially in the study of food technologies. Cooking pots, for example, have to withstand considerable use stress caused by repeated heating which can cause cracks, rendering the pot permeable and thus useless for cooking liquids over a fire. Materials analysis can reveal the performance characteristics of individual pots, providing important information on vessel

1 Based at the *Deutsches Archäologisches Institut* (DAI) in Berlin and funded by the Priority Programme 2143 "Entangled Africa" of the *Deutsche Forschungsgemeinschaft*.

Figure 62. Examples of coarse ware cooking pots from Hamadab, Sudan. Cooking vessels in the Middle Nile valley are typically thin-walled handmade jars of globular shape. The rounded base was often reinforced and textured with finger imprints or basketry impressions to enhance heat resistance and to prolong use-life. (photo S. Matthews CFW_PH_200215_01, © DAI, Connecting Foodways project).

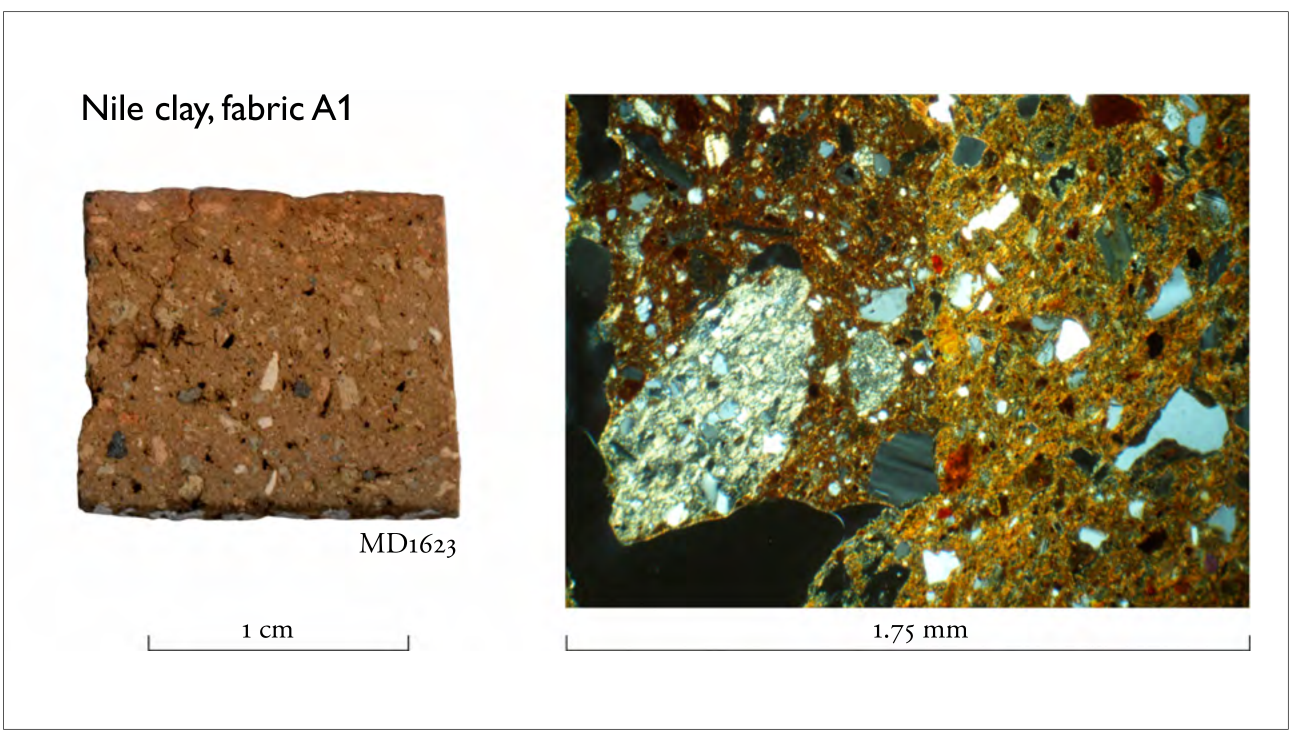


Figure 63. Macro-photo and thin section photo of a handmade vessel used in domestic cooking practices. The addition of coarse tempering agents such as clay aggregates or grog enhances the heat resistance of the Nile fabric (photos: M. Baranowski, G. Schneider; compilation: U. Nowotnick, © DAI, Hamadab project).

strength, porosity, water permeability, thermal conductivity and resistance to thermal shock (e.g. Daszkiewicz 2014, pp. 190-191; Skibo 2013). These help to determine if a vessel was better suited for cooking or storage, or for handling dry or liquid foodstuffs.

Production Technology

The study of pottery fabrics provides important insight into manufacturing choices made by potters when producing vessels for different food-related activities. For instance, pots used for cooking over a fire need to be heat-resistant, whilst containers used for liquids need to be waterproof. Such functional characteristics are achieved through a complex interplay of clay composition and temper, wall thickness, firing conditions and surface treatment (Orton et al. 1993, p. 221). Changes in a single variable during production can have considerable effect on how a pot could later be used. For example, a vessel manufactured with a high quantity of mineral temper such as sand or grog will have a higher resistance against thermal shock (fig. **63**). Surface treatments, typically considered decorative, can also affect vessel performance. Smoothing or burnishing compacts the surface and reduces permeability, whilst intentional texturing, such as rouletting, mat impressions or scraping, helps to lower thermal stress by reducing temperature differences between the inner and outer surfaces of a pot (Gibson, Woods 1990, p. 275).

Use Traces

As well as studying form and technology, the use to which a vessel was put often leaves traces of activities, which can be important for determining whether a vessel was employed in culinary tasks, as well as what kinds of activities and foodstuffs were involved.

Use-wear Traces

Traces of use alteration, such as soot marks, abrasions and surface attrition are direct indicators of culinary activities. These traces deserve close attention and systematic recording as they can reveal patterns of use for specific vessel types. For instance, damage patterns point to mechanical stress, attrition on the inside of a vessel may have been caused by acidic liquids, and the location of burn marks may indicate how a pot was placed in or near the fire, pointing to specific cooking methods (fig. **64**).

Organic Residue Analysis

The analysis of food traces represents a significant development in the study of pottery. These take the form of both visible macro traces, such as food crusts or spills, and micro traces. Organic residue analysis on the interior of vessels identifies the residues absorbed by the porous structure of the ceramic body. Application of chromatography and mass spectrometry (GC-MS) can chemically detect compounds of animal fats, aquatic resources, plant oils and beeswax (Barnard, Eerkens 2017). In combination with stable carbon isotope analysis, carcass fats can be distinguished from dairy fats, like milk. Analysis of these residues provides valuable information on what kinds of foodstuffs may once have been cooked and consumed, as well as the kinds of vessels used in such activities.

Figure 64. Base of a handmade cooking pot from el Tuweina, Sudan. The soot pattern indicates that the bottom of the pot (light grey ashes) was set in embers and the flames were licking at the sides, blackening the outer surface (photo: S. Matthews CFW_PH_200222_252, © DAI, Connecting Foodways project).

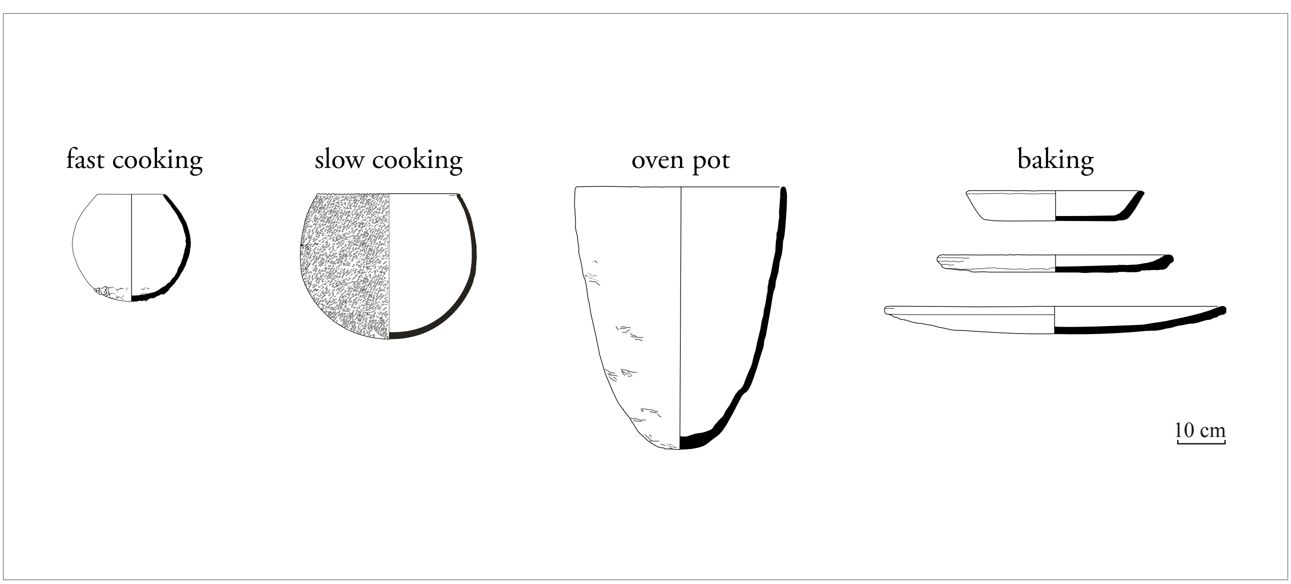


Figure 65. Four types of kitchen vessels from the Meroitic town of Hamadab, Sudan, have been identified as used in different food-processing technologies by means of functional analysis. Each type has a specific shape, fabric composition and surface treatment, relative to the performance characteristics and intended cooking function (drawing, compilation, © U. Nowotnick).

Summary

The detailed study of function can reveal the various uses to which pots were put as part of the culinary traditions of a group or culture. The selection of relevant variables relating to use therefore requires careful consideration. A more systematic concern with the technological and functional aspects of pottery expands the range of most traditional ceramic studies. By combining information on vessel shape, mechanical properties and use-wear traces, a greater appreciation of frequently neglected coarse wares, which typically comprise hand-made kitchenware and cooking pots, can be achieved.

We have employed these approaches in researching the culinary traditions of northeast Africa, classifying specific pottery types made for distinct cooking practices (fig. **65**), the identification of various kinds of kitchen contexts, the use of particular foodstuffs, and shared regional technological traditions (Matthews, Nowotnick 2019; Nowotnick 2022). Hence, an integrated study of kitchenware contributes not only to our understanding of ancient food preparation and consumption, but also offers insight into the social and cultural significance of domestic activities ■

[**U.N.** & **S.Mat.**]

VI

Ceramic Studies in French Institutes Abroad

The last chapter is devoted to the illustration of the research conducted by the French institutions hosted in the countries of the Nile Valley and in the Eastern and Middle East that made this manual possible. The Sfdas (Section française de la direction des Antiquités du Soudan) ensures a leading role in ceramic studies in Sudan (see Section VI.1). The Ifao (Institut français d'archéologie orientale) is the only foreign institution accommodating a permanent ceramic laboratory in Egypt (see Section VI.2). The Ifpo (Institut français du Proche-Orient) is a major regional actor of ceramic studies in Syria, Lebanon Jordania, Irak and Palestine (see Section VI.3). Finally, the Cefrepa (Centre français de recherche de la péninsule Arabique) aims to initiate, coordinate and support the archaeological exploration of the Arabian Peninsula in which ceramic studies play a major role (see Section VI.4) ■

Sudan: The Sfdas and Meroitic Ceramic Studies VI.1

The "French Unit" of the National Corporation for Antiquities and Museum (Ncam) has been conducting archaeological explorations of the Nile Valley for the past 50 years. This long-lasting tradition of collaboration with the Sudanese antiquity service has produced numerous academic papers and books that have enriched our knowledge of the great civilisations which successively settled in the Middle Nile valley (Cabon et al. 2017). Since the end of the 20th century, the Sfdas has been essentially involved in the excavation of the Meroitic (3rd century BC-4th century AD) remains: two necropolises in Middle Nubia, one at Saï and the other at Sedeinga, and a cultic area at el-Hassa and at Damboya in Central Sudan; additionally the Louvre Museum excavated the Meroitic town of Muweis some 40km south of el-Hassa. Consequently, material studies greatly thrived from the number of artefacts uncovered and helped to draw the outlines of the renewal of Meroitic studies. Among these, ceramic studies represent a particularly developed field of research under the aegis of the Sfdas.

Since the pioneering work of W.Y. Adams (1986) who presented a sum of his research conducted in Lower Nubia in a comprehensive approach, studies of ceramics from the Meroitic period flourished in Upper Nubia down to the Khartoum region. They highlighted the diversity of the pottery productions as well as the complexity of the chronological frame in which they were produced. Despite decades of research, we are still lacking a generic tool organising the pottery found in the Meroe region by type and chronology to serve as a basis for the development of cultural and economic approaches of the Meroitic ceramic (David 2019). Filling this gap is one of the main purposes of the Sfdas which benefits from the various excavations in which its team is involved.

Meroitic Pottery or Pottery from the Meroitic Period?

Until now, the definition of what a Meroitic pottery is has not been conclusive. An ambivalence of terminology can be witnessed by ascribing the term Meroitic to productions dated to the Meroitic period even if we do not know if they were really made by people belonging to the Meroitic political and cultural sphere. Ceramic technology (see Section II.5) is particularly helpful when approaching this topic and its limitation. When applied to the material of the Meroe region, such methodology provides an overview of the variety of techniques used contemporaneously to produce pots (David, Evina 2016). One may assume that these techniques are related to various social groups from different regions of what is today Sudan and who used to meet in the Nile valley. Potters mastering the wheel and producing the famous Fine Ware (fig. **66**) probably under political power control (David, Evina 2015) had likely not much in common with the ones moulding their black ceramics in a sub-Saharan tradition or with others manufacturing their pots with a paddle-and-anvil method on a mat (fig. **67**c), except the fact that they were living together. In such case, ceramic study can help to define the cultural features of each production and its link with specific social groups, the origins of which are still to be determined. However, recent exploration of the outskirts of the Meroitic Empire, within the southern region of the Gezira, in the desert reaching Darfur to the West or in the deserts to the east up to the Ethiopian border, is expected to provide a complete reassessment of our knowledge of these populations (e.g. Barnard 2008; Brass 2016; Gratien 2013).

Figure 66. Fine ware bowl from Berber (B-1-1) © R. David.

Figure 67. The containers of the Meroitic and post-Meroitic periods : **a**) 1st century AD; **b**) 2nd-3rd century AD ; **c**) 4th century AD © R. David.

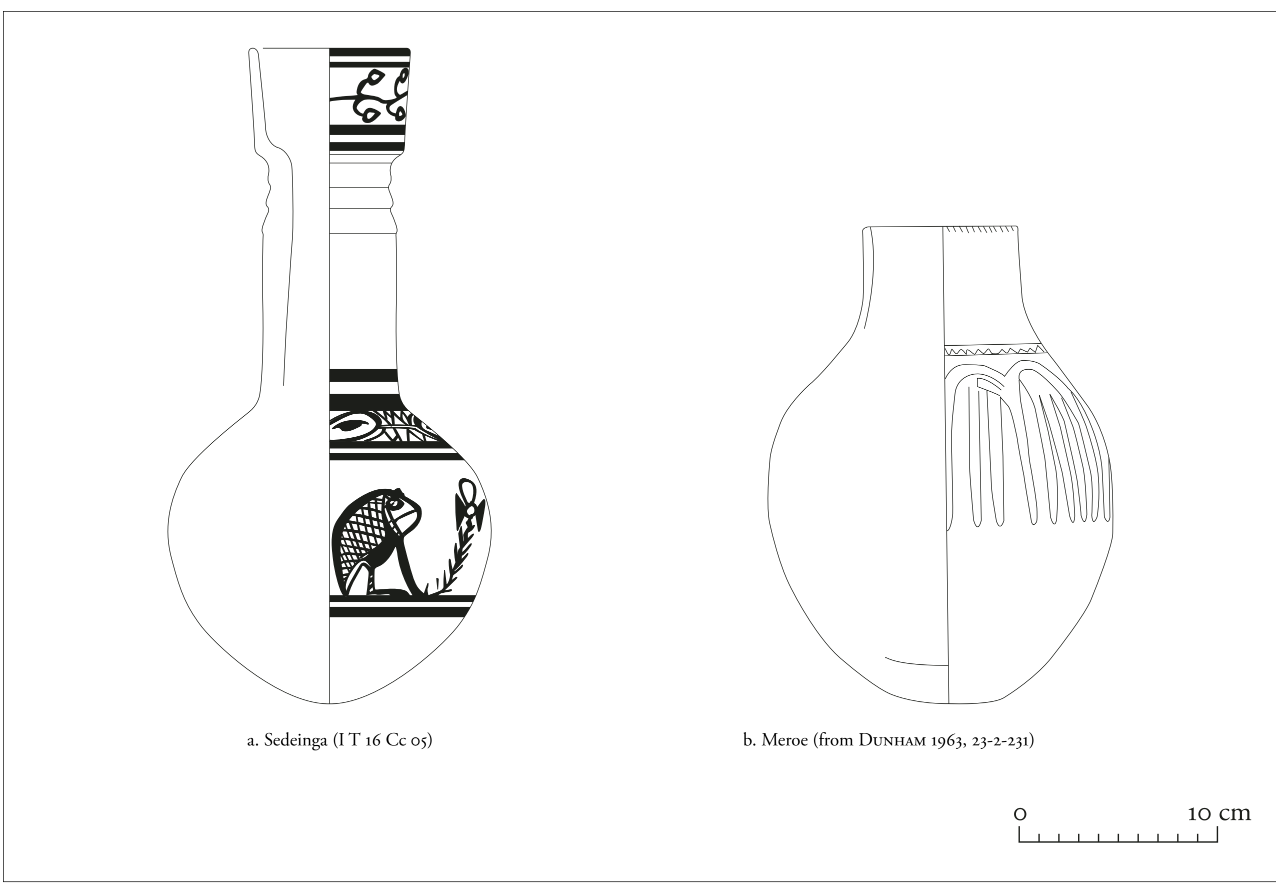


Figure 68. a) Long-necked bottle from Sedeinga (Middle Nubia); **b**) Hand-made black bottle from Meroe © R. David.

