THE PRODUCT OF LABOR: POTTERY TECHNOLOGY IN THE UPPER XINGU, SOUTHERN AMAZON, BRAZIL, A.D. 700-1770

By

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To my parents, Robert and Marie,

and to the memory of Jim Petersen

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CA	Collection Area, a 100 x 100 meter gridded area with 121 2.0 x 2.0 meter collection units spaced every 10 meters
CU	Collection Unit, a 2.0 x 2.0 meter square divided into 1.0 x 1.0 meter subunits
ET	Excavation Trench, a hand excavated trench
EU	Excavation Unit, a 1.0 x 1.0 meter or 1.0 x .5 meter square excavated in 10 centimeter levels within naturally occurring soil stratigraphy
KSA	Kuikuru Study Area
MPEG	Museu Paraense Emílio Goeldi
MT-FX	Mato Grosso-Formadores do Xingu, this is the designation for archaeological sites within the headwaters of the Xingu River including those along the Culuene River in the Kuikuru Study Area
MT-AX	Mato Grosso-Alto Xingu, this is the formal designation for archaeological sites along the southern portion, or upper portion, of the Xingu River but north of the confluence of the tributaries that comprise the headwaters
PIX	Parque Indígena do Xingu, the Indigenous Park of the Xingu where the Kuikuru Study Area is located
TU	Test Unit, a 0.5 x 0.5 meter square excavated in 10 centimeter levels within naturally occurring soil stratigraphy

Abstract of Dissertation Presented to the Graduate School
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By

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This study examines the variation in pottery technology from prehistoric sites in the headwaters region of the Xingu River in the southern Brazilian Amazon. The pottery analysis is combined with ethnographic observations regarding manioc subsistence and modern indigenous pottery use in the Upper Xingu in the traditional area of the Kuikuru indigenous tribe of the lower Culuene River, the main tributary of the Xingu River. Particular attention is given to the connection between material culture and social relations among past and present societies. Specifically, the analysis examines transformations in the technology of pottery used specifically for the processing of manioc, which along with fish, is the main staple of the Upper Xingu diet. Three specific domestic pottery forms, or types, are analyzed from archaeological contexts that span the period from A.D. 700-1770. The analysis uses a technofunctional method that focuses on ceramic attributes that specifically relate to the technology of pottery and their performance characteristics. These attributes include temper type and amount, vessel shape, vessel wall thickness, and overall vessel size. The largest portion of

metric attribute data was collected from three separate pottery assemblages, or groups, from two separate archaeological sites. These data were compared and examined to discern any statistically significant variations or changes through time. The most obvious changes observed are a significant decrease in the variety of vessel size, shape, and temper contents and an increase in vessel size and uniformity, collectively classified as increased standardization. These changes are hypothesized to be a result of the transformation of the relations of production that compelled pottery manufacture. This essentially socioeconomic transformation is correlated with other changes documented archaeologically including the early first millennium A.D. population increase and village expansion. These archaeological observations are also correlated with ethnographic data regarding social organization and labor control among chiefly societies of the Upper Xingu. Collectively, the increase in population and the demand for more labor from chiefly elites placed stresses on manioc processing and the production of pottery used in the processing method unique to the Upper Xingu. This increased the routinization and standardization in pottery production and manufacture which narrowed its production to the utilitarian vessels used specifically for processing manioc. This is indicative of a highly controlled and centralized production and manufacturing industry which likely transformed through time from a household level of production to a village level of production. This transformation is further explained by both local and regional developments including the arrival of new indigenous groups to the Upper Xingu and later the effects of the first arrival of Europeans to Brazil.

CHAPTER 1
PROBLEM ORIENTATION AND OVERVIEW

Introduction

> The devaluation of the world of men is in direct proportion to the increasing value of the world of things….This fact expresses merely that the object which labor produces—labor's product—confronts it as something alien, as a power independent of the producer. The product of labor is labor which has been embodied in an object, which has become material: it is the *objectification* of labor.
>
> —Karl Marx, *"Estranged Labor" from the Economic and Philosophical Manuscripts of 1844*

This study focuses on material culture and social relations within both past and present societies of the headwaters region of the Xingu River in southeastern Amazonia, Brazil (Figure 1-1). Specifically, it focuses on understanding two aspects of material change in Upper Xingu, or Xinguano, society from circa A.D. 700 to 1770 and how these aspects relate to each other. The first aspect is the transformation of ceramic technology within the continuous tradition of Xinguano pottery spanning this entire period and into the present. The second aspect is the physical expansion and elaboration of Xinguano villages during this breadth of time. Three further aspects tie these two material aspects together. First, the subsistence economy, specifically manioc horticulture and processing relying on the use of Xinguano pottery is examined. Second, the political economy, specifically the organization and use of female labor by both chiefly and non-chiefly heads of household in the Upper Xingu to maintain certain levels of manioc production, is examined. Third, the social (and symbolic) structures that enable these heads of household to manage and organize labor are examined.

These five aspects of Upper Xingu society, documented ethnographically, and examined archaeologically, are viewed together to address several anthropological and archaeological problems. These problems relate to issues in pottery studies and how a technofunctional study of pottery can shape archaeologists reconstruction of past societies and conversely how archaeologists reconstruction of past societies shape their understanding of pottery production and use and the mechanisms that structure that process. Finally, all of this is directly related to the influence of labor, and its organization, on material production.

The case study focuses specifically on two large circular plaza villages located near the Culuene River (the main headwater of the Xingu River) in the Parque Indígena do Xingu (PIX) and occupied between roughly A.D. 700 and 1770. Pottery assemblages of the two roughly contemporaneous sites are analyzed and compared with observations on historic and ethnographic assemblages among the Kuikuru indigenous community. These data suggest that a transformation in ceramic technology through time parallels a concurrent increase in village size, complexity, and population, all of which put a greater demand on manioc production. The transformation of pottery to a more uniform and standardized group of vessels, whose form and construction are more specifically suited for their function, parallels the increase in village size, the construction of village peripheral ditches, village segmenting roads, and the likely effect these developments had on social complexity. Taken together with the size of village surrounding anthropogenic forests, the landscape alterations, transformation in pottery production, and increased village size, all suggest that the intensification of manioc horticulture played a role in maintaining the increased population density of the region but was not the sole factor initiating that increase.

Figure 1-1. The Kuikuru Study Area (KSA) is located within the Parque Indígena do Xingu (PIX) on the southern periphery of the Brazilian Amazon.

This study also contributes to the ongoing task of better understanding Upper Xingu village complexes and networks late in time and the associated level of ceramic production within this regional scale of social organization. The stylistic differences in pottery present at these two prehistoric sites, and among other less studied sites throughout the Upper Xingu are characteristic of village level ceramic production with regional level influence on style and technology. This differs from the regional level of production that exists today, where one village manufactures pottery for all villages in the Upper Xingu. The consolidation of manufacture into one village is explained at least in part by the fifteenth century impact of European contact on the Xingu River and all of Amazonia. The effects of contact altered the scale of regional chiefdoms and had a direct impact on craft specialization.

This study follows in the tradition of other studies focused on pottery as technology and on pottery as the outcome of patterned behavior. James Deetz classic study of Arikara pottery was among the first to show that “the patterning of behavior which produces standardization in artifacts is largely conditioned by the culture of the makers of those objects" (Deetz 1965:2). Kenneth Sassamans study of the development and adoption of pottery among hunter-gatherers of southeastern North America demonstrated that social conditions not only perpetuate technological change but can also inhibited it (Sassaman 1993:218). As Randall McGuire points out, V. Gordon Childe first put forth the notion that tools reflect the social and economic conditions that produce them and that we can learn about the conditions from the tools but "neither the processualist view of material culture as a 'fossil' record nor the postprocessualist notion of material culture as text captures the complexity implied in Childe's two axioms"

(McGuire 1992:102). Finally, closer to the present study area, Warren DeBoer emphasized through his study of the Shipibo ceramic industry that "a fundamental resource in human life is labour. Labour fuels production by welding raw materials into cultural form and, in the case of female labour, uniquely limits the very reproduction of society" (DeBoer 1986:231). Applying this basic and complimentary theoretical framework to an examination of ceramic technological innovation encourages an explanation that accounts for both individual and group patterning. Following these studies and others, the present study attempts to explain the process of technological transformation in pottery within the context of its role as both a tool and a product of labor in the entirely female dominated industries of manioc harvesting, processing, and ceramic manufacturing. This is accomplished using both ethnographic data from past studies in the KSA and observations made during residence in the Kuikuru village from 2002-2005. These ethnographic data support the interpretation of archaeological data from region.

The Case Study

The present study focuses on the prehistory as well as the ethno-historic trajectory of pottery in the Upper Xingu. Clearly analogous examples of modern Xinguano pottery, used specifically for the processing of manioc, are documented at the latest prehistoric and protohistoric sites in the study area. Drawing on this connection improves the following analysis by allowing certain conclusions to be drawn about the relationship between form and function of pottery in the prehistoric Upper Xingu, especially as it relates to their use in processing manioc and cooking fish, as is well documented elsewhere (Carneiro 1983; Dole 1978; Heckenberger 1998).

Much of the field work for this project took place during the Southern Hemisphere Winter which is the dry season between June and September. The dry season in the Upper Xingu is the harvest season and each morning before dawn women ride bicycles to the manioc gardens outside of the village and return with sacks and baskets of manioc tubers. While most of the village remains asleep in their hammocks, the rhythmic sound of women peeling and grating manioc roots cuts through the cold morning air (Figure 1-2). Near the village chief's house the rhythm is more complex as several women are busy grinding manioc into large, round, flat bottomed vessels. The processed manioc will be dried and stored for use during the feasting intensive Kuarup ceremonies of August (Agostinho 1974). The stored manioc also provides the main element of the Kuikuru diet throughout the rainy season. This means that the sound of women grating manioc is heard throughout the village each day to ensure that enough manioc is processed to maintain household food supplies throughout the wet season.

This process of peeling and grating the manioc is followed by further processing to separate the liquid and the pulp. The grated shavings are rinsed with clean water and squeezed by rolling the mash into a *tuafi*, a woven matt that is placed flat over staves that straddle the large vessels. The *tuafi* is unique to the Upper Xingu and only a few other places throughout the Amazon (Dole 1964). The preferred method in almost the entire Amazon remains the *tipiti*, a tube-shaped plaited basket in which the grated manioc is squeezed, though this technology was not adopted in the Upper Xingu. Once squeezed dry, the pulp is formed into small loaves, dried in the sun, and saved as an inferior quality reserve stock. The juice, squeezed from the pulp, sits in large flat-bottomed vessels until the manioc sediment settles to the bottom of the vessel.

Figure 1-2. Kuikuru woman processing manioc with an entirely metal suite of pots and a single ceramic pot (*ahukugu*) over the fire in the background.

The water on the top is skimmed off and boiled throughout the day in another large ceramic vessel (*ahukugu*), suspended over fire with pot-stands (*undagi*) and cooked until the juice becomes a thick starchy liquid (*kuigiku*). If left to ferment the *kuigiku* would transform into a type of beer but this practice is not known in the Upper Xingu as it is in almost the entire northern Amazon. After the water is skimmed to boil into the *kuigiku*, the remaining sediment in the original processing vessel is left to dry until most of the water has evaporated. The cakes of sediment are then removed from the vessel to completely dry in the sun. This manioc sediment, when dried, is broken up and placed in a hollowed out tree stump and pounded into a fine powder with a wooden pestle (Figure 1-3). The powdered manioc will be mixed with water into a gruel that is consumed throughout the day. The powdered manioc will also be baked on a large griddle into flatbread that, along with fish boiled in a separate vessel (*atange*), is the main staple of the Upper Xingu diet. The flour is stored in silos and sacks within each residence (Figure 1-4). A stock of manioc flour is essential not only because of its value within the Upper Xingu diet but also for the performance of a chief and his duties (Heckenberger 2003). For these purposes manioc can be used as payment for services or to host village guests, especially important if one is to host a Kuarup ceremony when visiting villages will consume manioc provided by the sponsor of the Kuarup.

Figure 1-3. Kuikuru woman pounding dried manioc with a wooden pestle and a hollowed tree stump mortar.

An essential part of the processing method just described is the flat bottomed, high rimmed vessels. Today, these vessels are made of aluminum and bought in the Brazilian markets. These large metal vessels replaced the traditional ceramic vessel for all cold processing of manioc. Likewise, the traditional mussel shell has been replaced with a metal peeler for removing the skin of the manioc. Today, the Xinguano equivalent of the modern aluminum pot, the *ahukugu*, is used only for hot processing at which point it is designated as a montegoho. The ceramic *ahukugu* are over 100 cm in diameter, 3-4 cm thick on their lip and rim, almost 30 cm in height, and nearly identical in their manufacture. The measurements and standardized manufacture of the modern ceramic *ahukugu* are in contrast to the earliest *ahukugu* vessels found at archaeological sites.

Figure 1-4. Silo and sacks filled with manioc at the center of a Kuikuru house.

The processing and cooking activities just described, and all daily pottery related activity in the Kuikuru village, take place either in the backyard of the house or in the rear domestic area within the house. Standing in the middle of the Kuikuru village, in the center of the plaza, surrounded by the inward gaze of the long-houses ringing its edge, no pottery is visible (Figure 1-5). Glancing between two houses some pottery is visible in the backyard cooking and processing areas but the plaza itself is clean. New pottery that is awaiting its debut or movement in a trading session (*uliqi*) is often stored along the interior walls of houses, or beneath hammocks. During the dry season most cooking activities take place outside the house, in the backyard, but during the rainy season these activities are moved to the center of the house.

Figure 1-5. Kuikuru village adjacent to Lake Ipatse.

Within these main domestic areas, and nearby the boiling *kuigiku*, is found another small ceramic vessel sitting over a fire. In this pot, charred black on the outside from sitting within the lapping of the flames, is a fish gruel that also cooks for many hours. In accordance with taboos against meat and blood, fish are not gutted or cut but placed directly in the pot with water and boiled whole. These pots are not regularly cleaned and develop a thick layer of burned residue on the inside as well as the outside. One additional ceramic ware is found in domestic areas; the large, flat, griddle (*alato*) used for transforming the dried and pulverized manioc flour into flatbread. Nothing is mixed with the flour and the natural sugars melt and bind the flour together as it is spread evenly in a thin layer across the griddle which also sits low to the ground suspended by three to four *undagi*. A small fire is kept under the griddle with small branches that are fed into the fire, just enough to keep it flaming, while the flatbread is being cooked.

When the morning of manioc processing is finished and the wet processed manioc is set out to dry, all the large aluminum vessels used in the processing are tipped over to allow them to dry and some of them are placed on their side leaning against a tree or drying rack, where they sometimes fall and crack. This scene is similar around the village, behind every house. What is different, and perhaps more important, is the amount of vessels that are found behind each house. Some houses are clustered together and share back yard domestic areas. In the Kuikuru village this occurs in sections of the village where chiefly individuals live with larger extended families. It is in these houses or house clusters where wealth is accumulated in manioc flour. This is an essential accumulation that is used to sponsor feasts and serves as a reminder of the chief's hierarchical position and the amount of manioc processing labor he can command. To produce this excess of manioc flour the chief employs the labor of his many daughters and daughters-in-law. To allow for this amount of processing the chief is the owner of more large vessels than anyone in the village.

The large ceramic vessels are at constant risk of breakage from accidental mishandling or less frequently from thermal stress. Disposal of the broken pots is not immediate. Because the *alato* are essentially the same diameter as the *ahukugu*, when an *ahukugu* is broken on the body or rim, the base can often be used as an *alato*. The broken sides of the vessel can also be used as wind-breaks around the base of the fire, under the cooking vessels. In some cases the remnant of a broken vessel, with its rim still intact, will be used as a pot stand to elevate a new pot over the fire (Figure 1-6).

Figure 1-6. Manioc griddle (*alato*) with a rim portion of a broken manioc processing vessel leaning against it. Other sherds are used to elevate the griddle.

Pieces of broken pots that have no further use usually make it to a deliberate disposal behind the backyard or off the side of a trail leading away from the village. Along these areas a steady accumulation of organic waste creates visible trash mounds. Occasional stray sherds make their way into the soil of the backyard or even into the interior edges of the house if they are broken within the house. This is especially true of the smallest vessels that are used for non-cooking related activities such as storage of beads, salt, red pigment, or other daily and long term storage items.

This brief description of ceramic use in the ethnographic context of a modern Kuikuru village provides some reference for assessing the life of a ceramic pot in the archaeological record. In assessing the overall distribution of ceramic remains at the sites in this study it is clear that the patterns of use and discard that took place in prehistoric times were similar to those observed in the Kuikuru village, especially in the location of trash accumulation. Excavations in the center of the plaza at the archaeological sites resulted in the recovery of almost no ceramic remains and the small amounts that were found were not subsistence related. However, the midden ring around the edge of the village plaza of the archaeological sites revealed dense deposits of pottery. Excavations further away from the plaza revealed the densest midden on the site in areas just behind an excavated house.

The accumulation of ceramics at the archaeological sites has much to do with the overall construction of the site through time. The period of greatest accumulation seems to be during the period in which the plaza mounds were built-up and the village periphery ditches were excavated. Less accumulation is found in the various areas between the plaza mounds and the ditches. These areas seem to have densities that are the result of house locations, paths, and formal roads, all progressing out from the central plaza. Subsurface densities in this area are also indicative of long term accumulation. Areas closer to the plaza including the plaza berm itself, are denser with ceramic remains and in some cases contain darker soil.

This correlation between ethnographic observations and archaeological realities is the premise from which this study proceeds. Ethnoarchaeology as its own field of inquiry can provide the archaeologist with many insights but must be used with caution. Directly relating ethnoarchaeological observations without accounting for differential variables between the present and the past can lead to misguided assumptions about both. A brief review of some pertinent ethnoarchaeological studies follows with special attention to those related to ceramic ethnoarchaeology.

Ethnoarchaeology

This study is not a ceramic ethnoarchaeological study but rather falls into what Longacre termed “fortuitous ethnoarchaeology”, studies that “appeal more to the direct historical approach” than proper ethnoarchaeology (Longacre 1991:6). The Upper Xingu is a rare case in which the modern pottery has immediate analogs with pottery forms of the past and in ethnoarchaeological studies “analogical reasoning is fundamental to archaeological interpretation” (Longacre 1991:10).

Allowing for such analogies are the many modern ethnographic works of the region (Agostinho 1993; Basso 1973, 1977, 1984, 1995; Carneiro 1960, 1961, 1970, 1972, 1977, 1978a, 1978b, 1983, 1987a, 1987b, 1989, 2000; Dole 1956, 1964, 1978, 1983, 1984, 1991; Gregor 1977; Heckenberger 1996, 2005) and the ethnographic sketches from the earliest period of research in greater Amazonia (Hartman 1986; Oberg 1953; Steward 1948; Steward and Faron 1959; Von den Steinen 1886). Drawing on the most recent work in the KSA the current study examines the relationship between the demand for labor and the transformation of pottery related to that labor (Heckenberger 2005). The issue of identifying and evaluating social complexity in the Upper Xingu, indeed in the entire Amazon, has been a contentious one throughout the last half century (Carneiro 1960, 1970; Denevan 1976, 1991, 1996; Lathrap 1970; Meggers 1971, 2000, 2007; Roosevelt 1987, 1999a, 1999b; Heckenberger et al. 1999; Neves 1999b). The data presented here contributes to ongoing discussions that interweave hypotheses about landscape alteration, subsistence, and scales and rationales of social organization and complexity. Correlating the modern ceramic industry and the prehistoric industry requires the use of ethnoarchaeological observations combined with archaeological observations and inferences (Figure 1-7).

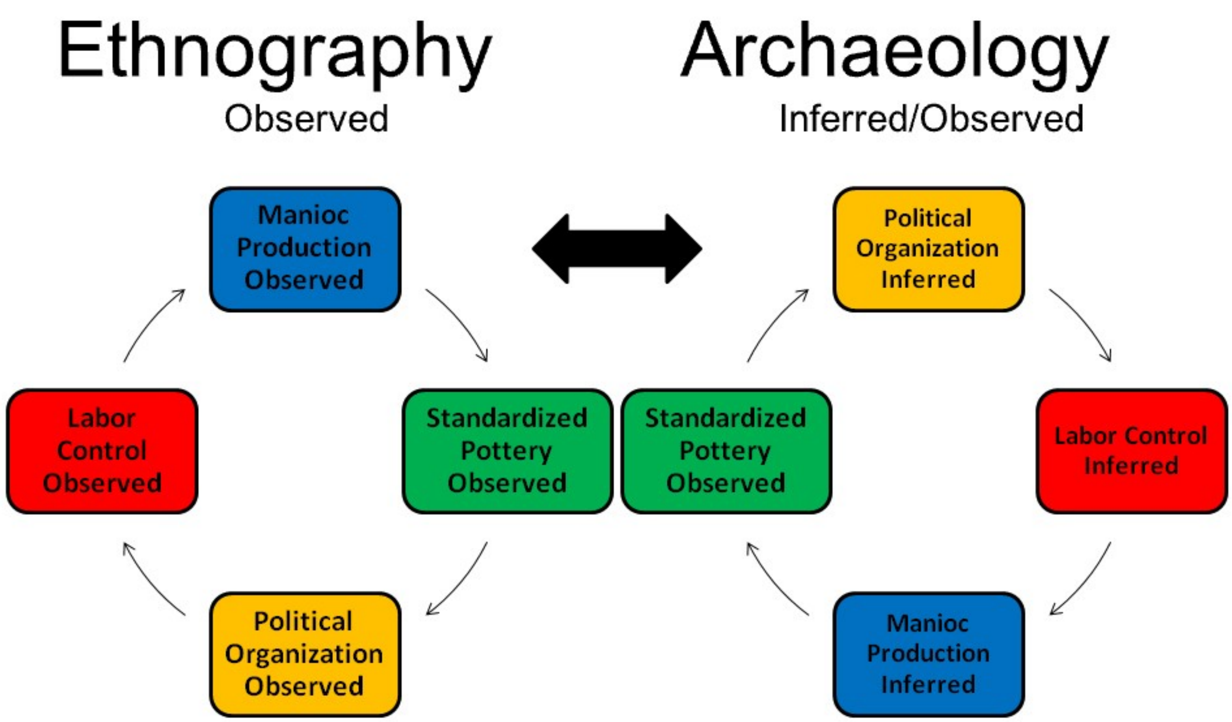

Figure 1-7. Thematic observations, inferences, and correlations used in this study.

Further, the correlation between the transformation and standardization of pottery production and the timing of developments in social complexity in the Upper Xingu region begins with the modern Kuikuru village. In terms of the ceramic industry, the transformation of the instrument of manioc production, pottery, and its relationship to labor in an Upper Xingu village, is examined in prehistory through the archaeological record. The production of pottery is intimately tied to the production of processed manioc in the modern Xinguano village. Situating the transformation of both pottery and the accumulation of surplus subsistence within the broader context of the social conditions in which it occurs in prehistory is also evaluated in terms of relations of production and the domestic and political economy of the modern Xinguano society, cautions by previous researchers not withstanding (DeBoer and Lathrap 1979; Longacre1991).

Technology

The aim of focusing on technological change is to accentuate the anthropological aspects of archaeological research without abandoning the historical aspects. This presupposes that the reasons for technological change are based in social factors that may or may not be expressed in the archaeological record. Implicit among these social factors is the place and control of labor. Technological change happens through labor, more specifically the intensification of labor, and the factors that influence labor thus influence technological change. More broadly, “the process of technological change is a concern, implicitly or explicitly, of most prehistorians…but it is also interesting to understand why these technological changes occurred" (Skibo 1994:113).

Technological change as an alternate vantage point on the processes of past societies is not without its obfuscations. Perceptions of technological change may be emic or etic and without the benefit of ethnographic analogy the difference may never be known. Anna Shepard perceived some of these problems early in the development of ceramic analysis in archaeology;

> There are three distinct obstacles to the use of technological features as classificational criteria: (1) identification of materials often requires laboratory facilities; (2) evidences of some important techniques are difficult to recognize or, in some cases, they actually leave no identifiable mark in the finished vessel; (3) physical properties are often influenced by both composition and technique and hence their interpretation may be uncertain (Shepard 1976:310).

Nonetheless, observed changes in technology must be situated and explained within the context of what is known of past societies. Once the difficulties are recognized and incorporated into the study of ceramic technology the advantages outweigh the faults. Though weary of the faults of focusing on technology, Shepard also pointed out the advantages;

> The study of technological features offers at least three distinct advantages in pottery classification…it directs attention to the human factor by making one think in terms of what the potter did…it enables the student to distinguish chance or accidental variations from significant ones…it offers simple criteria for delimiting types (Shepard 1976:311).

Shepard was concerned with classification on the basis of technology, which was also the focus of the first researchers in the Upper Xingu. Classification though is only one way of employing the study of technological change. Technological aspects of pottery can provide simultaneous readings of change or continuity where these processes are otherwise not apparent;

> No less important is the fact that abrupt change in one feature is often rendered inconspicuous by the prominence of features that are stable and therefore exhibit only the variations that result from lack of standardization and individual differences in skill (Shepard 1976:311).

This is especially true in the Upper Xingu where continuity moving towards standardization and uniformity easily masks any changes, especially technological, that are occurring simultaneously.

Archaeologists can determine through analysis *what* physical changes take place in the construction of pottery over a period of time but what is of interest as anthropologists is *why* these changes take place. In the Upper Xingu, a simple model of societal change is already understood based on broad landscape archaeology and ethnography (Heckenberger 1996, 2003, 2005). A model built on a timeline of Upper Xingu colonization, village expansion, village peripheral ditch construction, village abandonment, and modern ethnographic occupation, presents a framework in which to situate *what* changes occurred in pottery assemblages and better understand *why* these changes occurred in conjunction with the established timeline. The correlation between village expansion and pottery transformation is of particular interest to this study.

Subsistence and Landscape

In addition to technology, ethnography, and relations of production, subsistence is at the center of this study. Indeed, subsistence has been at the center of most discussions about complexity and social organization throughout the history of Amazonian archaeology. As Lathrap points out;

> Our understanding of the age and origin of Tropical Forest Culture is inextricably bound up with our understanding of the age and origin of the major cultivated plants which were basic to the agricultural system (Lathrap 1970:47).

Subsistence strategy is a central issue in discussions of the spread and growth of populations and political centralization throughout the prehistory of the Amazon. Lathrap’s seminal article, “Our Father The Cayman, Our Mother The Gourd", set the tone for discussions of the spread of root crop agriculture and the importance of early house gardens in the Amazon (Lathrap 1975). Understanding the importance of root crop agriculture in the Amazon is essential also to understanding the waves of migrations of people through, into, and out of the Amazon, as well as the networks of trade and exchange, as has been examined elsewhere (Anthony 1990; Boomert 2000). Again, as Lathrap noted early in the history of Amazonian archaeology;

> I wish to emphasize that the use of bitter manioc as a basis for bread and flour production is indicative not of a subsistence agriculture but instead of an intensified agricultural economy in which appreciable amounts of the food produced are being fed into extended trade networks (Lathrap 1977:740).

Whether being fed into the extended trade networks or fed into the local economy, there is little doubt that manioc contributed to the intensification of the political economy and was part of the economic structure of past societies as much as it is of today's Amazonian and Xinguano societies.

It has already been noted that chiefs in the Upper Xingu "maintain well kept silos for storage of manioc flour (sometimes well over a thousand kilos each)", far above that maintained by the average household (Heckenberger 2003:38). However, the final product may be less important than one's ability to command the production of that product (Heckenberger 2003). This relationship with subsistence is present throughout Amazonia and in chiefdom societies in general where "chiefs are seen to manipulate food supplies in various ways related to their positions as chiefs" (Drennan 1995:306).

The main problem with addressing any issue related to major cultivated plants of the past in Amazonia is taphonomic. The preservation of direct evidence of the presence and domestication of plants in archaeological sites is very rare. Ethnographic analogy, indirect evidence such as pottery remains, and landscape alteration such as anthropogenic soils and forests, remain the best evidence for examining early agriculture. Preservation issues, the abundance of cultivated plants, their origins, and their dispersals still require much study (Pearsall 1992). Nonetheless, through meticulous research spanning the entirety of Amazonia and Mesoamerica, much has already been achieved in the area of understanding cultivated plant origins.

The first hypothesized center of the development of root crop agriculture, specifically manioc horticulture, was thought to be in the central Amazon, near the confluence of the Negro and Solimões rivers. It was hypothesized by Lathrap that root crop agriculture was concomitant with the first settled village life in the Amazon basin (Lathrap 1970). New research, however, may place the origin closer to the Upper Xingu or at least in southwest Amazonia, with the available data favoring a savannah origin (Isendahl 2011). According to this new research, the geographical origin of manioc, domesticated as long as 10,000 years ago, was most likely in the savannas, the Brazilian Cerrado, to the south of the Amazon rainforest.

Though we may be closer to understanding the origin place of the first domesticated manioc we are not much closer to understanding the choice or preference for bitter manioc over sweet manioc and the timing of its dispersal throughout the Amazon. At the heart of the problem between bitter and sweet manioc is the toxicity of prussic acid and the cyanogenic potential (CNP) in bitter manioc when eaten unprocessed, unlike the prussic-acid-free sweet manioc which is simply boiled or roasted before consuming. But is prussic acid a red herring in discussions about why bitter manioc was widely adopted over sweet manioc in Amazonia? Wilson and Dufour (2002) point out that one possible explanation for the preference of bitter manioc over sweet manioc is due to the higher yields it produces. Wilson and Dufour (2002) find that Tukanoans of the Columbian Amazon region prefer bitter manioc in part for their ability to produce consistently higher yields. While they do not provide a conclusive explanation for the difference in yields between bitter and sweet manioc they surmise that “the most plausible inference is that the high-CNP plants are more likely to be disease and/or insect resistant" (Wilson and Dufour 2002:49). Further, as Nye (1991) points out, manioc is not processed in order to drive out the prussic acid but is processed to create a storable product that can be created in surplus. Lathrap noted this as early as 1977, stating that "bitter manioc is the more evolved or ennobled cluster of cultivars among the maniocs. The selection process leading to the bitter group of maniocs has been in terms of higher starch yield and in terms of starch of a quality more appropriate for making bread and flour" (Lathrap 1977:741). In fact, the complex method of processing bitter manioc creates a dried storable subsistence surplus and directly contributes to the creation of ceramic products that are used in the process, including griddles that are used to cook the processed manioc flour.

Subsistence and pottery both enter into the domestic economy with direct linkages to the political economy. Though we may speculate about the role or non-role of subsistence surplus in the formation of social hierarchy, we may not be able to ascertain whether the hierarchy of consumption was established before the product was produced or if the presence of the product itself was the impetus for the creation of complexity (Carneiro 1987; Heckenberger 2003). What we can examine is the correlation between the increased demand for food, an increased demand on the labor needed to produce that food, and technological changes in the pottery used by laborers to produce food.

Pottery, People, and Food

The pre-ceramic age is little known in the Amazon and it appears that Pleistocene hunters and later Holocene Hunter-gatherers were concentrated on the prairies and savannahs to the east and south of Amazonia until more active gathering of mollusks and other shellfish intensified along coastal regions (Heredia1994; Roosevelt 1991, 1996, 2002). These lithic technology based groups eventually expanded into forested areas by the ninth millennium B.C (Schmitz 1987). Quartz and chert flakes and other tools suggest that eastern South America was settled long before the appearance of the Clovis complex in North America (Gruhn 1991; Roosevelt et al. 1996, 2002) but very little evidence of that is found in the Amazon (Sanoja 1994:325). Instead, most archaeological evidence in the Amazon begins with the pottery rich cultures of Holocene horticulturalists. Commenting on the origins of pottery in South America, Sanoja succinctly summarizes the connection between pottery-production, those producing it, and the subsistence economy in which this production may have taken place;

> The beginning of pottery-making is not the result of pure chance. It appears at the precise time when cultivated plants begin to predominate over wild ones…the introduction of instruments of production such as containers is a consequence of the development of the productive forces that began to appear in societies with a gathering way of life (Sanoja 1994:631).

Whether or not pottery was first produced specifically for food, there can be little doubt that the productive forces associated with food production eventually had some impact on pottery related to food production. This theoretical contextualization of pottery fits well in the Upper Xingu where pottery is almost entirely utilitarian and used specifically for processing and cooking food. Though some smaller vessels are used for storage of other dry goods, most vessels are used for processing staple subsistence items. Vessels used for storage purposes are not the same vessels used in the preparation and cooking of food and based on the low amount of restricted mouth vessels in the Upper Xingu archaeological record, pottery was not used for major food storage. Subsistence related vessels consist of several varieties used for three tasks; processing manioc, cooking processed manioc, and cooking fish.

The importance of pottery to the study of subsistence in the prehistoric Amazon cannot be overemphasized and this is especially true in the Upper Xingu where little other material culture exists in the archaeological record. Though the improvement of archaeological techniques has allowed archaeologists to engage other micro-scale artifacts including botanical remains and macro-scale features including broad landscape alterations, it is the ceramic industries of the prehistoric Amazon that continue to lay the foundation for the construction of a culture history for the vast region. These ceramics hold the potential to advance much more than culture history if studied properly.

For example, outside of Amazonia, in the nearby Orinoco river basin, Anna Roosevelt's work at the site of Corozal in Venezuela demonstrated that tropical lowland sites have much more to offer than simple ceramic sequences. Roosevelt suggests that "future problem-oriented work will need to expand excavations horizontally across large sites...columnar excavations are not appropriate for investigating the range of contemporary activities or the composition and function of the groups living in a settlement" (Roosevelt 1997:180). In recent research in the Central Amazon, Eduardo Neves and colleagues have demonstrated the effectiveness of broad horizontal archaeology (Lima 2008; Neves and Petersen 2006). This approach is effective in the Upper Xingu as well, where village sites are well over 200 meters wide and ceramic remains can be associated with discrete activity areas within these sites (Heckenberger et al. 2009).

Finally, in assessing the usefulness of domestic utilitarian pottery remains we can proceed with the premise that “even where technology gave an impetus to the rise of civilization, it can be shown that the tools...involved were themselves developed in response to societal demands...this interpretation is presented, not as a repudiation of cultural materialism, but as an elaboration on it" (Carneiro 1973:179). In the Upper Xingu, three main lines of evidence support this basic premise regarding material responses to societal demands. First, evidence of the transformation of pottery production, second, ethnographic evidence regarding the use of pottery for subsistence processing, and third, landscape alteration and village elaboration suggesting increased horticulture and complex social organization that likely influenced the production and use of pottery.

Summary

This study combines ethnographic observation and archaeology to examine subsistence, material culture, and political and economic control over manioc processing and ceramic production in an Upper Xingu society over the past millennium. These elements all contribute to the structured relationship between labor and technological change through time. Specific to the Upper Xingu, this study also provides a new interpretation of regional complexes late in time and situates their development within the protohistoric migrations taking place throughout the Amazon prior to European contact in the Upper Xingu during the nineteenth century.

CHAPTER 2
AMAZONIAN ARCHAEOLOGY

Introduction

> The degree to which the network of huge rivers forming the Amazon system was the major avenue for communication and travel cannot be overemphasized.
>
> —Donald Lathrap, *The Upper Amazon*

The social history of the Amazon River basin, or Amazonia, is inextricably tied to rivers (Figure 2-1). Likewise, the history of archaeology in Amazonia is inextricably tied to rivers and the trajectory of archaeology in the region (like the archaeologically related Orinoco River) parallels the movement of explorers along rivers. The earliest archaeological information gathered from Amazonia is defined by the particular river basins that became the focus of early archaeological expeditions by Brazilians, Germans, and North Americans. The first major archaeological investigations were conducted at the mouths of rivers, such as the Negro River near Manaus, the Tapajós River near Santarém, and at the mouth of the Amazon itself near Belém and Marajó Island (Evans and Meggers 1950; Hilbert 1952, 1955, 1968; Meggers 1945; Meggers and Evans 1957).

Rivers also defined the movement and settlement of people in Amazonia both prior to and after the arrival of Europeans. Thus, Amerindians, explorers, and archaeologists all followed similar geographical routes. Even the main dichotomy of all land in Amazonia between dry, stable land, or *terra firme*, and seasonally flooded, fertile lowlands, or *várzea*, is defined by rivers and their effect on inhabitable land. This central difference is also what separates the savannahs of the southern Amazon, and the Upper Xingu, from the wet canopy forests of the main branch of the Amazon River.

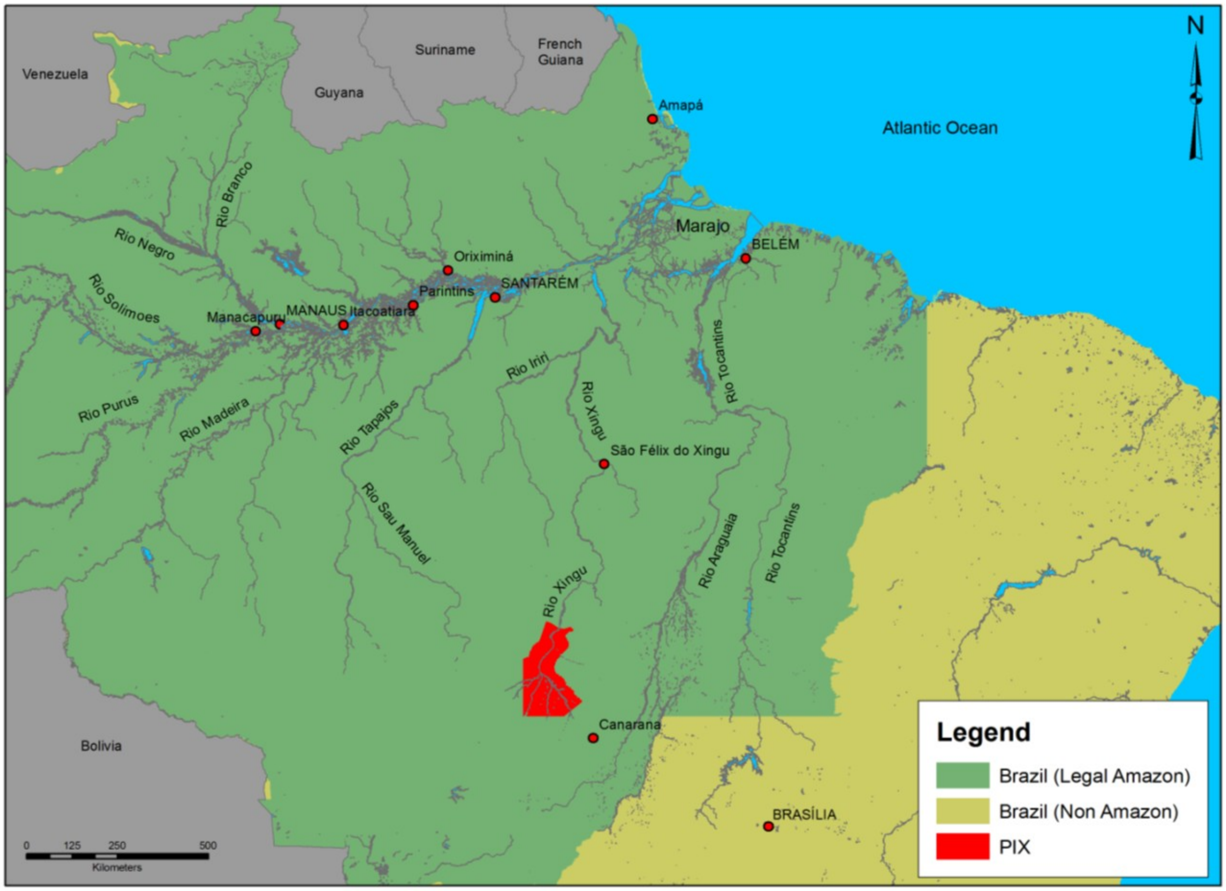

Figure 2-1. Major archaeological research in the Brazilian Amazon has been historically conducted in the Central Amazon (near Manaus), the Upper Amazon (west of Manaus), the Middle Amazon (near Santarém and Oriximiná), the Lower Amazon (near Marajó Island), and in the Upper Xingu (the Parque Indígena do Xingu or PIX).

The generalized landscapes where archaeology is conducted is fortuitous in most cases since Amazonian populations, like their ancestors, often settle in easily accessible areas along river banks, around lakes, or along sea shores. Without being overly deterministic we can draw conclusions about the relationship of people to the land they choose to settle. Economic and subsistence realities associated with these landscape features likely influence these settlements although they are likely also influenced by social and political factors (Carneiro 1987; Gross 1983).

In hydrographic terms the Amazon basin encompasses an area of about six million square kilometers or an area about the size of the continental United States, a challenging area to consider related developments prehistorically. Amazonia is characterized and defined by both its physical geography and its human geography, where diverse groups of native peoples and extensive networks of river valleys each combine to create unique histories (Moran 1993). However, combining the entire Amazon culturally, just as it often is geographically or environmentally blurs these individual histories. It is this process of synthesizing the entire Amazon that creates many of the difficulties encountered in its interpretation. As Moran (1993) points out, most anthropologists accept the *terra firme/várzea* dichotomy and in doing so place data from areas as ecologically different as the Xingu Basin, the Rio Negro Basin, and the central Brazilian savannas into the same category of "*terra firme* adaptations", or into the even more aggregating "lowland South America". He contends that this process masks the evidence from ecosystems with widely different soils, plants, and climates. In regard to anthropology, he further contends that this synthesizing is erroneously used to support radically opposing views explaining cultural development, village size, and population mobility (Moran 1993). These attempts to combine evidence from across the Amazon are a result of its size and the efforts of researchers working sporadically across this vast area to benefit from each other's research by applying it widely to areas that, although diverse, cannot be separated.

Closer to the Upper Xingu, transitional forests and savannas further distinguish this southern region from the northern Amazon. The transitional forests of the southern Amazon cover the plains known as the Planície dos Parecis within the geological basin formed between the southern Amazon River basin and the highland plateau of central Brazil. This geographic division is accentuated along the Xingu River by a series of rapids that separate the northern and southern portions of the river (Netto 1964). In the Upper Xingu the transitional tropical forest connects the southern upland scrub forests with the northern wooded savannas, where distinct broadleaf forests line the Xingu River (Figure 2-3). This transitional zone creates a unique environment that distinguishes the *terra firme* of the Upper Xingu from the *várzea* and *terra firme* areas of the lower, middle, and upper portions of the Amazon River to the north.

Figure 2-2. Aerial view showing an example of the mosaic landscape characteristic of the Upper Xingu which combines tropical forest and savannah flood plains. This view is within the Parque Indígena do Xingu near the Kuikuru Study Area and shows Lake Itafanunu in the background.

Savannas like those in the Upper Xingu cover almost two million square kilometers throughout the Brazilian Amazon and are found in the basins of the Middle and Upper Tocantins, Araguaia, Irirí, Tapajós and Xingu rivers. These savanna landscapes were mistakenly thought to have caused the limited populations first observed in the region (Steward 1939-1946). Later research demonstrated however that the limited populations were the result of the initial contact with Europeans and their diseases and not the soils of the savanna (Heckenberger 1996). Though it is true that the soils of the savannas of central Brazil are acid, leached, and very deficient in nutrients, they are now thought to be the origin place of the first domesticated manioc (Isendahl 2011).

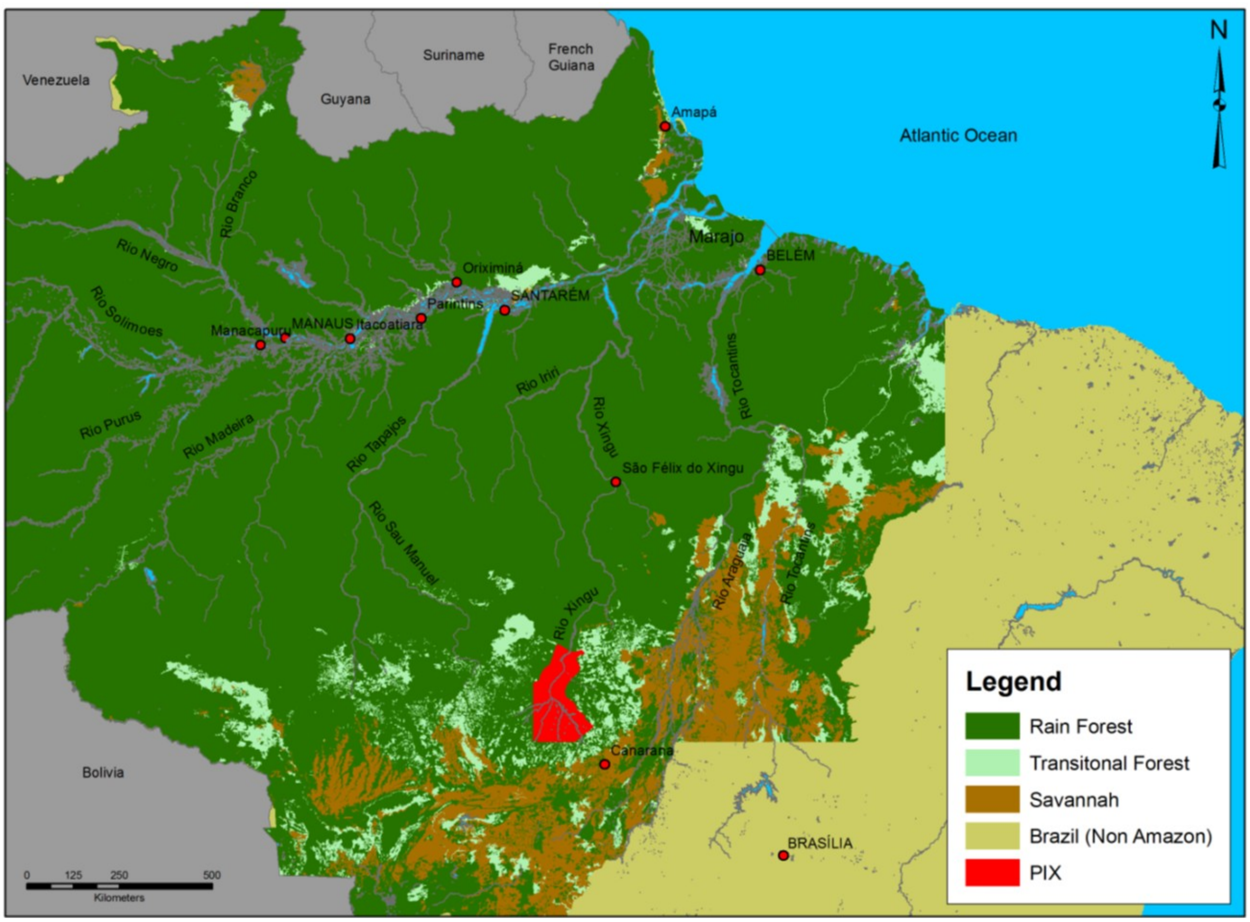

Figure 2-3. The Parque Indígena do Xingu (PIX) is situated at the transitional zone between the Amazonian Rain Forest and the Brazilian Savannah.

Over fifty percent of the soils in the Brazilian savannas are oxisols with high aluminum saturation. Ninety-eight percent of the soils have a pH below six and ninety-two percent of these soils have less than the critical level of phosphorous for many important cereals. Indeed, ninety-six percent of these soils have less than the critical level of calcium for many crops. Many Amerindian groups both past and present, including the Kuikuru, overcome these problems by planting in areas where the soil has already been enriched through centuries of human habitation and slash-and-char horticulture (Schmidt and Heckenberger 2009). This successful indigenous method is in sharp contrast to the slash-and-burn agriculture practiced by soy farmers today who rely on large amounts of chemical fertilizers that eventually render cleared areas unusable while contributing to the degradation of the water quality in Upper Xingu rivers through agricultural runoff.

Besides nutrients, Amazonian soils present another problem in that they only retain enough water in the top twenty centimeters to support crops for eight to ten days (Goedert 1983). When this is combined with the hydraulic restrictions imposed by the limited root depth attained by crops due to aluminum saturation, the crops are at risk during dry spells without irrigation. In contrast to modern introduced crops, the native plants of the savannas have very deep roots and are not affected by the dry spells.

The Amerindian populations of the central Brazilian savannas are hypothesized to include many groups that fled into these upland forests. A population in the savanna may be there because it fled either in the recent or distant past from another region in which its social and political organization developed under different environmental stresses. Thus, one group’s environmental practices and organization may be satisfactory in a new environment or it may be a highly adaptive strategy. Another group, in contrast, may have adjusted to the upland forests and may find itself today in the savannas, but its social and cultural institutions may still reflect the constructions that came about in a forested environment rather than in grassland savannah (Moran 1993:125). All of these factors should be considered when assessing social, political, and domestic structures of indigenous groups within Amazonia and especially the Upper Xingu.

Archaeological Models

There is no doubt that the Amazonian environment plays a large role in both the physical reality and the collective past of those living in the region but it is not the only factor in determining the course of history. This is true also of the archaeological research in the region. Early archaeological studies in Amazonia were shaped by the environmental and ethnographic observations outlined above. The dominant paradigm of environmental determinism in the early twentieth century greatly influenced the conclusions reached by archaeologists. This was coupled with an absence of historical perspective when examining the ethnographies that were shaping the archaeological conclusions. All of this resulted in simplistic views about past Amazonian societies which became the basis for further work, despite recent adjustments to this way of thinking (Meggers 1954, 1960; Steward 1949).

Later twentieth century studies in Amazonia have always been problem oriented rather than purely descriptive partly because of the accompanying and growing spectrum of anthropological data available for the region. As Neves (1999a) points out, these research problems can be grouped into three categories that have shaped the overall archaeology of Amazonia. These categories follow a linear path through the history of archaeology in Amazonia beginning with a focus on environmental factors, moving to ethnic and linguistic issues, and finally addressing the impact of both European history on the Amazonian indigenous past and the impact of indigenous history on the Amazonian environmental past. Today, cross disciplinary, broad scale landscape archaeology, often in combination with historical ecology dominates many large scale and long term research projects (Balée and Erickson 2006; Heckenberger 2006; Heckenberger et al. 2009; Neves and Petersen 2006; Schaan 2010; McKey et al. 2010).

Among early paradigms in Amazonian archaeology, Brazilian archaeologist Eduardo Viveiros de Castro distinguished between what he called the “standard model” and the “revisionist model” (Viveiros de Castro 1996). The first model of indigenous development in Amazonia, the “standard model”, was synthesized in archaeological terms in the mid 1950s by Betty Meggers. She argued that Amazonian soils were too poor to support the establishment of large settled villages based on root crop agriculture. This argument was based on a great deal of other work available at the time. The tendency of early twentieth century Amazonian research to focus on the environment as a contributing factor in the shaping of social and cultural processes of the past is in part attributed to the publication of the “Handbook of South American Indians” and the concept of Tropical Forest Culture (Steward 1949). This characterization placed the Amazon on the periphery of South American cultural development attributing many of its traits to outside sources in the Andes or northwest South America. By the 1970s the “standard model” characterization of Amazonian peoples was shown to be faulty and based on the ethnographies of Amerindians who were the survivors of the European arrival and subsequent onslaught of diseases and violence that decimated local indigenous populations (Heckenberger 1996; Hemming 1978).

New research replaced the model of limited development with the “revisionist model”. This new model refuted the environmentally deterministic view of the “standard model” based on new archaeological evidence of large, permanently settled villages, in the Central Amazon, Marajó Island, and the Upper Xingu (Deneven 1998; Lathrap 1970; Roosevelt 1999, 2000; Schaan 1997, 2000; Heckenberger et al. 1999; Neves et al. 2003). At the center of this debate was the search for evidence of the ability to grow enough food to support large populations and create some sort of surplus wealth to support social hierarchy and complexity. The supporting evidence for this argument abounded in new archaeology focused on landscape alterations and the size and permanence of prehistoric villages (Heckenberger et al. 1999).

In the case of the Upper Xingu, the ethnographic record combined with local indigenous oral histories provided a direct historical link to the prehistoric record. The mistake of early ethnographic work in the Amazon in projecting a picture of small scale, scattered tribes, into the past, was overcome by contextualizing the basic social and political structure within an historical framework. Also intimately tied to the “revisionist model”, later to be a focus of its own is the rich anthropogenic soil associated with archaeological sites known as *terra preta*, or Anthropogenic Dark Earth (ADE) (Lehmann et al. 2003; Woods et al. 2009).

Referred to as *egepe* by the Kuikuru, ADE in the Upper Xingu, though not as rich in organics as some examples from the Central Amazon, is located at prehistoric sites and well known to the Kuikuru who plant their crops in it (Heckenberger 2005; Schmidt 2010; Schmidt and Heckenberger 2009). In the Lower and Central Amazon, ADE focused studies show that variation in social organization can be documented by differential ADE distribution within a site (Schaan et al. 2009:139; Neves et al. 2004). The variability of ADE across time and space has led some to suggest that there is a difference between anthropic (unintentional) and anthropogenic (intentional) soils (Neves et al. 2003:35). This differentiation may help explain why ADE sites tend to be vastly different in their size (Neves et al. 2003). Explanations for the creation of ADE range from those favoring population density rather than time (Neves et al. 2004) to those favoring different use of the land especially differing cultivation practices, as evidenced by the lighter *terra mulata* (Denevan 2004).

The quest to understand the development of ADE has lead to the proliferation of more microscopic analysis especially phytolyth analysis of terra preta to determine refuse, agricultural, and domestic areas (Bozarth et al. 2009). This extends to pottery where micro analysis and protein residue extraction from ceramic samples may provide a new way to analyze prehistoric subsistence regimes (Barker et al. 2011).Regardless of how ADE were created or maintained, all are associated with dense ceramic concentrations (Costa 2004) that vary with the darkness of the soil and all are from the same broad period, speaking to "the emergence of a new way of life" (Schaan et al. 2009:129).

Although Amazonian archaeology generally embraces a single paradigm or trend, it remains a regionally focused place of research. Amazonian archaeology consists of divergent research and, like past societies, grows around major centers that disperse their influence. Archaeologists working in the Amazon use diverse and regionally specific data to continually refine the broader picture of Amazonian history while maintaining locally focused archaeological projects that provide the foundation for future research (Barreto 1998).

Regional Research

Despite the problem oriented nature of Amazonian archaeology, the issue of establishing culture histories persists. Archaeology is conducted across Amazonia and in places once ignored. Archaeologists have gone from a tantalizing amount of scattered data to an overwhelming amount of data that covers an ever increasing area. Chronologies benefit from refinement only in those places where archaeology has been conducted for the longest period of time. These chronologies, largely based on pottery and associated radiocarbon dates, are still the basis for reconstructing the indigenous past of Amazonia. A review of chronologies in those major areas of archaeological research in Amazonia is presented here with a particular emphasis on the observed developments in pottery technology, as related to the current study, which may provide clues to similar developments within the Upper Xingu specifically.

Lower Amazon Archaeology

The earliest studies in the Lower Amazon distinguished two main centers of culture in the Amazon Valley, Marajó and Santarém, based on a small collection of ceramics (Meggers 1945:208). Meggers also distinguished between these two "cultures" based on the presence of mounds and burial urns at Marajó and the lack of these features in Santarém. This focus on earthworks in Amazonia continues today and is in fact some of the most reported archaeology in the region in the last decade (Erikson 2006; Schaan 2010; McKey 2010; Heckenberger 2009). On Marajó Island itself more recent archaeology has shown how indigenous land use has affected the landscape of the island area (Roosevelt 2000). Meggers and Evans first stratigraphic archaeological investigations led them to develop an indigenous history, since challenged, of a highly developed culture arriving at Marajó Island only to find that the environment could not support them (Evans and Meggers 1950). Though this was one of the first systematic ceramic analyses on a collection from Marajó Island it did not benefit from the extensive collection of radiometric data available today.

Since the beginning of modern Amazonian archaeology researchers have tried to tie together vast geographic areas with incomplete ceramic chronologies (Howard 1947; Meggers and Evans 1961). This work began in the Lower Amazon (and on the Orinoco) especially at the mouth of the Amazon River on Marajó Island. These studies provide the basis for today's ceramic chronologies throughout Amazonia and provide the basic naming systems, despite their inadequacies and the inherent difficulties of comparing ceramics and cultures across such a vast region delineated by one of the largest watersheds in the world. Howards stated the problem as "the correlation of the distributional data pertaining to the ceramics of the lowland South America area and the formulation of historical interpretations suggested by these distributions" (Howard 1947: ii). He expanded this lowland area to include "not only the area lying east of the Andean foothills but also the Maritime Andes of eastern and central Venezuela, the island of Trinidad, and the West Indies" (Howard 1947: ii). His predecessor, Thomas A. Joyce, penned the first broad scale analysis of lowland South American ceramics in 1912 and divided them simply into the Tupi-Guariani and Arawak "complexes". His Tupi complex was generalized to the southern Amazon and was characterized by round bottomed vessels with inward facing shoulders. The Arawak complex was characterized by flat bottomed vessels with red-on-white and modeled decoration, similar to those found in the Upper Xingu.

Other broad studies of lowland ceramics followed through the 1920s and 1930s (Uhle 1921; Linne 1928; Metreux 1930; Nordenskold 1930; Bennett 1936; Lothrop 1940,1942; Rouse 1940; Palmatary 1939; Kroeber 1942). Howards study is the first to define specific ceramic units based on style, trait, and complex, and use these units to divide lowland South America into four distinct units including Amazonia "comprising the area drained by the Amazon and its tributaries with the exception of the Lowland Bolivia region" and the Orinoco and West Indies, including British Guiana (Howard 1947:17). Meggers and Evans (1961) study followed up on Howards Amazonia and Orinoco geographic divisions, each of which had several localized series of complexes. Meggers and Evans applied horizon styles to the regions identified by Howard but under the influence of the "Handbook of South American Indians" regrouped Howards subdivisions back into the Tropical Forest group and working backwards attempted to regroup those complexes that Howard analyzed, as well as newly presented complexes not available to Howard, into horizon styles following the methods of Alfred Kroeber (Meggers and Evans 1961). The result was the identification of four horizon styles that, for better or worse, are still in use today. These are the Zoned-Hachure, Incised-Rim, Polychrome, and Incised-Punctate.

The Zoned-Hachure horizon (500 B.C. to A.D. 500) includes complexes spread from the foothills of the Andes in eastern Peru to Marajó Island at the mouth of the Amazon. The diagnostic decoration on these vessels is a broad line incision bounding zones of fine line incision often in a cross-hatched pattern. Red bands of painting also co-occur on these vessels with the zoned incision. These vessels also contain a wood-ash temper (*cariapé*) that Meggers and Evans conclude is a precursor to the widespread use of *cariapé* throughout Amazonia including the Upper Xingu.

The Incised-Rim horizon (A.D. 100-800) includes complexes on the lower Amazon and middle Orinoco rivers. The diagnostic decoration on these vessels is a broad, flat-topped rim, decorated with broad incisions and red paint or slip covering all of the exterior or interior of the vessels. Meggers and Evans felt that this was the most hypothetical of all the four horizons given that the diagnostic traits were “less consistent and less prominent” than in any of the other horizons and conclude that the Incised-Rim horizon is identified more by lacking what other horizons have than by having a common trait. They apply one of the first radiometric dates to this horizon possibly narrowing its presence from roughly A.D. 500- 800 or as Rouse and Cruxent (1963) date it along the Orinoco, from A.D. 350-1150.

The Polychrome horizon (A.D. 600-1300) includes complexes from the Napo River eastward to the mouth of the Amazon. The diagnostic decoration is white slip with red and black painting and incised decoration combined with slipped surfaces which is absent from the other horizons. A cambered rim is also diagnostic of this horizon and the horizon occupies a similar chronological position in regard to the other defined horizon styles. The introduction of the urn burial into the lowlands is also associated with this horizon style. Interestingly, griddles, an important vessel type throughout the Amazon, are known from western Polychrome complexes but not from those to the east.

The Incised and Punctate horizon (A.D. 1000-1500) includes complexes on the lower Amazon, the Orinoco, and British Guiana. These include the sites of Arauquin, those near Santarém at the mouth of the Xingu River (Corrêa 1965), and across the Amazon River from Santarém in the Oriximina region, especially at Konduri (Hilbert 1955). The diagnostic decoration is a combination of incision, punctates, and especially modeling of anthropomorphic and zoomorphic adornos, the most elaborate examples of which come from Santarém (examples from the Upper Xingu are presented later). This is a uniformly late horizon and is associated with griddles and a late wave of people moving from the Orinoco into the Caribbean and south into the Amazon. Synthesis by Cruxent and Rouse of Venezuelan archaeology contains two main hypotheses about connections with the south. One suggests that "traits of Arauquin may have diffused...to Amazonia to produce some, if not all, of the modeling-incision of that region” (Cruxent and Rouse 1952:37).

Upper Amazon Archaeology

Though the lower Amazon received much of the early attention of Amazonian archaeologists, the Upper Amazon became the next focus. Lathrap’s extensive research on the Upper Amazon, specifically his work at Yarinacocha and the Ucayali basin, formed the basis for his treatise on the Upper Amazon, establishing it as the setting for the development of Amazonian Tropical Forest Culture (Lathrap 1958). In this early work he first found the connections between Barrancoid ceramics of the Lower Orinoco and Hupa-iya, even narrowing the comparison down to the Los Barrancos ceramics (Lathrap 1958:386). He also developed his ideas about the Upper or Central Amazon as an origin place, excluding Marajó or the Ucayali basin "as the point of origin for this polychrome tradition" (Lathrap 1958:386).

His classic work, “The Upper Amazon”, addressed many of the issues that persist in Amazonian archaeology today (Lathrap 1970). Among these broad issues are the effects of the Amazonian environment, agriculture and horticulture and their origins, language groups and their clues to past migrations, including the Barrancoid archaeological culture and the Carib and Arawak migrations, landscape archaeology, including the ridged fields of Bolivia, Ecuador, and the Guiana's, and finally, the archaeological cultures of the Upper Amazon, including those around Lake Yarinacocha and the Ucayali River basin.

Lathrap identified the “oldest clear-cut evidence for human occupation in the Upper Amazon Basin” along the bluffs near the northern end of Lake Yarinacocha in the Peruvian Amazon (Lathrap 1970:84). Based on the midden site of Tutishcainyo, he identified the Early and Late Tutishcainyo based on pottery remains and, based on comparisons with Kotosh pottery, placed the Early Tutishcainyo settlements between 2000 B.C. and 1600 B.C. Decoration included zoned incision and exterior red paint. Of the “several standardized forms”, three make up the majority of vessels (Lathrap 1970:85). Technologically, shell temper is dominate and based on “the considerable variety and high standardization of vessel shape all argue for a cuisine in which vegetable foods were varied and important” and he notes “the highly specific forms associated with processing bitter manioc are absent” (Lathrap 1970:88). Late Tutishcainyo pottery is related to the early period but “at least 450 years separated them”. However, based on this pottery he still felt that there seemed to be change in subsistence pattern or settlement size and the presence of exotic ceramic forms suggested trade over a considerable distance (Lathrap 1970:89). Finally, the Shakima pottery style, also a continuation of Early Tutishcainyo, is represented by large open mouthed flat bottomed vessels. Simple incision and well polished red exteriors take the place of the zoned incision of earlier forms.

In the final centuries B.C. a new type of pottery "displaces" the previous and carries with it distinct attributes of the Barrancoid (or Modeled-Incised) ceramic style first found in the Orinoco Basin (Lathrap 1970:117). Designated Hupa-iya in the Central Ucayali Basin, this pottery does not show continuity with Shakimu or Tutishcainyo. Decoration is present on over fifty percent of vessels and includes broad line incision and zoomorphic adornos. Lathrap surmised that "the frequency of the buck-pot form suggests that bitter manioc was the staple and was being processed for bread and flour" (Lathrap 1970:119). Beginning at roughly A.D. 100 a new type of pottery displaced the Hupa-iya called Yarinacocha. This pottery is thick and poorly made, according to Lathrap. Importantly, large griddles appear for the first time, which seem to "indicate the importance of bitter manioc" (Lathrap 1970:130).

By A.D. 500 another poorly made form of pottery replaces the Yarinacocha. Called the Pacacocha, the forms are dominated by globular vessels, poorly fired, and not well smoothed. Decoration is limited to all-over red slip and inward facing rim adornos. Importantly, Lathrap reports that "solid ceramic pot supports with a cylindrical body and flaring ends became common at this time" and "griddles with low rims indicate that bitter manioc continued as a staple" (Lathrap 1970:131). Over the 400 year duration of this pottery complex, Lathrap suggests that it evolved through three phases and during the middle phase, the Cashibocaño complex, the frequent use of a single row of "thumb-print corrugation", also known as thumbnail punctates, immediately below the rim is prevalent. The final phase is known from a single site, Nueva Esperanza, dated to roughly A.D. 700. This 100 meter circular plaza is characterized by an outer ringed midden with a clean plaza. These descriptions of pottery and village developments from the late first millennium Upper Amazon are strikingly similar to developments found in the Upper Xingu during the same period as will be presented later.

