

FABRIC. FORM. FUNCTION.
ANOMALOUS TEMPERS IN FINEWARE CERAMICS FROM EL-MAHÂSNA, EGYPT.

by

Dustin J. Peasley

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Dustin J. Peasley, B.S.

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During the 1995-2000 seasons of the el-Mahâsna Archaeological Project in Egypt, a small proportion of the recovered fineware sherd assemblage was identified as having been manufactured using anomalous tempers relative to the majority of those recovered. This paper will discuss the results of an analysis of these ceramics conducted during the recent 2009/2010 excavation season. In particular, this study examined the relationship between fabric, form, and function within the fineware ceramics at el-Mahâsna in an attempt to determine if temper was related to vessel function or rather was the result of the region of origin of the vessels.

Results of this study suggest that at the site of el-Mahâsna, a limited number of forms within the fineware ceramics contain tempering agents that were intentionally included for functional purposes. Further, results from this study suggest that the remaining forms that contained marginal amounts of sand temper likely originated from within the Abydos region. Lastly, results indicate that tempered polished redwares may have been associated with the cultic building discovered at the site of el-Mahâsna.

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INTRODUCTION

Beginning with W.M.F. Petrie in 1895 at the sites of Nagada and Ballas (Petrie and Quibell 1896) and extending until the late 1980s, ceramic analysis conducted by archaeologists excavating Upper Egyptian Predynastic sites focused largely on the classification of vessel types and forms for the sole purpose of constructing a chronological framework. Due to the amount of complete vessels and associated grave goods that archaeologists were discovering and analyzing from Predynastic cemeteries, archaeologists often chose not to allocate their time to intensive studies of the attributes of Predynastic ceramics. However, the rise of processual archaeology in the 1960s influenced an expansion of analytical studies based heavily on the application of scientific methodologies (Trigger 1989). As ceramics are arguably the most prevalent artifacts analyzed on archaeological sites throughout the world, new and modified methods of ceramic analysis were created to examine attributes previously ignored. However, theoretical progress in Egypt was hindered by a disconnect between Egyptologists and anthropologists over conflicting viewpoints of whether or not Egypt, as a “unique” state level society, could provide relevant improvements to anthropological thought (O’Connor 1997; Savage 2001). Thus, the advancement of archaeological methods in Predynastic studies was held up until the late twentieth century when new studies began to discover the complexity of Egyptian prehistory.

One such study that revolutionized the way in which Predynastic settlement ceramics are examined was conducted by Reneé Friedman in 1994. Friedman analyzed settlement ceramics from three Upper Egyptian Predynastic sites, Nagada, Hemamieh, and Hierakonpolis, by examining attributes such as surface treatment, clay type, shape, and temper of fragmentary

ceramic sherds to develop and refine ceramic typologies as well as to examine the relationship between ceramic fabric types and vessel form and function. Through studying these aspects of Predynastic ceramics, she was able to conclude that ceramic assemblages vary regionally throughout Upper Egypt, namely in the choice of temper (Friedman 1994). Friedman's study covered a large portion of Upper Egypt, but since the time of her study, several additional Predynastic settlement sites such as Adaïma, MA 21/83 near Armant, and Abadiya 2 have been excavated. These sites have not only added to our knowledge of Predynastic village life but have provided additional ceramic assemblages against which to test the conclusions drawn by Friedman. One such site is el-Mahâsna in the Abydos region, which is the focus of the present study.

Predynastic ceramics can be divided into two main categories: rough wares and fine wares. More specifically, the fine wares include two types of pottery known as black-topped red ware (B-ware), and polished red ware (P-ware), both of which were originally defined by W.M.F. Petrie in the late nineteenth century (Friedman 1994:90). Throughout Upper Egyptian Predynastic sites, finewares are typically untempered, meaning no artificial materials were added to the clay during manufacture (Friedman 1994:93). However, at the site of el-Mahâsna, Anderson (2006) has identified that a limited portion of the fineware assemblage contained temper, specifically sand and chaff. Utilizing the methods employed by Friedman (1994) and Anderson (2006), this paper attempts to explain the occurrence of these anomalous tempered vessels by examining if the use of temper can be correlated with vessel function, or, as Friedman has suggested for roughwares of the period, the choice of temper is more related to region of origin of the vessels.

PREDYNASTIC EGYPT

The period of cultural evolution in Egypt, in which a change from simple, widespread agricultural villages to a concentrated complex Pharonic society occurred, is known as the Predynastic period. The estimated dates of the Predynastic period has fluctuated throughout the history of archaeological research in Egypt, however recent research dates the period from roughly 4400 – 3000 BC (Anderson 2006; Bard 2000; Midant-Reynes 2000; Shaw 2000). Two distinct cultures inhabited Egypt during this time and were named for the sites at which remains were first found: the Buto Maadi culture of Lower Egypt in the Nile Delta and the Nagada culture of Upper Egypt in the Nile Valley (Bard 1994). Since the site of el-Mahâsna lies in Upper Egypt, this study will focus on the Nagada culture of the Nile Valley. This section provides a brief introduction to the chronological phases of Upper Egyptian Predynastic and the important cultural trends that would set the stage for Pharonic rule after 3000 B.C.

Chronological Phases of Upper Egyptian Predynastic

The Upper Egyptian Predynastic, or Nagada Culture had been broken down into three distinct periods for a large portion of the last century based on Petrie's seriation dating sequence he developed using ceramic vessels from cemeteries at Nagada and Ballas in 1896 (Petrie and Quibell 1896; Friedman 1994). Petrie labeled these three phases the Amratian, Gerzean, and Semainian. Today, most archaeologists distinguish these phases as Nagada I, Nagada II, and Nagada III/Dynasty 0¹, although Petrie's Amratian and Gerzean phase designations are still commonly used (Anderson 2006; Bard 1994; Friedman 1994; Hassan 1988; Hendrickx and Vermeersch 2000; Kemp 1989; Midant-Reynes 2000a; Savage 2001; Wenke 1989). Another cultural phase known as the Badarian has been shown to predate the Nagada phases in Upper

¹ Based on Kaiser's *Stufen* system (Kaiser 1957, 1990)

Egypt, but this culture seems to have originated in Middle Egypt, and only a marginal amount of cultural material has been found outside of Middle Egypt. Each of these four periods (Table 1) contained distinct cultural trends that developed over time which archaeologists have been able to use to interpret the cultural evolution of the Upper Egyptian Predynastic. However, the site of el-Mahâsna was only occupied during the Nagada I and II phases, therefore this discussion will focus primarily on these two time periods.

Table 1. Chronology of the Upper Egyptian Predynastic

Period	Absolute Dates
Badarian	ca. 4400 – 4000 B.C.
Nagada I (Amratian)	ca. 4000 – 3650 B.C.
Nagada IIa-b (Early Gerzean)	ca. 3650 – 3450 B.C.
Nagada IIc-d (Late Gerzean)	ca. 3450 – 3200 B.C.
Nagada III/Dynasty 0	ca. 3200 – 3000 B.C.

Source: Compiled from information in Patch (1991:Figure 1) and Shaw (2000:479) adapted from Anderson (2006:table 2.1), and Midant-Reynes (2000a).

Nagada I

The Nagada I phase, also known as the Amratian, has been argued to be an extension of the earlier Badarian culture and this ideal has been supported with radiocarbon dating and stratified sequences at Hemamieh. It also seems feasible that at least a portion of the Badarian culture continued to live alongside the Nagada cultures of Upper Egypt. Midant-Reynes (2000a: 186) even suggests that trade may have occurred between the two regions and that would explain the presence of rippled burnished ceramics in the Nagada-Mahâsna region (Figure 1).

Due to the amount of material being excavated, the majority of research from Nagada I sites focused on cemetery context, and until recently, virtually no settlement site was well documented. The main proponent of archaeological research of not only the Nagada I but of the Predynastic as a whole was Petrie and Quibell, who excavated thousands of tombs at the

cemeteries of Nagada and Ballas (Midant-Reynes 2000b:45). Petrie documented the array of ceramic vessels being excavated from the graves of these sites and determined that black-topped red ware (B-Ware) and polished red wares (P-Ware) made up the majority of the assemblage. However, the defining ceramic type of the Nagada I was the White Cross Line (C-Ware) wares, that were virtually identical in relation to the fabric of polished red wares but were unique in respect to the geometric and figural designs painted on the vessel wall with white paint. When Petrie was developing his seriation process with Predynastic pottery, it was believed that C-ware vessels disappeared from the ceramic assemblage at the end of the Nagada I, and any closed find with C-wares included were dated to the Nagada I period, which Petrie took advantage of when dating graves. However through modern settlement research and new dating methods, the chronological framework for C-wares has been extended into the early Nagada II (Anderson 2006:11; Friedman:23).

During the Nagada I we begin to see artifacts that have been attributed to the foundations of class or status stratification in Egypt. Items such as discoid mace heads, pottery, limestone, and unfired clay are representative of portable symbols of power that were found within larger tombs that are believed to belong to higher status individuals (Midant-Reynes 2000a:180). The elaboration of figurines during the Nagada I may also indicate a change in social stratification as male figures were beginning to be made with triangle shaped beards made out of a variety of raw materials including ivory, bone, and clay (Midant-Reynes 2000a:176). The beard was seen as a symbol of masculinity for Pharaohs later in Dynastic Egypt and this may show an early association of higher social status with the beard.

Our knowledge of settlements during the Nagada I is limited due to various factors, but chief among them is that the structures built during the Nagada I were small huts and wattle-and-

daub constructions that preserve poorly. Among these early structures, Egyptian archaeologists find hearths and small pits scattered throughout the habitation areas and from these features archaeologists have pieced together that Nagada I village life relied on an increased agricultural system, domesticated animals, and fishing (Anderson 2006:12; Midant-Reynes 2000b:49).

Nagada II / Gerzean

Significant cultural developments occurred during the Nagada II, which was divided into four sub-phases, Nagada IIa-d, by Kaiser (1957). However, the most common division of the Nagada II includes two distinct periods, Nagada IIa-b (Early Gerzean) and Nagada IIc-d (Late Gerzean), in which important fundamental changes occurred that transformed the Upper Egyptian cultural landscape (Anderson 2006; Friedman 1994; Hassan 1988).

