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CONTENTS

INDIGENOUS POTTERY AFTER THE SPANISH CONQUEST OF MEXICO: POTTERS' REACTIONS TO THE NEW COLONIAL SOCIETY

Gilda Hernández Sánchez

Abstract

The enormous cultural transformation produced by the Spanish conquest of Mexico has been well studied. Chronicles and other historical documents provide a wide knowledge of changes the conquest introduced to the indigenous society. The effects of the conquest on the material culture, however, have not been adequately explored, although they offer a more representative perspective of the colonization. Presented here is a brief study of the changes and continuities of the ceramic technology in the Basin of Mexico after the conquest. Ceramic fragments are used to analyse how indigenous potters of the early colonial period (A.D. 1521–1620) reacted to those difficult times and to early stages of the new colonial society. Specifically, several steps of the operative process of pottery production are considered.

Introduction

The enormous cultural, social and economic transformation produced by the Spanish conquest of Mexico has been well studied. Thanks to the existence of a wide corpus of historical documents, today we know many aspects of the impact of the colonization in the indigenous society (i.e., Gibson 1964; Lockhart 1992; Terraciano 2001). The abundance of documentary information, nevertheless, has created an obstacle. As recently noted (i.e., Lightfoot 1995: 201; Little 2007: 54; Lyons and Papadapoulus 2002: 1), documents usually offer a biased vision, especially in situations of colonialism. In Mexico, for example, most of the surviving colonial documents were written by the colonizers. Consequently, many historical interpretations based on those texts represent the Spaniards as active agents of progress while the indigenous peoples are shown as passive receptors. At the same time, material culture has been relatively little considered in studies of the Mexican colonial period, even though it offers a more representative, and inclusive, perspective of the history than documents, as Peter van Dommelen points out (van Dommelen 2006: 112). Things, buildings, and material culture in general, provide a wider panorama in different aspects of ancient societies, including those details of the daily life that are obviated in documents. In this context, is a brief study of the impact of the Spanish conquest on the indigenous pottery technology in the Basin of Mexico (Figure 1). It uses ceramic fragments to explore how indigenous

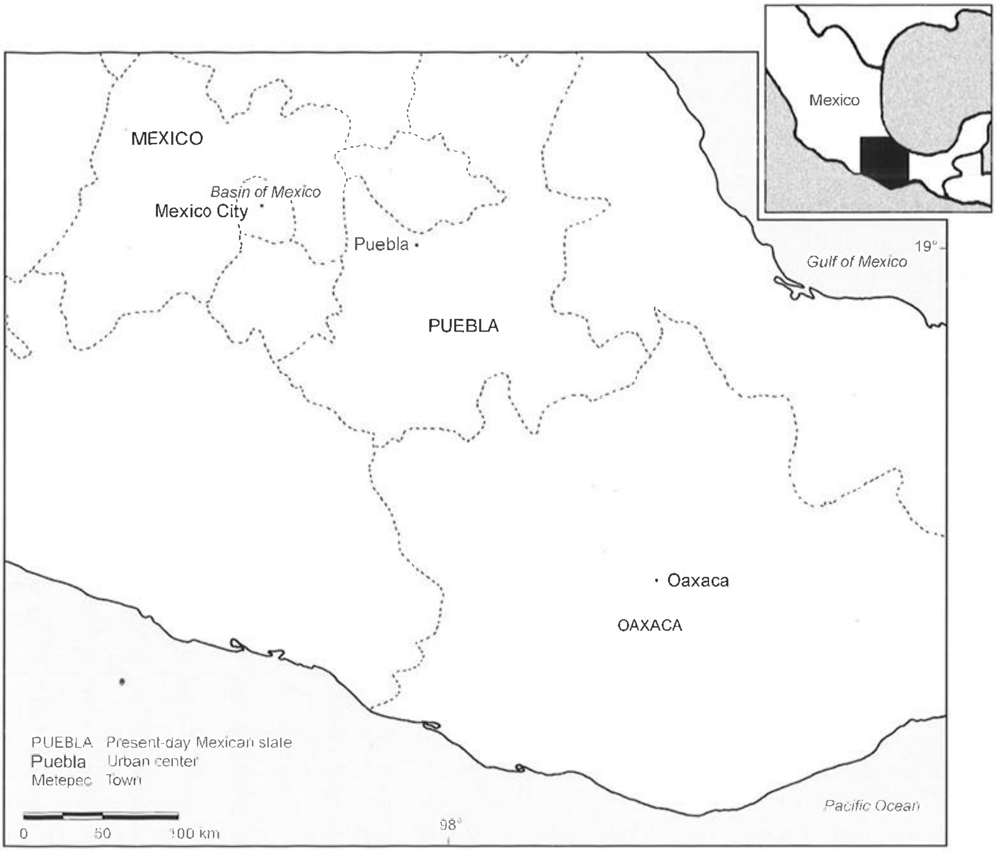

Figure 1. Location of the Basin of Mexico (based on World Länderkarte 1998).

potters of the early colonial period (A.D. 1521–1620) reacted to those difficult times and to the new colonial society that just began to be formed.

In pre-Hispanic and colonial Mexico, daily pottery – for cooking, serving, storing and transporting – was not recognized a fine handicraft. Like in many cultures of the world, potters and their products were often marginalized. As evidence we see that they are almost invisible in pre-Hispanic and colonial documents from that region. In spite of this apparent lack of importance, quotidian pottery is intimately related to family organization and food habits. In potters' workshops it is also associated to specific motor skills, transmission of knowledge, environmental conditions, distribution channels and local economy. In other words, pottery is close to people's life. It is, therefore, related to the manner in which people react to a colonial society. Within this framework, pottery is a viable medium to study the impact of Spanish colonialism in the indigenous material culture of Mexico.

Studying a pottery technology

According to Sander van der Leeuw (1993: 241, 256), it is not nature but culture that is the main determinant of a pottery technology. Thus, neither raw materials nor tools determine the manufacturing techniques, rather than the conceptualization that potters have about their technology. That is, how potters themselves conceive vessel shapes, how they divide them and in which sequence they are made. Their ideas about these aspects are fundamental conceptual elements of any pottery technology since they underlie the ways in which a particular culture deals with the problems encountered in the material world (van der Leeuw 1993: 259).

These conceptualizations are resistant to change since they are shared and people are largely unaware of their existence. Given that they involve motor habits usually learned during childhood, they are rooted in potters and resistant to change (Gosselain 2000: 192). The manufacture of pottery, furthermore, involves other aspects. Potters take decisions about clay selection, its extraction, processing and firing. These issues seem to reflect the interaction network of the potter, and accordingly can be easily modified (Gosselain 2000: 192). Potters also take decisions about vessel shape, surface finishing and decoration. These are visible and openly show potters behaviour, and in consequence they can be simply and often modified (Gosselain 2000: 191). Thus, if every step of the operative process is studied in detail, from conceptualization to decoration, we can have better insights into the development of a pottery technology.

Pottery technology in the Basin of Mexico

Early colonial period (A.D. 1521–1620) ceramics from the Basin of Mexico offer a useful perspective on Spanish conquest impact on the indigenous material culture. This region was occupied during late pre-conquest times by Nahua (Aztec) people. From A.D. 1350 till the Spanish conquest the Aztec empire had a big sizable impact in central and south Mexico. Spanish colonization there was more pervasive than elsewhere in Mesoamerica. Nahua people had a highly developed pottery technology before the Spaniards arrived, which has been well studied (i.e., Cervantes et al. 2007; Hodge and Minc 1990; Whalen and Parsons 1982). After the conquest, pottery did not disappear, and even today it is still produced in several communities that specialize in traditional pottery for cooking, serving and transporting. Moreover, in comparison to other regions where colonial pottery has been studied minimally, several analyses of early colonial pottery resulted in typologies and tentative dating (Charlton et al. 2007; Lister and Lister 1982; Whalen and Parsons 1982).

The colonial pottery of the Basin of Mexico, however, is not without its problems. As Thomas Charlton and colleagues point out, archaeological materials from sealed deposits from the conquest are scarce (Charlton et al. 2007: 429). The same applies for materials from contexts corresponding to short intervals between A.D. 1521 and 1620. Furthermore, it is not valid to make a straightforward correlation between indigenous pottery and indigenous users, neither between Spanish pottery and Spanish users. Today we know that the distribution patterns of vessels from both technologies were more complex (i.e., Rodríguez 2005).

In spite of these limitations, during the early colonial period indigenous pottery in the Basin of Mexico continued to be produced. Potters borrowed some methods, vessel shapes and decorations of the Spanish pottery tradition. Some attributes substituted those of pre-Hispanic times; others were reinterpreted and combined with native elements resulting in new styles. In addition, there were innovations that do not seem directly related to either technology. Considering such a varied panorama, this study involves all types of pottery vessels produced in the Basin of Mexico during the early colonial period, being of indigenous or Spanish traditions. The exception is the Majolica Ware. This pottery was introduced by Spaniards to the American colonies, and by the end of the sixteenth century Mexico City became an important producing centre. However, the manufacturing technology, vessel shapes and decoration of Majolica, and even the organization of its production, remained strongly related to Spanish pottery technology, and without influence of indigenous technology (Lister and Lister 1982).

At the time of Spanish conquest, pottery of the Basin of Mexico consisted mainly of vessels for cooking, storing and transporting. All have an orange surface. In archaeological typologies they are grouped as Orange Ware. Also there were service vessels (for eating, drinking and collective serving), which include Orange Burnished Ware, also known as Aztec Ware, or the decorated version, Aztec Black on Orange, or Red Ware, or less frequently Polychrome Ware. Besides, there was Smoothed Plain Ware, which consisted of censers and braziers. After the conquest, these wares did not disappear but experienced changes. The Spaniards introduced the Glazed Ware and the Majolica Ware, as well as a few European and Asian pottery imports.

The existing collections from the Basin of Mexico permit investigation of the following steps of its operative process:

(a) forming technique, which reflects potters' conceptualization,
(b) firing technology, which may reflect potters' interaction networks,
(c) vessel shapes,
(d) surface finishing, and
(e) decoration, this and the previous two aspects show potters' preferences.

(a) Forming technique

Post-conquest the conceptualization that indigenous potters have about their technology does not seem to change. That is, manufacturing traces left on the pots show that artisans continued using the same forming methods, and diving every pot in the same sections during its production process (i.e., jars are constituted of three horizontal parts: bottom, shoulder and neck, while small bowls have only one part). During the last pre-colonial centuries vessels were made with horizontal moulds (that is, moulds of horizontal sections of the vessels), and this suggests that potters conceived their vessels as composed of horizontal parts. Vessels were then completed using coiling and modeling techniques. In the early colonial period vessels continued to be made with horizontal moulds, and finished with coils and modeled elements.

After the conquest, the Spaniards introduced the potter's wheel to form vessels. This device, which in Europe had a long tradition, is usually considered a technical improvement since it increases productivity and standardization. However, during the colonial period, and even at the present, Mexican potters probably did not perceive the wheel as an important technical advantage (Foster 1960: 101; Katz 1977: 124–125), instead it was perceived as a risk, given that it was expensive and required new motor skills. Moreover, the speed and standardization attributed to the wheel were already obtained using the indigenous manufacturing methods (Nicklin 1971: 39). Thus, the potter's wheel was only sparsely and selectively used in the Basin of Mexico during the early colonial period, as different kinds of vessels of that time show. For example, still in production were: (1) vessels with pre-Hispanic shape and surface finishing showing traces of being produced with horizontal moulds, (2) vessels of the Smoothed Plain Ware, with some shapes typical of the indigenous tradition and other of the Spanish tradition, were made in mould, and (3) glazed vessels with shapes of indigenous and Spanish origin were mostly made in mould; the few cases made with potter's wheel have exclusively shapes of Spanish origin (Charlton et al. 2007: 489–490).

(b) Firing technology

The firing technology in Mexico during late pre-colonial times is poorly known, given the remarkable scarcity of published information on pottery workshops (i.e., Charlton et al. 2008; Winter and Payne 1976). In general it is assumed that pottery kilns were a Spanish introduction, since they have not been found in pre-Hispanic contexts until now, although it might also be that archaeologists have not yet managed to locate them. In any case, the Spanish introduction of the two-chamber kiln (Figure 2) probably was widely accepted by indigenous potters. At the present it is used in most workshops, even in conservative and isolated communities. The kiln's ability to save fuel surely attracted indigenous potters.

In the colonial period changes in the indigenous firing technology were made possible by the novel two-chamber kiln. Higher temperatures sustained for longer periods were more suited for glazed vessels, which require comparatively higher temperatures to melt the glaze (Rye 1981: 24, 44). The kiln, however, did not promote better control of the firing temperature. On the contrary, colonial pottery displays different levels of care and control of the firing process. For example, the pre-Hispanic Aztec Burnished Serving Ware usually exhibit good firing quality, versus the post-conquest pottery. Firing, among other aspects, deteriorates, as evidenced by the higher frequency of vessels with firing clouds and black cores (Charlton et al. 2007: 436, 440). The Burnished Ware disappears at the end of the period. Red Ware, in contrast, shows better firing control, and a general improvement, after the conquest (Charlton et al.

Figure 2. Two-chamber kiln of potter Juan García in Texcoco, a town in the Basin of Mexico that specializes in traditional pottery. This present-day kiln is similar to those introduced by the Spaniards in the sixteenth century. It has two chambers separated by a grate; on the bottom the firewood is placed and pots are put into the main chamber.

2007: 446). Thus, the changes in firing technology during the early colonial period coincide with the different trends of the pottery of the Basin of Mexico. Some wares deteriorated and vanished by the close of this period, while others flourished in the colonial society.

(c) Vessel shapes

According to the vessel shapes, it seems that during the early colonial period indigenous food habits did not have significant changes (Figure 3). In general pre-colonial vessel forms for cooking and storing continued after the conquest, although they occasionally show minor stylistic variation, in rim shape (Charlton et al. 2007: 436). In few cases, indigenous vessel shapes were substituted by Spanish shapes of equivalent functions; for example, the pre-colonial tripod bowl began to be replaced with the Spanish plate (Figure 4). This tendency of replacement, however, is more frequent after the early colonial period. The Spaniards introduced a few vessel shapes for needs that did not exist before, such as candlesticks. Introductions were again more common after this period.

Pre-Hispanic ceremonial vessels, such as censers with long modeled handle, disappear in early colonial times (see Figure 3aa). Service vessels, both the quotidian Aztec Burnished Ware as well as the fine Polychrome Ware, do not show changes in shape after the conquest, but they disappear at the end of early colonial times. Red Ware, in contrast, evidences great colonial creativity. Towards the end of the period potters began to produce Red Ware with Spanish shapes, such as candlesticks, cups, small pitchers, salt plates and lids (Charlton et al. 2007: 445–452). Red Ware was likely familiar to Spaniards, given that in the Iberian Peninsula a tradition of red vessels existed since Roman times. Most likely for this reason it was easily integrated in the new colonial society.

Glazed Ware is difficult to date; therefore it is still not clear how vessel shapes changed through time. Some tripod *molcajetes*, the common pre-Hispanic bowls with rough incised bottoms for grinding chilies and other ingredients for sauces (see Figure 3v), were produced and glazed during the early colonial period. Also, a few other cooking and service vessels of indigenous origin were glazed (Charlton et al. 2007: 486). Overall, indigenous vessel shapes still continued during early colonial times. Only when the period ends did major morphological changes begin, which signal changes in food habits and food service patterns.

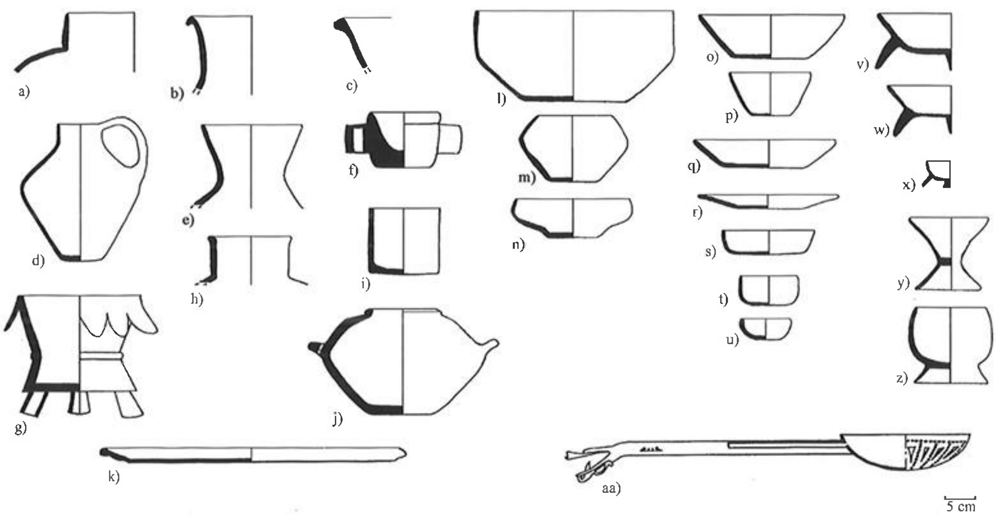

Figure 3. Vessel shapes in the Basin of Mexico during late pre-conquest times: (a, b, c, d, e, h) jars; (f, g) censers; (i) vase; (j) bowl with composite silhouette; (k) griddle or *comal*; (l, m, n) big bowls for cooking, storing or collective serving; (o, p, q, r, s, t, u) bowls, some for individual serving; (v, w, x) tripod bowls, for individual serving; (y, z) goblets; (aa) censer with frying-pan handle (based on García et al. 1999: Fig. 6).

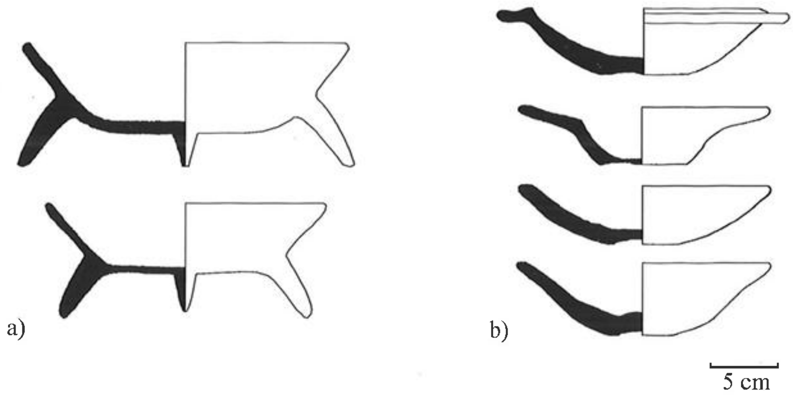

Figure 4. In early colonial times a few indigenous vessel shapes were substituted with equivalent Spanish shapes: (a) indigenous tripod bowl (modified from García et al. 1999: Fig. 6) that began to be replaced by the Spanish plate (b) (based on Somé and Huarte 2002: 232).

(e) Vessel surface finishing
After the conquest, pre-Hispanic vessel surface finishing associated with socially visible pottery, for example the Orange Burnished Serving Ware, deteriorated and disappeared as the early colonial period ended. In contrast, pre-Hispanic surface finishing related to less visible vessels, like the smoothed orange cooking and storing vessels, decayed in quality, but persisted. The surface finishing of Red Ware, associated with socially visible vessels, also continued (Charlton et al. 2007: 447), possibly due to its similarity to Spanish pottery. Thus, during this period pre-colonial surface finishing shows two tendencies. Finishes associated with vessels for visible contexts, like celebrations and other special occasions of food consume with guests, disappeared. Second, the time and care invested in finishing the surface of all visible and less visible vessels decreased. With exception of the Red Ware, there seems to have been an overall decline of the indigenous pottery technology.

At the end of the early colonial period, Glazed Ware became more frequent. Today it is the most common surface finishing of traditional pottery in the Basin of Mexico, both of vessels associated with visible as well as less visible contexts. Glazing, which in the Iberian Peninsula had a long tradition, is considered a technical advantage since it decorates and makes a vessel impermeable with little investment of time and effort. It seems that indigenous early colonial potters partially accepted this Spanish introduction, since still today it is used in some regions, like the Basin of Mexico, but not in others, like the Mixtec Highlands (i.e., Houben 2006) or the south of the state of Puebla (i.e., Druc 2000; Lackey 1981). The extra costs required for obtaining the glazing powder and the higher fuel requirements probably have been limitations since the conquest.

(f) Vessel decoration

After the conquest, pre-Hispanic decorative patterns formerly limited to a certain ware were now found on different wares. For example, in the early colonial period the Red Ware maintained its pre-Hispanic decoration, but also incorporated a pattern of lines and geometrical designs that earlier was exclusive of the Aztec Burnished Ware (Charlton et al. 2007: 450). Also tripod vessels of Aztec Burnished Ware included new supports, like those modelled in form of butterfly antenna, eagle, lion and duck heads, claws and faces of bearded men (Charlton et al. 2007: 442). Most of these supports were already present in late pre-Hispanic vessels of other regions outside the Basin of Mexico; however it is only after the conquest that they were applied to Aztec vessels. Furthermore, motifs of European origin began to be integrated in vessels with typical indigenous shape and decoration. For example, Aztec Black on Orange vessels maintained their characteristic pre-colonial decoration with lines and curvilinear motifs, but also included new motifs in European style as birds, fishes, leaves or flowers (Charlton et al. 2007: 441–443) (Figure 5). This suggests that in early colonial times the rigid pre-Hispanic stylistic canons for pottery imposed by the Aztec empire were relaxed.

In addition are polychrome vessels, which according to their shape and decoration were used as serving ware in feasts and as ritual paraphernalia (Hernández 2005), they show significant changes in decoration. In pre-Hispanic times some polychromes were painted with typical symbols of the religious and ritual iconography of central Mexico. After the conquest these vessels were still produced, however the symbols with clear religious and ritual connotations were no longer depicted. On the other hand, relative uncomplicated motifs, like flowers, feathers and volutes, continued to be represented until the disappearance of this ware at the end of the early colonial period. Aztec public rituals vanished after the conquest, probably along with the vessels used in those ceremonies, that is, the vessels with religious decoration. However, the persistence of polychrome vessels with other "harmless" motifs suggests that in early colonial times special occasions, like feasts, where these fine vessels were used still existed.

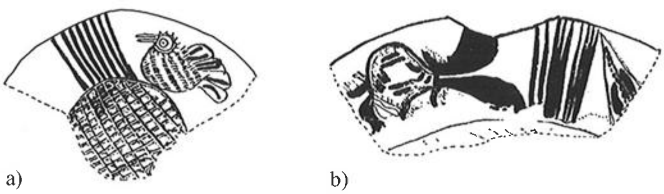

Figure 5. Aztec Black on Orange tripod bowls with the characteristic pre-colonial decoration of lines and curvilinear elements, plus motifs in European style, as (a) birds, and (b) flowers (based on Noguera 1975: Fig. 60).

Reactions of the indigenous pottery to the conquest

Pottery from the Basin of Mexico reacted to the Spanish colonization in a complex manner. Only few years post-conquest several tendencies toward change and continuity were already present, although they became increasing evident by the end of the early colonial period. Since the sixteenth century, potters made modifications in vessel shapes, surface finishing and decoration, while manufacturing techniques were maintained, and have survived until the present.

Thanks to J. Lockhart (1992) and C. Gibson (1964), we know that many aspects of the indigenous culture and society survived the early colonial period. It is until around A.D. 1620, when the Spanish program of relocation of indigenous communities became general, that the indigenous society began to be transformed. A similar result occurred with the pottery of the Basin of Mexico. During early colonial times there were some changes in vessel shapes, surface finishing and decoration, but most aspects remained unchanged. Not until the end of that period do such traits began to disappear and be replaced with a few Spanish equivalents or innovations. Also by the end of early colonial times new vessel shapes appeared, evidencing new food habits.

In addition, two tendencies in pottery production in that period include a general deterioration of the ceramic technology, and a spurt of creativity. The former is seen in the decreasing quality of surface finishing and firing. On the other hand, creativity is discernable in new vessel shapes. Spanish decorative elements incorporated on typical pre-colonial vessels, and decorative patterns, once limited to specific wares, start to be exchanged between wares. Both tendencies suggest a weakening of regional control of pottery production. In late pre-Hispanic times, the Aztec empire had a strong control on crafts production and exchange (Hodge and Minc 1990: 433); the government imposed tribute and regulated the big regional markets. After the conquest, when the Aztec empire collapsed, potters were surely more flexible and independent.

The well-known colonial introductions (potter's wheel, two-chamber kiln and glazing) affected in different degrees the pottery technology of the Basin of Mexico. In principle, the potter's wheel was capable of changing the conceptualization of the potters, however, it was not accepted by most indigenous craftsmen. The two-chamber kiln was adopted, but it had specifically an effect on the efficiency of vessel production and in its decoration. Glazing was also incorporated, and it had an effect on decoration and vessels' use. The conceptualization that potters had about their technology, however, was not affected by these introductions. That is, craftsmen continued forming pots in the same way as in pre-colonial times (using the same manufacturing techniques, sequences and shapes). Consequences of the early colonial potters' reaction to these technical innovations are still visible. Today, traditional vessels of the Basin of Mexico look different to those of pre-colonial times; however, their forming methods, sequence of manufacture and visualization of their constitutive parts are similar to that of the past. Thus, the basic principles that guided the relationship between potters and the material world before the conquest seem to be the same.

All this suggests that the transformation of the pottery industry occurred in potters' interaction networks and in their behavior. The conceptualization of their technology, in contrast, continued unchanged. Thus, probably the transmission of knowledge was not disrupted, and families and communities of potters were maintained. The relationship between them, their rules, organization and distribution networks, however, likely changed primarily due the epidemics that decimated the population, and the collapse of the Aztec trade system, in addition to other social and economical factors consequence of the conquest.

Potters' reactions to the conquest can be seen as a form of resistance, although this is a somewhat problematical concept (Rowlands 1998: 331). As Given (2004: 11) points out, a common colonial stereotype is the idea that when colonizers try to assimilate the local culture, resistance persists due to strong attachments to the traditional culture. Resistance is more complex. In material culture it involves several levels and mechanisms of rejection, acceptance, reinterpretation and innovation, as well as an impulse of creativity. The potters of the Basin of Mexico during the early colonial period are a good example.

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EARLY OSTIONAN OSTIONOID CERAMIC COMPONENT OF THE EL CABO SITE, DOMINICAN REPUBLIC: A MORPHOLOGICAL, TECHNOLOGICAL AND STYLISTIC CERAMIC EXAMINATION BASED ON AN ATTRIBUTE ANALYSIS

Cortney J. St. Jean

Abstract

This article is the product of research conducted for a Master of Arts dissertation by the author (St. Jean 2008) on a collection of Early Ostionan Ostionoid ceramics excavated at the El Cabo site in the Dominican Republic. It presents the results of a comprehensive morphological, technological and stylistic ceramic examination based on an attribute analysis with analytical vessels functioning as the unit of analysis. Since a limited amount of research has been conducted on Ostionan Ostionoid ceramics as compared to other known ceramic materials of the prehistoric Caribbean, this study provides important insight into the dynamics of Ostionan Ostionoid ceramics. Following a comparison with other Ostionan Ostionoid ceramics, tentative results demonstrate similarities between the Ostionan Ostionoid ceramics from the El Cåbo site and those of other Ostionan Ostionoid assemblages from Puerto Rico, Jamaica, the Bahamas and other regions of the Dominican Republic.

Introduction

The Early Ostionan Ostionoid ceramics are an intricate component of a larger, more complex Caribbean archaeological riddle. The Ostionoid development[1], one of several contentious debates among Caribbeanists centres upon the origin of the Ostionoid peoples, the presumed ancestors of the Taínos. Although the Ostionan Ostionoid ceramics are only a single facet of the Ostionoid culture, understanding the dynamics, variability and distribution of their existence can deliver much resolve in the investigation of the Ostionoid development. In its original delivery (St. Jean 2008), this research focused upon the Ostionan Ostionoid ceramics as well as their position within the Ostionoid development as it relates to the cultural framework of the Greater Antilles and the "Pre-Arawak Pottery Horizon".[2] In this article the research is primarily a medium for the investigation of the Early Ostionan Ostionoid ceramics from the El Cabo site in the Dominican Republic. Derived from the investigation, a comparison is made between the El Cabo Ostionan Ostionoid ceramics and the Ostionan Ostionoid ceramics of other selected assemblages. Together, the results of the analysis and

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comparison provide important information on the nature of Ostionan Ostionoid pottery. Admittedly, archaeological research has expanded well beyond the realm of artifactual qualification and quantification. However, a comprehensive understanding of the fundamentals of Early Ostionan Ostionoid ceramics is currently incomplete. This study sets out to determine what constitutes Early Ostionan Ostionoid pottery since previous investigations are neither common nor elaborate. The analytical approach implemented in this analysis is rather unconventional for Ostionan Ostionoid ceramics. The morphological, technological and stylistic examination of the pottery is based on an attribute analysis with analytical vessels serving as the unit of analysis. An attribute analysis allows each individual characteristic to be recorded independently of one another. The use of analytical vessels serves as a practical manner of attempting to reconcile individual artifacts into probable objects. The original M.A. research also included a detailed low-tech fabric analysis[3] to determine the variability in fabric and inclusion features, an exploratory statistical analysis[4] to determine the possible relationships between various attribute states and a self-test analysis[5] to determine the repeatability of the attribute analysis conducted by the researcher. However, these aspects of the analysis could not be adequately demonstrated here and were therefore omitted.

Site background

This research is based upon an examination of the Early Ostionan Ostionoid ceramic material excavated from two test units during the 2007 field work campaign at the Late Ceramic Age site of El Cabo in the Dominican Republic. Perched on a stretch of limestone coastline, this multi-period coastal village site was first thought to be occupied from 600 to 1400 C.E.[6] but with the recent discovery of typical Spanish exchange items such as glass beads and glazed pottery, the site's excavators now argue that it was likely occupied by indigenous peoples until the first few decades of the 16th century (Hofman et al. 2005: 3, 24-25; Hofman and Samson, personal communication, 2008).

The site of El Cabo was discovered by Elpidio Ortega in 1978 who excavated two test units yielding ceramic sherds, stone and coral objects as well as some bone and food remains (Hofman et al. 2007b: 4). Ortega, an associate of the Museo del Hombre Dominicano, determined that El Cabo represents two distinctive occupational phases. He used the presence of both Ostionoid and Boca Chica pottery to support his interpretation. Unfortunately, the site has been subjected to much damage since the initial test excavations took place. Local looters and collectors found their way to the site, littering it with large, illegally dug pits which have destroyed significant portions of the site.

El Cabo was revisited by the researchers of the Museo del Hombre Dominicano in the late 1990's during which time a survey revealed large elevated middens containing ceramic fragments, shell food remains and human bones (Hofman et al. 2007a: 5). In 2004, a survey carried out by Leiden University, University College London and the Museo del Hombre Dominicano confirmed that the El Cabo site would serve as an excellent location for further in depth investigations as part of the research project 'Living and Dying in a Taíno Community' (Hofman et al. 2005: 2; Hofman et al. 2007a: 3). El Cabo has been the location of four archaeological field work campaigns since 2005 cumulatively generating an impressive array of artifacts as well as hundreds of features including three burials (Hofman et al. 2005, 2007a).

From the large scale excavations and multiple geophyiscal assessments, it was determined that the El Cabo site extends 150 to 160 m inland from the coast and 280 m north to south making the site approximately 40,000 m^2 (Hofman et al. 2007b: 4). Based on the stratigraphic analysis of the excavated units, two overlapping occupational phases were identified, an Ostionoid phase as well as a later Chicoid phase, confirming Ortega's original interpretation. El Cabo can roughly be divided into two, more concentrated areas of occupation with earlier Ostionoid habitations to the north and west and a later Ostionoid Chican (Taíno) settlement to the south. Examples of the artifactual finds include a complete boat-shaped vessel with D-shaped handles, anthropomorphic and zoomorphic *adornos*, polished greenstone objects, axes, adzes, stone flakes, a diorite bead, pendants and a fragment of an igneous stone collar (Hofman et al. 2005: 26-30). Due to the high density of posthole features and pits containing food remains unearthed during the excavations, it is clear that the site was heavily occupied from the seventh to sixteenth century (Hofman et al. 2005: 3, 24-25).

Methodology

Selection of ceramic sample

The research material utilized for this project was excavated during the 2007 fieldwork campaign at the El Cabo site. In addition to the regular excavations in 2007, eight extra test units of 2 × 2 m, comprising four 1 × 1 m squares, were excavated in artificial levels of 10 cm. The ceramic material recovered from the two northernmost test units, each denoted by the southwest square, 75-26-62 and 84-34-80, is the subject matter of this analysis. In terms of the ceramic material recovered from 75-26-62 and 85-34-80, "one square from each unit was selected as a sample square from which all sieved remains were collected. The rest of the squares were sieved and 25 percent of ceramics, tools, and diagnostic artifacts were selected from the sieve from each artificial layer" (Samson 2007, unpublished site report). The material under study in this analysis was selected from the totality of ceramics (100 percent) recovered from 75-26-72 (southeast square of unit 72-26-62) and 85-34-80 (southwest square of unit 85-34-80) as well as a from the 25 percent of the ceramics excavated from squares 75-26-62, 75-26-63, 75-26-73, 85-34-81, 85-34-90 and 85-34-91 which were sampled only for rim sherds and other ceramic fragments deemed interesting in the field. Since the Early Ostionan Ostionoid and Chican Ostionoid pottery from the two test units recovered were found to be mixed throughout all the artificial layers, the author was assisted by Dr. Corinne Hofman who carefully separated out the Early Ostionan Ostionoid ceramics from the Early Ostionan

Ostionoid-Chican Ostionoid admixture. The final result of this selection as well as those in the field mentioned above saw all the ceramics which could confidently be associated to the Early Ostionoid development, which included rim sherds larger than 5 cm as well as various other ceramic fragments such as appendages, *adornos*, griddles and base fragments from the two test units grouped together to form the material under study in this analysis. From there, the two test units' rim sherds were grouped into analytical vessels based on physical mends and matching as well as upon the comparison of decoration, inclusion characteristics, overall shape and key measurements including rim and wall thickness. Body sherds present in the field sample assemblage taken from the two squares 75-26-72 and 85-34-80 which were completely (100 percent) sampled were disregarded from the analysis if they could not be confidently matched to potential analytical vessels. Due to the fragmented nature of the assemblage, vessel mending was very difficult.

A complete rim sherd capable of serving as part of an analytical vessel is one in which the interior surface, the lip and the exterior surface are intact. Having only complete rim sherds represent analytical vessels serves to minimize the occurrence of misinterpretations. As stated above, rim sherds of 5 cm or larger either in height, width or both were preselected in the field for shipment to Leiden University from squares 75-26-62, 75-26-63, 75-26-73, 85-34-81, 85-34-90 and 85-34-91. Naturally, the rim sherds from the total assemblages taken from squares 75-26-72 and 85-34-80 were also sent to Leiden University for analysis. Therefore, all analytical vessels in this study have been reconstructed based on rim sherds of 5 cm or greater. A total of 52 analytical vessels and 7 other ceramic fragments including appendages, *adornos* and griddles comprise the research sample. The number of analytical vessels in this analysis does not represent the minimum number of possible vessels from the two test units but rather those which could be confidently identified and reconstructed.

Use of analytical vessels

The examination of the pottery is based on an attribute analysis with analytical vessels serving as the unit of analysis. Analytical vessels are individual sherds grouped together under the assumption that they originate from the same vessel. The use of analytical vessels as the basis for an analysis is more conducive to a researcher's attempts at reconstructing the artifacts as they once were in order to describe their composition and proportion to one another. Using an analytical vessel approach in this situation is more appropriate because the researcher can first attempt to mend the individual rim sherds into possible vessels than record their characteristics (see Espenshade 2000 for an example in Caribbean literature). An analytical vessel approach obliges the researcher to consider the individual artifacts as well as the complete vessels which those artifacts used to represent. This is particularly important for pottery studies since determining the variability in decoration, inclusions and shapes as well as their percentage of occurrence which is frequently utilized in inter-site comparisons, are common fundamental research objectives. A weakness of analytical vessels, as discussed by Martelle (2002:

148-151), is the shear difficulty in reconstructing them. Analytical vessels are an ideal unit of analysis; they are certainly not the most practical in terms of laboratory time management.

In comparison, the use of an individual rim sherd approach only allows the researcher to consider artifacts as individual finds. For example, a larger pot tends to break into more pieces than a smaller pot. A researcher conducting an individual rim sherd analysis would conclude that all the physical characteristics of the larger pot are more common than those of the smaller pot simply because there are more individual pieces of the larger pot. This may be an untrue conclusion. Using an analytical vessel approach helps to minimize the over- or under-representation of various vessels. When an assemblage is examined according to individual sherds, systematic bias in the results are much more likely to occur. Physical mends and matching sherds of the same decoration, shape and physical propositions serve as the primary methods employed to group sherds into analytical vessels. The analytical vessel approach is more accurate in depicting the artifactual reality. Thus, by trying to avoid biases of certain vessel characteristics, the ceramics of the two test units from El Cabo are studied in terms of analytical vessels.

Use of attribute analysis

Since this study depends upon the researcher's ability to inter-compare multiple characteristics of the Early Ostionan Ostionoid ceramics recovered from El Cabo as well as compare those to the ceramics of other Early Ostionoid collections, a typological approach could not have permitted the kind of analytical capacity required for this research. As demonstrated by several researchers (see Espenshade 2000; Hamburg 1999; Hofman 1987, 1999; Hofman and Jacobs 2000/2001; Lundberg 1992, 1999; Martelle 2002; Ramsden 1977; Rice 1987; Rogers 2006; Smith 1983; Wright 1967, 1980 for example), the use of an attribute analysis is a logical approach since it permitted the researcher to compare all attributes of a vessel's characteristics independently of one another.

An attribute analysis is an effective method of recording the physical characteristics of the ceramic collection. It is useful because it allows for the recording of relatively detailed information about each analytical vessel and other ceramic fragments which permits a wider range of comparisons to be made and research questions to be resolved. This is very important for archaeologists who are trying to understand matters of cultural affiliation, population mobility and exchange networks. In an attribute analysis, the ceramic sample's characteristics are recorded independently of one another. For example, the presence of a certain rim form is not assumed to determine the presence of a particular decorative style nor is the occurrence of a type of griddle form expected to perpetually coincide with a certain mineral inclusion. Recording each physical characteristic separately allows the researcher the opportunity to cross-compare individual attribute states independently between both various analytical vessels as well as various other ceramic pieces such as *adornos* or griddles. This leads to a much larger variability in the number of possible relationships which can be tested both within the assemblage and with other collections. Various combinations of characteristics that might exist within an assemblage are more readily identified. This is important for establishing a definitive interpretation of the ceramics as opposite to a disorderly fusion of the most frequently occurring characteristics which do not necessarily appear together. This approach helps to eliminate the danger of lumping certain individual characteristics together in order to formulate typologies which inaccurately represent assemblages. Independently recording the attributes also helps to eliminate any of the researcher's preconceived notions set in motion through prior research experience with a similar collection of ceramics. For example, if a researcher is analyzing a particular vessel reflective of another pot previously studied, conducting an attribute analysis forces the researcher to analyse each of the particular characteristics of the latest vessel instead of automatically assuming homogeneity and recording it in exactly the same fashion as the first vessel encountered. Attribute analyses do not attempt to lump certain individual characteristics together nor do they limit the possibility of various combinations of characteristics from existing ones. Despite the fact that attribute analyses are structured on the basis of selecting categorical attribute states, this approach, as promoted by Wright (2006: 45), is an excellent balance between both the particular and the general views.

As Knappett (2005: 673) argues "the archaeologist rarely sets out to study pottery exhaustively, choosing instead to focus on a selection of [...] the variable features that pottery exhibits – size, shape, fabric, texture, hardness, strength, shaping method, surface treatment and decoration [...]." In this study, morphological, technological and stylistic attributes of the ceramic sample are recorded using two previously established methodologies. The first methodology, developed by Hofman (1987; 1993; 1999) and later clearly laid out by Hofman et al. (2007a) especially for the analysis of the El Cabo site's ceramics, structures the bulk of the attributes and associated attribute states recorded in this research. A secondary methodology for measuring selected attributes created by Smith (1983) and later refined (Smith 1991, 1997) was also implemented in order to supplement the latter methodology. The combination of the two attribute methodological approaches generates a balanced analytical formulation for the research at hand. Each of the attributes measured has a determined range of attribute states in which to match the ceramic samples in order to record the characteristic in question. Table 1 is a summary of each attribute comprised in this analysis. The range of attribute states for each attribute examined do not appear in this table.

Early Ostionan Ostionoid ceramics of El Cabo

Each attribute is structured upon the basis of several attribute states which together, reflect the entire range of variability found within that particular characteristic. A total of 25 attributes each with a varying number of attribute states are measured including for example vessel shape, lip form, wall thickness, surface finish, inclusion density and decoration. The researcher did not find it permissible to simply present the most frequently occurring attribute states of each attribute, glue them together

Morphological features	Attributes of form	Vessel shape Wall profile – exterior Rim orientation Rim exterior profile I – simplified Rim exterior profile II – elaborated Rim interior profile Lip form I – simplified Lip form II – elaborated Angle of lip interior Appendages Adornos Griddles
	Attributes of size	Lip width Vessel diameter Vessel wall thickness
	Attributes of colour	Colour interior Colour exterior Firing condition Surface finishing interior Surface finishing exterior Red slip
Technological features	Attributes of inclusions	Inclusion density Inclusion shape (roundness) Inclusion grain size
Stylistic features	Attributes of decoration*	Decoration

* Under stylistic feature, one attribute, decoration is examined.

Table 1. Attributes examined by the researcher.

and make the most typical Ostionoid ceramic vessel from the assemblage. This would be incorrect and frankly, quite inappropriate. Instead the researcher has individually recorded and subsequently presented the variability in each attribute recorded. Overall, the Early Ostionan Ostionoid assemblage demonstrated great variability in several attributes as demonstrated below.

Morphological features

Attributes of form

Vessel shape

In terms of the vessel shape, all 52 analytical vessels were measurable for this attribute. Understandably, the seven non-analytical vessel ceramics under study in this research were not considered for this attribute. A total of 26 analytical vessels exhibit an unrestricted vessel shape with simple contours. This is the most frequently occurring vessel shape. Table 2 demonstrates the frequencies of all the attribute states in detail. Masked by this attribute analysis is the presence of two boat-shaped analytical vessels among the ceramic sample.

	Frequency	Percent
unrestricted vessel with simple contour	26	50.0
restricted vessel with a simple contour	17	32.7
unrestricted vessel with a composite contour	8	15.4
restricted vessel with a composite contour	1	1.9
Total	52	100.0

Table 2. Frequencies of analytical vessel attributes: vessel shape.

Wall profile – exterior

In terms of exterior wall profile, 51 analytical vessels were measurable for this attribute. The exterior wall profile of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. The two most frequently occurring exterior wall profiles recorded in this assemblage are bowls with a convex wall with the largest part of the diameter under the half of the vessel at 34.6 percent and bowls with a straight wall with an angle greater than 50 degrees at 30.8 percent. Table 3 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
bowl with a straight wall with an angle > 50	16	30.8
dish with a straight wall with an angle > 50	2	3.8
bowl with a convex wall with largest diameter under the half of the vessel	18	34.6
bowl with a concave wall with largest diameter above the the half of the vessel	9	17.3
bowl with a straight wall with corner point	4	7.7
bowl with a concave wall with corner	2	3.8
Total	52	100.0

Table 3. Frequencies of analytical vessel attributes: wall profile – exterior.

Rim orientation

In terms of rim orientation, 51 analytical vessels were measurable for this attribute. The rim orientation of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. A total of 29 analytical vessels demonstrate a vertical rim orientation. This is the most frequently occurring rim orientation. A total of nine analytical vessels exhibit an outflaring rim orientation. This is the least frequently occurring rim orientation. Table 4 presents the frequencies of all attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
vertical	29	55.8
outflaring	9	17.3
insloping	13	25.0
Total	52	100.0

Table 4. Frequencies of analytical vessel attributes: rim orientation.

Rim exterior profile I – simplified

In terms of the simplified rim exterior profile, 51 analytical vessels were measurable for this attribute. The simplified rim exterior profile of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. The two most frequently occurring simplified rim exterior profiles recorded in this assemblage are convex at 48.1 percent and straight at 44.2 percent. Table 5 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
straight	23	44.2
concave	2	3.8
convex	25	48.1
extra convex	1	1.9
Total	52	100.0

Table 5. Frequencies of analytical vessel attributes: rim exterior profile I – simplified.

Rim exterior profile II – elaborated

In terms of the elaborated rim exterior profile, 51 analytical vessels were measurable for this attribute. The elaborated rim exterior profile of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. A total of 33 analytical vessels demonstrate a straight-vertical elaborated rim exterior profile. This is the most frequently occurring elaborated rim exterior profile. Table 6 demonstrates the frequencies of all attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
straight, vertical	33	63.5
horizontal	2	3.8
flaring	2	3.8
outflaring	5	9.6
incurved	9	17.3
Total	52	100.0

Table 6. Frequencies of analytical vessel attributes: rim exterior profile II – elaborated.

Rim interior profile

In terms of the rim interior profile, 51 analytical vessels were measurable for this attribute. The rim interior profile of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. The most frequently occurring rim interior profile recorded in this assemblage is concave at 63.5 percent. One analytical vessel demonstrates an extra concave rim interior profile. This is the least frequently occurring rim interior profile. Table 7 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
straight	14	26.9
concave	33	63.5
extra	1	1.9
convex	3	5.8
Total	52	100.0

Table 7. Frequencies of analytical vessel attributes: rim interior profile.

Lip form I – simplified

In terms of the simplified lip form, 51 analytical vessels were measurable for this attribute. The simplified rim exterior profile of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. The two most frequently occurring simplified lip forms recorded in this assemblage are flat at 51.9 percent and rounded at 42.3 percent. Table 8 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
flat	27	51.9
rounded	22	42.3
bevelled	2	3.8
Total	52	100.0

Table 8. Frequencies of analytical vessel attributes: lip form I – simplified.

Lip form II – elaborated

In terms of the elaborated lip form, 51 analytical vessels were measurable for this attribute. The elaborated lip form of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. The two most frequently occurring elaborated lip forms recorded in this assemblage are round unmodified with 13 analytical vessels and flat outward thickened with nine analytical vessels. Table 9 presents the frequencies of the recorded attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
round unmodified	13	25.0
round external taper	1	1.9
internal taper	1	1.9
flat unmodified	3	5.8
inward thickened internal semi-cylindrical bolster	1	1.9
inward thickened, rounded	1	1.9
inward thickened, taper	2	3.8
inward thickened, wedge	4	7.7
outward thickened external semi-cylindrical bolster	1	1.9
outward thickened external bolster, taper	2	3.8
outward thickened, rounded	1	1.9
outward thickened, flat	9	17.3
outward thickened, taper	1	1.9
outward thickened, border	1	1.9
outward thickened, wedge	3	5.8
double thickened, rounded	1	1.9
double thickened, flat 1	1	1.9
double thickened wedge, bilateral	5	9.6
Total	52	100

Table 9. Frequencies of analytical vessel attributes: lip form II – elaborated.

Angle of lip interior

In terms of the angle of lip interior, 51 analytical vessels were measurable for this attribute. The angle of lip interior of one analytical vessel could not be confidently determined. The seven other non-analytical vessel ceramics under study in this research were not considered for this attribute. A total of 30 analytical vessels exhibit an obtuse angle of lip interior. This is the most frequently occurring angle of lip interior. Table 10 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
indeterminate/unknown	1	1.9
acute	15	28.8
right	6	11.5
obtuse	30	57.7
Total	52	100.0

Table 10. Frequencies of analytical vessel attributes: angle of lip interior.

Appendages

A total of three ceramic samples under study in this analysis are appendages. Two are D-shaped handles and one is a spout-like lug. One handle occurs with an analytical vessel, one handle occurs with an *adorno* (Figure 1).

Adornos

In terms of the four adornos which occur without their vessel context, three are interpreted as anthropomorphic appliqués and one, which occurs on a handle, is a zoomorphic appliqué. *Adornos* are infrequent decorative morphological features which are rather difficult to generalize into a simple attribute category. Therefore, a simple differentiation between zoomorphic and anthropomorphic appliqués has been made. Figure 2 presents all the *adornos* present in the assemblages including those recorded under Attribute States of Decoration.

Griddles

In terms of the presence of griddle sherds in the ceramic sample under study, only two of the 59 ceramic samples are griddle fragments, therefore, these were the only two which were considered for the identification of the griddle type. One ceramic sample has been identified as a perpendicular or straight griddle fragment measuring 23.58 mm thick and the other as has been recognized as an unthickened or flat (pancake shape) griddle sherd measuring 12.78 mm thick.

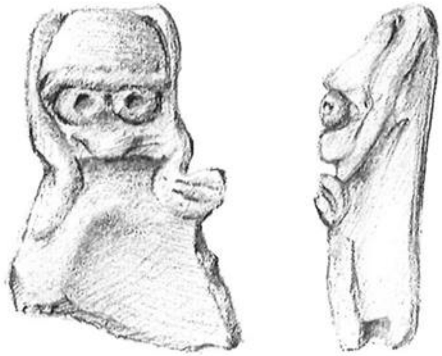
Figure 1. Total appendages from the ceramic sample.

