TECHNOLOGICAL STYLES OF LATE POSTCLASSIC SLIPPED POTTERY FROM THE CENTRAL PETÉN LAKES REGION, EL PETÉN, GUATEMALA

By

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B.A., M.A.

A Dissertation
Submitted in Partial Fulfillment of the Requirements for the
Doctor of Philosophy

Department of Anthropology
In the Graduate School
Southern Illinois University
Carbondale
April 2001

UMI Number: 3019249

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The Graduate School
Southern Illinois University

March 23, 2001

I hereby recommend that the dissertation prepared under my supervision by

Leslie G. Cecil

Entitled

The Technological Styles of Late Postclassic Slipped Pottery Groups in the Petén Lakes Region, El Petén, Guatemala

be accepted in partial fulfillment of the requirements for the

DOCTOR OF PHILOSOPHY degree

In Charge of Dissertation

Head of Department

Recommendation concurred in

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Committee
for the
Final Examination

AN ABSTRACT OF THE DISSERTATION OF

LESLIE G. CECIL, for the Doctor of Philosophy degree in ANTHROPOLOGY, presented on March 23, 2001, at Southern Illinois University at Carbondale.

TITLE: Technological Styles of Late Postclassic Slipped Pottery from the Central Petén Lakes Region, El Petén, Guatemala

MAJOR PROFESSOR: Dr. Prudence M. Rice

Historical, ethnohistorical, and architectural data suggest that multiple social groups occupied the Petén lakes region of Guatemala during the Postclassic (A.D. 950-1524) and Contact (A.D. 1524-1700) periods. However, no single class of data unambiguously confirms which social group occupied which archaeological site during the Postclassic and Contact periods. Through the comparison of pottery technological style data, I suggest that Petén Postclassic potters produced and reproduced pottery technological styles as part of their social identities.

Five ceramic groups of Postclassic slipped pottery are analyzed from Ch'ich', Tayasal, Ixlú, Zacpetén, Macanché Island, and Topoxté Island in Petén, Guatemala and from Tipuj in Belize in order to identify patterns of technological styles. Decorative styles are examined in terms of technique (e.g., painting and incising), motifs, colors, and form. Technological attributes are studied through "low-tech" analyses (hardness, slip and paste color, and refiring), binocular microscopy, petrography, x-ray diffraction (XRD), energy dispersive spectroscopy (EDS), scanning electron microscopy (SEM), and strong-acid extraction inductively coupled plasma spectroscopy (ICPS) analyses. Descriptive statistics and multivariate analyses of the data identify clusters of co-

occurring variables and help isolate technological styles. When these characteristics are examined together with ethnohistorical, architectural, burial, and decoration color and motif data from archaeological sites in Petén and northern Yucatán, I suggest which social group may have produced which technological style.

This research contributes to the discussion of what style is by combining many of the different views of style proposed by anthropologists, and because it goes beyond analysis of merely surface painting and design. In addition to theoretical significance, this research has methodological significance in that it demonstrates that the analysis of technological style can be operationalized through several types of analyses and that behavioral and technical questions asked by anthropologically-oriented archaeologists can be answered using archaeometric methods.

ACKNOWLEDGMENTS

This dissertation represents many years of pottery analysis in Guatemala and the United States, a critical evaluation of the state of Maya pottery studies, and invaluable advise and guidance from many people that have greatly improved this study.

Foremost, I would like to extend a heartfelt thanks to Prudence M. Rice, my dissertation advisor and a co-principal investigator of Proyecto Maya-Colonial. Her support and guidance with my graduate studies and the many hours of guidance in the pottery laboratory in Flores, Petén and in Carbondale, IL provided a unique opportunity to expand my knowledge of the Maya and pottery analysis. I would like to thank her for taking me under her wings.

I would also like to thank Don S. Rice, a co-principal investigator of Proyecto Maya-Colonial and a member of my dissertation committee, for his support and guidance in Petén and Carbondale. His knowledge of the Maya and our conversations about the Postclassic era were invaluable to my research.

C. Andrew Hofling, a member of my dissertation committee, provided me with the invaluable information about decorative motifs and Maya social organization. I would also like to thank him for his instruction and comments of my dissertation.

Jonathan Hill, a member of my dissertation committee, aided me in the theoretical concerns of my research. His comments on my dissertation are also greatly appreciated.

Richard Fifarek, a member of my dissertation committee, taught me about minerals, clays, and x-ray diffraction. I would like to thank him for introducing some "rouge" archaeologists into the world of clay mineralogy and x-ray diffraction. I also greatly appreciate the time that he spent with me analyzing and re-analyzing my x-ray diffraction data and thin-sections of pottery.

I obtained by pottery sample from Zacpetén which was excavated by Tim Pugh. I want to thank him for his excavation information and for his comments. Rómulo Sánchez-Polo excavated Ixlú. I would like to thank him for his data that pertained to Ixlú as well as for his endless hours of help in Guatemala. Without his kind assistance that ranged from obtaining workers to mundane household activities, I would still be in Petén washing sherds.

SEM and EDS analyses were conducted by Dr. John Bozzola, Dr. Steve Schmitt, and Dee Gates of the Micro-Imaging and Analysis Center at Southern Illinois University at Carbondale. Strong acid-extraction ICPS analysis was conducted under the guidance of Dr. Bradley Paul and Sisir Chaturvedula of the Department of Mining and Engineering at Southern Illinois University at Carbondale. They trained me in these methodologies and I would like to thank them for having faith in an archaeologist. I would also like to thank Kevin Davey for creating Figures 1 and 129.

I would also like to thank Dr. Gloria Greis at the Peabody Museum at Harvard University, Ann Cordell at the Florida Museum of Natural History at the University of Florida, Arlen Chase at Central Florida University, and Bernard Hermes at Yaxhá, Guatemala for allowing me to view the pottery collections from Topoxté Island, Macanché Island, Tayasal, and Topoxté Island (respectively). Their assistance and comments provided information that greatly expanded my research.

The research presented in this dissertation was made possible through funding from Proyecto Maya-Colonial of Southern Illinois University at Carbondale, from the National Science Foundation (Dissertation Improvement Grant SBR-9816325), from Sigma Xi Grants-In-Aid of Research, and from Southern Illinois University at Carbondale in the form of a University Fellowship and a Dissertation Research Award.

This dissertation was conducted as part of Proyecto Maya-Colonial. Don S. Rice, Prudence M. Rice, Grant D. Jones, and Rómulo Sánchez-Polo are the principal investigators of the project and I would like to thank all of them for including me as part of the project. I throughly enjoyed my experience in Petén and am eternally grateful for their support and critical evaluation of my research. In addition to the principal investigators, I would also like to extend my thanks to Miriam Salas who spent many months with me in the laboratory analyzing sherds and recording excavation information. Without her help, the laboratory would not have run as smoothly as it did and I would not have been able to complete my analysis in a timely manner. I would also like to thank Matt Rockmore, Kevin Schwarz, Bill Duncan, and Benito Burgos who also aided in my research and provided laughter in the lab. I would also like to thank IDEAH for allowing me to export my sample of pottery for analysis in the United States.

Finally, I would like to thank my parents for their support, love, and faith in my research and graduate career.

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CHAPTER 1

INTRODUCTION

On-going research into the Postclassic (A.D. 950-1524) and Contact (A.D. 1524-1700) periods in the Maya lowlands of Petén, Guatemala (Jones 1989, 1996, 1998; Jones et al. 1981; D. Rice 1986, 1988; Rice and Rice 1981, 1984, 1990; P. Rice 1979, 1986, 1987a, 1996a, 1996b, 1996c; Rice et al. 1996) reveals a situation of changing alliances, changing dominance relations, and repeated migrations of social/ethnic groups. Numerous ethno-socio-political groups may have co-existed in the Petén lakes region in the Late Postclassic period, but at the time of the Spanish conquest in A.D. 1697 two dominated, the Itzá and the Kowoj (Jones 1998) (Figure 1). Each had a principal province headed by a leader at a provincial capital, controlled different subprovinces, and had distinct origin and migration myths. Because of these archaeologically and ethnohistorically documented socio-political differences, I compare the Petén Postclassic slipped pottery technological style data from Ch'ich', Tayasal, Ixlú, Zacpetén, Macanché Island, Topoxté Island, and Tipuj to examine the proposition that potters in the Itzá and the Kowoj provinces produced and reproduced pottery technological styles as part of their social identities during the Postclassic and Contact periods.

The Itzá controlled the southern and western basin of Lake Petén Itzá, an area stretching from Lake Quexil west to Lake Sacpuy, with their capital, Nojpeten or Taj Itzaj, on modern Flores Island (Jones, Rice, and Rice 1981) (Figure 1). Their ruler, Kan

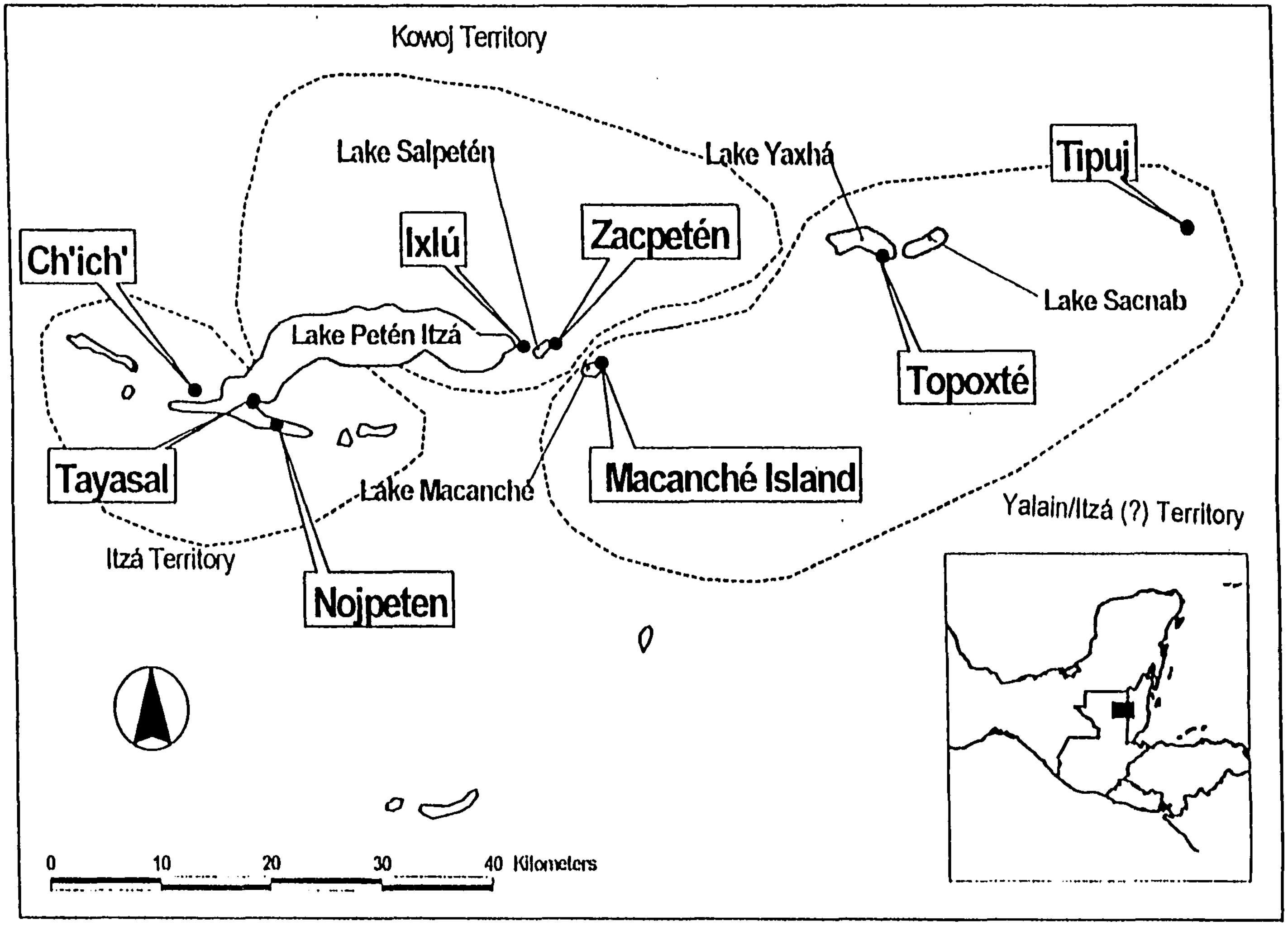

Figure 1: Postclassic Archaeological Sites and Ethnohistorical Social/Ethnic Groups discussed in text (adapted from Jones 1998:Map 3).

Ek', claimed ancestry from Chich'en Itza and stated that the Itzá migrated from the Yucatán peninsula when Chich'en Itza fell. The Kowoj claimed ancestry from Mayapán and migrated to central Petén after that city fell (Jones 1998). Kowoj patronyms and matronyms were held by prestigious individuals at Mayapán (e.g., the "guardian of the east gate") (Roys 1967:79). Late in the Contact period, the Kowoj occupied territory from the northern basin of Lake Petén Itzá to Lake Salpetén and had their province capital at Saklamakhal (probably in the eastern port region around the sites of Ixlú and Zacpetén) (Figure 1) (Jones 1998:66). Differing identities, Itzá and Kowoj, may be expressed in civic-ceremonial architecture (Pugh 1995, 1996; Rice, Rice, and Pugh 1997), burial practices (Duncan, personal communication 2000), and slipped pottery (Cecil 1999, 2000a, 2000b).

Initial archaeological results are consistent with the socio-political regionalization suggested by Spanish documents. Although Spanish documents suggest that many social groups lived in the Petén lakes region during the 17th and 18th centuries, data gathered by Proyecto Maya-Colonial detected the east-west socio-political differences between the Itzá and the Kowoj, respectively, based on differences in architecture, burial practices, and pottery. Further excavations and analyses of archaeological sites in the Itzá territory and other social group territories will undoubtedly enhance the current knowledge of the socio-political differences described in Spanish documents.

In this context, it is important to make use of the Postclassic and Contact period pottery of the lakes area to delineate differences among social identities, especially between sites/territories of the Itzá and the Kowoj. One way to accomplish this is through the analysis of "technological styles" of this pottery. "Technology" is seen here as the operational sequence of choices of manufacture that include decisions concerning matter (clay), energy (the forces that move and transform matter), objects (artifacts), human gestures (the movement of raw materials involved in manufacture), and specific knowledge (the "know-how" that produces the end product that is a result of all possibilities and choices for technological action or social representations) (Lemonnier 1992:5-6). "Style" refers to the "visual representations, specific to particular contexts of time and place, that at the least transmit information about the identity of the society that produced the style and about the situation or location where it appears" (Rice 1987b: 244). The visual representation can be painted, incised, appliqued, or modeled. By determining the existence of distinct Petén Postclassic technological styles, one can explore how technological differences in pottery manufacture and decoration can combine to constitute analytically different classes (i.e., technological styles) of pottery.

Pottery from the five slipped Petén Postclassic ceramic groups (Paxcamán, Fulano, Trapeche, Augustine, and Topoxté) are analyzed here employing the theory of technological style as defined by Lechtman (1977). I use Lechtman's concept of technological style to explore the technological and decorative variability of material culture (Lechtman 1977, 1979, 1981, 1984a, 1984b, 1988, 1993, 1994; Lemonnier 1986, 1989, 1992, 1993; Stark 1998; Wright 1985). Technological and decorative variability results from the relationships between decorative elements and the patterns people produce through various behaviors. When creating material objects, the producer may have many choices (operational sequences) to make that reflect the social and cultural constructs that underlie and direct her/his actions, and subtle differences in a choice (e.g., matter, energy, motor patterns, etc.) can influence the social representation of material culture (Lemonnier 1992:23, 1993:9; Lechtman 1977:6). Therefore, both the material and the process of manufacture contribute to an object's style as much as does the surface decoration because technological acts are embedded in a symbolic system that reflects social reality and indigenous knowledge.

Preliminary definitions of technological styles of Petén Postclassic slipped pottery are developed by means of analysis of pottery excavated from Ch'ich', Ixlú, and Zacpetén in Petén, and Tipuj in Belize. Existing collections of pottery from Tayasal, Topoxté Island, and Macanché Island (excavated earlier and/or by other projects) are then examined visually to determine if the same patterns of technological styles hold true for the entire region or if different technological styles can be distinguished at these sites. Sherds from these sites could only be visually examined because the collections are curated at other locations.

In order to identify patterns of Postclassic technological styles from pottery at Ch'ich', Ixlú, Zacpetén, and Tipuj, several kinds of analysis are conducted to gather technological and stylistic data: type-variety analysis, "low tech" analyses, mineralogical analyses, and chemical analyses.

The first level of analysis consists of typological analysis using the type-variety system (Smith, Willey, and Gifford 1960). This hierarchical system uses a series of categories–ware, group, type, and variety in descending inclusiveness–to organize levels of variability in archaeological pottery. All Postclassic slipped sherds from Ch'ich', Tayasal, Ixlú, Zacpetén, Macanché Island, Topoxté Island, and Tipuj are classified as to ware, ceramic group, type, and variety (where possible) (Chapter 5). For purposes of studying technological styles, it is particularly useful to consider pottery at the ware level.

Ware definitions are based primarily on paste attributes and surface finish, but also convey information about geographical location, time period, decoration, and function (Rice 1982:50). Differences at the ware level with regard to general paste characteristics such as color and inclusions, surface finish, decoration, quantities of form categories, and overall technology occur in this sample. The differences discussed in Chapter 5 are not numerous, but it is these small differences in wares and decorative modes that prove to be important when discussing the technological styles and social identity of groups in the central Petén lakes region. Because technological styles incorporate the relation of designs to patterns people produce through various acts, they distinguish the style of a particular category of material culture. The decorative aspects of design, whether a simple color or intricate combinations of motifs and elements, are a product of the behavior of the producers of that object. Thus, it is the integration of behavioral events at each level of manufacture that defines technological style.

My use of "design" through this research refers to the planned creation of a pattern (e.g., the placement of a series of curls or hooks to indicate the level of the watery Underworld). This is different from my use of "decoration" which refers to the painted, incised, appliqued, or modeled visual representation (e.g., a curl or hook motif). The use of technological styles focuses on the use of decoration in conjunction with technological characteristics of pottery.

The second level of analysis, "low tech" analysis, includes slip and clay paste color measurements, degree of dark coring, hardness measurements, surface treatment and decoration sequence identification, vessel form measurements, and refiring experiments (Chapter 6). As a result of differences in paste and surface characteristics, I define three general and preliminary technological styles that correlate to differences in the three ceramic wares of this study. These groups reflect differences in diversity indices of slipped surfaces, slipped surface characteristics such as double slipping and "waxy" surface finishes, and firing technologies. Technological style groups based on observations at this level of analysis suggest that Itzá and Kowoj potters made choices based on matter (clay and slip), energy (surface finish and decoration), and specific knowledge ("know-how," such as firing technology and surface finishes).

Mineralogical analysis, the third level of analysis, identifies the clay minerals, non-plastic inclusions, minerals, and rock fragments in a clay paste as well as slips on the vessel surface (Chapter 7). In order to gather this data, I conducted petrographic and x-ray diffraction analyses. Petrographic analysis allows for the identification of minerals by means of their unique optical properties and provides qualitative (shape and sorting) and quantitative (size and frequency) data for comparison at the ware level. Percentages of pores and inclusions in the clay paste are characterized through the comparison of various tables and ternary charts. Because petrographic analysis does not reveal the full mineralogical composition of a pottery sample, it is combined with x-ray diffraction analysis to identify clay minerals by their crystalline structure. X-ray diffraction also provides data on the presence of other minerals, such as gypsum and feldspar, that may have been difficult to identify through petrographic analysis.

Mineralogical analyses lead to the definition of four technological style groups based on the characteristics of the clay pastes: 1) clay pastes dominated by voids (Vitzil Orange-Red and Clemencia Cream Paste wares); 2) clay pastes dominated by cryptocrystalline calcite inclusions (Volador Dull-Slipped and Vitzil Orange-Red wares);

3) clay pastes with quartz, chert, chalcedony, hematite, and calcite mineral inclusions (Volador Dull Slipped, Vitzil Orange-Red, and Clemencia Cream Paste wares); and 4) clay pastes that include quartz, chert, chalcedony, hematite, calcite, and biotite minerals (Volador Dull-Slipped, Vitzil Orange-Red, and Clemencia Cream Paste wares). X-ray diffraction of sherd samples does not provide additional data to further differentiate the four groups because all sherd samples included montmorillonite and halloysite clay minerals. Technological style groups developed at this level of analysis suggest that Petén Postclassic Maya potters made choices based on matter (such as clays with different mineral suites) that may have been influenced by the socio-political milieu of contested boundaries during the Postclassic period.

The final level of analysis, chemical analysis, involves energy-dispersive spectroscopy (EDS), scanning electron microscopy (SEM), and strong acid-extraction inductively coupled plasma spectroscopy (ICPS) analyses (Chapter 8). Chemical analyses provide information on the elemental composition of the clay paste that, when combined with the other levels of analysis, provides a powerful tool of interpretation. EDS and SEM analyses are employed because x-ray diffraction analysis is not able to detect clay minerals fired above 450°C as a result of changing crystalline structures. EDS analysis produced clay groups based on various intensity peaks of the most common elements in the clay pastes. SEM analysis provided comparable images that further grounded the EDS clay groups. Strong acid-extraction ICPS analysis is conducted to determine the elemental and composition groupings of the pastes that resulted from different clay resource choices during manufacturing.

EDS and SEM analyses produced 10 elemental groups and strong-acid extraction

ICPS analysis produced seven chemical composition groups. EDS and SEM elemental groups reflect the differences between Volador Dull-Slipped and Vitzil Orange-Red ware pottery and Clemencia Cream Paste ware pottery because Volador Dull-Slipped and Vitzil Orange-Red ware pottery share a similar elemental suite. Strong-acid extraction ICPS analysis resulted in seven chemical compositional groups that represent different pottery wares. The elemental differences demonstrate choices in clay and/or mineral resources and possibly knowledge of the clays and minerals used by Maya potters.

When data from the four levels of analysis are examined together, seven technological style groups occur that reflect differences in choices made at the technological and decorative levels (Chapter 9).

As a result of many levels of analysis and methodologies, it is possible to determine the existence of multiple technological styles of Petén Postclassic slipped pottery. By comparing these data with architectural, burial, and additional pottery stylistic characteristics, it is possible to suggest which social/ethnic groups produced which technological style of pottery. This research builds on 20 years of archaeological research into Postclassic sites and pottery in the Petén lakes region to investigate the material representations of Maya identities by demonstrating that potters in the Itzá and the Kowoj provinces produced and reproduced pottery technological styles as part of their social identities during the Postclassic and Contact periods.

The technological styles of Petén Postclassic pottery discovered through this analysis demonstrate that: 1) technological and stylistic choices have a social context; 2) technology and style are social reproductions of Postclassic society; 3) some technological and stylistic choices were more compatible than others within Postclassic

Maya society; 4) technology affects style; and 5) these compatible choices reinforced the existing technology and social ideology. Similarities of formal arrangements of technological and stylistic patterns contribute to the assessment of the social/ethnic identities and histories of different social groups in Postclassic and Contact period Petén. By identifying distinct technological styles associated with different ceramic groups and/or archaeological sites, it is possible to refine our understanding of the settlement and socio-political relations of the Itzá and the Kowoj in Petén.

My research based on technological style contributes to the discussion of what constitutes "style" first because it combines many of the different views of style proposed by archaeologists and anthropologists, and second because it goes beyond analysis of only surface painting and decoration. Technological style incorporates aspects of technological choices in manufacture as well as decorative elements that are commonly considered "stylistic." The conjunction of technology and style in material culture provides additional means by which anthropologists can discuss social identity and social boundaries.

Finally, this research has methodological significance in that it demonstrates that the analysis of technological style can be operationalized through the use of type-variety analysis, "low tech" analyses, mineralogical analyses, and chemical analyses. It shows that behavioral and technical questions asked by anthropologically-oriented archaeologists can be answered by using archaeometric methods. This is important because archaeologists and archaeometrists frequently focus on different topics of interest. As a result, the archaeometrists' techniques often do not provide the information necessary to answer archaeological and anthropological questions. However, this use of technological style and methods of analysis demonstrates one of the ways that archaeometric methods can be effectively used in anthropological research.

CHAPTER 2

THE PETÉN LAKES REGION–THE SOCIAL GROUPS AND ARCHAEOLOGICAL SITES

The Maya occupied the Petén lakes region from the beginning of the Middle Preclassic (600 B.C.) throughout the Classic (A.D. 250-900) and Postclassic (A.D. 900-1524) periods to the present. During this broad time span, Maya material culture changed due to contact with other social groups, changing environmental conditions, and a changing political milieu that ultimately, by the end of the Classic period (ca. A.D. 900), resulted in population consolidation and reorganization around easily defendable lands near water sources. The Postclassic period defines the final period in pre-conquest Maya history.

Scholars propose two different views of socio-political organization during the Postclassic period. The first is based primarily on archaeological evidence-- pottery and other categories of material culture-- and proposes a time of great regionalization between the Terminal Classic period and the Historic period. This socio-political reconstruction of the central Petén lakes region is based on archaeological research carried out in the 1960s through the 1980s by Adams (1971), Bullard (1960, 1970, 1973), Chase (1979, 1983, 1985), Cowgill (1963), Rice (1979, 1985, 1986, 1987a, 1996a), and others. They suggested that from the Terminal Classic period to the Historic period, pottery types and other categories of material culture that correlate to changes in social and political organization demonstrate regional variability. Differences in quality and quantity of various pottery types and architectural features may have resulted from changes in Maya society as populations relocated in the central Petén lakes region from surrounding areas after the Late Classic collapse (D. Rice 1986).

The second, and more recent, view of socio-political organization during the Postclassic period is informed by Spanish documents and ethnohistories that illuminate the situation primarily from approximately A. D. 1450-1700 (Jones 1998). It reveals a situation of changing alliances, changing dominance relations, and repeated migrations of social/ethnic groups during the Late Postclassic and Contact (A.D. 1525-ca. 1697) periods in the Maya lowlands of Petén, Guatemala. It proposes that Petén was divided into administrative provinces headed by and named after a dominant lineage and each lineage controlled several subprovinces or territorial regions throughout the area. As a result of expansionistic tendencies, socio-political boundaries were contested (Jones 1998). The Kejach, Mopan, Yalain, Itzá, and Kowoj occupation in the Petén lakes region may have resulted in conflict between the social groups, especially among the Yalain, Kowoj, and Itzá, and social and political boundaries may have been created to enhance and enforce social differences. Dialect differences may also have existed to distinguish Itzá and Kowoj social groups (Hofling, personal communication 1997). In addition to possible dialect differences, civic-ceremonial architecture also differs. Zacpetén, an archaeological site in the Kowoj territory, has architecture that resembles Mayapán temple assemblages (Pugh 1996), while Ch'ich', an archaeological site in the Itzá territory, has architecture different from Zacpetén (Rice et. al. 1996). Yalain, an archaeological site in the Yalain territory, has architecture that is different from both Zacpetén and Ch'ich' (D. Rice, personal communication 2000).

Pottery in different regions shows great variability with a multitude of paste varieties, the introduction of new pottery types, and changes in form and size of vessels (Rice 1979, 1987a). For example, Chase (1983) states that the pottery at Tayasal differs in degree and kind from the pottery at Macanché Island analyzed by Rice (1987a). However, if one is to believe the socio-political reconstruction of the central Petén lakes region at the time of the Spanish conquest based on Spanish documents and ethnohistories, both sites are potentially within the Yalain/Itzá territory and may be more likely to have similar categories of material culture including pottery (Jones 1998:Map 3).

The above views of socio-political organization are based on Kejach, Mopan, Yalain, Itzá, and Kowoj interactions. Each social group and excavated archaeological sites within their ethnohistorically defined territorial boundaries are presented below. In addition to this information, Table 1 (after Rice et. al. 1996:Table 3) presents known Postclassic and Historic period archaeological sites in the Petén lakes region, their location with regard to the different lakes, their relation to proposed lineage territories, and their ethnohistorically documented names.

The Kejaches occupied the area to the north of the Petén lakes during the 16th and 17th centuries, but may have arrived as early as the 15th century (Jones 1998:23; 1996:13). Although a large area of uninhabitable land separated their homeland from the Itzá and Lake Petén Itzá, the Itzá frequently attacked the Kejaches. As a result, the Kejaches aided Cortés, Avendaño, and other Spanish conquistadores through their

Table 1: Postclassic Sites, Their Location, Associated Lineages, and Documented Names

Archaeological Site	Lake	Lineage Territory	Documented Name
Islas de Sacpuy	Sacpuy	Kan Ek' (Itzá)	Chun Ajaw
Pasajá	Petén Itzá (S.W.)	Kan Ek' (Itzá)	Unknown
Colonia Itzá	Petén Itzá (S.W.)	Kan Ek' (Itzá)	Unknown
Nixtun Ch'ich *	Petén Itzá (W.)	Kan Ek' (Itzá)	Ch'ich'
Ixlú*	Petén Itzá/Salpetén	Yalain (Disputed)	Saklamakhal/ Chaltunha'
Zacpetén*	Salpetén	Kowoj	Sakpeten
Yalain*	Macanché	Yalain	Yalain
Muralla de Leon*	Macanché	Yalain/Kowoj	Makanche'
Chachaclún	Petén Itzá (N.)	Kowoj	Unknown
San Pedro	Petén Itzá (N.)	Kowoj	Unknown
Uxpetén	Petén Itzá (N.)	Kowoj	Uxpetén
El Astillero	Petén Itzá (N.)	Kowoj	Unknown
Jobompiche I	Petén Itzá (N.)	Kowoj	Unknown
Piedra Blanca	Petén Itzá (N.)	Kowoj	Unknown

* indicates archaeological sites discussed below.

territory in their attempts to reach Petén and conquer the Itzá (Jones 1998:154-160).

According to Jones (1989:9), the Kejaches may have been "a collection of refugee polities made up predominantly of runaways from the *encomiendas* of northern Yucatan." They had a "lord" and representative of other large towns of the Kejach territory "each of which was a *cabecera*, a provincial capital" (Jones1998:32). The Spanish *entradas* into Petén encountered Kejach hamlets, some of which were fortified by a wooden wall and ditch; however, the hamlets were abandoned before the Spanish arrived (Cortés 1976:240). Finally, the Kejaches shared common surnames with the Itzá, such as B'alam, B'atun, Chan, and Puk, which suggests possible social and/or political Itzá connections (Jones 1998:Table 1.1).

The Mopan occupied territory south and southeast of the central Petén lakes region near the current Guatemala-Belize border (between the archaeological sites of Topoxté and Tipuj), the Belize River Valley, and parts of southern Belize (Jones 1998:5, 22). According to Jones (1998:22), "Fuensalida's report of a sizable fortified Chinamita town suggests that at least some Mopans lived in larger communities that were 'capitals' of politically centralized territories" as well as scattered settlements. Scattered settlements may have been a result of battles with the Itzá and Spanish invasions. Jones (1998:21,101) states that the Mopan may have defeated the Itzá in battle on three occasions and temporarily gained control of the corridor to Tipuj. In 1697, the Mopans were part of the Itzá territory and they and Itzá fought together "against Spanish penetration into adjacent Chol communities" (Jones 1998:22,99).

The other three socio-political groups, the Yalain, the Itzá, and the Kowoj, are better known through historical documents and appear to be the dominant ethno-socio-political groups in the central Petén lakes region during the Postclassic and Contact periods. Sometime during the Postclassic period, the Yalain may have had their own territory that stretched from the east shore of Lake Petén Itzá to Tipuj (Jones 1998:Map 6). The Chan family, originally from Nojpeten, ruled Yalain (Jones 1998:55, 66, 95). As a result of various marriage alliances and possible territorial wars, the Yalain territory became an outpost area for the Itzá in order to protect the Itzá from the Spanish on their eastern border. However, by 1695, the Itzá-Kowoj marriage alliance broke and Ajaw B'atab K'in Kante, the lineage head of Yalain, "had declared war against the Itzá ruler in an alliance with the Kowojs, now claiming control even over the Yalain region" (Jones 1998:167).

The Yalain territory may have included the archaeological sites of Yalain, Topoxté, Macanché Island, and Tipuj. However, only Yalain and Macanché Island are presented below. Topoxté Island is discussed in the Kowoj section due to its architectural and ceramic affinities to Zacpetén–a presumed Kowoj site, and Tipuj is discussed in the Itzá section due to its ethnohistorically known connections to the Itzá of Nojpeten.

Yalain is located 3 km from Lake Macanché on the northwestern lake shore. Jones (1998:66) believes that the town of Yalain was the center of subsistence production for the inhabitants of Nojpeten and "at one point served as the principal Itzá administrative center of the region." The architecture and pottery from Yalain date from the Middle Preclassic to the Late Postclassic period. The Postclassic period architecture is dominated by a north-south oriented ceremonial center construction in which a large open hall or temple faces two to three smaller open halls (D. Rice, personal communication 2000). Numerous small residential groups consisting of open halls and other Postclassic architecture surround the ceremonial center. This pattern is not typical of Mayapán temple assemblages (Proskouriakoff 1962) found in northern Yucatán and Kowoj sites in the Petén (Pugh 1996; D. Rice, personal communication 2000). Dates of the site were obtained from surveys by Bullard (1960) and the Cental Petén Historical Ecological Project (hereafter CPHEP) (D. Rice 1986; P. Rice 1986; among other publications).

Macanché Island is located in Lake Macanché and was first excavated by Bullard in 1968 (Bullard 1970, 1973; Rice 1987a). Pre-colonial construction occurs on the northeast end of the island at its highest point (Rice 1987a:12). Bullard's surveys and excavations indicate that the island was continuously occupied from the Late Classic period through the Postclassic period. All but one of his eight test pits/operations were located around the periphery of the mound. The eighth test pit was located 9 m to the southeast of the mound.

Test pit excavations and contour mapping by CPHEP expanded Bullard's excavations in 1968. Their excavations confirmed Bullard's proposition that Macanché Island was occupied from the Late Classic to the Postclassic periods, but indicated that occupation occurred primarily during the Postclassic period (Rice 1987a:2, 33). "Although the island has suffered modern disturbance, and there is little architectural trace of the structure or structures that may have been built upon the mound, the available evidence suggests that the use of Macanché Island was probably principally residential," but ceremonial artifacts (incensarios) indicated ritual activities (Rice 1987a: 33).

The Terminal Classic Maya constructed a low platform on the highest point of the island with three areas of activity: two deposits with reconstructable vessels and a modification of a low platform (Rice 1987a:33-34). Early Postclassic activity resulted in a 80 cm high large platform over the Terminal Classic platform (Rice 1987a:41). A structure located in the northwest portion of the island, a structure located in the central portion of the island and built over the Early Postclassic platform, and a refuse midden on the west side of the structure in the center of the island indicated Late Postclassic occupation of Macanché Island (Rice 1987a:41-43). In addition to architecture and pottery, CPHEP encountered twelve west-facing crania in two rows in the fill of a "non-descript mound on the mainland" (P. Rice 1986:264).

The Itzá, who were likely an alliance of socio-political groups, are said to have controlled the southern and western basin of Lake Petén Itzá stretching from Lake Quexil to Lake Sacpuy with their capital at Nojpeten or Taj Itzá, which was located on the modern island of Flores (Jones 1998:Map 3; Jones, Rice, and Rice 1981). They claimed ancestry to the archaeological site of Chich'en Itza in northern Yucatán and are said to have migrated from there to the Petén lakes region before the Spanish conquest (Jones 1998:11).

According to the *Chilam Balam of Chumayel* (Edmonson 1986; Roys 1933), the Itzá fled from Chakanputun to the forest or Chich'en Itzá between A.D. 1185-1204 (Roys 1962:43). Edmonson (1986) and Roys (1962) stated that the Itzá then returned to Chich'en Itza after two *k'atuns* of exile. Mayapán was founded and ruled by the Itzá lineage of the Kokom in A.D. 1263/83 (Roys 1962:43). At this time, the earliest structures in the Mayapán ceremonial core that resemble those from Chich'en Itza were constructed: the Castillo-like center temple, serpent-column facades, colonnaded halls, and small sacrificial altars (Proskouriakoff 1962:133). In A.D. 1362/82, a revolt brought the Kokom into power at Mayapán and they may have shared a joint rule with the Xiu in

A.D. 1421/41 (Roys 1962:44-46). However, problems soon arose for the Kokom. The *Chilam Balam of Chumayel* (Edmonson 1982) states that Hunac Ceel, a Mayapán lord and possibly of Kokom lineage, created a love charm that allowed Chac Xib Chac to abduct the bride of the ruler of Izamal during a wedding ceremony. This scandal resulted in the expulsion of the Itzá from Chich'en Itza. Roys (1962:47) notes that the ruler of Chich'en Itza, presumably the Kokom lineage ruler at Mayapán, and other followers "fled by sea down the east coast, and went inland to Lake Petén" and settled at Tayasal and this may indicate an earlier migration of the Itzá to Petén. Edmonson (1986:58) also states that a migration occurred after the destruction of Mayapán and "they went to the heart of the forest, Tan Xuluc Mul by name." As a result of the expulsions, Kokom rulership at Mayapán ended, Mayapán was destroyed, and nobles carrying codices and building temples in their "homelands" created 16 independent states (Roys 1962:47; Tozzer 1941:38, 98). In the end, the Kokom remained in eastern Yucatán and the Xiu in western Yucatán. Kokom patronyms, such as Balam, Chan, and Tun, were most numerous in the 16th century provinces of Sotuta and Mani (Roys 1957:Table 1).

Although migration myths in the *Chilam Balam of Chumayel* (Roys 1933:74, 147; Edmonson 1986:92, 135) stated that the Itzá came from northern Yucatán during the Late Postclassic period at approximately A.D. 1450, Rice et al. (1996) and Schele and Grube (1995) and Schele and Mathews (1998) believe that the migration during the Late Postclassic period was only one of many migrations of portions of the population to the Petén lakes region from northern Yucatán. The migrations from the Petén lakes region to Chich'en Itza may have been the result of a mass migration of displaced Itzá at the end of the Classic era and/or a migration of lineages (Schele and Grube 1995:16-17).

Migrations back to the Petén heartland may have occurred after the fall of Chich'en Itza (A.D. 948 or 1204) and/or after the fall of Mayapán (A.D. 1450 or 1530) (Ringle et al. 1991; Roys 1962).

Regardless of their migration history, the Itzá were present at Lake Petén Itzá when Cortés traveled through Petén on his way to Honduras (Cortés 1976:219-285). The Itzá territory, centered at Nojpeten, was ruled by the head of the Kan Ek' lineage(s), Ajaw Kan Ek', who claimed genealogical connections to Chich'en Itza (Jones 1998:11). In 1695, AjChan, Kan Ek's nephew, also claimed that his deceased mother was from Chich'en Itza, and "members of the Itzá nobility were still living there in the seventeenth century and successfully avoiding Spanish recognition" (Jones 1998:11). Some evidence exists for this connection through recorded patronyms in the 1584 and 1688 list of married residents: Can (Kan) is most prominent in Hocaba and Sotuta and Ek' commonly occurs in the Cehpech and Cochuah provinces (Roys 1957:Table 1).

The Spaniards described Nojpeten as having multiple temples for worshiping idols and hundreds of houses interspersed with the temples as well as large populations on the surrounding islands and the mainland (Thompson 1951:390-394). It served as the capital of a *multepal* of the Itzá region and the place where the Itzá ruling council lived. Itzá *multepal* rulership was also present at Chich'en Itza as early as the Terminal Classic period. According to Roys (1957, 1962), Tozzer (1941:177), and Lincoln (1994), a group of three brothers or plural rule existed at Chich'en Itza. Lincoln (1994:167) suggests that Itzá kingship may have consisted of up to four divisions of power with each leader/ruler taking a different role such as priest, warrior-based nobility, and royalty. Grube (1994:326) also believes that the Itzá had some sort of dual rulership: "Chich'en Itza has a non-monarchical government...involving more individuals and several sets of companions." In 1697, Ajaw Kan Ek' and K'in Kan Ek' jointly ruled the Itzá territory.

The Itzá territory may have included the archaeological sites of Nixtun Ch'ich', Tayasal, Ixlú, and Tipuj. Rice et al. (1996) believe Nixtun Ch'ich' to be the historical site of Ch'ich' and may have been part of the Kan Ek' or Itzá territory known as the Chak'an Itzá territory. In 1697, K'in Kan Kante and Tut (Noj Che) jointly ruled the Chak'an Itzá. The port area of Ensensada de San Jerónimo was controlled by the inhabitants of Ch'ich', was the passage to the northern Kejach territory, and was the place from which the Spanish attacked the Kan Ek' lineage in 1697 (Jones 1998:Map 4). After the Spanish conquest in 1697, K'in Kan Kante allied with the Kowoj to defeat the Itzá (Jones 1996:6).

Nixtun Ch'ich' has 450 mapped structures (Preclassic to Postclassic in date) and is located on the Candelaria Peninsula in Lake Petén Itzá, south of the Ensenada San Jerónimo and north of the western arm of Lake Petén Itzá (Rice et al. 1996:179). Postclassic architecture is scattered throughout the site. While the majority of Postclassic structures occur on the western side of the peninsula, clusters of Postclassic structures exist near the stone ramp at Ensenada San Jerónimo, along the ditch-wall complex, and on the surface of the fortification wall (Rice et. al 1996:Figure 103). Pottery and other artifacts indicate that the site was occupied from the Middle Preclassic period to the Historic period.

Tayasal is located on the Tayasal peninsula north of Flores in Lake Petén Itzá and was occupied from the Preclassic to the Late Postclassic periods. Postclassic architectural remains occur at the site center and along the periphery of the site.

Guthe (1922) was the first archaeologist to map and excavate distinct areas of Tayasal. He suggested that Tayasal was Nojpeten, but he was unable to locate Postclassic cultural remains that supported his hypothesis. Instead, the excavated material culture yielded Preclassic and Classic period dates. In the 1950s, Cowgill (1963) also investigated Tayasal as well as other archaeological sites along the shores of Petén Itzá and Lake Sacpuy. From his excavations into Postclassic construction fill, Cowgill (1963:84) developed one of the first Postclassic ceramic chronologies that included the ceramic groups of Augustine, Tachís, and Paxcamán. Tachís ceramics were specific to Tayasal and Flores Island and Cowgill (1963:84) dated them to the Middle and Late Postclassic period. Cowgill (1963:127) believed Augustine ceramics to be from the Early Postclassic period and Paxcamán to represent the Middle to Late Postclassic. He concluded that the differences in ceramic frequencies and types at different sites in the Petén lakes region resulted from regional variation and not from changes due to migrations of populations to different areas in the lowlands.

Chase (1983) also excavated several structures at Tayasal and stated that the site lacked an abundance of Postclassic architecture, making the area unlikely as the site of the Itzá capital of Nojpeten. (Remapping of portions of the site in 1996 by Pugh and Schwarz demonstrated the presence of more Postclassic architecture than was recorded by the University of Pennsylvania.) Chase (1985) demonstrated that there was a long population history in the Petén lakes region and that the Paxcamán, Augustine, and Trapeche ceramic groups represented the Postclassic period.

Ixlú is located on the isthmus between Lake Petén Itzá and Lake Salpetén at the extreme west edge of the of the Itzá/Yalain province or in the Kowoj territory. If the site occurs in the Yalain territory, it may be the ethnohistorical site of Chaltunha', and if Ixlú occurs in the Kowoj territory, it may be the site of Sakle'makal. Recent excavations, however, suggest that Postclassic Ixlú was not large enough to be Sakle'makal (D. Rice, personal communication, 2000). Because of the location of Ixlú on the edge of two socio-political group territories, Ixlú may have been a continually disputed site.