The early periods of the Nagada IIa-b still contained traces of the Nagada I culture including marginal amounts of C-ware vessels and the continued use of B-Ware and P-Ware vessels. However, the use of C-Ware vessels disappears during or near the end of the Nagada IIa, and as a result, a new ceramic assemblage began to appear in cemeteries and settlements throughout Upper Egypt. A new, utilitarian ware that Petrie called roughware (R-Ware) began to show up in graves, which caused Petrie to conclude that R-Ware vessels were an invention of the Nagada II culture; but recent research indicates that R-Ware vessels were prevalent in settlements context previous to the Nagada II (Midant-Reynes 2000a:189). In addition to the R-Ware vessels, two more new types of pottery were produced during the Nagada II called decorated wares (D-Ware) and wavy-handled wares (W-Ware). Both of these are believed to originate from the Nagada IIb and have been found with decorative motifs representing ritual activities and many examples of boats (Anderson 2006:14; Friedman 1994:30; Midant-Reynes 2000a:189, 2000b:50, Petrie and Quibell 1896:12).

The Nagada II, with research from el-Mahâsna, Nagada, Hierakonpolis, and Adaiïma, has been the most studied phase of Predynastic Egypt from a settlement context standpoint. However, our knowledge is still extremely limited but cemetery and settlement research thus far has shown that during the transition from Nagada IIa-b to Nagada IIc-d, several kingdoms with individual rulers began to form at Hierakonpolis, Nagada, and Abydos/Thinis (Anderson 2006; Kemp 1989). Perhaps the formation of these larger ruling centers influenced the expansion of the Upper Egyptian Nagada culture, which would explain the presence of Nagada material culture ranging from the Delta in the north to Nubia in the south (Midant-Reynes 2000b:50).

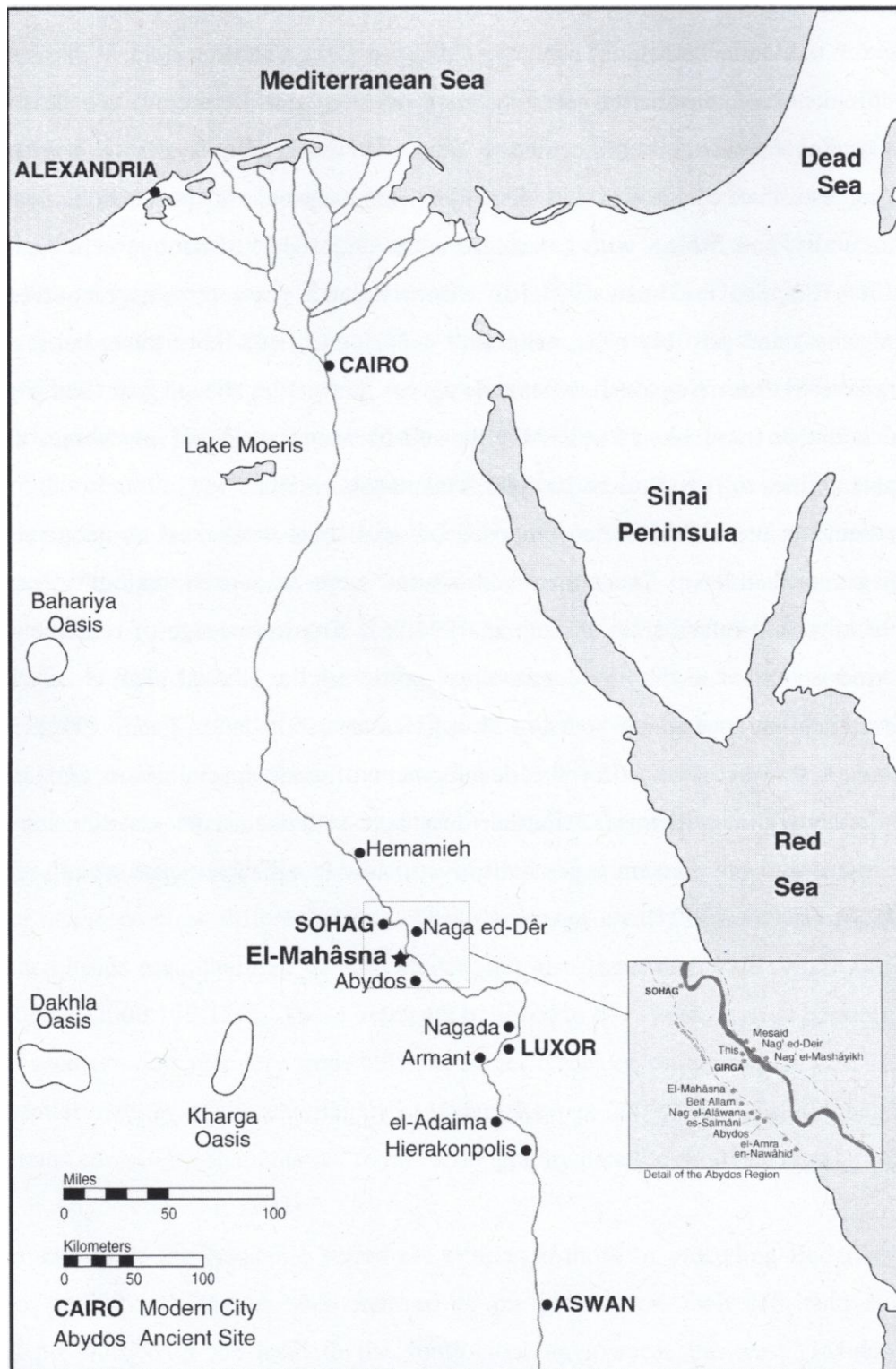


Figure 1. Map of Egypt showing Predynastic sites discussed in text.
Source: Anderson (2006:figure 2.1).

HISTORY OF UPPER EGYPTIAN PREDYNASTIC RESEARCH

The Predynastic period in Egypt was widely unknown or misinterpreted prior to the late nineteenth century when Jacques de Morgan coined the term Predynastic in 1896. Although Petrie is usually considered to be the main proponent for Predynastic studies, his initial interpretation of the cultural material excavated from cemeteries at Nagada and Ballas in 1895 stated that it belonged to a foreign race of invaders that replaced the preceding Neolithic culture (Friedman 1994:1; Petrie and Quibell 1895). Petrie retracted his interpretation later in favor for Morgan's Predynastic phase but his work influenced a surge of prehistoric excavation in Egypt (Savage 2001:102).

Cemetery

The majority of what we know about the Upper Egyptian Predynastic is based on excavations from cemetery context that were focused on uncovering the grave goods that were of more interest to excavators at the time than poorly preserved settlement remains (Bard 1994:267). Petrie's early efforts at Nagada inspired archaeologists of the early twentieth century to focus largely on the cemeteries from the entire region including Armant, Badari, Naga-ed-Dêr, and el-Mahâsna (Savage 2001:102). However, during these excavations approximately 20 settlements throughout Upper Egypt were stumbled upon in close proximity to the cemeteries but the main concern of the excavators were the graves and typically very little attention was given to settlement remains (Bard 1994:267; Friedman 1994:3; Savage 2001).

As in many parts of the world during World War II, a decline in archaeological work in Egypt occurred due to war efforts, especially in relation to Predynastic excavations (Savage 2001:102). Instead, the focus of research during the few decades following the war was on the

improvement of archaeological interpretation of preexisting data. One such anthropologist of this time was Werner Kaiser, who dedicated nearly a decade to reexamination of the graves in Petrie's reports. Much like Petrie, he identified three separate chronological phases of the Upper Egyptian Predynastic, which he labeled Nagada I-III; very much still in use today. Unlike Petrie, Kaiser believed that the period of culture transition from the Amratian to the Gerzean occurred more gradually due to the increase in trade networks outside of Upper Egypt and not an invasion from a foreign race from the east (Friedman 1994:4).

Settlement

During the 1950s and 1960s, a progression of archaeological methods and interpretations was taking place throughout the world with the rise of processualism. Processual archaeology was intimately associated with the application of scientific methods to explain the human component of the archaeological record (Trigger 2006). However, these new developments in archaeological thought took much longer to take hold in Egypt because of theoretical differences between anthropologically trained archaeologists and Egyptologists (Savage 2001: 104). When the Egyptian government began plans for the Aswan High Dam to help regulate the annual inundation of the Nile River, an influx of archaeologists were brought into the country to survey the area that would become Lake Nasser. This led to a revival of prehistoric archaeology in Egypt and helped change the view of an "unique" Egypt that could not be studied, theoretically, in relation to the formation of a state level society (Friedman 1994:6; Savage 2001:104; Trigger 2006).

Although theoretical differences between Egyptian archaeologists and Egyptologists still exist today, advanced methods and ideologies began to take root in Upper Egyptian Predynastic research in the late twentieth century. New research questions on the formation of Egypt as a

state level society influenced an increased interest in Predynastic settlement sites in Upper Egypt. Since the 1970s, settlement archaeology has increased our knowledge of prehistoric Egyptian lifeways, but the majority of comparative data available is still from cemetery context. However, recent excavations at Hierakonpolis, Adaïma, Nagada, and el-Mahâsna are major sites that are revolutionizing our view of Predynastic settlements (Anderson 2006; Bard 1994; Friedman 1994; Hassan 1988; Midant-Reynes 2000a; Savage 2001).

EVOLUTION OF UPPER EGYPTIAN CERAMIC RESEARCH

In accordance with the development of Upper Egyptian research as a whole, the evolution of ceramic research in Egypt was heavily based on vessels excavated from cemeteries. Because archaeologists were recovering hundreds of complete, intact vessels in cemeteries, settlement sites were pushed to the side, and the study of fragmentary sherds with it. Since Petrie developed his seriation of Predynastic ceramics in the early twentieth century, it was the only relative dating scheme for ceramics and Friedman (1994:7) suggested in her study, in which she established a new system to study fragmentary settlement sherds, that “Petrie’s corpus of whole vessels is not only inadequate for describing the fragmentary pottery of settlements, but is misleading with regard to some of the most important aspects of the ceramic assemblage.” This section will describe the development of Petrie’s corpus of whole vessels and Friedman’s new system of classifying ceramic settlement remains.

W.M.F. Petrie

Petrie’s corpus of whole vessels was based off approximately 4,000 graves he had excavated throughout the late 1890s when he discovered that large portions of the cultural material was unusual to him. The ceramic vessels that Petrie found were from the various phases of the

Predynastic and early Dynastic periods, but at the time the Predynastic had not yet been realized. However, with the help of Jacques de Morgan, he eventually determined the pottery to be from prehistoric times (Friedman 1994:1; Trigger 2006:294). Because the pottery discovered by Petrie showed no resemblance to existing typologies from the historical assemblages, there was no structured process for dating the vessels. Petrie took it into his own hands to create a dating process he called sequence dating, or seriation, in which he examined all the various types of ceramics he found and analyzed their chemistry, shape, and decoration.