The last migration into the Upper Amazon is represented by the Cumancaya pottery style. It shows no affinities with earlier styles in the area and is hypothesized to originate in Bolivia, the prehistoric correlate for later Shipibo-Conibo pottery styles.

Central Amazon Archaeology

Although first explored archaeologically in the 1960s by Peter Paul Hilbert, the Central Amazon began receiving more attention in the 1990s. The Central Amazon Project (or CAP) has identified over 60 prehistoric Amerindian archaeological sites within a study area of 900-1000 square kilometers near the confluence of the Solimões and Negro rivers near Manaus (Petersen et al. 2001a). This research has identified two major ceramic complexes and a third possible complex intermediate between them. Major archaeological sites of the Central Amazon reveal intense *terra preta* in prehistoric village sites dating back more than 2,000 years ago. This extensive work in pottery rich *terra preta* deposits has produced its own sequence (Petersen et al. 2001a) related to that established specifically for the Central Amazon by Hilbert (1968) and that developed by Meggers and Evans in the Lower Amazon.

The earliest deposits at stratified ceramic sites in the Central Amazon date from roughly 360 B.C. to A.D. 850 and contain Modeled-Incised pottery styles (or Incised-Rim, more broadly Barrancoid). Representative of the earliest of these complexes is the Osvaldo site, dated to A.D. 450-650. It is a 2-4 ha site arranged in a circular village pattern unlike the later ceramic complex sites which tend to be long and linear in configuration with defensive earthworks. At Osvaldo there is apparently not evidence of a stratified society. The beginning of the pottery sequence at this site is characterized by thin, hard pottery that is grit and grog tempered and bell shaped. It consists largely of unpainted and non-slipped vessels of various forms. It is only later that high amounts of riverine sponge temper (*cauíxi*) and griddles appear along with burial urns at the very end of this sequence. Similar pottery appears in the Upper Xingu almost a century later with the exception of the burial urns. A possible intermediate period, the Paredao (or Intermediate complex) is dated from A.D. 850 to 950.Though this may be a part of the later period, Lathrap suggest that it is a short lived invasion, as is found in the Upper Amazon around this same period.

Finally, the latest prehistoric period in the Central Amazon dates from roughly A.D. 950 to 1440. Locally known as Guarita, it is associated with the Amazon wide Polychrome or possibly Araquinoid series as found in the Orinoco basin and possibly throughout the Southern Amazon late in time. Guarita sites cover 30 ha or more and are long and linear, stretching over three kilometers. Guarita pottery shows a distant relation to the Araquinoid series with painted and slipped wares that show functional and possibly social distinctions typical of chiefdom level societies. *Cariapé* is a minority temper which appears only in fine Guarita wares. Pot stands and griddles are prevalent as are thumbnail punctates along the lips of vessel rims, again, similar to Upper Xingu developments during this same general period.

Summary

The descriptions of each of these regional chronologies are driven by change in pottery style and construction associated with village expansion. New paradigms in archaeology seek to find ways to understand this change aside from simple invasions, migrations, or exchanges. Since the 1970s archaeologists have moved away from grand unifying theories and shifted their focus to more specific anthropological issues with a few notable exceptions that benefit from a continued focus on the bigger picture (see Hill and Santos-Granero 2002; Fausto and Heckenberger 2007). Donald Lathrap, perhaps better than anyone in the 1970s, summarized and presented the issues central to explaining change in the form of settlement and subsequent cultural development of the entirety of Amazonia. Beginning with the idea of in-situ development of what was then confined to the term “Tropical Forest Culture”, he proposed areas within the tropical lowlands rather than a source in the Andes based on his reading of the archaeological data as well as other researchers including the geographer Carl O. Sauer who proposed areas in northern South America at the junction of riverine flood plains and arid savannahs (Lathrap 1970:49). While Sauer may have been right, new evidence may suggest that the junction of flood plains and arid savannahs was to the south rather than to the north (Isendahl 2011). Although the timing of ceramic developments and population growth across the Amazon are not simultaneous, they are similar enough to be related. The lack of contemporaneous developments is likely a result of lag from various migrations, diffusions, and other non-immediate transmissions of knowledge and culture.

CHAPTER 3
UPPER XINGU ARCHAEOLOGY

Introduction

The headwaters of the Xingu River and the indigenous tribes living in the region were entirely unknown to the Western world until Karl von den Steinen reached the area in 1884 (Steinen 1886, 1894). Several other explorers navigated their way into the area over the following 60 years and although the Kuikuru recall several excavations on the Curisevo River in the 1920s or 1930s, these were never reported (Heckenberger 1996). The first full and detailed ethnographic description of the area was published in 1948 with Claude Levi-Strauss's chapter in the "Handbook of South American Indians" where he described the Upper Xingu tribes collectively (Levi-Strauss 1948:321-348). This was followed by Kalervo Oberg's volume titled the "Indian Tribes of Mato Grosso, Brazil" which focused on describing collectively those tribes living on the Batovi, Curisevo, Culuene, and Tanguro rivers (Oberg 1953). These four major rivers form the eastern headwaters of the Xingu River. The combination of these two early publications and those of Steinen forged a collective image of Upper Xingu society and material culture.

Very little in the way of oral history was recorded in these publications however, and the image of Upper Xingu society created by these early documents became the image associated with past societies as well. Levi-Strauss acknowledged as much in saying that "the history of the area is not well known" and in recounting the movements of the Suya, Cayabi, and Baicari in and out of the Upper Xingu he generalized that,

> Similar migrations within a relatively small area are said to have been made by most of the tribes prior to Von den Steinen's visit…thus, the general trend is toward tribal intermixture and concentration of population on the river banks (Levi-Strauss 1948:323).

This fragmentary history is the starting point from which archaeology commenced in the region. Further migrations and movements of groups took place over the next decade or so until the formal creation of the Parque Indígena do Xingu (PIX) in 1961. All of the archaeological research discussed in this study was conducted in the Kuikuru Study Area (KSA). This area is located almost entirely within the PIX although the area traditionally inhabited by the Kuikuru and other Upper Xingu tribes extends to areas outside of the PIX including the site of Kamakuaka to the south.

Previous Archaeology

Throughout the 1950s and 1960s anthropologists continued to document various tribes of the Upper Xingu and included limited archaeological observations in their publications (Galvão 1953; Schultz 1961; Simões 1963; Schaden 1964; Galvão and Simões 1965). However, most of these studies remained north of the twelfth parallel and on the main branch of the Xingu River, never reaching past the major confluence of the headwater tributaries, or *formadores do Xingu* (Figure 3-1).

In 1953 and 1954, while conducting ethnographic fieldwork among the Kuikuru, Gertrude Dole and Robert Carneiro conducted the first archaeological work in the headwaters region south of the twelfth parallel along the lower Culuene River. The results of this work provided the first glimpse into the prehistory of the Upper Xingu (Dole 1961). Quite sophisticated for the period in Amazonian archaeology, Dole's limited testing provided some basic preliminary insights on the prehistory of the Upper Xingu, the pottery industry specifically, and also on the stratigraphic and taphonomic nature of the archaeological sites, anticipating future issues such as site reoccupation and reversed stratigraphy in major earthworks.

Figure 3-1. Upper Xingu and Lower Culuene archaeological areas and subareas within the Parque Indígena do Xingu (PIX, green shaded area, AX designation, upper large circle, FX designation, lower large circle).

Dole observed that no soil stratigraphy was present in any of the test units excavated and she made her chronological observations based on superposition alone (Dole 1961:400). Another important observation was made at the site of Atiki. Dole found ceramic remains almost 75 cm below the surface at this site which the Kuikuru informed her had been inhabited by their ancestors between 1870 and 1880. Dole surmised that this was not long enough to deposit ceramics to such a depth and that the deeply buried ceramics were either a product of very intense erosion or more likely of a much older age. Importantly, the information collected from the Kuikuru suggested that further archaeological work would need to address the issue of recent reoccupation of many sites.

Her excavations within site middens provide the first gross evidence of differences in early and late prehistoric pottery in the region. She found that pottery deposited in the upper levels was frequently painted red, rarely incised, tempered with *cauíxi*, and had gradually flaring rims. Pottery in the lower levels had less red paint, included *cariapé* temper along with *cauíxi*, and tended to have angular rims.

In the 1960s Mário Simões of the Museu Paraense Emílio Geoldi (MPEG) also conducted archaeological excavations at two locations on the Upper Xingu near the Posto Diauarum of the newly formed PIX and at Lake Ipavu on the lower Culuene River, north of the KSA and the sites investigated by Dole. Simões conducted fieldwork at five sites in the area of Lake Ipavu in 1966 (Simões 1967). He recorded seven sites (MT-AX-01 to MT-AX-07) for this area designated AX to denote the uppermost portion of the Xingu River proper (Alto Xingu) as opposed to the FX designation to denote the headwaters region of the Xingu River (Formadores do Xingu). Eduardo Galvão also conducted limited archaeological investigations at the site of Yakaré (MT-FX-09) in the 1950s (Galvão 1950; Oberg 1953).

Simões regional survey included limited excavations which provided enough data for several preliminary conclusions. The first broad conclusion was that the two areas, chosen because of their relatively dense concentration of sites, represented two distinct complexes within the Upper Xingu. This was mainly based on the fact that the sites near Diauarum contained pottery with a higher percentage of *cariapé* while the sites near Ipavu contained pottery with a higher percentage of *cauíxi*. It is not clear if Simões based this observation on stratified remains, surface remains, or some combination of both, but a closer look at his data in the following chapter may help to understand this. He also observed that pottery of the lower Culuene River sites was more likely to be decorated than that of the Upper Xingu river sites. Despite the differences among sites of the Xingu and Culuene rivers he also observed many similarities including the location of sites along river banks and lake shores, the presence of stone tools, and “the presence of sherds characteristic of one region in sites of the other” region (Simões 1967:142). This final observation opens the door to many questions regarding regional systems in the Protohistoric period. Simões observation of mixing of stylistic attributes at different sites, combined with Levi-Strauss’ recounting of tribes moving in and out of the Upper Xingu, and Dole’s recording of site reoccupation in recent times, all suggest that recognizing regional systems will be somewhat difficult until solid ceramic chronologies are built so that contemporary ceramics can be identified from those of past occupations.

Other research has shown that Simões cultural and temporal ceramic sequence may directly relate to the ceramic sequence from areas investigated farther to the south (Heckenberger 1996). Simões correctly identified differing pastes in the ceramics he identified, but his determination of whether or not this attribute was an indication of time or space remains suspect without further examination of his site stratigraphy and the context of his radiocarbon dates. Simões based very little of his limited analysis of the region on ceramic form and how it might have varied through time. He also did not benefit from our current understanding of village size and regional configuration, though he did recognize their basic layout (Simões 1967; Simões and Costa 1978).

In 1973 and 1980, Pierre Becquelin conducted investigations at one of Simões sites (MT-FX-07) which Becquelin named Tuatuari due to its location between Posto Leonardo, the confluence of the Tuatuari River, and the Culuene River (Becquelin 1993). Becquelin also conducted very limited investigations at Yakaré (MT-FX-09), Miararré (MT-FX-08), Morená (MT-AX-08), and Nokugu (MT-FX-06), the only other work conducted in the KSA besides that of Dole and Heckenberger.

Finally, the most comprehensive work in the Upper Xingu is that lead by Michael Heckenberger, as part of the Southern Amazon Ethnoarchaeological Project, beginning in the early 1990s. This work provides the basic working chronology for the Upper Xingu (Figure 3-2). This work focused specifically on the traditional territory of the Kuikuru tribe or the KSA (Figure 3-3 and Figure 3-4). As in most regions of Amazonia, archaeology in the Upper Xingu is restricted to the ceramic age. The earliest reliable radiometric data from the Upper Xingu place the earliest ceramic using people along the Buriti (*Angahuku*) River by at least A.D 700 but probably much earlier (Heckenberger

2005:88). According to Heckenberger, the appearance of circular villages by ca. A.D. 700 is evidence of the migration of Arawak-speakers into the area. To date, all prehistoric archaeological materials collected in the Upper Xingu are related to these circular village occupations which places these materials at the center of important questions related to the Arawakan Diaspora (see Hill and Santos-Granero 2002), among other issues.

Ceramic remains recovered from late prehistoric circular village occupations in the KSA show similarities in form, decoration, and technology to northern Amazonian ceramic complexes, as observed by Dole (1961) and Heckenberger (1996, 2005). Heckenberger also observed possible similarities to the ceramics of the Uru Tradition in central Brazil south of the KSA (Wüst and Barreto 1999), accentuating the transitional location of the Upper Xingu between the Amazon Lowlands and Central Brazil.

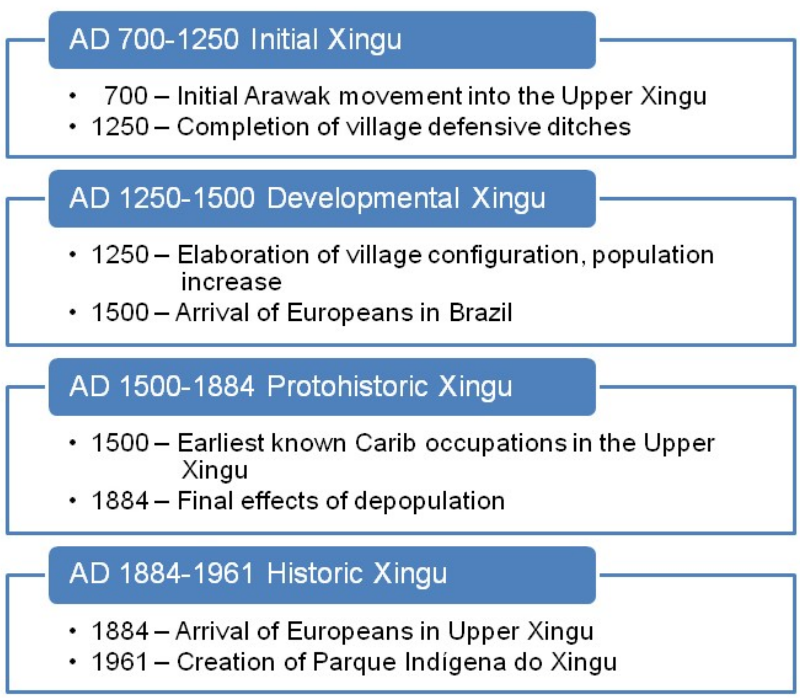

Figure 3-2. Upper Xingu periodization based on radiocarbon dates and historic events.

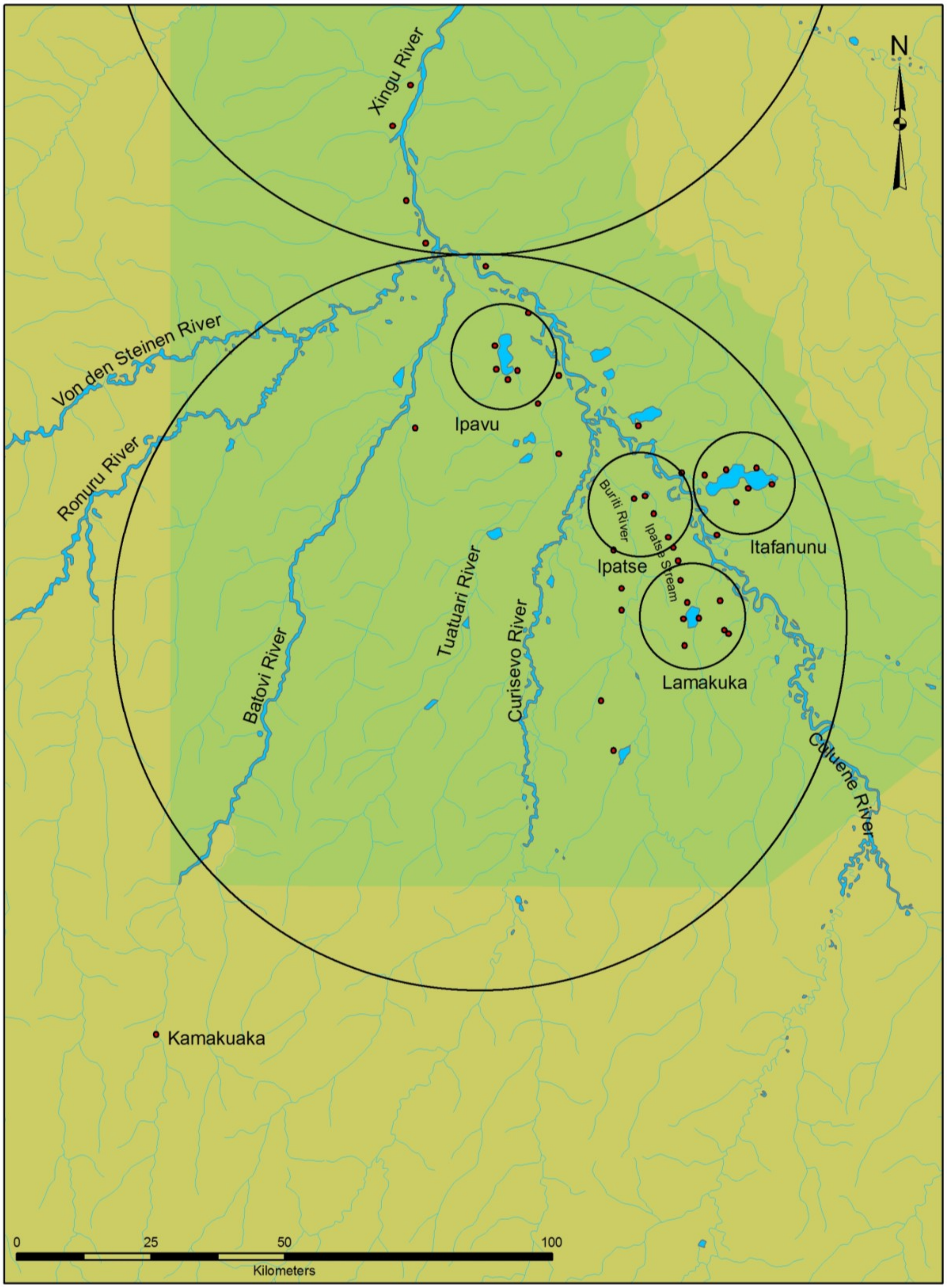

Figure 3-3. Major clusters of archaeological sites along the Culuene River and in the traditional territory of the Kuikuru near Lakes Itafanunu, Ipatse, and Lamakuka.

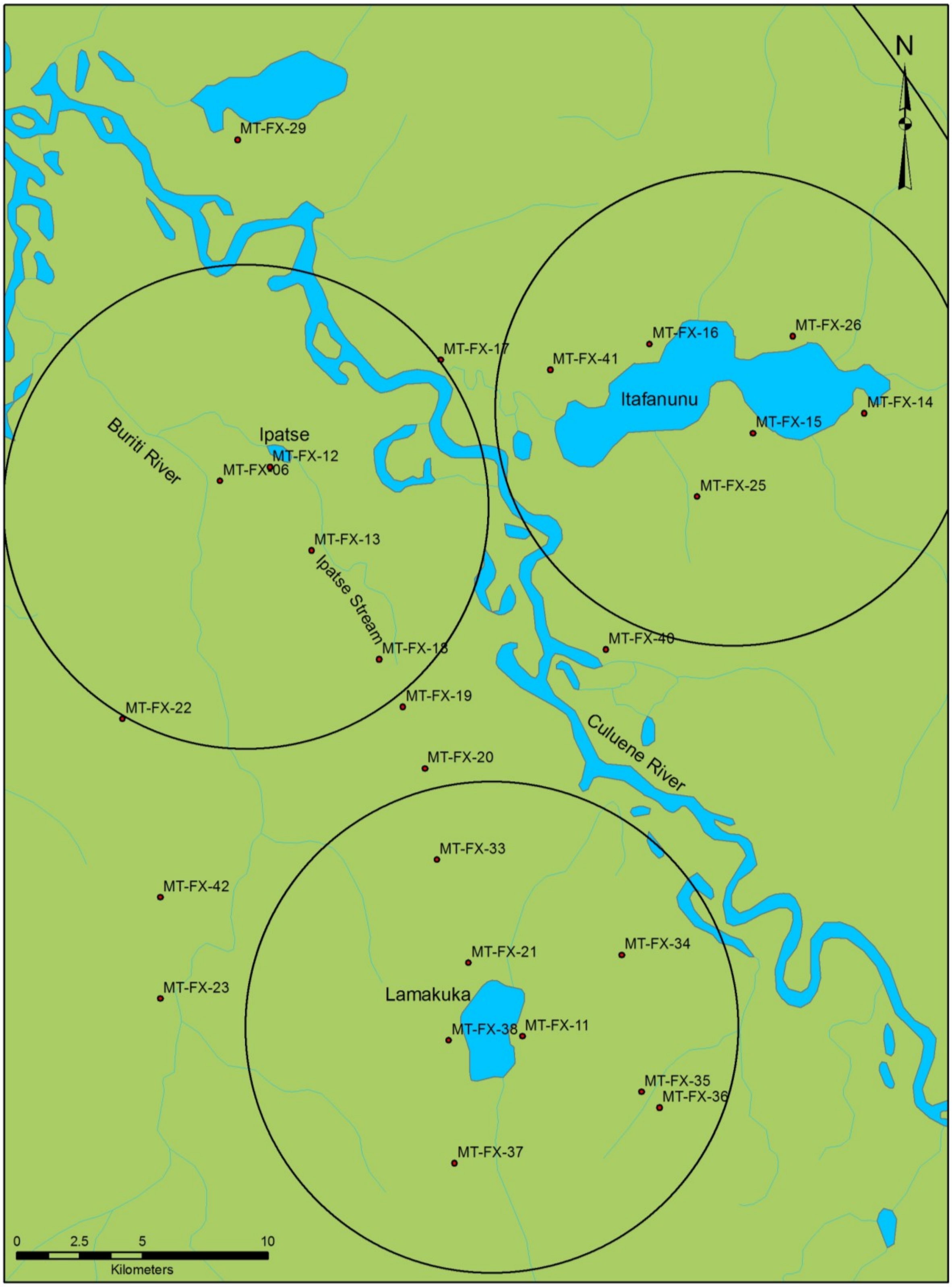

Figure 3-4. Major clusters of archaeological sites within the Kuikuru Study Area (KSA) based on the traditional territory of the Kuikuru.

Simões designated the Ipavu phase to refer to all the archaeological materials he encountered in the lower Culuene River, reserving Diauarum for those along the upper Xingu River, and excluding those attributed to the historic Xinguano or Waurá pottery. Simões published two radiocarbon dates, however, analysis of additiona unpublished dates show that stratigraphic inconsistencies and poor association cast at least some doubt on Simões evaluation of the archaeological materials (Heckenberger 1996). Settlement and other site data also suggest that, in fact, the Diauarum Complex and the Ipavu Complex may likely be “slightly divergent complexes of the same basic cultural pattern” (Heckenberger 1996:66) and related to other complexes in the lower Culuene area (Figure 3-4).

On the basis of new dates and more extensive stratigraphic excavations, Heckenberger divides the prehistoric sites of the lower Culuene into two geographically distinct archaeological complexes, the Eastern and Western complexes both of which share characteristics of Simões Ipavu phase ceramics. Sites identified by Simões north of the confluence of the Xingu tributaries appear to be related to Heckenberger's Western Complex of sites while the Diauarum sites, "may represent a third distinctive complex" (Heckenberger 1996:71). These complexes more closely approximate "archaeological cultures" sharing essentially identical features of material culture differentiated only by settlement patterns. The Western complex corresponds to the large fortified villages identified to the west and north of Lake Itafanunu (Heckenberger 1996, 2005) dating back to at least A.D. 1250 while the Eastern complex, situated closer to Lake Itafanunu, corresponds to the smaller unfortified villages with circular structures that do not have counterparts in the fortified villages to the west.

Heckenberger surmises that the Eastern complex villages likely represent the late movement of Carib speaking peoples into the area around A.D. 1500. Since this time, these discrete complexes (Western and Eastern) have merged forming the basis for the multiethnic regional culture (Xinguano) which continues to the present day. Since the Simões collections have not been fully analyzed, the relationships between the Eastern complex, the Western complex, and the Diauarum phase, are not fully understood but will be explored further following the pottery analysis in Chapter 5.

The Southern Amazon Ethnoarchaeological Project

All of the data presented here were collected during nine months in the KSA over the course of four years (2002-2005) and an additional four months of laboratory work conducted at the MPEG in Belem during 2007. During the most recent phases of field work in the KSA vertically stratified ceramic samples were obtained from various horizontal contexts at prehistoric sites throughout the KSA. These were the subject of a technofunctional analysis, complimented with ethnographic observations, to provide data sufficient to document technological and stylistic variation in ceramic samples across time and space.

During the first field season the primary goal of research was to map the known sites in the vicinity of the KSA. This mainly focused on those sites close enough to the Kuikuru village that allowed for our return to the village at the end of each day. However, our GPS survey also included several sites that included multi-day trips to other smaller Kuikuru villages as well as to areas around Lake Itafanunu where no indigenous villages or houses currently exist.

Each site was mapped with a sub-meter accurate Trimble® GPS unit with real-time correction. Typically, several Kuikuru assistants and a team of archaeologists hiked through the forest following anthropogenic landscapes such as road berms, plaza berms, and ditches, at prehistoric village sites. The ditches were generally known to the Kuikuru and accounted for by oral tradition and myth. Each of the village sites are referred to using names previously given by the Kuikuru (Dole 1961; Heckenberger 1996, 2005). Maps for each site, including all of the major landscape features, were completed in the first season of field work.

Several excavation trenches (ET) bisecting the village peripheral ditches were also completed in the first field season as well as smaller excavation units (EU). At the Nokugu site (MT-FX-06), a total of 13 ETs and a total of nine EUs were hand excavated. At the Heulugihïtï site (MT-FX-13), a single ET was excavated along with a single EU. Each one-meter-wide EU was excavated to sterile non-anthropogenic soil across each village peripheral ditch as well as across village plaza and roadside berms. After completion of each trench a 1.0 x 0.5 m EU was excavated at the end of each ET in 0.5 x 0.5 m subunits and in 10 cm levels within the natural stratigraphy. All soil from these excavations was screened through one-quarter inch mesh resulting in the recovery of pottery and charcoal remains. Additional charcoal samples were hand collected from the cleaned and profiled walls of both the main ET and the EU. Many of the dated charcoal samples form the basis for the cultural chronology of the KSA.

In the following field season several 100 x 100 m surface collection areas (CA) were designated. Collection areas were placed in six locations at MT-FX-06 and at three locations at MT-FX-13. Surface CAs were placed in various portions of the site, representing plaza proximal and plaza marginal areas, overlapping the plaza berm in the case of the latter, and overlapping the peripheral ditches in the case of the former.

Each site had one CA each for the northwest, southwest, and southeast quadrants of the sites, with additional CAs placed at MT-FX-06 in the northcentral, northeast, and peripheral south of the site. These additional CAs at MT-FX-06 were placed to further investigate the nature of presumed domestic areas and plaza marginal areas, respectively.

Inside each CA a 2.0 x 2.0 m collection unit (CU) was placed at 8 m intervals (10.0 m spaced on center) along eleven transects within the CA running north to south and counted from west to east. This created a total of 121 CUs per CA. Additionally each CU was subdivided into four 1.0 x 1.0 m subunits. After each CU was designated with pin-flags, trained Kuikuru assistants carefully cleaned each CU of vegetation which in most cases was light. Each CU was then scanned for all surface artifacts and collected according to subunit, placed in a bag, and labeled for later analysis.

In addition to the extensive surface collection, transects of sub-surface test units (TU) were also excavated within each CA to supplement the surface data and characterize the soil stratigraphy across the plaza marginal areas. Transects of TUs were placed across each CA in 20 m intervals running from west to east and from north to south. Along each transect six 0.5 x 0.5 m TUs were excavated in 10 cm levels and all soil was screened through one-quarter inch mesh. Profiles of all completed excavations were drawn and soil colors were recorded using the Munsell® Soil Color Charts. Additionally, all excavations were photographed and soil samples were taken in 10 cm intervals from each TU for later study (Schmidt 2010).

In the final field season MT-FX-06 was also the subject of a larger horizontal block excavation. This effort, along with a localized surface collection area south of CA01 was undertaken to investigate discrete domestic and residential areas possibly associated with house locations, related activity areas, and middens. The block excavation focused on an area within CA01 on the north side of the main plaza at MT-FX-06. Previous surface collections and subsurface testing indicated that this area was characteristic of a domestic area, with house trash middens surrounding a lower concentration of artifacts in lightly colored non-terra preta soils. Vegetation was carefully cleared from a 40 x 40 m area which extended from just north of the plaza berm to just overlapping the presumed house trash midden. The site wide grid was reestablished over the block excavation area. Excavation in this area proceeded in 1.0 x 1.0 m units further divided into 0.5 x 0.5 m subunits. Elevations were taken across the cleared area using a surveyor's transit and a localized datum.

The block excavation proceeded in 5.0 cm levels for the first 15 cm below the relatively even and flat surface in an effort to identify domestic features related to the construction of a house or household activities. This method identified several significant features just below the hard compact surface. Excavation of these features resulted in the identification of the most significant feature, a central hearth which had a definitive large central house-post feature to its east. The largest concentration of household ceramics were recovered near these features including pot stand fragments (*undagi*) and rims of large manioc processing vessels (*ahukugu*).

In addition to the excavation in the domestic area, a large area to the north of the house excavation was cleared and a similar grid of 1.0 x 1.0 m units and 0.5 x 0.5 m subunits. The area was photographed, surface collected, and then a 1.0 x 2.0 m area was excavated in subunits and 10 cm levels. This area was rich in ceramic deposits and the soil was much darker, almost black, representing the densest portion of the midden related to the house in the larger block excavation. Excavation within the residential area specifically provided further information regarding the structure of domestic areas.

The Nokugu Site (MT-FX-06)

A total of 12 linear trenches were excavated at MT-FX-06 during the 2002 and 2003 field seasons to expose the vertical stratigraphy of the anthropogenic landscape features (Figure 3-5). A single linear trench was excavated in 1993, designated Excavation Trench 1 (ET01) which along with data from elsewhere in the KSA was the basis for the cultural chronology of the study area (Heckenberger 1996, 2005). Like ET01, all ETs, EUs, and TUs were hand excavated. ETs were placed across plaza and road berms (ETs 3, 5, 6, 8, and 9), across village peripheral ditches (ETs 2, 4, 7, and 10), and road berms (ETs 11, 12, and 13). Vertical profiles of select ETs (corresponding to adjacent EUs) and all TUs are presented here as they further resolve periodization and physical configuration of the site.

Excavation Trenches

ET01 was excavated in 1993 and is fully described elsewhere (Heckenberger 1996, 2005). The stratigraphic sequence combined with radiometric data from ET01 provided the first basic chronology for the site. Stratum I was devoid of cultural artifacts and dates before A.D. 700. Stratum II is a series of continuous occupation layers that date from A.D. 900-1400. Stratum III is the reddish overburden which represents the initial construction of Ditch 1 and dates from A.D. 1400-1450. Stratum IV represents the infilling of Ditch 1 immediately after its construction. A date of A.D. 1590 was obtained from the middle of this stratum and a date of A.D. 1770 was obtained from the top of the stratum within two distinct macro-stratigraphic units (Heckenberger 1996:44).

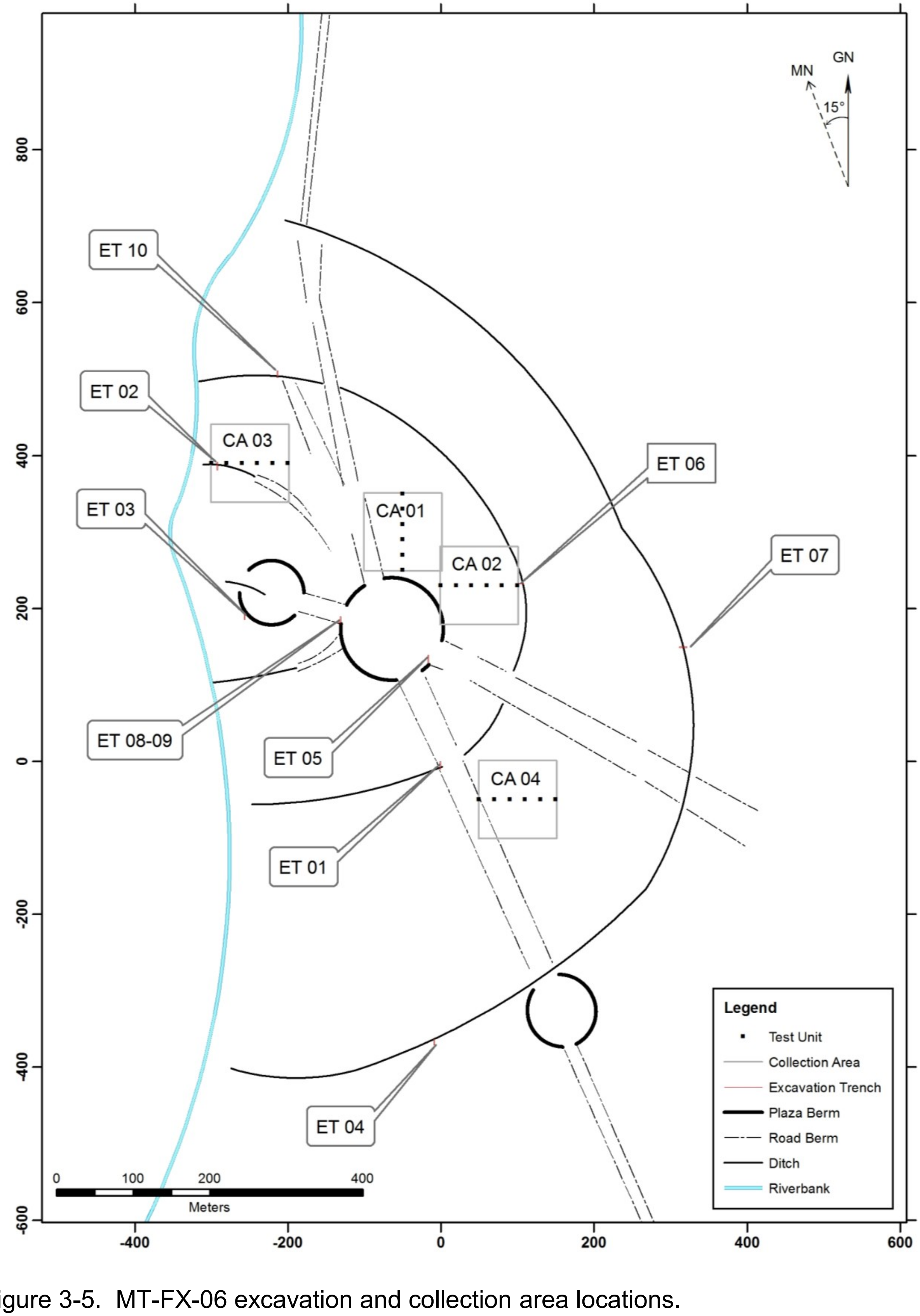

Figure 3-5. MT-FX-06 excavation and collection area locations.

Twelve more ETs were excavated during 2002-2005 fieldwork confirming and expanding on the information collected from ET01. The most recent ETs were placed across the main plaza berm (ET08-09 and ET05), across the secondary plaza berm (ET03) and secondary plaza ditch (ET02 and ET13), across the village outer ditch (ET04 and ET07), across the village inner ditch (ET06 and ET10), and finally across a roadside berm (ET11-12). These ETs provided a broad view of the site-wide stratigraphy related to the construction of berms and ditches. Dates obtained from these profiles further refine the chronology of the site and provide the basic framework to understand social and material developments. Profiles and data are presented for select ETs from this group including ET03, ET04, ET05, ET08, ET09, and ET10.

ET02 is a 1.0 x 12.0 m trench running north to south across the primary plaza peripheral ditch north of the main plaza. This ditch extends to the bank of the Buriti (*Angahuku*) River in the northwest portion of the site. The profile reveals a very deeply excavated trench containing later period pottery in the basin which began to infill sometime after the construction of the ditch (Figure 3-6 and Figure 3-8). Radiometric data obtained from charcoal samples from the bottom of this trench date the first episodes of infilling to roughly A.D. 1250.

ET03 is a 1.0 x 7.0 m trench oriented north to south across the berm of a smaller, perhaps earlier, plaza berm to the west of the main plaza. The stratigraphy of this trench revealed a very dark soil containing high amounts of pottery (Figure 3-9 and Figure 3-11). Various episodes of filling and other disturbance are also revealed in the trench profile. Four excavation units were placed on the south side of the trench and their contents are included in the overall ceramic analysis presented here.

ET04 is a 1.0 x 9.0 m trench oriented north to south on the far south end of the site bisecting the outer ditch. The profile of this trench revealed a relatively shallow ditch compared to the same ditch on the north side of the site (Figure 3-6 and Figure 3-7). Radiometric data from charcoal obtained from the bottom layer of the excavation date the first episodes of infilling of this ditch to A.D. 1250.

ET05 is a 1.0 x 9.0 m trench oriented north to south across the intersection of the main plaza berm and the south curb of the main road on the east side of the site. The profile of this trench revealed a deep layer of anthropogenic earth overlaying the original substratum (Figure 3-10 and Figure 3-12). The anthropogenic layer can be roughly divided into an upper and lower stratum but the soil transition is extremely gradual and diffuse. An excavation unit was placed on the south end of this ET and its contents are included in the overall ceramic analysis.

ET08 and ET09 are oriented north to south and east to west respectively and meet at the south and east ends. They are located at the intersection of the main plaza berm and the road berm which leads to the smaller plaza west of the main plaza. Soil stratigraphy from each of these ETs matches closely with that of ET05 (Figure 3-13 and Figure 3-14). Two excavation units were placed near the intersection of these two ETs and their contents is included in the overall ceramic analysis.

Excavation Units

EUs were excavated in all major landscape features including village peripheral ditches, plaza berms, and road berms. While the ETs provided a broad overview of the general stratigraphy of the village peripheral ditches and the plaza/road berms, the EUs provided controlled samples of pottery and charcoal to aid the diachronic analysis of the ceramic industry at the site.

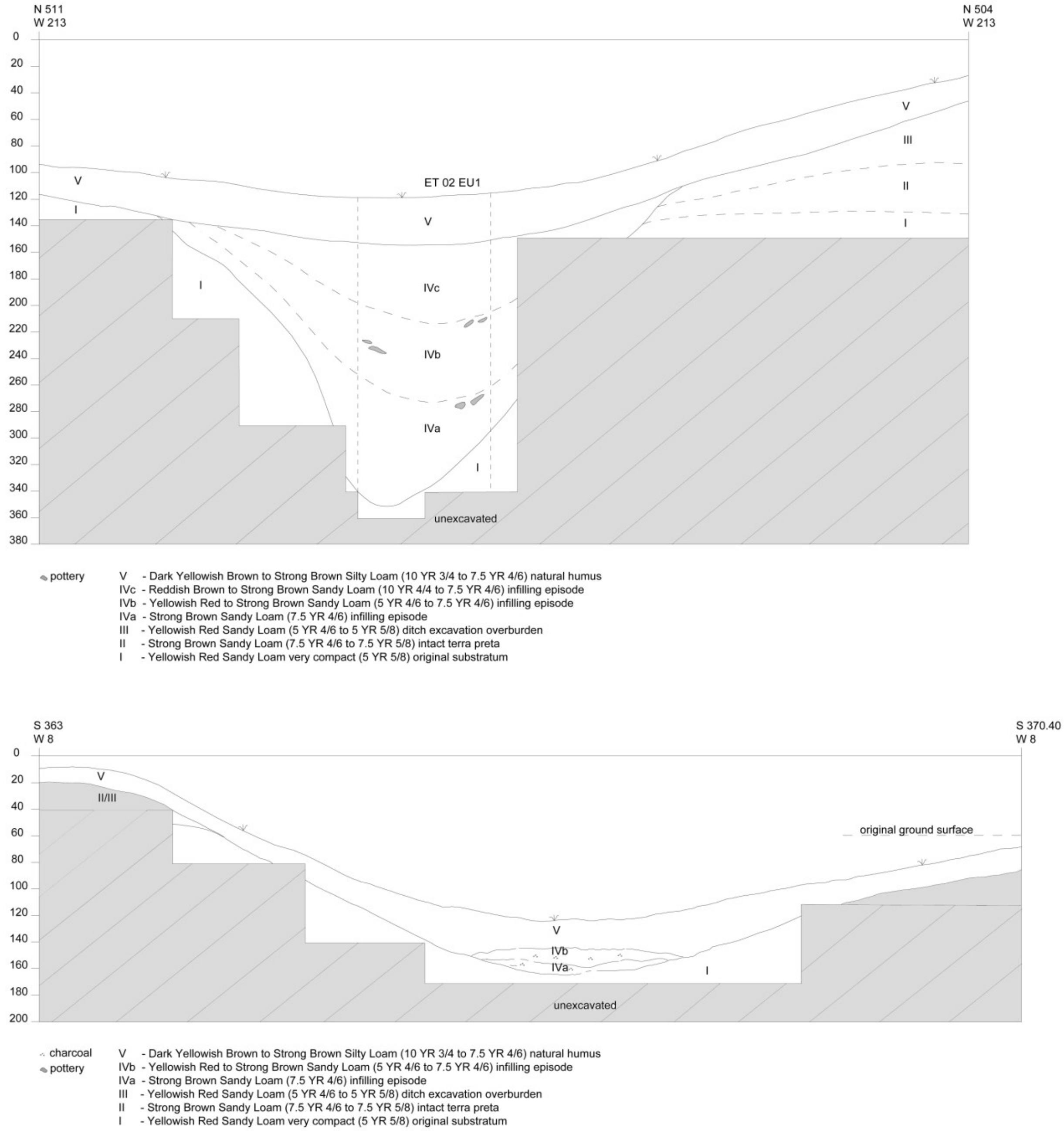

Figure 3-6. Profile drawing of ET 02 (top) and ET 04 (bottom).

Figure 3-7. East profile view of ET04 facing northeast with chaining pins at one meter intervals.

Figure 3-8. East wall profile view of ET 02 facing northeast with chaining pins at one meter intervals.

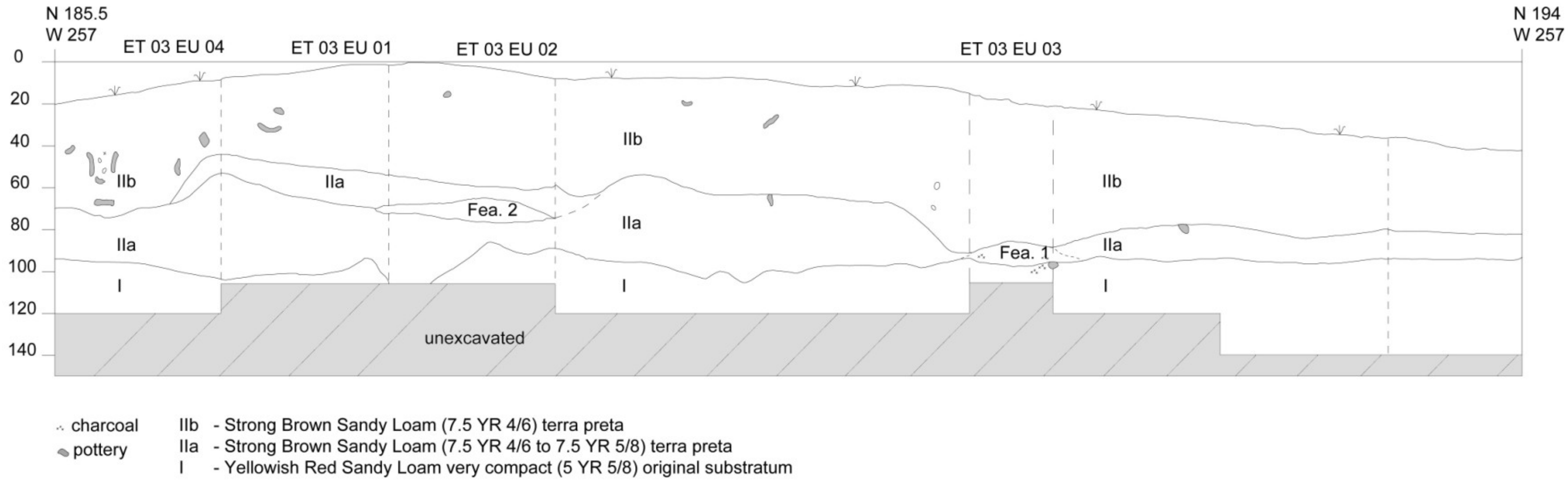

Figure 3-9. Profile drawing of ET 03 and its corresponding EUs.

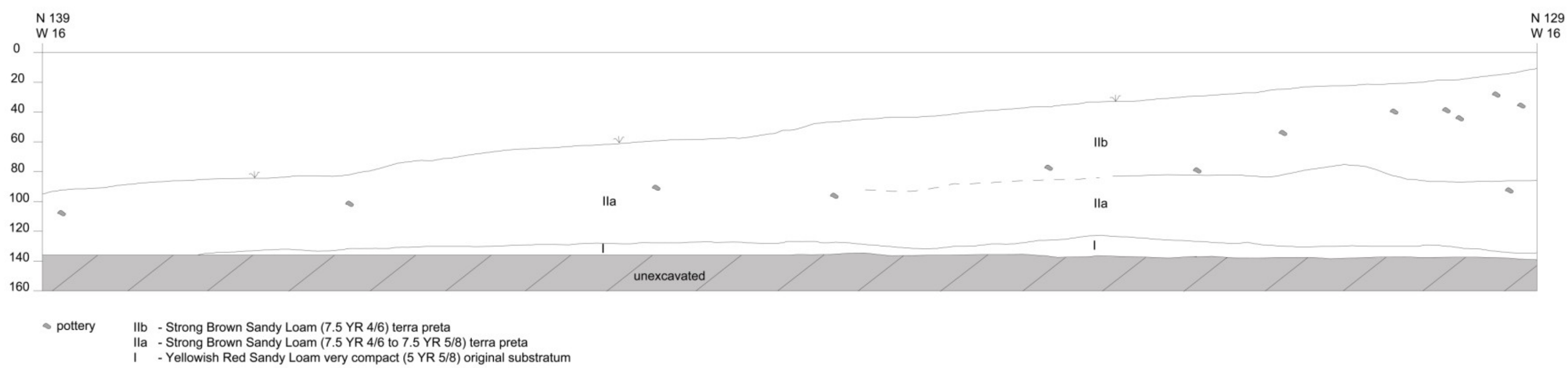

Figure 3-10. Profile drawing of ET 05. EU 05-1 was excavated on the south end of this ET.

Figure 3-11. West wall profile view of ET03 facing northwest with chaining pins at one meter intervals.

Figure 3-12. East wall profile view of ET05 facing southeast with chaining pins at one meter intervals.

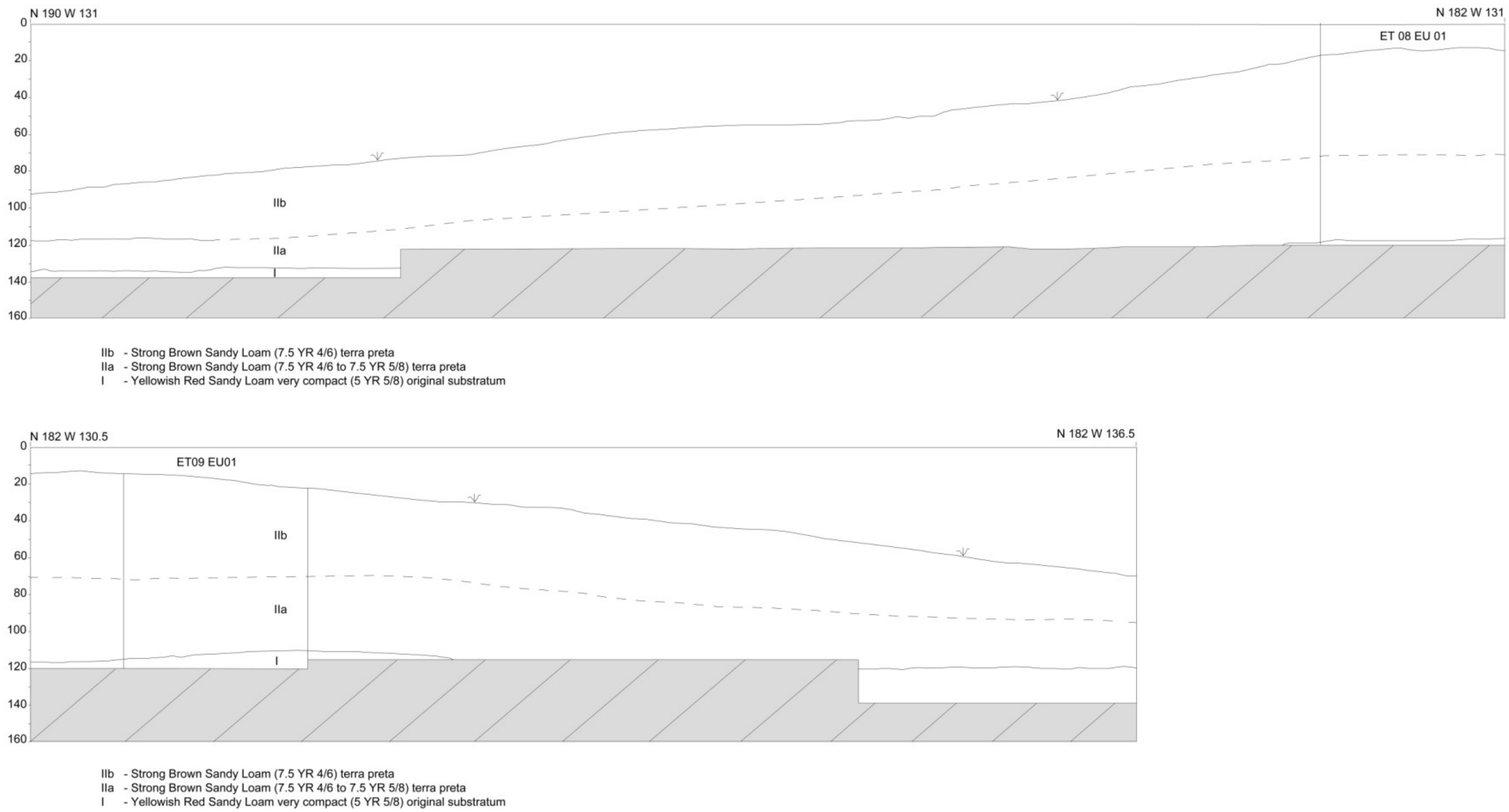

Figure 3-13. Profile drawing of ET 08 and ET 09 and their corresponding EUs.

Figure 3-14. Profile view of the intersection of ET08 and ET09 showing the east wall profile of EU 8-1 (left) and south wall profile of EU 9-1 (right).

The excavation units placed at the ends and centers of excavation trenches across the peripheral ditches (EU04 and EU02) contained very little ceramic remains compared to those placed in plaza and road berms (EU03-1, EU03-2, EU03-3, EU03-4, EU05-1, EU08-1, and EU09-1) and in some cases contained mixed stratigraphy. In the ditch excavation units, pottery was likely transported there by chance and in some cases is part of a reversed stratigraphy since these features were excavated and filled in well after the first occupations at the site. Like the somewhat problematic radiocarbon dates obtained from some ditch excavations, pottery in these was not used in the overall analysis.

Excavation Units in the plaza and roadside berms were useful in the ceramic analysis and provided seemingly reliable dates as well. The most beneficial of these were EU03-1, EU03-2, EU03-3, EU03-4, EU05-1, EU08-1, and EU09-1. A total of 24.05 kg (n=1,644) of pottery was collected from these 7 EUs. The depth of ceramic remains and their increasing numbers through time before dropping off are consistent with the proposed occupation sequence of the site and accumulation of the plaza berms (Figure 3-15 to Figure 3-20).

Test Units

Test Units were excavated through the center of all CAs. Rather than describe each test unit individually they are presented here as linear profiles stretching across each 100 x 100 meter collection area. Soil profiles recorded for each test unit reveal much about the overall site stratigraphy, which fluctuates from the center of the site (the plaza) to its periphery (the residential areas) (Figure 3-21). A total of 10.26 kg (n=1,107) of pottery was collected in the 24 TUs from CAs 1-4. Pottery from these excavations was included in the overall ceramic analysis.

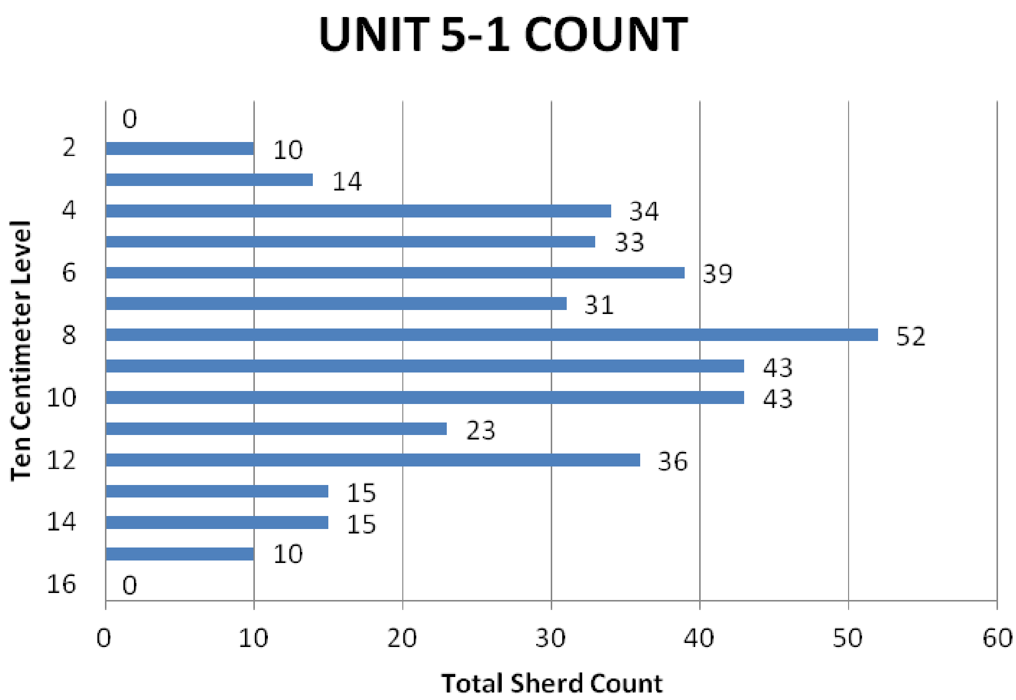

Figure 3-15. Excavation Unit 5-1 sherd count by depth.

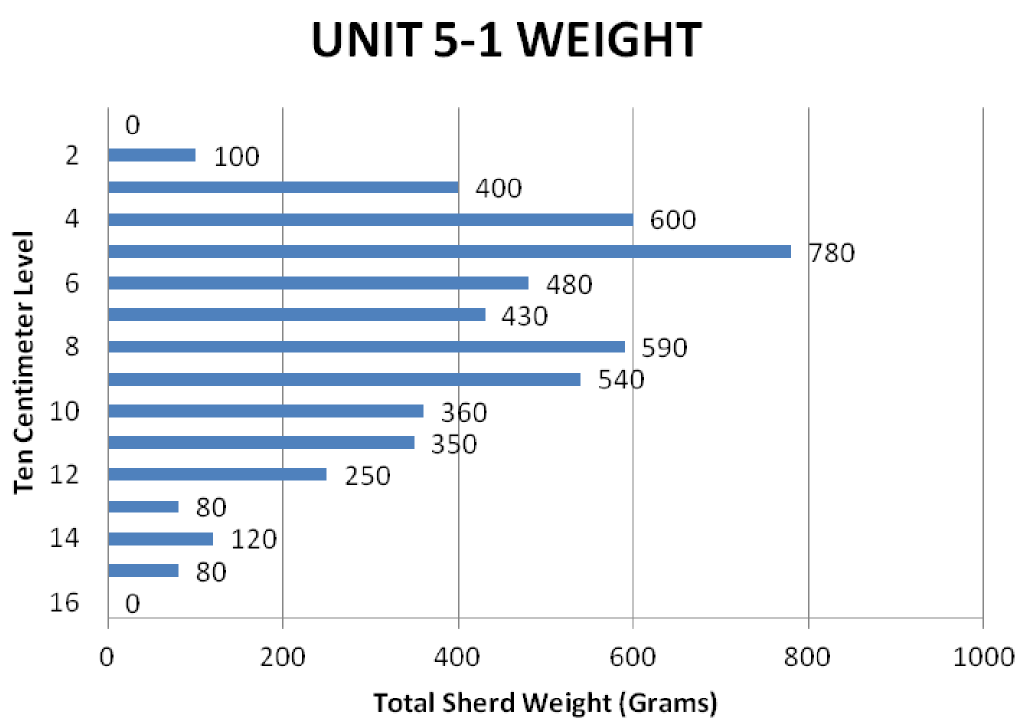

Figure 3-16. Excavation Unit 5-1 sherd weight by depth.

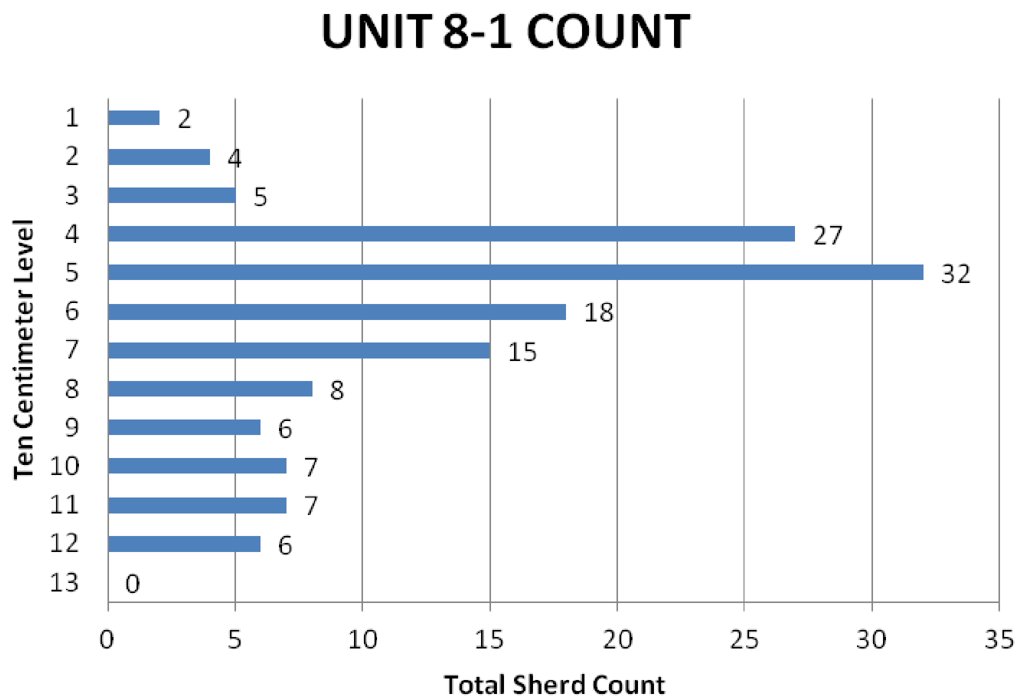

Figure 3-17. Excavation Unit 8-1 sherd count by depth.

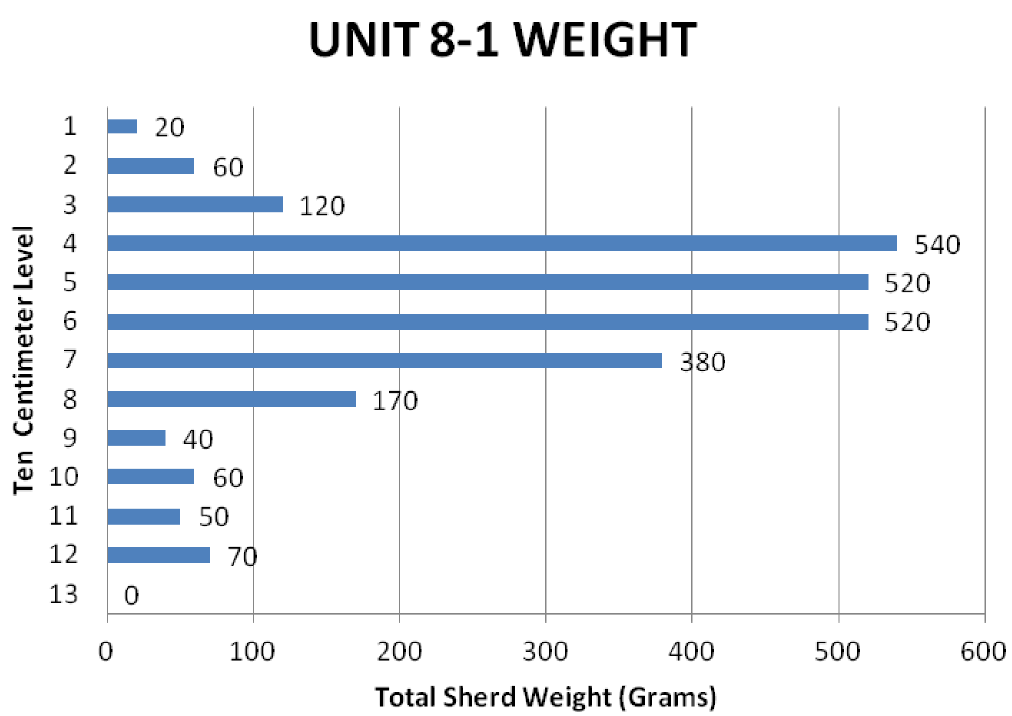

Figure 3-18. Excavation Unit 8-1 sherd weight by depth.

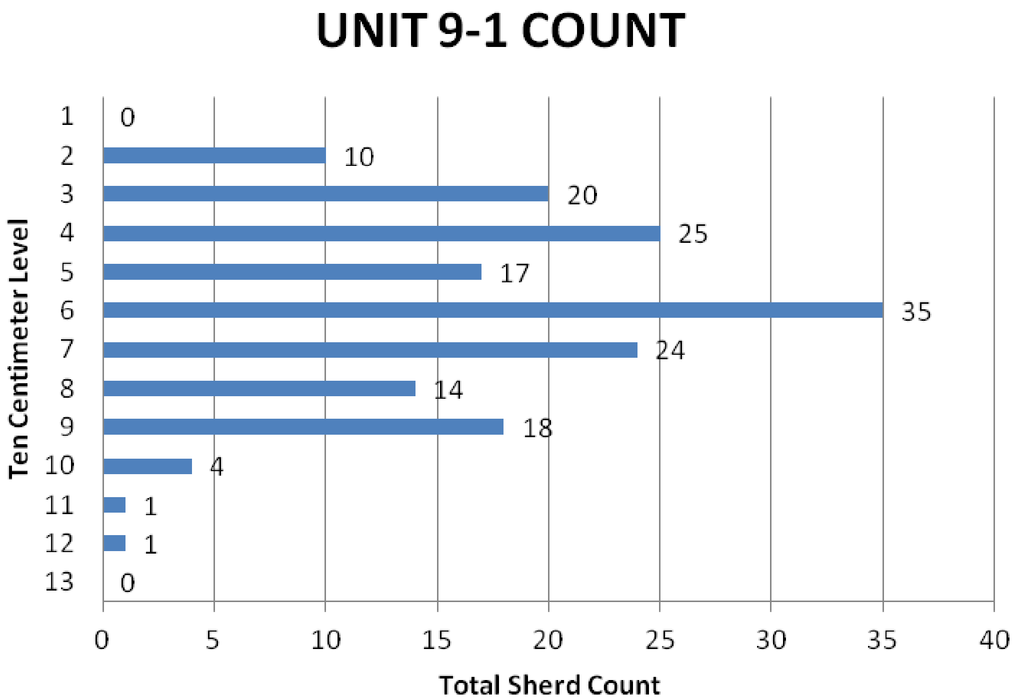

Figure 3-19. Excavation Unit 9-1 sherd count by depth.