Blom first mapped Ixlú in 1924. Morley (Morley 1937-38) also visited the site. In 1968, Bullard excavated two test pits at Ixlú while conducting research at Macanché Island and uncovered Late Classic, Terminal Classic, and Postclassic material culture (P. Rice 1986:266-277). After Bullard's excavation, the CPHEP team mapped the site because Blom's drawing indicated Postclassic occupation (P. Rice 1986:267). In the 1990s, Proyecto Maya-Colonial remapped Ixlú and produced a site map with 150 structures arranged in two large plazas and an elevated acropolis, the majority of which dated to the Postclassic period (Rice et al. 1996:100). Excavations by Bullard in 1968 and Proyecto Maya-Colonial in 1994 and 1999 produced architectural and ceramic evidence that suggested that Ixlú was occupied in the Middle Preclassic, the Late Preclassic, the Late Classic, the Terminal Classic, and the Postclassic periods (Rice et al. 1996:100; P. Rice 1986:266).

Postclassic architecture at Ixlú occurs as three building types: ceremonial groups, plaza groups, and C-shaped structures (D. Rice 1986:328). The ceremonial groups (C-E) are small and surround Postclassic monumental architecture. Large plazas at Ixlú are elevated and occur at positions and angles that are similar to Late Classic buildings buried beneath the Postclassic structures. Structure 2023, a temple in Group A, had two different types of crania caches. At provenience 6d2, a series of 15 crania were placed side by side in two rows facing east. A similar skull row occurs on the mainland of Macanché Island (P. Rice 1986). In addition to the skull row, three caches of two crania occur on an east-west line (corresponding to the last construction of the temple) on opposite sides of a small shrine (Str. 2020). All skulls faced east. Structure 2023 also had red painted stucco. In addition to the architecture, crania caches, and ceramics, Ixlú has two Terminal Classic stelae that date to 10.1.10.0.0 4 Ajaw 13 Kank'in (5 October 859)[1] and 10.2.10.0.0 2 Ajaw 13 Ch'en (24 June 879) and two altars, one of which dates to 10.2.10.0.0 2 Ajaw 13 Ch'en (24 June 879) (Rice 1996b:108, 110).

The Postclassic community of Tipuj flourished between A.D. 900 and A.D. 1525, but was also occupied from the Preclassic to Classic periods (Jones 1989). Tipuj is located on the Macal River in Belize at a cattle ranch known as Negroman. Ethnohistoric and archaeological investigations have been the focus of work at Tipuj. J. Eric S. Thompson (1977) and Jones (1983,1989) have been interested in Tipuj's place in the Maya social and linguistic spheres at the time of Spanish contact. Archaeologically, Kautz and Graham excavated prehistoric and historic architecture from 1980-1987, in field work aimed at locating the ethnohistorically known site of Tipuj. Excavations demonstrate that during the Postclassic periods, Tipuj had an increase in new house platforms that were either newly created or constructed over older archaeological remains (Graham, Jones, and Kautz 1985:209). Although the basic residential construction techniques remained similar to earlier phases, platforms tended to be more elaborate. In

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[1] Dating of the monuments at Ixlú follows the GMT 584283 correlation method (Gregorian).

addition to new platform construction, the Maya of Tipuj also constructed a new temple type (vaguely similar to Mayapán temple assemblages) and C-shape structures that may have functioned as ritual buildings (D. Rice 1986:328).

Ethnohistorically, Tipuj was a principal center of "anti-Spanish rebellion on the southern frontier" (Jones 1989:12). It was a "frontier" site that served as a location for Spanish missionaries to gather before entering into the Petén heartland. "To the Spanish, Tipuj was a fragile buffer between Christian civilization and the vast Petén pagan heartland" (Jones 1989:14). The 30 non-Christians living at Tipuj at the time of Pérez's 1655 *matrícula* had Itzá compound names that resulted from intermarriage (Jones 1998:54, Table 3.3). Some of the compound names correlate to the Itzá Kan royal lineage. "One of the couples represented a marriage between an AjKan Chi and an IxEk' Mas, each representing a royal name, Kan and Ek', whose combination in certain types of marriage (but not this one) produced the dynasty of Itzá kings known by the double name Kan Ek' . . . . Rather than having been taken to Chunuk'um by the 'Christian' Tipujans, these Itzás were representatives of Nojpeten who had themselves taken the Itzá-colonized population from Tipuj to Chunuk'um, allowing them to be counted there by the Spaniards" (Jones 1998:54-55). (Chunuk'um was a mission town from which Francisco Peréz, the *acalde* of Bacalar, compiled a *matriculá* of people from Tipuj in 1665.) Thus, Tipuj served as a site outside of the Petén lakes region that had a variation of Kowoj architecture and ethnohistorical ties to the Itzá and, therefore, may combine Kowoj and/or Itzá ideology and rulership.

The Kowoj controlled the northern and eastern areas of Lake Petén Itzá and Lake Salpetén. They claimed to have migrated from Mayapán around A.D. 1530 (Jones

1998:18). Spanish Capitán Don Marcos de Abalos y Fuentes (1704) wrote: "The Couohs are almost one and the same with the Itzás because they are located to the north on the shores of their lake. Both are descended from Yucatán, the Itzás from Nixtun Ch'ich' and the Couohs [*sic*] from Tancab [*sic*], ten or twelve leagues from this city. These [the Couohs] retreated at the time of the conquest, the others much earlier." According to Roys (1978:164), Tankah refers to Mayapán, which is 50 kilometers south of Mérida. In addition to Capitán Abalos y Fuentes' comments, Jones (1998:17-18) believes that the migration of the Kowoj from Mayapán resulted from Spanish contact and political turmoil; however, they may have had a series of migrations to and from Mayapán, of which one occurred after the fall of Mayapán at around A.D. 1450 and the last may have been around A.D. 1530 (Rice et al. 1996). The Kowoj relation to Mayapán is strengthened with the linkage of Petén Kowoj kinship patronyms and matronyms to prestigious individuals at Mayapán. For example, Roys (1933:79) noted that in the *Chilam Balam of Chumayel* the name Kowoj was associated with an individual listed as the "guardian of the east gate" at Mayapán.

Although the Kowoj lineage name is rare, the highest frequency of Kowoj matronyms or patronyms outside of the Petén lakes region occurred at Mani, the Xiu capital after the fall of Mayapán (Roys 1957:9, 66). Kowoj, Kab', Kamal, Kawich patronyms occurred in the towns of Tekit, Pencuyut, and Peto in the 16th and 17th centuries in northern Yucatan (Roys 1957:Table 5). In addition to lineage names, Landa (1941:56) and Roys (1957:168) state that the Kowoj lineage powerfully ruled the province of Champoton in the 16th century. Colonnaded open halls, a small temple to Kukulcan (the feathered deity celebrated in Maní after the fall of Mayapán), and a stone wall for fortification at Mayapán resembled those at Champoton (Roys 1957:69, 167). In addition to being at Mayapán, the Kowoj lineage name was found in other Yucatan areas and Belize.

In Petén, Kowoj matronyms and patronyms, such as Kab', Kamal, Kawich, Ketz, and Kowoj, existed in the Petén lakes region during the 17th century (Jones 1998:Table 1.1; Roys 1957:8-9, Table 1). The Kowoj provincial capital located on the northern shore of Lake Petén Itzá, Ketz, was ruled by AjKowoj and Kulut Kowoj (Jones 1998:17, 66). Although Jones assigned this area to the Kowoj, they may not have occupied all of this territory during the Postclassic and Contact period because the Kowoj territory may have come together and broken apart many times during the 17th century.

The Kowoj territory may have included the archaeological sites of Zacpetén, Muralla de Leon, Topoxté, and possibly Ixlú as well as much of the cultivable land on the escarpment of the north shore of Lake Petén Itzá.

Zacpetén is on a peninsula in Lake Salpetén and has a large concentration of Late Postclassic structures, but the site was occupied from the Middle Preclassic to the Historic period with intensive settlement beginning in the Terminal Classic period (Rice et al. 1996:288). The Central Petén Historic Ecological Project (CPHEP) investigated Zacpetén in the early 1980s, produced a map, and conducted preliminary excavations suggesting Postclassic occupation (D. Rice 1986:327). Their excavations and survey also located two stelae (carved and plain) in the northern most group that represents a "Zacpetén variant of Tikal's late Late Classic twin-pyramid complex" (Rice, Rice, Pugh 1997:247).

In 1994, Proyecto Maya Colonial remapped the site and Pugh (1996) began his dissertation research excavations at the site to explain Kowoj ritual architecture and material culture. Pugh's laser transit mapping and excavations more completely demonstrated the presence of three large ceremonial groups, densely clustered domestic structures below the ceremonial groups, a defensive wall composed of a wall-and-ditch construction at the northernmost portion of the peninsula, and an ossuary that contained postcranial skeletal remains of 100 or more individuals (Pugh 1996). Pugh (1995, 1996) believes that the temple assemblages in Groups A and C as well as human effigy censers found in the two groups resemble those found at Mayapán and Topoxté. Also similar to Mayapán, some structures at Zacpetén have painted stucco. Structures 719 and 764 in Group C have red and black painted stucco, Structure 606 in Group A has red painted stucco similar to that on Structure 2023 at Ixlú, and Structure 605 in Group A has fragments of black painted stucco (Pugh, personal communication 2000). Pugh (1996:39) states that the different architecture groups (Groups A and C) may represent two different moieties that conducted similar ritual ceremonies. The same architecture (and rituals) occurs at Mayapán and Topoxté (Pugh, personal communication 2000). Differences in architecture and ritual at Zacpetén accentuate the east-west dichotomy of civic-ceremonial complexes present in the eastern end of the Petén lakes region.

In addition to the five groups of architecture on the peninsula, Pugh excavated two halves of a carved altar and two plain stelae that were built into the southern walls of Structure 606 and one carved stela in the southern wall of Structure 601 (Rice, Rice, and Pugh 1997: 247-249). All are dated to the Terminal Classic period. The carved altar commemorates the birth of a Zacpetén ruler, indicates the lord's mother, his father, and has a possible Tikal emblem glyph that ties the rulers' parents to Tikal (Rice, Rice, and

Pugh 1997:250). The carved stela in Structure 601 shows a figure in profile "scattering" and the glyphs that appear in front of the figure are eroded (Rice, Rice, and Pugh 1997:251). Houston and Stuart suggest that the last glyph may represent the emblem glyph of Sak Petén (Rice, Rice, and Pugh 1997:252).

The Topoxté Islands, Topoxté, Canté, and Paxté, plus two other smaller islands, represent a major Postclassic period settlement that are believed to have produced a technologically distinctive group of pottery: the Topoxté ceramic group. The five islands are located on the south side of Lake Yaxhá in northeastern Petén, Guatemala. The main island, Topoxté Island, has primarily ceremonial architecture and may have been the location of important ceremonial activities in the region (Bullard 1970). The second island, Canté, lacks ceremonial structures and may have functioned as a residential island (Johnson 1985), and the third island, Paxté, has ceremonial and residential structures that suggest that the island served as a residential area for the elite class (Johnson 1985). According to Jones (1998:Map 3) Topoxté may have also been in the Yalain/Itzá territory.

Bullard's (1960, 1970, 1973) excavations at Topoxté defined the Postclassic Isla Phase. His excavations yielded information about the architectural style that demonstrated affinities to the architectural style present at Quintana Roo sites (Bullard 1970:301). In addition to defining the architecture of the Isla phase, Bullard developed an Isla phase ceramic chronology placing Topoxté group ceramics in the Late Postclassic and Augustine and Paxcamán groups in the Terminal Classic and/or Early Postclassic (Bullard 1973:231-241). Bullard (1970:304) believed that the Topoxté ceramic group represented a migration of people from the east coast of Quintana Roo and Mayapán to

Topoxté in the Middle Postclassic, and that the new arrivals into Petén with their "figurine censer cult" were different from the Itzá. With the migration of people came the introduction of a figurine censer cult created exclusively with cream-colored Topoxté Island or mainland clays and slips.

Although Bullard's ceramic chronology is no longer viable, Topoxté is noteworthy in that inhabitants of the site apparently produced Topoxté group pottery and exported it to other sites as far away as Negroman-Tipuj, but the inhabitants of Topoxté did not import pottery from other sites during the Late Postclassic period. "The Topoxté Islands do not share in the other Petén Postclassic ceramic traditions. No Trapeche-group sherds, for example, were found at Topoxté, and no Chilo Unslipped; only one sherd was tentatively classified as Augustine, and only three sherds were identified as being of probable Yucatecan manufacture. The inhabitants of the Topoxté Islands, in short, seem to have sent some of their pottery throughout a relatively broad territory in Petén [and elsewhere], but to have brought in very little in return" (Rice 1987a:159).

Muralla de Leon, located in Lake Macanché, is an island fortified by a wall. Within the wall are 22 structures of which only seven are thought to date to the Postclassic period (Rice and Rice 1981). These structures resemble the temple assemblages found at Mayapán, suggesting that Muralla de Leon may have been part of the Kowoj territory (Rice and Rice 1981:273).

The site has three occupations: the Protoclassic, the Late Classic, and the Postclassic periods (Rice and Rice 1981). CPHEP test pitted eight areas to obtain the dates.

These historical, ethnohistorical, and architectural data suggest that four to six social/ethnic groups lived in the Petén lakes region during the Postclassic period. Ethnohistoric data from Jones (1996,1998) and archaeological data from Rice et al. (1996) suggest that there are differences in social group ancestry and history as well as differences in architectural patterns. Because we also have material culture, such as pottery, collected from excavations at various archaeological sites, it may be possible to reinforce the ethnohistorical data and determine which social group occupied which archaeological site/territory during the Postclassic period.

Because of these potential differences in social group ancestry, I examine the Petén Postclassic slipped pottery in order to suggest which social group(s) made the different pottery. The potter's choices of resources (discussed at length below) may reflect the socio-political milieu in the Petén lakes region during the Postclassic period especially with regard to boundary maintenance and trading relations. Thus, my use of technological styles of Postclassic slipped pottery may be a more sensitive indicator than the pottery types developed in the type-variety system to identify these socio-political differences.

CHAPTER 3

THEORY OF STYLE AND TECHNOLOGICAL STYLE

The concept of style has been employed in anthropological and archaeological analyses and interpretations to make inferences about material culture as well as human behavior. Throughout the various paradigmatic shifts in archaeology (culture-history, processualism, and post-processualism), the concept and emphasis on style has also changed (Hegmon 1992; Plog 1995). Culture-historians use style to form a time line in which changing stylistic features are seen as fossil indices of cultural identity. Processualists see style as able to reveal adaptive cultural systems that render inferences concerning prehistoric social life. Post-processualists use style to describe power relations and see style as a social production. Although there is no general theory concerning style or what style does, the analysis of style in anthropology and archaeology has been one of the main methods by which patterns of material culture have been analyzed and has led to various perspectives in understanding style.

This chapter on stylistic perspectives describes how style was analyzed in the past and is currently being analyzed by anthropologists. I discuss the advantages and disadvantages of the major themes of stylistic analysis and suggest that because of their short-comings, technological style is a more appropriate stylistic analysis for the project because it accounts for design and behavioral characteristics of material culture that may ultimately differentiate social identities.

I. Cultural-Historical Analysis of Style

Culture-historians describe the archaeological record in terms of style because style is employed in the discovery of patterns of material culture (Dunnell 1986). Stylistic similarities from a common origin (homologies) provide chronologies of different phases within archaeological sites or used in seriation of different sites. Thus, style acts similarly to an artifact type (Conkey 1990:8). Because of the archaeologists' dependence on style to build chronologies, specific culture traits define specific culture groups. "The objects as artifacts, and the patterns among and between them, became the immediate subjects of . . . inquiry" (Conkey 1990:8). Material culture is an object of inquiry and basis for knowledge about past cultures.

Brainerd (1942) presented an analysis of four one-dimensional symmetries found on Anasazi pottery from the Monument Valley area, Arizona, and the Maya site of Chich'en Itza in Yucatán, Mexico. Brainerd (1942:165) believed that the patterns on the pottery of the two cultures resulted from conscious and unconscious repetition of preferred cultural norms that came from very different natural settings. Anasazi pottery had twofold rotation designs while multiple symmetries occurred most frequently on Maya Fine Orange pottery. "The predominance of bifold rotational symmetry in Southwestern pottery design suggests that this design did not originate in the attempt to copy living things, since this form of symmetry is not found in plants or animals," but instead related to cultural factors that define the culture, whereas Maya symmetries tended to resemble symmetries present in nature (Brainerd 1942:165). He concluded that the Maya and the Anasazi employ different decorative repertoires that correlate to the level of social complexity and the extent of interregional exchange. These characteristics acted as specific culture traits that distinguish the Anasazi and Maya (Brainerd 1942:165).

Because of the Brainerd's and other culture-historian's dependence on the style of artifacts to build chronologies and act as "fossil indices" denoting a specific culture, they seemed to assume that artifacts took on an autonomous role and culture changes because artifacts changed. Scholars described the archaeological record in terms of style and the definition of artifact types was based on style (Krieger 1944). Dunnell (1986:31) states that the only means by which the archaeological record can be explained and understood results from the examination of homologous similarities that are the result of diffusion, trade, persistence, and migration. Thus, style is important to the culture-historian because of its explanatory value.

II. Processual Analysis of Style

Processual archaeologists, reacting to culture-historians, viewed style in a different manner; they recorded style of functional/adaptational similarity (analogy) rather than place of origin similarity (homology), which leads them to account for the variation in the archaeological record in a different way than do culture-historians (Conkey 1990:8). Material culture is seen as the by-product of behavioral systems; however, the active role of the artifact is not an important characteristic because material culture functions as an adaptive component of a cultural system (Binford 1965). Patterns in the archaeological record are treated as coded information that can be "read" to "tell" about the functioning of past cultural systems. The methodological emphasis changes from establishing chronologies to creating strategies for pattern-recognition because patterns inform the archaeologist about style, context, and the role and functioning of social systems. According to Sackett (1977:372), style is a passive characteristic of material culture that informs the archaeologist about social groupings and/or ethnic boundaries.

Four examples of processual views of style provide the background for the more general theoretical statements provided above: social interaction theory; information exchange theory; emblemic theory; and isochrestic theory.

II.A. The Social Interaction Theory

Proponents of the social interaction theory see style as a by-product of behavioral systems (Deetz 1965; Hill 1970; Longacre 1970; Whallon 1968; among many others). This theory employs stylistic attributes to interpret the degree of interaction between social units. "[T]hese interaction analyses have been used to measure similarity of design element occurrences between two social organization units, . . . the homogeneity of element occurrences within a particular group, . . . and the associations of elements between different styles within or between groups . . . " (Rice 1987b:252). Social interaction theory makes assumptions about characteristics of prehistoric social organization on the basis of stylistic similarity within and/or between sites. The degree of interaction that occurs between social units co-varies with, and is indicated by, the degree of stylistic similarity between them. Styles of material culture from different social groups and/or individuals vary "inversely with physical and social distance," and the "diversity within a region will diminish with increasing intraregional interaction" (Voss and Young 1995:81). Therefore, individuals and groups will produce similar designs as a consequence of the degree to which they interact with other groups.

Longacre (1964, 1970) studied 6,000 pottery sherds from 39 dwelling rooms at the archaeological site of Carter Ranch in Arizona (A.D. 1100-1250) in order to determine if different patterns of behavior or societal rules such as matrilineality were reflected in patterns of artifacts. He tested the hypothesis that pottery designs will be more similar in a matrilineal society than in a patrilineal society. If such "styles" are more similar as in a matrilineal society, it should result in a non-random distribution of artifacts with between-group similarities. As a result of his study, Longacre (1970:47-48) concluded that the homogeneity of design elements present at Carter Ranch is indicative of a matrilineal society. Specific design clusters occurred non-randomly in room blocks associated with kivas. Therefore, each room cluster represented different matrilocal residence groups or lineages that produced internally coherent design element suites with mutual exclusion in the community. The room block data also demonstrates a similar pattern found in burials located adjacent to the village. Two of the three burial groups have design element clusters that resemble those found in the village. The third group contains a mixture of design elements from the other two groups indicating higher status (Longacre 1970:41-45)

Deetz (1965) undertook a stylistic analysis of Arikara pottery from the Medicine Crow site near Fort Thompson, South Dakota in order to determine the relationship between Arikara social structure and pottery decoration before and after cultural disruption. The study focused on three time periods: Component C (A.D. 1690-1720) before European contact; Component B (A.D. 1720-1750) European contact; and Component A (A.D. 1750-1780) after European contact. (Deetz 1965:39). Following Longacre (1964), Deetz (1965:2) hypothesized that:

under a matrilocal rule of residence, reinforced by matrilineal descent, one might well expect a large degree of consistent patterning of design attributes, since the behavior patterns which produce these configurations would be passed from mother to daughters, and preserved by continuous manufacture in the same household. Furthermore, these attribute configurations would have a degree of mutual exclusion in a community, since each group of women would be responsible for a certain set of patterns differing more or less from those held by other similar groups. Change in the social structure might then bring about a change in the nature of ceramic attribute patterning, if this change in any way tended to disrupt the exclusive nature of the shared behavioral patterns existing under a matrilocal residence rule.

In order to test his hypothesis, Deetz recorded surface finish, profile, shoulder-neck angle, lip profile, lip decorative techniques, lip design elements, collar design technique, collar design elements, neck decoration technique, neck design elements, location of decoration, appendages, handle decoration technique, handle design elements, and angle of rim to body of pottery from the Medicine Crow site. After gathering the data, he conducted statistical tests of significance to determine attribute patterns that may correlate to differences in matrilocality. Statistical tests showed that most attribute categories in Component C had low associations with other attributes, Component B marked a trend toward random association of attributes with one another, and Component A demonstrated a continued trend toward random association (Deetz 1965:55-85).

On the basis of ethnohistoric data, Deetz (1965:101) noted that the Arikara's migration into South Dakota was difficult and fraught with problems such as warfare with nomadic tribes and smallpox. As a result, the Arikara social structure, once purely matrilocal, became more generationally based to sustain the changing social environment. Changes in the social environment were reflected in pottery decoration, or lack thereof. Designs varied more than in the past (more random) and this demonstrated a period of great stress and that "rigid matrilocality was no longer practiced" (Deetz 1965:98).

Whallon's (1968) study of Iroquois pottery followed the work of Deetz and Longacre. He examined within-group homogeneity to determine if changes in variability of design elements relate to changes in interaction (1968:227). He assumed that the diffusion of design elements correlated to the nature of interaction. Whallon created lists of vessel morphology, rim types, and other vessel/design attributes from Owasco and Iroquois seriated types. The resulting attributes were calculated as to relative frequencies and coefficients of variability. After statistical manipulation (frequencies and correlation coefficients) of vessel morphologies and rim characteristics, Whallon (1968:234) determined that the increased trend toward stylistic homogeneity through time resulted from a high rate of matrilocality.

Although the social interaction theory is used in many studies, Plog (1978, 1980) and Hodder (1977, 1991) suggest that the degree of social interaction between individuals and groups has no necessary correlation with the amount of stylistic variability. To determine any type of stylistic variability, archaeologists need to examine material culture from more than one archaeological site (Hegmon 1992; Plog 1976, 1978). Many false correlations of group interaction and stylistic variability result from the lack of attention paid to factors of human behavior such as patterns of learning, complex and dynamic descent and residence rules, and archaeological record formation (Hodder 1977:240; Voss and Young 1995). For example, learning can be cross-clan, similar to that of the Hopi, and the final deposition of a vessel does not necessarily indicate its place of use. "Furthermore, style cannot be held to simply mirror social strategies and practices but can also *mediate* and therefore serve to actively reorientate those strategies" (Shanks and Tilley 1987:142). Style is not considered a static, never-changing medium of social interaction; instead, changes are influenced by social processes and social conditions of which the individual participant is involved.

II.B. The Information Exchange Theory of Style

The information exchange theory provides another example of processual use of style as a by-product of behavioral systems (Braun 1985; Hodder 1977, 1978, 1979; Wobst 1977). Stylistic messaging is adaptive because it makes social interaction more predictable and less stressful in exchanges of social and economic entities (Wobst 1977). Style becomes most important when sending messages to socially distant receivers, such as different kin groups or residential units (Wiessner 1983:258; Wobst 1977:327). For example, Wobst (1977:330) demonstrated that the colorful headdresses worn by Yugoslavians sent a social group message to distant kin groups that signified social identity and social group boundaries. Conversely, the utility of stylistic messages decreased when the social distance between sender and receiver decreased. The most efficient mode of stylistic messaging and information exchange with relation to receiving distant social members increased in size and complexity as the message becomes more important. According to Wobst (1977:350), artifacts most likely to be used in a messaging system will be the ones most commonly used and therefore most visible.

Messages reflect and enforce group and individual identity and affiliation, wealth, status, political ideas, and religious beliefs.

Because of the ability of style to convey messages, Wobst (1977:327-328) believed that style functioned in two ways. First, style made social interactions more predictable. This was accomplished through the use of visual information that immediately communicates between the group sending the message and the group receiving the message (e.g., social group headdresses). Social interactions became more predictable reducing stress between the two groups. Second, style reflected complexly organized cultures. As a culture became more complex, styles enhance within-group solidarity by stressing and reinforcing social differentiation and group rank or status.

Hodder (1977, 1979, 1991) examined three social groups in Baringo, Kenya to determine how ethnic boundaries are displayed. He provided information on material culture objects such as dress, drinking cups, maize flour baskets, stools, spears, and shields to support the proposition that material culture of a specific ethnic group functions as a "language" that demonstrated within-group homogeneity (Hodder 1979:447). For example, Hodder (1977:239, 269) stated that although socially distinct groups that communicate with each other share the Tugen-Njemps border, their material culture repertoire is not frequently exchanged. In situations when resources are not critical to the social group, social boundaries will be relaxed and trade with the other social groups occurs more easily. However, when resources are stressed or social conflict arises, people define social boundaries through material culture. Artifacts "symbolize 'belonging' to a group" and become more visible during periods of stress (Hodder 1979:450). The nature of social relations and information exchange becomes cooperative and emulative or competitive and distancing depending on the social milieu.

In addition to between group boundary definition, sub-group boundaries (boundaries within the group such as male/female dichotomies) also occur. Baringo calabashes represent the female social sub-group and mark the area of female control in a male dominated society. Women take great pride in decorating calabashes because calabashes hold cow's milk that symbolizes reproduction and fertility (Hodder 1991:74). The decoration represents women's identity, beauty, and sociability–their characteristics of value (Hodder 1991:82). According to Hodder (1991:89), women who decorate well make a social statement in that they achieve power through the control of children in support of, but also in reaction against, the elders. This type of sub-group boundary definition reinforces the women's political and economic control in Baringo society.

Braun (1983, 1985) believed that stylistic similarities resulted from social proximity, that pottery decorative styles aided in the structuring of social behavior, and that decorative styles were structured by face-to-face interactions. "The longer a set of connections are maintained, the more likely it is that their maintenance will be codified in ritual and symbolic structures" (Braun 1985:131). Social identity is expressed through style and, when social networks change, the individual's social identity also changes due to active choice (Braun 1985:133).

Braun suggested that the Middle to Late Woodland transition (A.D. 200-600) was a time of regionalization and social disintegration that should be reflected in pottery forms and decorative techniques. He demonstrated that within locality and regional decorative diversity (e.g., crescent dentate stamp, ovoid bar stamp, etc.) decreased during the Woodland transition (Braun 1985:130). The change of regional decorative diversity supported the hypothesis of increased supralocal cooperation rather than isolation and disintegration. Braun (1985:137, 147) also established that a decrease in rim thickness of cooking pots by 3-7 cm correlated to an increase in group interaction and communication, a decrease in local and regional diversity, and a decrease in social distance of the five potting communities. Thus, Braun (1985:139) stated that the style of cooking pots and other non-utilitarian pots "should exhibit several abstract properties of constraint relating to the structure of the symbolic code–highly redundant system of coding of the social messages, the transmission of invariant messages by invariant, conventional codes, the transmission of diacritical information by diacritical codes and gradational information by gradational/continuous codes, and the existence of a meta-code or syntactical structure common to each pair of communicating parties."

Again, the information exchange theory assumes that material culture passively transmits identity. Instead, style can be active in the transmission of complex and ambiguous information in order to establish and maintain social relations, and who creates style in order to transmit a message also needs to be considered (Hegmon 1992: 20, 22). The information exchange theorists often assume that style functions only in large social groups located at great distances from each other, and that material culture contains highly visible symbols (Voss and Young 1995:81). However, style can reflect personal identity at a smaller scale in order to establish a positive self image (Wiessner 1983:56). Style can also be an important part of a vessel that is not overtly displayed. For example, sacred decorated pottery carries a message, but it is often confined in a house (Sterner 1989). In this case, the "message" is in the content and use of the vessel by the domestic unit rather than a larger audience. Finally, the theory of information exchange employs different styles that may have broad meanings and could signify any number of messages to one or many groups (Hegmon 1992:20).

II.C. Wiessner's Emblemic and Assertive Styles

A third processual approach to style is emblemic or assertive style (Wiessner 1983, 1985). In Wiessner's discussion of style, she combined the social interaction theory and information exchange theory of style in order to examine "intragroup and intergroup relations that correspond to stylistic variation" (Wiessner 1983:253). Style functions to transmit information about personal and social identity and has a behavioral root in the process of personal and social identification in relation to others. Group and individual identity are transmitted through the population (emblemic) and the individual (assertive). Emblemic style is "formal variation in material culture that has a distinct referent and transmits a clear message to a defined target population about conscious affiliation identity," while assertive style is "formal variation in material culture which is personally based and which carries information supporting identity by separating persons from similar others as well as by giving personal translations of membership in various groups" (Wiessner 1983:257).

Because style is transmitted in both ways (emblemic and assertive), it is created through social comparison with other cultures to ensure social recognition and positive self-image (Wiessner 1985:161). Transmitted style carries information about boundaries, rates of interaction, nature of personal and social relationships, and social identity through time and one cannot predict where it will reside (Wiessner 1985:163). Style can also index types of social organization.

For example, Wiessner (1983) showed through projectile point styles that the San of the Kalahari have an egalitarian society based on risk-sharing strategies and a lack of personal ownership and stylistic homogeneity. She demonstrated that individuals could not distinguish their own projectile points, but that they could identify their language groups' projectile points from other language groups' projectile points because of the differences in tip width and body shape. Wiessner (1983:269) stated that the San believe that "if a man makes arrows in the same way, one could be fairly sure that he shares similar values around hunting, land rights, and general conduct." Therefore, San arrows, and presumably other types of material culture, are loaded with social and political implications (Wiessner 1983:261).

The ability to distinguish a culture group's material culture reflects assertive and agent based aspects of style because the formal variation in the projectile points manufactured by a specific language group defines identity characteristics by translating artifact patterns to group membership (Wiessner 1983:258). From this study, Wiessner (1985:164) concluded that emblemic and assertive styles contain information about "1) the existence of groups and boundaries, 2) rates of interaction, 3) the nature of personal and social relationships, and 4) the balance between expression of personal and social identity through time." Variation exists where stress occurs and boundaries intersect and provides a means by which to define "us" and "them."

Although Wiessner (1983) was able to demonstrate that projectile points reflect style at the level of the language group in San society, her emblemic and assertive styles have "no distinct referent" (Wiessner 1983:258). In addition to the lack of a referential base, emblemic and assertive styles are narrowly stylistic and do not reflect the San technological realm of society which needs to be considered when dealing with material culture (Sackett 1985). Finally, Wiessner is not able to determine the mechanisms by which styles change through time.

II.D. Sackett's Isochrestic Style

The fourth example of processual archaeologists' views on style is Sackett's isochrestic variation in which "there exists a spectrum of equivalent alternatives, of equally viable options, for attaining any given end in manufacturing and/or using material culture" (Sackett 1990:33). For Sackett (1982:72-73), there are four steps by which style and function relate: "1) although the style that the archaeologist views on an object of material culture 'may be appropriate to its function,' multiple alternatives exist; 2) artisans choose a specific way of doing something from the options in statement one; 3) chance dictates which alternative is chosen and that it is unlikely that two ethnically distinct cultures will choose the same option; and 4) a strong correlation exists among artifacts in a culture because of socially transmitted learning."

Sackett (1986:68) stated that isochrestic style resides in the formal variation "that is supplementary to, added on, or adjunct to the utilitarian functional form of an object" and this style reflects a "latent quality that at least potentially resides in all formal variation that is one way or another passed through a culture's matrix." In Sackett's isochrestic style, function and style are complementary and both result in stylistic variation (1982:68). Thus, style represents socially bounded choices that have specific meanings and are consistently expressed at a specific time and place due to social interaction. Styles express ethnicity because they are bound to culture and learned behavior and because ethnically distinct groups choose different styles to enhance their social interaction by expressing differences through the style and function of an object (Sackett 1982:72-73). Function resides in the form of the object as well as in the style of the specific context and choice of different designs, and style is not restricted to design alone (Sackett 1982:75).

To develop his concept of isochrestic style, Sackett (1966) examined Upper Paleolithic end scrappers. Sackett measured and coded front contour, front contour modifiers, front height, width, black class, body contour, and marginal retouch to determine statistically significant clusters of end scrapper attributes. Through statistical testing, a number of end scrapper attributes, such as front contour, piece width, and marginal retouch, cluster to form statistically significant groups that correlate to different seriations of Vezere Valley sites (Sackett 1966:378-387). The clusters of attributes represent choices of technology made by the manufacturers and the choices are variable and present regionally and subregionally. "A morphological feature such as marginal retouch may have served functionally either as an auxiliary cutting edge or as a means for shaping the front portion of end-scrapers, but at the same time its frequency of occurrence and mode of execution may have been subject to stylistic dictates" (Sackett 1966:389-390). In either case, the basic premise of an isochrestic style, a choice of function and style selected by a social group from an infinite number of possibilities that is dissimilar to other social group styles, is upheld.

Although Sackett attempts to discuss style in terms of stylistic features (design), functional features (form), and choices that are attributable to the definition of style, his use of style is passive and "dictated largely by the craft traditions within which the artisans have been enculturated as members of social groups" (Sackett 1985:157). He states that the three attributes of stylistic variation coincide with and reflect one another, but he does not make the connection that style and form or style and technology continuously define each other (Lechtman 1977; Lemonnier 1992).

III. Post-Processualists Analysis of Style

In opposition to the cultural historical and processual theories of style, post-processualists view material culture as an active constituent element of social practice and a social product. Material culture exhibits stylistic features formed through "social conditions" and "social constraints" that play an active role in relation to the human manufacturer of the artifact. "The artist is a material agent acting in a particular time and place under social conditions and constraints s/he has not created, and located in relation to social contradictions which, by definition, cannot be individually controlled" (Shanks and Tilley 1987:148). The individual becomes a cultural producer rather than a creator who created from divine inspiration. Production and manufacturing takes place in a social community that is structured by economic, political, material, and ideological relationships. Thus, material culture displays the ideology of a social group.

Post-processualists explain style in relation to the social reality (power and social strategies) inherent in the culture when an artifact is created. To understand the different forms of social reality, the researcher conducts a type of analysis that relates "to within and between-group social relations and the manner in which other aspects of material culture, in various social contexts, are produced and structured" (Shanks and Tilley 1987:152). This type of structural analysis can be seen in three works: Hodder (1982), Adams (1973), and Arnold (1983). (Although Adams and Arnold are not post-processual archaeologists, these two works employ structural theory in a similar manner as other post-processual archaeologists.)

Hodder's ethnoarchaeological example of the Mesakin Nuba of Sudan demonstrates that social structures underlie disparate attributes of material culture-patterning. The patterning relates to a common social element, such as the position of a hearth in a housing compound, that promotes group boundedness and purity (Hodder 1982:125-184). "Individuals organise their experience according to a set of rules. Communication and understanding of the world result from the use of a common language–that is, a set of rules which identify both the way symbols should be organised into sets, and the meaning of individual symbols in contrast to others. Material culture can be examined as a structured set of differences" (Hodder 1995:104). Decorated calabashes represent one such set of material culture. The structural opposition of clean/dirty, male/female, and the like appears in the Mesakin Nuba social structure and on decorated calabashes. Hodder (1982) described the decoration that appears on calabash as a structural grammar derived from a cross and arrow motif. The design motif organized in many different manners and dictated by specific rules is found on calabashes. Designs similar to those found on calabashes (the female domain and one-half of the structural dichotomy) are also linked to reproduction, witchcraft, liaisons with young unmarried men, and female circumcision–all characteristics of the dirty, female half of the Mesakin Nuba dichotomy. Consequently, these designs exert female control over the rules of purity, boundedness, and categorization (Hodder 1982).

Adams (1973) showed that the form and nature of social relations of the

Sumbanese of Indonesia structure the production and manufacture of textiles and their designs, the spatial organization of village settlement plans, and the small-scale society marriage alliances. These principles of social interaction also occur in the production of textile designs that transform social ordering. Men's ceremonial wraps, *hinggi*, have mirror reflection designs– the same design occurs twice on the textile (Adams 1973:267). "Each cloth consists of two identical panels, left and right. Further, from the exact center the upper and lower parts form mirror image halves. Finally, within the bands, individual designs appear either simply repeated or in mirrored sets of confronted or addorsed (back-to-back) pairs" (Adams 1973:271-272).

In addition to the mirror image of textile styles, the community's relation to the cosmological world, the seating arrangements of formal negotiations, the meetings to exchange goods, and the movement of brides in the marriage system also reflect mirror images. Sumbanese also divide ceremonial textiles into stratigraphic bands (Adams 1973:274). The large band, *hei*, is surrounded by subordinate rows and the center of the cloth is considered sacred and the most significant. The Sumbanese capital village is arranged in the same manner–the rulers' house is in the center surrounded by eight clan houses (Adams 1973:274). Adams concluded that the design of the textiles recreates the social structure of Sumbanese society.

This same structuring principal can also be seen in Arnold's (1983) ceramic study of Quinua, Peru. He related the design elements of pottery produced and used in the village to aspects of social patterning within the community and to the community's perception of its own environment. Arnold (1983) demonstrated that horizontal and vertical spatial orientation of community patterns corresponds to the decorative space on

Quinua pottery. For example, land and social structures are separated: the savannah area is divided into two *barrios* based on an irrigation system, geography of Quinua is divided into ecological zones, individuals are divided into two descent groups, and there are two social classes in the village. Pottery vessel design areas correspond to social and geographical features. Vessels have horizontal divisions with bilateral symmetry of motifs that are separated by a series of horizontal bands. The bilateral symmetry on the vessel demonstrates vertical reflection. Taken together, bilateral symmetry and vertical reflection are dominant characteristics of pottery decoration and social structure because human thought categories transcend social structured categories.

Similarly, when undertaking such studies, the post-processual researcher pays particular attention to combinations of elements, their arrangement in space, and the ways in which the design may be transformed into a type of grammar (Muller 1979; Washburn and Crow 1988). This grammar, like a sentence, is structured in such a way that one part (a verb) occupies a specific place in the design (in a sentence) and requires other elements (e.g., nouns with different functions) in a context for meaning. Thus, the structure of words in a sentence give the words meaning. In a similar manner, it may be possible to see the structuring and restructuring of social reality in various cultures through the arrangement of design elements on pottery as demonstrated above.

Finally, style for the post-processualist also exhibits a form of social practice; the individual is under the influence of a social whole (rather than individual practice). Because artists are part of a larger social group, they are influenced by social constraints and group ideologies that may not be under the control of the individual. Ideas are also structured and systematic and not under the independent control of the individual. "The relative uniformity of ideas in any given society rests on a successful claim to the universality and naturalness of what is, in fact, a partial perspective structured by those in positions of authority who possess the power to define what is real" (Shanks and Tilley 1987:149). Style reflects a structured signifying system that displays the ways in which people think about and react to social reality because it maintains existing systems of power and ideology.

Leone's (1988) discussion of Annapolis gardens and the Georgian Order demonstrates the post-processual concept that the larger social whole influences style. Creators of the 18th century gardens in Annapolis, such as William Paca, observed rules for the creation of social style in three dimensional space through the use of terraces, converging and diverging lines, and other gardening features (Leone 1988:250-252). By observing the rules of social practice, homeowners displayed their ability to observe and conquer nature and thus place themselves in the Georgian social order that was the base of wealth, capitalism, and power. "[T]he implications of these homes and landscapes were to convince people that a rational social order based on nature was possible and that those with such access to its laws were its natural leaders" (Leone 1988:250). Thus, the ability to copy nature through a set of rules, allowed the *nouveau riche* of Annapolis to establish their social and political security through conforming to the style dictated by the 18th century social order.

Style, because it reflects ideological views, may be manipulated in relation to between-group and within-group social strategies. Because of this phenomenon, the post-processual researcher observes the relationship between the material culture and the social group and how the social group relates to the object of material culture. Thus, style is a form of social practice studied in relation to habituating forms of social consciousness, restructuring social reality, and inserting ideology.

Although post-processual theories concerning style demonstrate the various effects (social and ideological) of representing and misrepresenting methods of domination and influence that may be apparent in the archaeological record, some aspects of style are not considered. First, style is divorced from the individual because the individual is only a mirror reflection of society leaving no room for innovation or experimentation. Second, behavioral and material choices in the manufacture of artifacts and creation of style are not addressed. Finally, post-processual theories deny style an active role in social identification--style merely reflects the ideology and social reality of a culture.

IV. Technological Style

Given the different approaches to style in material culture, none are sufficient in and of themselves to differentiate social identity based on technological/behavioral and stylistic attributes because none of the approaches conjoin technology and surface decoration to define a style. The one "theory" of style that accounts for the technological and stylistic characteristics of style is that of technological style (Lechtman 1977, 1979, 1981, 1984a, 1984b, 1988, 1993, 1994; Lemonnier 1986, 1989, 1992, 1993; Stark 1998; Wright 1985). In general, technological style allows one to discuss how the technology of the creation of a piece of material culture informs and creates a style, and how the created style may be defined through the technological characteristics of the object of material culture. "Technology" is defined here as the sequence of manufacturing choices that involve matter, energy, tools, motor patterns, and specific knowledge (Lemonnier 1992:5-6). "Style" refers to the "visual representations, specific to particular contexts of time and place, that ... transmit information about the identity of the society that produced the style and about the situation or location where it appears" (Rice 1987b:244). Through the examination of technology and style, one can establish the underlying similarities of formal arrangements of technological and stylistic patterns that represent and/or display social identities.

Lechtman (1977:4), the major proponent of technological style, describes technological style as the relationship of design elements and the patterns that people produce through various acts of behavior that distinguish the style of a particular category of material culture. The decorative aspects of design, whether a simple color or intricate combinations of design elements, are a product and aspect of the behavior of the producers of that object. One way to interpret the behavior of a producer is through the technological choices that s/he makes when creating material culture. The operations, material, and labor (technological activities) define the technological aspect of style. It is the combination of choices "defined by these relationships that is stylistic in nature" (Lechtman 1977:6). Thus, the integration of behavioral events at each level of manufacture defines technological style and technological style is "recognizable by virtue of its repetition which allows us to see the underlying similarities in the formal arrangements of the patterns of [manufacturing] events" (Lechtman 1977:7).