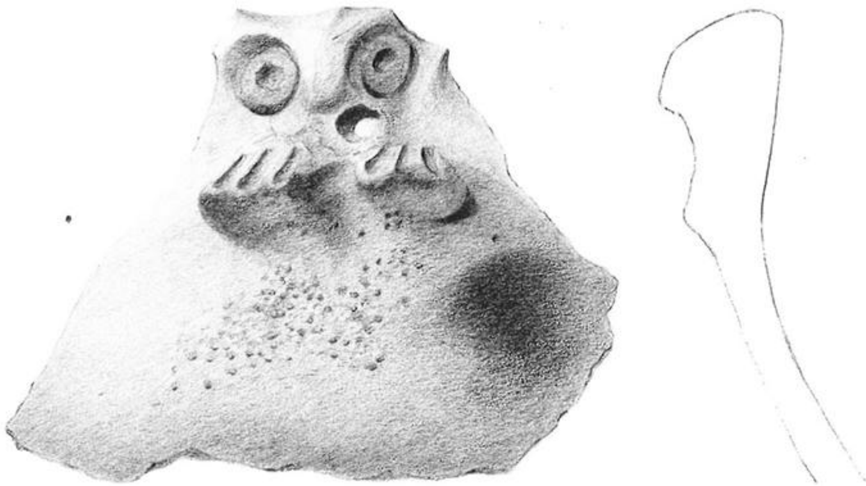
Attributes of size

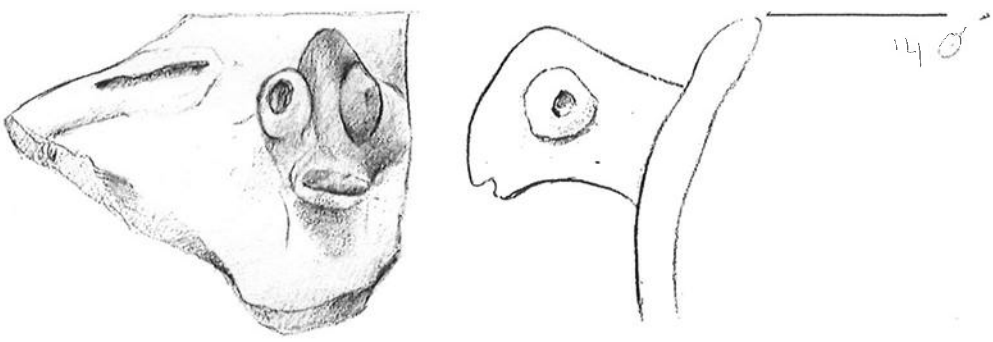
For lip width and wall thickness, the measurement was recorded at a precision of 0.01 mm. For vessel diameter, the measurement was recorded at an accuracy of 1 cm with a vessel diameter chart. However, for all three of the metric attributes recorded, including lip width, wall thickness and vessel diameter, measurement binned categories are established in order to facilitate the representation of the results. A summary of the important statistical figures for the three metric attributes may be seem in Table 11.

	N	Mean	Mode	Median	Standard deviation	Minimum	Maximum	Range
Lip width (mm)	50	6.68	5	5.78	3.27	2.36	16.2	13.84
Wall thickness (mm)	52	5.9	6.08	5.86	1.03	3.23	8.51	5.28
Vessel diameter (cm)	32	25.75	26	26	5.74	12	35	23

Table 11. Summary of important results for interval/ratio-level data.







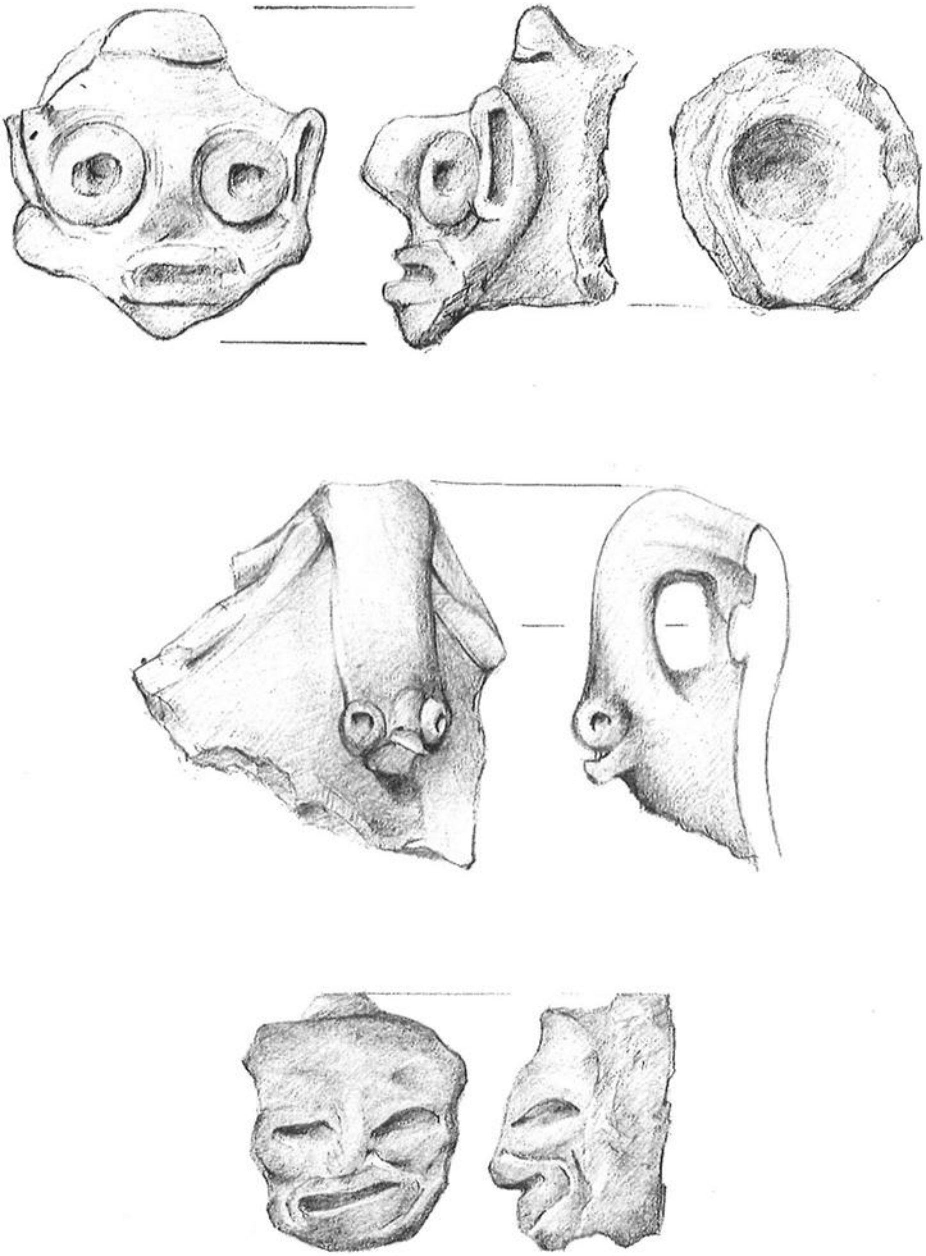


Figure 2. Total *adornos* from the ceramic sample (scale 1:1).

Lip width
In terms of lip width, 50 analytical vessels were measurable for this feature. The distribution of recorded lip widths in millimetres can be seen in Figure 3. It is observable from this histogram that lip widths of approximately 4-5 mm are the most frequently occurring measurements whereas those greater than 16 mm are the least frequently occurring. The distribution of the data can be labelled as positively skewed since the curve has what is commonly referred to as a 'positive tail' (Shennan 1988).

Vessel diameter
In terms of vessel diameter, 32 analytical vessels were measurable for this feature. The distribution of recorded vessel diameters in centimetres can be seen in Figure 4. It is observable from this histogram that recorded vessel diameters roughly produce a unimodal or normal distribution curve with the occurrence of one peak in the results. However, most of the recorded vessel diameters are located in the smaller diameter ranges. This kind of distribution might suggest the occurrence of mostly similar, medium to large sized vessels with infrequent vessels of greater and lesser diameters in the assemblage.

Vessel wall thickness
In terms of vessel wall thickness, all 52 analytical vessels were measurable for this feature. The distribution of recorded vessel wall thicknesses in millimetres can be seen in Figure 5. It is observable from this histogram that recorded vessel wall thicknesses roughly produce a unimodal or normal distribution curve with the occurrence of one peak in the results. However, most of the recorded vessel wall thicknesses are located in the range of approximately 5-7 mm with more vessel wall thicknesses occurring below this range than above.

Attributes of colour

Colour interior
In terms of the colour of interior, 58 ceramic samples were measurable for this attribute. One of the ceramic samples under study in this attribute could not be confidently determined. The cooking surface (smooth) of the two griddle sherd ceramic samples were taken as the interior surface and hence were recorded for the interior colour. A total of 12 ceramic samples exhibit a Hue 5YR 6/3, 6/4, 5/3, 5/4, 5/6, 6/6, 4/3, 4/4 light reddish brown to reddish brown and yellow red for the interior colour. This is the most frequently occurring colour interior. Table 12 demonstrates the frequencies of all the attribute states in detail.

Colour exterior
In terms of the colour of exterior, all 59 ceramic samples were measurable for this attribute. The non-cooking surface (rough) of the two griddle sherd ceramic samples

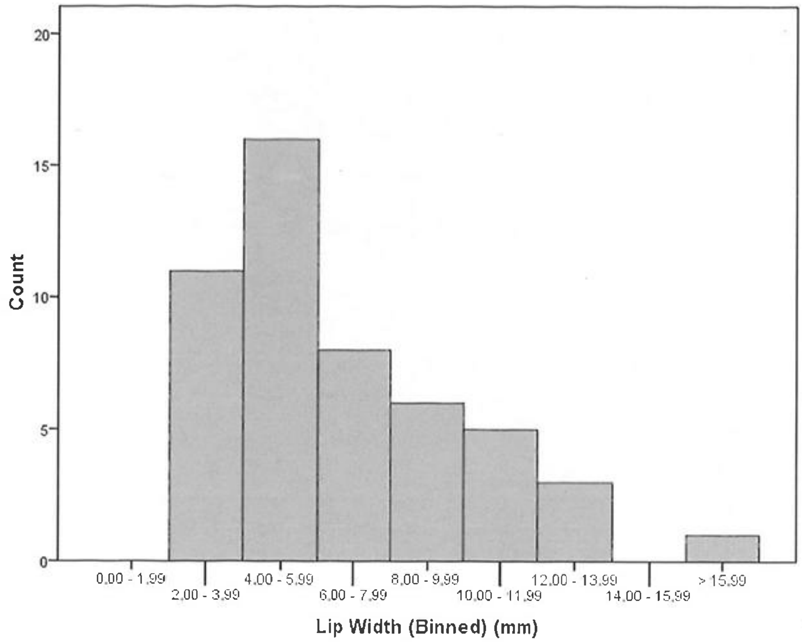


Figure 3. Distribution of lip width measurements.

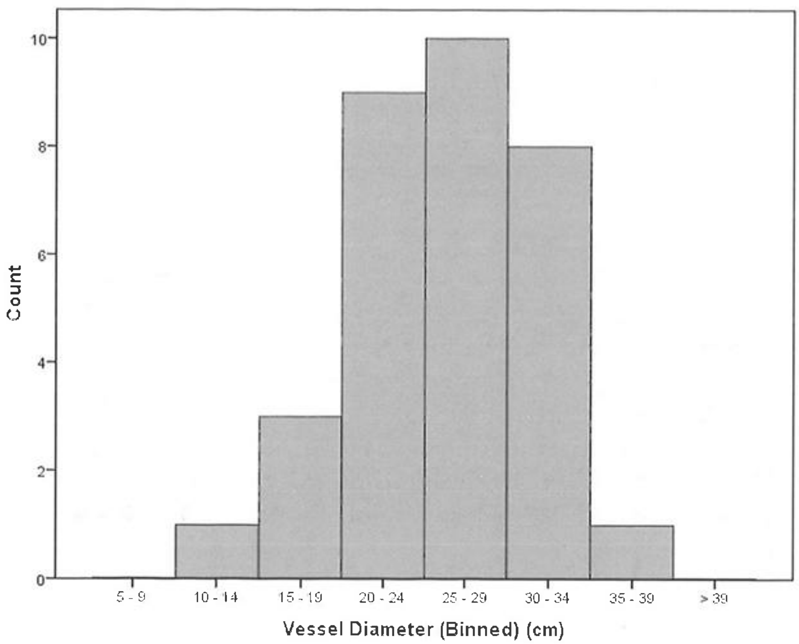


Figure 4. Distribution of vessel diameter measurements.

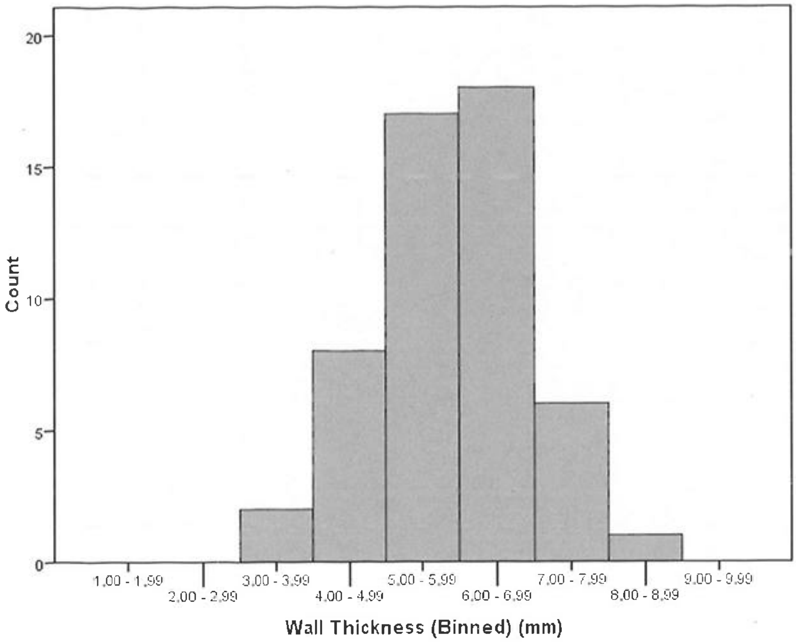


Figure 5. Distribution of wall thickness measurements.

	Frequency	Percent
Indeterminate/unknown	1	1.7
Hue 10YR 6/4, 6/3, 5/3, 5/4, 5/6, 5/8, 4/3, 4/4, 4/6 light brown-yellowish brown-brown	1	1.7
Hue 7.5YR 4/1, 3/1 dark to very dark grey	1	1.7
Hue 7.5YR 6/4, 5/6, 6/6 light brown-yellow	3	5.1
Hue 7.5YR 5/2, 5/4, 4/2, 4/3, 4/4, 3/2, brown-dark brown	8	13.6
Hue 5YR 7/1, 6/1, 5/1 light brown-grey	1	1.7
Hue 5YR 4/1, 3/1 dark grey-very dark grey	3	5.1
Hue 5YR 5/2, 4/2 reddish grey-dark reddish grey	3	5.1
Hue 5YR 6/3, 6/4, 5/3, 5/4, 5/6, 6/6, 4/3, 4/4 light reddishbrown to reddish brown and yellow red	12	20.3
Hue 2.5YR 5/3, 5/4, 4/3, 4/4 reddish brown	7	11.9
Hue 10R 5/6, 5/8, 4/6, 4/8 red	4	6.8
Hue 7.5YR 2.5/1; Hue 5YR 2.5/1 black	2	3.4
Hue 2.5YR 5/6, 5/8, 4/6, 4/8 red	9	15.3
Hue 7.5YR 6/3, 6/4 light brown	1	1.7
Hue 5YR 4/2; Hue 2.5YR 4/1, 3/1 dark reddish grey	2	3.4
Hue 7.5YR 8/3, 8/4, 7/3, 7/4 pink	1	1.7
Total	59	100.0

Table 12. Frequencies of analytical vessel attributes: colour interior.

were taken as the exterior surface and hence were recorded for the exterior colour. A total of 17 ceramic samples demonstrate a Hue 5YR 6/3, 6/4, 5/3, 5/4, 5/6, 6/6, 4/3, 4/4 light reddish brown to reddish brown and yellow red for the exterior colour. This is the most frequently occurring colour exterior. Table 13 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
Hue 10YR 3/1, 2/1, 2/2, Hue 7.5YR 3/1, Hue 5YR 2/1 very dark grey-black	4	6.8
Hue 10YR 6/4, 6/3, 5/3, 5/4, 5/6, 5/8, 4/3, 4/4, 4/6 light brown-yellowish brown-brown	2	3.4
Hue 7.5YR 6/1, 5/1 grey	1	1.7
Hue 7.5YR 4/1, 3/1 dark to very dark grey	1	1.7
Hue 7.5YR 6/4, 5/6, 6/6 light brown-yellow	1	1.7
Hue 7.5YR 5/2, 5/4, 4/2, 4/3, 4/4, 3/2, brown-dark brown	6	10.2
Hue 5YR 4/1, 3/1 dark grey-very dark grey	2	3.4
Hue 5YR 6/3, 6/4, 5/3, 5/4, 5/6, 6/6, 4/3, 4/4 light reddish brown to reddish brown and yellow red	17	28.8
Hue 5YR 3/2, 3/3, 3/4, 2/2 dark reddish brown	1	1.7
Hue 2.5YR 5/3, 5/4, 4/3, 4/4 reddish brown	2	3.4
Hue 10R 5/6, 5/8, 4/6, 4/8 red	3	5.1
Hue 7.5YR 2.5/1; Hue 5YR 2.5/1 black	2	3.4
Hue 2.5YR 5/6, 5/8, 4/6, 4/8 red	13	22.0
Hue 2.5YR 7/3, 7/4, 6/3, 6/4 light reddish brown	1	1.7
Hue 2.5YR 7/6, 7/8, 6/6, 6/8 light red	2	3.4
Hue 7.5YR 8/3, 8/4, 7/3, 7/4 pink	1	1.7
Total	59	100.0

Table 13. Frequencies of analytical vessel attributes: colour exterior.

Firing condition

In terms of the firing condition, all 59 ceramic samples were measurable for this attribute. A total of eight ceramic samples demonstrate an incompletely to relatively well oxidized reddish brown core and outerzones firing condition. This is the most frequently occurring firing condition attribute state. Table 14 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
complete reduction black core and outerzones	3	5.1
complete reduction dark grey core and outerzones	5	8.5
incomplete oxidation or reduction light grey core and outerzones	2	3.4
incomplete oxidation or reduction light grey core and red outerzones	5	8.5

	Frequency	Percent
incomplete oxidation or reduction light grey core and	4	6.8
reddish brown outerzones	2	3.4
incomplete oxidation black core and light grey outerzones	4	6.8
incomplete oxidation black core and red outerzones	6	10.2
incomplete oxidation dark grey core and red outerzones	6	10.2
complete oxidation red core and outerzones	8	13.6
incompletely or relatively well oxidized reddish brown core and outerzones	4	6.8
incompletely or relatively well oxidized brown core and outerzones	1	1.7
incompletely or relatively well oxidized black core and reddish brown outerzones	4	6.8
incompletely or relatively well oxidized dark grey core and	1	1.7
reddish red core and light grey exterior outerzone	3	5.1
red core and light grey interior outerzones	1	1.7
Total	59	100.0

Table 14. Frequencies of analytical vessel attributes: firing condition.

Surface finishing interior

In terms of the interior surface finishing, 58 ceramic samples were measurable for this attribute. One of the ceramic samples under study in this attribute could not be confidently determined. The cooking surface (smooth) of the two griddle sherd ceramic samples were taken as the interior surface and hence were recorded for the interior surface finishing. A total of 36 ceramic samples exhibit a smoothed interior surface finishing. This is the most frequently occurring interior surface finishing. Two ceramic samples demonstrate a polished interior surface finishing. This is the least frequently occurring interior surface finishing. Table 15 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
not applicable	1	1.7
crude	3	5.1
smoothed	36	61.0
lightly burnished	13	22.0
highly burnished	4	6.8
polished	2	3.4
Total	59	100.0

Table 15. Frequencies of analytical vessel attributes: surface finishing interior.

Surface finishing exterior
In terms of the exterior surface finishing, all 59 ceramic samples were measurable for this attribute. The non-cooking surface (rough) of the two griddle sherd ceramic samples were taken as the exterior surface and hence were recorded for the exterior surface finishing. A total of 27 ceramic samples demonstrate a smoothed exterior surface finishing. This is the most frequently occurring exterior surface finishing. Three ceramic samples demonstrate a polished exterior surface finishing. This is the least frequently occurring exterior surface finishing. Table 16 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
crude	4	6.8
smoothed	27	45.8
lightly burnished	19	32.2
highly burnished	6	10.2
polished	3	5.1
Total	59	100.0

Table 16. Frequencies of analytical vessel attributes: surface finishing exterior.

Red slip
In terms of the presence of red slip, all 59 ceramic samples were measurable for this attribute. A total of seven ceramic samples demonstrate the presence of a slip. Table 17 demonstrates the frequencies of the variability in the slip's placement in detail.

	Frequency	Percent
none	52	88.1
lip	1	1.7
all	3	5.1
outside and lip	3	5.1
Total	59	100.0

Table 17. Frequencies of analytical vessel attributes: red slip.

Technological features

Paste characteristics[7]

Inclusion density
In terms of the inclusion density, all 59 ceramic samples were measurable for this attribute. A total of 21 ceramic samples exhibit a common or 20 percent inclusion

density. This is the most frequently occurring inclusion density. One ceramic sample demonstrates an abundant or 40 percent inclusion density. This is the least frequently occurring inclusion density. Table 18 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
moderate 15 percent	10	16.9
common 20 percent	21	35.6
common 25 percent	18	30.5
very common 30 percent	9	15.3
abundant 40 percent	1	1.7
Total	59	100.0

Table 18. Frequencies of analytical vessel attributes: inclusion density.

Inclusion shape (roundness)

In terms of the inclusion roundness, all 59 ceramic samples were measurable for this attribute. A total of 19 ceramic samples exhibit sub-rounded with high sphericity inclusion roundness. This is the most frequently occurring inclusion roundness attribute state. One, ceramic sample demonstrates well-rounded with high sphericity inclusion roundness. This is the least frequently occurring inclusion roundness attribute state. Table 19 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
subangular with high sphericity	6	10.2
subangular with low sphericity	5	8.5
subrounded with high sphericity	19	32.2
subrounded with low sphericity	11	18.6
rounded with high sphericity	14	23.7
rounded with low sphericity	3	5.1
well-rounded with high sphericity	1	1.7
Total	59	100.0

Table 19. Frequencies of analytical vessel attributes: inclusion shape (roundness).

Inclusion grain size

In terms of the inclusion grain size, all 59 ceramic samples were measurable for this attribute. The two most frequently occurring inclusion grain size attribute states recorded in this assemblage are medium sand (grains measuring between 0.26 and 0.5 mm) with 24 ceramic samples and fine sand (grains measuring 0.25 mm or less) with 21 ceramic samples. Table 20 demonstrates the frequencies of all the attribute states in detail.

	Frequency	Percent
fine sand measuring less than 0.25 mm	21	35.6
medium sand measuring less than 0.50 mm	24	40.7
coarse sand measuring less than 1.0 mm	10	16.9
very coarse sand measuring less than 2.0 mm	3	5.1
granules measuring less than 4.0 mm	1	1.7
Total	59	100.0

Table 20. Frequencies of analytical vessel attributes: inclusion grain size.

Stylistic features

Attribute states of decoration

In terms of decoration, all 52 analytical vessels were examined for this attribute. The seven other non-analytical vessel ceramics including four *adornos* (one occurring with a handle), two griddle sherds and one handle piece under study in this research were not considered for this attribute. A total of 46 analytical vessels did not exhibit any form of decoration as delimited by the categories presented by Hofman et al. (2007a). Since such a small number of analytical vessels have decoration, each can easily be presented here (see also Table 21). One analytical vessel has red paint on the exterior, interior and lip surfaces. One analytical vessel has a modelled-incised zoomorphic appliqué or *adorno*. Two analytical vessels have incisions. Lastly, one analytical vessel exhibits two decorative attributes. This particular analytical vessel which appears to be boat-shaped, has the remnants of an *adorno* or modelled-incised appliqué of unknown nature (either zoomorphic or anthropomorphic) on the lip as well as an unique exterior surface treatment that consists of black and grey bands resembling a zebra pattern (Figure 6). Loe Jacobs (personal communication, 2008) believes that the black-greyish overlaying pattern was made with an organic paint, like a resin or that the pattern was sooted. This is a technique where part of the surface (the light part) is covered with soft clay. Next, the whole vessel is sooted in black smoke. After this the soft clay parts are removed leaving the decorative pattern.

	Frequency	Percent
none	46	88.5
incision (linear or curvilinear)	2	3.8
modelled-incised appliqué (zoomorphic)	2	3.8
other (organic black-grey resin or soot on exterior and remnants of adorno on lip)	1	1.9
monochrome red paint	1	1.9
Total	52	100.0

Table 21. Frequencies of analytical vessel attributes: attribute states of decoration.

Figure 6. Example of a unique decorative surface treatment.

The attribute analysis reveals great attribute state variability. For example, the elaborated lip form attribute recorded 18 different variations of lip form including round, flat, inward thickened, outward thickened and double thickened each with their own range of forms. Other attributes like exterior and interior colour as well as firing condition also demonstrated a large diversity in attribute states. In terms of vessel shape, both unrestricted and restricted vessels with simple contours are the most common. The presence of red slip and decorative features such as incision or modeled *adornos* are infrequent. The elaborate attribute analysis conducted here demonstrates the value of comprehensive artifactual analyses as well as the importance of a transparent analytical approach which can be attempted by others in order to confirm the results.

Early Ostionan Ostionoid ceramic in comparison

The results of the attribute analysis were used to compare the Early Ostionan Ostionoid ceramics from El Cabo to other Ostionan Ostionoid assemblages from Puerto Rico, the Dominican Republic, Jamaica and the Bahamas. These comparisons were made in order to acquire a better understanding of Ostionan Ostionoid ceramics and to determine the relationship among the various Ostionan Ostionoid assemblages. Unfortunately, to the researcher's knowledge, no other analysis of an Ostionan Ostionoid ceramic assemblage has been conducted in as much detail as found in the parent research (St. Jean 2008) of this analysis. Furthermore, only a relatively small number of scholars have examined Ostionan Ostionoid ceramics. In general, the Ostionan Ostionoid ceramics were both interesting and difficult to assess. Overall, the similarities between the assemblages from across the Greater Antilles is remarkable. As demonstrated through this preliminary comparison, the Ostionan Ostionoid ceramics are rather uniform in morphological, technological and stylistic dimensions.

Possibly the most widely used description of Ostionan Ostionoid ceramics among Caribbean archaeologists derives from Rouse (1986, 1992). Rouse (1986: 144) describes Early Ostionan Ostionoid ceramic material as conservative in order to emphasize its direct connection to Saladoid pottery. Rouse (1986: 144; 1992: 92-96) argues that Early Ostionan Ostionoid pottery is relatively well-made, thin, hard, fine and smooth as compared to Late Saladoid ceramic material. Ostionan Ostionoid pottery experienced a non-abrupt change from red paint to red slip which was first implemented on specific portions of a vessel such the base, shoulder and rim but later applied over the entire surface of the vessel which often also received a thorough polishing treatment. It is because of this evident characteristic that Ostionan Ostionoid ceramics are frequently referred to as redware. In terms of the Ostionan Ostionoid ceramics under study, a significant majority of the ceramic sample exhibit reddish exterior and interior surface colour but only 11.9 percent have red slip (see Table 17). Therefore, the inferred common presence of red slipped vessels in Early Ostionan Ostionoid ceramics should be reconsidered. The current ceramic sample also contains one analytical vessel exhibiting red paint over the exterior and interior surfaces (see Table 21). Furthermore, Rouse's description implies that polished vessel surfaces are typical. Again, in terms of the current Ostionan Ostionoid ceramics, only 3.4 percent of interior surfaces and 5.1 percent of exterior surfaces are polished (see Table 15 and Table 16). The most frequently occurring surface finish is smoothed and lightly burnished for both interior and exterior surfaces. Interestingly, Rouse (1992: 93) describes another surface treatment consisting of black-banded designs thought to be produced through smudging. Rouse (1992: 93) states that "the potter coated the surface on either side of the bands with a resin and smothered it during the firing process, so that the carbon from the fire was deposited instead of being combined with oxygen and carried off in the form of carbon dioxide. The resin melted off, removing all the carbon except on the bands themselves." Coincidently, an example of such a surface treatment is present in the current

Ostionan Ostionoid assemblage (Figure 6). Based on the results of this analysis, the researcher concludes that this surface finishing technique is rare. Rouse (1992: 92-93) states that the Late Saladoid decorative practises of incising, modeled incising and modeling which were used to produce anthropomorphic and zoomorphic *adornos* and head lugs are absent from Ostionan Ostionoid assemblages. According to Rouse (1992: 92-93), only Early Ostionan Ostionoid pottery contains modeled head lugs. In the relatively small ceramic sample under study, two analytical vessels exhibit linear incising and six modeled-incised *adornos*, both anthropomorphic and zoomorphic in form, are present (Figure 2). Perhaps these decorative techniques are not as absent as Rouse argues them to be. Rouse (1992: 92-93) states that overall, vessel shapes are simpler in Ostionan Ostionoid ceramics than the elaborate bell-shaped Saladoid pots. Early Ostionan Ostionoid vessels are straight-sided, open bowls which occasionally bear loop handles that terminate above the rim. In terms of the Ostionan Ostionoid analytical vessels examined here, both restricted and unrestricted vessels with simple contours are dominant vessel shapes (see Table 2) while bowls with a convex wall with largest diameter under the half of the vessel followed by bowls with a straight wall with an angle greater than 50 degrees are the two most common exterior wall profiles recorded (see Table 3). Therefore, Rouse's generalization of straight-sided open vessels is misleading. Furthermore, the two handles present in the El Cabo assemblage are D-shaped, not loop contrary to Rouse's notion that D-shaped handles ended with the disappearance of Late Saladoid ceramics (Figures 1 and 2).

Lee (2006) presents one of the few descriptions of Jamaican Ostionan Ostionoid ceramics which are also referred to as Jamaican Redware. Mostly known from 11 archaeological sites directly located on the southern coastline, Lee (2006: 155) quoting De Wolf (1953: 233) gives a brief introduction: "curvature of the surface; simplicity of decoration; ware, medium fine grained but poorly fired; colour, reds, tans and greys; average thickness 0.5 cm; shape, open bowls with some flat bottoms; shoulder, straight or incurving; rim, tapered to the lip; lip, rounded or flat; D-shaped handle, amorphous and tab lugs; some painting and rubbing of restricted area." Overall, this description conforms to what has been observed in the current Ostionan Ostionoid assemblage. However, some differences are evident. The firing conditions of the Ostionan Ostionoid ceramics examined from El Cabo greatly vary with the majority of the ceramic sample not exhibiting a poorly fired condition (see Table 14). As stated above, open bowls are not the only frequently occurring vessel shape. Although flat and rounded lip forms are the most common (see Table 8), the Ostionan Ostionoid assemblage under study exhibits an extensive array of lip forms (Table 9), which should not be ignored. Lee (2006) further elaborates upon this introductory description taken from De Wolf. He (2006: 156) argues that given his experience with the Jamaican Ostionan Ostionoid collections, fewer than 20 percent of the ceramic fragments are red slipped, which accordingly, tends to be limited to the exterior surface. As mentioned above, the current researcher subscribes to the notion that red slip is an infrequent characteristic of Ostionan Ostionoid pottery (see Table 17). Perhaps Rouse (1992: 92-93) unintentionally neglected to state that red slip, although according to him considered a diagnostic feature of Ostionan Ostionoid ceramics, is certainly not a predominant characteristic. Lee (2006: 156) notes that handles are always included in the painted or slipped zone of vessels. For example, "bowls with zoomorphic handles are almost always painted, while only the smallest of those with loop or D-shaped handles are" (Lee 2006: 156). Based on the single zoomorphic handle in the current assemblage, no red paint or slip is present either on the handle or the vessel. The other D-shaped handle in the El Cabo Ostionan Ostionoid assemblage is un-slipped or unpainted. Therefore, only the latter ceramic sample conforms to Lee's observation. Mirroring De Wolf's interpretation of Ostionan Ostionoid pottery, Lee (2006: 156) also argues that it is, in general, poorly fired as evidenced by black cores and frequent brittleness. As mentioned, the El Cabo Ostionan Ostionoid ceramics are not poorly fired. In fact, a remarkable feature is the durability (i.e. hardness) of most analytical vessels under study. Lee (2006: 156) estimates average Ostionan Ostionoid wall thickness to be between 4 and 5 mm with a range from 3 to 8 mm. In the current analysis, the mean wall thickness is 5.9 mm with a range of 3.23 to 8.51 mm. Lee (2006: 156) limits Ostionan Ostionoid lip forms to rounded. The researcher finds this characteristic the most disagreeable with her own ceramic sample. As demonstrated in Table 9, the variability in lip form is rather impressive given the small sample size. According to Lee (2006: 156), the Jamaican Ostionan Ostionoid griddles vary in thickness from 1 or 2 cm in the centre to over 4 cm at the rim. Of the two rim griddle fragments under study in this analysis, one measures 23.58 mm in thickness whereas the other is 12.78 mm thick. Therefore, these griddles are half as thick as some examples from Jamaican Ostionan Ostionoid ceramics. Lee (2006: 157) greatly elaborates upon handles which he classifies into five categories: D-shaped handle, looped, zoomorphic, geometric and amorphous tabs or lugs. Of these five types, the D-shaped handles are the most common. The current research sample contains three appendages, one D-shaped handle, one D-shaped handle with zoomorphic *adorno* and one spout-like lug (Figure 1). Although the sample size is extremely small, it matches well with Lee's observations. Lee (2006: 157) offers insightful details on the nature of Jamaican Ostionan Ostionoid zoomorphic handles. The most utilized creature was the turtle, with head and fore-flippers at one end of the vessel and tail and hindflippers at the other extremity. Other creatures depicted include crocodiles, snakes, parrots, ducks and various fish. In all cases, the potter would often emphasize the eyes, mouth, gills or fins with incising lines. The current ceramic sample contains one zoomorphic *adorno* handle clearly seen at the bottom left of Figure 2.

In addition to Lee (2006), Keegan and Atkinson (2006) describe the Early Ostionan Ostionoid ceramics found in Jamaica. In a very general manner, Keegan and Atkinson (2006: 22) state that Ostionan Ostionoid ceramics are "distinguished by simple hemispherical and boat-shaped vessels, frequently decorated with red paint." Thus far unmentioned in the latter descriptions, boat-shaped vessels infrequently occur in Ostionan Ostionoid assemblages. In the current ceramic sample, two (3.8 percent) of the analytical vessels are clearly boat-shaped. The authors (2006: 24) also note that Jamaica's Little

River pottery, argued by Howard (1965) as distinct enough to warrant its own name is often mistaken as Jamaican Redware or Ostionan Ostionoid. Unfortunately, the authors do not describe what differentiates the Little River pottery from its Ostionan Ostionoid counterpart.

Chanlatte Baik (2003: 240) describes the AGRO-III Early Taíno or Early Ostionan Ostionoid ceramics as simple and of an inferior production quality in comparison to the AGRO-I (Huecoid) and AGRO-II (Saladoid) ceramics. In fact, Saladoid ceramics are regarded as one of the most finely made pottery in the Americas. Chanlatte Baik (2003: 240) continues with his description by stating that the first AGRO-III (Ostionan Ostionoid) ceramics had only a pinkish slip on the exterior surface for decoration until later when incised motifs and modeled figurative handles depicting local animals emerged. In terms of the presence of red slip in the current ceramic sample, 11.9 percent or 7 ceramic samples exhibit this characteristic of which 1.7 percent occur only on the lip, 5.1 percent occur on the exterior surface and the lip and 5.1 percent occur uniformly over the entire vessel. It is therefore difficult to determine whether partial slipping preceded complete slipping or whether the two methods existed contemporaneously. Chanlatte Baik (2003: 240) adds that the animals were not naturalistic in appearance. Considering the appearance of the *adornos* present in the current assemblage, confidently identifying the potter's intended representation is challenging. Like Keegan and Atkinson (2006), the occurrence of boat-shaped vessels is noted, as is the importance of griddles. This is a very basic description of Ostionan Ostionoid ceramics which does not illustrate the ceramics very well. However, given its context, it was clearly not the author's intension to provide a detailed look at these ceramics.

Hofman et al. (2007b) examine the ceramic collections of four sites in the eastern Dominican Republic, namely Punta Macao, Punta Cana, La Iglesia and El Cabo in order to propose a simplification of the ceramic chronology utilized in the region. Hofman et al. (2007b) begin by describing the proposed Early Ostionan Ostionoid ceramics which are of the greatest relevance to the current research. In general, the authors (2007b: 8) characterize Early Ostionan Ostionoid pottery as thin, painted, rounded and with navicular vessel shapes. In terms of the current assemblage, painted and boat-shaped vessels, as mentioned above, are quite rare. Therefore, it is difficult to say whether such features should be considered diagnostic of Ostionan Ostionoid ceramics since they do not represent the majority of the pottery. Nevertheless, the authors (2007b: 10-11) elaborate on what defines Early Ostionan Ostionoid ceramics. Hofman et al. (2007b: 10-11) describe the basic vessel shaping technique as coiling. Unfortunately, the current researcher did not examine the assemblage in terms of forming techniques. The Early Ostionan Ostionoid ceramics exhibit a wide variety of shapes (see Espenshade 2000) with simple and composite contoured vessels as well as boat-shaped vessels (Hofman et al. 2007b: 11). From the results of the current analysis, this description is confirmed although as noted above, boat-shaped vessels are rare with only two samples present in the assemblage. Vessel lips are most often round or flat (Hofman et al. 2007b: 11). The author agrees with this characterization since these are the two most frequently occurring lip forms in the current assemblage. However, Ostionan Ostionoid lip forms, as demonstrated here, are quite variable with over a dozen different forms present in a relatively limited sample. According to Hofman et al. (2007b: 11), vessel walls are relatively thin averaging around 5 mm, which roughly conforms to the current research findings (see Table 11). Hofman et al. (2007b: 11) delimit exterior and interior surface finishing to smoothing, burnishing, polishing, as well as red and cream slipping with the majority of the vessels, regardless of surface treatment, demonstrating a reddish colour. Additionally, some Early Ostionan Ostionoid ceramics exhibit a use of white clay and some have a dark grey or black colour produced through the application of a resin. All of these characteristics have been confirmed by the current detailed attribute analysis with the exception of a vessel consisting of white clay, which is absent from this assemblage. Perhaps in a larger ceramic sample, an example of a white clay vessel would be present. In terms of appendages and decoration, vessels typically have D-shaped handles and decoration is principally in the form of small nubbins, vertical thickening of vessel walls, geometric modeling mostly on rims as well as modeled incised anthropomorphic and zoomorphic appliqués or *adornos* (Hofman et al. 2007b: 11). As stated above, D-shaped handles and modeled-incised anthropomorphic and zoomorphic *adornos* are present in the current assemblage as is two examples of linear incising. Although vertical thickening of vessel walls, nubbins or geometric modeling was not found, they should not be ignored as possible characteristics of Early Ostionan Ostionoid ceramics.

Carlson (1995: 89) gives a preliminary overview of the Ostionan Ostionoid ceramics from the Coralie site on Grand Turk in the Bahamas. The ceramics are hard with a red surface colour as a result of the paste or the presence of what Carlson (1995: 89) calls a "self-slip which is reportedly produced by wet-finishing vessels toward the end of the drying phase." The term "self-slip" is rather ambiguous and perhaps should be reconsidered. Decoration is rare with just under 1 percent of the collection exhibiting simple modeling or incisions (Carlson 1995: 89). This finding is not unusual given the typical rarity of such characteristics. Carlson (1995: 89) divides the Coralie site collection into two categories. Firstly, a fine ware which is hard, thin and exhibits an even-tooled finish with mostly sand inclusions, that accounts for two-thirds of the assemblage and, secondly, an ordinary ware which is thicker, unevenly finished with heavy sand and grit inclusions that represents one-third of the collection. The current ceramic assemblage does not contain a portion of 'ordinary ware' as Carlson describes it but this could be a result of the small sample size. However, no other scholar has suggested that some Early Ostionan Ostionoid ceramics are not finely made. Carlson (1995: 89) suggests that Ostionan Ostionoid ceramics exhibit remarkable variability in vessel types because based on her small assemblage, 11 different forms including griddles, boat-shaped bowls and dishes, necked vessels, open bowls, bell-shaped bowls as well as boat-shaped loop handled bowls are present. Although the current researcher has opted to present vessel shapes in a general manner because the analytical vessels utilized are largely incomplete, the variability in Ostionan Ostionoid vessel types demonstrated by Carlson is also echoed by Espenshade (2000).

Espenshade (2000: 2) provides a description of the characteristics of the PO-21 site's (south central Puerto Rico) Early Ostionan Ostionoid assemblage based on a sherd attribute analysis. This is followed by an analytical vessel analysis, which demonstrates the range of vessel types in Ostionan Ostionoid ceramics. According to Espenshade (2000: 2), painted and incised ceramics are extremely rare representing less than two and one percent of the assemblage respectively. This is representative of the current ceramic assemblage as well in which one ceramic sample is painted (1.9 percent) and two ceramic samples are incised (3.8 percent). Furthermore, smoothed and semi-burnished ceramics are the dominate surface feature accounting for over 80 percent of the collection. In the current ceramic assemblage, 83 percent of the interior and 77 percent of the exterior of vessels have smoothed or lightly burnished surfaces (see Table 15 and Table 16). In terms of surface finishing, these two collections are practically identical. Very coarse to granule limestone/sandstone and medium and/or coarse limestone/sandstone as well as grog are the dominant inclusion types found in the PO-21 assemblage. The inclusions found in the El Cabo Early Ostionan Ostionoid ceramics are more variable and consist of different dominant minerals (see St. Jean 2008: 148-160). According to Espenshade (2000: 2), D-shaped handles and three-dimensional lugs are absent whereas two-dimensional lugs and loop handles are infrequent (2000: 4). As mentioned, two D-shaped handles are the only handles represented in the current ceramic assemblage. From the analytical vessel analysis, ten vessel forms are represented at PO-21, including a manioc griddle. There are between two and eight examples of each vessel form presented. Espenshade (2000: 5) argues that additional uncommon forms are likely not captured by his analysis. Espenshade is the first researcher to attempt a detailed categorization of vessel shapes for Ostionan Ostionoid ceramics based on vessel shape as well as sooting and abrasions. The variability in Ostionan Ostionoid vessel types and function, as presented by Espenshade (2000) is remarkable.

The results of the attribute analysis conducted in this research have been dissected in comparative terms against other interpretations of Ostionan Ostionoid ceramics from Puerto Rico, the Dominican Republic, Jamaica and the Bahamas. Aspects of the morphological, technological and stylistic facets of Ostionan Ostionoid ceramics were considered. The researcher, given the lack of detailed knowledge on Ostionan Ostionoid ceramics sought out a proper representative understanding of what constitutes Early Ostionan Ostionoid ceramics in the Greater Antilles. Unfortunately, a relatively small number of scholars have examined Ostionan Ostionoid ceramics. Therefore, meaningful interpretations of the pottery's characteristics are limited. To the researcher's knowledge, the current analysis of Ostionan Ostionoid ceramics is the most detailed examination of an Ostionan Ostionoid ceramic assemblage conducted to date. From the above discussion, it is not difficult to discern the particularities, which make Ostionan Ostionoid ceramics both unique and challenging to describe. For example, many of the original features of Ostionan Ostionoid ceramics such as red paint or slip as well as boatshaped vessels are rarely present in an assemblage. This makes it impractical to consider these characteristics diagnostic of Ostionan Ostionoid ceramics. However, other features seem to better reflect the majority of vessels. For example, both smooth and burnished exterior and interior surfaces are a dominant characteristic of assemblages. Although round and flat lip forms are the two most popular types found in Ostionan Ostionoid ceramics, the presence of a variety of other lip forms alongside these types could serve to identify an Ostionan Ostionoid assemblage. As demonstrated, key measurements such as wall thickness appear to be a universal of Ostionan Ostionoid ceramics. The evident variability in vessel shapes can also help to delimit Ostionan Ostionoid pottery from other ceramic assemblages. Although inclusion density, shape, size and type demonstrate cross-assemblage similarities (see Cordell 2007; Hofman et al. 2007b; St. Jean 2008), utilizing these characteristics as a primary means of identifying Ostionan Ostionoid ceramics is inadvisable. Arguably, rare and infrequent decorative elements such as anthropomorphic and zoomorphic *adornos*, incising, both linear and curvilinear as well as geometric, black/dark grey banding and cream-coloured slip are important features of Ostionan Ostionoid ceramics but these are too unreliable to serve as confident assemblage indicators. Overall, the similarities between the assemblages from across the Greater Antilles are interesting. With the exception of a discrepancy on handle types (looped versus D-shaped versus co-occurrence of both), the Ostionan Ostionoid ceramics are rather uniform in morphological, technological and stylistic dimensions.

Conclusion

This article intended to demonstrate the morphological, technological and stylistic characteristics of the Ostionan Ostionoid ceramics of the El Cabo site in the Dominican Republic through the implementation of an attribute analysis founded upon the use of analytical vessels. The El Cabo Ostionan Ostionoid ceramics are one of a few Ostionan Ostionoid ceramic assemblages that have received analytical attention. The cumulative results of the ceramic analysis depict the El Cabo Ostionan Ostionoid ceramics as a mostly plain, simply shaped functional ceramic material with some noticeable variations in lip form and a range of uncommon but interesting decorative elements. This interpretation, when carefully considered in comparison to other Ostionan Ostionoid assemblages is substantiated. However, since an inadequate amount of research as been conducted on Ostionan Ostionoid ceramics to date, it is difficult to assess whether these preliminary findings carry potential resolve. Although serving as an example of an important avenue of exploration, this research is only a small fraction of the amount of analyses needed in Caribbean archaeology in order to decipher the intricacies of the Ostionan Ostionoid ceramics as well as their position within the prehistoric cultural realm of the Greater Antilles. Additional research involving both the comprehensive examination of the ceramics and elaborate inter-assemblage comparisons, as presented here though in an elementary fashion, can drastically improve our interpretations of the prehistoric Caribbean.

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Notes

1. Traditionally, the presence of Ostionoid ceramics across the Greater Antilles signalled the migration of Ostionoid peoples and the realization of the Ostionoid development. Therefore, hypotheses on the Ostionoid development largely depend upon the Ostionan Ostionoid ceramics. Several of these models are discussed and criticized including the traditional view by Rouse (1986, 1992), which argues that the Ostionoid development is the product of Puerto Rican Saladoid groups. Several other alternative views proposed by Keegan (2000), Chanlatte Baik (2003) and Curet (2005) all essentially argue that the Ostionoid development is the product of both Archaic and Saladoid-La Hueca groups in some shape or form. A new hypothesis, the "Pre-Arawak Pottery Horizon" view promoted by Keegan (2006) and Rodríguez Ramos et al. (2008) argues from a "continuum of modes" that pottery present in Archaic assemblages throughout Cuba, Hispaniola, Puerto Rico and quite possibly the northern Lesser Antilles, up to the second millennium B.C.E. could be a precursor of Ostionan Ostionoid ceramics. Therefore, the Ostionan Ostionoid ceramics are argued to be a direct derivative of Greater Antillean Archaic groups rather than the result of Puerto Rican Saladoid groups. However, the notion of Archaic pottery in the Caribbean remains an inexplicit topic.

2. Keegan (2006) and Rodríguez Ramos et al. (2008) conclude that Early Ostionan Ostionoid pottery closely resembles the ceramics found at Late Archaic age sites in Cuba, Hispaniola and Puerto Rico. Consult both Keegan 2006 and Rodríguez Ramos et al. 2008 for further details on this subject.

3. Detailed fabric analysis of a sub-sample of analytical vessels excavated from two-test units during the 2007 field campaign at El Cabo, Dominican Republic was conducted by the author under the direct supervision of Loe Jacobs of the Ceramic Laboratory of the Faculty of Archaeology at Leiden University who provided meticulous instructions and subsequent verifications to ensure the validity of the results. The results were utilized in order to make a comparison with both the Ostionan Ostionoid fabric analysis of Cordell (2007) and Hofman (2007b).

4. Exploratory statistical analysis structured upon attribute state cross-tabulations calculated with SPSS (Statistical Package for Social Sciences) involved comparing the number of cases (amount of ceramic samples) generated from the analysis to the number of expected cases. Expected cases for each attribute state versus attribute state comparison were calculated through the multiplication of the total number of cases found in the first attribute state by the total number of cases found in all attribute states of the second attribute in question followed by a division of that calculated number by the total amount of ceramic samples being compared in the comparison of those two attributes. The use of cross-tabulations are a common approach to undertake when first statistically evaluating non-parametric data.