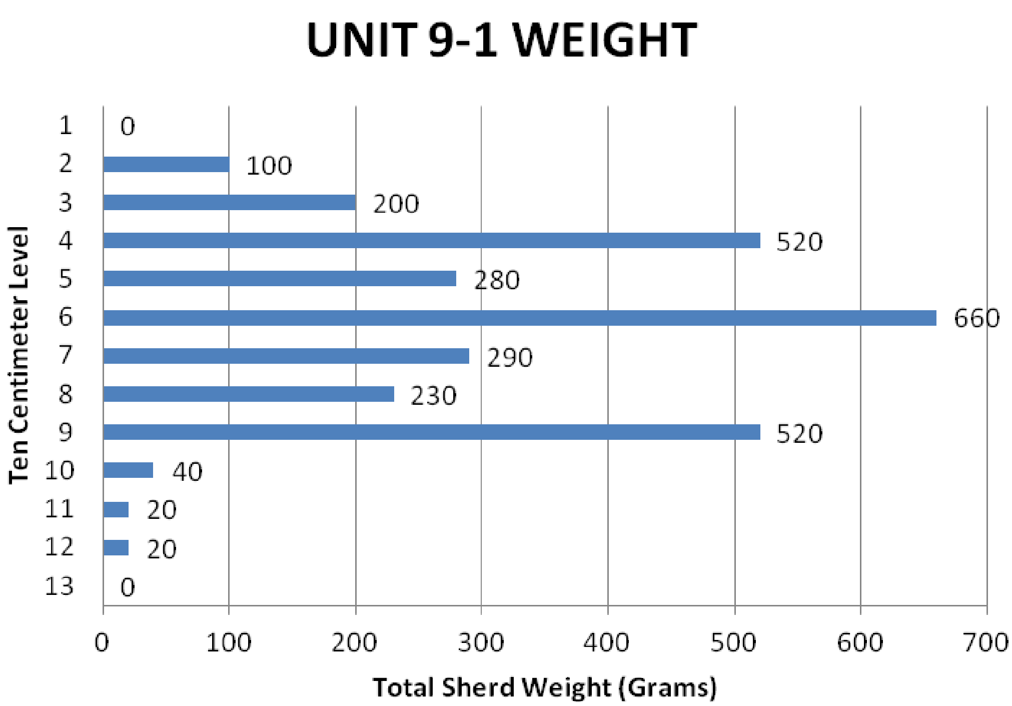

Figure 3-20. Excavation Unit 9-1 sherd weight by depth.

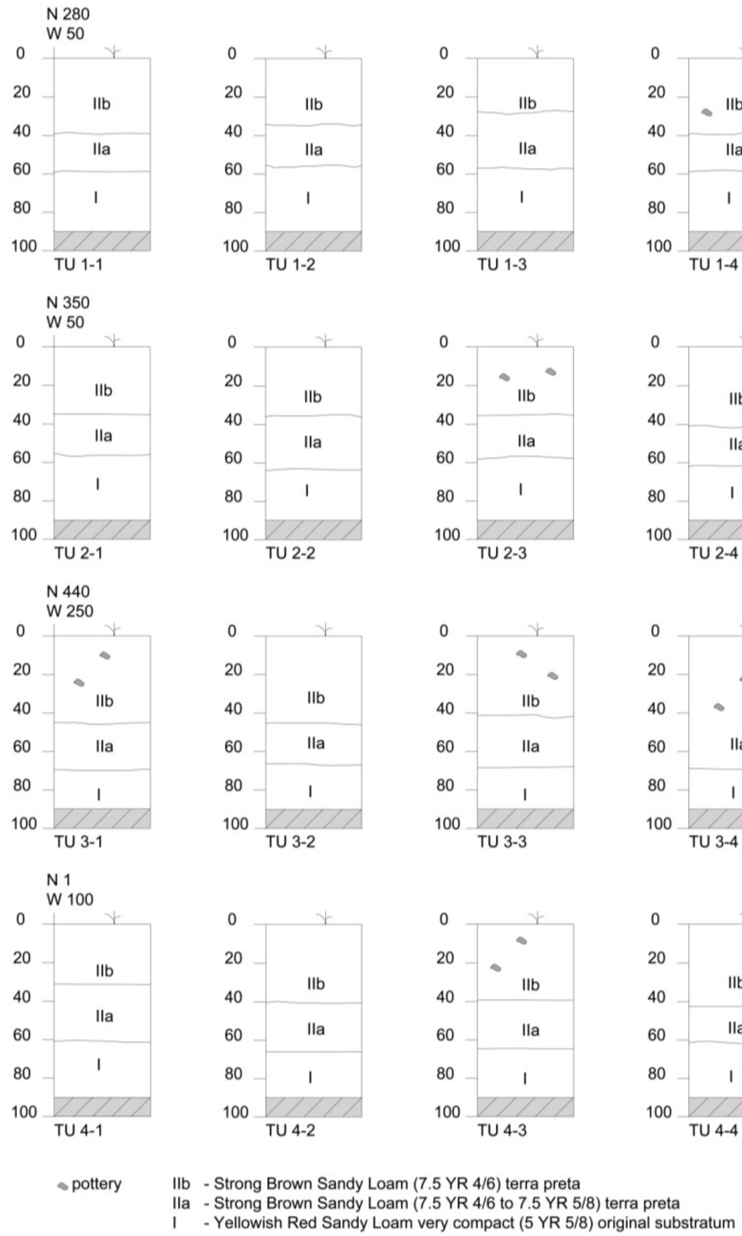

Figure 3-21. Test unit soil profiles for transects 1-4.

Surface Collections

Surface collected areas provided the largest samples of pottery from both sites. Surface collections contained all types and styles of pottery. A total of 102.68 kg (n=2,768) of pottery was collected from CAs 1-4.

The Heulugihïtï Site (MT-FX-13)

The site of Heulugihïtï (MT-FX-06) is six kilometers to the south of Nokugu (MT-FX-06) and is connected by a nearly straight prehistoric road identified by low-laying berms which form the sides of the road. The berms are 25-30 cm in height and do not contain artifacts on their surface once they extend past the main plaza. MT-FX-13 was examined with the same methods as MT-FX-16 to test horizontally and vertically with excavations and collection areas (Figure 3-22). At MT-FX-13 three 100 x 100 m collection areas were situated in three distinct segments of the village divided by roads leading out from the plaza center. A single ET was excavated to examine the stratigraphy of a segment of the plaza berm where it intersects with a road side berm. Additionally, a single EU was excavated on the end of the ET with finer vertical control. Transects of 0.5 x 0.5 m TUs were excavated through the center of each of the three CAs.

Like MT-FX-06, MT-FX-13 occupied continuously from late in the first millennium A.D. until it was abandoned around the same time as Nokugu or earlier. Based on this chronology and the connecting roads, it is hypothesized that these two villages were part of a larger complex of organized villages. The pottery from MT-FX-13 is distinctive from the pottery at the MT-FX-06 and based on its overall appearance and technology was not likely made by the same potters. Unlike the pottery at MT-FX-06, the assemblages from MT-FX-13 do not contain the variety of forms and styles through time that are present at MT-FX-06. However, some forms and styles are present at MT-FX-13 that are not present at MT-FX-06 and may be evidence of the mixture of different groups moving into the Upper Xingu in the Protohistoric period.

Excavation Trenches

ET01 is a 1.0 x 10.0 m trench oriented east to west across the southeast portion of the main plaza berm and the west curb of the main road. The profile of this trench revealed a deep layer of anthropogenic earth overlaying the original substratum (Figure 3-23 and Figure 3-24). An EU was placed on the east end of this ET and its contents are included in the overall ceramic analysis.

Excavation Units

A single 1.0 x 0.5 m EU was placed at the east end of the ET and excavated in 10 cm levels. This EU provided the most reliable stratified remains from MT-FX-13. The ceramic count from this excavation was somewhat low in comparison to EUs at MT-FX-06 but consistent with the overall low count of ceramics at the MT-FX-13 in general. Four other 1.0 x 1.0 m EUs were placed both within the plaza and in the presumed residential areas outside the plaza and these contained almost no cultural materials and were relatively shallow, less than 30 cm in most cases, to culturally sterile soil. A total of 6.23 kg (n=397) of pottery was collected from the single EU at the end of the ET.

Test Units

Once surface collections were completed 0.5 x 0.5 m TUs were placed on transects across the center of each CA and spaced at 20 m intervals running north to south. A total of six TUs were excavated across each CA and a total of 18 TUs were excavated at MT-FX-13. The clearest difference between the TUs at MT-FX-13 and those at MT-FX-06 is the depth of the cultural deposits. At MT-FX-06 the *terra preta* is more than one meter deep in some areas while at MT-FX-13 it is difficult to see even in shallow contexts and is much lighter in color and organic material. A total of 7.14 kg (n=1,087) of pottery was collected in the TUs.

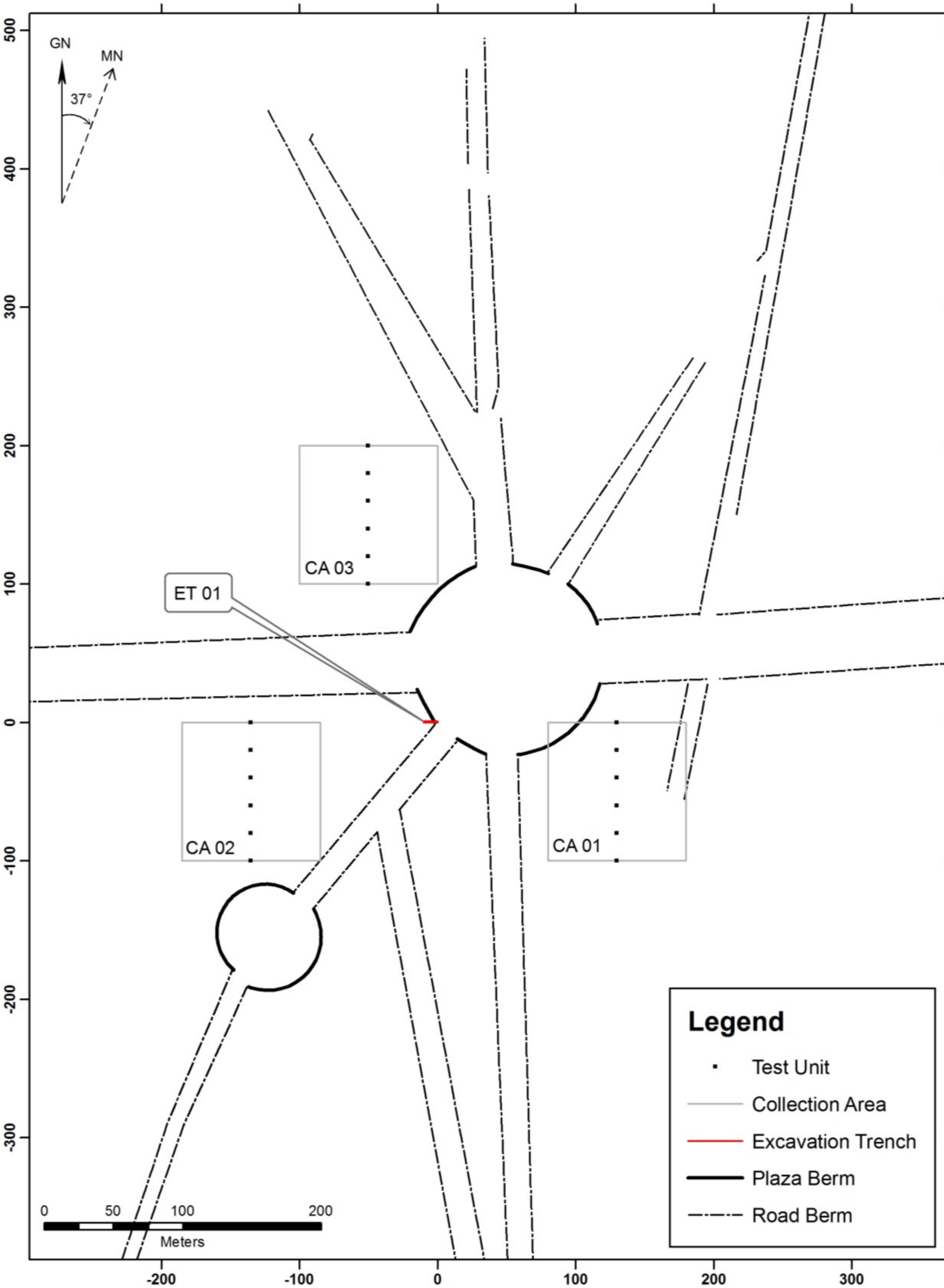

Figure 3-22. MT-FX-13 excavation and collection area locations.

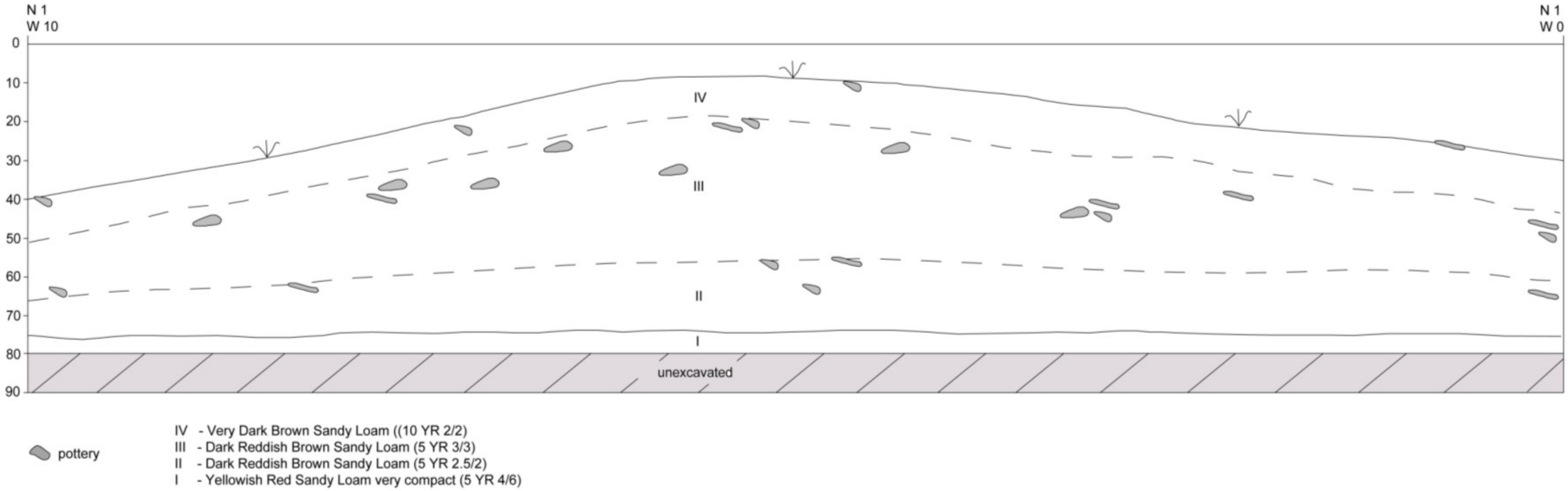

Figure 3-23. North wall profile of ET01 at MT-FX-13. The single EU was excavated at the east end of the trench.

Figure 3-24. Northeast view of ET01 at MT-FX-13 after excavation. The EU was excavated on the east end to the right.

Surface Collections

Surface collections were conducted in three 100 x 100 m CAs at MT-FX-13. CAs were situated in the southeast (CA01), southwest (CA02), and northwest (CA03) portions of the site. Each was placed on the same site wide grid and oriented with at least one portion extending into the plaza berm though mainly sampling the residential areas. Within each CA smaller 2.0 x 2.0 m CUs were placed 10 m apart on center beginning at the edge of each CA with the first and last CU extending one meter beyond the 100 m outline of the CA. The CUs were further divided into 1.0 x 1.0 m subunits. All artifacts collected from the surface of a subunit were grouped together for later analysis. A total of 121 CUs were completed for each CA. This resulted in a total of 29.56 kg (n=857) of pottery collected from MT-FX-13 in the surface collection effort.

Other Upper Xingu Sites

Only limited excavations were conducted at other sites during the 2002-2005 fieldwork. Test units were excavated at Akagahïtï (MT-FX-18) and non-systematic surface collections were made at other sites while mapping, including Akagahïtï (MT-FX-18), Ipatse (MT-FX-12), and Kuhikugu (MT-FX-11). The materials from these sites provide limited but important information regarding the overall pattern of ceramics in the Upper Xingu especially in the KSA and are presented here for their form and decorative attributes. These samples were collected from the surface of most sites and represent the last occupation at these sites. Finally, limited collections from the Museu Paraense Emílio Goeldi were analyzed along with their original field notes. These include collections from the work of Mario Simões at sites MT-AX-01, MT-FX-01, MT-FX-02, MT-FX-03, MT-FX-04, MT-FX-05, and MT-FX-09.

CHAPTER 4
POTTERY METHOD AND THEORY

Introduction

In the Upper Xingu the correlation between pottery and subsistence is already documented based on the presence of the same food producing and food consuming pottery vessels in late prehistoric, historic, and modern times and the overwhelming ethnohistoric evidence to support these observations (Figure 4-1). Pottery remains therefore provide the best tangible material connection to food production and consumption in the Upper Xingu past since paleobotanical remains are few and little studied, especially in the southern Amazon. Anthropogenic and anthropic landscapes both within and around archaeological sites also provide some clues about the scale and organization of human changes to the land related to food production and consumption. This lack of micro-scale evidence and the abundance of macro-scale evidence are balanced by the ubiquitous presence of pottery throughout all known archaeological sites of the Upper Xingu.

Working with the supposition that pottery played a significant role in subsistence activities, its advantage as a subject of study is its ability to reveal how food production and consumption might have varied through time in relation to its variable employment of pottery. Examined from its earliest appearance to its modern use, Upper Xingu pottery demonstrates a continued presence of certain vessels from late prehistory into the present. It also reveals the development of a preference for certain types of vessels and a technology related to these vessels. This trend towards uniformity and standardization is perhaps not on the level of mass production where standardization is from routinization but it is standardization on the level of a determined preference for a certain type of vessel and a certain technology for building that vessel. While this type of trend within a ceramic industry is traditionally analyzed in relationship to the urbanization or modernization of a society, here it is analyzed to understand how food production relates to the expansion and elaboration of a highly organized non-industrialized society.

Figure 4-1. Type 1 manioc processing vessels in use from 1884 (bottom, Steinen 1894:Tafel XV), 1950 (middle, Galvão 1953:51, Figure 9), and 2002 (top) where metal vessels have replaced all but a single Type 1 ceramic vessel in the background used for boiling manioc juice into *kuigiku*.

Ceramic Studies in the Amazon

Archaeologists in the Amazon have always employed ceramics in the job of creating chronology and connecting occupations and migrations across vast areas of Amazonia. However, studies that focus specifically on the technology of ceramics through time or across space in Amazonia are absent with a few notable exceptions (DeBoer 1975, DeBoer and Lathrap 1979, DeBoer 1986, Roosevelt 1996). Even these studies and others like them (Meggers and Maranca 1980) focus on how ceramic assemblages are chosen and arranged for later use in developing site or regional chronologies and not specifically focused on the technology of pottery (DeBoer et al. 1996; Meggers 1995b). These studies are concerned with the important archaeological processes of identifying and seriating site occupations as well as ceramic assemblages within these occupations.

The most detailed research in Amazonian ceramic studies most often employed an ethnoarchaeological approach. Warren DeBoer and his colleagues used ethnoarchaeological studies to address important problems encountered within ceramic studies. These included issues such as differential longevity of ceramic vessels skewing frequencies (DeBoer 1974), difficulties in identifying assemblages accurately (DeBoer et al. 1996; Meggers 1995b), and the tenuous nature of using ethnographic examples to project past behavior regarding ceramic production, use, and discard (DeBoer and Lathrap 1979). These studies, some of them cautionary, add stability to those studies that seek to use ethnographic analogy in a direct historical approach. Those archaeologists most keenly aware of problems with the direct historical approach are perhaps those studying hunter-gatherer societies because they are more likely to use ethnographic analogy, though these studies also are few. Archaeologists have thus taken this matter into their own hands, often recording pottery specific ethnographic information for themselves (Politis 2007). The result has been a small proliferation of ethnoarchaeological studies since at least the 1990s in Amazonia (though little of it ceramic) adding to the pioneering ethnoarchaeology first conducted elsewhere (Longacre 1991).

Like ethnographic data that specifically addresses the technological variation in pottery, similar data associated with prehistoric pottery is even less prominent in the Amazon, even though technological attributes are often recorded during routine analysis. A notable exception is Anna Roosevelt's study of prehistoric ceramics at Parmana (1996). Though not in Amazonia per se, her study, related to the Amazon based on early chronologies, notes variation in the technological attributes of pottery including temper type.

Ceramic Analytical Method

In Amazonia the long tradition of focusing on decorative motifs on pottery as indicators of change through time began very early (Hartt 1871) and was in part due to the lack of technology allowing for radiometric dating. Donald Lathrap acknowledged the undue focus on stylistic attributes early in the span of Amazonian archaeology.

> The archaeologist has been justly criticized for his preoccupation with pottery, but in the Amazon Basin the minutiae of ceramic style must carry the full burden of our attempts to study old population movements, old trade routes, and the boundaries of now extinct political units (Lathrap 1970:63).

Although ceramic style must carry some of the burden, we now have the resources to expand the list of our “minutiae” to include technological considerations in attempting to understand both "old population movements" and in-situ developments in regional variation. Increasingly, archaeological ceramics are seen as the record of human agency showing both the intended and unintended consequences of human action (McCall 1999:18). Pottery is not just used as a stylistic indicator of migrations and diffusions. Pottery viewed as material culture emphasizes "the constitutive process of artifact manufacture, use, and discard" amidst the influence of structural social processes (Chilton 1999:1). It is the social, economic, and political processes that drive the manufacture, use, and discard within a society. In this way ceramics are a product of social interaction and as such a key to understanding the social context in which they were produced.

In the Amazon material culture deepens our understanding of other important developments concerning the association of disparate cultures and their affinity with the land. Our understanding of the social processes that shape the manufacture of pottery is intimately linked to our understanding of the social patterns of those who produced and used pottery. Further, by refining the characterization of production we can situate it more accurately along a spectrum spanning from individual level to regional level production or from household level to village level production.

Through a technological understanding of pottery we acquaint ourselves better with their function and the process of construction. This information allows us to develop a model of economic and social patterning in the past and in the Amazon this model extends from the past into the ethnographic present. Pottery can of course also be used as it has been always, as an indicator of change and continuity, of movement and in-situ development, and of trade and exchange. Especially in the Amazon where we see widespread changes concurrently across a very expansive landscape, the introduction of new style horizons or new technological innovations into a region provide indications hinting at the extensive social transformations that took place at various times in the prehistory of Amazonia such as the successive waves of Arawak and Carib migrations and their impact on Amazonia as a whole, for example (Heckenberger 2001; Lathrap 1970).

Given the intense activity on either end of the roughly 1,000 year period of occupation of the sites included in this study, one may conclude that some clear changes should be reflected in the material culture of this group of people who on one end are enduring the massive movements of populations and environmental pressures, and on the other end of time, the encapsulation of their villages as reflected in the building of presumed defensive ditches around those villages. Given the presumed function of many pottery vessels in production and consumption and their role in the domestic economy we can comment on their place in a changing and apparently intensifying economy. As research already suggests, this period of time in the Upper Xingu was likely witness to a great intensification of manioc agriculture as noted from the massive secondary forest growth around these prehistoric villages. As well, it is surmised that chiefdoms were a part of this intensification, and the core social dynamics of current Xinguano peoples is evidence of that growth and later decline (Heckenberger 2005; Dole 1978).

Beyond Culture History

Over the course of the last thirty years ceramicists have shifted their gaze from the pot to the potter behind the vessel. Binford (1977) and others showed that asking questions about past actions and processes in different ways yielded meaningful results. Pots were viewed as more than decorated pieces of a fractured culture-history and became material remains of technological innovation that could be exploited to reveal more about the people who made, used, discarded, and reused them (Braun 1983).

Following seminal articles by Wobst (1977) and others suggesting that perhaps we could use pots as more than temporal and cultural diagnostics, archaeologists began to investigate the technological choices of potters to see how these choices reflected on their culture (Bronitsky and Hamer 1986). In the 1990s material culture studies flourished resulting in more anthropological evaluations of archaeological materials (Chilton 1999). With new questions being asked of archaeological pottery, new ways of answering these questions also began to develop spawning more micro-scale levels of examination such as compositional analysis (Arnold 1992). In the 1980s a shift from sherd based analysis to vessel lot analysis placed the focus of study on the archaeological vessel and its component attributes rather than on collections of attributes and typologies. Vessel lots were not universally accepted however, and as some found in database focused computational archaeology, both methods may benefit archaeological research (Buck 1993; Duff 1996).

Standardization Theory

The subject of standardization and specialization has been addressed extensively in the study of pottery by Prudence Rice (Rice 1984a, 1984b, 1984c, 1991). According to Rice "standardization refers to a relative degree of homogeneity or reduction in variability in the characteristics of the pottery or to the process of achieving that relative homogeneity" (Rice 1991:268). She makes also a useful distinction between "manufacture" of pottery, or the actual act of fabricating ceramics, and "production", the social and economic organizational arrangements within which pottery manufacture is carried out (1996:173). The relationship between standardization and production is further developed here as the relationship between those individuals who are producing the pots and those individuals who are controlling the labor that produces the pots. In 1981 Rice developed a "trial model" of the ways in which labor relationships were encoded in pottery in order to analyze the process of intensification of production using as her proxy indicator of intensity and scale, standardization, or reduction in variability (Rice 1981, 1996:177). One problem with testing what she calls the "standardization hypothesis" is identifying a case study that fits the proper criterion for such a study. Since standardization is seen as a process it requires comparison between units, or assemblages, among which that process can "legitimately be hypothesized to operate" (Rice 1996:178). This suggests that testing this hypothesis would be possible with ceramics that exhibit clear developmental relationships over a long period of time, perhaps 400-500 years or longer, and are with some certainty related, traditionally and economically, to the same process. For this reason, as outlined in the preceding chapter, the ceramics of the Xinguano tradition, specifically those from sites in the KSA, represent a well suited case study to test the "standardization hypothesis" outside of an industrialized setting. When combined with previous ethnographic and ethnoarchaeological research in the KSA describing the control of labor through social capital and political surplus, we can also situate the degree of standardization within the context of the local social and political structure (Heckenberger 2003). Another concern in testing this hypothesis is related to the study of ceramics in a more technological way. As Rice points out;

> Through time, changes in relative degrees of standardization and diversity in technological, formal, and decorative variables of pottery would reflect changing patterns of organization of production, some of which could be interpreted as specialization (Rice 1991:257).

This suggests that the measure of change in pottery should ideally focus on technological as well as decorative attributes. The abundance of utilitarian wares in the Upper Xingu creates a situation where this is even more important in the absence of elaborately decorated prestige vessels.

Clearly, dimensional attributes carry the most weight since the size and shape of a vessel are often related to the function and performance of the vessel. Vessel thickness, form, and paste relate specifically to function and performance in many cases. Criticisms of dimensional attributes notwithstanding, if problems such as analysts not recognizing size categories are taken into account, especially in the application of statistical analysis, these dimensional attributes will still prove useful (Longacre et al. 1988; Sinopoli 1988). Of course, with chemical characterization of ceramic pastes in archaeology gaining increasing prominence, the addition of technological and compositional attributes to dimensional attributes will alleviate this problem somewhat (Neff 1992). This will only be the case though if compositional attributes are used for the same purposes that decorative or stylistic attributes have been employed.

The anthropology of standardization, or understanding the processes related to standardized behavior, will also help in the analysis by guiding technological questions towards anthropological themes. In other words, the factors and causes that bring about standardization must be reconciled with the measured variation in the actual pottery assemblages to maintain an anthropological framework. Additionally, factors that may have stunted or prevented standardization can also be examined and factored into the study and juxtaposed with physical analysis of the pottery assemblage. In this effort we must distinguish between standardization in manufacturing technology and the associated factors that may cause this. Reduction in variability associated with specialization may be from a decrease in the number of producers and the factors that may have caused this must be accounted for.

In addressing these issues Rice has argued for a precise distinction between specialization and intensification (Rice 1991, 1996). To be clear, intensification is an economic process that involves increasing levels of investment of all types; it incorporates specialization but specialization does not require intensification. Specialization refers more directly to the restrictedness of manufacturing activity, and may or may not be related to the level of sociopolitical activity in which it occurs, which could be at any level. Rice suggests that we reserve the term standardization "as a process through which uniformity in ceramics increases through time" and use the term uniformity when we refer to "the qualitative state or result of that process" (Rice 1996). In the Upper Xingu we are concerned with both uniformity and standardization.

In a more recent evaluation of the concept of standardization in ceramics Roux (2003) found that standardization as measured in metric attributes falls along a continuum of production intensity where low-level intensity still shows standardization but with a higher coefficient of variation. This lead to the conclusion that “only in a high-rate production situation do we have motor habits that transcend emic conceptions of standardization" (Roux 2003:781). The apparent lack of a "high-rate" production situation in the Upper Xingu, or intensification, does not result in a lack of reliable data. The Upper Xingu coefficient of variation falls within the low level production found in other areas studied by Roux implying that the Upper Xingu potters were likely well aware of the standardization and change in technology they achieved.

Determining Types

Vessel types for the purposes of this study refer to formal types that correspond to basic vessel functions based on ethnographic analogies described by Heckenberger (1996:71-73, 2005). Typing vessels whether by form or function is not without its weaknesses and “since the pottery type is a generalization from many fragments and since there may be no individual example including all of its features, it is not infrequently referred to as an abstraction” (Shepard 1976:307). Despite this criticism of types, in the Upper Xingu we stand on solid ground in knowing that types are not only recognized by local indigenous groups but also observed functional types in the present day subsistence practices of these same groups.

In regard to using types to form chronologies we are also warned by Shepard who reminds us that in using types we should not rely on a type system that is “artificial in so far as it is selected to serve as a means of outlining relative chronologies, a purpose that has no relation to the conditions of production or original functions of pottery” (Shepard 1976:307). Again we find ourselves on solid ground because Upper Xingu forms are selected based on the functions of pottery both observed and confirmed through ethnographic examples. Despite her early warnings to archaeologists about types, Shepard does relinquish a bit in finding that “any feature that changes in time, irrespective of its possible meaning or lack of meaning to the makers and users of pottery, is accepted as a criterion of classification” (Shepard 1976:307). In this regard we again find a solid basis for the use of functional forms as classificatory types that change through time. Here we break from the common use of types based on decoration, temper, or other "abstractions". By assigning types that appear meaningful across a wide span of time we can address long term changes and continuities by accounting for these "same" vessels through time (and across space).

While these basically functional types help identify the use of many vessels through the ethnographic examples, grouping them this way archaeologically has the risk of blurring the differences between various vessel subtypes found within archaeological contexts, or types that are not emic. However, by having explicit types, one can argue for continuity in the presence of those vessel forms while also accounting for clear technological differences in the types through time. In other words, discerning types better equips us to explain change and continuity in the technological aspects of vessels as well.

Regardless of the potters' level of awareness of standardized types, as Hayden (1984) points out, emic types should be noted exclusively when they overlap with archaeological interests or questions. Some studies have resulted in criticism of attempts at discerning cognitive prototypes rather than archaeological types, noting the absence of local taxonomies in some areas where they were created only when asked for by anthropologists (Kaplan 1985:357). As difficult as it may be to find meaningful types in pottery analysis, either emic or etic types, the general principle of remaining anthropological should guide any study or as Anna Shepard puts it;

> Despite the fact that much has been written on the subject of the artificiality of the pottery type, the underlying cause of artificiality, the habit of viewing pottery as a physical object abstracted from the essentials of its composition and the method of its manufacture, in other words, the persistent tendency to ignore the role of the potter, has not received the criticism it deserves. It is indeed strange that pottery should be studied without considering its relations to the people who made it (Shepard 1976:310).

Labor and Society

The potter remains at the center of the process of standardization, the discerning of types, and the fabrication and innovation of pottery technology. Their relationship to the economic and political structure of a society is determined by the structure and organization of labor. Labor provides the connection between the potters and the social structure that influences manufacture. Labor thus becomes an important element in understanding the structure between potters and those they produce for. As Sassaman puts it “only the most powerful institutions are able to fully constrain the chaos one might expect from unbridled crafting" (Sassaman1998:93). In the Upper Xingu, this "powerful institution" is the complex form of chiefdom well documented by anthropologists in the region (Carneiro 1970; Dole 1983; Heckenberger 2005). Control of crafting is control of labor and the power to command labor. This power amounts to a surplus of symbolic capital in the form of labor control, labor that can produce ceramics and subsistence. In this way, the material surplus is handled by the chief because he is a chief (who holds control over labor), not because the material surplus makes him a chief (Heckenberger 2003).

Manufacture and Production

Discussions of ceramic production are common in the archaeological literature of complex societies and urbanism, where studies of craft specialization and its relation to political complexity have been abundant (Sinopoli 1999, see also; Blackman et al. 1993, Blackman and Vidale 1992; Costin 1991; Costin et al. 1989; Feinman 1985; Stein and Blackman 1993; Vidale 1989; Wailes 1996). It is suggested that perhaps urbanism should not be seen as a binary situation, either urban or not urban, but as a continuum with development falling within various degrees of urban (Heckenberger et al. 2008).

Using the term urban in this sense we can also broaden ideas about craft specialization and stretch out the continuum from individual potter to village level production, creating space for various levels between these that may not fall into categories already established. This does not weaken the usefulness of the term urban but requires that those using it qualify their description of urban societies without using a simple checklist. Questions about the social complexity of the southern Amazon in ancient times are at the heart of archaeological research in this region and defining in empirical archaeological terms what constitutes specialization, complexity, urbanism and the networks that connected them are at the core of Upper Xingu research today (Heckenberger 2009; Heckenberger et al. 2003, 2007, 2008). As in other parts of the world, ceramic production is a key indicator of many economic, social, and political elements of society. Levels of ceramic complexity may or may not be correlated with levels of social and political complexity. In the southern Amazon we can explore both issues separately before arriving at a conclusion regarding this relationship. The importance of specialized production is further emphasized by Longacre;

> For over twenty years archaeologists have been concerned with the identification of the early appearance of specialized production and the implications of such a production mode for understanding the rise of complex forms of social and political organization (Longacre 1999:44).

We have an established lexicon for discussing ceramic production and its various levels and Prudence Rice provides the best definitions when discussing standardization particularly. Product standardization is viewed as a by-product of specialization. Routinization is responsible for decreased variability in the products produced. In the Upper Xingu, current ethnographic models of pottery production have placed the specialization or 'Producer Specialization' (Rice 1991:263; Longacre 1999:44) in the hands of one village at least and possibly one household (Heckenberger 2005). If we place today's production and prehistoric production along a continuum of craft specialization that varies from small-scale household production to larger-scale factory production, we would surely find ancient production and modern production on two ends of this continuum, though likely not at the extremes, certainly not in the case of modern production.

Variation within levels of pottery production does not fit nicely into Old World models that compartmentalize and separate these levels or scales. A multi-scalar continuum is needed to situate and understand the variation in Upper Xingu production from A.D. 700-1500 and into the present. If this finer scale is applied it reveals linkages between the scale and transformation of social complexity and the scale and transformation of ceramic technology over the course of Upper Xingu history. Pottery production does not simply change because the scale of society changes, but rather, the change in pottery production is an unintended consequence of the changes in political and social complexity, and these are in turn are an unintended consequence of overall changes in the economic pattern of prehistoric peoples (McCall 1999; Mills 1999).

Ceramic Ethnoarchaeology

This study is strengthened by ethnographic and ethnoarchaeological observations describing the use of pottery in subsistence processing in the Upper Xingu (Carneiro 1983; Dole 1960; Heckenberger 1996, 2005). Ceramic ethnoarchaeology studies provide data that can be applied and used to assess archaeological assemblages and their comparative validity. These same ceramic ethnoarchaeological studies also have limitations in their ability to predict the archaeological record. This is true especially in helping to project past usage of all ceramic forms, by studying present usage of similar forms, where different social and functional factors may be present (DeBoer 1974:341). Ethnoarchaeological studies conducted over the past thirty years provide a wealth of information that encourages more of these studies.

For example, in regard to assessing types in the archaeological record, ethnoarchaeological research has pointed out that the frequencies of certain forms in archaeological assemblages can be affected by differential ceramic longevity (DeBoer 1974). Based on ethnoarchaeological studies, we can deduce that the relative proportional frequency of a ceramic type or form in the archaeological record is not only a function of its relative usage compared to other forms but to its durability and longevity before discard (David and Hennig 1972:20; DeBoer 1974).

A central problem in any ceramic analysis is the determination of types that allow for quantification of pottery through time and across space. The pros and cons of determining types have long been debated among archaeologists (Shepard 1956; Rice 1987). Like types, assemblages are equally difficult to determine, especially where clear stratigraphic separation is not clear. Proceeding from the identification of an assemblage to the identification of types and frequencies within that assemblage is the most reliable way to begin a ceramic analysis. As Barbara Mills points out;

> The relative frequencies of vessel classes in trash mounds may be the most secure method of identifying what the constant values of the relative frequencies of use classes should be...this assemblage type may then be treated as a baseline and deviations from it investigated...critical to assessing patterning in assemblages, however, is the use of functional types that are sensitive to differences in vessel uselife (Mills 1989:143).

Ceramic ethnoarchaeology can assist archaeologists in determining functional types and assessing the validity of the types they choose to assign to ceramics within an assemblage. David and Hennig found that "simple typologies based on criteria obvious to the uninitiated are likely to be adequate for most archaeological purposes" (David and Hennig 1972:28).

Sherd based spatial analysis also benefits from ethnoarchaeological studies. Archaeologists are always faced with the choice of determining whether distributional patterns based on the count or weight of ceramic remains offer the most reliable information. This choice also affects the frequencies of vessels and ethnoarchaeological studies suggest that vessel weight varies directly with vessel uselife (DeBoer 1985). This is important when assessing the relative frequencies of different vessel types within an assemblage but is less important when assessing the variations and similarities of the same vessel type between assemblages.

Overall, ceramic studies benefit from ethnoarchaeological studies especially in drawing out anthropological questions. As Pritchard and Van Der Leeuw suggest, these studies necessarily place the emphasis on the "ethnography of pottery" and that through this emphasis archaeological questions that focus on *when* and *where* are replaced with questions that focus on *why* and *how* (Pritchard and Van Der Leeuw 1984:6). In some cases the answers to these questions involve other aspects of anthropological research including linguistic. For example, in the northern Amazon, Duin shows that pottery production is intimately linked to women and their physiology both linguistically and through oral tradition (Duin 2000:55).

Ethnoarchaeological studies often lead researchers to attempt to replicate observations from the field or from historic accounts. This leads to experimental archaeology and the development of studies that specifically address technological variation in pottery (Schiffer et al. 1994; Skibo et al. 1989). Placing priorities on performance characteristics in explaining technological change has also been done through experimental archaeology (Schiffer and Skibo 1987). Experimental archaeology has successfully shown that our perceptions of pottery technology are sometimes flawed as in the case of experimental archaeology in Southwest North America showing that corrugated pots substantially degrades heat transfer instead of improves it as was once thought (Pierce 2005).

In assessing the nature of modern ethnographic pottery assemblages, archaeologists benefit from a handful of studies devoted specifically to the study of pottery produced exclusively for outsiders, or tourist pottery. This has been especially fruitful in the Amazon where Lathrap concluded that the potters involved in making tourist trade pottery have a general tendency to "favor the introduction and spread of exotic and unusual forms" making this pottery largely unsuitable for studying native ceramic assemblages in terms of their context within the general social and political system especially as direct historic analogs to pre-tourist pottery (Lathrap 1976:206-207).

Minimally, any ethnoarchaeological study should prevent an archaeological conceptualization of the past that is devoid of people. To this end;

> Artifacts 'speak' not so much because actors created them as 'texts' but because they are marked with the gestures and habits of their production and use, they are inscribed by the social processes involved in their creation, employment, and abandonment (McCall 1998:18).

As ceramicists are fond of pointing out, pottery production is an additive process, and through that process are left indications about the actions taken by potters and perhaps about the context in which those actions were conceived and implemented. Put another way “every action is an instance of interpretation and representation" (Sassaman 1998:93). Accessing the material aspects of individual "interpretation and representation" can be difficult, however, and it is often the case that group consciousness and collective action are rare in dispersed forms of production. In her assessment of Aztec specialists Brumfiel finds that “specialists were arrayed along a continuum, with the part time rural producers of utilitarian goods at the lower end of the scale and full-time urban producers of elite goods at the upper end" (Brumfiel 1998:151). Focusing on the "lower-end" of the specialist continuum presents even further obstacles since the routinized everyday traditions of domestic and communal realms are non-ideological in that they are not recognized in the fields of political action. However;

> Domestic communities are where most people exist…and where cultural traditions are perpetuated… yet these low-level traditional realms do lie within the field of 'actual relations of power'...with local producers being the agents of change (Pauketat and Emerson 1999:302-310).

Ethnoarchaeology highlights the social mechanisms that cast the products of labor as “non-ideological” symbols of ideologies of the past. Rather than simply viewing pottery as a reflection of the past it is viewed as a projection of the past or as Pauketat and Emerson put it, “symbols project relations, not reflect them, and symbolic projection involves more than what many have called ideology” (Pauketat and Emerson 1991).

A further elaboration of ethoarchaeology, or ceramic ethoarchaeology, is the closely related field of ceramic ecology (Arnold 1975). Seeing the context in which ceramics are created, used, and discarded as a complete system provides contextual advantages to understanding both the pottery and the system. Without being deterministic, the study of pottery can benefit from an understanding of the natural and social environment in which it was produced. For example, from his work with pottery-making communities throughout Latin America, Arnold finds that potters tend to obtain their ceramic resources within a five kilometer radius (Arnold 1975:192). This type of information is useful in assessing boundaries either social or natural that may limit or restrict pottery production. In some cases it may be the environment that prevents the craft from developing into a full time occupation, for example (Arnold 1975:190).

Ultimately, behavior is the root of ethnoarchaeological work, specifically, ceramic ethnoarchaeological work with the objective of "improved understanding of relationships between patterned human behavior and elements of material culture that may be preserved in the archaeological record" (Kramer 1985:77). But as Kramer also points out "one problem with ceramic ethnoarchaeology is that it almost never considers change and in fact is often conducted in a small area over a short period of time" (Kramer 1985:92).

Summary

There are many factors to consider when examining and evaluating pottery assemblages and ceramic technology in archaeological contexts. Social, economic, political, and environmental factors all have a symbiotic role. Although this study is focused on the technology of pottery, that technology is influenced by social factors, which can be accessed through ethnoarchaeology. Standardization is one important aspect of pottery manufacture that is linked intimately to the social and political structure in which it occurs. Standardization is visible ethnographically and for this reason ethnoarchaeological data drives much of the research and theory regarding standardization. Ethnoarchaeological studies provide information that can be brought to bear on the archaeological record. Ethnoarchaeological studies focus on archaeological and anthropological questions regarding the processes of manufacture, use, and discard and how these processes affect the formation of the archaeological record. Ethnoarchaeological studies also provide cautionary data guiding archaeological methods and techniques of examining the past. Combining archaeological and ceramic ethnoarchaeological data adds the dimension of time and brings ceramic studies closer to an historical ceramic ecology.

CHAPTER 5
POTTERY ANALYSIS

Introduction

The following technofunctional analysis and discussion address two aspects of Upper Xingu pottery; technology and decoration. Pottery form, function, and technology are aspects that distinguish ceramics both synchronically and diachronically and are used here for those purposes locally and are the main focus of this analysis. Decoration is used by archaeologists across the Amazon to connect or separate cultural units both temporally and spatially. Decorative attributes on Upper Xingu ceramics also allow for basic chronology building, but decorative distinction across time and space are not as well understood in the Upper Xingu as they are across Amazonia in general, especially in relation to examples south of the Xingu basin.

Both aspects of the analysis are based on pottery from several excavations and surface collections made at the Nokugu Site (MT-FX-06) and Heulugihïtï Site (MT-FX-13) during fieldwork conducted between 2002 and 2005. Pottery from surface collections at other Upper Xingu sites within the KSA are also described for their relevance in the discussion of regional stylistic variability. Pottery from the Museu Paraense Emílio Goeldi (MPEG) collected in the Upper Xingu region by Mario Simões in the 1960s was reevaluated in 2007 along with Simões original notes and also is included to benefit the regional analysis of Upper Xingu pottery as well as the technological study within the KSA.

Sample Selection and Method of Analysis

As is now common practice, a vessel unit of analysis, or vessel lot analysis, was selected to emphasize the technofunctional aspect of the overall study. A vessel lot oriented technofunctional analysis allowed for the maximum amount of functional and technological information to be collected from each "vessel". In regard to stylistic or decorative attributes, the vessel lot analysis is also preferable because it minimizes bias created by unequal coverage of decoration on certain vessels accentuated by simple sherd counts and sherd based analysis. However, in the Upper Xingu this is not as much of a problem since decorative attributes are mostly restricted to the rim portion of vessels, though highly decorated rims are often on smaller vessels, thus giving them overall smaller numbers in a sherd based analysis.

Vessel lot analysis is usually conducted with small defined assemblages from small excavations where reconstruction of vessels is much easier. Given the very large area covered by the surface collections and the relative distance between each collection unit within these areas a modified approach to the vessel lot analysis was undertaken. Vessel lot selection was conducted within each collection unit rather than the unmanageable and unfruitful task of connecting sherds across vast collection areas. The vessel lots were selected by first identifying all rim sherds in a collection unit and proceeding to match those rim sherds with non-rim sherds based on macroscopic attributes such as surface finish, thickness, and decoration. In most cases very few positive matches were made and vessel lots usually consisted of a single rim sherd. This resulted in a total of 1,142 vessels from all of the defined assemblages combined.

Vessels from each assemblage were analyzed for formal, technological (temper and metric attributes), and decorative attributes. Vessel form, as described previously, is derived from previous studies and ethnographic analogs but simplified somewhat based on rim form. Metric attributes included orifice diameter, rim thickness, and lip thickness. Other attributes included temper percentages, determination of complete or incomplete firing, and core color.

Additionally, decorative attributes were recorded as well as non-systematic observations regarding the application of decorative motifs. Decorative attributes were recorded for interior, rim, and exterior portions of each vessel and were also noted for non-vessel ceramic items including pot stands. Upper Xingu ceramics do not have the distinctive and elaborate decorative motifs that are found in other parts of the Amazon such as Marajó, Santarém, or the Central Amazon, for example. Distinctive, yet conservative, rim decorations do exist through time and across space in the Upper Xingu, however it is the rim form and its relation to function that is much more distinct and beneficial for study in this particular area of the Amazon.

The general forms that constitute Upper Xingu pottery also do not have other distinctive body attributes such as carinations or handles, in most cases. To round out the study, select body sherds, base sherds, and other ceramic objects such as pot stands are included in this analysis. Base sherds are particularly useful given their profile and ability to distinguish between different base styles or types such as pedestal or flat bases, allowing for inferences of direct-heat or indirect-heat use in cooking, though much of this can be inferred from direct ethnographic observation. Bases also record use-wear, especially on the interior in the form of eroded and pocked surfaces from use in hot processing of manioc.

Due to the factors outlined here, the analysis of ceramics recovered from the Upper Xingu sites were almost entirely focused on macroscopic attributes with the exception of temper. All measurements were taken using a standard caliper with subcentimeter accuracy. However, a microscope was used to record and characterize the temper content of each vessel. Fresh breaks on rim sherds of each vessel were examined using a Zeiss Stemi® SV6 8-50X power microscope set to 10X. Each temper type observed was recorded on a sliding scale from zero to five based on the amount of temper visible in the microscopes field-of-view. A score of zero was recorded if a temper type was not present, a one was scored for amounts less than 10 percent of the paste, a two was scored for amounts from 10-20 percent of the paste, a three was scored for 20-30 percent of the paste, a four was scored for 30-40 percent of the paste, and a five was scored for amounts greater than 40 percent of the paste.

Analysis Groups/Assemblages

The focus of this study on technological change requires clearly distinguished ceramic assemblages as discussed in previous sections. The basic chronology for the Upper Xingu is already well defined without the benefit of pottery, as presented previously, using radiometric and stratigraphic data from several excavations in the study area. This is represented by initial occupation of the sites from A.D. 700-1250 (essentially non-depositional, flat, village peripheral zones, sampled with controlled test unit excavations), village elaboration, initial defensive ditch excavation and subsequent ditch infilling from A.D. 1250-1500 or later (depositional, plaza and road-side berm deposits, sampled with controlled excavation units), and final site occupation and abandonment from roughly A.D. 1500-1770 (non-depositional surface deposits, sampled with systematic surface collection). Because similar decorative and stylistic attributes occur throughout most of the Upper Xingu past, they are not a good basis for well defined time periods and could not be used to separate ceramic assemblages with a typical seriation method. The three analysis groups, or assemblages, were chosen to essentially divide the continuous tradition of pottery into early, middle, and late phases as a technique to assess variation and change in a mostly continuous industry. That said, it was assumed that the proposed early and middle assemblages would contain a large amount of overlap, especially in the two excavated contexts representing the two earliest group assemblages, and this is in fact reflected in the data presented below.

Because of the essentially non depositional nature of Upper Xingu sites and the continuous tradition of pottery, the three units of analysis are a compromise between compressing and dividing the entire history of the study area. This is a compromise because excavations in the plaza peripheral, or residential, zones identified at least two distinct strata above the sterile sub-soil which are compressed into one assemblage representing the earliest phase of site occupation. Excavations into plaza berms also identified at least two distinct strata which are compressed into one assemblage representing the middle phase of site occupation. If left separate it is likely that the lower level in the plaza berms and the upper level in the plaza peripheral areas would be statistically similar in regard to their ceramic assemblages.

While there is absolutely no evidence to suggest that these stratigraphic separations represent different archaeological cultures or phases, they at least provide a point of departure for understanding any changes or continuities through time and are testable at other sites. At a minimum the surface artifacts and the excavated artifacts represent the earliest and the latest occupations of these sites. Excavations that took place across the site peripheral ditches were more complicated and represent, in some cases, reverse stratigraphy near places that were excavated in the past and then filled through natural deposition. These excavations were not used in the ceramic analysis as they generally contained very small amounts of pottery that was in mixed contexts.

Attribute Analysis

Previous preliminary analysis of samples of these assemblages demonstrated that attempting to reassemble once extant vessels by sorting portions did not produce positive results and that in most cases a single rim sherd represented a single vessel with only limited fragmentary body sherds adding to its overall description. Given this factor and the desire to cover a broad horizontal area, only rim sherds, base sherds, and adorno's were considered in the final attribute analysis. Like rim sherds, base sherds were counted as single vessels as they could rarely be matched to their rim counterpart. All ceramics collected from excavations and surface collection were cataloged to record count, weight, and vessel portion minimally. Once the initial catalog was finished, rim, base, and adorno fragments were isolated for detailed vessel attribute analysis. Each aspect of the attribute analysis is discussed below.

Metric Attributes

Several measurements were taken for each sherd including lip thickness, rim thickness (measured three centimeters below the lip), and oral diameter (on rims representing at least 15 percent of the overall estimated diameter). Measurements were also taken for base sherd thickness. Additional metric attributes were recorded on particular vessel forms, such as lip width for example, on vessels with thickened or flat-everted rims. Metric attribute data was also recorded for various decorations including incision width, incision depth, and punctate spacing, for example.

Temper

The primary method of identifying and quantifying temper type and amount was by examination of sherd profiles on fresh breaks, as described earlier. Four different types of temper were observed in all assemblages analyzed; *cauíxi* (a riverine sponge processed by potters to remove organic matter and use the silicate content), *cariapé* (a tree bark also processed before being added to ceramic paste), grit (sometimes referred to as mineral or sand tempered), and grog (sometimes referred to as sherd tempered). Though all four types of temper were common among most vessels analyzed, their combination and amount (or recipe) varied and will be discussed later. To quantify the temper content, for each sherd each temper type present was given a value between zero and five, as described earlier.

The most abundant temper in all assemblages is *cauíxi* followed by *cariapé* and grit, with smaller amounts of grog found in just some samples. Despite the importance of *cauíxi* in Amazonian pottery (it also appears in southeast North America) it has received very little detailed study other than measuring its presence or absence. *Cauíxi* is a riverine sponge that clings to tree branches during flooding. When rivers drop in level during the dry season branches with clusters of spicules are collected. The dried branches with *cauíxi* covering them are then burned and the ash and burned sponge is mixed with clay as the prime temper in modern Upper Xingu ceramics. Given that high amounts of sponge spicule naturally accumulate on the river bank when water levels recede in the same way that marine debris, seaweed, or shell accumulates at the high tide line, in would not be unexpected to find some amount of *cauíxi* in all pottery made from clay collected near river banks, precisely where Upper Xingu potters source their clay.

At least one Amazonian based study differentiates between *Metania reticulata*, a species of sponge found in floodwater habitats, and *Drulia uruguaiensis* or *Oncosclera navicella*, found on the rocky bottoms of Amazonian rivers and remarkable for its large spicules, high amount of silica, and low amount of spongine, or organic matter which binds the spicules (Gomes and Vega 1999:319). This distinction between at least two or three different types of *cauíxi* could provide a better understanding of clay sources or possibly exchange patterns if used for sourcing clay and thus pottery. To date, these *cauíxi* types are not well understood and difficult to distinguish. As an organic tempering agent *cauíxi* is also a reliable source for radiometric dating but has been little used for this as well (Evans and Meggers 1962).

The thermal properties of *cauíxi* are also significant in this study. Anna Shepard recognized early that the use of sponge spicule temper was a compromise. As an advantage it creates a light weight paste and therefore can be used in the construction of larger vessels without the risk of them collapsing under their own weight. Sponge spicule temper also reinforces against cross fracture but at the cost of some weakness;

> Temper that is platey like mica or acicular like sponge spicules affect the structure of paste because flat or elongated fragments are in part forced into parallel position in the forming and finishing processes. In low-fired pottery they may then have a reinforcing effect against cross fracture but they cause weakness in their own plane (Shepard 1976:27).

When used in low firing conditions fusion of the silica from the sponge is not possible. This means that to enjoy the full advantages of using an organic based silica an intense firing strategy must be used. Even if this is achieved through an intense firing process the resultant product may not benefit from the amount of silica present. An as Shepard points out;

> Changes in temper that have a favorable effect on the body in the low temperature range are not numerous…fusion might take place in opaline silica of organic origin—for example, sponge spicules…being fine and well disseminated in the paste could have some fluxing effect, but chips of paste containing sponge spicules showed no evidence of softening of the spicules when refired to 950 degrees Celsius (Shepard 1976:29).

Rather than re-firing Upper Xingu archaeological ceramics to ascertain the level of spicule fusion we can examine the core color and properties to understand the firing technique. Again, the Upper Xingu can benefit from ethnographic observation in knowing a priori that Upper Xingu vessels are open-air fired during the dry season (Heckenberger 2005).

Core Color

All core colors were recorded using a Munsell® Soil Color Chart. These colors were recorded after fresh breaks were made on each vessel. In cases of incomplete firing, colors were recorded for both the core and the margin. In cases of complete firing, a single color was recorded for the core. Core color is an important attribute when considering firing technique. Firing technique is often reflective of intensity of production within any given ceramic industry (Rye 1981). It can also assist in determining levels of standardization or routine present within a production system.

Decoration

Decoration was recorded for each vessel when present. Several methods of decoration were observed in all assemblages analyzed. Incision was the most common form of decoration observed and metric attribute data was recorded for thickness, depth, and spacing of incisions. So-called thumbnail punctates (Oberg 1953) on the lip of rim sherds were recorded and their orientation, slanting left or right from an overhead view, was also recorded. Thumbnail punctates were first observed on prehistoric pottery of the Upper Xingu in the 1940s. Oberg provides an important observation on ceramics encountered in 1948 at a site near Jacaré formerly occupied by the Trumai in the 1880s. Here he found pottery similar to that made by the Waurá both on the surface and in excavations. Oberg did notice one exception (emphasized by Dole) that, “there may be observed on the rims…a sort of indentation which is absent in the modern pottery. Some fragments showed likewise a corrugation (finger impression) which we do not observe on any modern piece" (Oberg 1953:9).

Only rare instances of paint and slip were noted likely due to the eroded nature of many of the specimens (Figure 5-1). Though painted decoration almost certainly existed, as it does on modern Upper Xingu pottery, the preservation of painted designs on prehistoric Upper Xingu pottery is rare. Other forms of distinguishable embellishments on pottery include modeling, usually in zoomorphic forms, and these also are restricted to rim portions of vessels. Thus the main decorative attributes used for comparison in the Upper Xingu remain those on the rim.

Though the techniques used to apply decoration are few, various symmetrical and asymmetrical line designs, thumbnail punctates, and *appliqué* designs are present. Decorative designs are also found on cylindrical and conical shaped pot stands (*undagi*). These are decorated on both the bottom and side of the cylindrical items in the form of incised lines and groups of single punctates. In contrast to this prehistoric decorative mode, both modern and historic pottery in the Upper Xingu contains no incisions, punctates, or other rim decoration. The exception is found in various modern vessels that have zoomorphic appendages and in some cases handles as first recorded by Steinen (Figure 5-2 and Figure 5-3).

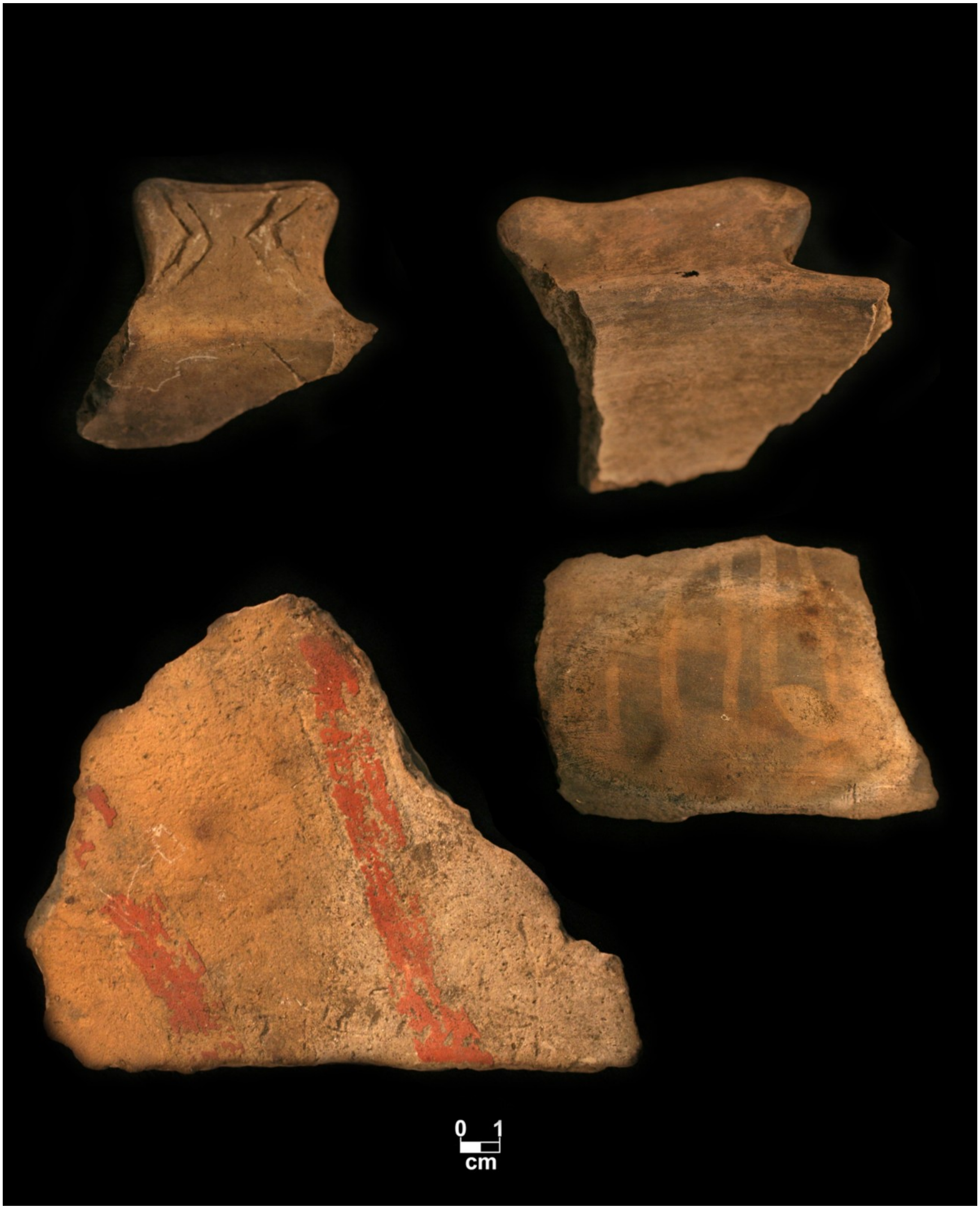

Figure 5-1. Examples of painting and modeling methods on decorated body sherds and handles from MT-FX-12.

Form and Type

A profile was drawn for each rim and base sherd representing a single vessel using a carpenter’s gauge. Based on form, each vessel was then assigned to a functional type category established during previous research in the KSA and based on modern ethnographic terminology for similar vessel forms (Heckenberger 2005:205,209).

Rim forms are the single most important attribute of this study and there are several ways to classify the rim forms found at the sites included here. Dole first split the rim forms she found at several Upper Xingu sites and noted 11 different everted rim forms (Dole 1961:405). She noted in her excavations at one Upper Xingu site that sherds showed “an evolution from angular rims toward gradually flaring ones" (Dole 1961:406). The ceramic types, or forms, used in the current study were first proposed by Heckenberger (1996:71-73) based on surface collections and limited excavations as well as extensive ethnographic research with both the Kuikuru and the Waurá tribes of the Upper Xingu.

These types represent pottery forms that span the entire known history of the Upper Xingu from roughly A.D. 700 or earlier to the present. The addition of modern indigenous knowledge and ethnographic examples to our understanding of pottery in the Upper Xingu also allows the addition of functional categories, or forms, to the analysis that can be tracked as they change or remain the same through time. This is especially important to this technofunctional study and its focus on the manioc processing vessel. This vessel is examined through each assemblage as it varies through time.

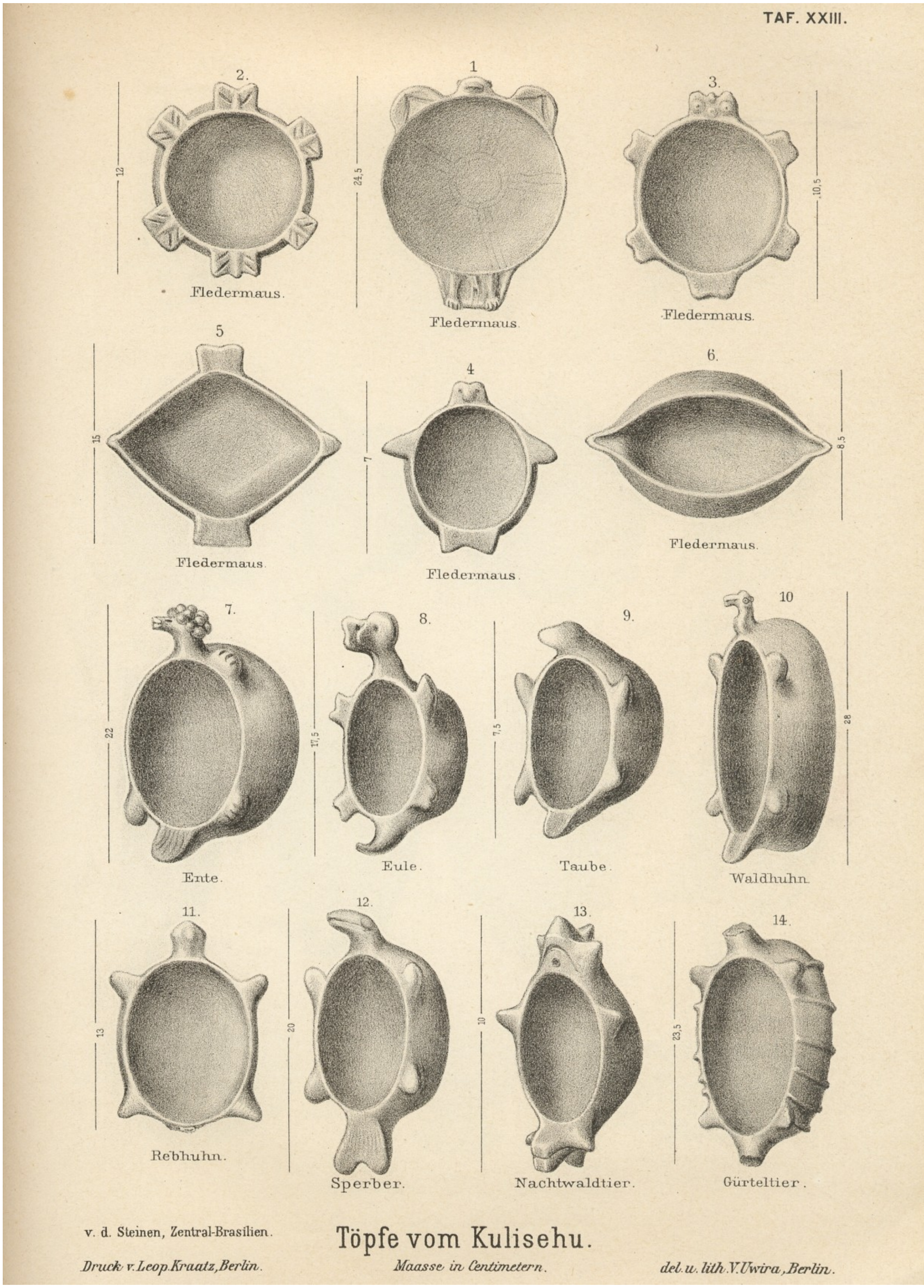

Figure 5-2. Zoomorphic vessel designs recorded by Steinen (1894:Tafel XXIII).