Technological style relies on choice in technology and style. When producing material objects, the producer may have many choices (operational sequence) to make that concern 1) matter (e.g., clay), 2) energy (e.g., the forces that move and transform matter), 3) objects (e.g., tools), 4) gestures (e.g., the movement of tools involved in a technological action), and 5) specific knowledge (e.g., the "know-how" that is a result of all possibilities and choices for technological action or social representations) (Lemonnier 1992: 5-6). These choices reflect sociological and cultural constructs that underlie and direct the producer's actions, and subtle differences in any one of the five choice realms listed above can influence the social representation of material culture and "the symbolic aspect of social life" (Lemonnier 1992:23, 1993:4, 9). Although Sackett does not propose technological style as a valid way to analyze style, he does state that the technology of a material cultural product is important in understanding its style and the possible cultural message(s) that is/are being sent. "Nonetheless, the instrumental form that is built in, rather than added on, to the pot is also a great reservoir of style. For the pot's manufacture and the utilitarian ends it was designed to serve required its maker to choose . . . among a considerable variety of . . . alternatives with respect to clays, tempers, shapes, thicknesses, and techniques of construction and firing, some or possibly even all of which can be just as ethnically--and hence stylistically--significant as the decoration that may be applied to its surface" (Sackett 1990:33).

Gosselian (1992), Steinberg (1977), and Childs and Killick (1993) provide three examples of how different aspects of the operational sequences are reflected in the material record. Gosselian (1992) demonstrates that the operational sequence is a learned process and thus the production of an object of material culture is dependent on a cultural framework. The Bagia of Cameroon make daily choices in the production of pottery, specifically in the shaping of the vessel (steps 2 and 4 above) that resemble those of food production, procurement, and preservation (Gosselain 1992:578, 583). Thus, the operational sequence and the choices that the Bafia make demonstrate the producers knowledge of production that permeates many aspects of cultural life, her/his social and natural environment, and ultimately ethnic identity.

Steinberg (1977) examined the operational sequence (techniques of procurement, choice of material for the object, and the process of working material) of Shang China (1600-1027 B.C.) and Iron Age Anatolia bronze casting. The process of creating bronze objects is a "complex translation of ceramics and other materials into metal" (Steinberg 1977:61). Shang China bronzes are made from ceramic molds and Anatolia bronzes are created by hammer smoothing that is also employed in pottery production. Both manners of bronze creation represent technological styles based in other realms of material culture in such a way that "reasons for certain forms are to be found in other aspects of each culture, especially in the standards of appreciation, the general level of skill, adaptation to environment, subsistence, religion, and trade" (Steinberg 1977:79).

Childs and Killick (1993) present an example of how the knowledge of the production of a technological style can place members of a society in highly respected positions. The Mafa of Northern Cameroon, the Bantu speakers, and the Ushi of Zambia revere their metallurgical producers because they are thought to have the specific ideological knowledge necessary to create objects reflecting social status and enhance the symbols of power and prestige. Transforming ore to metal is analogous to gestation, birth, fertility, and productivity (Childs and Killick 1993:331). Because the metallurgists are able to transform ores, producers have similar rights as kings (Childs and Killick 1993:328). Producers are also highly regarded because the location where they transform ore to metal is near the place of the ancestors (Childs and Killick 1993:328). Thus, metallurgists have a connection to ancestors because of their specialized knowledge of a specific technological style.

The material and the process of manufacture contribute to an object's style as much as the surface decoration because technological acts are also embedded in a symbolic system that reflects social reality and indigenous knowledge that is "translated by, among other things, implicit or explicit classification of the materials treated, of the processes brought into play, of the means and tools employed, and of the results obtained, without speaking of the presentation of the actor's roles" (Lemonnier 1986: 160). Thus, style is a technological performance of social production and mental schemas that need not carry directly observable meaning and can be learned and transmitted from generation to generation (Lechtman 1977:6, 1993; Lemonnier 1993:3).

By combining the choices available from the technological and stylistic realms, one can better understand "emic behavior based upon primarily etic phenomena of nature" (Lechtman 1977:7). This type of analysis is possible because the social representations behind the technological style presented on material culture are the perspective of the producer toward the raw materials that are used, "the attitudes of cultural communities towards the nature of the technological events themselves," and the attitudes of the community towards the end product (Lechtman 1977:10, 1988:369). However, to fully understand the technological and stylistic realms, one must conduct a synchronic and diachronic analysis of the design elements and the transformation and social representations that permeate beyond the material world (Lemonnier 1992:3).

As a result of this type of analysis, one understands that the essence of the object is as important as the surface stylistic message being sent and received by members of the same community or by members of different communities. The physical characteristics of an object are important, but how the object is made and used also reflects the relationship between social representations and the physical world (Lemonnier 1992:36). Therefore, beliefs and attitudes toward the materials of manufacture are supported through the technological process of production where the external appearance of an object depends upon the internal condition of the object (Lechtman 1979:33).

The Chavín and Chimú Andean cultures illustrate the importance of the essence of an object with the use of *tumbaga* objects to signify wealth and political power. *Tumbaga* is a copper-gold alloy created by dissolving gold in an aqueous solution in order to replace gold ions with copper ions. The metal is hammered to bring the gold ions to the surface (Lechtman 1984b:59). The resulting metal has an outward appearance of gold, and it may have been assumed that the inside of the object is also made of gold. In actuality, the *tumbaga* alloy only has minute fractions of gold on the interior of the object. The idea that the *tumbaga* object is solid gold was important because the color of gold reflects social beliefs of wealth and political power, reinforcing the power of the religious cult and separating the secular and religious spheres of society (Lechtman 1979:32, 1984a:9). Gold also symbolizes the sweat of the sun which is an important element of Inca origin myths and the royal family claimed ancestry from the sun (Lechtman 1984a:14; 1984b:63). Therefore, essential qualities that reflect social relations (the color gold equating power of the elite class) on the outside of an object must also be thought to be inside of the object for that object to have the underlying social qualities associated with its external appearance. The *tumbaga* tradition was perpetuated because the artisans approved the material and the nature of the technology and the culture approved the essence of the final product (Lechtman 1984a:30).

Technological styles and their associated technical processes tend to appear in suites of material culture. Lechtman extends her discussion of the creation of *tumbaga* to describe how similar developments in other classes of material culture such as cloth occur with similar social representations. Decorated cloth reflects ritual significance, wealth, and power because of its structural and superstructural design–what is in the inside and apparent on the outside (Lechtman 1984:31-33). The structural design consists of the warp and weft of the yarn. The manipulation of the fundamental building blocks of cloth results in weaving of the cloth and to remove any part of the base of the "style" would destroy the object. The second element of the technological style of cloth is the superstructural mode or the added design. Embroidered patterns appear on the surface of the cloth and are easily seen. However, if the underlying structure does not exist, the "style" of the cloth cannot be present and the cloth lacks any power or social status meaning because the cultural message is "embodied in and expressed by structure" (Lechtman 1984a:33-35; 1988:375). Structural and superstructural characteristics of cloth result in a symbolic reality that cannot be separated from its sociocultural context. Cloth and *tumbaga* objects display "the working tradition [that] was joined with a tradition focused on surfaces, emphasizing the ...surface as the carrier of information or the seat of visual communication" (Lechtman 1988:371). It is through the technological performances and social interaction that styles become symbols "through which communication occurs" (Lechtman 1977:13).

Different technological styles may be developed and operate synchronically, but they will not be perpetuated unless the technological style is compatible "with the natural environment and with the state of technological systems at the time of creation" (Lemonnier 1993:12). Because "choices are arbitrary from a technological point of view," technological styles are a result of accommodation rather than a result of alteration. As such, the new style has to fit into an already existing structure of social meaning and practices and the object needs to be able to be interpretable by those within the social group and by those from "competing" social groups to be perpetuated in a culture (Lemonnier 1992:18, 1993:14). As a result of a new technology having to fit into an already existing system, some choices will impinge on the transformation of technological systems. A technology also may not appear in society because it is not "in fashion" or does not look like something that already exists (Lemonnier 1989:166). If this happens, some innovations will not be reproduced and will never be seen by the cultural group at large because selective pressures at the individual and community levels always exist that decide what will represent social structures such as power, ancestry, and identity (Lemonnier 1993:15). On the other hand, it is possible to have many different stylistic schema representing the same social group because there is "no necessary or unique correspondence between the expression of a socially defined technical aim and the physical objects and actions that a given culture use to perform its function" (Lemonnier 1993:16). Therefore, the resulting technological style is the "source of precise information about the history of its own manufacture" (Lechtman 1994:5).

When conducting research on technological style, there are three levels of technological style systems that provide information on social representations of identity: 1) the operational sequence; 2) the interrelationship between artifact classes, raw materials, and techniques of formation; and 3) the relations between the technological style and social phenomena (Lemonnier 1992:10). These three characteristics of technological systems identify which styles may reflect social identity because it is the variations in the three characteristics that indicate differences in social relations. The operational sequence reflects choices that are embedded in the social structure and may be totally unconscious mental operations such as smoothing a pot (Lemonnier 1992:80). The interrelationship between artifact classes, raw materials, and techniques of formation suggests that techniques of manufacture may have been borrowed from other artifact classes and it demonstrates choices made during the manufacturing process. By examining other classes of artifacts and their "styles in which technology developed and gained physical expression" one observes the connections "with other cultural patterns and those patterns and the links among them can be looked for either in the artifacts produced by other technologies within the culture or perhaps in other cultural subsystems..." (Lechtman 1979:33). The relations between technological styles and social phenomenon reflect the organizing principles behind the diversity and arbitrariness of the technological choices that "relate structural features of technological systems to other social relations" (Lemonnier 1992:97). It is important to go beyond the materials from which an object of material culture was made and to examine the context and manner in which it was made and used. The social representation of technology encompasses the "representations of physical components and aspects of material culture, and not just representations underlying features of shape or decorations that immediately communicate something to people able to read them–certainly play a crucial role as a mediator between forces of production and social relations of production" (Lemonnier 1992:100). Different technological styles may represent different "mental processes that underlay and direct our actions on the material world [and] are embedded in a broader, symbolic system" (Lemonnier 1993:3). For example, ritual or sacred objects may have a different technological style than utilitarian objects because the "message" may not be the same (Lechtman 1977:16). Thus, the choice of a technological framework involves the definition of a social dimension of society because the anthropologist needs to relate structural features of technological systems to other social relations and other classes of material culture in order to develop a broader anthropological meaning of technology and style.

Because this project examines Petén Postclassic slipped pottery groups in order to identify technological styles and determine which social group created which technological style as a way to mediate social relations and differences in identity, Lechtman's technological style seems to be the most logical operational framework in which to proceed. Through the theory of technological style discussed above, I analyze the technological styles for this pottery to suggest that: 1) technological and stylistic choices have a social context; 2) technology and style are social reproductions of Postclassic society; 3) some technological and stylistic choices were more compatible than others with Postclassic Maya society; 4) technology affects style; and 5) these compatible choices reinforced the existing technology and social ideology and social identity. To demonstrate these aspects of technological style, I examine the similarities and differences in particular technological and stylistic traits through time and over space to determine if the similarities and discontinuities are related to social identity. I am able to do this type of analysis on Postclassic slipped pottery because "subtle social relationships through a society's social representations of technology influence the physical action of the material world" (Lemonnier 1992:23). Thus, through analysis of the Mayas' choices of technologies and styles, it may be possible to determine the extent to which social representations are reflected in the development and performance of technological and stylistic action in order to define social identity and ethnic boundaries.

CHAPTER 4

SAMPLING AND METHODS

Because the focus of the study is to determine the possibility that social groups in the Petén lakes region produced distinctive technological styles of pottery that displayed identity, I first chose sherds that were slipped and decorated. Without a decorative sample, I could not complete an analysis that compared the relationship of decorative elements, technological characteristics, and the patterns that people produce through various acts of behavior that distinguish the style of a pottery. However, not all sites included in this study had adequate numbers of decorated Postclassic slipped pottery in all pottery types and varieties. As a result, I selected monochrome slipped types to fulfill the stratified random sample of pottery.

Fifty sherds from each ceramic group at Ch'ich', Ixlú, Zacpetén, and Tipuj were chosen through a stratified random sampling methodology. Although all sherds should be available for selection, because of the type of analysis being conducted, six restrictions were placed on the sherds in order to qualify for the selection process (Rice 1987b:321-324). First, only sherds that were larger than 2.5 cm were considered for selection. Size restrictions were necessary because of the destructive methods of analysis described below. As a result of this requirement, not all excavated buildings from the four sites are represented in the study. Second, I selected only sherds representing different vessels in order to avoid over sampling one vessel at the expense of others. To ensure that different vessels were sampled, all sherds were reconstructed as completely as possible. Third, slipped and decorated surfaces had to be in good condition and not overly eroded in order to conduct a full technological style study. Fourth, unprovenienced sherds were not selected. In order to compare technological styles, I had to ensure that I analyzed the same time period. Fifth, rim sherds were selected first because of their potential for defining technological styles through form. Finally, no sherds that represented more than one-third of a vessel could be selected because the Guatemalan government restricted their export.

Stratified random sampling was the best method by which to obtain a sample for this study because Postclassic slipped pottery represents a heterogeneous collection with multiple subpopulations or types and varieties (Sinopoli 1991:48). The sampling methodology also enhanced statistical precision so that "the variability of the sampling distributions of whatever statistics are involved in the research will be decreased" (Hinkle, Wiersma, and Jurs 1994:161). I determined the number of types and varieties of decorated pottery present in each ceramic group, and selected a proportional allocation. In cases where 50 decorated sherds were not available from each ceramic group at each archaeological site, I selected monochrome slipped sherds by stratified random sampling.

Paxcamán and Topoxté ceramic group sherds were sampled in the same manner for each of the four sites. First, I placed all decorated sherds from one site on a table grouped according to the identification number of the structure from which they were recovered. Second, I ascertained the number of pottery types and varieties represented at each structure. The number of sherds per type and variety and structure determined the number to be randomly selected and the number varied depending on the structure, so that buildings with more decorated types were sampled more often. Third, I wrote each lot number of each sherd on a piece of paper and placed the papers in a container according to the structure and type and variety. The predetermined number of sherds to be selected for each structure determined how many lot numbers were drawn for inclusion in the sample. This selection process continued for all sites that had Paxcamán and Topoxté ceramic groups, each type and variety, and each structure. Ixlú did not have 50 Topoxté sherds from which to select, so I chose half the sherds in the pottery collection. Ch'ich' had no Topoxté sherds and was thus not included in the selection process.

Trapeche, Fulano, and Augustine monochrome slipped sherds were selected in the same manner as described above for the first three steps. However, first, all decorated sherds were selected because of their rarity. Because Trapeche and Fulano sherds were rare at Ixlú and Ch'ich', a total sample of less than 50 sherds resulted. The Trapeche ceramic group is not represented at Tipuj.

The above selection resulted in 551 sherds for analysis.

In order to identify the existence of patterns defining Petén Postclassic technological styles, several types of analysis were conducted to obtain technological and stylistic information: type-variety analysis; "low-technical" analyses; petrographic analysis; x-ray diffraction analysis (XRD); scanning electron microscopy (SEM); energy dispersive x-ray spectroscopy (EDS); and strong acid-extraction ICPS analysis. Table 2 presents the type of information that can be obtained from each type of analysis and how the techniques compare. Postclassic slipped pottery groups from the sites of Ch'ich', Ixlú, Zacpetén, and Tipuj are used to gather technological and stylistic data that could differentiate Postclassic slipped pottery technological styles. These base patterns discerned through analysis of pottery from these four sites were then applied to the Postclassic pottery collections from the sites of Tayasal, Macanché Island, and Topoxté, which were only visually examined because the collections are housed at other locations. The objective of this application is to "test" whether these styles can be identified in the material from other Postclassic sites in the region.

I collected type-variety, pre- and post-fire hardness measurements, pre- and post-fire color measurements, decorative manner and techniques, form measurements, and binocular microscope mineralogical data information for all sherds. From these data, I selected a sub-sample for petrographic analysis, x-ray diffraction, SEM and EDS analysis, and strong acid-extraction ICPS analysis. A proportional stratified random sample of sherds (as described above for the initial selection of sherds) from each ceramic group was selected for petrographic analysis. Selection procedures ensured that all types and varieties were included in the petrographic sample and the sample included a range of mineralogical information obtained through binocular microscopy. I chose a proportional number of sherds for ICPS analysis from each ceramic group and each site for a total of 100 samples. All types and varieties were included to ensure a range of data. The same 100 samples were used for EDS analysis. I collected SEM data on 24 sherds that represented the different groups of elemental concentrations as obtained

Table 2: Comparability of Methodologies

Methods of Analysis	Inferences			
	Behavior Choices	Physical Properties	Mineral Identification	Chemical Identification
Type-Variety	X	X	X	
"Low Tech"	X	X		
Petrographic	X		X	
XRD	X	X	X	
SEM and EDS	X	X	X	X
Acid-extraction ICPS	X	X		X

through EDS analysis. Eighteen XRD samples were chosen because their estimated firing temperatures were below 400°C and the clay structure had yet to collapse. I had originally planned to conduct x-ray diffraction data on a 100-sherd sample, but because of the higher than expected firing temperatures of the sherds, this was not possible.

I. Type-Variety Analysis and Establishment of a Regional Ceramic Complex

The first level of analysis to be conducted in this research program consists of morphological and typological analyses based on the type-variety classificatory system. This binomial nomenclature system, created by archaeologists, was developed in order to facilitate comparisons of pottery from different sites (Gifford 1960, 1976; Sabloff and Smith 1969; Smith, Willey and Gifford 1960; Wheat, Gifford and Wasley 1958). Ceramic analyses that utilize this system of classification employ a standardized set of levels of classification to name and hierarchically group categories of archaeological pottery.

Type-variety classification relies on the premise that attributes exist at different distinguishable levels of devised classifications that can be hierarchically nested. Four hierarchical units of analysis comprise the type-variety system: ware, group, type, and variety (Gifford 1976; Smith, Willey, Gifford 1960). The ceramic sphere and complex have been added as integrative units of classification. Ceramic spheres consist of two or more ceramic complexes that share a majority of the most common types (Willey, Culbert, and Adams 1967:306-314). Postclassic ceramic spheres in the southern Maya lowlands include the Isla ceramic sphere, the New Town ceramic sphere, and the Boca ceramic sphere. Complexes are defined as the sum of modes and varieties that comprise the full ceramic content of a particular site in time and space (Ball 1976:324). Southern lowland Maya Postclassic ceramic complexes include the Aura complex, the Dos Lagos complex, the Ayer complex, the New Town complex, and the Bayal complex. Wares represent paste and surface characteristics that indicate gross technological and manufacturing similarities (Rice 1976:539). Clemencia Cream ware, Vitzil Orange-Red ware, and Volador Dull-Slipped ware are examples of Petén Postclassic ware designations. Group affiliation is based on closely related types that demonstrate a "distinctive homogeneity in range of variation concerning form, color, technology, etc." (Gifford 1976:17). Petén Postclassic slipped groups include Paxcamán, Trapeche, Fulano, Topoxté, and Augustine. Types are defined as "aggregates of visually distinct ceramic attributes . . . which . . . are indicative of a particular class of pottery produced during a specific time interval within a specific region" (Sabloff and Smith 1969:278). Some Petén Postclassic types include Paxcamán Red, Fulano Black, Picú Incised, Chompoxté Red, and Graciela Polychrome. Finally, varieties are differences at the attribute level such as types of incising. Escalinata variety (black rim), Fulano variety, Thub variety (broad, post-fire incising), Akalché variety (banded designs), and Graciela variety are corresponding varieties for the Petén Postclassic types mentioned above.

Those scholars that use the type-variety system described above state that various classifications and typologies of pottery aid in the understanding of cultural reality because naturally created types used by archaeologists reflects societal activities. As Gifford (1976:32, emphasis added) states:

> In a theoretical sense it is possible to visualize the ceramic variety as a reflection of *overt individual* and small group behavior . . . , the pottery type as reflecting

> the interplay of both *covert individualness* and *covert culturalness*, and the ceramic group as reflecting overt *culture*, as this may be determined in pottery. I believe it is possible to postulate that the ceramic group is telling us of the everyday *ceramic activities* of a culture; that the pottery type is telling us of the subconscious ceramic value orientations of both the *culture* and the *individual*; and that the ceramic variety is an expression through pottery of individual and small social group preferences.

If what Gifford states is true, pottery types reflect cultural integration and possible interactions. However, some scholars question whether the type-variety system allows archaeologists to elucidate interpretation regarding social and economic issues beyond simple classification (Demarest 1986; Rice 1976).

Although the type-variety system is the main classification system used in the Maya region, three serious problems exist in its use. First, it is assumed that once a new name has been given to a new type of pottery, similar pottery from different sites and regions will be classified with the same designation. Unfortunately, rather than comparing similarities, many archaeologists magnify slight differences and unnecessarily define new pottery types. For example, Forsyth (1989:7), Ball (personal communication 1999), and Rice (personal communication 1998) all suggest that although Late Classic red slipped monochrome pottery from Guatemala and Belize is remarkably similar in terms of paste, slip, and form, many different type names that appear in Maya lowland ceramic reports establish false differences between the types. For example, Tinaja Red, Nanzal Red, and Belize Red are similar enough to be classified as the Tinaja Red type (Forsyth 1989:7). Unfortunately, ceramicists using the type-variety system have not consistently adhered to the original classification rules, with the consequence that archaeologists draw distinctions that may not exist.

Second, strict use of the type-variety system often leads to misclassification of sherds that come from the same vessel. Because of differences in firing over the surface of a vessel, uneven erosion patterns due to deposition, or placement of decoration or slip on a vessel, sherds from the same vessel may appear as two distinct types and possibly two different ceramic groups. For example, one sherd from a vessel may be incised and another not, and as a result, the two sherds may be classified as different pottery types. To decrease the problem of misidentification, Demarest (1986) advocates before-and-after reconstruction comparison of type classifications.

Finally, the type-variety system was created as a methodological tool to aid the archaeologist in comparative chronologies. Early archaeological projects and ceramic reports, such as those for the sites of Uaxactún (Smith 1955) and Altar de Sacrificios (Adams 1971), often artificially defined new classificatory levels based on changes in archaeological phases. For example, Saxche Orange Polychrome pottery of the Tepeu 1 ceramic sphere and Palmar Orange Polychrome pottery of the Tepeu 2 ceramic sphere appear similar but are artificially divided because they come from two different temporal contexts. Although the type-variety system is the starting point for many ceramic studies, many archaeologists place too much emphasis on the classification system to elucidate specific information about economic and political systems. As Shepard (1956:317) states, the type-variety system does not serve to answer questions concerning potter's knowledge, potter's capacity, or accidents of production. Therefore, when archaeologists use the type-variety system in ceramic analysis, they must realize its limitations.

In order to overcome the problems inherent in the type-variety system, pottery classification, based on attributes or features, must go beyond a simple type-variety classification in order to interpret cultural behavior (Rice1982: 48). Sabloff and Smith (1969) suggest that the archaeologist analyzes types, varieties, and modes of pottery in order to strengthen intersite comparisons. In addition to the analysis of modes, comparing pottery at the ware level eliminates the above concerns of types and varieties because the focus of classification is based on paste and/or surface characteristics. Debate exists as to the usefulness of combining paste and surface characteristics in the ware level. Rice (1976) suggests that archaeologists define wares based on paste or surface characteristics because they are two different subsystems. I base ware distinctions on the differences in pastes that include differences in texture, temper, hardness, and color. These differences may reflect the differences in environments. As such, ware level classification provides information about geographic location, time period, and paste attributes (Rice 1976; 1982:50). These characteristics inform the archaeologist more about political, social, and economic interactions than do the ceramic type (Demarest 1986: 54). Cross-cultural comparisons at this level also may be more helpful because it is less likely that an archaeologist will mis-classify sherds based on small paste differences and/or modal characteristics. This type of analysis has been suggested by Rice (1976) and Demarest (1986), but few ceramic analyses use the ware level for comparisons.

All Postclassic slipped sherds from the sites of Ch'ich', Ixlú, Zacpetén, Tayasal, Tipuj, Topoxté, and Macanché Island were classified as to ware, ceramic group, type, and variety (when possible).

II."Low-tech" Analyses

Color measurements, degree of dark coring, hardness measurements, surface treatment and manufacturing technique observations, rim diameter, thickness, form measurements, and refiring observations aid in the detection of Postclassic technological characteristics. These observational techniques of analysis allow me to group the five Postclassic slipped ceramic groups according to different technologies and styles. All sherds in the sample are subjected to each of the "low tech" procedures described below. Upon completion of the "non-technical" analyses, I re-grouped the sherds according to characteristics developed during this phase of analysis.

I.A. Color Measurements

Color measurements describe the color of the interior surface, the exterior surface, and the core color of sherds through the use of Munsell Soil Color Charts (Munsell Color Company 1975). The system standardizes color by organizing it into three variables: hue, chroma, and value. The Munsell soil charts provide numerical values as well as verbal color names and modifiers of specific hues (Rice 1987b:341). In addition to naming colors, Frankel (1994) demonstrates that by measuring the range and degree of occurrence of colors on pottery at different archaeological sites, one can infer variation within ceramic traditions as well as the degree of quality control or standardization. Thus, one can obtain considerable amounts of information from color alone. By establishing different color patterns, if they exist, it may be possible to distinguish technological behaviors and stylistic ethnic identifiers.

In order to quantify general patterns of slip color that may be specific to technological and stylistic behaviors, I calculated diversity indices (richness, evenness, and heterogeneity) of slips according to archaeological site and ceramic group.

Richness represents the relationship between the sample size and the number of colors. The greater the richness index, the higher number of colors in a given sample (Frankel 1994:212). Richness is calculated using the following formula (Bobrowsky and Ball 1989:formula 3)

$$R=S/\sqrt{N}$$

where S is the total number of colors and N is the number of sherds in the sample. Sample size influences richness measurements.

Evenness measures the number of sherds in the sample and the number of slip colors. A sample with a value of 0 and is completely homogenous, uniform, and highly standardized (Frankel 1994:213). On the other hand, a perfect evenness (value of 1) is characterized as a mixed assemblage or a broad spectrum of colors in even proportions (Frankel 1994:213). Evenness is calculated using the following formula (Pielou 1969:233)

$$J=H/H_{max}$$

where $H=\Sigma p_i \ln p_i$ ($p_i=n_i/N$, n_i is the number of sherds with a particular color and N is the total number of sherds) and H_{max} is ln S (S is the number of Munsell color hues, i.e., 10R, 7.5YR, etc.). Evenness indices assume all colors are present in all samples and "does not discriminate, for example, between those assemblages with equal representation of few or many colors" (Frankel 1994:213).

Heterogeneity combines measures of richness and evenness around a mean to produce an index of the complexity or structure of the sherd data set and not the individual sherd (Rice 1987b:202). High heterogeneity measures (closer to 1) indicate a wide array of colors that may be the result of varied types of interaction, stability and maturity in the ecological sense, probability of randomly selected sherds having the same color, and competition (Rice 1981:222). Heterogeneity is measured by the following formula (Simpson 1949)

$$D=1-\Sigma\{n_i(n_i-1)/N(N-1)\}$$

where n_i is the number of sherds with a particular color and N is the total number of sherds in the sample. Again, the heterogeneity index is skewed toward the most abundant color. However, this measure was successfully used by Frankel (1994) and will be used for this pottery sample.

II.B. Core Colors

Paste colors visible in sherd cross-sections may show distinctive colors resulting from a combination of paste constituents and firing conditions. A dark-colored core may result from a lack of primary removal of carbon by oxidation (dark core), or deposition of carbon from a reducing atmosphere (Rye 1981: 115). Core colors resulting from paste components and original firing and can be measured with published charts (Rye 1981: Figure 104). According to Rye (1981:116), core colors reflect sherds with the following characteristics: 1) oxidizing, organic material absent; 2) oxidizing, organic material present; 3) reducing or neutral atmosphere with organic material absent; and 4) reducing atmosphere with organic material present. Fully oxidized vessels or sherds contain no organic matter and have a uniform cross-section color. Clays fired in an oxidizing atmosphere that have a large amount of organics may show a gray or black core distinct from the surface color. However, core and surface layers may differ within the same vessel due to disproportionate heating, oxidation, and placement in fire. Sherds fired in a reducing or neutral atmosphere with a lack of organics exhibit a core center in which carbon deposits do not enter, and a diffuse margin may appear (Rye 1981:116). A reducing atmosphere, with the presence of organics, will appear in a sherd as a gray or black core.

I measured the degree of dark coring using a modified version of Rye's dark coring chart (Figure 2). Different cores were assigned a nominal value that allowed me to conduct statistical analysis of measurements of central tendency (mean), measurements of variation (standard deviation and range), and correlation coefficients for the sample according to ceramic group and archaeological site.

II.C. Hardness

Hardness was recorded in terms of resistance to scratching that is determined using the Mohs' hardness scale. Various types of hardness exist, and by using the Mohs' hardness scale, I measured scratch hardness. Interior surfaces, exterior surfaces, and

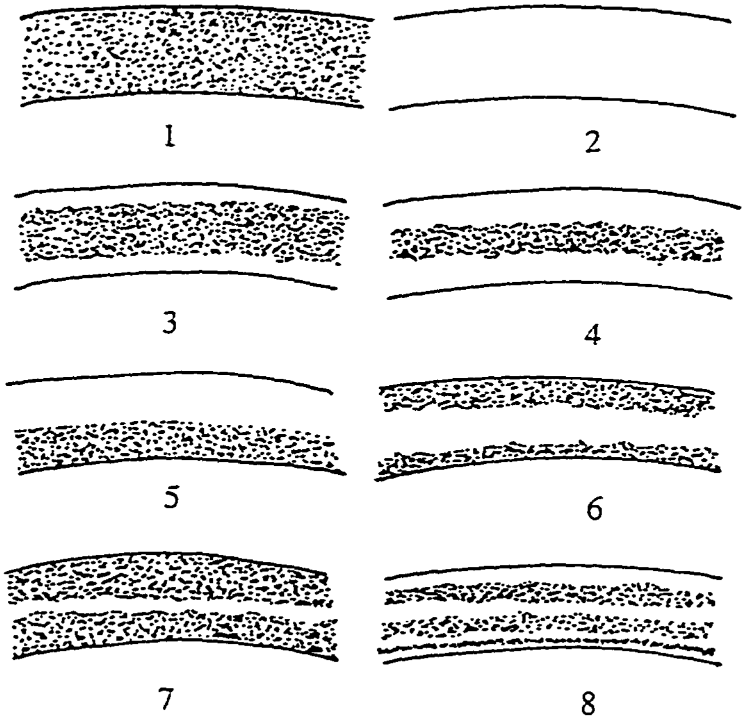


Figure 2: Stylized cross-sections comparing variations in the appearance of firing cores (after Rye 1981:134): 1) Oxidized or reduced atmosphere with organics present in the core (Volador Dull-Slipped ware); 2) Oxidized firing with no core (Clemencia Cream Paste and Vitzil Orange-Red wares): 3-4) Oxidized firing with difuse core margins: 5) Oxidized firing, coloring due to position in fire; 6-7) Reduced firing with "no core;" 8) Reduced firing demonstrating repeated rapid cooling with a "double core."

pastes are scratched in order to determine hardness characteristics of the slips and pastes. In addition to hardness of the sherd, other procedures are also being assessed with the Mohs' test: "the length and duration of firing, porosity, grain-size distribution, post-depositional environment and mineral composition all contribute to the 'hardness,' and although it should continue to be measured and recorded it is not a precise indicator (Orton, Tyers, and Vince 1993:138).

I measured scratch hardness with a Mohs' geological scale of minerals (see Table 3). Sherds were scratched before and after refiring experiments. The results were compared through statistical analyses of measurements of central tendency (mean), measurements of variation (standard deviation and range), and correlation coefficients for the sample according to ceramic type and archaeological site.

II.D. Surface Treatment and Decoration

Surface treatment and decoration are described. The most common surface treatment is burnishing, which can be visually and microscopically detected. Surface treatments, such as scraping while the clay is plastic, can be seen in the drag marks caused when grit or harder inclusions are dragged across the surface; the grains remain at the end of the drag. Design painting, impression, compression, or cutting are means of decoration that also appear in Petén Postclassic pottery. Design motifs, as well as other surface treatments, are described and illustrated when appropriate in order to compare stylistic attributes to technological characteristics.

Table 3: Mohs Scale of Hardness

Hardness	Mineral
1	Talc
2	Gypsum
3	Calcite
4	Fluorite
5	Apatite
6	Orthoclase
7	Quartz
8	Topaz
9	Corundum
10	Diamond

II.E. Refiring

Refiring procedures provide insight into the original firing conditions and original clay colors. By estimating the original firing temperature, information on time, temperature, and atmosphere characteristics of the pottery firing are provided. When refiring sherds at a temperature of 800˚C, one is able to arrive at "a general picture of the variability in the kinds of clays the prehistoric potters used . . ." (Rice 1987b: 344). As a result of such analyses, a researcher can ask questions such as: 1) Are particular clays used for particular vessels? 2) Are different firing procedures used for different clays? and 3) Does dark coring result from an abundance of organics or is it attributable to another cause?

Six small pieces (approximately .5 cm) of each sherd were placed in an electric kiln with a constant atmosphere and pressure. The temperature was set at 275°C and the sherds "soaked" at that temperature for 15 minutes. This temperature drove off atmospheric water that may have accumulated in the pores. After 15 minutes, the temperature was set to 550°C and the sherds soaked for 15 minutes after that temperature was reached. After the soaking period, one sherd piece was removed from the electric kiln and placed in an electric drying oven set at 40°C. This process was repeated at 600°C, 650°C, 700°C, 750°C, and 800°C. After all of the sherd pieces had cooled, I compared the broken pieces from the different firing temperatures to the original sherd to estimate at what temperature the sherd might have been originally fired. In cases where sherds were fired below 550°C, the procedure described above was repeated but at lower temperatures: 300°C, 400°C , and 500°C.

II.E. Form Measurement

In addition to the above testing procedure, I conducted measurement-based classification of forms in order to suggest possible changes in technological, functional, and stylistic attributes of the different pottery groups. By measuring the diameter of rim sherds that comprise more than 10 percent of the total rim diameter of a vessel, I was better able to demonstrate variation in vessel size of a given ceramic group and/or form.

In addition to measuring rim diameters where possible, I also measured jar neck heights to determine formal categories related to function. After obtaining measurements of vessel rims and neck diameters, I conducted measurements of central tendency (mean) and measurements of variation (standard deviation and range) for each of the form classes (jars, bowls, plates, dishes etc.) defined by site and by ceramic group. The use of the various measurements aid in the determination of technological choices and vessel size during the Postclassic period.

III. Mineralogical Analyses

III.A. Petrographic Analysis

In order to further investigate the possibility of different technological styles in Postclassic slipped pottery, I examined 273 sherds from the different groups of pottery from each site. First, a preliminary examination of pastes with a binocular microscope was completed in order to observe gross modal differences in paste categories and to ensure that a representative sample was selected for petrographic analysis (Shepard 1956: 140-141).

Petrographic analysis allows the analyst to identify minerals that are present in the clay pastes of different vessels. Petrography allows analysis of many clay materials and inclusions at one time. One can study "the clay itself, natural inclusions in the clay, purposefully added inclusions, and glazes or slips on the clay surface" (Childs 1989:24).

Petrographic analysis has been adapted from geological techniques of analysis for the study of soils and rocks and is useful for archaeological ceramics because, to a large extent, geological sources differ enough regionally to allow for comparison of different clays (Blatt 1992). These methods are applicable to pottery analysis because pottery can be regarded as metamorphosed sedimentary rock due to the composition of a sherd consisting of clastic grains imbedded in a clay matrix which has been transformed to "rock" through the process of firing (Bishop, Rands, Holley 1982; Rice 1987b:376). Understanding these basic principles of geology plus other principles of optical mineralogy, allow the description of pottery pastes and clays.

Additionally, petrographic analysis can be used to establish technological characteristics within the Postclassic ceramic complex because petrographic analysis aids in the classification of sherds into specific groups (Childs 1989:24). This aspect of petrography is most helpful when a sherd or vessel cannot be assigned to a typology based on surface decoration, vessel form, or rim diagnostics (Shepard 1956:165). I anticipated that the above situation would arise because many of the sherds are highly eroded and because the variability within pastes may be great enough that I could not easily identify the ceramic group. As a result, paste characteristics (clay matrix and inclusions) were examined to establish possible differences between types.

Once a sherd or vessel is assigned to a ceramic group, I can develop additional behavioral information from a classification based on petrography because petrography can answer process-oriented questions from a diachronic or synchronic perspective (Carr 1990; Childs 1989). It is possible to create a time series (double lenticular pattern) that models shifts in technological characteristics such as paste and temper characteristics (Braun 1982; 1985). Braun (1982;1985) created such a model in which he was able to predict the date of Middle and early Late Woodland cooking pots based on changes in temper density. By comparing clay pastes, temper types, and frequencies, Braun (1985) and Carr (1990) state that it is possible to draw inferences about the cultural and technological conditions that affected the production of various pottery types.

Although petrographic analysis is important to this research design, there are some limitations. Thin-sectioning may not produce the full mineralogical composition of a pottery sample due to sampling error and because the method of producing thin-section slides involves grinding and polishing of the sample (Orton, Tyres, and Vince 1993). In addition to problems with sample preparation, petrographic analysis alone cannot determine the type of clay mineral in the sherd because of the refractive characteristics of clay minerals. Because of these limitations, petrography will be combined with x-ray diffraction in order to obtain a full mineralogical complement.

All selected pottery (described above) was cut with a wet saw for the preparation of thin section slides. The sherds were sent to Spectrum Petrographics where they were embedded in an epoxy block. The most fragile sherds were vacuum impregnated and then embedded in an epoxy block. The block was cut in such a manner that a thin section measuring .03 mm thick resulted. The resulting thin section allowed me to identify minerals in the clay paste with the use of a polarizing microscope.

The polarizing microscope is composed of a light source, a polarizer, a condenser, a rotatable stage, objective, slots for a quartz wedge, an analyzer, and a Bertrand lens. Light originates from a light source at the base of the microscope and passes through the polarizer that aligns the light waves in a single plane or direction. The polarized light then passes through minerals on the rotatable stage and bends them according to the mineral structure because each mineral and inclusion transmits light differently and is thus identifiable (McLaughlin 1977). The objective magnifies the resulting light waves and the light passes through an analyzer. Analyzers allow light to vibrate in a plane perpendicular to that of the first polarizer. When the analyzer is in place (crossed nicols), birefringence colors appear and can then be compared to published charts to identify the mineral. If the crossed nicol color, angle of extinction, and other mineralogical characteristics are not sufficient in the identification of the mineral, the Bertrand lens and condenser produce interference figures that determine the mineral's sign (uniaxial or biaxial). Interference colors, in addition to the techniques described above, allow identification of most minerals.

Thin-sectioning provides one objective means of classifying pottery pastes through the analysis of mineral size, shape, roundness, and frequency. Mineral size, shape, and roundness are established through a comparison of various graphs and tables (see Figures 3-5) (Shackley 1975:44-51). The most common geological method of determining the quantity of minerals in a thin section is point counting. Point counting determines the number of different minerals along a predetermined area (for example, 10 mm) of the length and width of the section (Chayes 1956). Various studies have employed different methods for counting the frequency of inclusions: Peacock (1973)

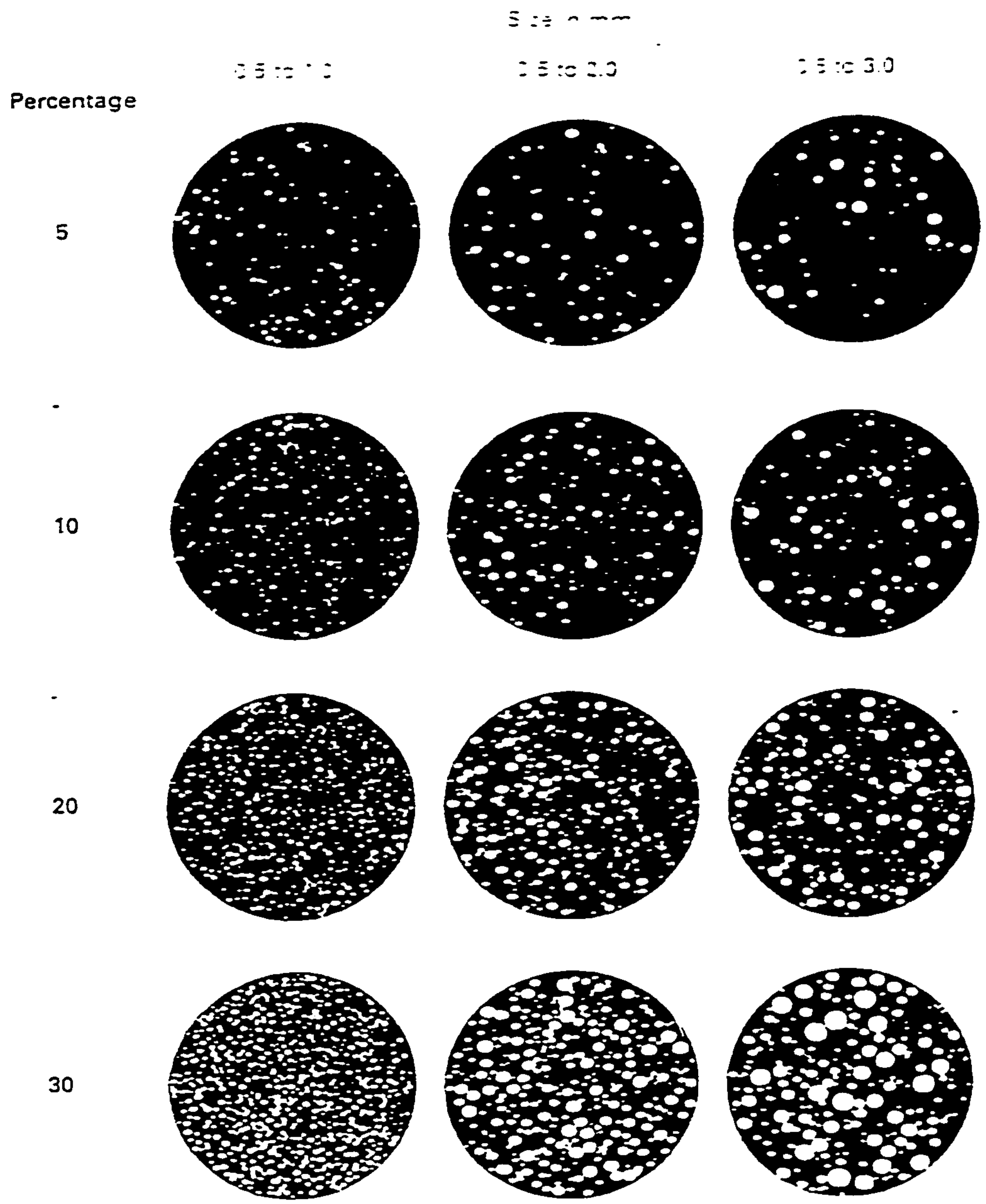


Figure 3: Percentage Inclusions Estimation Chart (Orton, Tyres, and Vince 1993: Figure A.4)

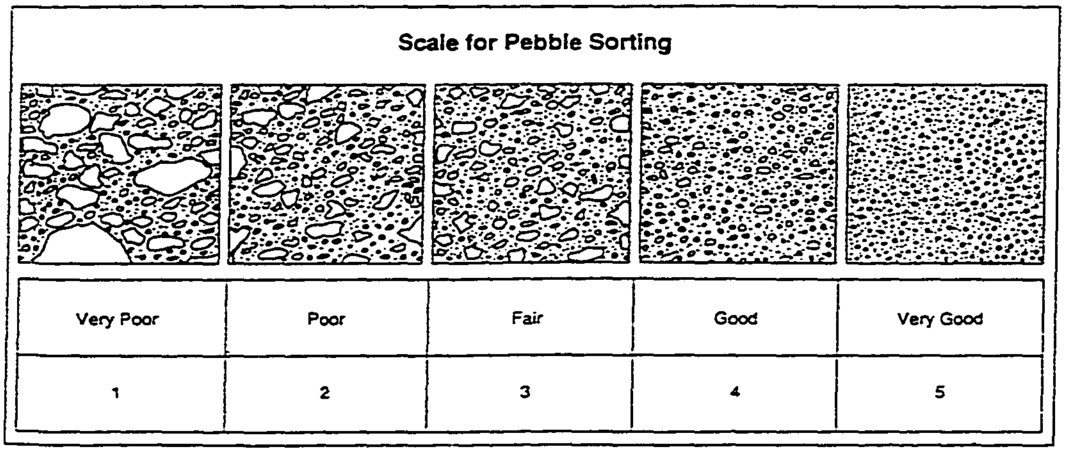


Figure 4: Inclusion Sorting Chart (Orton, Tyers, and Vince 1993:Figure A.6).