Petrie's seriation was based on the classification of over 900 vessel shapes divided into nine ware classes (Figure 2), described below (Friedman 1994:40; Petrie 1921). Petrie then was able to form a series of fifty relative sequence dates that he supported chronologically with the associated grave goods from the same context of the graves (Trigger 2006: 295). It was with these sequence dates that he was able to identify three different cultural occupations that were evidenced by major changes in the pottery including: Amratian, Gerzean and Semainian. To validate his claims, Petrie used oral histories, skeletal data, lithic technology, and the similarity in pottery styles of these recorded cultures to interpret relative chronologies of the Predynastic. The most remarkable feat of Petrie's seriation of Predynastic pottery is that it has lasted, albeit revised, for over a century (Friedman 1994: 2).

Petrie's Ware Classes

The nine ware classes defined by Petrie include Black-topped redware, Polished redware, Roughware, White cross-lined ware, Wavy-handled ware, Decorated ware, Late ware, Fancy ware, and Black incised pottery. Since this study only involves the first two classes, only these will be discussed in detail below. If the reader is interested in details on the other seven classes, these can be found in Petrie (1921), Friedman (1994), and Anderson (2006:45).

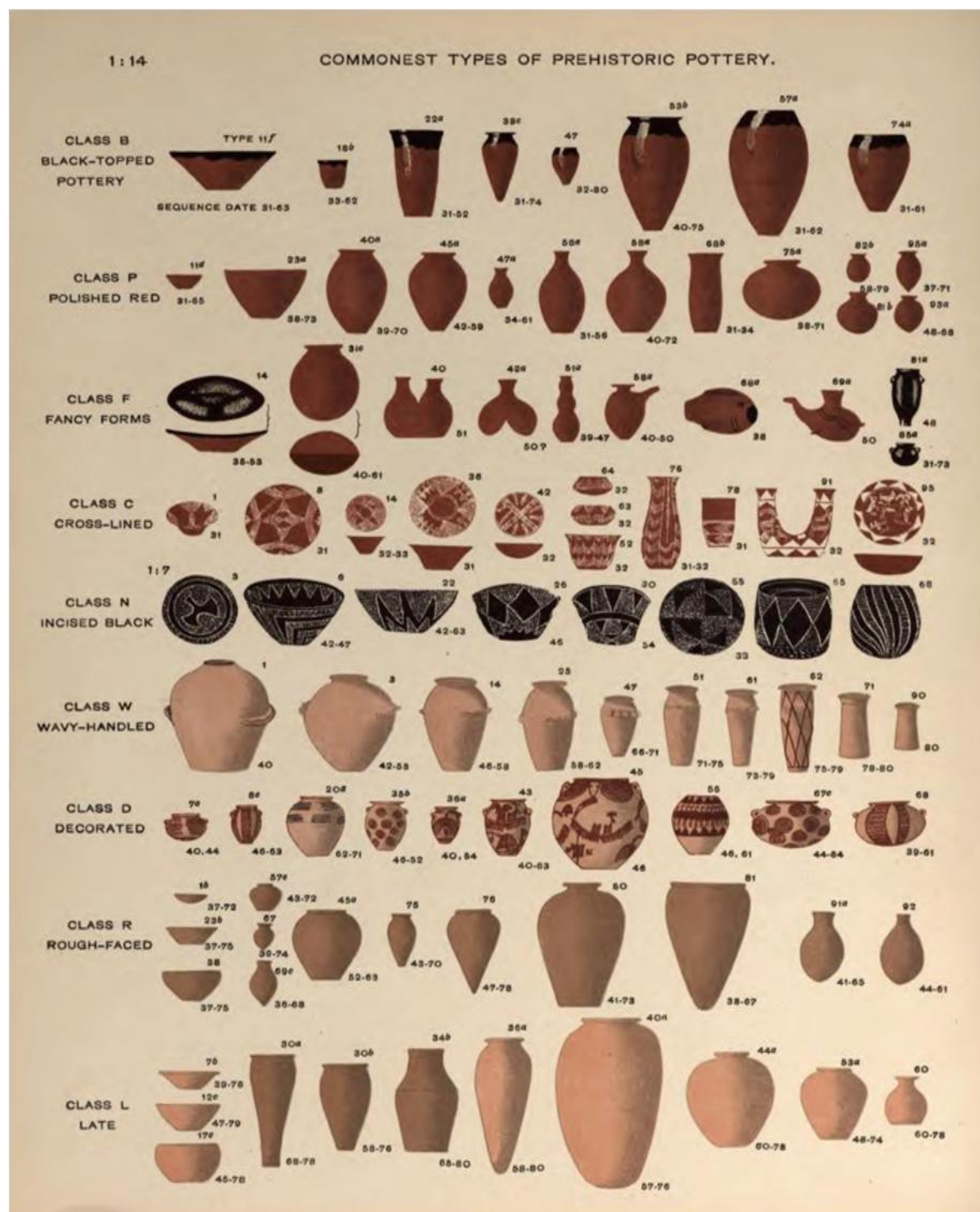


Figure 2. Petrie's Predynastic ceramic seriation process.
Source: Petrie 1921

Black-topped redware (B-Ware): B-ware ceramics (Figure 3) are one of the most common types of fineware ceramics recovered from Predynastic sites during Nagada I-II phases. B-Wares are vessels made of clays obtained from Nile River deposits typically without the addition of temper². B-Wares are generally heavily burnished or polished to create a very smooth and glossy surface. The most distinctive feature of B-Wares is the blackened area that extends from the top of the vessel to an arbitrary point further down the body; an effect most likely produced by smoke or an oxygen poor environment during a secondary firing process (Friedman 1994:93).



Figure 3. Black-topped redware vessel.
Source: <http://www.petrie.ucl.ac.uk/>.

² Not determined by Petrie due to classification on surface appearance but later discovered by Friedman.

Polished redware (P-Ware): P-ware vessels (Figure 4) were made in a similar fashion to B-ware and also consisted of Nile Valley silts. P-Wares were also polished or burnished to give the vessel's red ochreous slipped surface a high gloss appearance, but the vessels were fired only once and did not go through the secondary firing to create the blackened rim area (Friedman 1994:94).

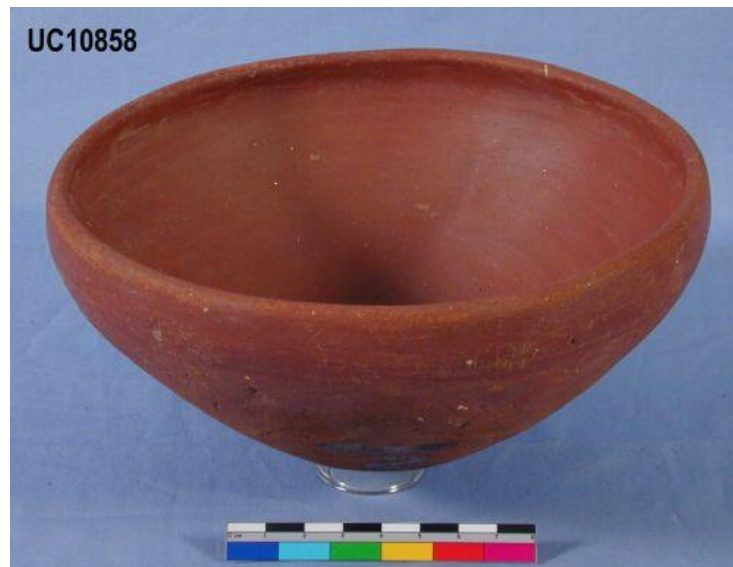


Figure 4. Polished redware vessel.
Source: <http://www.petrie.ucl.ac.uk/>.

Reneé Friedman

The system on which Friedman based her new fragmentary sherd classificatory scheme was the Hierakonpolis taxonomic system created by Hoffman and Berger in 1979 in order to classify the large numbers of sherds found at the settlement site HK29 (Hoffman and Berger 1982). According to Friedman (1994:127) the main goals of this system were: to make sorting, analysis, and quantification of large number of sherds a viable option in the field; to provide cost effective analysis of ceramic samples; to allow correlation between fragmentary sherds and complete

vessels; and to provide a classification system that was sensitive to regional and functional variation. The Hierakonpolis system in which Friedman utilized for her study was slightly modified from the original version as the original accounted only for four aspects of Predynastic sherds: the fabric/temper type, sherd type, open or closed form, and the subjective shape class. Friedman included surface treatment and decoration to her modified system (Friedman 1994:127).

In the present study, Friedman's goal to provide a system that was sensitive to regional and functional variation was essential in determining the functional or regional nature of unusual tempered sherds at el-Mahâsna. The examination of tempering agents within Upper Egyptian ceramics can help explain the alterations made by individual or regional bands of potters with the same clay resources at their disposal. When potters modify their clays with the addition of temper or the removal of impurities, the properties of the clay change and affect the overall result for certain behaviors or function. Friedman (1994:128) claims that when a "modification can be correlated with other aspects of the sherds such as shape, surface treatment, decoration, and geographical location the evidence for determining a regional tradition is strengthened." With the rise of settlement archaeology in Upper Egypt, Friedman's system has become extremely important because it addresses the difficult process of fragmentary analysis at a large scale (Anderson 2006; Friedman 1994; Midant-Reynes and Buchez 2002).

Vessel Form and Function

The form and function of a vessel are so intimately related that archaeologists can establish the ultimate function of a vessel by determining the overall form (Price 1987:211). Pottery vessels are made to accomplish a certain function efficiently and endure regular use over time. When determining function through form, archaeologists have to speculate on what tasks each form

would be the most advantageous for. Serving vessels will typically be more shallow open forms including platters and bowls, but storage or transport vessels will typically be more closed forms such as jars and bottles to better perform their function of retaining the contents within. Also, when examining the attributes of the vessel archaeologists have to determine the best explanation for the functional purpose of each attribute, such as stability during cooking or durability over time (Friedman 1994:243). Friedman explains one possible reason for the inclusion of temper in ceramic vessels in relation to function as techno-function (Friedman 1994:255).

During manufacture of a vessel, the potter may choose to use specific tempers to increase the likelihood that the vessel will perform its function properly. Each temper may have a slightly different techno-function according to what attributes it may strengthen. The “performance characteristics” of tempers related to Predynastic pottery were put through five tests: impact resistance, abrasion resistance, thermal shock, heating, and cooling (Friedman 1994:255-261).