5. Self-test analysis designed by the author to test the repeatability of the recorded data examined by the researcher during the ceramic analysis. The self-test analysis involved analyzing, at random, 25 percent of the ceramic sample a second time using the established methodology.

6. Please note, all dates referred to in this article are derived from calibrated radiocarbon dates.

7. The technological attributes presented here are investigated as a general supplement to the low-tech fabric analysis, which contained thirteen individual attributes of examination.

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IN SEARCH OF POTENTIAL CLAY SOURCES USED FOR THE MANUFACTURE OF THE PRE-COLUMBIAN POTTERY OF EL CABO, EASTERN DOMINICAN REPUBLIC

Abraham van As, Loe Jacobs and Corinne L. Hofman

Abstract

This article focuses on the search for potential clay sources used to produce the pre-Columbian pottery of the site of El Cabo, located on the east coast of the Dominican Republic. The site has been excavated by a team of the Leiden Faculty of Archaeology in cooperation with the Museo del Hombre Dominicano between 2005 and 2008. The shapes of the pottery repertoire are described and aspects of the production sequence (forming, finishing and firing) are presented. Since no workable clay seems to be available in the direct vicinity of El Cabo, the pottery must have been imported from elsewhere or potters at El Cabo must have taken their clay from far away. An answer to this question is sought by comparing the El Cabo pottery with contemporary pottery from other sites and by workability tests and analysis of clay samples taken in the wide surroundings of the site. This paper represents the first step in an attempt to explore the source of origin of the clay that was used to make the pottery of El Cabo. Through future XRF analyses the research will be completed.

Introduction

In 2005 a team of the Leiden Faculty of Archaeology started excavations at the pre-Columbian archaeological site of El Cabo, situated in the Eastern Dominican Republic (Figures 1 and 6).[1] The excavation project was carried out in close cooperation with the Museo del Hombre Dominicano. The participation of Leiden University was funded through the Netherlands Foundation for Scientific Research (NWO). The project was focused on chronology of the site, the settlement structure and the identification of household areas and reconstruction of the houses (Hofman et al. 2006, 2008b; Samson and Hoogland 2007). In addition, the technological and morphological study of the pottery plays an important role within the project. In this article the first steps are taken in an attempt to find the production location of the El Cabo pottery, and the results of the morphological, technological and fabric analyses are described.

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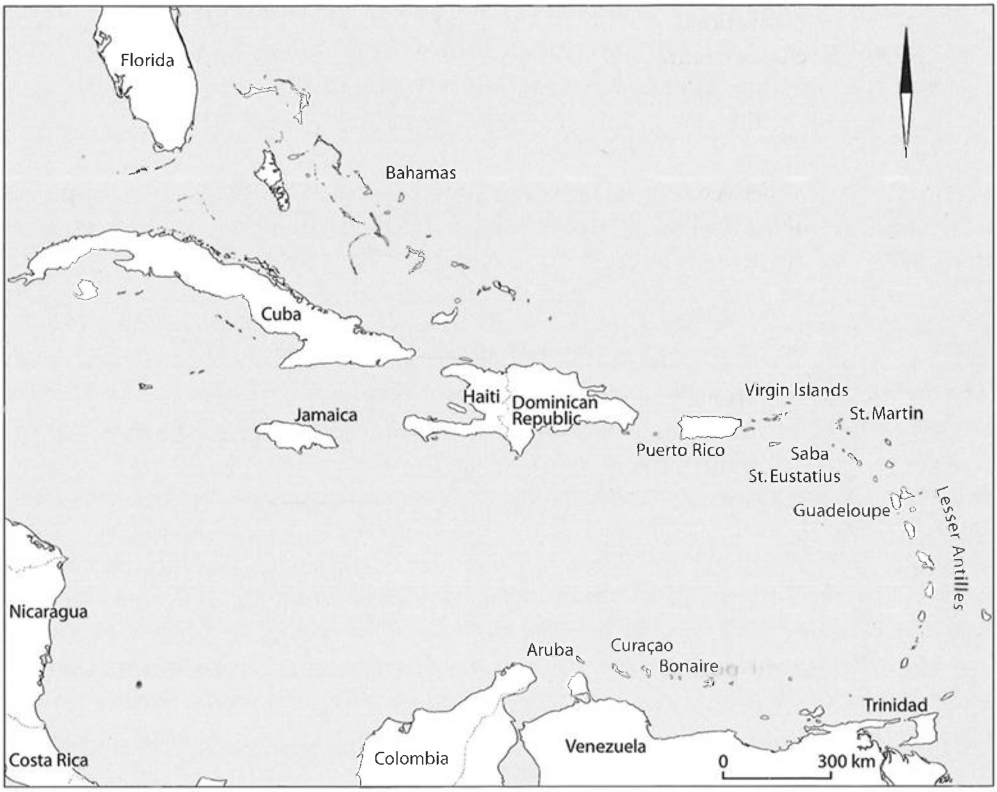


Figure 1. The location of El Cabo in the Eastern Dominican Republic.

The site of El Cabo

The site of El Cabo is situated on a stretch of grazed scrubland on the coast of the Eastern Dominican Republic. It is the southernmost known archaeological site along the Pleistocene strip of coast in the Altagraca-Higüey region. The site was identified in the late 1970s and two test units excavated from which pottery fragments, food remains and artifacts of stone and coral were recovered (Ortega 1978). Based on the ceramics, Ortega identified two occupation phases: an Ostionoid and a Chicoid component. Since then, the site has been visited by numerous looters whose illegal test-pits have destroyed large parts of the site.

Preliminary indications of the size of the site were determined by dense spreads of surface (ceramic and lithic) material, by elevated midden deposits and by an augering campaign over the terrain. The archaeological deposits extend approximately 150 m west inland. The sea forms the eastern limit. The north/south extent of the site is approximately 280 m.

Based on the excavations so far, the horizontal stratigraphy and the material analysis three phases have been identified: an Early Ostionoid, a Late Ostionoid and a Chicoid phase. The radiocarbon samples taken from shell, crab and charcoal produced absolute dates between A.D. 600 and 1400, in which three well-distinguished periods could be determined: a first one between A.D. 600 and 900, a second between A.D. 900 and 1200 and a third between A.D. 1200 and 1400, corresponding to the three phases based on the material analysis. Early colonial material also indicates the site was occupied until the early decades of the 16th century.

Morphological and technological characteristics of the pottery

The pottery of the various phases (Early Ostionoid, Late Ostionoid and Chicoid) can be characterized by vessel shape, applied manufacturing technique and the fabric of the clay that was used. In this paragraph the morphological and technological features are presented. In the next paragraph the results of the low-tech microscopic fabric analysis will be described.

Early Ostionoid

The Early Ostionoid pottery repertoire exhibits a large variety of vessel shapes, with simple and carinated contours and navicular-shapes. The vessel walls are very thin (ca. 5 mm). The rims are often rounded or flat and the vessels have typical D-shaped handles. The decorations mainly consist of small knobs on the vessel wall and different degrees of vertical thickenings of the wall. Geometric modeling is made up of rim modifications. In addition, there is evidence of modeled-incised anthropomorphic and zoomorphic appliqués.

The basic technique used for shaping Early Ostionoid pottery was coiling. Rather thin coils with a diameter around 1 cm or less were fixed together and pinched and smeared to form the walls. The vessels were usually finished by smoothing, burnishing or polishing (sometimes only on a part of the vessel). The small decorative knobs and vertical thickenings of the wall are the result of adding some extra clay to the vessel wall. The pottery is mostly reddish to light brown in colour. In some cases, a white firing clay was used. Some sherds have a cream or red slip. A few sherds exhibit dark/black bands produced through smudging a resin, which may have been applied as decoration. Quite a few sherds have repair drillings near cracks. This may point to the high value of the pottery, its scarceness, or to some ritual value. For a selection of Early Ostionoid pottery see Figure 2 (see also St. Jean, this volume).

Late Ostionoid

Although far more coarse than the pottery from the preceding phase, the Late Ostionoid pottery obviously in some aspects is a slightly modified continuation of the Early

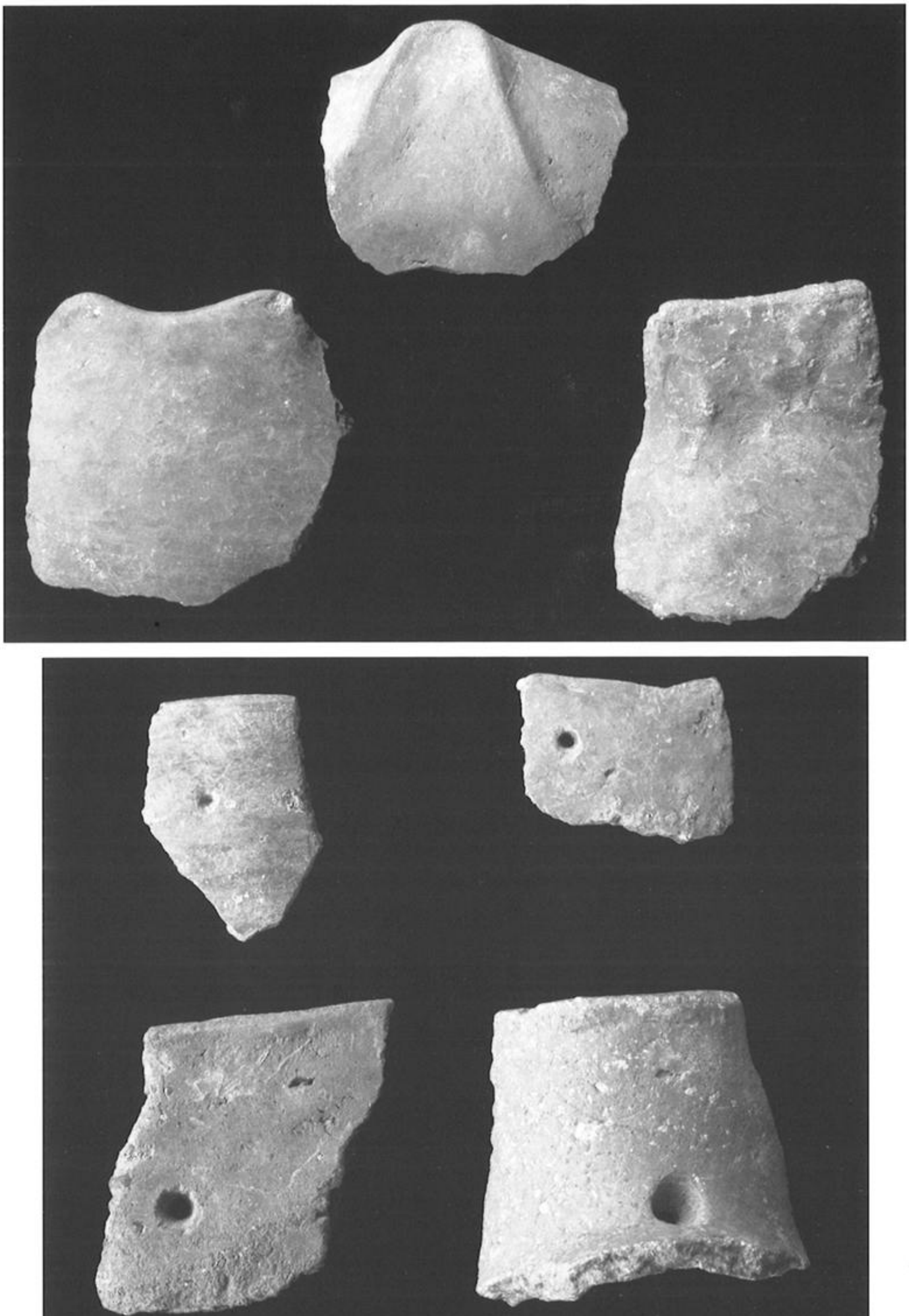


Figure 2. A selection of Early Ostionoid pottery from El Cabo (not to scale).

Ostionoid pottery tradition. The Late Ostionoid pottery repertoire exhibits characteristic rounded and navicular vessels with rounded but often outward folded and inward thickened rims. The vessels are fitted with D-shaped handles. Pelican-shaped handles and vertical lugs are also present.

Like in the foregoing phase, the coiling technique was also employed for shaping the Late Ostionoid vessels. The surface of the pottery is a little bit less smoothed and often less regular than in the Early Ostionoid phase. In some cases it is roughly burnished, polished or covered with a red slip layer. A small proportion of the Late Ostionoid vessels are decorated with incised lines. Besides this linear decoration, there are modeled figures, some with coffee beans eyes and appliquéd limbs, which seem to be a continuation of the so-called estilo Punta or transitional modeled appliqués. The firing colors of the pottery are red brown and partly grayish spotted. Oxidized colors prevail. For a selection of Late Ostionoid pottery see Figure 3.

Chicoid

The vessels belonging to the Boca Chica style series in the latest phase of the occupation history of El Cabo tend to be much thicker than the Ostionoid pottery. The major shaping technique of the Boca Chica pottery is coiling. The rim shapes are varied, rounded, flat, flanged or thickened. The surfaces of the pottery are often smoothed and burnished. Decoration mainly consists of linear and curvilinear incision and incision ending in punctation. Generally, these incisions have deep broad firm lines, applied just before the clay was leather-hard. After incising the surface was completely burnished. The D-shaped handles are decorated with modeled appliqué and incisions. In addition, there are many modeled-incised *adornos* typical of the Boca Chica style representing bats, owls and other creatures from the Taíno mythology as well as anthropomorphic faces (see also Veloz Maggiolo 1976). Some of the late Ostionoid modeled-incised appliqués are also present in this Boca Chica phase. The surfaces of the vessels have a variety of colors, ranging from cream, to brown and grayish-black. The original firing was neutral to only slightly reducing. For a selection of Boca Chica pottery see Figure 4.

Results of the low-tech microscopic analysis of the pottery fabrics

The microscopic fabric analysis of a representative sample of the sherds included the investigation of the matrix of the clay and the inclusions and pores observed (× 10 to × 50 magnification) on a fresh break and on a ground edge. With respect to the non-plastic inclusions, attention was paid to the type, shape, sorting, color, size and amount of grains present in the clay. For a summarizing overview of the fabric characteristics of the El Cabo pottery the reader is also referred to Table 1.

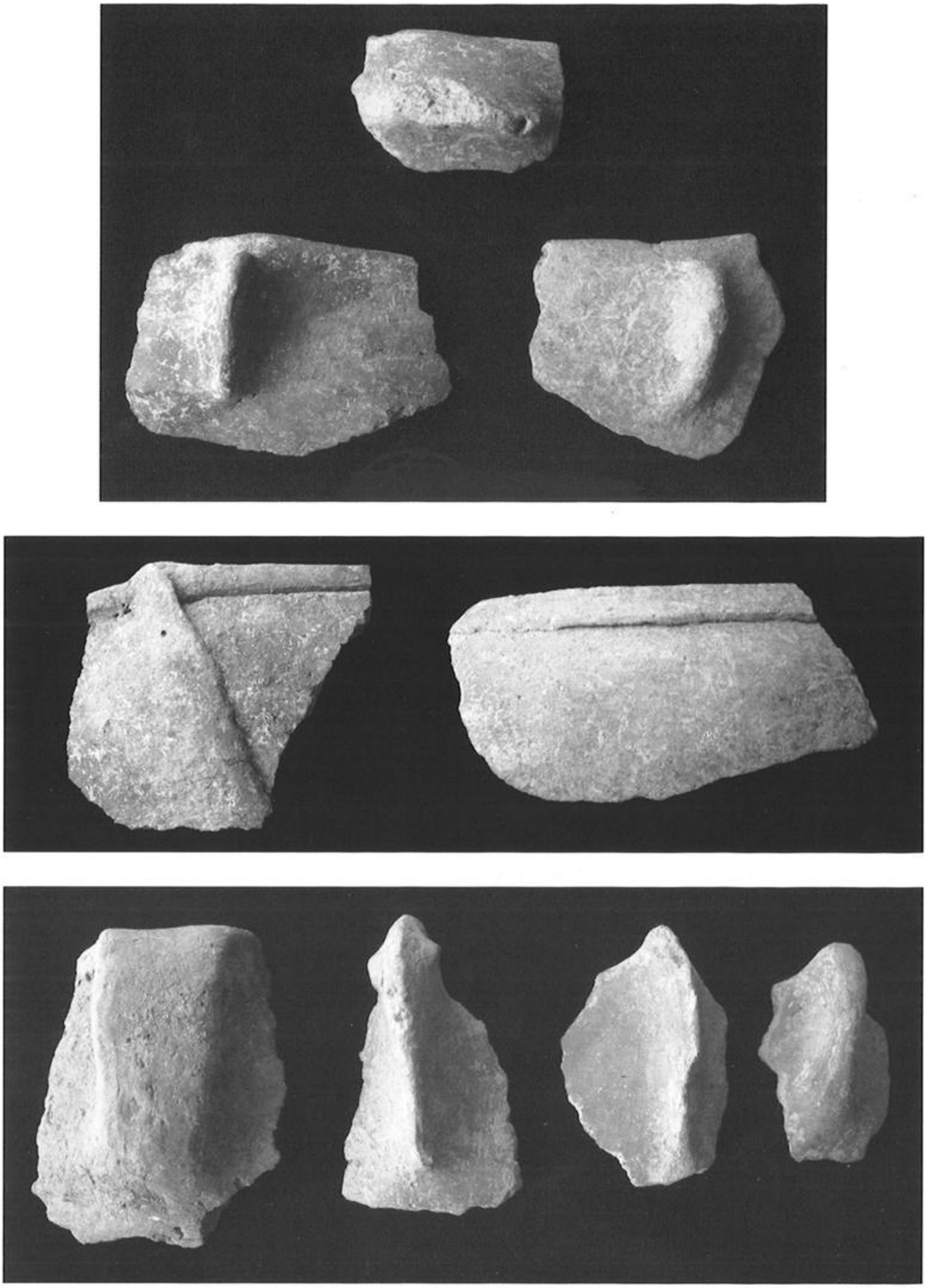


Figure 3. A selection of Late Ostionoid pottery from El Cabo (not to scale).

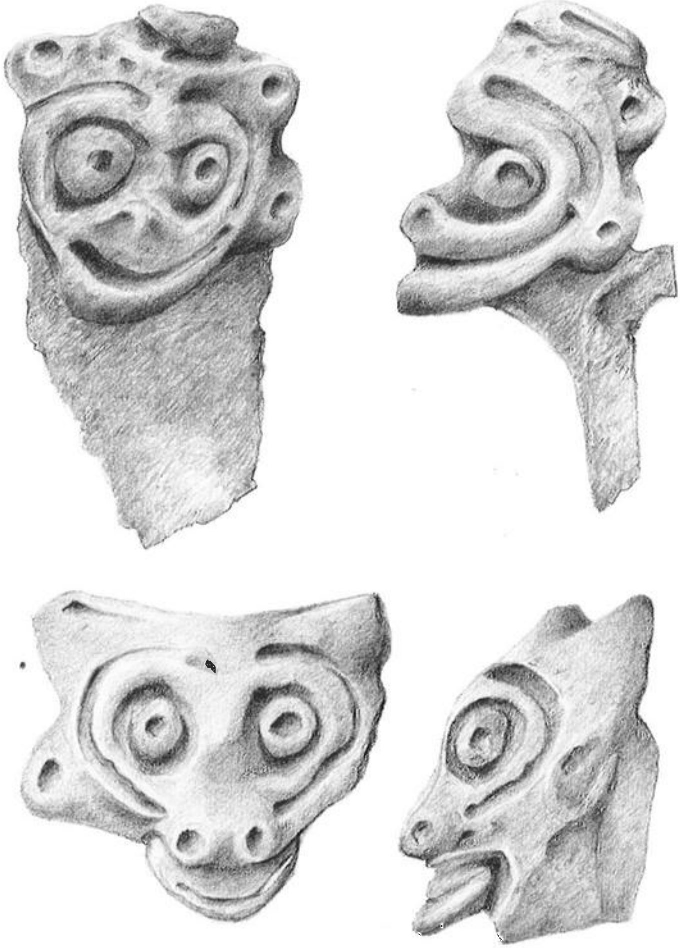


Figure 4. A selection of Boca Chica pottery from El Cabo (photographs not to scale, drawings scale 1:1).

Early Ostionoid

The Early Ostionoid pottery can be characterized as material with a compact fabric. It contains 25 to 35 % of mineral grains, which are mostly added to the clay as to make them more workable and to prevent the development of cracks during the drying and firing process. This tempering material consists of fine grains up to 1 mm in size. Incidentally, coarser grains up to 5 mm, like iron schists and/or hematite occur, which were most often natural to the clay. Still coarser grains were probably picked-out by the potter as undesirable. The most frequently occurring grain types include quartz, feldspar, iron-oxide siltstone and in some cases limestone. Sometimes grains of volcanic origin, like several types of tuff and some amphiboles (like hornblende) may occur. The grains are most often sub-angular and/or sub-rounded in shape. The colors of the fabrics, after re-firing them to 750° C under oxidizing circumstances vary from pink to light reddish brown and light red.

Late Ostionoid

The Late Ostionoid potters, like their forerunners in the Early Ostionoid phase, added roughly spoken the same kind of tempering material to their clay. Quartz, feldspar, limestone and hematite are the most frequently occurring. Some sherds also include ignimbrite, a melted variety of tuff. The grain sizes of the usually moderately to badly sorted non-plastic inclusions vary from 1 mm and smaller up to 3 mm and sometimes even up to 5 mm. The shapes vary from angular to sub-angular and sub-rounded. The fabric of the pottery is more often coarse or crumbly due to the grain size and quantity of inclusions. The quantity of grains is rather high, i.e. between 30% and 35% or sometimes even more.

Chicoid

The Chicoid material often contains grains of quartz, feldspar, iron oxide-siltstone and limestone. Relatively few and/or sporadic amphiboles and tuff grains are included. The amounts of mineral tempering vary from 20 to 35%, the grain sizes from smaller than 1 mm up to 4 mm. The grain shapes are angular, sub-angular and sub-rounded. The nodules are rounded in shape. In some cases the pore structure is a bit elongated. The sorting of the inclusions is moderate-, or moderate to good.

	Early Ostionoid	*Late Ostionoid*	*Chicoid*
Mineral inclusions			
Dominant particles:	quartz and/or limestone; feldspar; iron-oxide siltstone	quartz and/or limestone; feldspar; iron-oxide siltstone	quartz and/or limestone; feldspar; iron-oxide siltstone
Sporadically occurring:	iron schists; hematite; tuff; amphiboles	iron schists; hematite; tuff (ignimbrite); amphiboles	tuff; amphiboles
Dominant size:	≤ 1 mm	1 mm – 3 mm	1 mm – 4 mm
Incidental size:	5 mm	5 mm	
Shapes:	sub-angular/ sub-rounded	angular/sub-angular	angular/sub-angular/ sub-rounded
Percentage:	25 – 35%	30 – 35%	20 – 30%
Other characteristics:	compact material	moderately/badly sorted	**moderately/well** sorted

Table 1. Fabric characteristics of the El Cabo pottery.

In search of the potential clay sources used to make the El Cabo pottery

Looking at the pottery of El Cabo the question of the production location arises. Did the potters of El Cabo make their pottery using clay from the direct vicinity of the site? Or did they collect their clay farther away? Another possibility is that the pots found in El Cabo were imported from elsewhere. An answer to these questions might be found through a combination of complementary research methods (see also Hofman et al. 2008a): (1) technological analysis and low-tech microscopic fabric analysis of the pottery (see above), (2) analysis of clay samples, i.e. workability tests and fabric analysis (see below), (3) comparative pottery study (see below) and (4) geo-chemical analysis using X-ray Fluorescence Spectrometry (XRF).[2] This article deals only with research steps 1-3.[3]

Were the pots of El Cabo made of local clay?

Recent research suggests that in many cases the pre-Columbian pottery was manufactured with local clays when these were available (Hofman et al. 2005: 10). Therefore, we assumed at first that the pots found in El Cabo were made on the spot. So far, however, no evidence has been found for pottery production at El Cabo. No unfired pots have been recovered. Apart from that, it is difficult at this stage to identify tools that could have been used for pot making. However, although positive evidence for production is lacking, it cannot be excluded that pottery-making was going on at the site. Pottery production being a household affair in pre-Columbian times, the tools may be unspecialized (Costin 1991; van der Leeuw 1977; Peacock 1982).

Although we have no direct indications that the pottery of El Cabo was produced locally, we have sought suitable clay in the close vicinity of the site itself. According to the principle of least effort, the exploited clay deposits would be those most accessible to the manufacturing sites and are less likely to have been obtained from a distant location (Bishop et al. 1982: 315-316; Rye 1981: 12). However, distance to clay resources is highly variable. The exploitable threshold model based on ethnographic data and applied to ceramic resources implies that the geodesic distance to clay resources ranges from less than 1 km to 50 km (Arnold 1985: Figure 2.5). The preferred territory of exploitation of primary resources lies close to the working area, i.e. not further than 1 km (threshold A). The upper limit of the maximum range of exploitation (threshold B) is 7 km. After threshold B, the exploitation of clay resources is uneconomic. Arnold (1985: 35-38) remarks that the general exploitable threshold model applied to ceramic resources is affected by various factors like lack of many data, differences between sedentary and non-sedentary communities, the topographical situation, and transport costs. On the other hand, Arnold (1985: 38) referring to Strauss and Orans (1975) emphasizes that the energy limits of a population to the distance traveled in terms of a costs/benefits model is not affected by cultural contact, diffusion or other kinds of historical relatedness.

In an attempt to collect clay samples in the direct vicinity of El Cabo no suitable clay appeared to be present within either threshold of exploitation (A and B). Therefore, we may conclude that either the clay for pot making was imported from sources much farther away or the pots found in El Cabo were imported from elsewhere. To find an argument for the first possibility, we collected clay samples in the wider surroundings of the site (Figure 5). For the second possibility we sought similar contemporary pottery from other archaeological sites on the island.

Were the El Cabo pots made with clay imported from elsewhere?

We have ethnographic evidence of traveling long distances to gather clay (see Arnold 1985: 50, 51, 55, 56, Table 2.1; Rice 1987: 116-118), even if clay is available in the direct vicinity of a settlement (Duin 2000/2001; Vredenbregt 2004). In these cases we have to keep in mind that the geodesic and pheric canoe distances to clay resources greatly exceed the non-canoe distances (Arnold 1985: 50).

In an attempt to explore the potential clay sources used for the production of the El Cabo pottery, we collected ten clay samples in the wide surroundings of El Cabo: Higüey, La Aleta, Playa Macao (three samples), Anamuya, Caliche and Boca deYuma (four samples) (Figure 6). In Leiden the workability properties of the clay samples were tested. Next, the fabric of the suitable clay samples was analyzed. If the fabric of the clay samples matches the fabric of the sherds, we may assume we have found a potential clay source.

Analysis of the clay samples

Workability properties

Hamer (1975: 319) defines workability as "the character of clay that is a combination of strength, plasticity and thixotropy (the property of plastic clays to resist initial pressure)". It is "a human or subjective quality, defined by the potter's judgment of how well suited a particular clay or body is to the processes he envisages using" (Rye 1981: 20, 21).

The workability of the clay samples was tested by attempts to make small pots through pinching and coiling. The drying shrinkage was measured. Furthermore, the clay samples were fired to test the firing and post-firing behaviors of the clay for comparison with the potsherds of El Cabo. The workability tests (for the results see Table 2) showed that clay samples nos. 01, 03, 04 and 09 are suitable for making pottery in the pinching and coiling technique.

Figure 5. Clay sampling in Higüey: the local inhabitants exhibited a keen knowledge of the whereabouts of clay sources.

No.	Location	Workability properties	Linear Shrinkage a. dry b. total at 650° C	Color dry/ homogenized clay (MSCC
01	Higüey	* Well suited for pinching and coiling. * The plasticity is sufficient. * Though enough bones by nature, addition of some fine sand would make the clay less sticky and reduce its shrinkage.	5.5% 6%	7.5YR6/6 reddish yellow
02	La Aleta	* Short clay that lacks plasticity and coherence. * Hardly suited for coiling and pinching. * Useful as red colorant or for making red clay slip.	9% 11%	7.5YR6/7 reddish yellow
03a	Playa Macao	* After removal of the coarsest limestone grains, reasonably suited for pinching and coiling. * A bit sticky, but with enough bones.	7.5% 8.5%	5YR6/6 reddish yellow
03b	Playa Macao	* Reasonably to well suited for pinching and coiling. * Contains hardly any coarse limestone.	6.5% 7.5%	5YR6/6 reddish yellow
04	Playa Macao	* Reasonably suited for pinching and coiling. It lacks a bit in cohesive strength. * Presence of small limestone grains. * It misses some bones.	5.5% 5.5%	7.5YR7/4 pink
05	Anamuya	* Lack of cohesive strength * Hardly suited for pinching and coiling.	9.5% 10%	10YR7/4 very pale brown
06	Caliche	* Limited in plasticity. * Contains grains of limestone. * After removal of the grains of limestone the clay is just suited for pinching and coiling, but it misses some bones.	2% 2%	10YR7/4 very pale brown
07	Boca deYuma 1	* Relatively short clay. * Lack in plasticity and cohesive strength. * Black color and sulfuric smell. * It misses bones. * Moderately suited for pinching and coiling. * Addition of fine sand and further aging did not remarkably improve the workability properties.	9% 9%	10YR7/6 yellow
08	Boca deYuma 2	* Too sandy for pinching and coiling; no plasticity; a test bar could not be made	not measured not measured	2.5YR7/6 lighty red
09	Boca deYuma 3	* A little short and a little lack of cohesive strength. * Suited for pinching and coiling. * Development of small cracks during pinching. * Clay could be improved by aging.	6.5% 6.5%	7.5YR7/3 pink
10	Boca deYuma 4	* Black color and sulfuric smell. * Lack of plasticity and cohesive strength. * Just suited for pinching and coiling. * Addition of fine sand and further aging did not remarkably improve the workability properties.	6.5% 6.5%	2.5Y5/2 grayish brown
10	Boca deYuma 4 Improved	After adding 15% of fine quartz sand to the clay and two months further aging the workability properties were not improved	4.5% 4.5%	2.5Y5/2 grayish brown

Table 2. Workability properties of the clay samples

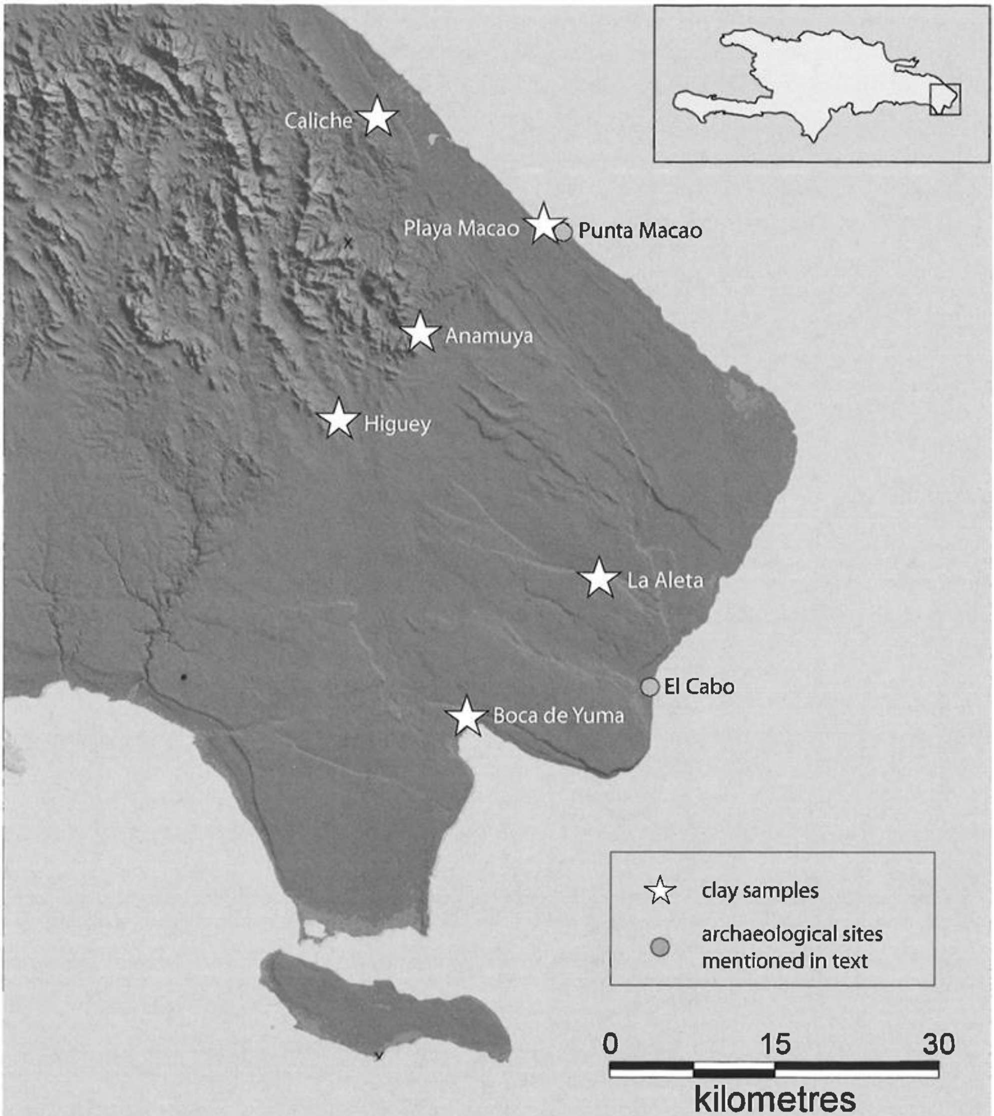


Figure 6. Map of the location of the origin of the clay samples.

Fabric analysis

In order to figure out whether clay samples 01, 03, 04 and 09 may have been the potential clay sources used by the potters of El Cabo, low-tech microscopic fabric analysis was conducted. Test bars made of the clay samples were fired in electric kiln at 750° C. Like the fabric of the potsherds, the fabric of the clay samples was analyzed on a fresh break and on ground edge of the test bars. The fabric of the clay samples contains the same kind of dominant and sporadically occurring mineral inclusions (Table 3) as found in the sherds (Table 1). The percentages of the inclusions, however, are generally lower. This can be explained by the fact that the fabric of the clay samples represents the natural clay, while the fabric of the sherds represents the clay body (prepared clay). The higher percentage of mineral inclusions in the sherds may have been be caused by adding temper to the clay.

	Clay sample Higüey (01)	Clay sample Playa Macao (03a)	Clay sample Playa Macao (03b)
Mineral inclusions			
Dominant particles:	quartz	limestone; iron oxide	limestone; mudstone
Sporadically occurring:	rock fragments; calcite; hematite		
Dominant size:	50μ ≤ x ≤ 1 mm	50μ ≤ x ≤ 2 mm	50μ ≤ x ≤ 2 mm
Shapes:	angular/sub-angular/ sub-rounded	angular/sub-angular/ rounded	sub-angular/sub-rounded/rounded
Percentage:	5-10%	10-15%	10-150%
Color (750° C):	2.5YR5/8 (red)	2.5YR5/6 (red)	2.5YR5/6 (red)
Other characteristics	moderately sorted	moderately sorted	moderately sorted

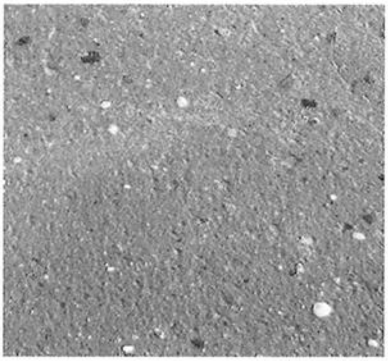
	Clay sample Playa Macao (04)	Clay sample Boca deYuma 3 (09)
Mineral inclusions		
Dominant particles:	limestone; coral	quartz
Sporadically occurring:	iron xoide nodules	shell fragments; kaolinite; feldspar; Mudstone; hematite
Dominant size:	50μ ≤ x ≤ 2 mm	50μ ≤ x ≤ 2 mm
Shapes:	sub-angular/sub-rounded	angular/sub-angular
Percentage:	25%	ca. 29%
Color (750° C):	5YR7/1 (light gray) to 5YR7/3 (pink)	2.5YR6/6 (light red)
Other characteristics	moderately sorted	moderately/well sorted

Table 3. Fabric of the clay samples suited for pinching and coiling.

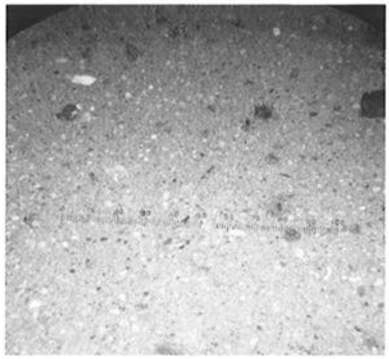
From comparisons between the results of the microscopic fabric analysis of the clay samples (Table 3) and the fabric of the sherds, we conclude that the clay samples collected from Higüey (01), Playa Macao (03a, 03b, 04) and Boca deYuma 3 (09) may represent potential clay sources for the manufacture of the El Cabo pottery (see Figure 7).

Were the pots found at El Cabo imported from elsewhere?

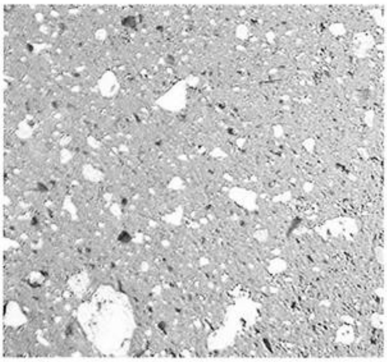
Punta Macao is one of the other major sites in the eastern part of the island where similar pottery to that of El Cabo has been excavated (Hofman et al. 2007). Punta



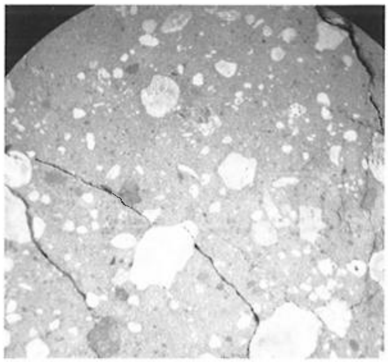
10 mm.
Clay sample Higüey 01.



10 mm.
Sherd sample 11. El Cabo, Early Ostionoid.



10 mm.
Clay sample Playa Macao 04.



10 mm.
Sherd sample 21. El Cabo, Early Ostionoid.

10 mm.
Clay sample Boca ddYuma 09.

10 mm.
Sherd sample 91. El Cabo, Chicoid.

Figure 7. Comparison of the fabric of clay samples and sherds.

Macao may thus as yet be considered as a possible production location of the El Cabo pottery. The clay collected at Punta Macao also shows good workability properties (see Table 2) and appeares to be suitable for both pinching and coiling.

Summary and conclusion

In search of potential clay sources used for the manufacture of the Pre-Columbian pottery found at El Cabo the following methodology was followed: (1) analysis of the manufacturing technique and fabric of the pottery, (2) analysis of clay samples (workability tests and fabric analysis), and (3) comparative pottery research. As a result of our study, the pottery appeared not to be made of local clay. Potential clay sources were found at Higüey, Playa Macao and Boca deYuma 3. The potters of El Cabo may have collected their clay in these far away locations during hunting or fishing trips by canoe. Since Punta Macao is one of the larger archaeological sites in the region (others being Atjadizo and sitio Pepe) where similar pottery (stylistically speaking) has been excavated, the El Cabo pottery may also have been made at one of these locations and brought to El Cabo. The results of our research can be considered as the first step to answer the problem. Through future XRF analysis, a valuable technique for archaeological provenance studies, we hope to find more substantive evidence for our preliminary results.

Acknowledgements

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Notes

1. Excavations took place in 2006, 2007, 2008 and 2009.

2. Since, in our opinion, low-tech ceramic analysis forms the basis for the selection of samples for high-tech research we prefer this research order (van As 2004: 12, 13)

3. The XRF analysis will be performed at the Faculty of Earth and Life Sciences of the Vrije Universiteit (VU, Amsterdam) in cooperation with Prof. Dr. Gareth Davies in order to identify the chemical signatures of the relevant clay samples and the pre-Columbian potsherds.

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DIFFERENT COMMUNITIES OR CHANGING POTTERY TECHNIQUES? THE TRANSITION FROM THE LATE CHALCOLITHIC TO THE EARLY BRONZE AGE DISCOVERED AT QATAR DAMIYAH (JORDAN VALLEY)

Eva Kaptijn and Michel de Vreeze

Abstract

During fieldwork in the Jordan Valley a concentration of sherds was discovered on the surface of the badlands of Qatar Damiyah. This group of sherds proved enigmatic as it contained morphological characteristics from both the Late Chalcolithic and the Early Bronze Age. Furthermore, two different ways of firing were visible and corresponded with different fabrics that were used. This seemed to denote that different groups inhabited this location on separate moments in time. However, closer inspection revealed that the different fabrics proved to be present throughout the vessel types and only a limited correlation between vessel type and fabric could be demonstrated. The firing techniques turned out to be two alternative solutions to the same problem, i.e. lime spalling. These conclusions together with a detailed study of the morphological characteristics of the assemblage showed that the Qatar Damiyeh assemblage to all likelihood resulted from a single occupation episode that took place at the transition between the Late Chalcolithic and the Early Bronze Age.

Introduction

In October 2005, on one of the last days of that year's fieldwork of the NWO-funded 'Settling the Steppe'-project of the Leiden Faculty of Archaeology, Fuad Hourani discovered a concentration of pottery sherds on a badland area in the middle Jordan Valley in an area which is locally referred to as Qatar Damiyah (Figure 1). As the geomorphologist of the project, Hourani had been investigating the so-called "qatar hills". This term refers to an erosional zone that forms the boundary between the plain of the Jordan Valley, the *ghor*, and the actual streambed of the Jordan River, called the *zor*. The *zor* lays c. 50-70 m below the *ghor*. The qatar hills consist of white marls from the Lisan formation and are subjected to severe erosion. Numerous wadis dissect this barren inhospitable terrain that is today unfit for cultivation. However, the sherds found and collected by Hourani suggested that at some time in the past, activity had taken place here. The sherds were too few to provide a clear indication of function and date, but provided an intriguing unresolved question. Therefore, the area was surveyed in detail in 2006 as part of the Zerqa Triangle Survey of the Settling the Steppe-project.[1]

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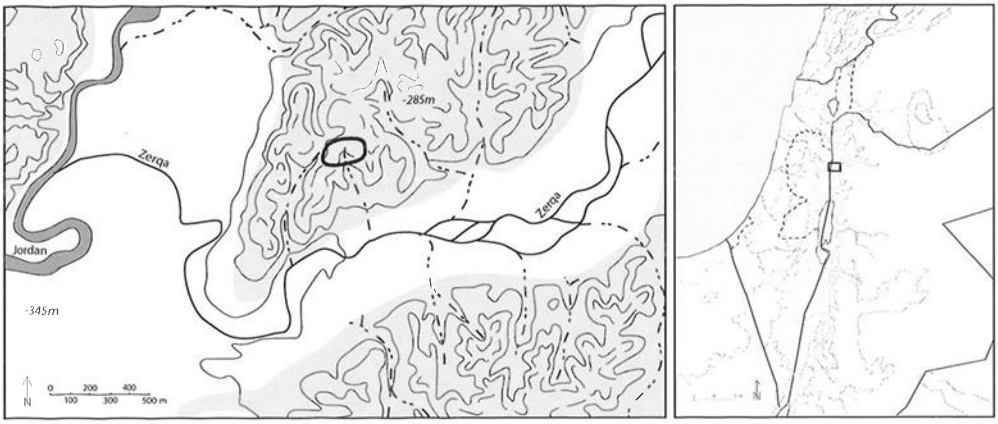

Figure 1. Location of the site in its regional setting with the qatar hills in grey and the alluvial plain in white.

In the area indicated by Hourani the many wadis dissecting the area prohibited a systematic survey method with transects and fixed collection areas. Depending on the shape of the bluffs the area was, therefore, divided into 8 blocks that were each surveyed for 20 minutes with the same number of people. Although this is by no means a statistical survey, the known size of the blocks and the fixed investigation time allows comparison between them. In this way the survey team collected an assemblage of 144 sherds in an area extending over c. 100 × 250 m. As many as 130 sherds of this collection seemed to date to the Late Chalcolithic (4600-3600 B.C.) and/or the Early Bronze Age I (3600-3000 B.C.), while 8 sherds stemmed from the Byzantine period (ca. 324-650 A.D.) and 6 could not be dated. Other finds included flint tools, e.g. tabular scrapers, Canaanean blades, a marine shell *Glycymeris sp.* that originated either from the Mediterranean or the Red Sea and a few fragments of grindstone tools.

The analysis of the pottery and flint artefacts at the Faculty of Archaeology at Leiden University soon revealed that the Qatar Damiyah assemblage did not allow a straightforward interpretation. Differentiation is visible in several aspects of the pottery assemblage, such as firing techniques, clays and temper, and chronological association as based on the morphological characteristics. Vessels seem to date to two different periods. Two types of firing were used and several fabric types are discernable. The question to be answered in the pages below is therefore: do these differences reflect the heritage of two or more different communities that occupied the same site at different moments in time, or did a single community that lived at the site for a restricted period of time use these different vessels and techniques?

Morphological characteristics

Based on morphological characteristics of the collected sherds, several types of vessels could be identified. The vessels types that were identified in this way can be divided in two groups. There are types commonly associated with the Late Chalcolithic period. Examples of this group are the so-called V-shaped bowls and the holemouth jar with a simple rim of even thickness (Figure 2). Very similar examples have been found in securely dated Late Chalcolithic contexts, e.g. at Teleilat Ghassul and Gilat (Lovell 2001: fig. 4.31, 34, 36; Commenge et al. 2006: pl. 10.1, 5, 7, 13-17). On the other hand, there are vessels and vessel features that have generally been associated with the Early Bronze Age I (EBA). These include ledge handles and cups (Figure 3) discovered in EBA contexts at for example Wadi Faynan site 100, Ashqelon Afridar and Lachish (Baumgarten 2004: fig. 12: 4, 13: 4; Golani 2004: fig. 29: 4; Tufnell 1958: pl. 56,

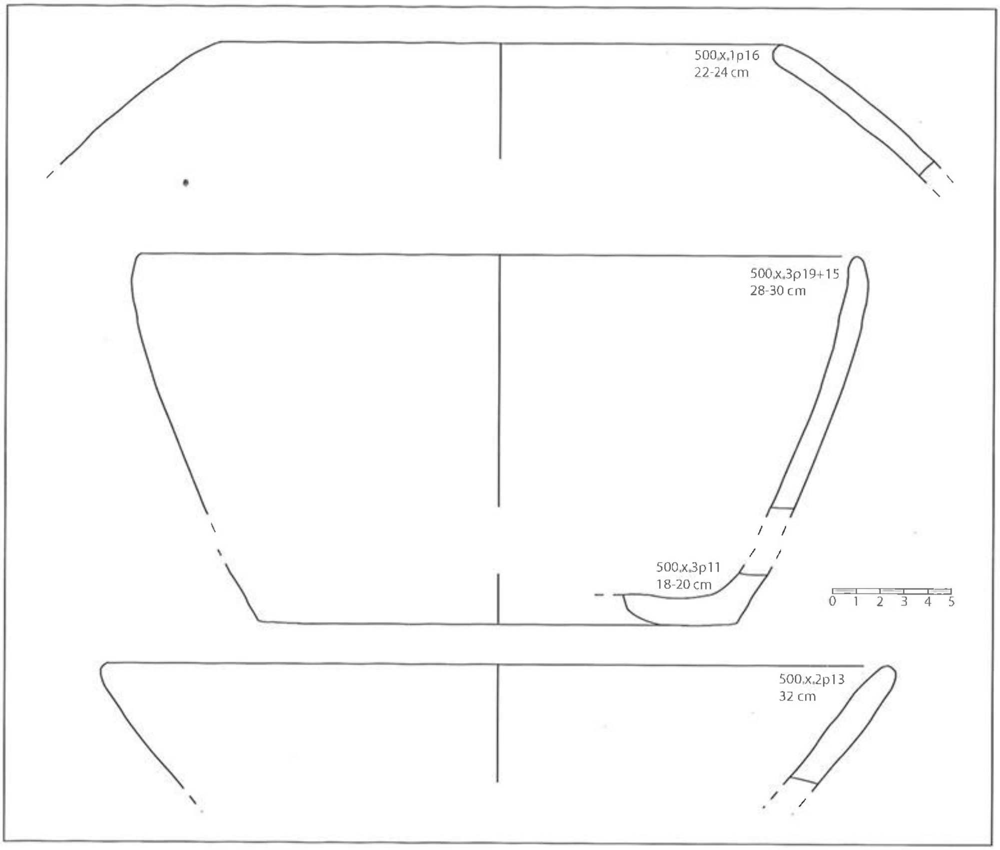

Figure 2. Sherds belonging to holemouth jar and V-shaped bowls discovered in the concentration.