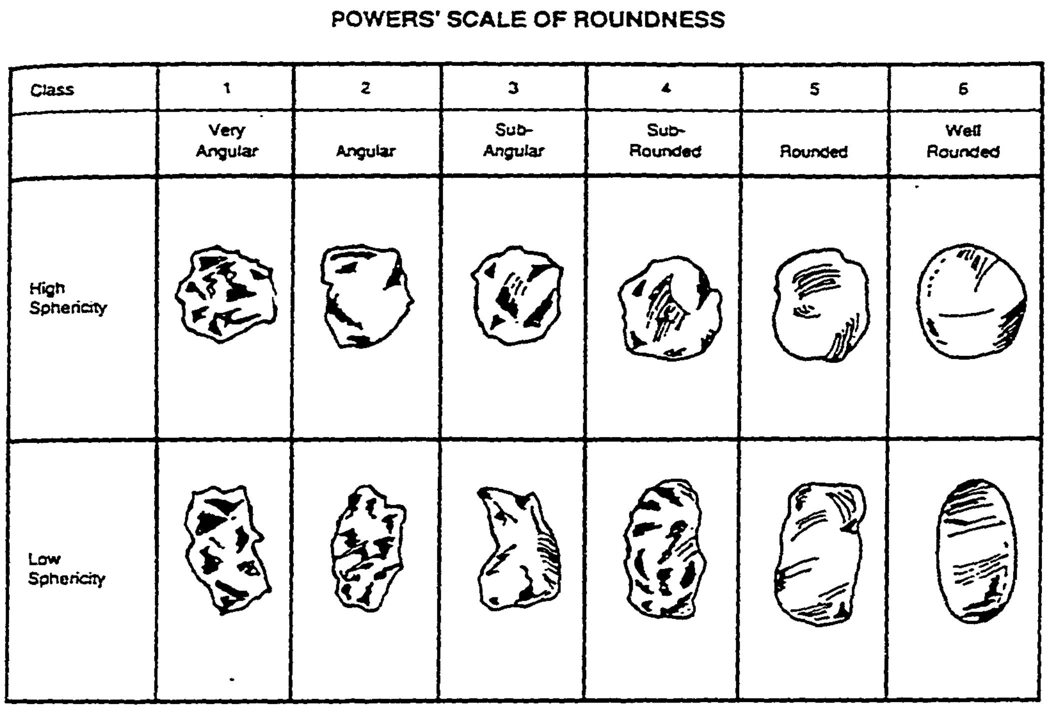


Figure 5: Sphericity/Roundness Estimation Chart (Orton, Tyers, and Vince 1993:Figure A.5).

uses a random grain selection, and Middleton, Freestone, and Leese (1985) use a variation of systematic sampling along linear transects with tests of accuracy for different thin-section samples. However, because I was not interested in the absolute number of minerals in the thin section, but rather in what minerals exist and their relative frequency, I used a non-volumetric area frequency counting method as described by Dickenson and Shutler (1979). They examined thin sections of Fijian pottery to determine that different temper types originated from different Pacific islands and were transported by boat to other islands. To determine that the pottery tempers were distinct and reflected different geological formation processes of the island chains, they used a non-volumetric area frequency count (Dickenson and Shutler 1979:1661-1662). Area counting pertains to counting all of the minerals in the standard image. Middleton, Freestone, and Leese (1985) compared area counting to standard geological point counting and determined that the number of minerals counted was equal and the only difference was that area counting resulted in a smaller mean mineral diameter. Because mean diameter of minerals was not critical to my study, I implemented area counting.

Before conducting an area count, I scanned the sherd to determine the range of minerals and mineral sizes as well as to note any details of manufacturing techniques and slip thickness. After determining the types of minerals present, I counted two standard image areas to ensure that each area was representative of the sherds as a whole and to detect changes in the clay matrix. The first counted area was located at the end of the slide farthest from the rim and the second was determined by rolling a die and moving the slide the corresponding number of centimeters. For example, if I rolled a 5, I moved the slide 5 cm and centered the microscope in an area that filled the standard image. For each mineral type, I measured the range of mineral sizes (the smallest and the largest), the relative frequency as determined by Figure 3, the degree of sorting as determined by Figure 4, the mineral roundness as determined by Figure 5, the number of minerals in the standard image, the frequency of all of the minerals in the clay matrix as determined by Figure 3, and the clay birefringence. Other abnormalities were also noted.

The frequency data were then converted to percentages based on the actual counts and the percentages examined by ternary diagrams to aid in the identification of Postclassic slipped pottery technological styles.

III.B. X-ray Diffraction

X-ray diffraction is used in conjunction with petrographic studies of pottery to identify clay minerals through their crystalline structure in order to understand the variability of the clay paste. It is a necessary complement to petrography because of the difficulties in identifying clay minerals through optical mineralogy. Because of this lacuna with x-ray diffraction identification of the clay mineral(s), I may be able to suggest possible working characteristics of those minerals that were part of the technological style of the vessel. This, in turn, would suggest behavioral and technological characteristics and choices that may contribute to the definition of Postclassic technological style (Klein and Hurlbut 1993:277).

X-ray diffraction is useful for the study of pottery pastes and inclusions because it can identify a small number of minerals in a clay or a fired sherd; however, because pottery frequently has many minerals as inclusions and as paste constituents, it cannot be used as a definitive method of analysis (Orton, Tyres and Vince 1993:20). X-ray diffraction is also useful in the identification of clay mineral constituents, and is most useful when the pottery has been fired at a high temperature (over 900°C) because some minerals can be better identified through the transformations they undergo at high temperatures (Mitchell and Hart 1989:145-147). These minerals which only form at high temperatures (anorthite, cristobalite, dehydroylated montmorillonite, gehlenite, lime, metakaolintie, mullite, periclase, spinel, and magnesium, and aluminum silcates) aid in the identification of minerals as inclusions and as paste characteristics (Mitchell and Hart 1989:148-149). However, refiring sherds to 900°C in this study did not create those high-temperature minerals yielding aluminum silicate peaks to identify clay minerals in the clay matrix.

Because clay mineral structures begin to collapse at temperatures around 400-600°C (see Table 4), only 17 sherds were available for XRD analysis. These sherds were estimated on the basis of refiring experiments to have had estimated firing temperatures below 400°C. In addition, a clay sample obtained from the lake shore of Zacpetén in 1998 and four clay samples from areas around Lake Yaxhá near the Topoxté islands collected by the CPHEP during the 1973-1974 field seasons were also analyzed to expand the sample of possible clay types used in the manufacture of pottery from the Petén lakes region.

Two methods of sample preparation were conducted to determine if similar results could be obtained in a less time consuming manner. The first method is described by Moore and Reynolds (1997) for use with the Millipore vacuum system. I removed

Table 4: Clay Minerals and Temperatures at Which Their Clay Structure Collapses

Clay Mineral	Temperature of Collapse (°C)*	Source
Allophane	100, 550-600	Nutting 1943:216
Kaolinite	400-600	Ross and Kerr 1931:166-170
Halloysite	400-500	Nutting 1943:210
Montmorillonite	100, 400-500	Ross and Hendricks 1945:48-54
Vermiculite	100, 250-400, 600-800	Nutting 1943:212
Illite	100, 350-600	Nutting 1943:211
Chlorite	500-550	Nutting 1943:212
Attapulgite	100, 200-400, 550-600	Nutting 1943:216

* A number of different ranges exist because there are different phases of water loss: the low range (around 100-275°C) represents the release of atmosphere water and the higher range temperatures (400°C up) represent the loss of OH^- lattice water.

exterior and interior surfaces using a Dremel motor tool, then crushed each sample with a mortar and pestle until fragments were approximately 5 mm in diameter. The crushed material was then sieved, placed in glass beakers, and distilled water was added until the water level reached 150 ml. The beakers were then placed in an ultrasonic bath for 15 minutes. After 15 minutes, I siphoned the water and clay-size particles suspended in the water and placed them in centrifuge cups. Additional distilled water was added to make the weight of each cup equal. The cups were then spun in a centrifuge chamber for two minutes at 10,000 rpm in order to separate clay-size particles from any other substances.

The next step involved the decantation of the dispersed suspension of clay-size materials. In order to obtain a "fair crystallite orientation" of the clay size particles, the centrifuged water mixture was placed in the Millipore filter transfer system (Moore and Reynolds 1997). According to Moore and Reynolds (1997), the Millipore method is the preferred method to orient clay minerals for qualitative analysis. I decanted the water into a vacuum filter apparatus that consisted of "a side-necked vacuum flask and a funnel reservoir clamped to a flat porous glass base" as well as a filter above the flat porous glass base (Moore and Reynolds 1997:217). After the material was filtered through the system, the filter paper was removed and placed against a glass slide. Pressure applied to the filter paper ensured a transfer of clay material from the filter onto the slide. The slides were then air dried for 24 hours before x-ray diffraction.

The second method of sample preparation was faster and less expensive. The sherd surfaces were removed using a Dremel motor tool, and samples were crushed using a porcelain mortar and pestle. The crushed sample was sieved through a 100 mesh screen so that only clay-sized particles would be used for XRD. Approximately one milligram of crushed sherd was placed in the center of a glass slide. Acetone was slowly added to the crushed sherd until a slurry was formed. The solution was evenly distributed over the slide using the end of a paper clip. The slide was allowed to air dry before x-ray diffraction.

Each slide, after being exposed to x-rays, was placed in an air tight container with ethylene glycol for a week. This was done to test for the possible presence of smectite and chlorite clay minerals. If the clay is a member of the smectite or chlorite group, the clay would swell changing the mineral's interplanar spacing (Moore and Reynolds 1997:242).

After the slides were dried and/or exposed to ethylene glycol, they were then placed in the x-ray diffractometer. (A discussion of how the x-ray diffractometer functions can be found in Moore and Reynolds 1997). The x-ray diffractometer measures the reflection of in-phase (not destructive) x-rays from the crystal structure of the mineral(s) in the sample. This identification results in d-spacing between the rows of atoms in the mineral (see Figure 6). D-spacing allows one to identify different minerals in a sample because each mineral's crystallographic orientation produces different intensities of x-rays and d-spacings (Moore and Reynolds (1997:69-71).

The mineral's identity can be determined using Bragg's law

$$2d \sin\theta = n\lambda$$

where d=interplanar spacing, θ=incident angle, n=any integer, and λ=wavelength. This equation relates "the wavelength of radiation, the periodicity of structure, and the angle of diffraction," thus allowing identification of minerals (Moore and Reynolds 1997:78).

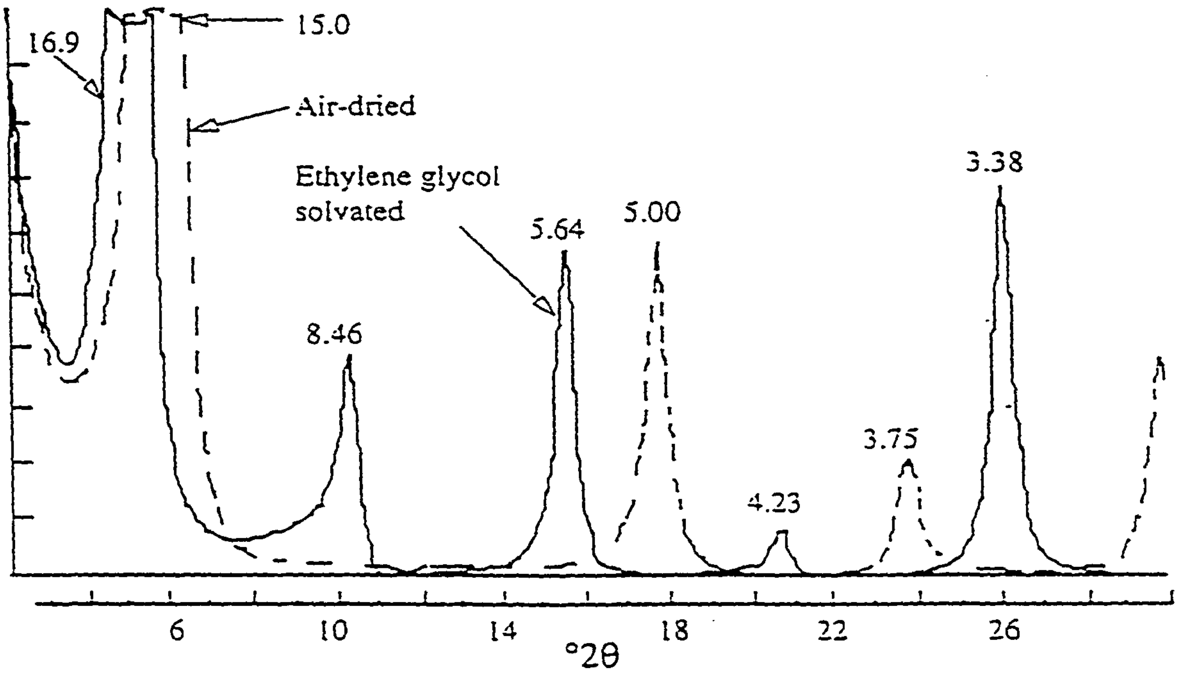


Figure 6: Montmorillonite Clay Mineral X-ray Diffraction Graph (Moore and Reynolds 1997:Figure 7.8).

A XRG 3100 X-ray generator and a XDS 2000 Sintag produced x-rays and recorded data for each sample. The x-ray energy source was set at 45 kV and 35 mA. Each sample was analyzed from 2 to 50 2θ which took approximately 48 minutes per sample. The diffractometer was calibrated before testing began to ensure the comparability of the resulting graphs. After the diffraction process was finished and the data collected, computer programs subtracted background noise, identified mineral peaks, and inserted or deleted peaks that had been misidentified. After peak correction, d-spacing was calculated for each peak.

I identified minerals through the comparison of d-spacing for each sample to d-spacings from published tables (Bayliss et. al. 1980; Brindley and Brown 1980; Chen 1977). The published tables provide d-spacing numbers for all known minerals according to their different crystallographic orientations. The tables also provide d-spacing intervals for those minerals, such as smectite and chlorite, that swell with the addition of water and/or ethylene glycol, making the presence of smectites and chlorites easily identifiable (See Table 5).

IV. Chemical Analyses

Two methods of chemical analyses, energy dispersive x-ray spectroscopy (EDS) and acid-extraction ICPS, were conducted to answer two different research questions. EDS and scanning electron microscopy (SEM) analyses aided in the qualitative detection of possible clay minerals and photographs of the clay minerals. This was necessary because of the limitations of the XRD with regard to firing temperatures and clay structures discussed below. In addition to SEM and EDS, strong acid-extraction ICPS tested the bulk sherd composition to achieve a quantitative analysis of Maya pottery manufacturing choices necessary for the definition of technological styles.

IV.A. Energy Dispersive X-ray Spectroscopy (EDS) and Scanning Electron Microscopy (SEM)

IV.A.1. Energy Dispersive X-Ray Spectroscopy. I conducted EDS analysis on a sample of 100 sherds (the same sample for ICPS analysis) in order to determine the clay mineral(s) that constitute the clay paste. This type of analysis is necessary because XRD analysis is only successful in detecting clay minerals that have been fired below 400°C because clay mineral structures begin to collapse at that temperature. Therefore, EDS analysis was conducted before XRD analysis in order to determine possible clay groups from which to test a subsample. Unfortunately, it was impossible to analytically determine the clay mineral(s) because of the dispersive effect of the electron beam. However, the results did produce elemental suites of the entire clay paste that could then be subsampled through XRD.

Elemental x-ray analysis is the result of an electron beam striking a sherd and emitting different types of energy signals that are detected by the SEM. An electron beam is generated in the illuminating system that consists of an electron gun and three condenser lenses to refine the probe (Bozolla and Russell 1999:371). The x-ray beam is emitted and strikes the shell electrons of the sample which in turn ejects the inner shell (Bozolla and Russell 1999:376). For example, elements with atomic weights below

Table 5: Minerals and Their D-Spacing (from Moore and Reynolds 1997:227-260)

Mineral	D-Spacing (in order of intensity)
Calcite	3.04, 2.29, 2.10, 2.50, 3.86
Dolomite	2.89, 2.19, 1.787, 2.02, 2.67
Gypsum	2.87, 4.28, 2.68, 7.61, 3.07
Biotite	1.538
Hematite	2.69, 2.20, 1.838, 1.692, 2.51
Halloysite	4.41, 2.562
Illite	10.1, 3.38, 5.00
Kaolinite	7.20, 3.58
Low Quartz	3.342, 4.27, 1.818, 1.541, 2.457, 2.282
Chlorite	7.10, 3.55, 14.2, 4.74
Montmorillonite (glycol-solvated)	16.9, 3.38, 5.64, 8.46, 4.23

electrons (Bozolla and Russell 1999:374). X-ray energy that is released as a result of the reaction and is then detected and recorded as a peak by a silicon detector crystal (Figure 7). "Different elements will fill the vacancies in shells in unique ways. This means that since each element will generate a unique series of peaks, the spectrum may be used to identify the element" (Bozolla and Russell 1999:374).

Unfortunately, the selected point of a specimen is not always the only matter measured by the emission of x-rays. Although a probe of electrons is aimed at a specific spot on the sample, the resulting x-rays come from a predetermined spot and the surrounding area (see Figure 7). Therefore, it is highly unlikely to obtain an elemental analysis of a clay mineral in a sherd unless a clay mineral can be separated from the sample sherd.

The detector consists of a silicon disk injected with lithium to correct impurities in the silicon mineral structure (Bozolla and Russell 1999:376). The resulting peaks of intensity come from the proportion of dispersed x-ray energy and the silicon disk current. Because the detection apparatus must be housed in a vacuum structure cooled by liquid nitrogen, low energy x-rays are absorbed by the detector window and are not recorded beryllium (carbon and sodium) may be detected at lower intensities. Therefore, quantitative results are not possible.

One hundred pottery sherd samples were obtained from the epoxy blanks used in petrographic thin section preparation. The blocks were ideal because they have a flat surface and contain epoxy material that does not transmit a x-ray if struck by the electron beam. The epoxy blocks were cut to approximately one centimeter squares and sprayed with freon to remove oils and other stray particles. They were mounted to a numbered

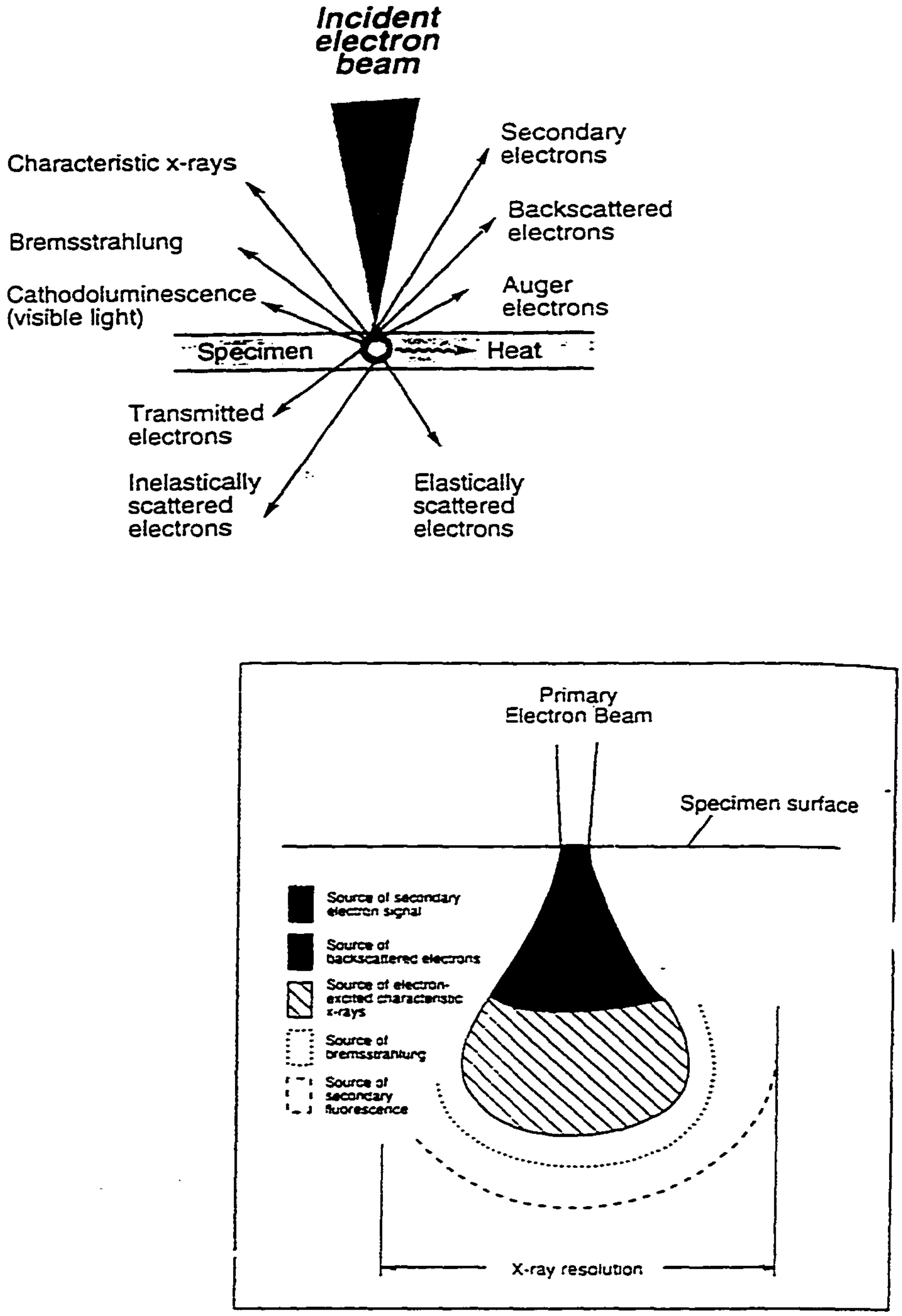


Figure 7: EDS/SEM Beam Dispersion (Bozolla and Russell 1999:Figure 15.1, 15.17)

aluminum rectangle with a carbon paint.

After drying overnight in a 50°C oven, the samples were placed in the vacuum chamber of the S2460 N Scanning Electron Microscope with X-ray Detector. The vacuum was allowed to stabilize for 15 minutes. The S2460 N ran at 30kV, 25Pa(scal), 70x magnification with a 15 mm working distance and a 215 beam current. Once the sherd sample was in view, it was scanned to find a location that was relatively free of possible inclusions. The electron beam was placed on the focus point and data were collected for 100 seconds. Data are presented in the form of graphs with relative elemental intensities. I created ceramic paste elemental groups from the intensity information.

IV.A.2. Scanning Electron Microscopy. SEM photographs were taken of the clay pastes to further identify possible clay minerals. Scanning electron microscopes allow for high magnification and high resolution images of specimens. The microscope has a series of lenses (three condenser lenses) that control the spot size (demagnification), focal length, and electron beam (Bozolla and Russell 1999:208). Magnification is changed by adjusting the length of the electron beam and the final condenser lens creates the final demagnification to finely focus without losing beam electrons. This process occurs in a cathode ray tube that contains two sets of deflection coils and a stigmator. "The deflection coils are connected to a scan generator to raster the electron spot across the specimen. Rastering not only moves the spot in a straight line across the specimen, but also moves the spot down the specimen as well" (Bozzola and Russell 1999:208).

When the electron beam with a specific low voltage comes in contact with a conductive surface, a number of rays are produced as discussed above and collected in the cathode ray tube to display an image. Rays can only be emitted after the specimen has been made conductive. The image can them be digitalized or photographed directly from a monitor.

Twenty-five freshly broken sherd fragments, approximately .5 cm in length; representing each group of elements detected from EDS, were affixed to a numbered aluminum rectangle by carbon paint. The aluminum rectangle and sherd fragments were placed in a drying oven set at 50°C and allowed to dry overnight. The samples were then placed in a direct current sputtering device that removed water and oxygen from the chamber and the sherd voids to a level of .1 Pa. When this pressure was achieved, argon entered the chamber to create a negatively charged field into which gold was introduced. A thin layer of gold was sputtered on the sherd surface as a result of bouncing gold and argon molecules. The thin gold coating ensured conductivity with the electron beam.

Once the sherds were coated, they were placed in the vacuum tube of the SEM. The SEM was set at 20 kV and a magnification of 11,000X . All photographs were taken at the same magnification to ensure comparability and were then compared to published clay mineral SEM photographs.

IV.B. Strong Acid-Extraction Inductively Coupled Plasma Spectroscopy (ICPS)

The final type of analysis that I conducted with the ceramic sample was strong acid-extraction ICPS. Fifteen sherds from each of the four ceramic groups at each of the archaeological sites (total of 100 samples) were randomly selected through stratified random sampling methods discussed below. Acid extraction is a chemical compositional characterization that detects levels of the following elements: Al, Ag, As, B, Ba, Be, Ca, Cd, Co, Cr, Cs, Cu, Fe, K, La, Mg, Mn, Na, Ni, Pb, Rb, Sb, Sc, Se, Si, Sr, Tl, Ti, V, and Zn.

Unlike other chemical characterization tests that are bulk methods of analysis, strong acid-extraction ICPS analyzes the ceramic paste in order to demonstrate the behavioral practices that are represented in the paste. This method makes no pretense to testing only the clay, but analyzes the chemical composition of the clay, the temper, and the firing temperature (Burton and Simon 1996:408). Because different technologies and pottery groups display different technological characteristics such as clay and temper, variability in chemical signatures indicates the differences in technological choices. Thus, one can obtain results that predict the above behavioral characteristics because "the variability is a virtue that informs us about technological choices" and it is these choices in technology that are essential to understanding technological style (Burton and Simon 1996: 408).

Strong acid-extraction ICPS is a controversial chemical compositional analysis method because some scholars believe that the "noise" produced in the analysis nullifies its usefulness (Neff et al. 1996:389). Although "noise" results from the mixture of clay, temper, and firing temperatures, it is the "noise" that indicates technological variability (Burton and Simon 1996). Some scholars question the reliability of acid-extraction analysis because it cannot produce "definite groups that form recognizably distinct centers of mass in the elemental concentration space" (Neff et al. 1996:390). However, acid-extraction does not attempt to source clay bodies, but it rather detects the "variability and contrasts among such vessels, regardless of the locations of their raw material sources" in order to indicate subtle differences in the manufacturing processes that can indicate different technological styles and ultimately different pottery groups (Burton and Simon 1996:409). For example, Burton and Simon conducted weak acid-extraction ICPS on pottery samples from Grasshopper Plateau, Arizona to determine which vessels were exchanged into the area and which vessels were made locally based on the grouping of different elements.

Therefore, acid-extraction is ideal for this research because it detects variability reflecting technological choices that may have been so small as to not be detected by the non-technical, petrography, or x-ray diffraction analyses. With the addition of strong acid-extraction ICPS to the methodology, I am better able to demonstrate the technological choices of Postclassic potters.

Acid digestion is a procedure used to determine the total concentration of the elements in solid matrices by solubilizing all the elements of interest. Acid digestion indicates the maximum amount of an element present irrespective of whether normal environmental conditions might result in its release. For this to be successful, two distinct tasks must be completed. First, the digestion procedure must decompose the sample matrix to expose the entire mass to the acid cocktail. Second, digestion must react with the elements of interest to form water-soluble compounds (Sisir Chaturvedula, personal communication 1999). Ultimately, the digestion process ensures that behavioral traits and chemical compositions are being tested.

Acid digestion results from the following procedure. Slipped and painted surfaces of 100 selected sherds were removed using a Dremel tool. The resulting clay body was then ground using a mortar and pestle to obtain a 200 mg sample of grains of 100 mesh or smaller. Weighed samples were placed into100 ml teflon beakers. Twenty milliliters of aqua-regia (3HCl:1N) and 20 ml HF were added. The samples in the solution were placed on a hot plate at 300- 400°F under a hooded fan and heated until the solution evaporated. When the solution evaporated, I rinsed the beaker walls with deionized water and the sample was heated to dryness a second time. These boiling steps remove HF from the solution and eliminate reactions with boron-bearing glass parts of the ICP spectrometer. Once evaporated, the sample was cooled, I added 1 ml of HNO_3 and 5 ml of deionized water to the beaker and heated it for 5 minutes to warm the solution to 70° C and redissolve the sample. An additional 30 ml of deionized water was added to the sample and heated for 15 minutes to dissolve the residue. I then added 50 milliliters of deionized water to a 100 ml glass volumetric flask and diluted it to100 ml with deionized water. The final solution was immediately transferred to a polyethylene bottle and placed in a refrigerator to cool completely before being analyzed.

A Perkin Elmer Plasma 400 Emission Spectrometer detected elements from the clay sherd samples in the aqueous solution described above. The sample was introduced to the plasma spectrometer through a pneumatic nebulizer. "In these devices the sample carrier gas flow is blown across the mouth of a capillary tube, along which the sample solution is either drawn by the gas flow or pumped by a small peristaltic pump . . ." (Gray 1988:263). The solution reached the chamber that contained a central filament of heated gas. Argon gas interacted with a Tesla copper coil to produce an intense plasma fireball that reached temperatures between 5,000-10,000° K (Gray 1988:260, 262). The introduced sample spent several milliseconds at the high temperatures becoming ionized. A nickel skimmer then extricated the ionized droplets from the plasma flame and immediately cooled them to "freeze" them in composition (Gray 1988:268). After passing through the skimmer, an electrostatic lens system collected the ions and introduced them into the mass analyzer where they were detected by an ion detector (Gray 1988:68). The computer then generated concentration data in parts per million based on a known standard mixture (see Table 6 for standard concentration used here).

Before analyzing the sherd samples, a series of standardized samples and blank (deionized water) samples were tested to calibrate the Perkin Elmer Plasma 400 Emission Spectrometer. First, the standards were analyzed. Next, a blank was tested. The blank served two purposes: 1) to test the system and 2) to clear the system. The sample

Table 6: Concentration of Elements in Group 1, Group 2, and Group 3 Standards

	Group 1 Elements		Group 2 Elements		Group 3 Elements	
Element	Standard 1	Standard 2	Standard 1	Standard 2	Standard 1	Standard 2
Ag			.50	.50		
Al	10.00	1.00				
As	2.5	.25				
B	40.00	4.00	2.00	.20		
Ba	10.00	1.00				
Be	.75	.075				
Ca	800	580	400	140		
Cd	1.50	.15				
Co	2.5	.25				
Cr			1.00	.10		
Cu	1.25	.125				
Fe	5.00	.50	100	10		
La					45	14
Mg	400	40	10	1		
Mn	31.00	3.10				
Mo	10.5	1.05				
Ni			10	1		
Pb	5	.5				
Sb			2.00	.20		
Sc					30	4
Se	2.00	.20				
Sr					350	10
Ti					15000	200
Tl	2.00	.20				
V	2.5	.25				
Zn	1.5	.15				

standard was analyzed a second time and the results were compared. After the blank was analyzed, the results were compared and as long as the standardized sample was within 10 percent of the accepted range and the blank read 0 ppm for all elements, analysis continued. If the standards were more than 10 percent incorrect, a new standard sample was made and tested. This procedure was repeated for all three standards. Each sherd solution sample was analyzed and parts per million counts for each of the elements are listed. Between samples, deionized water was allowed to circulate through the spectrometer to flush the system of any remaining sherd solution. After 12 sherd samples, standards were analyzed again to ensure proper calibration.

Concentrations of elements were measured in parts per million. Table 7 presents the lowest detection limits set by the Perkin Elmer Plasma 400 Emission Spectrometer (Boss and Fredeen 1989).

Because Na, K, Cs, and Rb could not be made into a concentrated standard solution that could be detected by the plasma spectrometer, elemental concentrations were achieved through atomic absorption. I tested all 100 sherd solutions for each of the four elements listed above. The atomic absorption spectrometer was calibrated for each element at the following concentration of parts per million: Na 500, 200, 100; K 100, 50, 20; Cs and Rb 100, 50, 20. The calibration procedure followed that for the plasma spectrometer described above. After 20 samples were analyzed, the standards and blanks were analyzed to check the atomic absorption detector calibration. The lower detection limits for the four elements are listed above in Table 7.

Table 7: Lower Limits for Detection by Plasma Spectrometry

Element	Detection Limit (ppm)
Ag	.07
Al	.45
As	.53
B	.10
Ba	.013
Be	.0027
Ca	.1
Cd	.025
Co	.07
Cr	.061
Cs*	1
Cu	.054
Fe	.062
La	.1
K*	1
Mg	.0015
Mn	.014
Mo	.12
Na*	1
Ni	.15
Pb	.42
Rb	1
Sb	.32
Sc	.015
Se	.75
Sr	.0042
Ti	.053
Tl	1.2
V	.075
Zn	.018

* indicates elements that were detected by atomic absorption.

The elemental concentrations were then normalized using base-10 logarithms. Normalization of the data served to "equalize the extent of variation among the variables" (Bishop and Neff 1989:63). Normalization was necessary because of the use of two different types of spectrometry, two different sets of concentration figures, and possible skewing due to excessively high or low concentrations. From the normalized data, multivariate statistics and bivariate plots of elemental concentrations examined for possible structure in the sample. By using multivariate statistics, complex variances of pottery elements were presented as a group of all of the elements rather than as single elements. Therefore, groups based on elemental concentrations were given shape and located in space (Bishop and Neff 1989:60-63).

Two types of clustering procedures determined elemental groups in the sample: cluster analysis using hierarchical cluster analysis and Ward's method and factor analysis. Cluster analysis is used before factor analysis to obtain the number of possible groupings to be tested with factor analysis. Hierarchical cluster analysis locates the closest pairs of samples with similar elemental concentrations according to a distance measure and places them in a cluster. The initial pairing is joined by others similar to it or separated from those dissimilar from it until all samples are accounted for and all the data appear in one cluster. The procedure is hierarchical because the one large cluster encompasses clusters from earlier stages of clustering that contain clusters from still earlier stages of clustering. Ward's method of cluster formation calculates means for all variables in each cluster and "for each case the squared Euclidean distance to the cluster means is calculated" (Norušis 1988:228). Each step of clustering results from the merging of samples with the smallest increase in the total sum of squared within-cluster distances (Norušis 1988:228). The result is spherical clusters with minium variance.

After obtaining the clusters of sherd samples with similar elemental concentrations, factor analysis was completed using a variance-covariance matrix with varimax rotation. As a result of the variance-covariance matrix, eigenvalues were calculated. Eigenvalues describe the shape of the data that has one axis for each variable. When the eigenvalues are multiplied by their eigenvectors and rotated to enhance interpretability, they produce principal components (Bishop and Neff 1989:64). Principal component analysis calculates the linear combination of variables used to maximize the distance between group means and calculates the variation of each dimension in a multivariate space (Norušis 1988:201). As a result of this type of calculation, the first principal component accounts for the maximum variance in the sample. The second principal component accounts for the second largest variance in the sample and so forth until all of the variance in the sample is accounted (Bishop and Neff 1989:64). Each component represents a set of reference axes that are orthogonal combinations of the original data and this preserves the original integrity of the data set. From principal component data, two- and three-dimensional plots are produced that graphically demonstrate data groups.

The above methods of analyses and sampling procedures allowed me to understand the variability in technological and design choices that were made in the manufacture of the Postclassic pottery from the seven sites in this project. All types of analysis produced data that relate to behavioral choices made during choosing resources, during processing of the resources, during the choice of tools and amount of energy used for manufacture, and that reflect the general knowledge of pottery manufacture. Type-variety, "low-tech,", x-ray diffraction, SEM and EDS, and strong-acid extraction ICPS analyses suggested the physical properties of the clays. Type-variety, petrographic, x-ray diffraction, and SEM and EDS analyses produced data that correspond to the mineralogical identification of the pottery. Finally, chemical identification of the pottery was obtained through SEM and EDS and strong acid-extraction ICPS analyses. As a result of the combination of all of the data obtained through the various methods of analysis, I was able to interpret the behavioral characteristics used in the manufacture of the pottery vessel.

CHAPTER 5

POSTCLASSIC SLIPPED POTTERY CLASSIFICATION

The following descriptions cover the five Postclassic slipped pottery groups (Paxcamán, Fulano, Trapeche, Topoxté, and Augustine) and three ware categories (Volador Dull-Slipped ware, Clemencia Cream ware, and Vitzil Orange-Red ware). Proyecto Maya Colonial excavations at Ch'ich'', Ixlú, and Zacpetén produced a large quantity of Postclassic slipped pottery from which the sample for this study was taken. In addition to the sample from Petén archaeological sites, the sample of pottery from Tipuj was obtained from a collection from Complex I excavations in 1982 and curated at Southern Illinois University Carbondale (Cecil 1999). As a result of a thorough laboratory analysis of pastes, slips, and forms in the field, Dr. Prudence M. Rice and I identified seven new varieties, four new types, and one new pottery group (Fulano Ceramic Group). Below is a list of wares, ceramic groups, and ceramic types and varieties that are described in more detail in the chapter. These new groups and types expand the typology of Postclassic ceramics originally described by Bullard (1970), Chase (1983), Cowgill (1963), and Rice (1979, 1984, 1985,1987).

List of Wares, Groups, and Types Used In This Study (*indicates new

Group/Type/Variety)

Volador Dull-Slipped Ware

Paxcamán Ceramic Group

Paxcamán Red: Paxcamán Variety

Paxcamán Red: *Escalinata Variety

Ixpop Polychrome: Ixpop Variety

Sacá Polychrome: Sacá Variety

Sacá Polychrome: *Rasgo Variety

Macanché Red-on-paste: Macanché Variety

Macanché Red-on-paste: *Tachís Variety

Picú Incised: Picú Variety

Picú Incised: Thub Variety

Picú Incised: *Cafetoso Variety

*Fulano Ceramic Group

*Fulano Black: Fulano Variety

*Sotano Red-on-paste: Sotano Variety

*Mengano Incised: Mengano Variety

*Mengano Incised: Bobo Variety

Trapeche Ceramic Group

Trapeche Pink: Tramite Variety

Mul Polychrome: Manax Variety

Picté Red-on-paste: *Ivo Variety

Xuluc Incised: Xuluc Variety

Vitzil Orange-Red Ware

Augustine Ceramic Group

Augustine Red: Augustine Variety

Pek Polychrome: Pek Variety

*Graciela Polychrome: Graciela Polychrome

Hobonmo Incised: Ramsey Variety

Hobonmo Incised: Hobonmo Variety

Johnny Walker Red: Black Label Variety

Clemencia Cream Paste Ware

Topoxté Ceramic Group

Topoxté Red: Topoxté Variety

Pastel Polychrome: Pastel Variety

Canté Polychrome: Canté Variety

Chompoxté Red-on-paste: Chompoxté Variety

Chompoxté Red-on-paste: Akalché Variety

Chompoxté Red-on-paste: *Kayukos Variety

Dulces Incised: Dulces Variety

Dulces Incised: *Bebeto Variety

This chapter is organized in the same manner as other published ceramic reports with the inclusion of a category for the types of analyses performed on each ceramic type and the number of sherds per type per type of analysis. For each ceramic type, the pottery name (type and variety), frequency, ware, where and who established the type, principal identifying modes, paste and estimated firing temperature, surface treatment and decoration, forms and dimensions, illustrations (the key for illustration colors appears in the Appendix), intrasite references, and intersite references is included. Intrasite references include contextual information from Ch'ich', Ixlú, Zacpetén, and Tipuj. Pugh (2000) provides structure information from Zacpetén and Sanchéz Polo (1999) describes structures from Ixlú. Intersite information includes my own observations of pottery collections from Tayasal (from Chase's collection at the University of Central Florida), Macanché Island (from Bullard's collection curated at the Florida Museum of Natural History), and Topoxté Island (from Hermes' collection at Yaxhá and Bullard's collection at the Peabody Museum). In addition to these data, comparative Postclassic pottery and socio-political organization observations from published reports from the last 46 years from excavations in Belize, northern Yucatán, and Honduras are utilized throughout the report. A brief history of Postclassic pottery analysis is presented below.

Many ceramic analyses in Petén, focus on Late Classic Maya pottery and only briefly mention Postclassic pottery. Because Postclassic pottery from Uaxactún (Smith 1955), Tikal (Adams and Trik 1961; Culbert 1973), Altar de Sacrificios (Adams 1964, 1971, 1973), and Seibal (Sabloff 1973, 1975) are different in paste and decoration from that of the Late Classic period, the authors suggested that the Postclassic pottery was a result of remnant, refugee populations (Uaxactún and Tikal) or the result of invading/replacement populations from the Tabasco or the Puuc regions that introduced fine paste pottery, censer cults, and "foreign" decorative features (Altar de Sacrificios and Seibal). More recently, Foais (1996:719) stated that pottery from Punta de Chimino and Tamarindo resembled that of Macanché Island because of the presence of the Paxcamán and the Pozo ceramic groups. The presence of some of the Petén Postclassic ceramic groups may represent a reoccupation of Punta de Chimino and Tamarindo during the Postclassic period by people who had contact with the central Petén lakes region or it may represent a migration of people from the Petén lakes region into the Petexbatun region (Foais 1996:720).

In the Petén lakes region, Postclassic ceramic analyses from Tayasal, Macanché Island, and Topoxté Island suggest ceramic variability. Chase (1983, 1985) examined the Postclassic pottery from Tayasal and provided a ceramic chronology that roughly correlates to that of Uaxactún and Belize. The Chilcob (New Town/Terminal Classic), the Cocohmut (Early Postclassic), and the Kauil (Late Postclassic) ceramic phases are defined because of the differential presence of the Augustine, the Trapeche, and the Paxcamán ceramic groups (Chase 1983:1216-1225). The Chilcob ceramic phase represents the advent of the Augustine and the Trapeche ceramic groups and Chase associates the presence of these groups with the presence of two ethnic groups at Tayasal. In the Cocohmut and Kauil ceramic phases, the Paxcamán ceramic group is prevalent and some Topoxté ceramic group pottery appears in the latter phase. According to Chase (1983:1223), in addition to the introduction of the Paxcamán and the Topoxté ceramic groups, the Paxcamán ceramic group pastes become more granular and darker gray in the Kauil ceramic phase. He suggests that the changes in ceramic phases represent a new population from northwest Petén that came into the Petén region and co-existed with remnants of Late Classic populations (Chase 1983:1278). This new group introduced the Augustine ceramic group. Migrations of new populations into the Petén lakes region with new ceramic groups continued throughout the Postclassic period.

Cowgill (1963) described Postclassic pottery from Flores Island that included the

Augustine, Paxcamán, and Tachís ceramic groups. He believed that the pottery decorated with reptilian/serpent motifs from Flores Island represented a substantial movement of people that may have come from northern Yucatán (Cowgill 1963).

Rice (1980, 1987a) examined the ceramic material from Bullard's excavation at Lake Macanché. She demonstrated that during the Postclassic period a great deal of variety existed in paste and slip characteristics. The variability resulted from a population of potters that lacked technological expertise and experimented with slip colors and firing techniques (Rice 1980:78-79). From her extensive studies of pottery from this site, she suggested that the pottery was made locally by social groups that shared decorative motifs and stylistic identities (Rice 1987a:100-101).

