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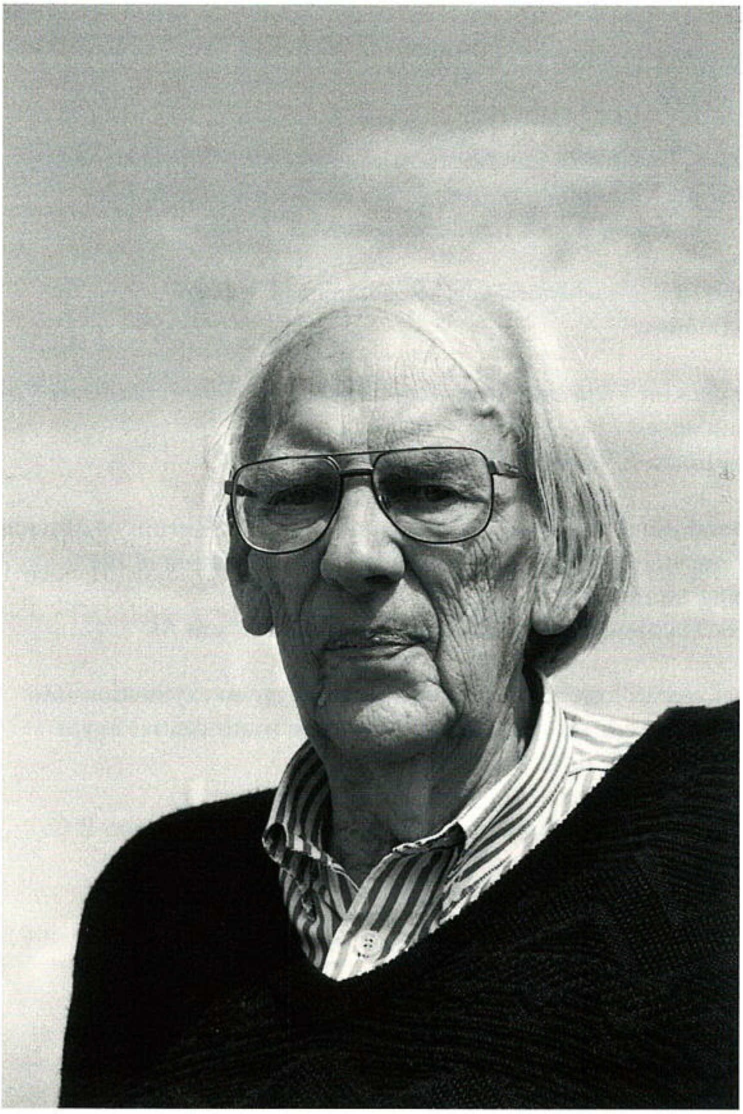

HENDRICUS JACOBUS FRANKEN (1917-2005)

Hendricus Jacobus Franken, emeritus professor in the Archaeology of Palestine and Surrounding Areas and the founder of the Department of Pottery Technology who started this Journal in 1983, died on the 18th of January 2005 aged eighty-seven.

Henk Franken studied theology at the University of Amsterdam, where he was trained in Semitic languages by professor Judah Leon Palache. During World War II he served as a minister in a parish near Zwolle. Here he became actively involved in the resistance against the German occupiers and in rendering assistance to Jews in hiding.

After the war Henk Franken went to Bali (the Dutch Indies) where he worked as a missionary till 1951. These were the years of the Indonesian independence war. As in World War II he was strongly opposed to occupation and oppression. The tales he told of those years were full of wonder and love for the people of Bali. A Christian missionary himself, he was proud to have converted an unhappy Christian to his original Hindu belief. His study of the Festival of Jayaprana at Kalianget, which he published in 1960, provided him with a detailed background of anthropological concepts, and it is no wonder he later emphasized the importance of ethnography and cultural anthropology in interpreting archaeological data.

When he returned to the Netherlands Henk Franken wrote a theological dissertation entitled *The Mystical Communion with JHWH in the Book of Psalms* (Leiden 1954). On initiative of the Old Testament scholar professor P.A.H. de Boer, Henk Franken was appointed lecturer in Palestinian Antiquities, a new position at Leiden University. Although he had never before been involved in archaeological work, he took on this new task full of enthusiasm. To learn the trade, he enrolled in Kathleen Kenyon's excavations at Jericho from 1955-1958. He knew nothing of pottery, and spent several weeks at the Rockefeller Museum in Jerusalem to draw all the pottery in the showcases. He also copied pottery plates from excavation reports. No copiers in those days – everything was drawn with pencil in a fine hand. He had a good eye for forms and was an accomplished aquarellist himself.

The months spent in Jericho, as part of a team consisting of many an eccentric, in close proximity to the Palestinian refugee camps, was another formative experience. He greatly enjoyed the rhythm of life in the Middle East, his work in the deep trench of Jericho, and the discussions with Kathleen Kenyon, whom he respected very much and often opposed fiercely. As in Bali he was genuinely interested in the lives and thoughts of the local population. And again he took a stand against occupation and oppression. In Holland he became active for the Palestinian cause.

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In 1962 Henk Franken was appointed Professor in the Archaeology of Palestine and Surrounding Areas. His inaugural lecture was entitled *Heilig-Land en heilige huisjes* (Holy Land and sacred cows). It conveyed a critical analysis of the way biblical archaeology was performed in those days. He proposed to apply the critical methods of modern archaeological research as practised in other countries to the excavations in the Holy Land and to separate the interpretation of the excavated remains from literary data. He was an ardent follower of H.J. Eggers, who stated that the archaeological data (thesis) should be set opposite the literary data (antithesis), after which both sets of data could be combined to formulate an historical synthesis.

To his students Henk Franken said: biblical archaeology is not about illustrating textbooks. It is important not only to read books, but also to use your eyes, your head and your hands while working with the material itself. These were not empty words. He seldom showed slides during his lessons. His courses focused on the logical analysis of the excavated material and the scientific interpretation of archaeological data.

In 1963, together with his wife at the time, Ann Franken-Battershill, he wrote *A Primer of Old Testament Archaeology*. The book was written mainly for theological students and aimed to put in their hands the tools for extracting relevant information from excavation reports. In it he analysed many excavation reports and criticized the authors for the way they worked in the field and wrote up their notes. It did nothing to make him popular among some colleagues.

After the Jericho years Franken was eager to start his own excavations. In 1960 he started at Tell Deir 'Alla. This excavation was aimed at studying the transition of the Late Bronze Age to the Early Iron Age, traditionally the period of the entry of the Israelites. Franken's intention was to excavate this "simple" site without temples and palaces, to get an idea of how ordinary people lived, of their material culture and the pottery they used. In his own words: "What I had in mind was a common sense question: did pottery change abruptly at that time as was suggested in the literature and if so, what could have caused it." A detailed study of the stratigraphy and an even more detailed analysis of the excavated pottery were the hallmark of his strategy. Together with professional potter Jan Kalsbeek, Franken developed a new method of pottery analysis based on the study of the raw materials and manufacturing techniques. At the end of the 1970s we see, as a consequence of the interesting results of this pioneering technological research on the Deir 'Alla pottery, an increasing demand by Dutch and foreign archaeologists for a similar analysis of the technological aspects of their pottery. This development culminated in 1980 to the establishment of the Department of Pottery Technology, directed by Franken. In 1983 Franken started to issue the *Newsletter of the Department of Pottery Technology (Leiden University)*, since 2004 renamed into the *Leiden Journal of Pottery Studies (LJPS)*. In a contribution – 'Leiden studies in pottery technology' – to the previous volume of the *LJPS* we have paid attention to the importance of Henk's pioneering research for the Leiden approach to archaeological ceramic studies.

Franken's first book on the excavations at Deir 'Alla, published in 1969, brought him praise as well as rejection. Many archaeologists criticized the "teaspoon archaeology" they felt he practiced. And Henk did not make it easy for his colleagues, because of his refusal to refer to standard pottery typologies and his vagueness concerning the dating of his occupational phases – a big sin in contemporary biblical archaeology. He also maintained that the pottery he had excavated did not show a clear brake between the Late Bronze Age and the Early Iron Age, and he questioned the entry of large groups of Israelites in the Land.

Many other publications on pottery followed, be it the Iron Age pottery from Kenyon's excavations in Jericho, the Islamic material from Abu Gourdan, or pottery from other sites in the Near East or from elsewhere. In 1984 he organized together with Denyse Homès-Fredericq the exhibition *Pottery and Potters / Past and Present: 7000 Years of Ceramic Art in Jordan* in the Royal Museums for Art and History in Brussels, later displayed in Tongeren and Tübingen.

It was his good fortune or bad luck that he stumbled at Tell Deir 'Alla upon a Late Bronze Age temple, complete with foreign objects and clay tablets inscribed with an unknown script. In 1967, when he expanded the excavated area to completely expose the temple, the Balaam plaster text was found in Iron Age layers. These finds forced him to once again turn his attention to religion as a driving force in human society.

After the six-day war, in the years 1972-1975, Henk Franken participated in the UNESCO archaeological research and rescue excavations in the region threatened with inundation by the construction of a dam in the Euphrates near Tabqa (the present day Lake Assad) in Northwest Syria. The aim of his excavations at the Jebel 'Aruda (Uruk period), Tell Hadidi (Bronze Age) and Tell Taas (Byzantine/Early Islamic period) was to obtain an insight into the pottery traditions in this area by means of techno-analytical research.

He returned to the heartland of "biblical archaeology" when he became involved in the publication of Kathleen Kenyon's excavations in Jerusalem. His offer to the Publishing Committee dealing with Kenyon's academic inheritance to publish the pottery of some excavation areas was met with relief. A large part of the material from the excavations was sent to Leiden, where its stratigraphy and pottery were studied. Respect for Kenyon's achievements and methods went hand in hand with opposition to her interpretations, and the data were analysed as if he was not studying the Holy City, but any other tell. Once again he could show that his pottery analysis would yield unexpected and important results.

After his retirement in 1984 Henk Franken was as active as ever. These were the years he published his second book on Deir 'Alla (1992). The first book on Jerusalem was published in 1990; it is a pity Henk has not been able to see the copy proofs of his new book *A History of Pottery and Potters in Ancient Jerusalem. Excavations by K.M. Kenyon in Jerusalem 1961-1967*, which arrived on the day of his death. In recognition of his important pioneering work in Jordan he received the Jordanian Order of Independence presented to him by Princess Sarvath al-Hassan in 1989. The last essay he wrote (and which will be published posthumously) conveyed his views on the religious function of Deir 'Alla, "his" tell, where he had put his ideas into practice.

Since his departure from Leiden we have missed the daily inspiration of his always sharp, fiercely independent and creative mind that brought him sometimes in conflict with other people. Henk's friends share the grief over his death with his wife and son.

Bram van As

Leiden, January 2005

CLAYS COLLECTED. TOWARDS AN IDENTIFICATION OF SOURCE AREAS FOR CLAYS USED IN THE PRODUCTION OF PRE-COLUMBIAN POTTERY IN THE NORTHERN LESSER ANTILLES

Corinne L. Hofman, A.J. Daan Isendoorn and Mathijs A. Booden

Abstract

This article focuses on the identification of source areas of clays used in the production of pottery on Saba and St. Eustatius, northern Lesser Antilles. Conventional archaeological methods and archaeometric techniques are used to determine the composition of present day clays and pre-Columbian potsherds dated between A.D. 400 and 1450. Petrographic analyses and technological research involving workability tests are combined with geochemical analyses (XRF) to improve our understanding about the provenance of the clays, their suitability for pottery production and to shed more light on the distribution of the pre-Columbian pottery styles on the islands of the Lesser Antilles. This research aims to arrive at a better understanding of the distinction between locally manufactured pottery as opposed to exchange wares. The results are used in combination with ethnoarchaeological data from northern South America in order to conceptualize the modes of clay procurement in traditional Amerindian society.

Introduction

To date, only fragmented evidence suggesting the existence of inter-island contact networks in the Caribbean archipelago is known. These networks are attested by the distribution of 'exotics', including lithic materials, specific pottery styles and to a far lesser extent to clays and pottery temper constituents.

The current knowledge regarding the provenance of pre-Columbian ceramic raw materials such as clays and temper materials, and the identification of examples showing the exchange of pottery among the inhabitants of the various islands is still largely insufficient. Only in rare cases technological research involving the study of manufacturing techniques (Hofman 1993; Bonnissent 1995; Jacobson 2002) or of paste and temper constituents of the clays has been carried out. In the latter case, mainly conventional methods involving fabric analysis and in some cases petrographic thin-sectioning have been used (Arts 1999; van As and Jacobs 1992; Belhache et al. 1991; Bloo 1997; Carini 1991a, 1991b; Cox O'Connor and Smith 2001; Donahue et al. 1990; Fuess 2000; Fuess and Donahu 1992; Goodwin 1979; Hofman and Jacobs 2000/2001, 2004; Hofman et al. 1993; Mann 1986; Petersen and Watters 1991; Reed and Petersen 1999).

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Archaeometric methods such as geochemical analyses have rarely been applied to the issues of provenance and exchange of raw materials in Caribbean archaeology to date (Hooijkaas and Booden 2004; Cox O'Connor 1997; Descantes, pers. communication; Gustave et al. 1991; Walter 1991). In addition, most of these studies have been limited to the analysis of potsherds from various sites and islands and have not included that of clays.

This article presents a case study on clays and potsherds from the islands of Saba and St. Eustatius in the northern Lesser Antilles as part of a much larger project on the identification of source areas for clays used in the production of pottery by the pre-Columbian peoples of the Lesser Antilles between 400 B.C. and A.D. 1492. Conventional archaeological methods involving petrographic analyses and technological research are combined with geochemical analyses to improve our understanding on the availability of clay raw materials on the islands of the Lesser Antilles, the suitability of these clays for pottery production and their distribution among the islands. Ethnographic information from northern South America is used to conceptualize the modes of clay procurement in traditional Amerindian society.

Clay provenance and distribution studies in the Lesser Antilles

The outcome of recent research suggests that in many cases the pre-Columbian pottery was manufactured with local clays when these were available (Cox O'Connor and Smith 2001; Fuess 2000; Hofman 1993; Hofman and Jacobs 2004; Walter 1991). However, if suitable clays were lacking they were apparently transported from one of the neighboring islands. In other cases, it was the finished pottery product that was distributed.

Petrographic analysis and neutron activation analysis (NAA) of pottery from the Aklis site on St. Croix, Virgin Islands, have proved the subsequent use of different source areas on the island to acquire pottery-making materials in pre-Columbian times (Cox O'Connor 1997; Cox O'Connor and Smith 2001:34-36). Similarly, an analysis of 33 potsherds from the sites of Diamant and Lorrain (Vivé and Fond Brûlé) has shown the use of local clay sources for the manufacture of the prehistoric pottery of Martinique. A clear petrographic distinction has been found between potsherds from the south of the island and those deriving from the northeast (Walter 1991: 13, 45).

There is evidence that in the Leeward islands of the Lesser Antilles, the islands of volcanic origin served as sources for raw materials of finished ceramic products for the limestone islands of Barbuda and Anguilla (Donahue et al. 1990: 229; Petersen and Watters 1991: 355). Volcanic clays/tempers have been found to characterize many of the potsherds from Fountain Cavern and other Late Ceramic Age sites on Anguilla (Crock 2000). Similar results were obtained with respect to potsherds from Barbuda (Donahue et al. 1990). In addition, petrographic analysis of 51 potsherds from various sites on Antigua (both from the Volcanic Hill district and the low-lying limestone, Antigua Formation) proved that generally volcanic-dominated temper materials formed the main corpus of all inclusions types identified (Fuess 2000). It thus seems that in both cases, volcanic temper was purposely selected. The disadvantage of volcanic rock is that it is difficult to crush. The advantage is that it provides strength to the vessel upon firing. The potters were clearly aware of this advantage. The results obtained from this study support the view of procurement at local sources if the needed raw materials were available. It is, however, not clear whether the clays and/or the temper materials were collected from the volcanic source areas or if in fact the pottery arrived at the sites in question in a finished state. In addition, other prerequisites may have played a role in clay selection (see below section ethnographic accounts).

In the southern Lesser Antilles ceramics pertaining to the Late Ceramic to Historic Cayo complex have been encountered. In St. Vincent part of the Cayo pottery assembly was found to be tempered with *caraipé*. This is the burned bark of the '*kwepi*' tree of the *Licania* genus, which is not indigenous to these islands and must have come from the mainland of South America or Trinidad where this tree species is found (Boomert 1986). Contacts between the islands and the South-American mainland during the Late Ceramic Age have therefore been postulated.

Sampling

The core area of the overarching research encompasses the islands of the Lesser Antilles including Trinidad. This area is considered to be ideal for a research project of this kind because of its geographic constitution as a chain of islands between the landmasses of the South American mainland and the Greater Antilles. The geological constitution of the island arc varies considerably from island to island and this has it repercussions for the presence of clay sources suitable to pottery making. Volcanic islands are more favorable in this respect than the low-lying limestone islands. Due to the high geological and ecological variability of the area, clay samples from various islands in the Antilles have been included in this study. In order to arrive at coverage of the entire archipelago, islands pertaining to the geologically most distinct areas of the Lesser Antillean chain, i.e., the north, middle and south, are included.

In addition, a fair number of pottery samples have been collected during excavations in the region over the past twenty years. The sample comprises potsherds from at least ten different islands and moreover from various sites on each island in order to get a grip on the provenance and distribution of clays and pottery on both an intra-island as well as an inter-island level.

To complement and homogenize the currently available data, a database of raw clay and pottery samples from the various islands has been designed. The case study presented here, however, only focuses on clay samples and potsherds from the islands of Saba and St. Eustatius in the northern Lesser Antilles (Figure 1).

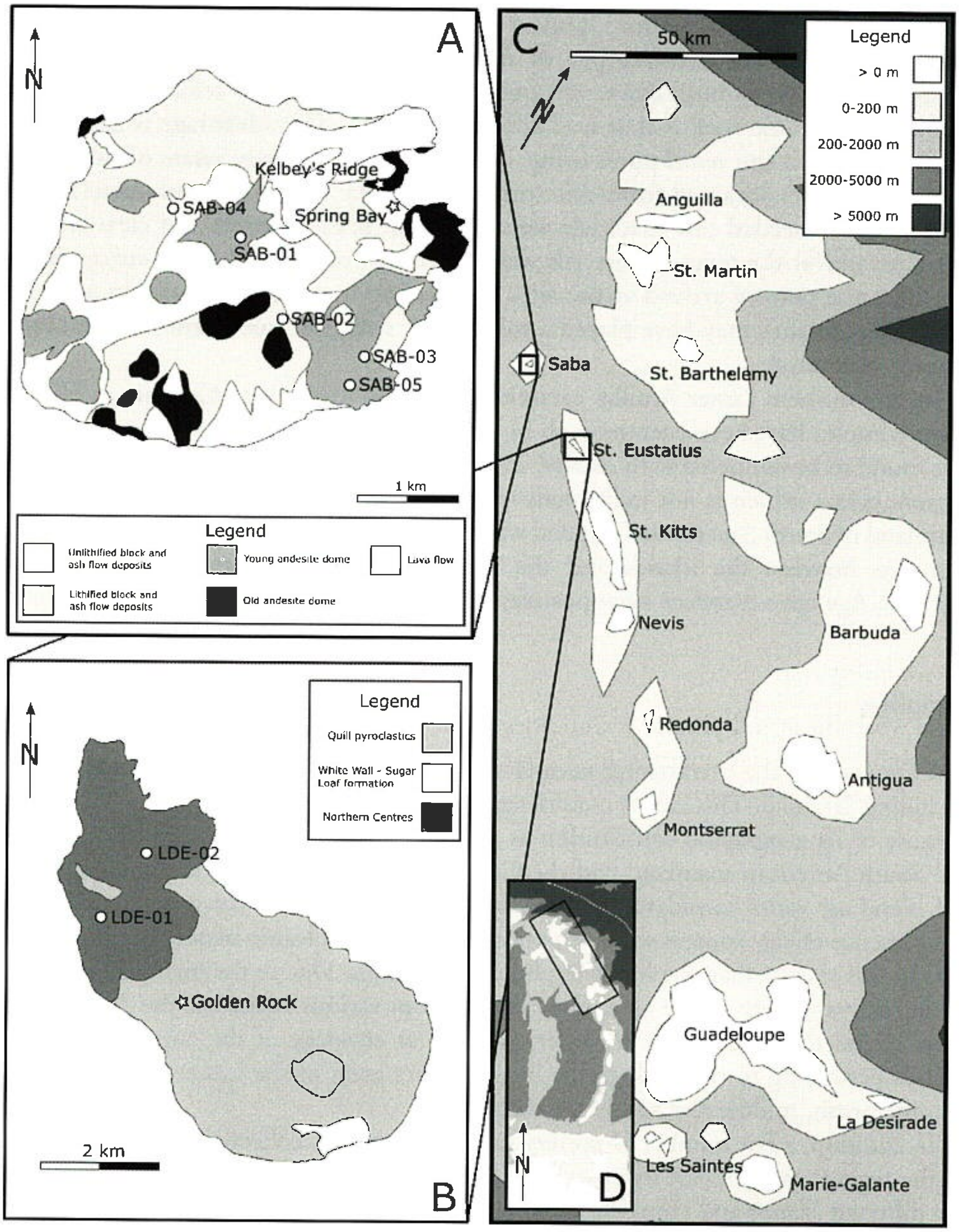

Figure 1. A: simplified geological map of Saba with locations of clay sampling sites and excavations indicated. Modified after Roobol and Smith (2004). B: simplified geological map of St. Eustatius with locations of clay sampling sites and excavations indicated. Black circular line marks the Quill crater. Modified after Roobol and Smith (2004). C, D: bathymetric map of the Lesser Antilles island arc (D) and detail of the northern part (C). White line in D marks the Atlantic-Caribbean plate boundary. Modified after van Soest (2000).

Complementary methods

Although comparative studies between raw clay samples, temper materials and pre-Columbian potsherds have not often been carried out in the Lesser Antilles to date, this kind of research is essential when studying the provenance and distribution patterns of pottery in the context of intra- and inter-island contact networks. For this study conventional archaeological methods involving petrographic analyses and technological research including workability tests are combined with geochemical analysis (XRF) for provenance identifications. Conventional methods such as thin-sectioning and microscopic fabric analyses have proved to be very suitable to large sample quantities and provide information on texture, temper and production techniques.

The pre-Columbian Amerindian use of *caraipé* as a temper material for pottery is a good example to explain why research methods such as the geochemical and the mineralogical approaches do not eliminate, but rather complement each other. Archaeometric techniques simply yield concentrations of certain elements and one would not necessarily discover the presence of organic inclusions such as *caraipé* in a potsherd. Conventional methods such as thin-sectioning or mineralogical analysis would however identify this material under a microscope.

Workability tests

The workability and plasticity properties of the clays have been tested. Additionally the suitability of the clay mixtures has been tested for the manufacturing techniques, which are known to have been used by the pre-Columbian potters. These are coiling, moulding, pinching and flattening. Experiments have been carried out with the collected clay samples. After kneading and pounding the clay, attempts have been made to coil the clay and build up small pots. The specimens that did not crack during drying were further tested. The next step was smoothing the surfaces. In order to do so, shell and calabash sherds have been used. Similar materials were probably employed by the pre-Columbian potters (Figure 2).

The clays were then experimentally fired to test the firing and post-firing behaviors of the mixtures and to enhance comparison with the pre-Columbian potsherds. In this context, test bars were fired at various temperatures for varying lengths of time and then measured for the degree of shrinkage (Figure 3). The combination of the degree of plasticity, the possibility to make coils and the degree of shrinkage finally determines whether the samples are workable or not.

Petrographic analysis

Petrographic analysis involving thin-sectioning as well as microscopic fabric analysis has been used for the identification of the mineral and non-mineral constituents in the clays and potsherds. By fabric is meant the composition of a fired pottery; i.e., the total

Figure 2. Workability tests on clay samples and the production of test vessels by the Ceramic Laboratory of the Leiden Faculty of Archaeology.

appearance of matrix and inclusions. It implies the texture, colour, hardness, type of non-plastics, their shape, size, quality, the presence of pores and cracks and their shape. The fabric analysis is carried out with the use of a binocular microscope. This technique is less thorough than thin-sectioning and subsequently analyzing the sample with a polarization microscope, but it is cheaper and much faster. For large sample quantities, this method is perfect because it provides a good set of useful data and is not time-consuming. Both workability tests and petrographic analyses were performed in cooperation with the Leiden Ceramic Laboratory.

For preparation of the cross sections, the potsherds were cut with a diamond saw and treated with fine sandpaper to obtain a smooth fraction surface. The sherds are numbered with a white fire resistant ink and fired in an oxidizing oven at a temperature of 800°C for 30 min. The refiring removes any organic impurities and improves the visibility of the inclusions, the paste colour and the texture of the fabric in general. Variation of fabric is considered a useful tool for the identification of local and non-local products.

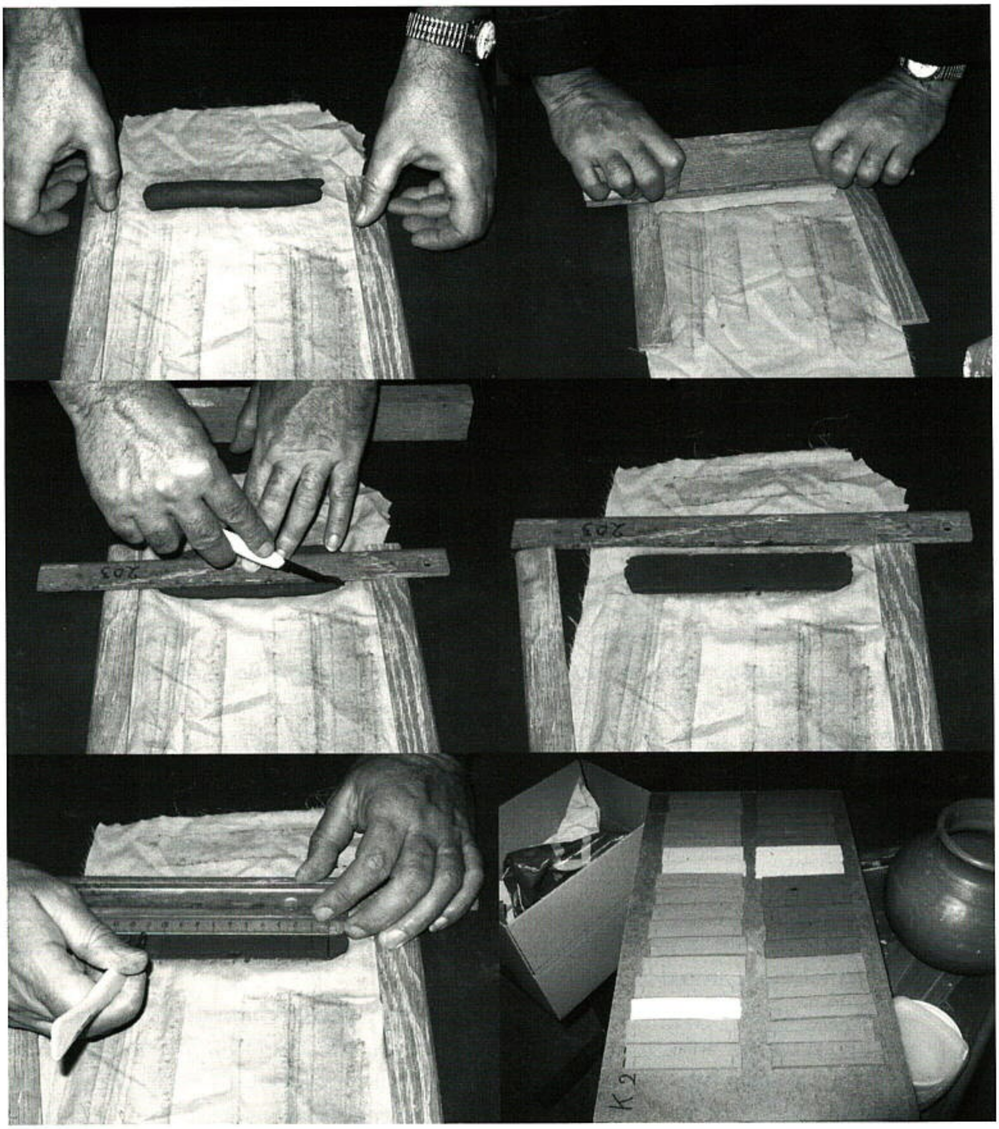

Figure 3. Experiments with clay samples and the production of test bars by the Ceramic Laboratory of the Leiden Faculty of Archaeology.

Geochemical analysis

Geochemical analysis using X-ray Fluorescence Spectrometry (XRF) has been performed in order to identify the chemical signatures of the raw clay materials and of the pre-Columbian potsherds in order to trace the provenance areas of raw materials and enhance the comparison between possible source areas and the pre-Columbian pottery. Element ratios in the clays and potsherds show several distinct groups, which are each geographically related. Since most potsherds can be geographically linked to their clay source, it is possible to identify exotic potsherds within the sample. The geochemical analyses were carried out in cooperation with Prof. Dr. G.R. Davies of the Faculty of Earth and Life Sciences at the VU in Amsterdam.

Geochemical signatures of the clays and potsherds have been determined by using XRF. Compositional bulk sample analyses are also anticipated to be carried out using Instrumental Neutron Activation Analysis (INAA). INAA will be used in the future, just as XRF, for compositional bulk sample analyses. It establishes the quantities of the various elements within a sample. This chemical characterization technique adds another dimension to provenance studies.

X-Ray Fluorescence determines the composition (the geochemical signature) of a sample by calculating the exact number of the various elements. An XRF spectrometer uses primary radiation from an X-ray tube to excite secondary (or fluorescent) X-ray emission from a sample. The radiation emerging from the sample includes the characteristic X-ray peaks of major and trace elements present in the sample. The dispersion of these secondary X-rays into a spectrum allows identification of elements present in the sample (Fitton 1997: 87). This method is useful for determining the provenance of pottery samples when combined with the results of the elemental compositional analysis of the clay samples. Before being able to perform the analysis, the samples have to be prepared. The clay samples are oven dried, then crushed in a jaw crusher, homogenized and finally pulverized in an agate planetary ball mill. The pottery samples are crushed and pulverized in a similar fashion. The powdered samples are then pressed into pellets after mixing them with 10% of binding powder (Emu) and homogenizing the mixture in an agate ball mill. These pellets are then loaded into the XRF-spectrometer to perform a quantitative analysis of the elements (Figure 4). After determining the concentrations of over 30 elements in each sample, the data is clustered using factor analysis and the ratios of certain elements are stored in diagrams.

The chemical signatures of the clays have been compared to those of the archaeological potsherds using the same archaeometric techniques. The combination of these techniques has yielded innovative and promising insights into clay source exploitation, pottery production and ceramic distribution as well as exchange among the pre-Columbian insular communities as will be illustrated by the case study below.

Case study: clay samples and potsherds from Saba and St. Eustatius

Workability tests

Four clay samples from Saba were collected in 1990 and tested for their workability properties. The clay locations on Saba were defined and sampled during the geological survey of the island by Paul van Olst (Olst and Hoogland 1996). The search for

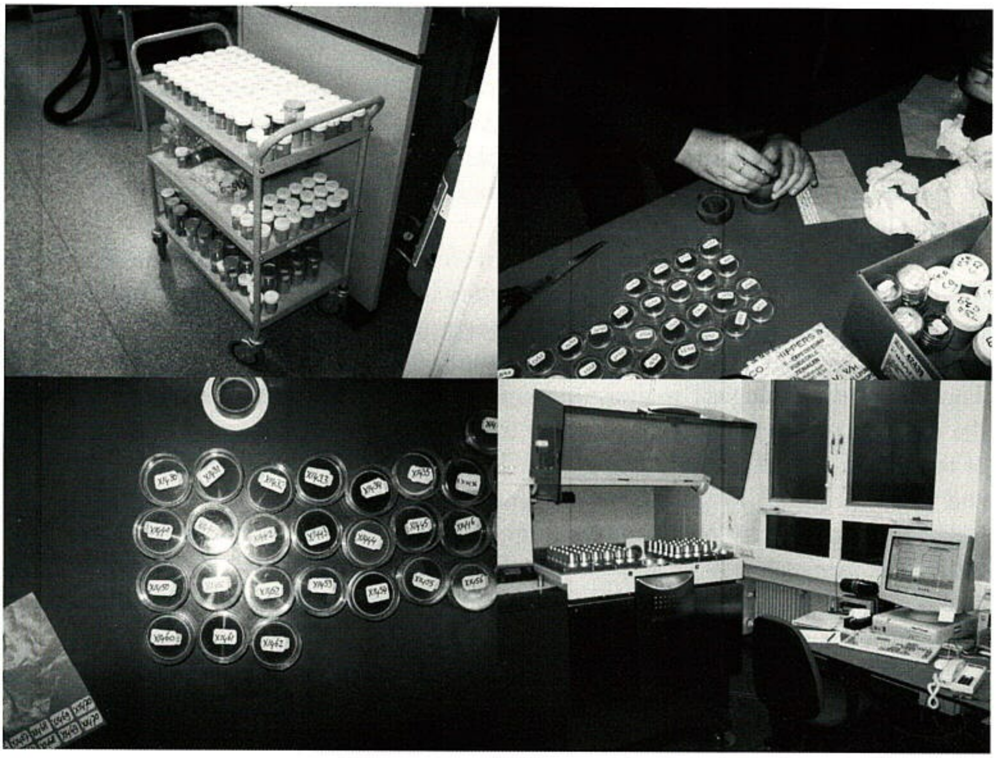

Figure 4. Preparation of pellets and a view of the X-Ray Fluorescence Spectrometer (Faculty of Earth and Life Sciences, VU Amsterdam).

potential clay sources on the island was part of the geological programme. Based on information provided by local people all possible clay sources were checked and those sources which seemed most suitable were selected for sampling. Three additional clay samples were collected during that same year from the neighbouring limestone islands of Anguilla and Long Island, Antigua. These samples were only included in this study for reasons of comparison because of their origin on non-volcanic islands. In addition, a random sample of 626 pre-Columbian potsherds (approximately 85 sherds per site) was selected from five Saban sites dating between A.D. 450 and 1400, comprising an equal distribution of sherds of various pottery categories, i.e., griddles, and decorated, red slipped as well as undecorated rim and body sherds next to bases.