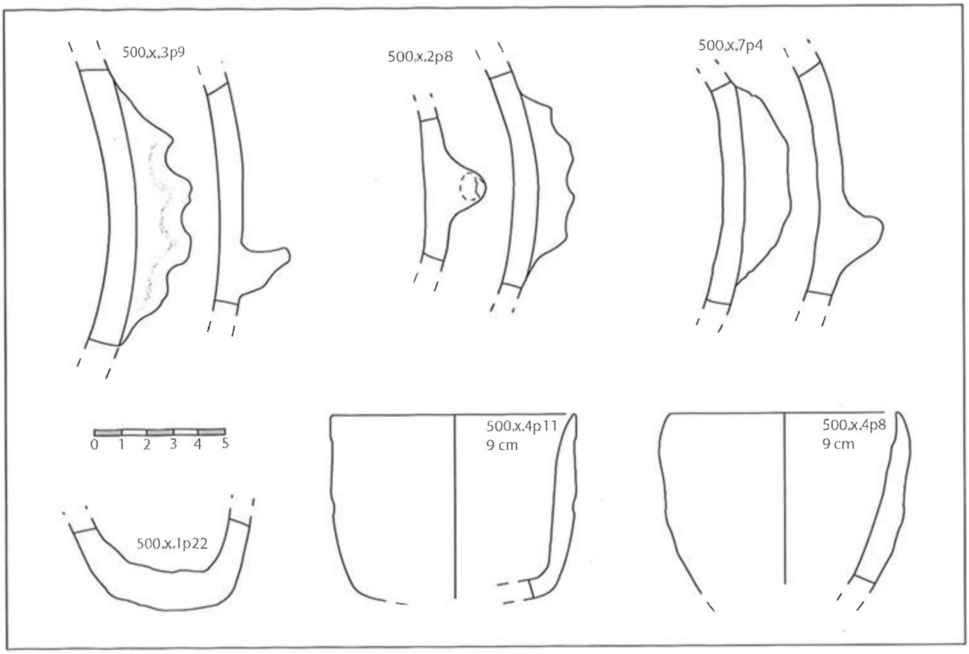

Figure 3. Ledge handles and cup fragments discovered in the concentration.

57; Wright et al. 1998: fig. 8:4, 9:1). Ledge handles have long been considered to be a hallmark of the EBA (Amiran 1969: 35ff).

In addition to these two groups a considerable number of jars with a circular shaped flaring neck have been found (Figure 4). This specific type of jar is common in both the Late Chalcolithic period and the EBA I. Good parallels have for example been discovered at Late Chalcolithic Gilat and EBA Tell Umm Hammad (Commenge et al. 2006: pl. 10.22; Helms 1992: fig. 179: 3 and fig. 206: 1-4). A special variant of this vessel type has impressions on its rim (Figure 4). Similar to the plain rimmed jar, this type is found in both Late Chalcolithic and EBA contexts, e.g. Gilat, Shoham, Tell Umm Hammad and Jericho (Commenge 2005: figs. 6.2:10, 6.26:1; Commenge et al. 2006: pl. 10.20: 11; Helms 1992: fig. 255: 4; Kenyon 1981: fig. 9: 25). However, this type of vessel is restricted to isolated examples. Nowhere have more than one or two examples been found, whereas several rims have been collected from the Qatar Damiyah concentration. The numbers of sherds that belong to a specific vessel type are depicted in Figure 10.

Parallels to the vessels discovered here suggests a date for the pottery assemblage starting in the Late Chalcolithic period and continuing into the EB I period, possibly with intermittent periods of disuse of the site. However, there is a problem with this

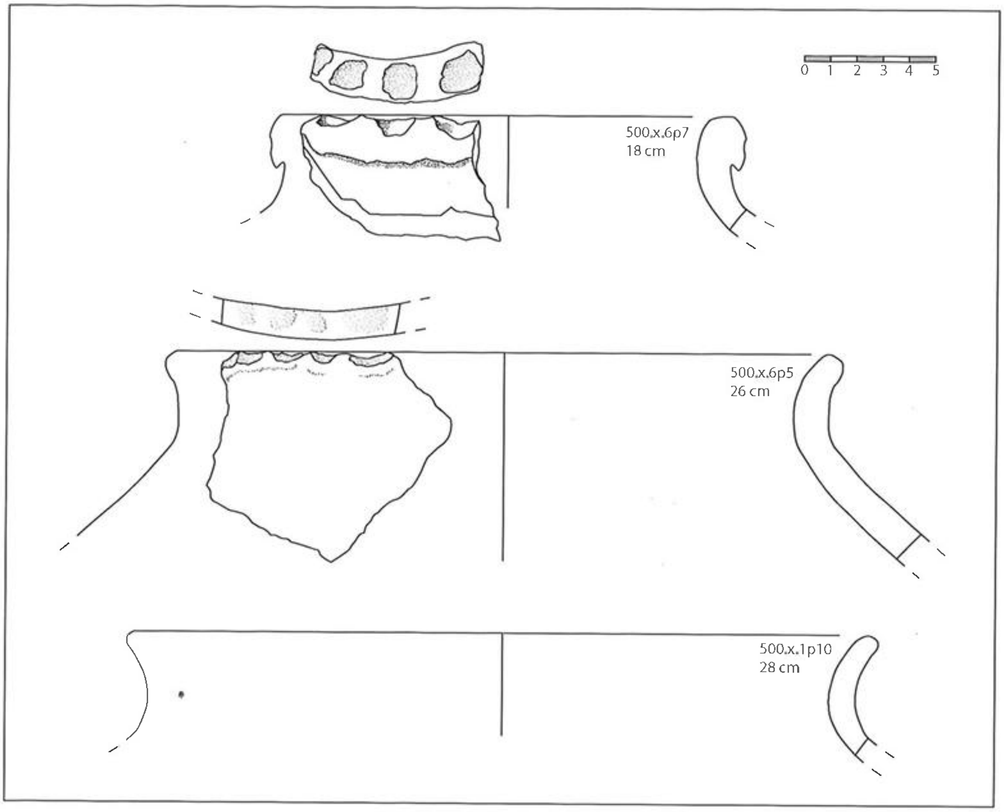

Figure 4. Sherds belonging to the circular necked jar type with a plain and an impressed rim.

hypothesis. If this site had been utilized in the Late Chalcolithic period one would expect a more diverse range of vessels. Many vessels or vessel parts typical of the Late Chalcolithic period are absent in this collection, e.g. churns, pedestalled bowls, loop handles and pithoi. In no other Late Chalcolithic context, either for habitation, burial or industrial use, has such a limited range of vessel types been discovered. The same applies to the EBA assemblage. Even other fragmented survey assemblages from the EB I period, discovered in the vicinity, displayed a wider range of vessels including everted rim bowls, different types of ledge handles, red slipped and burnished vessels (Kaptijn in prep.).

A closer inspection of the vessel types and their parallels suggests an alternative view. Although features like ledge handles have been regarded as characteristic of the EBA, recent analysis has revealed that ledge handles have occasionally been found in Late Chalcolithic contexts or those that have been dated to the transition from Late Chalcolithic to EBA, e.g. Shoham cave 4, Hujayrat al-Ghuzlan and field 27 of the Zerqa

Triangle survey (Commenge 2005: fig. 6.29:1; Kaptijn in prep.: fig. 4.16; Khalil et al. 2003: fig. 18:1-6). Furthermore, the ledge handles found in this assemblage are of a type that is generally found in early EBA I contexts while later EBA types are absent. The same holds true for the cups. Although cups are most often found in EBA contexts, a few (isolated) examples have been noted in Late Chalcolithic or transitional contexts, e.g. Teleilat Ghassul, Azor, Hujayrat al-Ghuzlan, Wadi Fidan site 4 (Adams and Genz 1995: fig. 3:4; Khalil et al. 2003: fig. 16:1-3; Koeppel 1940: pl. 83:1; Perrot and Ladiray 1980: fig. 75:12). The V-shaped bowl, although one of the hallmarks of the Chalcolithic period, clearly continues into the EBA and, while the EBA has many other types of holemouth jars as well, the simple rounded rim type is present in at least the early part of the EBA period, *e.g.* Bab adh-Dhra' with respect to the holemouth jars and Tell esh-Shuneh North for both vessel types (Gustavson-Gaube 1986: fig. 8 and 11:32-36; Rast and Schaub 2003: figs. 5.1 and 7.1).

The discovery of EBA types in Late Chalcolithic contexts and the continuation of Late Chalcolithic forms into EBA assemblages, although in small numbers, negates the strict break between these periods that was at one time supposed to exist (Gophna 1998: 272). Recently, sites like Hujayrat al-Ghuzlan and Ashqelon Afridar have been dated to the transition between the Late Chalcolithic and EBA and the very start of the EB I period (Braun and Gophna 2004; Golani 2004; Khalaily 2004; Khalil and Eichmann 2006; Khalil et al. 2003). Although the present collection as a whole is no direct parallel to the pottery assemblages discovered at these sites, they do provide the closest parallels for many sherds. The site of Ashqelon Afridar shows another strong parallel since it is the only other location where several necked jars with impressions on the rim have been found (Baumgarten 2004: fig. 9; Braun and Gophna 2004: fig. 19; Golani 2004: 27).

Based on the morphological characteristics of the discovered sherds, parallels with excavated and more securely dated sites suggest they date to the transition between the Late Chalcolithic and EB I periods. The range of vessels including large storage jars, smaller bowls and vessels that have probably functioned as serving and cooking vessels suggests the site should be interpreted as a settlement. However, this can only be securely established through excavation.

Production techniques

Given the fact that the assemblage is a surface collection, it is difficult to find traces that allow reconstruction of the production techniques. Most sherds show weathering which has obliterated many subtle traces on their exteriors. However, the collection is not as abraded as assemblages of similar age from other sites discovered in the survey and the size of the sherds is exceptionally large. This is most likely the result of the complete disuse of this area in comparison to the heavy cultivation practised in other parts of the region. This level of preservation allows a few remarks on the production techniques that were used.

All sherds have been made without the use of a fast turning wheel. On one example clear traces were visible that indicate a slow turning wheel was used during final modification of the vessel. This single sherd is from a necked jar (sherd 500.x.6p5). However, several other sherds showed clear evidence that no slow turning wheel had been used since finger streaks were visible that had no predominant orientation. We can therefore conclude that the slow turning wheel technique was known but by no means commonly used.

All vessels are formed by hand and several show indications of coiling. The walls of vessels, especially those of the holemouth jars and bowls, are remarkably thin in proportion to their size. Although traces have been smoothed away, it is highly likely that excess clay was scraped off the walls. In several instances scraping had also been performed on bases to remove the so-called heel created by applying the first coil to the base. However, an equal number of bases still retain this heel. Several cups show clear indications that they have been constructed by means of pinching (e.g. sherd 500.x.4p8). Some cups have quite irregular walls (e.g. sherd 500.x.4p8), while others have been more carefully finished (e.g. sherd 500.x.4p11)(Figure 3). This suggests that at least some of the cups have been made in a very quick ad hoc fashion.

Except for the cups all bases are flat. Some are quite irregular and the bases that have not been severely abraded show traces of having stood on a sandy surface while still wet. Two ways in which the walls were attached to the slab of clay that was to become the base have been attested. On the one hand a coil was applied on top of the edge of the slab (sherd 500.x.2p20). On the other hand the coil could be attached to the outside of a slab of clay (sherd 500.x.1p34). However, such production traces were only discernable in a few instances.

Other construction techniques that were visible included the finishing of holemouth jar rims, i.e. either slightly flattened by applying pressure to the rim with, for example, a finger, or smoothing it into a rounded shape. Furthermore, most circular necked jars displayed traces of the attachment of the flaring rim to the vessel body. This was apparently done when the body was already close to leather hard.

The use of slip or paint as surface treatment is rare. A rim fragment of what seems to have been a small bowl contains a trickle of red paint of no distinct pattern (sherd 500.x.2p26). In only one case red slip seems to have been applied (sherd 500.x.6p5), while selfslip was attested on a few vessels. The indentations on the rims of the necked jars and on one of the bowls do not have sharp edges and were probably made by applying pressure with a finger. However, in the case of one large bowl (sherd 500.x.7p11), the indents are small, rounded and have sharp edges. This is suggestive of the use of a small twig or reed to apply pressure.

Overall the assemblage, irrespective of being a survey collection, preserves considerable evidence of production techniques. Unfortunately, the number of sherds with traces is still too small to discern any patterns. The techniques used are in many respects very similar to those used during the Late Chalcolithic and EBA periods (e.g. Braun 2004: 202, 205-206; Commenge-Pellerin 1990). However, the surface treatment in the form of trickle paint on rims commonly found in the Late Chalcolithic period and the intensive use of slip and burnishing of the (later) EBA is completely absent in this assemblage. Furthermore, the thin walls that characterize most vessels of this assemblage are not prevalent in other survey assemblages from either the Late Chalcolithic or EBA periods discovered in the region (Kaptijn in prep.).

Fabric analysis

A sample of 18 sherds was selected for fabric analysis. This selection was not completely random but based on preliminary identification of characteristics like colour and inclusions that seemed to represent different groups within the total assemblage

First, the samples were re-fired under oxidizing circumstances using two different temperatures, i.e. 750° C and 850° C. The latter temperature was chosen because some of the darker fired sherds, with a purplish tone, where suspected to have been fired at a high temperature. To test this assumption the firing temperature of 850° C was used to see whether changes occurred.

Subsequently, the cross section was examined under a stereomicroscope with a magnification of up to 50 times. This allows the identification of the main inclusions and their general characteristics like colour and shape. Voids resulting from trapped air or burnt away organic inclusions were also taken into account. Reference collections established by the Ceramic Laboratory of the Leiden Faculty of Archaeology were used to determine the amount of inclusions based on their weight proportion.

In this way, four main groups were identified. Each group included minimally two sherds that were deemed similar in fabric. Two sherds deviated from these four groups and were classed as 'miscellaneous'. Variation exists within these groups, which is expressed in the subdivision of groups in a, b and c. After fabric analysis the entire pottery assemblage was investigated macroscopically to group them according to microscopically identified fabric groups.

Group 1

(Group 1: microscopic N = 4, macroscopic N = 15) (Figure 5)
Sherds in group 1 are characterized by a yellowish colour. The Munsell colours run from 10YR 7/3-8/3 (very pale brown) to 7.5YR 7/4 (pink) before re-firing and from 7.5YR 7/4 (pink) with very pale brown (10YR 8/3) to reddish yellow (7.5YR 7/6) after re-firing. In all samples the oxidation of the original firing was not complete. The fabric contains large quantities of calcite inclusions together with iron oxide as second dominant type of inclusion. The calcite was probably added intentionally. Different types of calcite were used in the sherds, which indicates that several calcite sources were available to the potters. One sherd (sherd 500.x.1p16) forms a subgroup because a different type of calcite was used and the percentage of inclusions is larger (c. 30 % of its weight). The calcite in this sherd is of a different source than the other sherds and the

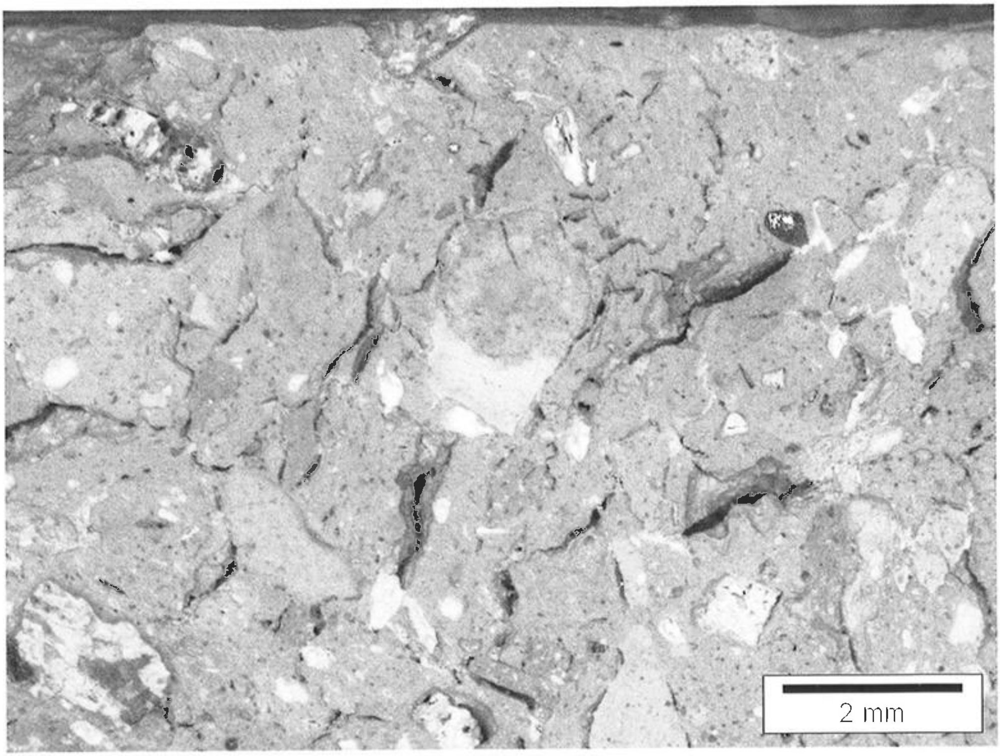

Figure 5. Fabric group 1 (sherd 500.x.7p4, magnification × 6.3).

shape of the particles is more angular and elongated. This indicates that the calcite was added without additional grinding. The iron oxide particles seem to have been originally present in the clay matrix. Round pores and channel pores suggest organic temper was added to the clay. On average the sherds in fabric group 1 contain 16-20% non-organic inclusions, when measured in weight.

Group 2

(Group 2: microscopic N = 2, macroscopic N = 4) (Figure 6)
This group consists of two sherds with fired clay colours running from pink – 7.5YR 7/4, light reddish brown -2.5YR 6/4 – 5YR 6/4 to pale yellow-2.5YR 8/4 before re-firing, and light brown 7.5 6/4 – pink 7.5YR 7/4 to very pale brown – 10YR 7.4 after re-firing. The change in colour resulting from re-firing indicates that the original firing did not occur under fully oxidizing conditions.

This fabric group is characterized by a poor sorting of inclusions. The dominant inclusions are iron-oxide, limestone and (quartz) sand. The iron oxide is present in

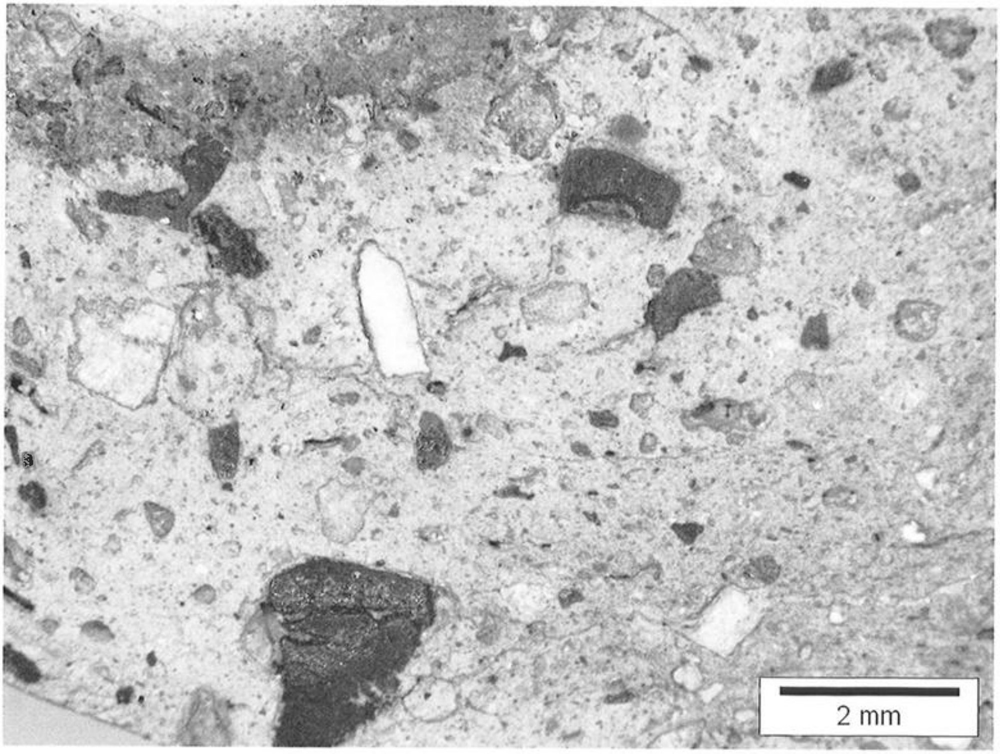

Figure 6. Fabric group 2 (sherd 500.x.2p17, magnification × 6.3).

different qualities, some clearly more metallic than others. Limestone is sometimes banded with iron-oxide (sherd 500.x.1p10). The physical link between iron-oxide, limestone and (quartz) sand suggests these inclusions were all naturally present in the clay. The (quartz) sand differs in roundness, which suggests a difference in deposition and therefore in clay source. The size of the channel and closed pores suggests organic temper took the form of thin vegetal matter, e.g. fine grasses. The two sherds that form group 2 contain 10-15% inclusions.

Group 3

(Group 3: microscopic N = 4, macroscopic N = 10) (Figure 7)
The sherds in this group are, before re-firing, characterized by rather divergent colours in a range of pinkish gray (5YR 6/2), reddish brown (5YR 5/4) to red (2.5YR 5/6). After re-firing the dominant colours are reddish yellow (5YR 6/6-5/3), light red (2.5YR 6/6) to pink (7.5YR 7/4). In all cases the re-firing caused the clay to become lighter, which indicates that the original firing was in a more reduced atmosphere. Some of the samples (sherds 500.x.1p12, 500.x.3p12, and 500.x.7p1) were re-fired at 850° C. The

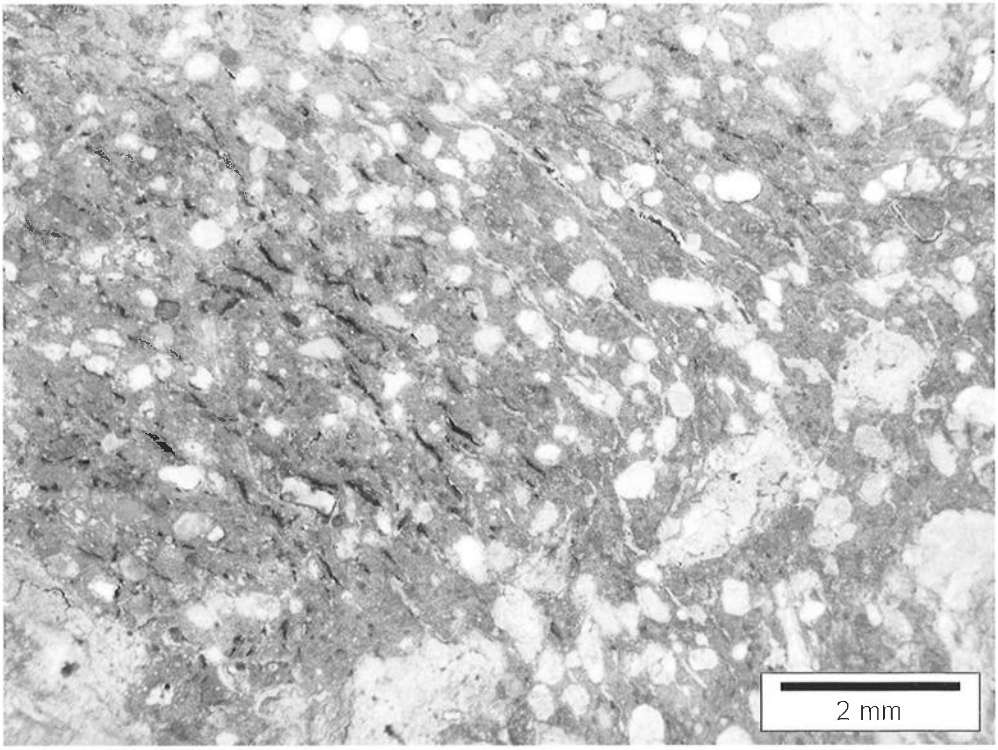

Figure 7. Fabric group 3 (sherd 500.x.1p12, magnification × 6.3).

continuing differences in lighter and darker hues after re-firing suggests that the original firing under partly reducing circumstances was done at relatively high temperatures exceeding 850° C.

The fabric group is characterized by a predominance of limestone. The limestone particles are rounded or sub-rounded showing a relatively high level of abrasion and are both elongated and spherical. Other inclusions comprise iron-oxide, calcite and (quartz) sand. A further characteristic inclusion is a dark grey to black, with red tones, conglomerate-like inclusion, that is both spherical and angular to sub angular. This inclusion is most likely a type of basalt with iron-oxide stains. Minor inclusions are mudstone and flint (sherd 500.x.3p9). Inclusions are quite numerous in this group (c. 30 %).

Group 4

(Group 4: microscopic N = 6, macroscopic N = 29) (Figure 8)

The fabric of this group is characterized by its predominant red colour, which undoubtedly indicates a higher iron-content. The dominant colours before re-firing are light

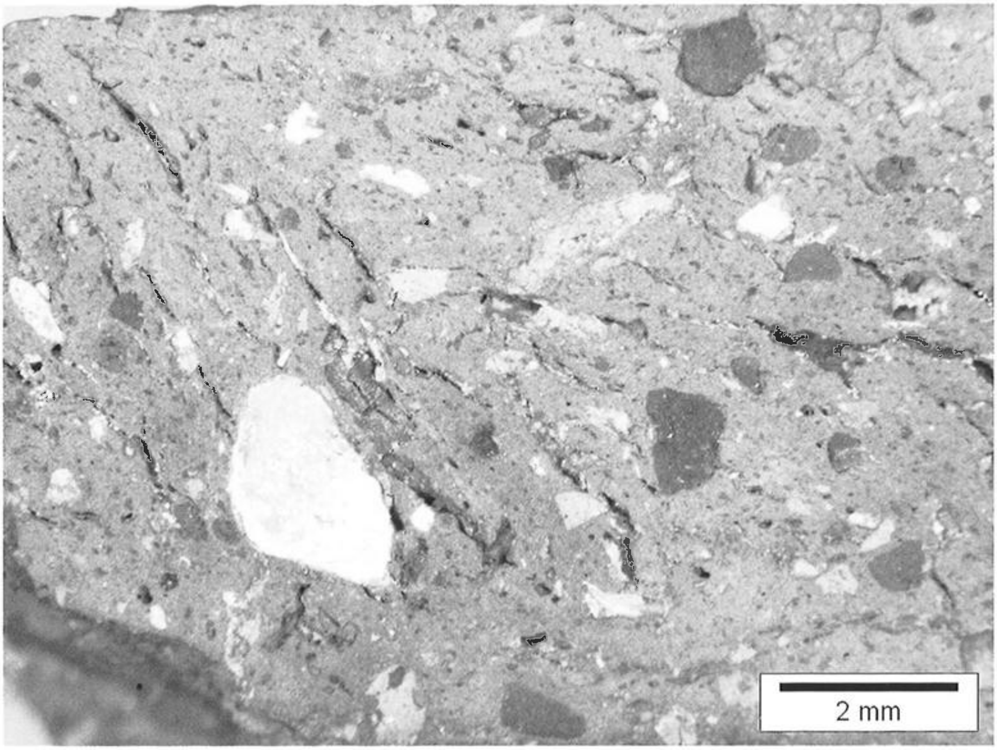

Figure 8. Fabric group 4 (sherd 500.x.1p17, magnification x 6.3).

brown (7.5 YR 6/3), reddish brown (2.5YR 5.4), and weak red (10R 4/3-5/3-4). After re-firing they are reddish yellow (5 YR 7/6), brown (2.5YR 5/4), and light red (2.5YR 6/6). The change in colour indicates that the original firing was not fully oxidizing, in some cases even partly reducing.

The dominant inclusions are limestone and iron-oxide. Mudstone, (quartz) sand and angular calcite particles are present as well. Basalt inclusions are sporadically present. A small group of inclusions consists of a greenish matrix with small holes. These are probably fragments of crushed ceramics that were or became sintered. This group contains the only clear proof of such practise within this assemblage (e.g. sherd 500.x.6p2).

The matrix of these samples is open and the inclusions are generally poorly sorted. This group can be subdivided on the basis of the dominant type of inclusion. In group 4a limestone is dominant, while iron-oxide dominates in group 4b. The numerous closed pores and elongated channel-pores indicate a high proportion of organic temper.

Of the 18 sherds whose fabric was analyzed microscopically, two sherds cannot be accommodated in one of the four fabric groups described above. These sherds seem to represent separate fabric groups, but they could not be defined more specifically because of the small sample. However, the macroscopic analysis suggests additional sherds belong to these two isolated groups (N = 5 and N = 4). A third group not represented in the microscopically analyzed sample seems to exist as well (N = 4). All three groups are made of light firing clays and resemble fabric group 1 most closely. Like the two microscopically examined sherds and the group 1 fabrics they were probably fired at low temperatures. These groups are referred to as miscellaneous below. Future analysis should clarify the character of these possible ware groups.

Firing

The yellowish fired sherds (Group 1 and miscellaneous groups) were re-fired at 750° C. The re-firing showed that the samples had not been completely oxidized. Furthermore, lime spalling occurred in some of the re-fired samples, which suggests that the original firing temperature *had* been below 700° C. Lime spalling namely occurs under oxidizing conditions when temperatures are above 700° C, but below a 1000° C (Rice 2005: 98).

The lighter fired sherds of group 2 have also been refired at 750° C. The diversity in colours after re-firing suggests that the original firing conditions were partly irreversible. This shows that the original firing temperature will have been higher than the 750° C at which the sherds were re-fired.[2]

Some of the samples of groups 3 and 4, that were re-fired at 850° C, show darker coloured patches which did not significantly change after re-firing under oxidizing conditions. This suggests that the original firing conditions were partly reduced and reached temperatures that exceeded 850° C.

Within group 4 several sherds show signs of sintering. This can be explained by the ferruginous clay and dominant lime temper of this fabric group. The reduced or partly reduced firing of clays rich in iron oxide causes the fluxing of the clay at temperatures around 800-900° C (Rice 2005: 94). A good example of this process is attested in sherd 500.x.2p20, where molten lime seems to have run into the voids left by organic temper (Figure 9). Fluxing of lime and vitrification of clays has also been attested at Middle Chalcolithic Teleilat Ghassul (Edwards and Segnit 1984).

The ferruginous clays of groups 3 and 4 are naturally rich in limestone inclusions and were therefore vulnerable to lime spalling, which could have disastrous effects on the vessel. It is highly likely that these vessels were deliberately fired in partly reduced atmospheres and to relatively high temperatures around 950° C as this caused the fluxing of the clay body and limestone inclusions. Group 2 vessels were probably also fired to high temperatures, but because less iron oxide was present these sherds did not sinter. In this way lime spalling was prevented from occurring after re-hydration and a hard fabric was created. It seems lime spalling was avoided in group 1 and the miscellaneous groups simply by firing the vessels at temperatures below 700° C.

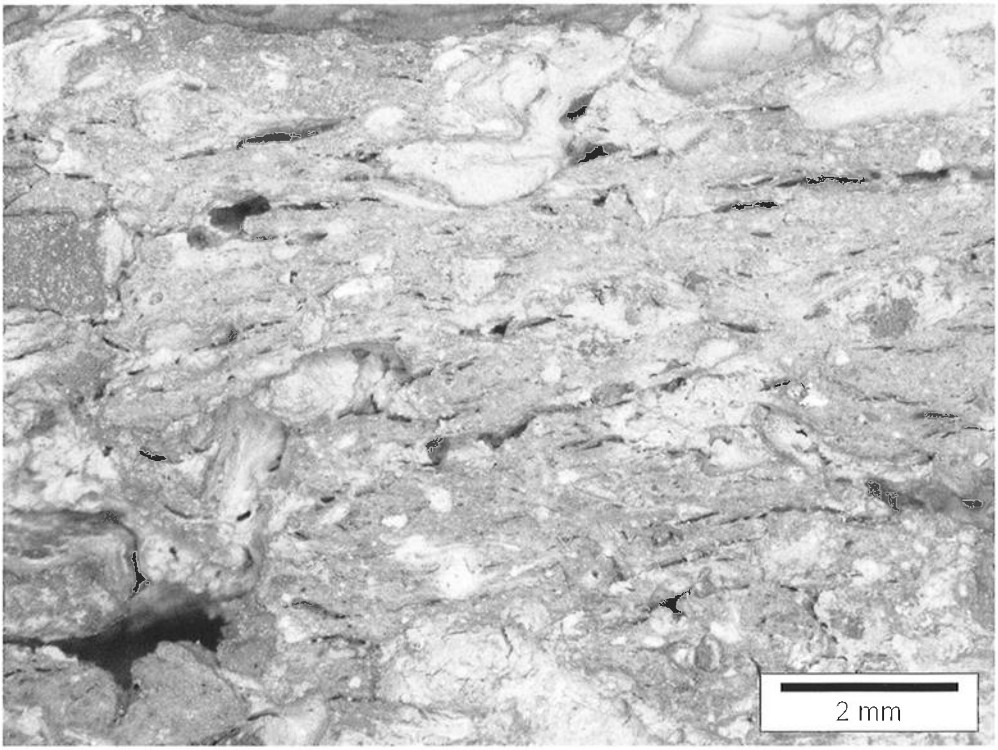

Figure 9. Vitrified sherds from fabric group 4 (sherd 500.x.2p20, magnification × 6.3).

This leads to the conclusion that there existed an intentional link between ware groups and firing techniques. The choice for fabric type and the distinction between high and low firing to avoid lime spalling might be related to the function of a vessel. To investigate whether this last link is indeed present vessel forms were related to the different fabrics.

Vessel types and fabric groups

By macroscopic analysis, the remainder of the assemblage was grouped into the microscopically assigned fabric groups. This is a tentative grouping and does not take into account minor differences in temper and clay. Nevertheless, 71 sherds could be assigned to a fabric group, while 13 were of unidentifiable fabric.[3]

In Figures 10a and 10b the fabric distribution over the five vessel types is depicted. The total number of vessels per vessel form is in some cases quite low, which prohibits any firm conclusions to be drawn (Figure 10a). However, the relative ware distribution does show a few trends that seem meaningful (Figure 10b).

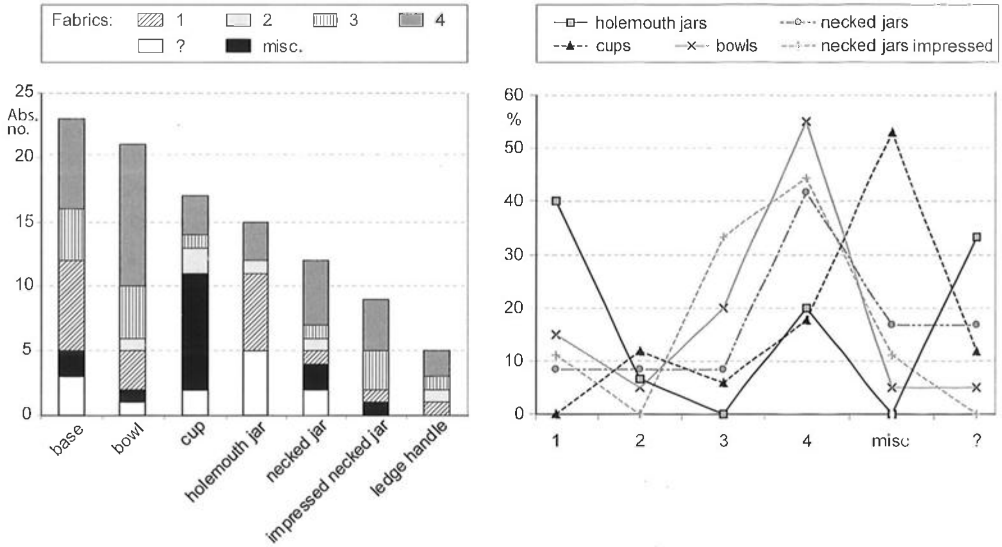

Figure 10. a. Absolute numbers per vessel form.
b. Fabric frequency per vessel form in percentages.

What catches the eye is that the fabric groups seem to be represented in most vessel types. Group 3 and the miscellaneous group are absent from the holemouth jars. Group 2 is absent from the impressed necked jars, but only six sherds were assigned to this fabric group which explains its absence. The fact that the different fabrics were used for most vessel types shows there was no absolute division between vessel types, function and fabrics.

The bowls, necked jars and impressed necked jars show the same general trend. A small percentage of these bowls is made from fabric 1 (8-15%; see Figure 10b). Fabric 2 is, due to its low frequency, rare in all vessel forms. Fabric 3 is more divergent as the bowls and especially the impressed necked jars show relatively high proportions of 20% and 33%, while only one necked jar was made with this fabric. All three vessel types, however, include a large percentage of vessels made from fabric 4 (42-55%). The miscellaneous and unknown fabrics were recognized in only a small percentage of these vessels.

This preference for ferruginous clays is paralleled in the latest stages of Chalcolithic Teleilat Ghassul, where an overall increase in the proportion of the hard fired ferruginous fabric (TG group 10) is visible (Lovell 2001: 35). A decrease in vitrification among vessels of this fabric is visible over time, but vitrified vessels continue to dominate the thin walled ceramics in the latest stages at the site (Lovell 2001: 36). Lovell, in accord with the findings of Edwards and Segnit, attributes the vitrification to the character of the clay and not necessarily to higher firing temperatures (Edwards and Segnit 1984, Lovell 2001:36). The decrease in vitrified vessels at Teleilat Ghassul is considered indicative of a better selection of clays and control of firing conditions by the potters.

The cups differ considerably from this general trend. Group 1 is absent. Groups 2, 3, and 4 are present in small quantities (6-18 %). Over 50 % of the cups are from miscellaneous fabrics. The latter, however, consists of at least three different fabric groups. It is safe to conclude that the cups are made from a wide range of different fabrics. This is most likely a representation of several different clay sources that were used. Given the simple production technique with which these vessels were made, it is very probable that clay and temper selection was not considered important in the manufacture of these cups. People simply used the clay that was easiest available.

The holemouth jars also show a trend diverging from the other vessel categories. In contrast to the other vessel forms, a large percentage of the holemouth jars has been made from fabric 1, whereas fabrics 3, 4 and the miscellaneous category, were much less used than for other vessel types (7 %, 20 % or absent). This can well be explained by reference to the function of holemouth jars. In several excavations from this period calcite tempered holemouth jars seem to have been used as cooking vessels (e.g. Adams 2003: 14, Lovell 2001: 35). Cooking pots are often tempered with considerable amounts of calcite, which has a similar expansion to fired clays when heated (Rye 1994: 33). This makes calcite tempered vessels resistant to repeated thermal stress and hence very suited for use as cooking pots. It is, therefore, very likely that the fabric 1 holemouth jars discovered in the Qatar Damiyeh concentration were used as cooking pots.

Conclusions

The question of whether a single community created the seemingly diverse pottery assemblage discussed here, or whether this collection incorporates the remains of two or more chronologically diverse groups can now be answered. The morphological differentiation at first glance contained shapes that on the one hand provided a date in the Late Chalcolithic period, but on the other hand contained hallmarks of the EBA. However, on closer inspection, parallels were found in well-dated assemblages that positioned the assemblage as a whole on the transition between the Late Chalcolithic and EBA. This assemblage, together with other recent investigations, are powerful arguments for a continuation of traditions between both periods in contrast to the complete cultural and habitational break that has long been thought to exist.

The marked difference in fabrics used for the vessels, which was easily visible even with the naked eye, is similarly not likely a result of chronological differentiation. The different vessel types occur in most fabrics, which shows there is no absolute break between these two aspects. However, there is a preference in fabric type visible with respect to function. Bowls and necked jars were predominantly made from ferruginous clays that showed signs of vitrification. It is likely that the characteristics of these clays allowed the walls of most vessels to be very thin, which seems to have been a valued characteristic. The parallel in clays and vitrification attested in the latest level of Teleilat Ghassul again positions this assemblage at the end of the Late Chalcolithic period.

The large difference in firing temperature, that was attested after re-firing some of the sherds, might be attributed to a single concern with preventing lime spalling, which will have been an important problem given the calcareous nature of many of the clays in this region. The low firing temperature (700° C) under almost oxidizing conditions, as well as the very high temperatures of c. 950° C in a slightly reducing atmosphere, both prevent lime spalling. As it is uncertain to what extent people were able to control the atmosphere of the firing, it is likely that they purposefully avoided the temperature range in which lime spalling occurs as much as possible.

Concluding it can therefore be stated that the pottery assemblage discovered at Qatar Damiyah in field 500 is left by a single group of people who inhabited this area for a restricted period of time somewhere at the transition between the Late Chalcolithic and EBA periods. Future excavation of this site would be able to provide valuable information on this poorly understood transition and the manner of existence of these people.

Acknowledgements

The research that has been described in this article has been carried out within the scope of the 'Settling the Steppe'-project funded by the Netherlands Organisation of Scientific Research (NWO) and carried out at the Faculty of Archaeology of the University of Leiden under direction of dr. Gerrit van der Kooij (NWO project number 360-62-020). Thanks must be expressed to dr. Fuad Hourani for his watchful eye that resulted in the discovery of this important site. Our gratitude also extends to dr. Fawwaz al-Khraysheh, Director General of the Jordanian Department of Antiquity with its staff for their support of this project. Furthermore, our thanks goes to dr. Omar al-Ghul and Yarmouk University for their year-long contribution to the fieldwork at and around Tell Deir'Alla. Thanks must, furthermore, be expressed to Niels Groot for photographing the fabric at Delft University of Technology (Figures 5-9) and Loe Jacobs from the Ceramic Laboratory of the Leiden Faculty of Archaeology for his assistance and advice in the fabric analysis and the refiring of the sherds.

Notes

1. For more information on the location of the site, the 'Settling the Steppe'-project and the Zerqa Triangle Survey in general one is referred to the preliminary article of the 2006 fieldwork and the general report of the survey (Hourani et al. in press; Kaptijn in prep.).

2. Re-firing of a group 2 sherd at 950° C showed almost no colour change, which suggests that the original firing was probably somewhere around this temperature.

3. 22 bases were left outside the sample.

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DEIR 'ALLA PHASE VII: THE NAISSANCE OF A DISTINCT CENTRAL TRANSJORDANIAN CERAMIC TRADITION

Niels C.F. Groot and Joris Dik

Abstract

This article presents results of the study of Early Iron IIC repertoire from Tell Deir 'Alla phase VII (± 700 B.C.). The research focused on the question of continuity and change of ceramic traditions between phases VII and VI (± 650 B.C.) at Tell Deir 'Alla. The present paper analyzed shapes, production techniques and fabrics. In the phase VII repertoire, the gradual advent of a Central Transjordanian tradition is visible. It encompasses new shapes, the application of novel techniques and the use of new cooking pot tempering materials. In Phase VI this new tradition is fully developed with features that were not yet present in phase VII.

Introduction

In the second half of the eight century B.C. the Neo-Assyrian empire instigated several campaigns to eventually incorporate the Southern Levant within its empire. This expansion included the conquest of the northern parts of Palestine and Transjordan, as well as the creation of vassal kingdoms in the south of Palestine and Transjordan. One of these new political entities was the kingdom of 'Ammon', which was located south of the new border of the Neo-Assyrian empire in Central Transjordan (see Figure 1). For 'Ammon'/Central Transjordan, the early stage of this new political constellation is not well known historically and archaeologically. Some work on the changes within the ceramic repertoire has been done by London (1999) and by Daviau (2001). Furthermore, the authors refer to an unpublished manuscript of Late Iron IIC-material from Tell Hesban. It currently awaits publication by Andrews University (London in prep.).

However, until now no in-depth study has been published for a corpus of excavated pottery from Central Transjordan during the era of Early Iron IIC (734-650 B.C.). This paper attempts to bridge this gap. Its primary objective is to describe the ceramic traditions present in the Early Iron Age IIC corpus (± 700 B.C.) from Tell Deir 'Alla, which is located at the edge of Central Transjordan in the Jordan Valley. This period is represented by phase VII, a densely built village on the eastern summit of the tell. It was constructed after almost a century of abandonment of the Phase IX village and its short-lived rebuilding attempt, Phase VIII. Phase VII was probably destroyed and

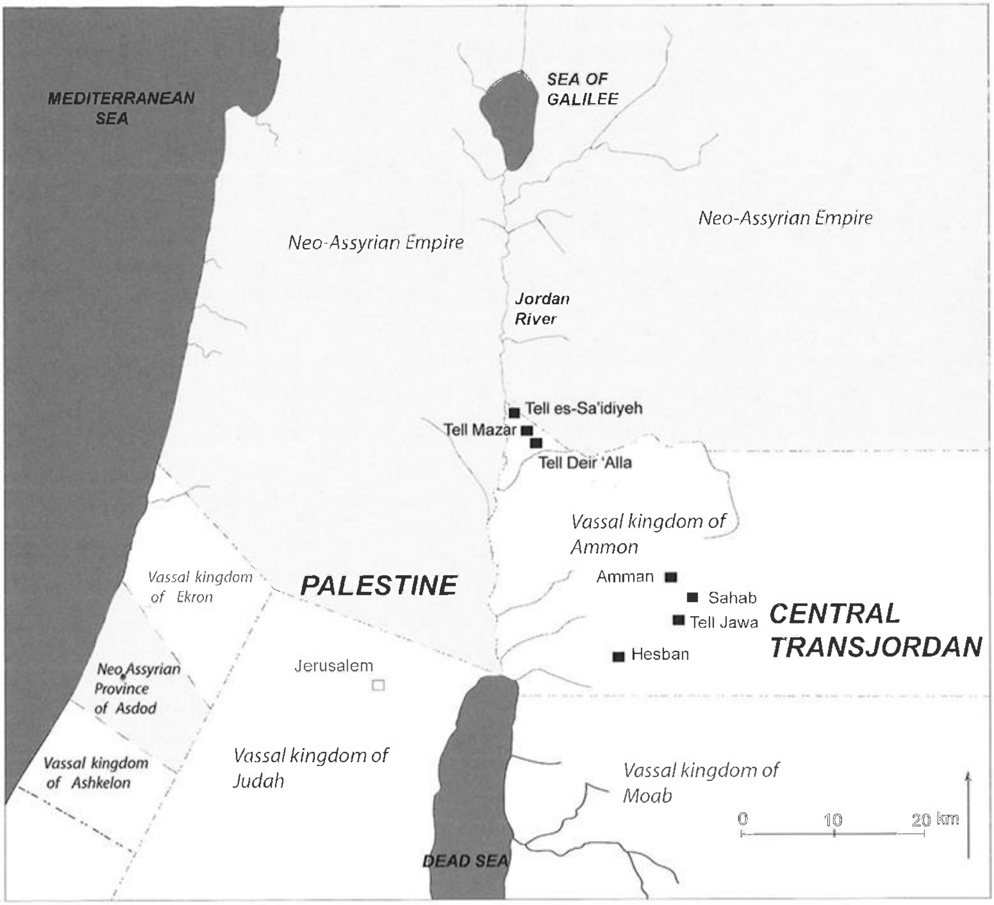


Figure 1. Map of the Southern Levant around 700 B.C.

abandoned after an earthquake in the early seventh century B.C. (van der Kooij 2001: 296-297). The second objective of this article is to establish the extent of continuity and/or change between the ceramic repertoires of phases VII and it successor phase VI, which can be dated to around 650-625 B.C. The ceramic repertoire of phase VI was discussed together with that of subsequent phase V/VI in the previous issue of this journal: Groot (2007).

This research forms a part of a PhD dissertation currently underway at Delft University of Technology, within the framework of the Centre of Art and Archaeological Studies (CAAS). It deals among others with pottery from the Iron IIC and Persian period occupational phases (734-332 B.C.) of Tell Deir ‘Alla (see Groot and Dik 2006).

Methodology

The current study maps continuity and change of the ceramic traditions between occupational phases at Tell Deir ʿAlla. A ceramic tradition can be described as a set of constants within a pottery repertoire, including shapes, techniques, fabrics and distribution pattern (see for further details Franken 2005; Groot and Dik 2006).

To study the phase VII pottery, 331 diagnostic sherds, consisting of rims and bases, were selected from various loci (Table 1). Firstly, the rims were divided into five diagnostic categories according to their shape:

1. Open bowls: rim diameter is the widest vessel diameter.
2. Closed bowls: rim diameter is smaller than the widest vessel diameter.
3. Jars/jugs.
4. Cooking pots: mainly characterized by a distinct fabric.
5. Lamps: bowl-like shape with a distinct pinched spout.

Sherd type		Number of sherds	% of the studied repertoire
Rims: Open Bowls		79	23,87
Rims Closed Bowls		73	22,05
Rims: Jars and Jugs		78	23,56
Rims: Cooking pots		39	11,78
Rims: Lamps		8	2,42
Bases		54	16,31
Total		331	100 %

Table 1. Overview of the studied diagnostic sherds.