Pottery from Topoxté Island was initially described by Bullard (1970, 1973) and reexamined by Rice (1979). Rice (1979) also examined pottery from Central Petén Historic Ecological Project (CPHEP) excavations on Canté Island. Bullard (1970) defined the Isla Ceramic Complex based on the presence of ceremonial and non-ceremonial Topoxté ceramic group pottery. He suggested that the pottery at Topoxté Island had affinities to that of the Tulum ceramic group because of the presence of scroll feet and tripod plates (Bullard 1970:302). Although similarities to pottery in northern Yucatán exist, Bullard suggested that the pottery at Topoxté Island reflected a local population's derivative of northern Yucatán types and decorations. In addition to defining the Isla Ceramic Complex, Bullard (1973) also developed a ceramic chronology based on the "Central Petén Postclassic Tradition." The complicated chronology, that is not longer used, suggested a stylistic break between the Classic Maya and Postclassic Maya populations suggesting Postclassic peasant-level groups without political control (Bullard

1973).

Rice (1979) examined the Isla Ceramic Complex pottery from Topoxté Island and Canté Island and refined Bullard's initial Topoxté Red typology. Her study suggested that this pottery was different from that of the New Town ceramic sphere and that it reflected local Petén types that resembled those in northern Yucatán (Rice 1979).

Excavations in Belize also produced Postclassic pottery. At Barton Ramie, Gifford (1976:288) defined the New Town ceramic sphere that includes the Augustine (Early Postclassic) and Paxcamán (Late Postclassic) ceramic groups. Sharer and Chase (1976:290) suggested that the change in pottery types between the Terminal Classic period and the Postclassic period resulted from a decline in Early Postclassic populations that were making older styles of pottery and the introduction of refugee groups and migrations of people from northern Yucatán. They noted that form, decoration, and paste characteristics resemble those of the Petén lakes region.

Analysis of the ceramic collections from Tipuj has been undertaken by many archaeologists (Cecil 1999; Foor 1994; Rice 1984, 1985; and Wilson 1991). Rice (1984,1985) synthesized the collection according to ceramic complexes from the Preclassic period to the Historic period and provided comparisons of Tipuj pottery to central Petén pottery. She also defined the ceramic complexes for the Postclassic period and suggested that the Postclassic pottery is a mixture of local and imported items that are more similar to pottery from the Petén lakes region than from northern Belize or Yucatán (Rice 1985). In addition to Rice's work, two Master's students (Foor 1994; Weber-Wilson 1991) produced theses based on pottery from Tipuj. Foor (1994) analyzed Late Postclassic censer material from Structure 2 of Complex I to determine how censers formed a stylistic, functional, and behavioral unit that reflected ritual events such as *katun* and *uayeb* rituals. Weber-Wilson (1991) examined Johnny Walker Red pottery to determine its temporal significance at Tipuj and possible communication networks of the inhabitants.

Postclassic pottery from Lamanai (Graham 1987; Pendergast 1986) also demonstrates the regionalization typical of many other areas. Postclassic Lamanai is characterized by the introduction of new pottery forms that are part of the Chichen ceramic sphere and show affinities to Mayapán.

Walker (1990) noted the presence of Postclassic pottery at Cerros in northern Belize. The Postclassic ceramic phase (Kanan) is characterized by pottery typically found at Mayapán. She (1990) states that Postclassic Cerros became integrated into the Postclassic occupation by Chetumal Bay populations conducting pilgrimages to the site. This is supported by the theory that the Postclassic pottery was imported and that the Kanan complex consisted only of ritual wares found in northern Belize and Yucatán.

Valdez (1987) noted the presence of Paxcamán and Augustine ceramic group pottery at Colhá. Locally produced Postclassic ceramics identical to those of Lamanai occurred in association with lithic workshops (Valdez 1987:14, 251). The Postclassic occupation does not resemble that of early time periods leading Valdez (1987:251) to suggest that Postclassic Colhá was occupied by a new Maya population from Yucatán that exploited the chert resources.

Postclassic pottery from Santa Rita (Chase 1985), Tulum and Tancah (Sanders 1960; Miller 1985) and Ichpaatun (Sanders 1960) resembles that of Mayapán. Chase (1985) stated that although the redware and censer pottery at Santa Rita is similar in form and slip to that of Mayapán, regional differences in pastes and firing techniques suggest that the pottery from Santa Rita was locally produced. Sanders (1960) and Miller (1985) reported that redware pottery from Tulum, Tancah, and Ichpaatun has close ties as to form and decoration to other Postclassic ceramic complexes on the east coast of Yucatán as well as Mayapán. Sanders (1960:230) stated that it is impossible to distinguish Tulum Red and Mayapán Red sherds. Incised decorations in the form of the *ilhuitl* glyph appear on pottery from Mayapán, Tulum, Lamanai, Tipuj, Zacpetén, and Ixlú. While Chase, Sanders, and Miller discuss the resemblances of pottery to archaeological sites on the east coast, they all agree that the pottery at their respective sites was most likely the result of local potters who had contact with the community of Mayapán.

Postclassic ceramics from Mayapán (Brainerd 1958; Smith 1971) forms the basis from which many archaeologists compare their pottery collections to examine interregional interactions and theories of migrations of portions of the Mayapán population. Smith (1971) provided a detailed description of the pottery from Mayapán with additional information from Chich'en Itza, Uxmal, and Kabah. Based on the types of pottery, the extent of its appearance in archaeological contexts throughout the region, and temporal distinctions, Smith (1971:167) stated that Cehpech (A.D. 800-1000) pottery, dominated by Puuc and Fine Orange wares, was the most widespread ceramic complex and was produced at many centers of manufacture. Pottery from this group has connections to Tepeu 3 pottery from Uaxactún because of the presence of modeled-carved techniques, basal z-angles, and fluting (Smith 1971:253). However, only 1.5 percent of the sherds from Mayapán represent this ceramic complex (Smith 1971:169). Although Sotuta (A.D. 1000-1200) pottery also occurs sparingly at Mayapán, it is abundant at Chich'en Itza. New forms, such as the grater bowl and the tripod plate are introduced during this time period. The pottery of the Sotuta complex may have been produced at Chich'en Itza due to the uniformity in pastes, slips, and decoration. Sotuta censers are found at Santa Rita (Chase 1985), Cerros (Walker 1990), and Becan (Ball 1977). On the other hand, Smith (1971:202-203, 254) stated that the Hocaba (A.D. 1200-1300) ceramic complex may have been produced locally by a new population base of unknown origins (but not Itzá) because it lacks continuity as seen in the Sotuta ceramic complex. Hocaba pottery is most abundant at Mayapán. The final ceramic complex at Mayapán, Tases (A.D. 1300-1450), also occurs almost exclusively at Mayapán (Smith 1971:206). The Tases ceramic complex is dominated by Chen Mul effigy censers in addition to many redwares and unslipped wares of the Hocaba ceramic complex. These wares are also locally produced. Smith (1971: 254-255) noted the similarities of Hocaba and Tases ceramic complex pottery to that of Postclassic pottery present in Petén, especially Topoxté, as well as Chompoton and the east coast of Yucatán. Current excavations at Mayapán may reveal more information concerning the Postclassic pottery and the extent of interregional connections.

Brainerd (1958) provided a comprehensive study of pottery from Chich'en Itza. His analysis provided a ceramic sequence of which the Postclassic period is signified by the Mexican stage that is divided into Early, Middle, and Late substages. Brainerd (1958:34-35) stated that Early Mexican pottery is the result of Mexican or Toltec populations who introduced X Fine Orange pottery. The Middle Mexican substage is distinguished by the presence of Coarse Slateware that is most abundant at Chich'en Itza and occurs sporadically at Mayapán (Brainerd 1958:95). Finally, the Late Mexican substage pottery is dominated by Maya-like redwares with a widespread distribution (Brainerd 1958:95). While Brainerd outlined the Postclassic pottery of the Early, Middle, and Late Mexican stages, much debate occurs with respect to Chich'en Itza pottery chronology because of the mixture of Cehpech and Sotuta ceramics (Chung and Morales 2000; Lincoln 1986; Ochoa-Winemiller 2000).

Current archaeological projects in Yucatán, Belize, and Guatemala are adding information as to ceramic complexes, settlement history, and interregional contacts. Unfortunately, many of the results from these projects are only now being analyzed and interpreted and as such there is a paucity of published material from which to draw comparisons.

Paxcamán Ceramic Group

Name: Paxcamán Red: Paxcamán Red

Frequency: This description is based on 59 sherds: 22 sherds from Ch'ich'; 10 sherds from Ixlú; 1 sherd from Zacpetén; and 26 sherds from Tipuj. Paxcamán Red: Paxcamán Red type represents 32 percent of the Paxcamán ceramic group sherds used in this study and 11 percent of the total sherds used in this study.

Ware: Volador Dull-Slipped ware.

Established: R.E.W. Adams and Trik (1961:125-127) defined and illustrated this type based on collections from Tikal. Descriptions have been elaborated by Chase (1983, 1985), Cowgill (1963), and Rice (1980, 1984, 1985, 1987a).

Principal Identifying modes: 1) Dark gray to light brown pastes; 2) Red to red-orange slips; 3) Bowls, tripod dishes, jars, grater bowls, and flanged tripod dishes and bowls.

Types of analysis: "Low-tech" (59 sherds); petrographic (27 sherds); x-ray diffraction (1 sherd); EDS and SEM and strong-acid extraction ICPS (8 sherds).

Pastes and firing: The majority of sherds of this type have light to dark gray (10YR 5/2, 2.5YR 6/1) pastes with snail inclusions, while reddish-brown (5YR 5/6) and tan (10YR 6/3) paste occur less frequently. Paste colors are highly variable at all of the sites, but tan pastes typically co-occur with Terminal Classic and Early Postclassic ceramic lots. Pastes from Ch'ich' are dark gray, light gray, and brown. Pastes from Zacpetén vary considerably and range from dark gray to light gray to reddish brown and to brown. The brown paste color occurs most frequently in sherds from Structure 719 (a residence).

While overfired sherds occur at all sites, Ixlú had the highest frequency of overfired sherds. The majority of the sherds from all locations are estimated to have been fired to 500°C-650°C, with four estimated to have been fired to 300°C-400°C. Core hardness ranges from 2-3 on the Mohs' scale.

Paxcamán Red pastes have euhedral and polycrystalline calcite, quartz, shell, and hematite inclusions, and some sherds also include biotite, chert, and chalcedony minerals. Although the reddish-brown pastes have snail inclusions, they are not present in the same quantities as in the gray paste sherds. Tan paste sherds generally do not have snail inclusion, but may have volcanic-ash-tempering. The amount of shell in the clay paste also varies at Zacpetén. Gray pastes tend to have a higher frequency of shell than brown pastes. Some medium to dark gray paste sherds from Tipuj have a sulfur smell that resembles those from Macanché Island. Lake Macanché's water has a high magnesium sulfate content (Deevey et al. 1980:410) which may source pottery made at the site of Macanché Island.

Surface treatment and decoration: Paxcamán Red sherds have a red to red-orange (10R 4/6 to 2.5YR 4/8) monochrome slip. Some of the slips have a low luster, but the majority have a matte finish. Low luster slips are relatively thicker (.625 mm) and have a higher Mohs' hardness indication (3-4), whereas the matte finish slips are thinner (.25 mm), usually eroded, and have a lower hardness indicator (2-3). Erosion commonly occurs in this collection.

Slips at the four sites exhibit the same variablity as seen in the paste colors. Ch'ich' slips are very eroded and thin. However, the three vessels near the interior shrine of Structure 188 have a thicker, well preserved slip. All of the tripod dish sherds have black fireclouding along the wall/base juncture. Zacpetén tends to have more dark, almost purplish, red slips than the other sites, and Ixlú has more orange-red slips. The orange-red color comes from a highly oxidized layer just below the slip. Because the slip is thin, the oxidized layer adds a tint to the color of the slip. Sherds from Zacpetén and Ixlú have black fireclouding. Tipuj slips are dark red, but not to the extent of having a purple tint similar to Zacpetén; they are thick and well preserved. While black fireclouds do occur, at Tipuj, tan fireclouds are much more prevalent.

Forms and dimensions: Paxcamán Red forms include most of the Postclassic forms: tripod dishes, bowls, collared bowls, flanged tripod plates, and jars. Of the 48 rims of this type included in this study, 24 rims are tripod dishes, 5 rims are bowls, 3 rims are flanged tripod plates, 6 rims are collared bowls, and 10 rims are jars. The most common forms are tripod dishes and narrow neck jars. However, two flanged collared bowls were found at Ch'ich' and Zacpetén. Tripod dishes and flanged dishes have trumpet and scroll supports.

Tripod dish rim diameters range from 20-34 cm ($\bar{x}$=25.8 cm). Direct rims are either rounded or interiorly beveled. Bowl rim diameters range from 9-30 cm ($\bar{x}$=21 cm) and their direct rims are also either rounded or interiorly beveled. Flanged tripod plate diameters range from 26-30 cm ($\bar{x}$=28 cm). Direct rims are rounded or interiorly beveled. Collared bowl rim diameters range from 8-36 cm ($\bar{x}$=23 cm). The direct rims are rounded, pointed, and interiorly beveled. Jar rim diameters range from 10-38 cm ($\bar{x}$=22.5 cm) and their direct rims are rounded. Ixlú's Structure 2041 has the largest jar forms with very thick folded rims (1-1.2 cm) and large diameters (34-42 cm).

Wall thickness ranges from 4.56-9.82 mm. Tripod dish wall thickness ranges from 4.89-8.29 mm ($\bar{x}$=6.62 mm), flanged tripod dish wall thickness ranges from 5.18-8.51 mm ($\bar{x}$=6.73 mm), jar wall thickness ranges from 4.56-8.26 mm ($\bar{x}$=6.02 mm), collared jar wall thickness ranges from 4.74-9.82 mm ($\bar{x}$=6.72 mm), and bowl wall thickness ranges from 4.88-7.89 mm ($\bar{x}$=6.65 mm).

Illustrations: Figures 8, 9, 10

Intrasite references: Paxcamán Red: Paxcamán Variety occurs at all of the sites in the study and in all excavated Postclassic structures.

Intersite references: Paxcamán Red vessels are ubiquitous at all Petén lake sites. However, Topoxté Island has the lowest quantity of Paxcamán Red sherds of any Postclassic in the Petén lakes region (Rice 1979).

My study of Paxcamán Red pastes from Tayasal shows that pastes from this site

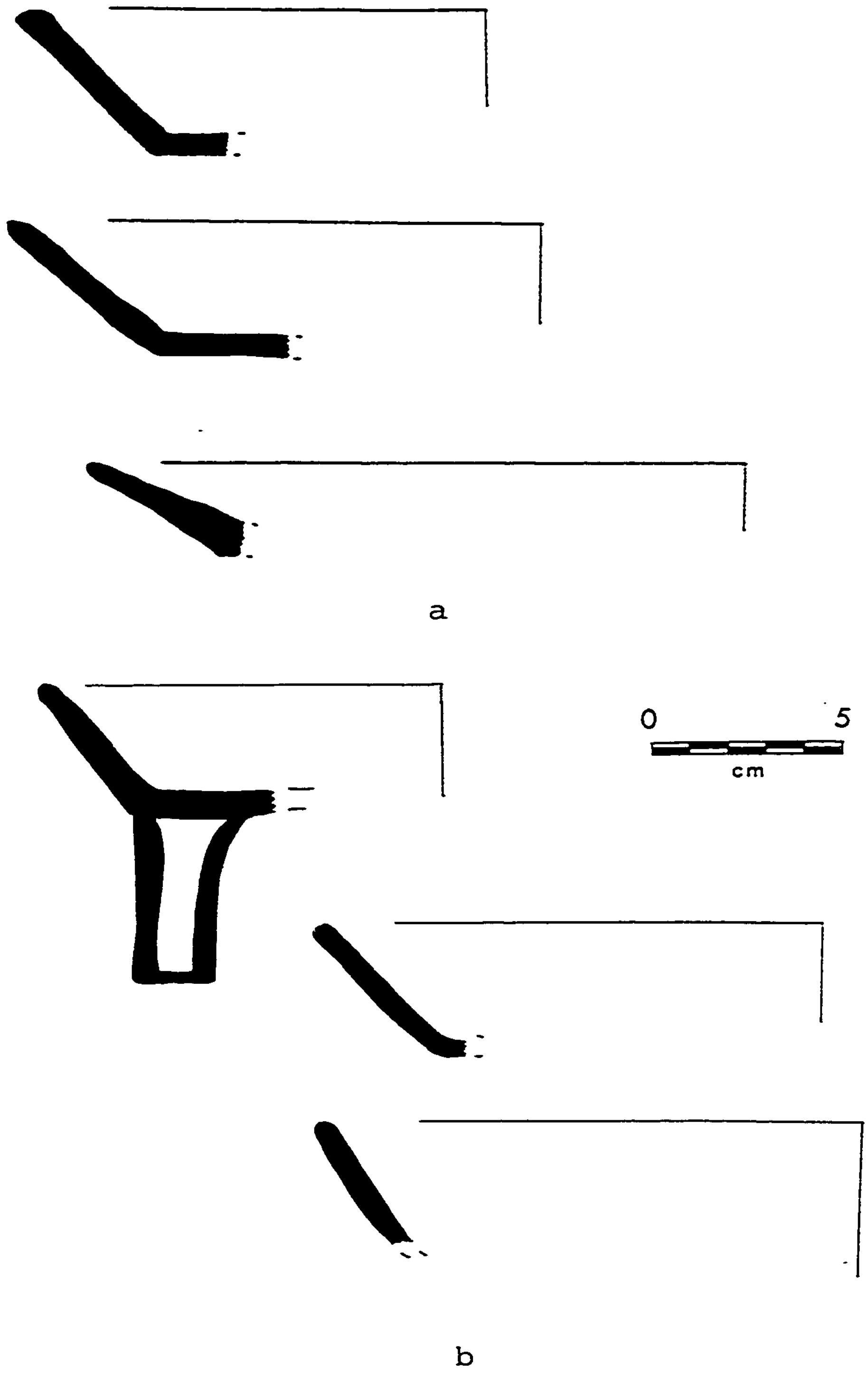


Figure 8: Paxcamán Red Tripod Plate Profiles from Tipuj (a) and Ch'ich' (b).

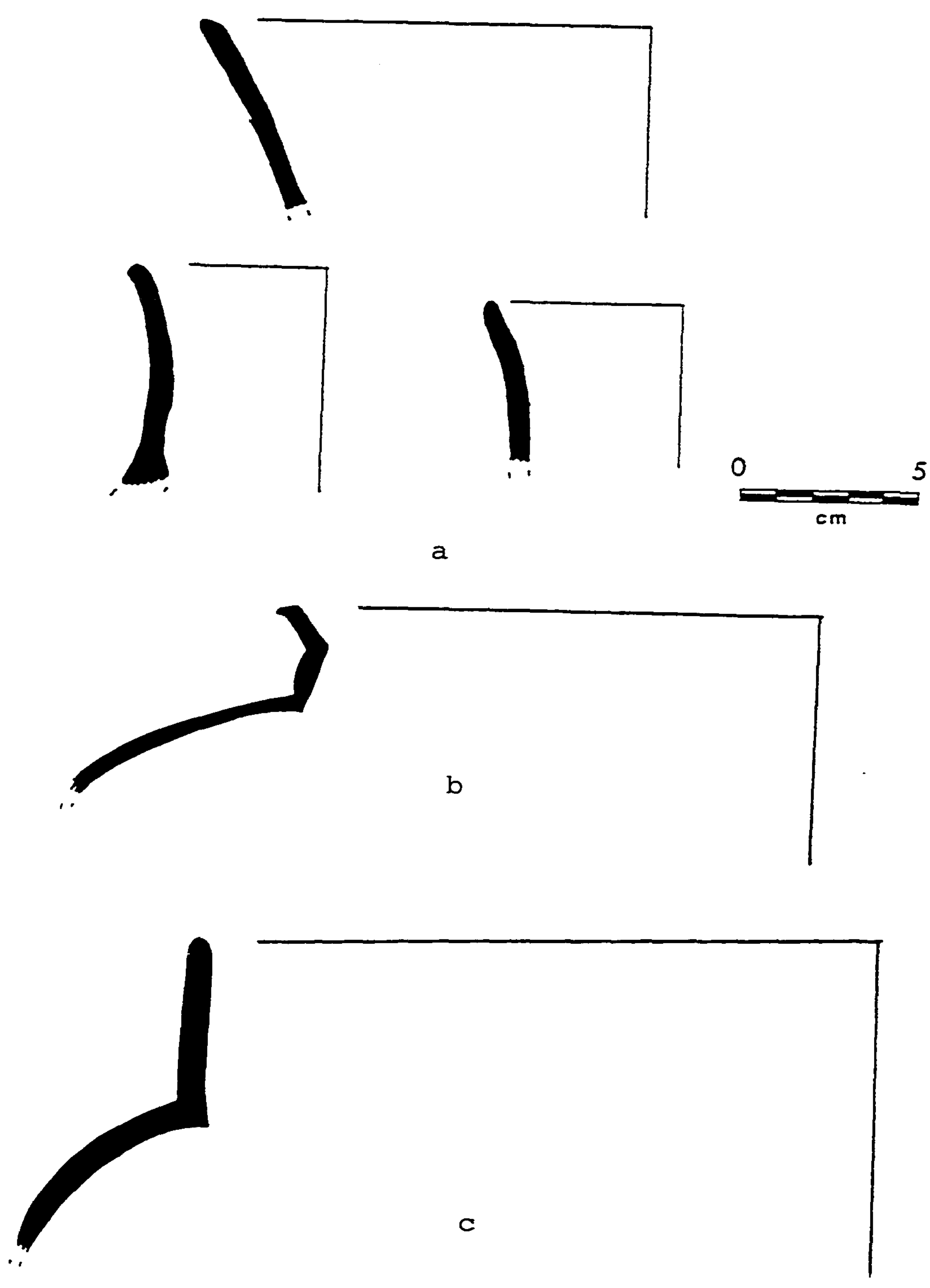


Figure 9: Paxcamán Red Jar Rim Profiles from Tipuj (a), Ixlú (b), and Ch'ich' (c).

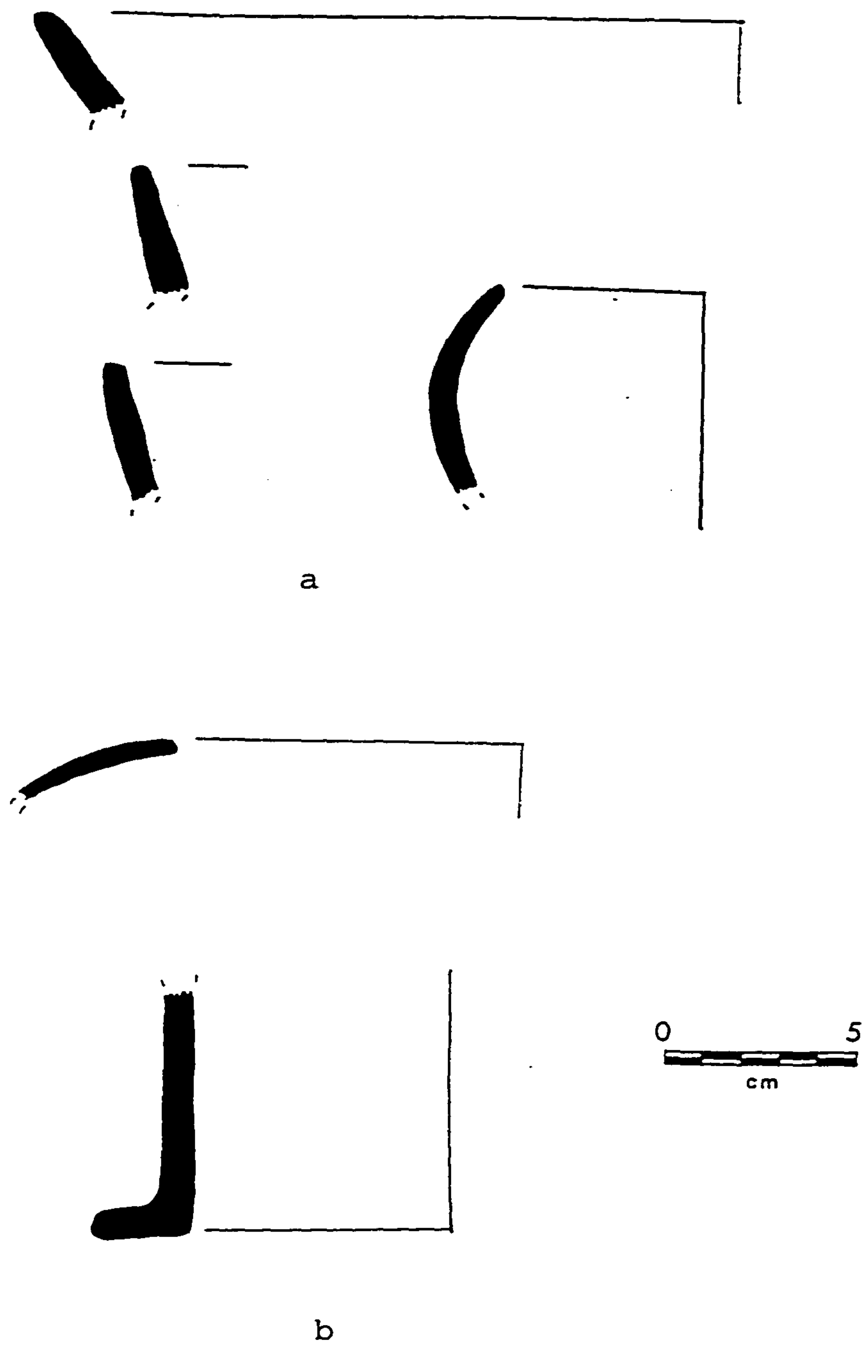


Figure 10: Paxcamán Red Bowl, Collared Jar, and Miscellaneous Rim Profiles from Tipuj (a) and Ch'ich' (b).

are predominantly reddish brown, but gray pastes do exist. The slips have a low luster, no evidence of a secondary or over slip, and black fireclouding on vessel walls. Most of the sherds from Tayasal represent narrow neck jars; however, a flanged bowl/dish has a left stepped flange.

My observations of the Paxcamán Red sherds from Macanché Island (currently at the Florida Museum of Natural History) suggest the same paste and slip variability as seen at Zacpetén. The paste colors range from tan to reddish brown to gray with a wide range of inclusion percentages. Darker colored pastes have an oxidized layer under the slip. Freshly broken sherds have a distinctive sulfur smell. Slip colors vary as much as paste colors. Some slip colors are slightly darker than Trapeche Pink slips while others are a rich deep red. Black fireclouding is common on matte to low luster finishes. Forms include tripod dishes, bowls, collared jars, narrow neck jars, and restricted orifice bowls. Tripod dishes at Macanché Island are smaller in diameter (19-23 cm) than those found at most other Petén Postclassic sites (Rice 1987a:118). All other form measurements are within the range seen at other Petén sites.

Canté Island, one of the islands in Lake Yaxhá, has the only occurrence of Paxcamán Red pottery at the Topoxté site (Rice 1979:64-66). Paste colors range from gray to brown and the amount of shell inclusions also ranges from abundant to rare, respectively. The paste variety resembles that of other sites in the Petén lakes region. Slip colors are generally red (2.5YR 4/8) and have a matte finish (Rice 1979:66). Forms include jars, tripod dishes, and collared bowls.

Cowgill's excavations at Flores Island produced many Paxcamán Red sherds. Like those from Zacpetén, Flores Island slips tend to be darker and have a low luster or matte finish. Gray snail inclusion pastes predominate; however, Cowgill (1963:89) notes the presence of brown paste sherds. Forms and vessel proportions resemble those from the Petén lakes region.

Paxcamán Red vessels have been located at Barton Ramie (Gifford 1976:294-297). The paste and slip colors and degree and kind of inclusions vary as much as any other site with the Petén lakes region. Bowls are the most common form at Barton Ramie, but tripod dishes and jars also occur. Bowl and plate diameters are relatively large (32-40 cm) compared to Petén sites.

Foais (1996:721-724) notes that Paxcamán Red sherds were found in excavations at Punta de Chimino. Forms include a "jar with outcurved restricted neck, sharp collar, thick body, and flat base," bowls, and a cylindrical support (Foais 1996:722). Slip and paste color resemble those described above. Black fireclouds occur.

Valdez (1987:224) notes the presence of Paxcamán Red tripod dishes and short and medium neck jars at Colhá. According to Figure 56a (Valdez 1987:213), the tripod dish has a deep sagging bottom with short supports with two circular vents. This form resembles those from Mayapán (Smith 1971).

Red slipped vessels (Mayapán Red, Chichen Red, and Tulum Red) also occur in northern Yucatan. Tripod dishes, jars, and bowls are the most common forms.

Name: Paxcamán Red: Escalinata Variety

Frequency: This description is based on 5 sherds: 3 from Ch'ich' and 2 from Tipuj. Paxcamán Red: Escalinata Variety represents three percent of the Paxcamán ceramic group and .90 percentage of sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on ceramic collections from Ch'ich' and Tipuj.

Types of analysis: "Low-tech" (5 sherds); petrographic (2 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Black rim on a red slipped vessel; 2) Gray, snail inclusion pastes; 2) Red to red-orange slips; 3) Tripod dishes, jars, and grater bowls.

Paste and firing: Pastes are light gray (10YR 5/2) to grayish brown (2.5Y 5/2). Snail inclusions are present, but not in high quantities. Subhedral and euhedral calcite, anhedral quartz, and hematite also occur in the clay matrix. The sherds are estimated to have been fired between 550-600°C with a paste hardness of 3.

Surface treatment and decoration: Paxcamán Red: Escalinata Variety sherds have a blackened rim. The blackened rim appears to be the result of differential access to oxygen during firing rather than an applied black pigment. The remaining body of the sherds are slipped red to red-orange as described above. Tan fireclouds occur on sherds from Tipuj. Slips from this variety are generally low luster, .375 mm thick, and have a Mohs' hardness of 2-3.

Forms and dimensions: Tripod dishes and collared jars have blackened rims. Tripod dish rim diameters range from 20-26cm ($\bar{x}$=23 cm) and the collared jar has a rim diameter of 36 cm. The direct rims of both forms have rounded and interiorly beveled lip shapes. Tripod dish wall thickness ranges from 6.61-8.16 mm ($\bar{x}$=7.34 cm) and the collared jar wall thickness is 8.25 mm. Trumpet and scroll supports occur on tripod dishes.

Illustrations: Figure 11

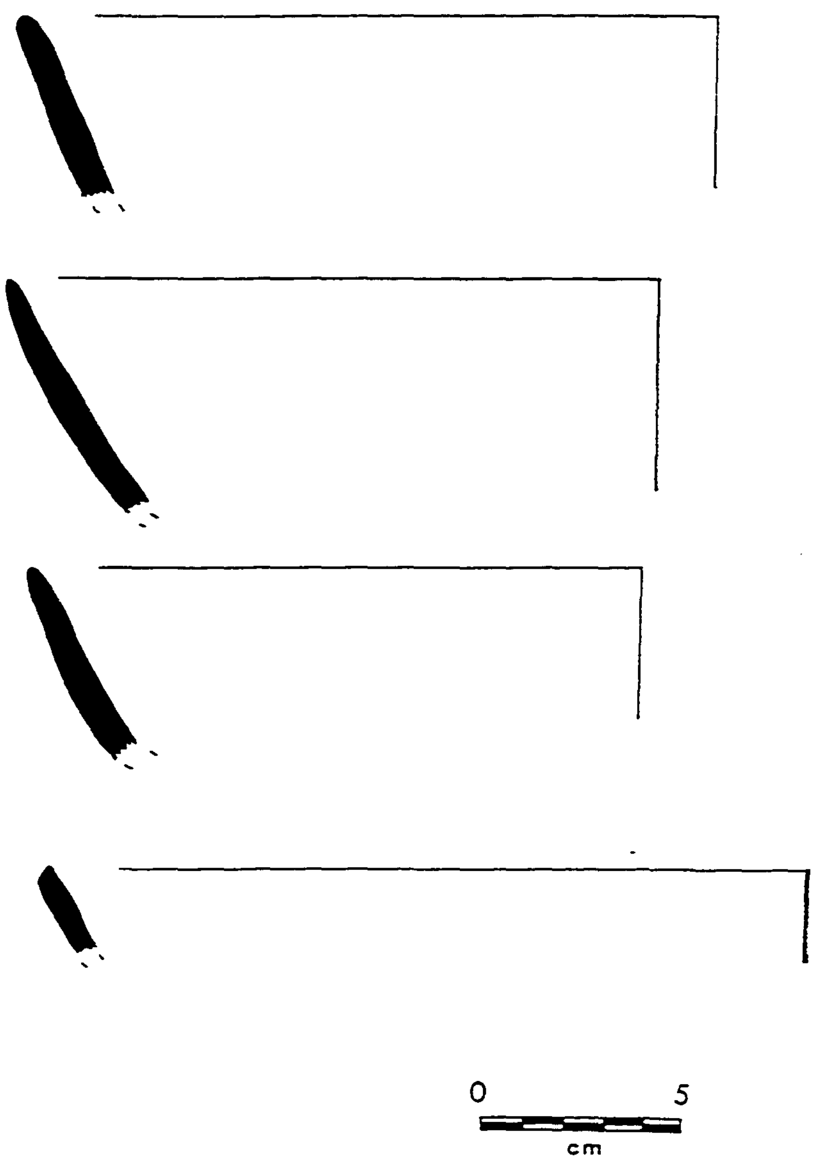


Figure 11: Paxcamán Red: Escalinata Variety Rim Profiles from Ch'ich'.

Intrasite references: While this study only includes Paxcamán Red: Escalinata Variety sherds from Ch'ich' and Tipuj, sherds of this variety also exist at Ixlú and Zacpetén. Twenty-three tripod dish sherds from Ixlú have black rims. While the majority of the pastes are gray, a significant quantity are also brown in color. Rim diameters range from 22-28 cm with the majority of the diameters between 22 and 24 cm. The rims occur in all of the Postclassic structures at Ixlú. Zacpetén blackened rims (n=18) occur in six structures: 606 (open hall), 719 (residence), 764 (temple), 758 (residence), 767 (open hall), and 1001 (plaza fill). The rim diameters range from 16-30 cm with the majority between 26-30 cm. Unlike Ixlú, gray pastes predominate at Zacpetén.

Intersite references: Black rimmed sherds similar to those described above occur at Tayasal and Macanché Island. The blackened rims resemble those of the Late Classic polychrome types; however, unlike the Late Classic polychrome types, most rims do not appear to be intentionally painted black. Instead, the black rims appear to be a result of differential access to oxygen during the firing process.

Name: Ixpop Polychrome: Ixpop Variety

Frequency: Sixty-five sherds represent this type: 15 from Ch'ich'; 22 from Ixlú; 20 from Zacpetén; and 8 from Tipuj. Ixpop Polychrome: Ixpop Variety represents 35 percent of the Paxcamán ceramic group and 12 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: R.E.W. Adams and Trik (1961:125-127) first described this type from the Tikal collection.

Types of analysis: "Low-tech" (65 sherds); petrographic (29 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (7 sherds).

Principal identifying modes: 1) Banded black line decoration; 2) Red to red-orange exterior and rim slip; 3) Tripod dishes, bowls, and jars.

Paste and firing: Ixpop Polychrome: Ixpop Variety pastes are typical Paxcamán ceramic group snail inclusion pastes. Paste colors range from dark grayish brown (2.5Y 4/2) to light brown (7.5YR 6/4) with gray coring present in 30 sherds. At Ixlú, pastes are also reddish brown and a small number of tan ashy pastes also occur. Estimated firing temperatures range from 550-700°C for brown pastes and from 300-500°C for sherds with gray cores. Paste hardness ranges from 2-3. Sherds from Tipuj have a distinctive sulfur smell when broken. This also occurs at Macanché Island.

Euhedral and subhedral calcite, quartz, chert, biotite, and shell appear in the clay matrix of Ixpop Polychrome.

Surface treatment and decoration: Slips of this type are red (10R 4/6) to red-orange (2.5YR 4/6) with low luster and matte finishes. Preservation of the slip is generally good; however, some sherds exhibit heavy erosion. Some exterior slips appear to be double-slipped--a red slip covered by a thin, semi-translucent tan/whitish over-slip. These sherds have a low luster, are better preserved than other Ixpop Polychrome sherds, and occur most commonly at Zacpetén. Slip thickness ranges from .625-.325 mm and slip hardness ranges on the Mohs' scale from 2-4.

Ixpop Polychrome: Ixpop Variety is defined by its black painted decoration that is usually on the interior of dishes and bowls, on the interior rim of collared jars, and on the exterior surface of jars. Typical Ixpop Polychrome decorative panels are marked by a double circumferential band toward the rim and a single circumferential band along the bottom of the panel. Double banding on the bottom of the decorative panel also appears; however, it is rare. One jar shoulder sherd has triple banding. The black bands are painted over a light tan to light orange undercoat. The decoration is painted next, and finally, the red slip is applied to the exterior surface, the rim, and the base. Slips are not carefully applied to the rim which results in the first top band and the bottom band being covered by the red slip.

Most decoration panels are heavily eroded and decorative motifs and elements are difficult to discern. When the decorative panels are better preserved, the typical decoration is a hook or plumelike element encircled by curved lines or parentheses. In addition to these two elements, stepped pyramids, circles with connecting lines, possible reptilian motifs, and variations of the Lamat glyph appear in the decoration panel.

Forms and dimensions: This sample of Ixpop Polychrome pottery contains jars (n=1), tripod dishes (n=49), collared jars (n=4), and hemispherical bowls (n=1). Tripod dishes have trumpet and scroll supports. The jar direct rim with a rounded lip has an 18 cm diameter and a wall thickness of 6.51 mm. Tripod dish rim diameters range from 20-34 cm ($\bar{x}$=26.24) with a wall thickness range of 5.06-9.86 mm ($\bar{x}$=7.05mm). All of the tripod rims are direct, and lip shapes are round, interiorly beveled, square, and pointed. Rounded and interiorly beveled direct rims are the most common lip shape among tripod dish forms. Collared jar rim diameters range from 6-32 cm ($\bar{x}$=22.5 cm). The smallest collared jar rim diameter belongs to a miniature vessel. Collared jars have outflaring necks with wall thickness varying from 4.56-8.89 mm ($\bar{x}$=6.28 mm). The hemispherical bowl has a rim diameter of 14 cm, a wall thickness of 4.72 mm, and a rounded direct rim.

Tripod dishes from Ch'ich' have only black line decoration. Ixlú Ixpop Polychrome sherds have shorter (lower) decoration areas and walls than most of the other forms from Ch'ich', Zacpetén, and Tipuj. Sherds from Structure 719 at Zacpetén most closely resemble the decoration panel size that occurs at Ixlú.

Illustrations: Figure 12

Intrasite references: Ixpop Polychrome sherds occur only in the following structures: 2006 (domestic), 2017 (open hall), 2018 (open hall), 2020 (oratory), 2022 (open hall), 2023 (temple), and 2041. All sherds are from the second (collapse) and third (floor) levels. One sherd comes from provenience 6d2 of Structure 2023 which is the same provenience as the linear skull cache (personal observation).

Zacpetén has the highest number of Ixpop Polychrome sherds. Only two structures (720 and 607, both statue shrines) lack Ixpop sherds. The majority of sherds come from the first three levels; however, some sherds come from level 8 of Structure 719. Pugh (personal communication, 2000) states that this level may represent a deposit of ritual wares.

Ixpop Polychrome sherds occur at Structures 1 (oratorio), 2 (temple), and 3 (open hall)at Tipuj. All sherds except one are from the first three levels. The remaining sherd was excavated from below floor 2 of Structure 2 (temple).

Intersite references: Ixpop Polychrome occurs at many other sites the Petén lakes region: Tikal, Tayasal, Macanché Island, Flores Island and Paxté and Canté Island and has correlates in Pek Polychrome, Pastel Polychrome, and Mul Polychrome. A common set of decorative elements that include mat motifs, plumes, circles, parentheses, and hooks appear in most if not all of the black line decorated types in the Petén lakes region.

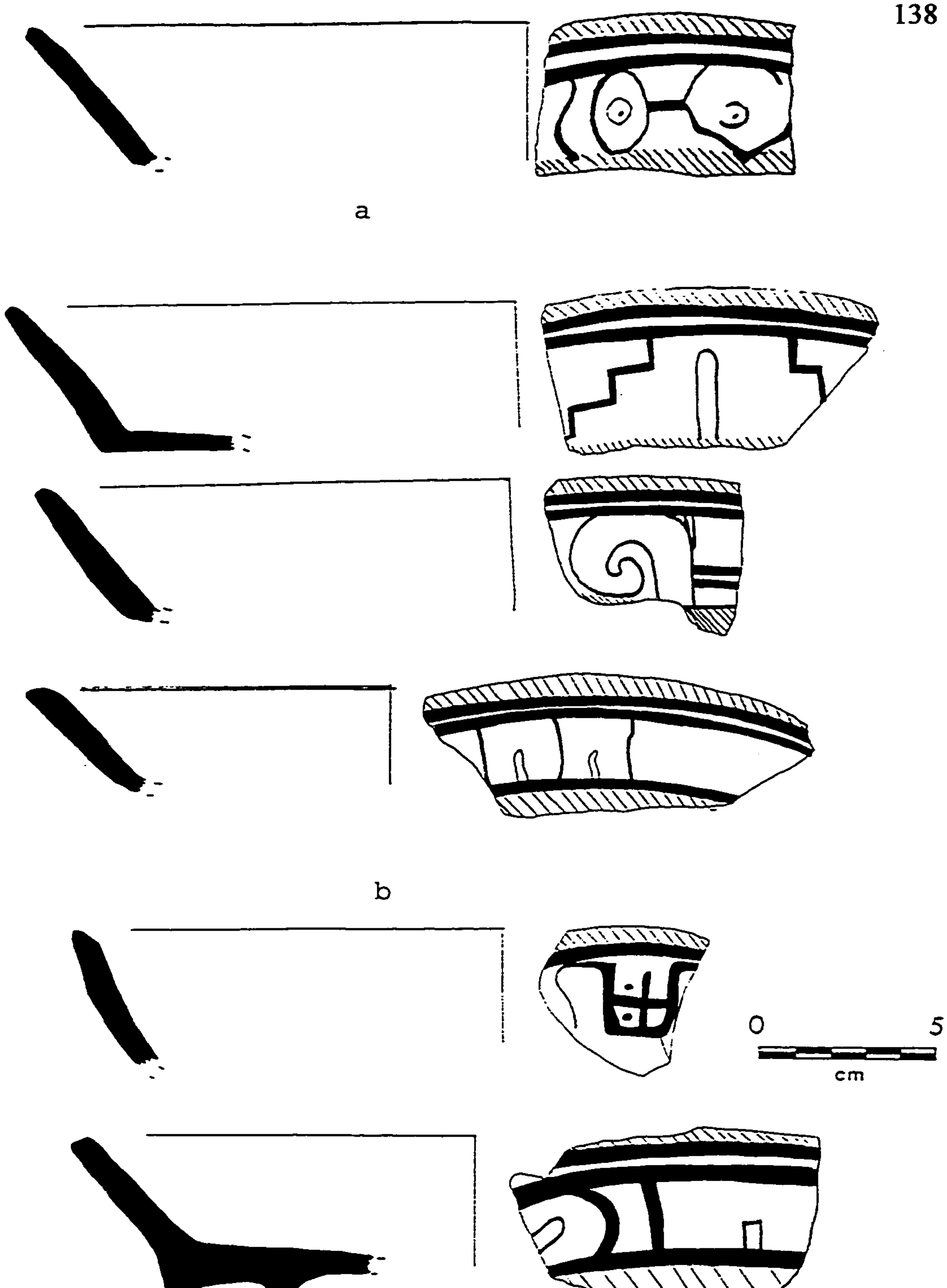


Figure 12: Ixpop Polychrome: Ixpop Variety Rim Profiles from Tipuj (a), Zacpetén (b), and Ixlú (c).