Regional Features of the Production and Internal Economy

Consequently, research tends to focus on the regional features of the ceramic production and leads to a subdivision of the Meroitic Empire and its outskirts into broad cultural areas. Along the Nile, Nubia, the Meroe region, the region south of Khartoum, then the Darfur/Kordofan to the west and the deserts to the east can be distinguished according to their ceramic traditions (Robertson, Hill 1999). Within the Nile Valley, the typological differences are qualified through an obvious political and economic centralisation of the power involving relays scattered along the Nile valley. For instance, standardised containers or widespread vessels reflect an internal trade and reveal the distribution network of the Meroitic Empire (David 2018). Some types of jars point out the evolution of the ceramic production of the Meroe heartland as well as the continuity of the supply of goods to the out-skirting regions from the Early Meroitic period to its end. Thanks to them, it has been possible to identify the shift from hand-made to wheel-made production of containers which were probably used for shipping goods during the 1st century AD (fig. **67** a-b), replaced at the end of the Meroitic period by hand-made mat impressed jars that became the chronological marker of the post-Meroitic transitional phase (fig. **67** c).

The regional features of the pottery production appear to be better observed through the scope of funerary archaeology, partly because Sudanese archaeology only turned to urban exploration recently, thus most of the documentation available stems from the multiple cemeteries excavated over the last century. Moreover, local customs are considered to be better evidenced in a grave, with a selected funerary set, than in a town. For instance, the people from the Middle Nubian area were buried along with a long-necked bottle (fig. **68** a) the distribution of which appears quite limited (Leclant 1985). In the Meroe region, black hand-made bottles (fig. **68** b) seem to fulfil the same function within a rather restricted area situated between Khartoum and Meroe (Lenoble 1995).

The development of laboratory analyses is also expected to provide more clues to approach these issues. The study undertaken at Musawwarat es-Sufra—the only excavated workshop of the Meroitic period up to now—serves as a model for future research to identify a specific production and to highlight its distribution (Daszkiewick, Wetendorf 2014). However, the homogeneity of the Nile clay, the chemical composition of which does not vary enough to enable to correctly locate the sources, is still an obstacle which needs to be overcome if we want to enlarge these first results to the majority of the productions of the Meroitic period. A scientific programme will shortly be launched to address this topic through precise chemical analyses.

Chronology and Typology

The growing interest in urban archaeology generated a considerable number of new shapes devoted to daily use. While the ceramic found in funerary contexts supplies valuable information relating to the chronology of any archaeological context dated to the Meroitic period (Bashir, David 2015), a great range of ordinary wares from domestic areas does not find any parallels in the corpus of selected funerary items. Moreover, the variety of the production is such that there is no existing classification representative of the material found. Each site being unique and each ceramic specialist having a personal system of classification despite common methods, comparisons between sites are still based on morphological parallels rather than well-defined productions. A recent attempt has been made to homogenise the classification system of the productions found in the Meroe region based

The "French Unit" of the NCAM

In addition to the scientific programme conducted on ceramics from the Meroitic period, the Sfdas (Section française de la direction des Antiquités du Soudan) is involved in various fields relating to ceramic studies.

As part of the National Corporation for Antiquities and Museum (NCAM), the Sfdas is collaborating in the study of ceramic material from various Sudanese fieldworks (e.g. BASHIR, DAVID 2015). Its team supplies material support and expertise to foster the research of ancient pottery and the publication of such in academic journals.

The Sfdas also organises training courses in the various fields of archaeology for NCAM inspectors and curators as well as for students from Sudanese universities. Regarding the ceramic studies, more than 30 students and professionals have been trained to use the ceramic documentation, from the sorting of material to the digital drawing thereof. Partnerships with the universities of Khartoum led to the organisation of workshops and seminars aiming to promote this very specific field of research. Finally, with the support of the French Embassy, some students can be selected to attend French courses and also benefit from fellowships for their doctoral studies in France. The present ceramic manual is also the result of the involvement of the institution in the promulgation of academic knowledge through the following generations.

The Sfdas has also launched a scientific programme aiming to document modern potters. Indeed, ethnoarchaeological surveys among modern potters are essential to answer current questions on the cultural and social anchoring of the material productions of ancient Sudanese societies. The state of art on this point is relatively limited and needs to be developed in a more systematic way to better serve the knowledge of the great civilisations of Sudan. The scientific interest here meets the emergency of safeguarding a cultural heritage threatened by the modernisation of economy which favours the abandonment of traditional know-how ■

Figure 69. Ezzeldin al-Hadj interviewing a potter at Khartoum (Al-Gamair) © R. David.

on the ceramic material from 3 sites, namely Muweis, El-Hassa and Hamadab (see David et al. forthcoming). This helps to characterise and compare the appearance of each isolated production from the three abovementioned sites according to their context (cultural, craft or domestic area) and within a broad chronological sequence (from the Early Meroitic to the Early Christian periods). The preliminary results show better appraisal of the evolution of the ceramic production in the Meroe region as well as the identification of chronological markers (David 2019).

Concluding Remarks

The promising work undertaken over the last decade in the region of Meroe is about to change our perception of the ceramic production during the Meroitic period radically. More focus on the cultural and economic background of the production through both the technological approach and the laboratory analyses led to the renewal of the issues raised by the ceramic material.

More attention is also paid to the use of the ceramics, for instance through research programmes on the food traditions in Ancient Sudan (see Section v.5). Other prospects such as systematic archaeological exploitation of the production centres could be considered as the next step of the research to explore the organisation of production and the Meroitic industrial network as well as their anchoring within the cultural frame of the Sudanese ancient societies ■

[R.D.]

Egypt: The Ceramic Laboratory of the Ifao VI.2

The approach adopted since the creation of the laboratory of ceramic studies at the Ifao has always been to characterise the regional groups. It could be useful to provide an update regarding the question of the production sites published to date from the Predynastic to the Arab period. The result is disappointing. The archaeological inventory presents important regional and chronological disparities and gaps (Marchand 2014; Arnold et al. 2018, pp. 220-224; Marchand et al. 2018; Barahona-Mendieta et al. 2019). In the absence of a sufficient number of preserved workshops, research on regional ceramic groups, for all periods, is therefore essentially based on the study of archaeological material from consumption sites.

Diachronic Survey through the Regional Ceramic Groups of Egypt

The criteria for the analysis of regional ceramic groups are of course set in historical, economic and cultural contexts that have changed considerably in Egypt throughout its long history. The richness as well as the diversity of Egyptian regional cultures, from Prehistoric times to the medieval period, have become obvious in recent years for the ceramic studies. Structuring the documentation at our disposal, site by site, region by region, about this question, is an undertaking that must be attempted, while keeping in mind the necessarily partial and evolving character of such an approach.

The Ceramic Laboratory of the Ifao

The Editorial Policy of the Ceramic Laboratory

Since its creation, the ceramic laboratory has been involved in the Ifao's publishing policy for its discipline through the publication of both the *Cahiers de la Céramique Égyptienne* (CCE) collection and the *Bulletin de liaison de la Céramique Égyptienne* (BCE) journal. Both of these works are reference tools for all ceramic specialists, but equally for archaeologists and historians. The *BCE* is the only periodical entirely devoted to Egyptian ceramics. It presents the latest in ceramic research, in an archaeological context following a "regional route" in Egypt and Nubia for all periods of their History, from the Neolithic to the medieval and modern periods. Each volume also includes a second part entitled "Studies" the themes of which are broadly open to all questions concerning ceramics.

- https://www.ifao.egnet.net/publications/catalogue/BCE/
- https://www.ifao.egnet.net/publications/catalogue/CCE/

The "Céramothèque" and the Specialised Research Library

This project is part of a coherent approach and the result of decades of knowledge accumulated in the ceramic laboratory of the Ifao supporting the study of the material culture of the ancient societies of the Eastern, Mediterranean and Nubian world. As a privileged ally for all archaeological and historical research, it became a must to create a new tool in Egypt devoted to Egyptian ceramic studies for the scientific community, archaeologists, ceramic specialists, historians and students. The "céramothèque" at the Ifao, the implementation of which began in 2018, is associated with a specialised library on ceramics. These tools are intended to be spaces open to the public. The "céramothèque" offers a collection of references of Egyptian and imported ceramic potsherds dated from the Neolithic to the medieval and modern periods. The creation of a reference system for Egyptian clays, the raw material for ceramic vases, is also being considered in collaboration with our geological partners ■

- https://www.ifao.egnet.net/recherche/services-archeologiques/ceramologie/
- https://www.ifao.egnet.net/recherche/operations/op17452/
- https://www.ifao.egnet.net/recherche/operations/op17222/

Cahiers de la céramique égyptienne (CCE)

Bulletin de liaison de la céramique égyptienne (BCE)

Figure 70.

The regions that make up Egypt are strongly marked and differentiated on a cultural and historical level since the earliest times. The consideration on the recognition of ceramics as a marker of belonging to a regional entity is one of the keys to understanding Egyptian ceramics.

It is obvious that the study of regional ceramic groups for the ancient periods, from the Neolithic to the Predynastic, cannot be conceived outside their affiliations to cultural units determined by their way of life and their material culture.

For the Pharaonic period, which falls within the frame of the 30 Manetho's dynasties, the existence of distinct cultural units did not always have a place within the Pharaonic civilisation. Its culture is forcefully expressed in its prestigious monuments, tombs, divine or funerary temples, which line the Nile Valley and the deserts, with texts and iconography contributing greatly to this feeling of an unchanging Egypt. Such historical vision emanates from the whole of the Pharaonic culture, that of a centralised state stemming from the Nile, with its writing, its Pharaoh, its gods, its temples and its rites. It appeared as early as the 4th millennium BC and disappeared at the end of the 4th century AD with the last known inscriptions from the island of Philae, which marked the end of the old Egyptian paganism. This somewhat fixed vision of the Pharaonic civilisation does not, however, reflect the richness and diversity of Egyptian regional ceramic cultures, not only during the ancient periods from the Neolithic to the Predynastic prior to unification, but also for the historical periods, in times of turmoil as well as stability, from the Pharaonic to the medieval period.

The evolution of ceramic studies in recent decades shows the growing interest in the characterisation of local and regional ceramic facies, the recognition of inter-regional exchanges, and the contribution of ceramics to cultural and economic history. The difficulty lies in the disparity and inequality of the archaeological documentation according to periods and regions. However, the importance of using a new reading grid for the ceramic material is now clear, comparing the regional groups placed in a double perspective, both synchronically within the framework of the regions that make up Egypt during the same period, and in a diachronic perspective. This approach highlights the relationships between production, distribution and consumption, but also the definition of a "regional style" and the influence of one regional group on another at a given moment in history. Foreign influences on Egyptian ceramics, exchanges, acculturation and imitations, which are fundamental phenomena that run through the whole of history and are widely debated elsewhere cannot be forgotten, of course (Defernez, Marchand 2016; Marchand 2019).

The history of Egyptian material culture, including ceramic developments, is a fairly accurate echo chamber of political changes (Bourriau 2000). It remains clear that a dynastic change, no matter how great it is, obviously has no immediate impact on the formal catalogue of basic domestic ceramics. During the three great Empires—Old Kingdom, Middle Kingdom, New Kingdom—during which the ceramic repertoires of the main regions of the Nile Valley, and of the desert oases, used a common vocabulary for the majority of the categories of vessels, the dominant style was often initiated by the region of the central political power with its royal workshops. This fact does not exclude regional particularities in the formal, decorative and technical repertoire. For example, in the Middle Kingdom, from the 11th to the 12th Dynasties, a wide range of vessels with specific shapes and incised decorations was created, linked to the use of calcareous clays from the Theban region which is unknown on the sites of Lower Egypt, and, for some sites in the Aswan region, decorations and shapes were clearly inspired by the Nubian tradition.

These Empires are interrupted by three so-called Intermediate periods. These are transitional periods, sometimes extending over several centuries which punctuate the long Egyptian chronology. We then witness a strong diversity, and observe a vivacity of regional ceramic groups. For these periods, a geography of ceramic cultures and the constitution

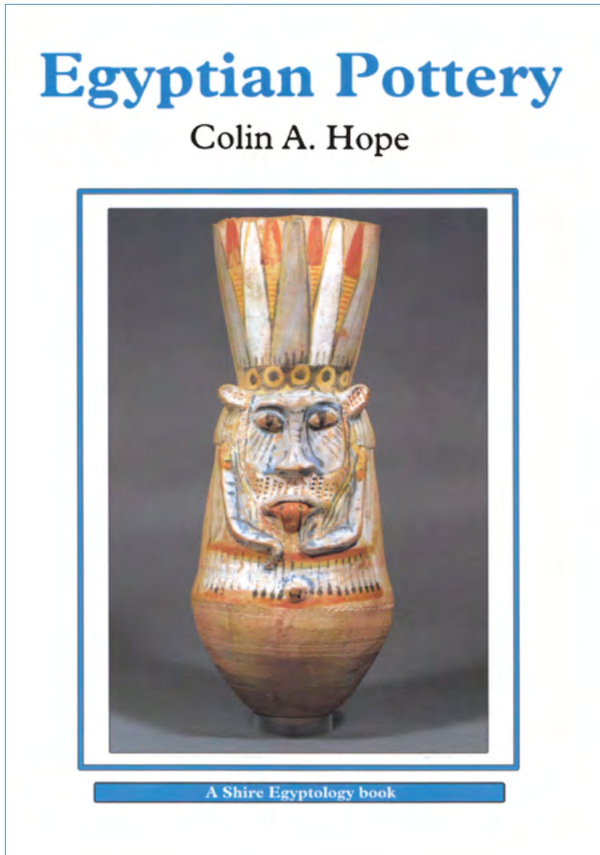


Figure 71. Bes Jar, Blue Painted Pottery, New Kingdom (front cover of Hope 2001).

Figure 72. ʿAyn-Manâwir, Kharga oase. Local productions, black painted on white slip. Late Period, 4th century BC. © Ifao.

of regional groups can be proposed with a certain degree of confidence based on the analysis of ceramics from numerous sites and recent publications. A division between the north and south of the territory is immediately obvious. The ceramic facies of the First Intermediate Period in the Nile Valley have been re-examined, and the work in the Dakhla and Bahariya oases completes our knowledge on this period. The Second Intermediate Period is a period of political and territorial divisions, during which nine regional ceramic groups are distinguished: the Eastern Delta, the Memphite region and the Fayum, Middle Egypt, the Theban region, Elephantine, the small oasis of Bahariya and "the" large oasis of the southern Western Desert including those of Dakhla and Kharga. The data on regional facies from the Third Intermediate Period are, without doubt, the most complex to analyse. From the 25th Dynasty onwards, we notice a renewal with specific containers in "Qena-Ware"/ Marl A originating from the Theban region. The common ceramics are still very close to the ceramic models of the Third Intermediate Period, which is characterised by forms and surface treatments of the beginning of this period and likely inherited from the end of the Ramesside period.

During the periods of unity, the centralisation of power also seems to set the tone for the realisation of a common style such as that of the New Kingdom, the origin of which is to be sought in the Memphite region and in the Fayum. This "New Kingdom" style is remarkable in its forms and painted—sometimes polychrome—decorations (fig. 71) which spread over the whole Egyptian region and were even adopted outside its historical territory, as in Nubia. New Kingdom ceramics, as was the case during Nagada II, are once again becoming a true vector of art for a significant part of their production, which will never be the case again. This trend does not exclude the existence of regional ceramic particularisms during this period, for example in regions far from the Nile valley, as in the oasis of Dakhla, with the existence of some categories of typical local ceramics including amphorae which were widely distributed in the Theban region. This has been the case for these oasis territories throughout most of their history. They had always formed a separate regional ceramic group with specific ceramic categories that were not produced in the Nile Valley.

The Late Period, with the Saite 26th Dynasty, inaugurates the last period of a unified state in Egyptian history. The ceramic industry continues the ceramic tradition that had debuted during the 25th Dynasty, which is why the distinction between these two periods can be difficult to determine. The Persian period, during the 27th Dynasty, begins to stand out from the old "Third Intermediate Period" facies, with the contribution of new techniques and new decorative effects. Only at the end of this period do we start to witness an important renewal of forms. Throughout the Late Period, the mark of regional ceramic groups is more clearly identified than before in the formal repertoire and in the specific use of certain clays, such as the calcareous clays of the Theban region as well as a division between the north and the south is highlighted. The real turning point in the ceramic facies took place, in my opinion, at the beginning of the 4th century BC with the 28th Dynasty. This change is especially visible at Kharga with an evolution of the existing forms, but above all it inaugurates the creation of a rich repertoire of painted decorations (fig. 72). The Kharga oasis was influenced by the decorative style of the Theban region. These forms and decorations, inaugurated during the last indigenous dynasties, persist unchanged throughout the following period, during the Ptolemaic period at least until the 3rd century BC, in southern Egypt (Marchand 2013).

The local Hellenistic ceramics of the late 4th to 3rd century BC illustrate a privileged moment in Egyptian material culture. This was a transitional phase during which a new local ceramic tradition was established. It gradually replaced the Pharaonic tradition inherited from the last indigenous dynasties, which was strongly influenced by its regional

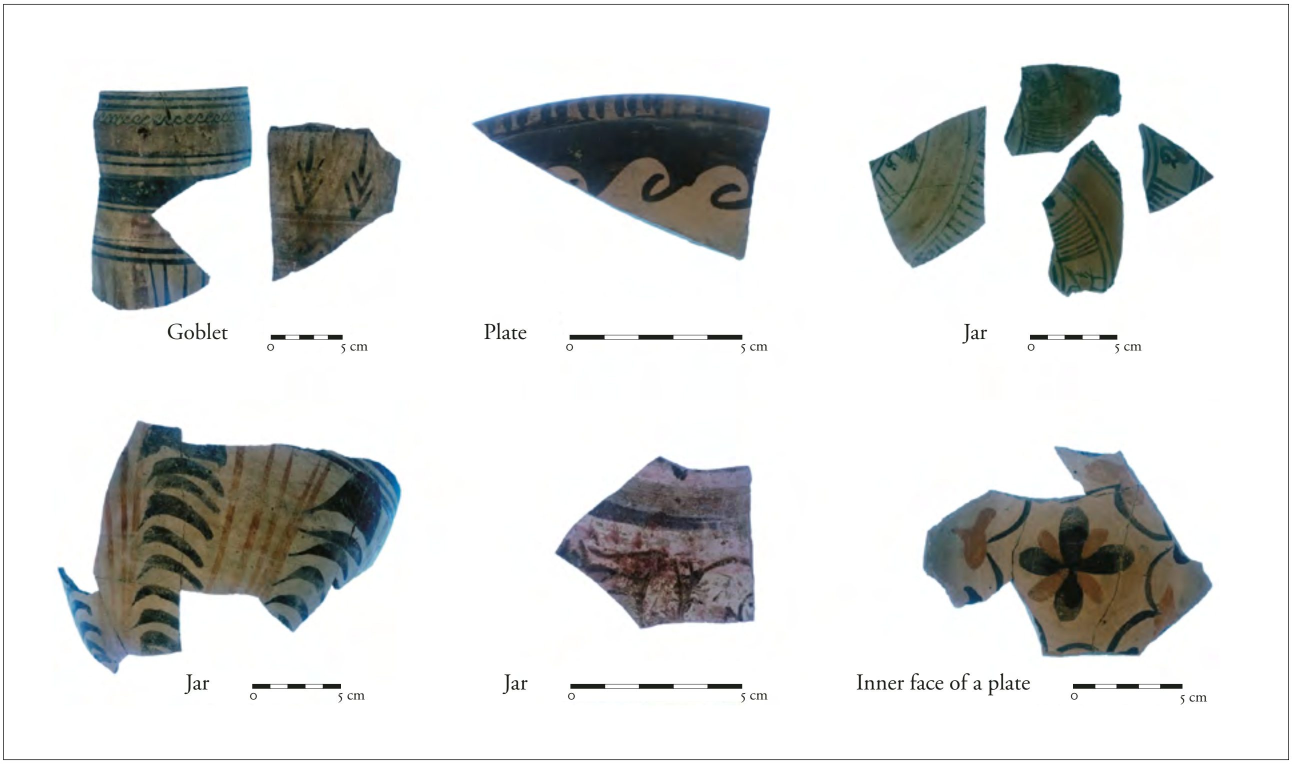


Figure 73. Egyptian tableware in Marl clay, painted black and red on a light background. Greek-inspired decorative repertoire: floral, animal (swans), geometric and erotic (polychrome painted decoration after firing on a stuccoed white, green, yellow, black and pink background). Ptolemaic period, mid 3rd century-2nd century BC. © J.Fr. Gout Ifao/university of Milan.