Subsequently, the rims and bases were divided into distinct typological categories. The Phase VII rims form three regional groups on the basis of parallels from other sites. The first is the *Local* group, which comprises shapes that have thus far not been found outside the Central Jordan Valley. The second is the *Central Transjordanian* group, which are shapes predominantly encountered in the entire Iron IIC (± 734-539 B.C.) in the traditional area of the vassal kingdom of ʻAmmon'. This Central Transjordanian entity encompasses the Southern and Central Eastern Jordan Valley and the highlands around the current city of ʻAmman, where the capital of the Iron Age kingdom was situated. The third regional category is the *General Southern Levantine group*, which encompasses shapes that cannot (yet) be assigned to a specific region and includes Central Transjordan and Palestine. The limited information concerning Early Iron IIC pottery from Central Transjordan makes it difficult to assess whether most of these shapes were predominantly found in Palestine or were also produced in Central Transjordan.

The description of the production techniques is based on the observation and interpretation of marks left by the potters.

For the low-tech study of fabrics, a representative sample of 91 samples was taken. The samples were ground until horizontal and refired in an oxidising atmosphere at 725° C at the Leiden Ceramic Laboratory. These samples were analysed by using a binocular microscope (5-50× magnification).

Shape

Open bowls

Local. The so-called 'mansaf bowl' is a type of large heavy bowl that seems to be confined to the Central Jordan Valley (Figure 2.1). At Deir 'Alla it has been found since Phase J of the Iron Age I settlement (Franken 1969: 157-160). That it was in use even after phase VII, it testifies to the preservation of an old ceramic tradition by the local community of potters (Groot 2007: 92).

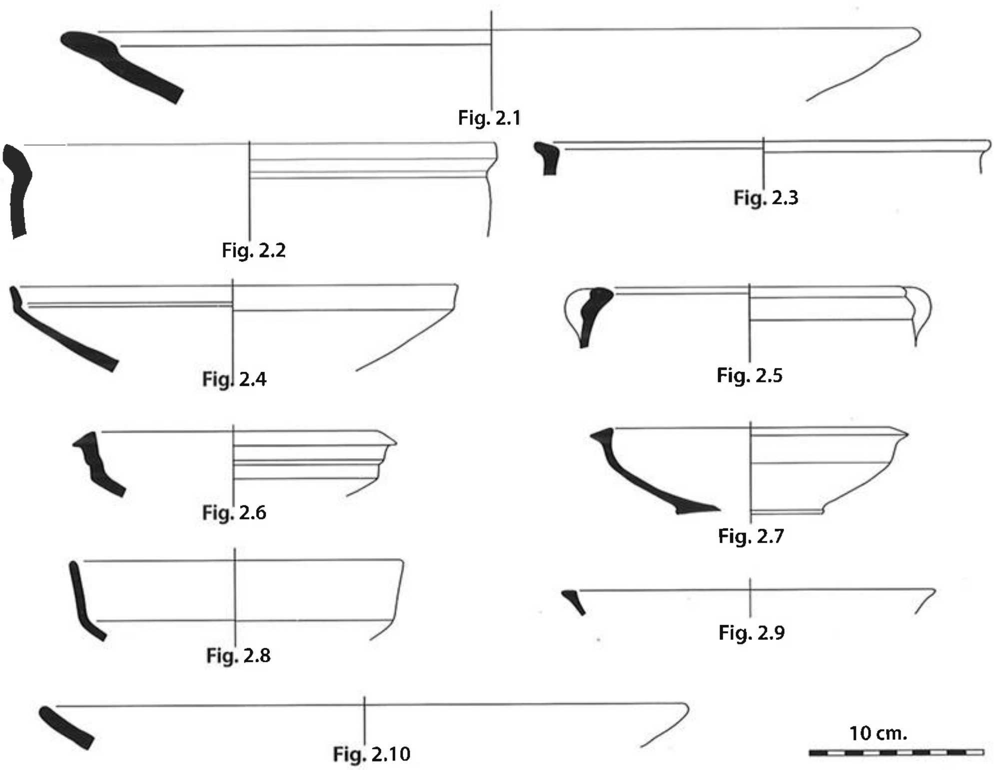


Figure 2. Selection of open bowls from phase VII.

Central Transjordanian. During phase VII the first examples of the 'Ammonite'/ Central Transjordanian shapes are encountered. The best example is the squatted hemispherical bowl, which will become a dominant type in phase VI (Figures 2.2,3). Also, less common 'Ammonite' types from phase VI (Groot 2007: 92, Figs. 2.18, 2.24) appear for the first time in phase VII, including a fine shallow plate and a type of ridged bowl (Figures 2.4,5). During phase VII, these were also rare types.

Other 'Ammonite' bowl-types limited to phase VII, include a distinctive ridged bowl and a fine high-fired dark-grey bowl (Figures 2.6,7). A parallel for the latter has been found in a tomb at adjacent Tell Mazar (Yassine 1984: Fig. 3.8) and an oxidising fired example was found in a tomb at Sahab (Harding 1948: Fig. 12).

General Southern Levantine. Present on both sides of the Jordan are several types, which are generally less fine than the Central Transjordanian shapes (Figures 2.8-10).

Closed bowls

Central Transjordanian. Limited to phase VII are two bowls with an inward folded rim (Figures. 3.1,2). These have also found at Tell es-Sa'idiyeh strata V and IV (Pritchard 1985: Figs. 14.3; 17.3). Continuity with previous phases is visible in the presence of the large holemouth bowl and the globular bowl with upright rim (Figures 3.3,4). Both types have been encountered in the phase IX/M. (van der Kooij and Ibrahim 1989: Fig. 58.27; Vilders 1992: 5.39).

General Southern Levantine. This category includes the hallmark of the new Neo-Assyrian hegemony, the so-called palace ware. It is a group of high-fired, wheel-thrown wares, which are marked by thinness of the walls, their hardness and a well-levigated fabric (Engstrom 2004: 69-71). In phase VII, fragments of a thin carinated bowl, typical of the repertoire, were found (Figure 3.5). The excavated fragments contrast with examples from the Assyrian heartland. The Assyrian examples are marked by either a pale pink colour or a light green to pale cream colour, while the examples from Deir 'Alla are dark grey, as is a similar bowl from nearby Tell Mazar (Yassine 1984: Fig. 3.3). This difference in colour indicates regional production of Palace Ware, as was suggested by Engstrom (2004) for Southern Palestine. This distinct type of bowl has not been encountered in phase VI, but the notion of carinated bowl persists in subsequent phases for a type 'Ammonite' bowl (Groot 2007: Figs 4.11, 5.6; Groot in prep.).

Continuity is visible in the presence of kraters (Figures 3.6,7) The krater itself is already encountered in the sub-phase preceding phase IX and is also found in Phase VI (Vilders 1992: Figs. 5.40-42; Groot 2007: Figs. 4: 8, 9).

Jars/jugs

Central Transjordanian. Three phase VII shapes in this category include a typical shape in Central Transjordan, the single handled cup/ 'mug'. At Deir 'Alla it has only been encountered in phase VII (Figure 4.1). The two other distinct phase VII vessels appear to be absent in Palestine. The first is a storage jar with a neck-like,

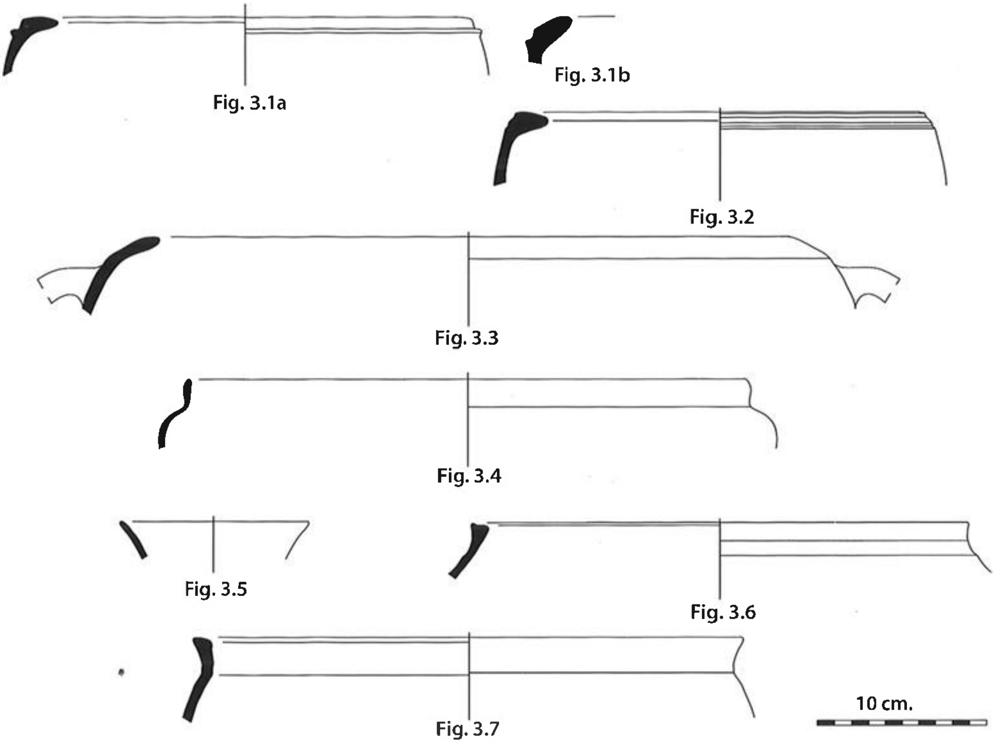


Figure 3. Selection of closed bowls from phase VII.

high incurving rim (Figure 4.2). It is limited to phase VII. A parallel has been found at Tell Jawa stratum VII (Daviau 2003: Fig. 12.6.2). The second type is a thin straight-necked jar with rounded rim (Figure 4.3). This shape has also been found, although somewhat coarser, in phase VI (Groot 2007: Fig. 6.6).

General Southern Levantine. Continuity in phase VII is visible in the two typical storage jar rims (Figures 4.4,5). Both have been encountered at Deir 'Alla since Early Iron phase H onwards and are also encountered in subsequent phases VI and V/VI (Franken 1969: 163-164; Groot 2007: Figs. 6.1,2; 7.1,2). Another distinctive shape is a large pilgrim's flask (Figure 4.6). It is a jar type which has been found at Deir 'Alla, since the fourteenth century B.C. (Franken 1992: 121, 151).

Cooking pots

Central Transjordanian. Two fully developed cooking pot types appear for the first time in phase VII. Both are descendants of the slightly carinated cooking pot, which appeared initially in the Late Bronze Age (Franken 1992: 158). The first and more

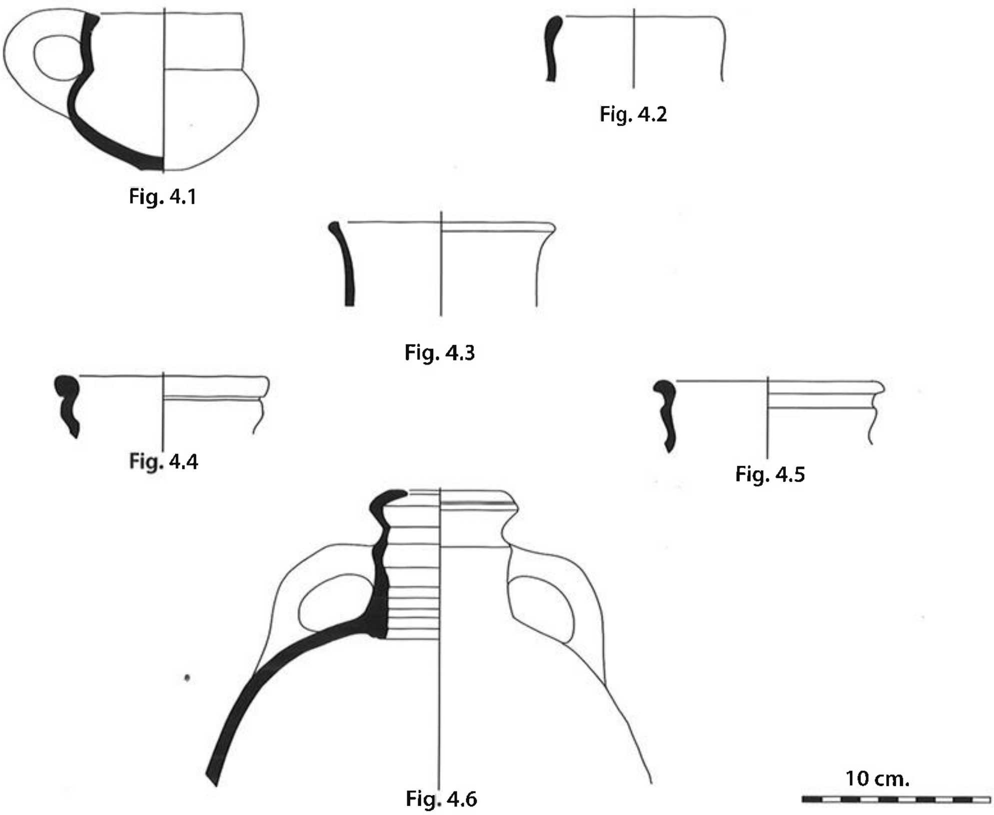


Figure 4. Selection of jars and jugs from phase VII.

dominant type is the cooking pot with the thickened, sometimes ridged vertical rim (Figure 5.1). The second new cooking pot has a thickened, rounded rim with a characteristic groove running underneath the rim (Figure 5.2). Both types will rise to further prominence in phase VI, where they become the dominant cooking pot types within the repertoire (Groot 2007: 96, Figs. 8.1-4, 6, 7; 9.1-4).

Yet another distinct type is the Iron Age I and II cooking pot with a dark grey exterior and yellowish interior (Figure 5.3). This shape, classified by Franken (1969) as cooking pot type 3, has been found from Iron Age phase G onwards and continues also in phase VI, where it was mistakenly classified as a closed bowl due to its unusual appearance (Franken 1969: 127-131; Groot 2007: Fig. 4.4).

General Southern Levantine. Five general types can be distinguished in phase VII. The first two are variants on the slightly carinated cooking pot mentioned above. In addition to a continuation of the Iron Age I-IIA cooking pot with folded rim. (Figure 5.4), is a

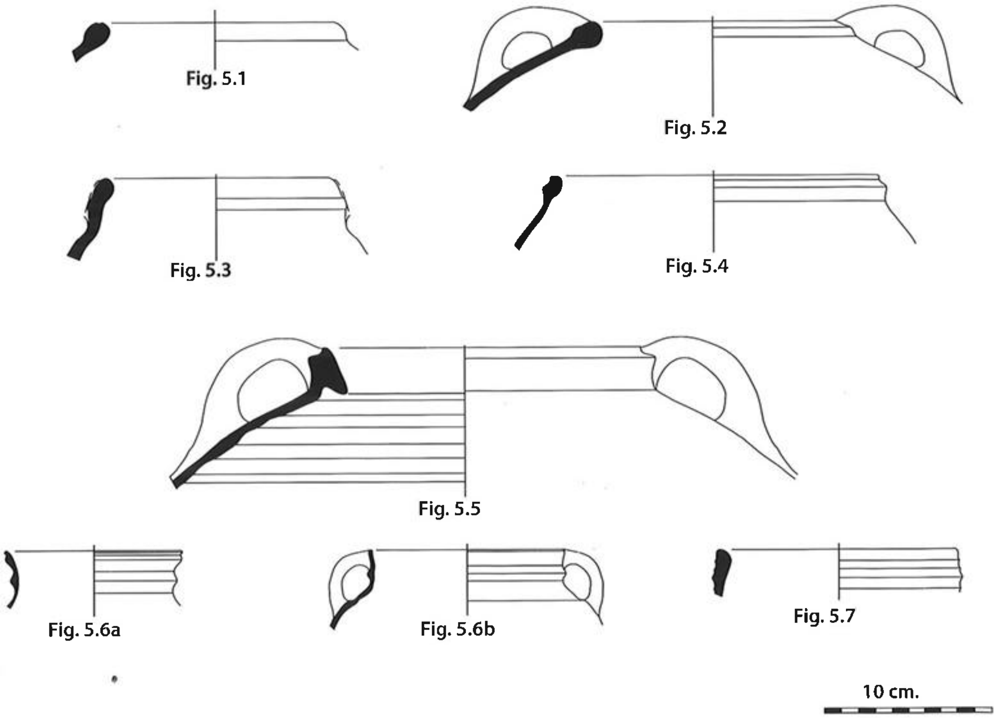


Figure 5. Selection of cooking pots from phase VII.

cooking pot with a thickened, everted and ridged rim. (Figure 5.5; Ibrahim and van der Kooij 1997: Fig. 5). The third type is a globular cooking pot with an everted and ridged rim (Figure 5.6).

The remaining two types are cooking jars, which have a well-developed necked jar. The first jar type is a delicate thin-walled, dark reddish cooking jar (Figure 5.6). The second type has a thicker wall and does not posses such a dark red colour (Figure 5.7). The last four cooking pots are common in Iron Age IIC (Southern) Palestine (see Amiran 1969: 227, 232, Pl. 76), but have not been found in the subsequent phase VI at Deir ʿAlla.

Lamps

In this phase for the first time a thin walled, wheel thrown lamp appears (Figure 6), which seems to be limited to the Iron Age IIC in Central Transjordan (Groot 2007: 96, Fig. 11). Besides its thin walls, this type is characterised by a coarse disc base. This type of base differs from the previous rounded bases (Franken 1969: 104-105).

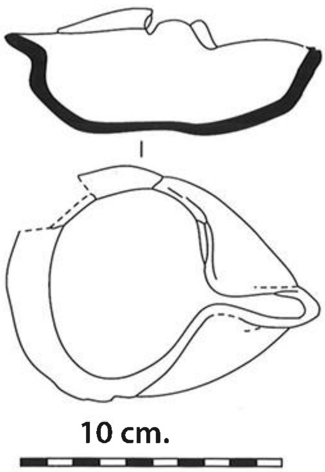


Figure 6. Wheel-thrown lamp from phase VII.

Bases

The dominant type is the ring base, representing 46,3% of the bases. During this phase, the double disk base appears as a new small group. In the collection of phase IX, it has not yet been encountered.

Continuity and change in the Early Iron Age IIC

In phase VII, several typical 'Ammonite'/Central Transjordanian shapes appear for the first time or rise to prominence (Figures 2.2-7; 3.1,2; 4.1-3). The implication is that during this period the typical Central Transjordanian/'Ammonite' corpus of Late Iron Age IIC was developing. Some typical 'Ammonite' shapes had not yet appeared, including the step-rim bowl, the carrot flask and two distinct types of storage jars (Groot 2007: Figs. 2.11; 6.7-9,13). Nevertheless, the ceramic corpus had already become distinct from neighbouring Palestine. Furthermore, during the period around 700 B.C. some distinct shapes appeared, which had disappeared by phase VI. Clear regional continuity during the Early Iron Age IIC is also visible in the presence of 'mansaf bowls' (Figure 2.1) and Franken's type 3 cooking pot (Figure 5.3).

The production techniques

Primary shaping technique

Mould-made. This technique could be used to produce the entire vessel, as was the case for the so-called 'mansaf bowl' (Figure 2.1). In addition, the technique was used for producing the base of the majority of cooking pot types (Figures 5.1-5). On top of this mould made part, with a aid of a potters' wheel, the potter added coils to create the upper half of the cooking pot.

Coiling and slab building. For the majority of the vessels the techniques of coil and slab building were combined with the use of a potters' wheel. This was the technique used for the larger vessels, for instance the larger closed bowls and jars among other pot types (Figures 3.6-7; 4.4,5). It could be combined with the technique of turning close the base of the vessel. A special case of closing by turning was the production of the pilgrim's flask (Figure 4.6). Its globular body was turned upwards and subsequently closed in one continuous process.

Wheel-made. In the Iron Age II the technique of wheel-throwing reappeared again after an absence of at least 700 years and is connected with Neo-Assyiran influence (Franken and Steiner 1991; London 1999). The re-introduction of wheel-throwing in the Southern Levant occurred in the interlude between phases IX and VII. At Deir 'Alla phase VII this technique was already fully developed and is evident for all categories of vessels. For example, the old lamp, which was made by means of a slow wheel (Franken 1969: 104), was replaced by wheel thrown lamps with markedly thinner walls (Figure 6.1). Another clear example is the introduction of thin walled and clearly wheel thrown cooking jars in the previously relative fixed repertoire of mould made cooking pots (Figure 5.6). It parallels the type F thrown cooking pot from Jerusalem (Franken and Steiner 1991: 107).

Secondary shaping technique

Slip and burnish. The use of slip during phase VII is quite rare for all categories in contrast to the phase VI where it was found on open, and to a lesser extent, closed bowls (Groot 2007: 99). In phase VII burnishing was applied as the finishing technique, mainly for both bowl categories. Approximately 35 % of the bowls were burnished partly or completely. Jars and jugs are predominantly smooth, only ± 5 % was burnished. The application of burnish continued in phase VI on mainly open bowls (Groot 2007: 99).

Paint. Paint was seldom applied on the phase VII vessels, in contrast to phase VI. In the latter phase the typical 'Ammonite decoration' with black and white bands appears (Groot 2007: 99).

Firing

Generally speaking, the objects were well fired in oxidising to neutral circumstances. During phase VII, a distinct firing technique was practiced to produce a hard, almost glassy ware. It entailed firing the vessels at a high temperature in reducing atmosphere. This process is indicated by re-firing samples at 750°C at which temperature the samples did not turn reddish again (Rice 1987: 94). It indicates the transition from Fe_2O_3 to FeO, a powerful flux, which creates a glassy body. This technique was used to produce the Assyrian Palace Ware bowls and the fine and dark grey bowl with thickened rim (Figures 3.5; 2.7). Additionally some vessels were fired at high oxidising temperatures, for example, the ridged open bowl (Figure 2.6).

One fragment of a closed bowl (Figure 3.1b) and a fragment of a ring base were fired in complete reducing circumstances below sintering point as the refiring of a sample taken from the bowl at 750° C attested (see also Groot 2007:100; London et al. 2007: 80-81) for re-firing Late Iron IIC black burnished bowls). These phase VII examples could be the first examples at Deir 'Alla of the typical black burnished pottery. It was a characteristic ware in Iron IIC Central Transjordan (Herr 2006: 525-527). The two fragments, possibly of one bowl, make it difficult to conclude; nevertheless the Black Burnished Ware appeared as a fully developed ware in phase VI (Groot 2007: 96, 100). Therefore, it is not unlikely that a gradual process of development preceded its appearance in phase VI.

Earlier than these techniques was another special firing technique, which continued to be used in phase VII and also VI for the production of the Franken's type 3 cooking pot (Figure 5.3). Its distinct dark grey exterior was created by subjecting it at a high temperature to reducing circumstances. This caused the reduction and partly sintering of the exterior scum layer of this vessel type (Franken 1969: 128-131).

Continuity and change in production techniques during Iron Age IIC

The introduction of the fast wheel in phase VII was not a short-lived attempt, but would continue to be an important technique throughout the remainder of the Iron Age. It would enable the appearance of several new shapes in phase VI, including the step rim bowl and the carrot flask. Also older techniques persisted throughout the successive phases, in which especially the mould made 'mansaf bowls' and the firing process for the type 3 cooking pot remained similar.

A clear alteration is visible between the secondary finishing of vessels between phase VII and VI. The increase in phase VI in the use of slip for especially open and closed bowls, together with the application of the typical 'Ammonite' motives of black and white bands are marked changes. Another change can be seen in the decrease of the in reducing atmosphere high-fired vessels and the rise or even appearance of the Black Burnished Wares. These changes/innovations are typical for the Late Iron Age IIC-ceramic repertoire of Central Transjordan. Therefore, it can said that techniques were introduced somewhere in the first half of the seventh century B.C.

Fabrics

A total of 91 samples have been taken for analysis of fabric from the study collection. Twelve samples were taken from cooking pots, which all possess a characteristic fabric, mostly with high percentage of non-plastics, as a result of their function. Non-plastics were added to withstand the thermal shocks during use. These are therefore not comparable with the other fabrics belonging to 79 samples taken from the other vessels types, including both types of bowls, jars and jugs.

Local fabrics

The local fabric is characterised by the presence of mudstone particles. These are clay fragments, which do not complete dissolve if the soaking time was too short and/or when there is insufficient kneading of the clay. This aspect is characteristic for the local clay deposition, the Damiya formation, of which several natural outcrops exist in the Central Jordan Valley. Tell Deir 'Alla is situated on one of these outcrops (Groot 2007: 100). Furthermore, archaeometrical analysis has showed that the presumed local fabrics and local clay ovens are made of the same clay. Consequently, it can be assumed that there was a local production in the region of Deir 'Alla. An exact location can likely never be ascertained due to the deposition of the Damiya formation throughout the entire Central Jordan Valley (Groot in prep.). Of the 79 non-cooking phase VII pot samples the majority, 71 %, is of a local origin. The fabrics with a local origin can be divided into three fabric types (see for description Table 2: 1-3).

The first fabric type is the most dominant and can have a high percentage of non-plastics. Usually quartz sand and lime are present. This is the most abundant of the three fabrics. The second type is characterized by the presence of lime as non-plastic, this fabric has a low amount of quartz sand. The third fabric type is marked by a lower percentage of non-plastics: Mudstone is the most dominant, while lime and even less quartz sand are also found. This fabric type is connected with wheel-thrown and high-fired vessels, including the distinct fine high-fired dark grey bowl (Figure 2.7), a distinct ridged bowl type (Figure 2.6) and a necked jar (Figure 4.3).

Non-Damiya fabrics

The study revealed that 29 % of the 71 sampled phase VII sherds were made from a different fabric. In total 16 different fabrics can be identified, of which 13 are singular types. The remaining three fabrics are larger groups, which all match with fabric types found in phases VI and V/VI (see for description Table 2: 4-6).

The first type of these three latter phase VII fabric types is marked by a somewhat coarse quartz and lime tempered fabric. This fabric is far less common in the collection of the succeeding phase VI. The second fabric group consisting of two samples, is marked by a pinkish colour and small inclusions, predominantly lime. It matches Central Transjordanian fabric type 4 from phase VI and V/VI (Groot 2007: 103). The third type is a sandy ware, which is characterised by sand in the silt fraction and a low percentage of larger non-plastics. It matches Central Transjordanian fabric type 5 from phase VI and V/VI (Groot 2007: 103).

Cooking pot fabrics

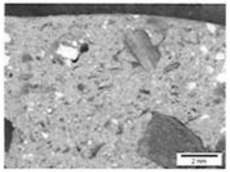
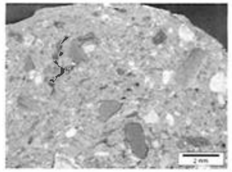
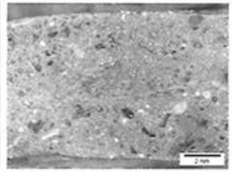
The 12 sampled phase VII cooking potsherds shows the presence of several fabrics, which include the following types (see for description Table 2):

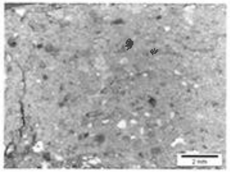
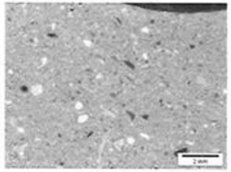
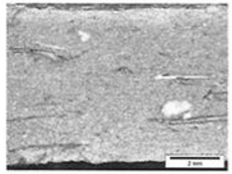
1. A red firing fabric, containing crushed calcite.
2. A red firing fabric, which has mainly quartz sand and some lime.
3. A red firing fabric, containing crushed flint and some lime.
4. A fine dark red firing fabric with very fine sand/silt.
5. A fine dark red fabric with small lime particles.
6. A yellowish firing fabric, containing amongst others much mudstone and some quartz sand.

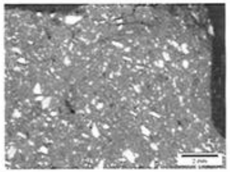
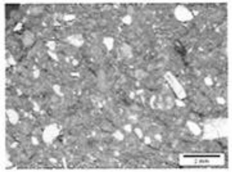
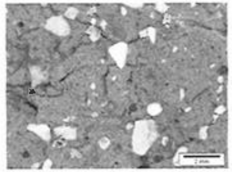
The sampled vessels demonstrate that already in phase VII, a marked transition had taken place in the use of cooking pot temper. It is the shift from calcite towards silica minerals, which is visible in fabrics 2-4. This shift can be attributed to the fact that silica minerals, in contrast to calcite, do not have the problem of lime spalling and can therefore be fired on a higher temperature (Rye 1981: 33-34). Nevertheless in cooking pot fabric types 2 and 3 lime continues to be added in a small amount.

The absence of these new temper types within phase IX and the presence within phase VII of fully fledged cooking pot types with silica mineral temper indicate that the development in Central Transjordan towards this new tradition took place in the interlude between both, the eight century B.C. This change was earlier than previously assumed (Groot 2007: 101; London 1999: 91), although in this phase calcite-tempered cooking pot-types are still present in the repertoire (Figure 5.5). The assigned era for this development corresponds with the date of this innovation in Jerusalem, which appeared in phase 3, also eighth century B.C. Here, the innovation went together with the introduction of the thrown cooking pots/ fast wheel, which are devoid of calcite and tempered with very fine sand/silt (Franken and Steiner 1991: 82, 107). Also at Deir ʻAlla the introduction of the thrown cooking pots (Figure 5.6) occurred alongside the introduction of the new cooking pot temper.

Together with the appearance of cooking pot fabric types 2 and 3, is the introduction of two new Central Transjordanian cooking pot types. Fabric type 2 is connected with the Central Transjordanian cooking pot with a thickened, sometimes vertical ridged vertical rim (Figure 5.1), which appears for the first time in phase VII. Fabric type 3 corresponds with the Transjordanian cooking pot type with a thickened rim and the groove underneath it (Figure 5.2). Thin-section analysis of several samples from this latter type showed that these stone particles were fragments of chert. It is likely that the appearance of both shapes was related to the shift towards silica mineral tempers. The fifth cooking pot fabric is solely found in combination with the distinct Iron Age I/IIa type 3 cooking pot (Figure 5.3). Unchanged since its appearance in Iron Age I phase G, its fabric is marked by a yellowish colour, coarse inclusions including quartz sand (see

Abbreviations used in this table:	LS: Low Sphericity HS: High Sphericity VA: Very Angular		A: Angular SA: Subangular SR: Subrounded		R: Rounded
Local Fabric type 1		**Local Fabric type 2**		**Local Fabric type 3**	
Samples	Σ=18		Σ=21		Σ=11
Mineral Inclusions					
Dominant Particles	Lime Mudstone		Quartz sand Lime		Mudstone
Dominant Size:	1.0-0.2 mm.		0.8-0.2 mm.		0.7-0.2 mm.
Roundness	Lime: HS/LS: SA/SR/R Mudstone: LS: SA/SR		Quartz sand: HS: SA/SR/R Lime: HS/LS: SA/SR		Mudstone: LS: SA/SR
Less dominant particles	–		Mudstone		Lime Hematite
Sporadically	Hematite Quartz sand		Hematite; Calcite		Quartz sand
Percentage	± 15-35%		15-35%		10-18%
Sorting	Very poor-poor		Poor-Fair		Fair
Fibres					
Percentage	1:3-1:6		1:2-1:6		1:3-1:8
*Maximum **length***	0.6 mm.		0.6 mm.		0.5 mm.

Trans-jordanian fabric 1:		Trans-jordanian fabric 2:		Trans-jordanian fabric 3:	
Samples	Σ=6		Σ=2		Σ=2
Mineral Inclusions					
Dominant Particles	Quartz sand Lime		Lime Mudstone		Quartz sand Lime Mudstone
Dominant Size	0.7-0.2 mm.		0.6-0.1 mm.		0.5-0.10 mm.
Roundness	Quartz sand HS/LS: SA/SR Lime HS/LS: SA/SR		Lime: LS/HS: SA/SR/R Mudstone: LS: SR/R		Quartz sand: LS/HS: SA/SR Lime: LS: SR Mudstone: LS: SA/SR
Less dominant particles	Mudstone		Calcite Hematite		–
Sporadically	Hematite		Quartz sand		Hematite
Percentage	15-30%		12-14%		5%
Sorting	Poor-Fair		Poor-Fair		Fair
Fibres					
Percentage	1:4-1:6		1:5-1:9		1:3
Maximum length	1.2 mm.		0.5 mm.		3.0 mm.

Cooking pot Fabric 1		Cooking pot Fabric 2		Cooking pot Fabric 3	
Samples	Σ=2		Σ=6		Σ=1
Mineral Inclusions					
Dominant Particles	Calcite		Quartz sand Lime		Lime Flint
Dominant Size	0.3-0.7 mm.		0.2-0.5 mm.		.0.6-1.6 mm.
Roundness	Calcite: L.S. VA-A		Quartz sand: LS/HS: SA-R Lime: LS/HS:SA-R		Lime: L.S.: SA-R Flint: L.S. A-R
Less dominant particles	–		Hematite		Hematite
Sporadically	Hematite, Mudstone		–		–
Percentage	40-45 %		30-40 %		25 %
Sorting	Very poor-poor		Poor-Fair		Very Poor
Fibres					
Percentage	1:10		1:8-1:10		1:10
Maximum length	0.3 mm.		–		–

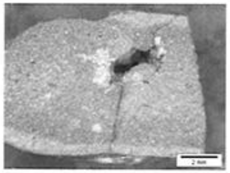
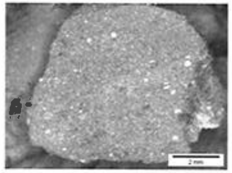
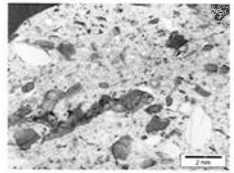
Cooking pot fabric 4		Cooking pot fabric 5		Cooking pot fabric 6	
Samples	Σ=1		Σ=1		Σ=1
Mineral Inclusions					
Dominant Particles	Very fine sand/silt: silty matrix		Lime Very fine mixed sand: silty matrix		Hematite Quartz sand Yellowish Stone
Dominant Size:	< 0.10 mm.		< 0.10-0.3 mm.		0.30-1.50 mm.
Roundness	Not observable		Lime LS: SA Very fine mixed sand Not observable		Hematite: LS: A/SA Quartz sand: HS/LS: SA/SR Yellowish stone: LS: SA/SR
Less dominant particles	–		–		Lime Mudstone
Sporadically	Lime Quartz sand		Calcite grain		–
Percentage	2%		15%		35%
Sorting	Very good		Good		Very poor
Fibres					
Percentage	<1:10		1:6-1:7		1:4
Maximum length	–		0.15 mm.		0.30 mm.

Table 2. Selection of fabrics from phase VII.

Franken 1969: 127-131). The presence of quartz in the fabric indicates that knowledge concerning the use of silica minerals, as temper, was already regionally present before the major shift towards the dominant use of silica minerals in cooking pots. Although not recognized prior, in phase VI this cooking pot and its distinct fabric continue.

Continuity and change in fabric types during Iron Age IIC

During the entire Iron IIC the local fabric types constitute the dominant group. The continuation from phase VII to VI of the two local fabrics with lime or quartz sand is clear. A change is visible in the marked decrease in phase VI of the third local fabric type of phase VII with its low amount of non-plastics. Concerning the presence of non-Damiya, possibly non-local, wares within the repertoire, continuity can also be seen. This includes the three largest phase VII fabric groups, which are all encountered in phase VI. The cooking pot fabrics constitute the only group that displays a clear shift in phase VI. In this phase, the presence of calcite as temper is very sporadic and the absence of phase VII cooking pot fabrics 4 and 5 is connected with the demise of the wheel-thrown cooking jars.

Conclusion

The study of the ceramics from Deir 'Alla phase VII illustrates the naissance of a new Central Transjordanian ceramic tradition in the early seventh century B.C. In this period, the development separate from the ceramics from Palestine becomes evident, entailing in the mainly regionally distinct shapes. In the latter part of the seventh century B.C., Deir 'Alla phase VI, this tradition has developed further and contains the characteristic features of what is called the 'Ammonite' style. This encompasses several distinct shapes, the application of distinct red slip as well as black and white painted bands. During this process changes occurred. Some characteristic shapes from phase VII were no longer produced, as is also the case for the distinct Palace Ware. Furthermore the technique of high-firing in a reducing kiln atmosphere was abandoned. The cooking pot fabrics also change, which is mainly due to the demise of the wheel thrown cooking jars and calcite temper. In contrast, the non-cooking pot fabrics change minimally. In addition, this asemblage illustrates innovations in ceramic production that took place in the eight century B.C., which include the introduction of the fast wheel and the use of quartz based tempers for cooking pots.

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COMPARISON OF COMPOSITIONAL ANALYSES OF IRON AGE CERAMICS FROM TWO SITES IN JORDAN

G. A. London, R. D. Shuster, J. Blair, and S. Kelly

Abstract

Iron Age pottery, including Late Bronze/Iron Age I collar rim storage jars, Iron Age II black burnished bowls, unique cult pieces, cookware, and the regular repertoire from two sites (Tell Hesban and Tell el-'Umeiri) is examined using petrographic analysis and Instrumental Neutron Activation Analysis (INAA). We compare the results of each study with the morphological categories based on vessel shape and surface finishes to learn about change and continuity of clay bodies and organization of the ceramics industry in ancient Jordan.

Introduction

Mineralogical and chemical analyses of pottery excavated at Tell Hesban was carried out to examine diversity of raw materials within and between the long span of habitation and use of the site from the Iron Age I to recent times.[1] To specifically investigate the regional Iron Age I and II ceramics industry, we compared sherds excavated at Tell Hesban and Tell el-'Umeiri (Figure 1). Relative proximity of the two sites, located southwest of Amman in the Madaba Plains region, permits a regional assessment of pottery manufacture and distribution for central Jordan.

Material and methods

Hesban pottery J. Sauer excavated and collected during the initial excavation seasons provides the basis for our compositional analysis. The material is currently part of the collection at Canadian University College in Lacombe, Alberta, on study loan from Andrews University.

Our original criteria for selecting Hesban sherds was to sample the widest range of vessel types, fabrics, and firing patterns based on macroscopic appearance of the clay bodies. An earlier, preliminary petrographic analysis of sherds from Tell el-'Umeiri (London et al. 1991), also guided our Hesban sherd selection.

The sherds submitted for Hesban petrographic analysis include 310 sherds from Tell Hesban (Petrographic Hesban samples (PH 1-291 and PH 298-316[2]) and six sherds excavated at Tell el-'Umeiri (PH 292-297[3]). Thin secion analysis of 230 sherds,

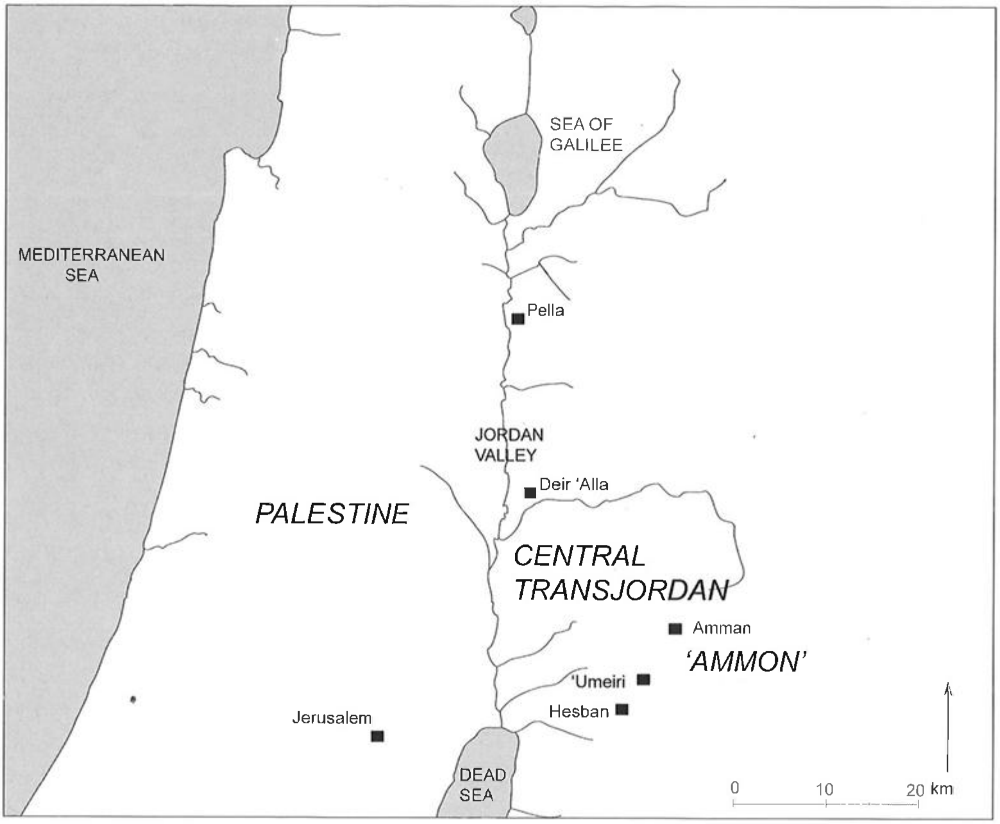

Figure 1. Location of Hesban and Tell el-'Umeiri in the Madaba Plains, Jordan

amongst which 86 sherds dating to the Late Bronze Age-Iron Age II/Persian period was executed.[4] For petrographic thin section preparation, sherds were cut parallel to the vertical axis of each pot to sample vessel walls rather than rims or handles. Examination of the thin sections, using a polarizing microscope and magnifications of ×40 and ×100, allowed identification of mineral types. R.D. Shuster, with students J. Blair and S. Kelly at the University of Nebraska, Omaha Department of Geology, recorded the type, size, orientation, shape, frequency, and sorting of inclusions in clay bodies from Hesban. Under the supervision of Jon Cole (Walla Walla University) and John Winter (Whitman College), students J. Quinn and L. Shultz examined 'Umeiri thin sections.

"Fabric" and "clay body" are used here to designate the mix of rocks, minerals, organic materials, either native or additives, blended together with the fine clay particles. In describing clay bodies, small 'voids' refer to spaces left by burned out organic material, in contrast to cracks, fissures, etc. caused during manufacture, drying, or firing. The quantities of non-plastics are in terms of 100% and do not include the amount of clay or voids. A clay body can have 75 % quartz, 20 % limestone, and 5 % grog inclusions. The same clay body can have 60 % clay, 35 % non-plastics, and 5 % voids of burned out organics. We differentiated 12 main ware types, each with a different predominant inclusion based on the mineralogical analysis of 230 sherds of all periods at Hesban.

After petrographic analysis 99 Iron Age sherds were selected for Instrumental Neutron Activation Analysis (INAA), i.e. 74 of the 86 thin section samples and 25 samples from ʿUmeiri (PU – Petrographic ʿUmeiri). The INAA was carried out by H. Neff and M. D. Glascock at the University of Missouri Research Reactor Center (MURR).[5] The 99 Iron Age sherds include 12 collar rim store jars of Iron Age I, 10 cooking pots, 38 burnished bowls, and 39 samples from either the Hesban normal repertoire or the unique pieces. Jars, jugs, and bowls, burnished or plain, constitute the Iron Age I and II control group against which we compare and contrast the 74 Hesban and 25 sherds excavated at Tell el-ʿUmeiri. Here we summarize the INAA chemical results and compare those findings to the petrographic mineralogical study. INAA separates the 91 of the 99 samples into Groups 1-4 with eight samples unassigned to any group.

INAA Group 1

Two-thirds of the 99 samples belong to INAA Group 1, including Iron Age I collar rim store jars, and the full range of Iron Age II jugs, jars, bowls, kraters, plates, plus one cooking pot (Figure 2). Group 1 encompasses virtually every petrographic group with predominantly grog, limestone, or a blend of quartz, limestone, and grog. Missing are wares with 50 % or more quartz temper. At Hesban, the latter primarily is a post-Iron Age fabric. Pottery from both Hesban and ʿUmeiri in Group 1 includes Iron Age I collar rim store jars, regardless of their precise shape, and Iron Age II burnished bowls with different rim shapes. Group 1 accommodates all wares (except those over 50 % quartz) and all surface finishes (plain, painted, or burnished) from both sites suggesting that it was local to the Madaba Plains and/or Central Jordanian Plateau area.

Of the ten INAA cooking pots sampled, only one, PH 91, fits the Group 1 chemical profile. The sampling strategy is not likely responsible for this situation. Mineralogically this particular cooking pot matches other Iron Age II pottery with limestone temper. However, limestone is a poor choice for cookware given its tendency to decompose at relatively low temperatures. The other nine cooking pots fall outside the limestone rich fabrics typical of Group 1. Petrographic analysis of the Hesban sherds reveals that grog, calcite, quartz, or a blend, are more prevalent than limestone in cookware. PH 91 has a trace (0.1 %) of powdery calcite, possibly native to the clay. In terms of rim morphology, the shape is in the newer, narrow-mouthed Iron Age II tradition.

INAA Group 2

The 14 Iron Age and one Hellenistic bowl (PH 145) contain grog, calcite, and limestone as the primary inclusions. Pots tend to be small in size, burnished, or unusual.

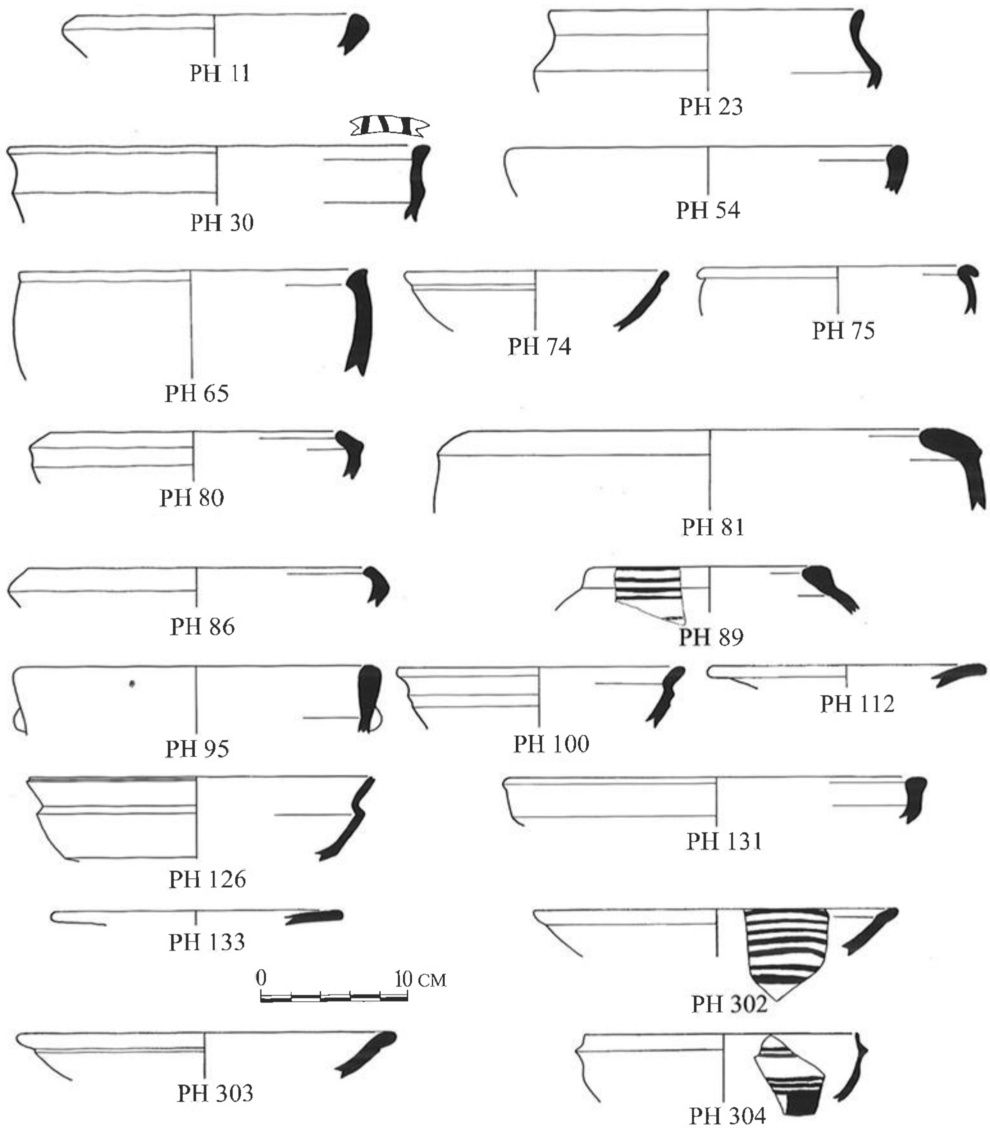

Figure 2. INAA Group 1: open forms including burnished bowls.