A tripod dish that resembles those found at Ch'ich', Flores Island, Ixlú, and Zacpetén was discovered in an intrusive burial at Temple I at Tikal. Adams and Trik (1961:126) state that the Ixpop Polychrome tripod dish with trumpet supports has a repeated *Eznab* day glyph.

My examination of Ixpop Polychrome sherds from Tayasal indicates that they are poorly preserved. The one decoration that remains has two top and one bottom circumferential black bands. The bands demark a decoration area that has a primary slip on top of which is painted a curvilinear line and small circle. All examples of Ixpop polychrome are tripod dish forms with pastes are similar to those described above.

My observations of Macanché Island sherds suggest that they also similar to those described above. The decoration area has a tan primary slip and is delineated by one or two top and bottom circumferential black bands. Exterior slips may be the result of a double slip due to their mottled appearance. Restricted orifice bowls have a series of three circumferential bands. Some decoration areas are paneled as is evident by two vertical lines and a repeating pattern. Reptilian motifs are more common at Macanché Island than at other sites in the Petén lakes region (Rice 1987a:125-130). In all other respects, decorative elements are similar to those described above.

Ixpop Polychrome sherds have been excavated at Canté Island (Rice 1979:66-68) and in 1998 excavations at Paxté Island. Sherds from Canté (n=3) are eroded and identified by traces of black bands on a tripod dish, characteristic red exterior slip, and snail inclusion paste. Excavations at Paxté Island in 1998 yielded three tripod dish sherds that are smaller in height and diameter than others from the Petén lakes region. Unfortunately, the decoration is eroded, but all other characteristics are similar to those described previously.

Cowgill (1963:91) states that Ixpop Polychrome vessels resemble those of other sites in the Petén lakes region except most of the dishes have trumpet supports. Decoration on the forms consists of a brownish black paint. Two top and one bottom circumferential bands delineate decoration areas. Decoration demonstrate vertical reflection symmetry and motifs include birds, Etznab and Men day glyphs, and hooks (Cowgill 1963:107-108).

Outside of the Petén lakes region, Ixpop Polychrome sherds are also located at Barton Ramie (Gifford 1976:298-300), and Punta de Chimino (Foais 1996:727-728). At Barton Ramie, tripod plates with rim diameters 20 to 32 cm bare black line decoration. The range of slip color and inclusions is similar to that of Zacpetén. Red slips are well preserved, have a "waxy" finish, and occasionally have black fireclouds (Gifford 1976:299). Stylized RE glyphs, Eznab day glyphs, and other curls occur in groups of two on a light yellow-brown primary slip (Gifford 1976:Figure 196).

One tripod dish sherd from Punta de Chimino has a thick red glossy exterior slip and an eroded interior surface (Foais 1996:727). Evidence of a black circumferential band exists on the interior surface below the rim. The paste is reddish brown and has euhedral calcite inclusions.

In addition to Barton Ramie, black painted decoration that is similar to Ixpop Polychrome occurs in northern Yucatán as Mama Red: Black-on-unslipped Variety Polychrome (Mayapán Red ware) (Smith 1971:22-23).

Name: Sacá Polychrome: Sacá Variety

Frequency: This description is based on 14 sherds: 12 from Zacpetén and 2 from Ixlú. Sacá Polychrome: Sacá Variety accounts for eight percent of the Paxcamán ceramic group and 2.5 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Sacá Polychrome: Sacá Variety was first described by Cowgill (1963:237-243) based on ceramic collections from Flores Island.

Types of analysis: "Low-tech" (14 sherds); petrographic (3 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal identifying modes: 1) Red and black painted decorations; 2) Red to reddish yellow exterior slip; 3) Snail inclusion paste; 4) Tripod dishes, flanged collared jars, and bowl forms.

Paste and firing: Sacá Polychrome pastes range from light brown (7.5YR 6/4) to light gray (5Y 7/1). Although most of the sample is oxidized throughout, three sherds exhibit dark coring. Inclusions in the paste consist of shell, subhedral and euhedral calcite, anhedral calcite, chert, biotite, and quartz. The pastes have a Mohs' hardness of 3 and are estimated to have been fired to 550-600°C.

Surface treatment and decoration: Slips are red (10R 4/6) to reddish yellow (5YR 7/8) and decorations are painted in red (10R 4/6-5R 4/4) and black (2.5YR 3/1-5YR 3/1). The decorations appear to be painted on a very faint primary slip. Tripod dish decorations appear on the interior while decorations on jars and bowls appear on the exterior. Like Ixpop Polychrome decorations, Sacá Polychrome: Sacá Variety decorations are banded. However, instead of two black lines at the top, a red line is between the two black bands.

The bottom of the decoration is marked by a single black line. Decorative elements appear in decoration panels below the banding that are marked by vertical black and/or red lines. Decorative elements include hooks, plumes, embedded triangles, and other eroded geometric shapes. Two collared bowls have flanges. The flanges are a single step to the right and are alternately painted red and black. Red (7.5R 3/6) slip occurs below the flanges. Slips are approximately .375 mm thick.

Forms and dimensions: Sacá Polychrome: Sacá Variety includes four forms in this sample: tripod dishes (n=4), flanged collared jars (n=2), and restricted orifice bowls (n=1). Tripod dish rim diameters range from 24-30 cm ($\bar{x}$=28 cm) with wall thickness varying from 4.93-8.0 mm ($\bar{x}$=6.52 mm). The direct rims have either rounded (most common), interiorly beveled, or square lip shapes. Flanged collared jar rim diameters range from 16-20 cm ($\bar{x}$=18cm) with wall thicknesses from 4.84-5.02 mm (mean=4.93 mm). One direct rim has an interiorly beveled lip shape. The second collared jar rim is exteriorly thickened with a rounded lip shape. Flanges are stepped to the left. The first steps average 11.5 mm and the second steps average 8.08 mm in height. The restricted orifice bowl has a rim diameter of 40 cm and a wall thickness of 7.8 mm. Its direct rim has a square lip shape.

Illustrations: Figure 13

Intrasite references: The two Ixlú sherds were located in Structure 2023 (temple) at levels 2 (collapse) and 4 (below the floor).

Sacá Polychrome sherds from Zacpetén were located in the following structures: 719 (residence), 720 (statue shrine), 721 (temple), 732 (residence), 748 (unknown), 758 (residence), 764 (temple), 765 (raised shrine), 766 (statue shrine), and 767 (open hall).

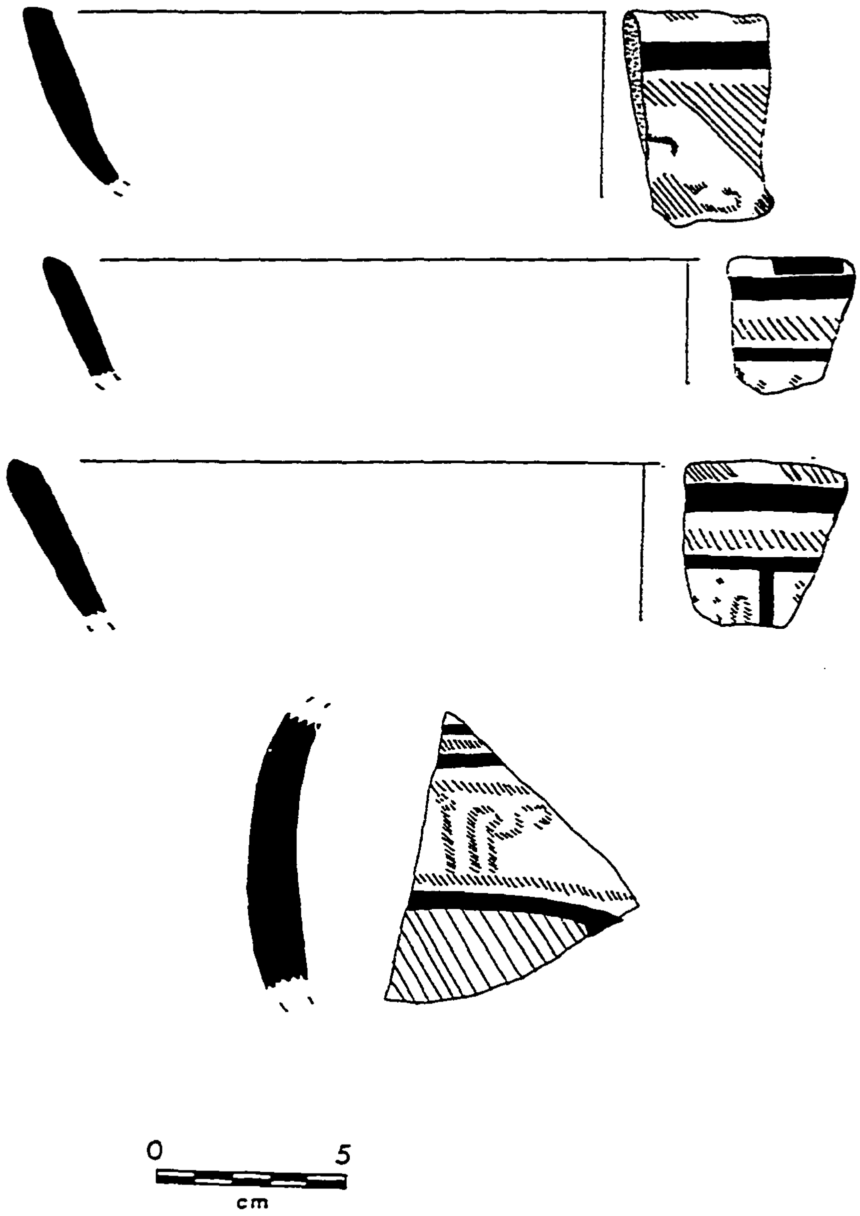


Figure 13: Sacá Polychrome: Sacá Variety Rim Profiles from Zacpetén.

The best preserved sherds come from Structures 719, 732, 748, and 766 and most of the Sacá Polychrome sherds were located in Structure 732. All but 2 sherds come the first three levels. One sherd from Structure 719 comes from level 5a in a test pit and the other sherd comes from level 4 of Structure 719.

Intersite references: Sacá Polychrome: Sacá Variety sherd decorations parallel those of Graciela Polychrome, Dolorido Polychrome, and Canté Polychrome in the Petén lakes area. Small quantities of Sacá Polychrome: Sacá Variety sherds were also found at Tayasal, Macanché Island, and Flores Island.

I examined the two jar sherds from Tayasal. They have reddish brown and light gray pastes with red and black decorations that are painted on a faint primary slip. Two red and black alternating top bands and a single red bottom band delineate a black decoration. The eroded curvilinear line decoration may be paneled by two vertical black lines.

Fourteen Sacá Polychrome: Sacá Variety sherds were excavated from the top of the Postclassic mound on Macanché Island. My examination of these sherds suggests a similarity to other Sacá Polychrome sherds with respect to decoration areas. The decorations are placed on a primary slip with a top series of bands consists of one red band between two black bands. Bands at the basal break are not detectable due to the fragmentary nature of the sherds. The red band and decoration paint is darker (10R 3/6, 7.5R 4/4) than the exterior slip and has a low luster. Decorative elements are nested chevrons and curved lines.

Cowgill (1963:110-111) describes 14 Sacá Polychrome: Sacá Variety sherds from Flores Island. Drawings of the sherds indicate a triangular decoration that occurs on pottery from Zacpetén (Cowgill 1963:Figure 5t).

Outside of the Petén lakes area, red and black painted decoration occurs at Punta de Chimino (Foais 1996:728-729) and in northern Yucatán. The probable tripod dish sherd from Punta Chimino has a glossy red exterior slip. The interior surface decoration is delineated by a two circumferential bands–one red and one black–and the decorative elements are eroded. In northern Yucatán during the Tases period, red and black painted decoration occurs on Pele Polychrome at Mayapán, Chichen Itzá, Dzibilchultun, Tecoh, Champoton, and Panabchen (Smith 1971:22). In Naco, Honduras small quantities of black and red decorated pottery occur after A.D. 1450 (Wonderley 1981:191) as Hidaldo, Vagando, and Posas Polychrome types.

Name: Sacá Polychrome: Rasgo Variety

Frequency: One sherd from Zacpetén. Sacá Polychrome: Rasgo Variety represents one percent of the Paxcamán ceramic group and .18 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal identifying modes: 1) Black and red decoration on interior and exterior surfaces; 2) Red to red-orange slip; 3) Snail inclusion paste; 4) Collared jar form.

Paste and firing: The paste is a yellowish color (10YR 7/6) with a gray core (2.5Y 5/1). Small, anhedral calcite dominates the clay matrix with a few snail shell, quartz, and hematite inclusions. The sherd is estimated to have been fired to 600°C, is incompletely oxidized, and has a core Mohs' hardness of 3.

Surface treatment and decoration: The exterior of the vessel is slipped red below the flanges and a thin pink (7.5YR 7/4) undercoat appears under the painted decoration. Two decoration zones appear on the vessel: one on the jar neck and one on the jar body. The jar neck is banded by two black (7.5YR 3/1) lines along the lip and a single black band at the neck/shoulder junction. A series of embedded triangles appears between the black bands.

The second decorative zone, on the body of the jar, is delineated by single circumferential red (10R 4/8) band and is paneled by two red vertical lines. The decorations are red or black and alternate from one panel to the next. Unfortunately, the decorative elements are indiscernible because of erosion.

The flanges consist of two steps that face right and are painted red.

The interior of the vessel has decoration on the vessel neck and is slipped yellowish brown (10YR 5/8) on the interior. The decoration area is marked by a single circumferential band on the top and bottom and the decoration area is paneled. The bands and the decoration are red (10R 4/8). Again, the decorative elements are almost completely eroded.

The slip has a thickness of .625 mm and all slips and painted decorations have a Mohs' hardness of 3.

Form and dimension: The flanged collared jar has a diameter of 16 cm and a wall thickness of 4.69 mm. The two flanges step to the right and the first step is 6.39 mm high and the second is 7.95 mm high. The direct rim is interiorly beveled.

Illustration: Figure 14

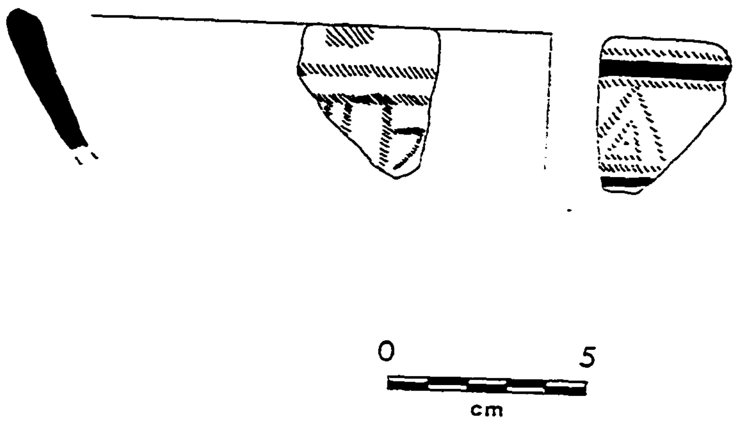


Figure 14: Sacá Polychrome: Rasgo Variety Rim Profile from Zacpetén.

Intrasite reference: This sherd was found in Structure 720 (statue shrine) at level 2 (collapse) at Zacpetén. An additional sherd of the same type, but not included in this study was found in nearby Structure 719 (residence). This sherd is either a tripod plate or a collared jar. No other sherds of this type have been found by Proyecto Maya Colonial.

Intersite reference: One other sherd of this type has been described by Rice (1987a:131). She noted that it was an "unusual vessel" and classified it as a Sacá Polychrome: Sacá Variety type. The collared bowl has a combination of black, red, and black banding with decorative panels of plumes or curved lines.

Name: Macanché Red-on-paste: Macanché Variety

Frequency: Fourteen sherds from Zacpetén are included in this study. This represents eight percent of the Paxcamán ceramic group and 2.5% of the totals sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Rice (1987a:133-135) first defined Macanché Red-on-paste: Macanché Variety. Cowgill (1963:110) included this type in his Sacá Polychrome type description.

Types of analysis: "Low-tech" (14 sherds); petrographic (9 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (3 sherds).

Principal identifying modes: 1)Red decoration on a gray paste; 2) Red to red-orange slip; 3) Tripod plates and flanged tripod plates.

Paste and firing: Paste colors vary from brown (10YR 5/3) to light gray (7.5YR 5/1) to black (7.5YR 2.5/1). While most of the sherds are oxidized throughout, four have dark cores. Inclusions in the paste also vary: brown and light gray pastes tend to have more shell, quartz, and anhedral calcite, whereas the black pastes contain predominately euhedral calcite inclusions. Core hardness ranges from 2-3 (mostly 3) on the Mohs' hardness scale with an estimated firing temperature of 500-700° C. One sherd was fired to 400°C.

Surface treatment and decoration: Slip and decoration on Macanché Red-on-paste sherds is red (10R 4/6-7.5R 4/4) to purplish red (7.5R 3/3). However, it is not common for the slip and decorative color to be the same chroma of red. Slips and decorations lack any luster and have a Mohs' hardness of 2-3. Although most of the samples are fairly eroded, slips are not as thick (.375 mm) or prominent as those found on Ixpop Polychrome sherds. Some rims are darkened, but the darkening appears to be a result of fireclouding of the paste rather than darkening of a slipped rim.

Typically, tripod dishes are exteriorly slipped and decorated on the interior of the vessel. On three sherds, decorations appear to be painted on top of a lighter gray to whitish undercoat. Decoration on the exterior and interior surfaces occurs on some flanged tripod vessels. The red pigment used in the slip and decoration paintings is darker than most of the Paxcamán group ceramic slips. The darker (almost purplish red) paint is similar to Tachís pottery from Flores Island described by Cowgill (1963:110). One sherd from Structure 765 (raised shrine) has stucco applied to the exterior surface.

Decorated areas are delineated by two circumferential bands near the lip and one band at the base. In some cases, single line paneling is apparent on the interior decoration. Circles and hooks are the most prevalent interior decorations, while unpaneled curvilinear mat motifs occur on the exterior. One unique decoration from Zacpetén, on the base of a dish, is a distinctive bird that is negatively painted (the background is red). In addition to the decorative elements described above, a flanged tripod dish from Structure 605 (oratorio) has a banded decorative area with repeated *ilhuitl* images around the circumference of the dish.

Form and dimension: Tripod dishes (n=8) and flanged tripod dishes (n=4) are the only forms of Macanché Red-on-paste used in the study. Tripod dishes and flanged tripod dishes have trumpet and bulbous supports. Tripod dish rim diameters range from 20-24 cm ($\bar{x}$=21.43) with wall thicknesses of 5.11-9.58 mm ($\bar{x}$=7.1 mm). The direct rims have round, square, and interiorly beveled lip shapes. Flanged tripod dish rims vary from 20-24 cm ($\bar{x}$=21.5 cm) with wall thicknesses of 4.89-6.62 mm ($\bar{x}$=6.11 mm). The direct rims have rounded and interiorly beveled lip shapes. Flanged tripod dishes have a sagging base (vs. Ixpop Polychrome straight bottomed dishes) and the flanges have two left facing steps. However, one plate's flange steps face right. The first flange step height ranges from 3.3-4.69 mm and the second step height ranges from 5.29-9.81 mm. The vessel walls are taller than those of other decorated Paxcamán group ceramics.

Additional tripod supports not included in this study include effigy supports from Structure 603 (ceremonial sakbe). The effigy figures resemble effigy censer figures seen on Kulut Modeled censers.

Illustrations: Figure 15

Intrasite references: Zacpetén is the only site that has Macanché Red-on-paste:

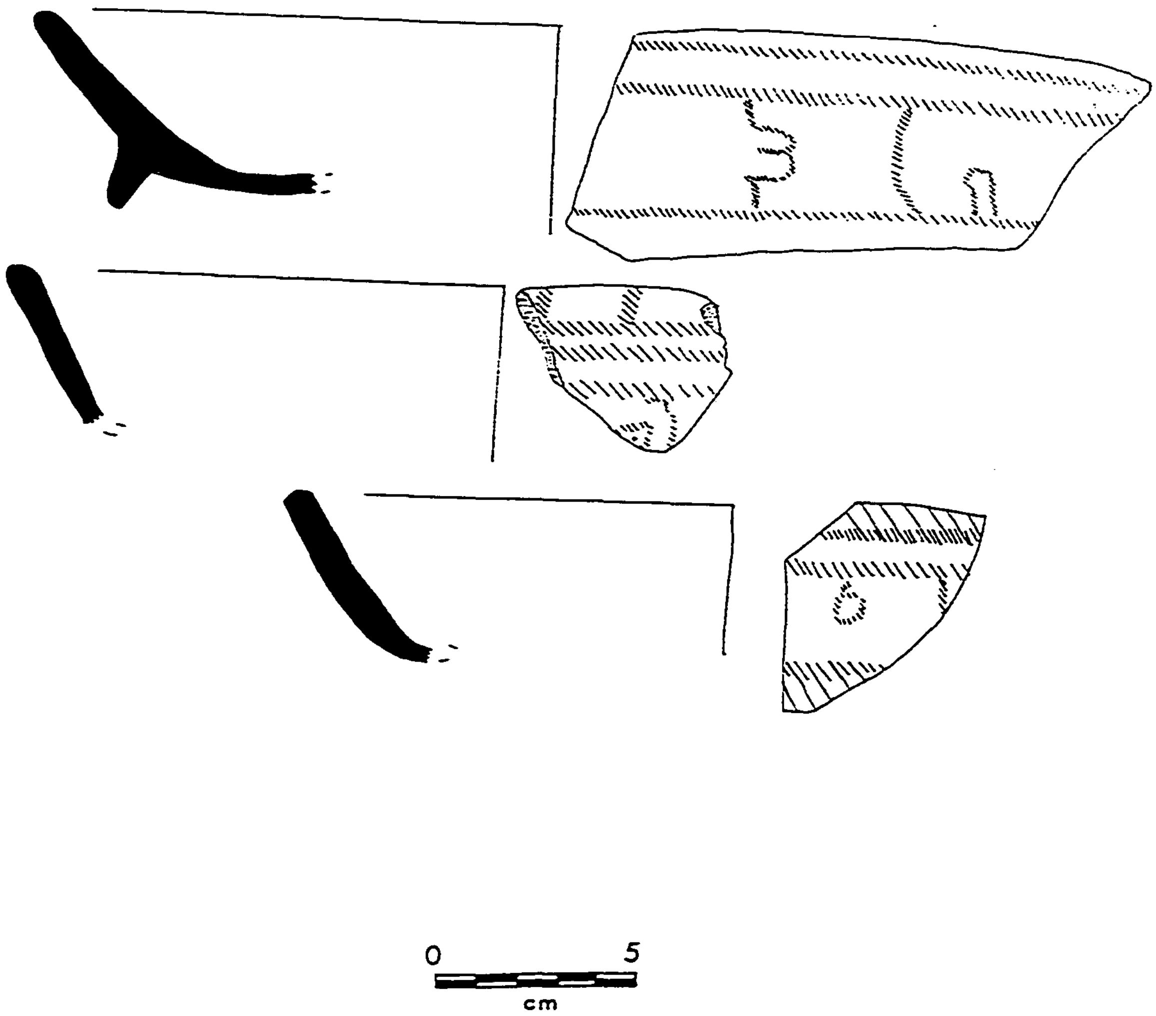


Figure 15: Macanché Red-on-paste: Macanché Variety Rim Profiles from Zacpetén.

Macanché Variety pottery. All of the flanged bowls were located in Structure 605 (oratorio) and Structure 719 (residence). Otherwise, all structures except 614 (oratorio) and 767 (open hall) contain Macanché Red-on-paste: Macanché Variety sherds. Structure 719 (residence) has the highest quantity of Macanché Red-on-paste: Macanché Variety sherds. All sherds come from the first three excavation levels.

Intersite references: Form and decoration technique of this type parallels that of Chompoxté Red-on-cream from Topoxté Island and Zacpetén. Macanché Red-on-paste: Macanché Variety also occurs at Tayasal, Macanché Island, and Canté Island.

My examination of the sherds from Tayasal shows that the sherds have a reddish brown or light brown gray paste. These pastes are different from those at other Late Postclassic sites in the Petén lakes region because Tayasal does not have the coarse paste with large quantities of euhedral calcite present at Zacpetén. Macanché Red-on-paste sherds from Tayasal also tend to have a pinkish exterior color that may suggest overfiring. The slip and decoration red pigments are not deep red or purple in color and have matte finish. Decorative elements consist of curvilinear lines and geometric decorations.

At Macanché Island, Rice (1987a:134) notes that Macanché Red-on-paste: Macanché Variety sherds appear in Protohistoric and Early Late Postclassic platform constructions. My observations of these pastes suggests a similarilty to those from Zacpetén–gray to reddish brown and snail inclusion with euhedral calcite. Exterior slips are red (10R 4/6), but one is more pink (7.5R 7/3). Decorative panels are marked by one or two red circumferential bands that are usually darker than the slip. Although most decorative elements are eroded, portions of curvilinear lines, hooks, and plumes are painted on a possible primary slip. Tripod dishes, collared bowls, jars, and flanged tripod dishes occur at Macanché Island. The flanged tripod dish has a single left facing step.

Rice (1979:68) provisionally defined a Red-on-paste type at Canté Island. The four sherds that represent tripod dishes and collared jars are eroded, but enough red painted decoration appears on a snail inclusion gray paste to define its presence at Canté Island.

Cowgill describes four Macanché Red-on-paste: Macanché Variety with his description of Sacá Polychrome sherds. He notes (Cowgill 1963:110) that one maroon-on-paste sherd takes a flanged dish shape and has a mat motif on the exterior surface.

Outside of the Petén lakes region, red-on-paste decoration occurs in northern Yucatán, Naco, Honduras, and the western Guatemalan highlands. The closest parallel to Macanché Red-on-paste: Macanché Variety decoration and form is from Chichen Itzá, Maní, and Mayapán. Tecoh Red-on-buff (San Joaquin Buff ware) occurs on tripod dishes and restricted orifice bowls in the Tases (A.D. 1300-1450) period (Smith 1971:29). Decorative elements include *ajaw* glyphs, circles, and mat motifs that are also common in the Petén lakes region (Smith 1971:231-232). Slatewares (Chumayel Red-on-slate and Canche Red-on-slate) also have red painted decoration on paste in northern Yucatán (Smith 1971:44-45). At Naco, Honduras, Nolasco Bichrome resembles Macanché Red-on-paste pottery (Wonderley 1981:172). Many red-on-white types with banded decoration areas and curvilinear lines also exist in the western Guatemalan highlands (Wauchope 1970).

Name: Macanché Red-on-paste: Tachís Variety

Frequency: One sherd from Zacpetén. This sherd comprises one percent of the Paxcamán ceramic group and .2 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal Identifying modes: 1) Angular red decoration on a gray paste; 2) Red slip; 3) Narrow neck jar.

Paste and firing: The pale brown (10YR 7/3) paste is oxidized throughout. It was fired to an estimated 600°C and has a Mohs' hardness of 3. Euhedral and subhedral calcite are the most prominent inclusions and the clay matrix also contains anhedral calcite, shell, quartz, and hematite.

Surface treatment and decoration: The slip and decoration have the same red (7.5R 5/8) color with a matte finish. The jar's neck exterior is slipped 42.27 mm from the rim and begins again below the decoration panel. Multiple "nested" chevrons appear in the unbanded, unpaneled decoration area. The interior of the neck is slipped from the rim to the neck/shoulder junction.

Form and dimension: This example is a narrow neck jar. The neck height is 9.5 cm and the rim diameter is 24 cm. The direct exteriorly thickened lip has a thickness of 9.66 mm and the neck wall thickness is 9.85 mm.

Illustration: Figure 16

Intrasite reference: This sherd was found at level 4 (below the last Postclassic f

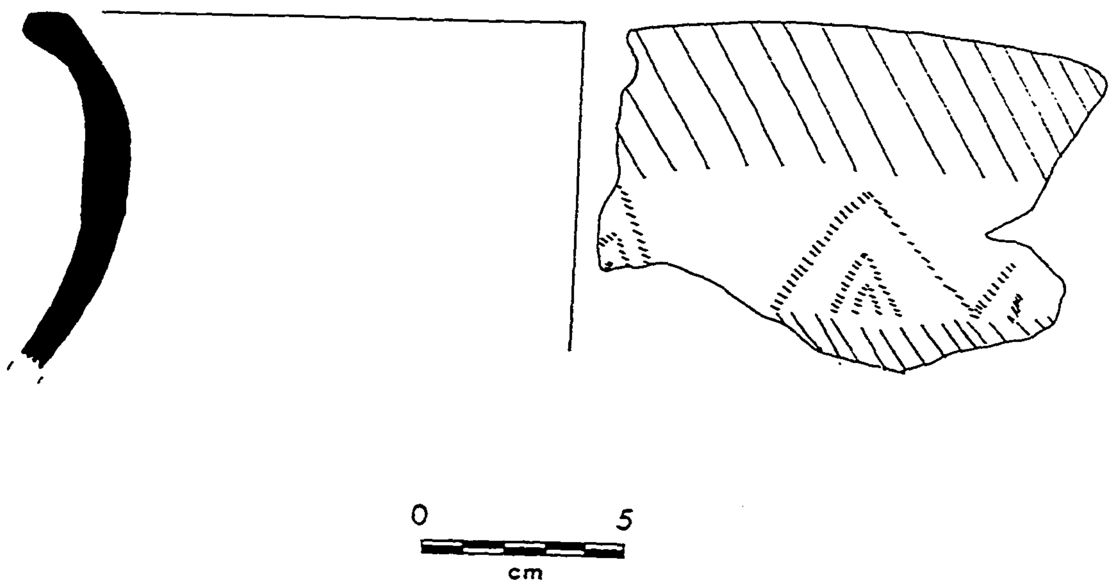


Figure 16: Macanché Red-on-paste: Tachís Variety Rim Profile from Zacpetén.

floor) in Structure 719 (residence) at Zacpetén.

Intersite references: Macanché Red-on-paste: Tachís Variety is analogous to Tachís pottery from Flores Island described by Cowgill (1963:112-115). The slip and decoration colors at Zacpetén are not a deep red to purple color as described by Cowgill. Red painted angled decorations on a paste background are also located at Tayasal and Macanché Island. I noted a series of nested squares on the flanged bowl sherd from Tayasal. The decoration color (10R 4/4) is darker than the exterior slip (10R 4/6), but not significantly darker. Decoration panels may exist and are marked by a solid block or red color.

Rice (1987a:133-134) includes this type in her description of Macanché Red-on-paste: Macanché Variety sherds. A narrow neck jar has a banded decoration area with embedded triangles.

Angular red-on-paste decoration (chevrons) also occurs in Tecoh Red-on-buff pottery from northern Yucatán in the Tases (A.D. 1300-1450) period (Smith 1971:29).

Name: Picú Incised: Picú Variety

Frequency: This description of Picú Incised: Picú Variety is based on 16 sherds: two from Zacpetén; six from Ixlú; one from Ch'ich'; and seven from Tipuj. This sample constitutes nine percent of the Paxcamán ceramic group and 2.9 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Cowgill (1963:96-109) first described Picú Incised: Picú Variety based on the ceramic collection from Lake Petén-Itzá.

Types of analysis: "Low-tech" (16 sherds); petrographic (8 sherds); x-ray diffraction (1 sherd); EDS and SEM and strong-acid extraction ICPS (4 sherds).

Principal identifying modes: 1) Post-slip, fine line incising; 2) Red slip; 3) Jar, collared jar, tripod plate, and restricted orifice jar forms.

Paste and firing: Picú Incised: Picú Variety has a reddish brown (5YR 5/4) to greenish gray (1 GLEY 5/1) paste color with five sherds exhibiting dark coring. The paste has a number of inclusions: euhedral and subhedral calcite; quartz; biotite; chert; and hematite. Nine sherds are fired to an estimated 550-700°C and seven are estimated to have been fired to 300°C. All cores have a Mohs' hardness of 3.

Surface treatment and decoration: Sherds are slipped various shades of red (10R 5-6- 2.5YR 5/8) with a majority of the sherds having a color value of 10R 4/6. Black fireclouds occur on sherds from Zacpetén and Ixlú while tan fireclouding occurs on sherds from Tipuj. Slip thickness is approximately .25 mm and slip hardness ranges from 2-3 on the Mohs' hardness scale.

Fine, post-fire incisions appear in decorative banded panels. Tripod plates and collared bowl decorations appear on the interior of the vessel (on the plate wall and neck wall, respectively) and jar and restricted orifice bowl decorations appear on the exterior of the vessel. Some decorations are done carefully while others are not, as indicated by poor line joins. Decorations are marked by one, two, or three circumferential bands. Jars typically have one at the top and bottom. Restricted orifice bowls, collared jars, one jar, and plates typically have two top and bottom bands. One collared jar has three top and bottom bands with a double middle band. The banded areas are normally broken by vertical double line paneling. Decorative elements include the *ilhuitl* glyph, nested chevrons, hooks, plumes, circular elements, mat motifs, birds, and possible split representations of the RE glyph (Rice 1987a:125). Although not included in this sample, an incised Lamat glyph appears on a collared jar from Ixlú. Decorations occur incised and excised.

Forms and dimensions: Tripod plates (n=2), collared jars (n=5), narrow neck jars (n=4), and restricted orifice bowls (n=2)have post-fire, fine line incising. Tripod plates have rim diameters that range from 24-28 cm ($\bar{x}$=6 cm) and wall thicknesses of 6.3-6.34 mm ($\bar{x}$=6.32 mm). The direct rims have square, round, and interiorly beveled lip shapes. Collared jar rim diameters vary from 22-32 cm ($\bar{x}$=28.4 cm) and wall thicknesses from 5.15-6.72 mm (6.22 mm). The direct rims have round or interiorly beveled lip shapes. Narrow neck jar rim diameters range from 14-28 cm ($\bar{x}$=20 cm) with wall thicknesses ranging from 4.7-9.82 mm ($\bar{x}$=6.17 mm). The direct rims have pointed, rounded, or exteriorly beveled lip shapes. Restricted orifice bowl rim diameters with rounded direct rims range from 10-18 cm ($\bar{x}$=14) with wall thicknesses of 4.82-4.89 mm ($\bar{x}$=4.86 mm).

Illustrations: Figure 17

Intrasite references: Picú Incised: Picú Variety sherds were located at Ch'ich', Ixlú, Zacpetén, and Tipuj. The sherds from Ch'ich' were located in level 2 (collapse) of Structure 188 (open hall). Ixlú sherds come from levels 1-4 of the following structures: 2015 (open hall), 2020 (oratory), 2021 (open hall), 2022 (open hall), 2023 (temple), 2034 (temple), and 2041 (residence).

Picú Incised: Picú Variety sherds from Zacpetén are found in all structures except 607 (statue shrine), 720 (statue shrine), and 758 (residence). All sherds come from the first four levels. Structure 767 (open hall) had the highest quantity of Picú Incised: Picú

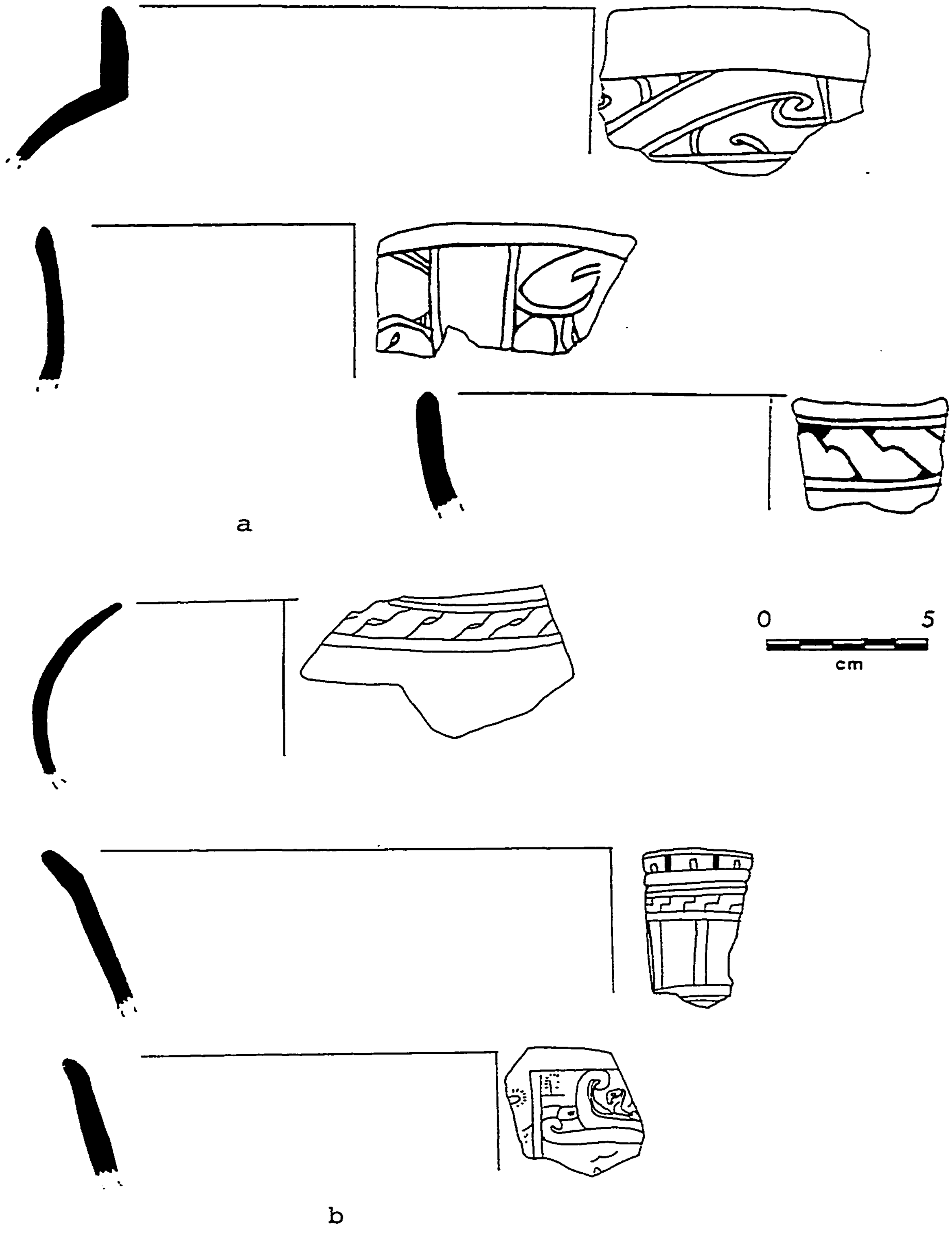


Figure 17: Picú Incised: Picú Variety Rim Profiles from Tipuj (a) and Ixlú (b).

Variety sherds. Tipuj structures 2 (temple), 3 (open hall) and 4 (open hall) contain Picú Incised sherds. All sherds come from the first four excavated levels. Structure 2 has the most elaborately incised vessels. The incised panels are combinations of birds and mat motifs. These sherds also are the most carefully made and best preserved.

Intersite references: Picú Incised: Picú Variety sherds were also located at Tayasal and Macanché Island. In general, the sherds the I examined from Tayasal exhibit exterior surface fine post-fire incising that resemble scratches. The other sherd represents a collared jar and is incised on the interior neck surface. The decoration is bounded by a single top and bottom circumferential band. The decoration appears to have been complex, but the only discernible decorative elements that remain are a series of curvilinear lines. Pastes are reddish brown and light gray with a red slip that is typical of other sites in the Petén lakes region.

I examined eight sherds from Macanché Island that had post-fire fine line incising. Cross-hatching and random scratches occur on the majority of the sherds of this type. One sherd, from Punta Nimá (Bullard's collection at the Florida Museum of Natural History), has a complex interior incised decoration. The top register of the decoration has a mat motif that is marked by three top and two bottom circumferential incised bands. The second register begins below the two bottom bands of the top register and consists of a probable reptilian motif (Rice 1987a:135). Some bowls are incised on the interior surfaces, but the decoration area is too eroded to determine decorative elements. Brown to light gray pastes with snail inclusions and red exterior slips at Macanché Island are within the range seen at other Postclassic Petén lakes sites.

The Picú Incised: Picú Variety collection from Flores Island exhibit complicated decorative motifs that are more similar to those at Tipuj than at other sites in the Petén lakes region (Cowgill 1963:Figure 4). All decoration areas are paneled and have alternating reptilian and mat motifs. Cowgill (1963:102) suggests a decorative motif affinity to Tulum in Quintana Roo.

Red-ware fine line incised pottery is common in northern Yucatán. Palmul Incised: Palmul Variety occurs at Tulum and Mayapán during the Tases period and Pustunich Incised Type: Pustunich Variety at Mayapán and Chich'en Itza (Smith 1971:30).

Name: Picú Incised: Thub Variety

Frequency: Eight sherds are the basis for the description of Picú Incised: Thub Variety: five from Ixlú, two from Ch'ich', and one from Tipuj. This type represents 4.3 percent of the sherds in the Paxcamán ceramic group and 1.4 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: A. Chase (1983:1220-1222) first described Picú Incised: Thub Variety from Tayasal ceramic collections.

Types of analysis: "Low-tech" (8 sherds); petrographic (4 sherds); x-ray diffraction (1 sherd); EDS and SEM and strong-acid extraction ICPS (4 sherds).

Principal identifying modes: 1) Pre-fire, deep incised lines; 2) Gray snail inclusion paste; 3) Red to red-orange slip; 4) Grater bowls and drums.

Paste and firing: Picú Incised: Thub Variety sherds have a gray (1GLEY 4/1) to brown (10YR 5/3) paste. Half of the sherds in the sample are incompletely oxidized and estimated firing temperatures range from 300-650°C with the majority of the sherds estimated to have been fired between 300-500°C. Core hardness is 3 on the Mohs' hardness scale. Euhedral, subhedral, and anhedral calcite and shell comprise most of the inclusions in the paste; however, biotite, chert, and ferruginous lumps (hematite) appear in small quantities.

Surface treatment and decoration: Grater bowls are slipped on the interior (to just below the top of the incised decoration) and exterior with a red (10R 4/6- 2.5YR 4/6) low luster slip and a Mohs' hardness of 2-3. Some of the low luster slips may be a result of double-slipping: a red base slip with a cream over-slip. Black and tannish-green fireclouds appear on the exterior surfaces of the grater bowls from Tipuj. The interior slip does not cover the incised portion of grater bowls. The drum sherd is slipped red (10R 4/6) below the vertical incisions.

Grater bowl pre-fire incisions encompass the bowls' sagging bottoms. The first line of incising occurs at the wall/base junction and encloses the incised pattern. A variety of patterns appear on interior surfaces of bowl bases with cross-hatched patterns most common. Curvilinear patterns are not uncommon. Not all of the vessels exhibit use wear.

The drum sherd has deep, vertical incisions that are approximately 24 mm in length. The incisions appear directly below an externally thickened rim. The matte slip begins 10 mm from the base of the incisions and covers the remaining sherd.

Form and dimensions: The type is comprises grater bowls (n=7) and drums (n=1). Grater bowl rim diameters vary from 22-28 cm ($\bar{x}$=24.57) with wall thicknesses of 6.66-8.86 mm ($\bar{x}$=7.62 mm). Direct rims are rounded or interiorly beveled. Grater bowls have sagging bottoms with scroll supports.