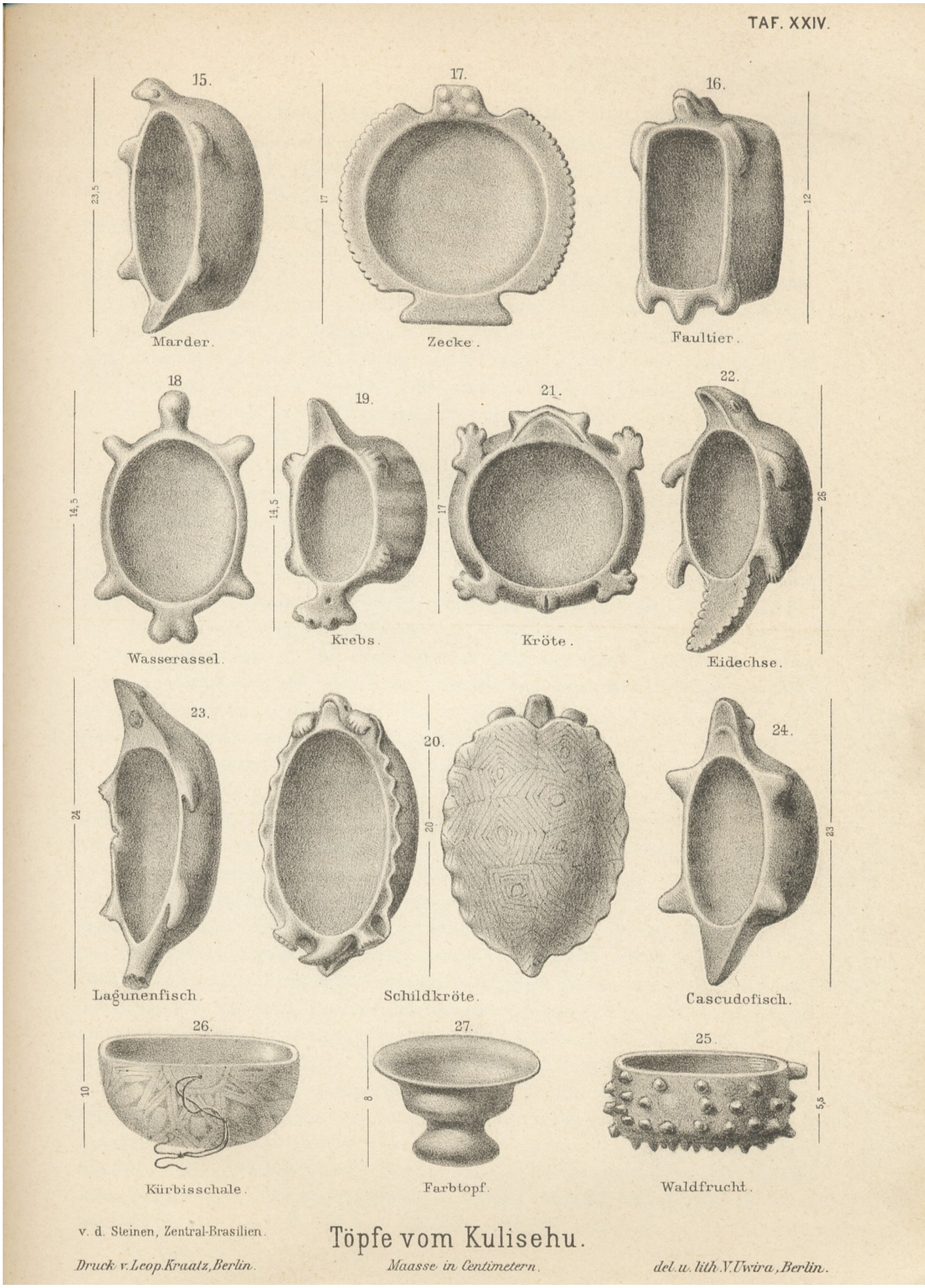

Figure 5-3. Zoomorphic vessel designs recorded by Steinen (1894:Tafel XXIV).

Vessels included in this study are limited to what Heckenberger referred to as Type IA, Type IB, Type II, Type III, and Type IV vessels, based on the amount of available data for each form. These represent the primary flat bottomed cooking vessels (Type IA for manioc and Type IB for fish), the most easily recognizable globular rim-decorated vessels (Type II and Type III), and griddles (Type IV). Also included are pot stands (*undagi)* because they are indicative of certain cooking processes across the Amazon (such as long-term boiling), are sometimes decorated, and are good indicators of domestic spaces within archaeological sites.

In the Upper Xingu equating vessel form with function is more easily done than in some regions given the modern ethnographic correlates to the prehistoric pottery in the KSA. This has situated function as the primary mode of identifying pottery variation, at least in the most recent studies within the Upper Xingu. This study approaches the idea of function separately from the attribute analysis and uses form as the basis for discovering other technological transformations through time. This is particularly fruitful in the main vessel forms that exist throughout the archaeological record in the Upper Xingu. While function was likely similar, the form of the rim changed while the form of the vessel remained quite similar through time. Because Heckenberger's taxonomy follows native classification of vessels based on function, and function is an essential part of this overall analysis, this study does not depart from the original taxonomy; it merely narrows the focus to specific vessel forms. The native classifications are useful in placing the overall vessel forms into broad categories, however, they do omit some of the variation in rim form found within these categories. In other words, while the types might be accurate in describing use, they are not necessarily accurate in describing manufacture.

Vessel Types

The following forms, or types, were initially defined by Heckenberger, as described above, based on ethnographic forms and information obtained from observations with the Kuikuru and Waurá of the PIX (Figure 5-4). Because the types distinguished in this study are somewhat different than those established by Heckenberger they are identified by using Arabic numbers rather than Roman numerals. The Arabic numbered types are designated only for this analysis and are not meant to replace the vessel type designations already established for the Upper Xingu. For analysis purposes, Heckenberger's distinction of Type IA and Type IB is further accentuated. Here I refer to Type IA as Type 1 (*ahukugu*), Type IB and Type II as Type 2 (*atange*). Type 3 combines all vessels with straight, direct, or inverted rims. Type 4 vessels are griddles (*alato*) and Type 5 are not vessels but pot stands (*undagi*). A short description of the vessel types, their original descriptions, and general observations are presented below.

Type 1 Vessels

Type 1 vessels, or *ahukugu*, are flat bottomed, thick bodied vessels with gradually excurvate rims and slightly thickened lips (Heckenberger 1996:71-71). Type 1 vessels are rarely found with decoration in archaeological contexts but modern equivalents are slipped and painted on both the interior and exterior, likely affecting their porosity. The largest *ahukugu* are those vessels associated with manioc cooking and processing; both activities involve the use of water. Today their metal equivalent is used for cold processing but the *ahukugu* vessel remains the preferred vessel for boiling the juice squeezed from the manioc during processing (once cooked it is referred to as *kuigiku*).

This is the only hot processing that the vessel is used for and these vessels are found in every household and obtained from the Waurá village. Archaeologically these vessels are also ubiquitous and though exhibiting variation across time and space as we will see below, they are found everywhere. The replacement of these vessels by metal pots for processing manioc occurred only in the last 50-60 years. In 1950 Eduardo Galvão recorded the use of *ahukugu* in the Upper Xingu and his photographs from that era show the use of many *ahukugu* in the processing of manioc (Galvão 1953:49-51, Figures 7-9). Karl von den Steinen also recorded these enormous vessels in the Upper Xingu as early as 1884 (Steinen 1894, Tafel XV).

Type 2 Vessels

Type 2 vessels are those vessels with folded rims. Type 2 designation includes all pots described by Heckenberger as Type IB and Type IIA. The distinction in these two types of folded rim vessels is mostly in size and this is directly related to use. They are combined into one type in this study as a blind test based on the similarity of the rim finishes. Using only the rims of these vessels it would be impossible to distinguish them as two types of vessels other than by size which falls along a continuum. Type IB are generally larger, thicker, flat bottomed vessels, used to cook fish while the Type IIA vessels are smaller, more globular in shape, with a flat pedestal bottom, and used for dry storage or as drinking containers.

The differences between the Type IB and Type IIA do not always reveal themselves based on rim sherds alone. However, these two types do distinguish themselves statistically based on other attributes as will be shown in the analysis. Also, both of these vessel types almost always have similar decorative incision on the rim and exterior lip further blurring their distinction. Of all the Type 2 vessels (IB and IIA) from surface collected contexts (n=50), 64 percent (n=32) have parallel incisions on the everted rim and most are in combination with thumbnail punctates around the exterior edge of the lip.

Heckenberger also notes that "unlike Type IA pots, several small examples of Type IB pots were identified" (Heckenberger 1996:72). Not only do small examples of Type IB pots exist but small examples of Type IA pots also exist. This similarity in vessel size variation between Type IA and Type IB further complicates dividing these types based on size alone.

Figure 5-4. Kuikuru outdoor cooking area showing Type 1 *ahukugu* vessel (large blackened vessel in background) and Type 2 *atange* vessel (blackened vessel on wire rack) surrounded by aluminum vessels. Globular metal vessels are mainly used for water transport while the low profile vessels are used for manioc processing.

Type 2 vessels are the most elaborately decorated pieces of the surface collected ceramics, though the rims of modern equivalents are not decorated. The combination of rim incisions on the top of the flat everted rim and thumbnail punctates on the outer lip of these vessels is not found on any Type 1 vessels, however the thumbnail punctates and incision can be found on some Type 3 vessels. The incision decorations vary quite broadly both in their execution and their design. Incisions range from very wide, shallow strokes to very narrow, deep strokes, though they are almost always applied to wet or leather hard clay with the exception of very late period vessels which have decoration motifs that are engraved on the rims after firing is completed. The thumbnail punctates are generally from left to right likely indicative of right handedness and the action of the potter spinning the pot with their left hand while forming the rim, and the punctates, with their right hand.

Type 3 Vessels

The Type 3 vessel designation combines those vessels described by Heckenberger as Type IIIA and Type IIIB. These vessels have direct rims with little to no thickening. They are sometimes slightly incurving or constricted and have thumbnail punctates on the exterior lip and infrequently one or two parallel incised lines on the narrow top portion of the lip. These vessels have been almost completely replaced with aluminum pots in today's Kuikuru village.

Type 4 Vessels (*alato*, or griddles)

Type 4 vessels are those described by Heckenberger as Type IV vessels. These are flat griddles that are not decorated and have very low upturned rims. These rims can vary in height and are more gradual or more angled where they leave the flat bottom portion of the griddle. In the present day Kuikuru village a Type 1 vessel that has broken sides is sometimes broken further so that only the bottom portion of the Type 1 vessel remains and is used as a griddle. In this way, positive identification of griddles is reserved for those sherds found that show the intact rim and bottom portion of the griddle in profile. Flat base sherds with the proper thickness could be from either a Type 1 or Type 4 vessel, though in some cases the Type 1 base will have interior deterioration from continued use in boiling *kuigiku*.

Type 5 (*undagi*, or pot-stands)

Though not vessels, pot stands (*undagi*) are designated as a type to include them as a separately produced ceramic product that has distinct form and decoration across the Upper Xingu.

The Nokugu Site (MT-FX-06)

A total of 8,026 ceramic sherds were collected from MT-FX-06 between 2002—2005. This includes specimens collected from systematic surface collection, excavation units (1 x 1 m), and test units (0.5 x 0.5 m) placed across the site. By far the most ceramics collected were from the surface collections with a total weight of 148.66 kg (n=4,077). The excavation units yielded a total weight of 28.08 kg (n=1,807) and test units yielded a total weight of 16.96 kg (n=2,142). Based on the established chronology for the site and the dating of the accumulation of the plaza mounds the following data are presented as three assemblages with the surface collection (CA) data representing the most recent (Group 1), the excavation unit (EU) data representing the middle period (Group 2), and the test unit (TU) data representing the earliest data from the site (Group 3). Means for all metric attributes are presented in Table 5-1 along with average temper contents in Table 5-2 and corresponding t-tests for correlations between means presented in Table 5-3, Table 5-4, and Table 5-5. These tests show that the most statistically significant differences are found in the lip thickness and orifice diameter of Type 1 vessels between Group 1 and Group 3.

Group 1 (Surface Collection)

A total of 2,768 ceramics were collected from surface collection areas 1-4. Of this total, 274 pieces were identified as rims. Of the 274 rims 70 percent are Type 1 (n=192), 26 percent are Type 2 (n=72), and 4 percent are Type 3 (n=10). Of these 274 rims only 90 were sufficient for determining orifice diameter. However, these 90 rims are almost identical to the total 274 in regard to vessel type percentage. Of the 90 rims sufficient for measuring orifice diameter 71 percent are Type 1 (n=64), 24 percent are Type 2 (n=22), and 5 percent are Type 3 (n=4).

Type 1 vessels from the surface are the most standardized vessel forms in the Upper Xingu (Figure 5-10, Figure 5-11, Figure 5-12, Figure 5-13, Figure 5-14, Figure 5-15, and Figure 5-16). Type 1 vessels have an average lip thickness of 1.56 cm (n=192), an average rim thickness of 1.15 cm (n=192), and an average orifice of 54.89 cm (n=64). However, the range for Type 1 vessel metric attributes is broad. Lip thickness ranges from 0.6 to 3.3 cm, rim thickness ranges from .41 to 2.68, and orifice diameter ranges from 7 to 90 cm. Despite this wide range, Type 1 vessels still cluster and mostly separate from Type 2 and Type 3 vessels (Figure 5-6). The Type 2 vessels that cluster with the Type 1 vessels represent the fish cooking vessels (*atange*) and are what Heckenberger referred to as Type IB. Although their rim form is similar to Type 2 vessels they may be flat bottomed and are usually much larger in size. The occurrence of extremely curved body sherds typical of globular vessels is very low in all surface assemblages. This fact combined with ethnographic data lead to the conclusion that many vessels are flat bottomed at least late in the prehistoric record of the Upper Xingu.

Type 2 vessels from the surface are somewhat more variable in their rim form (Figure 5-17, Figure 5-18, Figure 5-19, Figure 5-20, Figure 5-21, Figure 5-22, Figure 5-23). Type 2 vessels have an average lip thickness of 0.94 cm (n=72), an average rim thickness of 0.87 cm (n=72), and an average orifice diameter of 32 cm (n=4). Like Type 1 vessels, the range for Type 2 vessel metric attributes is somewhat broad. Lip thickness ranges from 0.4 to 2.9 cm, rim thickness ranges from 0.4 to 1.72 cm, and orifice diameter ranges from 12 to 74 cm. Like Type 1 vessels, Type 2 vessels also cluster together when considered by their thickness to orifice ratio (Figure 5-6).

Type 3 vessels are few in number and are generally small (Figure 5-21, Figure 5-22) Type 3 vessels from the surface have an average lip thickness of .94 cm (n=10), an average rim thickness of .80 cm (n=10), and an average orifice diameter of 25 cm (n=4). Lip thickness ranges from .46 to 2.14 cm, rim thickness ranges from .4 to 1.1 cm, and orifice diameter ranges from 12 to 40 cm. Type 3 vessels cluster together and with the smaller Type 2 vessels (Figure 5-6).

Temper statistics for surface collected vessels were calculated using all 274 rims (Table 5-2). They are presented in terms of percent of total temper present. Calculated with all vessels (n=274) the average temper composition is 67 percent *cauíxi*, 15 percent *cariapé*, 13 percent grit, and 5 percent grog. When broken down into vessel types the statistics change somewhat dramatically though this may be due to small sample size. Type 1 vessels (n=192) are 65 percent *cauíxi*, 16 percent *cariapé*, 14 percent grit, and 5 percent grog. Type 2 vessels (n=72) are 72 percent *cauíxi*, 11 percent *cariapé*, 13 percent grit, and 4 percent grog. Type 3 (n=10) vessels are 76 percent *cauíxi*, 17 percent *cariapé*, 7 percent grit, and they contained no grog.

Surface treatment for all vessels included smoothing with only occasional vessels showing burnishing. Type 1 vessels had the most exterior surface paint and slip (n=21) as well as interior orange slip (n=5) and only a single rim still showed signs of interior black paint. Type 2 vessels had no interior paint or slip and only some exterior red paint (n=4). However, Type 2 vessels have the highest frequency of decoration including rim incision with parallel line motifs, thumbnail punctates, and rare chevron motifs on very large vessels with broad, flat, handle-like rims (Figure 5-5).

Figure 5-5. Type 2 rim with chevron design from surface of MT-FX-06.

Type 3 vessels showed exterior red paint on only a single vessel. Of the 274 rims analyzed 64 percent (n=176) were completely fired showing no core and the remaining 36 percent (n=98) were incompletely fired with variably colored cores and margins. Of the non vessel rims only one Type 4 griddle was identified. Besides the clustering of diameter to thickness ratios (Figure 5-6), the clearest pattern in the overall distribution of pottery in the surface collection areas is the high amount of ceramic remains found on and around the plaza berm. Outside the plaza berm pottery does not generally cluster by type (Figure 5-7 to Figure 5-9).

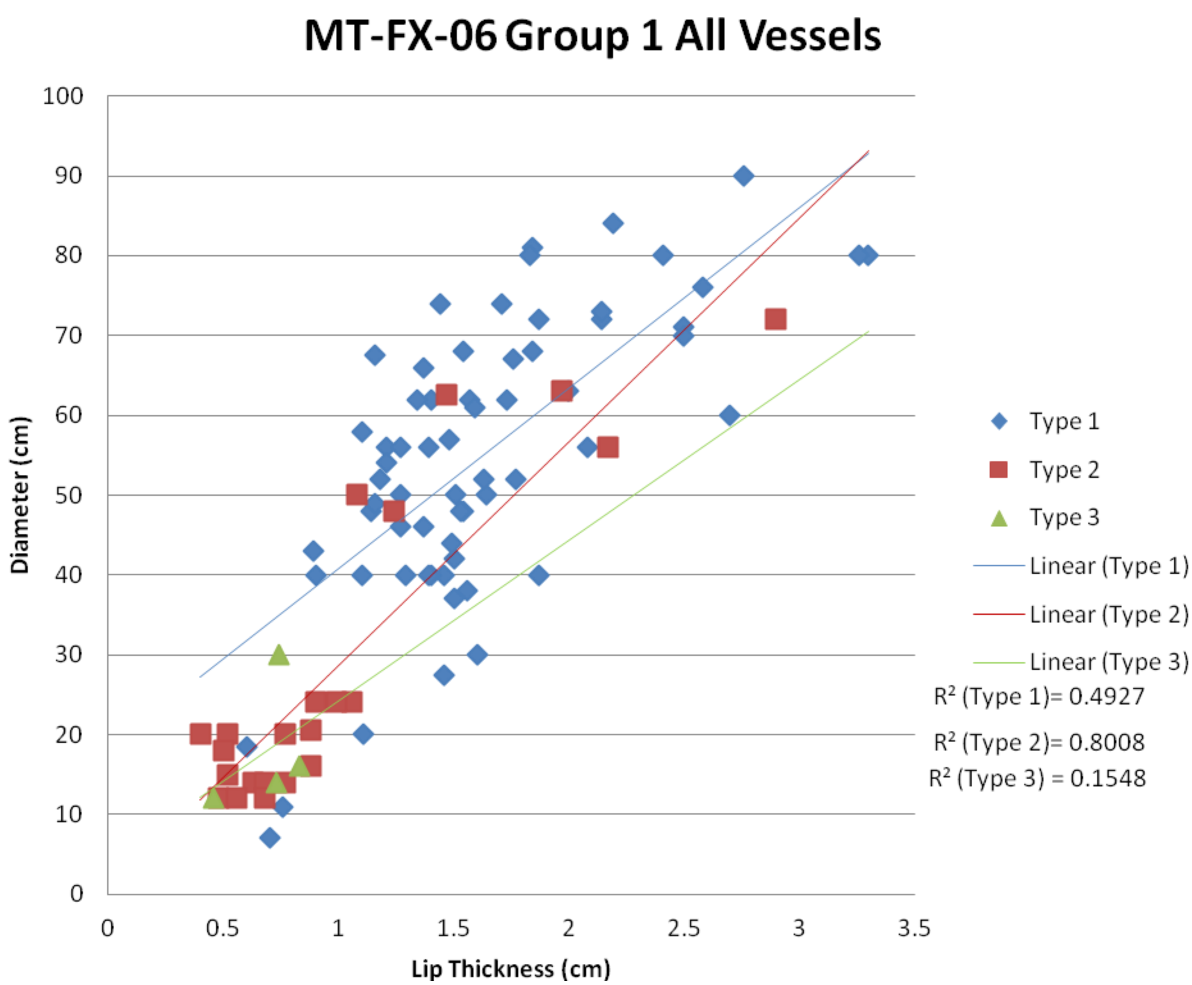

Figure 5-6. Lip thickness and diameter on all surface collected vessels from MT-FX-06.

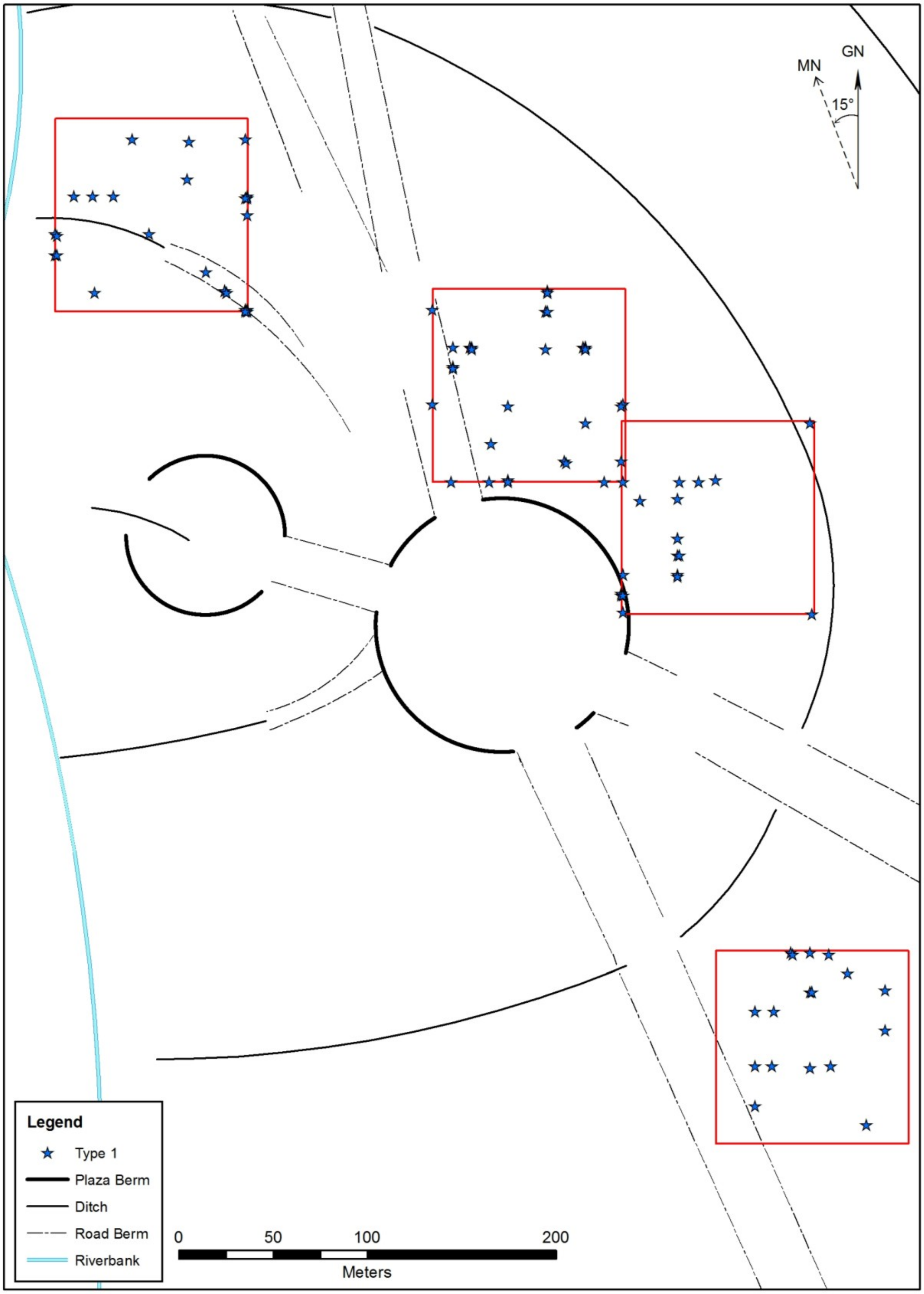

Figure 5-7. Distribution of Type 1 vessels in surface collection areas at MT-FX-06.

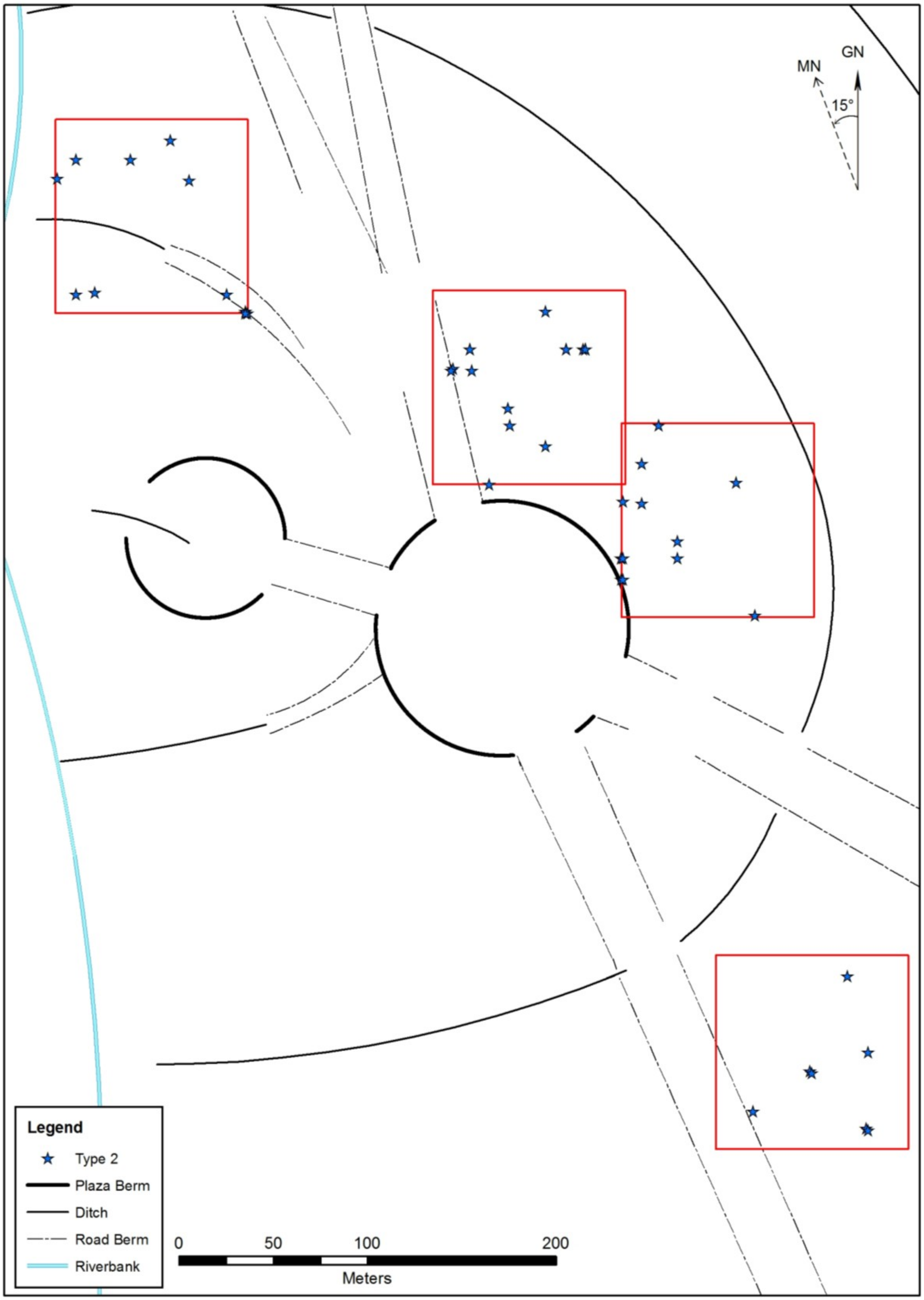

Figure 5-8. Distribution of Type 2 vessels in surface collection areas at MT-FX-06.

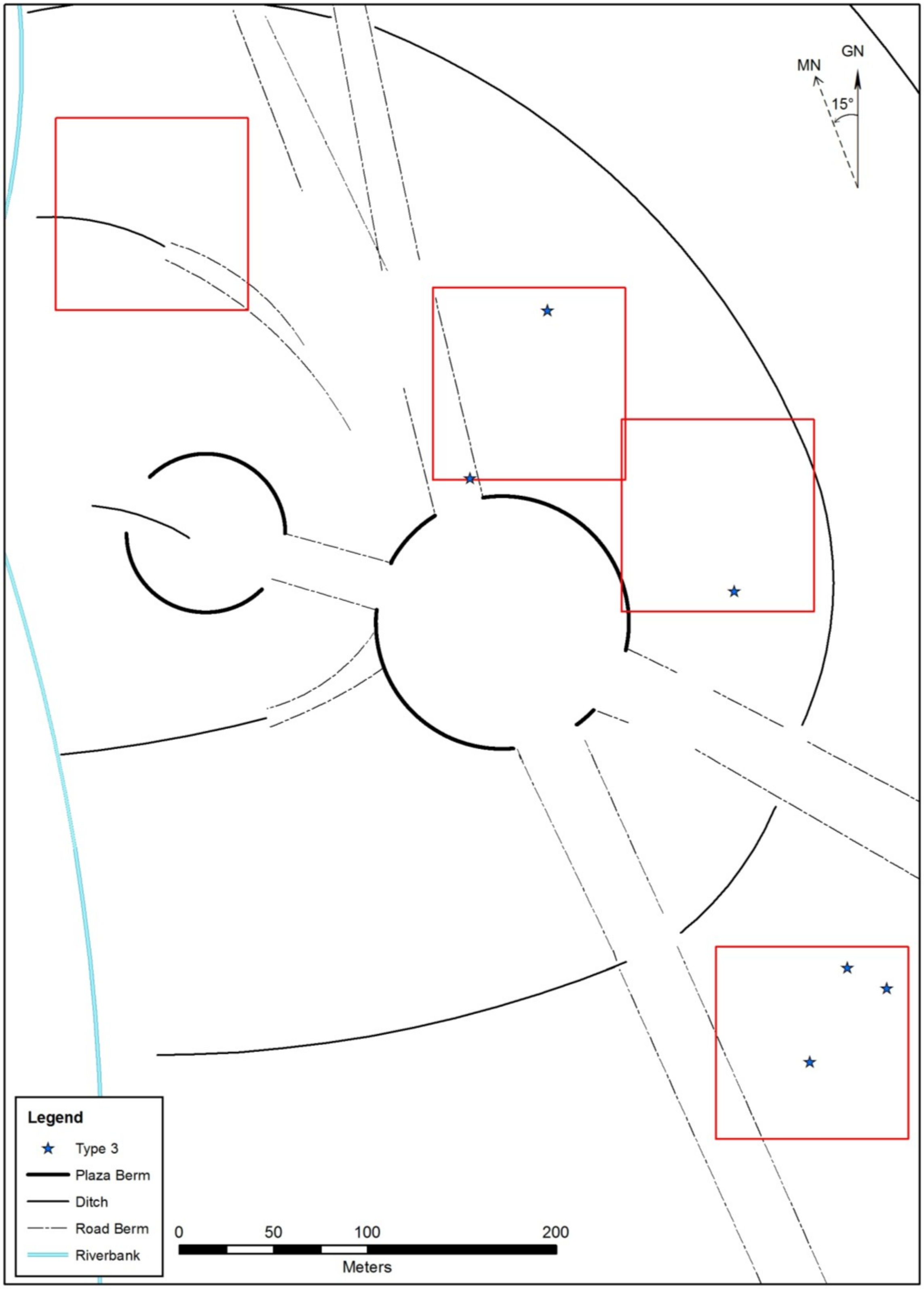

Figure 5-9. Distribution of Type 3 vessels in surface collection areas at MT-FX-06.

Table 5-1. Metric attribute means for all vessels in all groups at MT-FX-06.

Assemblage	Measurement	n	Mean	Min	Max	STDEV	CV
Type 1 Group 1	Lip Thickness	192	1.56	0.60	3.30	0.49	0.31
	Rim Thickness	192	1.15	0.41	2.68	0.37	0.32
	Orifice Diameter	64	54.89	7.00	90.00	17.75	0.32
Type 1 Group 2	Lip Thickness	37	1.31	0.55	2.24	0.42	0.32
	Rim Thickness	37	0.95	0.30	1.81	0.30	0.32
	Orifice Diameter	29	44.12	17.00	64.00	12.97	0.29
Type 1 Group 3	Lip Thickness	17	1.27	0.67	2.17	0.41	0.32
	Rim Thickness	17	1.05	0.77	1.33	0.16	0.16
	Orifice Diameter	6	49.66	30.00	60.00	12.01	0.24
Type 2 Group 1	Lip Thickness	72	0.94	0.40	2.90	0.42	0.45
	Rim Thickness	72	0.86	0.40	1.72	0.34	0.39
	Orifice Diameter	22	32.46	12.00	74.00	20.95	0.64
Type 2 Group 2	Lip Thickness	50	0.80	0.45	1.40	0.25	0.31
	Rim Thickness	50	0.78	0.36	1.22	0.19	0.25
	Orifice Diameter	33	25.87	11.00	55.00	11.51	0.44
Type 2 Group 3	Lip Thickness	14	0.81	0.44	1.59	0.29	0.36
	Rim Thickness	14	0.74	0.16	1.01	0.28	0.38
	Orifice Diameter	5	23.40	12.00	36.00	9.04	0.38
Type 3 Group 1	Lip Thickness	10	0.94	0.46	2.14	0.54	0.58
	Rim Thickness	10	0.79	0.40	1.10	0.20	0.25
	Orifice Diameter	4	24.85	12.00	40.00	11.48	0.46
Type 3 Group 2	Lip Thickness	15	0.70	0.50	0.88	0.10	0.14
	Rim Thickness	15	0.68	0.11	1.15	0.23	0.34
	Orifice Diameter	13	16.50	9.00	26.00	6.31	0.38
Type 3 Group 3	Lip Thickness	7	0.82	0.56	1.16	0.23	0.29
	Rim Thickness	7	0.59	0.45	0.90	0.15	0.26
	Orifice Diameter	5	11.60	9.00	20.00	4.77	0.41

Table 5-2. Average temper content for all vessels in all groups at MT-FX-06.

		Type 1		Type 2		Type 3		All Types	
Assemblage	Temper	n	Mean	n	Mean	n	Mean	n	Mean
Group 1	Cauixi	192	65.00	72	72.00	10	76.00	274	67.00
	Cariape	192	16.00	72	11.00	10	17.00	274	15.00
	Grit	192	14.00	72	13.00	10	7.00	274	13.00
	Grog	192	5.00	72	4.00	10	0.00	274	5.00
Group 2	Cauixi	37	54.00	50	69.00	15	70.00	193	61.00
	Cariape	37	20.00	50	11.00	15	12.00	193	18.00
	Grit	37	21.00	50	13.00	15	18.00	193	17.00
	Grog	37	5.00	50	6.00	15	0.00	193	4.00
Group 3	Cauixi	17	55.00	14	57.00	7	62.00	38	57.00
	Cariape	17	22.00	14	20.00	7	10.00	38	19.00
	Grit	17	22.00	14	23.00	7	18.00	38	21.00
	Grog	17	2.00	14	0.00	7	10.00	38	3.00

Table 5-3. T-test for equality of means for lip thickness measurements at MT-FX-06.

	t	df	two-tailed P value	mean difference	standard error of difference	95% confidence interval of the difference lower	upper	statistical significance
Lip Thickness Type 1								
Group 1 vs. Group 2	0.5783	57	0.5654	0.09	0.156	-0.2217	0.4017	not statistically significant
Group 1 vs. Group 3	3.4985	63	0.0009	0.37	0.106	0.1587	0.5813	extremely statistically significant
Group 2 vs. Group 3	1.3902	12	0.1897	0.28	0.201	-0.1588	0.7188	not statistically significant
Lip Thickness Type 2								
Group 1 vs. Group 2	1.3259	19	0.2006	0.25	0.189	-0.1446	0.6446	not statistically significant
Group 1 vs. Group 3	2.1759	20	0.0417	0.37	0.170	0.0153	0.7247	statistically significant
Group 2 vs. Group 3	0.8139	9	0.4367	0.12	0.147	-0.2135	0.4535	not statistically significant
Lip Thickness Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

Table 5-4. T-test for equality of means for rim thickness measurements at MT-FX-06.

	t	df	two-tailed P value	mean difference	standard error of difference	95% confidence interval of the difference lower	95% confidence interval of the difference upper	statistical significance
Rim Thickness Type 1								
Group 1 vs. Group 2	0.3925	57	0.6962	-0.07	0.178	-0.4271	0.2871	not statistically significant
Group 1 vs. Group 3	1.2415	63	0.2190	0.15	0.121	-0.0914	0.3914	not statistically significant
Group 2 vs. Group 3	1.1248	12	0.2827	0.22	0.196	-0.2062	0.6462	not statistically significant
Rim Thickness Type 2								
Group 1 vs. Group 2	1.9256	19	0.0692	0.29	0.151	-0.0252	0.6052	not quite statistically significant
Group 1 vs. Group 3	1.3198	20	0.2018	0.17	0.129	-0.0987	0.4387	not statistically significant
Group 2 vs. Group 3	0.9525	9	0.3657	-0.12	0.126	-0.4050	0.1650	not statistically significant
Rim Thickness Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

Table 5-5. T-test for equality of means for orifice diameter measurements at MT-FX-06.

	t	df	two-tailed P value	mean difference	standard error of difference	95% confidence interval of the difference lower	upper	statistical significance
Orifice Diameter Type 1								
Group 1 vs. Group 2	0.4068	27	0.6873	-3.56	8.750	-21.5142	14.3942	not statistically significant
Group 1 vs. Group 3	2.2835	31	0.0294	15.44	6.762	1.6494	29.2306	statistically significant
Group 2 vs. Group 3	1.7694	10	0.1073	19.00	10.738	-4.9260	42.9260	not statistically significant
Orifice Diameter Type 2								
Group 1 vs. Group 2	0.5179	7	0.6205	9.25	17.860	-32.9810	51.4810	not statistically significant
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Orifice Diameter Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

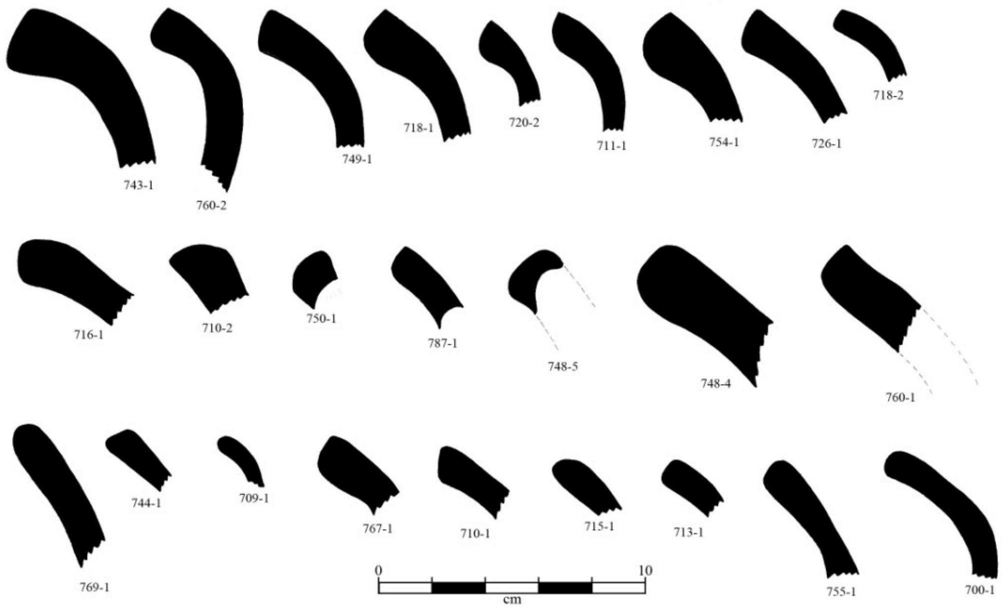

Figure 5-10. Type 1 rim profiles (700's) from the MT-FX-06 surface collection assemblage.

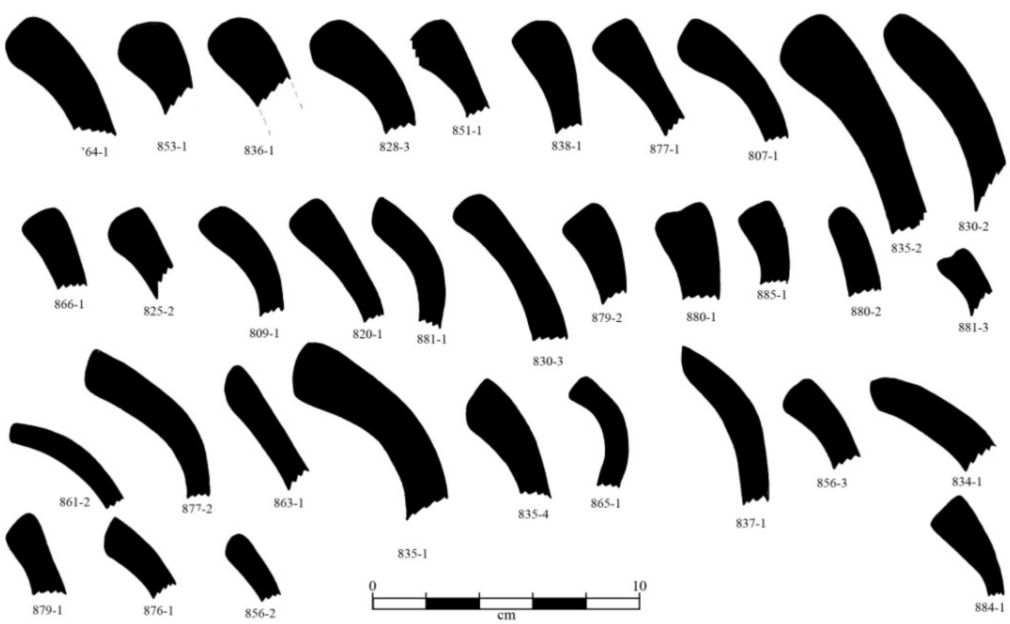

Figure 5-11. Type 1 profiles (800's) from the MT-FX-06 surface collection assemblage.

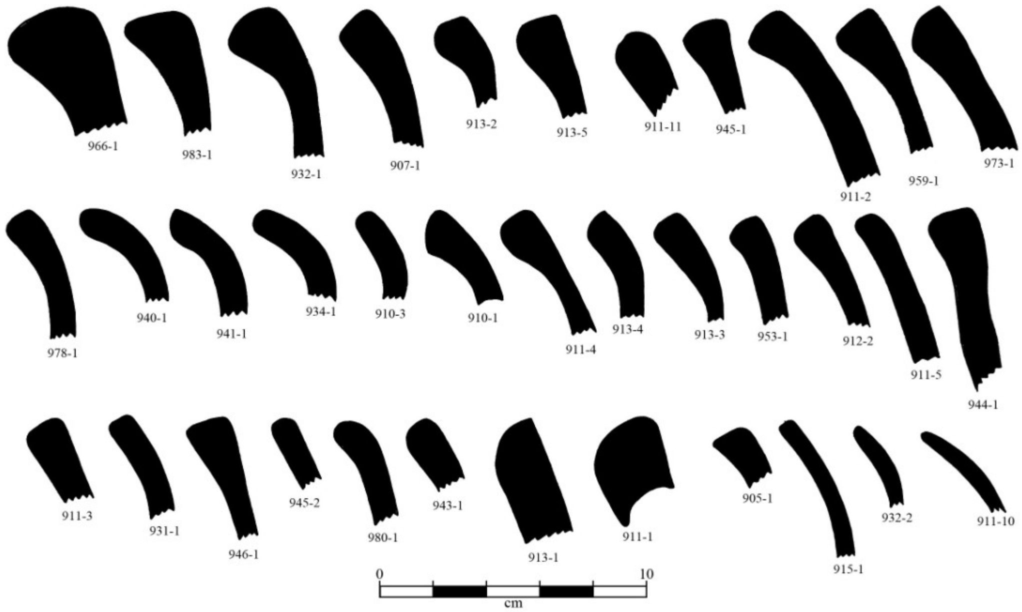

Figure 5-12. Type 1 profiles (900's) from the MT-FX-06 surface collection assemblage.

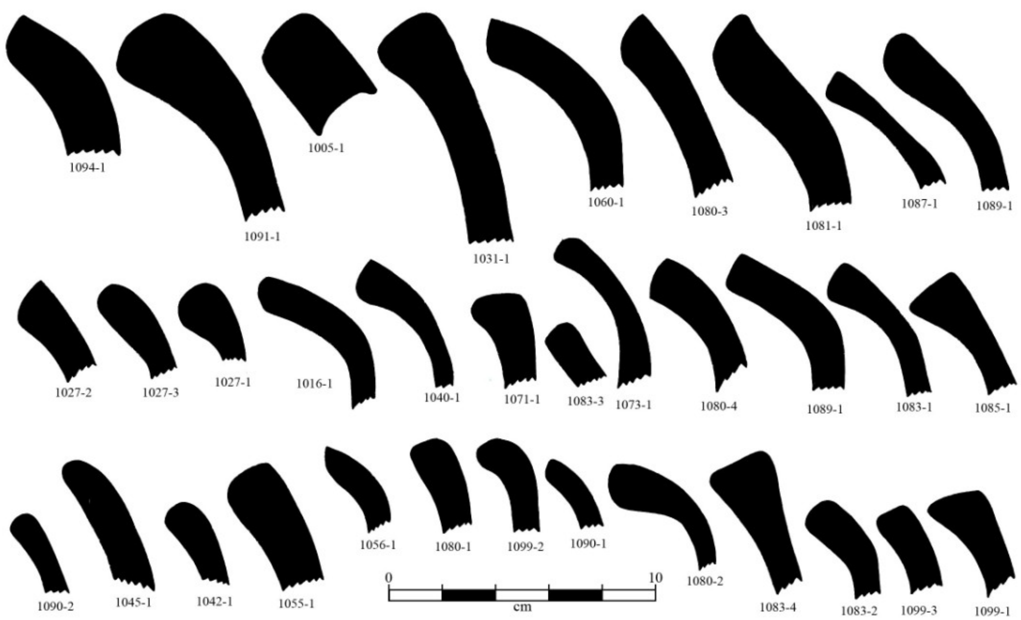

Figure 5-13. Type 1 profiles (1000's) from the MT-FX-06 surface collection assemblage.

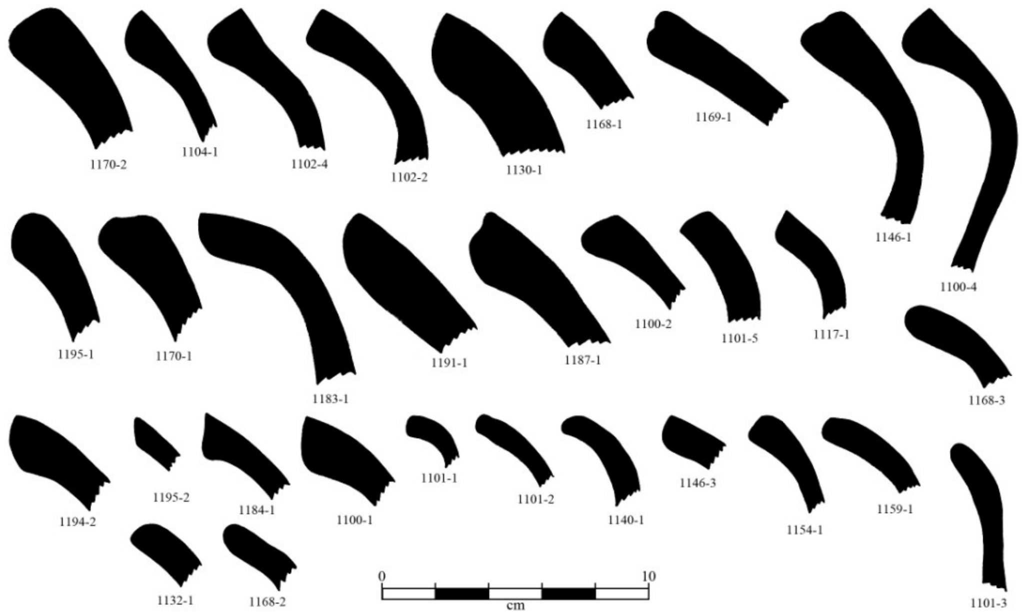

Figure 5-14. Type 1 profiles (1100's) from the MT-FX-06 surface collection assemblage.

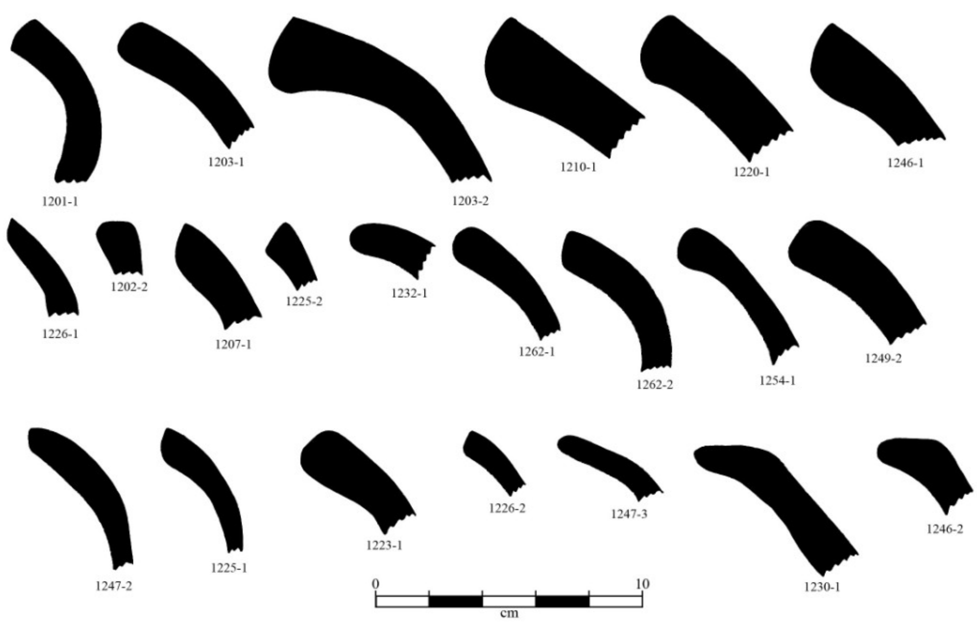

Figure 5-15. Type 1 rim profiles (1200's) from the MT-FX-06 surface collection

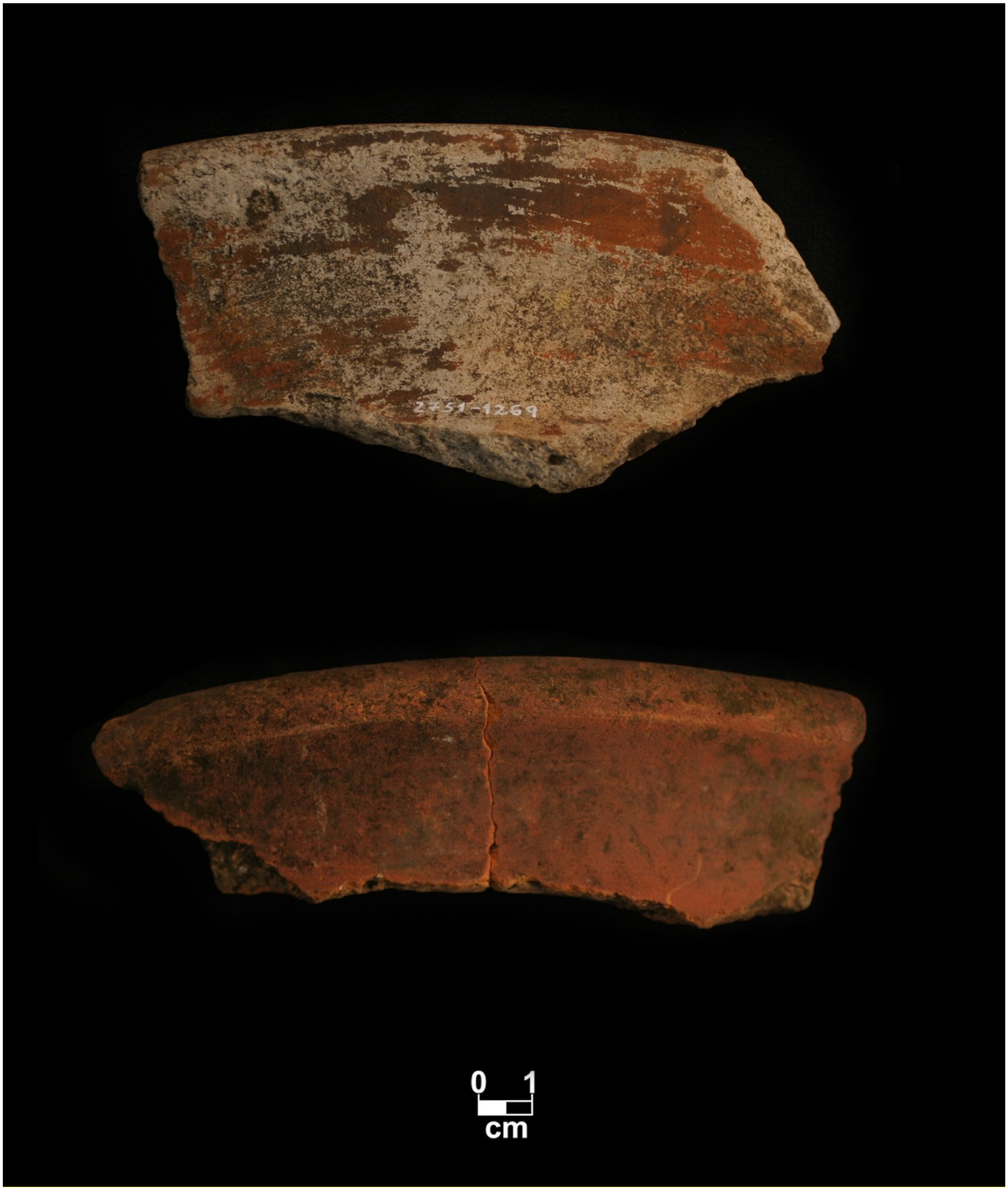

Figure 5-16. Exterior view of Type 1 rims from the MT-FX-06 surface collection.

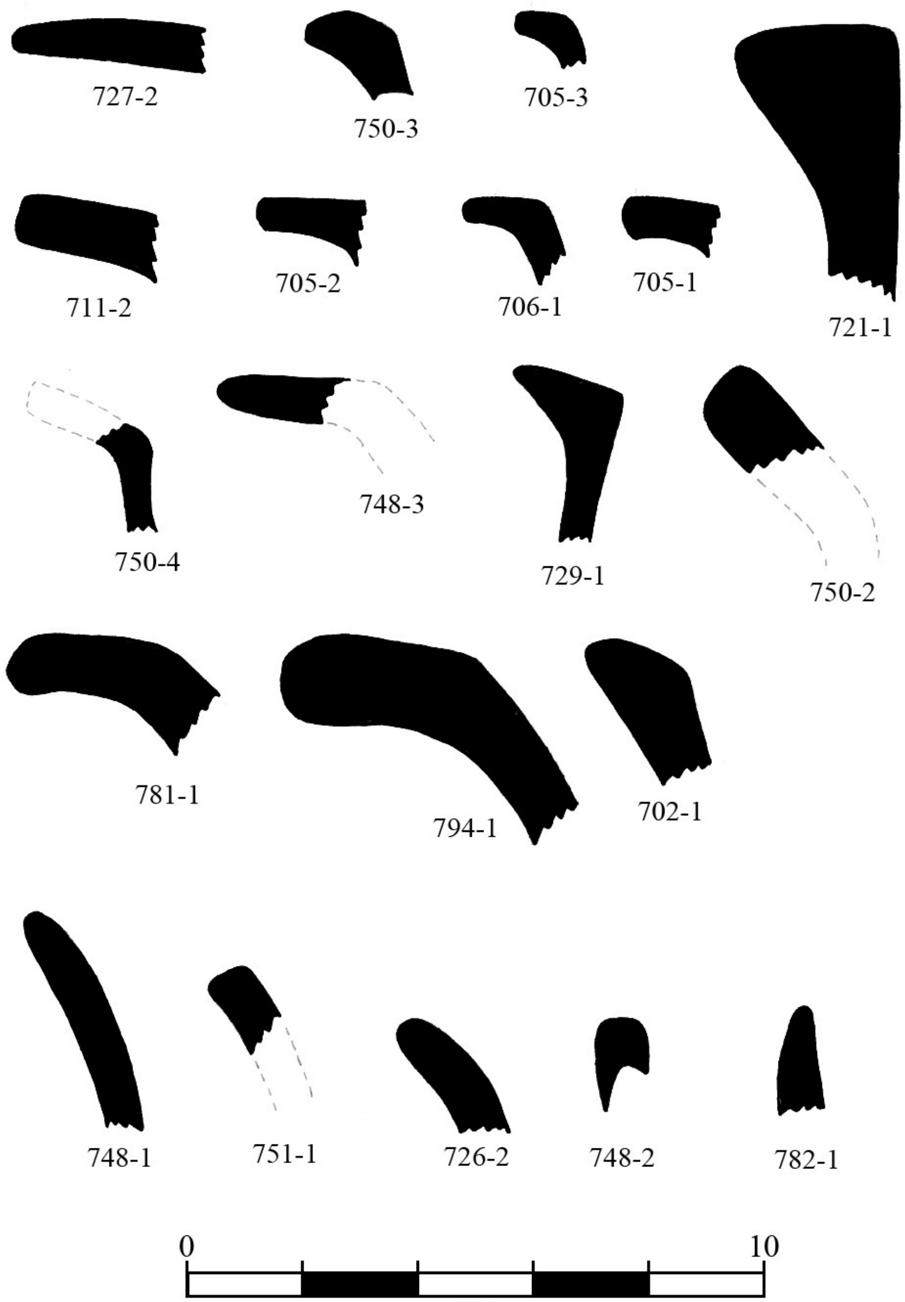

Figure 5-17. Type 2 profiles from surface collection (700's) from the MT-FX-06 surface collection assemblage.

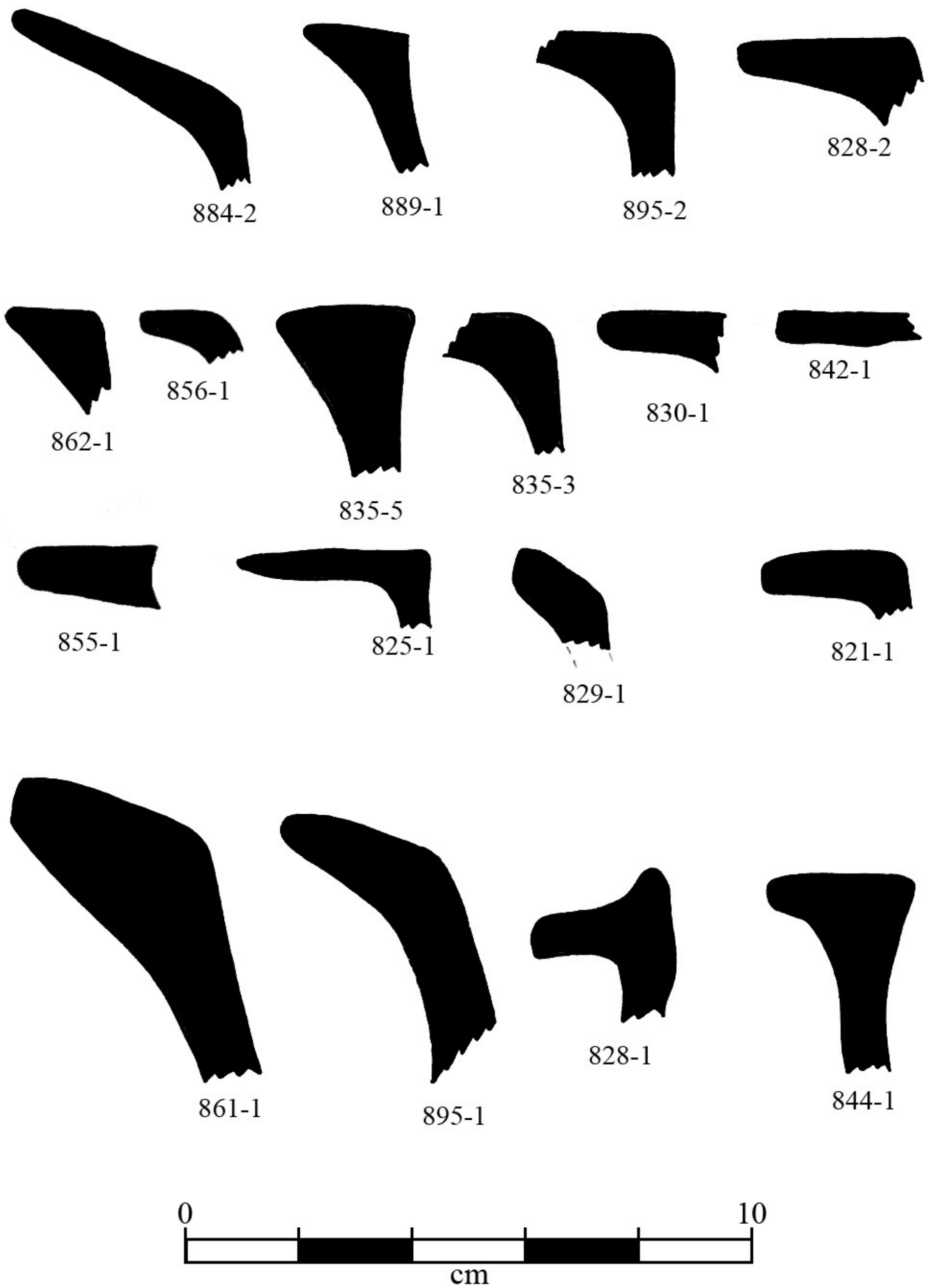

Figure 5-18. Type 2 profiles from surface collection (800's) from the MT-FX-06 surface collection assemblage.

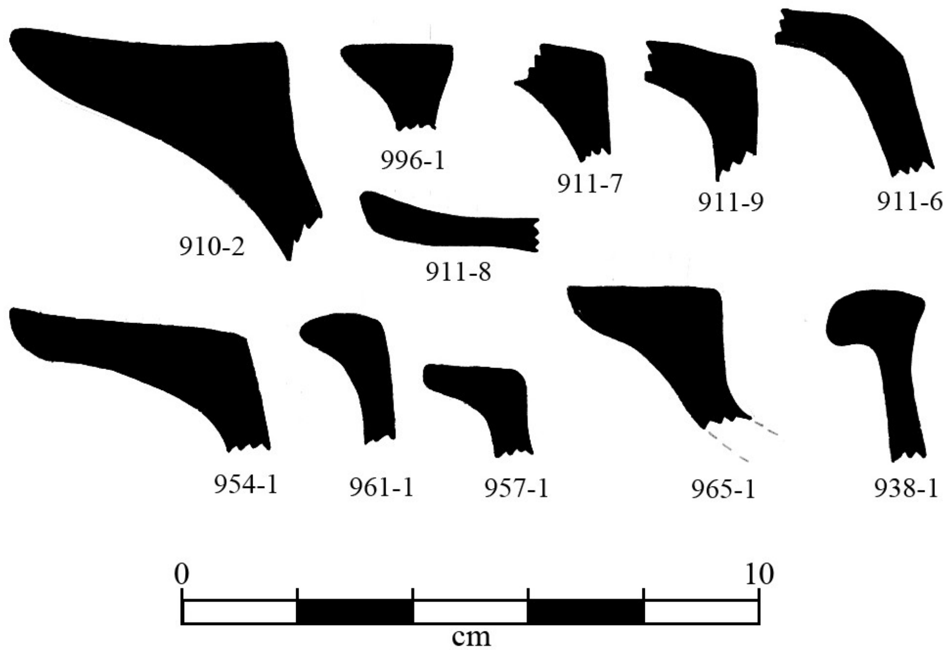

Figure 5-19. Type 2 profiles from surface collection (900's) from the MT-FX-06 surface collection assemblage.