The workability properties of the clays were tested, as was the suitability of the clay mixtures tested for coiling and moulding. The clays were experimentally fired to test the firing and post-firing behaviours of the mixtures and for comparison with the pre-Columbian potsherds. Fabric analysis was carried out in three successive stages, including macroscopic and microscopic observation, class definition and data processing. Thin-sections of the clays were compared with those from the potsherds, with the expectation that similarities in mineralogical composition would help to provide information about the source area(s) of the clays used for the manufacture of the pottery from the various Saban sites. The tests showed that some of the clays from Saba (provided from Rendez Vous) are suitable for making pottery whereas others provided from the top of the Mount Scenery, are less suitable or not suitable at all. These clays from St. Eustatius were all suitable for making pottery. Both the Anguilla and Long Island clays proved to be suitable for pottery manufacture as well.

Comparing the Saban clays with potsherds from the various pre-Columbian sites of this island provided insights into the similarities in mineralogical and textural composition. It also provided information on the potential source areas on the island and the workability and suitability of the various clays for pottery manufacture (Hofman 1993). The general technological analysis on manufacturing techniques showed that much of the traditional pottery consists of a rather friable material. This is caused by the presence of many non-plastic grains in the matrix. The finer material is composed mainly of silt and very fine non-clay components. In general, the actual clay content of the substances used for the pottery is low. Also, the original firing temperature of the fabric was relatively low: between 650°C and 800°C. These factors result in a fragile pottery that cracks easily, suggesting that the life span of the products made from this friable material was relatively short.

Another noteworthy point is the fact that despite the presence of many non-plastic grains that appear in the clay naturally, these mixtures seem to shrink a lot, especially during the first periods of drying from soft to leather-hard. This is illustrated by the high water content of the clay samples that were tested. These have equally high rates of linear shrinkage. Although there is good reason to believe that the pre-Columbian potters made a better selection of clay types, it is assumed that high shrinkage was a general problem with the types found on Saba. When high shrinkage and a lack of cohesive strength occur together, this indicates a high content of fine material in the mixture and low clay content. It is clear that the pre-Columbian potters also worked with such mixtures. Therefore, from a technological point of view, they had to make some concessions. To avoid the formation of cracks during drying, they had to dry their products slowly.

Also, their shaping techniques were highly tolerant. This is not only true for the coiling technique, but especially so for the moulding and flattening out of clay slabs. Such techniques can still be used when working with the poorest mixtures. When such techniques are used, the exact content of non-plastic grains does not make much of a difference. Thus, the problem faced by the pre-Columbian potters was to reduce the shrinkage of their clays and to dry their products slowly. If not, cracks formed during the drying process would destroy their ware even before firing. This theory would explain why, despite the natural presence of non-plastic grains in the clay, the potters still added temper to their mixtures.

It is remarkable that in these samples no vegetable fibres were present which could have served to strengthen the texture of the fabric. This would have been the best solution to improve the local clays. An addition of fibrous material to the clay reduces shrinkage and improves the cohesion of the mass. This is important during shaping and it prevents drying cracks (Skibo et al. 1989: 23).

In general terms, it can be concluded that, when compared with the clay samples from Saba and taking the geology of the island into consideration, all pre-Columbian pottery samples show mineral assemblages characteristic of Saba but also of the volcanic islands in the region in general (Goodwin 1979; Hoffman 1979; Bullen 1964; Bullen and Bullen 1972; Gauthier 1974; Mattioni 1982; Schroever *et al.* 1985; Petersen and Watters 1991; Donahue et al. 1990; van As and Jacobs 1992; Westermann and Kiel 1961).

Both pottery and clay samples show a very small variation in mineral content: of the non-opaque minerals, eight different types were identified, four of which only occur in small or negligible quantities, i.e., quartz, enstatite, hornblende and epidote. In the samples of pottery, feldspar (plagioclase) is by far the dominant mineral, followed by basaltic hornblende. The abundance of feldspar, often present in such overwhelming quantities that it obscures the presence of other minerals, is of special interest. The same applies to the basaltic hornblende. The other minerals, all silicates that are characteristic of volcanic regions, appear in varying quantities in both the pottery and the clay samples.

The difference in geographical position between the various sources on Saba is reflected by the mineral content of the samples. It is, nevertheless, important to realize that clay substances that derive from one and the same source may differ in composition and clay content, even though they have the same character. This is reflected by a shift in the workability properties among clays from the same source (Grimshaw 1971; Hofman 1993). It is conceivable that the clays used by the pre-Columbian potters were of a slightly better quality. These potters probably developed some experience in selecting their clays. On the other hand, their unstandardized way of working and their personal preference resulted in a spread of fabric between the kinds dictated by the shaping techniques. These techniques were rather tolerant on this point.

One of the potsherd matrixes in the Saban sample developed a light firing colour after refiring at 700°C under oxidizing conditions. This deviates from the clay samples from Saba. The fabric of the potsherds in question is very similar to that of one of the clay samples from Long Island, Antigua. But other evidence for exchange can be postulated as well. For instance, sherds containing shell temper are found in very low frequencies while clay sources that contain shells naturally are not found on Saba. This makes it likely that the shell-tempered fabrics found on Saba were imported. This theory is supported by the fact that clays that naturally contain shells or coral are found on neighbouring limestone islands such as Anguilla and Long Island, Antigua. Geochemical analysis is expected to provide clues on the exact provenance of these exotic clays. Similar to the clays from volcanic islands, those from the limestone islands in general may share some common characteristics. Geochemical signatures of the clays and potsherds are needed to refine the provenance data.

Geochemical analysis on clay and pottery samples

Five clay samples from Saba and two from St. Eustatius have been collected during a geological survey of the islands in 2005 by the second and third authors. In addition to samples collected at the previously sampled sites of Rendez-Vous and Mount Scenery on Saba, samples were taken from newly identified clay sources at Windwardside, The Bottom and Plum Piece. On St. Eustatius samples were taken at Gilboa Hill and from the pass to Tumble Down Dick Bay (Figure 5).

Figure 5. Clay sampling on Saba and St. Eustatius.

The clays have been analyzed using XRF spectrometry and were compared to potsherds from Saba and St. Eustatius from the sites of Spring Bay and Kelbey's Ridge (Saba) and Golden Rock (St. Eustatius). This sample consisted of in all of 20 potsherds from Spring Bay, 17 from Kelbey's Ridge and 21 from Golden Rock. Major elements and trace elements in both clays and potsherds were examined. The results of these tests are discussed below.

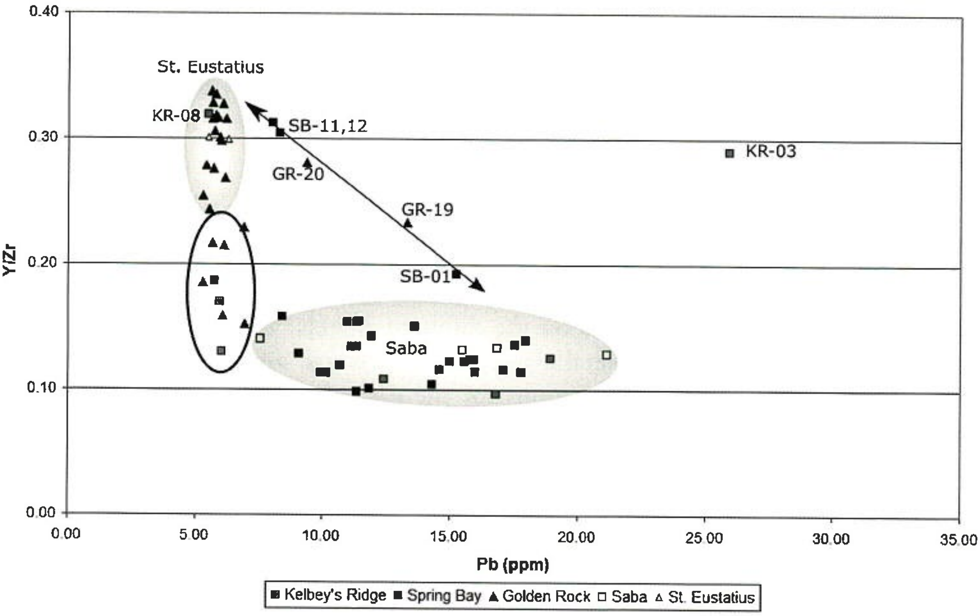

Figure 6. Diagram showing the results of the XRF measurements for Y/Zr and Pb of clay samples and potsherds from Saba and St. Eustatius.

The diagram (Figure 6) containing the ratios for Y/ZR and Pb provides the clearest cluster of samples. Furthermore, Y/Zr is a stable ratio of trace elements that are relatively unaffected by chemical weathering processes. This means that Y/Zr does not change significantly over time when a rock is transformed into clay and eventually into a ceramic. The diagram is helpful in interpreting the results of the XRF analysis[1]. The diagram shows two potsherds from Kelbey's Ridge that have Y/Zr and Pb concentrations, identical to the clays originating from St. Eustatius. The larger part of the sherds from Kelbey's Ridge contain element ratios that are identical to the clays collected on Saba from the different sources. The potsherds and clays from St. Eustatius show a clear cluster of element ratios pointing to the local origin of the majority of the Golden Rock pottery. Part of the Golden Rock and Kelbey's Ridge potsherds show close resemblances to each other and also to the ratios of two clays collected on Saba. Thus far no clear explanation has been found, but it cannot be excluded that an as yet not identified clay source, possibly related to the Quill volcano on St. Eustatius would provide a Y/Zr and Pb ratio that is identical to these sherds. This could also imply that two clays, one from Saba and one from St. Eustatius, were mixed.

Pb concentrations are more or less similar for both clay and potsherds from Saba. Pb concentrations for St. Eustatius, however, vary a lot. The reason for this is as yet unclear, although the difference could possibly be due to different weathering conditions.

In summary, the analyses discussed show that the potsherd sample from the Spring Bay site was predominantly made of local Saban clays, while two potsherds from the site of Kelbey's Ridge show clear signatures similar to those characterizing the clays from St. Eustatius. The Golden Rock potsherds in the sample were all made from local Statian clays.

Procurement, provenance and distribution of raw materials

The geological diversity of the islands in the Lesser Antilles is responsible for the variation in availability of clay sources on the different islands. The volcanic islands are very rich in clays whereas in general clay sources are scarce on the limestone islands. This must have had direct repercussions for the gathering of raw materials for the manufacture of pottery by the pre-Columbian potters. Thus far, it is evidenced that, when available, local clays were used for the manufacture of the majority of the pre-Columbian pottery. Import wares are therefore quite easy to discriminate on the basis of their mineralogical constituents. Their exact provenance, however, is more difficult to determine. Geochemical analysis of the clays from Saba and St. Eustatius and the potsherds from both islands has proved to be a very useful tool for identifying the provenance of clays used for the production of pottery at the different sites on the islands.

Workability tests on the local clay samples from Saba and petrographic and geochemical analyses of clays and potsherds have provided insight in the mode of procurement and selection of the clays and temper materials of the pre-Columbian potters. A broad variation of fabrics has been identified within the samples from Saba and St. Eustatius. One may conclude that besides availability of the clays on both islands, also careful selection in terms of the amount of size and particles at the clay source took place. The pre-Columbian potters must have been aware of the extant variations in quality. These had implications for the properties of the fabrics and their suitability to specific functions, but clearly the personal preference of the potter, determined by specific socio-cultural behaviour or personal choices, may have played a role. Although one may conclude that most of the pottery was probably made locally on each of the islands, there is some evidence that exchange of either raw materials or finished products took place.

Conceptualising clay procurement: an ethnographical account

Ethnoarchaeological research performed in the 90's by master students from the Faculty of Archaeology among traditional potters in the Tropical rainforest of Surinam and French Guiana might be illustrative for understanding the modes of clay procurement among traditional Amerindian society and the socio-cultural parameters, which are involved in the selection of clays and tempers and their modes of procurement (Bel et al. 1995; Jacobs and Bel 1995).

The Wayana potters of French Guiana gather the clays needed (*nenuwë* = kaolin clay and *pulune* = black clay), both located in the same clay bed, nearly 20 kilometers from their home village, requiring at least two hours by canoe up the Marony River. Clay gathering is combined with a hunting and fishing trip of several days with the whole family (Duin 2000/2001: 46).

Among the Kari'na of the Maroni River in Suriname, pottery clay is collected by the women from *Ura:ni*, a place along the riverbank of the Maroni River where a former village has disappeared in the river. This place is about 30 minutes upstream from the home village by motorboat (Vredenbregt 2002: 115, 2004).

Among the Palikur of Kamuyune in French Guiana, *caraipé* or *kwep* from the bark of *Licania* sp., is used to temper the clay. The clay (*hibug*), obtained from an alluvial clay deposit rich in kaolin but low in potassium carbonate and sodium carbonate, is in itself not suitable to the coiling technique but with the addition of the *kwep*-ashes to the clay, a substance is obtained that is suitable to employing this technique (Bel et al. 1995). The preference for burnt and pounded *kwep* used as a temper material is likely defined by ancestral tradition. Next to the fact that porosity increases in its burnt state, it also has the functional advantage of being highly absorptive (Jacobs and Bel 1995: 130). The knowledge about specific clay recipes among the Palikur was passed from mother to daughter, from generation to generation.

Among the Kari'na, *ori:no* is the generic term for pottery products in general, and also for clay, their raw material. Various types of clay are known, each with a different colour and texture, taken from several locations. Generally speaking, only the clay used for making vessels is called *ori:no*, while clays that are used as slips to decorate the pottery are referred to by their proper names, e.g., *ta:wa*, *ku:li* or *ka:muyu*. More specifically, the different sorts of *ori:no* are called after the localities where they are found, while the *ta:wa*, *ku:li* or *ka:muyu* are always referred to by these terms regardless of their source areas. A small bowl is made on the spot and is left there or sunk into the water for the *ori:no akï:rï*, the spirit connected with the clay who resides at that place. The clay-spirit is the manifestation of *Okoÿumo*, the water spirit but it carries a different name for each sort of clay. For instance, clay, *ori:no*, taken from the location called *Ura:ni* is called *Ura:ni*; its spirit, its *ori:no akï:rï*, is *Ura:ni akï:rï*, the spirit residing at *Ura:ni* (Vredenbregt 2002: 115, 2004). The clay is collected with the hands, formed into roughly shaped balls and in this form put into the boat to be taken to the village. Here these balls of clay are left to dry until they are needed. Before the clay can actually be used for pottery making, the clay has to be tempered, and this is done with *kuwepi*. The *ara:naba:ri* and *kuwepi* trees, from which the bark is taken, are considered to be inhabited by forest-spirits that need to be respected. Hence, menstruating women are not supposed to collect the bark since they are not supposed to enter the forest: their 'smell' would upset the spirits. When the bark is burned to form ash and charcoal it is ground in a wooden mortar. The coarseness of the grinding depends on the intended size of the vessel. For large vessels a coarse grinding is needed, while for smaller vessels a finer grinding is required (Vredenbregt 2002: 115-116; 2004).

Closing remarks

The combination of archaeological and archaeometric techniques as presented in this study has proved to be indispensable to address questions of provenance and distribution of raw materials in a geologically varied area such as the Lesser Antillean archipelago. In the coming years the refinement of the methods and the intensive collection of clays and pottery in the other islands of the archipelago should tremendously broaden our scope on the provenance and exchange networks of materials and goods among pre-Columbian island communities. In this respect, the elaboration of ethnoarchaeological research seems crucial in conceptualising the modes and the socio-cultural implications involved in the procurement of the raw materials used in the pottery manufacturing process.

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Note

1. The clay from Mount Scenery does not plot in the diagram. It shows unnatural concentrations of trace elements that may have been caused by human activity.

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GOLDEN GROVE:
A LATE-PREHISTORIC CERAMIC COMPLEX OF TOBAGO

Arie Boomert

Abstract

This article discusses the characteristics and cultural affiliations of the late-prehistoric Golden Grove complex, a ceramic tradition on the island of Tobago. It analyses the Golden Grove vessel repertoire and its assemblage of pottery, stone, bone and shell artifacts. In all eight archaeological sites have yielded Golden Grove ceramics, e.g., the type site, Golden Grove (Strata IV-V), (Late) Sandy Point and Lovers' Retreat (Section B). The Golden Grove complex appears to be closely related to the late-prehistoric Troumassan Troumassoid subseries of the Windward Islands and to represent the direct ancestor of Tobago's Plymouth complex, which shows significant ceramic similarities with the subsequent Suazan Troumassoid subseries. However, the Golden Grove complex also displays individual pottery traits shared by the ceramics of the contemporaneous Guayabitan Arauquinoid subseries of Trinidad. According to criteria of pottery style and calibrated radiocarbon dates, the Golden Grove complex can be placed between cal A.D. 850 and 1150.

Introduction

Tobago is a relatively small, tropical island which, situated on the northern margin of the South American continental shelf, forms one of the southernmost members of the Lesser Antillean archipelago. It is more or less elliptical in shape and consists of two major physiographic units, i.e., the Main Ridge, a central dorsal ridge of highland which forms the backbone of the island, and the Coral Lowlands, an elongated coral limestone platform which adjoins the foothills of the Main Ridge to the southwest (Figure 1). Tobago's flora and fauna reflect the entirely continental character of the island and, albeit slightly impoverished, closely resemble those of Trinidad. Originally most of Tobago was covered by tropical rainforest, predominantly lowland evergreen forest and deciduous seasonal forest. By now much forest has become severely affected by man due to clearing operations for monocropping, logging and slash-and-burn cultivation. The island's shoreline is heavily indented, showing an alternation of rocky cliffs and promontories, lagoonal swamps and marshes, next to bays with dunes and sandy beaches grown with littoral woodland. Mangrove tidal forests fringe large parts of the Coral Lowlands and the river estuaries of the island's windward coast. Live coral is growing directly offshore around

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most of Tobago, especially on its leeward side. The island's southern part is susceptible to severe droughts during the dry season while landslides, slumping, gullying and soil erosion are rampant in the wet season, notably in the Main Ridge area. Tobago is situated at the southern fringe of the Caribbean hurricane zone and revolving tropical storms of hurricane force seldom struck the island in the past centuries.

The first inhabitants of Tobago were Amerindians who arrived in the island from Trinidad and the mainland of South America as early as the Archaic Age. They subsisted on small-game hunting, fishing and gathering of wild vegetable foods, fruits and edible mollusks. Settlement traces of these Archaic Indians have been encountered only in the southwesternmost part of the island. In the first centuries of our era Tobago was invaded by probably Arawakan-speaking Amerindians who introduced pottery making to the island and added horticulture to the indigenous subsistence economy. The first Ceramic Age Indians of Tobago can be ascribed to the Cedrosan Saladoid subseries, a cultural tradition characterising the earliest horticulturalists in most of the West Indies. The Early Ceramic Age of Tobago is typified by a series of three partially subsequent Cedrosan Saladoid pottery assemblages, i.e., the Courland, Mount Irvine and Friendship complexes, the sites of which are to be found along the shores of the entire island (Boomert 1996: 15-16, 59, 2000: 169-202). Subsequent to the Saladoid epoch, the Late Ceramic Age saw the development of two successive ceramic assemblages in the island, i.e., the Golden Grove and Plymouth complexes, of which the latter appears to be affiliated with the Suazan Troumassoid subseries of the Windward Islands and Barbados (Boomert and Kameneff 2003). This article analyses the first of these two Late Ceramic earthenware assemblages, the Golden Grove complex, briefly discussing its pottery and other items of material culture, subsistence patterns and distribution in Tobago as well as its dating and affiliations with the contemporaneous Amerindian ceramic traditions throughout the region. The relationship of the Golden Grove complex with the Troumassan Troumassoid subseries of the Windward Islands and Barbados, next to that with Trinidad's Bontour complex, belonging to the Guayabitan Arauquinoid subseries of Trinidad and East Venezuela, are examined.

The sites

Pottery of the Golden Grove complex has been encountered at in all eight archaeological sites on Tobago, i.e., Diamond (TOB-27), Cove (TOB-73), Culloden Bay (TOB-67), Dutch Fort (TOB-32), Friendship (TOB-15), Golden Grove (TOB-13), Lovers' Retreat (TOB-69) and Sandy Point (TOB-1). All of these sites are situated in the Coral Lowlands and the adjoining littoral part of the Main Ridge (Figure 1). They include five settlement sites, characterised by one or more midden deposits, and three (littoral) ephemeral camp or bivouac sites, utilised by the prehistoric Amerindians during fishing, hunting or collecting expeditions. Two settlement sites yielded inhumation burials which can probably be dated to Golden Grove times. Except for the type site, Golden Grove, all sites are to be found close to the present coastline, i.e., at less than 250 m from the shore. Golden Grove forms an 'inland site' in Tobagonian sense, although its distance from the sea is only 1-1.1 km. Most sites are situated at a distance of less than 500 m from a source of potable water, generally a permanent freshwater stream or spring. The littoral sites are characterised by an original vegetation cover consisting of littoral woodland, grading into deciduous seasonal forest. In addition, the Golden Grove complex sites are generally close to mangrove woodlands as well as offshore reef complexes. Pedologically, they are typified by chromusterts (vertisols), tropudalfs (alfisols) and ustropepts next to eutropepts (inceptisols). Site elevation is generally less than 7.5 m; only Lovers' Retreat occupies a somewhat higher position, ca. 10 m above MSL. Slope differences are on the whole insignificant. Five sites, i.e., Culloden Bay, Friendship, Golden Grove, Lovers' Retreat and Sandy Point, are multicomponent deposits, also yielding ceramics of one or more of the other Ceramic complexes known from Tobago.

The type site, Golden Grove, is a multicomponent settlement site to be found in the centre of Tobago's Coral Lowlands. The site consists of a series of shell midden deposits close to the edge of a coral limestone plateau. A permanent freshwater stream passes in a small valley below the site. It debouches into an extended mangrove swamp fringing Bon Accord Lagoon on Tobago's leeward coast. Archaeological excavations were carried out at Golden Grove by subsequently Llanos, Harris, Boomert, Steadman and Stokes, and Steadman and Heckenberger in 1971, 1974, 1985, 2000 and 2005 respectively (Boomert 1996: 49-60, 2000: 172; Harris 1976; Steadman and Stokes 2002). The major refuse deposit at the site, which is clearly visible on the surface of the ground as a series of slight elevations, yielded a complex shell midden stratification consisting of horizontal layers composed of densely packed shell debris, archaeozoological remains, pottery and stone, bone and shell artifacts, rock fragments, charcoal, etc., intersected with layers of earth containing much less dense amounts of food remains and cultural materials. This deposit extends down to a depth of ca. 108 cm below the surface of the ground. Pottery of the Mount Irvine complex (Strata Ia-c), superimposed by ceramics of the Friendship complex (Strata Ic-III) typify the lower part of the midden. The upper portion of the deposit, down to a depth of 24/30 cm, consists of a 'shell' layer (Stratum IV) yielding Cedrosan Saladoid ceramics post-depositionally mixed with Golden Grove complex refuse, capped by an 'earth' layer (Stratum V) with pure Golden Grove debris. This stratigraphic situation suggests subsequent periods of intensive and much less intensive refuse deposition, perhaps corresponding to periods of dense and sparse habitation of the site's area.

Sandy Point and Lovers' Retreat represent somewhat less extensive multicomponent settlement sites of the Golden Grove complex. Sandy Point is a littoral site situated at the westernmost end of Tobago. It consists of a series of midden deposits occupying a sandy ridge stretching parallel to the shore. A depression holding rain water for some time and a small spring are to be found in the vicinity of the site. Archaeological excavations were carried out at Sandy Point by the author in 1983 and 1985, and by Kameneff in 1992-1993 (Boomert 1996: 94-98, 2000: 171; Kameneff 1993; Kameneff and Merlin 1994). Pottery of the Mount Irvine complex, associated with shells, crab claws, animal and fish bones as well as stone artifacts, was encountered from the surface of the ground to the bottom of the midden, at a depth of ca. 90 cm. The upper portion of the deposit, down to ca. 40 cm depth, yielded Mount Irvine ceramics mixed with Golden Grove complex pottery. Human burials, possibly associated with the latter complex, were encountered eroding from the shore in 1981, 1989 and 1992. Lovers' Retreat occupies a rocky headland on Tobago's leeward coast. A permanent stream flows to the southwest of the site which shows a distinct horizontal stratification and can be divided into three geographical portions, i.e., Sections A, B and C, representing midden deposits and inhumation burials associated with the Friendship, Golden Grove and Plymouth complexes, respectively. The site was investigated archaeologically by Cambridge in 1948, Bushnell in 1955, Gilchrist in 1961 and 1963-1964, Llanos in 1968, Harris in 1976, Boomert in 1981-1982 and 1985, Bernett in 1989, and Reid in 2004-2005. Section B, which is situated along the southwestern edge of the Lovers' Retreat plateau, was examined by Harris and the author. It yielded pottery, stone artifacts, charcoal, shells, next to animal and fish bone materials to a depth of ca. 40 cm below the surface of the ground (Boomert 1996: 68-77, 2000: 181-182; Harris 1980).

Dutch Fort and Cove are small settlement sites of the Golden Grove complex. Dutch Fort is a single-component site, to be found at the location of the seventeenth-century Dutch fortification *Sterreschans* in Lower Town Scarborough. It occupies a low hill some 100 m behind the shore of Rockly Bay on Tobago's windward coast. The site consists of a now destroyed midden deposit yielding shells and other food remains as well as pottery and stone artifacts. It was inspected by the author in 1986-1987 (Boomert 1996: 45-46). Cove is a shallow midden deposit, associated with an inhumation burial, on the shore of Canoe Bay in Tobago's Coral Lowlands. It yielded pottery of the Golden Grove complex next to a few shells as well as animal and fish bones. A surface search of the site was made by Boomert and Harris in 1989 (Boomert 1996: 41-42). In addition, small scatters of Golden Grove complex pottery have been found at four sites, i.e., Culloden Bay, Diamond and Friendship. All appear to represent littoral camp or bivouac sites. Friendship faces the Cove settlement site, being equally situated on the shore of Canoe Bay. This multicomponent site yielded predominantly Cedrosan Saladoid pottery and other cultural materials and represents the type site of the Friendship complex. It was examined archaeologically by the author in 1982 and 1985 (Boomert 1996: 46-49). Diamond is a pottery deposit situated near the mouth of the Diamond River on Little Rockly Bay in Southwest Tobago. A surface search of the site was made by the author in 1987 (Boomert 1996: 44-45). The Culloden Bay site, finally, represents a multicomponent deposit situated close to the mouth of a small stream which debouches into Culloden Bay on the west coast of the island. It yielded predominantly pottery of the Friendship complex, next to sparse pieces of the Mount Irvine, Golden Grove, Plymouth and Culloden complexes. The site was inspected by the author in 1987 and 2002 (Boomert 1996: 43-44).

The archaeozoological remains encountered at the Golden Grove, Lovers' Retreat and Dutch Fort sites suggest that the Amerindians of the Golden Grove complex subsisted on horticulture, notably the cultivation of bitter cassava, hunting, fishing and food collecting. Assuming the principle of least cost, at Golden Grove horticulture was practised in the deciduous seasonal forest close to the settlement, notably on the slopes of the stream valley east of the site. This relatively open environment would have been favourable to hunting as well. According to the animal bone materials found, especially mammals such as agoutis (*Dasyprocta aguti*), nine-banded armadillos (*Dasypus novemcinctus*), collared peccaries (*Tayassu tajacu*) and black-eared opossums (*Didelphus marsupialus*) were targeted, next to iguanas (Iguanidae). Red brocket (*Mazama americana*) may have been hunted in the denser woods of the evergreen seasonal forest to be found on the hilly terrain further away from the settlement (Steadman and Stokes 2002; Klift 1987). The mangrove woodlands to be found at a distance of a few kilometres from the site formed important collecting areas of blue crabs (*Cardisoma guanhumi*) and mollusks such as Thick lucinas (*Phacoides pectinatus*), West Indian crown conchs (*Melongena melongena*), and 'Coon oysters (*Ostrea frons*) (Boomert 2000: Tables 50-52, Figure 63). The sandy beaches of Bon Accord Lagoon were used for capturing sea turtles (Cheloniidae), while the shallow-water, sandy-bottom lagoonal environment itself yielded bivalves such as Cross-barred venus (*Chione cancellata*) clams and fish species including jacks (Carangidae), snooks (Centropomidae), porgies (Sparidae), drums and croakers (Sciaenidae), and needlefishes (Belonidae). Finally, the extensive coral reefs and their eel-grass beds offshore Southwest Tobago were exploited for fishing, notably of species such as snappers (Lutjanidae), parrotfishes (Scaridae), groupers and seabasses (Serranidae), grunts (Haemulidae), sharks (Squaliformes) and surgeonfishes (Acanthuridae), and the gathering of mollusks, especially Atlantic pearl oysters (*Pinctada radiata*) and Queen conchs (*Strombus gigas*), as well as sea urchins (probably *Tripneustes ventricosus*).

The pottery

The present discussion of the Golden Grove ceramics is primarily based on the quantitative analysis of the author's finds from the Golden Grove (1985) and Lovers' Retreat (1981-1982, 1985) sites. The terminology of ceramic description employed is based on those of Hofman (1993: 160-172) and Boomert (2000: 132, 511), which follow Shepard (1968: 224-248), Rye (1981: 89-90) and Rice (1987: 212-215). At Golden Grove the author dug a 3×2-m-measuring trench, divided into 1-m squares and controlled in 5-cm artificial levels. Excluding pottery artifacts, the upper portion of this trench, i.e., Strata IV-V (0-30 cm below the present surface), yielded in all 4741 potsherds (weight 63,020 g) which can be classified as to belong to the Golden Grove complex (Boomert 2000: Table 14). At Lovers' Retreat, Section B, the author excavated five 1-m squares of a 2×4-m-measuring trench, controlled in 10-cm artificial levels, which, excluding pottery artifacts, yielded in all 5866 potsherds (weight 77,760 g) of the Golden Grove complex (Boomert 1996: Table 6).[1] All finds are kept in the collection of the University of the West Indies, St. Augustine, Trinidad.

Manufacture and fabric classification

Preliminary analysis of the Golden Grove complex pottery suggests that coiling formed the primary manufacturing technique while firing apparently took place in an open fire. The clay used by the Amerindian potters appears to contain varying quantities of local Tobagonian waterworn sand, containing very fine to coarse-sized particles of predominantly translucent quartz, occasionally mixed with minor amounts of plagioclase feldspar and dark minerals, including augite and hornblende, as well as translucent green minerals, notably epidote (Cassandra T. Rogers pers. comm.). Whether these non-plastics were deliberately added to the potter's clay or formed natural impurities of this clay has not been determined yet.[2] According to surface treatment, fabric, colour, texture and thickness, the Golden Grove complex ceramics can be divided into five major categories, i.e., Fine Ware, Medium Ware, Coarse Ware, Coarse Scraped Ware, and Coarse Scratched Ware.[3] In addition, a small Unclassified category of pottery showing clearly different fabrics can be distinguished, most likely representing non-local ('trade') ceramics (Table 1). The Fine Ware and Medium Ware categories can be considered to form the high-quality ceramics of the Golden Grove complex, primarily serving purposes of ceremonial or at least non-domestic nature, while the Coarse Ware, the Coarse Scraped Ware and the Coarse Scratched Ware were apparently used exclusively in purely household contexts. The high-quality pottery encountered at Golden Grove (Strata IV-V) and Lovers' Retreat (Section B)[4] comprises in terms of potsherd numbers/weight 40.5/43.7% and 50.8/46.5%, respectively, while the low-quality ceramics amount to 59.2/56.1% and 49.1/53.4%. The numbers of Unclassified potsherds are negligible. Some potsherds show perforations applied post-firing, apparently representing old repair holes.