The drum sherd has a diameter of 16 cm and a wall thickness of 8.92 mm. As stated previously, the direct rim is exteriorly thickened. The drum neck resembles those of narrow neck jars.

Illustrations: Figure 18

Intrasite references: Grater bowls from Ixlú come from level three (floor) of Structure 2023 (a temple), the grater bowls from Ch'ich' are level 2 (collapse) of Structure 188 (a colonnaded hall), and the grater bowl from Tipuj is from level 2 (collapse) of the Postclassic Plaza. The drum sherd from Ixlú comes from level 2 (collapse) of Structure 2034 (a large range structure).

In addition to the sherds used in this study, Picú Incised: Thub variety sherds also occur at Zacpetén in the form of grater bowls and drums. Grater bowls from Zacpetén occur in the following structures: 606 (open hall), 614 (oratorio), 615 (open hall), 664 (residence), 719 (residence), 721 (temple), 732 (residence), 747 (residence), 748 (residence), 758 (residence), 764 (temple), 765 (raised shrine), 766 (statue shrine), 767 (open hall), and 1001 (plaza fill). Drum sherds occur in the following structures at Zacpetén: 603 (ceremonial sakbe), 719 (residence), 748 (residence), 764 (temple), 765 (raised shrine), and 767 (open hall). Drum incisions occur in groups of two or three. Tipuj grater bowls come from Structures 2 (temple) and 3 (open hall). A grater bowl from Structure 2 was burned.

Grater bowls from Zacpetén tend to have darker red to purple slips with occasional black fireclouds. The slips are relatively thick and well preserved. Grater bowls that were not used may have been ceremonial, thus possibly explaining their

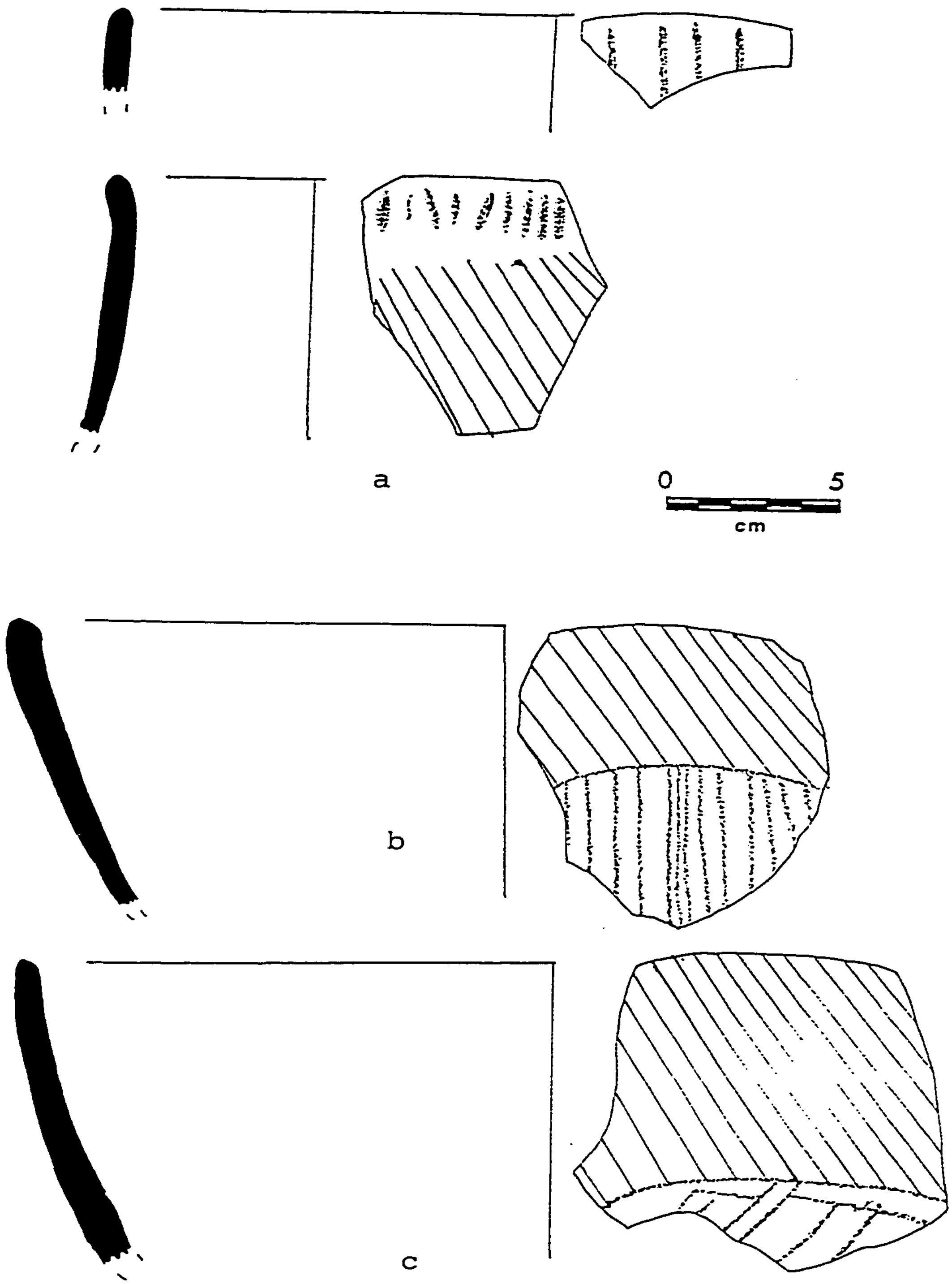


Figure 18: Picú Incised: Thub Variety Rim Profiles from Tipuj (a), Ixlú (b), and Ch'ich' (c).

appearance in the ceremonial structures from Ch'ich', Ixlú, and Zacpetén.

Intersite references: Grater bowls and drums exist in all Postclassic slipped pottery types: Hobonmo Incised: Hobonmo Variety, Xuluc Incised: Tzalam Variety, Dulces Incised: Bebeto Variety, and Mengano Incised: Bobo Variety. Deep line pre-fire incising occurs on grater bowls and drums from Tayasal and Macanché Island. My observation of grater bowls from Tayasal indicate the presence of two different decorative patterns characterized by a single incised circumferential band. The first pattern consists of a series of diagonal lines and in between the lines is a series of rounded punctations. The entire vessel including the incised area is slipped. The second pattern is a series of "v"s. Slip does not occur in the incised area. Drum forms at Tayasal have a series of vertical incision below the rim and the slip begins below the incisions. Reddish brown to light gray paste colors occur in both pottery forms at Tayasal. The clay matrix is coarser than those at other Petén lake sites.

My examination of the grater bowls from Macanché Island shows that incisions are divided into four sections and each section is cross-hatched. The incised area is enclosed by a circumferential incised band. The interior surface is slipped the same color as the exterior and the slip does not appear in the incised area. Slip colors are typical Paxcamán Red slips with matte and low luster finishes. Black fireclouding is rare. All grater bowl sherds have evidence of use wear. Paste color and textures vary from tan to brown to gray with ashy to coarse textures.

Drums from Macanché Island have vertical incisions beginning at the lip and terminating at the shoulder. The vertical incisions are approximately 2.5-3.2 cm long and is slipped red below the incised area. Although the sherds are fragmentary, the incisions do not appear to be in groups of two or three as described above. Pastes are gray with an orange oxidized layer underneath the slip.

Grater bowls and drums exist in northern Yucatán. Xuku Incised (Chichen Red Ware), Pencuyut Incised: Pencuyut Variety (San Joaquin Buff ware), Xcanchakan Black-on-cream (Peto Cream ware), and Chichen Slate ware have grater bowl forms that resemble those found in the southern lowlands (Smith 1971: 16,17, 27, 45). Postclassic drum forms occur in Mama Red (Mayapán Red Ware) and Tekit Incised (Puuc Slate) types (Smith 1971:22, 27).

Grater bowls occur in unslipped types and occur in Late Classic and Terminal Classic deposits at Uaxactún (Smith 1955), Zacpetén, and Ixlú (personal observation). Drums may also have begun in the Classic era. Individuals are seen on Late Classic polychrome vessels carrying and/or playing "drums." Therefore, as noted with respect to the above description of Postclassic grater bowls and drums, the grater bowl and the drum are not Postclassic creations, but have their antecedents in the Late Classic period.

Name: Picú Incised: Cafetoso Variety

Frequency: One sherd from Zacpetén defines this type. Picú Incised: Cafetoso Variety comprises one percent of the sherds of the Paxcamán ceramic group and .2 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal identifying modes: 1) Pre-fire, thin incisions on a tan to brown slip; 2)

Red slip; 3) Snail inclusion paste; 4) Tripod dish.

Paste and firing: The pale brown (10YR 6/3) paste has a dark core (2.5Y 6/1). It was estimated to have been fired to 650°C and has core Mohs' hardness of 3. Anhedral calcite dominates the clay matrix, but quartz, shell, euhedral and subhedral calcite, ferruginous lumps (hematite), and possibly biotite appear as other inclusions.

Surface treatment and decoration: The exterior of the sherd has a well preserved red (2.5YR 5/8) low luster slip with a Mohs' hardness of 3. The interior surface is slipped brown (10YR 5/4), but the brown color is mottled. The brown slip also has a low luster and a Mohs' hardness of 3. Red slip from the exterior surface and rim bleeds into the brown slip.

Fine line, post-fire incising appears in the brown slipped area of the interior surface. The decoration is marked by an upper double band. Plumes and curved lines with a two "eyes" or a possible stylized RE glyph occur within the defined decoration area.

Form and dimensions: This sherd appears to be from a tripod dish (but could also be part of a small collared bowl) with a rim diameter of 18 cm and a wall thickness of 5.3 mm. The direct rim has a square lip.

Illustration: Figure 19

Intrasite reference: The sherd described here was found at Structure 764 (temple) in a collapse level (level 2). Picú Incised: Cafetoso sherds not included in this study were also located in Structure 719 (residence).

Intersite references: No parallels exist in the Petén lakes region or in other Maya lowland areas.

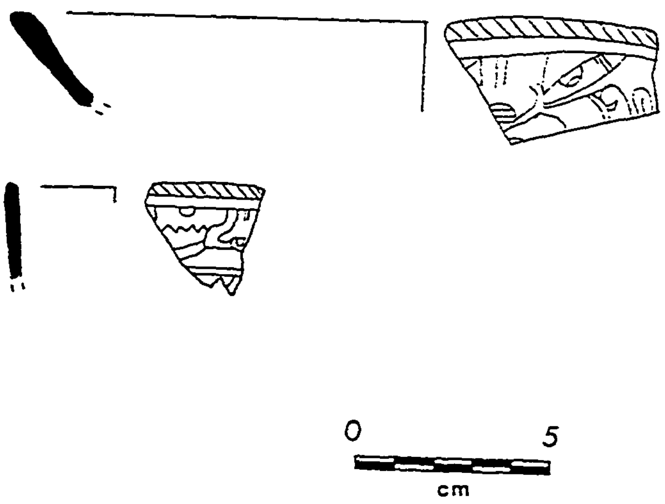


Figure 19: Picú Incised: Cafetoso Variety Rim Profiles from Zacpetén.

Fulano Ceramic Group

The Fulano ceramic group is a new designation based on Postclassic pottery collections excavated from Zacpetén, Ixlú, and Tipuj. Fulano ceramics were found at Zacpetén, Ixlú, Ch'ich', and Tipuj. They differ from those of the Paxcamán ceramic group on the basis of paste and slip characteristics, being gray with darker gray cores. Unlike the Paxcamán ceramic group pastes, those of the Fulano ceramic group do not demonstrate the wide color and texture variability. Fulano pastes include euhedral and subhedral calcite, shell, ferruginous lumps (hematite), quartz, biotite and small, rounded fossils. Cryptocrystalline calcite is also abundant, but may be a natural mineral in the clay matrix.

Fulano slips are black (7.5YR 3/1 to 2.5Y 2.5/1) and can have a low luster. Occasionally, the black slip is interspersed with red mottling which may suggest that the slip coloring resulted from firing in a reducing atmosphere. Experimental refiring of sherds to 800°C in an oxidizing kiln resulted in half of the slips changing to red (10R 4/2 to 2.5YR 5/8) while half remained black (7.5YR 3/1). The majority of the sherds whose slips changed to red are monochrome types (Fulano Black: Fulano Variety), while the majority of the sherds whose slips remained black are decorated (Sotano Red-on-paste: Sotano Variety and Mengano Incised: Mengano Variety). The differences in firing time, temperature, and atmosphere of the Fulano ceramic group may mirror that of the Trapeche ceramic group. Refired paste color variability resembles that of the Paxcamán ceramic group discussed above.

Therefore, the principal identifying modes of the Fulano ceramic group are as follows: 1) Gray snail inclusion paste and 2) Black, low luster slip.

Name: Fulano Black: Fulano Variety

Frequency: Nine sherds define this type: four from Ixlú, one from Ch'ich', and four from Tipuj. Fulano Black: Fulano Variety comprises 64 percent of the Fulano ceramic group and two percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Ch'ich', Ixlú, and Zacpetén.

Types of analysis: "Low-tech" (9 sherds); petrographic (3 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (2 sherds).

Principal identifying modes: 1) Black slip; 2) Gray, snail inclusion paste, 3) Tripod dishes, narrow neck jars, and collared bowls.

Paste and firing: Paste color varies from grayish brown (10YR 5/2) to gray (5YR 6/1) to dark grayish brown (2.5Y 3/2). Dark gray cores commonly occur. Estimated firing temperatures range from 300-600°C (darker cores indicating firing at lower temperatures) with a core Mohs' hardness of 3. Cryptocrystalline calcite predominates the clay matrix and may be naturally occurring; however, the clay matrix also includes euhedral and subhedral calcite, quartz, shell, hematite, biotite, and small rounded fossils.

Surface treatment and decoration: Slips have a matte or low luster finish and a Mohs' hardness of 3. Thicknesses range from .375 to .25 mm. The matte finish may be a result of erosion because all of these sherds were located in the humus level (level 1) of excavation. Some areas of the black slip have red spots that may indicate that the black slip is a firing variant of a red slip. This is further supported by refiring tests in which most of the Fulano Black: Fulano Variety black slips did turn red at 800°C. Interior and exterior surfaces are slipped.

Forms and dimensions: Tripod plates (n=2), narrow neck jars (n=5), and collared jars (n=2) appear in this type. Tripod plate rim diameters range from 16-30 cm ($\bar{x}$=23) with wall thickness of 5.19-6.22 mm ($\bar{x}$=5.71 mm). The direct rims have a round or interiorly beveled lip shape. Narrow neck jar rim diameters range from 14-26 cm ($\bar{x}$=18) with wall thicknesses of 5.11-8.95 mm ($\bar{x}$=6.93). The direct rims have a rounded lip shape. Collared jar rims diameters range from 32-38 cm ($\bar{x}$=35) and wall thicknesses of 6.56-8.93 mm (mean=7.75 mm). The direct rims have a rounded lip shape.

While not part of the sample for this study, scroll supports and restricted orifice bowls occur with black slips.

Illustrations: Figure 20

Intrasite references: Fulano Black: Fulano Variety sherds that are used in this study were found in the first two levels (humus and collapse) in the following structures at the following sites: Ch'ich' Structure 188 (open hall) ; Ixlú Structure 2017 (open hall), Structure 2022 (open hall), and Structure 2021 (open hall); Tipuj Structure 1 (an oratory) and Structure 2 (temple).

In addition to the above locations, Fulano Black: Fulano Variety was also noted in the following structures from Zacpetén: 601 (raised shrine), 605 (oratorio), 606 (open hall), 614 (oratorio), 664 (residence), 719 (residence), 721 (temple), and 747 (residence). Structures 719 and 764 have the highest frequency of Fulano Black sherds.

At Ixlú, Structure 2021 has the highest frequency of Fulano Black sherds. Fulano Black sherds were also located in the following Ixlú structures: 2003 (residence), 2005 (building in the twin-pyramid complex), 2023 (temple), 2034 (temple), and 2041 (residence).

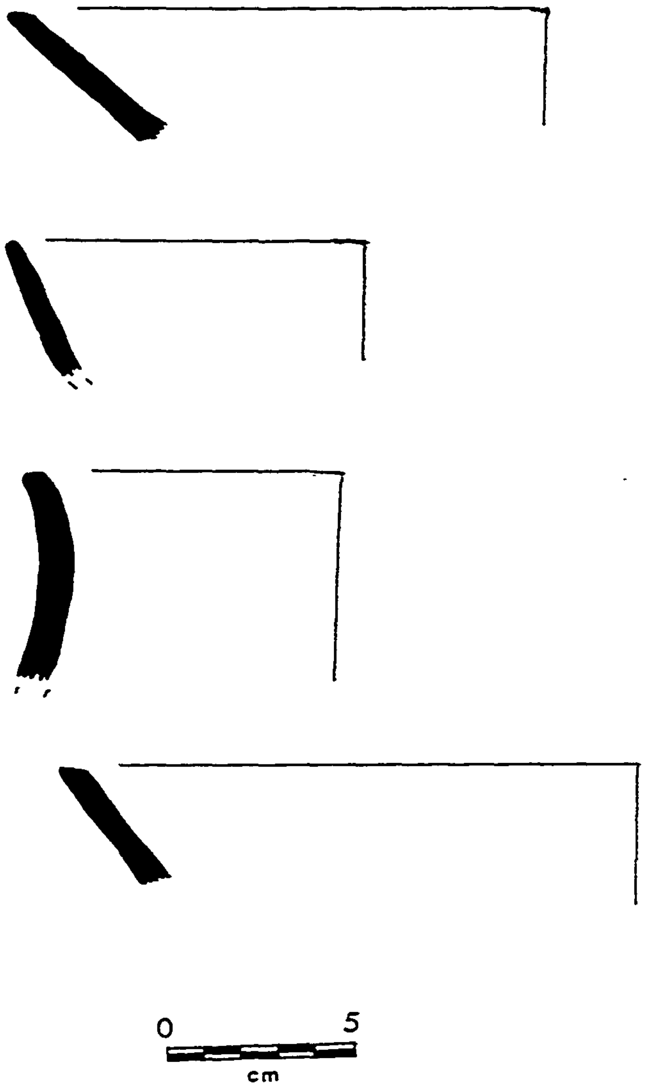


Figure 20: Fulano Black Rim Profiles from Ixlú.

Intersite references: Fulano Black: Fulano Variety has no equivalents in the Postclassic period in the Petén lakes region. However, the Terminal Classic and Late Classic periods do have black-slipped pottery. Some black slips of the Late and Terminal Classic periods, such as Achote Black, Infierno Black, and Mt. Maloney Black, resemble those of the Fulano Black slips. These black slip may be a result of a reduced Paxcamán Red slip as described above.

My examination of sherd from Tayasal and Macanché Island yielded some Fulano Black sherds. Tayasal Fulano Black sherds have a dark gray paste with a black slip. The black matte slip has spots of red and tan colors. Tripod dishes and jars are represented in the collection.

Rice (1987a:155-157) describes a gray slipped pottery type at Macanché Island that upon my reexamination should be categorized as Fulano Black. All sherds have a dark gray paste that is typical of the Fulano Black pastes at other sites. Most of the slips have a matte finish and an oxidized layer exists beneath exterior slips. Low luster slips, while rare, do occur and resemble the slips of Zacpetén sherds.

Outside of the Petén lakes region, black slipping occurs in northern Yucatan. Types, such as Mayapán Black, have slips that appear to be analogous to the Fulano Black slips (Smith 1971:17-20). These types are widely distributed in the entire Postclassic period and are more common than those in the Petén area.

Name: Sotano Red-on-paste: Sotano Variety

Frequency: Four sherds (two from Zacpetén and 2 from Ixlú) from the present study define this type. Sotano Red-on-paste: Sotano Variety comprises 29 percent of the

Fulano ceramic group and one percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Ixlú and Zacpetén.

Types of analysis: "Low-tech" (4 sherds); petrographic (3 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal Identifying modes: 1) Red decoration elements on a gray paste background; 2) Gray snail inclusion paste; 3) Tripod dishes.

Paste and firing: Pastes are incompletely oxidized and colors range from light gray (5Y 7/1) to dark gray (10YR 3/1). The sherds were estimated to have been fired between 400-600°C with a core Mohs' hardness of 3. Some of the lighter gray sherds have a darker gray core. Inclusions are similar to those described for Fulano Black: Fulano Variety.

Surface treatment and decoration: Exterior surfaces are slipped black with a low luster finish; however, one sherd has a matte finish. The sherd with a matte finish also shows spots of red in the black paint. When the sherd with the matte finish was refired to 800°C, the exterior surface changes to a weak red (10R 4/2) while the low luster black exterior surfaces remain dark brown (7.5YR 5/6) to black (2.5YR 2.5/1). Slips are approximately .25 mm thick.

Interior surfaces are decorated with a dark red (10R 4/2) paint. The interior surfaces, where preserved, have a very pale brown (10YR 8/3) undercoat on which the decoration is painted. Similar to Macanché Red-on-paste: Macanché Variety decorations, the decoration area is banded. Single or double circumferential bands appear near the rim and the wall/base junction has a single circumferential band. Painting seems to be done in a three step process: 1) decoration is painted first; 2) bands are painted; and 3) the exterior and rim are slipped. Decorative elements, two of which remain, appear to be curvilinear and a possible glyph representation. The curvilinear decoration is a negative decoration (the background is painted red rather than a line drawing). The other two decoration areas are eroded. Hardness measurements of the interior decoration and undercoat range from 2 to 3.

Forms and dimensions: The four sherds discussed here are from tripod dishes. The tripod dish diameters vary from 16-24 cm ($\bar{x}$=20.67) with wall thickness of 4.77-8.16 mm ($\bar{x}$=7.03). The direct rims have interiorly beveled or round lip shapes.

Illustrations: Figure 21

Intrasite references: The two sherds from Zacpetén are from Structure 719 (residence): one is from a level 1 (humus) and one is from level 8 (a level in a Postclassic deposit). The two sherds from Ixlú are from Structure 2021 (open hall): one is from level 2 (collapse) and one is from level 4 (below the first occupation floor). Other Sotano Red-on-paste sherds have been found at Structures 732 (residence) and 764 (temple) at Zacpetén.

Interregional references: Sotano Red-on-paste resembles Macanché Red-on-paste: Macanché Variety and Chompoxté Red-on-paste: Akalché Variety. The decoration area is delineated by red circumferential bands and the decorations are painted red. Sotano Red-on-paste red decorations tend to have a brown tint instead of being dark red to almost purple red.

Macanché Island is the only other site in the Petén lakes region that has Sotano Red-on-paste pottery. Again, these sherds were classified by Rice (1987a:155-157) as an

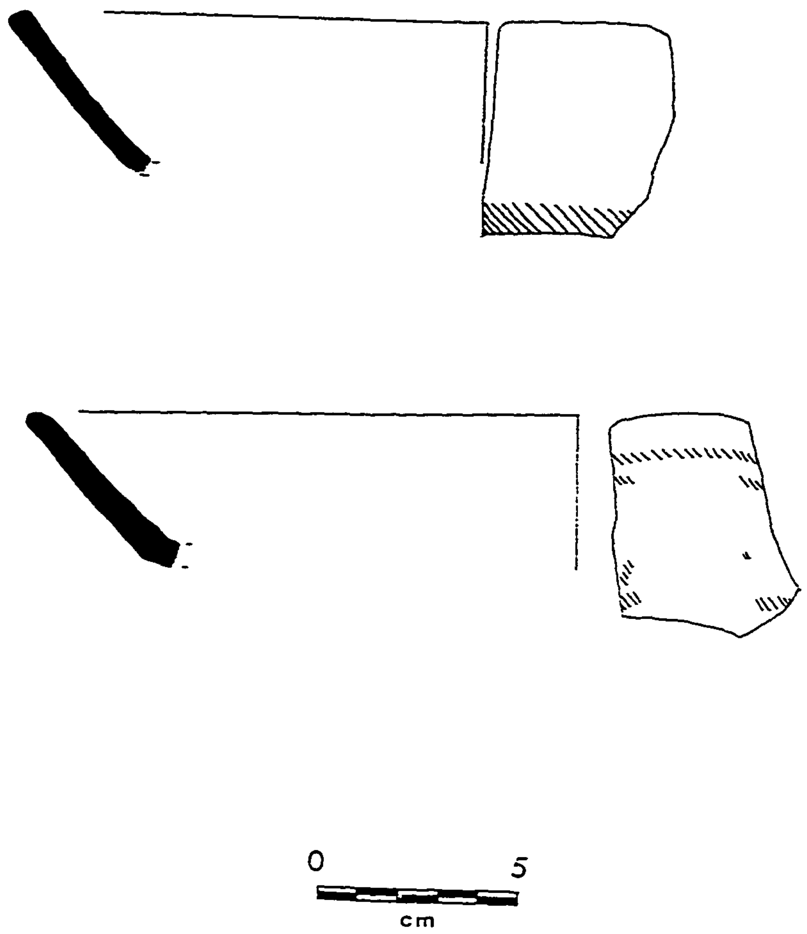


Figure 21: Sotano Red-on-paste: Sotano Variety Rim Profiles from Zacpetén.

unnamed gray ware with eroded band decoration. Upon my further examination of the Macanché Island collection at the Florida Museum of Natural History, jars, restricted orifice bowls, and tripod dishes have red bands with black slip. The decorations and bands are fairly eroded, but enough remains to refine the classification of this pottery.

Similarities to this type do not exist outside of the Petén lakes region.

Name: Mengano Incised: Mengano Variety

Frequency: One sherd from Zacpetén. Mengano Incised: Mengano Variety comprises seven percent of the Fulano ceramic group and .2 percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal Identification modes: 1) Post-fire, fine line incising and excising; 2) Black slip; 3) Gray snail inclusion paste; 4) Collared jar.

Paste and firing: The gray (2.5Y 6/1) paste is similar to that described for Fulano Black: Fulano Variety. Core Mohs' hardness is 3 with an estimated firing temperature of 400°C. Euhedral and subhedral calcite, quartz, hematite, and shell appear in the clay matrix with cryptocrystalline calcite occurring most commonly.

Surface treatment and decoration: The exterior surface is slipped black (2.5Y 2.5/1) and has been burnished so that it is glossy in places. Thickness range from .625-.25 mm and have a surface Mohs' hardness of 3. When refired to 800°C, the slip color does not change.

The interior neck of the collared bowl is incised. The neck is also slipped black (2.5Y 2.5/1), but when refired to 800°C, light red (2.5YR 6/6) spots appear in the black slip. The interior slip also has a hardness of 3. Decorations are excised so that the background color is the paste color and the decorative element is black. The decoration area is double banded on the top and single banded on the bottom with a bird motif appearing between the bands.

Forms and dimensions: The collared bowl has a wall thickness of 6.7mm. The rim diameter cannot be measured because of the smallness of the sherd, but the direct rim has a rounded lip shape.

Illustration: Figure 22

Intrasite reference: This sherd was located in level 2 (collapse) of Structure 719 (residence) at Zacpetén. In addition to Structure 719, Mengano Incised sherds were located in Structure 732 (residence) at Zacpetén and Structure 1 (oratorio) at Tipuj.

Intersite references: Mengano Incised: Mengano Variety resembles Picú Incised: Picú Variety, Hobonmo Incised: Ramsey Variety, and Dulces Incised: Dulces Variety. The post-fire fine line incising is similar in the negative decoration technique, circumferential banding, and motifs to other sherds in the Petén lakes region. However, negative decorations are far more rare than positive decorations. In addition to Postclassic types, the black slip incising is similar that of Cubeta Incised and Carmelita Incised types in the Late and Terminal Classic periods in the Maya lowlands.

Macanché Island is the only other site in the Petén lakes region to have Mengano Incised: Mengano Variety sherds. Rice (1987a:155) describes incised vessels with

Figure 22: Mengano Incised: Mengano Variety Rim Profile from Zacpetén.

"indeterminate incised motifs" as an Unnamed Gray Slipped type. Upon my further examination of the Macanché Island collection at the Florida Museum of Natural History, Rice's Unnamed Gray Slipped type with incisions is Mengano Incised: Mengano Variety. Vessel forms include bowls, jars, and collared rims. However, unlike the examples from Zacpetén and Tipuj, the incising is not of high quality.

Fine line incising on black slipped Postclassic pottery occurs in northern Yucatán. Pacha Incised: Pacha Variety of the Mayapán Black ware occurs in the Hocaba and Tases periods at Mayapán (Smith 1971:22).

Trapeche Ceramic Group

Name: Trapeche Pink: Tramite Variety

Frequency: Sixty-three sherds are the basis for this description of Trapeche Pink: Tramite Variety: 41 from Zacpetén; 20 from Ixlú; and two from Ch'ich'. This constitutes 86 percent of the sherds in the Trapeche ceramic group and 11.5 percent of the sherds in the present study.

Ware: Volador Dull-Slipped ware.

Established: Rice (1987a:139-145) defined this variety based on Bullard's Macanché Island pottery collection. A general designation of Trapeche Pink pottery was first described by Chase (1979:104-109).

Types of analysis: "Low-tech" (63 sherds); petrographic (37 sherds); x-ray diffraction (4 sherds); EDS and SEM and strong-acid extraction ICPS (15 sherds).

Principal identifying modes: 1) Cream to "pink" to orangish-red slip; 2) Gray snail inclusion paste; 3) Tripod dishes, collared jars, bowls, and narrow neck jars.

Paste and firing: Trapeche Pink: Tramite Variety pastes are very similar to those of Paxcamán Red and Fulano Black types. The pastes are dark gray (2.5Y 4/1, GLEY1 4/N) to gray (10YR 6/1). Approximately one-half of the sherds have darker gray cores indicating that they were incompletely oxidized. Estimated firing temperatures range from 300-600°C. Core hardness is 3 on the Mohs' hardness scale.

The clay matrix is composed of gray colored clay, cryptocrystalline calcite, shell, quartz, and hematite inclusions. Twenty-five percent of the clay matrices also include euhedral and subhedral calcite, biotite, and/or chert.

Surface treatment and decoration: The exterior and interior (when slipped) slip colors range from red (2.5YR 5/6) to yellowish red (5YR 5/6) to light brown (7.5YR 6.4) to light brownish gray (10YR 6/2). The majority of the sherds are double slipped: the primary slip near the sherd surface is red, dark brown, or greenish brown, and it is covered by a thin, translucent tan to a creamy white secondary slip with a "waxy" feel. In some areas, the double slipping is obvious while in other areas the double slipping is difficult to distinquish. Double slipped surfaces also have a low luster. In thin section, the slip (.125-.1 mm) is over an oxidized layer (.225-.1 mm). The overslip appears to be thinner (.05 mm) than the primary slip. The slips are generally well preserved with a Mohs' hardness of 2-3. Black fireclouding appears infrequently.

Forms and dimensions: Tripod dishes (n=14), flanged tripod dishes (n=1), collared jars (n=5), restricted orifice bowls (n=2), and narrow neck jars (n=8) are represented in the Tramite variety sample. Of the 63 sherds that are used to describe this type, only 30 are distinguishable as to form. Tripod dishes have a flat base with slighly outflaring walls. Tripod dish rim diameters range from 20-28 cm ($\bar{x}$=25.43 cm) with wall thickness of 5.12-8.12 mm ($\bar{x}$=6.22 mm). The direct rims have rounded or interiorly beveled lip shapes. Tripod scroll supports occur in this collection of pottery.

Collared jar rims are outflaring. The rim diameters vary from 26-34 cm ($\bar{x}$=30.33) with wall thicknesses of 5.12-8.85 mm ($\bar{x}$=7.36). The direct rims have rounded or interiorly beveled lip shapes.

Restricted orifice bowl mouth diameters range from 10-14 cm ($\bar{x}$=12) with wall thicknesses of 5.96-6.45 mm ($\bar{x}$=6.21 mm). One direct rim has a pointed lip shape and the other has an interiorly thickened lip shape.

The narrow neck jar rim diameters range from 12-32 cm ($\bar{x}$=16.62 cm) with wall thicknesses of 6.49-10.09 mm ($\bar{x}$=8.69 mm). The direct rims have exteriorly thickened lip shapes.

The flanged plate is represented by a body sherd with a two-stepped flange that faces left. The flanges are 6.73 mm in height.

Illustrations: Figures 23, 24

Intrasite references: The sherds in this study were excavated at Ch'ich', Ixlú, and Zacpetén. Trapeche Pink sherds in Structure 188 at Ch'ich' were excavated in the first and second levels (humus and collapse). Ixlú Trapeche sherds also appear in the first two levels of excavation in the following structures: 2003 (residence), 2017 (open hall), 2021 (open hall), 2022 (open hall), 2023 (temple), 2034 (temple), and 2041 (residence). Trapeche Pink sherds from Zacpetén were found in levels one through four in Structures 601 (raised shrine), 603 (sakbe), 605 (oratorio), 664 (residence, 720 (statue shrine), 721 (temple), 732 (residence), 747 (residence), 748 (unknown), 758 (residence), 764 (temple),

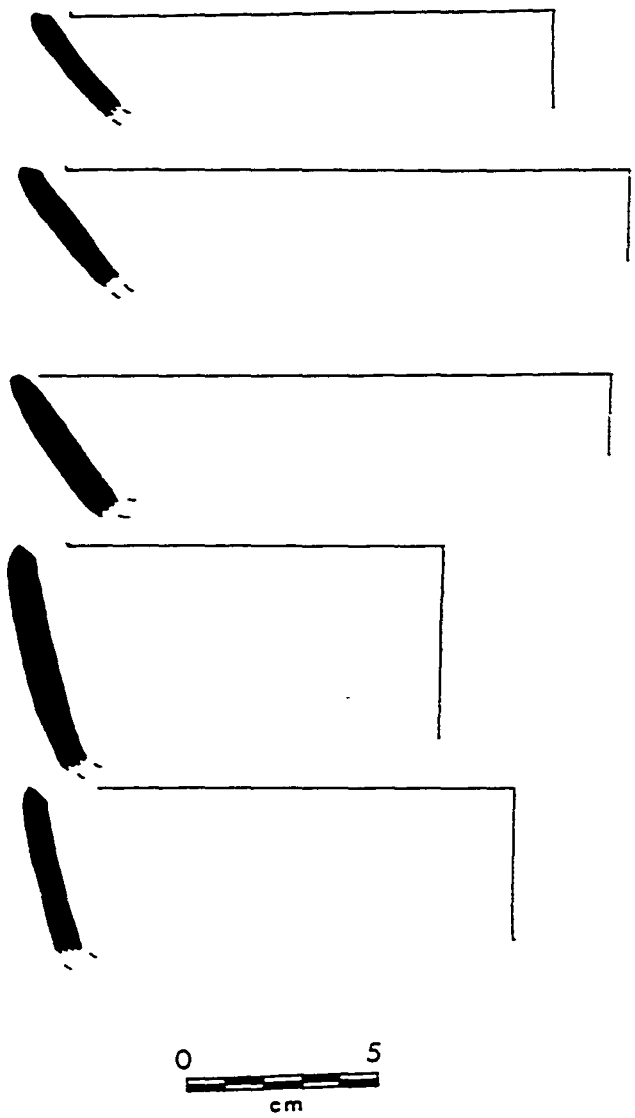


Figure 23: Trapeche Pink Tripod Plate Rim Profiles from Zacpetén.

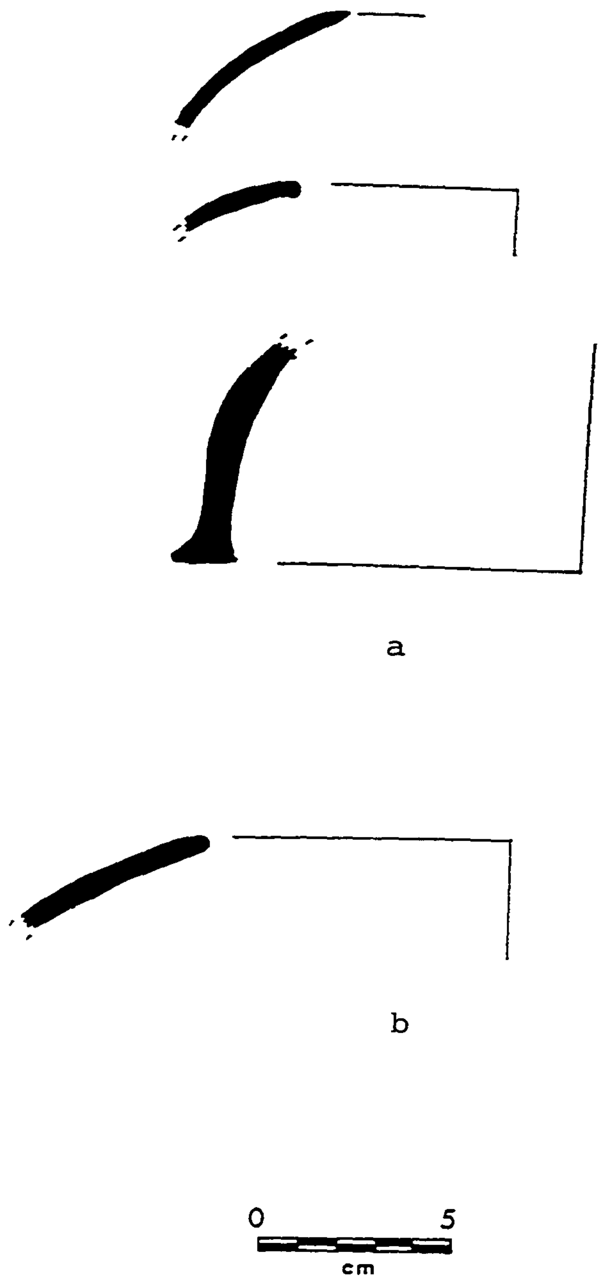


Figure 24: Trapeche Pink Miscellaneous Rim Profiles from Zacpetén (a) and Ixlú (b).

767 (open hall), and in levels one through four and eight of Structure 719 (residence). The majority of Trapeche Pink sherds come from Structure 721 (temple).

In addition to the above locations, other Trapeche Pink sherds were found at Ixlú in Structure 2005. Zacpetén Trapeche Pink sherds also occur in the following structures in levels one and two: 606 (open hall) and 615 (open hall).

Intersite references: Some Trapeche Pink slips tend to be more red than pink or have areas where a red primary slip is seen below a creamy secondary slip. The redness of the primary slip is very similar to Paxcamán Red slips (Rice 1987a:112-113). In addition to the similarities between Trapeche Pink and Paxcamán Red slips, Trapeche Pink outer or secondary slips also resemble Harina Cream slips of the Terminal Classic period.

Trapeche Pink sherds were also excavated at Tayasal and Macanché Island. I noted from my examination of the Trapeche Pink sherds from Tayasal a wide variety of paste colors that range from reddish brown to light gray. Unlike the sherds from Zacpetén, Tayasal sherds do not have dark gray pastes. The sherds from Tayasal demonstrate the distinct Trapeche Pink double slip that is a result of a double slip: red and cream. These Tayasal slips are also thicker and more "waxy" which may be the result of preservation. While the double slipping is prominent, some sherds have a single tan or creamy (7.5YR 6/6) slip. These slips usually have a matte finish. Forms and dimensions are within the range described above.

I also examined a large collection (n=1162) of Trapeche Pink: Tramite Variety sherds from Macanché Island. The sherds also have either a "waxy" double slip of red and cream or a single thick cream slip. Black fireclouding is prevalent. Typically, a thin bright orange oxidized paste layer occurs beneath the black fireclouds and the rest of the paste is dark gray. Unlike, Tayasal, most Macanché Island Trapeche sherds have very dark gray pastes (1GLEY 4/1), but some paste appear to be volcanic ash tempered resulting in a tan (10YR 6/3) paste color. Sherds with the tan paste also have a tan slip with red mottling. Thirty-five percent of these sherds have black fireclouds.

Tan or cream slips that resemble those of Trapeche Pink: Tramite Variety sherds occur in northern Yucatán. Some slatewares such as Thin Slate and Puuc Slate (A.D. 800-1000) have a tan to gray waxy slip (Smith 1971:164-165). In addition to slatewares, Peto Cream, Kukula Cream, and San Joaquin Buff wares (A.D. 1200-1450) have creamy to tan slips that range to pink or pinkish cinnamon (Smith 1971:27, 29, 45, 231). Vessel forms resemble those of Trapeche Pink: tripod dishes, jars, and restricted orifice bowls.

Name: Mul Polychrome: Manax Variety

Frequency: Five sherds of Mul Polychrome from Zacpetén are included in this study. This type comprises seven percent of the sherds in the Trapeche ceramic group and one percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: The Manax Variety of Mul Polychrome was first defined by Rice (1987a:146-149) based on Bullard's collection of pottery from Macanché Island. Chase (1979:110-112) defined a general the Mul Polychrome type from Tayasal pottery collections.

Types of analysis: "Low-tech" (5 sherds); petrographic (2 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Black painted decoration; 2) Cream to red exterior slip; 3) Gray snail inclusion paste; 4) Tripod dishes.

Paste and firing: Mul Polychrome pastes are typically gray (10YR 6/1to 2.5YR 5/1) with brown (10YR 6/2) to light brown (10YR 8/3) exterior oxidized margins. Estimated firing temperatures range from 550-600°C with a firing Mohs' hardness of 3. The clay matrix includes cryptocrystalline, euhedral, and subhedral calcite, quartz, hematite, shell, biotite, and chert.

Surface treatment and decoration: The exterior surfaces are slipped reddish yellow (7.5YR 6/6) to strong brown (7.5YR 5/6). Like the Trapeche Pink: Tramite Variety slips, Mul Polychrome exterior slips are double slipped with a creamy beige slip. However, unlike the Trapeche Pink: Tramite Variety sherds, these slips do have a matte finish. The slip is approximately .0625 mm thick and a Mohs' hardness of 2-3.

Interior surfaces are decorated. The decoration area is delineated by a black circumferential bands: one or two top bands and one black band along the wall/base juncture. The decorative elements are eroded.

Forms and dimensions: All Mul Polychrome: Manax variety sherds are from tripod dishes, but only two represent rims. The walls appear to be slightly flared. Both tripod dishes have a rim diameter of 22 cm and wall thickness ranges from 5.19-5.21 mm ($\bar{x}$=5.2 mm). Both sherds have direct rims: one direct rim has a rounded lip shape while the other is interiorly beveled.

Illustrations: Figure 25

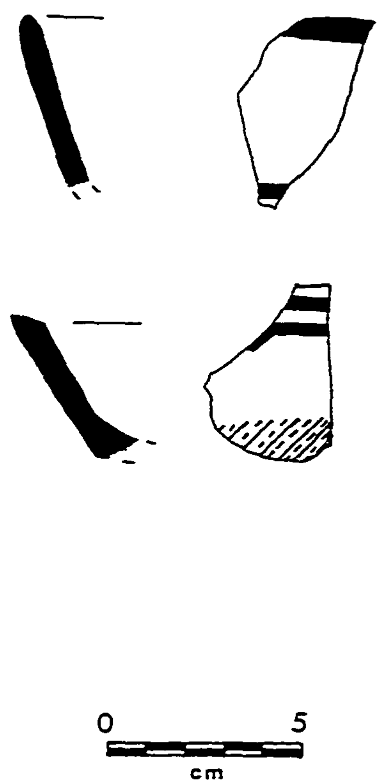


Figure 25: Mul Polychrome: Manax Variety Rim Profiles from Zacpetén.

Intrasite references: All of the Mul Polychrome: Manax variety sherds came from excavations at Zacpetén. Three sherds are from level 1 (humus) and level 2 (collapse) of Structure 719 (residence) and two are from the humus level of Structure 615 (open hall).