Impact Resistance: Impact resistance is the ability of a vessel to endure impact without breaking, which was tested by dropping steel balls on ceramic sherds. Conclusions from the test were that untempered, burnished vessels were the most resistant to impact which may indicate untempered fineware bowls in Upper Egypt (Friedman 1994:256).

Abrasion Resistance: Abrasion resistance refers to the ability of a vessel to resist scratches and other damage through extensive patterns of use including cleaning. The results of this test indicated that the differences between various tempers may not have been significant enough for potters to realize. However, it was observed that sherds with voids tended to inflict the most damage (Friedman 1994:257).

Thermal Shock: Thermal shock resistance refers to the ability of tempers to endure rapid changes in temperature without cracking. The results of this test showed that untempered sherds

lost the most strength when heated and cooled while organic and sand tempered sherds retained their strength. Also it was observed that the more temper added to a sample of any type made the sample stronger and more crack resistant (Friedman 1994:258-259).

Heating: Each tempered sample was heated to determine its high thermal conductivity capacity and the results indicated that sand tempered sherds were observed to conduct the most heat. However, Friedman (1994:260) suggests that intentional sand tempered sherds occur sparingly throughout Predynastic assemblages.

Cooling: The permeability or porosity of a vessel was examined in this test to show the effect tempers may have on the process of storing and cooling water. The results of this test proved that organic tempered jars were most likely used for cooling and storing liquids. Also it was observed that sand tempered bowls were the least porous and would have been the most problematic vessels with liquids (Friedman 1994:261).

THE SITE AT EL-MAHÂSNA

The site of el-Mahâsna is located approximately 10.5 kilometers north of Abydos and was first discovered by John Garstang in 1900-1901. Although interested in Old Kingdom tombs present in the cemetery located at el-Mahâsna, Garstang found domestic materials indicative of a settlement site and thus began one of the earliest studies of a Predynastic settlement (Anderson 2006:21). The first full scale excavation of el-Mahâsna after Garstang didn't occur until 1995 when Anderson (2006) launched the el-Mahâsna Archaeological Project (MAP).

Recent Excavations

In 1995, Anderson conducted 55, 5m x 5m, square collection units in the southern portion of the site that had been affected by modern agricultural plowing, however when he returned in 2000, a

full site surface survey was conducted. The full site survey included 240, 25 m² circular collection units spaced at 15 m intervals that combined with the 1995 surface collections, covered approximately 9.2% of the entire site (Anderson 2006:40-46). Full scale excavations began in 2000, consisting of 3 x 3 m excavation units throughout the site based on surface collection densities. Several times throughout excavation, multiple 3 x 3 m units were excavated adjacent to one another creating larger excavation blocks of various sizes that will be discussed further below. In total, 405 m² of controlled excavations including 9 excavation blocks, consisting of 45 individual 3 x 3 m units, had been excavated by the end of the 2000 season (Anderson 2006:48). Figure 5 is a map showing the location of each excavation block as well as the approximate location of Garstang's excavation area.

Through analysis of the features and artifacts from each excavation block, Anderson interpreted the most probable usage of each area. Excavation Block 1 dated to the Nagada Ic-IIab and included a large structure based on the recovery of 58 wooden and reed posts delineating a wall with at least two other perpendicular walls and most likely represented an in-situ habitation area. Excavation Block 2 included a possible fence or wall structure that separated an outdoor activity zone and trash disposal area and dated to the Nagada Ic-IIc. Based on several large postholes and ceramic figurines discovered within Excavation Block 3, this area may have been a large structure utilized for a ritual or cultic purpose that dated to the Nagada Ic-IIab. Excavation Block 4 was interpreted as a domestic activity area, in which several ash features were discovered possibly indicating food processing activities, which dated to the Nagada Ic-IIb. Excavation Block 5 was dated to the Nagada Ic-IIc was interpreted as an outdoor activity and trash disposal area. Excavation Block 6 was the location of lithic tools and human bone fragments, on which registration numbers were written in pencil. Anderson interpreted the

cache of artifacts as Garstang's leftover artifacts from the courtyard of the nearby expedition house. Excavation Block 7 was the location of Garstang's expedition house and was used to authenticate and overlay the map that Garstang created of the site in 1900. Excavation Block 8 was located at the southern end of the site which had been destroyed by modern agricultural plowing. Fortunately, Predynastic cultural materials were still intact beneath the plow zone layers including post molds and pit features dating to the Nagada Ic-IIb. Excavation Block 9 was a small 2 x 2 m unit at the southern edge of the site to determine the extent of damage to the site. Results revealed that approximately 50 cm of intact Predynastic remained underneath the destroyed agricultural layers (Anderson 2006:71-150).

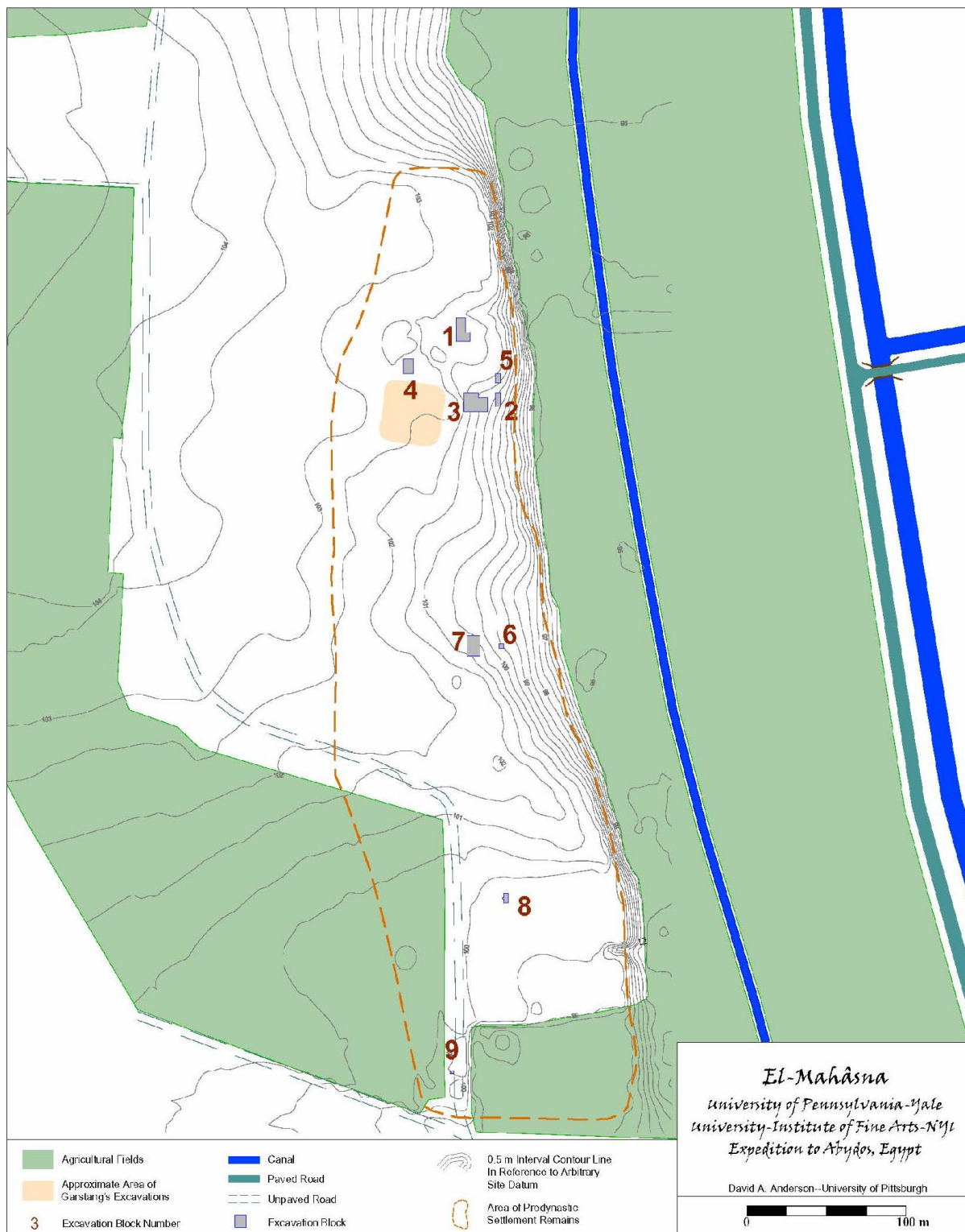


Figure 5. Map of el-Mahâsna showing location of excavation blocks.
 Source: Anderson (2006:figure 3.10).

METHODOLOGY

This section details the various field and analysis methods utilized for this present study. These methods, with slight variations, have been established as standard archaeological procedures by many Egyptian archaeologists when analyzing ceramic sherds (Anderson 2006; Friedman 1994; Midant-Reynes and Buchez 2002; Köhler 1993). The hands-on analysis methods specific to this study were implemented in the field during the December 2009-January 2010 season of the el-Mahâsna Archaeological Project of the University of Wisconsin-La Crosse. The remaining analysis methods described in this section were carried out after returning to the United States.

Ceramic Analysis

In order to assess whether the appearance of tempered fineware sherds in the el-Mahâsna assemblage was the result of functional improvements to ceramic vessels or a regional manufactured inclusion, it is first necessary to determine the form of vessels from which the anomalous sherds originated. Of the previously analyzed ceramics from the 1995 and 2000 seasons of excavation, 127 tempered fineware rim sherds had been recovered from the site. Further, another 599 body and 23 base sherds of tempered finewares were also recovered. During the previous excavation seasons, all ceramic sherds were assigned provenience numbers (MAP numbers) based on their location of origin at the site. For this study, the rim sherds were collected by sorting, confirming the temper and recovering the tempered rim sherds from the assemblage of each provenience found to contain tempered fineware sherds from the past seasons. However during this reexamination, four rim sherds previously identified as tempered were found to be untempered and a further 19 rim sherds were unable to be located in the storage magazine.