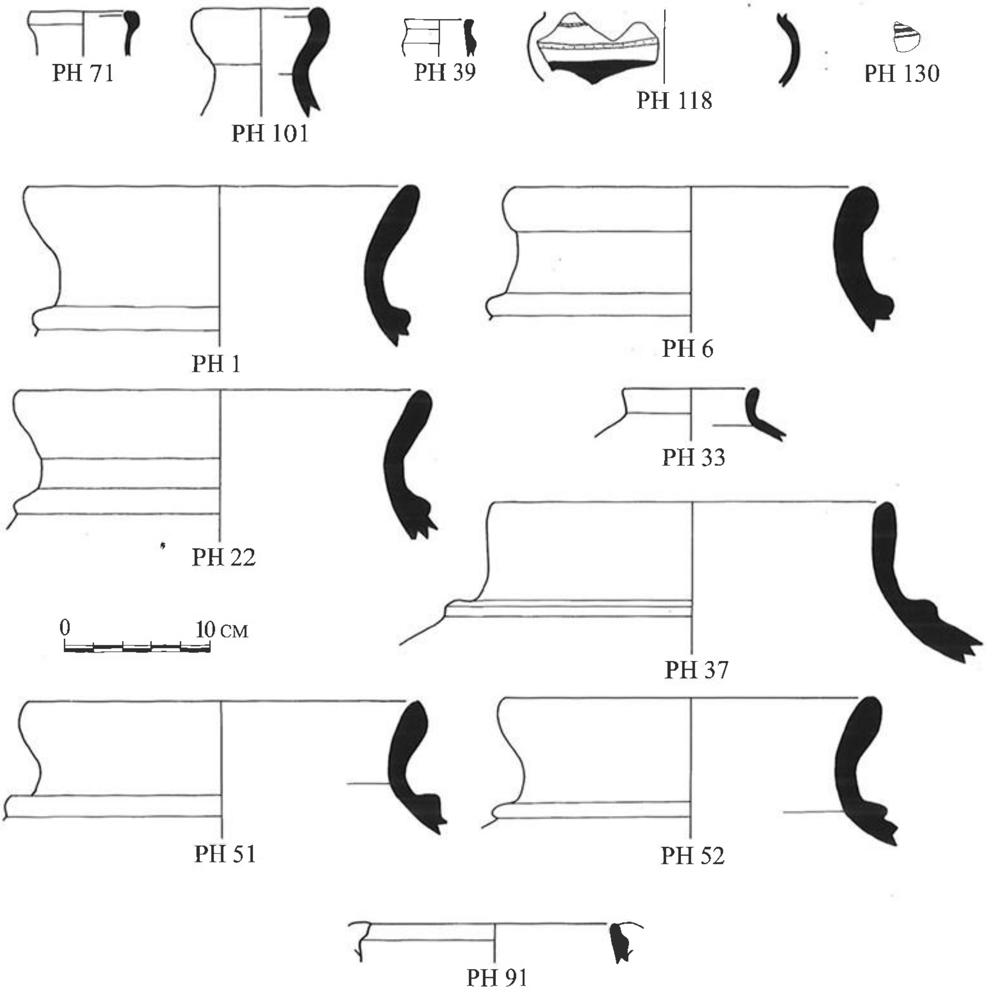

Figure 2 continued.
INAA Group 1: closed forms – six collar rim store jars and a cooking pot.

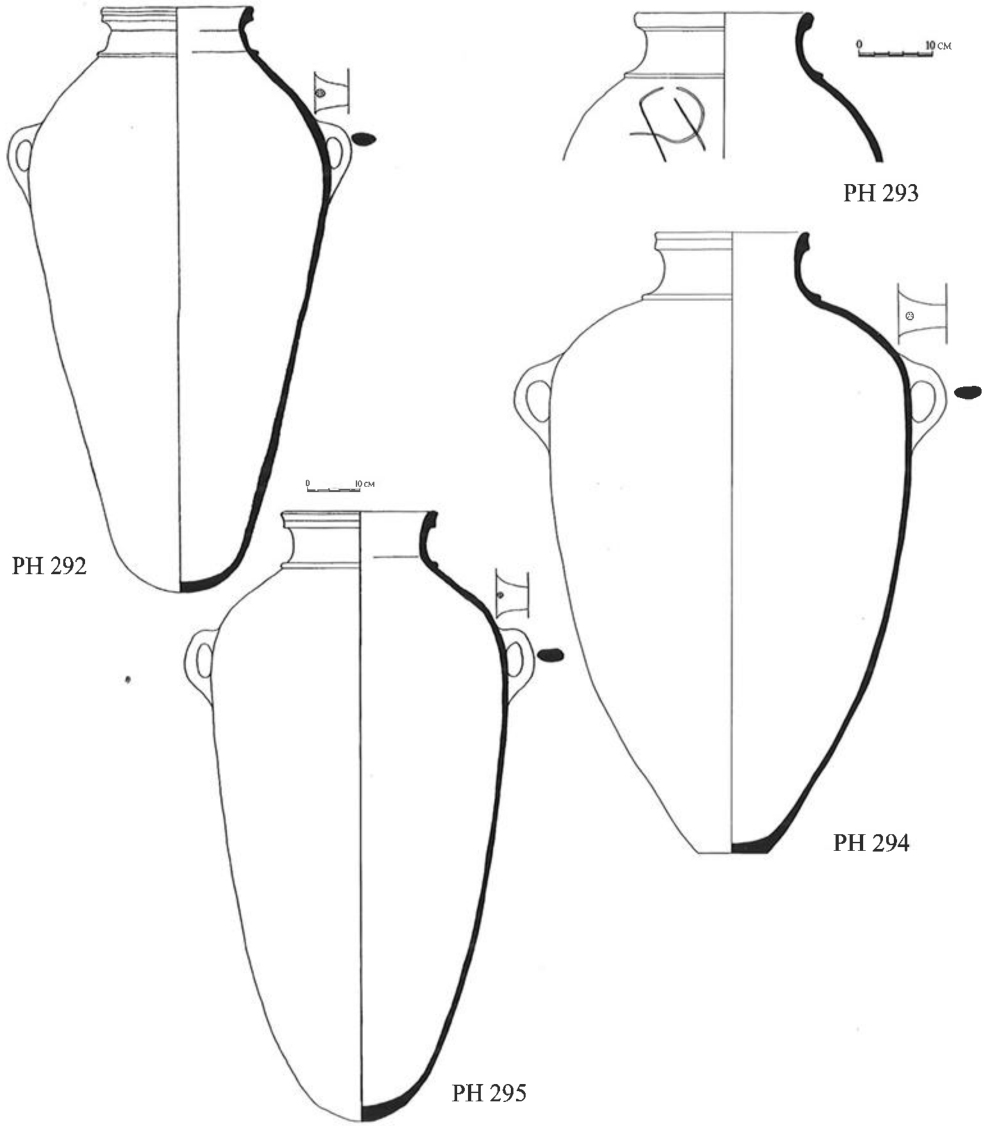

Figure 2 continued.
INAA Group 1: collar rim storage jars.

Burnished bowls are in addition to the infrequent pieces such as the plaque, flask, and mug (Figure 3). The single larger piece belongs to a possible cult stand. Cooking pots and storage jars, which constitute 25 % of the total sample, are absent not due to sampling strategy. Instead, their absence reflects different sources than the less frequent shapes and some burnished bowls, including some with the nicest sheen and luster.

INAA Group 3

The seven samples in Group 3 include: one Iron Age II jug, one Roman period bowl, and five Iron Age II cooking pots, all from Hesban (Figure 4). Unfortunately, no cookware from ‘Umeiri was submitted and as a result, it cannot be concluded that Group 3 pots did not reach the site. No Iron Age bowls or jars of any size, shape, or finish are in this sub-set. The normally ubiquitous limestone is not a prominent inclusion in any sample. Calcite, quartz, or grog, predominate in individual sherds. Others have a blended mix. All except PH 124, which is grog-rich, contain some calcite. PH 135 alone has basalt. Given that five cooking pots and a jug are categorized together suggests that the same raw materials possibly suited certain non-cookware or this is a heating jug.

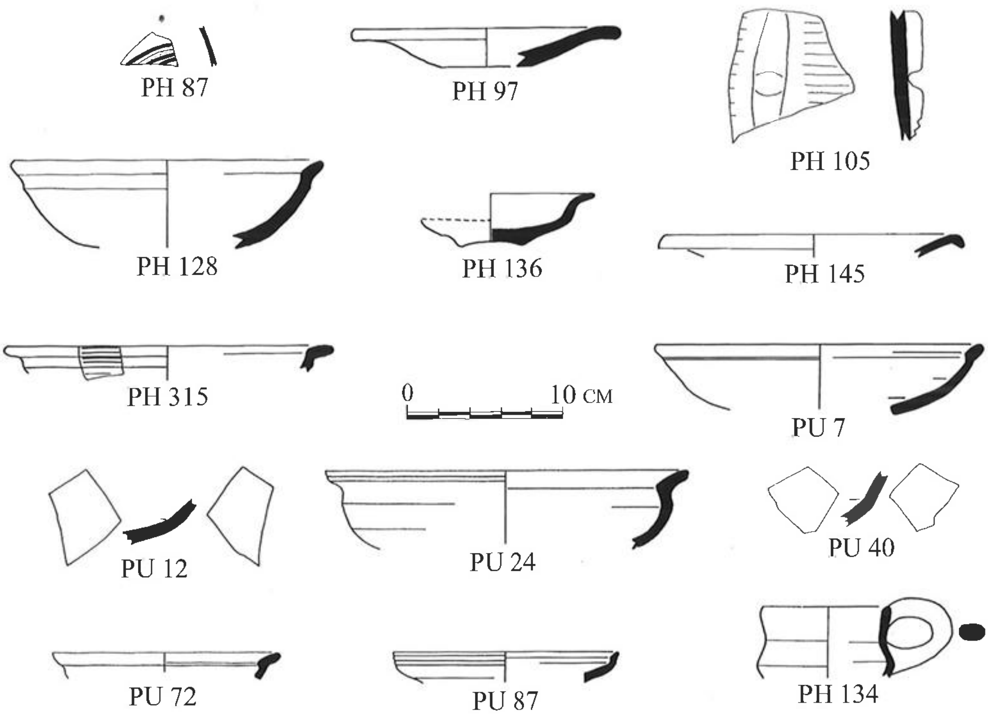

Figure 3. INAA Group 2: burnished bowls and infrequent ceramic shapes.

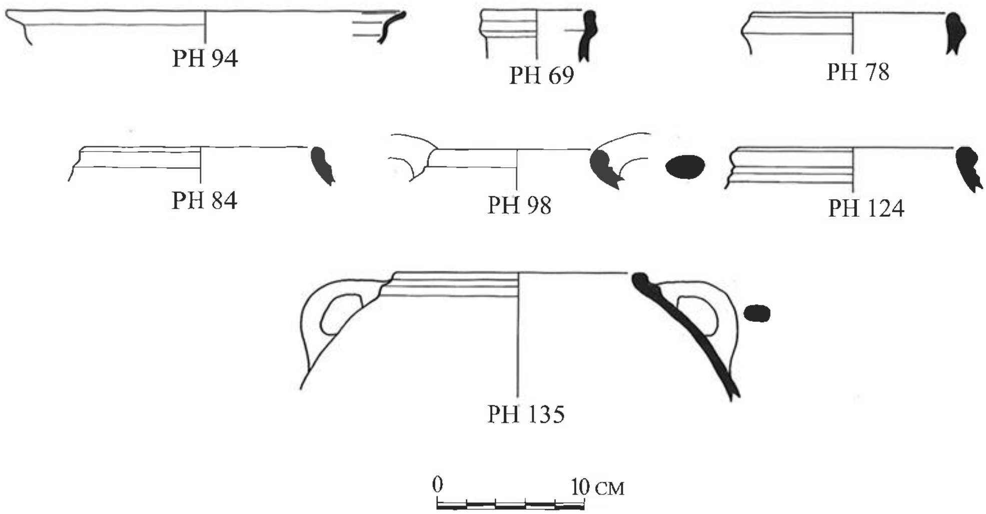

Figure 4. INAA Group 3.

The mineralogical and chemical compositions of cookers differ, in general, from most other pots. Calcite temper in PH 84 and 98 reaches approximately 95 % of the total inclusions. Grog is a rare choice for temper in cookware, but it accounts for 70 % of the intentionally crushed and added sherds found in PH 124. In these samples, the great abundance of a single inclusion type is rare in non-cookware.

The quartz (55 %) and calcite (35 %) mix in PH 135 is an uncommon combination in our sample. Most Hesban sherds with over 50 % quartz are of Late Iron Age II/ Persian date. Similarly, at Tell Deir 'Alla, phases V/VI of the 6th century Late Iron Age IIC, bowls include a new fabric characterized by quartz sand. In contrast, cooking pots with quartz temper start already in phase VII of the 7th century (Groot 2007: 101). PH 135 is either Late Iron Age II/Persian or it one of the early quartz-rich shapes in the Iron Age II repertoire. The implication is that cooking pots led the shift from carbonaceous inclusions, such as calcite and limestone, to quartz.

INAA Group 4

Four Hesban cooking pots with predominantly quartz temper, to the exclusion of other minerals, comprise INAA Group 4 (Figure 5). Rim morphology varies considerably: inward or outward slanting, thin or thickened, bulbous or not. PH 298 has a rounded bulbous rim from which a handle extends. It bears closest resemblance to Group 3 rims, in contrast to the other three cookers, two with everted rims and the holemouth form of PH 300. Handles on two pots are wide, flattened ovals rather than circular in shape as on other cookers. As a group, the four rims shapes are distinct from INAA

Group 3. Herr (per. com. 2007) dates PH 298-301 to the 6-5th centuries rather than the 7th century, i.e. Persian rather than Iron Age. The entire collection could represent a chronologically distinct group from Groups 1 and 3.

Unassigned

Eight samples fall outside the four INAA groups (Figure 6). From the 'Umeiri excavation are two collar rim store jars and a red burnished bowl. From Hesban is one of the only wheel-thrown jugs, PH 108, as well as two additional jugs and a burnished bowl. Mineralogically these samples have predominantly limestone, grog, or a blend of non-plastics plus some basalt. One red burnished bowl is made of a blend of calcite ground fine plus quartz. The collar rim store jar (PH 296) could be a Group 1 outlier. The implication is that most of the ten store jars were of local or regional manufacture designated as Group 1, while two might come from elsewhere, although it remains possible that they are somewhat unique, but distant members of Group 1.

Discussion

The sampling strategy for the petrographic and INAA compositional studies incorporated maximum diversity in shape, color, and firing of available sherds from Hesban. Our starting point was to use mineral and chemical analyses to test the morphological and macroscopic variations archaeologists regularly detect in precise vessel morphology and clay bodies. One result of adopting such a strategy is the limited number of samples within each category of vessel type and rim shape. For example, there are differences within burnished bowl rims and bodies, and cooking pot rims. Can we determine if the source of variation resulted from different workshops, potters, and/or manufacture in different times or places? Were the red and black burnished Iron Age II bowls, known in the literature as "Ammonite Ware", made in different contemporaneous workshops in the Madaba Plains, central Jordanian plateau or elsewhere? What do differences in the firing colors represent in terms of pyrotechnology? Refiring tests taught us that the black burnished color resulted from a reducing kiln atmosphere (London et al. 2007: 82). Why did some bowls fire without the black surface and core? Were red bowls versus black bowls made from two distinct clay bodies? Some cooking pots fire red while others are dark in common with Bronze and Early Iron Age cookers. Does firing color alone change or are there other attributes, which change simultaneously?

Trends in clay bodies

INAA Groups 1 and 2, in addition to the petrographic studies, demonstrate the overlap of fabrics used for Late Bronze/Iron Age I and II pottery. The Iron Age I material was limited to the collar rim storage jars. Cooking pots and a jug in INAA Group 3

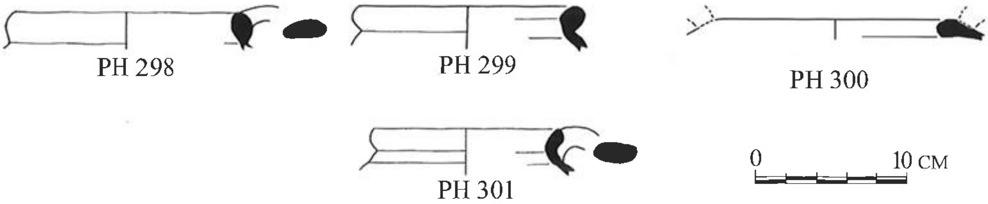

Figure 5. INAA Group 4: cooking pots.

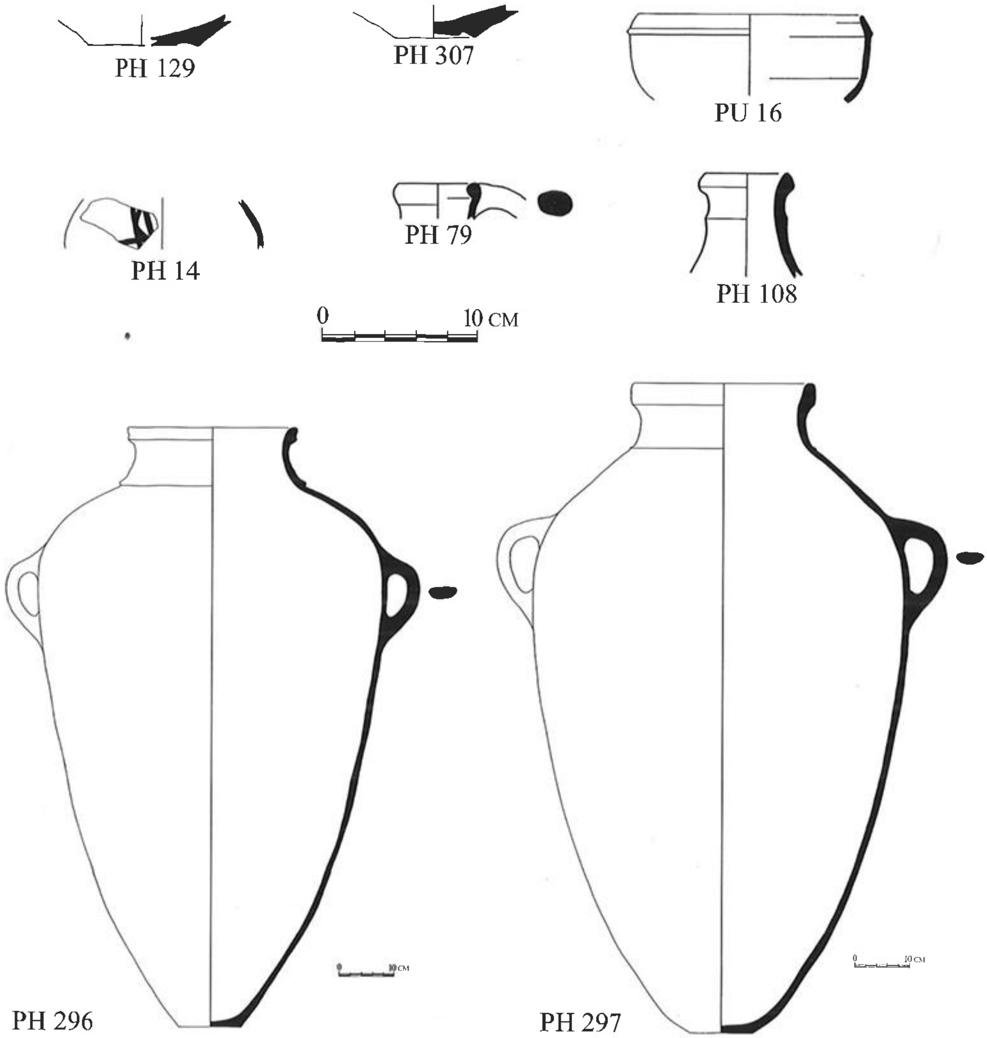

Figure 6. INAA unassigned sherds from Hesban and ʿUmeiri.

display an exclusivity of non-plastics uncharacteristic for Iron Age II pottery. INAA Group 4 shows discontinuity of clay body in the choice of quartz temper for new cookware. The same is found for cookware from Deir 'Alla (Groot 2007: 101). It is feasible that potters responsible for cooking pots were among the first shift to quartz.

To understand why cooking pots might have been in the forefront of ceramic technology, even without changes in foodways, uselife of cookware can be considered. No type of pot has a shorter lifespan than cooking pots. Used daily, it experienced the most wear and tear of any pot. Archaeologists rely on changes in cooking pot rim profiles as sensitive chronological markers precisely because the pot broke and was replaced faster than any other pot. As a consequence, cookware clay bodies can shift before others given the need to replace them faster than any other type of container.

Iron Age I collar rim store jars

Eight of the ten collar rim jars, excavated at Hesban or 'Umeiri, were made of clay bodies similar to the bulk of Iron Age II pottery assumed to represent local or regional manufacture. For the two outliers, an origin elsewhere is feasible, but it is impossible to make broader inferences. Herr (2000: 281) cites the repertoire from the highlands north of Jerusalem, in the region of Shechem, as most comparable to the 'Umeiri assemblage in terms of overall morphological similarities. This raises the issue of an origin of these large, heavy jars some place west of the Jordan River.

Regional trade

People at Hesban and 'Umeiri accessed similar deposits or raw materials. The prevalence of limestone can make it difficult to be more precise about the origin of the jars. If not in the immediate surroundings, people at both sites took advantage of the same markets and middlemen to buy or barter for pottery. If true, the implication is Iron Age I and II societies at Hesban and 'Umeiri belonged to the same economic/trade area. Although INAA Groups 3 and 4 include Hesban sherds alone, this can easily be explained as a sampling problem due to the omission of Late Iron Age II or Iron Age II/Persian cooking pots excavated at 'Umeiri.

The greater diversity of petrographic wares than chemical groups might reflect: (1) differential treatment of the same basic clay supply; (2) variations within individual clay deposits; (3) disparate but nearby clay sources; or (4) chronological distinctions. Petrographic analysis allows one to divide Iron Age I and II pottery into more clusters than the chemical analysis, in part because we distinguish clay bodies with varying percentages of inclusions. Grog, limestone, and a blend of non-plastics, all are accommodated in INAA Group 1. Only the petrographic study recognizes basalt in pottery, usually in association with primarily limestone, calcite, or grog inclusions. In fewer instances, basalt was native to the clay, rather than an addition, intentional or not. Basalt fragments are always rare. They could have entered the clay body as a by-product from using basalt grinding equipment to crush limestone, calcite, grog, etc. Since the chemical analysis of the clay bodies discussed here, did not identify the basalt, the assumption is that it was not native to the clay. For example, in PH 135, the angularity of the grog, limestone and calcite attest to their deliberate crushing, probably using basalt equipment.

Organization of the Iron Age I and II ceramics industry

According to the INAA and petrographic analyses, organization of the local ceramics industry involved potters with access to similar, locally available raw materials suitable for practically the entire repertoire of normal pottery, including jugs, jars, bowls, plus burnished or plain bowls, and cooking pots. These potters and/or workshops whose products are designated as Group 1, worked with a limestone-rich clay body to make the full range of shapes. Cooking pots, an infrequent part of the local repertoire, were perhaps made on occasion to fill the gap when no other sources of cookware were available. Late Iron Age II cooking pots from Deir 'Alla similarly contain little limestone tempering material (Groot 2007: 101). Limestone cookware was acceptable, but less desirable than cooking pots made of other inclusions.

Local ceramics include a tradition of decorated painted as well as burnished surfaces. It cannot be assumed that painted Iron Age I or II pottery represented imported pieces. Certain burnished Iron Age II bowls were made of the same basic raw materials and in the same shapes as unburnished pots. Collectively, burnished bowls do not constitute a 'fine ware' given that, in many instances, inclusions in the bowls are no finer than those in thicker walled, larger pots. In addition, the same rims and bowl types, with thick or thin walls, were available with or without burnish.

Occasionally the clay bodies of those with a burnish were made of a more refined fabric than other forms, suggesting manual crushing and/or sifting. Limestone tempering material in the local fabrics prevented potters from firing kilns to a temperature high enough to cause the inclusions to decompose. As a consequence, a low heat kiln assured that locally made bowls had a dark black or gray surface and core as a result of incomplete burning of the organic material in the clay. The low temperature assured preservation of the sheen as well.

Iron Age II burnished bowls

INAA Group 2 is a collection of some of the finest burnished, almost lustrous, bowls. Also in this group are the unique cult-related ceramics, a plaque and possible cult stand. Based on the petrographic study, none were recognized as distinct from other burnished bowls. Neither rim shape nor mineralogical composition induced us to separate them into a special category as INAA suggests. The bowls and other pieces include grog, calcite, and limestone rich clay bodies, as do Group 1 burnished bowls. One feature they share, however, is firing color. Burnished bowls in Group 2 fired without a darkened core. They are thoroughly oxidized. The absence of a darkened core implies an improved and/or more complete firing, special treatment or selection of the non-plastics, or a more forgiving clay body capable of withstanding a wider range of temperatures than burnished bowls made elsewhere using other fabrics. Absence or presence of a darkened core is significant and a feature that seems to differentiate among products of different workshops. It is likely that black burnished bowls with a dark core zone were fired in a reducing kiln atmosphere under 900 degrees Centigrade (London et al. 2007: 82). Some bowls fired red, or red and black, indicative of an oxidizing kiln atmosphere. Refiring experiments demonstrate that black bowls, burnished or not, will start to become red at 725 degrees Centigrade (Groot 2007: 100).

The results of the mineralogical and chemical tests show that Iron Age II black burnished bowls were products of multiple sources, including the region of Hesban and 'Umeiri, but not exclusively. Within the region, products of different potters or workshops have grog temper while others have the normal blend of carbonaceous inclusions, including calcite and limestone (London et al. 2007: 84). Similarities between our samples in Group 2 and raw clay material from the region around Pella indicate a second production region according to the INAA findings. Particular characteristics found in the clay bodies could signify chronological distinctions as well as different locations of manufacture. Vessel shape and rim profiles at the present are not specific to Groups 1 or 2, implying that all workshops produced the same repertoire. A larger sample might prove otherwise. INAA demonstrates that observation of the core color hints at the diversity of clay bodies and firing technologies used to make and perhaps mimic burnished bowls.

INAA divides burnished bowls into Groups 1, 2, and the unassigned category. Petrographic analysis differentiates fabric types based on the mineralogical composition of grog or limestone-rich clay bodies. The INAA addresses the important question of where the pottery might have originated and demonstrates that although the bulk of the samples probably derive from the region around Hesban and 'Umeiri, there are notable exceptions. INAA Group 2 represents pottery originating to the north of Hesban, in the Jordan Valley, possibly near Pella. Group 2 includes the rare and exotic shapes, such as the plaque, cult stand, and a flask along side the more typical, but highly burnished bowls. The implication is that unusual 'special' ceramic objects might have originated in a region outside the Madaba Plains along with a small quantity of normal and burnished shapes. Large jars of Iron Age I and II as well as cooking pots, were not among the ceramics brought from the more northern source.

Infrequent ceramic shapes

Specialty items, such as the flask, plaque, and cult stand, are more likely to have been brought from greater distances than the more utilitarian ceramic pieces. Neither Iron Age I collar rim store jars nor Iron Age II cookware traveled the same route as certain burnished bowls, or the infrequent shapes including the plaque, flask, and mug. The fragment designated as a potential cult stand likewise could have been the creation of a potter who worked far from Hesban. The calcite-rich flask, was identified as mineralogically distinct the rest of the samples tested.

Sherds of undetermined origin

Jars of all types belong to Group 1, other than the two unassigned samples, which could be outliers of the same group, or not. The unassigned black-burnished bowl with a stepped base excavated at Hesban, PH 307, was possibly made outside the region entirely, as was a red burnished bowl from ʿUmeiri, PU 16. Neither fits the four INAA Groups.

To help resolve the unassigned bowl, consideration of the manufacturing technique of open forms with stepped bases is useful. At times the base center might fire to a slightly different color, or present a minimally different texture, than the rest of the bowl. The precise method of fabrication might account for the use of two slightly different clay bodies for the bowl. To build the bowl, initially potters made an open form, finishing the rim completely. The base, however, was left thick, flat, and unfinished. After the bowl rim was sufficiently dry to support the weight of the pot, the bowl was re-centered upside-down, on a turntable. To shape the stepped base from a thick, flat bottom, potters had two choices. One could shape and cut steps into the thick base, if the clay were still malleable. Alternatively, if it was overly hard, potters would remove the drying clay and insert fresh, wetter clay, often containing more inclusions than the bowl body. Extra inclusions were necessary in the wet clay to help it dry as fast as the bowl body. Inclusions can facilitate evaporation of moisture by opening the clay and creating space through which water migrates to the surface. An uneven drying rate would result in the drier body pulling or shrinking as it dried faster than the freshly added wet clay of the base. But this should not impact INAA designation. Potters would have added extra inclusions to the same basic clay, which sometimes fires to a slightly different color than the bowl. Therefore it appears that we have several sources, minimally three, for burnished bowls.

Cooking pots

INAA differentiated most cookware (Groups 3 and 4) from the regular repertoire. Cooking pots contain exceptionally high quantities of a single non-plastic, higher than for most other vessel categories. This is probably intentional. Groups 3 and 4 have low calcium. All samples in Group 4 lack calcite or limestone, which are sources for calcium.

Group 3 samples PH 84, 98, and 135 have similar rims thickened at the top and an exterior ridge at the bottom of narrow mouths. They slant inward and two preserve a handle, although two handles was probably the norm. The presence of calcite, and the general lack of orientation for elongated voids, are reminiscent of the older Bronze Age and Early Iron Age style of cooking pot manufacture in contrast to the more forward looking narrow mouth diameters. One further new element is their red firing color of PH 84 and 98.

Although calcite predominates in PH 84, it is not the calcite rhombs of the earlier tradition. Instead, calcite powder, measures no larger than 0.01-0.4 mm. In PH 94, calcite granules measure up to 0.5 mm and no larger. The shift from large angular calcite rhombs to fine sized calcite, suggests that potters choose, for some reason, to use ground calcite or no calcite for cookware. They would pound and pulverize calcite or limestone and then sift it to remove the larger granules before adding it to the clay. Alternatively they could select quartz, which not only requires less preparatory work, but also can withstand relatively high firing temperatures, at least higher than large calcite fragments. The red firing color and absence of a darkened core is evidence for high kiln heat.

Differences in clay body composition might reflect the versatility and/or uncertainty of potters. They could represent different facets of the transition to a new technology, in which quartz temper would eventually dominate by the late Iron/Persian Age (London et al. 2007: 83). Additional evidence of the new tradition is discernable in PH 84 and 98 which both fired red and have handles. In earlier times, darkened cores and surfaces prevailed because large calcite rhombs would have decomposed before a red firing color was achieved, but the secret to the success of these pots was in grinding the calcite into powder.

Exclusivity of temper, evident in PH 84, 98 and 124 was not accidental. These clay bodies were deliberately and carefully prepared in a process requiring several steps. To achieve homogeneity of temper necessitated removal of all other non-plastics. The preferred temper, grog, quartz, or calcite was then introduced. For PH 135, the angularity of the inclusions and presence of basalt imply another stage in the work. Before the quartz and calcite were shifted, they were crushed between basalt tools. As a consequence basalt chips entered the clay body with the crushed and sifted tempering material.

The rilled rim jug in Group 3 suggests that few other shapes were made of clay bodies expressly created for cookware. No other Iron Age II jugs, jars, or bowls were made of these same fabrics. The implication is that cookware was the work of a specific group of potters who did not make the full repertoire. In PH 135, on the other hand, one sees the shift from reliance on calcite to quartz, the post-Iron Age temper of choice. It appears as if the cooking pot makers were at the forefront of ceramic change despite the highly traditional nature of their product.

Quartz is the post-Iron Age period temper of choice, yet in our sample, Late Iron Age II cooking pots appear to have been an early form with over 50% quartz sand. Two outside sources for cooking pots are defined as Groups 3 and 4. No cookware comes from the potentially northern Group 2. Differentiation of two cooking pot groups could imply chronological distinctions and/or separate places of manufacture where clay was prepared specifically for cookware. Group 4 is likely later than the Late

Iron Age II Group 3 cookers. If fabricated from clay bodies that differed from non-cookware, Group 3 cooking pots conceivably were the work of a separate group of specialists. In contrast, potters using clay body INAA Group 1 made cookware as well as the full repertoire of utilitarian shapes. The implication is that while some cookware was produced by cooking pot specialists, cookware was also in the repertoire of craft specialists responsible for the bulk of Iron Age II ceramics. It is the latter group of potters who maintained the older Bronze-Iron Age traditions in cookware clay bodies. Cookware specialists appear to have been on the cutting edge and responsible for the shift to quartz temper for cooking pots and eventually most other shapes.

Summary

INAA and petrographic analyses reveal complexity and continuity of Iron Age I and II ceramic sources. Eight of the ten Iron Age I collar rim storage jars are of local manufacture. Iron Age II burnished bowls originated from multiple sources both within and outside the immediate region of Hesban and 'Umeiri. There was no single source. At present, we lack sufficient samples to determine if there is a correspondence between rim or body shape and clay body. If the pots were contemporaneous, several different fabrics for Iron Age II cooking pots similarly imply a range of sources. In Late Iron Age II/Persian times, potters experimented with cooking pot fabrics and could have been in the forefront of the shift to quartz temper as found in later fabrics used to shape a wide range of ceramics. The conclusion is that people at Hesban and 'Umeiri had multiple sources and options for bowls and cookware, unless it can be demonstrated, through well-stratified deposits, that the various clay bodies were chronologically distinct.

Acknowledgments

For support from the Shelby White-Leon Levy Program for Archaeological Publications, we thank the donors and Martha Joukowsky, Phillip King, and administrators of the program, Anthony M. Appa and Kimberley Connors-Hughes. Directors of Madaba Plains Project – 'Umeiri, Lawrence T. Geraty, Larry G. Herr, and Douglas R. Clark graciously granted access to the 'Umeiri pottery. Loe Jacobs of Leiden University carried out the re-firing tests. At the Horn Archaeological Museum of Andrews University, Paul Ray selected Hesban sherds included in this study. Denise and Larry Herr graciously extended hospitality during the sampling in Lacombe.

University of British Columbia students prepared the thin sections for the petrographic analysis. Jon Cole of Walla Walla University, along with John Winter at Whitman College, supervised Whitman students Laura Shultz and Jason Quinn in their petrographic analysis of 'Umayri thin sections. Petrographic thin section analysis carried out by Jason Blair and Sheryl Kelly, former students of Robert Shuster at the University of Nebraska at Omaha thanks to a faculty grant from UNO. Geologist

Otto Kopp offered his geological expertise on numerous occasions before his untimely death. Henk J. Franken provided the inspiration and direction for the study.

Notes

1. The Tell Hesban pottery study was made possible by a grant from the Shelby White-Leon Levy Program for Archaeological Publications. Full details of the samples will be published in the final publication currently with Andrews University Press.

2. These sherds (PH samples 298-316) were selected by P. Ray from the Hesban sherds housed at Andrews University.

3. Sherds excavated at 'Umeiri and submitted as part of the Hesban petrographic analysis carry a "PH" designation, such as PH 292-297. All other 'Umeiri sherds have "PU" numbers.

4. Thin sections of Hesban sherds include 86 Late Bronze-Iron II/Persian sherds (38%), 84 Hellenistic-Byzantine (37%) and 60 (25%) of Islamic date.

5. The Hesban INAA research will be published in detail in the final Hesban pottery volume or elsewhere.

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THE IRON AGE POTTERY OF AL-LEHUN, JORDAN: FABRICS AND TECHNOLOGY

Margreet L. Steiner and Loe Jacobs

Abstract

From 1978-2000 the site of Khirbet al-Lehun, located in ancient Moab in Jordan, has been excavated by a Belgian team. A walled Iron Age I village with a later (possibly Iron Age II) fortress was uncovered in area D. The pottery of area D is currently being studied in Leiden as part of a larger program analyzing the Iron Age pottery of Moab (Steiner 2006).

Introduction

The site of al-Lahun/Lehun or Khirbet Lahun is located in Jordan, on the northern plateau of the Wadi Mujib (Palestine Grid: 36RYV712-849). The plateau between the Wadi Mujib (ancient Arnon) in the south and the Wadi Wala / Wadi Thamad in the north is considered to be the heartland of ancient Moab.

Lehun was excavated during seventeen seasons between 1978 and 2000 by the Belgian Committee of Excavations in Jordan in close collaboration with the Department of Antiquities in Jordan. The excavations were directed by D. Homès-Fredericq (1978-2000) and P. Naster (1978-1984). Lehun is a large site of 1100 m by 600 m (66 ha) and is divided in different natural sectors (excavation areas A-D). Excavated are prehistoric flints, an Early Bronze Age fortified town in area C1, and a walled Iron Age I village with a later (possibly Iron Age II) square fortress in area D. Traces were also found of Nabataean and Roman occupation (areas A-B), as well as remains from the Islamic period (area A).

The excavation of Area D started in 1980 with the opening up of several trenches inside the square fortress. From 1983-1987 excavations continued in that area. The fortress was provisionally dated to the Iron Age II period because of the sherds found in its upper layers. Underneath the south and western walls of the fortress remains of an earlier casemate were discovered. From 1992-1997 research focused on the casemate wall and houses north of the fortress, dating to Iron Age I.

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Context of the pottery

The pottery discussed in this report comes from houses of the Iron Age I village. This village, provisionally dated by the excavators to the 12th and 11th centuries B.C., is enclosed by a precinct wall surrounding an elliptical area of 17,000 sq m (1,7 ha). The settlement was characterized by a peripheral belt of houses along the protection wall and a large central open space, partially filled in with houses. A total of twenty-four structures were completely or partly excavated. Additional structures were located below the square fortress but these could not be adequately examined. Only four houses were excavated down to bedrock: houses 1, 2, 11 and 12. Of the others only the outlines were uncovered and some rooms excavated (Homès-Fredericq 1997; Swinnen in press).

The pottery excavated in the village is a mixed lot. There are some (restored) complete pots, large vessel fragments, smaller fragments and very small pieces. As the precise layer in which the pottery fragments were found was not noted during the excavation, it is assumed here that the large fragments and complete pots were retrieved from the floors and occupation layers in the houses and the courtyards, and from the roofs. Smaller fragments may have been excavated from the later debris and wash layers which covered the ruins. The tiniest pieces are supposed to have come from the mixed upper layers of the tell; these sherds are hard to date.

However, one should not assume that all pottery in use during the occupation of the settlement has been retrieved. Most of the pottery found inside the houses was very heavy: large kraters, storage jars and larger bowls. It is worth noticing that only very few small finds were found in the village: some flints, stone pounders, a bronze needle, several spindle whorls made of stone and bone, a bronze arrowhead, a bronze dagger, a fragment of a cosmetic palette and a scarab seal (Swinnen in press). The combination of the presence of mostly large vessels and the virtual absence of small finds seems to indicate that the inhabitants have left the settlement peacefully. They took most of their belongings with them and left behind only what was too heavy to carry: large and heavy vessels, together with heavy stone tools as grinders and pestles, and unmovable objects as bread ovens and troughs. No traces were found of a sudden destruction by enemies or earthquakes. Some door openings were found blocked with heavy stones, so the inhabitants were probably expecting to come back at some point.

Goal of the study

The original goal of the study was twofold. First of all it would comprise an analysis of the Iron Age I sherds including the typology, construction techniques, fabric analysis, surface treatment, rim diameters and color. This part of the pottery study would then result in a description of the Iron Age I pottery repertoire found at Lehun; a dating of the pottery; a comparative study of the pottery in its Transjordanian context and a technological analysis of the sherd material.

The second aim was to place the rims and complete vessels in their stratigraphic and spatial contexts. This part of the pottery study would then result in a discussion of the start of the Iron Age I settlement at Lehun, the development of the village, the way the habitation ended, and possible differences in function and wealth of the house complexes. However, because of the method of excavation and registration of the sherds the second goal of this study was difficult to accomplish. Not all excavated pottery seem to have been found its way into the storage in Brussels – for instance House 1, the pillar house, yielded only eight rim sherds. Besides that, pottery from the mixed upper layers in a square were not kept separate from the pottery found on the floors, and room numbers were seldom mentioned on the pottery tags.

Of the 288 diagnostic sherds taken to Leiden some 180 were classified as Late Bronze/Iron Age I. The other sherds were mostly Iron Age II, some were from earlier or later periods, and of the remaining (mostly small) sherds the dating is undecided. The following results pertain to the Iron Age I material only.

In Leiden the sherds were first laid out to get an impression of the repertoire. A first classification was made of the diagnostics based on shape, function, and finish. These classes were then analyzed in the Ceramic Laboratory of the Leiden Faculty of Archaeology. The preliminary classification was then refined on the basis of this analysis. Within most classes several subtypes could be distinguished on the basis of shape, construction technique and /or finish. Then 26 sherds were selected for analysis of the fabrics. Their fabrics were compared to the clay samples taken and analyzed in 1992 (van As and Jacobs 1995).

Construction techniques of Iron Age I vessels

It is clear that several construction methods were used. Some vessels were turned made on a slow, heavy wheel, others thrown on a fast wheel, while for cooking pots a combination of moulds and the fast wheel was used.

Turning

Large storage jars and large open vessels were made in parts on a rather heavy slow wheel. Storage jars were made of coils and turned at low speed, without making use of centrifugal forces (less than about 20 rotations per minute), possibly alternated with phases of higher rotation speed. After drying a new coil of clay was added and fixed. From this quantity of surplus clay the wall was raised five to ten centimeters. The rim was thickened by pushing the clay up and down again, combined with slightly folding. Kraters and large bowls were turned in a normal position (less than about 30 rpm.). During turning twice a coil of clay was added at the top, to have enough clay to form the upper part of the body. After some drying two or more handles were pulled from pieces of clay which were stuck to the rim. The lower attachment of a handle was reinforced with some extra clay.

Throwing
Smaller jars, jugs, small bowls and lamps were thrown on quick potter's wheel (more than 30 rotations per minute), with normal rotation speed. Traces of this method were clearly recognizable on the inside of the vessels; the shape of these vessels was, however, not very standardized. The small bowls were made in an upright position after which their bases were scraped upside-down. The lamps are thrown in an up-right position, then cut from the cone and placed aside. The lip was reshaped to form a spout for the wick. After a while, when the clay was in a leather-hard condition, the base was reworked by scraping away some clay.

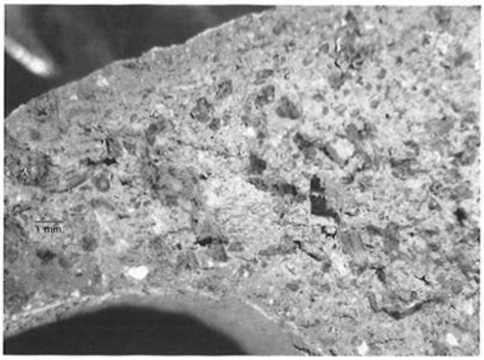
Mould-made and thrown
Cooking pots were made in this way. The convex base was made by pressing a clay slab into a mould. Porous saucers made of baked clay were probably used as a mould. Then the mould was placed on the head of a potter's wheel. One or two coils of clay were fixed around the edge of the clay slab that was in the mould. From the extra clay of these coils the upper part of the cooking vessels was thrown and eventually handles were fixed. Still inside the mould the vessel was set aside to dry for a while. Then the vessel was removed from the saucer, reworked where necessary and left to dry in an upside-down position. Making use of a mould allowed the potters to apply very "short" clay-sand mixtures. Thus a good heat-shock resistance and a better durability could be obtained.

Fabric analysis of Iron Age I material

Several fabrics could be distinguished.

Fabric A
This fabric was used for large storage jars and for medium and small bowls. It contained ferruginous rock fragments and iron oxide concretions as the main ingredients. These grains are likely to have been part of the clay matrix. Mudstone grains and limestone grains are present in lower quantities. Sporadically some flint, quartz grains, siltstone grains, hematite or shale occurred, and very seldom small amphibole and pyroxene grains.

The shape of these grains is angular to sub-angular and they occur in quantities of 20 to 30 % and sometimes a bit more. Sizes are most between 2 and 3 mm, but incidentally bigger grains do occur. In storage jars the coarse grains are more frequent. The fabric did not suffer from cracks. Sorting of the grains was mostly moderate to poor, because several grain types occurred in different quantities and sizes (mixed). About half the samples contained some fibers, but these were not more than 2 % by volume and very small in size. This organic material was probably added as dung, to improve the plasticity of the clay for throwing. After re-firing the colors vary from pink and pinkish gray to reddish yellow. They do not differ, or only slightly, from the original colors. By re-firing most of the black cores, if present, were burned away. From these features it was concluded that the pottery from this repertoire was kiln-fired under neutral to oxidizing conditions.



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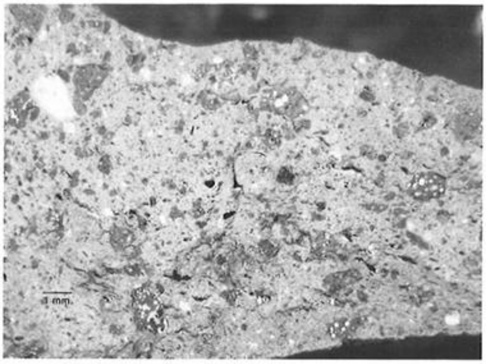

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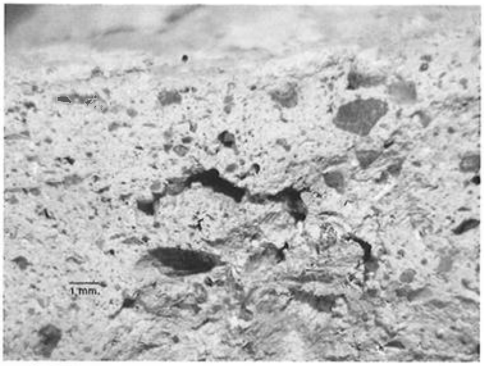

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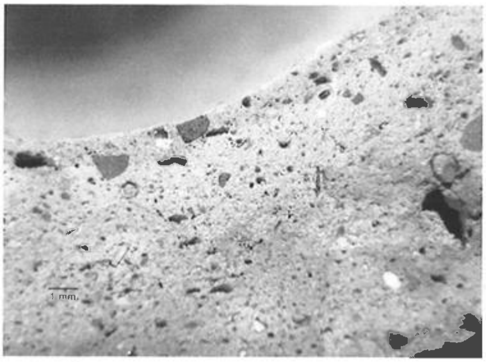
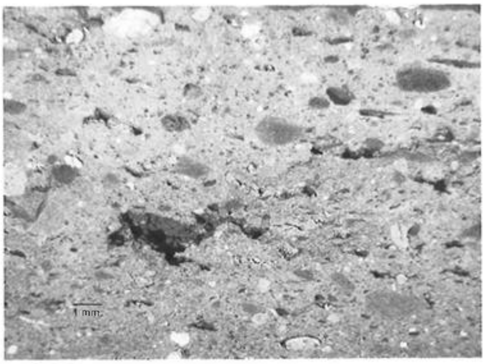


1 mm. (SB) 177.

Fabric B

This fabric was used mainly for kraters. Some kraters have a whitish slip layer on the outer surface. Fabric B contains mudstones, limestone, calcite and shales. Less frequently several types of siltstone and grains with iron oxide as a main component do occur. Grain shapes are mostly sub-angular and sub-rounded. Grain sizes are up to 3 mm. Smaller grains occur in quantities from 20 to 30 %. There are no cracks and the sorting is moderate to good. The pore structure is normal, and if organic fibers are present, they are less than 2 % by volume. The size of these fibers is limited to 1 or 2 mm. in length. Colors vary between pink and light reddish brown.



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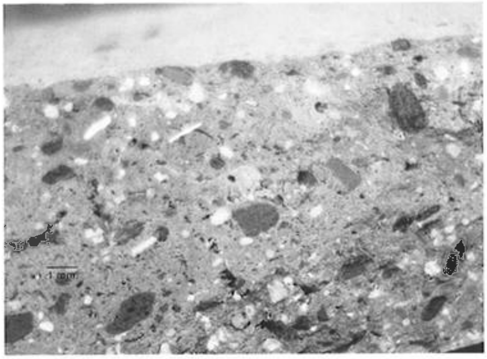
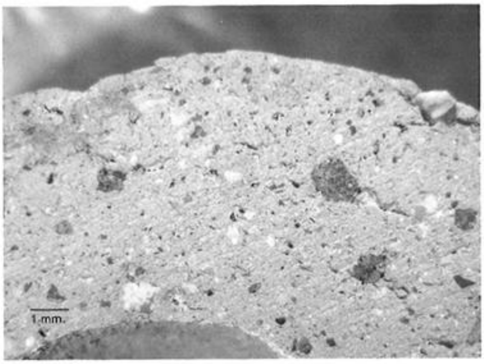


1 mm. (KR) 211.

Fabric C

This was the fabric cooking pots were made of. The dominant grain type in this fabric is crystalline calcite. Ferruginous rock fragments are present in lower quantities. Mudstone and or siltstone and some small quartz grains are present in relatively small amounts or sporadically. The shape of the grains which are present in quantities of 25 to 30 % is angular to sub-angular and the upper grain size is limited at 1 mm. Therefore the sorting is qualified as moderate to good and the pore structure is considered as normal. The re-fired colors vary from light reddish brown to reddish brown.