Fine Ware. This ware contains well-sorted, very fine to medium quartz sand and shows a well-kneaded, compact, relatively fine-grained texture without air pockets and burnished, generally even surfaces, yellowish orange to reddish grey in colour. Mean wall thickness is 6.5 mm; surface hardness is 2.5. Firing conditions varied: oxidising is incomplete to complete.

Medium Ware. This ware contains well-sorted, fine to medium quartz sand and shows a well-kneaded, relatively compact and fine-grained texture without air pockets and burnished to smoothed, even to somewhat uneven surfaces, yellowish orange to light brown in colour. Vessel exteriors are generally better finished than interiors. Mean wall thickness is 6.5 mm; surface hardness is 2.5. Firing conditions varied: oxidising is incomplete to complete.

Coarse Ware. This ware contains relatively well-sorted, fine to medium quartz sand and shows a poorly kneaded, occasionally friable, coarse-grained texture with many air pockets and badly smoothed, very uneven and sometimes bumpy surfaces with interiorly unobliterated coils, yellowish grey to dark grey in colour (Figure 8). Mean wall thickness is 7.5 mm; surface hardness is 2.0. Firing was uncontrolled: oxidising is incomplete.

Coarse Scraped Ware. This ware contains fine to coarse quartz sand and shows a poorly kneaded, occasionally friable, coarse-grained texture with many air pockets and badly smoothed, very uneven and sometimes bumpy surfaces with marks produced due to smoothing without obliterating coil boundaries, and thin, light scratches either occasioned by sticking-out temper grains or by smoothing with a small bundle of grass. These 'scraping' marks are typically unidirectional, apparently covering only small, widely dispersed parts of the vessel surface. Mean wall thickness is 7.5 mm; surface hardness is 2.0. Firing was uncontrolled: oxidising is incomplete.

Coarse Scratched Ware. This ware contains fine to coarse quartz sand and shows a poorly kneaded, occasionally friable, coarse-grained texture with many air pockets and very uneven and sometimes bumpy surfaces with marks produced due to smoothing without obliterating coil boundaries and deep, wide scratches occasioned primarily by smoothing with a bundle of grass or small sticks. These 'scratch' marks are closely spaced and groups of them tend to be multidirectional, apparently covering large parts of the vessel surface. Mean wall thickness is 7.5 mm; surface hardness is 2.0. Firing was uncontrolled: oxidising is incomplete.

Vessel shape classes

Six major vessel shapes can be distinguished (Table 2). Vessels are small to large-sized, i.e., showing orifice diameters up to 40.0 cm if circular in horizontal cross section.

Form 1. Dish or bowl with unrestricted orifice, showing simple contours (Figures 2:1, 4, 5, 6). This vessel shape may be circular or oval in horizontal cross section. In terms of potsherd numbers, this represents one of the two most popular vessel forms. It is predominantly made of high-quality ceramics.[5]

Form 2. Bowl or jar with unrestricted orifice, showing simple contours. This vessel shape is circular in horizontal cross section and has almost vertical walls near its orifice; it is occasionally provided with handles (Figure 2:2). This is the second most popular vessel form. No preference for either high- or low-quality ceramics can be shown.

Form 3. Bowl or jar with restricted orifice, showing simple contours. This vessel shape, which is circular in horizontal cross section, is occasionally provided with handles (Figure 2:3). No preference for either high- or low-quality ceramics can be shown.

Form 4. Bowl or jar with independent restricted orifice, showing inflected contours. This vessel shape, which is circular in horizontal cross section, is occasionally provided with handles (Figure 2:4). It is predominantly made of low-quality ceramics.

Form 5. Bowl or jar with unrestricted orifice, showing composite contours. This characteristic vessel shape, which is circular in horizontal cross section, has a concave profile above its corner point (Figures 3:1, 7). It is exclusively made of high-quality ceramics.

Form 6. Bowl with unrestricted orifice, showing simple contours, provided with a heavy, longitudinally perforated trapezoidal extension. This vessel shape, which is circular in horizontal cross section, most likely represents a so-called 'nostril bowl' or 'sniffing bowl', used for either inhaling hallucinogenic drugs or, more likely, the pouring of tobacco or pepper juice into the nose during shamanic healing ceremonies (Figure 8:1). Only one specimen is known; it is made of high-quality ceramics.

Base forms

Five base forms, all circular in horizontal cross section, can be distinguished (Table 3).

Base A. Flat, showing an unmodified basal angle (Figure 3:6). This form is rare; no preference for either high- or low-quality ceramics can be shown.

Base B. Flat, showing a pedestalled basal angle (Figure 3:7). This form is represented by only one specimen.

Base C. Concave, showing an unmodified basal angle (Figure 3:8). This form is rare; no preference for either high- or low-quality ceramics can be shown.

Base D. Annular ('ring-shaped'), showing an unmodified basal angle (Figures 3:9, 4, 5, 6). This represents by far the most popular base form; no preference for either high- or low-quality ceramics can be shown. It is associated with at least vessels of Forms 1 and 4.

Base E. Rounded, provided with at least three short feet which are oval to round in horizontal cross section (Figure 3:10). Only two specimens are known of which one represents a non-local ('trade') sherd.

Rim types

Four rim types can be distinguished (Table 4).

Type 1. Direct, showing a rounded lip (Figures 3:2, 7). This is one of the two most popular rim types. It is associated with vessels of Forms 1-5.

Type 2. Direct or occasionally somewhat swollen, typically showing a flattened lip (Figures 3:3, 4, 5, 6). This is the other popular rim type. It is associated with vessels of Forms 1-5.

Type 3. Interiorly thickened and bevelled, showing a rounded lip (Figure 3:4). This is a less common type, at least associated with vessels of Forms 1, 4 and 6.

Type 4. Exteriorly thickened, showing a rounded lip (Figure 3:5). Only one specimen of this type is known; it is associated with a vessel of Form 2.

Decorative techniques and motifs

According to potsherd numbers, in all 4.6% (GG) and 3.6% (LR) of the Golden Grove complex ceramics show some form of ornamentation. The decorated pottery predominantly comprises high-quality ceramics: not less than 95.9% (GG) and 86.4% (LR) of the decorated potsherds belong to the Fine Ware and Medium Ware categories (Table 5). The various vessel shapes show significant differences as to their being decorated or not. While in terms of potsherds by far most vessels of Forms 2, 3 and 4 and a majority of Form 1 are undecorated, most vessels of Form 5 typically show some kind of ornamentation. In addition, the single specimen of Form 6 is decorated (Table 6). Five techniques of decoration can be distinguished, i.e., painting and slipping, incising and gouging, punctating, simple modelling and complex modelling (Table 7).

Painting and slipping. Red painting and white slipping are extremely rare techniques of ornamentation, occurring on 1.6% of the decorated potsherds at GG and LR. The red pigment was most likely derived from red ochre (hematite) while kaolin clay apparently formed the source of the creamish white colouring matter. Motifs include: (1) overall red-painted or white-slipped surfaces; and (2) widely incised lines filled with orangy red pigment.

Incising and gouging. This is the most popular technique of ornamentation, occurring on 79.1% of the decorated potsherds. The linear design elements are invariably wide and U-shaped in cross section, measuring predominantly 1.0-2.5 mm across, although examples showing widths of up to 5.0 mm occur as well. Clearly, the narrowest lines were applied with a broad stylus with rounded end, but for the widest ones a small gouge made of a bird bone or hollow reed may have been used (see Rice 1987:146). Three motifs can be distinguished: (1) single or multiple, straight horizontal lines below the rims on the inside or outside of vessels of Forms 1, 2, 3 and 5, and on the corner point of vessels of Form 5 as well as on appendages attached to vessel rims (Figures 5, 8:2,5, 9:3); (2) single or multiple, curving or wavy lines, arcs, spirals and circles on the inside or outside of vessels of Forms 1 and 2, the outer walls above the corner point of vessels of Form 5, and rarely on the squarish lips of rims of Type 2 and the interior bevels of rims of Type 3 belonging to Form 1 vessels (Figures 4, 5, 6, 7, 8:1,3,4,6,8,9,10, 9:1,2,3,4,10, 10:2); and (3) friezes consisting of combinations of one or two parallel, horizontal or arc-shaped, relatively long lines alternating with one or two parallel, vertically placed, short lines, applied to the squarish lips of rims of Type 2 and the interior bevels of rims of Type 3 belonging to vessels of Forms 1 and 2 (Figures 4, 8:2,7,8, 9:6, 10:6). On average, motifs (1), (2) and (3) include 28.4%, 70.8% and 14.1% of the potsherds decorated with incised or gouged designs at GG and LR.

Punctating. This is a rare technique, occurring on 2.1% of the decorated potsherds. Designs consist of shallow, round or ovalish punctations, applied with a broad stylus with rounded end. All occur in combination with incised or gouged designs of motif (2) on vessels of Forms 1 and 5 (Figures 8:5, 9:2,7,8,10).

Simple modelling. This is the second most popular ornamentation technique; it is encountered on 24.4% of the decorated potsherds at GG and LR. It includes a series of modelled decorative elements which often occur in conjunction with incised or gouged designs. Four motifs can be distinguished: (1) simple triangular, trapezoidal or 'horned' lugs, occasionally showing undulating sides, a few parallel incised lines and/or round depressions, attached to the rims of vessels of Forms 1 and 2 (Figures 4, 8:1,4,7,9,10, 9:1,2,4,5,7,8,9, 10:5); (2) ovalish or wedge-shaped appendages, often showing a flat upper side, placed on top of the rims of vessels of Forms 1 and 2 (Figure 8:4); (3) round, oval or crescent-shaped knobs placed on the rims, walls or handles of vessels of Forms 1, 2 and 4 (Figures 9:1,4, 10:7); and (4) rim depressions, only occurring on vessels of Form 1 (Figure 6). On average, motifs (1), (2), (3), and (4) include 68.0%, 11.6%, 17.5%, and 2.9% of the potsherds decorated with simple modelled designs at GG and LR.

Complex modelling. This is a rare technique of ornamentation, occurring on 2.8% of the decorated potsherds. It encompasses a diverse number of designs, often showing complex modelling associated with incised or gouged as well as punctated decorative elements. Two motifs can be distinguished: (1) anthropozoomorphic head lugs, attached to the rims of vessels of Forms 1 and 2 (Figure 10:1,2,3); and (2) geometric head lugs of variable execution, similarly attached to the rims of vessels of Forms 1 and 2. Open, triangular lugs of low-quality ceramics, consisting of three joined, small clay 'pillars', belong to this category (Figure 10:4).

Non-local ceramics

Small quantities of Unclassified pottery belonging to apparently non-local wares have been encountered at the GG and LR sites, i.e., ceramics showing fabrics without quartz sand as the major constituent, but instead containing anti-plastics such as pounded shell, crushed potsherds (grog) and freshwater sponge spicules (*cauixí*).

Shell-tempered Ware. This ware contains insufficiently sorted, medium to very coarse, angular, thus deliberately crushed, pieces of shell, some of which have been leached out, which comprise about half of the paste, next to some very fine to fine particles of waterworn quartz sand and feldspar, most likely representing impurities of the potter's clay. The fabric has a relatively well-kneaded, reasonably compact and coarse-grained texture with few small air pockets. Surfaces are unevenly smoothed and yellowish orange in colour, showing many protruding temper particles. Mean wall thickness is 6.5 mm; surface hardness is 2.5. Firing conditions were controlled: oxidising is complete. GG yielded one potsherd of this ware; none is known from LR, but some pieces have been found in Golden Grove complex context at the (Late) Sandy Point and Friendship sites.

Grog-tempered Ware. This ware contains well-sorted, very fine to medium, angular potsherd particles, yellowish grey in colour, and shows a well-kneaded, compact and fine-grained texture without air pockets and smoothed, even surfaces, yellowish to light brown in colour. Vessel exteriors are generally better finished than interiors. Mean wall thickness is 7.0 mm; surface hardness is 2.5. Firing was uncontrolled: oxidising is incomplete. In all two and four potsherds of this ware have been found at GG and LR, respectively.

Cauixí-*tempered Ware.* This ware contains numerous very fine, transparent freshwater sponge spicules (length about 0.5 mm), the majority of which appear to be intact, showing bipointed outlines. Most of the sponge spicules, which comprise about half of the paste, are aligned along the length axis of the original clay coils. In addition, the fabric contains some very fine waterworn quartz sand and a few fine hematite particles, both most likely impurities of the potters' clay. The fabric has a well-kneaded, compact and fine grained texture with few small air pockets. Surfaces are evenly smoothed and greyish yellow to grey in colour; they have a typically unpleasant, sandpapery feel. Mean wall thickness is 8.0 mm; surface hardness is 2.5-3.0. Firing conditions varied: oxidising is incomplete to complete. In all ten potsherds of this ware have been found at GG and one specimen at LR. Besides, *cauixí*-tempered potsherds are known from the (Late) Sandy Point and Friendship sites.[6]

Ceramic artifacts

Three types of pottery artifacts have been encountered at GG and LR, i.e., (cassava?) griddles, spindle whorls and vessel supports ('pot rests') (Table 8).

Griddles. These represent the most common category of pottery artifacts. Both platters provided with flat, unmodified rims and those showing thickened and triangular or upturned rims are present, suggesting that, if indeed used for manioc processing, discs of cassava bread as well as pellets were produced (see Boomert 2000: 326). Griddles are typically made of low-quality ceramics, including Coarse Ware, Coarse Scraped Ware and Coarse Scratched Ware, while GG yielded potsherds of a *cauixí*-tempered specimen, obviously a 'trade' piece. In addition, a shell-tempered griddle fragment was encountered at the (Late) Sandy Point site. Griddle diameter is about 40 cm; thickness varies between 12 and 15 mm. Bottom sides are generally uneven and somewhat crinkled (Figure 3:12).

Spindle whorls. These include simple, centrally perforated disks, occasionally showing a circular thickening around the hole, made of predominantly high-quality ceramics. Diameters vary between 5.2 and 9.5 cm. One specimen is decorated with incised curvilinear motifs (Figure 3:11).

Vessel supports. These utilitarian pot rests are typically ring-shaped and made of low-quality ceramics, including Coarse Ware and Coarse Scratched Ware. Besides, a *cauixí*-tempered piece showing crude incised decorative motifs was found by Peter O'B. Harris at GG.

Stone, bone and shell artifacts

As this article is primarily concerned with the ceramics of the Golden Grove complex, its non-pottery artifacts will be discussed only summarily.

Stone artifacts. The stone implements encountered include predominantly polished stone axe heads, showing pointed, rounded or rectangular butts. All appear to have been made of local Tobagonian rock types, e.g., greenstone, greenschist, andesite, and dolerite (Cassandra T. Rogers pers. comm.; Boomert and Rogers in press). Such axe heads have been found associated with Golden Grove complex ceramics at GG and LR as well as at the (Late) Sandy Point and Dutch Fort (Derick Lal pers. comm.) sites. In addition, a pitted anvil, apparently used for the cracking of palm nuts, and a small stone pestle have been found at LR, while a similar pestle, an adze fragment, polishing stones for pottery, and hammerstones are known from GG. All other stone artifacts are non-utilitarian, including beads, pendants and 'miniature axes'. Especially GG has yielded many blanks next to finished specimens of cylindrical as well as button- and barrel-shaped beads, made of local Tobagonian diorite. Only a few blanks of diorite beads are known from LR, while a cylindrical greenschist pendant and a flattish greenstone one were found at GG, the latter by Peter O'B. Harris (pers. comm.). Finally, rectangular stone 'miniature axes', predominantly made of greenstone and greenschist, have been recovered from GG and LR. They may represent blanks of pendants or have served other non-utilitarian purposes.

Bone artefacts. GG yielded various items of worked animal bone, all intended as bodily ornaments except for a carefully made bone spearhead. The bone accoutrements encompass several cylindrical or button-shaped beads, including one showing incised linear designs among which a line ending in a dot. Finally, a peccary tusk drilled at its distal end represents a clearly male-associated pendant, signalling prowess and success in hunting.

Shell artefacts. These comprise various button- and barrel-shaped beads, a squarish pendant, an earplug, a 'miniature axe', and two pieces of worked shell which may have been intended or used as arrowheads. All were found at GG.

Dating

In all four radiocarbon dates are available for the Golden Grove complex. Scattered charcoal from levels 2 and 3 (10-30 cm depth) of pits G, M, Q and R at Lovers' Retreat (Section B), collected by the author in 1982, yielded a radiocarbon age of 760 ± 105 B.P. (Beta-4905). According to the laboratory, this sample was 'exceedingly small' and low in carbon content. Its result points to a slightly too young date of cal A.D. 1170-1310, 1350-1380 for the Golden Grove complex habitation at the Lovers' Retreat site (Boomert 1996: 74). Three radiocarbon dates are available for Golden Grove (Strata IV-V). Marine shells from levels 4 (15-20 cm depth) and 5 (20-25 cm depth), i.e. 'shell' layer Stratum IV, of pit B7, collected by the author in 1985, yielded radiocarbon ages, uncorrected for marine reservoir effect, of 955 ± 35 B.P. (GrN-14,960) and 860 ± 35 B.P. (GrN-14,959). These dates, too, appear to be slightly too young (Boomert 1996: 57). Finally, an AMS radiocarbon age of 1000 ± 40 B.P. (Beta-153,149) was obtained from purified bone collagen of an agouti pelvis collected by Steadman and Stokes in 2000 from level 2 (6/9-11/16 cm depth), i.e., 'shell' layer IIA (corresponding to our Stratum IV), of their Golden Grove excavation unit 1, pointing to an acceptable calibrated date of cal A.D. 980-1060, 1080-1150 for the Golden Grove complex habitation at the type site.

Cultural affiliations

The ceramics of Tobago's Golden Grove complex appear to be closely related to the pottery of the Troumassan Troumassoid subseries which characterizes the period immediately postdating the Saladoid series in the southern Lesser Antilles, i.e., from approximately A.D. 850 to 1150 (Allaire, 1973: 31-32, 1978, 1997, 1999, 2003).[7] The Troumassan complexes closest to Golden Grove include Caliviny of Grenada (Bullen 1964: 3, 25-28; Bullen and Bullen 1968a), Grand Bay of the Grenadines (Bullen and Bullen 1972: 12-13; Sutty 1976, 1983, 1990), Indian Bay of St. Vincent (Bullen and Bullen 1972: 71-73), Troumassée B and Massacré of St. Lucia (McKusick 1960: 84-88, 110-113, 126,135; Harris 2001a), next to Paquemar of Martinique (Allaire 1977: 236-238). The resemblances with Greenland, i.e., the Troumassan complex of Barbados, are less outspoken (Hill G. Harris 1991, 2000), suggesting that the latter island was culturally as distinctive from the Windwards as from Tobago.[8] Accordingly, three major (groups of) Troumassan complexes, showing distinctive local characteristics, can be distinguished, i.e., those of the Windward Islands, Barbados and Tobago. This cultural situation duplicates that during the subsequent Suazan Troumassoid epoch as Tobago's Plymouth complex, dating to this period, shows similarities as well as differences with the Suazan assemblages of the Windwards and Barbados (Boomert and Kameneff 2003). All of this illustrates the geographically marginal position of Tobago in the southern Lesser Antilles. Whereas evidence of interaction between the inhabitants of Trinidad and Tobago in late-prehistoric times can be shown easily, the ceramic data available at present suggest that nevertheless throughout the Troumassoid epoch the Amerindian communities of Tobago were culturally closer to the Lesser Antilles than to Trinidad, which after A.D. 700/850 was dominated by the Guayabitan subseries of the Arauquinoid series. Of course, this contrasts strongly with the situation in Saladoid/Barrancoid times (Boomert 1996: 24).

The post-Cedrosan era is generally seen as a period of insularity and regionalisation during which a major cultural division between the Leeward and Windward Islands developed and a lesser distinction within the latter between its northern and southern members (Allaire 1999, 2003). The overall ceramic development in the eastern Caribbean shows local as well as regional aspects, indicating that a differential rather than uniform parallel evolution out of the Saladoid cultural heritage took place. In the Windward Islands the transition from Late Cedrosan to Troumassan is characterised by a still insufficiently known short episode during which the typically Saladoid pottery repertoire was rapidly replaced by less elaborately ornamented ceramics, and, moreover, a clear dichotomy between a high-quality, decorated ceremonial ware and a low-quality, predominantly plain domestic ware began to crystallise. The latter development has long been misunderstood as these functionally distinct pottery categories were first interpreted simply as two chronologically subsequent ceramic complexes, which indeed at one time were considered to represent the manifestations of the supposedly most recent ethnically identifiable Amerindian populations of the Windward Islands. According to this scheme, the fine ware or Caliviny 'series' would predate the coarse ware or Suazey 'series' of which the latter was identified as the Island Carib pottery of late-prehistoric and protohistoric times (e.g., Bullen and Bullen 1976).[9] Neither of these hypotheses has stood the test of time although it is true that throughout the Troumassoid era an ongoing regression in ceramic standards appears to have taken place in especially the Windwards and Barbados, resulting in a lessening of the quality of the fine ware component in the Suazan pottery repertoire. However, this tendency was definitely not duplicated in

Tobago. Although the revised interpretation of the post-Cedrosan ceramic sequence in the Lesser Antilles sketched above became apparent as the result of archaeological investigations by Allaire (1977) in Martinique during the 1970s, it lasted until the last decade of the previous century that his conclusions were widely accepted (see Boomert 1987).

Tobago's Golden Grove complex clearly fits in this reconstruction of the first stage of post-Cedrosan ceramic evolution in the Lesser Antilles. High-quality (burnished) oval ('boat-shaped') and hemispherical bowls or dishes, provided with annular bases and primarily decorated with simple modeled triangular or trapezoidal, occasionally 'horned', lugs and wedge-shaped appendages or dimpled rims, closely resembling those which dominate the Golden Grove high-quality ware, are well known from the Troumassan communities of the southern Lesser Antilles. However, in the Windward Islands and Barbados these vessels are typically painted red all-over or show interiors with so-called Caliviny Polychrome designs consisting of fine, red or black curvilinear and rectilinear painted motifs, mainly scrolls, spirals and rectangles, on a buff or cream background (Bullen 1964: 49-50; Hill G. Harris 1991, 2000). Similar designs were applied to the upper exteriors of biconical bowls (*cazuelas*), i.e., a vessel shape which in Tobago does not appear until Suazan times. Besides, Caliviny Polychrome painting is unknown from the island, except for a few non-local pieces dating to the Plymouth period (Boomert and Kameneff 2003), while the possibility cannot be excluded that the few red- and white-painted potsherds encountered in the Golden Grove complex equally represent non-local specimens. Throughout Troumassoid times in Tobago the typically Caliviny Polychrome designs are replaced by elaborately incised or gouged rectilinear and curvilinear motifs. Interestingly, friezes consisting of incised or gouged horizontal or arc-shaped long lines alternating with vertically placed short lines (Motif 3), applied to the squarish, slightly swollen, rims of Type 2 and the interior bevels of Type 3 rims belonging to high-quality round or oval vessels of Forms 1 and 2, are shared by all islands of the Troumassan interaction sphere (e.g., Bullen 1964: 49; Bullen and Bullen 1968a, 1972: 143; Bullen et al. 1973; Friesinger and Devaux 1983).[10] Composite shapes such as Golden Grove Form 5 are generally widespread, but appear to be less frequent (e.g., Allaire 1981; Petitjean Roget 1975: 70; Sutty 1976).[11] The same applies to nostril (sniffing) bowls (Bullen 1964: 6; Bullen and Bullen 1968a, 1972: 29, 1976).

The low-quality ware of the Golden Grove complex with its coarse, unmodified, scraped or scratched vessel surface treatment closely resembles the coarse component in the contemporaneous pottery assemblages of the Windward Islands and Barbados. Cauldrons showing scraped and scratched vessel surfaces such as found in Tobago represent conspicuous vessel shapes in the Troumassan repertoire of the southern Lesser Antilles. In contrast, scratching is slightly less common in Barbados. In Tobago vessels showing scraped surfaces date back to Late Cedrosan times, contemporaneous with the onset of the Troumassoid series in the Windward Islands. However, deep, wide scratching covering entire vessel surfaces typically marks the beginning of the Golden Grove complex in the island (Boomert 2000: 183-184). Bowls provided with three, occasionally 'shouldered', feet and footed griddles are diagnostic of the Troumassan subseries in both the Windwards and Barbados. Tripod ring supports are probably restricted to St. Lucia and St. Vincent (Bullen and Bullen 1968b; Harris 2001). Footed bowls and griddles are unknown from Tobago's Golden Grove complex and rare in Grenada. A few specimens of such footed griddles appear in the Plymouth complex of Suazan times (Boomert and Kameneff 2003; Hill G. Harris 1988). The (rare) occurrence of simple, triangular, trapezoidal or 'horned' lugs on the low-quality pottery, similar to those found on the fine ware component of the Golden Grove complex, is repeated in the Windward Islands (Bullen 1964: 50-52). Besides, exact duplicates of the complex modelled open, more or less triangular lugs consisting of three joined, small clay 'pillars', decorating some of the low-quality vessels in the Golden Grove complex, have been encountered in the Windwards, e.g., in St. Vincent (Bullen and Bullen 1972, Pl. XXI:h). Clearly, during Troumassoid times Tobago formed part of the cultural sphere encompassing the southern islands of the Lesser Antilles.

The non-local pottery encountered in association with the Golden Grove ceramics suggests that exchange relationships were kept up between Tobago and the contemporaneous Amerindian communities of Trinidad as well. At the time the latter island was dominated by the ceramics of the Bontour complex, a member of the Guayabitan subseries of the Arauquinoid series. Apart from Trinidad, Guayabitan pottery is known from the Lower Orinoco Valley and the East Venezuelan coast (Boomert 1985). The large majority of Bontour pottery is tempered with finely crushed pieces of shell, suggesting that Trinidad may be the place of origin of the specimens of the shell-tempered ware found in the Golden Grove complex deposits at Golden Grove and Sandy Point. It is noteworthy that shell-tempered Bontour pottery has been encountered on the Testigos Islands and as 'trade' ceramics in Troumassan context at Grand Bay on Carriacou in the Grenadines (Sutty 1990). The potsherds showing *cauixí* tempering found associated with the Golden Grove ceramics on Tobago may equally derive from Trinidad. In all 4.3% of the Bontour pottery on the latter island shows a fabric containing sponge spicules. The low proportion of *cauixí*-tempered pottery indicates that the latter formed a 'trade' ware in Trinidad as well, most likely originating in the Lower Orinoco Valley or Delta. This is suggested also by the fact that many of the *cauixí*-tempered specimens found in Trinidad and Tobago actually derive from griddles, perhaps pointing to the trade of especially these household items. In the Windward Islands pottery tempered with sponge spicules is reported only from Grand Bay, Carriacou. These pieces may equally have arrived in the Grenadines from Trinidad which also applies to specimens found at this same site showing a fabric containing quartz and micaschist, i.e., sand typical of the rivers of Trinidad's Northern Range (Sutty 1990).

The rectangular or 'horned' lugs attached to the rims of the Forms 1 and 2 oval or round bowls or dishes, discussed above, most likely represent bat heads and tails, suggesting that these vessels, notably the oval ones, are actually bat effigies. The incised lines at the margins of many of these lugs and, interrupted by short gashes, on top of the often flattened rims adjacent to these lugs are easily identifiable as the folded-up wings of the animal. The symbolism of these bat-shaped lugs is discussed by Boomert and Kameneff

(2003) with reference to the specimens found in the context of the Plymouth complex, which apparently developed out of the Golden Grove pottery assemblage. The iconography of these lugs is strikingly parallel to that of many Chicoid (Taíno) vessels from Hispaniola and Puerto Rico provided with bat-shaped handles typically showing centrally placed perforations (e.g., García Arévalo 1997). According to Pané (1999: 18-19), the Taíno believed that bats embodied the shades of the deceased who came out at night to feast on guava fruits. For them, bats and owls formed nocturnal images of death. The Island Caribs held similar beliefs (Boomert 2000: 448). Moreover, the Taíno were convinced that spirits in general lacked navels and that as such the souls of the dead can be easily distinguished from the living. It was pointed out by García Arevalo that the circular perforations in the bat-shaped Chicoid vessel handles allude to the presumed lacking of navels by the shades of the deceased, embodied as bats (Arrom and García Arévalo 1988). Clearly, this can be taken to be the meaning of the centrally placed depressions, incised circles, perforations or elongated punctations on the lugs of the Golden Grove and Plymouth bat effigy bowls as well. Although the symbolism of these Troumassoid bat-shaped lugs can thus be explained by using Pané's account on the Taíno beliefs, the actual inspiration for these vessels may have originated in Trinidad or the Orinoco Valley as their closest parallels are to be found in the Bontour complex. This applies to other individual aspects of the Golden Grove complex as well, e.g., the composite vessels of Form 5 (Boomert 1985). However, as a whole Bontour and Golden Grove, and by extension Guayabitan and Troumassan, are quite different.

Conclusions

Analysis of the ceramics of Tobago's Golden Grove complex and their affiliations shows that during the post-Saladoid epoch a series of wide-ranging communication networks developed in the Lesser Antilles of which the Troumassan interaction sphere involved three culturally distinct areas, i.e., the Windward Islands, Barbados and Tobago. This situation continued during the subsequent episode of Troumassoid development, that of the Suazan subseries. While belonging to the Troumassoid cultural centre albeit situated at its margin, the ceramic evidence suggests that Tobago may have played a mediating role between the contemporaneous Amerindian communities of Trinidad and the South American mainland on the one hand and those of the Windward Islands on the other hand. This foreshadowed the position the island had in protohistoric times when it was used by the Island Caribs and Kalina as a half-way station between the Windwards and the mainland and was referred to as such in the tales of Island Carib origins (Boomert 2002).

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Notes

1. These totals exclude non-local ceramics, which amount to 13 and 5 potsherds at Golden Grove (Strata IV-V) and Lovers' Retreat (Section B), respectively.

2. Detailed examination of selected samples of the Golden Grove complex ceramics in order to investigate this question and similar problems will take place under the auspices of the project 'Mobility and exchange: dynamics of material, social and ideological relations in the pre-Columbian insular Caribbean' directed by Dr. Corinne L. Hofman of the Faculty of Archaeology at Leiden University.

3. A 'ware' is defined here as a technologically distinct pottery category, i.e., a class of ceramics characterized by a specific method of manufacture and range of firing conditions, resulting in particular types of surface treatment and fabric, as shown by its non-plastic inclusions, texture, hardness, and colour variations.

4. Further abbreviated as GG and LR, respectively.

5. A largely complete specimen of a Form 1 vessel, made of Fine Ware, showing an oval horizontal cross section and a circular annular base, was recovered Peter O'B. Harris from GG (Figure 4). This shallow bowl, which is decorated with incised and modelled designs, is on exhibition in the Tobago Museum of History (TMH), Scarborough.

6. It is noteworthy that although deliberate admixture of freshwater sponges as a tempering agent to potter's clay has been reported from Amazonia (Linné 1925: 49-57, 1965), it remains possible that special deposits of clay containing 'fossil' sponge spicules were collected as well. Provided the pottery was fired slowly, the spicules would not have disintegrated (see Boomert 1985, 2000: 205).

7. The latest revision of Rouse's cultural taxonomy of Caribbean prehistory is followed here (see Rouse et al. 1995). This distinguishes a Troumassoid series in the Windward Islands, divided into two chronologically subsequent subseries, i.e., Troumassan and Suazan. These were formerly known as the Troumassoid and Suazoid series, respectively.

8. Throughout Troumassoid times Barbados was perhaps closest to St. Lucia, i.e., the island which is reached most easily when drifting with the current from Barbados. It is noteworthy that the Greenland complex was formerly termed Chancery Lane 2 (Boomert 1987).

9. It was assumed that post-depositional disturbance obliterated any originally existing stratigraphic evidence suggesting the evolution from Caliviny to Suazey at the sites in the Windward Islands yielding post-Cedrosan ceramics.