Figure 74. Detail of a scene from the tomb of Petosiris at Hermopolis/Touna el-Gebel dated to the end of the 4th century BC. Putting wine in Egyptian amphorae of Greek tradition and in Egyptian "torpedo" of Syro-Palestinian tradition (from Cherpion et al. 2007, p. 56).

cultures (Marchand 2013). A new formal, functional, decorative and technical repertoire was then created, largely inspired by the Greek ceramic repertoire (figs. 73-74). It evolved rapidly in the second half of the 3rd century BC to give rise to a "classical" Egyptian repertoire with its ceramic productions of the 2nd century BC integrated into the standard of Hellenistic Mediterranean repertoire (Marchand 2013; Defernez, Marchand 2016).

The transition to the Roman period was gradual, with the introduction of new forms and techniques, and the boundary between the Ptolemaic and Roman periods was not so strict. It is from the 2nd century AD onwards that a clear change begins with the renewal of the typology of many vessel classes. The period of the 3rd century AD, which is well known thanks to papyrological documentation, is difficult to identify in the Egyptian ceramic literature of the Nile Valley.

With Christian Egypt, integrated into the Byzantine Eastern Roman Empire in the 4th century AD, the past was swept away. The repertoire of tableware, amphorae and many common ceramics was renewed. The end of the period, from the end of the 6th century AD and during the first half of the 7th century AD, is well documented in the archaeological records, and its facies merges with the first century of the Arab period, which is conveniently called the proto-Islamic period.

During the first two centuries after the Arab conquest, and at least until the beginning of the 10th century AD, Egyptian ceramics, with the *terra sigillata* from Aswan, were still very close to the Roman-Byzantine world in their forms and techniques. However, in the early 9th century, we witness the birth of "Islamic ceramics" marked by oriental trends and other new influences. This ceramic, with its new techniques (glazed ceramics), and its forms has nothing to do with the old Romano-Byzantine traditions.

The period from the Mamluk to the Ottoman period is probably the least documented. However, thanks to the, albeit few, excavations scattered over the area, we can come closer to the richness and diversity of regional and micro-regional ceramic cultures throughout these periods, especially in the Kharga oasis. The ceramic facies is characterised by numerous regional groups that combine wheel-made and hand-made productions, sometimes decorated for domestic and specialised ceramics. Products from the Nile Valley are abundant on the sites of these periods, notably with the imports of glazed ceramic serving ware ■

[S.Mar.]

Lebanon: Ceramics from the Islamic Period at the Ifpo VI.3

The Project "Between Land and Sea"

One of the main ceramic projects currently carried out by the Ifpo focuses on ceramics from the Islamic period, and more particularly on the reconstruction of the ceramic repertoire from Lebanon.

The project "*Between land and sea: material culture and human landscape during the Islamic period in Lebanon*", aims to reconstruct the history of settlement in Lebanon during the Medieval period by questioning material culture and, more specifically, ceramic evidence.

The region of present-day Lebanon plays a strategic role in the history of Bilad al-Sham during the Islamic period. It is a region with a complex natural landscape, crossed by high mountain ranges, and rich in crops and pastures. It is located on an important road axis connecting northern Syria to southern Bilad al-Sham, passing through the Beqaa Valley (which hosts major urban centres of the period, i.e. Anjar and Baalbek), and includes coastal urban sites, which are gateways to the Mediterranean (Beirut, Tyre, Tripoli, Byblos). Conquered by the Muslim armies right after their victory against the Byzantines in Yarmouk (636 AD), Lebanon also experienced, in Medieval times, the Crusaders invasion, being partly occupied by the County of Tripoli (1102-1289 AD) and the Kingdom of Jerusalem (1099-1291 AD) until the Mamluk reconquest in 1291 AD. It was englobed in the Ottoman Empire in 1516 AD.

Despite such a rich past, the region has never been the subject of a systematic study of human occupation and material culture in the Medieval period. This is not only the case of Lebanon, but also of other regions of the medieval Islamic world, which have rarely been the subject of a general analysis of settlement patterns and, as far as we are concerned here, of the spread and production of ceramics. Most of the archaeological works related to ceramic evidence of this period have been mainly focused on assemblages from specific sites or areas (several examples can be mentioned for Lebanon or neighbouring regions, such as Syria, Israel/Palestine, Jordan).

The reason why synthetic works on production and diffusion of ceramics in the Islamic period are still missing is that much still needs to be done in the typological and chronological understanding of this repertoire, before being able to provide a more global picture. Although there are some sites that present a chrono-typology of reference, some regions and some historical periods remain completely underrepresented. Thinking more specifically about Lebanon, where some sites or areas offer interesting sequences, such as the Tripoli region (Salamé-Sarkis 1980) or Baalbek (Sarre 1925; Daiber 2006; Vezzoli 2015) (fig. 75), much still remains to be done to understand the diversity of the territory. Specifically, rural and mountain areas are largely underrepresented. Moreover, the complex variety of ceramic productions (especially common wares) of the Ottoman period would need to be largely investigated.

Nevertheless, some recent regional studies have brought to light a very rich archaeological and ceramic documentation, which testifies of an intense occupation of the territory during this period: research on the site of Ej-Jaouzé and its region have highlighted the nature of the occupation and its related material culture in the medieval period (Nacouzi et al. 2018); archaeological investigations on the medieval citadels of Jbeil and Tripoli have brought to light aspects of military installations (Chaaya 2018); the role of the coastal city of Tyre has been questioned (Gatier et al. 2011; Rousset 2016); and several ceramic assemblages have enriched the knowledge on the ceramic horizon (Haidar Vela, Pieri 2012; Homsy-Gottwalles 2016; Homsy-Gottwalles 2017; Shaddoud 2018), trying to approach, even if still quite rarely, the Ottoman period too. Moreover, several regional surveys have enabled to draw up a broader picture of the long term human landscape in Lebanon, for example in the Akkar plain (Bartl 1999), in the Nahr Ibrahim Valley (Gatier et al. 2005), and in the Beeka Valley (Fischer-Genz, Ehrig 2005; Newson 2016).

Taking advantage of this acquired data and to involvement in several on-going projects, this research aims to provide a primary reconstruction of the history of the occupation of the region during different periods of the Islamic era and to determine the production and circulation of ceramics. The main challenge is to lay the foundations for a broader reflection on the medieval period in Lebanon, highlighting its complex regional and chronological varieties and placing this region in a wider historical framework, between the Mediterranean and Mesopotamia.

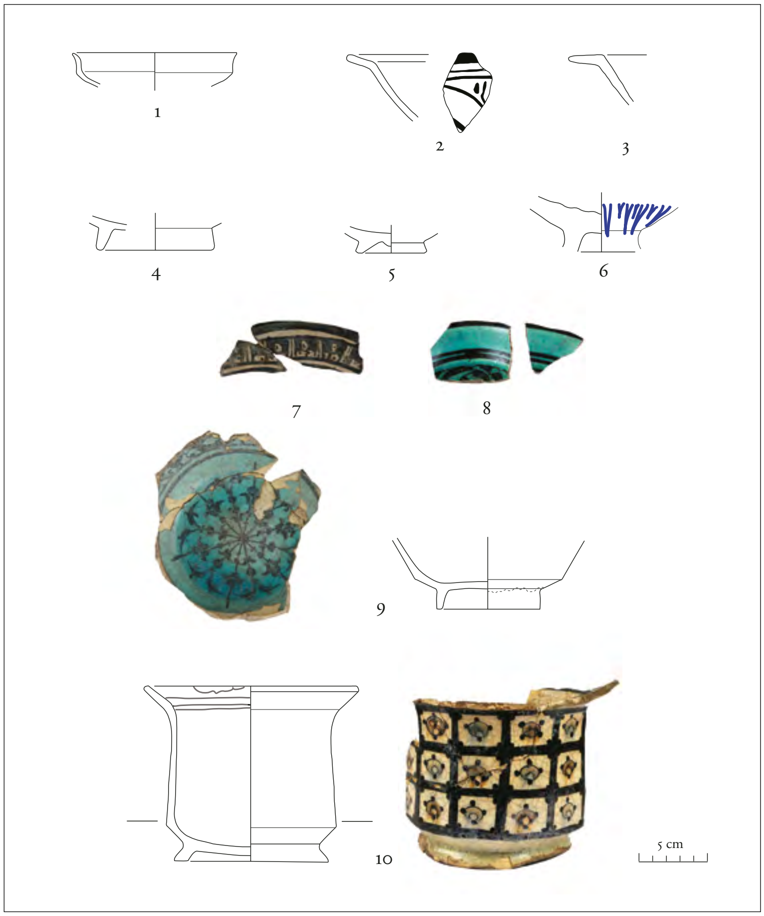


Figure 75. Fine glazed wares from archaeological investigations in the area of Bustan Nassif (Baalbek). Vezzoli 2015.

Figure 76. Provenance of the ceramic assemblages studied within the framework of Ifpo's project "*Between land and sea: material culture and human landscape during the Islamic period in Lebanon*".

The in-depth study of the ceramic evidence will allow to question, more specifically, three major issues:

1. The definition of the main features in the management of the territory, determining the nature of the relationships between major and secondary sites and between hinterland and coastal sites;

2. The distribution of ceramic types and the identification, whether possible, of production centres;

3. The reconstruction of the conditions of more recent settlements (Ottoman period), which, although well documented by the administrative archives, remains largely unknown by archaeological research.

One of the principle limitations faced by this project remains the poor sampling for petrographic and archaeometric analysis of medieval ceramic assemblages (Waksman 2002; François et al. 2003), so it is still unclear where the areas and centres of production were located. One of the objectives of the research is therefore to strengthen this aspect and enrich the documentation.

The project, debuted in September 2018, targets significant areas of the territory located in the hinterland, the mountains and the coast. Its initial ambition was to take into account the whole Islamic period but, given the nature of the ceramic assemblages analysed and the complexity of the repertoire, it essentially concerns the Middle Islamic and Ottoman period (from the late 11th century to the early 20th century); the latter, as we already mentioned, is still poorly studied.

Since its initiation, the project has been enriched by new collaborations and is now able to cover different geographical, economic and chronological contexts. Among the ceramic materials included in this study are (fig. 76): from the region of the Beqaa Valley, the ceramic material from archaeological investigations carried out in the city of Baalbek (Deutsches Archäologisches Institut and Lebanese University) and from the regional survey in the Central Bekaa (American University of Beirut); from the coast, the assemblages from major sites such as Jbeil and Tripoli (Lebanese University) as well as Tyre (French Ministry of European and Foreign Affairs); from the mountain areas, the ceramic assemblages from Ej-Jaouzé (French Ministry of European and Foreign Affairs); from Northern Lebanon, the material from the survey program Northern Lebanon Archaeological Project (Università degli studi di Udine and Lebanese University). All these projects benefit from the support of the General Directorate of Antiquities of Lebanon.

More concretely, the project focuses on the study of assemblages from different archaeological contexts (mainly excavations and surveys); for this reason, a diversified approach was necessary. Survey material is particularly problematic to identify and date, as it is not always possible to rely on comparative assemblages. This is even more complex in the case of more recent (Ottoman era) ceramic productions, for which the association with better-known glazed material (such as *Çannakale ware* or *Didymoteicon ware*) has been necessary to identify common types.

At the present state of research, it has not yet been possible to establish a chrono-typology for the Lebanon in its whole (and actually, this is not the purpose), but rather to opt for building chrono-typologies with a regional character, which will be compared and commented in order to create a broader picture and highlight similarities and differences.

The preliminary study of such a rich repertoire has demonstrated how ceramic evidence can represent a precious tool, not only to determine the dating of the investigated sites, but also their nature, their social and economic function. The study of such variegated assemblages will also render the understanding of the distribution of common ceramic types (tableware, kitchen and storage wares) possible, by determining the networks of influence

Ceramic Studies at the Ifpo

In recent years, the Ifpo has promoted a number of activities related to the study of ceramic materials and has primarily encouraged training activities, organized by the *Département d'Archéologie et Histoire de l'Antiquité* (DAHA) and the *Département d'Études Arabes, Médiévales et Modernes* (DEAMM) in collaboration with universities and national directorates of antiquities. Research programs on ceramic assemblages are today one of the priorities at the Ifpo, as demonstrated by several ongoing projects in Iraqi Kurdistan, Jordan, the Palestinian Territories and Lebanon. This dynamic is reflected in the ongoing project on medieval ceramics in Lebanon, mentioned above, but also in the presence of a specific research axis *Culture Matérielle et archéologie des techniques* at the *Département d'Archéologie et Histoire de l'Antiquité* (DAHA), which supports various activities developed around ceramic evidence: fieldwork, petrographic and archaeometric analyses, and research on the connection between material culture and society.

It is probably in Lebanon that ceramic studies are undergoing an important development. Until the 1990s, our knowledge of Lebanese ceramics was limited to vases and utensils found along the maritime fringe. Excavations carried out for nearly a century on large coastal sites such as Tyre, Saida, Byblos or Tell Arqa have indeed made it possible to establish a general panorama of the ceramics produced in Phoenicia during Antiquity. But it is from the excavations carried out in downtown Beirut since 1993, in the framework of the reconstruction of the neighborhoods damaged by the civil war, that significant progress has been made through specialized studies on the production, distribution and marketing of ceramics from the Bronze Age to the Ottoman period. Today, research is focused on the inland and mountain zones of Lebanon, long neglected by archaeologists. Thus, recent archaeological surveys and excavations have revealed numerous sites often occupied discontinuously between the ancient and medieval periods, very active in commercial exchanges (Yanouh, Jaouzé), and even involved in the production of pottery (Chhîm).

In order to maintain a high level of training in ceramology, Ifpo has been organising several workshops since 2018 that would be regularly repeated within each of its branches (Beirut, Amman, Erbil). The workshop "*Training on the study of archaeological ceramics. From the field to the publication*" aims at introducing students to the different stages of the study of ceramic material from different archaeological contexts (excavations, surveys, trenches) thus providing the basis for an all-round analysis of this evidence (from the processing of data in the field, to digital documentation, to the interpretation of data for publication). The workshop "*Training to ceramic drawing in archaeology*" provides a more practical, exercise-based training for drawing ceramic in an archaeological context, both by hand and digitally ■

Figure 77. Rachelle Antonios explaining the drawing of a ceramic as part of the training courses organized at Ifpo.

(at a local or inter-regional level) as well as the trade routes. Excavations of major sites, including Baalbek, Beirut and Damascus, provide references for this study and show important differences in the distribution of ceramics, between coastal and hinterland zones; this has been also proven by data issued from surveys.

Lebanon cannot be considered as a separate and unique entity, as portrayed by its historical and economic connections with the rest of the Mediterranean as well as with other regions of Bilad al-Sham, all of which emerge through the analysis of ceramic evidence and evolve and modify through the centuries ■

[**V.V.** & **D.P.**]

Arabian Peninsula: a Ceramic Study Programme at the Cefrepa VI.4

One of the aims of the Cefrepa (previously entitled Cefas) based in Kuwait, is to support the work of researchers and students in human and social sciences and in archaeology in the territories forming the Arabian Peninsula, in collaboration with national Authorities and French research teams working in these countries. Financial support for internships, for mobility and for analyses and studies is granted each year to researchers and students attending French Universities in order to carry out programs of research in different regions of Arabia.

One of the programmes of research supported entails defining the different steps of the evolution of regional settlement in South-east Arabia (United Arab Emirates and Sultanate of Oman) from the end of the Bronze Age (mid-2nd millennium BC) until the Iron Age (end of the 2nd millennium BC), through the study of the pottery collected on the site of Masāfī-5 (MSF-5).

The Pottery Study at Masāfī-5 (MSF-5)

The site of Masāfī-5 (MSF-5) is located in the Emirate of Fujairah (UAE), in the northern part of the Hajjar Mountains. Archaeological excavations at MSF-5 have been carried out by the *French Archaeological Mission in the UAE*[1] since 2011, in collaboration with the *Fujairah Tourism and Culture Authority* (FTCA) (Degli Esposti, Benoist 2015). The pottery assemblage unearthed during the last four campaigns is dated between the 16th and 11th centuries BC. This interval corresponds to the transitional period between the late Bronze Age and the early Iron Age in the north of the United Arab Emirates. As such, the discovery of this new ceramic assemblage provides key elements to understand the different stages of chrono-cultural evolution between these two periods. The pottery study was subsequently extended to all the settlement sites as well as to a large part of the funerary sites of the region

1 The French Archaeological mission in UAE is led by S. Méry. From 2006 until 2016 systematic research at Masāfī were conducted by A. Benoist and since 2017 the excavations are under the supervision of J. Charbonnier.