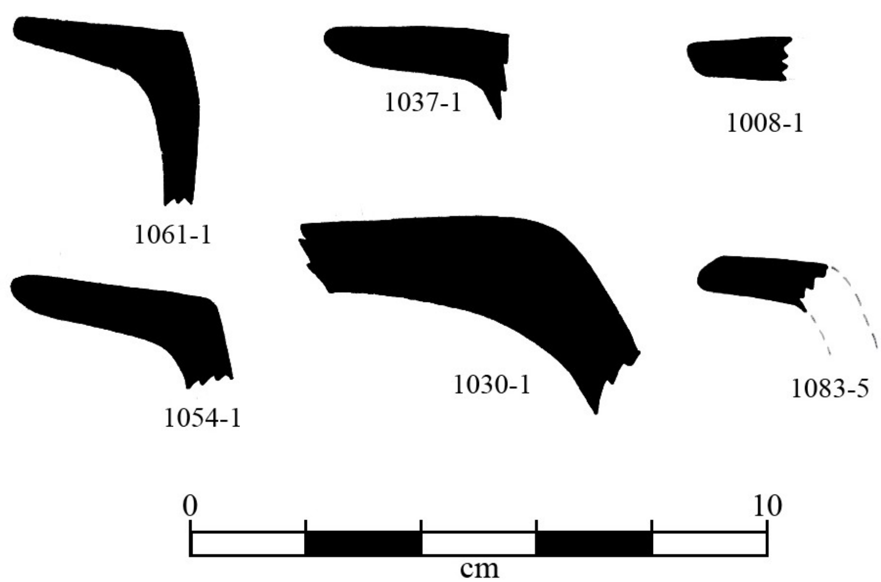

Figure 5-20. Type 2 profiles from surface collection (1000's) from the MT-FX-06 surface collection assemblage.

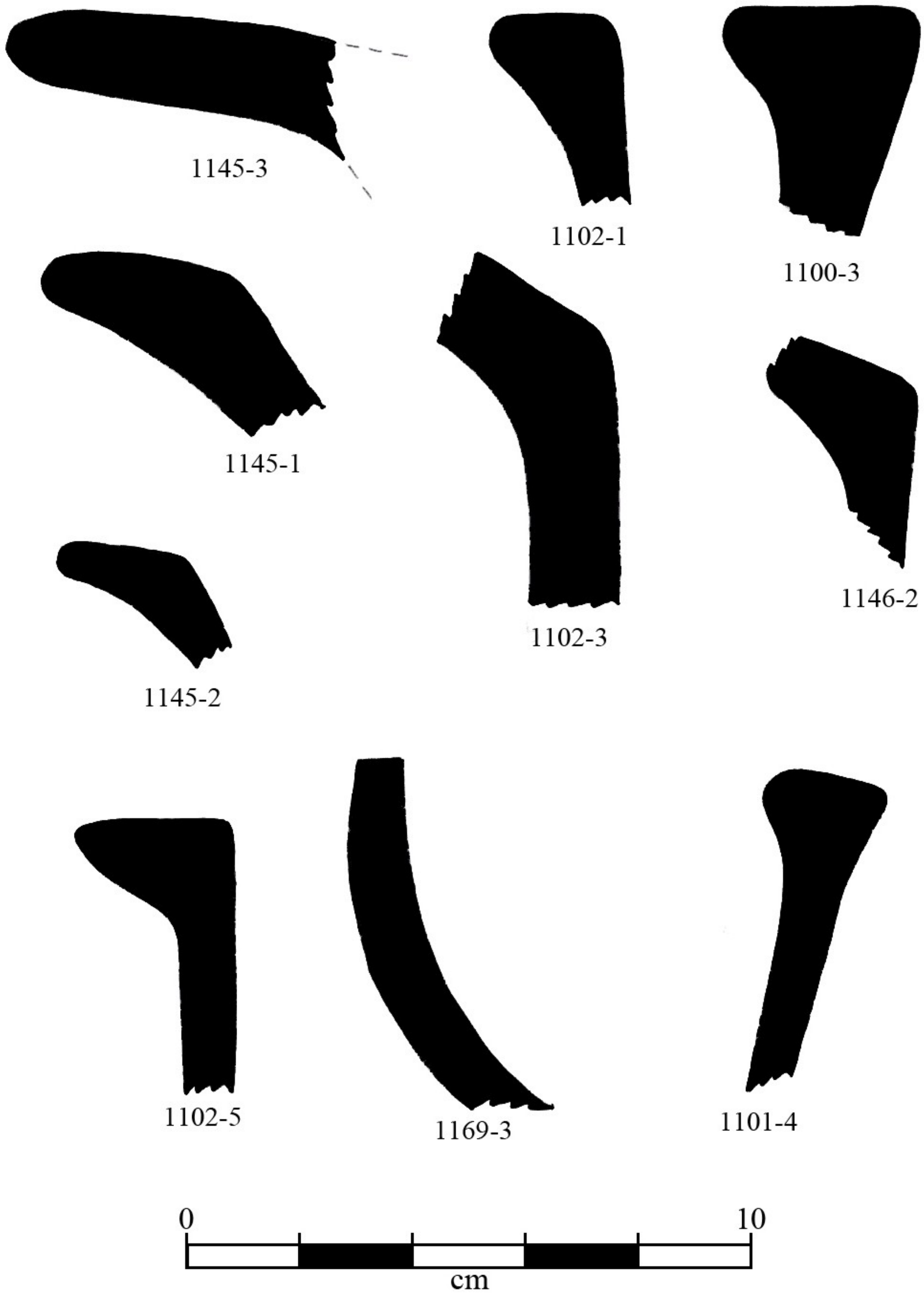

Figure 5-21. Type 2 and Type 3 profiles from surface collection (1100's) from the MT-FX-06 surface collection assemblage.

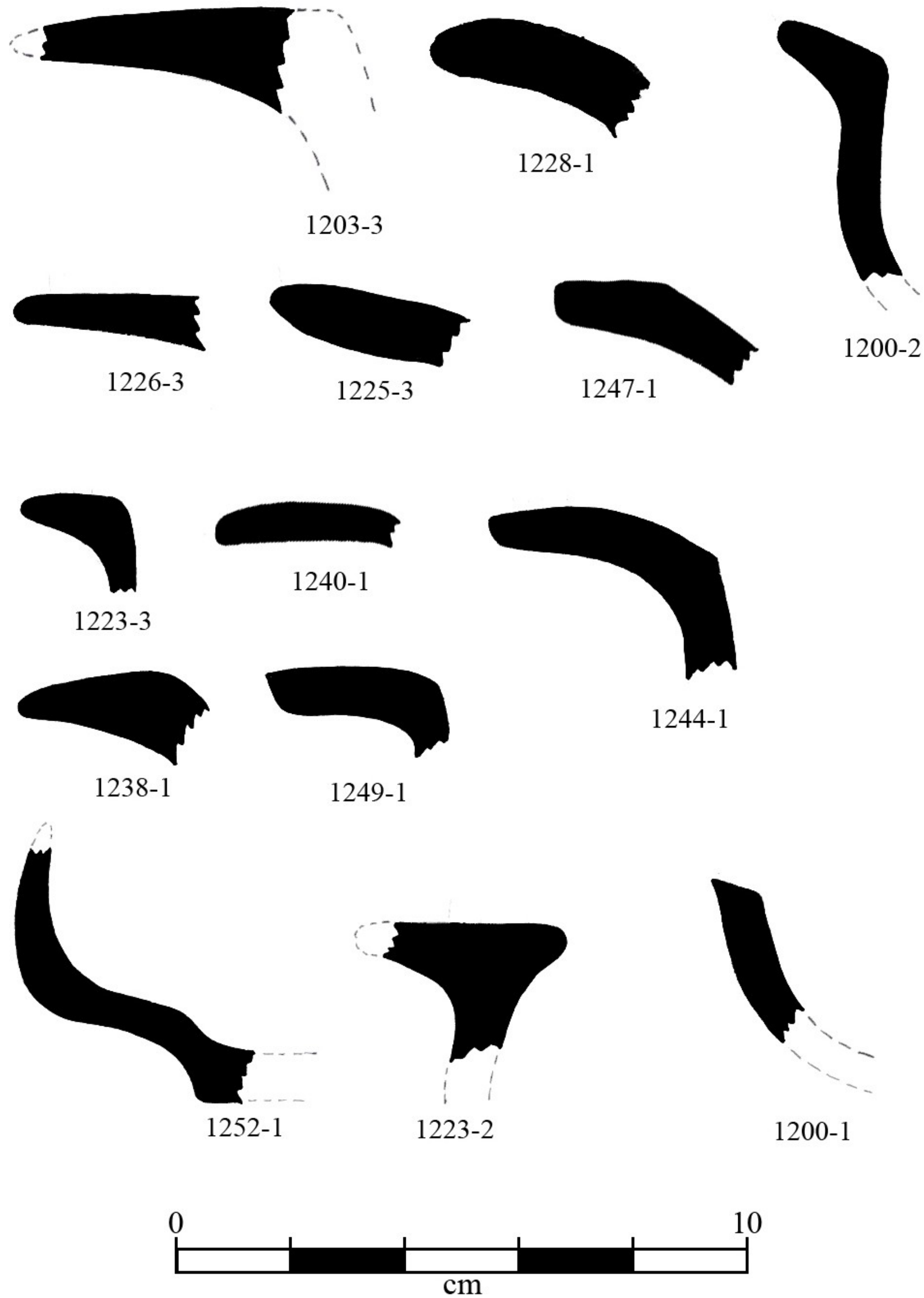

Figure 5-22. Type 2 and Type 3 profiles from surface collection (1200's) from the MT-FX-06 surface collection assemblage.

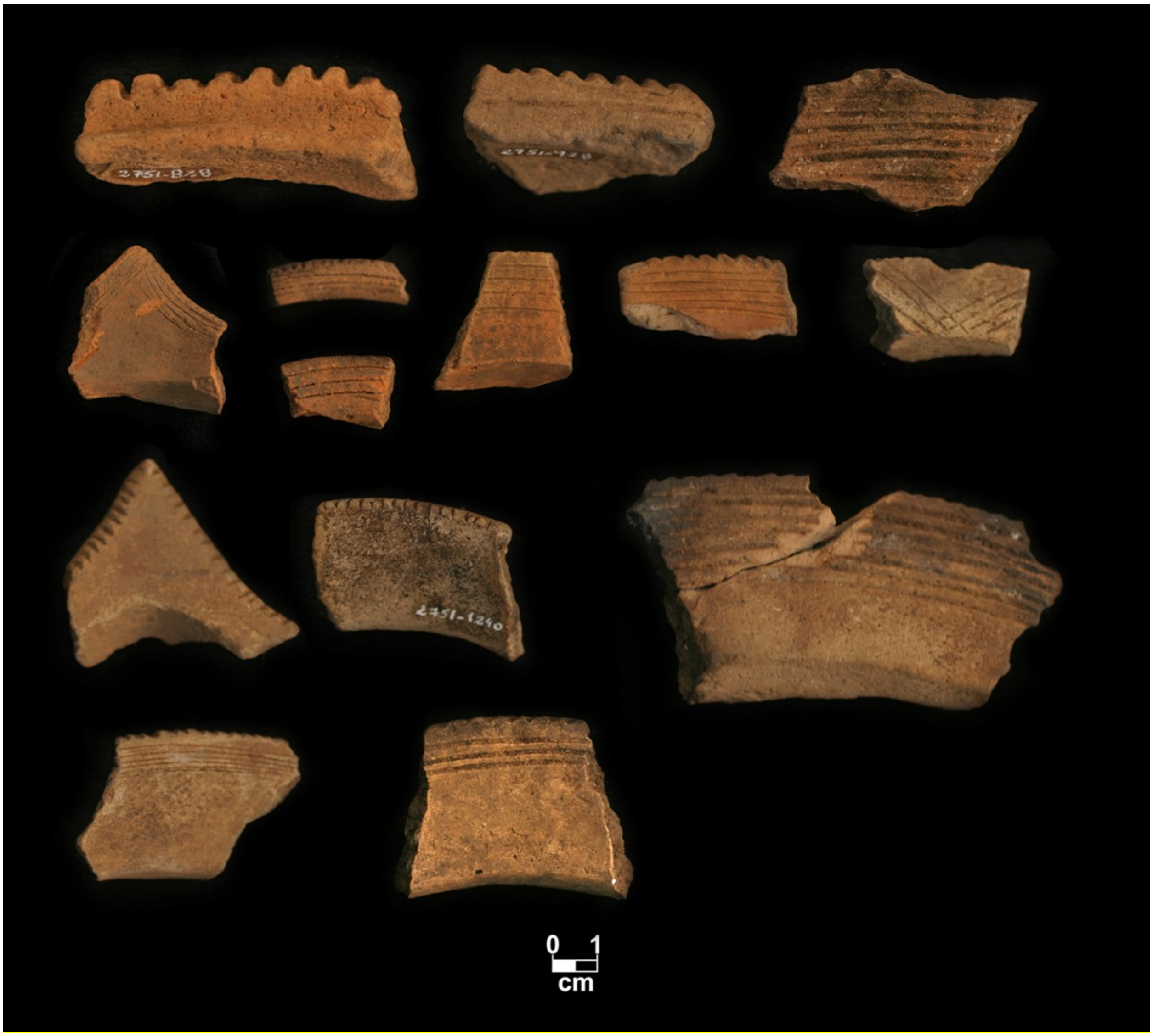

Figure 5-23. Type 2 rims from the MT-FX-06 surface collection assemblage.

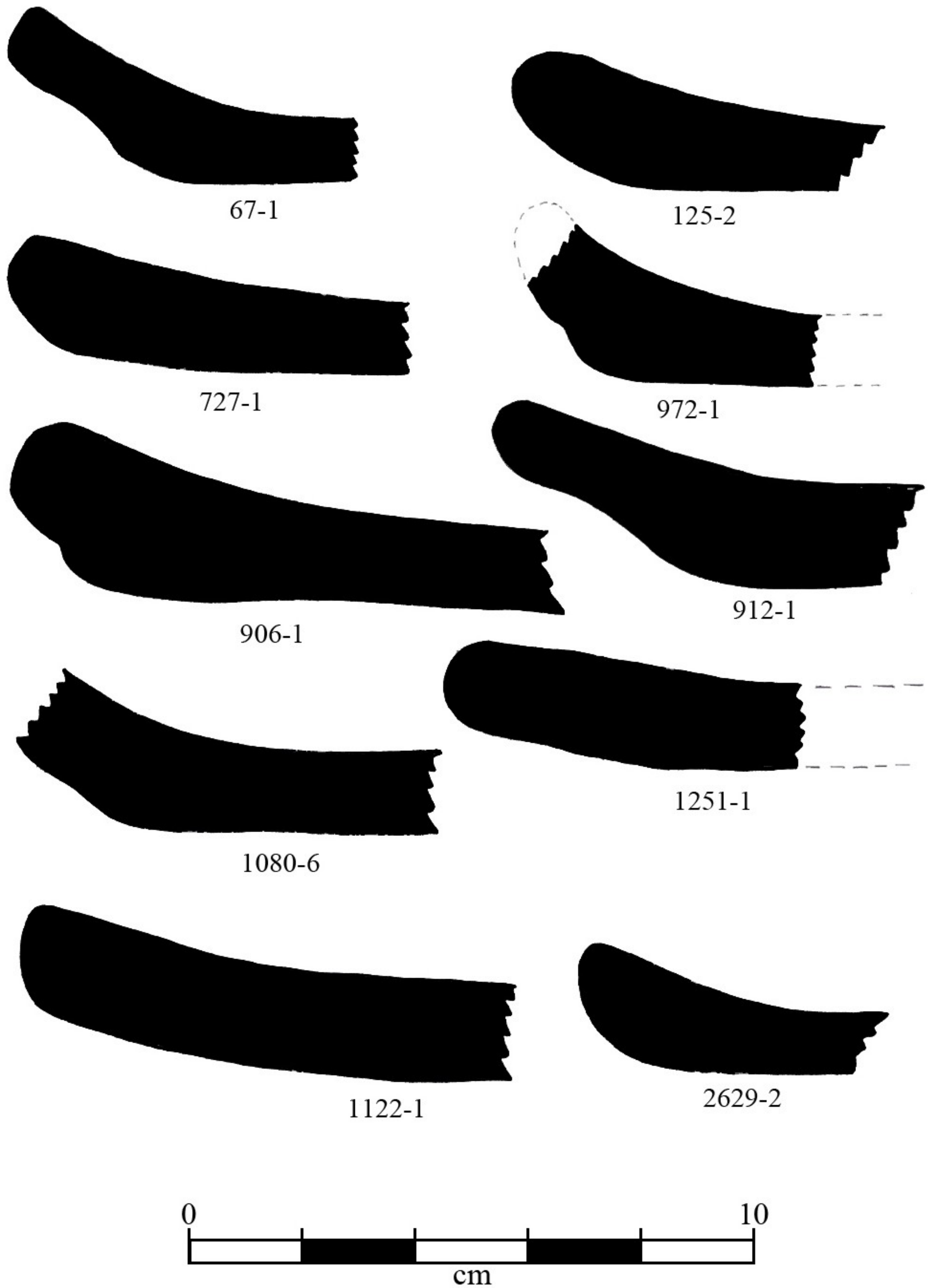

Figure 5-24. Type 4 (griddle, or *alato*) rim profiles from the MT-FX-06 surface collection and EUs (top two examples 67-1 and 125-2).

Group 2 (Plaza Berm Excavations)

A total of 1,807 ceramics were collected from all excavation units. Of this total 193 pieces were identified as rims (Figure 5-17 to Figure 5-23). Of the 193 rims only 102 could be accurately assigned to a vessel type. Of the 102 rims 36 percent are Type 1 (n=37), 49 percent are Type 2 (n=50), and 15 percent are Type 3 (n=15). Of these 102 rims only 75 were sufficient for determining orifice diameter. These 75 rims are almost identical statistically to the total 102 in the vessel type breakdown. Of the 75 rims sufficient for measuring orifice diameter 39 percent are Type 1 (n=29), 44 percent are Type 2 (n=33), and 17 percent are Type 3 (n=13).

Type 1 vessels from the unit excavations are less standardized in form than those from Group 1 but more so than Group 3 (Figure 5-28). Type 1 vessels have an average lip thickness of 1.32 cm (n=37), an average rim thickness of .95 cm (n=37), and an average orifice of 44 cm (n=29). One of the best examples of these smaller versions of the modern day vessel was excavated from ET03 (Figure 5-26).The range for Type 1 vessel metric attributes is somewhat narrower than for surface collected Type 1 vessels. Lip thickness ranges from .55 to 2.24 cm, rim thickness ranges from .3 to 1.81, and orifice diameter ranges from 17 to 64 cm. Type 1 vessels generally cluster together and mostly separate from Type 2 and Type 3 vessels but not as distinctly as in the surface assemblage (Figure 5-25).

Type 2 vessels from the unit excavations are somewhat variable in their form (Figure 5-29 and Figure 5-27). Type 2 vessels have an average lip thickness of .90 cm (n=50), an average rim thickness of .78 cm (n=50), and an average orifice diameter of 26 cm (n=33). Like Type 1 vessels, the range for Type 2 vessel metric attributes is narrower in the unit excavations. Lip thickness ranges from .45 to 1.4 cm, rim thickness ranges from .36 to 1.22, and orifice diameter ranges from 11 to 55 cm. Like Type 1 vessels, Type 2 vessels also generally cluster together when considered by their thickness to orifice ratio, however this is much less distinctive than in the surface assemblage (Figure 5-25).

Type 3 vessels from the unit excavations are extremely variable in their form and usually quite small (Figure 5-29). Type 3 vessels have an average lip thickness of .7 cm (n=15), an average rim thickness of .68 cm (n=15), and an average orifice diameter of 16 cm (n=13). Lip thickness ranges from .5 to .88 cm, rim thickness ranges from .11 to 1.15 cm, and orifice diameter ranges from 9 to 26 cm. Type 3 vessels cluster together and with the smaller Type 2 vessels but unlike other vessel types do not consistently increase in orifice diameter as they increase in thickness (Figure 5-25).

Temper statistics for unit excavation vessels were calculated using all 193 rims. They are presented in terms of percent of total temper present. Calculated with all vessels (n=193) the average temper composition is 61 percent *cauíxi*, 18 percent *cariapé*, 17 percent grit, and 4 percent grog. When broken down into vessel types the statistics change somewhat dramatically though this may be due to small sample size. Type 1 vessels (n=37) are 54 percent *cauíxi*, 21 percent grit, 20 percent *cariapé*, and 5 percent grog. Type 2 vessels (n=50) are 69 percent *cauíxi*, 13 percent grit, 11 percent *cariapé*, and 6 percent grog. Type 3 (n=15) vessels are 70 percent *cauíxi*, 18 percent grit, 12 percent *cariapé*, and they contained no grog.

Surface treatment for all vessels included smoothing with only occasional vessels showing burnishing. All types of vessels were represented by more surface paint and slip than the surface collected vessels but his is likely a product of preservation. Type 1 vessels had the most exterior surface paint and slip (n=12) as well as interior black paint (n=4) and interior orange slip (n=3). Type 2 vessels have several examples of exterior red paint (n=6), exterior black paint (n=4) and orange slip (n=4). Type 2 vessels also have several examples of interior red paint (n=4), black paint (n=2), and orange slip (n=5). Type 3 vessels have examples of exterior red paint (n=6) and orange slip (n=2) with one example each of interior red paint, black paint, and orange slip.

Of the 193 rims analyzed 72 percent (n=139) were completely fired showing no core, 26 percent (n=51) were incompletely fired with variably colored cores and margins, and 2 percent (n=3) were too fragmentary to determine firing. Both the completely fired and the incompletely fired pieces have variably colored profiles.

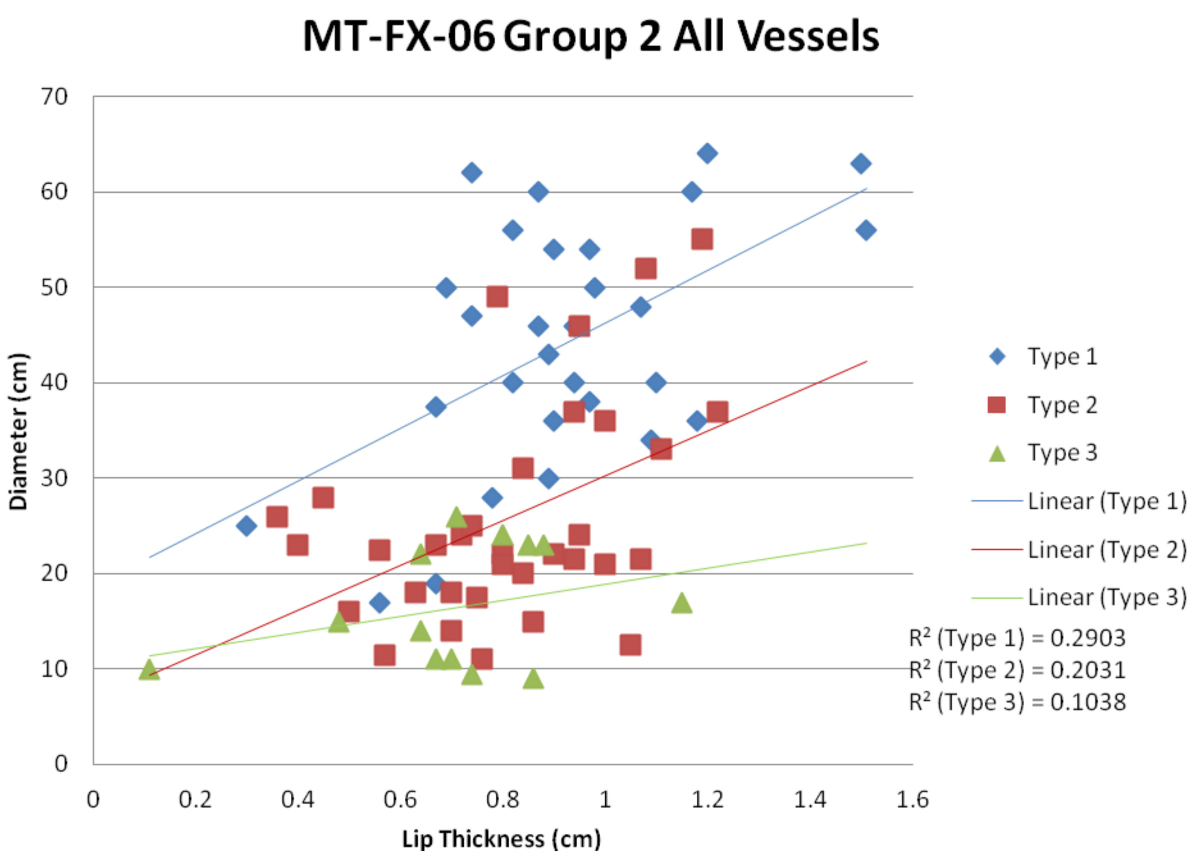

Figure 5-25. Lip thickness and diameter on all Group 2 vessels from MT-FX-06.

Figure 5-26. Nearly complete Type 1 flat bottom vessel from EU 3-1.

Figure 5-27. Type 2 rims from EUs at MT-FX-06.

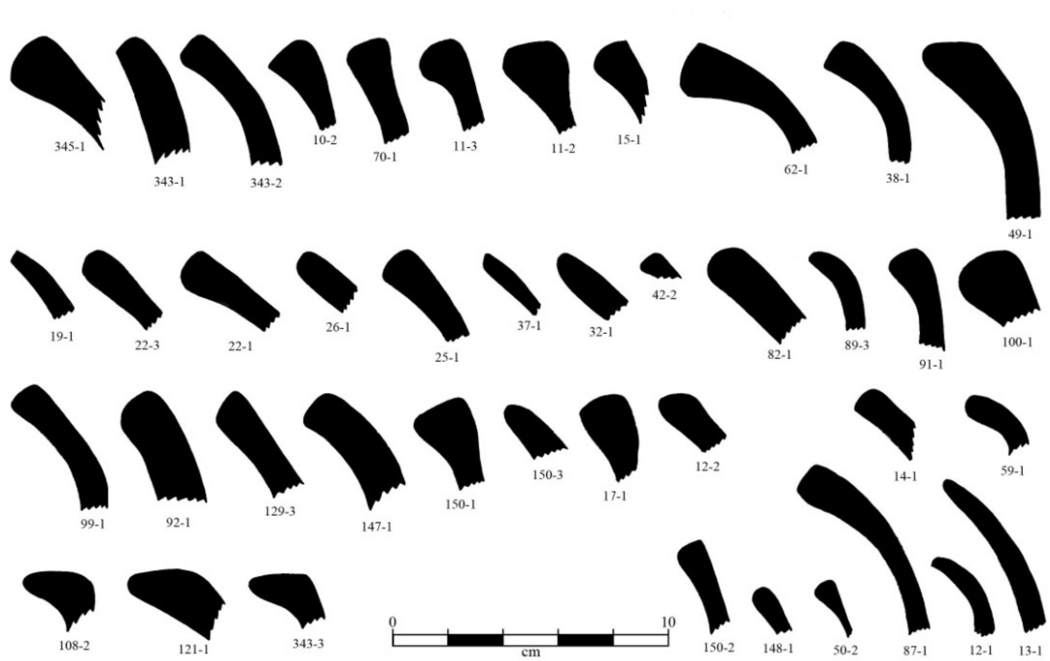

Figure 5-28. Type 1 rim profiles from EUs at MT-FX-06.

Figure 5-29. Type 2 and Type 3 rim profiles from EUs at MT-FX-06.

Group 3 (Plaza Peripheral Excavations)

A total of 2,142 ceramics were collected from all test unit excavations. Of this total 38 pieces were identified as rims. Of the 38 rims all could be accurately assigned to a vessel type. Of the 38 rims 45 percent are Type 1 (n=17), 37 percent are Type 2 (n=14), and 18 percent are Type 3 (n=7). Of these 38 rims only 16 were sufficient for determining orifice diameter. These 16 rims are somewhat skewed statistically compared to the total 38 in the vessel type breakdown likely due to the small sample size. Of the16 rims sufficient for measuring orifice diameter 38 percent are Type 1 (n=6), 31 percent are Type 2 (n=5), and 31 percent are Type 3 (n=5).

Type 1 vessels from the test unit excavations have an average lip thickness of 1.28 cm (n=17), an average rim thickness of 1.05 cm (n=17), and an average orifice of 50 cm (n=6) (Figure 5-31). The range for Type 1 vessel metric attributes is somewhat narrower than for surface collected Type 1 vessels. Lip thickness ranges from .67 to 2.17 cm, rim thickness ranges from .77 to 1.33, and orifice diameter ranges from 30 to 60 cm. Type 1 vessels generally cluster together and mostly separate from Type 2 and Type 3 vessels but not as distinctly as in the surface assemblage and less than the unit assemblage (Figure 5-30).

Type 2 vessels from the test unit excavations have an average lip thickness of .81 cm (n=14), an average rim thickness of .74 cm (n=14), and an average orifice diameter of 23 cm (n=5) (Figure 5-32). Like Type 1 vessels, the range for Type 2 vessel metric attributes is narrower in the test unit excavations. Lip thickness ranges from .44 to 1.59 cm, rim thickness ranges from .16 to 1.01, and orifice diameter ranges from 12 to 36 cm. Like Type 1 vessels, Type 2 vessels also generally cluster together when considered by their thickness to orifice ratio, however this is much less distinctive than in the surface assemblage and less than in the unit assemblage (Figure 5-30).

Type 3 vessels from the test unit excavations have an average lip thickness of .82 cm (n=7), an average rim thickness of .59 cm (n=7), and an average orifice diameter of 12 cm (n=5). Lip thickness ranges from .56 to 1.16 cm, rim thickness ranges from .45 to .90 cm, and orifice diameter ranges from 9 to 20 cm. Type 3 vessels cluster together and with the smaller Type 2 vessels but unlike other vessel types do not consistently increase in orifice diameter as they increase in thickness (Figure 5-30).

Temper statistics for unit excavation vessels were calculated using all 38 rims. They are presented in terms of percent of total temper present. Calculated with all vessels (n=38) the average temper composition is 57 percent *cauíxi*, 21 percent grit, 19 percent *cariapé*, and 3 percent grog. When broken down into vessel types the statistics remain relatively consistent. Type 1 vessels (n=17) are 55 percent *cauíxi*, 22 percent grit, 22 percent *cariapé*, and 2 percent grog. Type 2 vessels (n=14) are 57 percent *cauíxi*, 23 percent grit, 20 percent *cariapé*, and contain no grog. Type 3 (n=7) vessels are 62 percent *cauíxi*, 18 percent grit, 10 percent *cariapé*, and 10 percent grog.

Surface treatment for all vessels included smoothing with only occasional vessels showing burnishing. Three Type 1 vessels have red paint present on the outside surface and only one has black paint on the inside surface.

Of the 38 rims analyzed 68 percent (n=26) were completely fired showing no core and 32 percent (n=12) were incompletely fired with variably colored cores and margins. Both the completely fired and the incompletely fired pieces have variably colored profiles.

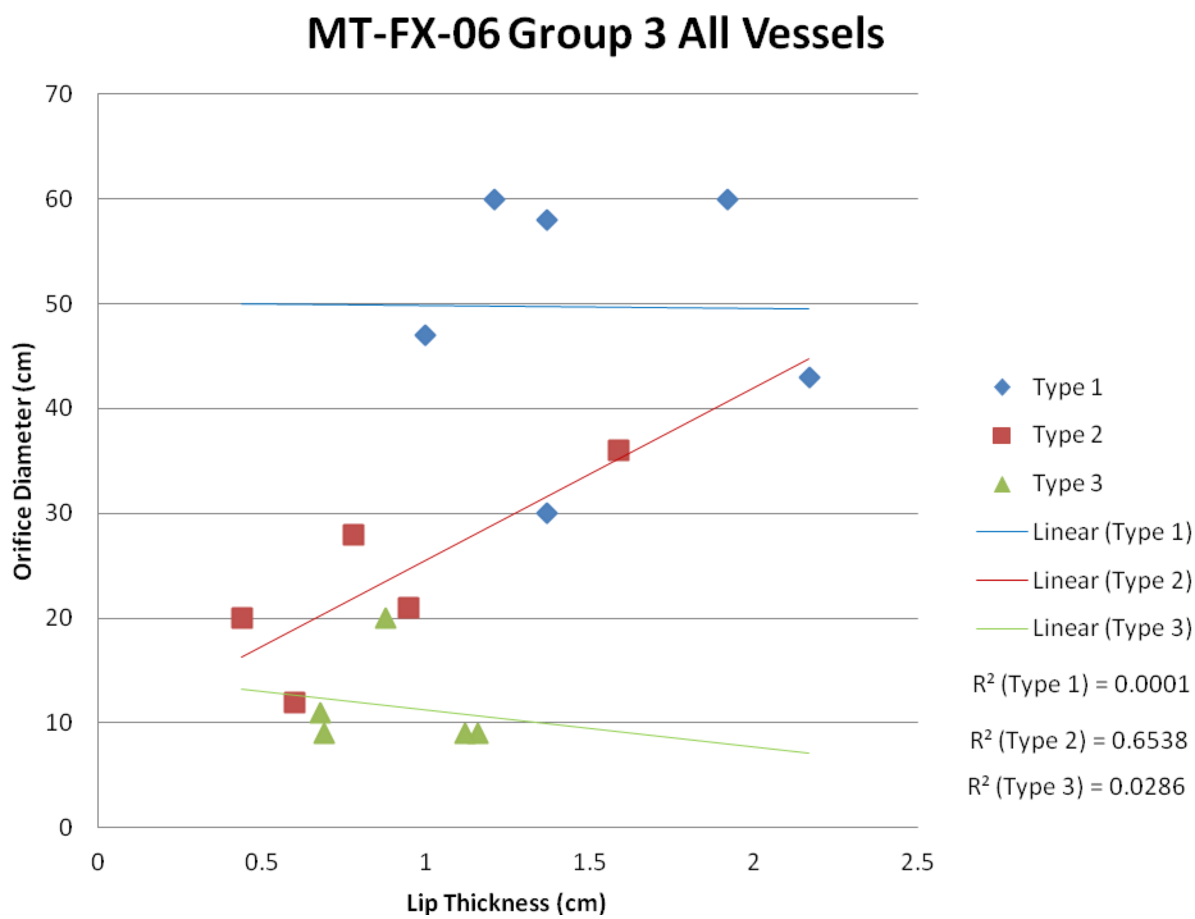

Figure 5-30. Lip thickness and diameter for all Group 3 vessels at MT-FX-06.

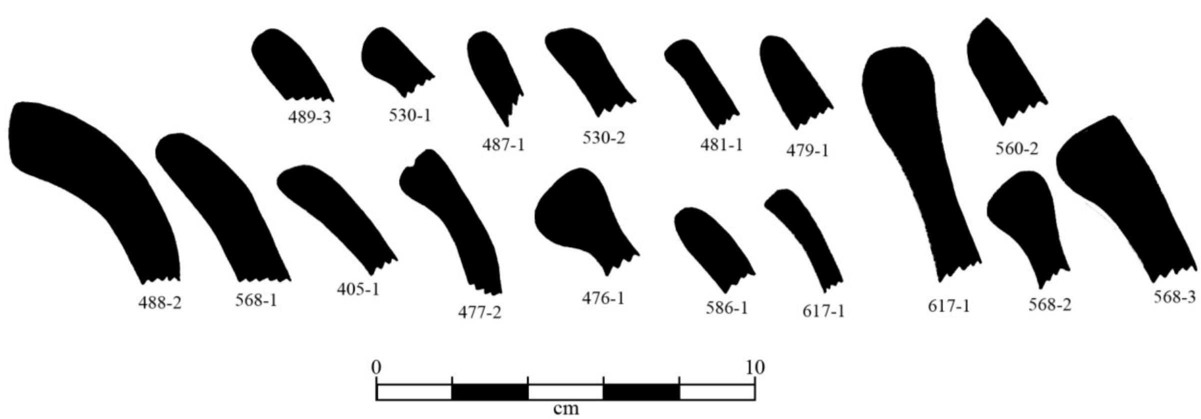

Figure 5-31. Type 1 rim profiles from TUs at MT-FX-06.

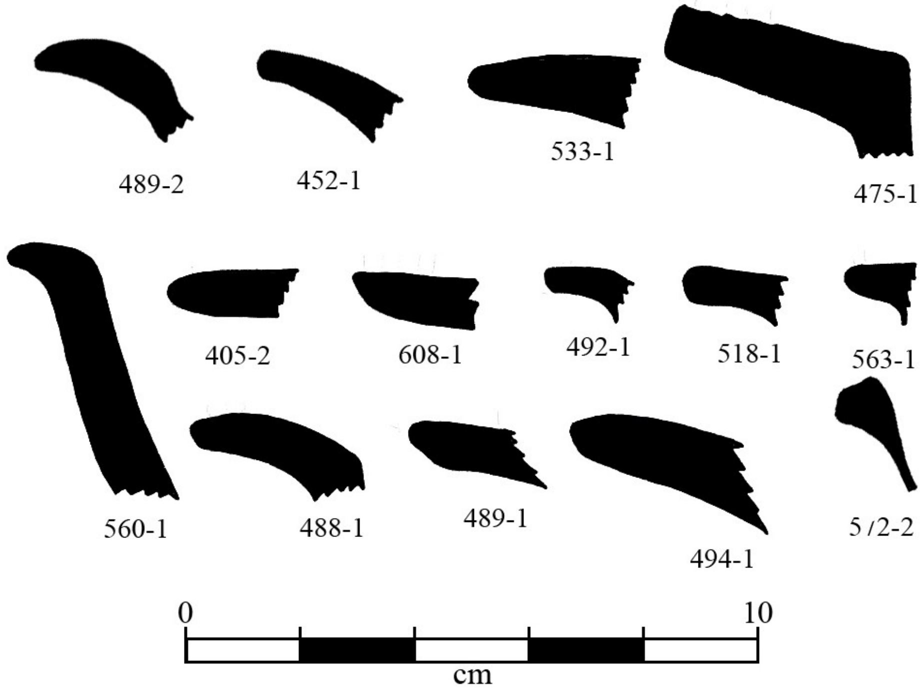

Figure 5-32. Type 2 rim profiles from TUs at MT-FX-06.

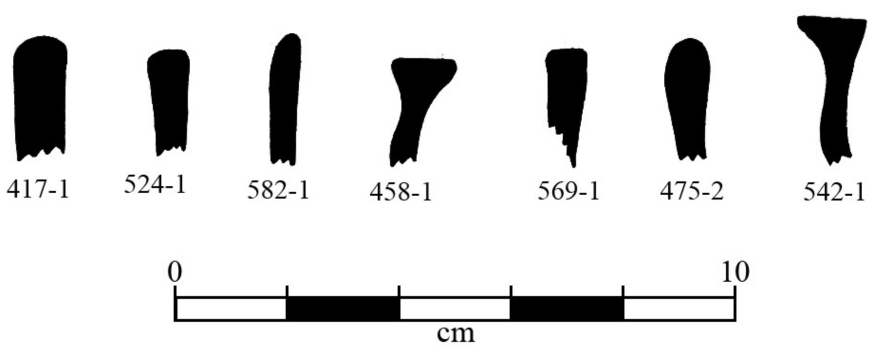

Figure 5-33. Type 3 rim profiles from TUs at MT-FX-06.

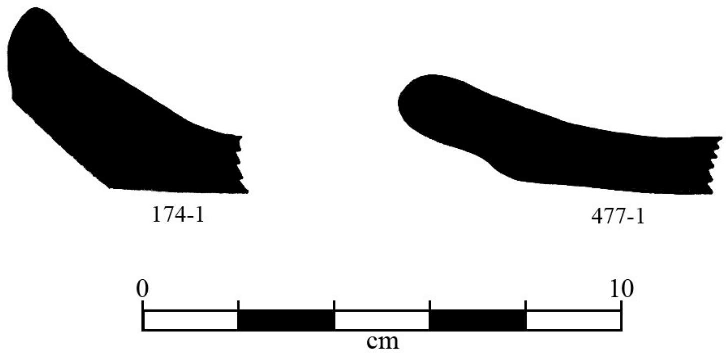

Figure 5-34. Type 4 rim profiles from EUs at MT-FX-06.

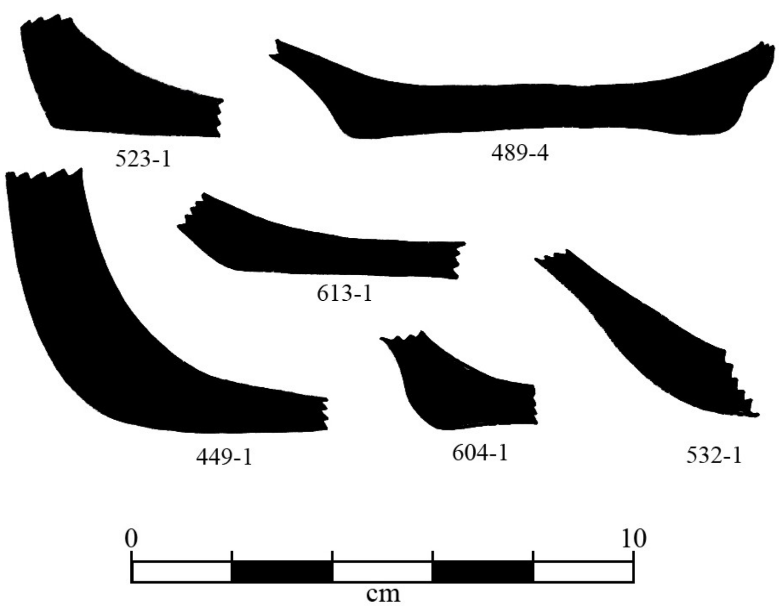

Figure 5-35. Base sherd profiles from TUs at MT-FX-06.

Residential Excavation

Excavation within the residential zone just north of the plaza berm and east of the northern road was conducted in 2005 (Figure 5-36 and Figure 5-39). A house outline (House 1) was identified within this excavation block based on the location of domestic features, post holes, and domestic pottery remains. Radiometric data obtained from wood charcoal (beta 272640, 510 ± 40 BP) from a feature within the block excavation places the occupation of the house sometime between cal A.D.1400 to 1460, or the peak of village elaboration and expansion. Pot-stands, large Type 1 vessels, and other domestic ceramics are associated with this feature. This combination of data substantiates the assignment of the surface collected ceramics to the latest period of occupation at the site. The limited nature of the residential excavation does not provide data sufficient to comment on residential population or density, however, based on this and other subsurface features the layout of the house excavation (Figure 5-36 and Figure 5-37) is consistent with the size and orientation of a modern Kuikuru house and related domestic areas (Figure 5-38).

To further supplement this data, an additional area was surface collected adjacent to the plaza berm south of the house excavation. The surface collection confirmed another domestic area based on the presence of Type 4 vessels in association with Type 1 vessels. Voids in the surface collection area are likely the location of a second house (House 2). Distributions of pottery in the surface collected area further characterize the use and disposal of pottery at the site (Figure 5-39 to Figure 5-49). The surface data show that the distribution of pottery across the site based on function is minimal and mainly restricted to the disposal of Type 4 ceramics.

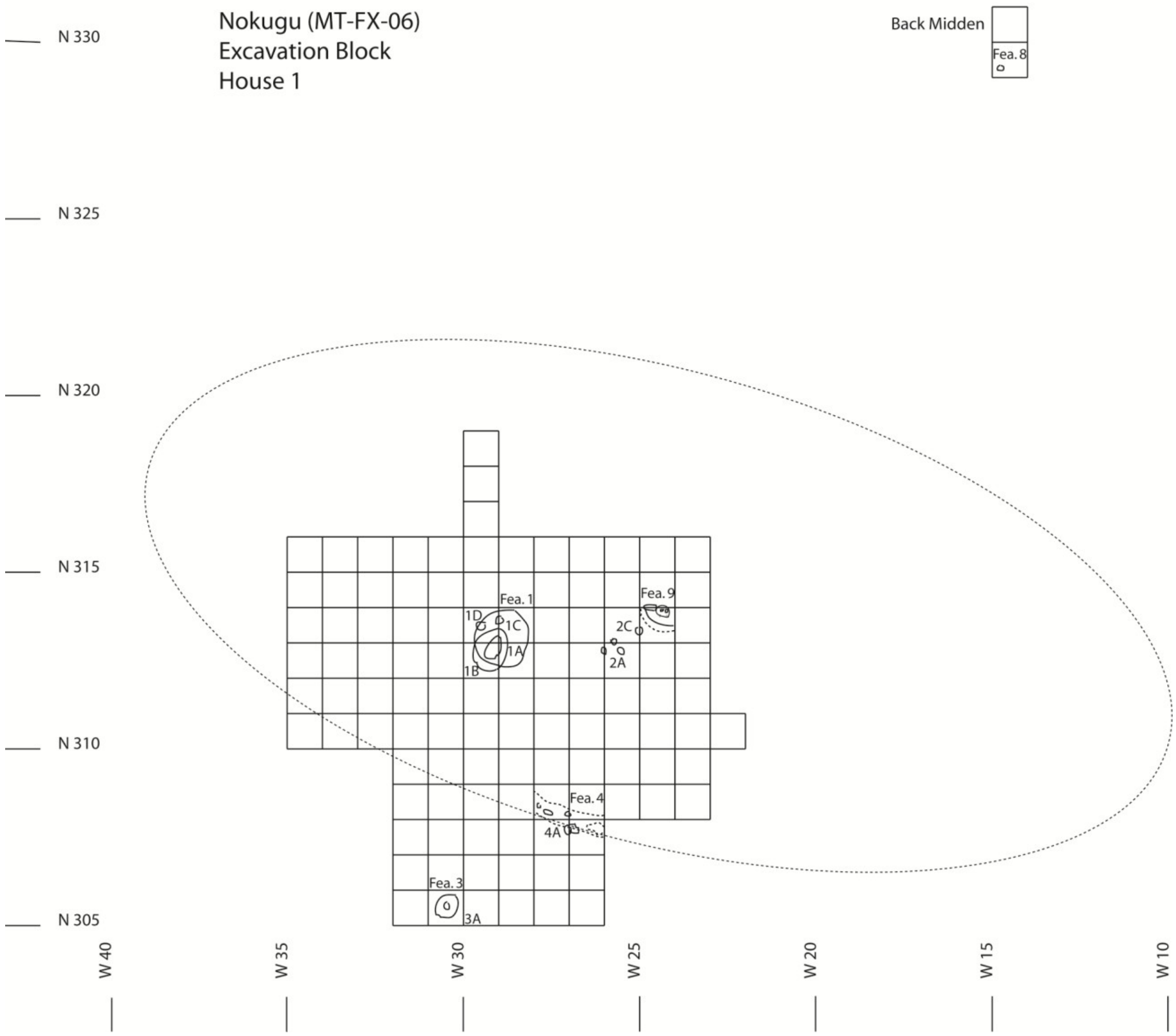

Figure 5-36. Block excavation at MT-FX-06 showing proposed outline of House 1(dashed line) in the peripheral/residential zone north of the main plaza. The House 1 outline is based on the location of central house posts (Feature 9, between N 314 and N 315), wall posts and associated trench (Features 4 and 4a, between N 307 and N 309), and the interior cooking area (Features 1a—1d). A single radiocarbon date obtained from wood charcoal in Feature 9 dates the likely occupation of the house to sometime around A.D. 1450. The rear house midden contained ceramics characteristic of the Late Ipavu Period and Protohistoric Period.

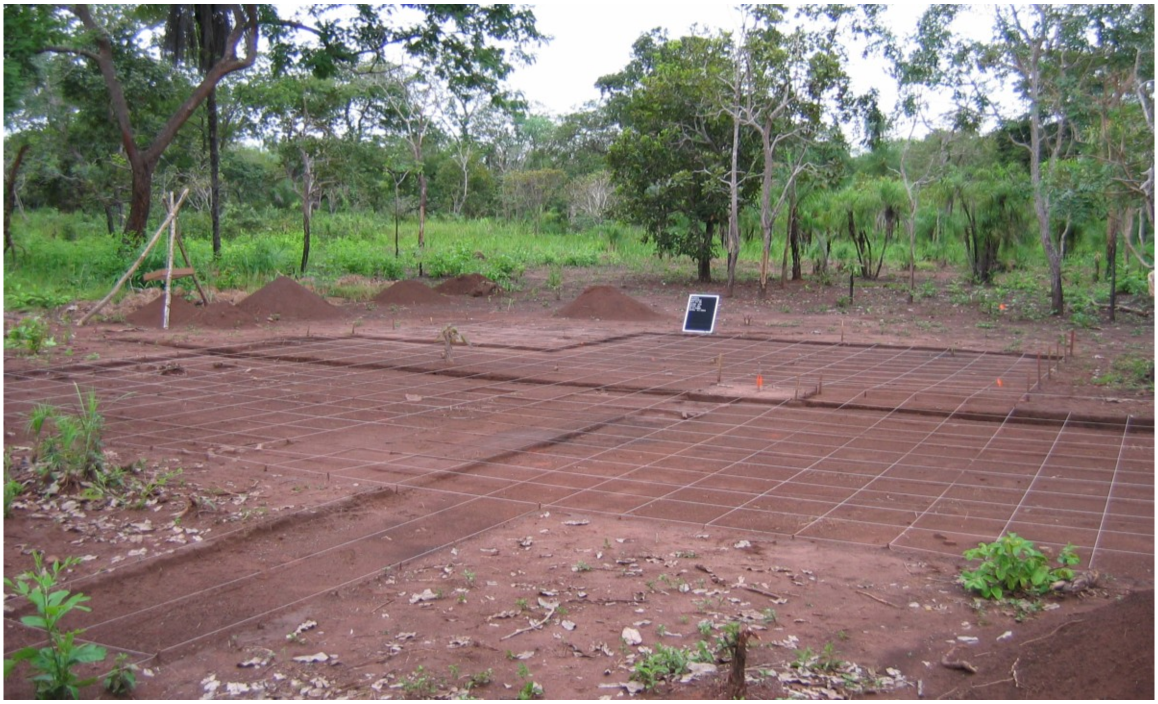

Figure 5-37. South facing view of the block excavation of House 1 at MT-FX-06.

Figure 5-38. Overview of Kuikuru village in 2002 showing newly constructed house frame and older houses arranged around the central plaza. The layout and size of this house is comparable to that hypothesized in the block excavation at MT-FX-06.

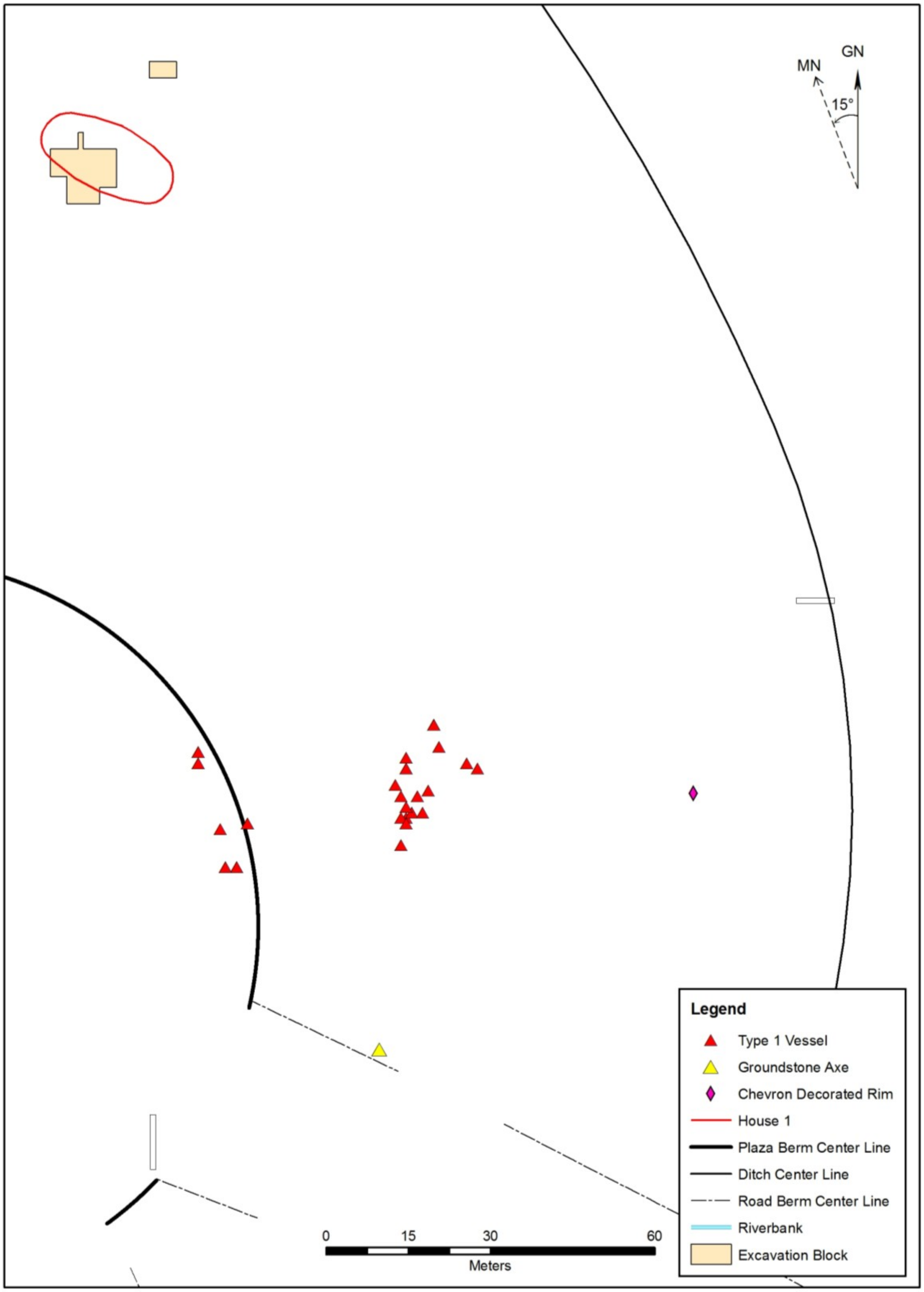

Figure 5-39. Distribution of Type 1 vessels in sub-collection area and in relation to House 1 excavation to the north.

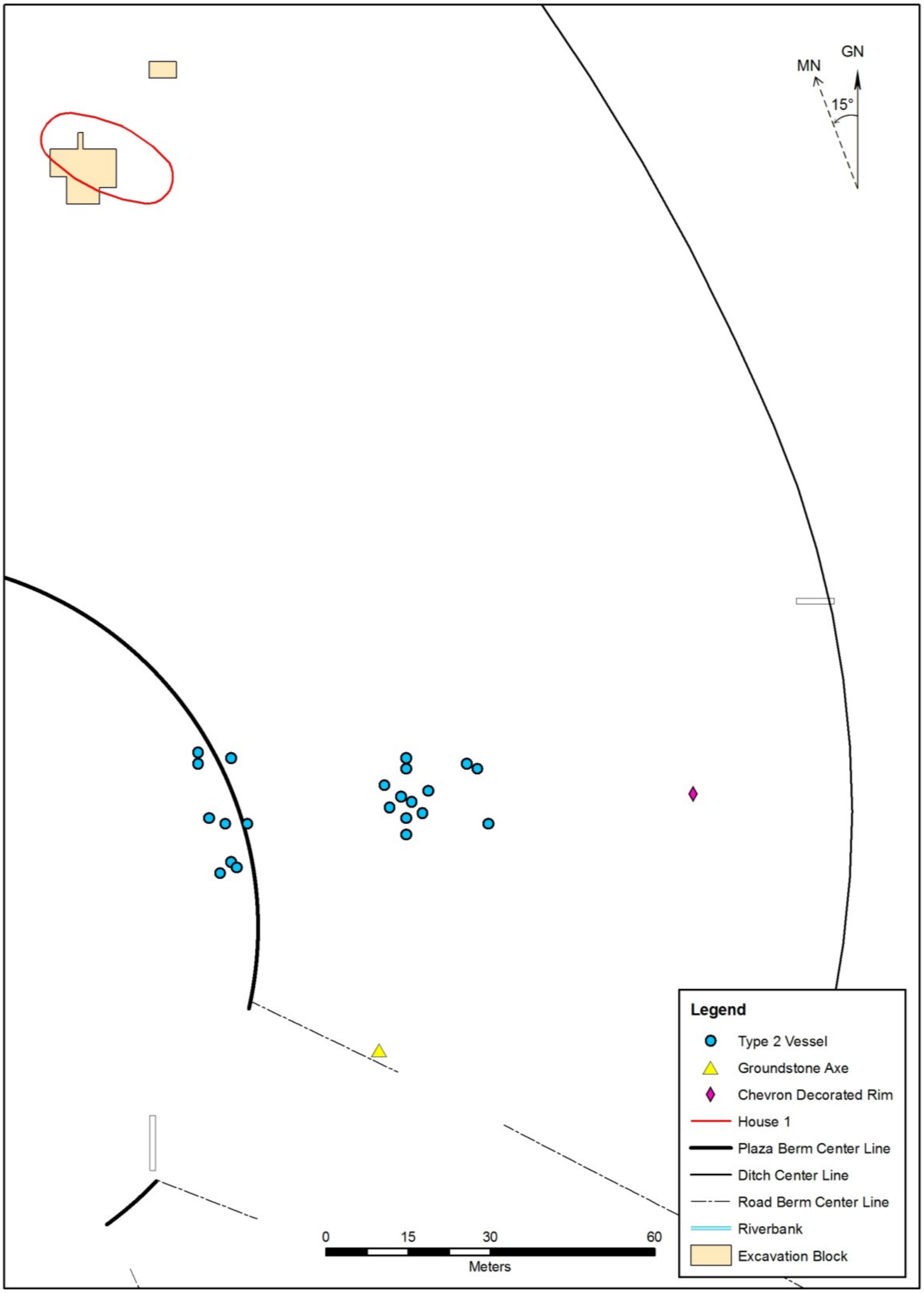

Figure 5-40. Distribution of Type 2 vessels in sub-collection area and in relation to House 1 excavation to the north.

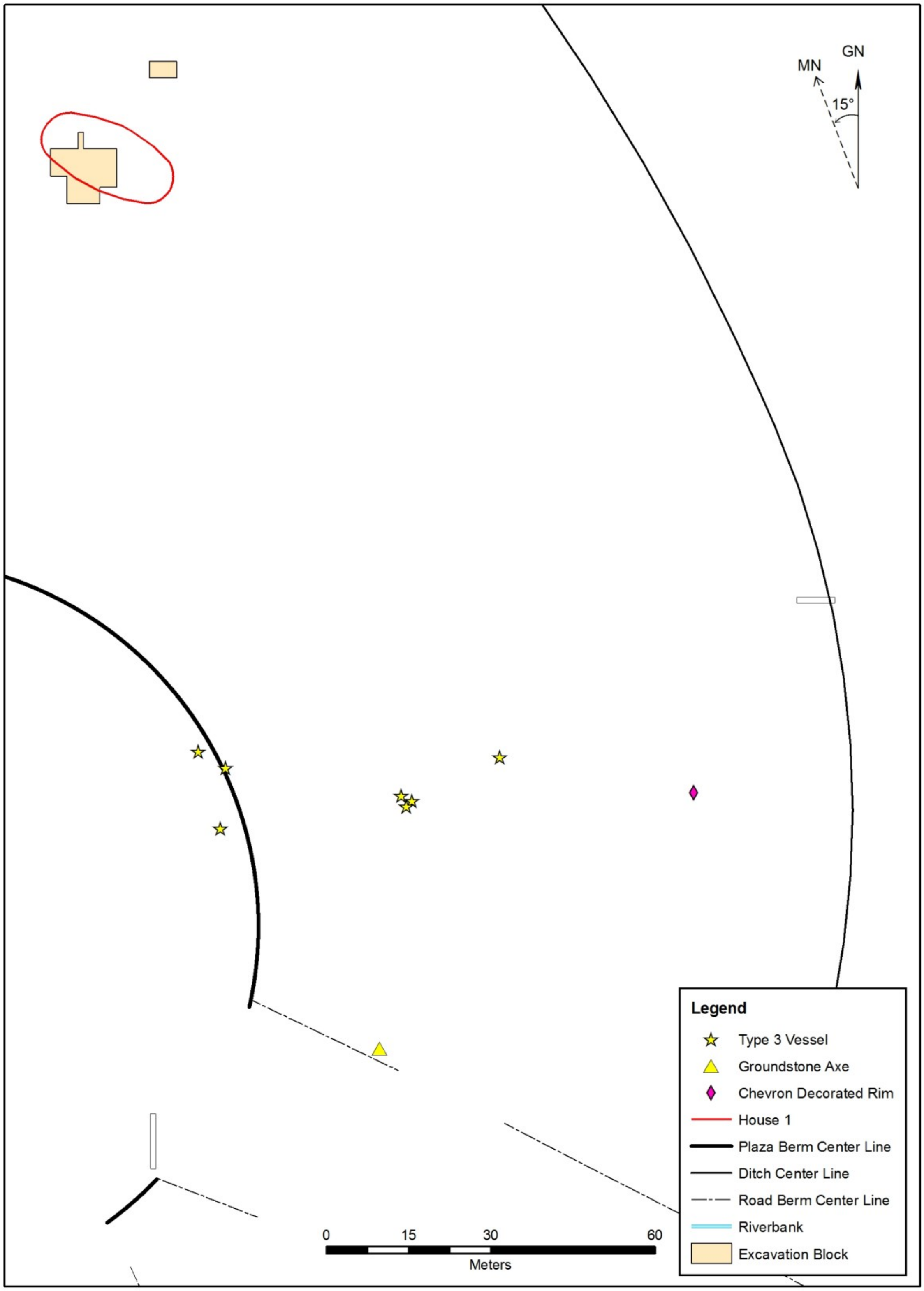

Figure 5-41. Distribution of Type 3 vessels in sub-collection area and in relation to House 1 excavation to the north.