10. This is the so-called 'décor labyrinthe' discussed by Petitjean-Roget (1975: 72).

11. An inturned bowl showing broad-line incised, parallel wavy lines accompanied by space-filling punctates on its upper exterior, such as are typically found on Form 5 vessels in the Golden Grove complex, is known from St. Lucia (Bullen and Bullen 1970: Figure 11:j).

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Depth	Fine		Medium		Coarse		C. Scrp.		C. Scrt.		Unclass.		Totals	
(cm)	*n*	we.	*n*	we.	*n*	we.	*n*	we.	*n*	we.	*n*	we.	*n*	we.
Golden Grove														
0-5	85	550	46	610	145	900	14	120	9	100			299	2280
5-10	310	4340	361	3050	873	6400	88	1470	27	430	2	10	1661	15700
10-15	335	5900	351	4420	834	8600	72	3230	45	1100	4	40	1641	23290
15-20	143	3530	195	1920	452	5610	72	3050	22	1000			884	15110
20-25	51	1880	37	990	125	1700	27	890	10	810	3	40	253	6310
25-30	8	380	3	20	1	20					4	40	16	460
Totals	932	16580	993	11010	2430	23230	273	8760	113	3440	13	130	4754	63150
%	19.8	26.2	20.9	17.4	51.1	36.8	5.7	13.9	2.3	5.5	0.2	0.2	100.0	100.0
Lovers' Retreat														
0-10	138	720	134	830	194	1190	20	220	26	260			512	3220
10-20	821	9500	499	5820	920	10020	160	4130	186	4420	2	20	2588	33910
20-30	801	10880	376	5520	712	8350	133	3410	243	5540	3	30	2268	33730
30-40	126	1680	85	1280	244	2670	17	730	31	590			503	6950
Totals	1886	22780	1094	13450	2070	22230	330	8490	486	10810	5	50	5871	77810
%	32.1	29.3	18.6	17.3	35.3	28.6	5.6	10.9	8.3	13.9	0.1	<0.1	100.0	100.0

Abbreviations: C. Scrp., Coarse Scraped; C. Scrt., Coarse Scratched; Unclass., Unclassified; we., weight.

Table 1. Frequency of major pottery wares of the Golden Grove ceramic complex (number and weight of potsherds).

	Form 1		Form 2		Form 3		Form 4		Form 5		Form 6		Totals	
Wares	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR
Fine	154	195	23	105	1	30	1	1	17	77		1	196	409
Medium	38	75	43	72	1	13	5		3	24			90	184
Coarse	14	26	78	65	5	30	17	40					114	161
C. Scrp.	3	2	40	29	1	6	6	9					50	46
C. Scrt.	8	9	19	43		8		26					27	86
Unclass.														
Totals	217	307	203	314	8	87	29	76	20	101		1	477	886
%	45.5	34.7	42.5	35.4	1.7	9.8	6.1	8.6	4.2	11.4		0.1	100.0	100.0

Abbreviations: GG, Golden Grove; LR, Lovers' Retreat; C. Scrp., Coarse Scraped; C. Scrt., Coarse Scratched; Unclass., Unclassified.

Table 2. Frequency of vessel shapes of the Golden Grove complex subdivided according to major pottery wares (number of potsherds).

	Form A		Form B		Form C		Form D		Form E		Unclass.		Totals	
Wares	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR
Fine		9				9	39	132				1	39	151
Medium	4	5				3	55	130					59	138
Coarse	3	5	1			3	3	16		1	12	16	19	41
C. Scrp.														
C. Scrt.								2						2
Unclass.									1				1	
Totals	7	19	1			15	97	280	1	1	12	17	118	332
%	5.9	5.7	0.9			4.5	82.2	84.4	0.9	0.3	10.2	5.1	100.1	100.0

Abbreviations: GG, Golden Grove; LR, Lovers' Retreat; C. Scrp., Coarse Scraped; C. Scrt., Coarse Scratched; Unclass., Unclassified.

Table 3. Frequency of base forms of the Golden Grove complex subdivided according to major pottery wares (number of potsherds).

	Type 1		Type 2		Type 3		Type 4		Unclass.		Totals	
Vessels	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR
Form 1	14	106	165	162	33	37			5	2	217	307
Form 2	99	170	103	142			1			2	203	314
Form 3	5	62	3	24						1	8	87
Form 4	12	61	15	6		1			2	8	29	76
Form 5		7	11	47					9	47	20	101
Form 6												
Totals	130	406	297	381	33	39	1		16	60	477	886
%	27.2	45.8	62.3	43.0	6.9	4.4	0.2		3.4	6.8	100.0	100.0

Abbreviations: GG, Golden Grove; LR, Lovers' Retreat.

Table 4. Frequency of vessel shapes of the Golden Grove complex subdivided according to rim types (number of potsherds).

	High-qual.		Low-qual.		Unclass.		Totals		%	
	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR
Decorated	208	185	9	29			217	214	4.6	3.6
Undecorated	1717	2795	2807	2857	13	5	4537	5657	95.4	96.4
Totals	1925	2980	2816	2886	13	5	4754	5871	100.0	100.0

Abbreviations: High-qual., high-quality wares; low-qual., low-quality wares; GG, Golden Grove; LR, Lovers' Retreat.

Table 5. Frequency of decoration among the major pottery wares of the Golden Grove complex (number of potsherds).

	Form 1		Form 2		Form 3		Form 4		Form 5		Form 6		Totals	
	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR	GG	LR
Decorated	120	63	11	15		2	1		14	59		1	146	140
Undecorated	97	244	192	299	8	85	28	76	6	42			331	746
Totals	217	307	203	314	8	87	29	76	20	101		1	477	886

Abbreviations: GG, Golden Grove; LR, Lovers' Retreat.

Table 6. Frequency of decoration among the vessel shapes of the Golden Grove complex (number of potsherds).

	Pntd/slpd		Incd/gd		Punctd		Si. mod.		Cp. mod.		Totals
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	
GG	2	0.9	199	91.7	8	3.7	23	10.6	3	1.4	217
LR	5	2.3	142	66.4	1	0.5	80	37.4	9	4.2	214
Totals	7	1.6	341	79.1	9	2.1	103	23.9	12	2.8	431

Abbreviations: Pntd/slpd, painted/slipped; Incd/gd, incised/gouged; Punctd, punctated; Si. mod., simple modelled; Cp. mod., complex modelled; GG, Golden Grove; LR, Lovers' Retreat.

Table 7. Frequency of decorative techniques among the pottery of the Golden Grove complex (number of potsherds).

Depth	Griddles		Spindle whorls		Vessel supports		Totals	
(cm)	*n*	we.	*n*	we.	*n*	we.	*n*	we.
Golden Grove								
0-5	4	580					4	580
5-10	50	1840					50	1840
10-15	37	1670					37	1670
15-20	19	2090	1	80	1	30	21	2200
20-25	9	610			1	50	10	660
25-30								
Totals	119	6790	1	80	2	80	122	6950
Lovers' Retreat								
0-10	6	150	1	20			7	170
10-20	37	2740					37	2740
20-30	30	1760	4	100	3	70	37	1930
30-40	7	590					7	590
Totals	80	5240	5	120	3	70	88	5430

Abbreviations: We., weight.

Table 8. Frequency of pottery artifacts of the Golden Grove complex (number and weight of potsherds).

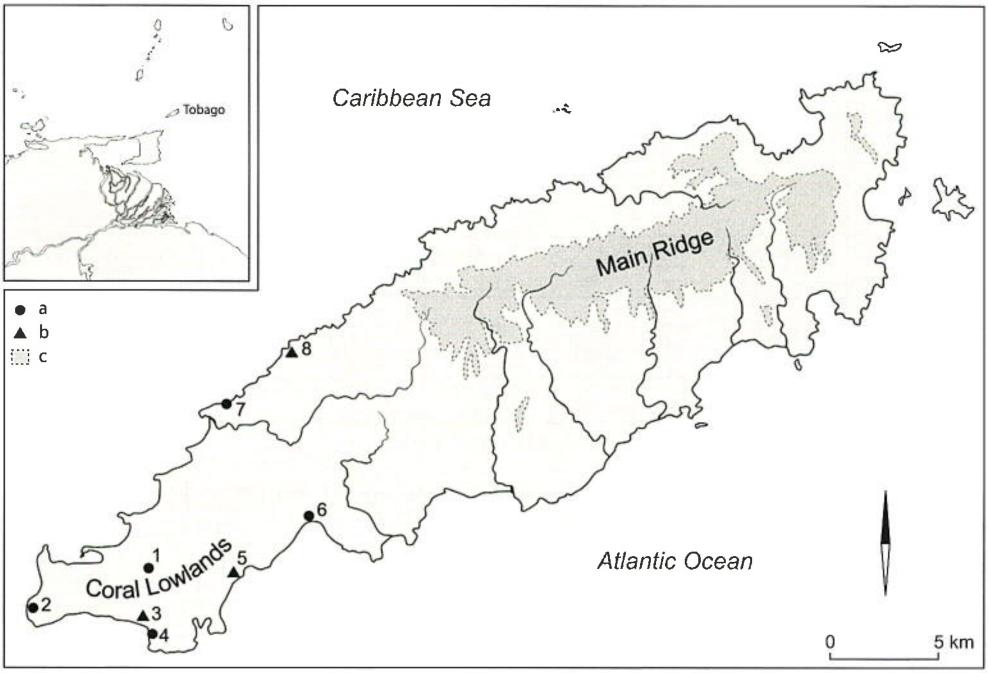

Figure 1. Map of Tobago, showing the distribution of archaeological sites of the Golden Grove complex. *Legend:* (a) settlement sites; (b) ephemeral camp or bivouac sites; (c) land beyond 1000 feet above MSL. Key to site numbers: (1) Golden Grove; (2) Sandy Point; (3) Friendship; (4) Cove; (5) Diamond; (6) Dutch Fort; (7) Lovers' Retreat; (8) Culloden Bay. Inset: geographical situation of Tobago offshore the South American mainland.

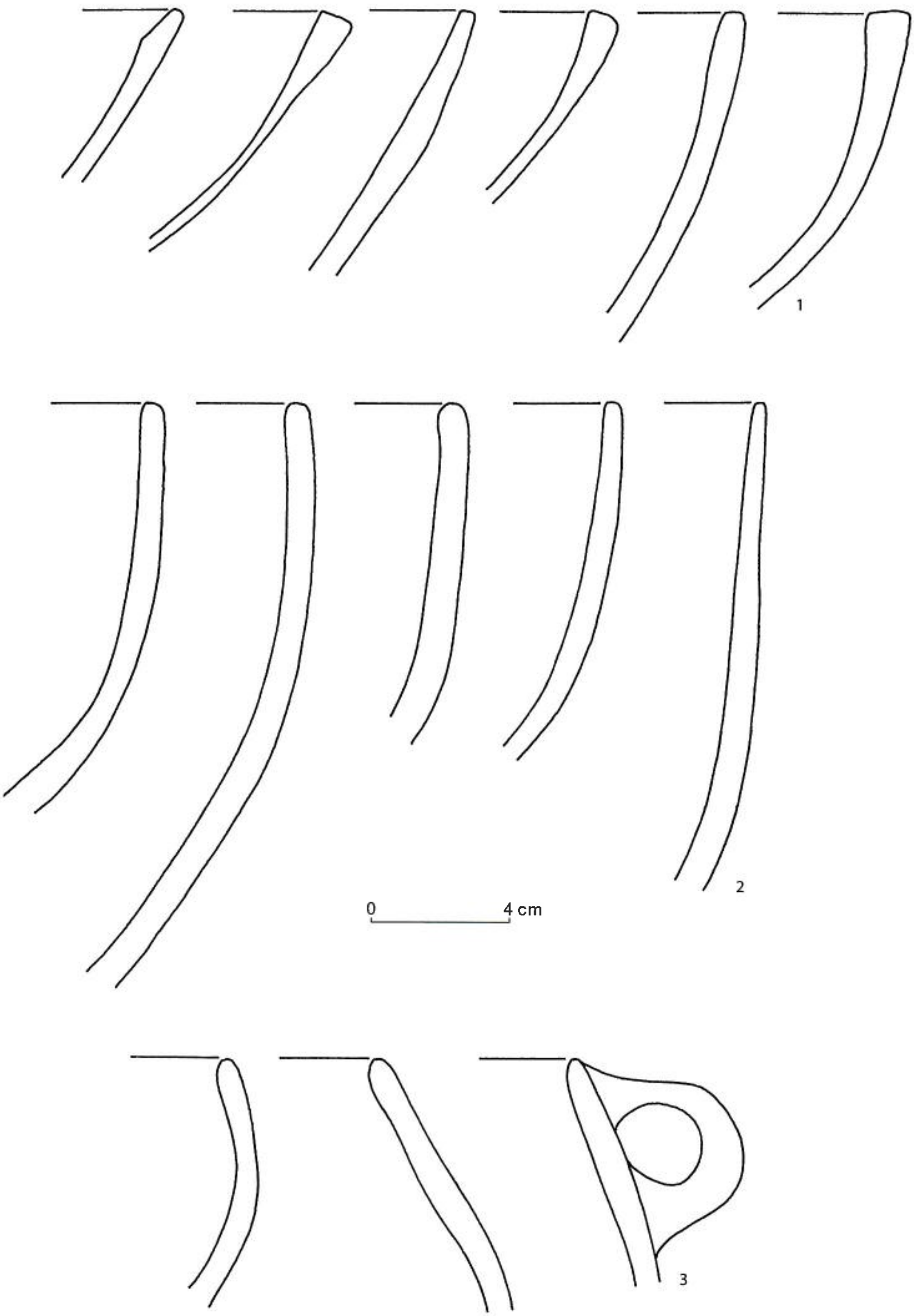

Figure 2. Vessel shape classes of the Golden Grove complex, Tobago: (1) Form 1; (2) Form 2; (3) Form 3; (4) Form 4. Coll. UWI.

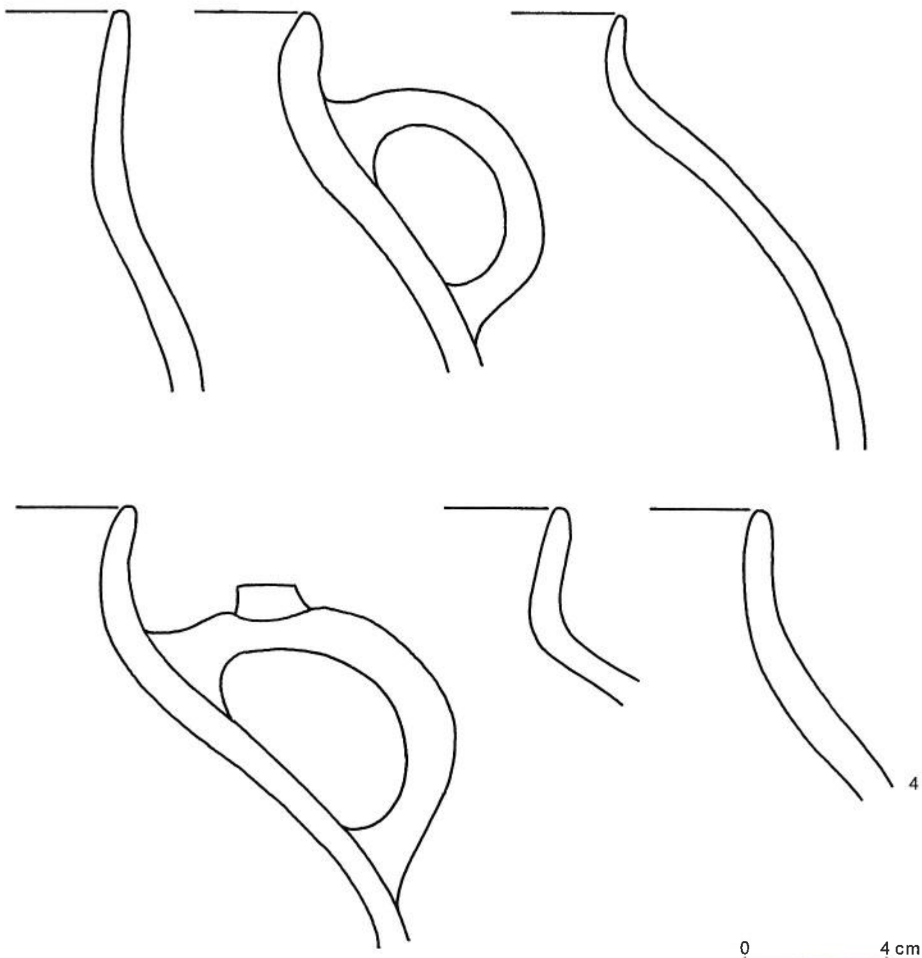

Figure 2 *(continued)*. Vessel shape classes of the Golden Grove complex, Tobago: (4) Form 4. Coll. UWI.

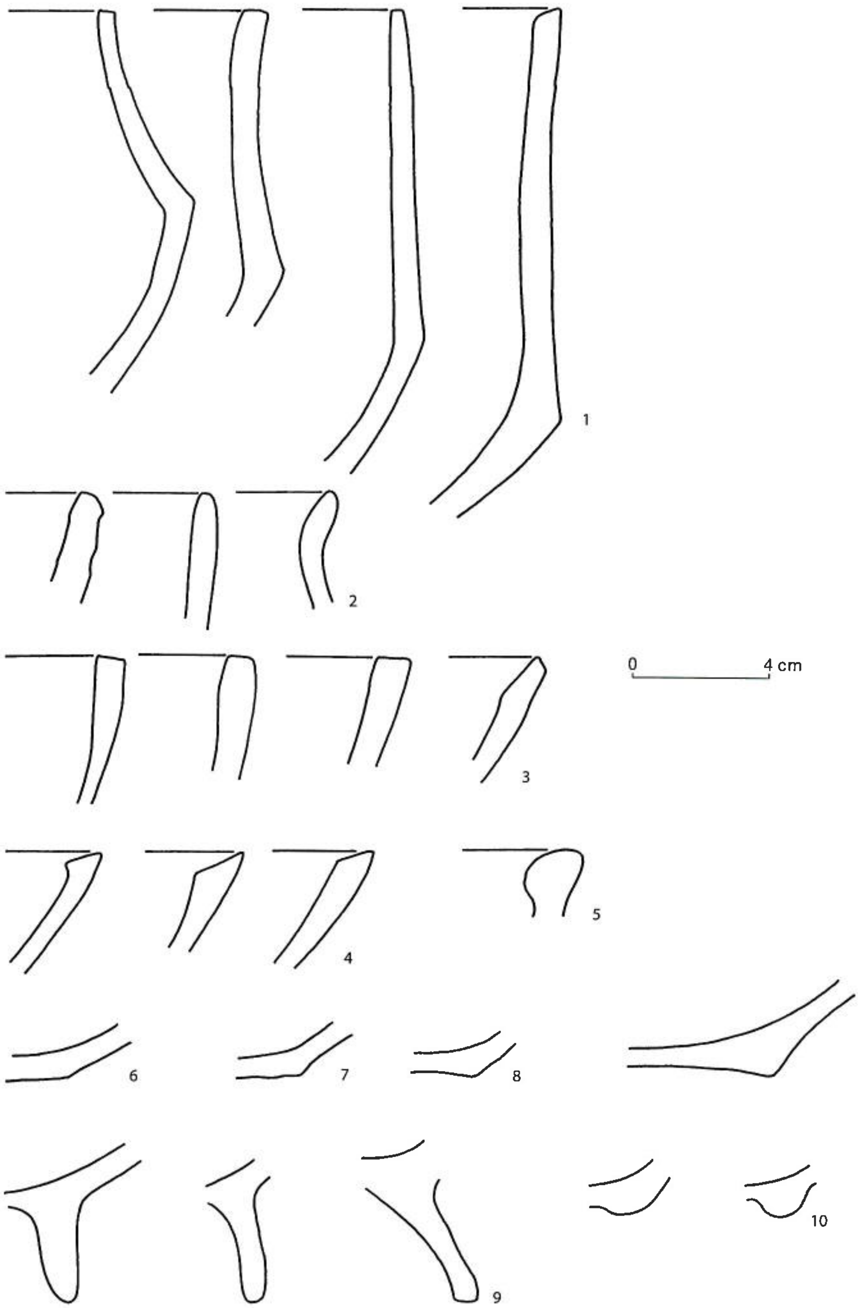

Figure 3. Vessel shape classes, rim types and base forms of the Golden Grove complex, Tobago: (1) Form 5; (2) Rim Type 1; (3) Rim Type 2; (4) Rim Type 3; (5) Rim Type 4; (6) Base A; (7) Base B; (8) Base C; (9) Base D; (10) Base E. Coll. UWI.

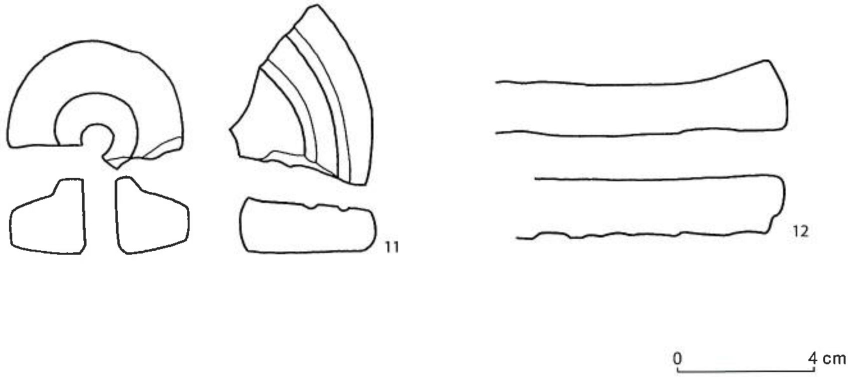

Figure 3 *(continued)*. Pottery artifacts of the Golden Grove complex, Tobago: (11) spindle whorls; (12) griddles. Coll. UWI.

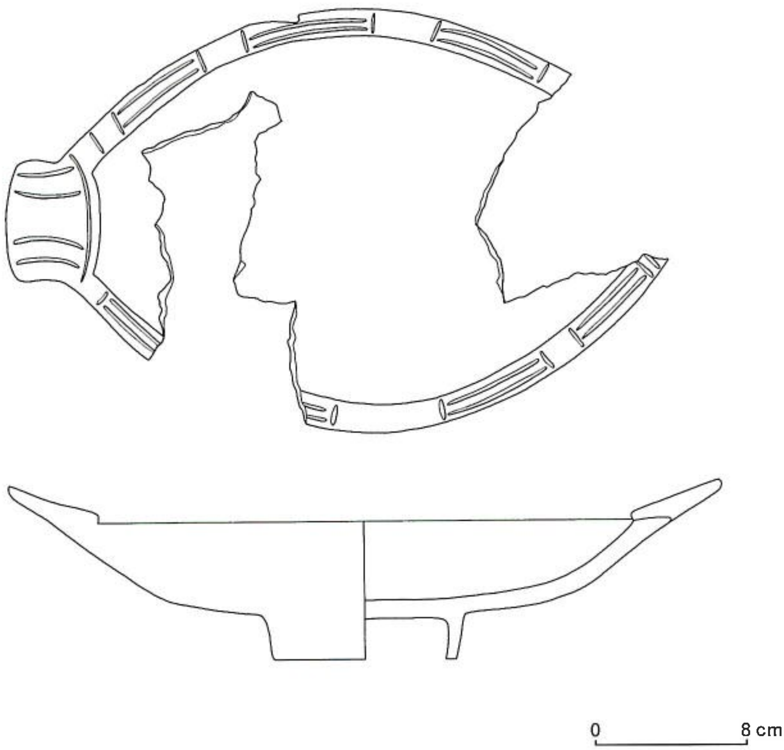

Figure 4. Form 1 bowl of the Golden Grove complex, Tobago, showing Rim Type 2 and Incised/gouged Motifs 2 and 3 next to Simple modelled Motif 1. This vessel was recovered by Peter O'B. Harris during his 1974 excavations at the Golden Grove site. Coll. TMH.

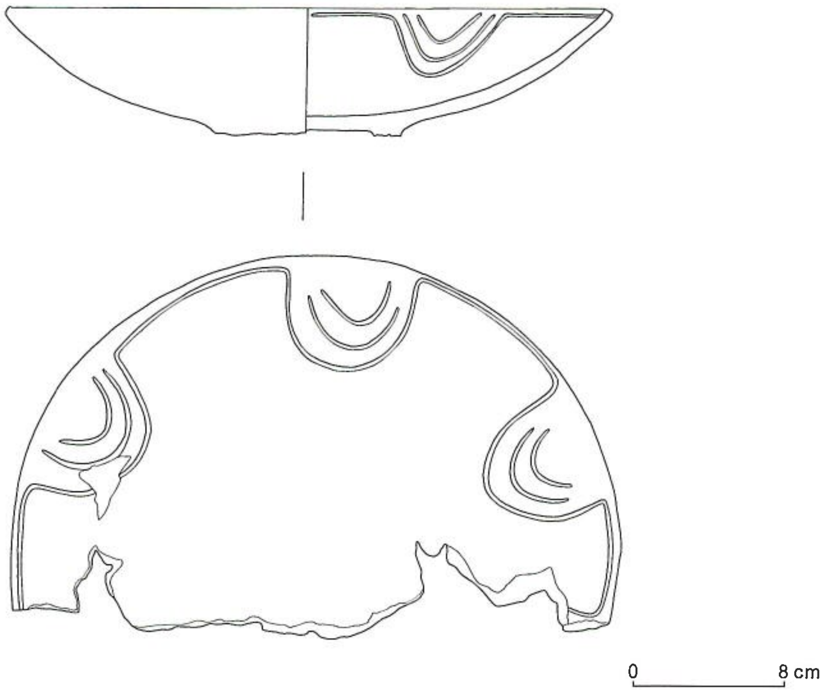

Figure 5. Form 1 bowl of the Golden Grove complex, Tobago, found at the Golden Grove site (1985), showing Rim Type 2, Base D, and Incised/gouged Motifs 1 and 2. Coll. UWI.

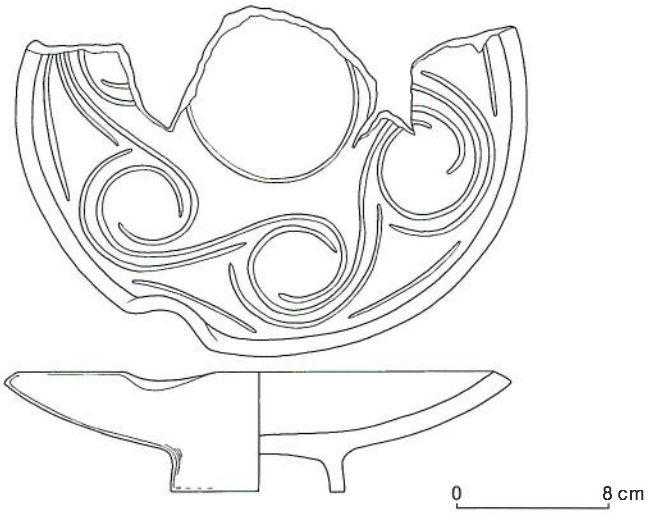

Figure 6. Form 1 bowl of the Golden Grove complex, Tobago, found at the Golden Grove site (1985), showing Rim Type 2, Base D, Incised/gouged Motif 1 and Simple modelled Motif 4. Coll. UWI.

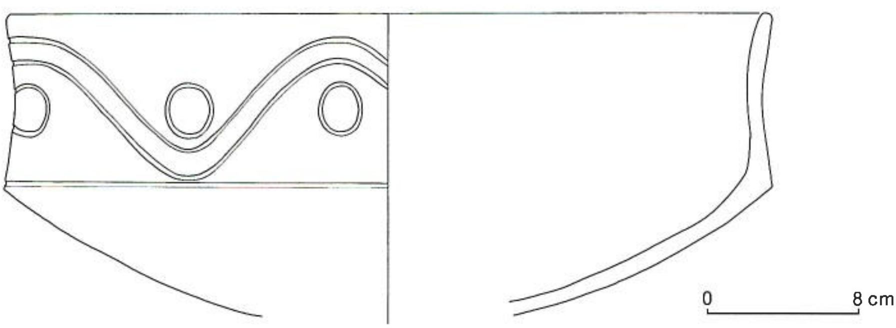

Figure 7. Form 5 jar of the Golden Grove complex, Tobago, showing Rim Type 1 and Incised/gouged Motif 2. This vessel was recovered by Peter O'B. Harris during a survey of the Sandy Point site in 1979/1980. Coll. UWI.

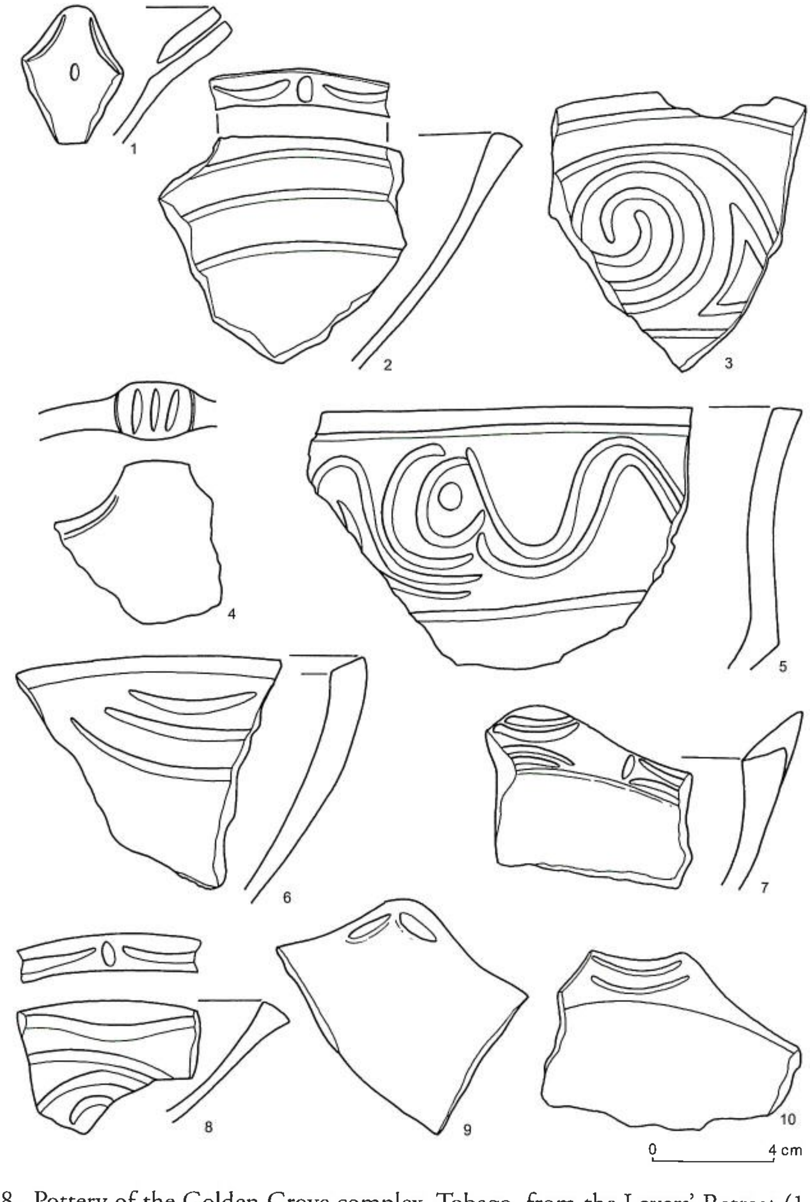

Figure 8. Pottery of the Golden Grove complex, Tobago, from the Lovers' Retreat (1,4,9-10) and Golden Grove (2-3,5-8) sites (1981/1982,1985): (1) Form 6 (sniffing bowl), showing Incised/gouged Motif 2 and Simple modelled Motif 1; (2) Incised/gouged Motifs 1 and 3; (3) Incised/gouged Motif 2; (4) Incised/gouged Motif 2 and Simple modelled Motifs 1 and 2; (5) Incised/gouged Motifs 1 and 2 next to a Punctated design; (6) Incised/gouged Motif 2; (7) Incised/gouged Motif 3 and Simple modelled Motif 1; (8) Incised/gouged Motifs 2 and 3; (9) Incised/gouged Motif 2 and Simple modelled Motif 1; (10) Incised/gouged Motif 2 and Simple modelled Motif 1. Coll. UWI.