The standard ceramic rim analysis utilized to ultimately discover form and function of the vessels was structurally based on that of Anderson's (2006) investigations at the site of el-Mahâsna, which was modified from Friedman's (1994) study of Upper Egyptian Predynastic ceramics. Utilizing standard procedures of archaeologists for rim profile analysis, each rim sherd was drawn by hand on graph paper using digital calipers, a wood block, and molding combs (Anderson 2006; Friedman 1994; Midant-Reynes and Buchez 2002; Köhler 1993). These procedures begin with determining the "stance" of the rim sherd by placing the rim against a wood block which was perpendicular to the graph paper, and then rotating the sherd until it was flush with the wood block. When the stance of the rim sherd could not be established due to erosion of the rim, the sherds were excluded from this study because a reliable vessel shape could not be determined. Thus, two rim sherds were removed from the study due to erosion of the rim. For the remaining sherds that could be reliably stanced, a rough outline was drawn with a mechanical pencil. Then, using a molding comb against the exterior and interior vessel walls of each sherd, the cross section and rim contour were refined and hand drawn.

In addition to drawing the rim profile, the diameter of the orifice (opening of the vessel) of each sherd was recorded using a standard diameter template with one centimeter intervals as described in Rice (1987:222-223, figure 7.9). In addition to the diameter, the percent of the total vessel circumference, or the chord, was estimated to the closest two and one-half percent increment. This measurement was important because any sherd with less than five percent of the vessel's total circumference was regarded as unreliable for diameter measurements (Anderson 2006). As a result, 33 rim sherds were removed from the present study because of a chord measurement less than 5 percent. Therefore after further analysis, 58 of the 127 tempered rim

sherds were removed from the assemblage of the present study because of the inability to ensure the accuracy of the measurements previously discussed.

After the rim profile and chord measurement were recorded for the remaining 69 tempered rim sherds utilized in this study, each individual sherd profile drawing was then assigned an identification number for database records in the format of 09.2.1. The “09” was predetermined as the year of investigation, the second number, or “2” in this example, was the page number of sherd drawings, and the last number, or “1” in this example, was the number of the sherd drawing on each page. In addition to the identification number, the provenience number (MAP number), and the six digit ware code for each sherd were also recorded.

Form and Function

When establishing the general form and function of the fineware tempered assemblage, it was necessary to determine the subjective shape of each individual rim sherd using the rim profiles that had been drawn in accordance with the subjective shape class system (Figure 6) developed by Friedman (1994:221-228) and further modified by Anderson (2006:57). The shape classes are generally divided between two vessel forms: open and closed (Anderson 2006:Appendix B). Vessels were considered open if the angle of the rim sherd’s stance on a horizontal line was greater than 90 degrees. Vessels with an angle less than 90 degrees were considered closed (Friedman 1994:221-228).

Once a sherd was determined to be either open or closed, a visual comparison of the sherd’s shape to a similar subjective shape class was made. After the subjective shape class was determined, the general form and functional category could be concluded based on the relationship of each shape class with form and function. As in Anderson’s study (2006: 57), this study adopted Friedman’s broad form categories, such as bowls, jars, and beakers, in which open

forms of vessels were most likely used for food preparation and consumption, while the function of closed forms was most likely related to storage and transportation. For a complete list of subjective shape classes, general forms, and related functional categories found previously at the site of el-Mahâsna, refer to Anderson's study (2006:table 4.2).

The final step in determining whether the inclusion of temper in the anomalous fineware sherds can be correlated with vessel function, or is a result of the region of origin, is comparing the proportional frequency of vessel forms within the tempered assemblage against that of the untempered assemblage comprised of 96 untempered rim sherds recovered during the previous 1995 and 2000 excavation seasons. If the results of proportional frequencies of a particular form within the tempered assemblage shows a higher proportion of vessels than the related untempered assemblage, this may indicate a functional correlation with temper. However, if the proportional frequencies of a particular form within the untempered assemblage shows the expected higher proportion of sherds than the related tempered assemblage, this may indicate that the choice of temper was more related to region of origin.

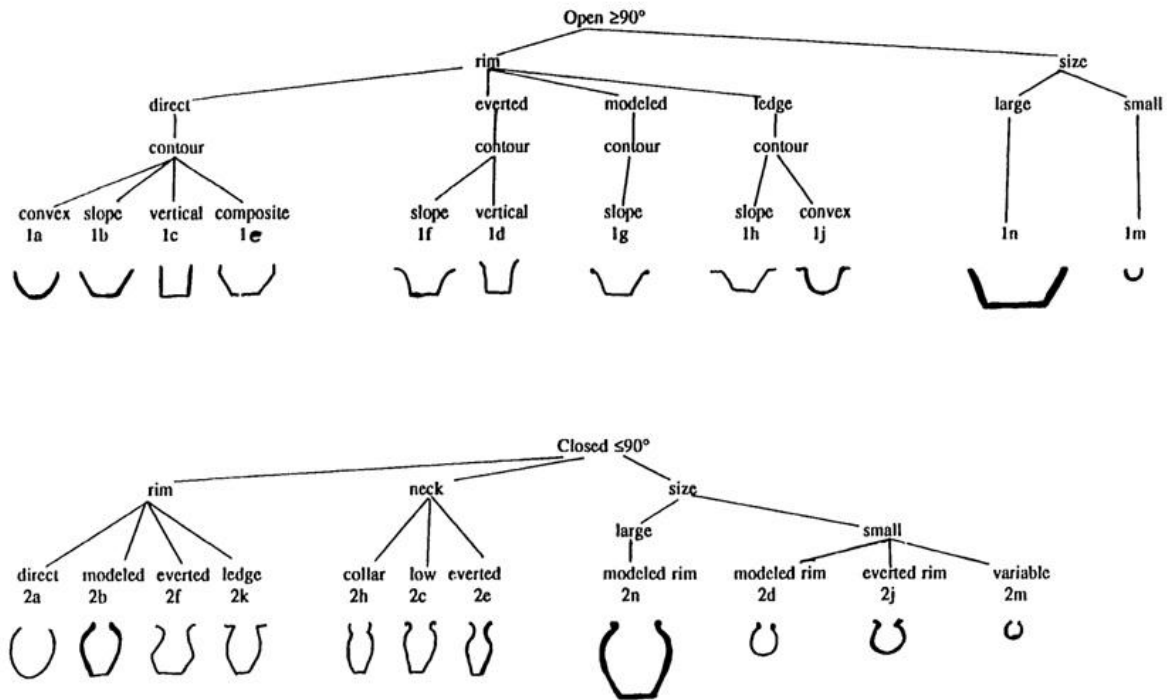


Figure 6. Subjective shape class system developed by Friedman (1994:figure 6.3).

Intrasite & Intersite Analysis

In addition to determining the proportion of vessel forms between the tempered and untempered fineware assemblages, an intrasite distribution analysis was conducted to determine the dispersal of tempered fineware sherds throughout the site of el-Mahâsna. An intrasite investigation is extremely important for this study because the examination of the archaeological context in which the sherds were recovered could help indicate the cultural context of the tempered sherds as well as to support the functional categories suggested by the rim analysis. However, in order to fully incorporate the entire site into the survey and avoid archaeological bias³, only sherds recovered during surface collections were utilized when creating the intrasite distribution maps using Golden Software's Surfer software (Golden Software 2009). Eighty-one tempered

³ Anderson's excavations focused heavily on the northern area of the site, including Block 3 due to the amount and type of materials found.

fineware sherds were utilized for the intrasite map that was created using proportional densities of each individual surface collection to avoid archaeological bias, as the greatest density of surface sherds were recovered in the areas around Excavation Block 3.

The final portion of this study consists of an intersite analysis of the sand tempered fineware assemblage at el-Mahâsna compared to related ceramic assemblages from the Upper Egyptian Predynastic settlement sites at Nagada, Hierakonpolis, and Adaïma. These three sites were chosen to represent comparative regions of Upper Egypt because of the similar level of detail recorded by the archaeologists examining the Predynastic ceramics from the settlement components of each site⁴. If a functional correlation with sand tempered fineware sherds is present at the site of el-Mahâsna, then determining if sand tempered sherds were found and in what context at either Nagada, Hierakonpolis, or Adaïma could indicate a larger regional understanding of the inclusion of sand temper in ceramic vessels. On the other hand, if the inclusion of sand temper is a result of the region of origin, then determining if sand tempered sherds were found and in what context at these sites could indicate a possible trade network, as the Abydos region is believed to be the main source of sand tempered ceramics (Anderson 2006).

RESULTS

This section presents the results of this study in three subsections. First, the analysis of tempers within P-ware and B-ware ceramics in relation to the form or regional origin of the vessel will be described. The general forms within the fineware assemblage are discussed in two broad categories, P-wares and B-wares. Due to the nature of the initial general form results, more in depth analysis of individual P-ware forms was warranted. The next subsection details the results

⁴ Friedman (1994) extensively examined Predynastic settlement ceramic assemblages from Nagada and Hierakonpolis and Midant-Reynes and Buchez (2002) also extensively examined a related Predynastic ceramic assemblage from Adaïma.

of the intrasite analysis, followed by the final subsection presenting the related occurrences of tempered fineware ceramics regionally throughout Upper Egypt. These three phases of analysis have provided the information necessary to accurately portray the relationship between vessel fabric, form, and function and the possible explanations for the inclusion of temper within the fineware assemblage at el-Mahâsna.

General Discussion of Fineware Assemblage

The finewares at el-Mahâsna account for approximately 33 percent of the entire analyzed ceramic assemblage. When broken down into the two types of finewares, the collection is comprised of 45% B-Wares, 34% P-wares, and 21% K-wares, which were finewares that could not be identified as either B- or P-wares based on the similar manufacturing features (Anderson 2006:153)⁵.

As finewares are traditionally void of tempering agents throughout Upper Egyptian Predynastic sites, the fineware assemblage at el-Mahâsna is atypical in relation to temper. Although the majority of B- and P-wares at the site are untempered, Table 2 and Table 3 demonstrate that a significant amount of unusual tempers exist within both ceramic classes, specifically a with respect to a large proportion of sand tempered remains. Within the B-wares, 6.77 percent ($n = 237$) were found to contain temper, and among those, 199 (84%) sherds are sand tempered. Further, among the P-ware assemblage, 20.5 percent ($n = 535$) of the sherds were documented as being manufactured using temper, with 509 (95%) of those sherds containing evidence of sand temper.

⁵ Sherds which were classified as “K” wares were not included in further analysis as it was not possible to assign them exclusively to either the B- or P-ware categories.

Table 2. Percentage of tempering agents in B-Ware ceramics.

Temper	Total Sherds (3,490)	Proportion
None	3,253	93.21%
Sand	199	5.70%
Normal	8	0.23%
Chaff/Straw	10	0.28%
Limestone	1	0.02%
Not Defined	19	0.54%

Table 3. Percentage of tempering agents in P-ware ceramics.