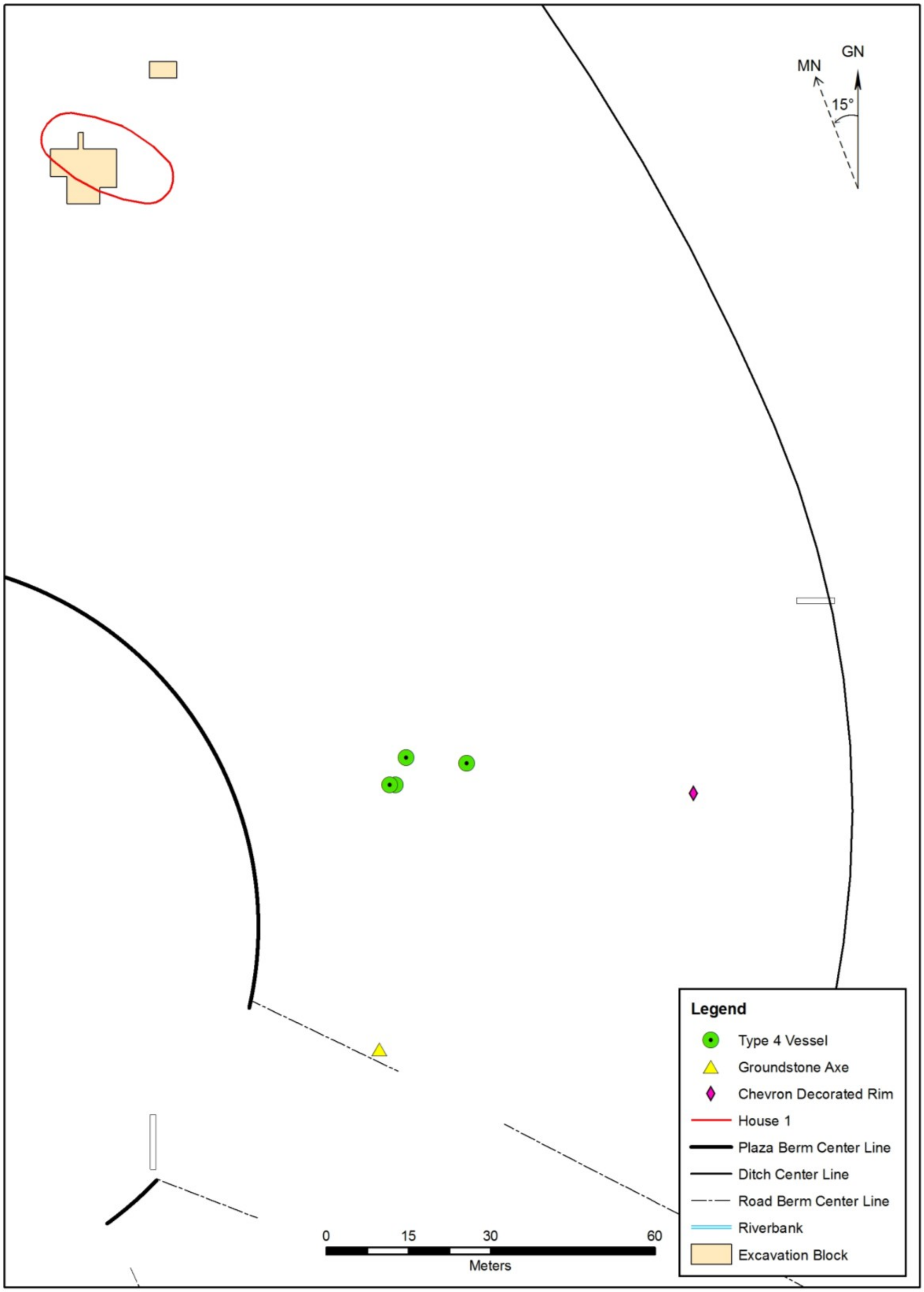

Figure 5-42. Distribution of Type 4 vessels in sub-collection area and in relation to House 1 excavation to the north.

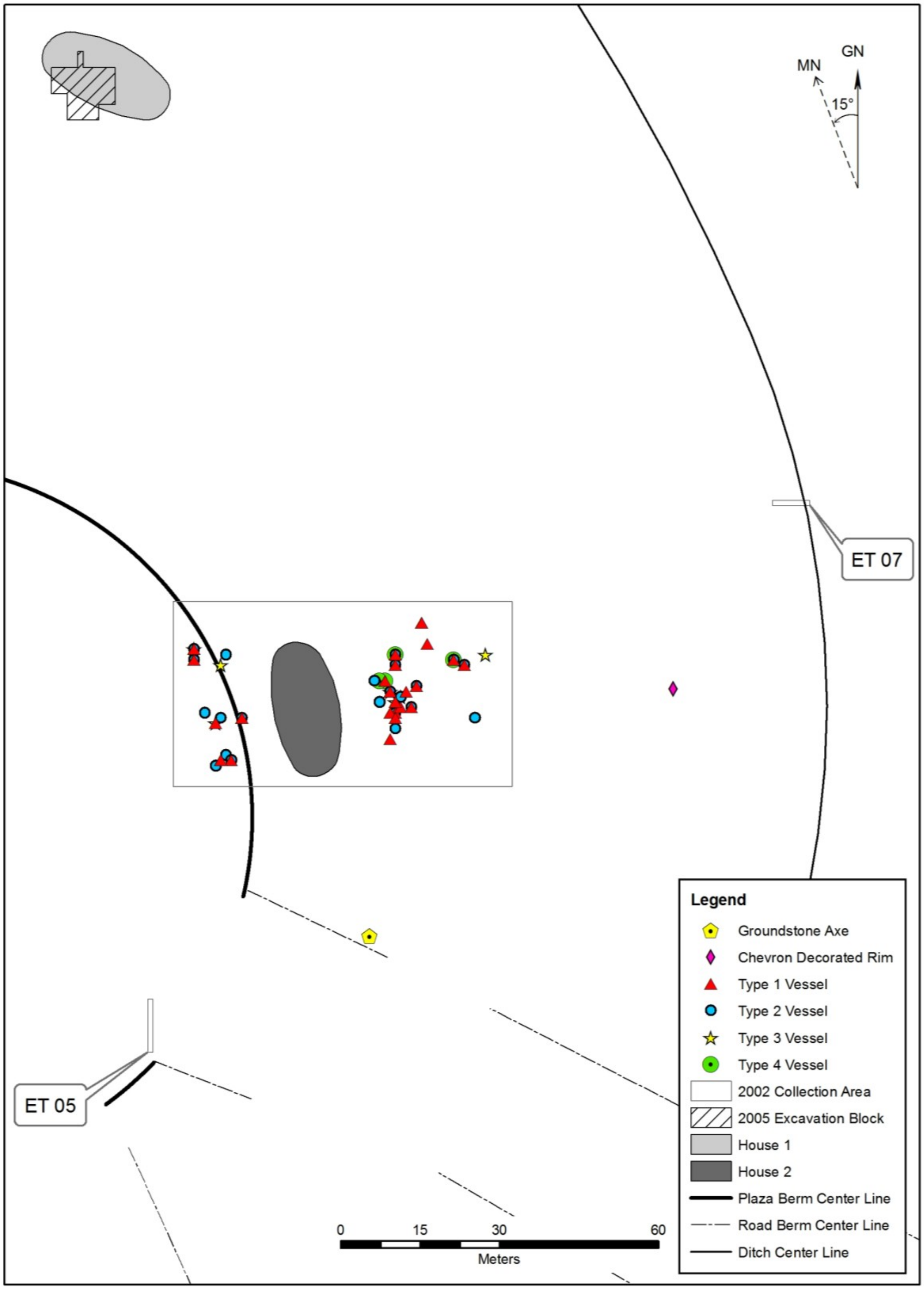

Figure 5-43. Hypothetical location of second house based on distribution of pottery in sub-collection area and in relation to House 1 excavation to the north.

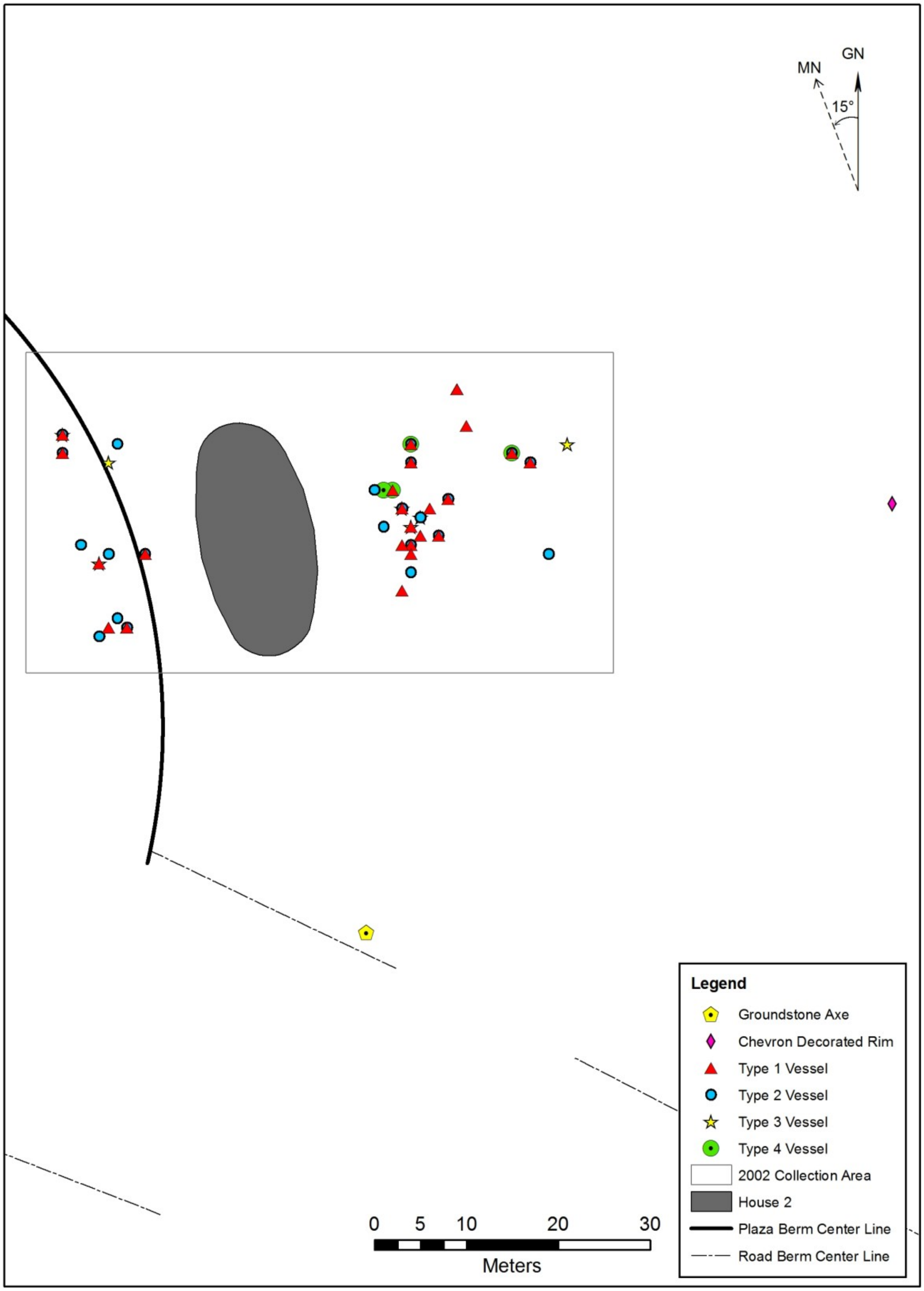

Figure 5-44. Close-up of sub-collection area and hypothetical House 2 location in relation to road and plaza berm.

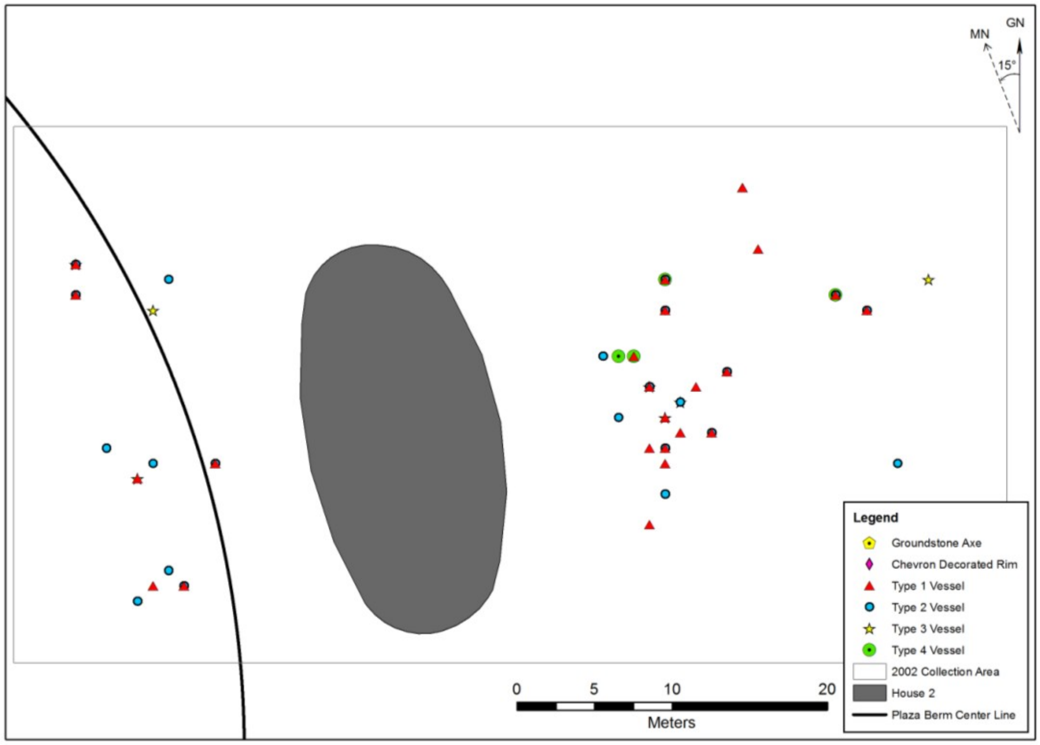

Figure 5-45. Hypothetical House 2 location and vessel type distribution.

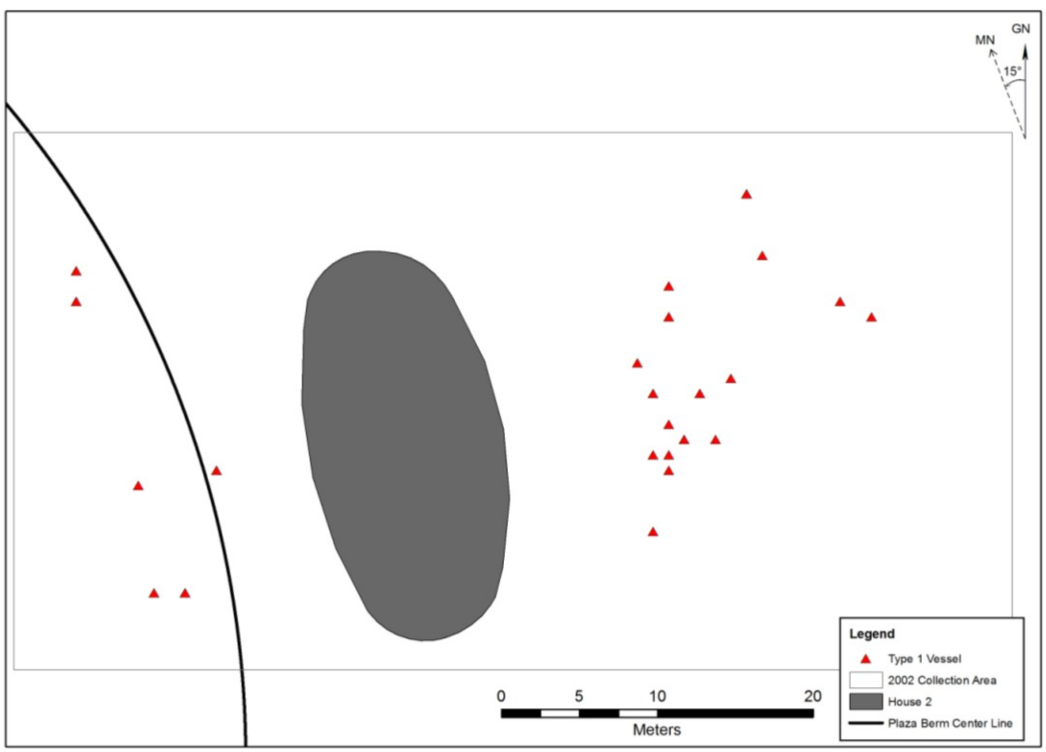

Figure 5-46. Distribution of Type 1 vessels in sub-collection area.

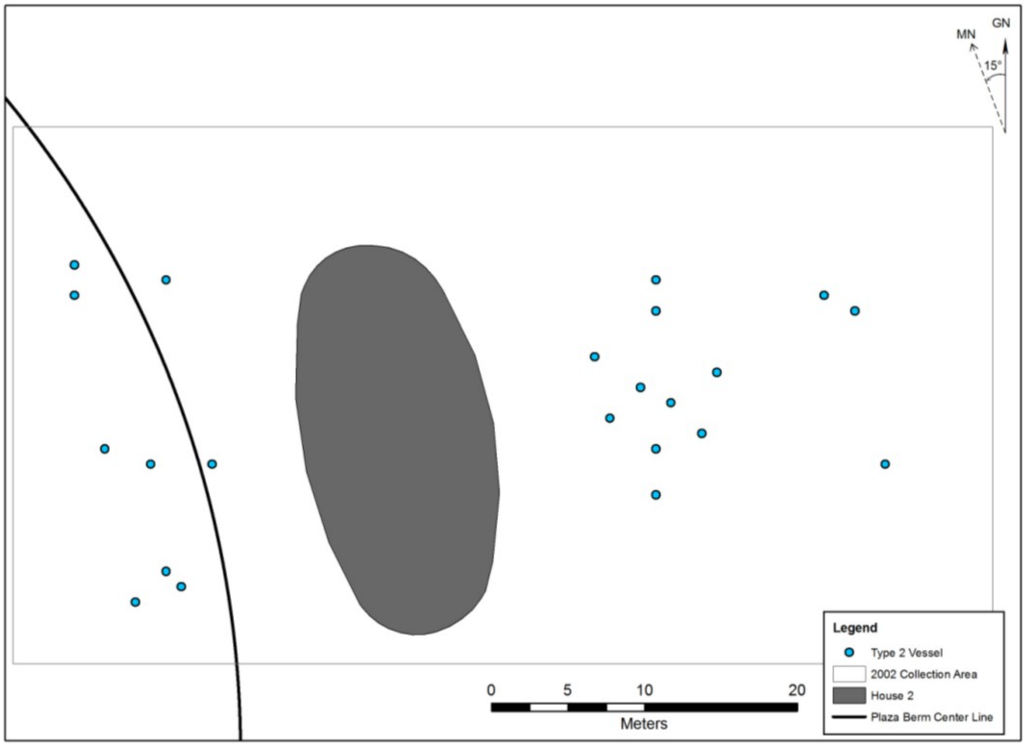

Figure 5-47. Distribution of Type 2 vessels in sub-collection area.

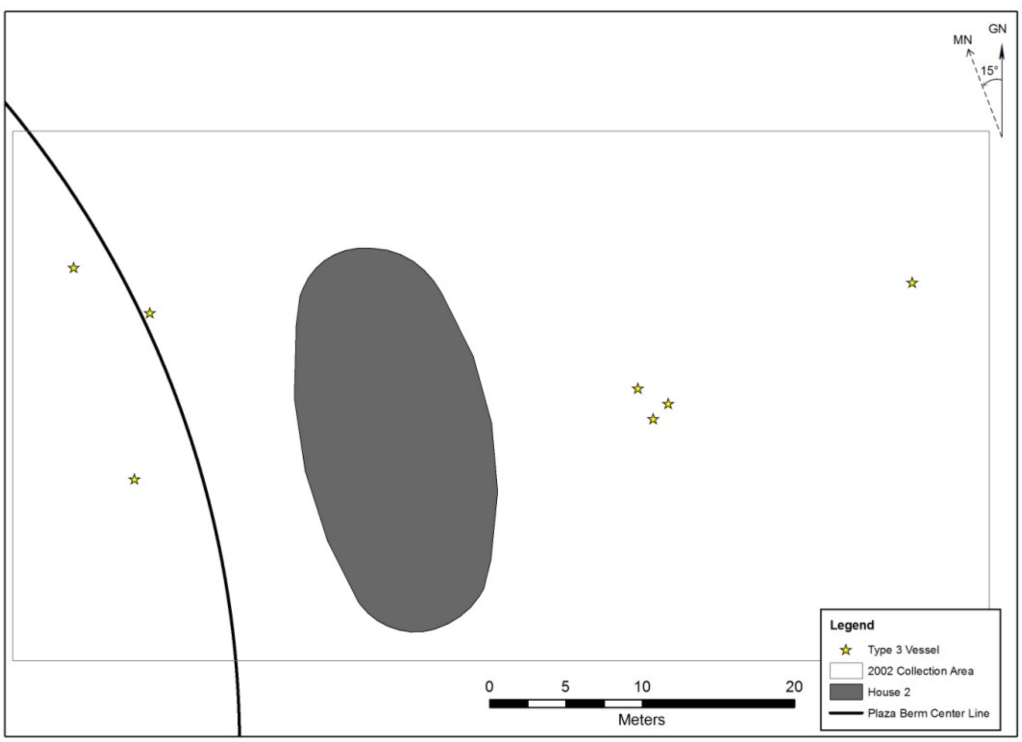

Figure 5-48. Distribution of Type 3 vessels in sub-collection area.

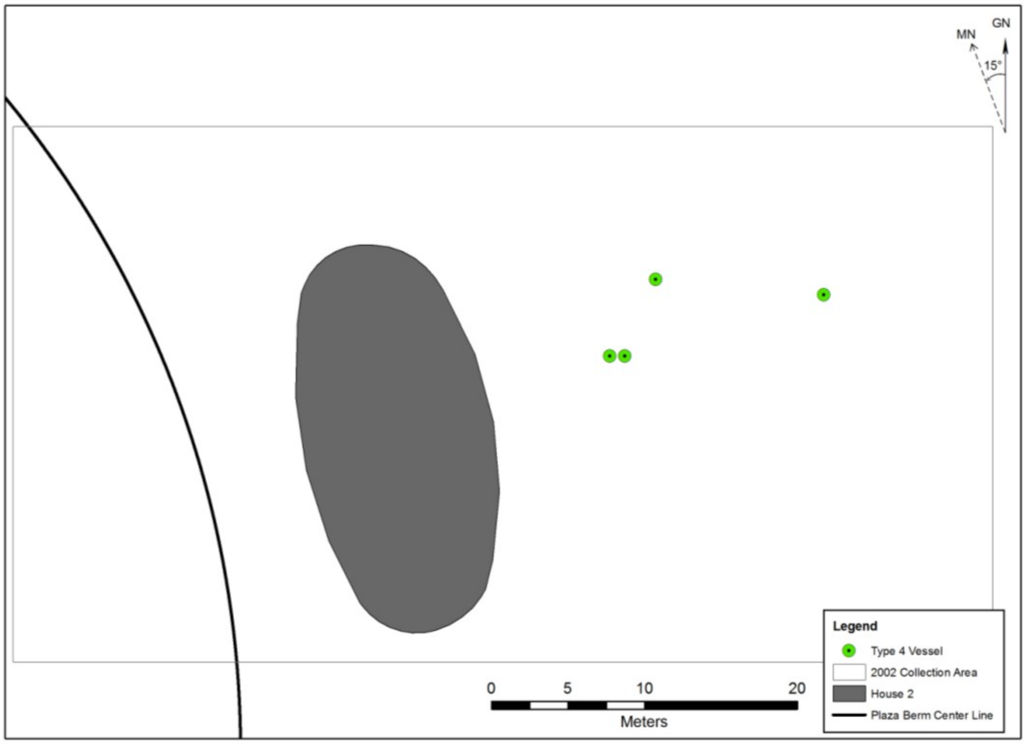

Figure 5-49. Distribution of Type 4 vessels in sub-collection area.

The Heulugihïtï Site (MT-FX-13)

A total of 2,133 ceramic sherds were collected from MT-FX-13 between 2002—2005. This includes specimens collected from systematic surface collection, excavation units (1 x 1 m), and test units (0.5 x 0.5 m) placed across the site. The most ceramics collected were from the surface collections with a total weight of 29.56 kg (n=857). The excavation units yielded a total weight of 6.23 kg (n=189) and test units yielded a total weight of 7.14 kg (n=1,087). Based on the established chronology for the site (like MT-FX-06) and the dating of the accumulation of the plaza mounds the following data are presented as three assemblages, or groups, with the surface data representing the most recent (Group 1), the excavation unit (EU) data representing the middle period (Group 2), and the test unit (TU) data representing the earliest data from the site (Group 3). Means for all metric attributes are presented in Table 5-6 along with average temper contents in Table 5-7 and corresponding t-tests for correlations between means presented in Table 5-8, Table 5-9, and Table 5-10. These tests show that the most statistically significant differences are found in the lip thickness and orifice diameter of Type 1 vessels between Group 1 and Group 3, the same significant difference as found at site MT-FX-06. Additionally at MT-FX-13, the difference between lip thickness in Type 2 vessels between Group 1 and Group 3 is also statistically significant. Just as at site MT-FX-06, the low *n* values for most types within each group likely contributed to the lack of statistically significant differences even though there are clearly visible trends.

Group 1 (Surface Collection)

A total of 857 ceramics, weighing 29.56 kg were collected from all surface collection areas. Of this total 74 pieces were identified as rims. Of the 74 rims 74 percent are Type 1 (n=55), 22 percent are Type 2 (n=16), 3 percent are Type 3 (n=2), and 1 vessel could not be typed. Of these 74 rims only 30 were sufficient for determining orifice diameter. These 30 rims are slightly different statistically to the total 74 in the vessel type breakdown. Of the 30 rims sufficient for measuring orifice diameter 83 percent are Type 1 (n=25), 14 percent are Type 2 (n=4), and 3 percent are Type 3 (n=1).

Type 1 vessels from the surface have an average lip thickness of 1.32 cm (n=55), an average rim thickness of 1.24 cm (n=55), and an average orifice of 52 cm (n=25). Two clearly different variations of Type 1 rims from MT-FX-13 are visible. The most standardized form is the tapered variant (Figure 5-51) and the less standardized form is more gradually flaring like those from MT-FX-06 (Figure 5-52). The range for Type 1 vessel metric attributes is somewhat wide. Lip thickness ranges from .51 to 1.87 cm, rim thickness ranges from .49 to 2.31, and orifice diameter ranges from 12 to 80 cm. This wide range is reflected in the lack of clustering of Type 1 vessels, though they are still mostly separate from Type 2 and Type 3 vessels at least in their large size (Figure 5-50).

Type 2 vessels from the surface have an average lip thickness of 1.07 cm (n=16), an average rim thickness of .1.03 cm (n=16), and an average orifice diameter of 38 cm (n=4) (Figure 5-53, Figure 5-56, and Figure 5-57). Like Type 1 vessels, the range for Type 2 vessel metric attributes is somewhat broad. Lip thickness ranges from .58 to 2.1 cm, rim thickness ranges from .6 to 1.5, and orifice diameter ranges from 13 to 74 cm. Though based on a very small sample size, Type 2 vessels do not cluster together when considered by their thickness to orifice ratio (Figure 5-50).

Type 3 vessels from the surface have an average lip thickness of .73 cm (n=2), an average rim thickness of .74 cm (n=2), and an average orifice diameter of 17 cm (n=1) (Figure 5-53). Lip thickness ranges from .71 to .76 cm, rim thickness ranges from .7 to .78 cm, and orifice diameter on the single available vessel is 17. Type 3 vessels cluster together and with the smaller Type 2 vessels, though again, this is a very small sample size and these statistics are highly suspect (Figure 5-50).

Temper statistics for surface collected vessels were calculated using all 74 rims. They are presented in terms of percent of total temper present. Calculated with all vessels (n=74) the average temper composition is 67 percent *cauíxi*, 15 percent *cariapé*, 9 percent grit, and 9 percent grog. When broken down into vessel types the statistics change somewhat dramatically though this may be due to small sample size. Type 1 vessels (n=55) are 65 percent *cauíxi*, 17 percent *cariapé*, 9 percent grit, and 9 percent grog. Type 2 vessels (n=16) are 80 percent *cauíxi*, 10 percent grog, 6 percent grit, and 4 percent *cariapé*. Type 3 (n=2) vessels are 57 percent *cauíxi*, 15 percent *cariapé*, 14 percent grit, and 14 percent grog.

Surface treatment for all vessels included smoothing with only four vessels showing evidence of scraping. Some Type 1 vessels have exterior surface paint or slip (n=2) but none on the interior and no evidence of interior black paint. Type 2 vessels had no interior paint or slip and only some exterior red paint (n=2). Type 3 vessels showed exterior red paint on only a single vessel.

Of the 74 rims analyzed 65 percent (n=48) were completely fired showing no core and the remaining 35 percent (n=35) were incompletely fired with variably colored cores and margins. Similarly, even the completely fired pieces have variably colored profiles. In addition to Type 4 and base sherd examples that are more variable than those found at MT-FX-06 (Figure 5-54 and Figure 5-55), MT-FX-13 also has several examples of what may be related to the Araquinoid tradition found across the late prehistoric Amazon (Figure 5-56 and Figure 5-57). These examples are decoratively different, fired differently, and made of much darker clay than any pottery from MT-FX-06 further accentuating the differences between these two sites and perhaps others in the Upper Xingu.

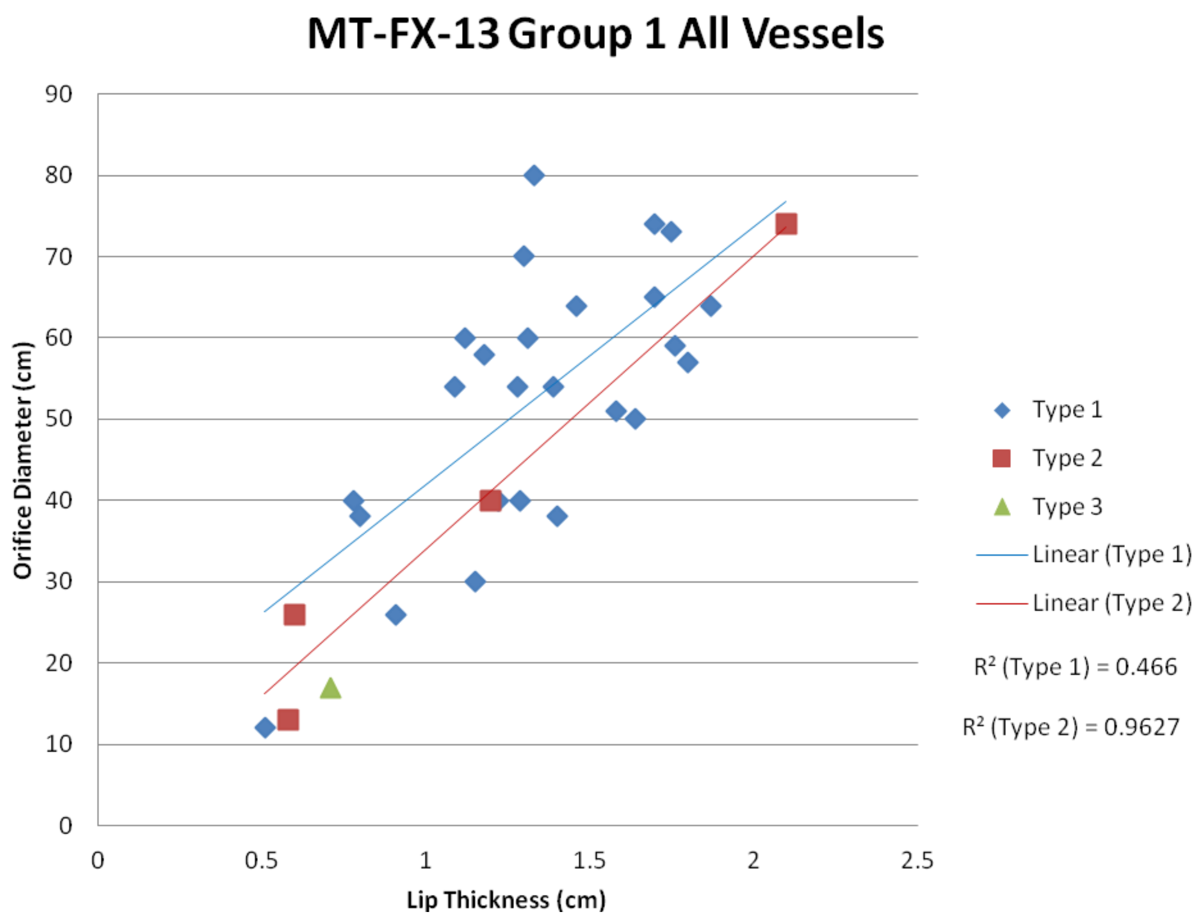

Figure 5-50. Lip thickness and orifice diameter for Group 1 vessels from MT-FX-13.

Table 5-6. Metric attribute means for all vessels in all groups at MT-FX-13.

Assemblage	Measurement	n	Mean	Min	Max	STDEV	CV
Type 1 Group 1	Lip Thickness	55	1.32	0.51	1.87	0.30	0.23
	Rim Thickness	55	1.24	0.49	2.31	0.35	0.28
	Orifice Diameter	25	52.44	12.00	80.00	16.23	0.30
Type 1 Group 2	Lip Thickness	4	1.23	0.84	1.54	0.31	0.25
	Rim Thickness	4	1.31	0.98	1.46	0.22	0.17
	Orifice Diameter	4	56.00	42.00	74.00	16.40	0.29
Type 1 Group 3	Lip Thickness	10	0.95	0.67	1.80	0.35	0.36
	Rim Thickness	10	1.09	0.81	1.95	0.36	0.33
	Orifice Diameter	8	37.00	20.00	68.00	18.00	0.48
Type 2 Group 1	Lip Thickness	16	1.07	0.58	2.10	0.39	0.36
	Rim Thickness	16	1.03	0.60	1.50	0.30	0.29
	Orifice Diameter	4	38.25	13.00	74.00	26.25	0.68
Type 2 Group 2	Lip Thickness	5	0.82	0.52	1.20	0.27	0.33
	Rim Thickness	5	0.74	0.45	1.09	0.27	0.36
	Orifice Diameter	5	29.00	12.00	60.00	26.90	0.93
Type 2 Group 3	Lip Thickness	6	0.70	0.45	1.14	0.22	0.32
	Rim Thickness	6	0.86	0.71	1.00	0.14	0.16
	Orifice Diameter	1	21.00	*	*	*	*
Type 3 Group 1	Lip Thickness	2	0.73	0.71	0.76	0.03	0.04
	Rim Thickness	2	0.74	0.70	0.78	0.05	0.07
	Orifice Diameter	1	17.00	*	*	*	*
Type 3 Group 2	Lip Thickness	1	1.27	*	*	*	*
	Rim Thickness	1	0.68	*	*	*	*
	Orifice Diameter	1	32.00	*	*	*	*
				*	*	*	*
Type 3 Group 3	Lip Thickness	1	0.88	*	*	*	*
	Rim Thickness	1	0.66	*	*	*	*
	Orifice Diameter	1	20.00	*	*	*	*

Table 5-7. Average temper content for all vessels in all groups at MT-FX-13.

		Type 1		Type 2		Type 3		All Types	
Assemblage	Temper	n	Mean	n	Mean	n	Mean	n	Mean
Group 1	Cauixi	55	65.00	16	80.00	2	57.00	73	67.00
	Cariape	55	17.00	16	4.00	2	15.00	73	15.00
	Grit	55	9.00	16	6.00	2	14.00	73	9.00
	Grog	55	9.00	16	10.00	2	14.00	73	9.00
Group 2	Cauixi	4	54.00	5	100.00	1	0.00	10	64.00
	Cariape	4	32.00	5	0.00	1	33.00	10	21.00
	Grit	4	14.00	5	0.00	1	0.00	10	12.00
	Grog	4	0.00	5	0.00	1	67.00	10	3.00
Group 3	Cauixi	10	58.00	6	62.00	1	62.00	17	60.00
	Cariape	10	24.00	6	22.00	1	0.00	17	22.00
	Grit	10	15.00	6	5.00	1	0.00	17	12.00
	Grog	10	3.00	6	11.00	1	33.00	17	6.00

Table 5-8. T-test for equality of means for lip thickness measurements at MT-FX-13.

	t	df	two-tailed P value	mean difference	standard error of difference	95% confidence interval of the difference lower	upper	statistical significance
Lip Thickness Type 1								
Group 1 vs. Group 2	0.5783	57	0.5654	0.09	0.156	-0.2217	0.4017	not statistically significant
Group 1 vs. Group 3	3.4985	63	0.0009	0.37	0.106	0.1587	0.5813	extremely statistically significant
Group 2 vs. Group 3	1.3902	12	0.1897	0.28	0.201	-0.1588	0.7188	not statistically significant
Lip Thickness Type 2								
Group 1 vs. Group 2	1.3259	19	0.2006	0.25	0.189	-0.1446	0.6446	not statistically significant
Group 1 vs. Group 3	2.1759	20	0.0417	0.37	0.170	0.0153	0.7247	statistically significant
Group 2 vs. Group 3	0.8139	9	0.4367	0.12	0.147	-0.2135	0.4535	not statistically significant
Lip Thickness Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

Table 5-9. T-test for equality of means for rim thickness measurements at MT-FX-13.

	t	df	two-tailed P value	mean difference	standard error of difference	95% confidence interval of the difference		statistical significance
						lower	upper	
Rim Thickness Type 1								
Group 1 vs. Group 2	0.3925	57	0.6962	-0.07	0.178	-0.4271	0.2871	not statistically significant
Group 1 vs. Group 3	1.2415	63	0.2190	0.15	0.121	-0.0914	0.3914	not statistically significant
Group 2 vs. Group 3	1.1248	12	0.2827	0.22	0.196	-0.2062	0.6462	not statistically significant
Rim Thickness Type 2								
Group 1 vs. Group 2	1.9256	19	0.0692	0.29	0.151	-0.0252	0.6052	not quite statistically significant
Group 1 vs. Group 3	1.3198	20	0.2018	0.17	0.129	-0.0987	0.4387	not statistically significant
Group 2 vs. Group 3	0.9525	9	0.3657	-0.12	0.126	-0.4050	0.1650	not statistically significant
Rim Thickness Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

Table 5-10. T-test for equality of means for lip orifice diameter measurements at MT-FX-13.

						95% confidence interval of the difference		
	t	df	two-tailed P value	mean difference	standard error of difference	lower	upper	statistical significance
Orifice Diameter Type 1								
Group 1 vs. Group 2	0.4068	27	0.6873	-3.56	8.750	-21.5142	14.3942	not statistically significant
Group 1 vs. Group 3	2.2835	31	0.0294	15.44	6.762	1.6494	29.2306	statistically significant
Group 2 vs. Group 3	1.7694	10	0.1073	19.00	10.738	-4.9260	42.9260	not statistically significant
Orifice Diameter Type 2								
Group 1 vs. Group 2	0.5179	7	0.6205	9.25	17.860	-32.9810	51.4810	not statistically significant
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Orifice Diameter Type 3								
Group 1 vs. Group 2	*	*	*	*	*	*	*	not sufficient data
Group 1 vs. Group 3	*	*	*	*	*	*	*	not sufficient data
Group 2 vs. Group 3	*	*	*	*	*	*	*	not sufficient data

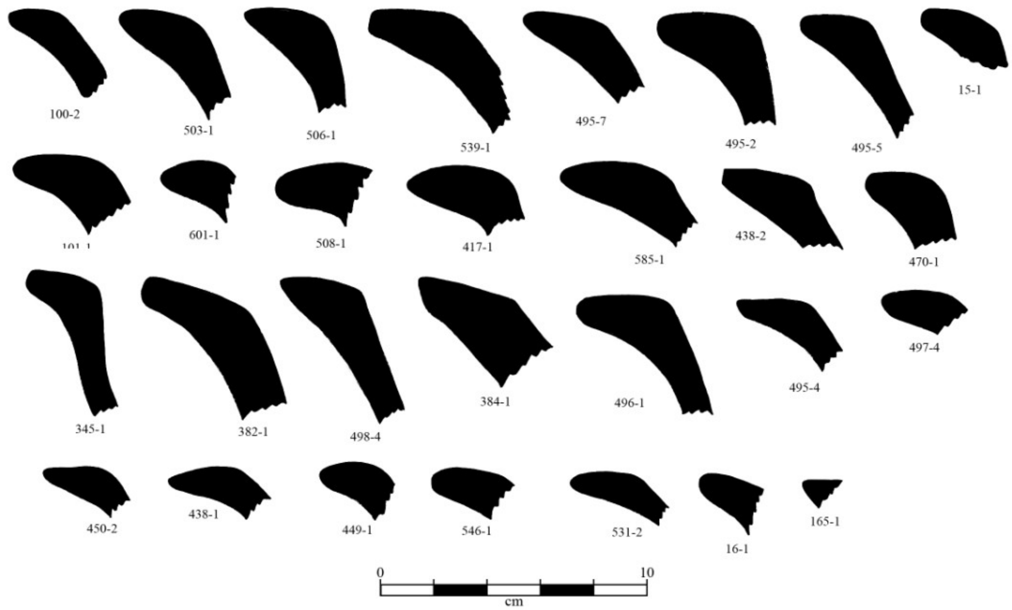

Figure 5-51. Type 1 rim profiles (tapered variant) from surface collection at MT-FX-13.

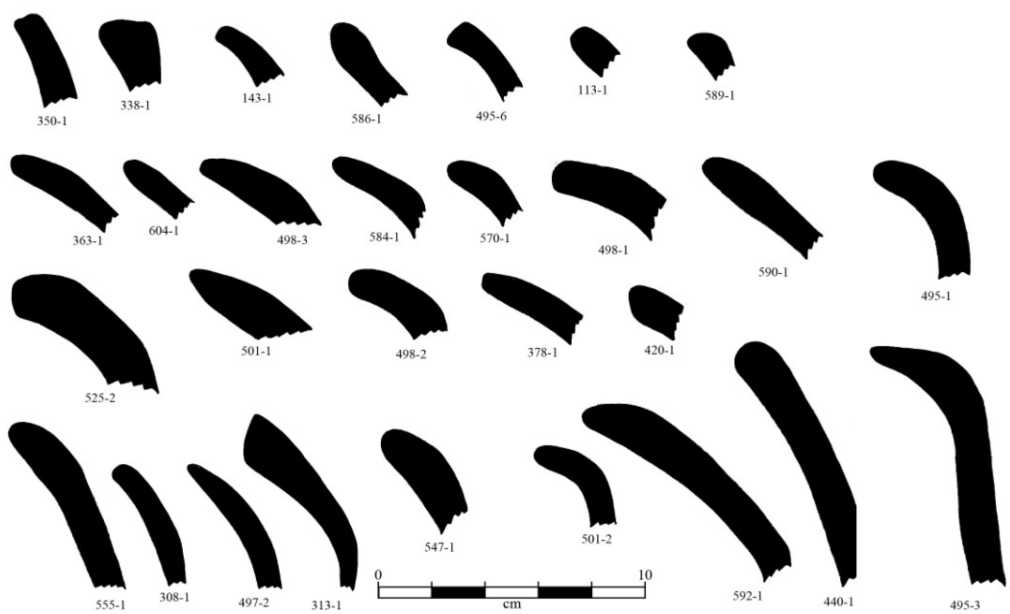

Figure 5-52. Type 1 rim profiles (other variant) from surface collection at MT-FX-13.

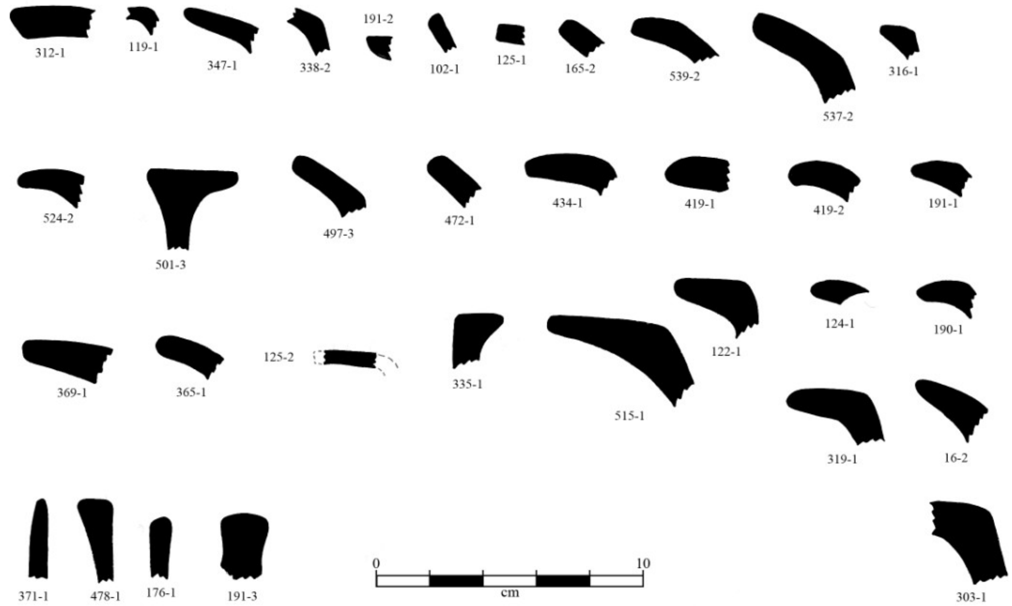

Figure 5-53. Type 2 and Type 3 rim profiles from surface collection at MT-FX-13.

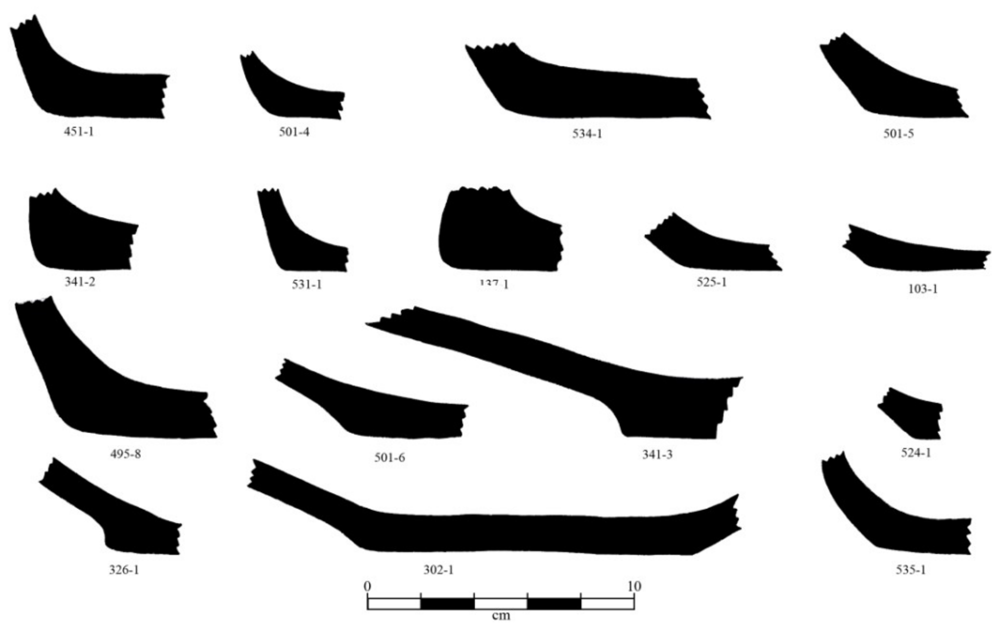

Figure 5-54. Vessel base profiles from surface collection at MT-FX-13.

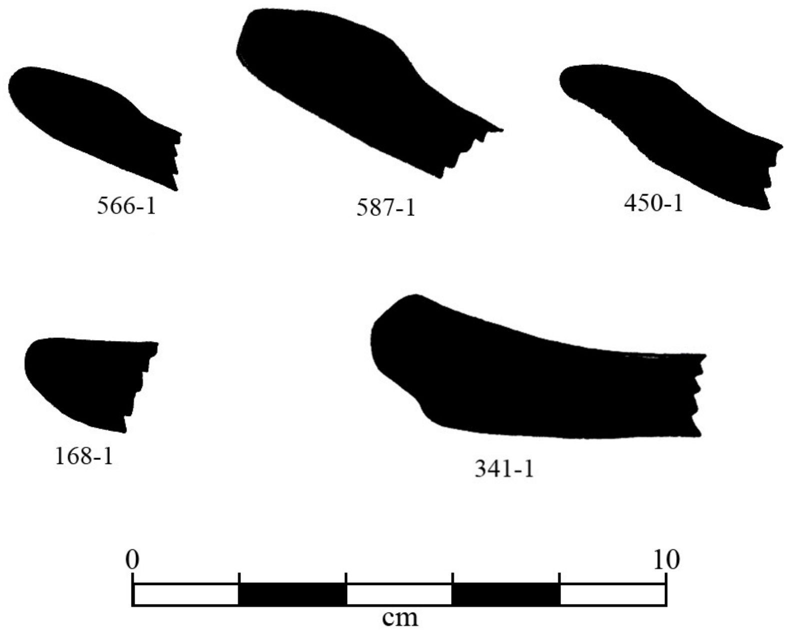

Figure 5-55. Type 4 rim profiles from surface collection at MT-FX-13.

Figure 5-56. Type 2 adorno (Araquinoid-like) from surface collection at MT-FX-13.

Figure 5-57. Type 2 rim from surface collection at MT-FX-13.

Group 2 (Plaza Berm)

A total of 189 ceramics, weighing 6.23 kg, were collected from all levels of the single 1.0 x 5.0 m EU placed at the end of ET01 at MT-FX-13 and the five 1.0 x 1.0 m EU's placed inside and just outside the main plaza. Of this total only 22 pieces were identified as rims and only 10 of those were complete enough to obtain comparable data and determine vessel type. Although this is a very small number to obtain statistically significant data from, it is presented here for comparison. Of the 10 rims 40 percent are Type 1 (n=4), 50 percent are Type 2 (n=5), 10 percent are Type 3 (n=1). Of these 10 rims all were sufficient for determining orifice diameter.

Type 1 vessels from the plaza berm have an average lip thickness of 1.23 cm (n=4), an average rim thickness of 1.31 cm (n=4), and an average orifice of 56 cm (n=4). Lip thickness ranges from .84 to 1.54 cm, rim thickness ranges from .98 to 1.46, and orifice diameter ranges from 42 to 74 cm. This wide range is reflected in the lack of clustering of Type 1 vessels though they are still mostly separate from Type 2 and Type 3 vessels at least in their large size (Figure 5-58).

Type 2 vessels from the plaza berm have an average lip thickness of .82 cm (n=16), an average rim thickness of .75 cm (n=5), and an average orifice diameter of 29 cm (n=5). Lip thickness ranges from .52 to 1.2 cm, rim thickness ranges from .45 to 1.09, and orifice diameter ranges from 12 to 60 cm. One significantly decorated Type 2 rim exhibits Araquinoid like decoration (Figure 5-59). Though based on a very small sample size Type 2 vessels do cluster together when considered by their thickness to orifice ratio with one exceptionally large vessel represented (Figure 5-58). Only a single Type 3 vessel was recorded from the plaza berm excavation with a lip thickness of 1.27 cm, a rim thickness of .68 cm, and an orifice diameter of 32 cm.

Temper statistics for plaza berm vessels were calculated using all 22 rims. They are presented in terms of percent of total temper present. Calculated with all vessels (n=22) the average temper composition is 64 percent *cauíxi*, 21 percent *cariapé*, 12 percent grit, and 3 percent grog. When broken down into vessel types the statistics change somewhat dramatically though this may be due to small sample size. Type 1 vessels (n=4) are 54 percent *cauíxi*, 32 percent *cariapé*, 14 percent grit, and no grog present. Type 2 vessels (n=5) are 100 percent *cauíxi* with no *cariapé*, grit, or grog, and very high levels of *cauíxi*. The single Type 3 vessel is 33 percent *cariapé* and 67 percent grog, a very unique mixture and likely not representative of Type 3 vessels.

Surface treatment for all vessels included smoothing with only three vessels showing evidence of scraping. Some Type 1 vessels have exterior surface paint or slip (n=2) but none on the interior and no evidence of interior black paint. Type 2 and Type 3 vessels had no interior paint or slip but all showed burnishing on the interior and exterior surface (n=6). Of the 22 rims analyzed 82 percent (n=18) were completely fired showing no core and the remaining 18 percent (n=4) were incompletely fired. Unlike vessels from MT-FX-06 all of the core colors and margins ranged from black to very dark brown or dark gray.

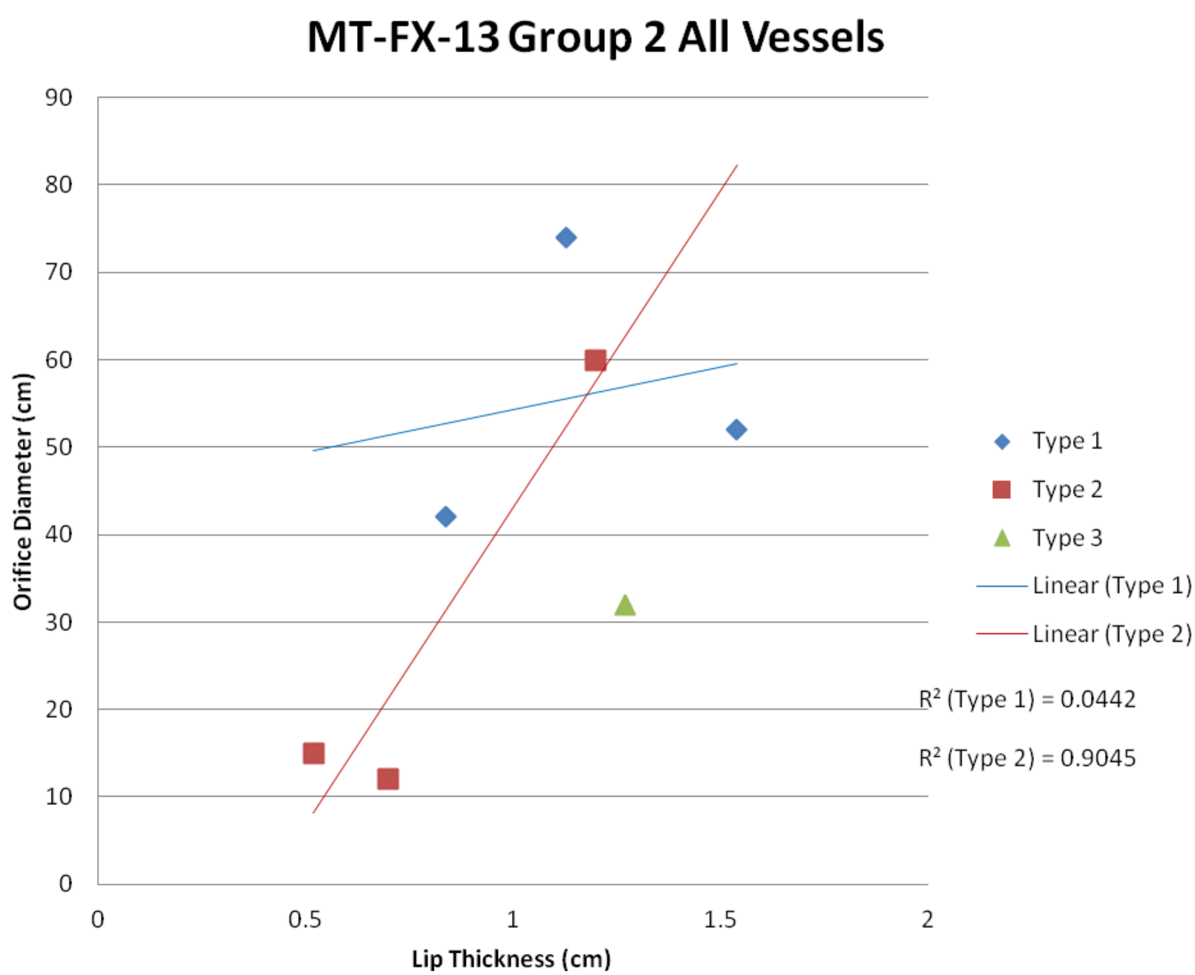

Figure 5-58. Lip thickness and orifice diameter for all Group 2 vessels from MT-FX-13.

Figure 5-59. Type 2 rim (Araquinoid-like) from EU at MT-FX-13.

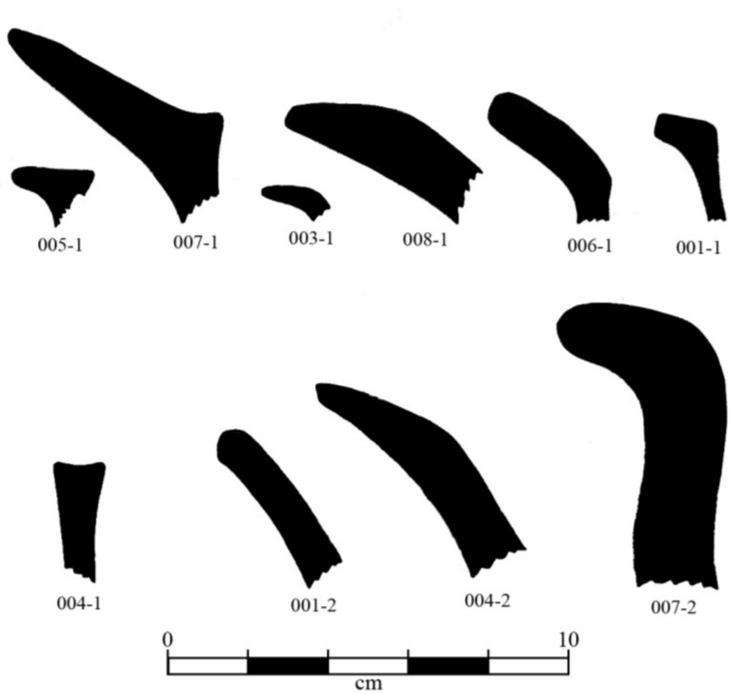

Figure 5-60. Type 1 (bottom right), Type 2 (top row), and Type 3 (bottom left, 004-1) rim profiles from EU at MT-FX-13.

Group 3 (Plaza Peripheral Excavations)

A total of 1,087 ceramics, weighing 7.14 kilograms, were collected from all test unit excavations in the plaza peripheral areas of MT-FX-13. Of this total 18 pieces were identified as rims. Of the 18 rims, 17 could be accurately assigned to a vessel type. Of the 17 rims 59 percent are Type 1 (n=10), 35 percent are Type 2 (n=6), and 6 percent are Type 3 (n=1). Of these 17 rims only 10 were sufficient for determining orifice diameter. These 10 rims are somewhat skewed statistically compared to the total 17 in the vessel type breakdown likely due to the small sample size. Of the10 rims sufficient for measuring orifice diameter 80 percent are Type 1 (n=8), 10 percent are Type 2 (n=1), and 10 percent are Type 3 (n=1).

Type 1 vessels from the test unit excavations have an average lip thickness of .95 cm (n=17), an average rim thickness of 1.10 cm (n=17), and an average orifice of 37 cm (n=10). The range for Type 1 vessel metric attributes is somewhat narrower than for surface collected Type 1 vessels. Lip thickness ranges from .67 to 1.80 cm, rim thickness ranges from .81 to 1.95, and orifice diameter ranges from 20 to 68 cm. Type 1 vessels generally cluster together and mostly separate from Type 2 and Type 3 vessels but not as distinctly as in the surface assemblage and less than the unit assemblage, though the sample size is very small (Figure 5-62).

Type 2 vessels from the test unit excavations have an average lip thickness of .70 cm (n=6), an average rim thickness of .86 cm (n=6), and an average orifice diameter of 21 cm (n=1). Like Type 1 vessels, the range for Type 2 vessel metric attributes is narrower in the test unit excavations. Lip thickness ranges from .45 to 1.14 cm, rim thickness ranges from .71 to 1.00, and orifice diameter on the only vessel measurable is 21 cm. One Type 2 rim adorno, too small to measure metric attributes, does have significant Araquinoid like decoration (Figure 5-61). The single Type 2 vessel large enough to be measured is separate from the Type 1 and Type 3 vessels when considered by orifice to thickness ratio (Figure 5-62).

A single Type 3 vessel was identified from the test unit excavations and has a lip thickness of .88 cm, a rim thickness of .66 cm, and an orifice diameter of 20 cm. The single Type 3 vessel is separate from the Type 1 and Type 2 vessels when considered for orifice to thickness ration (see Figure 5-62).

Figure 5-61. Type 2 rim adorno (Arquinoid-like) from TU at MT-FX-13.

Temper statistics for test unit vessels were calculated using all 17 rims. Calculated with all vessels (n=17) the average temper composition is 60 percent *cauíxi*, 22 percent *cariapé*, 12 percent grit, and 6 percent grog. When broken down into vessel types the statistics remain relatively consistent. Type 1 vessels (n=10) are 58 percent *cauíxi*, 24 percent *cariapé* 15 percent grit, and 3 percent grog. Type 2 vessels (n=6) are 62 percent *cauíxi*, 22 percent *cariapé*, 5 percent *grit*, and 11 percent grog. The sole Type 3 vessel is 62 percent *cauíxi*, 33 percent grit, with no *cariapé* or grog. Surface treatment for all vessels included smoothing, occasional burnishing (n=2), and scraping (n=3). One Type 2 vessel has red paint present on the outside surface. Of the 17 rims analyzed 76 percent (n=13) were completely fired showing and 24 percent (n=4) were incompletely fired. Core colors ranged from black to very dark brown.

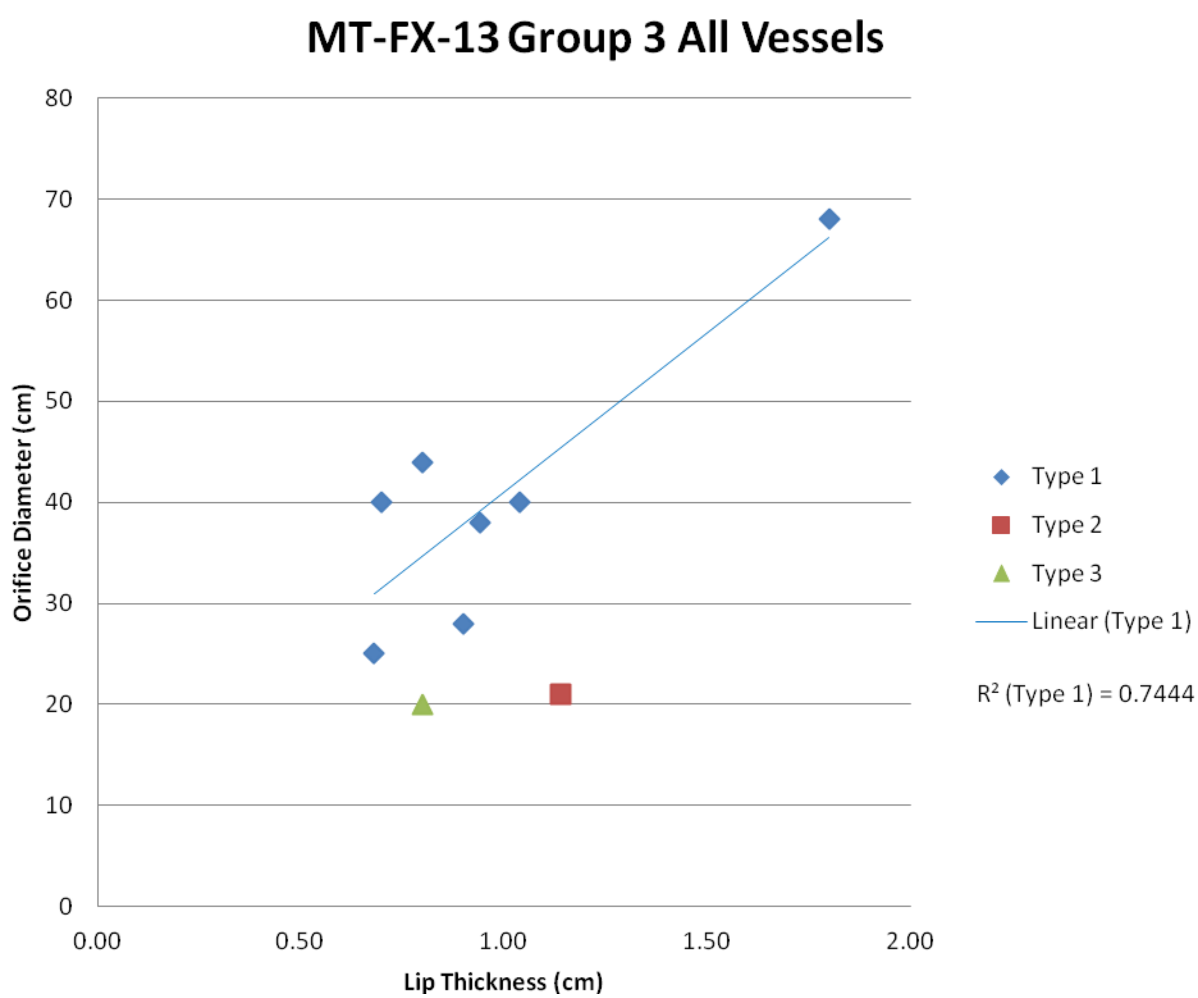

Figure 5-62. Lip thickness and oral diameter for all Group 3 vessels from MT-FX-13.

Other Upper Xingu Sites

Alto Xingu

Data for this the Alto Xingu or AX designated sites is limited to that collected by Mario Simões at MT-AX-01 Posto Diauarum and reevaluated at the MPEG. Statistical data collected from Simões' original note cards on file at the MPEG and reorganized here (Figure 5-63, Figure 5-64, Figure 5-65) show that similar trends were found at three excavations (Corte 1-3) conducted by Simões' at the site. This data shows a general trend with higher amounts of cauíxi in the upper stratum and lower amounts of cariapé. This is similar to data presented here from the sites of MT-FX-06 and MT-FX-13. Vessels at MT-AX-01 also have thick flat bottomed bases (Figure 5-66) and uniform Type 1 and Type 2 vessels, based on rim profiles (Figure 5-67) as well as the presence of pot-stands (Figure 5-68).