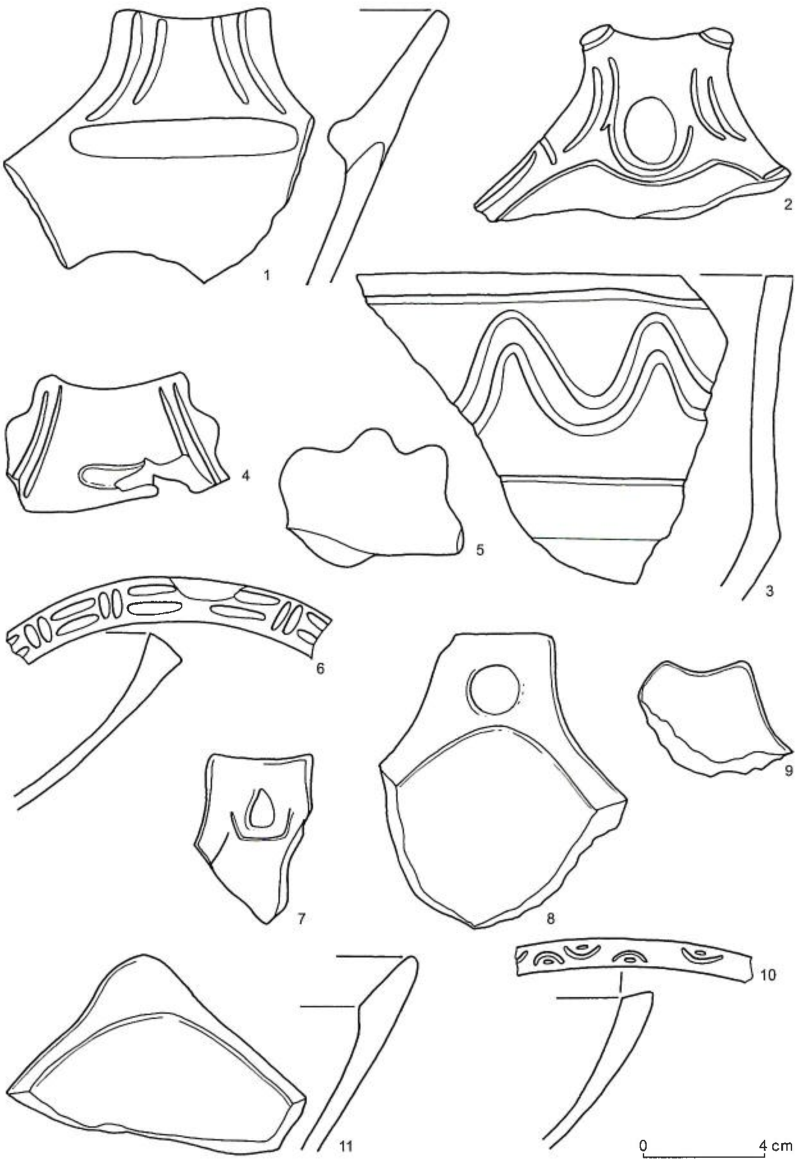

Figure 9. Pottery of the Golden Grove complex, Tobago, from the Lovers' Retreat (1,4-5,7,9) and Golden Grove (2-3,6,8,10) sites (1981/1982,1985): (1) Incised/gouged Motif 2 and Simple modelled Motifs 1 and 3; (2) Incised/gouged Motif 2, Simple modelled Motif 1 and a Punctated design; (3) Incised/gouged Motifs 1 and 2; (4) Incised/gouged Motif 2 and Simple modelled Motifs 1 and 3; (5) Simple modelled Motif 1; (6) Incised/gouged Motif 3; (7) Simple modelled Motif 1 and a Punctated design; (8) Simple modelled Motif 1 and a Punctated design; (9) Simple modelled Motif 1; (10) Incised/gouged Motif 2 and a Punctated design. Coll. UWI.

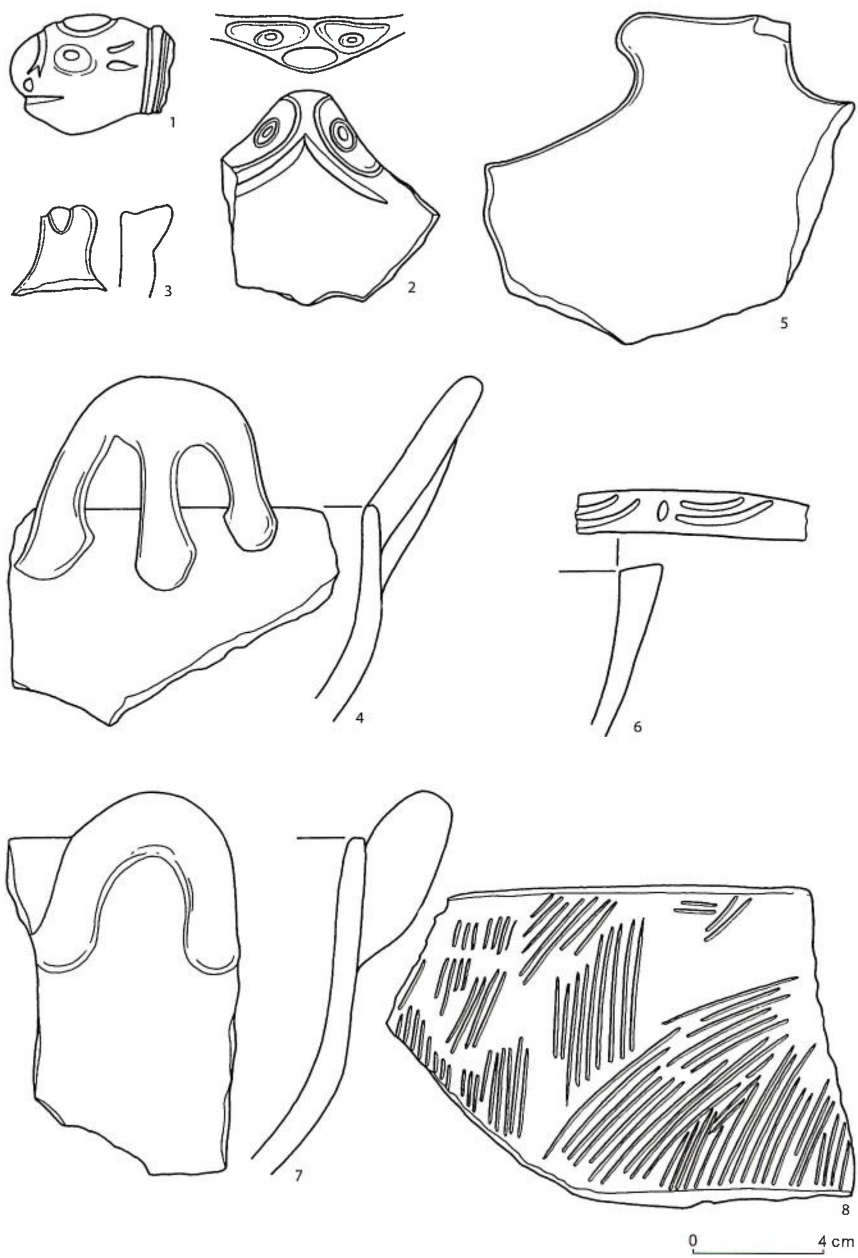

Figure 10. Pottery of the Golden Grove complex, Tobago, from the Lovers' Retreat (1-3,5), Sandy Point (4) and Golden Grove (6-8) sites (1981/1982,1985): (1) Complex modelled Motif 1; (2) Incised/gouged Motif 2 and Complex modelled Motif 1; (3) Complex modelled Motif 1; (4) Complex modelled Motif 2; (5) Simple modelled Motif 1; (6) Incised/gouged Motif 3; (7) Simple modelled Motif 3; (8) Coarse Scratched Ware. Coll. UWI.

PRELIMINARY DATA ON VĂDASTRA POTTERY FROM TELEOR 003, TELEORMAN RIVER VALLEY, SOUTHERN ROMANIA

Abraham van As, Loe Jacobs and Laurens Thissen

Abstract

This contribution is a preliminary report of a study of Neolithic pottery excavated at Teleor 003 by the Southern Romania Archaeological Project (SRAP) directed by Douglass Bailey (Cardiff University) and Radian Andreescu (National Museum, Bucharest [București]). It contains the results of a technological analysis of pottery belonging to the Vădastra period (end sixth millennium B.C.). The report links up with a preliminary report on pottery of the previous Starčevo-Criş and Dudeşti periods (sixth millennium cal B.C.) published in the LJPS (2004). In the present report a comparison is made between the technology of the Vădastra pottery and the preceding Starčevo-Criş and Dudeşti pottery. Moreover, it includes the results of the further analysis of clay samples earlier taken in the vicinity of the site.

Introduction

In the context of the Southern Romania Archaeological Project (SRAP), active since 1998 and investigating prehistoric land-use and settlement patterns in the Teleorman River Valley in the Lower Danube Plain (Bailey et al. 1999, 2001, 2002), the study of pottery use and manufacture plays an important role. Various archaeological sites were investigated. One of the sites, Teleor 003 (Figure 1) excavated in the years 2002-2004 was inhabited throughout the sixth millennium cal B.C., during the successive Starčevo-Criş, Dudeşti and Vădastra periods. Here, emerged a good opportunity to trace the shifts in the ceramic assemblages over this time-span. In 2003 the Starčevo-Criş and Dudeşti pottery was technologically analysed in the Teleorman County Museum of Alexandria (van As et al. 2004). The present report deals with the results of the technological analysis of the Vădastra pottery carried out in 2004. The clay samples, in 2003 taken in the vicinity of Teleor 003 and brought to Leiden, have been further analysed in the Ceramic Laboratory of the Leiden Faculty of Archaeology as to its composition and workability properties. The results are presented in this report.

Material and methods

A total of 800 diagnostic and non-diagnostic sherds were recovered from Teleor 003 dating to the Vădastra period (end sixth millennium B.C.), deriving from three discrete pit

Leiden Journal of Pottery Studies 21, 2005: 61-68.

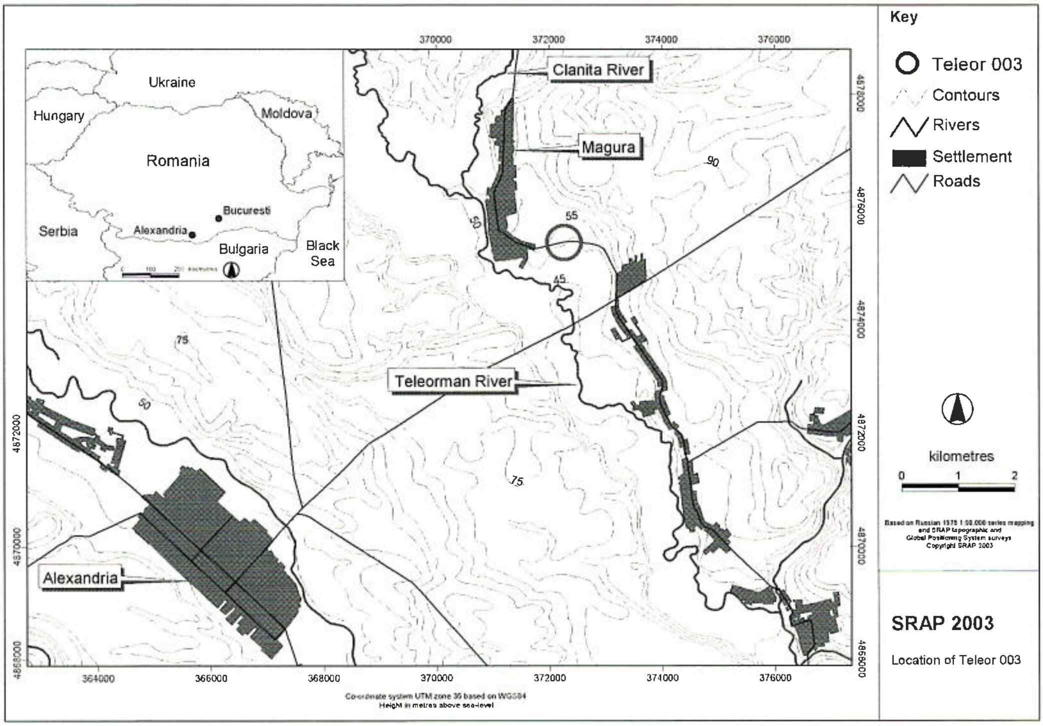

Figure 1. Location of Teleor 003 in the Teleorman River Valley in south central Romania (courtesy Steve Mills).

contexts (Figure 2). After a study of this pottery assemblage (including the fabric analysis), a more in-depth technological analysis was executed in the Teleorman County Museum in Alexandria (28 August until 10 September 2004). The sample used for this analysis came from sondage 10/B, complex C17 excavated in 2003 by the SRAP team. The analysis covered (1) the reconstruction of the manufacturing technique (forming, decoration and firing) based on observable characteristics of the manufacturing process (e.g., crack patterns, thickenings of the vessel's wall, colour and hardness) of the diagnostic sherds and (2) the fabric analysis, i.e., the microscopic investigation (10 – 50 x magnification) of the mineral inclusions and pores in the clay body observed on a fresh break and a grounded edge of a representative sample of sherds. Because of the dark core of most of the sherds in the assemblage the study of the mineral inclusions was rather difficult. Therefore, a sample of 50 light-coloured sherds was selected. Another sample of 50 sherds with a dark core was brought to Leiden. In the Ceramic Laboratory of the Leiden Faculty of Archaeology the sherds were refired in an electric kiln (oxidizing atmosphere) in order to turn the dark core of the sherds into a light colour. To determine the original firing temperature of these sherds, we measured sherd hardness and porosity after we had refired the sherd at a series of different temperatures (i.e., increasing 50°C at a time).

Figure 2. Two Vădastra vessels.

Close to Teleor 003, eleven clay samples were taken in 2003: three from the floodplain of the Teleorman River and eight from the floodplain of the Clanița River, a tributary of the Teleorman (Figure 1). In the field, the clay samples were tested for their workability properties (determination of the plasticity by means of the piglet's tail test and by making small pots using the pinching technique). In order to execute simulation experiments in 2004, another clay sample was taken from the floodplain of the Clanița (see van As et al. this volume, pp. 104-106). In Leiden, the firing colour of the clay samples and sherds was determined by firing them under the same firing conditions (oxidizing atmosphere in an electric kiln at 750°C).

Results

The pottery manufacture

The pottery was handmade by using the coiling technique. Looking at the finishing of the surface of the pottery, three categories could be distinguished.

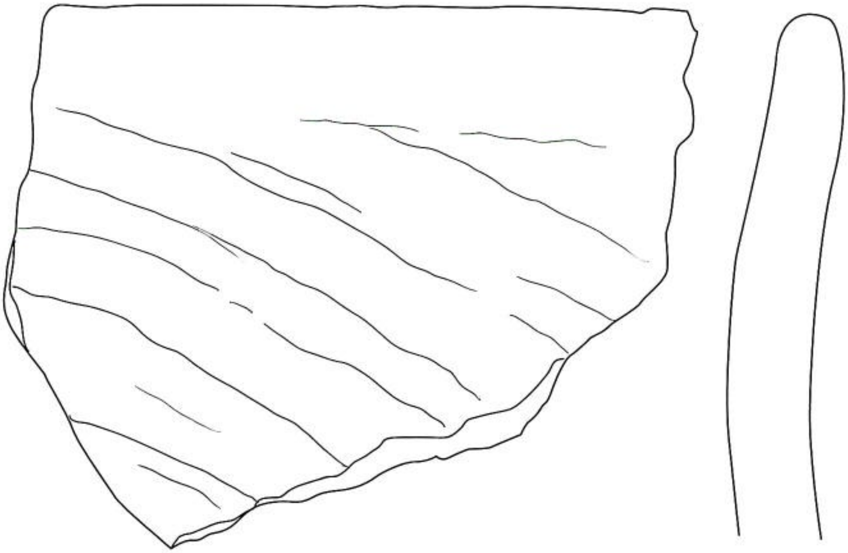

Figure 3:1. Vădastra surface roughened ware (scale 1:1).

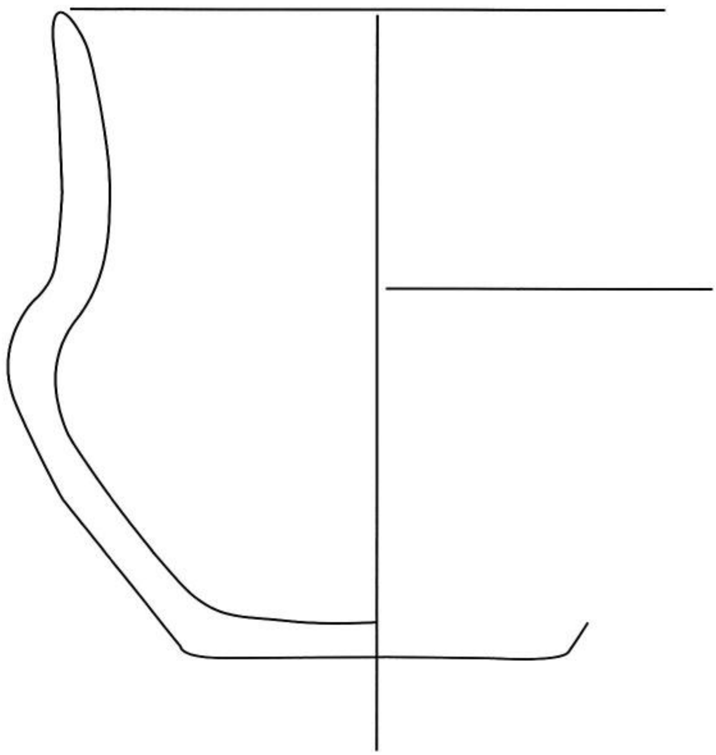

Figure 3: 2. Vădastra plain burnished ware (scale 1:1).

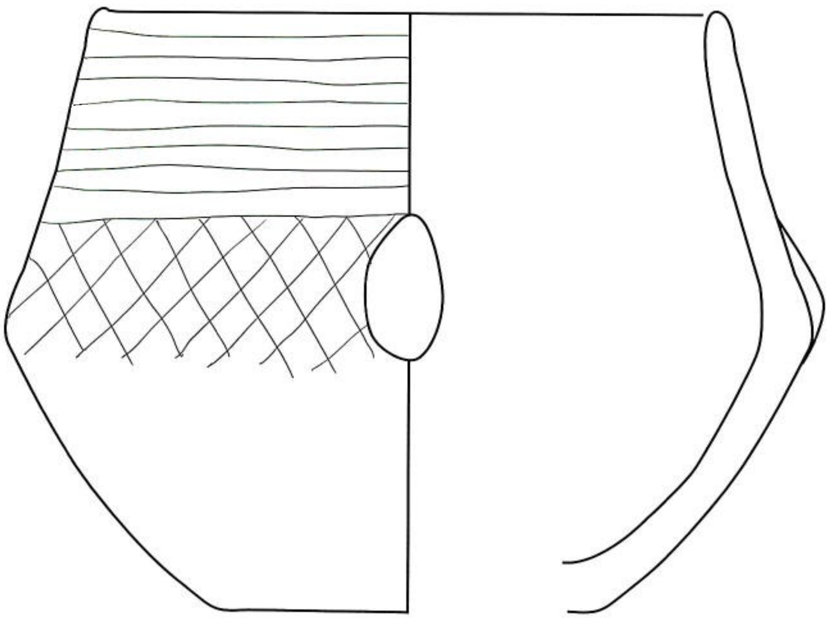

Figure 3: 3. Vădastra decorated burnished ware (scale 1:1).

Surface roughened ware (Figure 3: 1). The surface of this ware was either roughened by applying a rough clay coat on the outside or by scraping. When scraped it seems that in some cases a flint tool was used.

Plain burnished ware (Figure 3: 2). The surface of this ware was burnished. In general the burnish gloss is not very shiny.

Decorated burnished ware (Figure 3: 3). This ware includes various decoration techniques: polishing patterns, appliqué, tool or fingernail impressions and incisions (sometimes with chalk incrustation).

Many pottery sherds have a black core. The surface colours are not always uniform, but often show a range of colouring. The colours vary between light brown (7.5YR6/4), grey (7.5YR5/1), very dark grey (10YR3/1), pale brown (10YR6/3), pinkish grey (7.5YR6/2), light reddish brown (5YR6/4) and brown (7.5YR5/2). This indicates that the pottery was fired in a pile where the pottery was in direct contact with the fuel and flames. The atmosphere varied from reducing to neutral. The firing temperature of the pottery was around 750°C.

The pottery fabric

In Table 1 (columns 1-3) a description of the fabric of the various pottery categories of the Vădastra period is given. In this description of the clay body (prepared clay) only the dominant type and maximum size of the mineral inclusions and fibres are mentioned.

The dominant mineral inclusions are quartz in clear and milky varieties. Besides these, feldspar, iron oxide siltstone, calcareous siltstone, pyroxene and some other mineral inclusions are also found in varying minor quantities. The mineral inclusions in the Vădastra pottery correspond with the mineral inclusions in the earlier Starčevo-Criş and Dudeşti pottery (see van As et al. 2004: Tables 1 and 2). A relatively small part of the Vădastra pottery assemblage was tempered with fibrous material of organic origin. In some cases, the addition of organic fibres seems to have been desirable. During the forming process, when the clay is still in a plastic condition, the organic fibres tend to keep the clay mixture together. Furthermore, the organic fibres may have been used to prevent the development of cracks due to uneven drying (see also van As et al. this volume, pp. 104-106).

The clay samples

Further investigation of the clay samples taken from the floodplain of the Teleorman and Claniţa River confirms the earlier findings (van As et al. 2004: 126). In general the natural clay is suited for the manufacturing techniques as applied by the potters in

	1. Vădastra surface roughened ware	2. Vădastra plain burnished ware	3. Vădastra decorated burnished ware	4. Fired clay samples
Samples	n = 48	n = 30	n = 22	n = 12
Mineral inclusions				
Dominant mineral	quartz	quartz	quartz	quartz
Maximum size	8 mm	3 mm	2.5 mm	5 mm
Roundness	angular (A) sub angular (SA) sub rounded(SR)	A/SA/SR	A/SA/SR	A/SA/SR
Percentage	10-35%	10-35%	10-25%	10-50%
Sorting	moderate	moderate	moderate	moderate
Fibres				
Percentage	none -20%	none-25%	none-25%	
Maximum length	1 cm	1 cm	1 cm	

Table 1. Fabric of Vădastra pottery from Teleor 003 (columns 1-3); fabric of fired clay samples taken in the floodplain of the Teleorman and Claniţa River (column 4).

this region during the Neolithic period. Seven out of twelve clay samples are suited for making pottery using the coiling technique. The colours of the fired clay samples and refired sherds (both in an electric kiln at 750°C in an oxidizing atmosphere) are identical, varying between light brown (7.5YR6/4), reddish yellow (7.5YR6/6) yellowish red (5YR5/6), pink (7.5YR7/4), very pale brown (10YR7/4) and pink (7.5YR7/3). In other words, the clay samples and the clays used to make the pottery in the Neolithic period have the same firing colour. This makes it plausible that the pottery of Teleor 003 was made of local clay. The fired clay samples present the same types of mineral inclusions as the sherds. This is another indication for a local pottery production. As to the measurable characteristics (size, roundness, percentage and sorting) of the mineral inclusions about half of the clay samples roughly matches with the sherds. The other clay samples contain a relatively high percentage of mineral inclusions, some even over 50%. Such clays are not suitable for pottery production. We may assume that the potters must have been selective in the choice of their clays. They probably collected only those clays that were usable for making their pottery without a minimum of preparation.

Conclusion

Technologically, the Vădastra pottery from Teleor 003 resembles the pottery dating to the preceding Starčevo-Criş and Dudeşti periods. It is a continuous technological tradition. During the entire sixth millennium B.C. potters selected local clays for the production of their pottery. Although not as common as it had been in the Starčevo-Criş period, the potters in the Vădastra period sometimes added fibrous material to the clay. Remarkably enough, no fibrous tempered pottery was found in the intermediate Dudeşti period. The Vădastra pottery was handmade using the coiling technique. The surface of the pottery was either roughened or burnished. The potters decorated their ware by using various techniques: appliqué, tool or fingernail impressions and incisions. Only in the Starčevo-Criş period did they apply a (painted) red slip decoration. In the Vădastra period a decoration with chalk incrustation could be observed. The shifts in pottery shapes during the Starčevo-Criş, Dudeşti and Vădastra periods will be discussed in the final publication of the pottery of Teleor 003.

Acknowledgements

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A WHITE-GROUND LEKYTHOS FROM THE NETHERLANDS NATIONAL MUSEUM OF ANTIQUITIES: THE ACQUISITION, CONSERVATION AND EXPERIMENTAL RECONSTRUCTION OF THE MANUFACTURING TECHNIQUE

Ruurd B. Halbertsma, Renske Dooijes, Loe Jacobs and Abraham van As

Abstract

This article focuses on a white-ground lekythos dating to the fifth century B.C. belonging to the exhibited collection of the Netherlands National Museum of Antiquities, Leiden. In 1887 the fragments of the complete lekythos were acquired by the Museum through Jan Six. The lekythos was restored for the first time around 1900. Recently, the lekythos was restored again. On this occasion, the fragments were taken apart and the Ceramic Laboratory of the Leiden Faculty of Archaeology was able to reconstruct the manufacturing technique by observing the characteristics visible on the inside of the lekythos. The reconstruction of the manufacturing technique was tested by performing simulation experiments. The results of the experimental reconstruction broadened the insight into the technical skills of the ancient Greek potters. In this contribution attention is successively paid to the acquisition and conservation of the lekythos and the experimental reconstruction of its manufacturing technique.

Introduction

With the ancient Greeks a lekythos (ληκυθος) was a vessel used to store oil or ointment. They are egg-shaped or cylindrical-shaped vessels with a thin, rather high neck, funnel-shaped mouth and a low base, with or without handles. White-ground lekythoi are covered with a coat of white clay slip, on which a scene was painted in varying techniques.[1] The first lekythoi produced in Attica and Corinth date to the early sixth century B.C. In the middle and later part of the fifth century B.C. the white-ground lekythoi became part of the burial ritual. They were used to embalm the deceased and were afterwards placed either on top or in the grave. Some of these funeral lekythoi have a small container on the inside of the neck. Thus, the lekythoi could appear full to the rim, but with little expense (Cook 1972: 28). One of the lekythoi with a container belongs to the exhibited collection of the Netherlands National Museum of Antiquities (Figures 1 and 2). This lekythos (inventory number ASx 2) was acquired in 1887 as a pile of sherds. Around 1900 the lekythos was restored. A recent inspection showed that the lekythos needed further conservation. The latter took place in 1999 in the conservation department of

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Figure 1. Lekythos in the National Museum of Antiquities, Leiden (The Netherlands) (inventory number Asx 2; height: 36 cm).

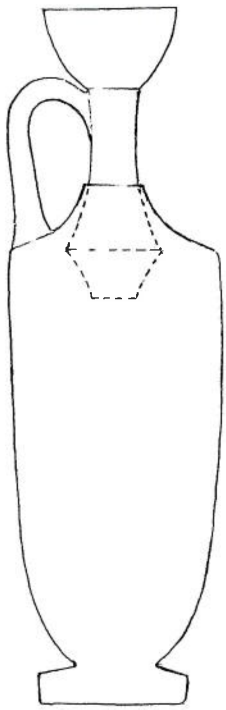

Figure 2. Sketch of the profile of the lekythos with container.

the museum. The conservation was performed using modern techniques. Before the conservation process could proceed the lekythos had to be taken apart on the original joints. The then visible signs of the manufacturing technique were, following a request by the museum, studied by the Ceramic Laboratory of the Leiden Faculty of Archaeology. Subsequently, the reconstructed manufacturing technique was experimentally simulated.

This article will, consecutively, pay attention to the acquirement of the lekythos by the Netherlands National Museum of Antiquities, the current applied methods of restoration and the aspects of the manufacturing technique, which were discovered during the technical reconstruction experiments.

The acquisition (R.B.H)

In May of the year 1887 Conrad Leemans, director of the National Museum of Antiquities, added a new acquisition to the inventory book. The object was a white-ground lekythos dating to the fifth century B.C. Leemans described the vessel as follows:

Figure 3. Dr. Jan Six Esq. (1857-1926).

> *Embalming vessel (lekythos), broken in many pieces, but restored. Neck, handle, belly and base black, on yellow-red ground, the remaining black contours on white ground. The front shows a cippus on a platform consisting of three receding pedestals. On the right a boy, completely naked with an outstretched right arm, holding two long poles in the left hand resting against the left shoulder. On the other side of the cippus, a boy with the remnants of a cloak over his neck and right shoulder, the right hand and arm stretched slantingly towards the stele. Above this representation a line of meanders.*[2]

Together with the above-described vessel two other ancient Greek objects had been bought for the museum: an almost identical lekythos and an Attic-Geometric pyxis with a lid, having two little horses as handles.[3] The antiquities were bought in Athens by the mediation of a young classical scholar, archaeologist and art historian from Amsterdam, Dr. Jan Six Esq. (1857-1926) (Figure 3).[4]

Jan Six belonged to a well-known family of regents from Amsterdam with a long-standing tradition of collecting and protecting the arts. Six's wide interest in the field of antiquity, aesthetics and art history brought him into contact with professors at different universities in the field, even while he was still a student. He studied classical languages in Amsterdam and took courses in the Academy of Expressive Arts. He continued his studies in Classical Archaeology in Bonn where he took courses given by famous German archaeologists. In 1889 he received a position at the University of Amsterdam as lecturer in Classical Art History. A year later he became professor in General Art History at the National Academy of Expressive Arts. From a classical-archaeologist he gradually developed into an art historian. In 1896 he became professor extraordinary of Aesthetics and Art History, being the successor of Dr. Allard Pierson; an appointment, which turned into a regular professorship in 1917. In the field of classical archaeology his accomplishments were mainly focused on the identification of antique portraits, the composition of statue groups in Greek temple pediments and in studies related to the polychrome vessel-painting technique, which was named after him and is internationally known as the 'Six-technique'.[5]

After finishing his studies in 1886, Six decided to travel to Greece to acquaint himself with the Greek art he admired so much. He travelled via Belgium and France to Marseille where he took a boat to Athens. It is remarkable that, being such an admirer of Greek aesthetics, he totally ignored Rome and Italy on this *grand tour*. From Athens, on January 29, 1887, he wrote a letter to Willem Pleyte, curator of the Egyptian department of the National Museum of Antiquities in Leiden. Pleyte handed the letter, which mentioned the possibility of the acquirement of antiquities, to his director Conrad Leemans. The latter replied on February 7, 1887. Leemans showed an interest in a bronze hydria, a geometrical pyxis and the two lekythoi, conditioning that they could be bought for a reasonable price. One month later, Six wrote from Athens that, unfortunately, the bronze hydria had already been sold. He had acquired the pyxis and the lekythoi for Leiden, but a more important artefact had appeared on the market: a marble statue of *Venus Genetrix,* a Roman replica of the Greek original by the artist Kallimachos. Of the latter he added a sketch. Leemans hurriedly replied commissioning him to buy this statue for Leiden. Unfortunately, the letter never reached Six. On April 14, 1887 he wrote to Leemans from Amsterdam:

> Owing to the sickness of my mother I was forced to return from my journey. Therefore, I have only just received your letter and am unable to comply.[6]

Six's mother died on June 18, 1887. The short mission of Six as an art agent in Athens on behalf of the National Museum of Antiquities ended here. However, at the handing over of the three artefacts of Greek pottery, including the lekythos this article deals with, he came with a pleasant surprise. From his personal collection he donated three archaic terracotta idols to the museum. These were gratefully accepted by Leemans for the Leiden collection.[7]

The conservation (R.D.)

Remarkable about the lekythos is its spotty appearance. This is mainly due to the fact that the lekythos, which consists of many sherds, was fired secondarily. Probable is that the lekythos was fired again in antiquity, after it had been broken, thus refiring a part of the sherds in a reduced atmosphere. The iron-rich, orange-coloured sherds fired grey. In addition, the white slip layer on the belly and the shoulder of the lekythos partly turned grey. Also, the white slip layer over the whole surface of the jar was damaged. The scratches and abrasion spots are clearly visible due to their light colour. On a few places, the white slip layer is almost completely gone and the sherd underneath is visible, fired to a dark colour. Black spots are visible on the white slip layer, possibly as a result of manganese or iron in the original soil conditions of the lekythos (see Abramitis and Barnes 1999). On a few places pieces of charcoal stick to the surface, probably being the remains of the secondary firing process. The base, the lower part of the belly, the neck, the mouth and the handle of the lekythos are covered with a black, shiny slip layer. Most of this layer is eroded away to the surface of the sherd.

The lekythos was restored previously, but of this restoration, which presumably took place a long time ago, no report existed. However, the assumption is that this restoration took place in the 19th or early 20th century. In those days animal glues, i.e., bone glue or skin glue, were often used to mend broken pottery. These glues become brittle after a certain period and lose their gluing characteristics. From the inspection of the lekythos it became obvious that the joints were no longer up to standard. Also, the applied glue had coloured dark making the ancient repairs very apparent. This was the inducement to restore the lekythos again.