P Ware	Total Sherds (2,609)	Proportion
None	2,074	79.50%
Sand	509	19.50%
Normal	15	0.57%
Chaff/Straw	10	0.39%
Not Defined	1	0.04%

Form and Function

To determine if the inclusion of temper was the result of a functional advantage within B- or P- wares, the subjective shape designations along with the related general forms were recorded for each of the 69 tempered and 96 untempered rim sherds. The breakdown of the complete assemblage of B- and P-ware rim sherds and the associated temper classes utilized can be seen in Table 4 and Table 5. The B-ware rim assemblage in regards to temper supports the typical results found throughout Upper Egypt, namely the majority of the vessels being untempered. However, the results from the P-ware show a very atypical pattern with sand tempered rim sherds comprising the majority of the P-ware assemblage. This pattern of unusual amounts of

sand temper found in the entire fineware assemblage, as well as the rim assemblage, may suggest that sand, rather than being a natural inclusion in the fabric of the vessels, was purposefully chosen as a tempering agent.

Table 4. Percentage of tempers within B-ware rim assemblage.

Temper	Rim Sherds (<i>n</i> = 74)	Proportion
None	61	82.43%
Sand	12	16.21%
Normal	1	1.36%

Table 5. Percentage of tempers within P-ware rim assemblage.

Temper	Rim Sherds (<i>n</i> = 91)	Proportion
Sand	52	57.14%
None	35	38.46%
Chaff/Straw	3	3.29%
Normal	1	1.11%

With respect to the results shown in Table 4 and Table 5, the analysis of general forms between the untempered and tempered finewares shows an unexpected pattern for a few vessel forms within both the B- and P-wares. Figure 7 shows the proportions of various general vessel forms for both tempered and untempered B-ware. As can be seen in the graph, only beakers, shallow bowls, and large beakers of black-topped redware were manufactured using temper. However, in the case of the shallow bowls and large beaker forms, the presence of temper is represented by a single sherd from each vessel form and may therefore be the result of unintentional, natural inclusions in the clay utilized for their manufacture. On the other hand, the use of tempering in beaker class appears to be intentional as it occurs in 12 examples recorded during the study. Further, the nearly fifty percent higher proportion of beakers (86%) among the

assemblage of tempered vessels compared to the proportion of beakers (38%) in the untempered assemblage is highly significant ($p < 0.01$; Figure 8) and likely indicates that the inclusion of temper was for a functional purpose within the B-ware beakers.

In comparison to the B-ware general forms, the P-wares indicate a similar pattern that may provide direct evidence of intentional inclusion of temper within specific forms during the manufacturing process. Beakers, shallow bowls, bowls, and jars, as seen in Figure 9, all contain sherds with anomalous tempers. However, jars only have one tempered sherd and could be a result of natural processes rather than intentional inclusion and thus will be excluded from further discussion. The P-ware bowl form consists of six tempered sherds and eight untempered

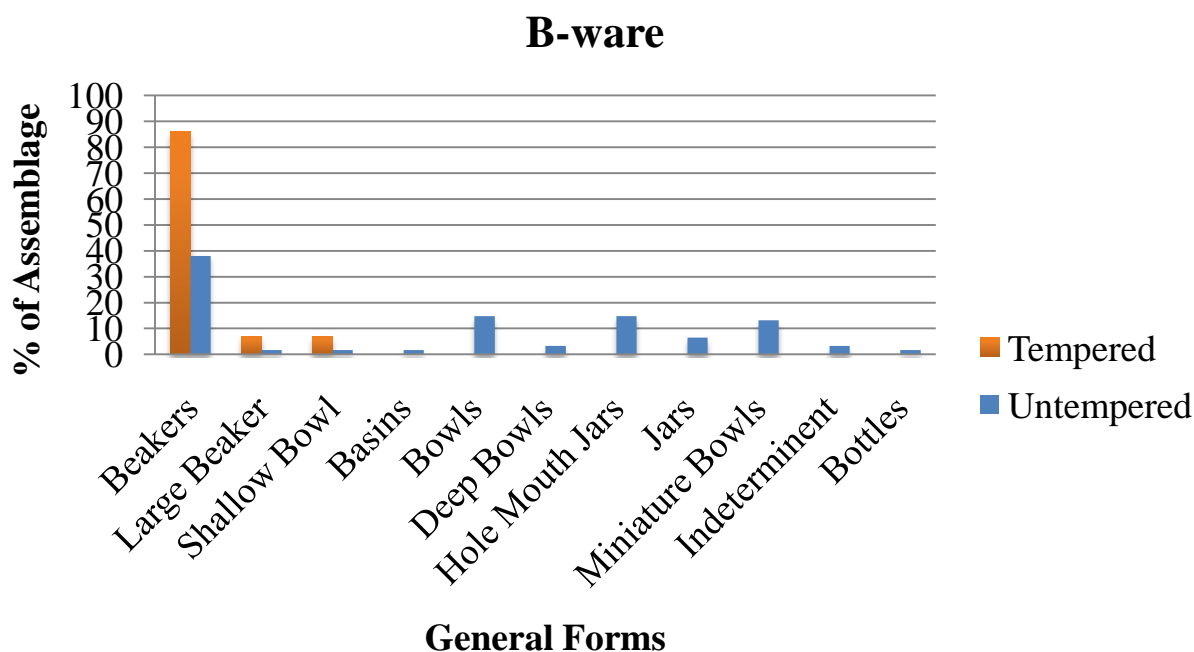


Figure 7. Relative proportion of vessel forms within B-ware rim assemblage.

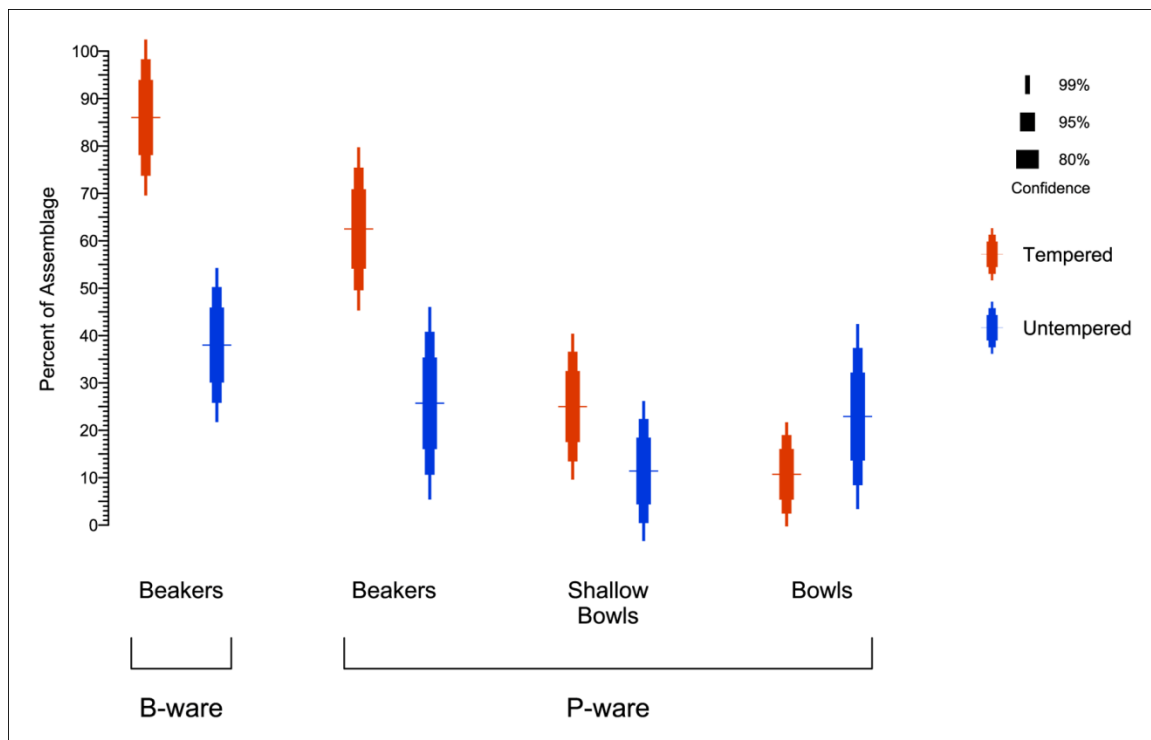


Figure 8. Statistical comparison of the proportions of tempered vessel forms to untempered vessel forms in both the B-ware and P-ware assemblages.

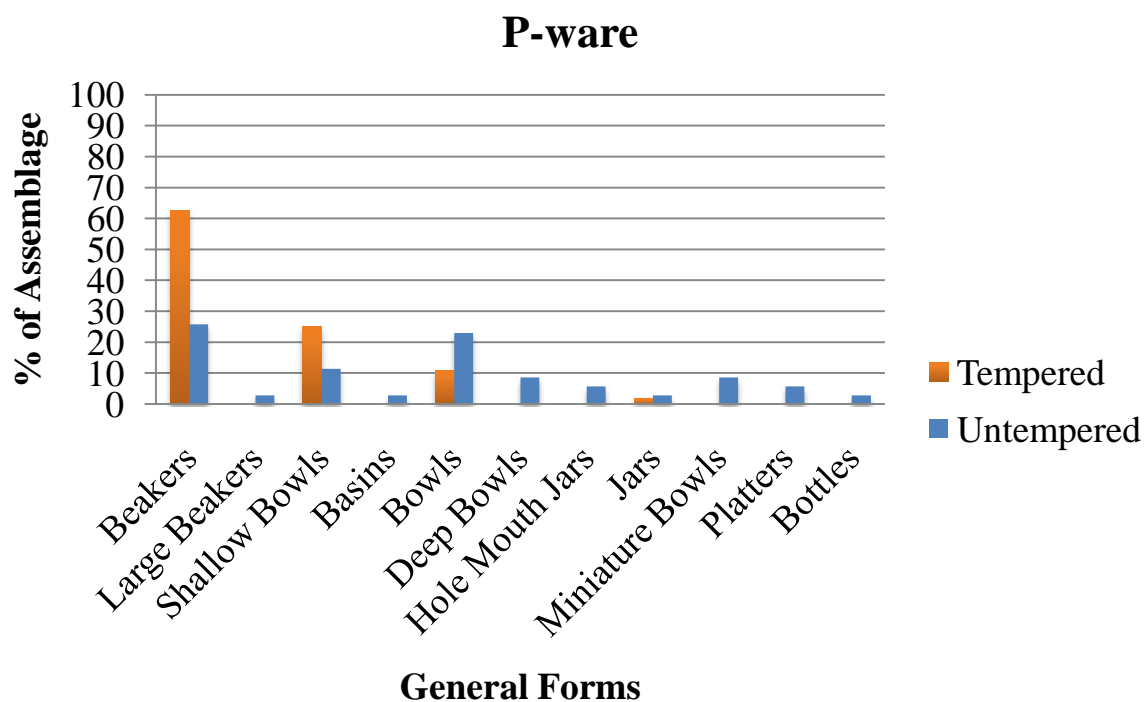


Figure 9. Relative proportion of vessel forms within P-ware rim assemblage.