Formadores do Xingu

Ceramic examples from other sites in the lower Culuene (or the formadores do Xingu) are almost entirely surface collected examples. Analysis shows that surface collected examples are clearly related to late period, surface collected pottery, in the KSA. Of particular interest is the presence of various types of pot-stands with differing decorations. Such a bulky and heavy ceramic object is durable by its nature and unlikely to be traded. In the future these objects may provide good markers for individual houses, villages, or at least pottery producing groups given their likely stationary nature combined with their seemingly unique and localized decorative attributes (Figure 5-68, Figure 5-72, Figure 5-77, Figure 5-90, Figure 5-93). Other patterns among late period pottery from across the Upper Xingu include the wide spread presence of Type 2 vessels with flat-folded rims and engraved chevron-esque designs that are found at several sites. Present alongside these distinctive rim forms are animal adornos, and broad-line incision (Figure 5-71, Figure 5-75, Figure 5-76, Figure 5-80, Figure 5-81, Figure 5-84, Figure 5-91, Figure 5-92). At MT-FX-01 Type 2 rim profiles show the same uniformity as other late period vessels across the Upper Xingu (Figure 5-69). The presence of adornos, fine line incision, red slipped Type 1 vessels, and engraved designs on folded Type 2 rims, all suggest a mixing of late period Carib pottery with established local forms that are also present in the KSA (Figure 5-69, Figure 5-70, Figure 5-71, Figure 5-72). Site MT-FX-02 has much of the same pottery as MT-FX-01 including Type 1 vessels with uniform rim profiles, Type 2 vessels with much thicker, but still uniform, rim profiles, characteristic Carib (Protohistoric period) engraving, red slipped Type 1 vessels, broad-line incision, and modeling (Figure 5-73, Figure 5-74, Figure 5-75, Figure 5-76, Figure 5-77, Figure 5-78). The nearby site MT-FX-03 also has late period engraved rim Type 2 vessels in association with red slipped Type 1 vessels and very uniform rim profiles for both (Figure 5-79, Figure 5-80, Figure 5-81). At MT-FX-04 the engraved design usually reserved for Type 2 folded rim vessels is found on an example of a red slipped Type 1 vessel further accentuating the merging of old and new styles of pottery in the Developmental (Late Ipavu) and Protohistoric period of the Upper Xingu (Figure 5-82, Figure 5-83, Figure 5-84). The sites of MT-FX-05, MT-FX-09, MT-FX-11, MT-FX-12, and MT-FX-18 also show a variety of vessels with some uniformity in rim shape and a mixture of decorative attributes including modeling, incision, and late period engraving, a decorative attribute that seems to be wide spread across the Upper Xingu between the Late Ipavu and Protohistoric periods (Figure 5-85, Figure 5-86, Figure 5-87, Figure 5-88, Figure 5-89, Figure 5-90, Figure 5-91, Figure 5-92, Figure

5-93). This cursory evidence from many sites located along the Xingu and Culuene rivers provides the basis for establishing a hypothesis for pre-European trade and exchange networks in the Upper Xingu where localized economies of village clusters (centered near lakes) were intertwined through regional networks that increasingly merged into a single Xinguano culture.

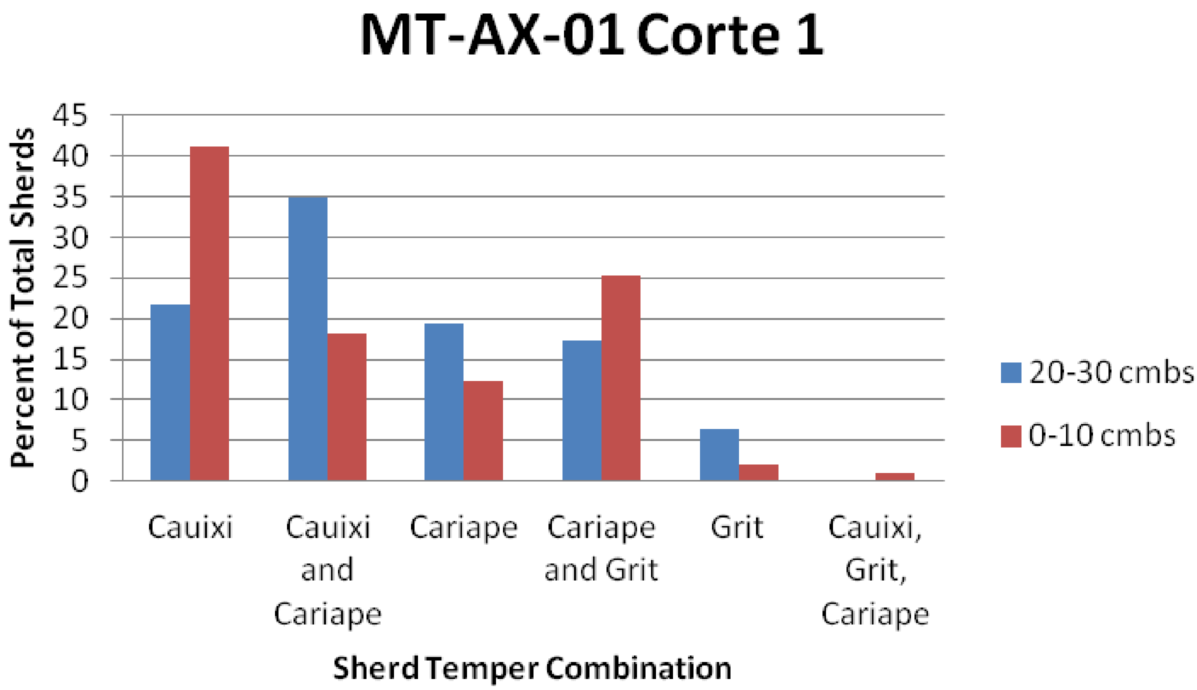

Figure 5-63. Temper statistics from Simões first excavation at MT-AX-01.

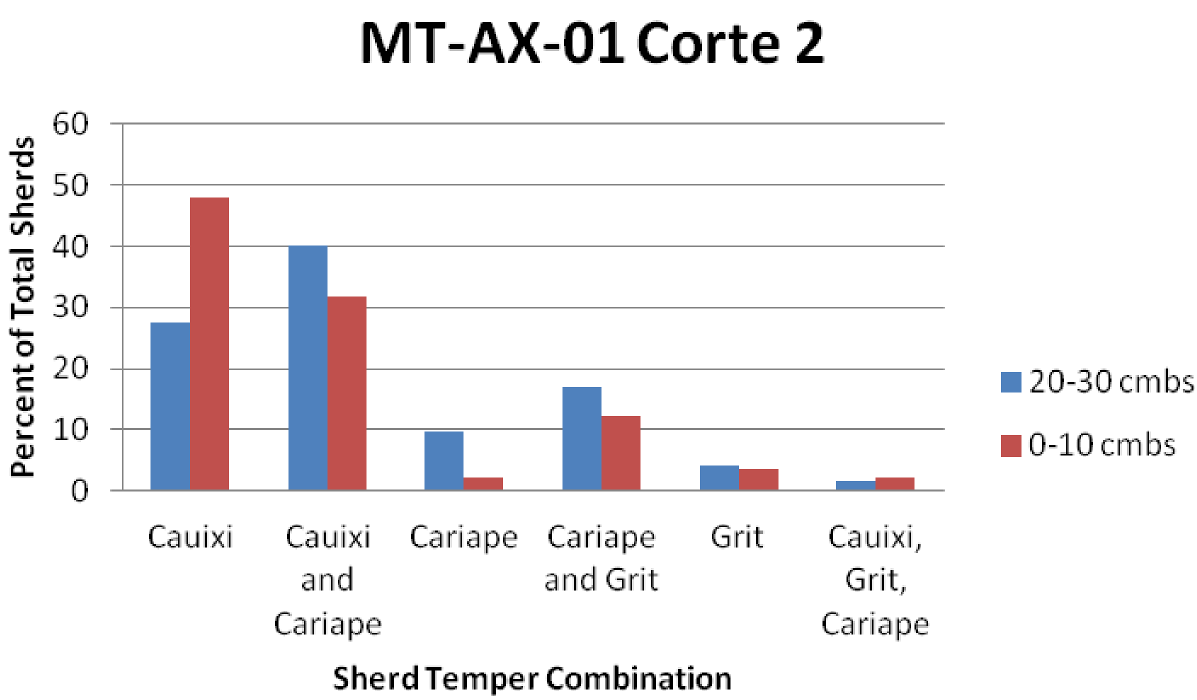

Figure 5-64. Temper statistics from Simões second excavation at MT-AX-01.

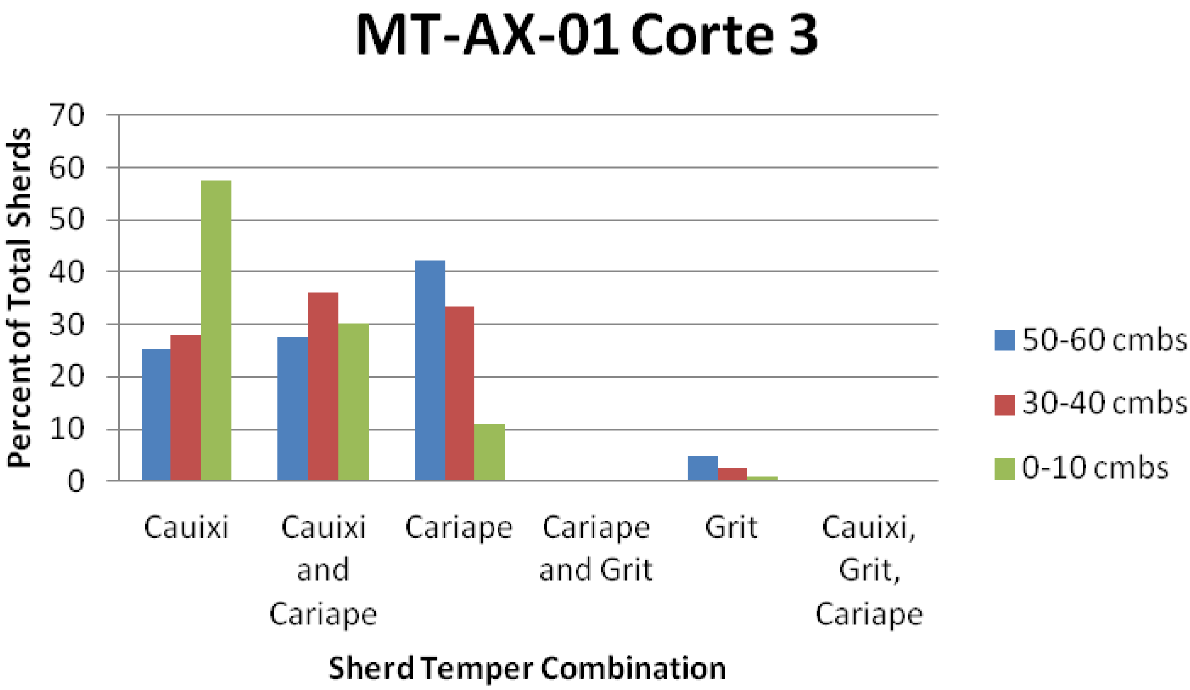

Figure 5-65. Temper statistics from Simões third excavation at MT-AX-01.

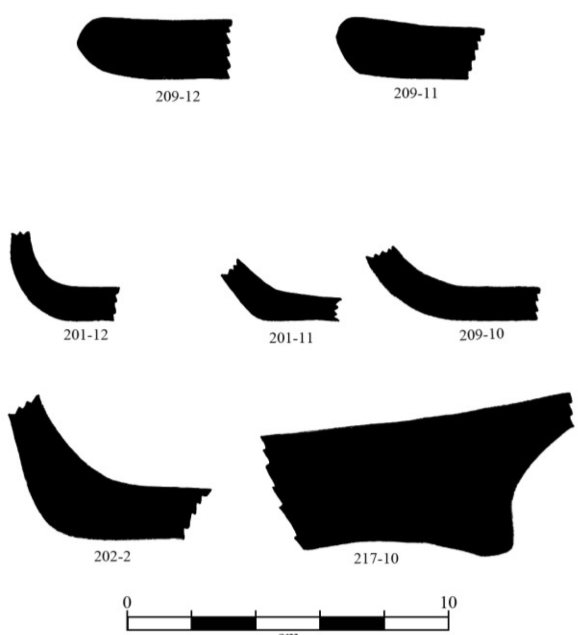

Figure 5-66. Type 4 rim profiles (top row) and base sherd profiles (bottom rows) from Simões MT-AX-01 surface collection.

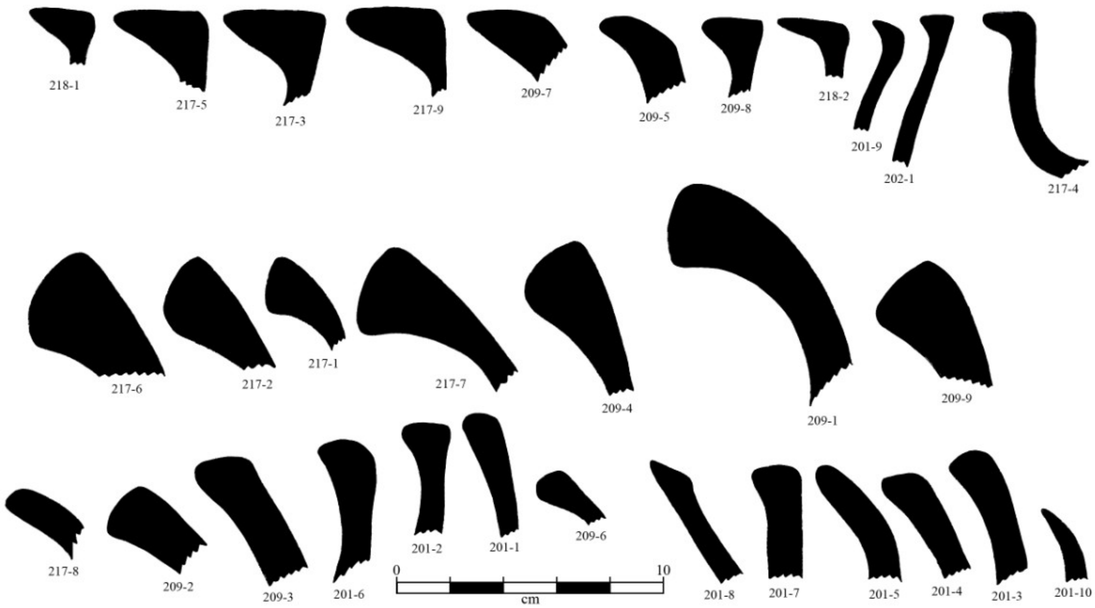

Figure 5-67. Type 2 rim profiles (top row) and Type 1 rim profiles (bottom rows) from Simões MT-AX-01 surface collection.

Figure 5-68. Type 5 (or pot-stand, *undagi*) from Simões MT-AX-01 surface collection.

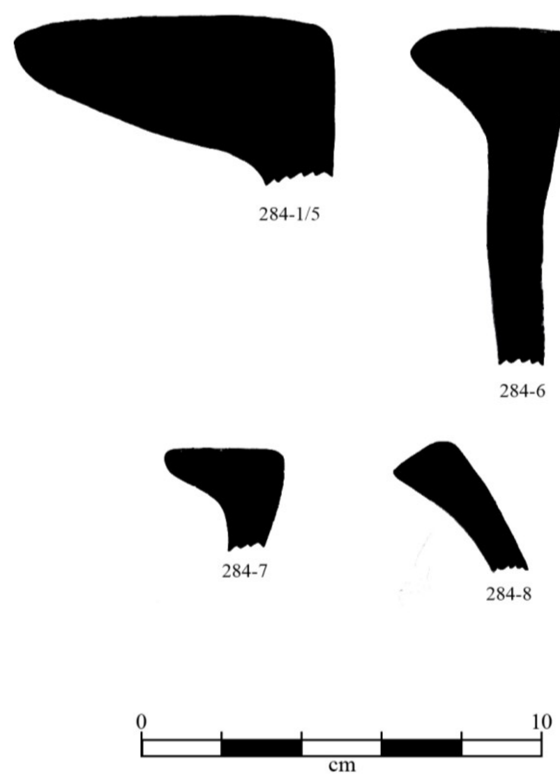

Figure 5-69. Type 2 rim profiles from MT-FX-01.

Figure 5-70. Rim adorno's from MT-FX-01 surface collection.

Figure 5-71. Type 2 rims from MT-FX-01 surface collection with engraved decoration.

Figure 5-72. Type 1 rims (bottom), Type 2 rims (middle), and Type 5 fragment from MT-FX-01.

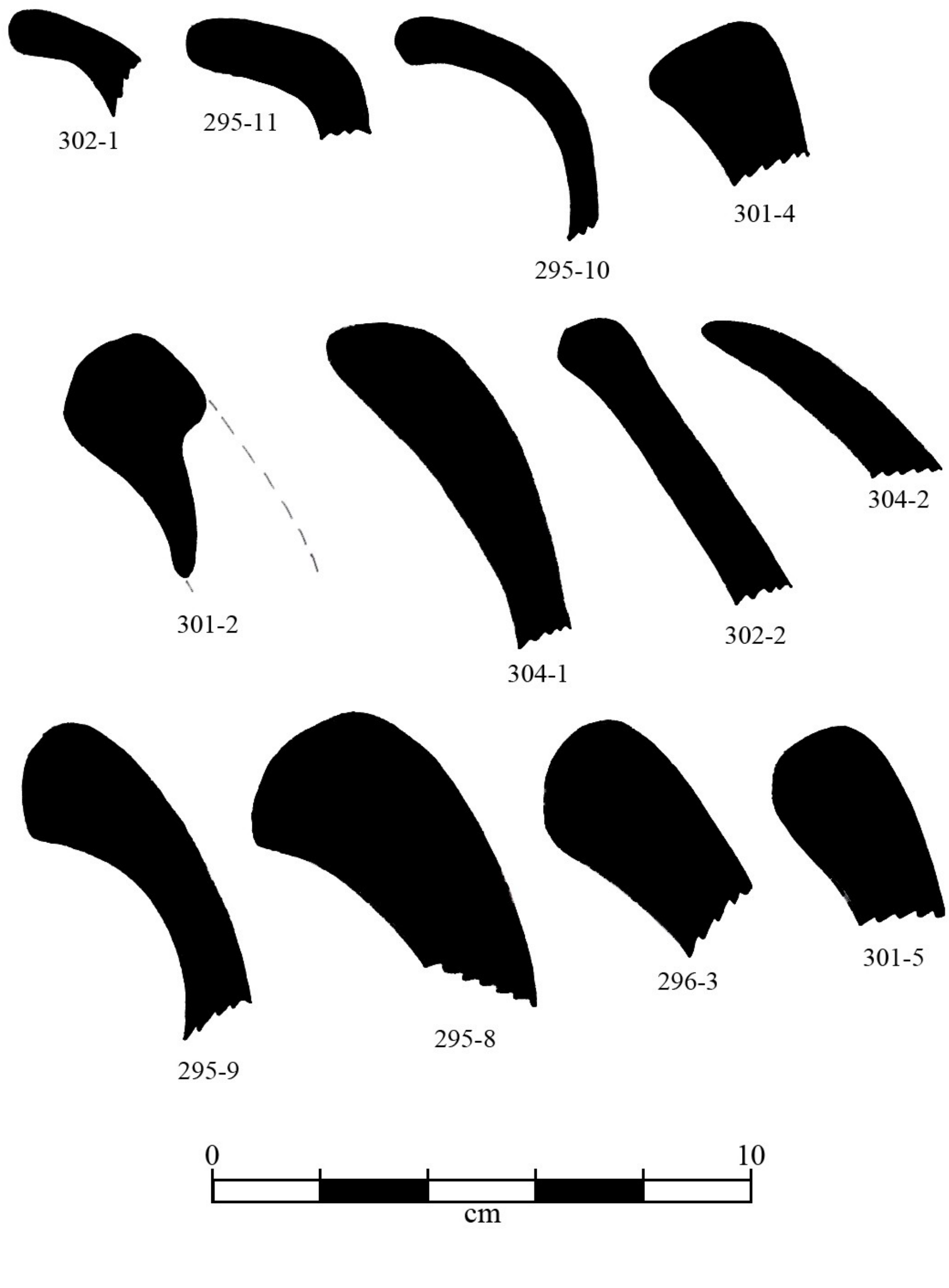

Figure 5-73. Type 1 rim profiles from the MT-FX-02 surface collection.

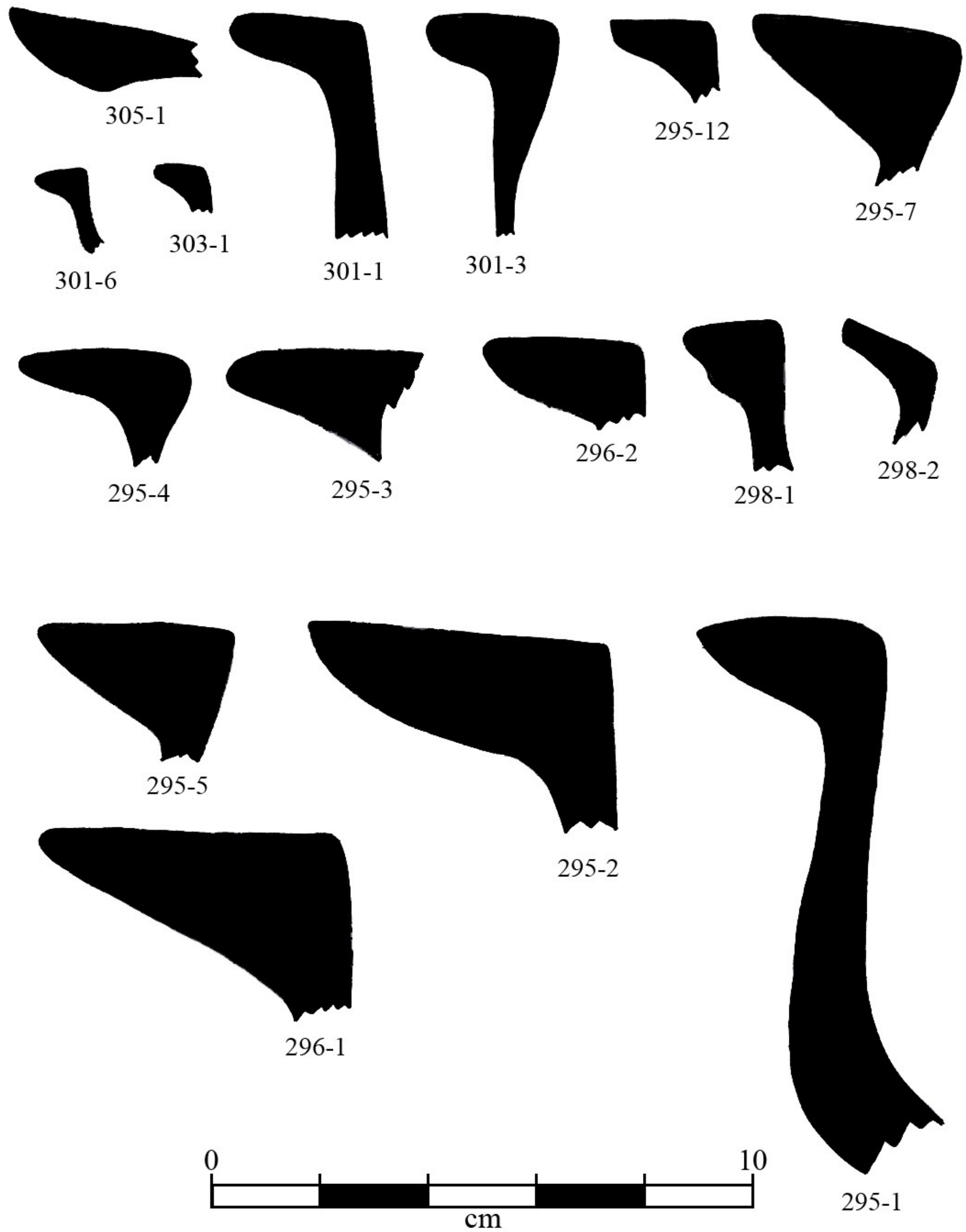

Figure 5-74. Type 2 rim profiles from the MT-FX-02 surface collection.

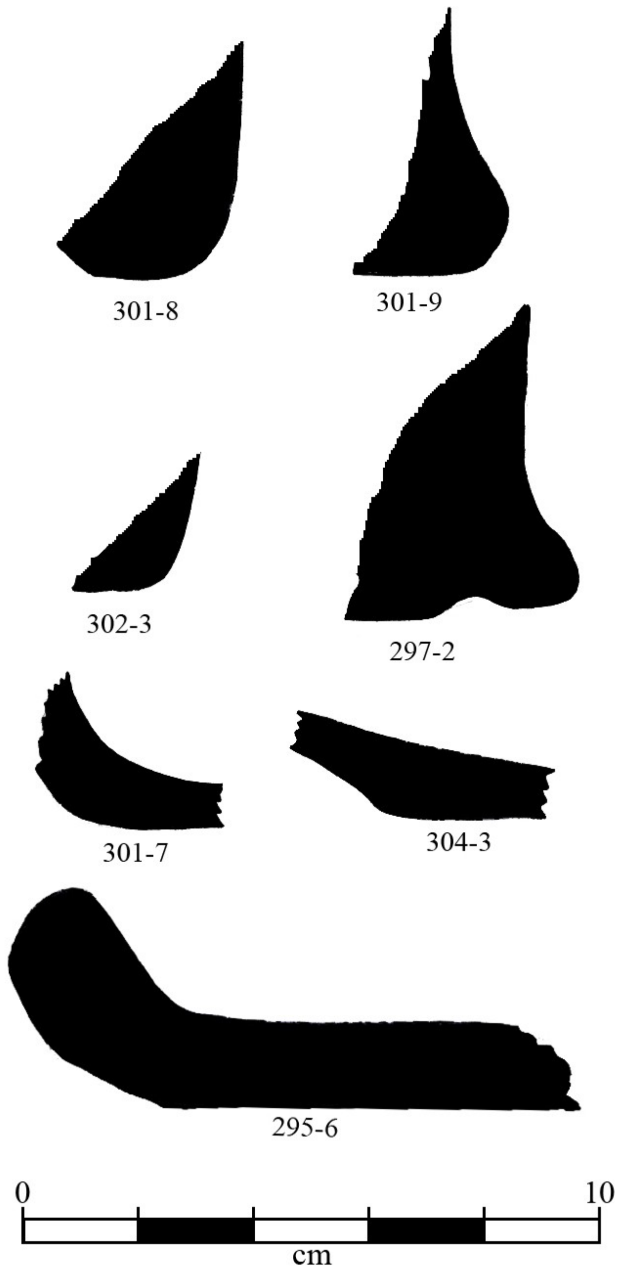

Figure 5-75. Type 5 fragments (top two rows) base fragments (third row from top), and Type 4 rim profile (bottom row) from MT-FX-02 surface collection.

Figure 5-76. Type 2 rims from MT-FX-02 surface collection with incised, engraved, and thumbnail punctate decorations.

Figure 5-77. Type 1 rims (top row) and Type 5 fragments from MT-FX-02 surface collection.

Figure 5-78. Modeled and incised rim sherds from MT-FX-02 surface collection.

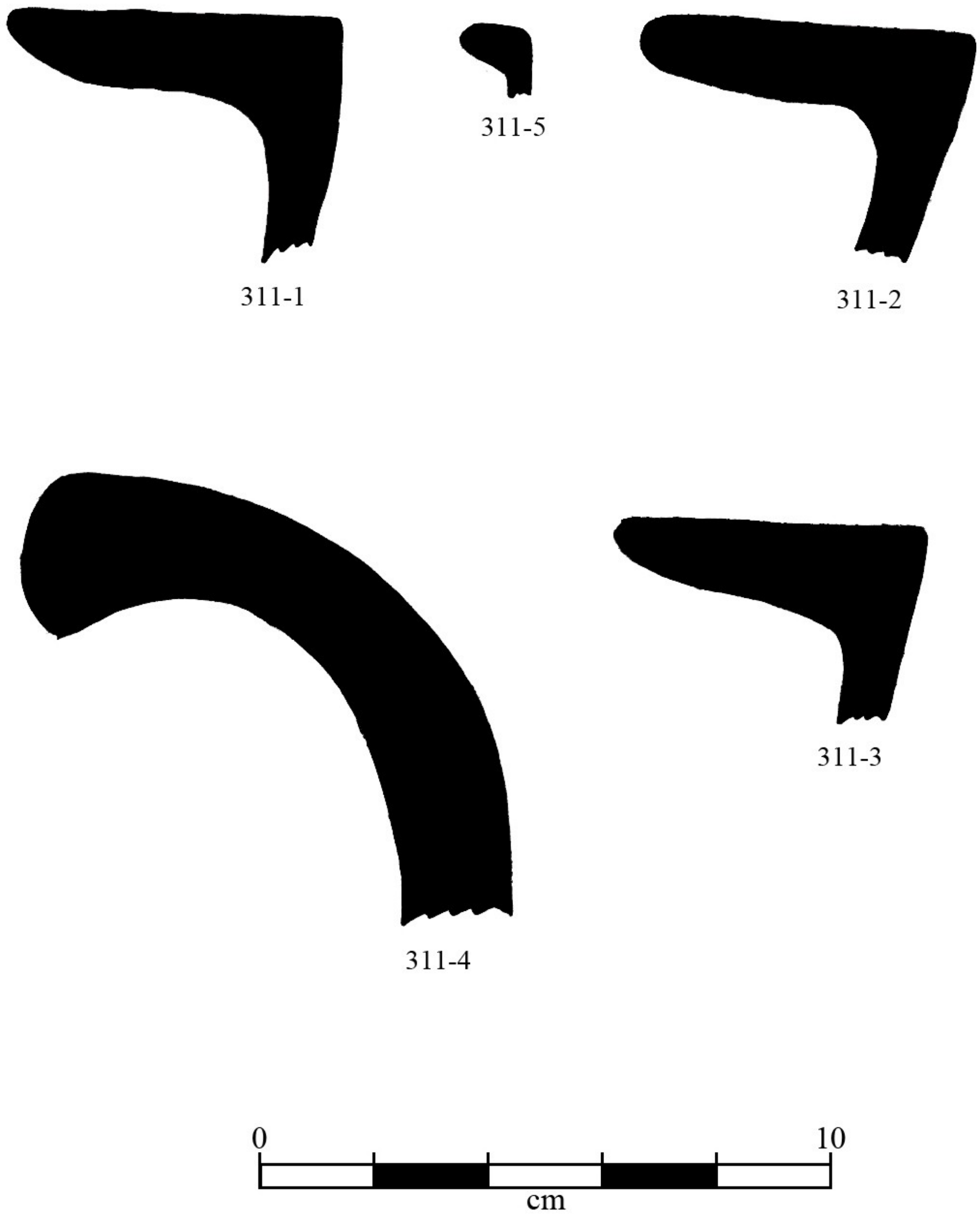

Figure 5-79. Type 1 (bottom left) and Type 2 (top row and bottom right) rim profiles from MT-FX-03 surface collection.

Figure 5-80. Type 2 rims from MT-FX-03 surface collection with engraved decoration.

Figure 5-81. Type 2 rims with engraved decoration (top three rows) and Type1 rim (bottom row) from MT-FX-03 surface collection.

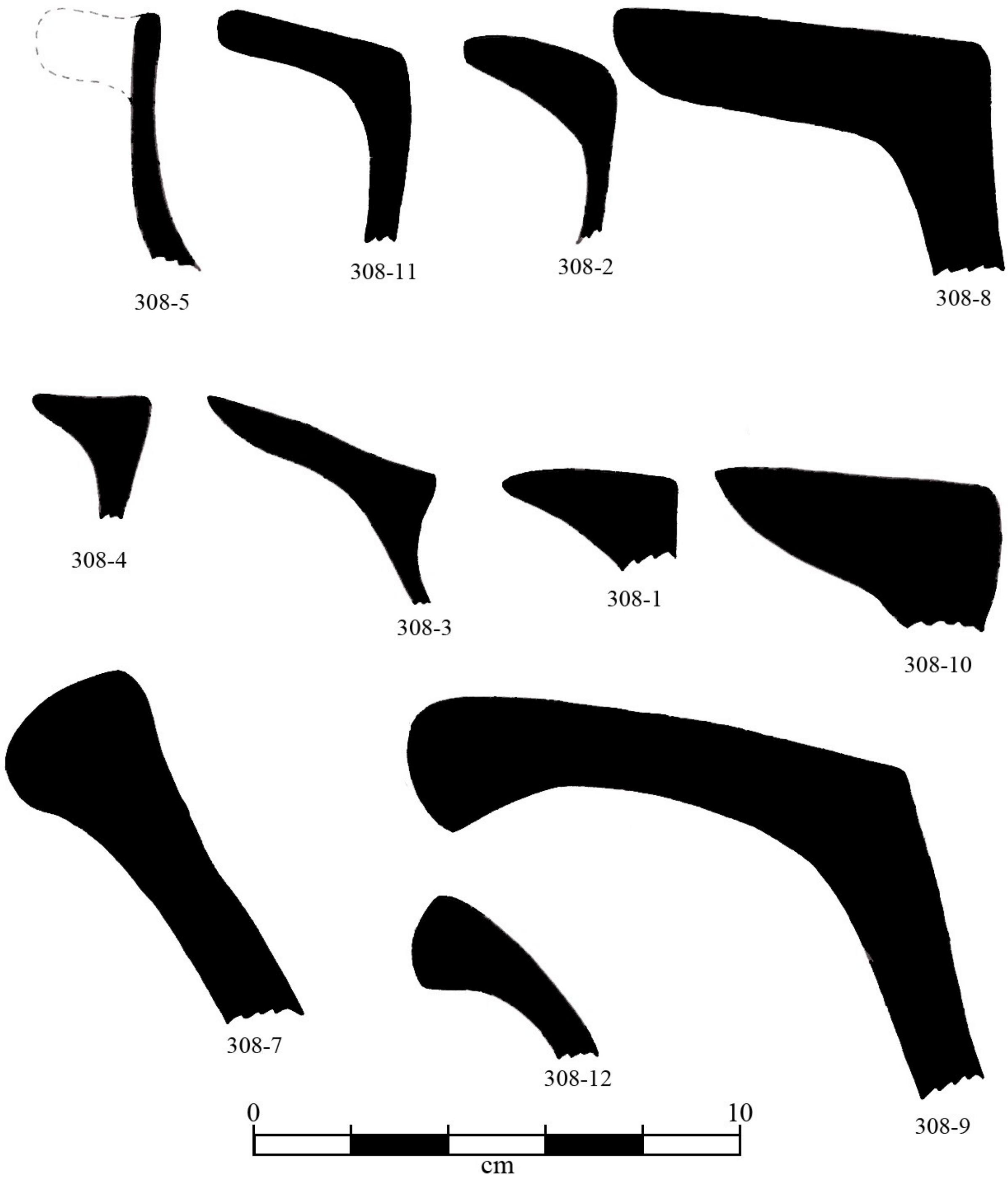

Figure 5-82. Type 2 rims (top two rows) and Type 1 rims (bottom row) from MT-FX-04 surface collection.

Figure 5-83. Type 1 rim from MT-FX-04 with engraved decoration on the interior (top) and red slip on the exterior (bottom).

Figure 5-84. Type 2 rims with engraved decoration (top four rows), incised decoration (bottom right), and adorno (bottom left) from MT-FX-04 surface collection.

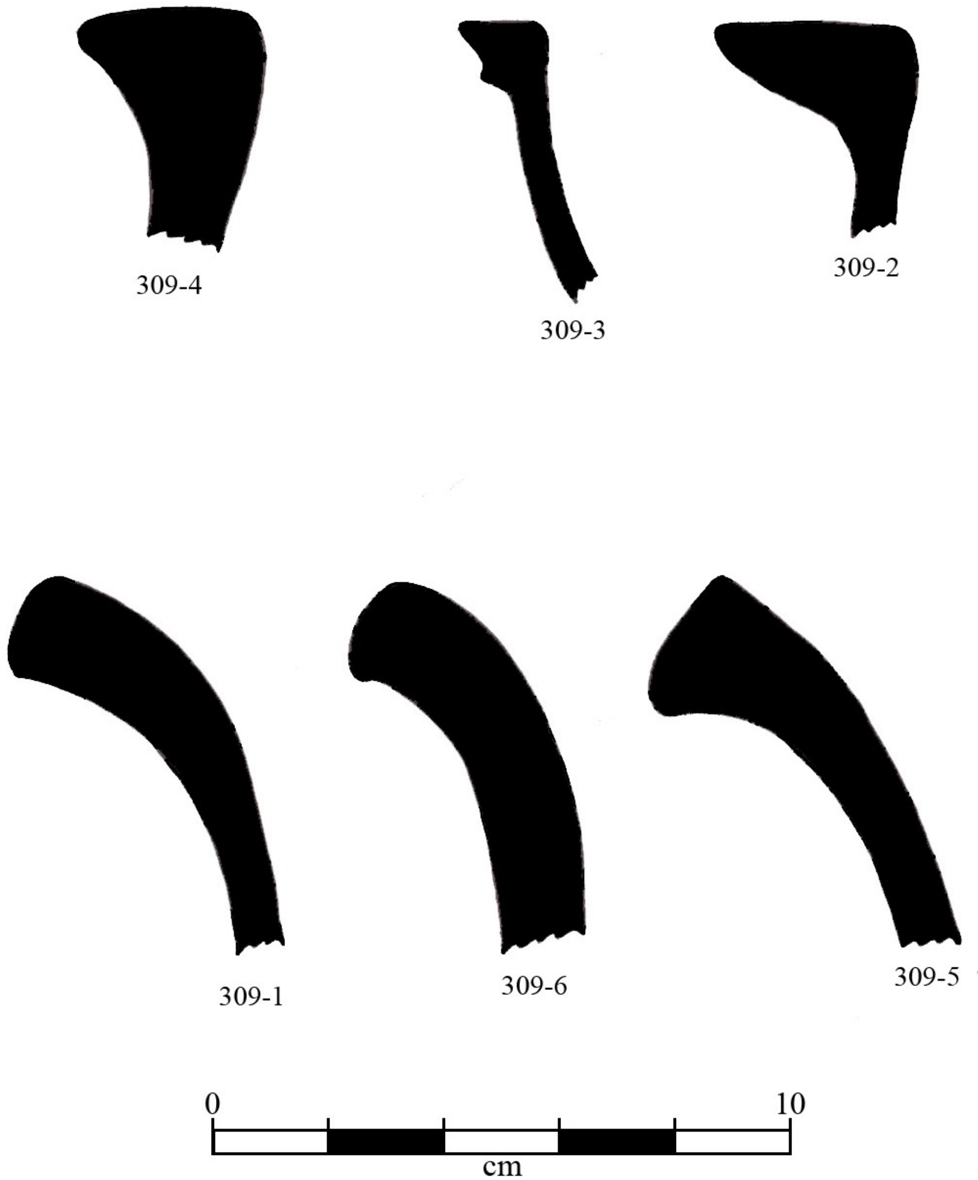

Figure 5-85. Type 1 rim profiles (bottom row) and Type 2 rim profiles (top row) from MT-FX-05 surface collection.

Figure 5-86. Type 2 rims with incised decoration from MT-FX-09 surface collection.

Figure 5-87. Type 2 rims with incised and thumbnail punctate decoration from MT-FX-09 surface collection.

Figure 5-88. Type 2 rims with modeled and incised decoration from MT-FX-09 surface collection.

Figure 5-89. Type 1 vessel (small) from MT-FX-09 surface collection.

Figure 5-90. Whole pot-stand (*undagi*) from MT-FX-11 surface collection.

Figure 5-91. Type 2 rims with engraved decoration from MT-FX-11 surface collection.

Figure 5-92. Type 2 rims with engraved decoration from MT-FX-12 surface collection.

Figure 5-93. Decorated pot-stand fragment (top left), Type 2 incised rims (top right), and Type 1 rim with red slip (bottom) from MT-FX-18 surface collection.

Summary

This discussion concerns the apparent patterns in comparing the three assigned comparative units; Group 1 (the surface artifacts), Group 2 (the plaza berm artifacts), and Group 3 (the test unit artifacts). This discussion takes into account the almost certain overlapping of ceramics from different time periods occurring in all of these units of analysis especially between Group 2 and Group 3. However, it is clear, based in the chronology outlined in previous research and in previous sections, that site deposits can be broken down into at least three contiguous periods where the deepest deposits can be assumed to be the oldest (circa A.D. 700-1250) while the surface artifacts can be assumed to be the most recent (circa A.D. 1500-1770) and at the Nokugu and Heulugihïtï sites, the plaza berms associated with plaza elaboration, circumferential ditch excavation, and likely population increase, fall in the middle (circa A.D. 1250-1500). Given this generalized periodization at these sites we can proceed to compare pottery assemblages and draw conclusions about the development of pottery technology over this roughly 1,000 year period. The first attribute of the ceramics analyzed is the form or type. Given the importance of certain vessels, particularly the Type 1 vessel, to the processing of manioc, it is important to see how this vessel varies through time, both technologically and in its relative preference compared to other vessel types.

Vessel types are correlated ethnographically with particular functions. Type 1 vessels are associated with manioc processing, Type 2 vessels are associated with cooking fish, and Type 3 vessels are associated with dry goods storage and traded as tourist goods. Archaeologically, Type 1 vessels are clearly the dominant vessel type in the surface assemblage as well as the TU assemblage while they are slightly edged out by Type 2 vessels in the EU assemblage (Figure 5-94). Type 2 vessels are the second most dominant vessel type in each assemblage with the exception of the EU assemblage where they are the dominant type as previously mentioned. Finally, Type 3 vessels are the minority vessel in each assemblage constituting less than 20 percent in all assemblages.

A clear pattern emerges from this data showing a dramatic increase, from 45 percent to 70 percent, in Type 1 vessels from the earliest deposits to the latest (Figure 5-94). Type 2 vessels decrease overall in preference from the earliest to the latest deposits with the exception of an increase from 37 percent to 49 percent in the middle assemblage. Finally, Type 3 vessels remain at a constant low percentage throughout time to the point of almost dropping out completely in the surface assemblage.

Overall metric attributes for vessel types show a distinct trend through time (Figure 5-95 to Figure 5-97). Type 1 vessels increase in average lip thickness by 22 percent from the earliest deposits to the surface assemblage while average rim thickness increases by 10 percent and average orifice diameter increases by 8 percent. Type 2 vessels increase in average lip thickness by 16 percent from .81 cm to .94 cm while average rim thickness increases by 18 percent from .74 cm to .87 cm.

Average orifice diameter increases 39 percent from 23 centimeters to 32 centimeters. Type 3 vessels increase in average lip thickness by 15 percent from .82 cm to .94 cm while average lip thickness increased by 36 percent from .59 cm to .80 cm and average orifice diameter increase by 108 percent from 12 cm to 25 cm. The increase in average size combined with a decrease in standard deviation from these averages demonstrates an increased uniformity or standardization of vessels. Trends toward a decrease in temper variability add further validity to this observation.

Cauíxi temper remains the dominant type throughout all assemblages; however, its dominance in the surface assemblage suggests a conscious effort to use it over other available temper types (Figure 5-98 to Figure 5-100). *Cauíxi* temper increases by 18 percent from the earliest deposits to the surface deposits where it represents 67 percent of the total temper (Figure 5-98). *Cariapé* decreases by 27 percent constituting only 15 percent of the total temper in the surface assemblage. Grit temper decreases by 62 percent though this is only a decrease from 21 percent to 13 percent of the total temper present. Finally, grog temper increases by 67 percent though remains at less than 5 percent of total temper throughout all assemblages. This general pattern of increases in *cauíxi*, decrease in *cariapé*, and decrease in grit is found in the statistics for separate vessel types as well (Figure 5-99 and Figure 5-100).

Cauíxi temper has been at the center of many discussions about pottery throughout Amazonia and in the Orinoco River basin. In the Central Amazon Hilbert first identified *cauíxi* as a possible indicator of time or migrations (Hilbert 1955:33-37). Temper was previously used in the Upper Xingu as an indicator of cultural difference through time and space as well (Simões 1967). As far away as the Middle Orinoco basin, sponge-spicule is noted for its sudden appearance during the Corozal phase around 1000 B.C. making it one of the earliest lowland complexes with examples of *cauíxi* tempered pottery (Roosevelt 1997:159).

Based on these previous studies, a distinction between vessels that favored *cariapé* and vessels that favored *cauíxi* was anticipated, thus recording the presence and amount of this type of temper was a priority. The results presented here clearly show that temper is an indicator of difference and variation through time at sites in the KSA. These results are clear evidence for ceramic technological change at least from the Initial Period to the Protohistoric Period of the Upper Xingu.

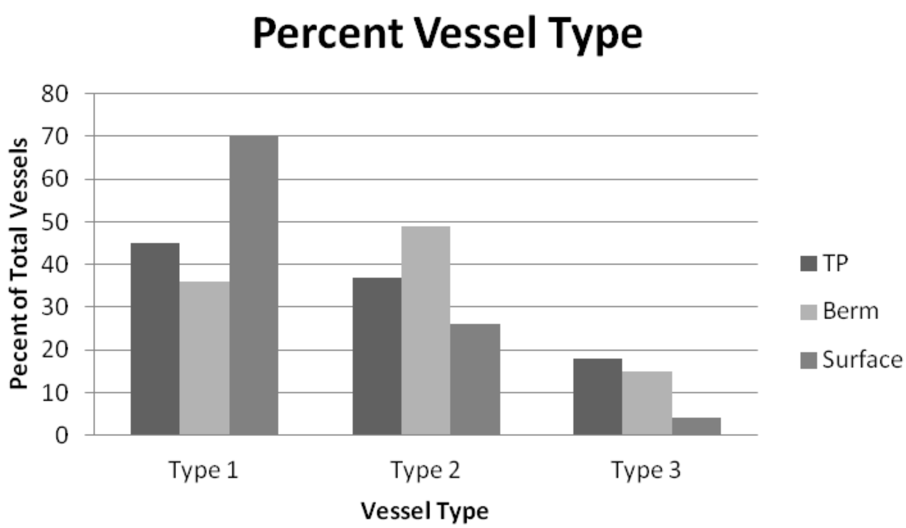

Figure 5-94. Vessel type percentage within the three analysis groups at MT-FX-06.

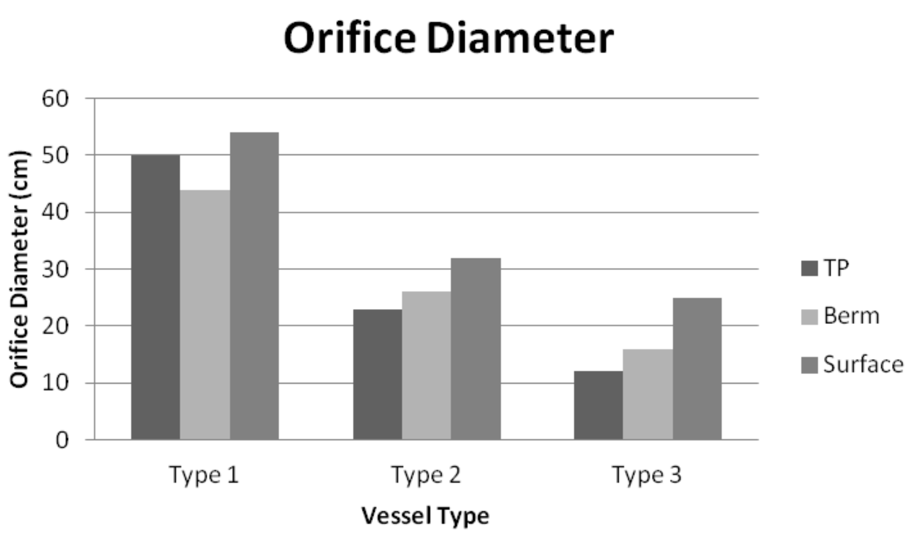

Figure 5-95. Average orifice diameter among vessel types within the three analysis groups at MT-FX-06.

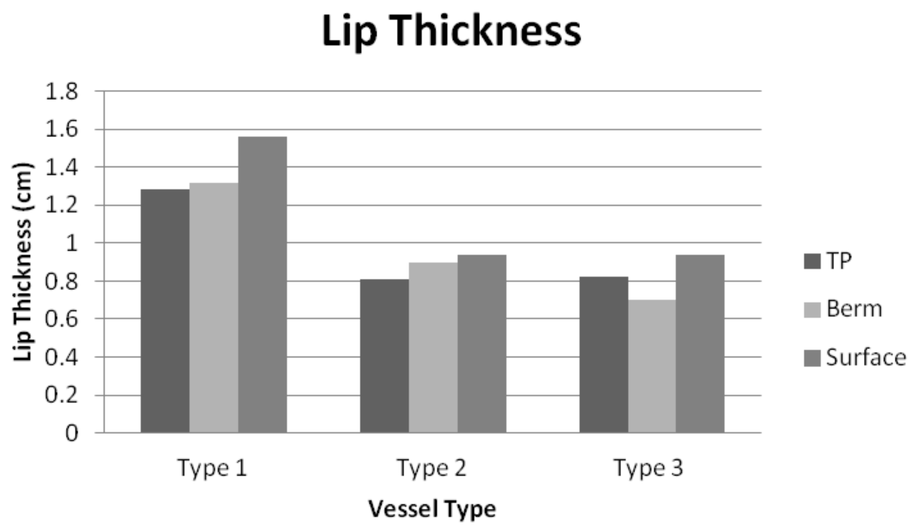

Figure 5-96. Average lip thickness among vessel types within the three analysis groups at MT-FX-06.

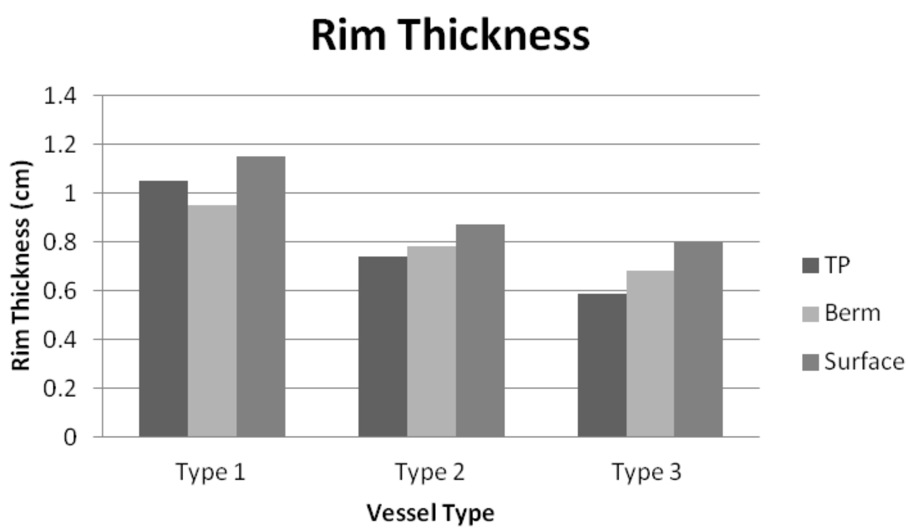

Figure 5-97. Rim thickness by vessel type and assemblage.

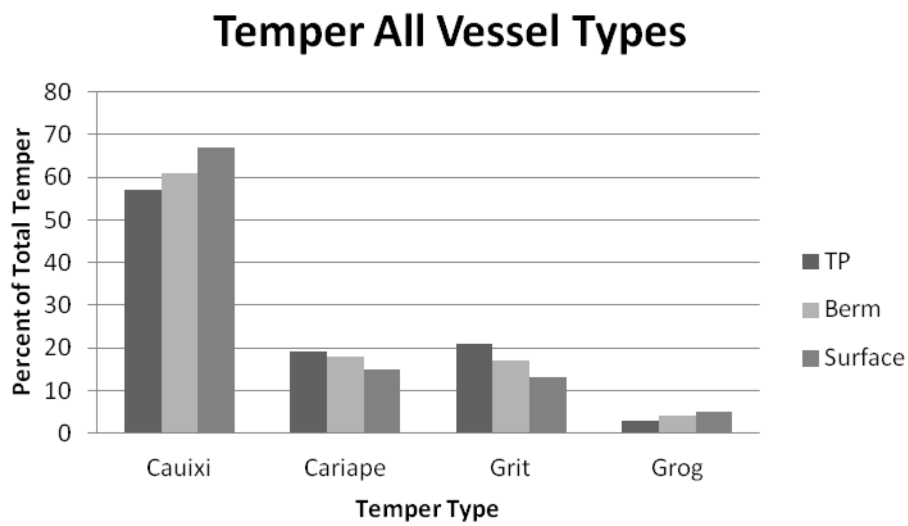

Figure 5-98. Temper percentage for all vessel types combined within each assemblage from MT-FX-06.

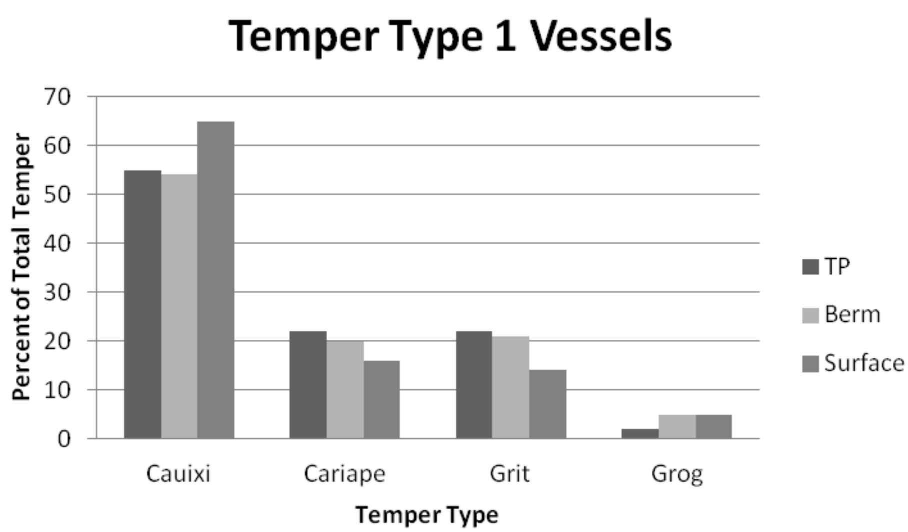

Figure 5-99. Temper percentage for Type 1 vessels within each assemblage from MT-FX-06.

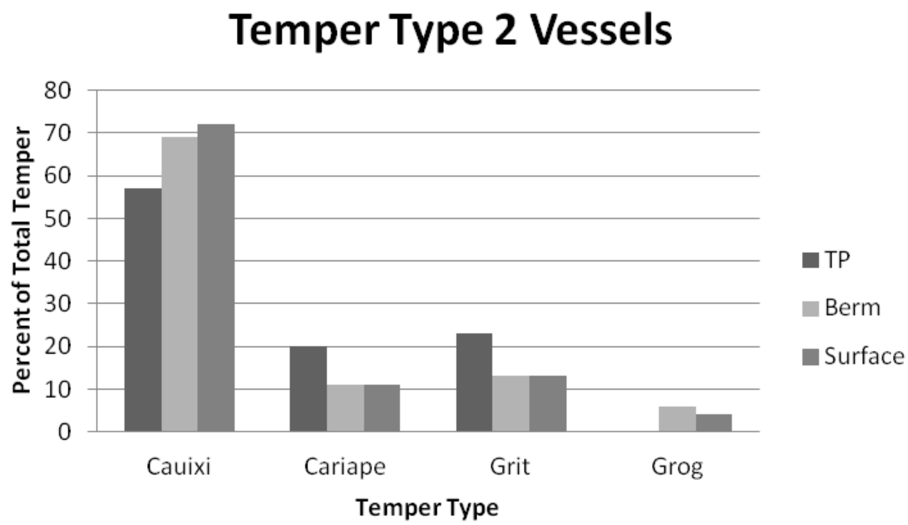

Figure 5-100. Temper percentage for Type 2 vessels from TFX06.

CHAPTER 6
ARCHAEOLOGICAL INTERPRETATION

Introduction

Archaeological work in the Upper Xingu, combined with recent work conducted in the Central and Lower Amazon, establishes the framework for the revisionist model and a more historicized understanding of settled and complex societies of the Amazonian past. Archaeological and ethnographic field work conducted in the KSA reveals the presence of densely settled circular plaza villages throughout the lower Culuene River in the PIX that are directly related to the present day societies of the Upper Xingu. Mapping of these archaeological sites and the landscape features that characterize them illustrates the presence of these permanent villages throughout the region in prehistory. Archaeological investigation and associated radiocarbon dates show that these villages were contemporaneous and connected by roads that reached several kilometers between villages (Heckenberger 2005; Heckenberger et al. 2007, 2008).

While this work raises serious doubts regarding the standard model it also raises several questions regarding the similarities and differences between the modern Xinguanos and their prehistoric ancestors. The most obvious question is related to how such a complex system of villages in the past is now represented by only a few scattered villages. Regardless of continuous doubts about the validity of ethnohistoric accounts (Meggers 1995a) the massive depopulation brought on by the spread of disease and the displacement of people in the wake of early contact with Europeans is hinted at by early ethnographies (Levi-Strauss 1948), recorded in later census data (Heckenberger 1996) and historical accounts (Hemming 1978; Whitehead 1993), and shown in kinship analysis where kin terms remain in use where the structure for there origin no longer exists (Dole 1991: 396). Still other questions regarding the genesis of Xinguano culture remain including how and when Arawakan speaking people arrived in the Xingu, how and when Carib peoples arrived and mixed with Arawakan speaking people, what village and regional social organization looked like in the past, how material culture was manufactured and distributed, and how subsistence regimes were formed.

The starting place for several of these questions is in the ethnographic present and each of these questions can be related to the most prevalent form of prehistoric remains, pottery. Today, all pottery in the Upper Xingu is made by Arawakan speaking people in one village and traded to the other villages. Almost all pottery is made in relationship to the processing of manioc which is not clearly the case throughout the archaeological record of the KSA. Finally, besides form, function, and technology, changing styles of pottery decoration likely tell us something about the movement of different people into the Xingu, as in other major study areas of the Amazon.

Upper Xingu Chronology

Archaeological research in Amazonia has generally focused on the culture areas of the Lower, Middle, and Upper Amazon, with relatively little attention given to the upper reaches of its major tributaries. The Xingu River, the focus of detailed ethnographic research since the late nineteenth century, provides ample data on socio-political dynamics in native Amazonia, both past and present. In the last fifteen years, substantial archaeological research has complimented the ethnographic research in this area and some of the ceramic data from that research is presented here.

Archaeological research in this area during the mid twentieth century established the presence of prehistoric villages but limited excavations and almost no surface mapping of the sites left only vague information about the earliest inhabitants of this area (Dole 1961). Archaeological research shows that just prior to initial contact with the first Europeans to reach Amazonia, the Xingu supported vast populations that seem to be elaborate expressions of the same basic socio-political system that is found among the Xinguano of today (Heckenberger 2005). Using a direct historical and ethnoarchaeological approach, Heckenberger successfully showed that the present day condition of Xinguano people is in fact a product of contact with Europeans (Heckenberger 1996). He also showed continuity between late prehistoric and present day Xinguano economic and social organization based in part on a comparison of late prehistoric and modern day Xinguano pottery.

The earliest documented occupation of the Upper Xingu, based on radiocarbon dates, places people in the area beginning circa A.D. 700 and probably earlier. Heckenberger favors a broad range for the initial occupation of the Xingu stating that, "the known cultural history of the region begins by circa A.D. 500-800, and perhaps much earlier", however his assessment concentrates on "the last 500 years", from about A.D 1500 to the present (Heckenberger 2005:67). Though other research in the southern and central Amazon is scant with a few notable exceptions (Wust 1990; Ireland 1990; Prous 1992; Kipnis 1998), Heckenberger observes that "it is clear that the known sequence represents a single evolving cultural tradition: the Xinguano regional tradition" (Heckenberger 2005:68). According to Heckenberger, ceramic occupations begin in the region no later than A.D. 800 and are associated with a single industry. This single industry, named the Ipavu Phase by Mario Simões based on work further to the north and downstream, is likened to the several traditions from the Amazon proper including the Incised-rim, Incised-modeled, and Amazonian Barrancoid traditions. According to this summary these early inhabitants united by a single ceramic industry maintained their culture until around A.D. 1500 when they were met by Carib and other groups.

Heckenberger's prehistoric chronology is based on "solid empirical grounds, including a well controlled sequence of radiocarbon dates, systematic mapping and distributional studies of entire sites, detailed analysis of prehistoric technologies, and a ‘regional’ site survey” (Heckenberger 2003:68). Based on these solid empirical grounds he goes further than Simões and divides the cultural sequence of the region into two major cultural phases, the Ipavu Phase and the Xinguano Phase. More importantly for this study he further divides these phases into cultural periods with the Ipavu divided into Early (800-1250) and Late (1250-1650) while the Xinguano Phase is broken into the Transitional Period (1650-1750), the Early Xinguano (1740-1884), and the Late Xinguano (1884-1950). Referring back to his assertion that "a single evolving cultural tradition" exists in the region, he breaks up these periods with a different naming sequence, where the Early Ipavu becomes the Developmental period, the Late Ipavu becomes the Galactic period, the Transitional Period is subsumed by the Early Xinguano Period, and the Late Xinguano becomes the Historical Xinguano Period. This sequence is based on single radiocarbon dates, clustering of radiocarbon dates, and a single historical event, the arrival of explorer Karl von den Steinen.

This rather complex method of dividing Upper Xingu prehistory allows for the discussion of complex socio-political developments throughout Upper Xingu history. Another way of dividing up the prehistoric period from earliest occupation to the contact period in Brazil, which begins roughly around A.D. 1500, is by the landscape alterations and other cultural formations. For this Heckenberger places the "structural elaboration", "nucleation in villages", and "establishment of 'galactic cluster' regional organization" in the period from 1250 to 1650. Radiocarbon dates provide more detail for this. At the site of Nokugu (MT-FX-06) there are dates reported from several contexts. From the base of a "sub-curb" on the central plaza a date of A.D. 980-1030 is provided, indicating the very earliest this central plaza landscape delineation could have begun. From the small plaza at this site two dates were obtained from another "sub-curb" though not designated as basal. These dates of A.D. 1400-1430 and A.D. 1420-1480, since not basal, suggest that this sub-curb was initiated sometime before A.D. 1400. Another critical date is obtained from "ditch 2 (S), sub-berm intact" (Beta 78979). Given the location of this date at the base of the berm associated with ditch 2 it suggests that ditch 2, at least in this location, was initiated around A.D. 1260-1300. A complimentary date from ditch 1 suggests that this ditch had already filled in about 70 cm by A.D. 1270-1300 (Beta 176136).

At the site of Heulugihïtï (MT-FX-13) a date of A.D. 1260-1300 is provided from the "central plaza, sub-curb, intact". Excavations beneath the plaza berm provided a date of A.D. 690-1030 an early occupation for this site prior to plaza berm accumulation with "artificial earthworks constructed some hundreds of years after initial site occupation" (Heckenberger 2003:90) around A.D. 1260-1300. This suggests that the entire road/plaza marginal mound complex at Heulugihïtï is roughly contemporary with those documented at Nokugu and Kuhikugu, after circa A.D. 1300-1400 or later (Heckenberger 2003:91).

The basic chronology of the Upper Xingu is shaped by the inferred changes in society based on landscape alterations detailed above, including village size and elaboration, for example (Heckenberger 2005:68-75). Unlike much of the rest of the well studied Amazon, in the Upper Xingu there are not well established ceramic traditions, phases, or complexes nor a chronology in which to place them. As mentioned, some attempt at distinguishing complexes was attempted by Simões. In addition to the Ipavu (also referred to as Culuene to distinguish it from the Xingu River proper) he identified the Diauarum complex based on sites far to the north of Lake Ipavu at Posto Diauarum. Heckenberger distinguished the Eastern and Western complexes which may be more aptly named the Ipatse and Tafununu complexes after the lakes around which they were found (Heckenberger 2005:102-103). These geographical complexes do not however address the chronological sequences for the Upper Xingu and tend to blur the earliest and latest occupations of these areas as single components.

Simplifying this complex array of dating we may settle on a few time periods that move away from using place names to identify time periods. The suggested periods are the Initial Period (AD 700-1250), Developmental Period (1250-1500), Protohistoric Period (1500-1884), and Historic Period (1884-1950). These periods are based on the earliest archaeological evidence for colonization of the Upper Xingu, structural elaboration of village configurations, the first unrecorded contact between Europeans and Xinguanos, and the first recorded contact between Europeans and Xinguanos, respectively, as outlined in this section. None of these periods were based on ceramic seriations or stratigraphic archaeological deposits at specific sites, with the exception of the beginnings the Initial and Developmental periods which are based on radiocarbon dates collected directly beneath village plaza mounds and site peripheral ditches.