(Tell Abraq, Shimal, Kalba,[1] and several collective tombs in the north-eastern UAE) (fig. 78). Finally, the chrono-cultural evolution emerging from the comparative study of these different sites was compared to the one recently suggested in central Oman by research carried out on the monumental site of Salut by the *Italian Mission to Oman* (IMTO).

The Issue of Defining the Transition Period between the Late Bronze Age & the Iron Age

Beyond the necessity of a better definition of the transition between the Late Bronze Age and the Iron Age, the question is raised as to the reasons that can be attributed to the formation at the end of the 2nd millennium BC and during the first half of the 1st millennium BC of a unified regional prosperous culture combining irrigated agriculture, handcraft production (copper, softstone, etc), the use of domestic camel for transportation and exchanges and sharing several practices such as rituals organised around one or several deities or principles associated to the image of the snake. Several driving forces have been successively emphasized to explain this development: the possible importation of irrigation techniques using subterranean galleries from Iran, domestication of the camel, redevelopment of interregional exchanges favouring exportation of copper. Today, some of these assumptions have been invalidated; others are recognised as possible elements *among others* that might have played a role in this process.

One of the particularities of this region that was known as the land of Magan or Makkan in Mesopotamian sources is that it didn't experiment the development of writing before a considerable lapse of time, although it was surrounded by other regions (Mesopotamia, Iran, Yemen,) where writing had already been developed. Thus, internal historical sources are missing to explain the origin of such a unified culture identifiable only by archaeological data, and to hierarchize processes that might have been at the origin of the formation there of possible kingdoms, such as the kingdom of Qadê, mentioned in the archives of the Ishtar temple at Niniveh.

The development of the Iron Age unified culture follows a period still little known and barely understood, that has long been considered as obscure, a period marked by an apparent decline during which local populations abandoned by their previous commercial partners (Mesopotamia and Indus) and facing technological difficulties (possible drying up of water tables such as evidenced at Hili) turned themselves towards an extensive way of living combining more reduced agriculture, semi-nomadic herding and exploitation of marine resources. The re-discovery and redefinition of the end of the Bronze Age and the beginning of the Iron Age have been the occasion of several discussions. Two opposing pictures are offered by two different searchers, one in the UAE, the other in central Oman. Meanwhile in the UAE, two periods were defined, called "Late Bronze Age" (1600-1300 BC) and "Iron Age I" (1300-1100 BC) (Magee 1996); the absence of any culture comparable to the Iron Age I was underlined by J. Schreiber (Schreiber 2010), while C. Phillips suggested a beginning of the period of apparition of the Iron Age, as defined in the UAE as the "Iron Age II" culture (1100-600 BC: Magee 1996), as early as 1300 BC (Phillips 2010). The discovery of Masāfī-5 was the opportunity to re-examination of the question.

1 The samples from these other sites were analysed thanks to the kind authorisation of P. Magee (director of Tell Abraq international project), C. Velde (field director of the German Archaeological mission in Shimal) and C. Phillips (field director of the English Archaeological mission in Kalba).

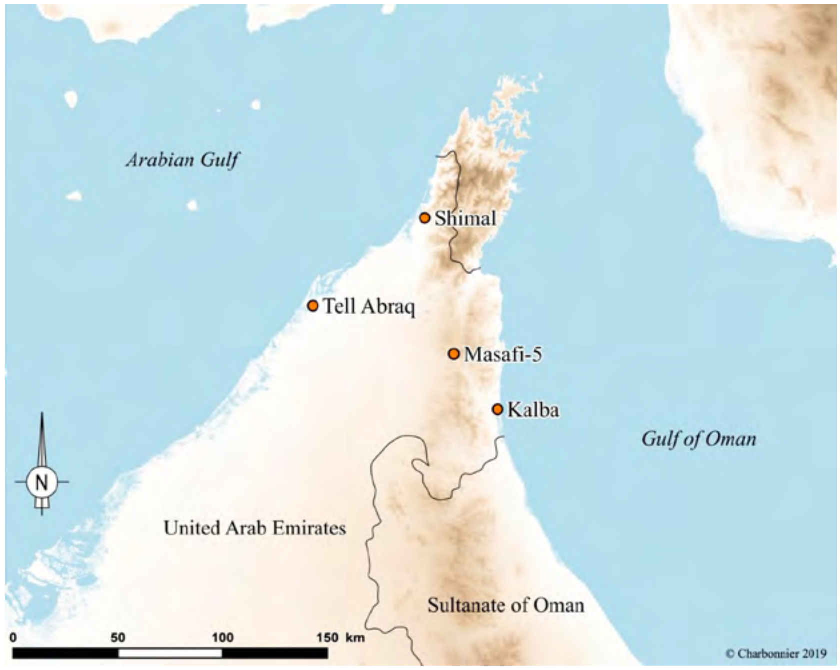


Figure 78. Map showing the main sites mentioned in the text (© J. Charbonnier).

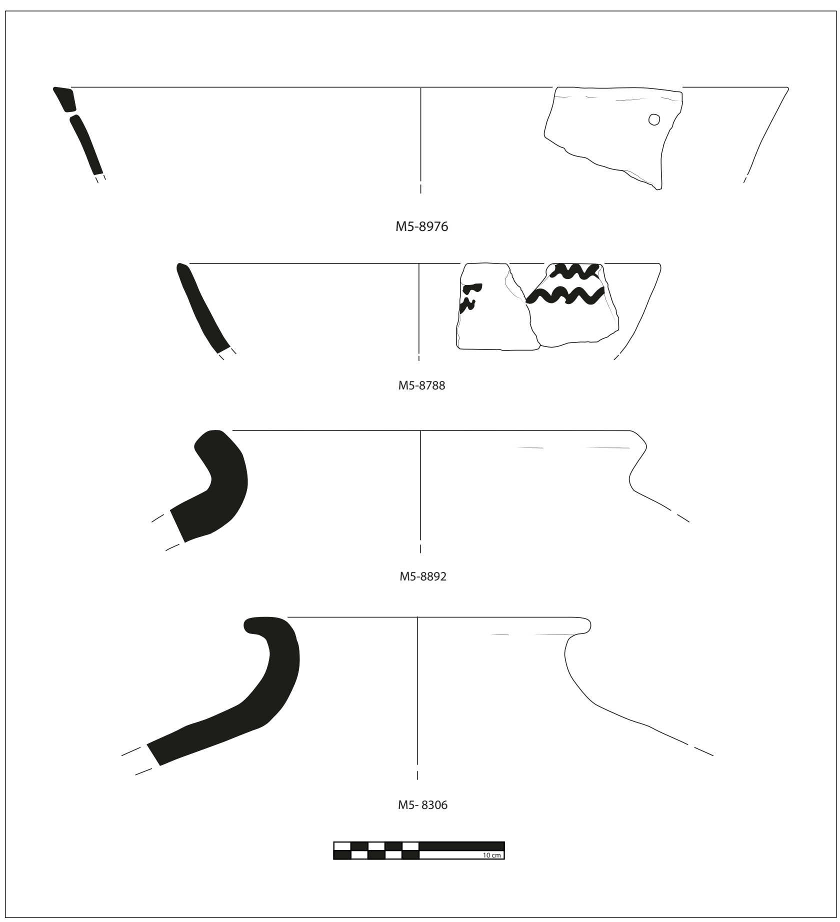


Figure 79. Characteristic shapes of Group 1 (M5-8976 and M5-8788) and Group 2 (M5-8892 and M5-8306) identified at Masāfī-5 (Drawing. M.-P. Pellegrino).

Masāfī-5's role in chrono-cultural definition

The site of Masāfī-5 yielded a rich assemblage organised in different stratified levels which could be dated between 1600 and 1100 BC. This collection was soon understood to be an original corpus, sharing some common points with other assemblages from the northern UAE (Shimal, Tell Abraq, Kalba), but also unique for its fabrics, for some of its shapes and for its decoration techniques.

The methodology used for the study of the pottery combines:

— A macroscopic study (associating the study of fabrics, shapes, surface treatments and decoration);

— A technological examination of the potsherds aiding the identification of practices regarding the shaping of the different vessels;

— Petrographic analysis of some samples from different sites located in the northern UAE.

The latter was carried out in collaboration with Sophie Méry, and once the data available, a comparison of the pottery composition and the geological background of the sites was made with the help of geomorphologists.

The macroscopic study of potsherds from Masāfī-5 enabled the definition of several groups, each characterised by different criteria of matrix, temper, surface treatment, shapes and decoration. The petrographic analyses of samples from each group corroborated the homogeneity of the fabrics of most of them, allowing their definition as production groups (Pellegrino et al. 2020). The most frequent group at Masāfī-5 (Group 1) is characterised by a petrographic composition compatible with local geology (fig. 79).

The different groups identified at Masāfī-5 were traced by macroscopic and petrographic analyses on other sites of the northern Emirates, although in different quantities. Some of them could be regionally localised owing to their compatibility with the geological environment of the site where they were the most frequent. For instance, Group 2 was identified as a probable production originating from northern Emirates (region of Ras al Khaimah). The presence of these groups on several sites evidenced exchange networks from one site to the other, exchanges to which Masāfī-5 was fully integrated; meanwhile the technical characteristics, the set of shapes and the decorations of each group pointed to a relative diversity of the different productions, opening up new questions on the phenomenon of transmission of older techniques, here obviously quite distinct from one area to another.

Additionally the question of pottery evolution in northern UAE could be reviewed through a systematic study of the evolution of the corpus on each site. It has been demonstrated that the limit proposed by P. Magee for distinguishing two periods in this region (Late bronze Age and Iron Age I) were not coherent with the very slow and progressive evolution of the corpus on each site, changes being more linked to a slow evolution of network patterns than to a technical and cultural break. This result led to cancel the somewhat artificial subdivision previously proposed in this region between a "Late Bronze Age" (previously 1600-1300 BC) and an "Iron Age I" (previously 1300-1100 BC), extending the appellation "Late bronze Age" up to the period covering the whole interval (1600-1100 BC). The disappearance of the appellation "Iron Age I" gave place to the proposal to replace the appellation Iron Age II (Magee 1996) by "early Iron Age".

The Cefrepa Cooperation for Pottery Studies

Considering ceramic studies, the main contribution made by the Cefrepa is the support it provides to research on pottery developed thanks to cooperation with French archaeological missions and researchers or students working on ceramics in Arabia.

Among the former missions should be mentioned the French-Koweïti Archaeological Mission in Failaka, supervised by J. Bonneric, which includes a review of the pottery sequence of the Hellenistic fortress of Tell Sa'id (3rd century AD) and of the Sassanid-Islamic site of al Qusur (5th-9th century AD).

In South-east Arabia, the Cefrepa is a partner of the French Archaeological Mission in the UAE (Dir. S. Méry), which has developed several projects extending from the Neolithic period (Aqab, Umm al Qusayn) up to the Iron Age (Masāfī). It is also associated to the research developed in central Oman (regions of Adam, Jebel Moudhmar and Bisyah) by the Archaeological Mission in Adam (Dir. G. Gernez, and since 2020, M. Jean and M. Sauvage), as well as the archaeological mission on the coastal Islamic site of Qalhat (Dir. A. Rougeulle).

In Saudi Arabia, the Cefrepa is associated to the project "Oasis de l'Arabie déserte" (Dir. G. Charloux) which investigates several antique sites from Saudi Arabia (Najrân ; Dûmat al-Jandal ; al-Kharj). It is also participating in the French-Saudi-Nederland's Archaeological project on the pre-Islamic city of Thāj (Dir. J. Rohmer, M. Al-Hajiri, A. Al-Jallad). All these missions have incredibly accelerated the construction of chrono-cultural sequences of North-western, central and eastern Arabia, from the Bronze Age to the Middle Islamic period.

These archaeological research missions in Arabia have enabled the discovery and excavation of several workshops dating from the late pre-Islamic and the Islamic periods. (Thāj, Yamāma, al Kharj, Qalhāt). The Cefrepa is also supporting a project devoted to the study of these workshops developed by Fabien Lesguer (University of Paris I). The aim is to study the *chaine opératoire*, the spatial organisation and the integration of a potters' workshop during the pre-islamic and Islamic periods in order to highlight the evolution of pottery traditions in the long term. Archaeological studies are supplemented by ethno-archaeological research (region of Bahla, central Oman) ■

Figure 80: Maria-Paola Pellegrino at Tell Abraq.

Conclusions

Finally, the comparison between the situation observed in the UAE and the situation observed in the Sultanate of Oman allowed to propose a global hypothesis regarding the evolution of pottery traditions in these two regions and the formation of a homogenous cultural complex in the region at the very end of the second/beginning of the 1st millennium BC. The Late Bronze Age defined in the United Arab Emirates appears to be geographically restricted to a region comprised between Ras al Khaimah and al Aïn. In central Oman, direct evolution of the potter's traditions from existing cultural characteristics during the Middle Bronze Age (also called Wadi sud period: 2000-1600 BC) to those that will remain predominant during a large part of the Iron Age until the 6th century BC and possibly even later. They were developed in central Oman 200 years before they appeared in the UAE where they were the result of diffusion. In view of this aspect, the origin of the Iron Age culture that extended over all south-east Arabia during the first half of the 1st millennium BC can be located in central Oman. Such an example shows the importance of the study of pottery in proto-historical approaches of the evolution of settlement patterns and in the definition of cultural entities ■

[**M.-P.P.** & **A.Ben.**]

VII

Lexicon

Bibliography

This lexicon proposes commonly adopted definitions for some of the technical terms employed in the present manual. These definitions are based on existing publications to which the reader can refer for more detailed information (see e.g. Yon 1981; Balfet et al. 1989; Shepard 1956; Rice 1987; Rye 1981, Orton et al. 1993; Roux, Courty 2019; etc.). Thematic plates (shapes, manufacturing techniques, surface treatment) illustrate the text and are inserted as tools to correctly complete the charts provided in the section devoted to classification and ceramic description ■

Amphora أمفورة *amfūra*

A container employed for transporting products. It is usually tall bearing two handles enabling it to be carried by one or two men. Amphorae are mainly used to highlight long-distance trade (pl. **I**). See Yon 1981, pp. 18-19; University of Southampton 2014.

Applied (decoration) زخرفة مُضافة (زخرفة) *zaḫrafa muḍāfa (zaḫrafa)*

A moulded or modelled element fixed on to the surface of a ceramic forming a decoration in relief (pl. **IV**, no. **12**). See Shepard 1956, p. 195; Balfet et al. 1989, pp. 137-140; Rice 1987, p. 148.

Base قاعدة *qāʿida*

The lower part of a ceramic, either formed in the continuity of the vessel or as an added element. A base can take various shapes or forms and, for example, be named a "foot" in the case of taller elements (pl. **II**). See Yon 1981, p. 35; Balfet et al. 1989, p. 32.

Basin حوض *ḥawḍ*

An open shape usually seen as a large bowl, the diameter of which exceeds 40cm (pl. **I**). See Balfet et al. 1989, p. 15.

Beaker كأس *kaʾs*

An open shape with a cylindrical or slightly flared body, the height of which is superior to the diameter, with or without a handle (pl. **I**). See Yon 1981, p. 110; Balfet et al. 1989, p. 17.

Body البَدَن / الجسم *al-badan / al-jism*

The main part of a ceramic figuring between the rim of the upper part and the base of the lower part. The body can adopt various shapes according to the type of ceramic (pl. **II**). See Yon 1981, pp. 176-180.

Bottle قارورة *qārūra*

A closed shape, without a handle, the height of which exceeds its diameter, bearing an elongated neck intended for pouring a liquid (pl. **I**). See Yon 1981, pp. 42-43; Balfet et al. 1989, p. 8.

Bowl طاسة *ṭāsa*

The generic term employed for an open shape which can be either slightly flared or convex the diameter of which is inferior to 40cm. A deep bowl refers to a bowl which height is superior to its diameter (pl. **I**). See Yon 1981, pp. 39-40; Balfet et al. 1989, pp. 15-16.

Brushing التشطيب بالفرشاة *al-tašṭīb bil-furšā*

A type of surface finishing obtained by using a rough tool (e.g. a cob corn) on the paste when it is at a leather-hard stage which aims to homogenise the surface and to remove any impurities (pl. **IV**, no. **3**). See Roux, Courty 2019, p. 94; Rice 1987, pp. 139-140.

Burnishing الصقل *aṣ-ṣaql*

A type of surface treatment consisting in rubbing the surface with a hard tool so as to compact the upper layer of clay giving it a shiny effect. The term is sometimes distinguished from polishing according to the degree of drying or to the extent of the process but the gesture remains the same. Burnishing can leave some facets or alternating shiny and mat bands according to the orientation of the gestures (pl. **IV**, no. **2**). See Martineau 2010; Rye 1981, p. 90; Roux, Courty 2019, pp. 96-98.

Ceramic analysis تحليل الفخار *taḥlīl al-fuḫār*

The study of the composition and properties using laboratory techniques, according to standards derived from the natural sciences. Ceramic analyses provide information on provenance of raw materials (via chemical analysis, thin-section, scanning electron microscopy, etc.), the physical characteristics (e.g. vessel strength, porosity), or the functional properties (e.g. water permeability, thermal shock resistance. See Section II.4 and Tite et al. 2001.

Chaîne opératoire السلسلة العملية لإنتاج الفخار *al-silsila al-ʿamalīa l-ʾintāǧ al-fuḫār*

In the case of ceramics, a *chaîne opératoire* covers all operations from the collection of raw materials (clay, temper, fuel) to the firing of the pot, including all stages of paste preparation, shaping and finishing. See Section II.5 and Roux, Courty 2019.

Closed shape شكل مغلق *šakl muġlaq*

A shape bearing a rim or neck the diameter of which is inferior to that of the maximum diameter of the body. Amphorae, jars, flasks and jugs come within this category. The inner surface finishing is usually less elaborated than that of the exterior except in the case of waterproofing the pot. See Yon 1981, p. 95; Balfet et al. 1989, p. 8.

Coarse ware الفخار الخشن *al-fuḫār al-ḫašin*

A generic term generally ascribed to thick ceramics, carelessly executed, which function allows for a rough finishing.

Coiling التصنيع باللفائف الطينية *at-taṣnīʿ bil-lafāʾif al-ṭīniya*

A roughing-out technique which consists in combining ceramic fragments of coil-shaped clay assembled by superimposed closed circles or in a spiral (pl. **III**, no. **2**). See Balfet et al. 1989, p. 52; Rye 1981, pp. 67-69; Shepard 1956, pp. 57-59; Rice 1987, pp. 127-128.