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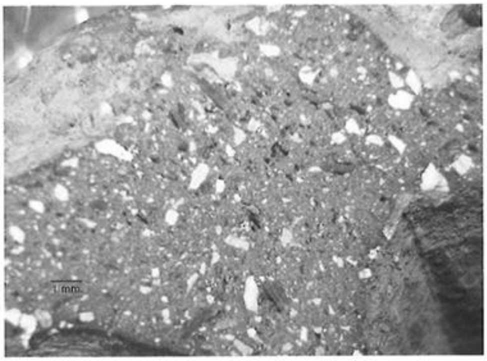
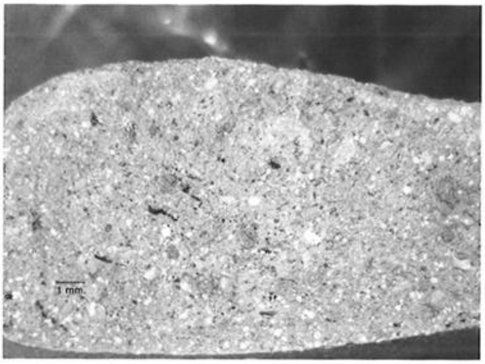


1 mm. (CP)132.

Fabric D

The dominant grains in this particular fabric are microfossils of the ostracoda type, combined with some calcite and siltstone grains. The shape of these small grains is rounded and sub-rounded, sometimes a bit ovoid. The size is limited at 250µ and quantities vary from 25 to 30 %. This fabric does not show any cracks and the matrix is normal. Where the sorting is good, the structure is a bit open due to the burning out of about 15 % by volume of organic fibers, with a maximum length of about 5 mm.

These fibers were added to the clay on purpose, probably to improve the coherence of the substance. This fabric also occurs in the pottery repertoire of Khirbet al-Mudayna (Steiner, 2006) and the vessels may have been imported from that region.



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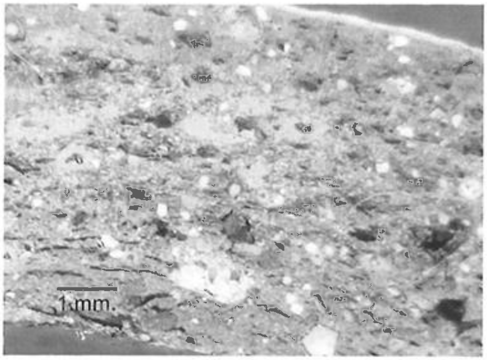

! 1 mm. (OL) 6.

Clay analysis

In October 1992, during the excavation campaign, van As and Jacobs took about thirty clay samples in the Wadi Lehun, situated on top of the plateau, and three clay samples in the Wadi Mujib, situated deeper under the plateau. Some results of the analysis of this clay have since been published (van As and Jacobs 1995). The clays from the Wadi Lehun and the Wadi Mujib have now been compared with the fabric of the pottery samples described above and with pottery samples from the Early Bronze Age town.[1]

It is clear that the investigated Early Bronze Age pottery was made with local clays, originating from the Wadi Lehun. The clays used for the Iron Age pottery of Lehun did have the same general characteristics, but did not come from the Wadi Lehun. Clays from that source lack the necessary plasticity for throwing. Iron Age potters probably collected clay from the Wadi Mujib or from some deposits further away.

Preliminary conclusions

The pottery repertoire of the Iron Age I village of Lehun shows several interesting characteristics. The large vessels (storage jars and large kraters and bowls) were turned on a slowly rotating potter's wheel, and smaller vessels were thrown on a faster wheel. The bases of cooking pots were mould-made, while the upper parts were thrown. Several fabrics were used, one for cooking pots, one for large kraters, and one for most other vessels. The clays used for these fabrics come from deposits in the Wadi Mujib or further away from the site. The Iron Age potters used different clays that the potters from the Early Bronze Age because they needed plastic clays fro throwing.

Acknowledgements

This study was made possible through a generous grant of the Shelby White-Leon Levy Program for Archaeological Publications. Prof. Denyse Homès-Fredericq kindly made the pottery available to me and provided me with information on the excavations.

Note

1. The Early Bronze Age pottery is currently studied by Mrs. Ingrid Swinnen.

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CYPRIOT POTTERY AT THE UNIVERSITY OF MELBOURNE: AN EXAMINATION OF HISTORICAL CONTEXT AND CONSERVATION ISSUES

Petronella Nel and Andrew Jamieson

Abstract

The University of Melbourne's collection of Cypriot antiquities recently featured in an exhibition at the Ian Potter Museum of Art, from 5 September 2007 to 16 March 2008, and a new catalogue on the collection was published in 2008. Together these events demonstrate significant interest in the Cypriot collection. Investigations were conducted into seven ceramic vessels providing insights into their historical context and highlighting various conservation issues, such as: the presence of salts resulting in fragile surfaces; the possible presence of organic residues and past restorations resulting in failing adhesives that are damaging break edges. Further work focused on identifying adhesives associated with the previous reconstruction of three vessels. Adhesive identification revealed important information about past repair practices and on how the adhesives performed over time.

The University of Melbourne Cypriot Collection

The University of Melbourne has one of the most significant collections of Cypriot antiquities in Australia (McAuliffe and Yule 2003: 17-18; Sagona and Zimmer 1988: 125-139; Salter 2008). It comprises an impressive range of Cypriot Bronze Age, Iron Age, Hellenistic and Roman period artefacts.

The Cypriot Collection is largely the legacy of the late Professor James Stewart, at one time Edwin Cuthbert Hall Professor of Middle Eastern Archaeology at the University of Sydney, and director of the (University of) Melbourne Cyprus Expedition. Between the late 1930s and his untimely death in 1962, Professor Stewart conducted three lengthy and productive excavation seasons in Cyprus, as well as purchasing, while visiting the island, many vessels from Cypriot antiquities dealers and from the reserves of the Cyprus Museum in Nicosia (Salter 2008). During Professor Stewart's lifetime it was legally possible for excavators and collectors to obtain permission to bring their finds and acquisitions back to their homelands. As a result numerous Australian universities, museums and other institutions received importamt assemblages of Cypriot artefacts (Garner 1983: 127-128).

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Pottery is the dominant medium represented in the University of Melbourne's Cypriot collection, which also includes stone, bronze and copper artefacts. In 1987 the University purchased from the Australian Institute of Archaeology (AIA) over 200 objects excavated by Stewart. Thus supplementing its already important collection and forming an almost complete sequence of ceramic development from the island of Cyprus spanning some two and a half millennia (Sagona and Zimmer 1988; Salter 2008).

Ancient Cyprus and Cypriot pottery

From the beginnings of civilisation, Cyprus (Figure 1) played an important regional role and developed a unique and distinctive culture. The island's status as a major trading post in antiquity was strongly influenced by its geographical location. Situated at the eastern end of the Mediterranean, Cyprus was a natural meeting point for the major civilisations of the ancient world. Pottery vessels were produced on Cyprus from as early as 4500 BCE, and the island continued to produce a unique and distinctive ceramic culture that lasted into Hellenistic and Roman times.

In the Early and Middle Bronze Age, Red Polished Ware vessels (Figures 6 and 7) dominated the ceramic repertoire. The pots were hand-made and often decorated

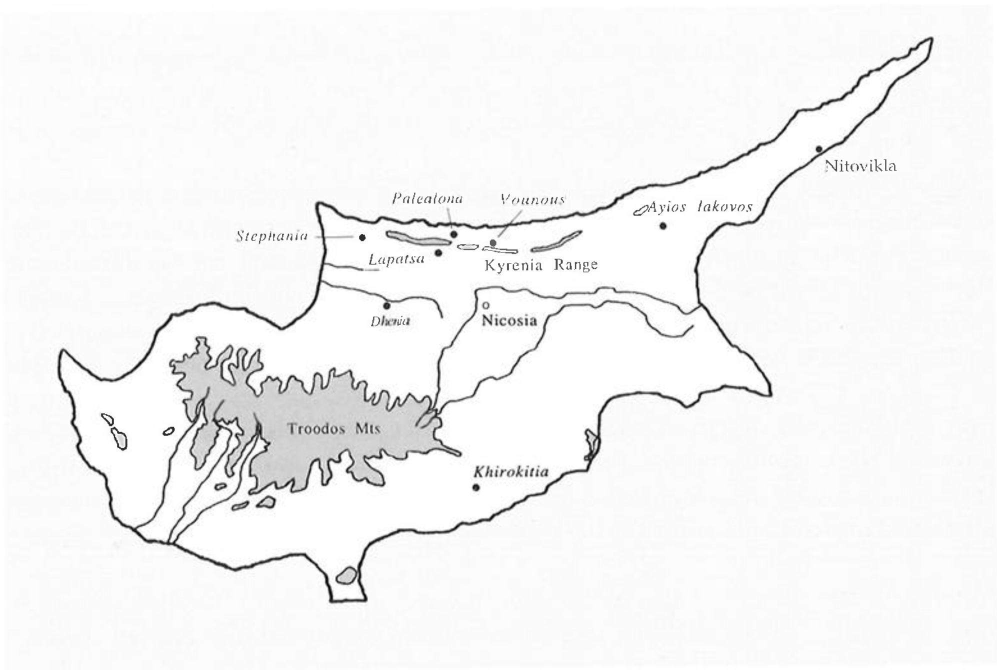

Figure 1. Map of ancient Cyprus.

with incised patterns. By controlling the firing conditions it was possible to produce vessels with a mixture of red and black surfaces. The Middle Bronze Age was marked by the appearance of a new tradition of painted wares, the most common of which was known as White Painted Ware (Figure 2). It is characterised by vessels with white surfaces that were decorated with painted linear patterns in red or brown. In the Late Bronze Age hand-made pottery continued and Base Ring (Figures 3 and 4) and White Slip (Figure 5) became the dominant wares. Base Ring Ware, named after the ring-shaped bases applied to nearly every vessel, had thin walls that were often covered by a highly polished brownish slip. The White Slip Wares were often decorated with linear patterns in orange, brown or black, or combinations of two colours.

During the Late Bronze Age, presumably as a result of contact with neighbouring lands, wheel-made pottery was introduced. Over the two following periods, the Geometric and Archaic periods, two of the most distinctive wheel-made products were Bichrome Ware (Figure 8), on which geometric and floral patterns and figured scenes were painted in red and black, and Red Lustrous Ware. These Red Slip and Black on Red Wares imitated shapes and patterns possibly inspired by an external influence. In addition, the quality of Iron Age Cypriot pottery improved significantly and pictorial styles of decoration were attempted. The practice of elaborately painted vases lost favour to less time consuming methods, coincinding with the appearance of new shapes, in the Hellenistic and Roman periods.

Case studies: conservation issues associated with seven vessels in the University of Melbourne Cypriot Collection

The recent exhibition of Cypriot antiquities at the Ian Potter Musuem of Art at the University of Melbourne presented key works covering the main historical periods of ancient Cyprus, primarily illustrated by stylistic developments in the ceramic record. Seven vessels (Figures 2-8) within the Cypriot collection were investigated to clarify their conservation status in terms of stability for research and display purposes.

Various issues were identified, such as: the presence of salts and concretions; fragile surfaces and fabrics; the possible presence of organic residues in untreated vessels, failing adhesives damaging break edges; structural weaknesses; loss areas; and past reconstructions (Nel 2005). Whilst no past treatment records were available for any of these vessels, it was recognised that old repairs on the vessels would provide valuable insights into earlier archaeological conservation practices and materials performance. An analysis methodology, based on visual observation, ultra-violet (UV) fluorescence, solubility tests, chemical spot tests and fourier transform infra-red (FTIR) analysis was used to identify adhesive samples that were removed from three of the vessels selected for examination (Nel 2005, 2007). The seven vessels involved in the current study are discussed in detail below.

Cypriot White Painted Ware III Kylix (MU no. 1987.0181) (Figures 2a,b,c,d)

The provenance of the Kylix vessel (Figure 2a) is unknown. It was purchased by the University of Melbourne from the Australian Institute of Archaeology in 1987. The reconstructed vessel is from the Cypro-Geometric III to the Cypro-Archaic I period (Salter 2008). Visual investigation by Shepherson (2006) determined that the surface of the ceramic was disrupted by salt formations, due to soluble salts migrating to the surface, crystallising and lifting surface decoration, ceramic material and possibly causing the separation of two lug-shaped handles, which are now absent, from the main body. Salt damage was more pronounced on the external surface of the kylix where the salt formations were more concentrated, especially on the one side where the surface was almost entirely obscured (Figure 2b). Inside the interior the salt formation was hard and thick. Shepherson (2006) decided to remove these salts, in order to prevent any further damage to the ceramic and to allow the decorative elements of the vessel to be viewed clearly.

Figure 2a. White Painted Ware Kylix Vase (MU no. 1987.0181), front view, before treatment.

Figure 2b. Salts on White Painted Ware Kylix Vase (MU no. 1987.0181), proper right view, before treatment.

The exterior salts were removed by soaking the vessel in water over a period of nine weeks, with fresh changes of water two to three times per week. With the desalination treatment, the salt formations in the interior separated into two visually distinct accretion types: a yellowed water-soluble accretion generally visible on the walls and a lighter water insoluble accretion at the bottom of the vessel. Micro-chemical spot testing (Odegaard et al. 2000) identified the soluble salts of sulphate and nitrate. The interior accretions were removed by softening with solvent and physical removal. The use of a synthetic fibre brush was aborted as in addition to removing accretions it also risked abrading the underlying decorations.

While the ceramic was wet, the adhesive became opaque. Where the adhesive was visible as surface fingerprint residues and join line protrusions, it was physically removed. In order to pull joins apart, join lines were softened with acetone. After the joins were separated, adhesive residues were physically removed from the sherd edges. The opaque yellowed adhesive films were brittle and lifted from the ceramic surface in small flakes. The desalinated vessel was re-adhered with the conservation grade adhesive Paraloid B72 (Figures 2c and 2d).

Figure 2c. White Painted Ware Kylix Vase (MU no. 1987.0181), front view, after treatment.

Figure 2d. White Painted Ware Kylix Vase (MU no. 1987.0181), proper right view, after desalination treatment.

Cypriot Base Ring Ware Poppy Flask (MU no. 1987.0291) (Figures 3a,b)

The poppy flask (Figure 3a) was excavated by Gjerstad under the auspices of the Swedish Cyprus Expedition (1927-1931) from a tomb at the Nitovikla (Figure 1) fortress (Åström et al. 1972: 150; Gjerstad et al. 1934: 410-414). It was acquired by the Australian Institute of Archaeology (Salter 2008), and subsequently purchased by the University of Melbourne in 1987 (Sagona and Zimmer 1988: 70). The poppy flask was of particular interest due to the presence of accretions on the surface and a small solid

Figure 3a. Cypriot Base Ring Ware Poppy Flask (MU No. 1987.0291).

lump (possibly of soil or clay) inside the vessel (Figure 3b), suggesting that the flask was not washed with water at the time of excavation. If unwashed and untreated, the poppy flask has potential value for organic residue analysis. So it should be noted that an awareness of the vessel's ('original') condition and potential scientific value is an important consideration in determining any proposed conservation treatment. As noted by Brogan and Koh (2008), even washing with water dramatically reduces the possibility of successfully detecting organic residues.

The condition of the poppy flask also raises other conservation-related issues such as those associated with its display. Traditionally, many museums only exhibited complete objects or works that had been fully restored. Restoration procedures included plaster in-fills and thorough cleaning of objects. More frequently, a less interventive approach is advocated by the conservation profession. Minimal invention preserves surviving residues and other important elements which may inform us about the objects past. For instance, a broken or incomplete vessel, with visible traces of residue and useware may reveal more about the objects history than a heavily cleaned and overly restored item that is aesthetically pleasing to look at. In an exhibition environment these 'orginal' surving features (cracks, breaks, missing parts, ancient repairs, residue traces, and wear patterns) may require an additional level of interepretation to assist the visitor to understand the object and fully appreciate its associated values. Museum curators need to make informed decisions when selecting works for exhibition and conservation, and they are required to work in close consultation with archaeologists and conservators to ensure that no potential information is lost or destroyed in preparing works for display and when stabilising works for storage.

Figure 3b. Cypriot Base Ring Ware Poppy Flask (MU No. 1987.0291), detail of lump of soil inside vessel.

Cypriot Base Ring Ware Jug (MU no. 1987.0308) (Figure 4) and Cypriot White Slip Ware Bowl (MU no. 1987.0194) (Figure 5)

The jug (Figure 4) and bowl (Figure 5) were excavated by Hennessy in 1951 from a tomb in Stephania (Figure 1). Both vessels were distributed to the Australian Institute of Archaeology, and later became part of the University of Melbourne's collection purchased in 1987. The field report for the excavation (Hennessy 1964: 35-44), notes that the chamber was filled with silt and that the contents were disturbed; the tomb contained few intact pots and many scattered sherds. As a result the jug (Figure 4) acquired two find numbers and the location of the bowl (Figure 5) within the tomb was not

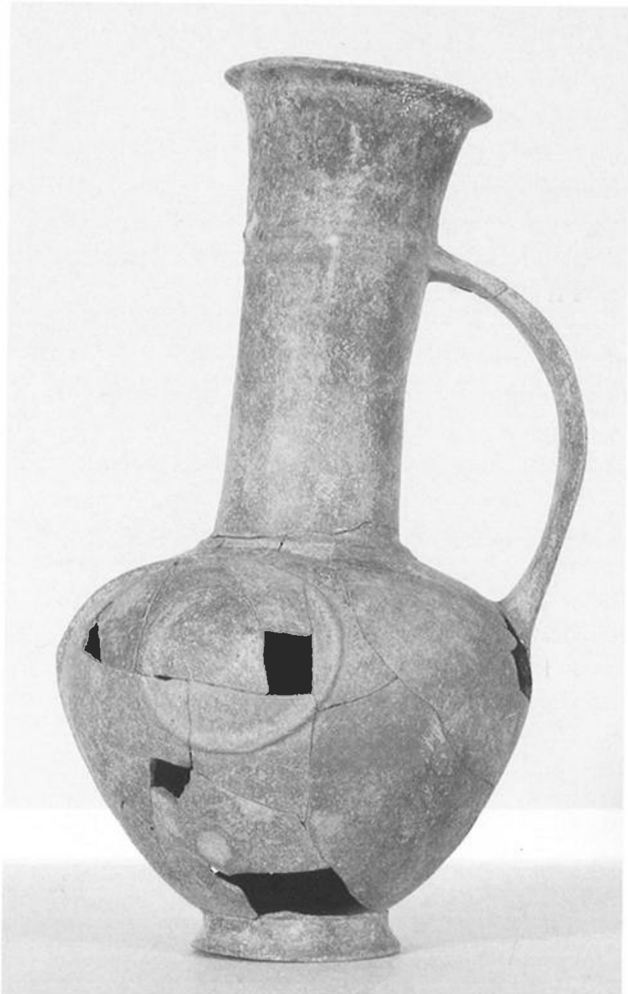

Figure 4. Cypriot Base Ring Ware Jug (MU 1987.0308).

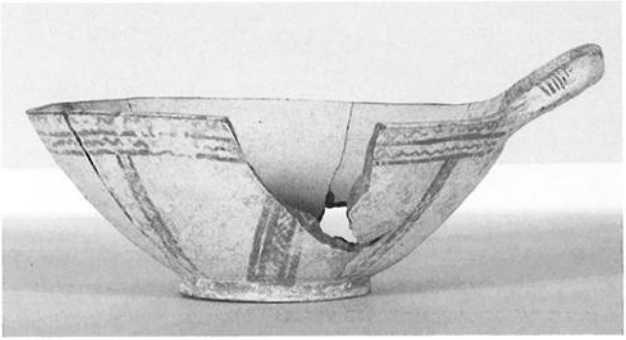

Figure 5. Cypriot White Slip Ware Bowl (MU No. 1987.0194).

recorded because it was reconstructed later from fragments collected throughout the tomb. The dullness of the slip surface on the Base Ring Ware jug reflects the action of water in the tomb environment. Therefore, unlike the Cypriot Base Ring Ware poppy flask (Figure 3), these two vessels are not suitable candidates for organic residue analysis as it is likely the floodwater will have removed any remaining material.

Of particular note is the manner in which these two restored vessels stand out from the other reconstructed vessels in the Cypriot collection. It is apparent that the most of the material from Stephania excavation was reconstructed to a high standard, characterized by the pre-cleaning of break edges and the precise application of adhesive with practically no trace surface residues present along any of the join lines. By contrast, many of the other restored vessels in the Cypriot collection from other excavation sites appear to be less well conserved. An excessive application of adhesive was used in the reconstruction of many examples, which has caused delamimation along poorly or uncleaned break edges.

These observations highlight a major dilemma in the reconstruction of ancient pottery from archaeological excavations. On one hand, vessels from Stephania were well cleaned in preparation for their reconstruction. However, in the cleaning process, traces of surviving residues were most likely removed. In addition cleaning also altered the surface to some extent, resulting in a dull surface (slip) sheen.

Cypriot Red Polished Ware Basin (MU no. 1987.0259) (Figures 6a,b)

The basin (Figure 6a), was excavated by Stewart on his first Cyprus expedition (1937-1938), from a tomb at Vounous (Figure 1) (Stewart and Stewart 1950: 164-169). It was acquired by the Australian Institute of Archaeology, and was later purchased by the University of Melbourne in 1987 (Salter 2008). At the time of excavation archaeologists noted that spring showers almost completely filled the tombs with water. The end result was considerable disturbance within the chambers, with layers of silt covering the

Figure 6a. Cypriot Red Polished Ware Basin (MU No. 1987.0259).

Figure 6b. Cypriot Red Polished Ware Basin (MU No. 1987.0259), detail of slip surface damage due to adhesive peeling away from surface.

finds (Stewart and Stewart 1950). It may be postulated that the floodwater physically damaged the basin and introduced salts into the fabric. Subsequent salt efflorescence has damaged the slip surface, making it fragile. At some point after excavation the vessel was reconstructed with a cellulose nitrate (CN) based adhesive (Nel et al. 2007), which is now in an advanced state of deterioration characterized by yellowing and brittleness. Along the interior join lines of the vessel, removal of the deteriorated slip surface is clearly visible where the adhesive had been originally smeared along the break edge surface, which is in the process of peeling away (Figure 6b). These observations indicate either no or insufficient desalination of the vessel prior to reconstruction.

Cypriot Red Polished Ware Jug (MU no. 1972.0121) (Figure 7)

The jug (Figure 7) was excavated by Stewart on his third and last Cyprus excavation (1960-1961) from a tomb at Lapatsa (Figure 1); he died soon after in 1962. The jug was among a group of Cypriot artefacts that Basil Hennesy, a friend and colleague of Stewart, delivered to the University of Melbourne in 1972 (Salter 2008). Unpublished excavation notes (Nel 2005) record that pots in the Lapatsa tomb chamber were badly shattered. Sources indicate that the vessel was reconstructed prior to its delivery to the University (Nel 2005). Evidence suggests that the vessel has undergone subsequent repair possibly on more than one occasion. Visual examination using UV light, determined that the jug had two different adhesives associated with its reconstruction. The first adhesive, identified to be a CN based adhesive (Nel et al. 2007), had been neatly applied to most break edges. At a later date, adhesive failure occurred in the handle and the neck-to-body join areas, possibly due to lack of strength and/or inappropriate handling of the artefact. It appears that a second (different) adhesive was used to repair the

Figure 7. Cypriot Red Polished Ware Jug (MU No. 1972.0121).

neck-to-body join area when the first CN join failed and to insert a sherd into the main body, which may have been located after the original restoration. The second adhesive was identified to be a poly(vinyl acetate) (PVAc) based adhesive, which also contains a small amount of CN resin (Nel et al. 2007). These findings have been confirmed by two pieces of anecdotal evidence.

Cypriot Bichrome Ware Pedestal Bowl (MU no. 1987.0179) (Figures 8a,b)

The pedestal bowl (Figure 8a), was purchased by Stewart from a dealer sometime before 1962 (Salter 2008), and its provenance is unknown. It was later acquired from the Australian Institute of Archaeology by the University of Melbourne in 1987 (Sagona and Zimmer 1988: 92). At some point following excavation the bowl was reconstructed, possibly on more than one occasion. Visual observations determined that two adhesives had been used to repair the pedestal bowl in the past. The first adhesive was visible on most of the main body of the bowl and was identified to be a PVAc based adhesive, which contains a small amount of CN resin (Nel et al. 2007). The adhesive was clear in colour and was observed to pull at the fabric (Figure 8b), which may indicate the following factors: the adhesive is too strong for the fabric; there is a problem with the technique of application; or poor surface preparation. Alternatively the presence of CN in the PVAc formulation may be the cause of the problem. A second adhesive that protruded from a join line on the foot of the bowl was tentatively identified to be an acrylic based adhesive (Nel et al. 2007).

Figure 8a. Cypriot Bichrome Ware Pedestal Bowl (MU No. 1987.0179).

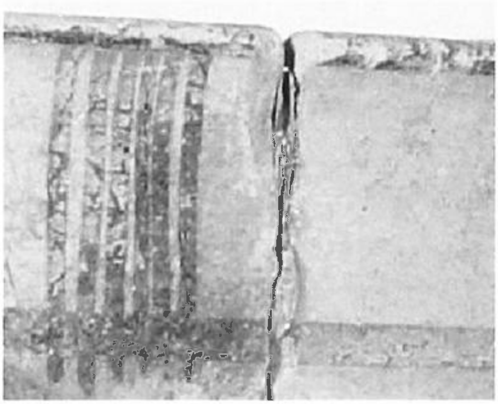

Figure 8b. Cypriot Bichrome Ware Pedestal Bowl (MU No. 1987.0179), detail of adhesive inside join pulling at fabric.

Review of adhesive performance on the selected vessels

In summary, Nel et al. (2007) identified the use of CN, PVAc and the possible use of an acrylic on three (Figures 6-8) of the seven vessels investigated. Current conservation criteria require that an adhesive should be of appropriate strength, be reversible and have good ageing properties (Cronyn 1990). Acetone reversible adhesives that have been recommended in the past by the conservation profession are CN, PVAc and the acrylic Paraloid B72 (Cronyn 1990; Sease 1994; UKIC 1981). In contrast to accelerated ageing studies, identification of the adhesive samples removed from these artefacts, allows an assessment to be made of adhesive performance under real/normal ageing conditions.

The CN based adhesives associated with the two Red Polished Wares (Figures 6 and 7), clearly illustrate the controversy that surrounds the use of CN based adhesives such as HMG heat and waterproof adhesive (H. Marcel Guest Ltd./HMG Paints Ltd.), and UHU. As summarized in Table 1, CN based adhesives are popular due to their ease of use, good working properties, rapid drying to form a strong film, solubility in acetone and high glass transition temperature (Tg) of ~50° C, making it suitable for use in hot climates. However, it yellows, dries out and becomes brittle with ageing (Buys and Oakley 1993; Horie 1987; Sease 1994). Koob (1982) has also noted the polymer's instability. More detailed research (Selwitz 1988) has determined that CN is susceptible to decomposition via acid catalysis, heat and UV radiation. Shashoua et al. (1992) argue that CN is reasonably stable inside break edges where exposure to light is minimal. However as demonstrated by the Red Polished Ware basin (Figure 6), light sensitivity is a contraindication for smearing the adhesive along the pottery surface, where light induced degradation will damage the slip surface, especially when already fragile.

Commercial Products	Properties and use	Ageing properties	Stability (years)
Cellulose nitrate – synthetic derivative of cellulose mixed with plasticiser			
• Heat and waterproof adhesive (HMG) • UHU – Hart (UHU)	• Easy to use, dries rapidly to form strong film, reversible with acetone, suitable for use in hot climates. • Tg ~50° C	• Clear to light yellow. • Yellows, dries out, becomes brittle.	6-20
Poly (vinyl acetate) – synthetic derivative based on single monomer unit			
• Aquadhere PVA wood glue (Selleys) • UHU – all purpose (UHU)	• Sets quickly, reversible with acetone, softens when hot. • Tg ~20-30° C	• Clear to light brown. • Yellows with ageing.	>100
Acrylic – synthetic acrylate and methacrylate monomer units			
• B72 Restoration adhesive (HMG) • Paraloid B72 (Rohm & Haas)	• Not easy to use, sets slowly, reversible with acetone, not suitable for use in hot climates. • Tg ~40° C	• Clear. • Stable, resistant to ageing.	>100

Table 1. Summary of commonly used adhesives and their properties.

If used, artifacts should be handled with care and exposure to light and elevated temperatures should be minimized. A limited lifespan of 6-20 years should be anticipated (Horie 1987).

Poly(vinyl acetate)-based adhesives were identified on the Red Polished Ware jug (Figure 7) and on the main body of the Bichrome Ware bowl (Figure 8). As documented in Table 1, users should be aware that because of the low Tg of ~20° C of PVAc adhesives, vessels are susceptible to 'dirt pick-up' and 'cold flow' (Horie 1987) and tend to soften in hot conditions (Sease 1994). As a result they are of limited use in the field, and perform best in a controlled environment. However if 'UHU all purpose' is used, it may have a higher Tg due to the presence of CN in the PVAc based formulation. 'UHU all purpose' is commonly used due to its world-wide availability. It is not known whether the presence of CN in any way compromises the performance of the PVAc based adhesive. However soon to be published accelerated ageing studies conducted by Down (2009) indicate good initial performance, followed by a dramatic decline.

Identification of formulation changes that have important conservation implications

An additional, and unexpected, issue was revealed by these investigations on the Cypriot pottery. Whilst conducting tests on control adhesive products, and consulting with archaeologists and conservators involved with the resconstruction of archaeological ceramics, and some adhesive manufacturers, Nel (2005, 2008) identified two potentially important formulation changes that are not commonly known.

There are a range of CN-based products available on the market. These include brands such as UHU-Hart, HMG heat and waterproof adhesive and Tarzan's Grip. With the popular brand, Tarzan's Grip it emerged that a formulation change occurred in 1997. The old CN based formulation is easily reversible with acetone. However, the current product is based on polyurethane (PU) (pers. comm. with the manufacturer Selleys, Sydney office, 2005). PU is resistant to solubilisation and is noted for its instability (Buys and Oakley 1993; Horie 1987). As a result, Tarzan's Grip is no longer appropriate for use in reconstructing pottery vessels, which may require conservation treatment.

Of further concern is the only recently reported formulation change for B72 adhesive (HMG), which occurred in 1995. Since 1995 the manufacturer has been adding CN to the acrylic adhesive (Nel 2008; Nel and Lau 2008). The impact of the added CN has not yet been assessed, but may compromise performance. Parloid B72 is commonly used due to its thermoplastic properties, clear white appearance, good long-term ageing properties and solubility in acetone (Buys and Oakley 1993; Horie 1987). However, the introduction of CN into the formulation by the manufacturer (HMG) reflects the ongoing search to improve its working properties and to elevate its glass transition temperature (Tg) of ~40°C to reduce the risk of softening and slumping at high temperatures.

The need for documentation of past repairs

To some extent the absence of conservation records or documentation of past repairs prompted the investigations conducted on the seven vessels presented in this report. It highlights the importance of maintaining conservation histories. In a biographical account on Stewart, Robert Merrillees (1983: 33-52) notes observing Cypriot Bronze Age pottery in almost every part of Stewart's Mount Pleasant home around 1959-1960. Of interest are the sherd trays from Professor Hennessy's excavations at Stephania, seen lying in the basement. It is conceivable that during post excavation analysis, some ceramics may have been repaired and reconstructed. It is an ongoing reality that not all excavation projects are staffed with object conservators. Today many archaeologists continue to undertake pottery reconstruction as part of the ceramic analysis and recording process. From a conservation perspective it is desirable for archaeologists to document intervention materials and methods in their field notes as well as in official publications. Otherwise, when faced with assessing adverse adhesive performance on reconstructed vessels, a conservator is required to employ complex analysis methodologies in order to identify adhesives that were used in past undocumented repairs. Not to mention the negative impact of the use of unsuitable products on valuable archaeological and cultural heritage materials.

Conclusion

It has been demonstrated that valuable information can be obtained, using non-invasive investigation methodologies, to shed light on various conservations issues, such as: the possible presence of organic residues, and ceramic deterioration due to the presence of salts and failing adhesives. Most importantly, it is recommended that CN based adhesives should only be used with an awareness that they age far more rapidly than the PVAc and acrylic-based adhesives and thus protective measures should be taken such as avoiding elevated temperatures and minimising light exposure. Recent reports have identified the importance of monitoring formulation change. These discoveries illustrate the importance of assessing adhesives on vessels and monitoring commercial products in order to identify issues that may require further investigation. Furthermore it is important that both conservators and archaeologists be kept informed about recommended materials and practices for reconstructing vessels. And finally, we have highlighted the importance and value of documenting any treatment activity undertaken by both conservators and archaeologists.

Acknowledgements

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A NEW LIFE FOR OLD POTS. EARLY POTTERY REPAIRS FROM 7TH MILLENNIUM TELL SABI ABYAD (NORTHERN SYRIA)

Olivier P. Nieuwenhuyse and Renske Dooijes

Abstract

This paper presents early pottery repairs from Late Neolithic Tell Sabi Abyad, northern Syria, made with plaster. Dated to 6450-6200 cal. BC, they may represent the earliest pottery repairs currently known in the Near East.

Introduction

The study of pottery technology does not end at the stages of ceramic production, distribution and exchange. In particular the stage of ceramic consumption is a complex one. Often the biographies of ceramic vessels were not cut short after the vessel had broken. Every archaeologist or museum curator has come across at least some instances of vessels that were kept in use after they had stopped being fully functional, or that were re-used for purposes entirely different from their primary function. Recently archaeologists, ceramic specialists, and professional restorers have become increasingly fascinated by the way broken pottery vessels were mended in the past. The interpretative potential of ancient repairs on archaeological artefacts – visual reminders of the object's tormented cultural biography (Kopytoff 1986) – is more and more being acknowledged (Appelbaum 2007; Bentz and Kästner 2007; Caple 2006; Chapman and Gaydarska 2007; Dooijes and Nieuwenhuyse 2007; Dooijes et al. 2007). This has resulted in a stronger emphasis on the careful recording and documenting of the repairs observed; most archaeologists today would no longer casually dismiss or even omit the ancient repairs they observe from their find descriptions.

Here we shall discuss the recent discovery of some very early pottery repairs from Tell Sabi Abyad, northern Syria (Figure 1). Dated to the 7th millennium BC, a period known as the Early Pottery Neolithic, they may well represent the earliest pottery repairs currently known in the Near East. They provide an interesting perspective on the prehistoric practices of pottery repair and re-use.

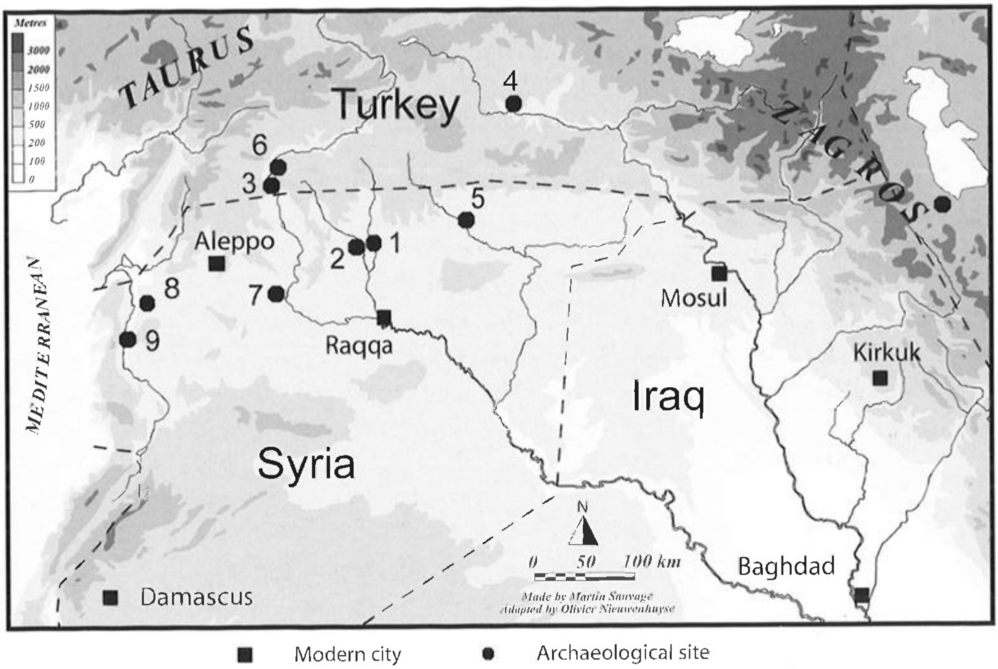

Figure 1. The location of Tell Sabi Abyad and other Early Pottery Neolithic sites in Upper Mesopotamia. No. 1: Tell Sabi Abyad. No. 2: Tell Damishliyya. No. 3: Mezraa Teleilat. No. 4: Salat Cami Yani. No. 5: Tell Seker al-Aheimar. No 6: Akarçay. No. 7. Tell Halula. No. 8. Tell el-Kerkh. No. 9: Šir.

The Early Pottery Neolithic at Tell Sabi Abyad

Tell Sabi Abyad is a four-hectare mound (Arabic: *tell*) in northern Syria. Excavations since the late 1980s have exposed extensive remains dating from the later 7th and early 6th millennia, from what is locally known as the Pre-Halaf, Transitional and Early Halaf periods (Akkermans 1993; Nieuwenhuyse 2007). More recently, work has begun to explore much earlier levels dating from the earlier stages of the 7th millennium cal. BC, known as the Early Pottery Neolithic. The excavations have revealed a highly complex stratigraphy, with at least eight distinct occupation levels attributed to the Early Pottery Neolithic. A vigorous radiocarbon dating program has pushed back the earliest of these levels (level A-10) to about 6800 cal. BC. The final stage of the Early Pottery Neolithic (level A-3) is currently dated at around 6300/6200 cal. BC (Akkermans et al. 2006). The pottery from the EPN levels is dominated by a coarsely finished, plant-tempered ware, which, for want of alternatives, we have simply termed Coarsely-Made Plant-Tempered Ware (van As et al. 2004; Nieuwenhuyse 2006). The repairs discussed in this contribution come from levels A-5, A-3 and A-2, the final stages of the EPN and the start of the Pre-Halaf. They date between ca. 6450 and 6200 cal. BC (Figure 2).

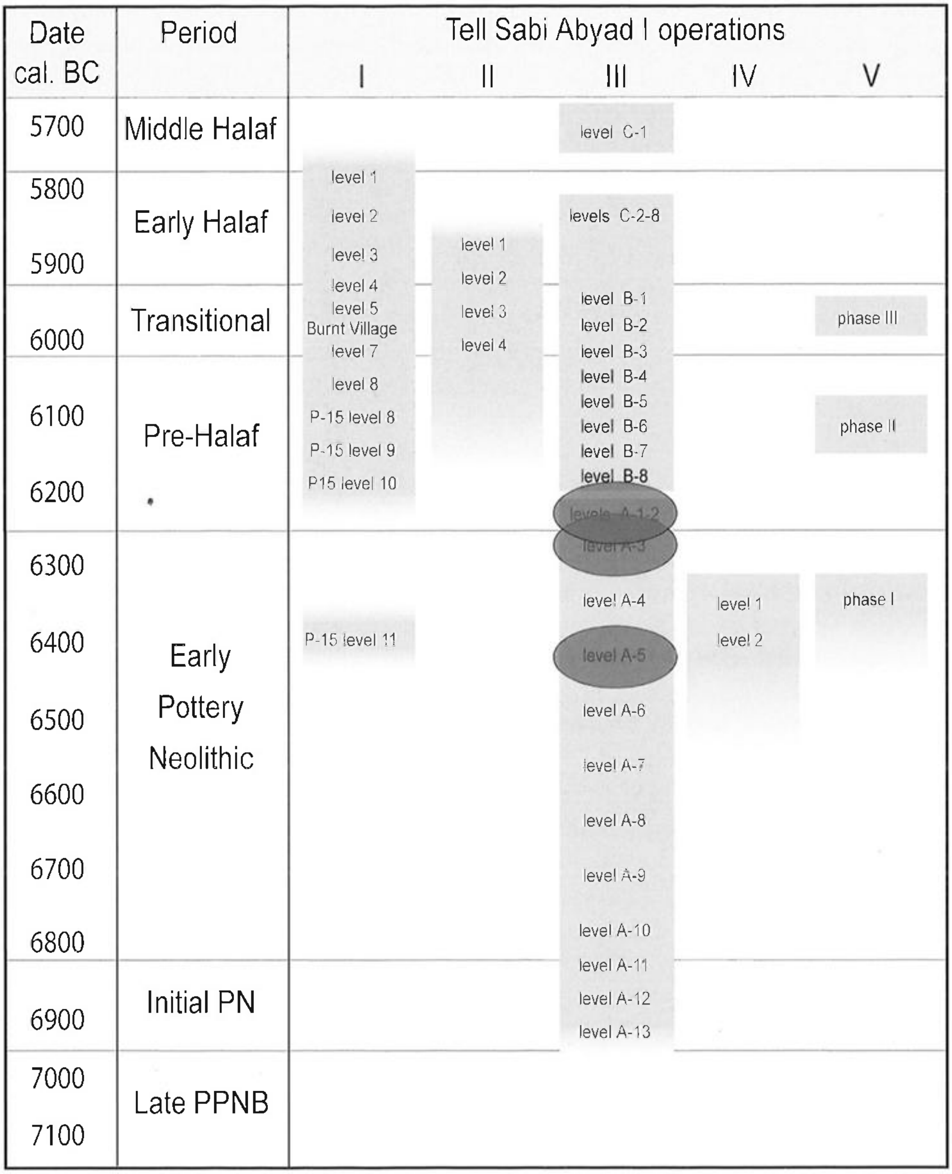

Figure 2. The culture-historical sequence of Tell Sabi Abyad (Operations I to V), showing the stratigraphic position of the plaster repairs discussed in this paper.

It is important to note that alongside the pottery various alternative technologies existed at Tell Sabi Abyad for making durable containers during the EPN. Vandiver (1987) and Rice (1999) have argued that early low-fired ceramic containers in the Near East were part of, what they term, a broad "software complex" or "soft stone technologies" for making various types of artefacts (also Dyson 1965). At Tell Sabi Abyad this included the prodigious production of stone vessels, bins of unfired clay, and bitumen-coated baskets (Akkermans et al. 2006). Particularly common at Tell Sabi Abyad were large plaster containers, the so-called White Ware (Nilhamn et al. 2008). Research has shown that in the Near East two different raw materials were employed for making White Ware: either lime (calcinated calcium carbonate, $CaCO_3$) or gypsum (hydrated calcium sulphate, $CaSO_4 2H_2O$). These materials are virtually indistinguishable to the naked eye, but their chemical and functional properties are in fact very different (Kingery et al. 1988; Maréchal 1982; Nilhamn 2003). A study of EPN White Ware from Tell Sabi Abyad suggests that these containers were made from calcium sulphate, or gypsum (Nilhamn and Koek 2009, pers. comm., February 2009). For the sake of convenience, we shall henceforth simply use the term plaster.

Interestingly, although the production sequences and functional properties of ceramics and White Ware were certainly very different, some intriguing similarities can be pointed out. As both types of containers were made of soft, plastic material, measures were taken to prevent the vessel from sagging during shaping. Pottery clay was of course tempered; in the case of the CMPTW with coarse plant fibres. White Ware containers, on the other hand, sometimes included reused pottery sherds as a coarse "temper". In both technologies vessels were shaped vertically by adding successive layers. White Ware is well known for the impressions of woven tissue, showing that baskets were used as a support. Curiously, very similar impressions have been observed on some of the ceramic vessels during the EPN. Pottery vessels were sometimes shaped while standing on a cloth or reed basket, and at least two examples have been observed of pottery vessels shaped *around* a woven support.[1] Containers in both categories were relatively coarsely finished and were virtually never decorated. Moreover, the two technologies were often used in combination. Pottery vessels were frequently plastered with gypsum, presumably to reduce the porosity of the vessel wall or to insulate the vessel.[2] And finally, we now know that gypsum plaster was sometimes used to repair pottery vessels when they became damaged.

The early pottery repairs

Here we shall discuss four examples of CMPTW vessels that were repaired with plaster during the Early Pottery Neolithic. It is important to note that although these are so far the only ones known, it is quite likely that in the past plaster repairs were more common. Plaster is extremely fragile and very susceptible to fragmentation. Once detached from the pottery vessel, a plaster repair is very unlikely to remain intact to the degree that it may be recognized as such by the archaeologist. The chances of finding a complete plaster container or an intact plaster coating on pottery are very small, unless circumstances of preservation significantly increased the chances of survival. Most of the excavated contexts at Tell Sabi Abyad, as at most other prehistoric sites in the Near East, represent secondary or tertiary depositions. For reasons as yet poorly understood, the remains from levels A-3 and A-2 at Neolithic Tell Sabi Abyad have yielded relatively large numbers of well-preserved ceramic vessels. The proportion of vessels in the archaeological record carrying a plaster repair is therefore considered to be an underestimate.

The earliest example is a small goblet recovered from one of the buildings of level A-5 (Figure 3). At some point in the past part of the upper body was broken, leaving a large gap. Gypsum was pressed into this gap from the exterior. The rough, unfinished exterior surface of the plaster suggests that a handful of plaster was simply plugged into the gap without much further ado. No traces of tools are visible on the exterior, nor have traces of pressing or smearing of the soft material been observed. On the interior, however, a support was used for counter pressure. This is clearly shown by the smooth, somewhat concave shape of part of the interior of the plaster fill. A low ridge at the lower end of this smoothened surface suggests that the support was pushed inwards a few millimetres. The support may have been a piece of cloth or leather, but the regular, concave surface suggests something more solid was used, for instance a re-used pottery sherd. Evidently, the support was kept in place while the plaster was hardening, which may have taken more or less ten minutes. It is possible that something was used to fill the ceramic vessel to press the support against the wall, for instance a piece of wrapped cloth or even sand. Perhaps more likely, the person responsible for the repair simply sat it out, keeping the vessel in his or her hands until the plaster had hardened sufficiently.

A most interesting repair – as far as we are aware, unique in the prehistory of the ancient Near East – is represented by a large jar from level A-3, unfortunately found in a very fragmented state (Figure 4). In this case, the porous material was placed in a circular perforation of about 5 cm in the vessel wall, filling it completely. It remains unclear how this hole had come about; the jar may have been broken, but it is also possible that the perforation was made deliberately, for unknown purposes. One way or another, the repair resulted in a roughly circular plug of about 6 cm in diameter. A blob of plaster was gently pushed into the hole from the exterior. Counter pressure was applied from the interior, perhaps simply with the palm of the hand. The plaster slightly pushed the counter support inside, resulting in the slightly convex shape of the interior of the plug. It was made sure that the plaster covered the break edge of the surrounding perforation completely, thus making a strong bond between the plaster and the ceramic. The exterior surface was very roughly smoothed.