During the first restoration mistakes had been made when the sherds were mended. Consequently, the joints did not fit precisely. The changes in level and the remaining fracture lines in the object had been filled in with filler based on chalk (calcium carbonate) and a binding agent, which in this case probably was an animal glue. Subsequently, these additions were retouched, whereby the original surface of the jar was partly overpainted.

Due to the fact that animal glue swells up in water, it was relatively easy to remove the filler from the fracture lines by wetting them using a paint brush dipped in distilled water. In order to protect the fragile white slip layer, hardly any water was used here. Subsequently, it was possible to remove the glue, which had been used during the previous restoration, via the joints using the same method. After the glue had swollen up sufficiently it was possible to take the sherds of the lekythos apart (Figure 4). The remaining glue on the joints was then removed using cotton buds and distilled water. The paint remains on the vulnerable white-grounded surface were removed by rolling cotton buds dipped in acetone. At the rims of a few sherds the surface underneath the paint layer was damaged. The white slip layer showed signs of abrasion on these spots and was lighter in colour.

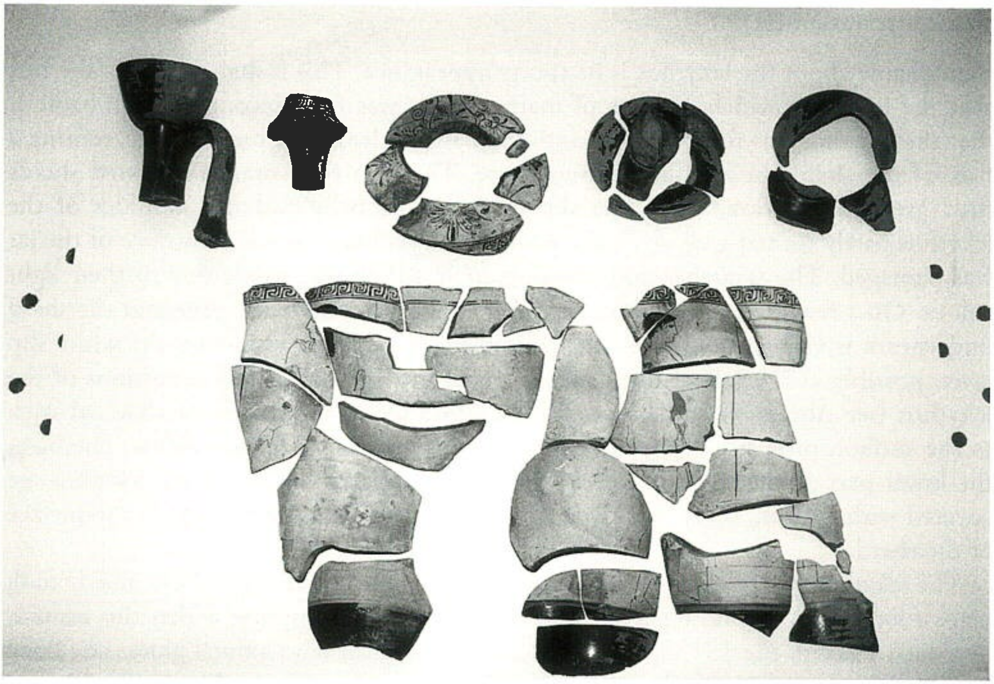

Figure 4. The lekythos taken apart during the restoration in 1999.

The sherds were glued together again using *Paraloid B72*[8], in a solution of 50% in acetone. *Paraloid* is glue developed especially for conservation purposes, and has excellent aging characteristics. Research has shown that *Paraloid* retains its binding force over a long period of time and does not turn yellow. In addition, the glue is reversible, i.e., it is easily removable using acetone.

The joints between the sherds were filled in with *Modostuc*, a filler based on calcium carbonate, calcium-carbonate silicate, barium sulphate, PVAC and a softening agent. The *Modustuc* was mixed with dry pigments to obtain the colour of the surface of the lekythos. Where necessary these additions were retouched, using Golden acrylic paint.

Owing to its spotty surface it was difficult to find a colour that would produce a good transition between the differently-coloured sherds. Eventually, in the case of the additions it was decided to work towards the colour of one of the adjoining sherds. No attempt was made to create a smooth transition between the sherds. This way, the individually, differently-coloured sherds are still visible in the surface. The many superficial damages in the white slip layer of the lekythos caused an extra problem during the filling in and the retouches. Most of these damages run along the joints making them very apparent next to the additions. It was, however, not possible to camouflage them, because retouching (by principle) is only done on top of the added parts, and the original surface is left alone. Additions to the original surface can create stains, which are difficult to remove. Also, the original appearance of the lekythos would be hidden from sight. The missing parts of the decoration were retouched using Golden acrylic paint on the additions, but only there where it was obvious how the original drawing continued originally.

The experimental reconstruction of the manufacturing technique (L.J. and A.v.A.)

The elements which became visible during the restoration of the lekythos made it possible to gain insight into the manufacturing technique. Using this insight a number of experimental reconstructions of the manufacturing technique were conducted. The aim was to enlarge our knowledge of the manufacturing technique of the lekythoi by means of practical experience.[9]

The conducted experiments had their limitations. Thus, no clays from the original production area were used. Also, the firing process, as known from Antiquity, was not used: the reconstructed lekythoi were fired in an electrical oven. Thus, the reconstructed lekythoi do not correspond completely with the original lekythos.

The manufacturing technique

As the majority of the Attic pottery, the lekythoi were made on the potter's wheel (Noble 1984: 32, 1988: 20; Scheibler 1995: 77).[10] Also, the lekythos from the museum shows all the characteristics of having been made on a potter's wheel. Since the pottery wheel used in Geek antiquity, according to Noble (1984: 32, 1988: 24,), was kept at the right speed by an assistant it was feasible to conduct the experimental reconstruction under similar conditions on an electrical wheel. The throwing of the specific shape of the lekythos in the proper dimensions and proportions was not easy. It took some time to attain a certain routine. Quite soon, it appeared that the lekythos must have been produced in parts (see also Noble 1984: 33).[11] It is quite impossible to throw a shape like this in one go. Also, traces on the museum lekythos point to this having been assembled. The phasing of the production process was delicate. The elements were produced separately and had to be joined, afterwards, quite quickly. This had to be done as soon as the clay was dry enough to be handled without resulting in deformation. The four separately produced elements were (1) the neck and mouth, (2) the body and shoulder, (3) the handle and (4) the base. Another possibility was that the base and body were thrown from one lump of clay. However, it was shown that throwing these elements separately resulted in better proportions and a thinner wall thickness.

In essence, the neck/mouth of the lekythos is a juglet. From one lump of clay a whole series of these could be produced (Figure 5).[12] The shoulder of the lekythos was created by placing the fairly dry neck/mouth in the, at that moment still open, thrown right-

Figure 5. Throwing the neck/mouth of the lekythos.

Figure 6. Placing the neck/mouth over the body.

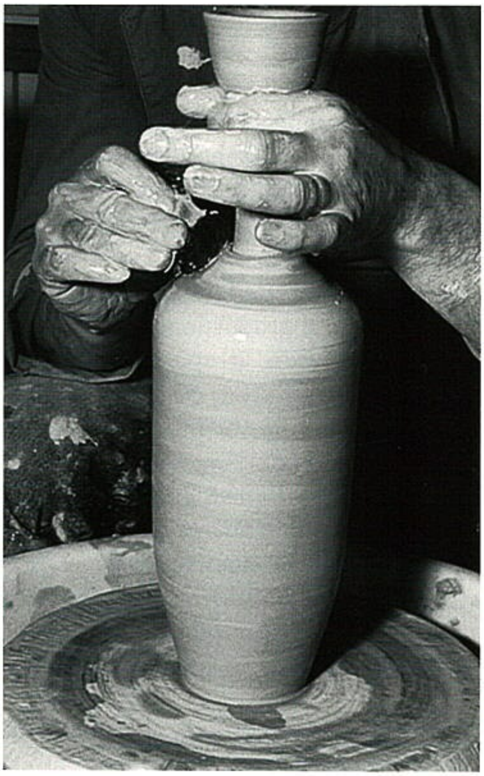

Figure 7. Connecting the neck to the body.

Figure 8. Adding a handle.

standing, cylindrical-shaped body (Figure 6). The upper part of the body was then, while throwing, narrowed, whereby eventually the neck was connected to the body (Figure 7). The then occurring friction at the joining of the static neck to the quickly rotating body was sufficiently reduced by the wet slip-rich left hand with which the neck/mouth was held. It is very important that this part of the process is dealt with in the right stage and using the right speed. The neck/mouth has to be firm enough not to deform, but not that dry resulting in cracks due to shrinkage differences at a later stage. If the potter works too slowly, too much friction will occur between the hand and the neck. Since the clay wall continuously absorbs water the neck will stick to the hand instead of slipping through it.

Subsequently, using the bent side of the rib[13] the still soft shoulder was modelled into a fairly, levelled-off surface. This produced a rather sharp bend in the profile of the wall on the lower side of the shoulder. This process is made easy, even made possible by the air trapped in the body. Once the neck/mouth is connected to the body this trapped air can no longer escape. On the other hand, even in the case of examples with a normal open neck without a reservoir, one can make use of the principle of counter pressure of trapped air, by closing the neck temporarily with a small plug of wet clay before the construction, resulting in a kind of airbag. This airbag produces counter pressure to the downwards pressure exercised by the (using the rib) shaping of the levelled surface as well as to the sudden extra weight of the neck. Without the airbag the still fairly weak clay would collapse. Off course, the trapped air was supposed to escape after the first drying stage. Otherwise, the lekythos while drying further, would explode due to the ever rising air pressure, or would explode during firing. To this end in the case of the lekythoi with a reservoir in the neck, a little hole in the shoulder was made, on an inconspicuous place behind the handle. In the case of the lekythoi with an open neck the added plug was, after some drying, removed from the neck, leaving no traces.

Finally, a handle was added (Figure 8).[14] The experiments showed that a lot of shrinkage tension originates in the handle. This is mainly due to the shape and length of the handle. When this tension builds up too high the handle will shrink loose on the top or on the bottom. By covering up the handle during the drying process or by slowing down the drying process this can be avoided, up to a certain point. Most important is that the handle is attached at an early stage, preferably immediately after the production of the neck and the body. This proves that, at a later stage during the throwing of the body, a supporting ring is necessary with room for the handle. The handle was formed using soft clay. Firstly, a reasonable amount of clay was made homogeneous by kneading and then made into a roll. This is important, since otherwise it is no longer possible afterwards to pull a completely-round strip from the clay. The, held on one side, clay roll was pulled longer and thinner by making a milking movement with the other hand. In other words, the handle was rolled and pulled. Subsequently, the soft clay strips were bend in the desired shape and laid down on a clean surface to dry a little, thus partly shrinking. As soon as the handles were stiffened they were cut of at the right size. Next, the thick part

Figure 9. The application of a slip layer

Figure 10. Reducing the wall thickness.

Figure 11. Attaching the base.

of the handle was stuck to the lower part of the shoulder and the thinner part was stuck along the neck of the still soft jug.

After the application of a slip layer (Figure 9) this part was now ready to be turned around in a supporting ring after which the body could be trimmed thus reducing the wall thickness (Figure 10). Finally, an earlier produced base was attached (Figure 11).

The reconstruction experiments have shown that the base and the lower part of the body could not have been finished off in an upside-down position while throwing. The leather-dry lekythos would have to have been placed on the wheel supported by its neck and rim. For this, the diameter of the mouth is too small and the overall construction too fragile and instable. However, it is possible to place the jug upside down in a supporting ring. But then the handle is in the way, unless one makes room for it in the supporting ring (Figure 12). Anyway, no traces of the use of the supporting ring were found on the shoulder. Even if this technique had left its traces, they would have disappeared due to the later finishing off of the lekythos.

Opposed to the above-given reconstruction of the manufacturing technique of the lekythos from the National Museum of Antiquities, Noble (1988: 66) suggests that the body and foot were thrown together, the shoulder and neck as a separate piece, and the mouth also as a separate piece. All three sections were turned individually, then joined and turned together. In our example no traces of the joint between the shoulder and neck were discovered on the interior (Figure 13).[15] That the bowl-shaped mouth was added separately seems most unlikely; more so because both this lekythos shows no signs of this on the interior, nor do the fragments of the other lekythoi from the National Museum of Antiquities show any signs of this on the exterior. The traces of wrenching of the constriction are, only just, visibly continuing on the interior. In addition, the throwing and connecting of such small items is rather finicky work. Therefore, potters will only use this method if there is no other way. Considering the latter it is more likely that the bowl-shaped part of the neck was thrown simultaneously with the neck itself.

The white slip layer

Since decoration can only be applied to completely even, smooth surfaces, during the experiments use was made of a sharp, metal rib during the last stage of the throwing process. In order to smooth the surface even more a slippery piece of leather was held against the turning surface. Next, a white slip layer was applied. It appeared that the slip layer had to be very fine in order to be able to draw or paint on it. This can be achieved by deflocculation[16] and selection of the finest clay particles by means of levigation. By dipping the complete vessel in a bowl of clay slip a very regular white surface was attained. A problem occurring was that the strong suctioning surface absorbs the fluid from the clay slip quickly thereby weakening the relatively thin clay wall. Partly owing to the high shape and the sharp-profiled wall of the lekythoi this would easily have resulted in sagging of the dipped vessels. Another method is by using a brush to apply the slip on the rotating surface (Figure 14). The latter showed good results. The chance of sagging was much less, if not absent. Therefore, one can conclude that this was probably the method used in Antiquity. By polishing the slip layer, when leather-dry, using a piece of agate or another hard, smooth object a light eggshell gloss was achieved. Only now the lekythos was ready, after further drying, to be decorated.

Figure 12. A supporting ring without room for the handle.

Figure 13. No traces of a joint between shoulder and neck.

Figure 14. Applying a white slip layer using a brush.

The decoration

Remarkable about the decoration of the lekythos are the fine lines and detailed way in which the figure on the belly and the decoration on the shoulder are represented. Noteworthy is how thin and straight the lines around the bottom and the shoulder of the lekythos were applied using a paint brush (Figure 15).[17] One can only have achieved this result if the vessel was turning rather fast and was well centred. To avoid the occurrence of a too dry or an interrupted lining the suction force of the surface was not allowed to be strong. Therefore, care was taken that the porosity of the surface was small. Thus, the painting was done while the surface was still not complete dry. The meander motifs on the shoulder were applied by hand, using a brush or reed stick. Possibly, these concurred with the palmet motifs on the shoulder and were executed by the potter. In this part of the vessel the brushstrokes are often somewhat coarser and more mechanic, while the firing colour of the "black" often differs slightly from the "black" of the figures. In addition, in contrast to the figurative elements this constantly deals with similar motifs. The latter therefore are ideal to be applied in a more mechanic way. Consecutively, the vessels would have been decorated further by specialized vessel painters. After the application of the drawing, specific parts and larger items were filled in by hand using a broader brush. A drawback of the applied way of decoration was that the vessels, in this stage, were still very vulnerably, acquiring extremely delicate handling. Correct timing and a proper sequence were vital during the whole of the production- and decoration process. Since there were no means of correction, the painting had to be applied correctly in one go. To achieve this, usually a sketch was made using a lead or graphite pen (Noble 1988).

Figure 15. Decorating lines using a paint rush.

The firing process

Due to the want of a suitable oven the original firing process was not part of the experiments. Despite this, a lot is known concerning the firing of Attic Ware (Noble 1988, 1984: 31-41; Scheibler 1995; Schreiber 1999). In order to complete the story of the manufacturing technique of the lekythos a few remarks are made on the firing process. The latter is not based on personal experience but on well-known literature.

Kilns in Greece were mostly updraught kilns were wood or charcoal was used as firing material. The height of the kilns could have been up to two or three meters, depending on the size of production of the potter's workshop. The foundation of the kiln was consisted of stones, which were sealed with clay. The larger part of the kiln was presumably built with mud bricks, whereby the gaps were carefully sealed. Only after the first firing process the mud bricks on the interior are fired and the oven became durable. The filling process of the kiln was a precise job, so that all the objects would be heated equally. Where possible, the open forms were stacked, and in between the vessels distance keepers of fired clay, i.e., sherds, were placed to acquire space. As soon as the kiln was filled the door opening was sealed and the firing could begin. In a gradual fashion, the temperature was brought up to circa 950° to 1000°C. Consecutively producing an oxidizing, a reducing and a re-oxidizing atmosphere, whereby oxygen was either introduced into the kiln or shut out. The well-known black- and red-figured ware from the Classical period owns its black-coloured, shining slip layer and decoration to this firing process. In a reducing atmosphere, i.e., oxygen-poor conditions, carbon monoxide (CO) develops owing to the burning of wood, which was used as fuel to fire the kiln. This smoke gas is keen on oxygen and withdraws oxygen from the iron oxide (Fe_2O_3) present in the clay and in the clay slip. Owing to the latter, the triple iron oxide changes from red to black, because it converts to iron monoxide (FeO). The oxygen withdrawn from the iron binds itself to the surplus of carbon resulting in carbonic-acid gas (CO_2). Once the kiln is at its highest temperature the fine, iron-rich slip layer turns to glass. The very small particle size of the elements enhances this process. The thus created black iron oxide behaves as a flux. With the melting of the black iron oxide with silica oxide a black glaze layer is developed which will not transmit oxygen, and in the subsequent oxidizing phase will not discolour back to its original, orange-red colour. The parts of the vessel, which were not covered with clay slip, where the sherd has contained a more open structure, will return to their orange-red colour. The latter results from the reaction between the already-present iron in the clay with the oxygen during the last, oxidizing phase of the firing process. In these sections the iron and silica levels are lower than in the slip-painted sections and also, the particles are coarser. Due to a combination of these factors the unpainted sections of the vessel are not turned to glass during the firing process.

The white-ground lekythos is decorated on the white ground with the same iron-containing slip as described above. During the firing process this decoration, also, turns dark brown or black. The white ground of these lekythoi is made of a pure, primary clay type, that contains none or hardly any iron. Therefore, this white slip layer regains its white colour during the firing process.

Concluding remarks

The, in 1887 acquired, lekythos via the mediation of the Amsterdam professor Jan Six by the Netherlands National Museum of Antiquities (Leiden) was restored for the second time in 1999. During this process the lekythos was taken apart at the old joints making the study of the manufacturing technique possible. Based on this the Ceramic Laboratory of the Leiden Faculty of Archaeology was able to conduct an experimental reconstruction

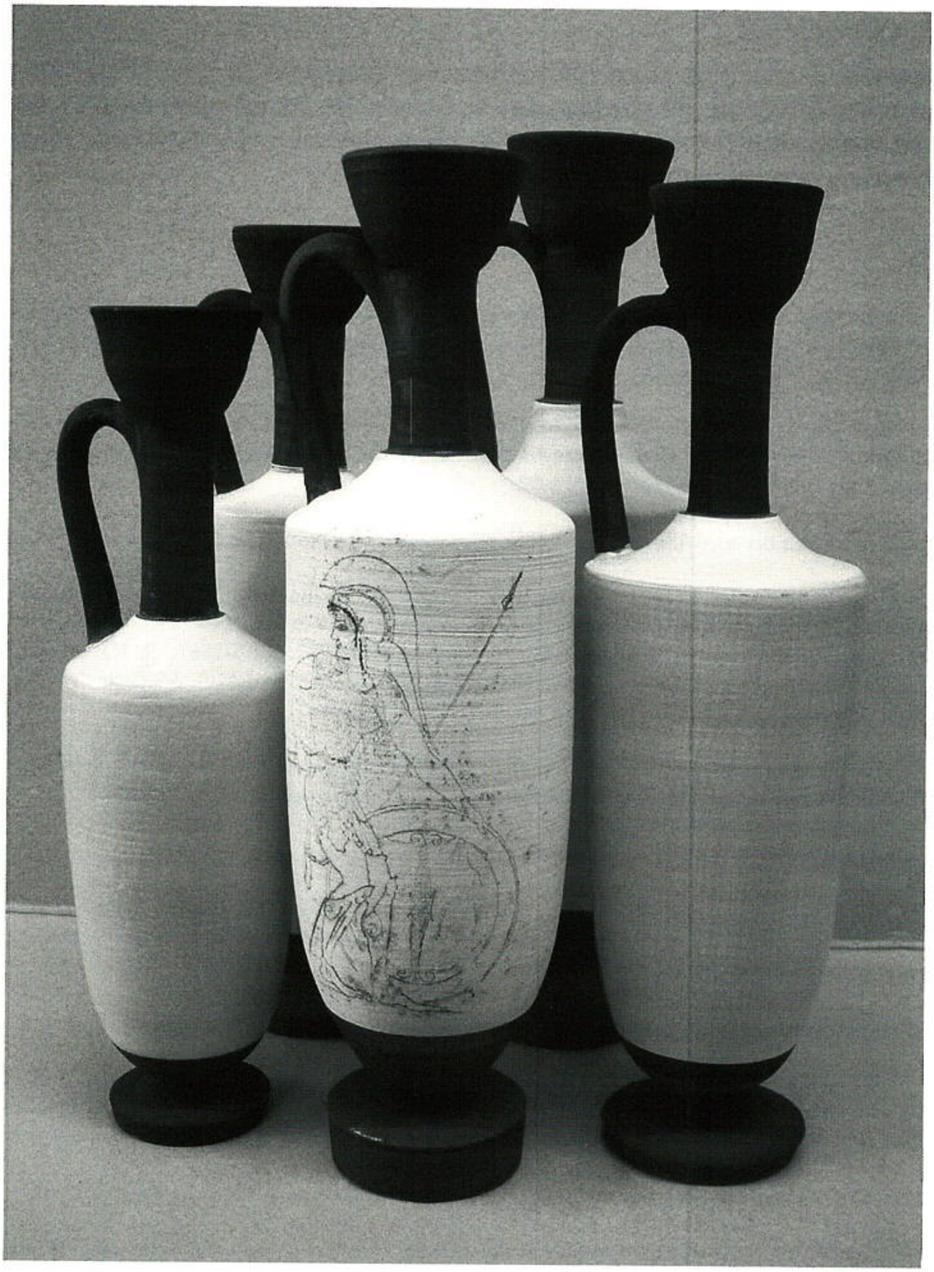

Figure 16. Experimental reconstructed lekythoi.

of the original manufacturing technique (Figure 16). This showed that the used manufacturing technique in detail differs from the one Noble (1988) described.

Acknowledgements

The authors wish to thank Peter Jan Bomhof, photographer of the Netherlands National Museum of Antiquities for providing figures 1 and 4. We are indebted to the University Museum Amsterdam for a portrait of Jan Six (Figure 1). Finally, we wish to thank Monique Vilders for the translation.

Note

1. For the various aspects of white-ground lekythoi we refer the reader to the following selection of literature: Boardman 1991; Folsom 1975; Noble 1965, 1984; Richter and Milne 1935; Scheibler 1995; Schreiber 1999; Wehgartner 1983.

2. Inventarisnummer ASx 2, Inventarisboek 14 (1887), Archief Rijksmuseum van Oudheden, 1.1/14. Published in: Holwerda, J.H., *Catalogus van het Rijksmuseum van Oudheden te Leiden: afdeeling Griekenland en Italië, I (vaatwerk),* Leiden, 1905, XVII b 22.

3. Inventory number resp. ASx 3 en ASx 1. The price paid for these three Greek vessels was 32,50 Florins.

4. For the life and woks of Esq. Dr. Jan Six we refer the reader to: Boissevain, U.Ph., Levensbericht van Jhr.Dr. Jan Six, *Jaarboek Koninklijke Nederlandsche Akademie van Wetenschappen (1928-29),* Amsterdam 1929, 1-68. Brieven van Six aan Leemans: 16-3-1887; 14-4-1887; 17-5-1887, RMO, Briefarchief, 17.1.2/33. Brieven van Leemans aan Six: 7-2-1887; 29-3-1887; 13-5-1887, RMO, Briefarchief, 17.1.1/42. Six's first letter to Pleyte dated 29-1-1887 is not part of this collection.

5. The application of polychrome on late archaic black-varnished vessels: Six, J., Vases polychromes sur fond noir de la période archaïque, *Gazette Archéologique*, XIII, 1888, pp. 193-210; 281-299.

6. Six to Leemans, 14-4-1887, RMO, Briefarchief, 17.1.2/33.

7. Inventarory numbers: ASx 4 t/m 6. He bought the pieces in Athens, but were rumoured to have been found in Boeotia. See: Leyenaar-Plaisier, P.G., *Les terres cuites grecques et romaines, Collections of the National Museum of Antiquities at Leiden,* vol. III, Leiden, 1979, pp. 24-5, nrs. 35, 32, 34.

8. Paraloid B72 is een ethyl methacrylate co-polymere.

9. Radiographic techniques like Xeroradiography and Computer Tomography can help to understand how a vase was made (see Glanzman 1987; Koens and Jansen 1999; Vandiver 1987; Vandiver and Tumosa 1995). However, it does not give an explanation of the applied technique from a potter's point of view.

10. For a short history of the study of Greek pottery production see Stissi 2002: 12-18.

11. It is obvious that to bring the assembly of the different elements to a good end not only the separate stages of the manufacturing process had to be executed in the right order. Also, the used clay had to possess certain characteristics. The material had to be plastic enough, but on the other hand had to possess certain firmness and a low shrinkage level. These characteristics seem contradictory, but are possible owing to a clever combination, whereby it is vital that the very plastic clay contains very fine tempering material in silt fraction. The latter produces a sufficiently open structure during the drying process, thereby avoiding unequal shrinkage as much as possible, while giving the substance a bit more body during the

throwing process. Thus, the clay is not flabby and putty, but is easily formed, and the constructed shape is preserved well. Owing to the small dimensions of the silt particles the surface, especially during the finishing stage of the production, does not turn coarse. The high plasticity sees to the mutual coherence of the clay mass during the manufacturing process, making relatively thin and yet obvious curved walls possible.

12. This technique was called throwing from the hump (see Rye 1981: 75).

13. A metal, bone or wooden plate which the potter holds against the rotating clay wall, aiming to create a smooth and thin wall. Usually, the rib has a straight and a bend edge, which is either concave or convex depending on the required wall profile.

14. Yet, it was no option to attach the handle at a later stage, after the finishing off thus after a preliminary drying phase. This method would result in unacceptable large shrinkage tension resulting in the coming apart of the handle.

15. We cannot completely overrule the fact that there could have been more than one method in usage in regard to the forming process of the lekythoi, which differed in detail.

16. Deflocculation is a process whereby the occurrence of lumps in a clay/water mix was prevented by the addition of small amounts of alkaline elements such as wood ash. Once the clay particles float freely in the solution, it is very easy for the fine fractions to be separated from the coarser ones, which drop to the bottom. The separation of the different clay fractions can be produced by continuous levigation of the not yet sunken material. Depending on the clay composition one can add acid elements, such as vinegar instead to deflocculate the mixture. The behaviour of certain clay/water mixtures can best be determined experimentally. See also Hamer 1975: 96.

17. The substance with which was painted was not to be too thin, and on the other hand had to cover a wide as possible area in a short time. This was vital so one could work quickly, and be able to draw straight lines over the fast-rotating surface. Also, irregularities of the paint had to be prevented. Perhaps light oil, such as olive oil, was added as a medium.

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EXPERIMENTAL ARCHAEOLOGY AND PREHISTORIC TECHNOLOGY: NEOLITHIC POTTERY PRODUCTION IN THE DAKHLEH OASIS, SOUTH CENTRAL EGYPT

Andrew Jamieson and Ashten Warfe

Abstract

Experimental studies can offer insights into past processes that are not clearly visible in the archaeological record. This article reports on an experiment in reproducing Neolithic pottery during the 2002/2003 archaeological field season of the Dakhleh Oasis Project in south central Egypt. One important objective was to replicate each stage of production in keeping with the materials used by, and the constraints imposed on the early potters. The available evidence suggests that the present geomorphological and environmental setting of the Dakhleh Oasis is similar to that of antiquity, including the prehistoric period.

Introduction

The Dakhleh Oasis is situated in south central Egypt (Figure 1). Since the beginning of the archaeological Dakhleh Oasis Project the study of the ancient pottery has formed a major research objective. It has been reported that in the Oasis ceramic production appears to have been relatively continuous since the earliest times (Edwards and Hope 1987; Hope 1999, 2002). Hope notes that the earliest pottery dates from the Epipalaeolithic Period (ca. 8000 B.C.) and finds have been made which enable a sequence to be developed, albeit an interrupted one, extending into the Islamic Period. It is suggested by Hope, therefore, that it is possible to study the manufacture of pottery and its use in the Oasis for a time span of at least 8000 years. Whilst the Pharaonic and later periods are relatively well known, the pottery from the prehistoric periods is less widely understood (Hope 2002).

The experiment described in this article is intended to compliment a detailed study of the archaeological ceramic material from the Neolithic period in the Dakhleh Oasis. The primary aim of the experiment is to produce material that bears the hallmarks of the Neolithic pottery, using traditional manufacturing techniques and local resources. Secondary objectives include recording the labour and time costs involved in each stage of manufacture, the availability of resources and the impact of environmental conditions on the pottery producing process.

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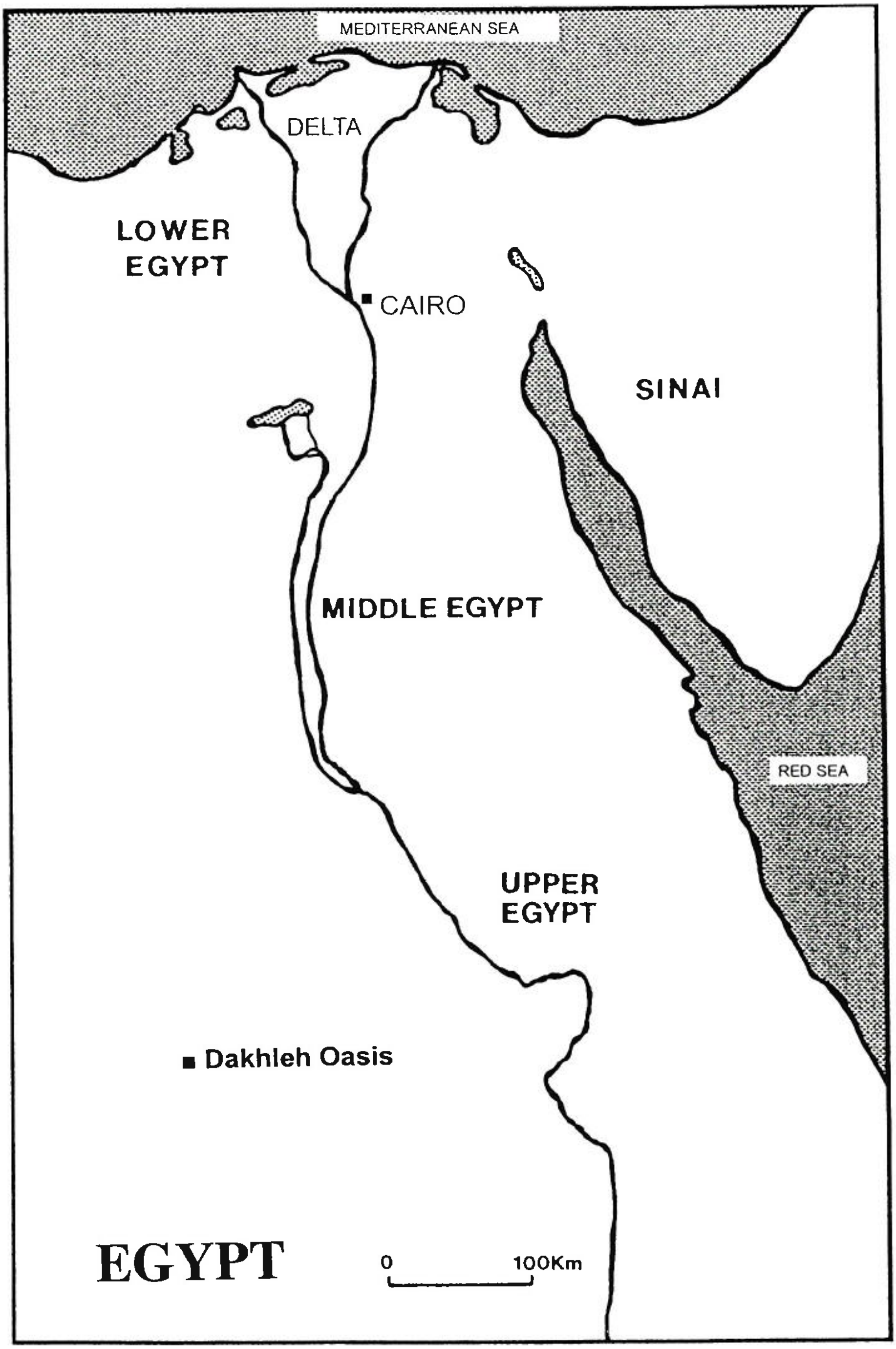

Figure 1. Map of Egypt.