Combed (decoration) ممشّط (زخرفة) *mumaššaṭ (zaḫrafa)*

A type of decoration technique involving the use of a combed tool (i.e. fish-bone, wooden or ceramic comb) the teeth of which create a hollow on the paste when impressed (pl. **IV**, no. **8**) or parallel lines when applied for incisions (pl. **IV**, no. **10**). See Balfet et al. 1989, p. 101; Rye 1981, p. 90.

Common ware الفخار العام (الفخار الشائع) *al-fuḫār al-ʿām (al-fuḫār al-šāʾiʿ)*

A generic term ascribed to multi-purpose ceramics that are neither fine nor coarse, generally undecorated, and which represent the majority of the ceramic production found in archaeological contexts.

Craft specialisation التخصّص الحرفي *at-taḫaṣṣuṣ al-ḥirafī*

A specific productive activity the nature (e.g. degree of standardisation) and intensity (e.g. volume produced) of which can be measured to define the organisation of the production. It is generally admitted that specialised craftsmen depend, at least partly, on their production for their livelihood while consumers depend on them for commodities they do not produce themselves. See Costin 1991; Di Paola 2013; Costin 2020.

Cup كوب *kūb*

A bowl or goblet bearing a foot and which can have small handles (pl. **I**). See Yon 1981, p. 62.

Decoration زخرفة *zaḫrafa*

The modification of the appearance of the surface of a ceramic by addition (e.g. painting, applied decoration) or removal (e.g. incision) of material, or deformation of the surface (e.g. stamping, impression) for esthetical or functional purposes (pl. **IV**). See Yon 1981, p. 73; Rye 1981, pp. 89-95; Rice 1987, pp. 144-152; Roux, Courty 2019, pp. 102-109.

Fabric نسيج العجينة *nasīǧ al-ʿaǧīna*

An analytical grouping of the raw materials from which a vessel is formed, determined either by macroscopic attributes or by laboratory analyses; it consists of two primary components: the hardened clay—plastic groundmass—and the added non-plastic inclusions as temper. See Section II.3 and Daszkiewicz 2014.

Fine ware الفخار المُتقن (الفاخر، الناعم) *al-fuḫār al-mutqan (al-fāḫir, al-nāʿim)*

The generic term ascribed to thin-walled ceramics devoted to service purposes which are finely executed.

Finishing التشطيب *at-taštīb*

A rubbing operation that changes the appearance of the surface of the ceramic at the end of the shaping process before surface treatments and the decorative operation e.g. smoothing, brushing (pl. **IV**). See Rice 1987, pp. 136-141; Roux, Courty 2019, pp. 92-96.

Firing الشيّ (الحرق) *aš-šayy (al-ḥarq)*

The process consisting in subjecting an object shaped using clay to a temperature high enough to obtain an irreversible transformation. See Balfet et al. 1989, pp. 65-69; Rye 1981, pp. 96-122; Rice 1987, pp. 80-112; Roux, Courty 2019, pp. 110-121.

Firing atmosphere وسط الشيّ (بيئة الشيّ، بيئة الحرق) *wasaṭ aš-šayy (bīʾat al-šayy, bīʾat al-ḥarq)*

The term used to define the oxygen (oxidizing) and carbon (reducing) rate of the flow of air surrounding the ceramics during the firing and the cooling processes which have an influence on the colour and the hardness of the vessel. An oxidizing atmosphere will confer a reddish colour while a reducing atmosphere results in a darker and even black tint. See Rye 1981, p. 98; Rice 1987, p. 81; Orton et al. 1993, pp. 133-135; Roux, Courty 2019, p. 111.

Glaze التزجيج *at-tazjīj*

A surface treatment involving a vitrified transparent or opaque coating fused with the surface of the ceramic that can be coloured with oxides (pl. **IV**, no. **6**). See Rye 1981, p. 40; Rice 1987, p. 151; Roux, Courty 2019, p. 101.

Grog فخار مهشّم *fuḫār muhaššam*

Particles of crushed pottery, intentionally added as temper to the groundmass to achieve a higher resistance against thermal shock. See Rye 1981, p. 33; Tite et al. 2001.

Grooved (decoration) مخدّد (مثلّم) (زخرفة) *muḫaddad (muṯallam) (zaḫrafa)*

A type of decoration implying the removal of paste in a linear movement to create a groove on the surface (pl. **IV**, no. **14**). It is sometimes seen as a type of incision. See Orton et al. 1993, p. 85; Roux, Courty 2019, p. 107.

Handle مقبض *maqbaḍ*

A functional element fixed on to a ceramic enabling it to be used. A handle is described according to its shape and its section (pl. **II**).

Hand-made مصنوع يدوياً *maṣnūʿ yadawiyan*

A term used to define a ceramic manufacturing technique performed without a turning device such as coiling, moulding, modelling, hammering (pl. **III**). See Roux, Courty 2019, pp. 54-72; Rye 1981, p. 67.

Hammering التشكيل بالطَرق *at-taškīl bil-ṭarq*

A roughing-out technique consisting in beating the clay mass with one's fist or using a specific tool (hammer) to rough out its shape. The beating leaves some depressions on the inner surface of the ceramic (pl. **III**, no. **4**). See Roux, Courty 2019, p. 61; Huysecom 1994, pp. 32-35.

Hardness الصلابة *aṣ-ṣalāba*

The analytical criterion used to evaluate the quality of the firing process that can be determined according to the ceramic's resistance to scratching (Moh's scale) using various tools. A simpler version defines a "soft" result when a ceramic can be scratched with a fingernail; "hard" when it is not possible to scratch the surface with a fingernail; "very hard" when even a knife cannot scratch the surface. See Shepard 1956, pp. 113-117; Rice 1987, pp. 334-336; Orton et al. 1993, p. 233.

Impressed (decoration) مَطبوع (زخرفة) *maṭbuʿ (zaḫrafa)*

A type of decoration implying the pressure of a tool against the paste to design a motif. Various movements and tools have been highlighted that can precise the type of impression and its cultural link (pl. **IV**, nos. **7**-**8**). See Rye 1981, p. 92; Roux, Courty 2019, pp. 104-10; CerAfIm; Caneva, Marks 1990.

Incised (decoration) محزّز (زخرفة) *muḥazzaz (zaḫrafa)*

A type of decoration resulting from the continuous application of a pointed tool to draw a pattern (pl. **IV**, nos. **9-10**). See Shepard 1956, pp. 195-203; Rye 1981, p. 90; Roux, Courty 2019, pp. 107-108.

Inclusions الشوائب *aš-šawāʾib*

Mineral or organic particles naturally present in the clay ground that are measured in terms of nature, frequency, size, sorting and roundness to describe the composition of raw material used to produce a ceramic. See Orton et al. 1993, pp. 138-140.

Jar جرّة *jarra*

The generic term used for containers of medium to large sizes, without handle, intended for storage or transporting a liquid or solid (pl. **I**). See Balfet et al. 1989, p. 19; Yon 1981, pp. 128-129.

Jug إبريق *ʾibrīq*

A closed shape of small to medium dimension with a handle, with or without a spout, intended for pouring liquid (pl. **I**). See Balfet et al. 1989, p. 19; Yon 1981, p. 65.

Leather-hard paste عجينة شبه جافة *ʿajīna šibh jāfa*

The term "leather-hard paste" refers to a stage of drying of a paste that has lost moisture and is therefore no longer as plastic as it was at the time of shaping but still sufficient to allow deformation and removing of clay matter. See Rye 1981, p. 146; Rice 1987, pp. 63-67.

Kneading العَجن *al-ʿajn*

The final operation of homogenisation of the non-plastic particles into the fine mass and reduction of porosity just before the shaping process. See Roux, Courty 2019, p. 39.

Manufacture التصنيع (التشكيل) *at-taṣnīʿ (at-taškīl)*

The process consisting in shaping a clay paste to produce a pot. See Balfet et al. 1989, p. 52.

Modelling النَمذَجة (التشكيل اليدوي) *an-namzaja (at-taškīl al-yadawī)*

A roughing-out technique consisting in shaping a mass of clay by discontinuous pressures with the fingers of one or both hands. This technique is also known as "pinching" (pl. **III**, no. **1**). See Rye 1981, p. 70; Shepard 1956, pp. 55-57; Rice 1987, p. 125; Roux, Courty 2019, pp. 60-61.

Moulding الصبّ (التشكيل بالقالب) *aṣ-ṣabb (at-taškīl bil-qālab)*

A roughing-out technique involving a convex or concave mould giving the shape to the clay pressed on it (pl. **III**, no. **3**). See Balfet et al. 1989, p. 57; Shepard 1956, pp. 63-65; Rice 1987, pp. 125-126; Rye 1981, pp. 81-82; Roux, Courty 2019, pp. 61-64.

Moulded (decoration) مُشكّل بالقالب (زخرفة) *mušakkal bil-qālab (zaḫrafa)*

A type of decoration resulting from the use of a mould to produce high-relief or negative designs on pottery (pl. **IV**, no. **15**). See Shepard 1956, p. 195.

Organic residue analysis تحليل المخلفات العضوية *taḥlīl al-muḫallafāt al-ʿuḍwiya*

The study of organic traces preserved as food crusts or spills on the surface or as micro-traces on the vessel wall; analytical techniques include chromatography and mass spectrometry (GC-MS) to detect chemical compounds of animal fats, aquatic resources, plant oils and beeswax and stable carbon isotope analysis, e.g. to distinguish carcass fats from dairy fats. See Sections v.4 and v.5; Barnard, Eerkens 2014.

Open shape أواني مفتوحة *ʾawānī maftūḥa*

A shape, the maximum diameter of which is located at the rim, such as plates, cups and goblets. See Balfet et al. 1989, p. 8.

Painted (decoration) مَطلي (ملوّن) (زخرفة) *maṭlī (mulawwan) (zaḫrafa)*

A type of decoration implying the application of colour (coloured clay, pigments or oxides) with a brush or fingers on the surface of a pot. Painting can occur before or after the firing (pl. **IV**, no. **13**). See Shepard 1956, p. 203; Roux, Courty 2019, pp. 102-103.

Paste العجينة *al-ʿajīna*
The internal component of a ceramic mixing clay material and non-plastic inclusions. See Fabric.

Petrofabric وصف أو تصنيف العجينة بحسب محتواها *waṣf ʾaw taṣnīf al-ʿajīna biḥasab muḥtawāhā*
The analytical grouping of petrographically defined inclusions and clay appearance. See Section II.3 and Ownby, Brand 2019.

Pinching القرص بالإصبع *al-qarṣ bil-ʾiṣbaʿ*
See Modelling.

Plate طَبَق (صحن) *ṭabaq (ṣaḥn)*
An open shape with very flared walls devoted to serving and presenting food (pl. **I**). See Balfet et al. 1989, p. 10.

Polishing التلميع *al-talmīʿ*
A type of surface treatment consisting in the smoothing, using repeated rubbing of the surface of a pottery at the end of the drying process. In this manual, the term does not differ from the burnishing. See Roux, Courty 2019, p. 96-98.

Porosity المسامية *al-masāmiya*
The volume of space or pores within the walls which let liquids seep through the body (permeability). The degree of porosity has an influence on the density, the strength and the resistance to weathering or thermal shock. See Shepard 1956, pp. 125-130; Rice 1987, p. 231.

Pot قِدر *qidr*
A generic term used for a closed shape without any specific characteristics. See Balfet et al. 1989, p. 19; Yon 1981, p. 196.

Rim فُوَّهة *fuwwaha*
The upper edge of a ceramic corresponding to the mouth that can have various profiles (pl. **I**). See Yon 1981, pp. 143-144.

Refitting تركيب القطع (ربط القطع) *tarkīb al-qiṭaʿ (rabṭ al-qiṭaʿ)*
The reconstruction of the profile of a ceramic from sherds joined together; also named "mending". See Verdan 2011.

Scraping الكشط *al-kašṭ*
A fashioning operation consisting in thinning and profiling the walls of the ceramic by using a sharp tool (pl. **III**, no. **7**). Scraping is sometimes seen as shaving. See Roux, Courty 2019, p. 64; Rice 1987, p. 137.

Shape الشكل *aš-šakl*
The morphological characteristics of a ceramic adapted to its function and following cultural trends used by a ceramic specialist as a tool for the classification purpose. See Shepard 1956, pp. 224-248.

Shaving التشذيب *at-tašzīb*
A fashioning operation consisting in removing excess clay using a cutting tool to thin the walls, unify the surface and design the final shape of the vessel (pl. **III**, no. **8**). See Roux, Courty 2019, p. 68.

Sigillata سيجيلاتا *sījīllātā*
A term employed to designate fine red glossy ancient Roman pottery which influenced pottery production in all the Mediterranean countries.

Slip البِطانة *al-biṭāna*
A type of coating made with liquefied clay eventually mixed with pigments applied by soaking the ceramic or by rubbing it on the surface of the ceramic (pl. **IV**, no. **4**). See Rye 1981, p. 41; Rice 1987, pp. 149-150.

Smoothing التمليس *at-tamlīs*

A finishing operation consisting in unifying the surface when still wet by removing the last impurities with a soft tool or one's hand (pl. **IV**, no. **1**). See Balfet et al. 1989, p. 77; Rice 1987, p. 138.

Soot آثار الحرق (السخام) *ʾāṯār al-ḥarq (al-suḫām)*

Black carbonised residues usually found on the surface of ceramics used over fires such as cooking-pots. See Rice 1987, p. 235.

Spout مِثعب *miṯʿab*

Part of a ceramic used for pouring a liquid out that could be fashioned by pinching the rim or by addition. See Yon 1981, p. 36.

Stamped (decoration) مختوم (زخرفة) *maḫtūm (zaḫrafa)*

A type of impressed decoration involving pressing a stamp on the leather-hard surface of a ceramic (pl. **IV**, no. **11**). See Shepard 1956, pp. 194-195.

Surface treatment المعالجة السطحية *al-muʿālaja al-saṭḥiya*

A finishing operation consisting in rubbing the surface to modify the final aspect of the ceramic such as burnishing or polishing. See Orton et al. 1993, p. 126.

Tableware أواني المائدة *ʾawānī al-māʾida*

The generic term ascribed to ceramics, generally thin-walled and devoted to serving purposes.

Temper شوائب مُضافة *šawāʾib muḍāfa*

The non-plastic element added to improve the malleability of a clay or to modify its properties such as its resistance to thermal shock, its porosity, etc. See Rye 1981, p. 37; Rice 1987, pp. 406-413.

Use-wear traces آثار الاستخدام *ʾāṯār al-ʾistiḫdām*

Abrasion and damage caused by use, interpreted for vessel functions and techniques, e.g. burn marks or soot point due to heating over a fire, surface abrasions caused by stirring or frequent handling, and surface attrition on the inner vessel walls which may stem from acid formation in fermentation processes. See Rice 1987, pp. 232-236.

Utility ware الفخار الخَدمي *al-fuḫār al-ḫadamī*

The generic term used for ceramics, the function of which is unequivocal such as bread plates or water pipes.

Wash طبقة طينية رقيقة (ماء الطين) *ṭabaqa ṭīniya raqīqa (maʾu aṭ-ṭīn)*

A type of coating either seen as a more fluid layer than a slip applied before firing or a post-firing coating (pl. **IV**, no. **5**). See Rye 1981, p. 41; Rice 1987, p. 151.

Wedging العجن المتجانس *al-ʿajn al-mutajānis*

The operation of amalgamating the non-plastic particles into the fine mass and reducing the porosity by fine kneading performed during the preparation of the paste and its storage. It is distinguished from kneading only in the case of a time-gap between wedging and shaping. See Roux, Courty 2019, p. 39.

Wheel-coiling التصنيع باستخدام اللفائف الطينية على العجلة
at-taṣnīʿ bistiḫdām al-lafāʾif al-ṭīniya ʿalā al-ʿajala

A roughing-out technique using the rotation of a turning device to shape coils of clay (pl. **III**, no. **6**). See Roux, Courty 2019, pp. 84-87.

Wheel-made مصنوع بواسطة العجلة *maṣnūʿ biwāsiṭat al-ʿajala*

A term used to define a ceramic manufacturing technique using a turning device such a wheel or a turn-table. See Roux, Courty 2019, pp. 72-90; Rye 1981, pp. 64-65.

Wheel-throwing تصنيع الفخار من كتلة طينية على العجلة
taṣnīʿ al-fuḫār min kutla ṭīniya ʿalā al-ʿajala

A roughing-out technique using the rotation of a turning device to shape a mass of clay with continuous pressure of hands and fingers (pl. **III**, no. **5**). See Roux, Courty 2019, pp. 72-83 ■

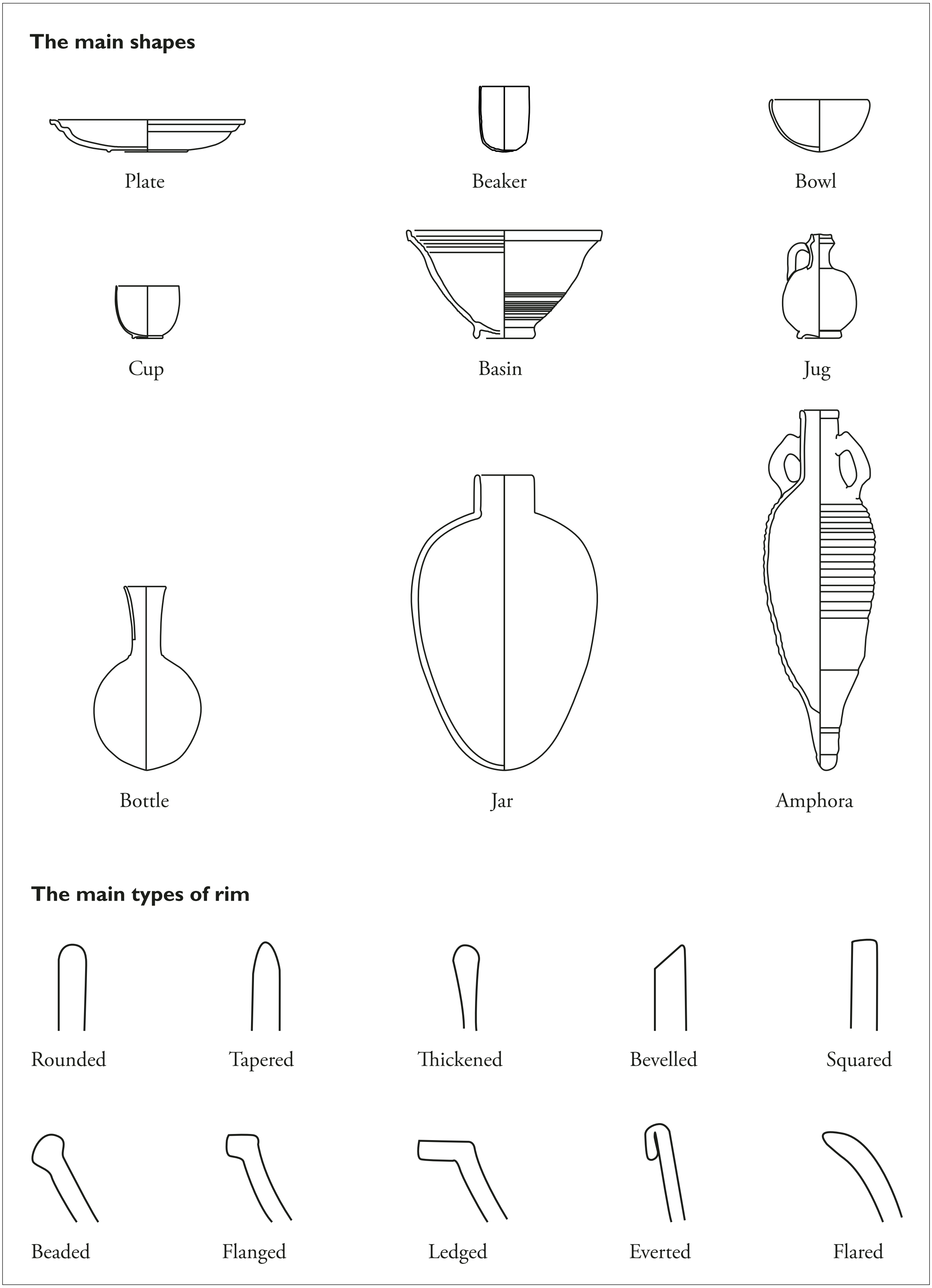


Plate I. Ceramic description: the main shapes and the main types of rim (after Adams 1986, fig. 95; Yon 1981, fig. 314).