sherds, which could suggest a limited amount of intentional inclusion, however this cannot be substantiated with sufficient confidence ($0.05 < p < 0.20$). The best evidence for functional inclusion of temper within the P-wares is in the shallow bowl and beaker forms. The shallow bowl form contains four untempered sherds and 14 tempered sherds and accounts for a 13.6 percent higher proportion of tempered vessels than in the untempered vessels, a difference which is fairly highly significant ($0.01 < p < 0.05$). Among the recovered P-ware beakers nine untempered and 35 tempered sherds were identified, indicating a strong correlation between the inclusion of temper and the P-ware beaker forms. The P-ware beaker form category accounted for 62.5 percent of the entire P-ware tempered assemblage, which like the B-ware beakers is a highly significant difference ($p < 0.01$) compared with untempered forms, and suggests a functional reason for the inclusion of temper. To determine if these correlations represented a functional advantage or not, further analysis of the P-ware shallow bowl and beaker forms was conducted.

Further analysis of the tempered P-ware shallow bowls and beakers included a more in depth examination of subjective shape classes and the diameters of each rim sherd. The results of the subjective shape class study for shallow bowls is shown in Figure 10, in which 12 of the 14 tempered rim sherds are classified as class 1a1. Subjective shape class 1a1 is defined by Friedman (1994:Table 6.1a) as a shallow to medium depth bowl used for a food serving function. As the overwhelming majority of the tempered shallow bowls belong to class 1a1, it could be suggested that a functional reason was the cause for the inclusion of temper. The range of diameters within P-ware shallow bowls can be seen in Table 6. Although the majority of the

shallow bowls are within the 12-24 cm in diameter range, the four sherds that originate from vessels 32 cm in diameter and larger make it difficult to suggest an intentional inclusion of temper due to size of vessel.

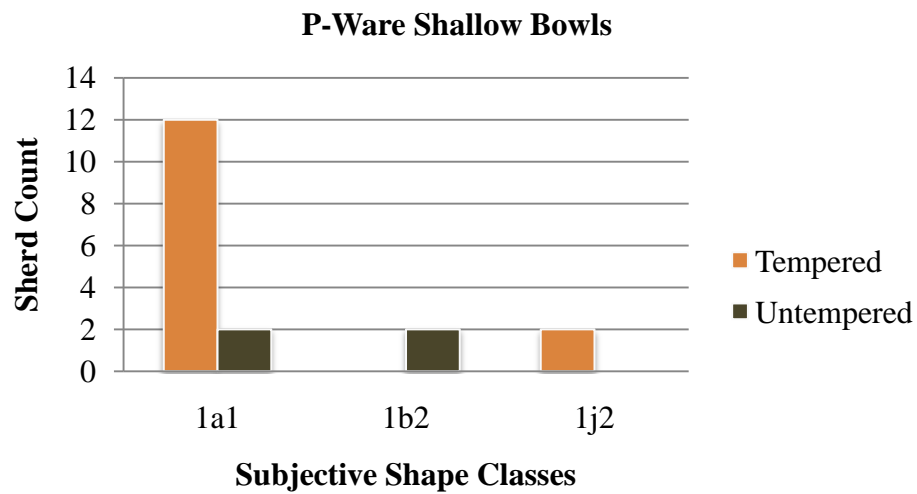


Figure 10. Relative proportion of subjective shape classes within P-ware shallow bowls.

Table 6. Diameters of tempered P-ware shallow bowls.

Diameter (cm)	Number of Sherds (X=1)
12	X
14	XXX
16	X
18	
20	X
22	XX
24	XX
26	
28	
30	
32	X
34	X
36	X
38	
40	
42	
44	X

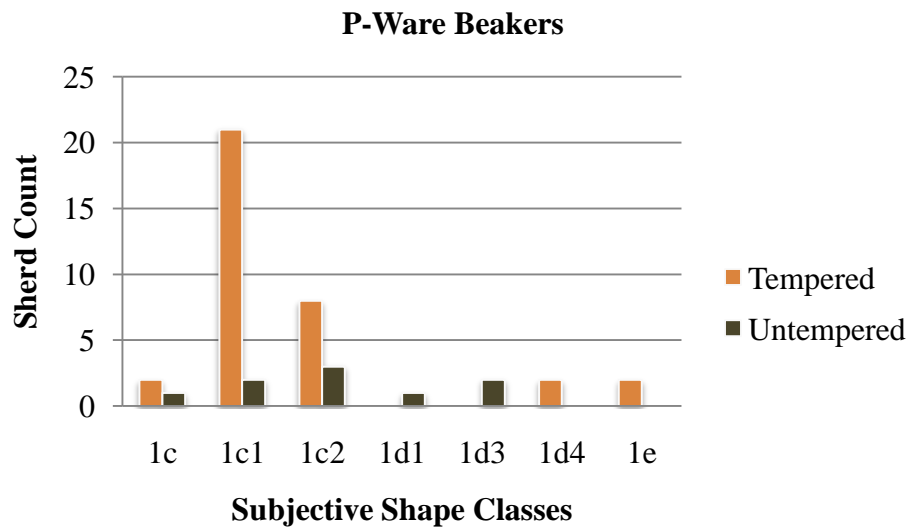


Figure 11. Relative proportion of subjective shape classes within P-ware beakers.

Table 7. Diameters of tempered P-ware beakers.

Diameter (cm)	Number of Sherds (X=1)
12	XX
14	XXX
16	XXXXXX
18	XX
20	XXXX
22	XXXX
24	XXX
26	XXXX
28	XXX
30	XX
32	XX
34	
36	
38	XX

The results of the subjective shape class study for P-ware beakers shows even more possible functional correlations as seen in Figure 11. Two separate subjective shape classes, 1c1 and 1c2, stand out from the others. Subjective shape class 1c1 is described as a beaker with vertical (90°) walls and a direct rim while 1c2 is described as a beaker with near vertical (100°) walls and a direct rim with both utilized for food preparation (Friedman 1994:Table 6.1a). The subtle difference between the two may not have been realized by Predynastic potters, thus the functional purpose of the two forms were most likely one and the same. As these two forms account for 29 of the 35 tempered beakers in the study, it could be suggested that the inclusion of temper was the result of enhancement to the functionality of the vessel. The range of diameters within P-ware beakers can be seen in Table 7. Although the majority of the beakers are within the 16-26 cm diameter range, the remaining rim sherds form a wide range that makes it difficult to suggest an intentional inclusion of temper due to size of vessel.

Intrasite Distribution Map

Intrasite distribution maps to display the frequency of tempered fineware sherds against the total amount of sherds within each surface collection unit from the 1995 and 2000 excavation season were created for both B- and P-wares. Based on the analysis of excavation blocks at el-Mahâsna by Anderson (2006), distribution patterns in specific areas of the site can be relatively associated with the established archaeological context. Figure 12 displays the distribution of B-ware tempered sherds, in which no strong patterns are evident as the small collection of sherds are spread throughout the site.

Within the distribution of P-ware tempered sherds however, a clustered pattern does appear in the northern portion of the site near excavation Blocks 3 and 4, as seen in Figure 13. Excavation Block 3 has been suggested to be a possible Predynastic ritual structure and its related archaeological deposits (Anderson 2006:123) and Excavation Block 4 has been suggested as a domestic activity area with food processing activities (Anderson 2006:132). Thus, the proximity of the cluster to the ritual center could suggest a ceremonial significance as well as a functional advantage to the inclusion of temper in P-ware beakers and shallow bowls. Further evidence for the association of tempered fineware rim sherds with the ceremonial area at Excavation Block 3 is found within the excavated portions of the site. Of the 69 rim sherds found within closed excavation contexts, 47 (68%) were recovered from Excavation Block 3.