Epipalaeolithic and Neolithic pottery in the Oasis

The majority of the prehistoric pottery thus far discovered in the Dakhleh Oasis is essentially crude, characterised by coarse fabrics, uneven and thick walls, and rough, heavily textured surfaces. However, some finer examples do exist. These later items are made of finer fabrics, thin and even walls and well-finished smooth surfaces. This variation is not a reflection of different potters' capabilities and it is more likely that the cruder material was designed and manufactured to serve particular utilitarian needs while a different set of priorities explains the production of the finer wares.

The Epipalaeolithic Period in the Dakhleh Oasis has been termed the Masara Cultural Unit; the Neolithic Period has been divided into two units: the Bashendi Cultural Unit and the Sheikh Muftah Cultural Unit, the former probably being the earlier of the two (McDonald 1998). The range of fabrics from the Bashendi Cultural Unit is quite diverse, but generally the sherds contain differing proportions of sand and fine to coarse shale (Eccleston 2002; Hope 2002). Some sherds are also straw tempered. Most vessels appear to have been coil-built. The pottery of the Sheikh Muftah Unit represents a clear tradition of handmade wares, either modelled from a single piece of clay in the case of the smaller vessels, or coil-built in the case of the larger forms.

The local clay deposits that were exploited during prehistoric times provided the potters with an iron-rich body containing a high percentage of tempering material, predominantly in the form of shale and sand. While some of these clays may have been treated to remove the larger inclusions, most of the fabrics distinguished among the Sheikh Muftah Unit material, for example, appear to contain deliberately abundant non-plastic temper.

Experiment

The experiment reproducing Neolithic pottery was conducted over a period of nine days (in December 2002) during which time clay was collected, prepared, manufactured and fired. The experiment was executed at the expedition dig house based at Ain Gundi, near Mut the capital of the Dakhleh Oasis. For convenience, the experiment is divided here into three main stages: clay collection and preparation, the construction and drying of objects, and the firing process.

Clay collection and preparation

Clay occurs readily in many parts of the Oasis and has been exploited by potters in the area for thousands of years, and is still exploited by modern potters (Henein 1997, see also Jamieson 2000). The most commonly occurring clays are iron bearing silts. Marl clays are also represented but are used less frequently.

Recent building activities in the immediate vicinity of the expedition house resulted in the disturbance of below ground levels exposing abundant clay deposits (Figure 2).

Figure 2. Clay deposits at Ain Gundi in the Dakhleh Oasis.

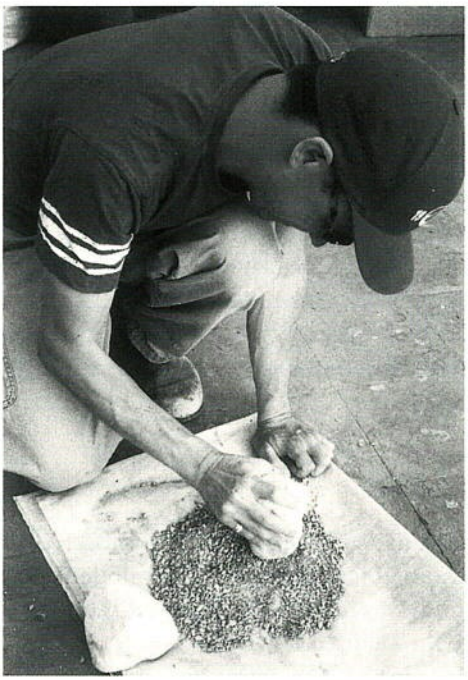

Figure 3. Crushing dry clay using stone implements.

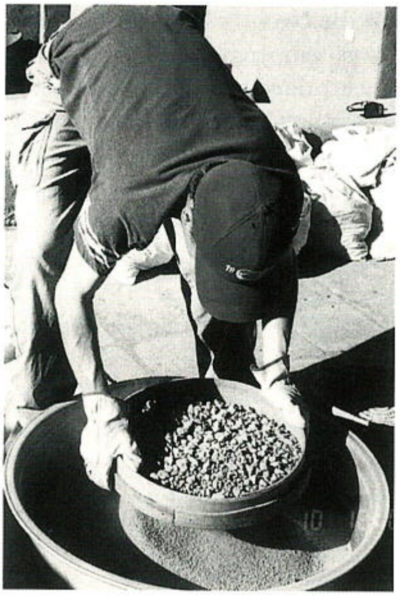

Figure 4. Sieving crushed clay.

Figure 5. Mixing clay.

This clay was a grey to green colour (7.5YR 5/2-6/2), a dry consistency and occurred in a semi hard to hard state. It appeared to be free of extraneous material. A sample was collected (approximately 22 kg) and approximately half was prepared for tests in reproducing Neolithic pottery objects.

The dry clay was broken down into smaller pieces and then crushed using stones and large chunks of dry clay (Figure 3). This process required considerable stamina and took approximately one hour and 30 minutes. Once crushed, the ground clay was placed through a sieve and the larger pieces were again pulverised until small enough to pass through the sieve (Figure 4). Water was then mixed with the crushed clay. Enough liquid was added to form a plastic paste (about 5500 ml). The dry material quickly absorbed the water and became pliable (Figure 5). It was also observed that once the water was added the mixture omitted a distinct damp, clay-like odour. The clay was then placed in the shade to mature overnight. Whilst it is unknown how long clay was rested in antiquity local potters working at Qasr, located at the southern end of the Dahkleh Oasis, prepare and throw clay within relatively short periods of time (Henein 1997).

While the clay was resting a series of different tempering agents were collected to add to the newly prepared clay. It was decided to use a variety of tempering agents in order to assess the effects of these materials on the texture and appearance of the clay.

The clay was divided into six portions, each weighing approximately 1.8 kg and assigned a roman numeral to which the different kinds and quantities of temper were added. The additives were mixed by hand kneading the clay until evenly distributed. Six different fabrics (I-VI) or wares were prepared based on the Neolithic examples. Fabric I was tempered with fine to medium shale. Fabric II was tempered with coarse shale. Fabric III was tempered with coarse straw. To Fabric IV was added fine to medium sand. Fabric V was tempered with crushed fired clay or grog. No temper was added to Fabric VI. All the tempering agents were easily available and gathered from the immediate area. For example: sand is readily occurring and abundant in the oasis; straw is used widely in many of the villages of Dahkleh and commonly added to mud bricks as a strengthening agent; shale deposits, characterised by greenish bands in the landscape and often associated with limestone caps, is also widely available (Kleindienst et al. 1999); and grog or crushed fired clay, coarse in texture, was easily obtainable from fragments of broken and discarded pottery.

It was observed that these different materials altered the texture and workability of the clay. However, as it turned out after the inclusions were added the clay was not as malleable as was hoped and around 300 gm of sand was added to each of the six samples, including Fabric VI, to enhance the texture and workability of the clay.

Construction and drying

All the Neolithic pottery recovered from Dahkleh is handmade. Most Neolithic pots are characterised by simple conical/hemispherical shapes. They commonly have rounded bases. The rims tend to be direct and may be rounded or taper slightly. Decoration is not common but many vessels have well finished surfaces that are wet-smoothed or self-slipped, or compacted to some degree.

Pinch and coil methods are thought to have been the main techniques used for production during the prehistoric period. Therefore, simple handmade methods of manufacture were used to replicate the vessels in this experiment. No tools were used and shapes were kept deliberately simple.

The construction of the vessels took place over two days and the drying process also took a few days. Two test bars of each fabric were made and incised with 10 cm scales to measure shrinkage of the different fabrics. In all, 12 rectangular-shaped test bars or 'briquettes', 19 vessels and one perforated disc were made: it is not sure what function the discs served, even though they are common on prehistoric sites across the region (Gatto 2002; Hope 2002; Riemer and Kuper 2000).

It was interesting to note that some fabrics performed better than others in the vessel manufacturing process. For instance, the grog-tempered fabric (V) was the easiest to form, though it tended not to hold its shape, dried rapidly and the clay appeared to become fatigued as it dried at a faster rate than the other fabrics. Fabric III, tempered with straw, was also particularly hard on the hands, though this may not have been a concern for the prehistoric potters. It was observed that the sand and fine shale tempered fabrics (I and IV) appeared to provide the best balance of workability and strength.

An additional insight gained from this exercise was how the environment can influence the construction process. For instance, it was observed that the ideal time to construct

Figure 6. Drying handmade pinch and coil-built pots.

vessels, in the open at least, was from mid-morning to early afternoon. In the early morning and the evening the clay was cold and less malleable and therefore more difficult to work. In the late afternoon the sun and wind would dry the clay at a faster rate than desired making production difficult. In some instances exposure to the sun of an unfinished pot was useful, accelerating the drying of the vessel increasing its strength so that additional coils could be added without causing a distortion of the vessel shape. In short, environmental conditions could be exploited or avoided depending on the potter's interests and priorities during the manufacturing process.

The finished pots were placed initially in the shade and once leather-hard kept in the sun to dry completely (Figure 6). It was noted that after a 24 hour period the test bars had shrunk by five percent, 48 hours later a further five percent shrinkage was noted, after which point there was no shrinkage.

Firing Process

The fuel for the firing was collected within a 150m radius of the expedition house. This included whatever natural sources were available and combustible, such as donkey dung,

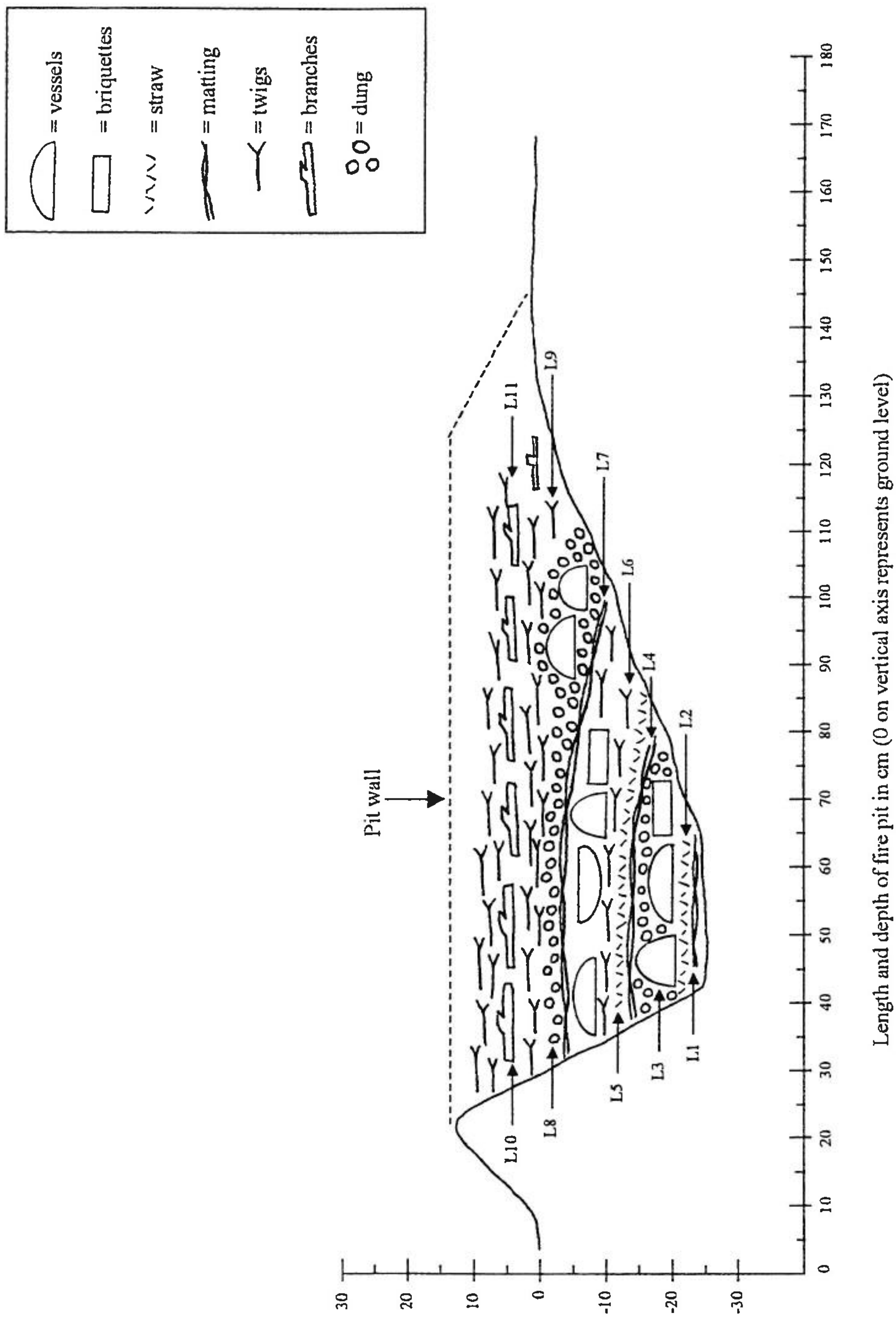

Figure 7. Schematic sketch of the fire pit.

straw, palm matting, and twigs and branches from Tamarix and Acacia. All these materials, except for the donkey dung and straw are known to have existed in the Oasis during the prehistoric period. While there is no evidence for grasses in the archaeobotanical record there could be several alternatives that the Neolithic potters used. Likewise, if donkeys were not yet introduced into the Oasis, there were a range of other animals that produced dung. Overall, an estimated 50 kg of fuel was collected.

It is generally assumed that most Neolithic pottery was open or pit fired (for distinction see Nicholson 1993: 108). As yet no kilns structures have been recorded on prehistoric sites in the Oasis. It is suggested, however, that 'proto-kilns' may have been used, which have since disappeared from the archaeological record. A proto-kiln is conceived as a pit in which both vessels and fuel are stacked together and on top of which dung is heaped to retain sufficiently high temperatures (Edwards and Hope 1987: 4).

For this experiment an open area in front of the expedition house was cleared for the fire pit (Figure 7). A shallow depression was formed in the sand measuring approximately 120 cm in length, 95 cm in diameter and 25 cm deep. The pit sloped towards the base and a narrow opening was formed at the opposite end. A low wall or embankment was formed around the edge of the pit. The orientation of the pit, as well as its shape, was designed to capture and maximise the prevailing wind that is common in the late afternoon at this time of the year in the Oasis. By channelling the wind into the pit it was hoped to be able to increase the firing temperature and also control excess smoke produced during the initial stages of the firing.

Some of the dry pots and test bars were placed on a layer of straw and palm fibre matting at the base of the pit. Generally, larger and heavier vessels were placed at the bottom of the pit with smaller vessels placed between and above the other pots. In most instances the pots were inverted so that the vessels rested on their rims. Straw, small twigs and palm matting were stacked over the unbaked pots with larger sticks and branches then heaped on top of the pit.

The firing began in the late afternoon (around 16.00 hr) to coincide with the onset of the daily northerly winds. In the initial stages of the firing a considerable amount of fuel was used, mostly branches of Tamarix and Acacia, owing to the dry state of this material. It was estimated about 20 kg or so of fuel was placed on top of the fire during the first stages of firing (Figure 8). In an attempt to reduce the rate of combustion, the opening of the pit was reduced with surrounding sand so that the wind was prevented from channelling or fanning the flames of the fire excessively (Figure 9). After 40 minutes, most of the fast burning fuel was smouldering and had formed a canopy of ash over the fire pit. At this point, the walls of the pit were pushed inwards and the slow burning fuel (dung) was heaped on top of the fire to completely smother any remaining flames.

The pit was left to slowly smoulder over night and for the next day and a half. Whilst there were no flames and minimal smoke emanating from the pit it was possible to detect the glow of hot coals in some places and feel an intense heat radiating from the pit. Whilst no gauges were used to measure the precise firing temperature it is possible

Figure 8. Initial stages of firing.

Figure 9. Later stages of firing following the addition of animal dung.

Figure 10. Beginning to unpack the pit.

to estimate the firing range based upon the texture and hardness of the baked vessels. It was noted that the baked pots have a 'bricky' resonance when struck suggesting a firing temperature in the range of 550-750°C.

Observations

There was a low failure rate (Figures 10-13). Only two vessels that were extensively pitted and one that revealed minor fractures along coil joins. More importantly, at least for the purposes of this study, the experiment was considered successful as the vessels were found to resemble the Neolithic pots in a number of ways (Figures 14 and 15).

The reddish-brown (2.5YR 5/6-5YR 5/4) fired surface colours of the experimental vessels closely resemble the colour range of the Neolithic pots.

- Examination of the texture of the iron-rich fired clay used in the experiments appeared similar, if not the same, as that used predominantly by the early potters.
- Scratch tests conducted on the experimental pottery (2.5–3.5 *Mohs*) resembles the profile of the prehistoric examples.
- The section or core of the experimental pottery resembles most of the prehistoric pottery. The same firing patterns and colouration occur.

Figure 11. Fired pots.

The only difference that might be noted is the inclusions. In the case of Fabric V the grog particles look nothing like the temper found in the Neolithic pottery. Likewise the shale particles in the shale-tempered Fabrics I and II do not resemble the prehistoric pottery.

An unexpected but important finding resulting from this experiment related to the firing pit. Archaeologists frequently encounter ash lenses and remains of firing pits. Frequently these are interpreted as hearths used for cooking. It is quite likely that some of these features from antiquity may in fact represent the remains of pottery firing pits.

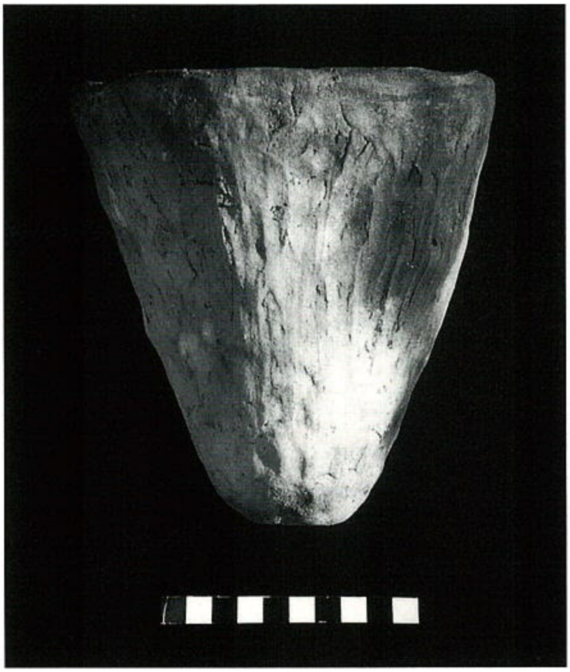

Figure 12. Fired experimental conical vessel.

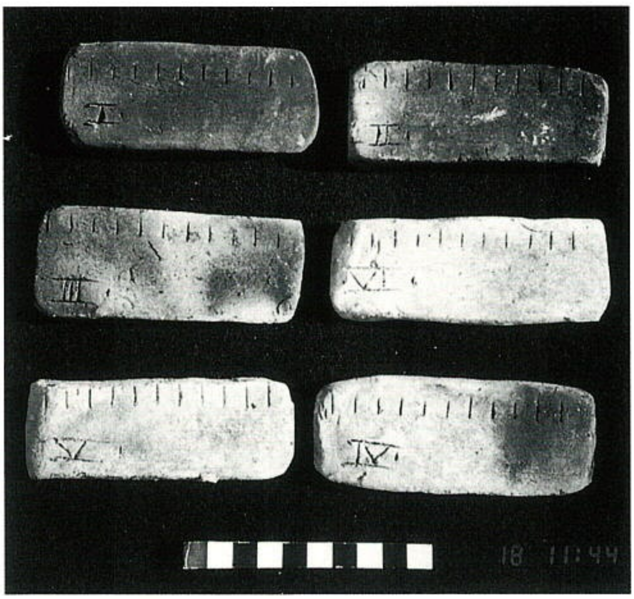

Figure 13. Fired experimental briquettes.

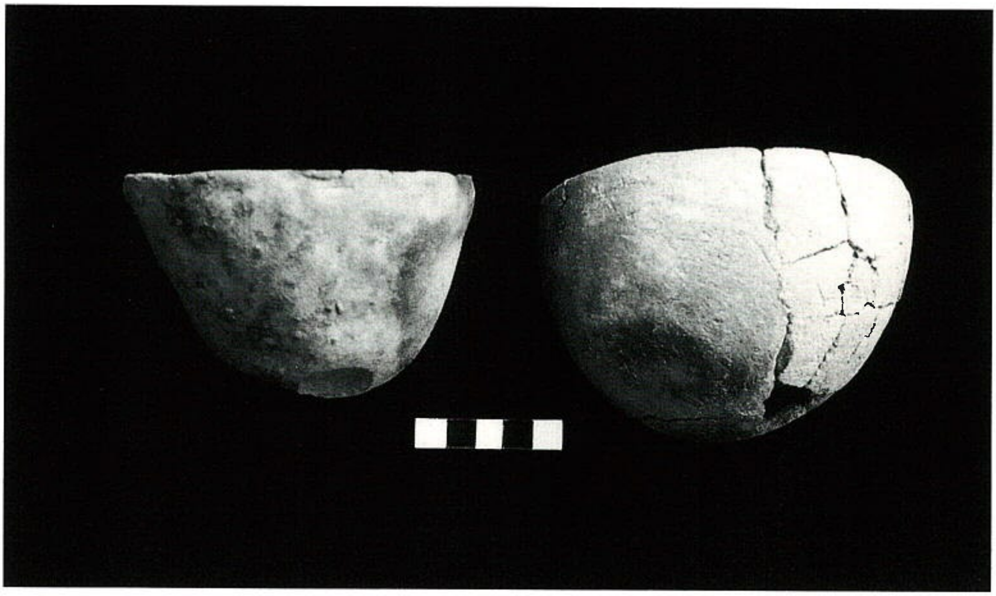

Figure 14. Fired experimental hemispherical bowl (left) and Neolithic bowl (right).

Figure 15. Fired experimental clay ring (left) and Neolithic clay ring (right).

Perhaps the most important finding resulting from this experiment is that it demonstrates that it is possible to produce pottery in one location without the need to travel long distances to collect the necessary and different resources for successful ceramic manufacture.

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ARGUMENTS FOR AND AGAINST STONE COOKING IN EARLY SIXTH MILLENNIUM B.C. SOUTHERN ROMANIA

Abraham van As, Loe Jacobs and Laurens Thissen

Abstract

This contribution deals with experiments carried out in connection with technological research on pottery belonging to the Neolithic Starčevo-Criş period (sixth millennium cal B.C.) excavated at Teleor 003 by the Southern Romania Archaeological Project (SRAP) directed by Douglass Bailey (Cardiff University) and Radian Andreescu (National Museum, Bucharest [Bucureşti]). Certain characteristics of the Starčevo-Criş cooking pots indicate the possible practice of stone cooking in the early Neolithic. In order to test the plausibility of this idea, a number of stone cooking experiments was carried out. Three vessels were made of clay dug not far from Teleor 003 on the border of the Claniţa, a tributary of the Teleorman River. In one of these vessels water was boiled both using the stone cooking method and in the normal way on a fire. The arguments for and against stone cooking are discussed.

Introduction

The Southern Romania Archaeological Project (SRAP) has been active since 1998 investigating prehistoric land-use and settlement patterns in the Teleorman River Valley in the Lower Danube Plain (Bailey et al. 1999, 2001, 2002). In this project the study of pottery manufacture (see van As et al. 2004, this volume pp. 61-68) and use plays an important role. Assuming the Starčevo-Criş society as partly mobile, or semi-sedentary, one of the major aims of the pottery studies is to understand how mobility might relate to pottery use. In this context the aim is to find answers on difficult questions like 'were cooking methods a continuation from older, previous practices, or had ceramics and new foodstuffs a major impact on ways of preparing food?' (cf. Thissen 2005). Certain characteristics of the cooking pots within the ceramic assemblage of the Neolithic Starčevo-Criş period (sixth millennium cal B.C.) excavated at Teleor 003 seem to lead to the hypothesis of the practice of stone cooking in this period of incipient pottery production. This hypothesis stimulated us to carry out a number of stone cooking experiments. Water was brought to boil by using fired clay balls and clay rings. In addition to stone heating of water, water was also normally boiled in a vessel on a fire. The stone cooking experiments were carried out using a vessel of local clay from the borders of the Claniţa River and thus the experiments could be combined with an investigation of the workability of local clay (see also van As et al 2004: 126, this volume, pp. 66-67).

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Pottery characteristics potentially indicating the practice of stone cooking

There is a dominant category of restricted, bag-shaped vessels in the Teleor 003 assemblage that we label as 'pots' (in the strict sense). All vessels belonging to this group have their exterior surfaces roughened in one way or other, which may be slashed, impressed/pinched by nail, grooved, or barbotined. The average wall thickness amounts to 9–10 mm, while mouth diameters range from 12–30 cm, but concentrate between 12 and 20 cm. Such vessels have thick, solid disk bases, which always have traces of use-wear underneath. General exterior colours are buff or brown. Interior colours usually have a darker shade than outsides, occasionally even dark brown to blackish and real black colours. The insides of the pots are covered with a diluted clay-slip and carefully burnished all-over. There are few clear traces of smudging or smoke blackening. However, some of the base interiors, though burnished, show traces of use-abrasion, where the burnish is slightly duller. The interior zones bordering this lighter-coloured centre area do show traces of smudging. Some of the base fragments have bleached interiors, and may be the result of frequent water heating and cooking. The nature of smudging on base interiors and its absence on vessel exteriors leads us to contemplate the possibility that these pots were not heated directly on an open fire. Their shape and technology make them suited for indirect moist heating with cooking stones.

The manufacture of the cooking pots

The aim of the manufacture of some experimental modern vessels was to test the workability properties of local clays. Two vessels were made that bear more or less the hallmarks of the Starčevo-Criş cooking pots. Apart from these pots one small vessel was made. The experiments took three days: two days for preparing the clay body and shaping the vessels (August 31 and September 1, 2004) and one day for firing the vessels (September 8). The period in between was barely long enough to let them thoroughly dry.

On the first day of the experiment the clay was selected in the floodplain of the Clanița River (see van As et al. this volume, Figure 1) (Figure 1). Next, the clay was prepared by

Figure 1. Clay bed selected in the floodplain of the Clanița River.

Figure 2a. Shaping pottery.

Figure 2b. Shaping pottery.

adding chopped straw and a small amount of sand. The chopped straw was coarser than the fibres observed in the Starčevo-Criş pottery (van As et al. 2004: Table 1). Later on, during the forming process it became clear that finer chopped straw would have made it easier to scrape the vessels.

The next day, three vessels were made (Figures 2a and b). From a potter's point of view the conditions were not ideal. The shaping of the pots took place in full sunlight. As a consequence, the prepared clay body dried very rapidly and became stiff during the forming process. This could have been avoided by working in the shadow or under a shelter. After rolling a number of clay coils the base was made by flattening out a piece of clay. Four coils of clay were used to make the lower part of the body. While this part

Figure 3. Transport of wood used as fuel.

was drying the clay was kneaded for the manufacture of a second vessel in the same way. As soon as the lower body of the second vessel was formed, the first vessel was dry enough to make the upper body of three more coils of clay. Next, the rim was finished and the outside body was scraped and roughened by using clay slip and a handful sand. The inside was polished. The second vessel, finished in the same way, was decorated with nail impressions. The remaining prepared clay was used to make a coiled small vessel. The shaping of the three vessels lasted ca. five and a half hours.

After a week of drying in the Teleorman County Museum in Alexandria, the vessels, clay balls and clay rings were fired in an open pit fire to a temperature of about 750°C under neutral to reducing conditions. The pit measured 1.5 x 1 m with a depth of ca. 0.5 m. Wood was used as fuel (Figure 3). The firing lasted well over six hours.

Stone cooking

The stone cooking experiment was carried out in the small vessel, one of the coiled vessels made of a straw-tempered clay that had been selected from along the Claniţa River (see above). In order to make this vessel less permeable, its wall (7 mm thick) was polished on the inside as well as on the outside. The vessel had a volume of ca. 1.5 litre and was about 20 cm high. The diameter of the mouth was ca. 15 cm.

For stability and some extra isolation to avoid a quick cooling down, the vessel was placed in sand. Next, the vessel was filled up to the rim with clear water of about 20°C. Though the vessel felt a bit damp, its porosity was so low that the water level inside didn't sink notably. Made of the same Claniţa clay, five clay-baked rings were used as heaters or cooking stones and were fired in the same pile as was the vessel. Each doughnut-shaped ring had a diameter of about 6 cm and a weight of about 90 gram. Though some rings began to show small cracks none of them actually broke and all survived the aggressive treatment of repeatedly reheating and very quick cooling. In contrast to balls the doughnut-shaped rings were very much easier to manipulate. Moreover, the chaff and sand temper improved their heat-shock resistance.

On the day of the experiment the rings were put in a small charcoal fire. At 11 a.m., with use of a stick, the first two rings were put into the cold water; there was a sizzling sound and the water became warm (Figure 4). Two or three rings were alternatively heated and put into

Figure 4. The use of clay-baked rings.

Figure 5. Boiling water by using heated clay rings.

the water. After eight cycles of this type were completed the water began to simmer at 12 o'clock. A quarter of an hour later the water boiled violently, developing many bubbles and steam (Figure 5). At the same time, about half the water in the vessel was lost, mainly because it either adhered to the porous chaff-tempered clay rings or it evaporated. A disadvantage of the method described here is that with each use the wet cooking rings need to be placed in the fire to absorb heat again. Because of this, a considerable amount of time and energy is lost. Each time a set of clay rings is changed, between five and ten minutes are needed to reheat them. During these periods the water in the vessel cools down again. Altogether, this time-consuming way of stone cooking keeps a person continuously at work. However, the amount of energy that could be stored in the clay rings was surprising.

In an attempt to bring the water to the boil faster a second experiment was undertaken. This time the clay rings were not heated by turns. Thus, five cooking rings were kept together and heated in the fire for twenty minutes. The rings were put into the cold water, which made a sizzling sound and the water was brought to boil in no more than twenty minutes and continued it to cook.

Discussion

There are arguments for and against the practice of stone cooking in the early sixth millennium B.C. in Southern Romania. The characteristics of some cooking pots may indicate that stone cooking was practised. Although experiments (see also Jones 1998) show that it is possible to bring water to boil by using heated stones or fired clay balls/rings, it seems a rather inefficient method viewed through modern spectacles. However, it is a fact that stone cooking, or indirect moist heating, has been common practice for example in American Indian contexts and it was associated with thick walled fibre-tempered vessels (cf. Braun 1983; Brown 1989; Crown and Willis 1995; Sassaman 1995). Pre-heated stones were used to boil the vessels' contents, and baked-clay objects might have been successfully used for the same purpose. In the American south-east, perforated soapstone cooking stones which were first interpreted as net sinkers are now understood as heating elements; perforations enabled the use of sticks or antlers for easy manipulation and for to transporting them from fire to pot (Sassaman 1995: 229 and figure 18.4, mentioning ethnographical examples). Given this proven capability to boil water with preheated cooking stones and baked-clay objects, we should rethink the (often perforated) baked-clay objects found within Starčevo-Criş contexts all over the Balkans and traditionally labeled as net sinkers, loom weights or even figurines, taking into account the potential use of these objects for indirect moist heating.

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THE TELL ES-SA'IDIYEH BAKING TRAY

Monique Vilders

Abstract

This article pays attention to a somewhat overlooked type of pottery vessel: the baking tray. This vessel, in small amounts, is found in Late Bronze and Iron Age (ca. 1200-600 B.C.) occupation layers in the Levant. In addition to a morphological and technological description an attempt is made to gain more insight into its function by means of a simple experiment.

Introduction

This article focuses on a specific vessel type occurring in Palestine during the Late Bronze Age and the whole of the Iron Age – the baking tray, sometimes referred to as a griddle. Largely overlooked in the archaeological literature, this low-domed vessel, somewhat resembling an inverted platter, has not received the attention it deserves. During the course of the 1985-96 British Museum's excavations at Tell es-Sa'idiyeh (Figure 1),

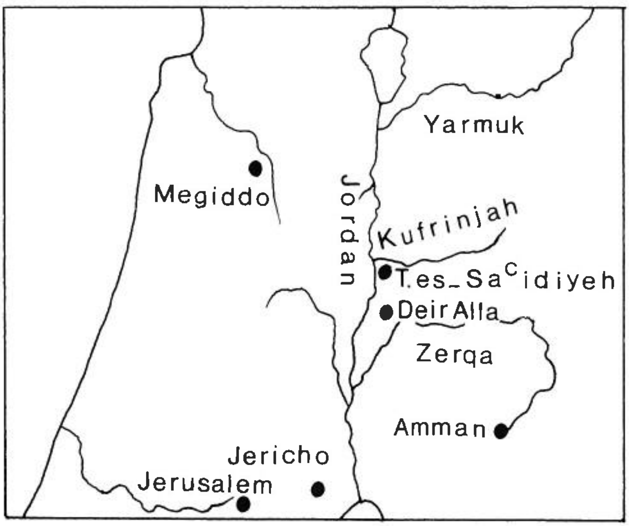

Figure 1. Location of Tell es-Sa'idiyeh.