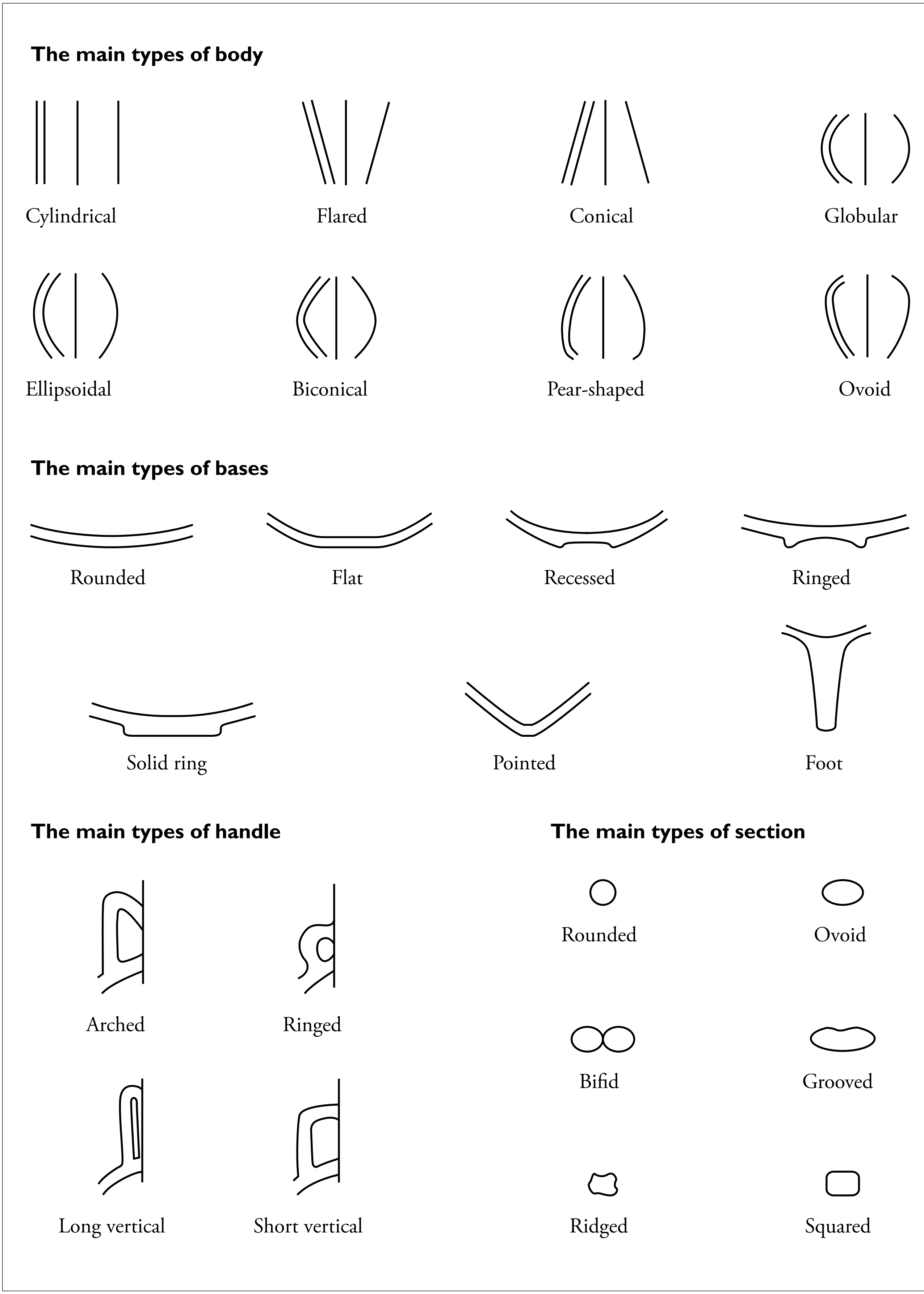
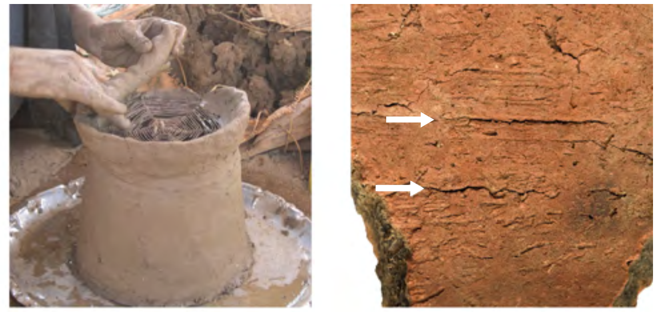


Plate II. Ceramic description: the main types of body, handle and base (after Adams 1986, figs. 95-96; Yon 1981, fig. 188; University of Southampton 2014).

1. Modelling and its traces



2. Coiling and its traces

3. Molding and its traces

4. Hammering and its traces

5. Wheel-throwing and its traces

6. Wheel-coiling and its traces

7. Scraping and its traces

8. Shaving and its traces

Plate III. Roughing-out techniques and their traces (© E. Jadot, R. David; picture no. 3: Courtesy of the Polish Centre of Mediterranean Archaeology of the University of Warsaw, © E. Czyżewska-Zalewska/PCMA/Pots Project).

Type of surface finishing


1. Smoothing


2. Burnishing


3. Brushing

Type of coating


4. Slip


5. Wash


6. Glaze

Type of decoration


7. Impressed


8. Comb impressed


9. Incised


10. Comb incised


11. Stamped


12. Applied


13. Painted


14. Grooved


15. Moulded

Plate IV. Surface finishing, surface treatment and decoration techniques (© E. Jadot, R. David; picture no. 6: courtesy of Valentina Vezzoli; pictures no. 10 and 12: courtesy of EHAS project, Iraqi Kurdistan; picture no. 15: © Ifao).

VII

Lexicon

Bibliography

This bibliography gathers the references quoted by the contributors of the present manual. It contains reference manuals as well as more specific papers addressing the topics approached by the authors in their case study. This can be considered as an introductory bibliographical tool to be enriched with further readings ■

Adams 1986
W. Y. Adams, *Ceramic Industries of Medieval Nubia*, Lexington, 1986.

Adams, Adams 1991
W. Y. Adams, E. W. Adams, *Archaeological Typology and Practical Reality: A Dialectical Approach to Artifact Classification and Sorting*, Cambridge, 1991.

Adan-Bayewitz 1993
D. Adan-Bayewitz, *Common Pottery in Galilee. A Study of Local Trade,* Bar-Ilan University Press, Jerusalem, 1993.

Adan-Bayewitz et al. 2009
D. Adan-Bayewitz, A. Karasik, U. Smilansky, F. Asaro, R. D. Giauque, R. Lavidor, "Differentiation of Ceramic Chemical Element Composition and Vessel Morphology at a Pottery Production Center in Roman Galilee", *Journal of Archaeological Science* 36, 2009, pp. 2517-2530.

Al-Dayel 1995
O. Al-Dayel, "Characterization of Egyptian Ceramics by Neutron Activation Analysis", PhD Thesis, University of Manchester, 1995.

Allen 1996
M. S. Allen, "Style and Function in East Polynesian Fish-hooks", *Antiquity* 70 (267), 1996, pp. 97-116.

Arcelin, Rigoir 1979
P. Arcelin, Y. Rigoir, *Normalisation du dessin en céramologie*, Documents d'archéologie méridionale, Montpellier, 1979.

Arcelin, Tuffreau-Libre 1998
P. Arcelin, M. Tuffreau-Libre (dir.), *La quantification des céramiques, conditions et protocole, Actes de la table ronde du Centre archéologique européen du Mont Beuvray (Glux-en-Glenne, 7-9 avril 1998)*, Bibracte 2, Glux-en-Glenne, 1998.

Arnold et al. 2018
F. Arnold, S. Marchand, G. Williams, "Introduction: Medieval Pottery in Egypt (7th-19th Century AD). State of the Research", *Bulletin de la Céramique Égyptienne* 28, 2018, pp. 213-224.

Aston 1998
D. A. Aston, *Die Keramik des Grabungsplatzes QI. Teil* 1. *Corpus of Fabrics, Wares and Shapes*, FoRa 1, Mainz, 1998.

Aston 1999
D. A. Aston, *Elephantine XIX, Pottery from the Late New Kingdom to the Early Ptolemaic Period*, Archäologische Veröffentlichungen 95, Mainz, 1999.

Bader 2001
B. Bader, *Tell el-Dab'a XIII. Typologie und Chronologie der Mergel C-Ton Keramik. Materialien zum Binnenhandel des Mittleren Reiches und der Zweiten Zwischenzeit*, Vienna, 2001.

Bajeot et al. 2020
J. Bajeot, I. Caricola, L. Medeghini, V. Vinciguerra, V. Forte, "An Integrated Approach Based on Archaeometry, Use-wear Analysis and Experimental Archaeology to Investigate the Function of a Specific Type of Basin Diffused in the Predynastic Sites of Lower Egypt (4th mill. BC)", *Quaternary International* 555, 2020, pp. 135-149.

Baklouti et al. 2016
S. Baklouti, L. Maritan, L. Casas Duocastella, N. Laridhi Ouazaa, R. Jerrega, M. Prevosti, C. Mazzoli, B. Fouzaï, S. Larabi Kassaa, M. Fantar, "Establishing a New Reference Group of Keay 25.2 Amphorae from Sidi Zahruni (Nabeul, Tunisia)", *Applied Clay Science* 132-133, 2016, pp. 140-154.

Balfet et al. 1989
H. Balfet, M.-F. Fauvet Berthelot, S. Monzon, *Lexique et typologie des poteries*, Paris, 1989.

Ballirano et al. 2014
P. Ballirano, C. De Vito, L. Medeghini, S. Mignardi, V. Ferrini, P. Matthiae, D. Bersani, P. P. Lottici, "A Combined Use of Optical Microscopy, X-ray Powder Diffraction and Micro-Raman Spectroscopy for the Characterization of Ancient Ceramic from Ebla (Syria)", *Ceramics International* 40, 2014, pp. 16409-16419.

Banning 2000
E. B. Banning, *The Archaeologist's Laboratory. The Analysis of Archaeological Data*, New York, 2000.

Barahona-Mendieta 2016
Z. Barahona-Mendieta, "La producción cerámica en época ptolemaica en Medamud, hasta comienzos de la dominación romana", in R. David (ed.), *Céramiques ptolémaïques de la région thébaine*, Cahiers de la Céramique Égyptienne 10, Cairo, 2016, pp. 25-45.

Barahona-Mendieta et al. 2019
Z. Barahona-Mendieta, F. Relats Montserrat, R. Séguier, "Nouvelles données sur un four à céramique des xvii[e]-xviii[e] dynasties à Médamoud. Contexte archéologique, comparaison architecturale et étude céramologique", *Bulletin de la Céramique Égyptienne* 29, 2019, pp. 165-229.

Barnard 2008
H. Barnard, *Eastern Desert Ware: Traces of the Inhabitants of the Eastern Deserts in Egypt and Sudan during the 4th-6th centuries CE*, BAR-IS 1824, Oxford, 2008.

Barnard, **Eerkens** 2017
H. Barnard, J. W. Eerkens, "Assessing Vessel Function by Organic Residue Analysis", in A. Hunt (eds.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 624-648.

Barraclough 1992
A. Barraclough, "Quarternary Sediment Analysis: a Deductive Approach at A-Level", *Teaching Geography* 17, 1992, pp. 15-18.

Bartl 1999
K. Bartl, "Islamic Settlements in the Plain of Akkar/Northern Lebanon", *Al-'Usur al-Wusta* 11-2, 1999, pp. 29-33.

Bashir, **David** 2015
M. S. Bashir, R. David, "The Meroitic Cemetery at Berber. Recent Fieldwork and Discussion on Internal Chronology", *Sudan & Nubia* 19, 2015, pp. 97-105.

Baxter 2003
M. J. Baxter, *Statistics in Archaeology*, Arnold, London, 2003.

Baud 2008
M. Baud, "The Meroitic Royal City of Muweis: First Steps into an Urban Settlement of Riverine Upper Nubia", *Sudan & Nubia* 12, 2008, pp. 52–63.

Binder, **Courtin** 1994
D. Binder, J. Courtin (eds.), *Terre cuite et Société. La céramique, document technique, économique, culturel : xiv[e] Rencontres internationales d'archéologie et d'histoire d'Antibes, 21-22-23 octobre 1993*, Juan-les-Pins, 1994.

Binford 1981
L. R. Binford, *Bones: Ancient Men and Modern Myths*, New York, 1981.

Bishop 2017
G. Bishop, "Statistical Modeling for Ceramic Analysis", in A. M. W. Hunt (ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 58-72.

Bortolini 2017
E. Bortolini, "Typology and Classification", in A. M. W. Hunt (ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 651-670.

Botticelli et al. 2020
M. Botticelli, S. Mignardi, C. De Vito, V. Liao, D. Montanari, M. Shakarna, L. Nigro, L. Medeghini, "Variability in Pottery Production at Khalet al-Jam'a Necropolis, Bethlehem (West Bank): from the Early-Middle Bronze to the Iron Age", *Ceramics International* 46, 2020, pp. 16405-16415.

Bourriau 2000
J. Bourriau, "The Second Intermediate Period", in I. Shaw (ed.), *The Oxford History of Ancient Egypt*, Oxford, 2000, pp. 173-206.

Bourriau et al. 2006
J. D. Bourriau, A. Bellido, N. Bryan, V. Robinson, "Egyptian Pottery Fabrics: A Comparison between NAA Groupings and the 'Vienna System'", in E. Czerny, I. Hein, H. Hunger, D. Melman, A. Schwab (eds.), *Timelines. Studies in Honour of Manfred Bietak*, Orientalia Lovaniensia Analecta 149/3, Leuven, Paris, Dudley, MA 2006, pp. 261-292.

Brass 2016
M. Brass, *Reinterpreting Chronology and Society at the Mortuary Complex of Jebel Moya (Sudan)*, Oxford, 2016.

Budka 2020
J. Budka (dir.), *AcrossBorders* II: *Living in New Kingdom Sai*, Archaeology of Egypt, Sudan and the Levant 1, Vienna, 2020.

Cabon et al. 2017
O. Cabon, V. Francigny, B. François, M. Maillot, M. Musa Ibrahim, O. Nicoloso, C. Rilly, O. Rolin, *Histoire et civilisations du Soudan, de la Préhistoire à nos jours*, Paris, 2017.

Caneva, **Marks** 1990
I. Caneva, A. Marks, "More on the Shaqadud Pottery: Evidence for Saharo-Nilotic Connections during the 6th-4th Millenium B.C.", *Archéologie du Nil Moyen* 4, 1990, pp. 11-35.

Cavalieri et al. 2003
D. Cavalieri, P. E. McGovern, D. L. Hartl, R. Mortimer, M. Polsinelli, "Evidence for *S. cerevisiae* Fermentation in Ancient Wine", *Journal of Molecular Evolution* 57, 2003, pp. S226-232. https://www.penn.museum/sites/biomoleculararchaeology/wp-content/uploads/2010/03/ScorpionYeast.pdf (accessed 4/30/2020).

CerAfIm
Working Group on African Impressed Ceramics: https://lampea.cnrs.fr/cerafim/ (accessed 08/09/2020).

Chaaya 2018
A. Chaaya, "Results of the First Season of Excavation at the Medieval Castle of Gbail/Byblos", in B. Horejs, C. Schwall, V. Müller, M. Luciani, M. Ritter, M. Guidetti, R. B. Salisbury, F. Höflmayer, T. Bürge (eds.), *Proceedings of the 10th International Congress on the Archaeology of the Ancient Near East 25-29 April 2016, Vienna*, vol. 2, Wiesbaden, 2018, pp. 475-484.

Cherpion et al. 2007
N. Cherpion, J.-P. Corteggiani, J.-F. Gout, *Le Tombeau de Pétosiris à Touna el-Gebel. Relevé photographique*, Bibliothèque générale 27, Cairo, 2007.

Collett 2012
L. Collett, *An Introduction to Drawing Archaeological Pottery*, IfA professional practice paper 10, Reading, 2012.

Costa 2020
S. Costa, *SVG Pottery Documentation*, 2020. https://readthedocs.org/projects/svg-pottery/downloads/pdf/latest/ (accessed 15/11/2020).

Costin 1991
C. L. Costin, " Craft Specialization: Issues in Defining, Documenting, and Explaining the Organization of Production", *Archaeological Method and Theory* 3, 1991, pp. 1-56.