The next specimen is a large jar recovered from one of the level A-2 buildings. It shows what appears to be a gap in the rim filled with plaster (Figure 5). The vessel was heavily plastered on the interior, as well as on the exterior lower body. The interior plaster, with a total thickness of some 12 mm, has several distinct layers. Each successive layer was applied only after the previous layer had set. This resulted in poor

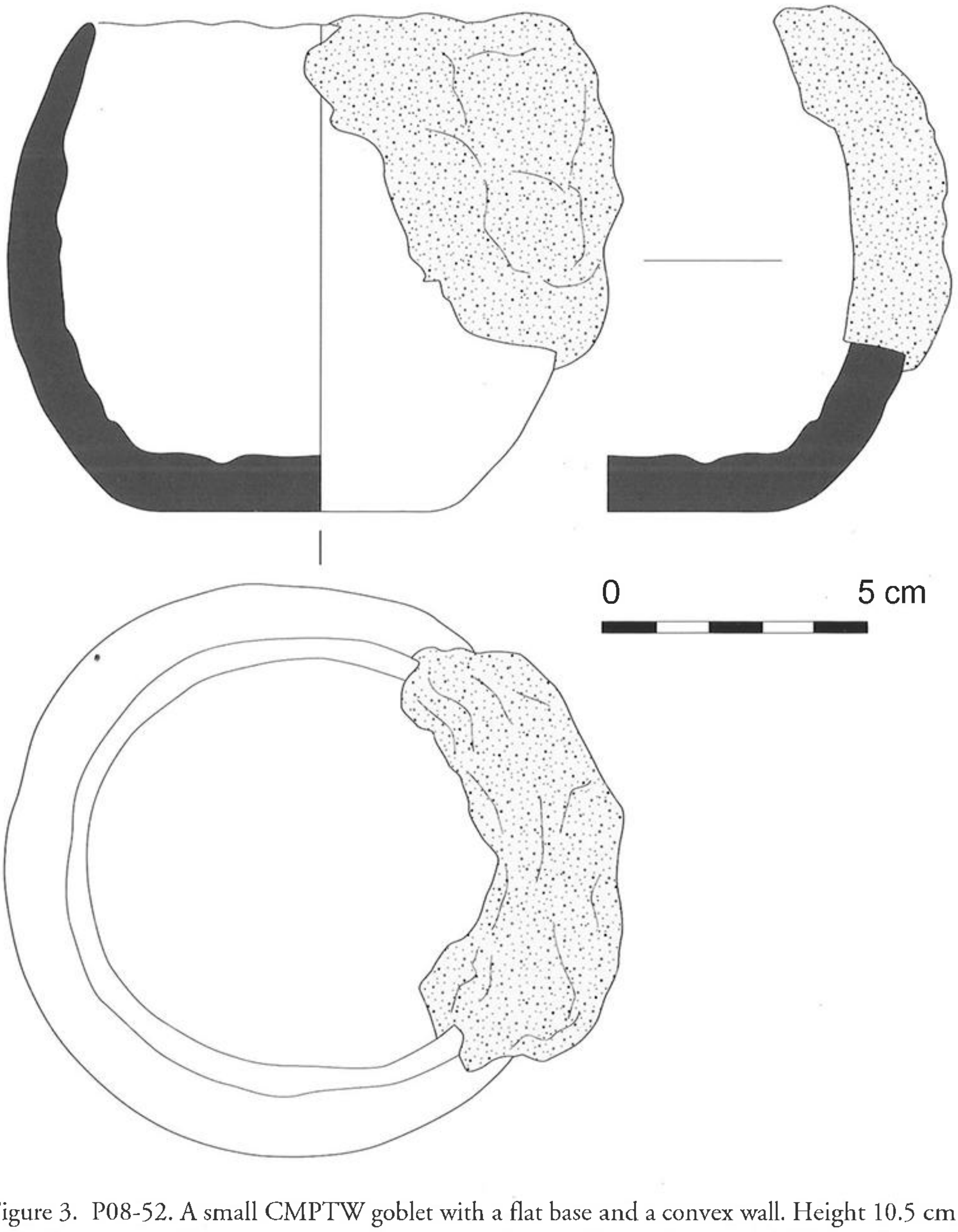

Figure 3. P08-52. A small CMPTW goblet with a flat base and a convex wall. Height 10.5 cm; rim diameter 8 cm. Excavated from a level A-5 room fill dated around 6450 cal. BC.

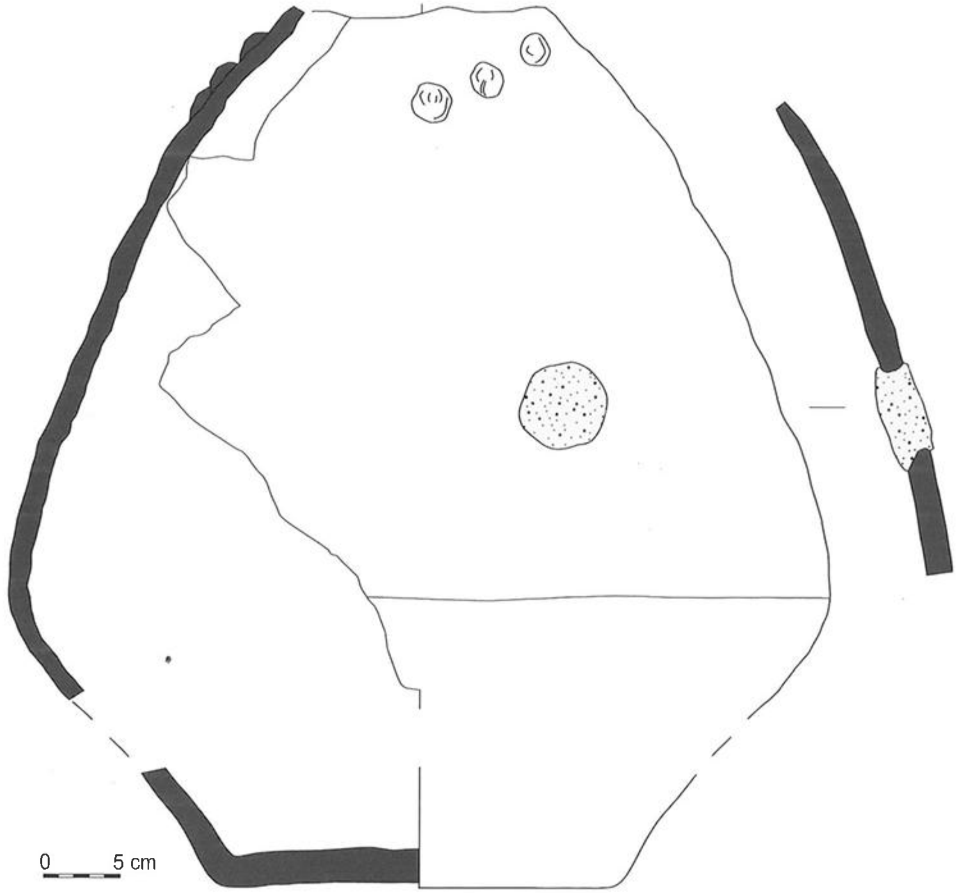

Figure 4. P-07-116. The lower part of a large CMPTW jar with a flat base, a slightly concave lower body and a carinated contour. Heavily fragmented and tentatively reconstructed. Appliqué decoration on the upper body, consisting of three circular blobs placed in a diagonal row. Height 75 cm; maximum body diameter 44 cm. Excavated from a level A-3 open area dated to about 6300 cal. BC.

cohesion between the layers, and now causes them to come apart. It is possible that the repair was done at the same time the surface coatings were applied. Part of the rim is missing, in the form of a triangular gap approximately 8 cm long. The plaster was sculpted in a thick layer over the break, covering part of the exterior as well. In contrast to the interior plastering, the repair does not show a layered structure, suggesting that the plaster was applied only once. The exterior of the repair shows no traces of finishing; the interior was roughly smoothed. The plaster appears to have been applied and then left to dry without significant further treatment.

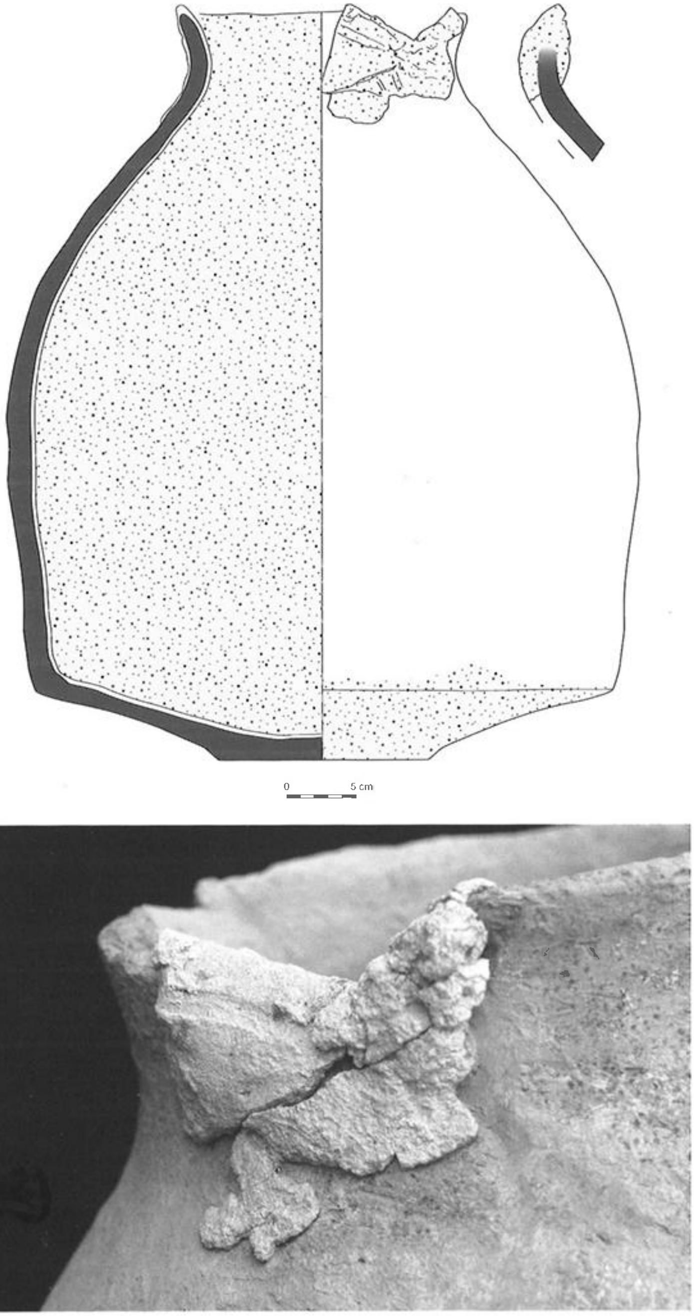

Figure 5. P05-82. A large CMPTW jar with a flat base, concave lower body and carinated contour. A 12 mm plaster covered the interior surface from base to shoulder. Height 53 cm; rim diameter 21 cm. Excavated from a level A-2 room fill dated around 6200 cal. BC.

The last example to be discussed is a jar that shows two ancient cracks in the upper part of the body, both treated with plaster (Figure 6). The damage would have been sufficiently serious to reduce the vessel's level of performance significantly. One long, winding crack branches downward from the rim for about 20 cm. It is possible that this crack had already formed during the firing stage. The uppermost part of the crack, where it is the widest, has been filled with plaster, whereas a wide area surrounding the lower, curving part has been smeared with a thin layer of plaster. A second, vertically oriented crack on the other side of the vessel may have resulted from some form of blunt impact stress: where part of the rim is missing this stress may have exerted its major impact. The upper part of this crack is covered in an approximately 3 cm wide band of thin plaster, running down for about 12 cm. As with the previous example, the vessel interior and exterior lower body have been extensively plastered.

Some concluding comments

In selecting CMPTW vessels for repair during the Early Pottery Neolithic it appears that pragmatic, functional considerations prevailed. The plaster repairs on pottery vessels discussed here were closely related to the production of White Ware containers, which flourished between ca. 7000 and 6200 cal. BC. Plaster was widely available, and considered to be suitable material for the occasional repair. The basic principle was that of a *fill*, of filling-in conspicuous cracks and gaps with a plastic, but waterproof material. The vessels would have been fully functional after the repair.

The restorations were, of course, highly visible. This would have been very difficult to avoid with the techniques discussed above, but we doubt that the visual appearance of the ceramic containers after a repair was of any concern during the Early Pottery Neolithic. After all, the pottery vessels themselves remained plain and coarsely finished throughout the EPN. The production of both ceramics and White Ware containers is generally held to have been organizsed at the household level (Nieuwenhuyse in press, Nilhamn 2003). It would seem that the pottery vessels were incidentally repaired within the individual households, whenever the need arose. No specialist "restorers" were needed for these repairs.

At Tell Sabi Abyad the large-scale production of White Ware and the use of gypsum plasters came to an end at around 6200 cal. BC. As White Ware largely disappeared, so did plaster repairs. Not a single example has thus far been recovered from the extensively-excavated Pre-Halaf, Transitional and Early Halaf levels at the site. The authors are not aware of additional examples from later stages of Syrian prehistory. Interestingly, however, a very comparable technology for restoring pottery was in vogue much later in time, during the Late Bronze Age. An Assyrian potter's workshop excavated at Tell Sabi Abyad, dated to ca. 1200 BC., yielded several examples of damaged vessels repaired with plaster (Duistermaat 2008).

Of course, people did not stop repairing their vessels after the EPN. However, the restoration techniques attested in the archaeological record, limited as they are, show a

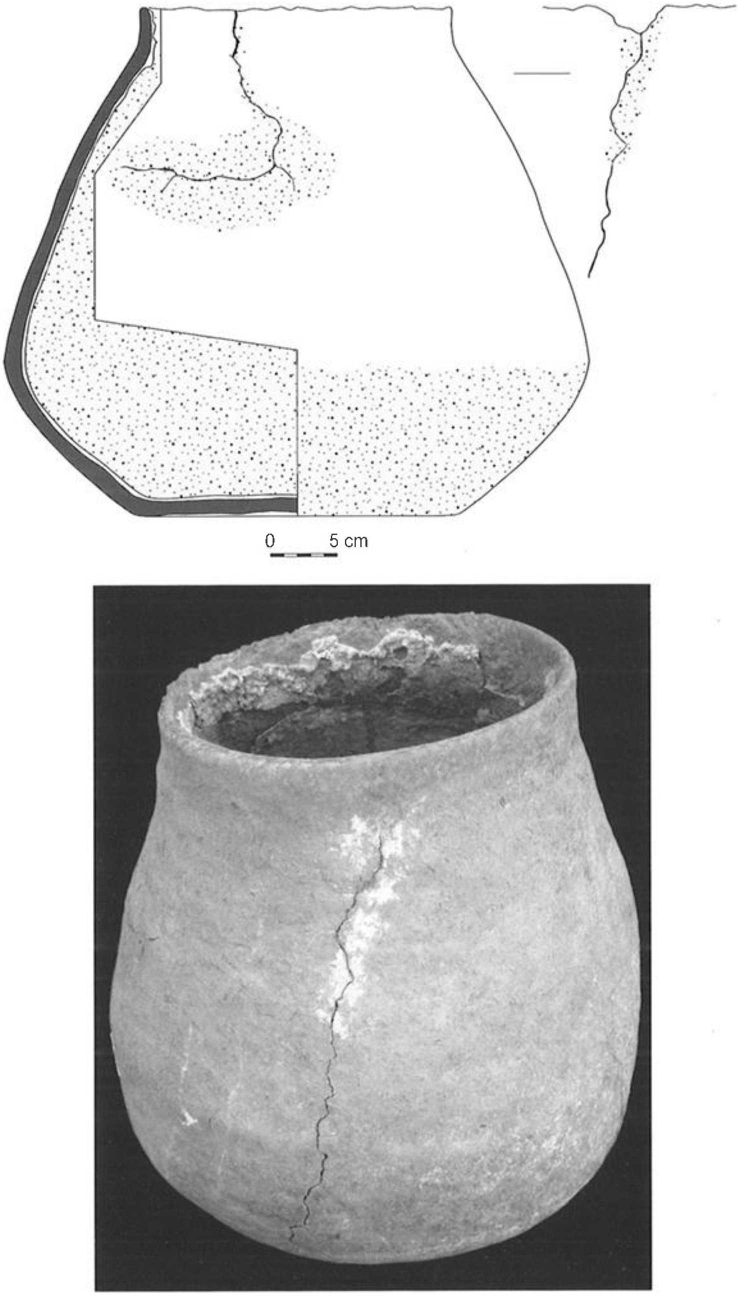

Figure 6. P07-88. A CMPTW jar with a slightly concave base, a convex lower body, a carinated contour and an oval mouth. The entire interior surface was covered with several layers of gypsum plaster, with a joint thickness of 4 mm. The exterior lower body was covered with a thin layer of plaster. Height 38 cm; rim diameter 23 cm. Excavated from a level A-2 room fill dated around 6200 cal. BC. Photo: after restoration.

marked change. The earlier plaster repairs made way for a restoration technique that *mutatis mutandis* remained in use until modern times. People drilled small perforations along the break edges, and used organic staples and glues such as bitumen to keep the sherds together (Dooijes and Nieuwenhuyse 2007). This technique is based on the principle of *bonding*, of refitting different elements together. Ceramic innovation now focussed upon Fine Ware serving vessels made from more compact, mineral-tempered clay, and pottery repairs were limited to this functional category (Nieuwenhuyse 2007). The lack of refits in the Early Pottery Neolithic may have had a very practical reason: the low-fired, fibrous material was less suitable for neat perforations, and less force could be exerted to keep the individual parts closely together. Consequently, changing restoration techniques from around 6200 cal. BC onwards should be seen within the wider context of the innovation in pottery production and consumption.

Acknowledgements

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Notes

1. These examples, however, remain exceptional. On the whole the solution adopted by the early potters was to reduce the plasticity of the clay with a strong temper of plant fibres.

2. Often the interior surface of large jars was plastered completely, while on the exterior the plaster was limited to the part below the point of maximum vessel diameter.

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AN ETHNOGRAPHIC STUDY OF THREE BETAMMARIBÉ POTTERY WORKSHOPS IN NORTHWESTERN BENIN

Lucas P. Petit

Abstract

This ethnographic study aims to discuss the tradition of pottery making in northwestern Benin, West Africa. Three recent individual pottery workshops of the Batammaribé tribe were studied. It is concluded in this article that for these workshops the stimuli of innovation and change should be sought outside the particular potter's working space.

Introduction

An ethnographic study was carried out in January 2001, for 3 days, as part of the archaeological exploration of north-western Benin by the University of Frankfurt am Main and the University of Contonou (Petit 2001, 2005; Petit et al. 1999).[1] The archaeological material collected from the surface and within stratigraphic excavations during three earlier field seasons had revealed only a limited number of production techniques, shapes and decoration types, irrespective of chronology. This uniformity was reason for discussions among the team members[2] about conservatism, tradition and scientific omissions. What could have been the reason underlying this absence of cultural diversity? While we wanted to start from the 'known', we decided to carry out a brief ethnographic study of three traditional potters belonging to the Betammaribé.[3] With this set of data in our backpack, we ultimately wanted to proceed to the 'unknown': extracting innovating behaviour (and the lack of it) from archaeological material.[4]

Numerous variables are involved in the process of innovation that finally lead to a different product, a different technique or a different decoration (van der Leeuw et al. 1991: 146-147). Decision-making during production and finishing stages among the potters seems important for the final product. But these processes are influenced by many other mechanisms, outside the potter's range of influence. This brief ethnographic study tries to get insight into these stimuli: what dimensions influence the final outcome of pottery production? Is the potter playing a main roll in the process of change (cf. Ogundele 1991: 119) or are other, external mechanisms deciding how the product should be created?

In the following pages, I summarise the information collected during our research and will end with some consideration and thoughts about conservatism and tradition.

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This study was not designed as a complete account, nor as a guideline for ethnographers or archaeologists. In addition to the research objective, it saves some valuable information about West African pottery production that is unfortunately disappearing with incredible speed (cf. Rye 1981: 14; Sargent and Friedel 1986).

Environmental and demographic setting

The ethnographic fieldwork was carried out among potters of the Atakora department in northwestern Benin (Figure 1). This area is characterised by a NE-SW running mountain ridge, the Atakora Mountains, with altitudes between 400 and 600 m. North and south of this ridge the area is relatively flat, except for some sporadic incised water gullies and streams. Today several ethnic groups with their own languages are living in this semi-arid area. One of these groups is called Betammaribé, known for their great mud castles: the *Tate Somba* (e.g. Blier 1987; Maurice 1986; Mercier 1948, 1968). They earn their livelihood mainly from agricultural production and livestock rearing.

Organisation and status

Among the Betammaribé, women practise pottery making. They are specialists, however their mode of production corresponds to what is defined by Peacock (1982: 6-11) as a part-time individual workshop. Pottery is produced all year, but slows down during the rainy seasons. There are abundant clay resources in the area and the potters are spread regularly through the region. The pottery of the Betammaribé is different in decoration and appearance from neighbouring ethnic groups, such as the Wama or Natemba (Dakpangou 2001; Petit 2005). The exact symbolic meaning and social status of this craftsmanship needs more investigation. Probably, due to our unsystematic questioning methods and limited research time, we recorded different and conflicting answers and explanations. Similar to neighbouring areas, however, a relationship with metal producers was noted (cf. Stößel 1986: 244).

Case study 1: Dikouetikouni (Figure 2)

The village Dikouetikouni is located a little south of Perma along the road to Djougou. Houses are spread over a large region, allowing the inhabitants to have their agricultural field in close proximity. Potter *N'Tchet M'Po*, originates from a small village near Boukombé and arrived at Dikouetikouni by marriage. Her mother taught her the pottery making techniques, and *N'Tchet M'Po* likewise used to pass this craft to her children. During the last couple of years, however, her children prefer school over pottery production. In addition to being a part-time potter, she works as housekeeper and farmer.

The first stage in the pottery production is the procurement of raw material. The yellow-brownish coloured clay comes from the banks of the river Koutié-Tchatidoh,

Figure 1. Research area and living locations of the three potters.

some 500 m away from the compound. She digs large clumps of yellow-brownish coloured clay and brings it to her house. After drying, the clay is crushed and soaked in water for one day. She prepares the materials a few days before a group of pots has to be produced. During this time the clay is stored in a large container in the courtyard. The only temper material she adds to the clay, is *Foui de Fonio* stalk, a plant that is cultivated on the farmlands around the house.

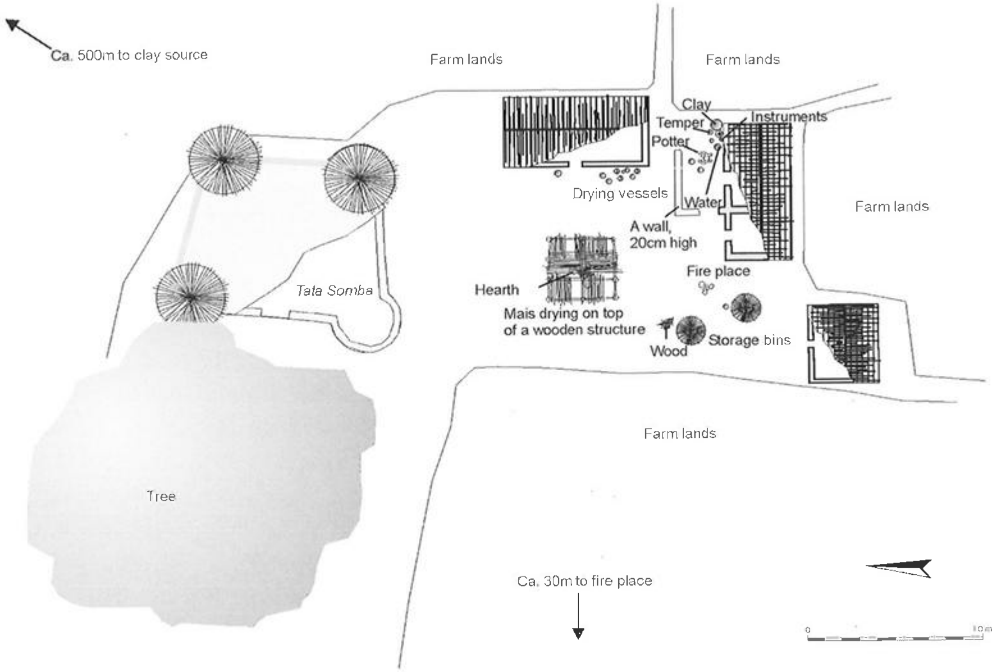

Figure 2. Compound of the potter in Dikouetikouni.

The first step in the production process is the formation of a base. A clay disc is moulded over the rounded base of an older, partly damaged pot. In order to avoid sticking, ashes are put on the mould, the clay and the hands. After it is dry enough to stay in the right shape, the clay was removed from the mould. To increase the size and height, coils are added. If the vessel has the correct shape, the rim is cut off horizontally and sometimes smoothed by a leaf of a *Mukonrimu* tree. The thick vein of the leaf causes a groove at the rim's lip. The potter could not explain, why this groove was made other than to say that she had learned this technique from her mother. After a short period of drying, surface modifications and other finishing techniques were carried out. The kind of decoration applied depends on the vessel function. Since her customers order the vessels in advance, she is able to decorate them accordingly. Beside different roulette types, incisions and combing for the exterior, she also uses the seeds of the *Néré* tree. Mixed with water, the paste is smeared over the inner side of open vessels. According to her, this causes a dark colour after firing. *N'Tchet M'Po* was not able to answer the question why the interior has to be black. This practice might to be associated with iron smelting. There exists a metamorphic association between both activities: the polluting transformation of earth by fire (Haaland et al. 2004: 82; Hahn 1991a, 1991b: 47). This association is often manifested in symbolic similarities.

After additional smoothing and two till three days of drying the pots were fired in a shallow pit with a diameter of approximately 2 m. The fuel and vessels, bottom up, were placed in alternating layers. Different fuel materials were used, such as *Foui de Fonio*, husk and small twigs. According to the potters, larger wood is never used, because the extreme heat would cause the pottery to break. From the moment the pile was set on fire in the evening, the potter is not allowed to speak to anybody, until the vessels were ready, normally in the early morning.

Case Study 2: Koutaagou (Figure 3)

The village Koutaago is situated not far from Boukombé, in the eastern part of the research area. Pottery production was and still is an important income for the inhabitants. However, cheap metal and plastic containers are abundant on the local market, making ceramic vessels expendable. For this reason the villagers were planning to create a workshop with a special focus on tourists. They tried to become independent by a combination of mass production and a good marketing plan, but we do not know if they were successful. One of the potters of Koutaagou, named *N'Tcha N'Tchei Delphine*, was interviewed and observed during several production stages.

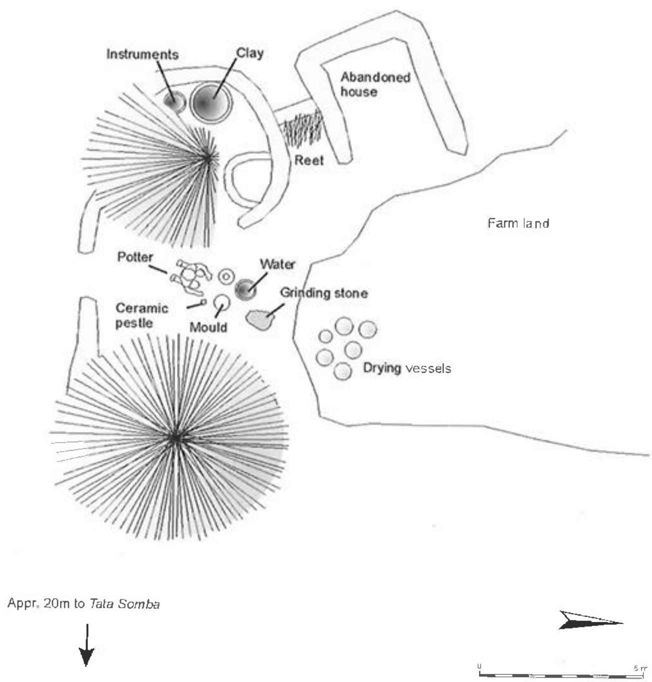

Figure 3. Compound of the potter in Koutaagou.

The clay originates from either the river Kounadorgou or Koutaagou. After drying and crushing, the material was soaked in water for one day. Similar to the first case-study only *Foui de Fonio* stalk was used as non-plastic additive. The potter did not know of any other materials with the same characteristics that could be added to the clay.

The potter uses two forming processes. The first method starts with a lump of clay that is formed into a container by pitching a hollow in the centre (Rye 1981: 70). The sides are made regular using the thumb and finger with some water. To prevent sticking, ashes are regularly put on the hands and tools during all production stages. The second technique resembles that observed in Dikouetikouni: a clay disc with a diameter of 30 cm is placed on the top of an old pot (bottom up). By carefully beating with a pestle, the clay is packed regularly over the mould. If a stand-base is needed, she fixes a coil to this disc. After a short drying period, the base is removed from the old pot serving as the mould. The interior is scraped to create an even and regular wall thickness. The rest of the pot is formed by adding coils around the circumference and by smearing the joins between them. The rim is formed by hand or with use of a leaf of the *Mukonrimu* tree. The leather-dry vessel is decorated with rouletting, combing or smoothing.

The firing is carried out at a small open place relatively far from the living units. Different firing materials are used for regulating the temperature. Above a layer of cow faeces, *Foui de Fonio* is laid. The unfired pots are then placed up side down on top of this construction, followed by small pieces of wood and again a layer of *Foui de Fonio*. The potter told us that this plant is used to create a black colour on the interior as well as to extend the length of firing. The fire is lit in the afternoon and lasts until the early morning. No ceremony or special symbolic tradition exists during the firing process.

Case Study 3: Tchirimina (Figure 4)

The third potter, we interviewed and observed, *N'Ko M'Po*, lives in Tchirimina not very far from the regional capital Natitingou. She originates from the village of Koutaago, where she was taught the craft by her mother. The potter was rather pessimistic about the future of pottery making, although one of her daughters knew all production techniques.

The clay derives from a small river called Futuryere, running not very far from the house. Clay preparation is the same as in the other two villages. During our visit, we saw a small child kneading together clay, water and *Foui de Fonio*.

N'Ko M'Po uses two different starting operations: moulding and pinching. The mould is an old pot, turned up side down in front of the potter. By using a potsherd as a pestle, she forms a clay disc around the rounded base. A flat stand base is created by adding a coil and smoothed with a leaf of the *Tuyapaati* tree. After a short drying period, the rest of the vessel is built with coils. The second method differs only at the initial production stage. The lower body is shaped from a clay ball. A hollow is pinched with the thumb, after which the clay is pushed out and upwards. If a larger vessel is needed, clay coils are added to the body. Sometimes, scraping is carried out to achieve

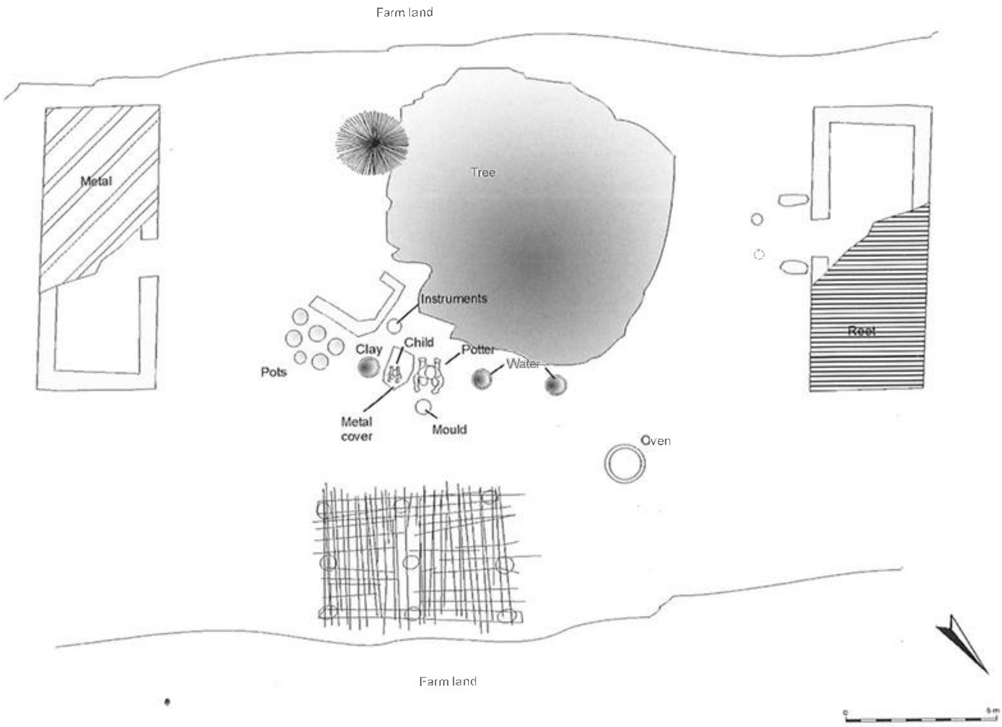

Figure 4. Compound of the potter in Tchirimina.

an equal wall thickness. Most vessels are smoothed and their lips grooved with a leaf of the *Tuyapaati* tree. In addition to smoothing, the pots are decorated extensively. Each pot type has its own decoration: strip roulette for cooking pots and comb-impression for water containers. The period of time the pots need to dry, depends on the weather and size of the vessels. After some hours of drying the vessels are polished, first with straw, then with a small stone and at the end again with straw. A paste from fruits of *Néré* is applied at the interior, to create a black finish as a result of the firing.

The firing place is set up on a flat surface, and starts with a layer of grass. Any kind of grass could be used, and regularly also cow faeces. The unfired vessels are placed up side down on top of this pile and covered with small pieces of wood and a layer of grass. *N'Ko M'Po* mentioned that the final colour of the interior carries a symbolic meaning. Whereas a black interior is simply the result of smoke, a red colour indicates contamination by iron production. This happens, for example, when someone in the family is producing iron at the same time. The colour of the exterior seems not important. *N'Ko M'Po* can produce four pots a day and the whole cycle last around six and a half days. Sometimes she goes to the market to sell pots, but people regularly order ceramic vessels at her home.

Conservatism and tradition

An important aim of this ethnographic study was to investigate, the sociology and behaviour of traditional pottery making, in addition to the production, finishing and firing processes involved. In the West African Iron Age similar production techniques were used over a relative large area.[5] Archaeologists, for whom pottery is the most common find and one of the best sources of information, are hampered enormously by this conservatism. I have been taught that pottery is a result of a craftsmanship, reflecting potter's behaviour. The pottery production techniques should be analysed to reconstruct the potter's society. Excavations in the research area reveal, however, that the production techniques of the ceramic assemblage of a 5th century A.D. village resembled the one of another village some 700 years later (Petit 2005). Does this mean that the societies of the two settlements were alike? This is certainly not always the case, but such a long-lasting tradition reflects uniformity and conservatism. In addition to this past uniformity, our brief ethnographic study has shown a similar resistance to change at the three potters in northwestern Benin. And even more intriguing is that the pottery production techniques identified during our brief ethnographic study, resemble those of the Iron Age. Was there never a wish to change the *chaînes opératoires*? Why does a potter produce a certain vessel the way she does, and why not differently? The potters in the Atakora department answered: "while my mother has taught me so", sometimes added with the phrase "the customer wants the vessel to be like this". Needless to say that the idea of an almost 1500 years old pottery tradition in northwestern Benin needs more investigation and can not solely based upon this ethnographic study.

Are potters really artisans (Arnold 1985)? Modern potters see their activities as the useful product of hard work: a labour of responsibility rather than an expressive art (Dietler and Herbich 1989: 148). Yet at the same time, many potters do derive a sense of aesthetic satisfaction from their craftsmanship. Among the Betammaribé in Benin aesthetic satisfaction of the potter seems to derive from the uniformity of the vessels, which does not directly stimulate changes. This ethnographic study demonstrates that the potter followed fixed *chaînes opératoires*, obviously free from any independent constraints. Behaviour and choices of the Betammaribé potter were directed by others, without any alternatives available.

Changes are hardly visible in the 1500 years of pottery production in northwestern Benin, even though all parts of the production process are susceptible to alteration and the potters possess considerable freedom of action. This is, at least for 21st century scholars, rather difficult to understand. Nevertheless, it explains the conservative and uniform pottery traditions in Western Africa during at least the last two millennia. Potters do pursue change if and when they feel they must do so (Papousek 1989: 141). But when there is no reason to innovate, the ceramic assemblage with all its characteristics will be copied from generation to generation.

Notes

1. Financed by the German Research Council.

2. The work of all team members is appreciated during and after the fieldwork of 2000/2001.

3. The interviews and production stages were photographed and filmed by the author.

4. The historical significance of the outcome was unfortunately relatively meagre (Petit 2005).

5. Note that this paper discusses technique and not *style*. The latter differs significantly from area to area (e.g. Thompson 2007).

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A NEW ETHNOARCHAEOLOGICAL DOCUMENTATION PROJECT AT THE FUSTAT POTTERY WORKSHOPS, EGYPT

Kim Duistermaat and Niels C.F. Groot

Abstract

This brief article introduces a new ethnoarchaeological project concerning potters of the Fustat area in Cairo. Currently the potters are being evicted from their workshops, which will be replaced by new, government-built workshops. This process will lead to the disappearance of a traditional potters quarter. An ethnoarchaeological project by the Netherlands-Flemish Institute in Cairo (NVIC) and Leiden University aims to document the already partly demolished quarter and study the potters before they relocate.

Introduction

The modern traditional pottery workshops in Fustat (Cairo, Egypt) are one by one being demolished. In an attempt to modernize the industrial and touristic area of Fustat and to provide cleaner, less polluting and more sanitary working circumstances for the potters, the potters are involved in a programme of renewal and development. Whether or not these changes will eventually improve conditions for the potters, they will inevitably change the way the potters are working. Now that the potters are facing major changes in the near future, it seems appropriate to document their craft. This offers the opportunity to study the changes that have occurred since the last documentation of their work (see below), and the reasons behind these changes. Also, a new documentation provides a background against which the future workshops can be studied.

The NVIC and Leiden University are currently carrying out an ethnoarchaeological documentation project, funded by the Embassy of the Kingdom of the Netherlands in Egypt. This article provides an outline of the project, and is also a call for contributions. Ceramic or other specialists in possession of structured but unpublished information on the Fustat workshops over the ages, whether they are field notes, photographs, video's, historical data, technical notes or maps, are invited to contribute to the final publication.

The pottery workshops of Fustat

The last extensive ethnoarcheological documentation of the Fustat potters, and one of the few studies of contemporary traditional potters in Egypt, was carried out in the early 1970s (Golvin et al. 1982). The potters were then located around the Mosque of Amr ibn al-'As, situated north of the present quarter. The current potters quarter was constructed as a result of eviction from the area around the mosque, when the Supreme Council of Antiquities evacuated most of the archaeological area of the medieval city of Fustat. The workshops are now located in an area called 'Batn el-Baqara' and 'Al Fawakhir al-Gedida', between the archaeological site and the cliffs of the stone-quarry to the south. They share the area with gypsum factories, many of which also produce ceiling ornaments and fantastical garden decorations. In 1998 van der Kooij and Wendrich (2002) briefly described the potters at Batn el-Baqara.

Our visits to the area started in March 2008 and concentrated on the area around the small mosque, including a rooftile workshop and several pottery workshops (Figures 1 and 2). When compared with the situation in 1998, much had changed. The potters

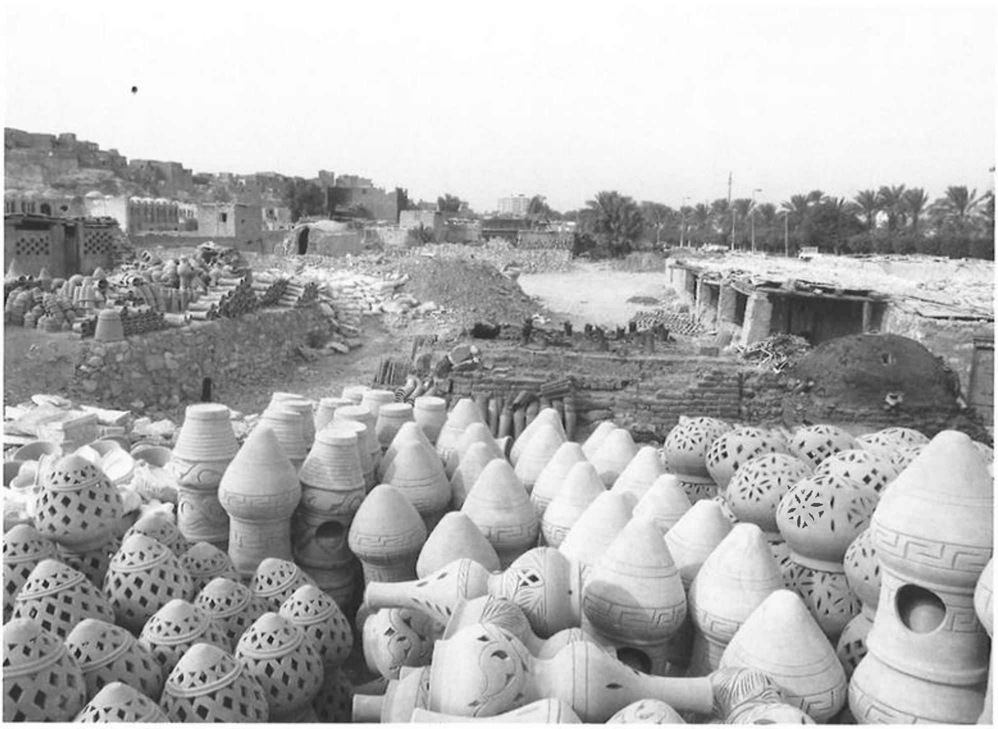

Figure 1. Overview of the pottery workshops in Batn el-Baqara, Fustat, looking towards the west. The workshop at the right is the rooftile workshop. In the background, the remains of a large kiln can be seen.

had abandoned the production of plain flowerpots, although old and unused stacks of these pots were still observed along a dilapidated large kiln west of the quarter. The potters, excluding the rooftile workshop, are currently producing a large variety of garden pots, garden decorations, lamps and decorative pots for use inside. A variety of shaping and decorating techniques is used, including the fast wheel, various moulds, hand-shaping, incised, applied, cut-out decoration, and painting with water-based or synthetic paints. Some workshop owners have workshops elsewhere to produce glazed pottery. The pottery is made of clays from Aswan mixed with local Nile clays.

The wares are fired in updraft kilns stoked on scrap wood or diesel oil. The huge double or triple kilns described by Golvin et al. (1982: 41-77) are no longer in use. The ruins of one dilapidated large kiln are still visible. It was in use when van der Kooij and Wendrich (2002: Figs. 13: 1,2,3) visited the area in 1998. Part of the produce is sold directly to people who pass by on the street in front of the workshops, but most of it is sold to wholesalers and shops in Egypt and abroad.

Mr. Ali Darwish Ali, owner of one of the workshops and chairman of the Fustat Association for Pottery Production, told us that originally there were more than 60

Figure 2. Overview of the roofs of the pottery workshops in Batn el-Baqara, Fustat, looking towards the south-west. The small mosque where the Fustat Pottery Association holds office can be seen in front of the new workshop buildings by the government.

pottery workshops in this area. Now, some ten to twenty workshops remain. In addition, isolated workshops can be found around the general areas of Fustat and Old Cairo, to the east and south of the archaeological site. These workshops are not threathened by the new developments.

In our contacts with the potters, we were struck by their extreme hospitality and willingness to show us all the details of their craft. We are allowed to film and interview all workshop staff freely and everyone volunteered to explain or show us what they meant, whether in reaction to specific questions or spontaneously. Apart from the apparent enthusiasm for their craft, the potters also show a remarkable insight in modern politics, economics, markets, 'eco-tourism' and the increasing popularity of 'craft products' among foreigners and upper class Egyptians.

Future changes

The thick black smoke emerging from the kilns was the main reason for the Egyptian government to take action against the workshops in an attempt to fight pollution in the city of Cairo. In 1999, a ministerial decree called for closure or relocation of the workshops. In 2000, forced evictions had started to take place. Implementation of the decree would have ultimately led to the destruction of the craft, and to increased unemployment.

The potters' community, with the help of a local NGO (CEOSS), then took the initiative to propose a plan to save the workshops and guarantee continuity of the craft and employment in the same area. The plan includes the building of modernised workshops and housing, and the introduction of gas-fired kilns to reduce pollution. The government, after approving the plan, allocated 3.5 *feddan* (ca. 1.5 ha) to develop new workshops in the same area where the present workshops are located. The project is funded through a grant from the government of Italy. One by one the old workshops are now being torn down, while new workshops are built. Some potters have temporarily moved their activities to other areas around Fustat awaiting the new facilities. Others have abandoned the craft.

The new workshops are designed by Egyptian architects and are built of concrete with flat or domed roofs. None of the new workshops is in use yet, although most of the old workshops have been torn down. The new buildings are not yet connected to facilities such as sewage, water and electricity. Moreover, the potters regret the fact that they were not actively involved in the design process. As the main design flaws they point out the lack of large open spaces both indoors and outdoors, and the lack of large flat roofs for storage purposes.

When we visited Batn el-Baqara for the first time in March 2008, the demolition of old workshops was nearing the final stage. Once the potters would relocate into the new workshops, the craft would unavoidably change, whether with respect to the use of space, the use of gas kilns and electrical equipment, or the production organisation. It was clear that we had to move quickly if we wanted to document the current production in the Fustat potteries.

The NVIC – Leiden University Fustat Potters Project

Due to the severe limitations in time, both caused by the monthly demolitions of workshops in Fustat and by the tight schedules of the project team, the project is necessarily of a limited nature. The project consists of the following elements:

- a study of the techniques of pottery production
- a study of the building history of the complex
- a study of the use of space
- a study of the organisation of production
- a historical perspective on pottery production in Fustat
- an archaeological perspective on pottery production in Fustat

In these studies, archaeological questions provide the framework and direction. At the time of writing, specialists from Leiden University Faculty of Archaeology (A. van As and L. Jacobs) and Delft University of Technology (N.C.F. Groot), together with three MA students of Archaeology from Leiden University, have spent three weeks of

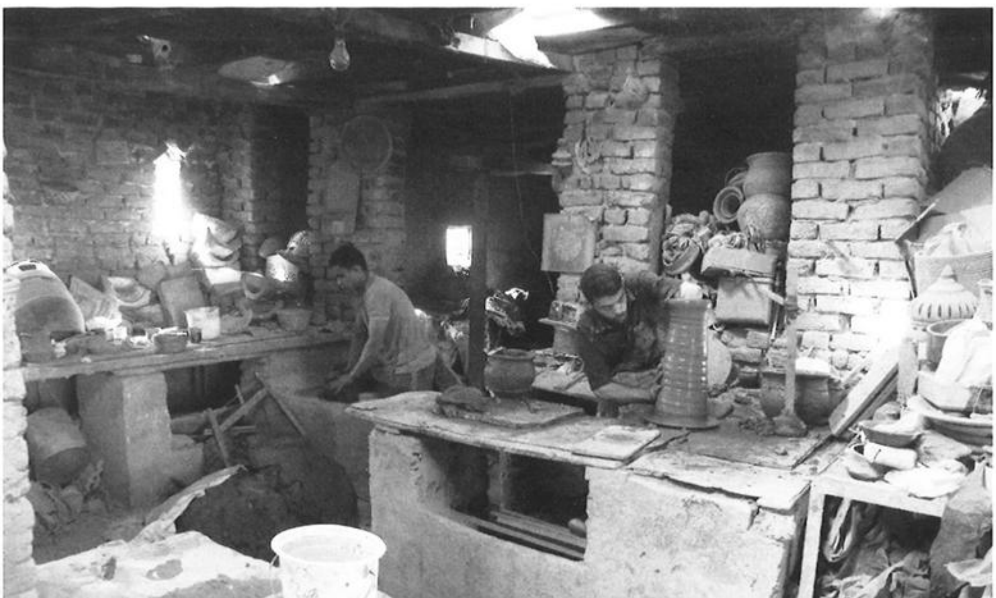

Figure 3. Potters at work in Batn el-Baqaras, Fustat.

fieldwork in Fustat. Together with a student of Visual Anthropology involved with video documentation, they provided a detailed study of techniques and use of space in eight workshops around the mosque (Figures 2 and 3). Egyptian architects, under the direction of D. Bakhoum, provided accurate architectural drawings of the workshops and facilities in the area, including detailed drawings of two updraft kilns. M. Kaçaçnik took care of the professional photographic documentation. Currently, K. Duistermaat is working on a study of the organisation of production in the eight workshops documented by the technical team. This study will be based on interviews with the workshop owners and personnel. Furthermore, E. Jacobs and P. Sheehan will contribute with a study of the historical data on pottery production in Fustat and an overview of the information on pottery workshops and kilns brought to light during archaeological excavations in the larger area of Fustat.

Together with additional information on the current situation drawn from the various parties involved in the development project, we aim to produce a coherent picture of the different aspects of current pottery production in Fustat. The final publication will include maps and drawings, photographs and videos.

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CURRENT RESEARCH OF THE LEIDEN DEPARTMENT OF POTTERY TECHNOLOGY (2008)

Research projects in cooperation with:

Leiden University (Faculty of Archaeology):

Caribbean Archaeology:

- 'Communicating Communities, Ceramics and Social Change' (Netherlands Foundation for Scientific Research /NWO; C. L. Hofman);
- Tobago (A. Boomert).

Meso-America:

- 'Ceramics and Social Change. The Impact of the Spanish Conquest on Middle America's Material Culture (Netherlands Foundation for Scientific Research /NWO; G. Hernández Sánchez).

Leiden University (Faculty of Archaeology / the Netherlands National Museum of Antiquities:

- 'Abrupt Climate Change and Cultural Transformation' (Netherlands Foundation for Scientific Research/NWO; P.M.M.G. Akkermans and O.P. Nieuwenhuyse).

The Netherlands-Flemish Institute in Cairo (NVIC)/Leiden University:

- An ethnoarchaeological documentation project at the Fustat pottery workshops, Egypt (K. Duistermaat).

Delft University of Technology and Leiden University/Faculty of Archaeology:

- Iron Age III pottery from Tell Deir Alla (Centre of Art and Archaeological Studies/ CAAS; J. Dik and N.C.F. Groot).

University of Cardiff:

- Southern Romania Archaeological Project (D.W. Bailey and R. Andreescu).

Wilfrid Laurier University, Waterloo, Canada:

- Iron Age pottery from Khirbet Mudayna, Jordan (P.M.M. Daviau and M.L. Steiner).

Royal Museums for Art and History, Brussels:

- Bronze Age pottery from Lehun, Jordan (I. Swinnen).
- Iron Age pottery from Lehun, Jordan (M.L. Steiner).

Working Group on Mesopotamian Pottery:

- A Corpus of Mesopotamian Pottery (Second Millennium B.C.) (H. Gasche and J.A. Armstrong).

The Netherlands National Museum of Antiquities:

- Pottery reconstructions for educational purposes.

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