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Figure 2. Sherds of a unique type of baking tray from Tell es-Sa'idiyeh.

nine baking tray sherds were recovered from the Late Bronze II-III and Iron Age I-II levels (Figure 2). A search for parallel vessels in the archaeological reports from Israel and Jordan produced a disappointing result: mention of them is limited to an odd drawing and in the best case two lines of text. In an attempt to stimulate interest in the baking tray, therefore, this article provides not only morphological and technological descriptions of the type, but, by means of a simple experiment, seeks to illustrate its function on the one hand and historical context on the other.

Description

Morphology

Based on a surface find from Tell es-Saʿidiyeh, in addition to published examples from Beer-Sheba (Herzog 1984, Figure 30:13), Beth-Shean (Fitzgerald 1930, Pl. XLV: 8 and 9), Jericho (Sellin and Watzinger 1913, Blatt 36: A, 48b, A, 49), Megiddo (Loud 1948, Pl. 85: 11), Samaria (Crowfoot and Kenyon 1957, Figure 28: 4 and 5), Tell en-Nasbeh (Wampler 1947, Plate 88: 2 and 3) and Tell Keisan (Briendt and Humbert 1980, Pl. 21:10; 46: 5a, 8, 8a; 52: 16; 55: 4, 5; 63: 3; 77: 6) baking trays are seen to be convex plates with a rim diameter between 24 and 34 cm, and a height somewhere between 4 to 6 cm. The wall angle of the short body is fairly straight with the rim on the same line. Published sherds from Ashdod (Dotha 1971, Figure 58: 14), Jericho (Selling and Watzinger 1913, Blatt 36: A, 48a) and Megiddo (Loud 1948, Plate 85: 10) show that they can have one or two horizontal loop handles attached to the rim or one or two vertical handles attached to the body and the rim. The Tell es-Saʿidiyeh rims are rounded, rectangular or ridged. The colour ranges between dusky red (2.5YR 4/2) and brown (7.5YR 5/4). Normally the exterior convex surface is covered with a scattering of grooves (see below).

Technology

The Tell es-Saʿidiyeh baking trays were probably made in a mould (similar to the LB and IA cooking pots from this site (Vilders 1993: 149). This would be the easiest method of manufacture considering their rather flat shape. Presumably, the mould would have been ceramic and wheel-made and would have had a diameter slightly larger than that of the tray itself. The mould would have been fixed to the potter's wheel and a slab of clay placed into it. Next, with the wheel spinning round, the clay would have been pressed firmly on to the mould's surface; throwing traces were formed on the inner surface. Nevertheless, traces of hand finishing and smoothing occur too). The next stage in the process would have been to cut the circumference to size with a needle and then finish off to produce an unprofiled rim with either a rounded, rectangular or ridged shape. The mould with the freshly formed tray in it would then have been removed from the wheel and set aside to dry. In those places where the wall was judged to have been too thick, clay would have been removed by scraping. This would have been done with the tray either rotating on the wheel or by hand. Finally, one or more concentric circles would have been drawn on the convex side, which were then filled up with lines or grooves using the point of a small stick (see below).

The ware of the Tell es-Saʿidiyeh baking trays is very similar to that used for the cooking pots from this area in the Late Bronze and Iron Age, consisting of local, iron-rich clay with calcite and organic material added. The advantage of using this type of added material is that it makes the vessel heat resistant (Vilders 1993: 150-153).

Decoration

The exterior, convex surface of the tray is always seen to be covered with a zone of grooves or small-incised lines. Most examples imply that this was done at random, but there is one, undated sherd from Tell es-Saʿidiyeh which suggests a pre-determined layout. This vessel has a design of seven concentric circles with each zone between the circles possessing a different decoration and alignment. Generally, however, the convex side can have up to eight (Loud 1948: Pl. 85: 10) evenly spaced concentric circles. The zones between the circles are filled up with grooves, and the outer circle is always ca. 10 cm from the rim.

Function

Considering that the Tell es-Saʿidiyeh baking trays were produced using the same ware as the cooking pots (see above), it would be reasonable to assume that they too were used

Figure 3. Bedouin woman in Palestine using a *saj* to bake bread (picture copied from Dalman 1935: 43).

to prepare food. For what type of food then can an upside-down shallow vessel be used to prepare?

As early as the first half of the 20th century Gustave Dalman published his impressive four-volume *Arbeit und Sitte in Palästina* in which, based on his observations of contemporary Palestinian society, he sought to illustrate biblical references to, amongst other things, the preparation of bread (Dalman 1928-1935). According to the Biblical texts[1], there were apparently three methods of preparing bread: on a heated stone (Dalman 1935: 34-38), on a baking tray (Dalman 1935: 41-45) (Figure 3) and in an oven

(Dalman 1935: 96-104)). The "modern-day" version of the baking tray is the metal *saj* (Ar)[2], a vessel which was still in use in the 1980s in the Jordan Valley (author's observation), and which, considering the mention of a "metal baking tray" in Ezekiel[3], can probably be traced back to Biblical times. It would seem probable, therefore, that the baking tray was indeed used for baking bread, but what kind of bread?[4] Furthermore, the occurrence of the grooves[5] on the ceramic baking trays requires explanation. The latter were probably multifunctional; not only do they ensure that the heat reaches all around the product, but they also prevent the dough from sticking.

Experiment

In order to answer the questions posed above, a simple experiment was devised, using a reconstructed baking tray (ø 28 cm) with one outer concentric circle (ø 23 cm) "decorated" with random grooves, a Bunsen burner as heat source and two sets of dough[6] – leavened and unleavened [7]

The Bunsen burner reached a temperature of about 850° C. In total six, unleavened loaves were baked using varying periods of baking. In all six cases the oxygen in the grooves prevented the dough from sticking to the surface of the tray. Baking the loaf for about 8 minutes and turning it halfway down gave the best result: the dough was done and the bread was crispy and tasty (Figure 4). In attempting to bake leavened bread, on

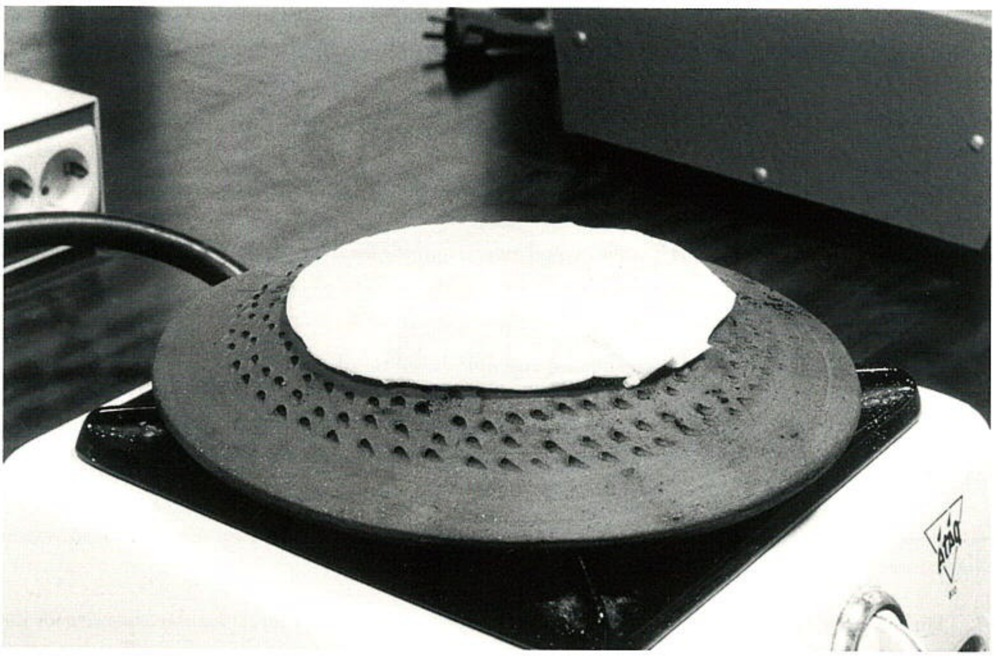

Figure 4. Experimental baking of unleavened bread.

the other hand, the dough did not mould to the tray's surface at all, and after 10 minutes it was still not done.

Conclusion

The experiment clearly demonstrates that the ceramic baking tray was specifically designed and used for baking unleavened bread. By contrast, leavened bread was produced in bread-ovens (*tabun*, *tannur* or *wagdiah* see McQuitty 1984: 259). The occurrences of such bread-ovens in the Near East during the Late Bronze and Iron Age are abundant, either in private kitchens or in conglomerations possibly indicative of bakeries. In other words, the settled population had no need for baking trays, and this might well account for the very low occurrences of such vessels in ceramic assemblages. For shepherds, nomads and travelling merchants, however, the baking tray would have made an ideal means of producing bread "on the move." In these circumstances, the vessel's loop handles might not only have been useful for have for handling while cooking, but would also have provided a convenient method of attachment while travelling.

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Note

1. Lev 2: 5; 6:21; 7:9; 26:26; Isaiah 44:19, I Kings 19:6; I Chronicles 23:29.

2. Avitsur 1975: 236: ... it is really a cheap modern replacement for the traditional baking implement, ...

3. Ezekiel 4:3: מחבת ברזל

4. The Old Testament refers to both leavened and unleavened bread.

5. During the course of this study, the Institute's draughtsman whose eldest son was training to become a baker explained to the author how croissants are baked nowadays: they are placed in the oven on large, perforated metal trays.

6. Basic dough recipe for unleavened bread: wheat flour, water and salt and for leavened bread: wheat flour, water, salt and baker's yeast.

7. For the experiment I used wheat flour because the other option: barley meal, was too expensive for the common population (Anchor Bible 1922: 462). Archaeo-botanical research in the Jordan valley shows that especially macaroni wheat and hulled barley were grown for bread (Clapham 1988: 82).

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THE RELATIONSHIP BETWEEN SUBSISTENCE AND POTTERY PRODUCTION AREAS: AN ETHNOARCHAEOLOGICAL STUDY IN JORDAN

Nabil Ali

Abstract

In this article an attempt has been made to correlate between pottery production location and subsistence strategies. Usually, the schedule of pottery production has been correlated with other different economical practices. The relation between these practices and their spatial context at the one hand and the location of pottery production on the other has not been addressed. This article evaluates such a relationship and addresses the causes that might limit our inference of pottery location at the household level.

Introduction

The identification of a given handicraft location is an important step to evaluate the different components of the organization of production. These components might include the locus of control on the craft, the constitution of production unit, and the identity of producers (Costin 2000). Archaeologically speaking, in pottery-related studies it is often difficult to find *in situ* debris or other features that can be an indication of craft location. This can be a result of the different stages of preservation of the toolkits used in the production, or is due to the evaluation of the dynamic context of a given craft context. Hence, several ethnoarchaeological studies have been conducted to correlate the dynamic context of pottery production and with the materials of the handicraft (Kramer 1985; Stark 2003). These ethnoarchaeological studies have dealt with the identification of the material correlates of two scales of pottery production. One that deals with the household as the locus of production (Arnold 1991; Deal 1998), and the second one focuses on the production of workshops (van der Kooij and Wendrich 2002; Kramer 1997). In each case, these studies show the proper criteria that can be archaeologically informative on identifying the location of pottery production. These include the presence of the raw materials (clay or pigments) employed in pottery making, the tools employed in forming (e.g., moulds and scrapers) features such as firing pits or kilns, and wasters (Deal 1998; Pool 1992; Stark 1985; Sullivian 1988). However, the limitation of these criteria has been emphasized, especially when the locus of production is the household (Deal 1988: 113). In most ethnoarchaeologically observed cases, pottery production on a

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household scale leaves little evidence of craft practices. This might be due to the continuous cleaning activity of the working area, and the nature and the limited types of tools used in pot forming.

In this article, two interrelated issues will be evaluated that might affect the identification of the pottery production area. These are the scale of production, and the relationship between production process and the socio-economic context. Usually, the schedule of pottery making, as an economical activity, has often been examined within the larger context of other activities (Arnold 1985). Moreover, several ethnoarchaeological studies reveal the correlation between the economical factors and the intensity of pottery production, e.g., part-time or full-time production. But the extent to which economical factors might effect the location of pottery production has been less evaluated. It is this correlation – the effect of subsistence strategies on pottery producing systems – that hope to be evaluated in this article. The discussion in this article is based on the gathered data from an ethnoarchaeological pottery study in northern Jordan.

Potter's identification

Data on the potter's population have been gathered from different villages (Ali in press). These villages are distributed in the northern part of Jordan, which is characterized by a mountain region intersected by several wadis (Figure 1). The number of potters at each village varies. Pottery making in these villages is a female activity. The economical base of potter's household depends largely on agriculture and animal husbandry. The scale of practice of these subsistence strategies varies between the potters. Agriculture is practiced by potters who are landowners. Non-land owners lease orchards and raise animals and work as wage-labor (collecting olives) to earn their income.

The household is the domestic and economic unit. Each household consists of a nuclear family (if the potter is a widow) or an extended family, but the latter is common. The household architectural unit varies in size and in associated features. Some potters' houses are two storeys high, others only one. They may consist of only a single room, or they may consist of many rooms. Each household is associated with an open space or courtyard where features like storage rooms, animal pens, and sometimes oven-rooms are found.

Pottery making in the visited villages in northern Jordan is a small-scale production. It is a seasonal activity conducted during the summer. The rate of pottery production is low, not exceeding 15 pots per season. Each potter produces very limited pot-functional types. These are mainly water jars and cooking pots. Secondary pot-types include bowls and craters. Middlemen are the primary pottery consumers as very few of the products are consumed locally. These middlemen usually came from two main sites: Sūf and Jerash. They transport the pots from the villages by car or pick-up. The organization of pottery production in Jordanian villages would be considered as specialized household production (Balfet 1965) or individual specialists (Costin 1991: 8). This type of pottery organization is characterized by the fact that a low rate of production is consumed locally,

Figure 2. Map of northern Jordan (see segment).

whereas the main locus of pottery consumption is outside of the village boundary. Each potter works alone. Pots are produced by two forming techniques: coiling and moulding after which they are fired in pits or in bonfires.

The raw materials

In northern Jordan, there is variability of raw material used in pottery making. This refers mainly to the tempering materials. All potters in the study area use grog as tempering material. Except at one village, Arjan, potters use calcite as temper in cooking pot production. There is variation in the quantity of gathered raw materials. At the beginning of each season the assumed quantity of raw material is collected. The assumption on what will be needed depends largely on the scale of production, the number of persons involved in the process of gathering raw materials, the distance to these resources and the means of transportation.

Not all potters gather the needed clay at once, each time more clay is required, the process of gathering starts anew. The amount may differ, e.g., of temper more is gathered than is needed. No potter, at the beginning of each season, has said that she had stored enough clay from last season that would enable her to start pottery making. If clay was left from the previous seasons, it will be in few quantities. Mainly, this is due to the schedule of raw material gathering during the working season. Grog is always found at each household. It is found either as sherds or in grounded form. Calcite is usually found in a cobble form, less in grounded form. It should be noted that the amount of these materials in most cases is visible but differ between potters.

Raw materials are stored either in plastic or textile bags, or in iron containers. The former is a common practice among the potters. Both clay and temper are stored in the same place close to each other. They are kept in a storage room such as the basement, or in a separate room where other things are stored. These raw materials are absolutely absent from non-potter households.

Toolkit for making pottery

Potters' toolkits are among the main direct evidence of pottery activity that archaeologists hope to find in the archaeological record (Deal 1988, 1998). However, the quantity of tools employed in pottery making by the potters in Jordan is limited. Tools of high status of preservation used in raw material preparation can be restricted to two types: lower and upper grinding stones. Smashing the raw materials, clay and temper, is performed with a fist-size stone collected from nearby the house. No stone is kept for more than one active process and will be thrown away after use. The use of ground stones is different. It is a cylindrical stone (30-40 cm in size) obtained from around the house. All potters kept this stone for more than one season.

Tools employed in pot forming are generally perisheable. Potters use a wooden scraper in forming the pots. Sometimes, judging by the use-wear, they may use this tool even longer than one season (but as an organic matter its preservation status is low). The wooden scraper is sometimes also used as smoothing tool. Some potters employ a broken spoon for forming and smoothing.

Location of production

From an economic perspective, most of the pottery studies focus on the schedule of pottery making to other economical activities (cf. Arnold 1985). This correlation between pottery manufacturing and other activities was devoted mainly to define whether the craft is carried out as a part-time or full-time employment. Something which is not further discussed in several ethnoarchaeological studies is the relationship between the subsistence strategies, their spatial schedule, and the location of pottery production. In northern Jordan, it has been noted that this relationship has affected the place where pottery is made. Differentiation has been noted between potters who settle in seasonal camps during the season of pottery production, and the ones who chose to work at house. It should be noted, before further details in regard to these two pottery locations, that both groups of potters work at the same rate and produce the same vessels. Differences in pottery areas are due to whether the household leases a plot of land or / and practices summer cultivation. Seasonal settling outside the village has been noted at one household who leased an orchard. The main cultivated crops are summer fruits such as figs, apples and pomegranates. Also, the second potter's household settles in a seasonal camp in summer, but owns the land. However, the type of cultivated crops in summer required the settling in a temporary site to take care of the products.

The economical practices of each household during the season of pottery production results in two different production contexts: the household area, and the seasonal camp. Potters who stayed at their houses during the working season performed raw material preparation, forming activity and firing within the household area. The household area includes the open space surrounding as well the house itself. It includes the platform, made of cement, which is surrounded by a garden. In this spatial context, raw material preparation is conducted at the platform. All the residues of preparation activities are subjected to cleaning and rest in the soil of the garden. With most potters the location of the preparation is also the place where the pots are formed, but in a different time sequence. With other potters the forming location is not the same one as the one for material preparation. The garden, where shadow is provided, is the pot-forming location (Figure 2). Here the clay body residues will be more clustered and mixed with soil. They are left in their location and there is no need to clean them.

The second spatial context of raw material preparation and forming is totally different. The seasonal camp is the location of both material preparation and forming. Where hard surface is available, raw material grinding will be conducted. Natural stone surfaces or cultural ones like a building surface will be used. The forming location is usually conducted close to the tent (Figure 3). Comparison between the potter's household where potting is conducted within the house area with potter's household of seasonal location is important. For example, the cylindrical stone used in grinding is absent in the second case.

Firing location

The firing location is another issue that should be clearly evaluated. Two types of firing features are distinguished: pit-firing and bonfire. In cases where firing conducted in pits and potting activity is conducted within the household area, the distance of the firing location to the main structure varies. At some point, this pit has an oval shape of 30-40 cm in depth, 100-140 cm in width and is usually not more than 5 m from the main house structure.

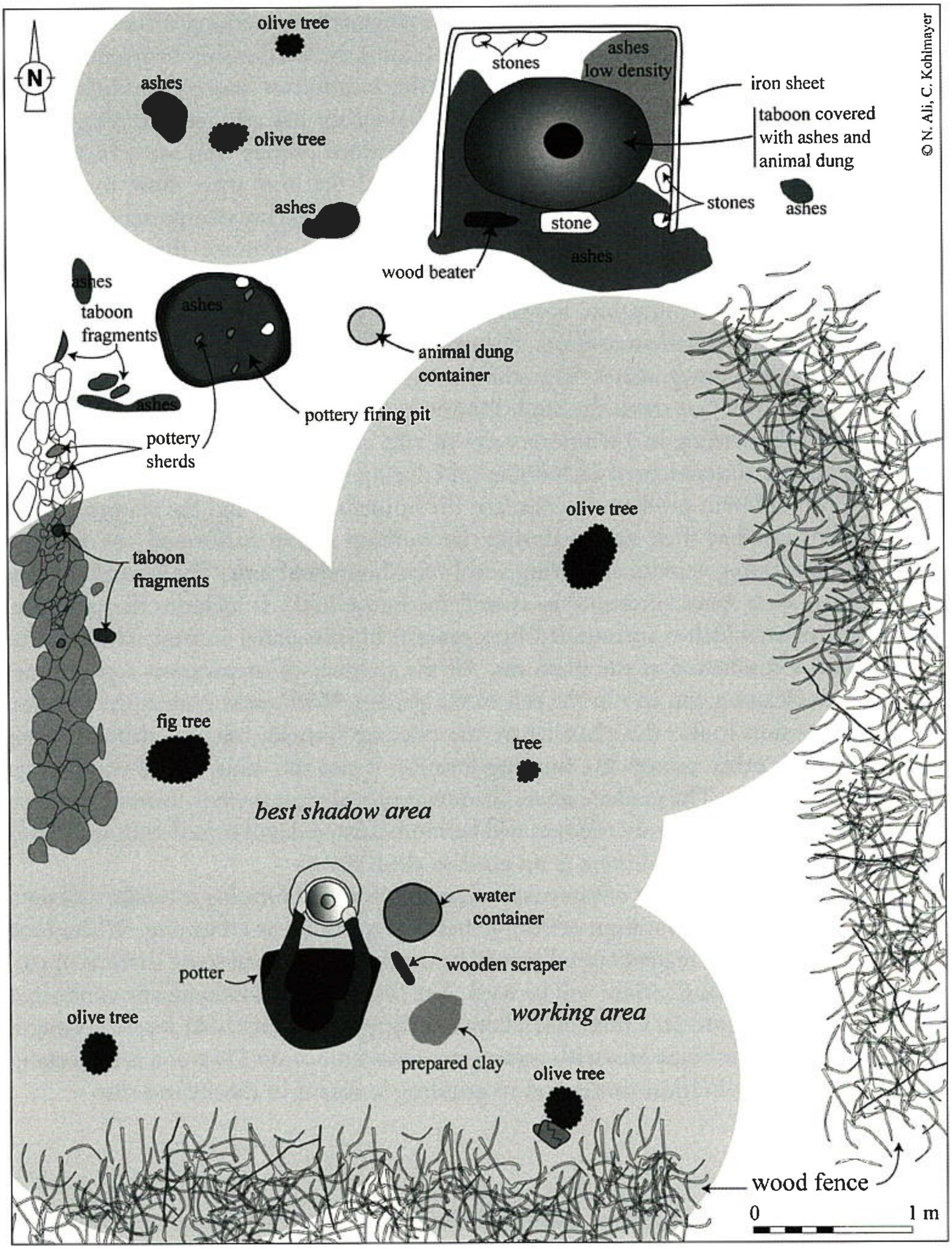

Figure 2. Map of the pot-forming location within the household area.

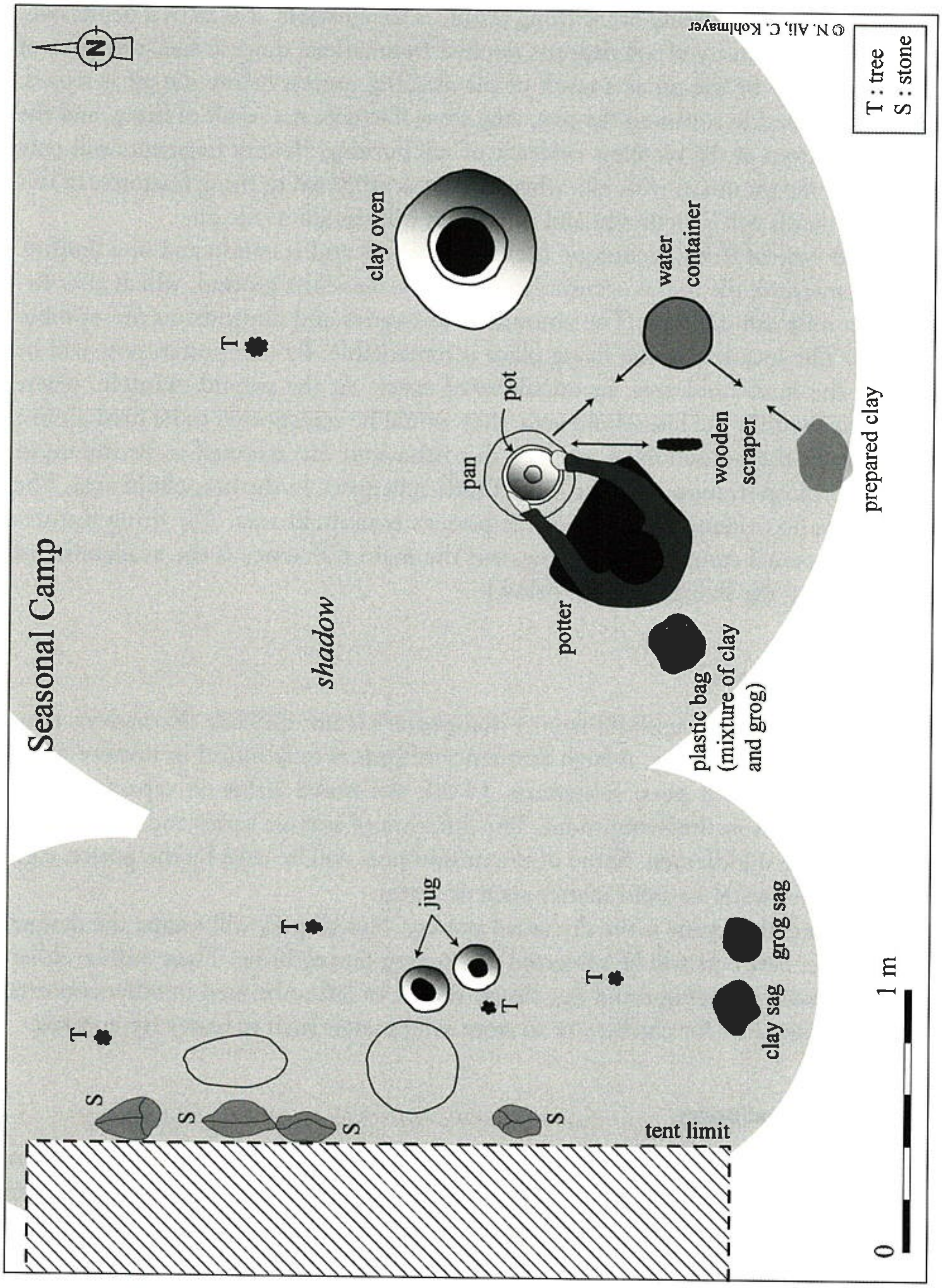

Figure 3. Map the pot-forming location in the seasonal camp.

However, the distance increases where more space is available around the main house. At two examples firing takes place at least 10 m away from the house structure. Taken the distance as a constant factor, the visibility of the firing feature is recognizable. It is an oval depression, has a relatively high density of ash deposits resulted from animal dung as fuel, and piles of ashes are found near by the pit as a result of the cleaning process before the pit is reused. When stones are used to surround the pits, they show fractures as a result of firing, and the sides and the bottom of the pit show evidence of soil burning. Pottery fragments will only be found inside the pit mixed with ash, when the pot is subjected to firing fractures. In this case, the large sherds will be removed and small ones will remain in the pit.

The second type of firing technique uses wood as fuel and is conducted in a bonfire. In this firing method, the fuel is accumulated directly above the ground, which after firing will form only ash deposits. The amount of ash varies and depends on the number of fired pots. The location of the firing place is remarkable. By one potter, pots will be fired within the household area, in uncultivated space. At the second example, where pots are formed within the household area, they would be transported to be fired almost 1 km away from the household. Causes of this behaviour are assumed to be the input energy of fuel transportation, and the lack of sufficient space in the household area. The later case leaves no evidence of firing in the potter's household area. The firing features found in the seasonal camps are the same, but the main difference is the availability of space surrounding the living area (see below).

Potter's household record

To distinguish a potter's household from a non-potter's is not difficult. Nowadays, people do not use a lot of pottery. A high frequency of pots is only found in pottery-making households. Finished pots, sometimes 15-20, are stored either in separate storerooms, or sometimes in the living room. The duration of storage varies and depends on the demand of the middlemen. Some of the unsold pots will be used by the potter, e.g., water jars, to store water or solid matter such as wheat.

Another remarkable point is the discarded pottery. Not all pots will escape the danger of firing fracture. Few pots will be subjected to cracking during firing. These will be either mended if the crack is not large and not clearly visible, or left to be used in other contexts such as a food container for chicken, or to store solid matter such as barley for animals.

Discussion and conclusion

Defining pottery-manufacturing locations requires the identification of the interrelation between pottery production activity and types and locations of other activities. It is clear that environmental factors, such as climate, affect the season of pottery performance (Arnold 1985). Moreover, the schedule of pottery making with other activities such as agriculture has been stated. To which extent the seasonal activities might affect the location of pottery production areas has not been well evaluated.

Agriculture practice has been advocated as a factor in the schedule of pottery making (Arnold 1993). During the agriculture season potters would stop producing pots. This is true in both cases observed either by seasonal camp potters or in settled households. Moreover, the schedule of the craft is also affected by other seasonal activities such as olive gathering.

The seasonal settling of some of the potters in camps away from their households affects the visibility and the nature of the evidence that can be employed in defining the location of pottery making. Material traits such as firing features and grinding stones used in raw material preparation will be absent from the settled potter's household. The absence of this middle to high visibility evidence (Deal 1998) should therefore not be explained as an absence of the practice of the craft. Other conjoined traits should be evaluated and identified. The frequency of pots and their types, for example, can be used as evidence to define pottery location (see also Deal 1988). Potters whose subsistence system associated with seasonal spatial movements will produce their pots in a camps, like the examples from northern Jordan. The finished pots will, in turn, be transported to the permanent house. Comparing this group of potters and the ones who conduct and store their finished pottery in permanent house will be significant. Both groups, for example, will show similarities in the high ratio of water jar types that are stored in their houses. This will be a common phenomenon between potter's populations at the community level.

The presence of clusters of pots in a given room does not always point to the use of these pots as utilitarian objects by the household for storage. At the same time, the high density of products and their locations are an important consideration in defining pottery production. Despite the fact that the objects' density is a less significant factor in this regard, the unused ware is a complementary factor to be considered (Costin 1991). Pottery objects found at potter's households will be characterized by the absence of use ware compared with other objects found at other households.

The location where finished products are kept is significant in defining pottery production location. This is to be mentioned in conjunction with the unused ware factor. All potters store their products in a special small room adjacent to the house. Usually, it is a storage room not only for pottery but also for other things. The finding of these pots is an indication of their storage to be further sold. Another option is that pots were stored to be sold or exchanged by potters when needed. This phenomenon will be evaluated as evidence of defining pottery location in the absence of other visible features such as firing-pits. Moreover, the type of seasonal subsistence activity and its associated schedule with pottery making would be important to understand the absence / presence of toolkits and features associated with pottery making such as firing pits.

The practice of some of the segmental activities of pottery making outside of the household area should pay more attention to less visible evidence. Soil sampling (as also suggested by Deal 1988) will be a tool in defining pottery location. Open areas such as courtyards will be more suitable areas for discovering evidence of pottery location than structures. This can be correlated with the effects of environmental factors, which affect the seasonal practice of pottery making on the one hand and the location of handmade pottery production on the other hand.

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CURRENT RESEARCH (2005)

Research projects in cooperation with:

Leiden University/Faculty of Archaeology:

Caribbean Archaeology:

- Mobility and Exchange. Dynamics of material, social and ideological relations in the pre-Columbian insular Caribbean (C.L. Hofman);
- Tobago (A. Boomert).

Prehistory:

- Linearbandkeramik from Geleen (P. van de Velde).

The Netherlands National Museum of Antiquities, Leiden:

- Tell Sabi Abyad Project (P.M.M.G. Akkermans).

The Netherlands Institute for the Near East:

- Yenişehir II – The earliest link in the agricultural history of northwest Anatolia (J.J. Roodenberg).

The University of Amsterdam:

- Pottery from Ras Ibn Hani and Ras el Bassit (L. LePied).

Museon, The Hague:

- A series of reconstructions of Ubaid pottery.

University of Cardiff:

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

Wilfrid Laurier University, Waterloo, Canada:

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

Royal Museums for Art and History, Brussels:

- Bronze Age pottery from Lehun, Jordan (I. Swinnen).

Working Group on Mesopotamian Pottery:

- A Corpus of Mesopotamian Pottery (second millennium B.C.) (H. Gasche).

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