Costin 2000
C.L. Costin, "The Use of Ethnoarchaeology for the Archaeological Study of Ceramic Production" *Journal of Archaeological Method and Theory* 7 (4), 2000, pp. 377-403.

Costin 2020
C.L. Costin, "What is a Workshop?", in A. H. Hodkingson, C. L. Tvetmarken (eds.), *Approaches to the Analysis of Production Activity at Archaeological Sites*, Oxford, 2020, pp. 177-197.

Daiber 2006
V. Daiber, "Baalbek: Die Mittelalterischen Feinwaren, Studien zur Spätantiken und Islamischen Keramik", *Hirbat al-Minya-Baalbek-Resafa*, Band-Archäologie Band 18, 2006, pp. 111-166.

Dal Sasso et al. 2014
G. Dal Sasso, L. Maritan, S. Salvatori, C. Mazzoli, G. Artioli, "Discriminating Pottery Production by Image Analysis: a Case Study of Mesolithic and Neolithic Pottery from Al Khiday (Khartoum, Sudan)", *Journal of Archaeological Science* 46, 2014, pp. 125-146.

Daszkiewicz 2014
M. Daszkiewicz, "Ancient pottery in the Laboratory. Principles of Archaeoceramological Investigations of Provenance and Technology", *Novensia* 25, 2014, pp. 177-197.

Daszkiewick, Wetendorf 2014
M. Daszkiewick, M. Wetendorf, "A New Series of Laboratory Analyses of Coarse Wares from 'Pottery Courtyard' 224 of the Great Enclosure in Musawwarat es-Sufra (Sudan)", *Der Antike Sudan, Mitteilungen der Sudanarchäologischen Gesellschaft zu Berlin* 25, 2014, pp. 99-104.

Daszkiewicz, Maritan 2017
M. Daszkiewicz, L. Maritan, "Experimental Firing and Re-firing", in A. M. W. Hunt (ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 487-508.

Daszkiewick, Wetendorf 2017
M. Daszkiewicz, M. Wetendorf, "Experimental Archaeology: First Steps to Understanding the Firing Technology of Meroitic Pottery from Musawwarat es-Sufra", *Der Antike Sudan, Mitteilungen der Sudanarchäologischen Gesellschaft zu Berlin* 28, 2017, pp. 7-14.

David 2016
R. David (ed.), *Céramiques ptolémaïques de la région thébaine*, Cahiers de la Céramique Égyptienne 10, Cairo, 2016.

David 2018
R. David, "Funerary Ceramics and Meroitic Economy: a First Insight", in M. Honneger (ed.), *Nubian Archaeology in the XXIst Century. Proceedings of the Thirteenth International Conference for Nubian Studies, Neuchâtel*, 1st-6th September 2014, Orientalia Lovaniensia Analecta 273, Neuchâtel, 2018, pp. 481-488.

David 2019
R. David, "Ceramic Industries of Meroitic Sudan", in D. Raue (ed.), *Handbook of Ancient Nubia*, 2019, pp. 877-897.

David, Evina 2015
R. David, M. Evina, "La *fine ware* méroïtique, marqueur d'une civilisation", *Égypte, Afrique et Orient* 78, 2015, pp. 49-56.

David, Evina 2016
R. David, M. Evina, "Introduction à l'évolution des chaînes opératoires des céramiques méroïtiques", *Dotawo* 3, 2016, pp. 83-126.

David et al. 2016
R. David, M. Naguib Reda, Z. Barahona-Mendieta, A. Consonni, G. Lecuyot, N. Licitra, A. Marangou, S. Marchand, A. Masson, G. Schreiber, A. Simony, "Theban Ceramics in Ptolemaic Context—Fabrics Classification", in R. David (ed.), *Céramiques ptolémaïques de la région thébaine*, Cahiers de la Céramique Égyptienne 10, Cairo, 2016, pp. 11-22.

David et al. forthcoming
R. David, J. Phillips, M. Wetendorf, S. Buechner-Matthews, M. El-Tayeb, A. Benoist, "The Classification of Meroitic Ceramic", in *Proceedings of the 14th International Conference for Nubian Studies*, forthcoming.

Defernez, **Marchand** 2016
C. Defernez, S. Marchand, "État actuel de la recherche sur l'industrie amphorique égyptienne des IV^e^-III^e^ siècles av. n. è.", in B. Bader, C. Knoblauch, E. Köhler (eds.), *Vienna 2—Ancient Egyptian Ceramics in the 21st Century. Proceedings of the International Conference held at the University of Vienna 14th-18th of May, 2012*, Orientalia Lovaniensia Analecta 245, Leuven, Paris, Dudley CT, 2016, pp. 127-154.

Degli Esposti, **Benoist** 2015
M. Degli Esposti, A. Benoist, "More on Masafi Ancestors: the Late Bronze Age Site of Masafi", *Proceedings of the Seminar for Arabian Studies* 45, 2015, pp. 57-74.

Di Paolo 2013
S. Di Paolo, "The Historiography of the Concept of 'Workshop' in Ancient Near Eastern Archaeology: Descriptive Models and Theoretical Approaches (Anthropology vs. Art History)", in M. H. Feldman, B. Brown (eds.), *Critical Approaches to Ancient Near Eastern Art*, New York, 2013, pp. 111-132.

Dixneuf 2011
D. Dixneuf, *Amphores égyptiennes. Productions, typologie, contenu et diffusion (III^e^ siècle avant J.-C.-IX^e^ siècle après J.C.)*, Études Alexandrines 22, Cairo, 2011.

Dorrell 1994
P. Dorrell, *Photography in Archaeology and Conservation*, 2nd ed., Cambridge, 1994.

Dreyer 1999
G. Dreyer, *Umm el-Qaab I. Das prädynastische Königsgrab U-j und seine frühen Schriftzeugnisse*, Archäologische Veröffentlichungen 86, Mainz, 1999.

Dunnell 1971
R. C. Dunnell, *Systematics in Prehistory*, Caldwell, NJ, 1971.

Duistermaat 2016
K. Duistermaat, "The Organization of Pottery Production. Toward a Relational Approach" in A.M.W. Hunt (ed.) *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford University Press, 2016, pp. 114-147.

Fischer-Genz, **Ehrig** 2005
B. Fischer-Genz, H. Ehrig, "First results of the Archaeological Survey Project in the Territory of Ancient Heliopolis-Baalbek", in M. Van Ess and K. Rheidt, "Archaeological Research in Baalbek. A Preliminary Report on the 2004 and 2005 Seasons", *Bulletin d'Archéologie et d'Architecture Libanaises* 9, 2005, pp. 135-138.

Foster, **Barker** 1996
G. V. Foster, N. J. Barker, "Close-Up Photography of Archaeological Objects", *Journal of Field Archaeology* 23, no. 3, 1996, pp. 369-375.

Fowler 2017
K. Fowler, "Ethnography", in A. N. W. Hunt (ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 469-486.

François et al. 2003
V. François, V. Nicolaïdès, L. Vallauri, Y. Waksman, "Premiers éléments pour une caractérisation des productions de Beyrouth entre domination franque et mamelouke", *Actes du VII^e^ Congrès International sur la Céramique Médiévale en Méditerranée, Thessalonique, 11-16 octobre 1999*, Athens, 2003, pp. 325-340.

Gatier et al. 2005
P.-L. Gatier, C. Atallah, J. Nassar, D. Pieri, M.-O. Rousset, T. Zaven, "Mission of Yanouh and the Upper Nahr Ibrahim Valley", *Bulletin d'Archéologie et d'Architecture Libanaises* 9, 2007, pp. 161-188.

Gatier et al. 2011
P.-L. Gatier, J. Aliquot, L. Nordiguian (eds.), *Sources de l'histoire de Tyr. Textes de l'Antiquité et du Moyen Âge*, Beyruth, 2011.

Gibson, **Woods** 1990
A. Gibson, A. Woods, *Prehistoric Pottery for the Archaeologist*, Leicester, 1990.

Gliozzo 2020
E. Gliozzo, "Ceramics Investigation, Research Questions and Sampling Criteria", *Archaeological and Anthropological Sciences* 12: 202, 2020.

Gosselain 2002
O. Gosselain, *Poteries du Cameroun méridional. Styles techniques et rapports à l'identité*, CRA Monograph 26, Paris, 2002.

Gratien 2013
B. Gratien (dir.), *Abou Sofyan et Zankor. Prospections dans le Kordofan occidental (Soudan)*, Lille, 2013.

Griffiths et al. 1990
N. Griffiths, A. Jenner, C. Wilso, *Drawing Archaeological Finds*, London, 1990.

Haidar Vela, **Pieri** 2012
N. Haidar Vela, D. Pieri, "La céramique byzantino-omeyyade du secteur de la cathédrale de Tyr", in *L'histoire de Tyr au témoignage de l'archéologie, Actes du séminaire international (Tyr, 2011)*, Bulletin d'Archéologie et d'Architecture Libanaises H-S 8, Beyruth, 2012, p. 362.

Harlaut, **Hayes** 2018
C. Harlaut, J. W. Hayes, *Pottery in Hellenistic Alexandria*, Études Alexandrines 45, Alexandria, 2018.

Hartung 2001
U. Hartung, *Umm el-Qaab II: Importkeramik aus dem Friedhof U in Abydos (Umm el-Qaab) und die Beziehungen Ägyptens zu Vorderasien im 4. Jahrtausend v. Chr.*, Archäologische Veröffentlichungen 92, Mainz, 2001.

Homsy-Gottwalles 2016
G. Homsy-Gottwalles, "The Medieval and Ottoman Periods at Saydet el-Rih Anfeh (Lebanon): Ceramic Evidence", *Berytus* LVI, 2016, pp. 313-349.

Homsy-Gottwalles 2017
G. Homsy-Gottwalles, "Beyrouth post-médiévale. Étude de cas: la céramique", in S. Bocharov, V. François, A. Sitdikov (eds.), *Glazed Pottery of the Mediterranean and the Black Sea Region (10th-18th centuries)*, Kazan-Kishinev, 2017, pp. 245-256.

Hope 2001
C. A. Hope, *Egyptian Pottery*, Shire Egyptology 5, Buckinghamshire, 1987.

Hunt 2017
A. N. W. Hunt (ed.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017.

Huysecom 1994
E. Huysecom, "Identification technique des céramiques africaines", in D. Binder, J. Courtin (eds.), *Terre cuite et Société. La céramique*, *document technique*, économique, *culturel* : *XIV^{e} Rencontres internationales d'archéologie et d'histoire d'Antibes*, *21-22-23 octobre 1993*, Juan-les-Pins, 1994, pp. 31-44.

Leclant 1985
J. Leclant, "Bouteilles globulaires à long col en Moyenne Nubie", in F. Geus, F. Thill (eds.), *Mélanges offerts à Jean Vercoutter*, Paris, 1985, pp. 185-204.

Lenoble 1995
P. Lenoble, "La petite bouteille noire, un récipient méroéen de la libation funéraire", *Archéologie du Nil Moyen* 7, 1995, pp. 143-162.

Licitra, David 2016
N. Licitra, R. David, “L’évolution des céramiques ptolémaïques à Karnak d’après la documentation du Trésor de Chabaka”, in R. David (ed.), *Céramiques ptolémaïques de la région thébaine*, Cahiers de la Céramique Égyptienne 10, Cairo, 2016, pp. 77-121.
Livingstone Smith et al. 2005
A. Livingstone Smith, D. Bosquet, R. Martineau (eds.), *Pottery Manufacturing Processes: Reconstitution and Interpretation, Actes du XIVème congrès UISPP, Université de Liège, Belgique, 2-8 septembre 2001, Section 2, Archaeometry, Colloque/symposium 2.1*, BAR-IS 1349, Cambridge, 2005.
Lock 2003
G. Lock, *Using Computer in Archaeology. Towards Virtual Past*, London, 2003.
London 2000
G. London, “Ethnoarchaeology and Interpretations of the Past”, *Near Eastern Archaeology* 63 (1), 2000, pp. 2-8.
Magee 1996
P. Magee, “The Chronology of the South-east Arabian Iron Age”, *Arabian Archaeology and Epigraphy* 7, 1996, pp. 240-252.
Marchand 2013
S. Marchand, “Céramiques d’Égypte de la fin du ivᵉ siècle av. J.-C. au iiiᵉ siècle av. J.-C. : entre tradition et innovation ”, in N. Fenn, C. Römer-Strehl (eds.), *Network in the Hellenistic World. Pottery in the Eastern Mediterranean and Beyond. (23-26 February 2011, Köln-Bonn)*, BAR-IS 2539, Oxford, 2013, pp. 239-253.
Marchand 2014
S. Marchand, “Inventaire archéologique des sites de production céramique du Prédynastique à l’époque moderne. Égypte et Basse-Nubie”, *Bulletin de la Céramique Égyptienne* 24, 2014, pp. 201-224.
Marchand 2019
S. Marchand, “Conteneurs de transport égyptiens dans l’Égypte ancienne. Imitations, assimilations et transposition de modèles étrangers”, in L. Bonadies, I. Chirpanlieva, E. Guillon (eds.), *Les Phéniciens, les Puniques et les autres. Échanges et identités entre le monde phénico-punique et les différents peuples de l’Orient ancien et du pourtour méditerranéen, journées d’étude 13-14 mai 2016, Paris*, Orient & Méditerranée 31, Paris, 2019, pp. 73-100.
Marchand et al. 2018
S. Marchand, R.-L. Chang, S. Nannucci, “Philadelphie 2018. Amphores égyptiennes locales AE1 en pâte calcaire. Époque ptolémaïque, seconde moitié du 3ᵉ s. av. J.-C.”, *Bulletin de la Céramique Égyptienne* 28, 2018, pp. 125-154.
Maritan 2019
L. Maritan, “Archaeo-ceramic 2.0: Investigating Ancient Ceramics using Modern Technological Approaches”, *Archaeological and Anthropological Sciences* 11, 2019, pp. 5085-5093.
Maritan 2020
L. Maritan, “Ceramic Abandonment. How to Recognise Post-depositional Transformations”, *Archaeological and Anthropological Sciences* 12, 2020, p. 199.
Maritan et al. 2005
L. Maritan, C. Mazzoli, V. Michielin, D. Morandi Bonacossi, M. Luciani, G. Molin, “The Provenance and Production Technology of Bronze Age and Iron Age Pottery from Tell Mishrifeh/Qatna (Syria)”, *Archaeometry* 47, 2005, pp. 723-744.
Maritan et al. 2015
L. Maritan, P. Holakooei, C. Mazzoli, “Cluster Analysis of XRPD data in Ancient Ceramics: What for?”, *Applied Clay Science* 114, 2015, pp. 540-549.

Maritan et al. 2017
L. Maritan, F. Tourtet, G. Meneghin, C. Mazzoli, A. Hausleiter, "Technological Transfer? Comparative Analysis of the 2nd-3dr/4th century CE 'Late Roman' Pottery from Tayma, Saudi Arabia, and Petra, Jordan", *Journal of Archaeological Science Reports* 12, 2017, pp. 712-725.

Maritan et al. 2020
L. Maritan, R. Piovesan, G. Dal Sasso, S. Baklouti, L. Casas, C. Mazzoli, L. Salmaso, L. Corain, "Comparison between Different Image Acquisition Methods for Grain-size Analysis and Quantification of Ceramic Inclusions by Digital Image Processing: how much Similar are the Results?" *Archaeological and Anthropological Sciences* 12, 2020, p. 167.

Martineau 2010
R. Martineau, "Brunissage, polissage et degrés de séchage", *Les Nouvelles de l'archéologie* 119, 2010, pp. 13-19.

Matthews, **Nowotnick** 2019
S. Matthews, U. Nowotnick, "Culinary Interactions. Connecting Foodways in Early Iron Age Africa", *Azania: Archaeological Research in Africa* 54:4, 2019, pp. 468-486.

Mayor 2010
A. Mayor, "Ceramic Traditions and Ethnicity in the Niger Bend, West Africa", *Ethnoarchaeology*, 2 (1), 2010, pp. 5-48.

McGovern 2019a
P. E. McGovern, *Ancient Wine: The Search for the Origins of Viniculture*, 2nd ed., Princeton, 2019.

McGovern 2019b
P. E. McGovern, "Alcoholic Beverages as the Universal Medicine before Synthetics", in M. V. Orna, G. Eggleston, A. F. Bopp (eds.), *Chemistry's Role in Food Production and Sustainability: Past and Present*, ACS Symposium Series, vol. 1314, Washington, D.C., 2019, pp. 111-127. https://pubs.acs.org/doi/book/10.1021/bk-2019-1314 (accessed 30/04/2020).

McGovern et al. 1997
P. E. McGovern, U. Hartung, V. R. Badler, D. L. Glusker, L. J. Exner, "The Beginnings of Winemaking and Viniculture in the Ancient Near East and Egypt", *Expedition* 39, 1997, pp. 3-21. https://www.penn.museum/sites/biomoleculararchaeology/wp-content/uploads/2010/04/The%20 Beginnings.pdf (accessed 30/04/2020).

McGovern et al. 2001
P. E. McGovern, D. L. Glusker, L. J. Exner, "The Organic Contents of the Tomb U-J Syro-Palestinian Type Jars: Resinated Wine Flavored with Fig, and the Origins of the Tomb U-j Syro-Palestinian Type Jars as Determined by Neutron Activation Analysis", in U. Hartung (ed.), *Umm el-Qaab II: Importkeramik aus dem Friedhof U in Abydos (Umm el-Qaab) und die Beziehungen Ägyptens zu Vorderasien im 4. Jahrtausend v. Chr.*, Archäologische Veröffentlichungen 92, Mainz, 2001, pp. 399-403 and 407-416.

McGovern et al. 2009
P. E. McGovern, A. Mirzoian, G. R. Hall, "Ancient Egyptian Herbal Wines", *The Proceedings of the National Academy of Sciences USA* 106, 2009, pp. 7361-7366. https://www.penn.museum/sites/biomoleculararchaeology/wp-content/uploads/2010/04/PNASEgyptherb.pdf (accessed 30/04/2020).

McGovern et al. 2010
P. E. McGovern, M. Christofidou-Solomidou, W. Wang, F. Dukes, T. Davidson, W. S. El-Deiry, "Anticancer Activity of Botanical Compounds in Ancient Fermented Beverages (Review)", *International Journal of Oncology* 37, 2010, pp. 5-14. http://www.penn.museum/sites/biomoleculararchaeology/wp-content/uploads/2010/03/AnticancerIJO.pdf (accessed 30/04/2020).