Returning to pottery, certain vessel types based solely on form can be found throughout the record in all of the proposed periods. Other vessel types based solely on form, decoration, or size, are found only in certain periods. Those vessel forms that can be traced throughout the record demonstrate variation through time in size, temper, and amount. The size and temper changes, presumed to be a technological change, provides clues about the changing use of these vessels. The changing amount, both percentage of total vessels and amount of total vessels, likely reflect the growing need for these vessels by a growing population.

Because the sites examined for this study contain very macro-scale stratigraphy, additional arbitrary stratigraphy was used to seriate the ceramics from three broad contexts roughly correlating to the Initial, Developmental, and Protohistoric periods. These are the village wide late surface deposits (Group 1), man-made plaza berms and roadside berms (Group 2), and village wide residential area excavations (Group 3). The village circumferential ditches also show distinct strata that may be correlated to those just described however, because they involved both prehistoric digging and accumulation in their construction, thus reversing their stratigraphy in some cases, they were not considered here for analysis but can be better understood apart from the other parts of the site. In describing the pottery from these broad strata we can consider the changes and continuities visible in the subsurface and berm zones as compared to those from the surface artifacts, presumably the most recent.

Initial Period (Early Ipavu)

The Initial Xingu period is represented by pottery styles related to Incised Rim Tradition or Series known elsewhere in Amazonia. Pottery associated with the earliest radiocarbon dates in the Upper Xingu is found at sites of the Ipatse Complex (or Western Complex). They are characterized by small, thin vessels, which exhibit a higher frequency of scraping, burnishing, and red paint than later vessels. Their primary decorative feature is a row of parallel incised lines that appear on thickened and/or folded rims. These vessels are globular and have a pedestal base rather than the flat base found in later periods. They may be included with the Incised-Rim tradition of greater Amazonia. Prominent on this localized (and late) version of the Incised-Rim tradition are thumbnail punctuates along the edge of the lip of these vessels (which persists into later periods, though the context for these vessels is likely mixed). These punctates are so distinctive as to be able to discern handedness or at least rotation of the vessel during the application of this decorative technique which may be compared with those applied at other sites in future studies. The frequency of these punctates is almost a truly Upper Xingu preference and is found rarely in such amounts in contexts along the main route of the Amazon. However, examples are known from Konduri sites and near Oriximina sites and also noted in early pottery of the Upper Amazon (Hilbert 1955; Lathrap 1970). Besides being generally smaller and thinner than later period vessels, Initial Period vessels in the Upper Xingu use higher proportions of *cariapé*, grit, and grog temper than later period vessels while maintaining high amounts of *cauíxi* temper. The forms, both rim and body, are clearly part of the same tradition as later vessels though their function may have been different based on changes in overall size and technology.

Developmental Period (Late Ipavu)

The Developmental Xingu period is represented by the same basic assemblage of pottery from the Initial period but exhibits somewhat more uniformity. The Developmental Period represents the final local variation of pottery before Carib occupations in the Upper Xingu began to influence local potters perhaps towards the end of this period. Ceramics from this period are not securely separated from those of the Initial Xingu based on radiocarbon dates or depositional deposits. However, based on ceramic chronologies elsewhere in the Amazon we would expect to find either Polychrome or Incised-Punctate horizon ceramics this late. Ceramics found at MT-FX-13 are dated between A.D.1040 and 1300 and representative of the Developmental Period of the Ipatse Complex with possible affinities to the Araquinoid pottery of far northern Amazonia (Figure 5-56).

Protohistoric Xingu

The Protohistoric Xingu is represented by a mixed assemblage of Carib influenced local pottery and the continuation and further standardization of forms from previous periods. The Protohistoric Period pottery in the Upper Xingu is a mixture of the local Arawak style developed through the Initial and Developmental periods combined with what Dole referred to as “old Kuikuru” and what Heckenberger referred to as Eastern Complex (though found in limited quantities in the Ipatse Complex sites and further north at site of the Ipavu and Diauarum complex’s as well). This pottery represents an introduced form of pottery that was briefly mixed with the *in-situ* local styles roughly between A.D. 1500 and 1770 or later. Pottery with this form, temper, and decorative application (engraved rather than incised) is documented at sites near Lake Itafanunu (MT-FX-14, MT-FX-15, and MT-FX-26) and Lake Ipatse (MT-FX-12) (Heckenberger

2005:103-106). One of the most striking aspects of this pottery's decoration style is on the flat rims. Chevron designs are engraved onto the rim after the vessel has been fired. This is in stark contrast to potters from earlier periods who applied all incised design on wet to leather hard clay before it was fired. The extremely folded rim on large vessels is also in sharp contrast to the gradually flaring Type 1 rims developed through time in the Upper Xingu.

It is not clear if the new application of the chevron motif is an imitation of an *in situ* local style or a poorly executed version of a style carried from outside the Upper Xingu although the latter is more likely given several factors. First, there are very little chevron decorative motifs from the Initial through the Developmental periods of the Upper Xingu when parallel incised lines are popular. Second, as Lathrap points out, and if suppositions that these are indeed Carib invaders are true, the men may have brought the style without the skill of the execution with them.

> As a result of this kind of partial ethnic replacement, not all aspects of Carib culture would have been disseminated with uniformity and full understanding. If it is correct to assume that art style and ceramic technology were feminine domains, it would be predictable that these patterns would be transmitted in a poorly understood and garbled form, since there would be few, if any, properly trained women moving out of the old Carib hearth-land (Lathrap 1970:164-165).

One other important detail that supports this Carib introduction to the Upper Xingu can be found outside of the material remains and in the presence of a regionally specific origin myth that is Carib (Carneiro 1989).

The question still remains whether or not the Carib added some imported style to an already made local pot or imported the entire form and style. Radiocarbon dates from both sites at the Itafanunu Complex and a single site from the Ipatse Complex place these sites squarely within the Protohistoric Period of the Upper Xingu, roughly between A.D. 1500 and 1770.

In attempting to explain the mixture of local Xingu style with the newly introduced Carib style we may look to Lathrap's apt descriptions of Barrancoid movement out of the Orinoco;

> The taking over of the lower Orinoco was by no means the limit of the territorial acquisitiveness of the Barrancoid peoples. Before the Barrancas style had started to evolve into Las Barrancas colonies were budding-off from the settlements on the Lower Orinoco. One wave moved east along the Guiana coast…Somewhat later a Barrancoid ceramic style was spread into Trinidad…The migration routes and distribution pattern of the Antillian, Venezuelan and Guianan Barrancoid peoples makes it almost certain that they were the invaders who introduced Maipuran Arawak into these areas (Lathrap 1970:114-116).

Describing these movements and "invasions" in terms of ceramic technology and style, specifically in the Upper Xingu as it relates to modern ethnographic ceramic styles, he states further that,

> The nature of the modern ceramic style of the Upper Xingu, brought into the area by Maipuran-speakers, suggests an ultimate derivation from the Barrancoid tradition on the Central Amazon... in the two millennia following the Maipuran expansion many groups would have adopted the styles of their neighbors or so modified their own style as to make Barrancoid derivation no longer evident (Lathrap 1970:127).

Historic Xingu

The Historic Period in the Upper Xingu is the first ethnographic documentation of the ethnogenesis and cultural merging that occurred in the previous centuries. Historic period pottery, or Waurá-Xinguano pottery, is the final product of the Xinguano style of pottery developed from the Initial Period through the Protohistoric Period prior to the rapid destabilization of the region and the multiethnic consolidation that leads to the village specialization of several crafts including pottery. As recorded in the nineteenth and twentieth century's, this pottery is the closest archaeological and ethnohistoric analog to modern Upper Xingu pottery. Characteristic attributes of this pottery are roughly the same as most Protohistoric pottery as recorded on the surface at Ipatse Complex sites (MT-FX-12) and Itafanunu Complex sites (MT-FX-11). Though this pottery is found in much smaller amounts in buried contexts it appears to be primarily associated with historically known occupations of many Upper Xingu sites. These vessels were recorded by Karl von den Steinen in 1884 (Figure 5-3) and can be seen in Xinguano villages today, made exclusively by the Waurá tribe (Coelho 1981; Lima 1950b).

Upper Xingu Regional System

Any attempt at identifying a regional system in the Upper Xingu must focus on the late prehistoric period when village complexes reached the zenith of regional integration. Contemporaneous clusters of villages around Upper Xingu lakes and corresponding roads linking these villages provide the clearest evidence for regional networks. This archaeological information can be combined with ethnographic data that illustrates the nature of social principles that may have ordered prehistoric village networks;

> Xinguano communities and regional clusters are hierarchically ordered, according to genealogy, works, gender, and age, and we see that ancestors or, more precisely, ancestral places are likewise arranged according to these social principles (Heckenberger 2007:304).

Further characterization of these communities and their relationship to each other is discernible through ceramic remains. Pottery decorative styles and forms found among the surface assemblages of sites from Lake Itafanunu, Posto Diauarum, Lake Ipavu, and Lake Ipatse illustrate that late in time there was regional if not village level distinction among pottery producers. Eventually these styles and forms developed into what is known as the Xinguano tradition made exclusively by the Waurá. Earlier studies by Simões and Dole already documented differences between pottery present at the Itafanunu, Ipatse, Ipavu, Lamakuka, and Diauarum complexes. Later work by Heckenberger further documented the differences in village and house arrangements at Itafanunu and Ipatse.

In the Upper Xingu and in the study area specifically, ceramic forms and decorative motifs were previously categorized and used to document regional variation. Mario Simões first divided his findings into two regional distinctions based on the presence of different types of temper at the Diauarum and Ipavu complexes. The only other significant regional distinction was that recorded by Heckenberger between the complexes of Itafanunu and those of Ipatse which he designated the Eastern and Western complexes. The main distinction was made between those sites with circular houses and those sites with typical Upper Xingu long-houses.

Based on Simões and Heckenberger's previous descriptions of pottery and their dating, it appears more appropriate to describe pottery based on its locale which in most cases is near a lake or river confluence. Within these geographical locations there seems to be an apparent division of decorative and formative techniques in pottery production. Given the amount of overlapping dates we can only begin to distinguish between local groups and their degree of interaction when we can distinguish between their distinctive pottery styles. Within each locale there is the more arduous task of distinguishing changes and continuities through time.

Ipavu and Diauarum

Simões first described Diauarum Complex pottery based on his excavations at seven sites near the confluence of the Rio Xingu, Rio Suiá-missu, and Rio Manitasauá, though did not use the designation Diauarum until later (Simões 1967:142,1972:29,39). Simões dated the Ipavu to A.D. 1200-1300 based on the presence of "Ipavu type" ceramics superimposed over "Diauarum type" ceramics radiocarbon dated to A.D.1120 ± 90 at other Diauarum sites (Simões1967) . He noted that Diauarum ceramics were tempered with *cariapé* and Ipavu ceramics were tempered with *cauíxi*, the first observation that *cauíxi* was present in later ceramics. Becquelin proposed an end date for the Ipavu around A.D. 1350 based on radiocarbon dates obtained from Lake Miararré in the vicinity of Lake Ipavu.

Ipavu Complex ceramics were first described by Galvão, Simões and Dole. Thus far they are the earliest dated ceramics in the upper Xingu and lower Culuene. Their rim forms vary from straight to horizontal. Horizontal rims often have notches or thumbnail punctates on the lip around the entire vessel. These are often on a bias when looking down at the pot resulting from either left or right hand application. These everted rims also commonly have from 1-7 parallel incised lines that very in degree of precision, width, and depth. These vessels are globular commonly with pedestal bases. They are generally thin but range in oral diameter from 5 to 35 centimeters. There temper is variable and often contains a mixture of *cariapé*, *cauíxi*, grog, and grit or mineral. They never have the amount of *cauíxi* temper that is found in later Xinguano phase vessels.

Ipatse, Itafanunu, and Lamakuka

Later period sites at Lake Itafanunu represent both Carib and Arawak ceramics and are found at sites described elsewhere (Heckenberger 2005). These are present at sites across the Upper Xingu. In assessing the late Upper Xingu regional system, however, it is clear that the Itafanunu sites represent the Carib neighbors of the Arawak groups to the east. This has been demonstrated based on village configuration previously and by pottery style as well. Described by Dole as "old Kuikuru", pottery with this same rim form and rim decoration are known from sites at Lake Lamakuka, Lake Itafanunu, and at sites further north such as MT-AX-01, MT-AX-02, MT-AX-03, and MT-AX-04. They represent a widespread late form of rim and rim decoration attributable to Carib peoples just prior to the historic period based on evidence from Lake Itafanunu (Heckenberger 2005:106). This style was first referred to as Eastern Complex due to its abundant presence east of the Culuene River at presumed and historically known Carib sites along the shores of Lake Itafanunu.

This most distinct form of this style is a flat bottomed vessel with straight walls and a robust folded flat rim. Decoration is restricted to the top portion of the rim and consists of engraved (as opposed to incised) chevron designs. Unlike any other line designs in the Upper Xingu, those on the Carib rims are applied after the vessels are fired giving them the appearance of being scratched. The difficulty of engraving on hard fired pottery is apparent in the lack of precision of these designs. These vessels tend to be darker in color and are neither painted nor slipped.

Based on radiometric data from the Itafanunu sites containing these rim forms they slightly predate Von den Steinen's visit to the Xingu and may thus be attributed to the Protohistoric Period. Pottery with this form of rim and rim decoration is not present at MT-FX-06, MT-FX-13, or any of the other Ipatse stream sites except MT-FX-12, the main archaeological site at Lake Ipatse and the most recent Carib occupation west of the Culuene River, according to local oral history and radiometric data which dates the site to about A.D. 1770 (Heckenberger 2005:106). This late date for Upper Xingu Carib pottery places it as the direct contemporary of the latest pottery at MT-FX-06, the direct archaeological ancestor of modern Waurá, or Arawak, pottery.

Also called Miarrare by Becquelin, and Group 3 by Dole, it is clear that a distinct standardized set of rim and vessel forms with decoration limited to zoomorphic adornos on smaller pots and painted designs on larger pots, consolidated itself sometime after the Initial and Developmental periods (and perhaps concurrently with the Kuikuru or Carib ceramics, given the survival of Waurá ceramics into the present and the abandonment of the Carib ceramic forms). Dole hypothesized that this was a direct result of the use of the larger vessels for manioc processing. She concluded that the Kuikuru forms, based on fracture lines, could not withstand the pressure of the Xingu specific technique of draining manioc pulp through mats on top of the vessels, rather than use of the *tipiti* for this task, as in most parts of Amazonia.

> The absence of the tipiti in these outlaying areas among peoples who raise manioc suggests that the development of manioc cultivation was accompanied by a movement of peoples upstream, and that many of them reached the headwaters of the Amazon before having an opportunity to participate in the full-fledged Tropical Forest culture…the tipiti is thus seen as a relatively recent invention (Dole 1960:246).

Thus the more gradual flare of the Waurá vessels, which developed through time, replaced the Carib vessels shortly after Carib arrival in the area. This is also illustrated in the increased amounts of *cauíxi* temper that facilitate these larger, thicker vessels. Its light weight and thermal shock resistance made it the clear choice for very large vessels that needed to sit on the fire cooking manioc juice for many hours.

Dole's hypothesis about groups of people reaching the headwaters of the Amazon before having an opportunity to participate in the "full fledged Topical Forest culture" may have its flaws, but in regard to material culture, such as the *tipiti*, and pottery, it has its merits. Like the *tipiti*, many decorative and manufacturing styles are missing from Upper Xingu potteries that are found throughout the rest of the Amazon within similar Barrancoid-like pottery assemblages. However, comparable data from other southern headwaters communities is not available to verify the same process in other communities at some distance from the main Amazon River.

Amazonia and the Upper Xingu

A persistent problem in Amazonian archaeology is the identification of evidence to link the histories of cultural groups from vast areas of the region. Identifying migration routes and distinguishing Arawak from Carib settlements archaeologically is one element needed in solving this problem. The Upper Xingu is particularly difficult to correlate with other parts of the Amazon because of its distance and relative isolation archaeologically. Add to that the condensed occupation history based on the earliest known radiocarbon dates from the area. Yet finding the archaeological evidence that ties the Upper Xingu into the cultural history of the rest of the Amazon remains important. Since the 1970s various hypothesis have been formulated about when, why, and how, Xinguanos arrived in the Upper Xingu. The focus on horticulture and fertile land prompted Lathrap to suggest that the Upper Xingu was occupied as part of the search for fertile land;

> This competition for agricultural land has been going on for a long time, and began several millennia before Orellana's voyage of discovery…the groups who have lost the battle have been many, and they have been pushed further up-stream and off the major rivers into the intervening expanses (Lathrap 1970:19).

Even this argument does not retreat completely from the standard model in its use of environmental factors to explain change. Because of the nature of previous models, ecology has been important to each side's argument. These arguments and explanations for the relationship between the Upper Xingu and Amazonia are tied also into the appearance and spread of manioc horticulture.

Lathrap felt that the active floodplains were much more attractive apart from the vast ancient alluvial deposits in general (Lathrap1970:26, 48-57). He developed a history that suggested Amazonian agriculture matured on the flood plain of the Central Amazon. These Proto-Arawakan groups experienced population pressure and the limited expanses of alluvial flood plain forced colonists to move out in the first Arawakan migration around 3000 BC. Later, as population pressures continued to increase on the Central Amazon flood plain a second wave of migrations took place between 1000 B.C and A.D. 500. These Proto-Maipuran peoples moved following the same routes as their ancestors and went further even going down stream along the Amazon and even up the Xingu to small patches of alluvial land in its upper watershed.

> This fight for the limited supply of productive farm land has been the most important single force in the culture history of the Amazon Basin, and more than any other factor is clearly visible in the archaeological record (Lathrap 1970:20).

His entire hypothesis is based on three key factors; relatively continuous population pressure, constant rates of migration, and the search for a specific ecological niche in good alluvial soils, such as the Upper Xingu (Lathrap 1970:75).

Whether population pressure, environment, or social and political factors, archaeological research across Amazonia illustrates that some major event or sequence of events prompted change in the last half of the first millennium A.D. or earlier. In the Lower Amazon Meggers and Evans found that "the first cultures of the Tropical Forest Pattern, characterized archaeologically by settled villages and the manufacture of pottery, make their appearance on the Island of Marajó at a time estimated as somewhere around A.D. 700 (Meggers and Evans 1957:598). While more recent research pushes that date back somewhat, it is still important to recognize that;

> The chronology of cultural change shows initial occupation by cultivators with a generalized economy of living in small autonomous villages. By A.D. 400, people moved to the headwaters and lakes in order to establish permanent villages and intensively exploit the abundant fish resources. In a few decades, cooperation and competition in such bountiful areas led to the emergence of chiefdoms (Schaan et al. 2009:130).

In this description of the northern Amazon we find similarities to the Upper Xingu in the establishment of permanent villages and village clusters near lakes and along headwaters. Similarly, further to the south, in describing the raised fields of the Southern Amazon, Lathrap found that "It is unlikely that any of the ceramic styles at present known from the Lowlands of Bolivia date from earlier than A.D. 600 to 700" (Lathrap 1970:123).

Moving back to the north, near the confluence of the Solimoes and Negro rivers in the Central Amazon, archaeological research places similar developments during roughly the same span of time. In addition to the appearance of settle villages, archaeology in the Central Amazon also illustrates the increase in village size;

> Early Ceramic age settlements of Amazonian Barrancoid tradition, ca. 300 B.C. to A.D. 800, only covered a few hectares…by the late Ceramic Age, that is, after A.D. 900 or A.D. 1000, local settlements within the CAP area were much more variable in size and content…virtually always with notable ADE sediments and copious pottery sherds (Petersen et al. 2005:9).

Finally, in the Upper Xingu settled villages with ceramics appear also around the same time where “the known cultural history of the region begins by circa A.D. 500-800” (Heckenberger 2005:67).

Thus, the archaeological evidence seems clear; by the late first millennium A.D. major changes were taking place all across Amazonia. In most locations these changes were preceded by long traditions of pottery producing groups. In the other areas, such as the Upper Xingu, these late first millennium changes were the first appearance of people in these regions, perhaps seeking new fertile land in an otherwise crowded Amazon. Like the lowlands of Bolivia, the Upper Xingu stands out as unique from its Amazonian counterparts in these developments. Across the Amazon “small autonomous villages” give way to settlements “with notable ADE sediments and copious pottery sherds”. In the Upper Xingu however, there is not the same evidence for centuries of development prior to the appearance of larger villages. Instead the Upper Xingu shows rapid development between its initial settlement and the beginning of the second millennium A.D. or what can locally be called the Initial and Developmental periods(or Early and Late Ipavu periods) and what Heckenberger has called the developmental phase of the Xinguano tradition (Heckenberger 2005:72). In the Developmental Period large fortified villages are dwarfed in distinction by localized clusters of sites or complexes paralleling the developments in Marajó reported by Schaan where distinctive groups of mounds develop, the largest of which is the Camutins site (Heckenberger 2005:73; Schaan et al. 2009:130).

Another example of the disjunction among regional Amazonian developments occurs around the mouth of the Tapajos River in the context of Santarem. Although contemporaneous with Amazon Polychrome developments, Amazon Polychrome is virtually absent in Santarem where the Incised and Punctate horizon was dominant, much the way the Arauquinoid is present in Venezuela rather than the Amazon Polychrome. This may be true of the Upper Amazon and the Upper Xingu, where there is not a truly Amazon Polychrome tradition but rather an Incised-Punctate/Araquinoid form. This lag or gap in the spread of certain styles may suggest that early suppositions by Lathrap were right. We would expect to find waves of development, not simultaneous development across the Amazon. Successions of people moving out and taking new ideas and styles with them and passing these on either in wholesale replacement or in combination with previous ways of living. If we take what is known of the last 2,000 years in Amazonian prehistory we see some of these waves emerge and thus place the variability present in the Upper Xingu within a broader Amazonian context. It is in fact the "more obvious and significant of these waves" that formed the basis for Lathrap's seminal work on the Upper Amazon (1970). Much of the changing territory, technology, and culture is hypothesized to relate to dramatic environmental changes including intense dry and wet periods and the changing flora and fauna as a result (Whitmore and Prance 1987; Meggers 1994a, 1994b; Meggers and Miller 2003) even in later periods the changing course of rivers can help explain the absence or presence of sites during different periods (Lathrap 1968).

The “Handbook of South American Indians” in 1948 first identified the Tropical Forest Culture of South America by four diagnostic features the first of which is the cultivation of tropical root crops, especially bitter manioc. Lathrap hypothesized that direct evidence on the beginnings of manioc cultivation would date to around 5000 to

7000 B.C. based on the length of time it takes to domesticate wild cultigens (Lathrap 1970:57). He further suggested that the origins of Tropical Forest Culture were to be found in the extensive areas of riverine flood plain in the Amazon about 3000 B.C. (Lathrap 1970:67). However, not until almost 4000 years later do we see any evidence of Tropical Forest Culture in the Upper Xingu. If Lathrap is right this would suggest that the evidence of this culture in the Upper Xingu around A.D. 700-1000 or earlier is the result of its movement out of the Central Amazon much earlier than it appears in the Upper Xingu. This lag is accentuated by the fact that the first ceramics in the Upper Xingu represent the middle first millennium arrival of people from elsewhere in Amazonia and reflect the lack of several central aspects of Amazonian culture that are still not present in the Upper Xingu, including the brewing of beer and the burial of the dead in urns (Mowat 1989). There is other evidence to suggest that Amazonian peoples who moved into the Upper Xingu did not carry with them the full suite of characteristics developed later in the Central and Upper Amazon. One piece of evidence is the way in which bitter manioc is processed in the Upper Xingu. In almost all of Amazonia the shredded tuber is processed through a cylindrical basket called a tipiti. In the Upper Xingu however the *tipiti* is substituted with the *tuafi*. The Upper Xingu has the distinction of being the only place in the Amazon to use the *tuafi* rather than the ubiquitous tipiti. Dole's early recognition of the differential distribution of the *tipiti* and *tuafi* (Dole 1964) and Carneiro's later summary (Carneiro 2001) are in line with other material evidence such as native fiber industries (Petersen et al. 2001) that show cultural distinction across the Amazon. This combined with an understanding of the relationship between Caribbean, Orinoco, and Amazon pottery suggests that the attempts to tie together the entirety of the Amazon through ceramic styles is not entirely unfounded or impossible especially considering the other evidence of successive waves of migrations throughout the prehistory of Amazonia (Petersen et al. 2001a, 2004).

In assessing the movement and possible origins of Upper Xingu cultures using historic and modern ethnographic information, there has been much speculation about native acculturation and assimilation including explanations that involve refuge from violence to the north or south (Gregor 1990:180; Schaden 1964). At least as far as migration from the south is concerned, the intimate knowledge of the forest by Upper Xingu tribes, suggests that they are not purely savannah folk from the south (Carneiro 1978). They also distinguish between primary rain forest (*itsuni*), secondary forest (*tafuga*), *terra preta* (*egepe*), and savanna (*oti*), a developed lexicon that would have developed over a long period of integrating culture and livelihood with the tropical forest environment (Carneiro 1978a:203-204).

Summary

Much is still unknown about the first occupants of the Upper Xingu, when they arrived, and from where they came. The earliest dates are around A.D. 700 though this does not mean earlier dates are not out there to be found. Clearly there are two different foci in the Upper Xingu as laid out by Heckenberger, the eastern and western complexes. Other "new arrivals" are noted at this same time in other disparate portions of the Amazon. Lathrap reports evidence at Pacacocha for the arrival of bitter manioc using, crude pottery making peoples from "downstream" around A.D. 700. Similarly, he reports the appearance of a circular village at Nueva Esperanza around A.D. 700, much like the ones taking shape in the Upper Xingu at this time. These people were later displaced by Cumancaya peoples from the south, at the same time Caribs moved into the Upper Xingu, presumably from the north, following a pattern of multiple migrations and displacements along (or generally up) river valleys, as population and other pressures caused people to move into less fertile areas where they adapted their tropical forest economies to the savannahs and gallery forests, supplemented with fishing.

Finally, the Amazon basin itself, or Amazonia, is diverse in its geographical landscape, soils, topography, and ethnographic diversity. All of this lead one of the pioneers of twentieth century archaeology in the region, Donald Lathrap to the conclusion that, "It is doubtful if the culture history of the tropical forests of South America will ever be successfully encompassed in a really simple developmental model" (Lathrap 1970:21). Even in 1973 Meggers and Evans proclaimed that "although little archaeological investigation has been conducted in the Amazon Basin, even along the main river, existing evidence indicates great variation in the prehistoric pottery (the principal surviving cultural remains) through space and time, implying a complicated history" (Meggers and Evans 1973:66).

The relationships between variation in prehistoric pottery technology, labor, and subsistence demands are presented throughout this study. Ethnographic and archaeological data provide a framework in which the constants and variables of Upper Xingu history can be examined simultaneously. Manioc, a constant source of subsistence throughout Amazonia and in the Upper Xingu, is the main product of labor while pottery is a secondary product of labor. Variations in pottery technology reflect both the increase in demand for manioc and an increase in the demand for labor which produces manioc. Each of these three elements of society, pottery, manioc, and labor, are specific examples of structural elements of society; the control of craft production, social and political control, and subsistence reliance respectively. Each of these is examined separately in light of the new data.

The differences in pottery assemblages present at the sites of MT-FX-06 and MT-FX-13, and between other sites throughout the Upper Xingu region, demonstrate that each village or possibly each household produced its own pottery late in prehistory before shifting at some point to a village specialization system where a single village manufactured pottery consumed be each of the other villages in the regional network. This archaeological evidence fits with other interpretations of the area suggesting that the impact of European contact on the Upper Xingu in the fifteenth century altered the scale and organization of regional chiefdoms and village organization.

Sometime around A.D. 700 a group of people moved into the headwaters region of the Xingu River. They brought with them a pottery tradition that is not dissimilar to the Barrancoid style of pottery, originally documented in the Orinoco River basin but also well documented in the Amazon River basin, particularly in the Upper Amazon in the Ucayali valley and the central Amazon near Santarem. There is almost no doubt that this assemblage of early Upper Xingu pottery was used in the processing of bitter manioc based on both archaeological evidence such as the presence of griddles, or *alato*, and on ethnographic evidence from the Upper Xingu. As population increased during this initial and developmental period the people of the Upper Xingu, Xinguanos, responded with a reorganized and more centralized social and political system. The increased population demanded more food which was handled on a household basis. Village regional density increased and as this happened across the Amazon, and in the

Upper Xingu, conflict arose. Within these regional stresses are situated the village level stresses. This includes a stress on those producing the increased food supplies and those producing the pottery to process those food supplies. The reflection of, or response to, this social stress is found in the transformation of pottery directly linked to the processing of food.

Variation between pottery assemblages through time reflects a concurrent rise in the importance of manioc horticulture and the processing of this root crop early in the chronology. The demand for processed manioc, and therefore the demand for labor to produce it, fueled the change in the pottery used specifically to process it. The transition to a more standardized and uniform suite of pottery vessels whose form and technology suited their function, coincides with an increase in village social complexity and the construction of village peripheral ditches and village segmenting roads, all part of a complex alteration and expansion of the chiefly society of the Upper Xingu. Taken together, the landscape alterations and the shift in pottery production suggest that the chiefly demand for manioc production played a pivotal role in the transformation of pottery technology in the region.

This study attempts to reconcile previous ceramic chronologies from the Upper Xingu and contribute a foundation upon which further analyses in the region can rest with the hope that distinct Upper Xingu ceramic complexes can be more clearly delineated and eventually be more firmly contextualized within a broader Amazonian framework. Although this has been done to some degree by correlating the Upper Xingu ceramics with the Amazonian Barrancoid, Incised-Punctate, Incised-Rim and Amazonian Polychrome traditions, these correlations are very broad and blur local distinctions both spatially and temporally. In short, upper Xingu prehistory (and proto-history) is far too complex to fit well into any of the broad Amazonian traditions. To overcome this and correlate the Upper Xingu first within its own context, a much more detailed attribute analysis was undertaken on ceramics that represent those found and described in each of the previous studies and also represent the full span of indigenous occupation thus far identified in the Upper Xingu. Additionally, ceramics collected by Mario Simões during field studies in 1960s were reanalyzed at the Museu Paraense Emílio Goeldi (MPEG) and included in the overall analysis to link prehistoric remains in the lower Culuene project area with those little studied sites on the Xingu River proper. This geographical distinction between the lower Culuene and upper Xingu is also important. Several other regional distinctions are made here, for example, between Lake Lamakuka and Lake Tafununu, as well as, Lake Ipavu.

One of the primary goals of the ceramic analysis was to better understand changes and continuities in ceramic technology through time and space within the KSA and throughout the Upper Xingu region and broader Amazon more generally. Through systematic sampling both horizontally and vertically, the samples analyzed here represent the full span of time known in the study area, roughly from A.D. 700 to the present. The samples also represent the full range of activity areas across the well mapped prehistoric villages of Nokugu (MT-FX-06) and Heulugihïtï (MT-FX-13). A third goal of this analysis was to identify social distinction within the prehistoric village complexes of the Upper Xingu based on hypothesis set out by previous research (Heckenberger 2005:123). According to this hypothesis the construction of earthworks served to physically enhance social divisions that were already in place. If this is so we would expect to find some difference in the material remains within each of these divisions. The second part of this analysis is also related to the development of these divisions. Previous research also suggests that the increase in population and subsequent social hierarchy was the result or helped along by the increase in manioc production, the main staple of the upper Xingu diet. This increase in production is hypothesized to be reflected in the manufacture of pottery which would have become more specialized for a single use, the processing of manioc. This technique of using the manufacture of ceramics to understand the social organization it produced or was a product of is layered over an already robust knowledge of the spatial organization of both the prehistoric project area and the modern day villages of the project area.

CHAPTER 7
THEORETICAL CONCLUSIONS

Introduction

This study and its corresponding interpretations are based on an analysis of pottery from archaeological sites in the KSA and limited amounts of pottery collected by Mario Simões and others north of the KSA. The amount of data collected from the Nokugu site (MT-FX-06) and the Heulugihïtï site (MT-FX-13) allow for a more detailed understanding of the diachronic trends in pottery form and style from the Initial Period to the Historic Period in the Upper Xingu. The data collected from various sites throughout the Upper Xingu, mostly from surface collections, and analyzed at the MPEG, allow for some interpretation of the synchronic widespread appearance of certain pottery forms and styles sometime during the Developmental and Protohistoric periods.

A transformation in pottery technology is the most statistically significant change over time. This is apparent especially in the Type 1 vessel, or *ahukugu*, used specifically for manioc processing. The most compelling evidence of this transformation is found in the increasing proportion of *cauíxi* temper in comparison to *cariapé* temper. Increased amounts of *cauíxi* improve the thermal properties and physical composition of the vessels creating a lightweight vessel that can be used in long-term hot processing and moved easily for cold processing. Thickness and overall diameter of the Type 1 vessels also increase allowing for more durability and increased productivity. In addition to these technological transformations, *ahukugu* vessels become more standardized in their thickened form and increased size, especially in the style of rim finish.

Sometime during the Developmental Period or early in the Protohistoric Period, after Type 1 vessels were well on their way to the standardized form of their historic counterparts, a regional complex of sites is visible based on decorative variation across the Upper Xingu. Based on surface collected ceramics that date to at least 200 years prior to abandonment of these sites (and probably well into the historic period), a preliminary model of synchronic variability in the late prehistoric Upper Xingu is evident. This model suggests that a regional system existed in which village based pottery production resulted in transmission of village specific manufacturing knowledge through intervillage exchange and exogamous marriage practices and even kidnapping.

> Numerous reports implicate the Suya as feared burglars of the Waurá and other villages of the region, where they steal pots and steal women. Among the Suya there was a minimum of three Waurá women who make all the baked clay pots for the tribe, as explained by Chief Pentoti. These pots were however different from the pots that Waurá women make in their native village. Of circular form, smoothwall, and tapering slightly, they measure in height almost the same as they do in orifice (Schultz 1961:327) [translation by author].

Contrasting this supposition other ceramic ethnoarchaeological studies suggest that "ceramic change is not simply a function of altered post-marital residence patterns or of the immigration of new peoples" (Kramer 1985:95). Clearly, many factors influence the structure of pottery manufacture and production including social and technological circumstances.

Technological Considerations

As historic examples of Suya men stealing pots and women from Waurá villages suggest, knowledge about pottery manufacture in the Historic Period was concentrated into the women of one tribe. This knowledge was so sought after that these women were the subject of kidnapping. Clearly, knowledge about technology in pottery is not restricted to the ceramicist, archaeologist, or scientist. As this historic example illustrates, it is reasonable to assume that prehistoric potters had a level of understanding and sophistication that allowed them to understand the effects of various temper on the workability, drying shrinkage, firing behavior, and fired properties of pots (Rye 1976:109). For anthropologists this is important because the strategies adopted to manipulate these properties are the product of available materials, the transmission of knowledge, and the influence of society, all factors that are reflected in the potter's final product. Consideration of these strategies and influencing structures are critical to a complete understanding of the technology of pottery in the past. As Arnold points out,

> The kicks that turned technological innovations in pottery production into deviation amplifying mechanisms were probably the result of feedback processes like population pressure and increased demand for ceramic vessels (Arnold 1985:220).

Implicit in this statement is the increased demand for more subsistence and in the Upper Xingu this specifically relates to the hot and cold processing of manioc. This demand compelled Upper Xingu potters to develop a vessel that was technologically sound for these processes. They specifically required a large vessel that was not too large to move and could withstand extended periods over a fire. One of the most important aspects of ceramic technology specifically related to performance characteristics in extreme firing conditions is temper. Since the vessel was flat bottomed, unusual for a pot that is used for cooking, the vessel had to be tempered to withstand direct firing during cooking.

As studies in the technology of temper in prehistoric pottery show, the smaller the temper the more resistant the pot is to thermal shock (Bronitsky and Hamer 1986:96). These studies also show that an increase in the amount of small temper also increased the resistance to impact testing after thermal shocking. Bronitsky and Hamer concluded during one of their experimental archaeology studies on the use of small temper that using small temper was in fact “the only instance in the entire testing program in which amount of temper affected briquette performance" (Bronitsky and Hamer 1986:97; Steponaitis 1982).

In the Upper Xingu *cauíxi* provides a small temper that is used in vessels receiving daily long term thermal shock. Although the rate at which potters increased the use of *cauíxi* remains vague, what is clear is that the technological innovations were contemporary with the increase of village size and population. As there was an increased need for larger manioc boiling vessels that could withstand thermal fatigue as a result of longer periods over a fire, the increased amounts of *cauíxi* temper provided thermal resistance in a lighter vessel that allowed for increasing vessel size. Increased vessel size was likely related to increased production capacity. Although today ceramic pots are used almost exclusively for the boiling process, as late as the 1950s they were used for the entire process and would have been produced in much larger quantities (Galvão 1952).

An alternate hypothesis for the increased preference for *cauíxi* temper is a change in diet. If it was not an increase in production that inspired these changes perhaps it was a shift in what was being produced, at least early in Upper Xingu occupation, perhaps during the Initial and Developmental Periods (circa A.D 700-1250), when a variety of crops may have been supplanted with a more manioc focused diet. The use of sweet manioc is known from some areas of the Amazon and the shift in technology may have been a shift to accommodate the introduction (and likely intensification) of bitter manioc processing among a group of people previously accustomed to the low processing requirement of sweet manioc and its variety of associated pottery.

Social Considerations

Changes in temper constituency should not overshadow the concurrent changes in other technological and stylistic attributes. Although "distinctions of temper and firing may be useful chronological markers, refined distinction of vessel shape, rim profile, and style of decoration are more likely to be superior indicators of time" (Lathrap 1964:354). These reflect greatly on the intended use of the vessel which has much to tell us about the sociality and economics of the people using them (Chilton 1999). The fact that Upper Xingu communities reduced the variety of vessel forms to mostly large-mouthed, flat-bottomed vessels, and homogenized the technology to thicker-walled, densely tempered vessels, with standardized rim forms, suggests an intensification or homogenization of subsistence processing and consumption as well as pottery production.

The intensification of domestic ceramics in the Upper Xingu agree with even the most divergent viewpoints in the area regarding the intensive manioc agriculture that took place there in late prehistory (Heckenberger et al. 1999). Given the tumultuous activities that occurred in the final years of occupation at prehistoric Upper Xingu sites and the correlated population changes, shifts, and increases, it is likely that production was on a steady increase at least until A.D 1500. As steady increases in population created a need for more subsistence, in this case processed manioc, there was also a demand for more quantity and more durability in the core ceramic vessel used in the processing of manioc. In present day ethnographic examples it is entirely the women who process the manioc, from harvest to consumption. An increase in agricultural production would have meant a decreased amount of time for the production of pottery especially since harvest and production take place during the same short dry season that is used for pottery production. This would have created an immense stress within each household and perhaps lead to a more focused specialization where one household in each village or even one village produced all the pottery, as documented historically and as is the case in the present-day Upper Xingu. This narrowing of production would surely have lead to a decrease in variety, both technologically and stylistically. Although this is somewhat in contrast to Arnold's supposition that "efficiency is not important because women's time in the home does not contribute economically to agriculture" (Arnold 1985:220), it does seem to fit with the Upper Xingu example where ethnographically men plant and tend manioc in the fields and women harvest and process manioc from before sunrise until late in the morning each day throughout the dry season. In the years before A.D. 1500 (and perhaps just after), before population pressure was affected by European arrival to Brazil, innovation in technology may have resided in the individual household or regional precinct with different kinds of innovation being carried out in individual houses or villages connected by regional networks (Arnold 1985:220).

In the Upper Xingu the identification of social boundaries, regional networks, and identifiable social units, is directly related to identifying the formation of chiefdoms, social hierarchy, and regional social organization. The identification of these units also bears directly on the pattern of organization and its cultural origins. Indeed, the identification of social groups has been a perennial concern throughout the history of archaeology (Stark 1999:25). Ethnographic work in the southern Amazon provides most of the details on the organization of social groups, the identity of tribes, and the differences that are found between the two (Basso 1973; Gregor 1977; Heckenberger

2005). But as more historically oriented research has pointed out, the process of history has done much to change the appearance of these organizational structures from what they may have looked like prehistorically (Dole 1978; Heckenberger 1996). Besides the evidence for contemporaneous village plazas, oriented, connected and segmented by roads, there is little other direct evidence regarding the social organization of the prehistoric Upper Xingu, and even less regarding the intravillage organization of these communities.

A possible first step towards understanding how these units were organized, or even distinguished, is to identify them archaeologically. Not surprisingly, like elsewhere in the prehistoric world, archaeological ceramics offer abundant material culture from which to begin this search for identifiable, prehistoric, social units. This may be done by identifying the so-called "middle range" links between sociopolitical behavior of potters and patterns in clay composition, for example (Neupert 2000). Like form and decoration, compositional variability, including temper, corresponds well with local traditional social boundaries and is a function of both natural and cultural sources of variation such as geographic location or origin (Stark et al. 2000). However, as other research shows, material constraints are not the only factor in choosing clay or temper, social distinction also plays a role (Gosselain 1994). Focusing on other forms of pottery besides those associated with subsistence, when they are available, can also provide important clues about sociality especially since pottery is not always associated with food production (Oyuela-Caycedo 1995).

Besides social boundaries or distinction, ceramic ethnoarchaeology reminds us that technological change and persistence can occur for a variety of reasons including technofunctional performance characteristics as seems the case in Upper Xingu pottery (Stark 2003:207). Detecting motor habits, such as handedness when applying certain decoration or producing perishable materials, can also be useful, as shown in the thumbnail punctates of sites in the KSA and in studies elsewhere (Hill 1977; Petersen, Heckenberger, Wolford 2001). Bronitsky points out that "changes in ceramic technology such as shifts in types, grades, or amounts of temper have ramifications beyond simple changes in cultural preferences” (Bronitsky 1989:2). This extends to the life cycle of pottery and how the technological style may affect its durability (Tite 1999). Even where social changes are reflected in material culture the correspondence may not be easily interpreted. This is especially true for pottery which "responds sluggishly to dramatic external or internal social and political happenings, and only then, when these make themselves felt in more basic day-to-day concerns of living and making a living” are they found in ceramic changes (Rice 1984b:274). Identifying ceramic changes that correspond to day-to-day concerns is successful if analysis is focused on ceramics used in everyday activities.

Archaeologists have long turned to domestic remains to address a wide range of social and everyday concerns. These concerns pertain to the physical process of site formation and the anthropological process of cultural, social, and economic organization (DeBoer et al. 1996). The popularity of using domestic remains to address these concerns results from the households’ status as a universal social unit as well as the ubiquity of the domestic archaeological record, usually in the form of ceramics. Besides nuclear families, households are often described as basic units of human societies, and domestic remains are the common archaeological indicator of such units. In addition, households often leave a distinct archaeological signature and are thus relatively easy to recognize both through soil analysis and patterned refuse.

Household Archaeology

Household archaeology is typically approached as settlement pattern archaeology. This type of study generally attempts to reconstruct social and economic organization through analysis of spatial distribution and the grouping of dwellings. Differentiation in wealth, social status, and domestic activities are all gleaned from this type of study and aid in its conclusions. While the opportunity to have a direct historical comparison in the Kuikuru village affords the opportunity to inform and focus archaeological investigation of prehistoric households, it also risks blurring and confusing interpretation of the archaeological data. Without embracing the Pompeii Premise we can assume a certain degree of replication between human practice in the past and patterned refuse in the archaeological record. In places like the Upper Xingu, ethnographic data can help to resolve questions whose answers are not found in the archaeological record. As well, ethnographic observation can skew our reading of the past if we are not careful to account for those elements of the ethnographic present that were not a part of the archaeological past but have instead emerged from the influence of historical factors.

Challenging the search for universal categories of micro-scale social units, such as the nuclear family and the house, and recognizing the variability of the social context of domestic action, facilitates a more open dialogue with the past that doesn't assume that what we see ethnographically is precisely what we should see prehistorically. That said, the overall model provided by research in the Upper Xingu today does suggest a broad underlying principle of social organization that is replicated on a macro-scale, or within and between those units of analysis above the household level (house, village, polity, regional system). The question is whether or not these underlying principles are replicated on a micro-scale, or within and between those units of analysis that fall below the village level, such as the household.

As other research has demonstrated, exploring domestic processes through the household does not necessarily need to involve excavating dwelling remains (Bermann 1994). In fact, equating architectural remains with households could even hinder the study of prehistoric life, particularly for those societies in which co-residential groups did not coincide with dwellings. In the Upper Xingu this example is true especially for the groups that performed domestic tasks in socially oriented sub-plazas representing large extended families. Domestic organization and activities in such areas may have little to do with the houses in which people slept and tell us more about the social unit for which their labor was directed. Investigations of domestic processes should involve excavation away from residential dwellings and information gathered from what are usually considered non-domestic contexts and house arrangements (Sá 1983). This is further supported by direct observations made in the Kuikuru village. These ethnographic observations included complete inventories of the ceramic and metal vessel assemblages for representative houses from each quadrant of the Kuikuru village (Figure 7-1). Vessel inventories and relationships between houses in these quadrants revealed that certain types of vessels related to manioc processing were shared among related residences. Although each house could establish its own vessel inventory within their dwelling, when it came to vessels in shared areas there was some difficulty in attributing vessel ownership to a particular house.

Figure 7-1. A full vessel inventory for a single non-chiefly Kuikuru house. A Type 4 griddle is in the foreground, a large Type 1 *ahukugu* is decorated to the right, and five Type 2 vessels of various sizes sit behind the griddle, four of them blackened from cooking activity. The cooking area in the background contains examples of Type 1 and Type 4 vessels both suspended over fire. A stack of manioc filled sacks is seen in the upper right. Additional metal vessels are stored behind the house, used exclusively for processing manioc.

Vessels directly related to manioc processing are exclusively located in shared areas outside the house where the occupants of a few houses are jointly in possession of these vessels (Figure 7-2). Clustering of domestic activity between houses is a key link between the ethnographic realities of the Upper Xingu and the archaeological remains. How these house clusters might have looked in the prehistoric Upper Xingu relates directly to identifying analysis groups. Questions about scale and complexity can also be addressed since the appearance of modern day villages is a scaled down version of that present prior to historic population denigration (Heckenberger 1996).

Figure 7-2. This manioc processing area is shared by two households and is located in the backyard between the two houses. Two Type 1 *ahukugu* sit over fires cooking *kuigiku* and several metal vessels are scattered throughout the area.

In addition to these bridging ethnographic observations regarding human practice, domesticity, and social organization, there are taphonomic and sampling issues that must be reconciled to validate any direct historical comparison. Distribution of specific vessel types throughout the archaeological sites suggest that broad horizontal sampling is not biased towards specific activity areas. Additionally, the identification, excavation, and analysis of ceramic remains from House 1 and House 2 show that with the exception of Type 4 vessels, there is very little clustering of vessel types in relation to specific activity areas. This archaeological data conversely fits well with further ethnoarchaeological observations made between 2004 and 2005. Generalized mapping of modern Xinguano houses took place both during occupation in 2004 and immediately after several houses within the village burned and were subsequently abandoned in 2005. Mapping of the burned houses also took place one year after their destruction, noting the process of reuse of materials, abandonment of materials, and the fate of those abandoned materials. Abandoned houses were mostly free of ceramic and other domestic remains. Even the burned remains of house posts were removed and reused. The most characteristic remnants were the in-filled holes from the posts and the trenches around the outside of the house where several rows of various sized wall posts had been located. This area also contained the most accumulated debris from daily house sweeping and the partial burying of the walls on the outside from windblown soil and intentional burying to keep water out during the rainy season.

As outlined here, direct ethnographic observations bring much to bear on the archaeological record regarding the identification of dwellings, social groups, and their organization at the house and village level. The house and its related domestic space used as a unit of analysis can be applied to the archaeological record to denote the possible space occupied and used by a household in areas where archaeological houses are not immediately visible by the distribution of archaeological features. For example, dividing the village into pie-shape wedges, as is indicative of the modern Xinguano village, includes backyard trash middens and plaza-side activity areas, for which very little refuse is found. Given the presumed larger populations of the prehistoric Upper Xingu this method may need to be altered slightly to account for clusters of houses that do not adhere to the historically scaled down modern village's pie shaped scenario.

Still, this division, or some relative form of it, can be overlain on the archaeological village using the observations from the Kuikuru village and the single excavated House 1 at MT-FX-06 as a guide. The extremely low counts of non-domestic pottery may situate these vessels as key indicators of non-domestic areas or the location of specialized places or persons. Despite these possibilities, domestic wares are the main focus of this study and provide the context needed to divide ceramics collected archaeologically into meaningful groupings that can be analyzed for the detection of social bodies contained within houses leading then to the further division of activities and social distinction within households.

Pottery and Technology

The Upper Xingu is a perfect case study for examining change in ceramic technology precisely *because* it is a long, continuous tradition, with recognizable pottery forms and decorative styles that can be traced and compared through a more than 1,000 year tradition which includes modern ethnographic examples. The Upper Xingu also offers a well documented ethnographic and ethnohistoric record that compliments archaeological research. Upper Xingu ceramics are sparsely decorated which situates variation in ceramic technology as a better indicator of diachronic societal development. This leaves difference and similarity in pottery decoration as a better indicator of synchronic societal variation especially late in time when technological developments seem to plateau and village and regional complexes exhibit distinct decorative styles and techniques.

While both technological and decorative attributes can be used to address chronology and identify regional systems of interaction, the main focus of this study is on technological variation, or change, through time. Technological change is tracked here as change in vessel attributes that affect performance, acknowledging that “new insights can be provided about the causes and consequences of ceramic change if one focuses on vessel *performance characteristics*" (Skibo 1994:113). Performance characteristics are accounted for in vessel construction including rim form, overall size, and paste recipes. Because nothing is abandoned or replaced along the trajectory of Upper Xingu pottery development, technological attributes can be followed through time and at some point conjoined with societal changes as understood through traditional archaeological research such as regional survey and mapping as well as village level household archaeology. This is all accomplished with the understanding that "the best-designed study of even the smallest technological change must eventually take the 'leap of faith' when trying to explain the process of interest" (Skibo 1994:113). The processes of interest in this study are two; the process of technological change in pottery and the processes operating within the social structure in which the technological change occurred. These are examined under the premise that the variation in ceramic technology found in the archaeological ceramics of the Upper Xingu is inextricably tied to the social and political developments reflected in village plaza organization and the contemporaneous centralization of political and social control over labor.

Labor and Society

One of the benefits of working in Amazonia is the broad scope of ethnographic research, conducted in various forms for well over 100 years, available in almost all areas of the region including the Upper Xingu. Recent and historical ethnographies of the people of the Upper Xingu provide important elements for this study and allow for a direct historical approach to be combined with the technofunctional analysis of pottery presented here. At the core of this study is an explanation for the observed variation in pottery technology through time. Part of that explanation is found in the specific tasks that pottery was implemented in achieving; the processing of manioc and the cooking of fish. The two main vessel forms, the *ahukugu* and the *atange*, follow these functions. Pottery in the Upper Xingu was produced as a tool for those processing manioc and those cooking fish. More importantly, the demand for increased amounts of manioc resulted in the increased demand for labor to process manioc and thus to produce more pottery to be used in production of manioc.

In exploring the role of labor, the role of technology must remain neutral, as one aspect, or indicator, and not as the *reason* for other factors. Jonathan Friedman suggests navigating this dilemma by enforcing that the "relations of production are not generated by the technology….The process of historical development depends on the relation *between* technology and relations of production" (Friedman 1974:450). The relations between those who make and use pottery, and those who provoke or compel these actions, are the relations of production in this study. Further explained;

> We must always distinguish the technological from the social process of reproduction. Relations of production of those *social relations* which dominate (i.e. determine the economic rationality of) the material process of production in given techno-ecological conditions—at a given stage of development of the forces of production (Friedman 1974:446).

Following this structure of reasoning, the social relations between the physical processors of manioc and those who demand the processing are the relations that directly affect the tools of production, especially in a society where those who process manioc and those who produce pottery are the same people, the women, as is the case in the Upper Xingu (Carneiro 1983; Dole 1978; Oberg 1948).

Those who demand processing in the Upper Xingu, or those who control labor, are those who are “chiefly”. These individuals are imbued with a social and symbolic capital that allows them to demand processing. As Heckenberger surmises;

> Some individuals have a capacity, due to their accumulated symbolic capital, to transform symbolic power into political or economic power that far outstrips that of others. This is particularly evident in terms of labor control, the true measure of chiefly power (Heckenberger 2003:39).

Though it has long been argued that a surplus of food is required for increased social complexity across the globe, in the Upper Xingu the model suggests that a surplus of social capital is perhaps more critical and required first.

Specifically, this social capital, usually a chiefly lineage or ownership of ritual privelage, is converted to the ability to command labor (Heckenberger 2003). Commanding non-subsistence related labor, such as thatching a roof, requires that food be supplied to the laborers (Figure 7-3). This food is produced by the wives and daughters of the man commanding the labor. In this way the resource of labor, both to produce food, and bought with food, is the ultimate form of wealth. Again, as Heckenberger points out;

> In Amazonia, there is little evidence of agricultural surplus or hoarding of wealth by elite families. If there is something controlled it is labor, not material goods (Heckenberger 2003:11).

The relationship between those in power and those whose labor produces material wealth is found between the existence of potential labor and the authority to demand use of that labor. Part of the ability to command labor begins with the ability to accumulate laborers within your house. Negotiating residence patterns are part of the ability to negotiate labor, especially women’s labor used directly to process manioc.

Figure 7-3. Community roof-thatching project where all laborers will be paid with meals consisting of manioc and fish.

Pottery use to process manioc is situated as an object, a subject, and a product of labor. In these roles it is well placed to reveal the nature of those relationships between labor and its use in production. Pottery is an object of labor because it is used by laborers in the processing and production of manioc. It is a subject of labor because it reflects the demands of those who use it and those who manufacture it. Finally, pottery is a product of labor both as the object produced by potters and the subject transformed by the influence of labors necessity; it is the final product of several processes.

Since women are both the laborers who produce the pottery and the laborers who use the pottery, sending the message to the producers that the users need a larger more durable vessel is a simple transmission. Ethnographic work in the Upper Xingu suggests that overall power resides in a chiefs' ability to control labor as symbolic capital (Heckenberger 2003; Menget 1993). Among the Kuikuru this is mostly demonstrated by his ability to compel women to produce surplus manioc. In the past this power likely extended to major community projects such as the excavation of the ditches surrounding MT-FX-06, but through time that power has somewhat waned.

> The question remains, however, whether chiefs, even though pregnant with symbolic capital, can transform this into economic capital, in the form of goods and labor, to achieve greater political power" (Heckenberger 2003:36).

In 1973 Robert Carneiro stated that “even where technology gave an impetus to the rise of civilization, it can be shown that the tools…involved were themselves developed in response to societal demands” (Carneiro 1973:179). In the Upper Xingu, three main lines of evidence suggest this is true. First, an examination of the variation in pottery through time, second, ethnographic evidence regarding the use of pottery, and third, landscape and village configuration suggesting a rise in population and an elaboration of social organization. Carneiro quotes Robert Adams in a statement that sums up the situation in the Upper Xingu nicely, by saying that “it seems to have been primarily changes in social institutions that precipitated changes in technology, subsistence and other aspects [of culture]…rather than vice versa" (in Carneiro 1973:179).

Summary

This study is driven by two broad research questions. First, in what ways can we study archaeological ceramics to learn more about the society that produced and used them and second, what can archaeological ceramics tell us about prehistoric social dynamics in Amazonia and the Upper Xingu? To answer these questions this study focused on two prehistoric villages in the Upper Xingu of the Southern Amazon occupied between ca. A.D. 700-1770 and ethnographic data from the historic period from roughly 1884 to the present. These dates are particularly important to this study for two reasons. First, it is around A.D. 700 or earlier that widespread movements of prehistoric people have been documented archaeologically in the Amazon basin and second, it is documented that between A.D. 1250 and 1500 these villages were fortified with newly constructed defensive ditches, both in the Upper Xingu and the Central Amazon.

We may now perhaps refine the research question to this; does the archaeological ceramic assemblage from two prehistoric sites in the Upper Xingu reflect the dramatic activities that occurred at the beginning and end of the occupation of these sites? At what point does pottery production in the Upper Xingu move beyond simple household production and become a household industry (Rice 1987:184; Feinman 1999). This basic connection between pottery development and complex societies remains a central theme for many archaeologists;

> For archaeologists this subject has been important because, despite the operational problems of identifying specialists in prehistory, economic specialization in production and distribution is generally acknowledged to be a concomitant of large, complex, highly differentiated societies and to depend on other intensive production arrangements, for example, in agriculture (Dow 1985; in Rice 1987).

Given this generally accepted principle, the Upper Xingu provides the perfect case study to test this hypothesis by examining changes between the Initial Period and the Developmental Period. It is in the Developmental Period that Heckenberger has documented the expansion of large fortified villages, connected by roads, and the sudden appearance of defensive ditches around these villages. As well, satellite imagery shows marked forest alteration around prehistoric villages dated to this period.

All of this suggests that in the Developmental Period, populations were large, horticulture was intense, and socioeconomic complexity was reaching new heights.

Some of this change in production level can be attributed to the waves of European contact in more recent times beginning at A.D. 1500 on the coasts and rapidly spreading along river routes. However, much of this change occurs well before European contact and in the context of broader environmental and social changes happening throughout Amazonia. These changes are well documented in other areas around the end of the first millennium A.D. In the Upper Xingu we see these changes with the initial settlement of the area around A.D. 700 and with the growth and fortification of these settlements from about A.D. 1250 to 1500. Caught in the maelstrom of change, or in fact, reflective of this change, is the Upper Xingu ceramic industry. At first this production can be classified as one of household or village level production and later perhaps as a regional level of production (Feinman 1999; Rice 1987; Longacre 1991).

Though the period between household and village production is not well understood apart from other periods, something clearly caused the specialization of ceramic production to be focused among one group of people. It is possible that each village may have been responsible for producing different ceramics until the intense focus on manioc production caused the decline of production variation in ceramics among other groups and a monopoly on production was created by the group responsible for producing the vessels needed for the processing of manioc. Indeed, this group, the Waurá, is one of only three Arawak groups in the area, the language group hypothesized to have arrived in the region first and in this case likely to have reached a local level of sophistication in manioc production before other invading groups, such as the Carib, Paraci, and others arrived. Further evidence of this relationship may be found in how manioc is processed in this region which as others have pointed out, is entirely unique to the Upper Xingu. The process of using *tuafi's* rather than *tipiti's* relies on the use of the large low collared *ahukugu* vessels; in fact this type of processing would be impossible or very difficult and inefficient with a smaller diameter, pedestal base vessels. In other parts of the Amazon a technique using the *tipiti*, a long woven tube that is hand squeezed and left to drain, does not require such specific vessels and there are no correlates to this vessel in other parts of the Amazon to the north (Carneiro 2000).

Observable changes in village organization also illustrate the changes of the early prehistoric Upper Xingu. Heckenberger presents evidence for the construction of defensive ditches during the Developmental Period at both MT-FX-06 and MT-FX-11 beginning around A.D. 1250. He notes the construction of defensive ditches and corresponding roads and berms, suggesting that the internal constructions and the resultant village configuration were the "developmental apogee" of the concentric circular village pattern seen today in the region (Heckenberger 1996:97). Heckenberger goes further to say that "the pie-shaped partitioning of the site created discrete domestic precincts or 'neighborhoods' situated between roads and also delimited by the plaza and excavated ditches" (Heckenberger 1996:97). He further suggests that within each precinct resided “political action groups or factions” that in prehistoric villages "were undoubtedly much larger, more clearly defined and more internally complex" (Heckenberger 1996:97). Given the undoubtedly more complex social divisions and their clearly defined hierarchy we should expect to see some reflection of this in the material culture of these groups or factions across the village unit depending on the level of manufacture of pottery.

In characterizing the development of Xinguano culture during prehistory, three aspects of the ceramic technology remain important. The first aspect of this industry is related to its function. The survival into modern times of a large vessel that is used in the processing of manioc suggests that the development of this technology was an important process for the subsistence economy of the Xinguano. The second aspect of the ceramic industry is the structure of social relations involved in its production. Today, a single tribe is responsible for the manufacture of pottery for several separate tribes. Understanding the scope and timing of this development from presumed household production to village production is a key factor in understanding the development of the Xinguano society. Finally, contextualizing ceramic technology and its development in the Upper Xingu with developments elsewhere in the Amazon situates the Xingu into a wider context of regional and local influencing factors.

In summarizing the results of this analysis three clear transitions can be documented from the Initial Period through the Protohistoric Period. First, a clear preference for *cauíxi* or sponge spicule temper appears to originate in the later part of the Initial Period and continues to increase through the Developmental Period while other tempering agents decrease or remain the same. Second, the overall variety in vessel forms diminishes in the late Initial Period and continues into the Developmental Period where Type 1 manioc cooking and processing vessels become more common. Third, as the preference for Type I vessels in the Developmental Period continues their rims become more standardized and increase in thickness. Vessel size measured by oral diameter also increases creating an overall more robust vessel where the average rim thickness has almost doubled.

A discussion of these transitions in ceramic technology can be placed within the general outline of Upper Xingu culture history specifically in relation to three major developments. First, while earlier dates may exist in the Upper Xingu, research thus far suggests that the earliest settlement of this area by pottery producing groups occurred around A.D. 700. Second, between A.D. 700 and A.D. 1500 a transition in the manufacture of pottery, significantly the transition to flat bottomed vessels, large amounts of *cauíxi* temper, and gradually out-flaring rims, a vessel essential to manioc processing, suggests a concurrent and dramatic transition in subsistence which is taken to be more intensive processing and accumulation of bitter manioc. Third and finally, between A.D. 1250 and A.D. 1770, Upper Xingu pottery demonstrates a marked process of standardization that coalesced concurrently with the first expression of social complexity found in the archaeological visibility of a connected network of circular plaza villages. Given the connection between manioc processing and its specialized pottery, these developments suggest that manioc production played a key role in the expansion and development of the social complexity of the region as expressed in the landscape transformations and standardization of ceramics. In relating this to the rest of the Amazon we can first look to the Central Amazon, where many suppose a settled Amazonian agricultural way of life first developed. Here a continuous complex of pottery is documented uninterrupted from 350 B.C. until A.D. 750 when a new complex of pottery appears. This noticeable pattern of change concurrently appearing across the Amazon still lacks a definitive explanation although environmental pressure, population pressure, subsistence changes, and social transformations have all been suggested, often in relation to each other. Clearly, much has changed over the last 1,200 years in the Upper Xingu. Settlement patterns grew from small single plaza villages to larger village complexes connected by networks of roads. The ceramic industry changed from one of greater variability to one of great homogeneity with increasing vessel sizes likely related to chiefly demand on labor. Unfortified circular villages became larger fortified villages and again in recent times singular, isolated, non-fortified villages.

Finally, discussions of ceramic production are common in the archaeological literature of complex societies and urbanism, where studies of craft specialization, and standardization, are considered in relation to political complexity. The Upper Xingu case falls within these discussions of standardization, specialization, and routinization. In the Upper Xingu there is a direct correlation between the development of ceramic production and the development of complex social organization. This is most clearly illustrated in the transformation of pottery which parallels the elaboration of regional and village level social complexity. The role that ceramics played in the intensified production of manioc and manioc’s role in the apparent increase in population, place the production of pottery squarely in the center of any discussion about the development of complex social and political organization in the Upper Xingu. The timing of these events and their seeming ubiquity across the Amazon raises still more questions for Amazonian archaeologists.

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BIOGRAPHICAL SKETCH

Joshua Robert Toney was born in Brattleboro, Vermont in 1974 and graduated from Brattleboro Union High School in 1992. After one year at the University of Rhode Island he moved back to Vermont to study history and anthropology at the University of Vermont. He began his archaeological career in 1995 when he enrolled in a summer field school taught by Dr. James B. Petersen. He received a BA in history and philosophy in 1997 and continued travelling the lower 48 states in search of archaeological fieldwork before moving back to Vermont in 1999 where he worked as an archaeologist at the University of Vermont's Consulting Archaeology Program. At the encouragement of Dr. Petersen he began graduate studies at the University of Florida under Dr. Michael J. Heckenberger, travelling to the Upper Xingu in 2002 to begin his fieldwork. He received his MA from the University of Florida in 2005, moved to Hawaii in 2009 to finish writing his dissertation, and received his PhD from the University of Florida in 2012.