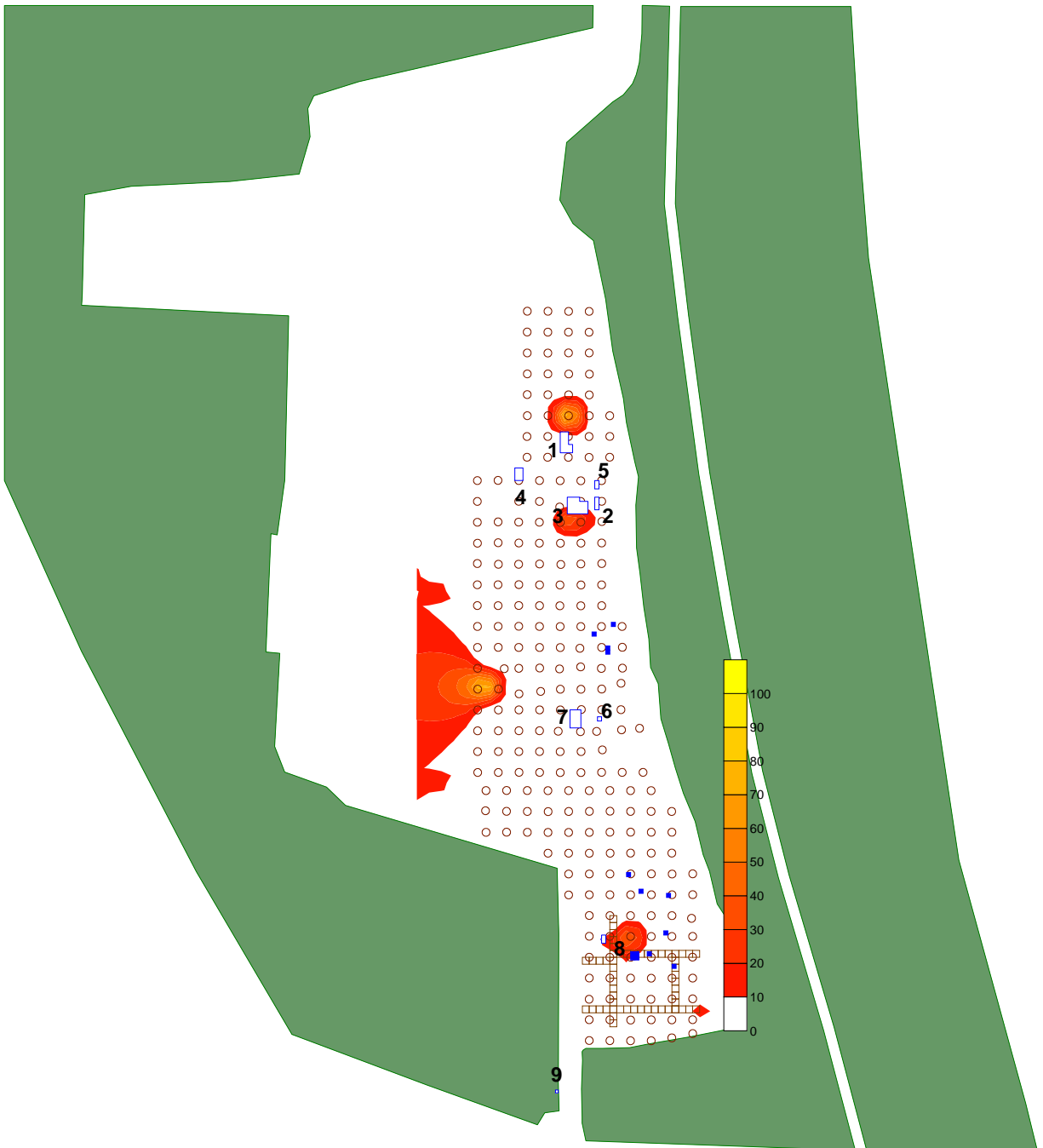
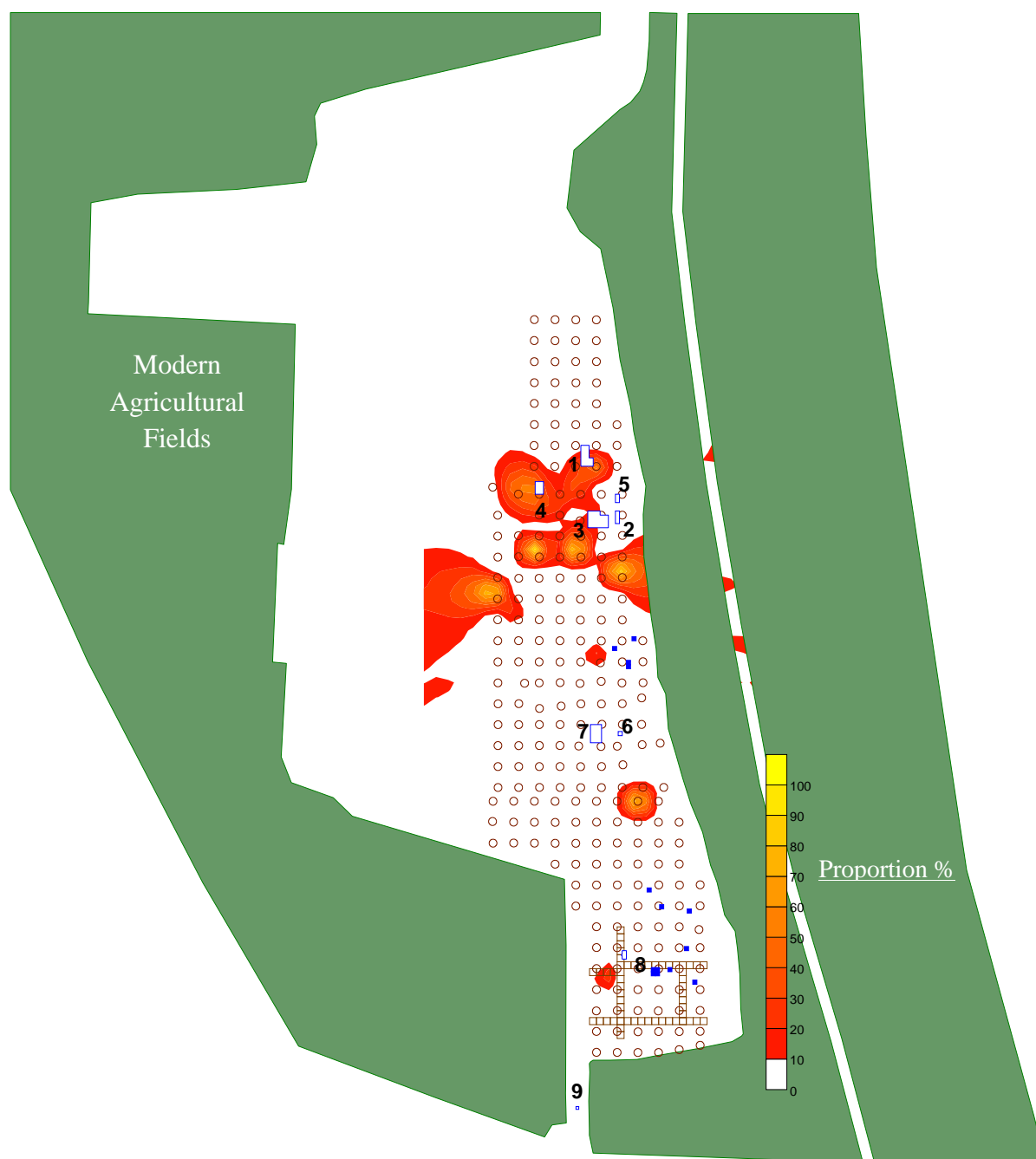


Figure 12. Distribution map showing frequency of tempered B-ware sherds.
Base Map Source: Anderson (2006).



**Figure 13. Distribution map showing frequency of tempered P-ware sherds.
Base Map Source: Anderson (2006).**

Intersite Analysis

To evaluate the region of origin of the B- and P-ware tempered sherds at el-Mahâsna, an interregional analysis was conducted to examine the presence of sand temper within related ceramic assemblages throughout Upper Egypt. Although the inclusion of sand temper in finewares may be of local tradition to the Abydos/Thinite nome, the ceramic assemblages from the sites of Nagada, Hemamieh, and Hierakonpolis, all of which were all analyzed by Friedman (1994), were examined for evidence of sand tempering. Results of her study showed that Nagada and Hemamieh contained no evidence of sand tempered finewares. At Hierakonpolis, she found two fineware sherds at HK29A, the earliest documented Predynastic ritual center in Upper Egypt (Friedman 1994). However, Friedman explained the sand was naturally occurring and not an intentional inclusion. Excavations at Adaïma were conducted by Midant-Reynes and Buchez during the 1980s and early 1990s and it appears that there were no occurrences of sand temper within the fineware assemblage. However, a more detailed analysis of the Adaïma collection was inconclusive due to the unique classification typologies established by Midant-Reynes and Buchez (2002).

CONCLUSIONS

Ceramic analysis previous to this study had supported Friedman's claim that temper varies regionally within Upper Egyptian roughwares, as a large portion of the roughware assemblage at el-Mahâsna consists of "normal" temper, which consists of a mix of limestone, chaff/straw, and sand, unique to the Abydos region. However with the results of this study, Friedman's conclusion that fineware ceramics are untempered throughout Upper Egypt should be modified for the Abydos region. In addition to the "normal" temper found within roughwares at el-

Mahâsna, the large proportion of sand temper within the entire assemblage strongly suggests a local tradition of intentional inclusion of sand temper in fineware ceramics.

Evidence for Function of Vessel

Prior to this study, very little evidence existed for the inclusion of temper for functional strengthening in Predynastic fineware vessels, however this study has produced strong evidence for the presence of sand tempering within limited forms, particularly the beakers forms of B- and P-ware vessels. The tempered B- and P-ware beakers and shallow bowls each indicate a strong correlation between form and temper due to the significant disparity between tempered sherds and untempered sherds of these forms. Further evidence for functional strengthening of the vessel with temper is supported by the limited number of subjective shape classes that contained temper found within these forms.

Reasons for why Predynastic potters would include temper within the fineware assemblage when the rest of Upper Egypt was not is more difficult to decipher. One explanation that makes sense is Friedman's discussion of techno-function, in which temper is included to help strengthen the performance characteristics of vessels to either last longer or perform more efficiently. Using the results of the five tests described above, it was shown that ceramic sherds with sand temper had a few advantages over untempered sherds. Sand tempered sherds were shown to be excellent conductors of heat and were also shown to retain the most strength during thermal shock tests, in which the sherds were exposed to rapid changes in temperature (Friedman 1994: 258-260). As beakers and shallow bowls were used for food preparation and serving functions, the ability to withstand cooking processes and retain heat would have been extremely important and could be an explanation for the inclusion of temper within these two forms during the Predynastic.

Evidence for Regionality

Besides the B- and P-ware beaker and shallow bowl forms, the proportion of tempered sherds against untempered sherds held true to the Friedman's conclusion that finewares are typically untempered. However, the amount of tempered fineware sherds present in the el-Mahâsna assemblage is still significant and needs another explanation. The main problem now becomes attempting to determine the region of origin of these anomalous sherds. It has been suggested that the inclusion of sand within Predynastic ceramics may originate from the Abydos region, and the results of the intersite analysis at Nagada, Hemamieh, Hierakonpolis, and Adaima seem to support this claim (Anderson 2006:153-155).

Evidence for Cultural Context

The cultural significance of the intrasite distribution of the tempered B- and P-wares show varying interpretations. B-wares exhibit no cultural patterns that can be associated with closed excavation context but within the P-wares, a large concentration at the northern portion of the site may indicate an association with the cultic building found at Excavation Block 3. This could also be a result of a small sample size of B-ware tempered rim sherds compared to the much larger P-ware tempered rim assemblage.

Suggestion for Future Research

Although the chronology and ceramic analysis of Predynastic settlements is developing more into focus since Friedman's revolutionizing study, more research is needed to fill in the gaps. At the site of el-Mahâsna, more questions arise within the tempered fineware assemblage. Is the occurrence of temper change temporal? What other reasons for function can be explained? Can the P-ware beakers and bowls be proven archaeologically to be associated with the cultic building in excavation block 3? Finally, more sites need to be examined both intraregionally in

the Thinite nome and from other regions of Upper Egypt, for the presence of temper, specifically sand, within the fineware assemblage to determine if the inclusion of temper is widespread or a local tradition in the Abydos region.

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