McGovern, **Hall** 2015
P. E. McGovern, G. R. Hall, "Charting a Future Course for Organic Residue Analysis on Archaeology", *Journal of Archaeological Method and Theory*, 2015, pp. 592-622. https://www.penn.museum/sites/biomoleculararchaeology/wp-content/uploads/2010/03/Uluburun-JAMT-paper-June-2015.pdf (accessed 30/04/2020).

Medeghini, Nigro 2017
L. Medeghini, L. Nigro, "Khirbet al-Batrawy Ceramics: A Systematic Mineralogical and Petrographic Study for Investigating the Material Culture", *Periodico di Mineralogia* 86, 2017, pp. 19-35.

Medeghini et al. 2019
L. Medeghini, M. Sala, C. De Vito, S. Mignardi, "A Forgotten Centre of Ceramic Production in Southern Levant: Preliminary Analytical Study of the Early Bronze Age Pottery from Tell el-Far'ah North (West Bank)", *Ceramics International* 45, 2019, pp. 11457-11467.

Nacouzi et al. 2018
L. Nacouzi, E. Capet, G. Charpentier, F. Alpi, J. Chahoud, M. Laguardia, G. Pagès, D. Pieri, V. Prigent, "Ej-Jaouzé (Metn). Rapport sur les travaux menés en 2014, 2015 et 2016", *Bulletin d'Archéologie et d'Architecture Libanaises* 18, 2018, pp. 79-200.

Newson 2016
P. Newson, "Archaeological Landscapes of the Bekaa: Past Results and Future Prospects", *Berytus* LVI, 2016, pp. 1-24.

Nordström, Bourriau 1993
H.-Å. Nordström, J. D. Bourriau, "Ceramic Technology: Clays and Fabrics", in D. Arnold, J. D. Bourriau (eds.), *An Introduction to Ancient Egyptian Pottery*, SDAIK 17, Mainz, 1993, pp. 149-190.

Nowotnick 2022
U. Nowotnick, *Ceramic Technology, Production and Use in an Urban Settlement on the Middle Nile. The Pottery Assemblage from Late Meroitic Hamadab, Sudan (2nd to 4th Century A.D.)*, Archäologische Forschungen in Afrika 1, Wiesbaden, 2022.

Oates 1959
D. Oates, J. Oates, "Ain Sinu: A Roman Frontier Post in Northern Iraq", *Iraq* 21, no. 2, 1959, pp. 207-42.

O'Brien, Lyman 2000
M. J. O'Brien, R. L. Lyman, *Applying Evolutionary Archaeology: A Systematic Approach*, Kluwer, New York, 2000.

Olin, Dillon 1987
J. Olin, B. D. Dillon, "Ceramics", in B. D. Dillon (ed.), *The Student's Guide to Archaeological Illustrating*, 2nd ed., Los Angeles, 1987, pp. 95-109.

Orton et al. 1993
C. R. Orton, P. A. Tyers, A. G. Vince (eds.), *Pottery in Archaeology*, Cambridge, 1993.

Ownby 2009
M. F. Ownby, "Petrographic and Chemical Analyses of Select 4th Dynasty Pottery Fabrics from the Giza Plateau", in T. Rzeuska, A. Wodzińska (eds), *Studies on Old Kingdom Pottery*, Warsaw, 2009, pp. 113-137.

Ownby 2016
M. F. Ownby, "Petrographic Analysis of Egyptian Ceramic Fabrics in the Vienna System", in B. Bader, C. Knoblauch, E. Köhler (eds.), *Vienna 2—Ancient Egyptian Ceramics in the 21st Century. Proceedings of the International Conference held at the University of Vienna 14th-18th of May, 2012*, Orientalia Lovaniensia Analecta 245, Leuven, Paris, Dudley CT, 2016, pp. 459-470.

Ownby, Brand 2019
M. F. Ownby, M. Brand, "Advances in Egyptian Ceramic Petrography", *Bulletin de la Céramique Égyptienne* 29, 2019, pp. 371-391.

Ownby, Griffiths 2009
M. F. Ownby, D. Griffiths, "Issues of Scum: Technical Analyses of Egyptian Marl C to Answer Technological Questions", *Ägypten und Levante* XIX, 2009, pp. 229-239.

Ownby et al. 2017
M.F. Ownby, E. Giomi, G. Williams, "Glazed Ware from here and there: Petrographic Analysis of the Technological Transfer of Glazing Knowledge", *Journal of Archaeological Science Reports* 16, 2017, pp. 616-626.

Pellegrino et al. 2020
M.-P. Pellegrino, S. Méry, A. Benoist, S. Costa, J. Charbonnier, "Ceramic Exchange in the Northern UAE during the Late Bronze Age: Preliminary Results of Macroscopic and Petrographic Analyses", *Proceedings of the Seminar for Arabian Studies* 50, 2020, pp. 259-273.

Phillips 2010
C. Phillips, "Iron Age Chronology in South-east Arabia and New Data from Salut, Sultanate of Oman", in A. Avanzini (ed.), *Eastern Arabia during the First Millennium BC*, Roma, 2010, pp. 71-80.

Phillips 2010
J. Phillips, "Preliminary Analysis of the 'Mat'- and 'Basket'-Impressed Ceramics from the Southern Dongola Reach Survey", in W. Godlewski, A. Łajtar (eds.), *Between the Cataracts: Proceedings of the 11th Conference for Nubian studies*, *Warsaw University*, *27 August-2 September 2006*, II.1, Warsaw, 2010, pp. 227-236.

Reshetnikova, **Williams** 2016
N. Reshetnikova, B. Williams, "Pottery Production during the Middle Kingdom at Serra East Fortress in Nubia", in B. Bader, C. Knoblauch, E. Köhler (eds.), *Vienna 2—Ancient Egyptian Ceramics in the 21st Century. Proceedings of the International Conference held at the University of Vienna 14th-18th of May*, *2012*, Orientalia Lovaniensia Analecta 245, Leuven, Paris, Dudley CT, 2016, pp. 487–505.

Rice 1987
P. M. Rice, *Pottery Analysis: A Sourcebook*, Chicago, 1987.

Riviera 2014
P. S. Rivera, "Applying the Methods of Evidence Photography to Archaeological Collections", *Technical Briefs in Historical Archaeology* 8, 2014, pp. 22-31.

Robertson, **Hill** 1999
J. H. Robertson, E. M. Hill, "Two Traditions or One? New Interpretation of the Hand-made/Wheel-made Ceramics from Meroe", in D. Welsby (ed.), *Recent Research in Kushite History and Archaeology: Proceedings of the 8th International Conference for Meroitic Studies*, British Museum Occasional Papers 131, London, 1999, pp. 321-329.

Rose 2018
P. J. Rose, "Egyptian Pottery from the Site of Sesebi", in R. David (ed.), *Céramiques égyptiennes au Soudan ancien: Importations, Imitations et Influences*, Cahiers de la Céramique Égyptienne 11, Cairo, 2018, pp. 135-149.

Rousset 2016
M.-O. Rousset, "Latrines et espaces d'ablution dans les mosquées du Proche-Orient médiéval : l'enseignement des fouilles de Tyr", in P. Cressier, S. Gilotte, M.-O. Rousset (eds.), *Lieux d'hygiène et lieux d'aisance en terre d'Islam*, Vincennes, 2016, pp. 105-128.

Roux 1994
V. Roux, "La technique du tournage: définition et reconnaissance par les macrotraces", in D. Binder, J. Courtin (eds.), *Terre cuite et Société. La céramique*, *document technique*, économique, *culturel* : *XIVe Rencontres internationales d'archéologie et d'histoire d'Antibes*, *21-22-23 octobre 1993*, Juan-les-Pins, 1994, pp. 45-58.

Roux 2003
V. Roux, "Ceramic Standardization and Intensity of Production: Quantifying Degrees of Specialization" *American Antiquity* 68 (4), 2003, pp. 768-782.

Roux, **Courty** 2019
V. Roux, M.-A. Courty, *Ceramics and Society. A Technological Approach to Archaeological Assemblages*, Springer, 2019.

Russo et al. 2018
G. Russo, S. Amicone, C. Berthold, R. Siddall, P. Sconzo, “Early Bronze Age Painted Wares from Tell el-’Abd, Syria: A Compositional and Technological Study”, *Journal of Archaeological Science Reports* 21, 2018, pp. 359-366.

Rye 1981
O. S. Rye, *Pottery Technology, Principles and Reconstruction*, Manuals on Archaeology 4, Washington, 1981.

Salamé-Sarkis 1980
H. Salamé-Sarkis, *Contribution à l’histoire de Tripoli et de sa région à l’époque des Croisades*, Paris, 1980.

Santacreu et al. 2017
D. A. Santacreu, M. C. Trias, J. G. Rosseló, “Formal Analysis and Typlogical Classification in the Study of Ancient Pottery”, in A. Hunt (eds.), *The Oxford Handbook of Archaeological Ceramic Analysis*, Oxford, 2017, pp. 181-199.

Sarre 1925
F. Sarre, “Keramik und andere Kleinfunde der Islamischen Zeit von Baalbek”, in T. Wiegand (ed.), *Baalbek. Egebnisse der Ausgrabungen und Untersuschung in den Jahren 1898 bis 1905*, vol. 3, Berlin-Leipzig, 1925.

Schreiber 2010
J. Schreiber, “The Iron I Period in South-east Arabia. A View from Central Oman”, in A. Avanzini (ed.), *Eastern Arabia during the First Millennium BC*, Roma, 2010, pp. 81-90.

Shaddoud 2018
I. Shaddoud, “Céramiques des xi^e^-xv^e^ siècles des fouilles de l’église de Sainte-Marina à Qalamoun (Liban nord)”, in N. Panayot-Harounb, S. Mady, “The Saint Marina Rock Shelter in Qalamun Archaeological Investigations”, *Bulletin d’Archéologie et d’Architecture Libanaises* 18, 2018, pp. 224-241.

Shennan 1997
S. Shennan, *Quantifying Archaeology*, University of Iowa Press, Iowa City, 1997.

Shepard 1956
A. O. Shepard, *Ceramics for the Archaeologist*, Washington, 1956.

Skibo 1992
J. M Skibo, “Ethnoarchaeology, Experimental Archaeology and Inference Building in Ceramic Research”, *Archaeologia Polona* 30, 1992, pp. 27-38.

Skibo 2013
J. M. Skibo, *Understanding Pottery Function. Manuals in Archaeological Method, Theory and Technique*, New York, 2013.

Spencer et al. 2017
N. Spencer, A. Stevens, M. Binder (eds.), *Nubia in the New Kingdom. Lived Experience, Pharaonic Control and Indigenous Traditions*, British Museum Publications on Egypt and Sudan 3, Leuven, 2017.

Stahl 1993
A. B. Stahl, “Concepts of Time and Approaches to Analogical Reasoning in Historical Perspective”, *American Antiquity* 58 (2), 1993, pp. 235-260.

Stockhammer 2013
P. W. Stockhammer, “From Hybridity to Entanglement, from Essentialism to Practice”, in W. P. van Pelt (ed.), *Archaeology and Cultural Mixing, Archaeological Review from Cambridge* 28(1), Cambridge, 2013, pp. 11-28.

Terry, **Chilingar** 1955
R. D. Terry, G. V. Chilingar, “Summary of ‘Concerning some Additional Aids in Studying Sedimentary Formations’ by M. S. Shvetsov”, *Journal of Sedimentary Petrology* 25, 1955, pp. 229-234.

Tite, Maniatis 1975
M. Tite, Y. Maniatis, "Examination of Ancient Pottery using the Scanning Electron Microscope", *Nature* 257, 1975, pp. 122-123.

Tite et al. 2001
M. S. Tite, V. Kilikoglou, G. Vekinis, "Strength, Touchness and Thermal Shock Resistance of Ancient Ceramics, and their Influence on Technological Choice", *Archaeometry* 43, 3, 2001, pp. 301-324.

Tobert 1984
N. Tobert, "Ethno-Archaeology of Pottery Firing in Darfur, Sudan: Implications for Ceramic Technology Studies", *Oxford Journal of Archaeology* 3 (2), 1984, pp. 141-156.

University of Southampton 2014
University of Southampton, *Roman Amphorae: a digital resource*, York, Archaeology Data Service, https://doi.org/10.5284/1028192

VanPool, Leonard 2011
T. L. VanPool, R. D. Leonard, *Quantitative Analysis in Archaeology*, Oxford, 2011.

Verdan 2011
S. Verdan, "Pottery Quantification: some Guidelines", in S. Verdan, T. Theurillat, A. Kenzelmann Pfyffer (eds.), *Early Iron Age Pottery: A Quantitative Approach. Proceedings of the International Round Table organized by the Swiss School of Archaeology in Greece (Athens, November 28-30, 2008)*, BAR-IS 2254, Oxford, 2011, pp. 165-171.

Verhoeven 2016
G. Verhoeven, "Basics of Photography for Cultural Heritage Imaging", in E. Stylianidis, F. Remondino (eds.), *3D Recording, Documentation and Management of Cultural Heritage*, Caithness, 2016, pp. 127-251.

Vezzoli 2015
V. Vezzoli, "The Area of Bustan Nassif (Baalbek) between the 12th and the early 15th cent.: the Ceramic Evidence", in M. J. Gonçalves, S. Gómez-Martínez (eds.), *Proceedings of the 10th International Congress on Medieval Pottery in the Mediterranean, Silves and Mértola, 22-27 October 2012*, Mértola, 2015, pp. 133-138.

Vezzoli 2016
V. Vezzoli, *La céramique islamique d'Apamée de Syrie. Histoire de l'occupation du Quartier Nord-Est du xii^e au xiv^e siècle*, Fouilles d'Apamée de Syrie 3, Académie Royale de Belgique, Brussels, 2016.

Vokaer 2011
A. Vokaer, *La Brittle Ware en Syrie. Production et diffusion d'une céramique culinaire de l'époque hellénistique à l'époque omeyyade*, Fouilles d'Apamée de Syrie 2, Brussels, 2011.

Waksman 2002
S. Y. Waksman, "Céramiques levantine de l'époque des Croisades : le cas de productions à pâte rouge des ateliers de Beyrouth", *Revue d'Archéométrie* 26, 2002, pp. 66-77.

Wodzińska forthcoming
A. Wodzińska, "Methodology of Pottery Processing in Dongola", in A. Obłuski, D. Dzierzbicka (eds.), *Old Dongola 2018-2019. Vol. 2. Material Studies*, forthcoming.

Woelfel 2014
V. Woelfel, *Digital Archaeological Illustration for Ceramics: A Step by Step Guide to Creating a Ceramic Drawing in Adobe Illustrator*, 2014.

Yon 1981
M. Yon, *Dictionnaire illustré multilingue de la céramique du Proche Orient ancien*, Lyon, Paris, 1981.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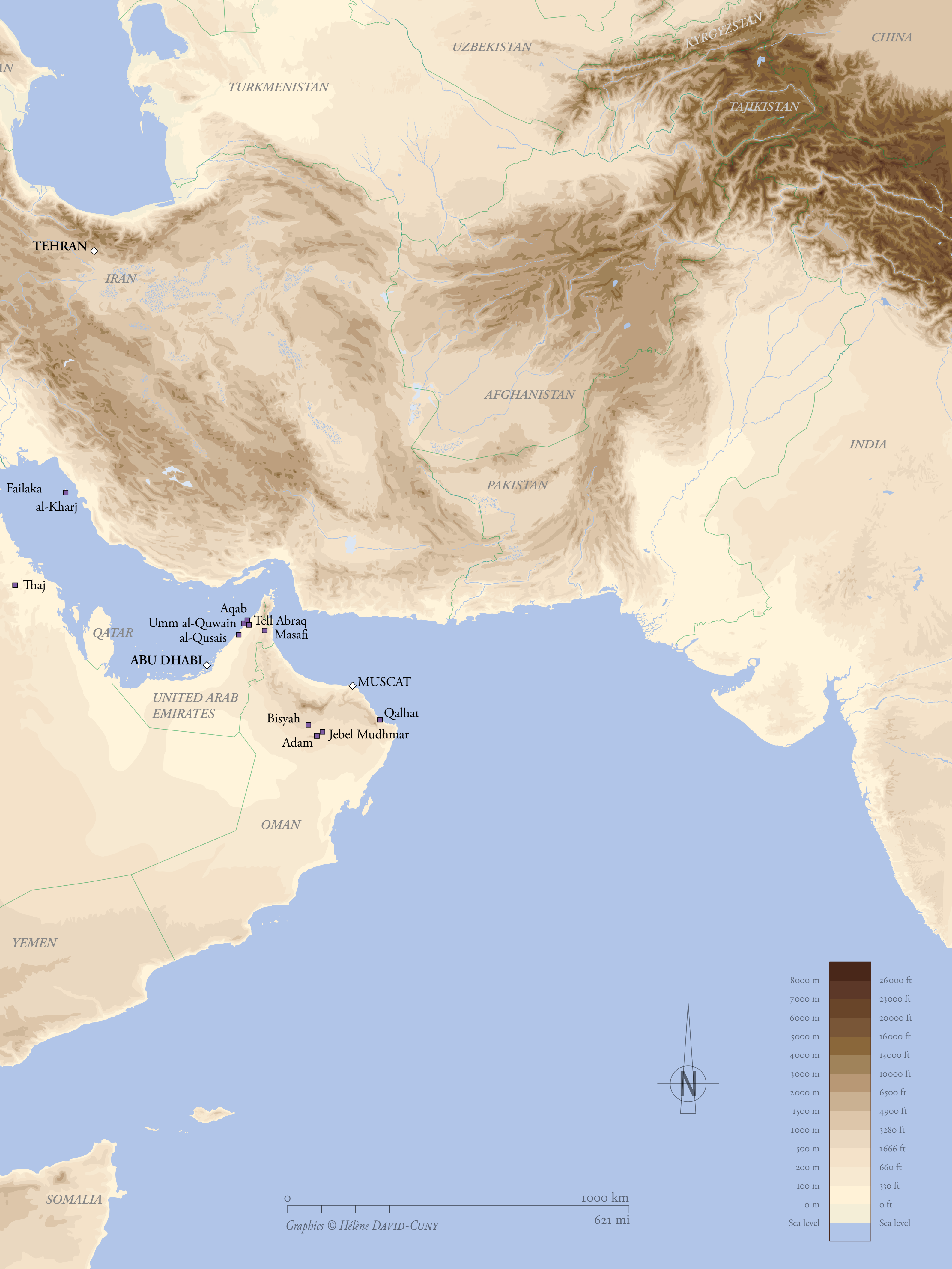

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24
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