Intersite references: Mul Polychrome decorative technique and decorative characteristics are resemble those of Ixpop Polychrome: Ixpop Variety, Pastel Polychrome: Pastel Variety, and Pek Polychrome: Pek Variety. Although decoration elements are eroded, the four types have decoration areas that are delineated by black circumferential bands.

I examined Mul Polychrome sherds from Tayasal and Macanché Island. The sherds from Tayasal have double slipped "waxy" exteriors and some sherds have blackened rims. For the most part, the decoration areas are eroded, but circumferential bands remain.

Macanché Island has a rather large (n=155) collection of Mul Polychrome sherds. Unlike circumferential bands at other Postclassic sites in the Petén lakes area, the majority of the decorative panels at Macanché Island are single banded. The decorative paint at Macanché Island is a brownish red (2.5YR 3-4/2) (Rice 1987a:146) rather than black that occurs at other sites in the Petén lakes region. Forms at Macanché Island are similar to other sites; however, most tripod supports are cylindrical without vent holes. Rim diameters of tripod dishes range from 10-24 cm.

Outside of the Petén lakes region, black painted decoration with cream to tan slips occur. At Naco, a bichrome (Forastero Bichrome) is noted for its black-on-cream decoration (Wonderley 1981:182-186); however vessel forms are similar to those in the Petén lakes region. In northern Yucatán, Holactun Black-on-cream and Xcanchakan

Black-on-cream (Smith 1971:44-45) types are found at Uxmal, Kabah, Chichen Itzá, and Mayapán from A.D. 1000-1450.

Name: Picté Red-on-paste: Ivo Variety

Frequency: This description is based on one sherd from Zacpetén. Picté Red-on-paste: Ivo Variety comprises one percent of the Trapeche ceramic group and .1 percent of the sherds in this sample.

Ware: Volador Dull-Slipped ware.

Established: Present work based on collections from Zacpetén

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Unbanded red-on-paste decoration; 2) Yellowish-red slip; 3) Snail inclusion paste; 4) Tripod dish.

Paste and firing: Cryptocrystalline calcite dominates the light brown (7.5YR 6/3) to gray (2.5Y 6/1) pastes. In addition to cryptocrystalline calcite, quartz, hematite, euhedral and subhedral calcite, biotite, and chert occur in the clay matrix. The sherds are estimated to have been fired between 550-650°C and have a Mohs' hardness of 3.

Surface treatment and decoration: Exterior surfaces are slipped while the interior surface is decorated. Exterior slips are similar to those described for Trapeche Pink: Tramite Variety. The double slipped surfaces are yellowish red (5YR 5/6), with a matte finish. The slip is approximately .25 mm thick and has a Mohs' hardness of 3.

The interior rim and dish bases are the same color as the exterior slip. A primary pinkish white (5YR 8/2) slip with a Mohs' hardness of 3 occurs in the decoration area.

The decoration area is not banded. Decorations are too eroded to determine the decorative motifs, but portions of decorative paint in the decoration panel are yellowish red (5YR 5/6) and red (2.5YR 5/6).

Form and dimensions: Tripod dishes are represented by three sherds. The rim diameter of the tripod plate with a measurable rim is 28 cm and has an interiorly beveled lip shape. The wall thickness of the three sherds ranges from 6.72-8.91 mm ($\bar{x}$=7.84 mm).

Illustrations: Figure 26

Intrasite references: Picté Red-on-paste: Ivo Variety was found in two structures at Zacpetén: 615 (open hall) and 719 (residence). The sherd found in Structure 615 (open hall) was located in level 1 (humus) and the two sherds from Structure 719 (residence) were found in level 2 (collapse) and level 5 (below the last construction floor).

Intersite references: The red-on-paste unbanded decorations present on Picté Red-on-paste: Ivo Variety resembles those of Chompoxté Red-on-cream: Chompoxté Variety in that no evidence of banding exists.

This type does not appear at other sites in the Petén lakes region. Outside of the Petén lakes region, some possible correlates to Picté Red-on-paste: Ivo Variety exist: Mayapán's Tecoh Red-on-buff (Smith 1971:29) and Naco's Nolasco Bichrome (Wonderley 1981).

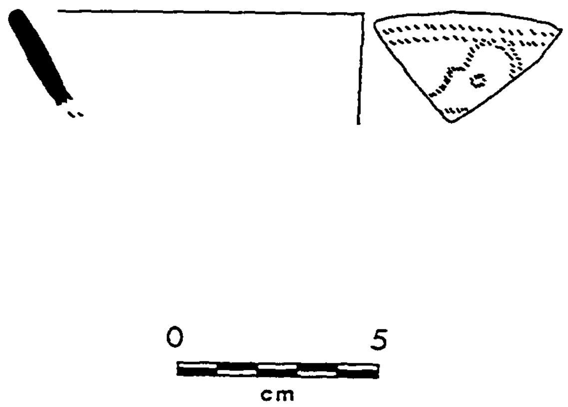


Figure 26: Picté Red-on-paste: Picté Variety Rim Profile from Zacpetén.

Name: Xuluc Incised: Tzalam Variety

Frequency: Four sherds (three from Zacpetén and one from Ixlú) are the basis for this description. Xuluc Incised: Tzalam Variety represents five percent of the sherds in the Trapeche ceramic group and one percent of the sherds in this study.

Ware: Volador Dull-Slipped ware.

Established: Rice (1987a:153-154) first described the Tzalam variety based on Bullard's pottery collection from Macanché Island. The general Xuluc Incised type was first described by Chase (1979:106-110) from his Tayasal pottery collection.

Types of analysis: "Low-tech" (4 sherds); petrographic (2 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal identifying modes: 1) Deep, prefire incising; 2) Light reddish brown to yellowish red slip; 3) Gray snail inclusion paste; 4) Grater bowls and drums.

Paste and firing: The gray (2.5Y 6/1) pastes have brown (10YR 5/3) oxidized margins that are approximately 3 mm wide. Estimated firing temperatures range from 550-600°C resulting in a core Mohs' hardness of 3. Cryptocrystalline calcite dominates the clay matrix with additional euhedral and subhedral calcite, shell, hematite, biotite, and quartz inclusions.

Surface treatment and decoration: Exterior surfaces are slipped light reddish brown (2.5YR 7/3) to yellowish red (7.5YR 6/4). The surfaces are double slipped and similar to other types in the Trapeche ceramic group. Slips are approximately .25 mm thick, have a low luster, and a Mohs' hardness of 2-3.

Interior walls are slipped and have the same characteristics as described for exterior surfaces. Slipping ends at the incisions that appear on the interior base of grater bowls. A single or double circumferential incision delineates the incised area that consists of vertical lines or crosshatching.

Drum sherds have vertical incisions. Incisions begin below the everted rim; however, the length of the incisions cannot be estimated due to their fragmentary nature. The incised area is not slipped, but the slip begins just below the vertical incisions.

Forms and dimensions: Two grater bowls and two drum fragments are the basis for this type definition. The grater bowl walls are taller than the tripod dish walls, have a slight curve, and an interior concave base. The one measurable grater bowl has a direct rim with a rounded lip shape is 28 cm in diameter. Wall thicknesses of all grater bowls range from 8.47-8.88 mm ($\bar{x}$=8.64 mm).

Although there are two drum sherds, only one has a rim. The everted direct rim has a diameter of 18 cm. Wall thickness ranges from 6.42-7.8 mm ($\bar{x}$=7.11 mm).

Illustrations: Figure 27

Intrasite references: The two grater bowls were found at Zacpetén. One was found in level 2 (collapse) of Structure 732 (residence) and the other was found in level 3 (floor) of Structure 719 (residence). One drum fragment was located in level 2 (collapse) of Structure 765 (residence) at Zacpetén. The other drum fragment was located in level 2 (collapse) of Structure 2034 (temple) at Ixlú.

Additional grater bowl fragments were excavated in levels 2 (collapse) and 3 (floor) of Zacpetén Structures 758 (residence) and 764 (temple). Grater bowls were also found in level 1 (humus) of Structure 2041 at Ixlú.

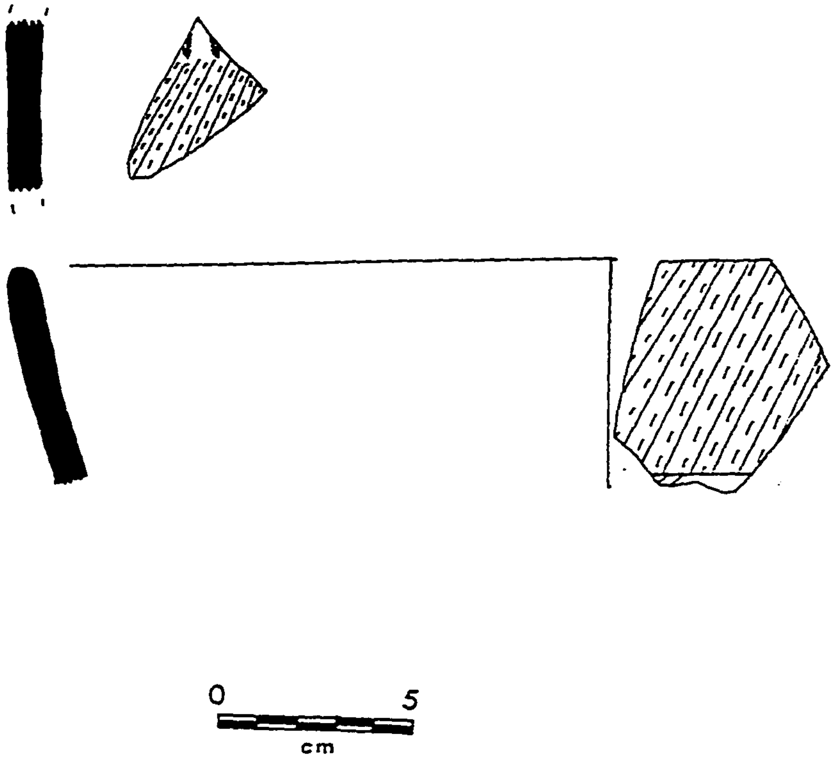


Figure 27: Xuluc Incised: Tzalam Variety Rim Profiles from Zacpetén.

Intersite references: Grater bowls and drums exist in all Postclassic slipped pottery types: Picú Incised: Thub Variety, Hobonmo Incised: Hobonmo Variety, Dulces Incised: Bebeto Variety, and Mengano Incised: Bobo Variety. The Trapeche ceramic group grater bowls and drums that I examined strongly resemble those of the Paxcamán ceramic group in form and dimension.

I also examined Xuluc Incised: Tzalam Variety grater bowls and drums excavated at Macanché Island. Slips resemble other Trapeche Pink double slipped sherds and black fireclouding is common. Gray pastes with snail inclusions predominate; however, one sherd paste is reddish brown and lacks shell inclusions. All but one grater bowl fragment demonstrates use.

Two drum sherds occur at Macanché Island. The vertical incisions with a length of 1 cm appear in groups of three on one rim and deep 3 cm incisions occur near the bolstered rim on the other drum sherd (Rice 1987a:153). "Pink" slip begins below the incisions.

Outside of the Petén lakes region, grater bowl and drum forms exist in northern Yucatán. Xuku Incised (Chichen Red ware), Pencuyut Incised: Pencuyut Variety (San Joaquin Buff ware), Xcanchakan Black-on-cream (Peto Cream ware), and Chichen Slate ware grater bowls resemble those found in the southern lowlands (Smith 1971:16,17, 27, 45). Postclassic drum forms occur in Mama Red (Mayapán Red Ware) and Tekit Incised (Puuc Slate) types (Smith 1971:22, 27).

As previously discussed, grater bowls occur in unslipped types and occur in Late Classic and Terminal Classic deposits in the Maya lowlands.

Augustine Ceramic Group

Name: Augustine Red: Augustine Variety

Frequency: The following description is based on 111 sherds: 40 from Zacpetén; 22 from Ixlú; 21 from Ch'ich'; and 28 from Tipuj. This constitutes 77 percent of the Augustine ceramic group and 20.18 percent of the sherds in this study.

Ware: Vitzil Orange-Red ware.

Established: R.E.W. Adams and Trik (1961:125-127) first established this type based on the Tikal ceramic collection. Chase (1979) defined the Vitzil Orange-red ware category.

Types of analysis: "Low-tech" (111 sherds); petrographic (60 sherds); x-ray diffraction (3 sherds); EDS and SEM and strong-acid extraction ICPS (17 sherds).

Principal identifying modes: 1) Red to red-orange slip; 2) Red to yellowish red carbonate paste; 3) Tripod dishes, bowls, collared jars, and medium high neck jars; 4) Effigy feet.

Paste and firing: Augustine Red paste colors range from red (2.5YR 5/6-2.5YR 5/8) to pale red (10YR 7/4) to yellowish red (5YR 5/6-5YR 5/8). While the majority of the sherds are completely oxidized, some sherds exhibit slightly lighter margins. The completely oxidized sherds were estimated to have been fired at 550-600°C. Those with lighter margins were estimated to have been fired to 300°C and when these sherds were refired to 800°C in an electric kiln, a dark gray margin appeared directly below the slip. The core hardness of all sherds is 3 on the Mohs' hardness scale.

The Augustine Red carbonate pastes include euhedral and subhedral calcite, quartz, hematite, biotite, and chert. Two different clusters based on inclusions occur in the present samples of Augustine Red sherds. The first is a clay matrix with very few inclusions (< 5%) and dominated by voids. The second paste group consists of the inclusions listed above and few voids.

Surface treatment and decoration: A red (2.5YR 4/6, 2.5YR 5/8, 10R 4/6) to pale red (10R 6/4) slip covers the interior and exterior surfaces of Augustine Red: Augustine Variety sherds. The slip is approximately .25 mm thick and has a Mohs' hardness of 2-3. Most of the sherds exhibit a well preserved slip that has a low luster to an almost glossy finish. Few sherds have a matte finish and are eroded. Sherds from Zacpetén and Ixlú have black or tan fireclouds whereas sherds from Ch'ich', Tipuj, and Zacpetén (a very small number) have tan fireclouds. Fireclouding typically occurs on dish bases. The different fireclouding colors may be the result of differential access of oxygen to the slip, mineral differences in slips, and/or technological choices made by the Postclassic Maya.

Forms and dimensions: Augustine Red: Augustine Variety takes many forms that include tripod dishes (n=20), restricted orifice bowls (n=4), collared jars (n=20), and narrow neck jars (n=17). Tripod dish rim diameters range from 20-30 cm ($\bar{x}$=25.5 cm) with wall thicknesses of 5.2-9.64 mm ($\bar{x}$=6.63 mm); rims are direct with rounded, interiorly beveled, and pointed lip shapes. Walls are slightly flared, the dishes have flat bases, and tripod supports take many forms. The two most common tripod support forms are the scroll foot and the cylinder foot with round vent holes, but effigy and bulbous supports with vertical or diagonal vent holes also occur in the collection.

Bowl rim diameters range from 12-25 cm ($\bar{x}$=19.25 cm) and wall thicknesses are 4.91-7.90 mm ($\bar{x}$=6.47 mm). The direct rims have rounded or pointed lip shapes.

Collared jar rim diameters vary between 19-36 cm ($\bar{x}$=26.15 cm). Wall thicknesses are 4.75-10.16 mm ($\bar{x}$=6.89 mm). Direct rims have rounded and interiorly beveled lip shapes.

Medium high neck jar rim diameters range from 14-34 cm ($\bar{x}$=20.82 cm) with wall thicknesses of 5.3-8.5 mm ($\bar{x}$=7.12 mm). Although the majority of jar necks are vertical, some are outcurving. Direct rims have rounded, interiorly beveled, everted, and exteriorly thickened lip shapes.

Illustrations: Figures 28, 29, and 30

Intrasite references: The red slip of Augustine Red sherds is part of the same tradition as that of Paxcamán Red and Topoxté Red types and other Maya lowland red monochrome slipped types. Augustine Red slips from Tayasal and Tipuj are fairly thick with a low luster to "waxy" finish that resembles that of the Preclassic Sierra Red type.

Augustine Red sherds occur at Zacpetén, Ixlú, Ch'ich', and Tipuj. Tipuj has the highest quantity (by frequency and weight) of these sherds. Augustine Red: Augustine Variety sherds were found in all five excavated Postclassic structures and in all levels of Complex 1 at Tipuj. At Ixlú, Augustine Red sherds came from the following structures: 2003 (domestic), 2006 (domestic), 2022 (open hall), 2034 (temple), and 2041 (residence). All but 6 sherds were located in the first three levels (last occupation) and the remaining sherds were located in fill layers below the first floor and above the second floor.

In addition to the sherds described above, all Zacpetén structures except 664 (residence) have Augustine Red sherds. At Ixlú, Structures 2017 (open hall), 2021 (open

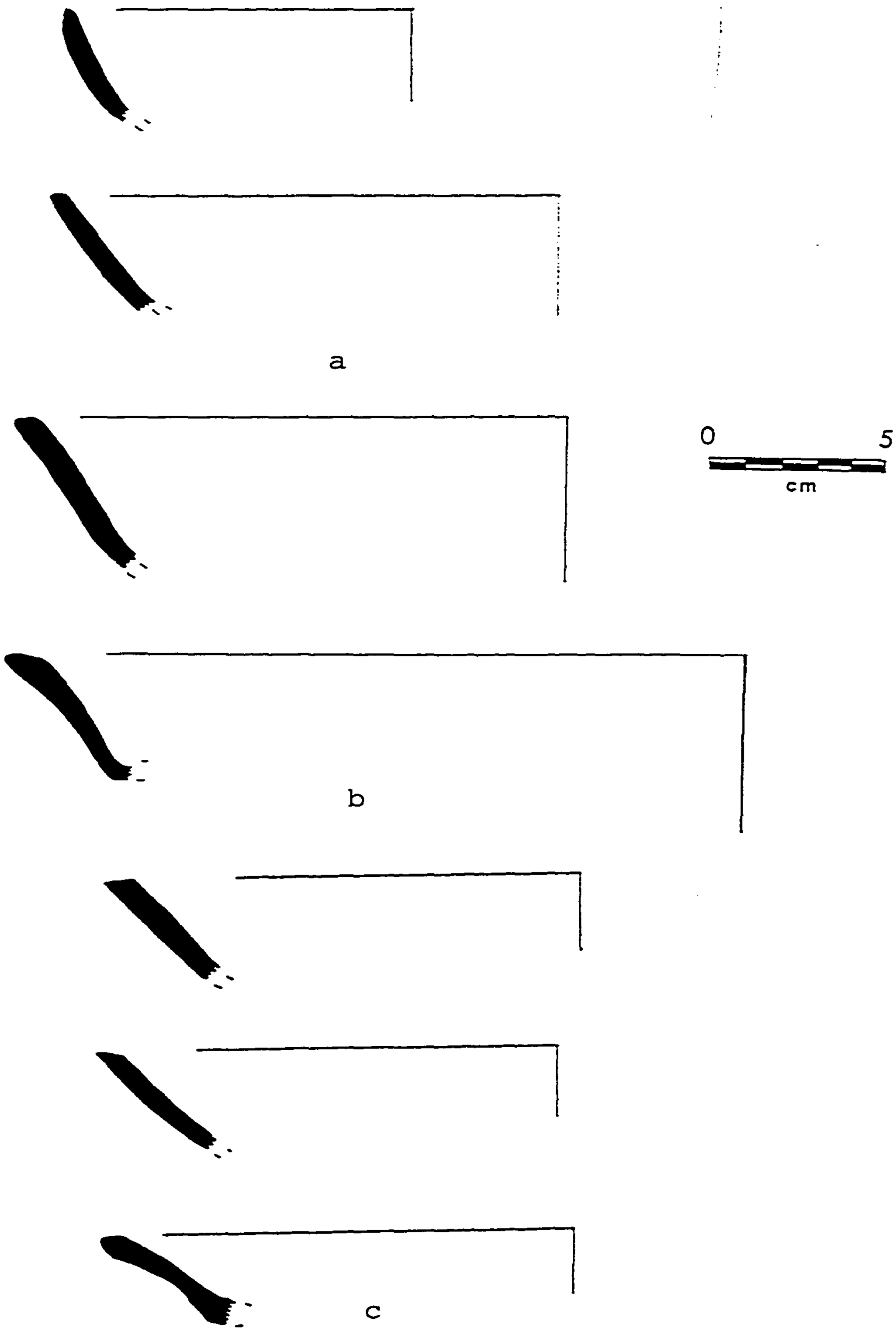


Figure 28: Augustine Red Tripod Plate Rim Profiles from Ixlú (a), Ch'ich' (b), and Tipuj (c).

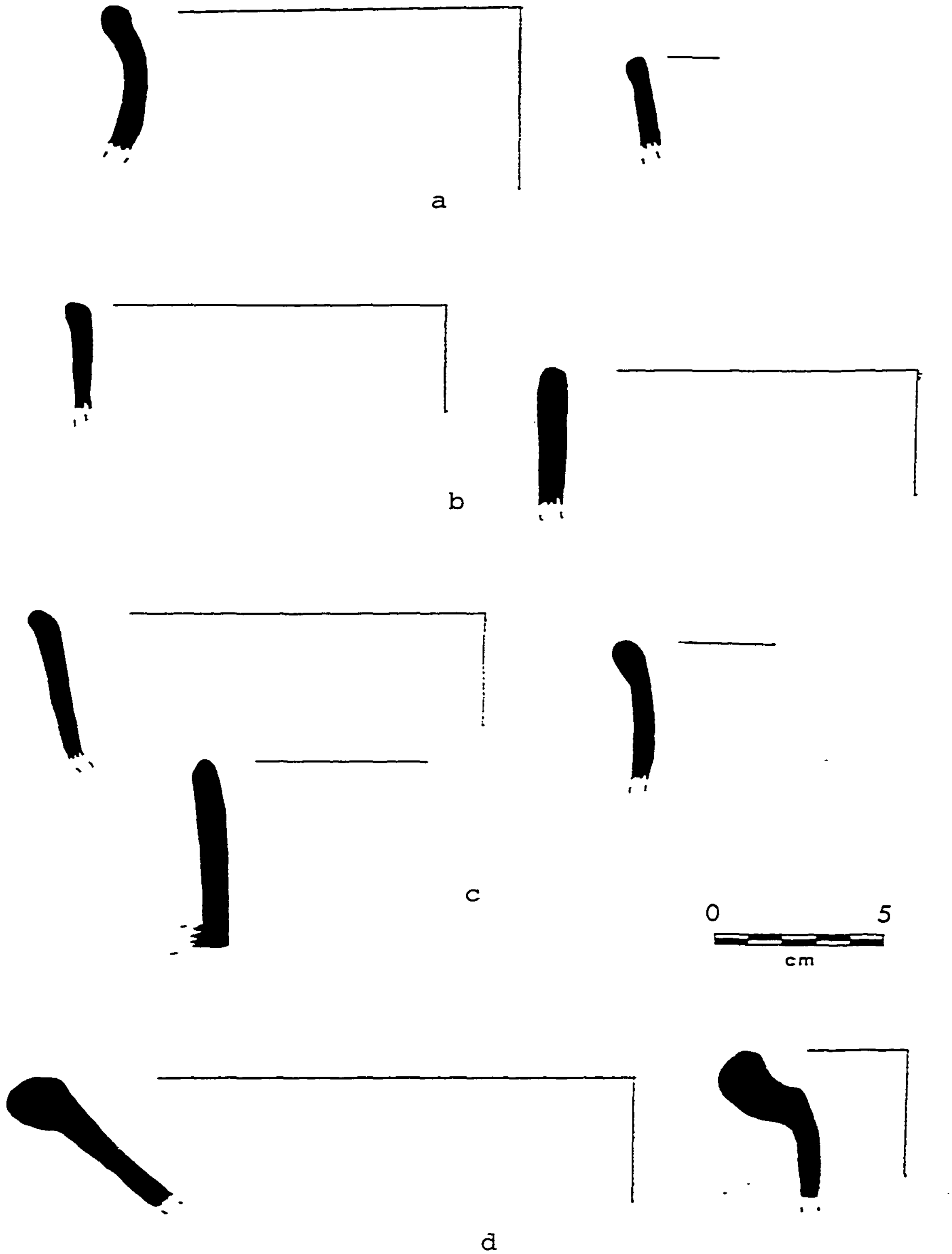


Figure 29: Augustine Red Jar Rim Profiles from Zacpetén (a), Ixlú (b), Ch'ich' (c), and Tipuj (b).

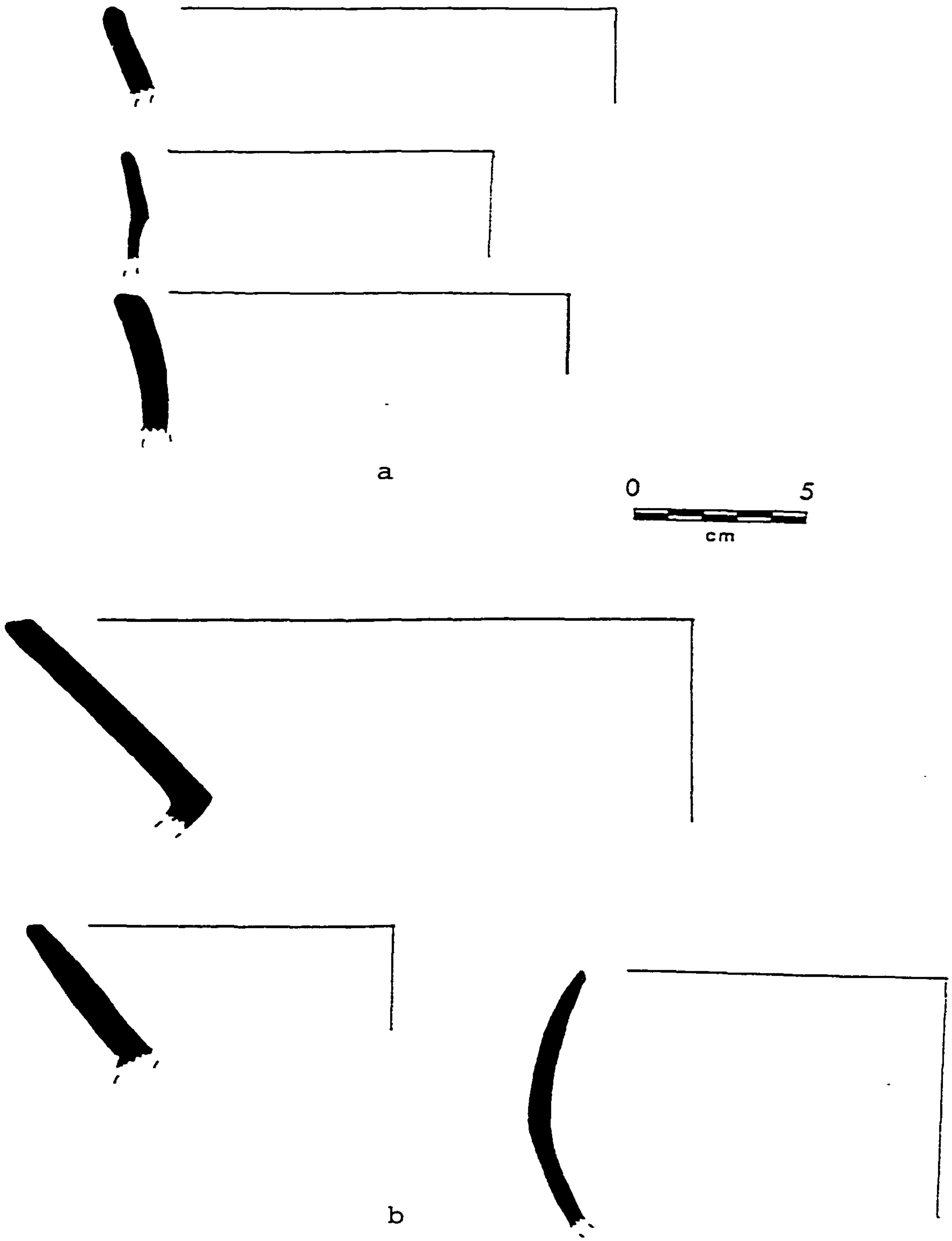


Figure 30: Augustine Red Miscellaneous Rim Profiles from Zacpetén (a) and Tipuj (b).

hall), and 2023 (temple) also included Augustine Red sherds.

Intersite references: I examined Augustine Red sherds from Tayasal and Macanché Island. The majority of Postclassic sherds from Tayasal are of this type. Paste colors from Tayasal vary from orangish red to half orangish red and half tan to completely tan. Tan pastes occur where slips have tan fireclouds. The same pattern is present at Tipuj. Slips at Tayasal are red (10R 4/6), fairly thick, and have a low luster. For the most part, the slip characteristics are similar to those at Tipuj; however, paste colors vary. Collared bowls, tripod dishes, jars, and restricted orifice jars occur at Tayasal. Rim diameters in all form classes are similar to those described above. Excavations by individuals from the town of San Miguel (the modern city constructed over the archaeological site of Tayasal) for modern lakeside residences in 1996 yielded an enormous amount of supports. Effigy forms dominated, but scroll, cylinder, and bulbous forms also occurred.

Although Augustine Red sherds appear at Macanché Island, they do not occur in the large quantities similar to Tayasal and Tipuj. Paste and slip characteristics resemble those described for Tayasal, but black and tan fireclouding occurs. Tan fireclouded areas resemble Trapeche Pink double slips. Some exterior slips may have been double slipped, as judged from the presence of a cloudy cream overslip with a low luster. This may be a double slip or the result of post-depositional alteration, but unlike Topoxté Red sherds described below, the creamy overslip also has a low luster finish.

In addition to Tayasal and Macanché Island, the Quexil Islands, Tikal, and Flores Island also have Augustine Red sherds. Rice (1987a:167) notes that CPHEP excavations at Lake Quexil revealed a significant quantity of Augustine Red sherds. Augustine sherds from Tikal come from excavations in Temple 1 (Adams and Trik 1961:125-127).

Cowgill (1963:76-85) description of the Augustine sherds from Flores Island leads me to believe that the "red" paste colors he describes are similar to those from Tayasal, Ch'ich', and Zacpetén and slips he describes resemble those of Tipuj because of the orange red color, tan fireclouds, and the "waxy" finish. Forms include tripod dishes with scroll and effigy supports, bowls, restricted orifice bowls, and low, medium, and high neck jars. Rim diameters are within the range described for other sites in the Petén lakes region.

Outside of the Petén lakes region, Augustine Red sherds appear at Barton Ramie (Sharer and Chase 1976:291-293) and Colhá (Valdez 1987:212, 216). The sagging bottom tripod dish with effigy supports form is not seen in the Petén lakes region, but the Barton Ramie effigy supports resemble those from Tipuj and Tayasal. The pink orange paste and "waxy" red slip described by Sharer and Chase (1976:293) is similar to pottery at Tipuj. Sharer and Chase (1976:293) state that these sherds may be earlier than those in the Petén lakes region.

Valdez (1987:216) notes the presence of a tripod dishes with scroll and bulbous supports.

Name: Pek Polychrome: Pek Variety

Frequency: The following Pek Polychrome description is based on 17 sherds: two from Ch'ich'; three from Ixlú; six from Zacpetén; and six from Tipuj. This sample constitutes 12 percent of the Augustine ceramic group and 3.09 percent of the total sherds in this study.

Ware: Vitzil Orange-Red ware

Established: Cowgill (1963:76) first described Pek Polychrome: Pek Variety based on ten sherds from his Lake Petén Itzá collection.

Types of analysis: "Low-tech" (17 sherds); petrographic (11 sherds); x-ray diffraction (1 sherd); EDS and SEM and strong-acid extraction ICPS (7 sherds).

Principal identifying modes: 1) Black painted decorations; 2) Red slip; 2) Red to yellowish red carbonate paste; 4) Tripod dishes, bowls, collared jars, and narrow neck jars.

Paste and firing: Paste colors are red (2.5YR 5/8, 4/8) to yellowish red (5YR 6/4, 5/6). All but three sherds are well oxidized; however, when all of the sherds were refired to 800°C, over two-thirds of the sample exhibited a black margin below the slip. These sherds have an estimated firing temperature of 300°C and the remaining one-third of the sample has an estimated firing temperature of 550-600°C. Core hardness for all sherds is 3 on the Mohs' hardness scale.

All but two sherds from Ixlú have a clay matrix that is dominated by cryptocrystalline calcite. Subhedral and euhedral calcite, hematite, quartz, chert, and biotite are also in the clay matrix. The remaining two sherds from Ixlú have a clay matrix that is predominantly angular voids with a few (< 2 percent) chert, quartz, and hematite inclusions.

Surface treatment and decoration: Exterior slips are red (10R4/6, 4/8, 2.5YR 4/6, 4/8) and the majority have a low luster finish. The remaining sherds are fairly eroded and have a matte finish. Slip thicknesses vary from .125-.375 mm with a Mohs' hardness of 2-3. Although uncommon, black fireclouding occurs on rims.

Pek Polychrome: Pek Variety interior surfaces are decorated with black (7.5YR 3/1, 5YR 3/1, 2.5Y 2.5/1) line bands and decorative elements. The black decorations are painted over a light red (2.5YR 7/8) primary slip. Decoration areas have either double or single top and bottom circumferential bands. One sherd, a possible bowl from Ixlú, has a quadruple upper circumferential band. Decorations are highly eroded, but where discernible, hooks, plumes, curvilinear lines, and mat motifs occur on Pek Polychrome: Pek Variety sherds.

Form and dimension: Black line decorations appear on tripod plates (n=7), collared jars (n=2), and narrow neck jars (n=1). Tripod plates have slightly outcurving walls, flat bases, and direct rims with pointed, rounded, and interiorly beveled lip shapes. Rim diameters range from 24-44 cm ($\bar{x}$=27.86 cm) and wall thicknesses of 5.01-7.89 mm ($\bar{x}$=6.85 mm).

Two tripod plates have basal flanges. The flanges are composed of two steps on both the right and left sides. The first step has a height of 5.20 mm and the second step has a height of 4.68 mm. Rim diameters are 28 cm and 30 cm ($\bar{x}$=29 cm) with wall thicknesses of 6.65 mm and 8.83 mm ($\bar{x}$=7.49 mm). The direct rims are rounded and squared.

Collared bowl necks are outflaring and the direct rims have rounded and interiorly beveled lip shapes. Rim diameters range from 24-32 cm ($\bar{x}$=28 cm) and wall thicknesses of 5.14-5.22 mm ($\bar{x}$=5.18 mm).

One sherd represents a medium high-necked jar with a neck height of 5.5 cm. The jar rim diameter is 24 cm and a wall thickness of 7.90 mm. The direct rim is rounded.

Illustrations: Figure 31

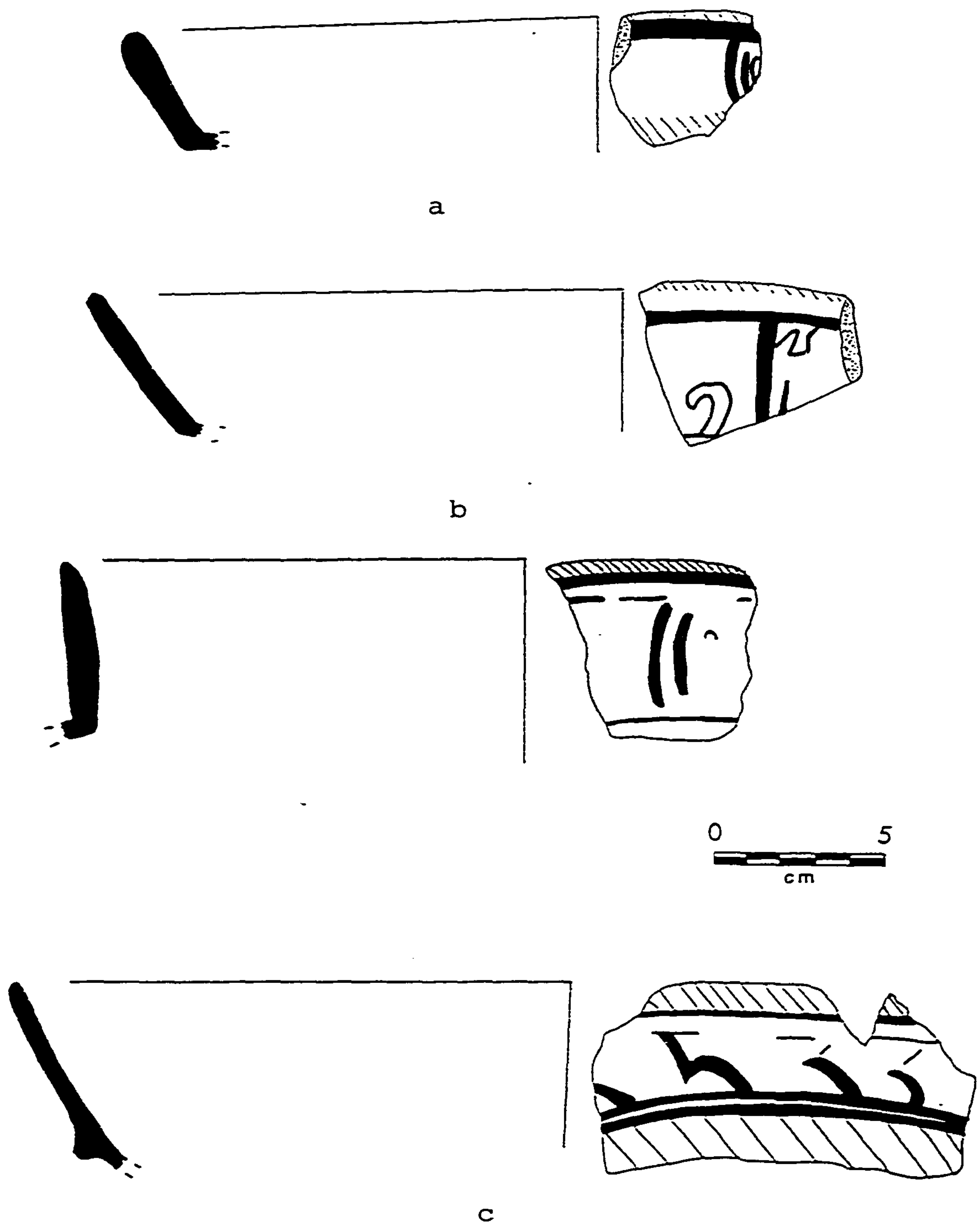


Figure 31: Pek Polychrome Rim Profiles from Zacpetén (a), Ch'ich' (b), and Tipuj (c).

Intrasite references: All Pek Polychrome: Pek Variety sherds in this study were found in the first two levels of excavation (humus and collapse). At Ch'ich' all sherds come from Structure 188. Pek Polychrome sherds from Ixlú were found in Structure 2034 (range structure). Sherds from Zacpetén come from Structures 606 (an open hall)and 767 (an open hall). Structures 1 (oratorio) and 2 (temple) and the Complex 1 plaza floor at Tipuj had Pek Polychrome sherds.

Additional Pek Polychrome sherds come from Zacpetén Structures 605 (oratorio), 614 (oratorio), and 719 (residence) and Structures 4 and 5 (open halls) at Tipuj.

Intersite references: Pek Polychrome resembles other black painted decorative types in the Petén lakes region such as Ixpop Polychrome, Mul Polychrome, and Pastel Polychrome. Tayasal and Flores Island are the only other sites in the Petén lakes region to have Pek Polychrome sherds.

Pek Polychrome sherds that I examined from Tayasal have tan to orange pastes and the exterior slip is red similar to that described above. The decoration areas have a lighter color primary slip that is delineated by two or three top circumferential bands. Unfortunately, all other elements of the decoration are eroded.

Cowgill (1963:83) compared Pek Polychrome sherds from Flores Island to Ixpop Polychrome sherds. Unfortunately, he grouped Pek Polychrome with Augustine Red sherds and did not provide a description or drawings.

Barton Ramie and Colhá are the only sites outside of the Petén lakes region that have Pek Polychrome sherds. As at other sites, Pek Polychrome sherds are rare–only 10 at Barton Ramie (Sharer and Chase 1976:294). Some decorations do, however, differ from those in the Petén lakes region. There are at least two cases where the decoration is negatively painted. The negative and positively painted decorations are on top of a lighter orange primary slip and are defined by two upper and one lower circumferential bands. Rim diameters are also smaller (20-38 cm) than those from Ch'ich', Ixlú, Zacpetén, and Tipuj.

Valdez (1987:217-218) states that Colhá excavations produced three Pek Polychrome sherds. The interior decorated surfaces are slipped orange (perhaps a primary slip) with black painted decoration.

In addition to Barton Ramie and Colhá, black painted decoration that is similar to Ixpop Polychrome occurs in northern Yucatán as Mama Red: Black-on-unslipped Variety Polychrome (Mayapán Red ware) (Smith 1971:22-23).

Name: Graciela Polychrome: Graciela Variety

Frequency: The following Graciela Polychrome description is based on three sherds from Zacpetén. Graciela Polychrome: Graciela Variety comprises two percent of the Augustine ceramic group and .55 percent of the total sherds in the study.

Ware: Vitzil Orange-Red ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (3 sherds); petrographic (2 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (1 sherd).

Principal identification modes: 1) Red and black painted decoration; 2) Red exterior slip; 3) Light reddish brown to reddish yellow carbonate paste; 4) Tripod dishes, flanged tripod dishes, and collared jars.

Paste and firing: Graciela Polychrome: Graciela Variety pastes are light reddish brown (5YR 6/4) to reddish yellow (5YR 6/6) in color. The pastes are well oxidized and two are estimated to have been fired to 300°C while the third is estimated to have been fired to 700°C. Core hardness is 3 on the Mohs' hardness scale.

Graciela pastes are dominated by cryptocrystalline calcite. Additional minerals in the clay matrix include euhedral and subhedral calcite, quartz, hematite, and biotite.

Surface treatment and decoration: Exterior surfaces and the interior lip are slipped red (2.5YR 4/8). The slip finish is generally a low luster, but one eroded sherd has a matte finish. One sherd has single-step basal flanges that are slipped. Slip thickness is approximately .25 mm, with hardness of 2-3.

Interior surfaces are decorated. Black (5YR 3/1) and red (7.5R 4/6) decorations are painted on top of a reddish yellow (7.5YR 6/6) primary slip. The decoration area is delineated by red and black circumferential bands. The top series of bands has either four bands (black then red then red then black) or two bands (red then black). Only one sherd has a single bottom black band. Although, decorative elements are eroded, a curvilinear line occurs on one sherd.

Form and dimension: This Graciela Polychrome: Graciela Variety description is based on three form types: a tripod dish, a flanged tripod dish; and a collared jar. The tripod dish has slightly flared walls and a direct rim with a squared lip shape. The rim diameter is 28 cm with a wall thickness of 7.88 mm.

The flanged tripod dish sherd is a body sherd. The wall thickness is 6.64 mm and the flange height is 4.76 mm.

The third sherd represents a collared bowl with a flared neck. The rim diameter is 28 cm with a wall thickness is 7.91 mm. The direct rim has a square lip shape.

Illustrations: Figure 32

Intrasite references: The three sherds that are examples of this type were found in levels 1 and 2 (humus and collapse) of Structure 719 (a residence) at Zacpetén. Graciela Polychrome sherds also appear in Structure 767 (open hall) at Zacpetén and Structure 2 (temple) at Tipuj.

Intersite references: Graciela Polychrome's red and black painted decoration patterns can also be seen in the Canté Polychrome, Sacá Polychrome, and Dolorido Polychrome types. All of the types have a series of red and black circumferential bands with either red and/or black decorative motifs. Unfortunately, the decorative elements described above are eroded and do not permit intersite comparisons.

This type does not exist outside of the Petén lakes area. However, Pele Polychrome jars of the San Joaquin Buff are at Mayapán may be similar in that they are decorated with red and black painted decorations (Smith 1971:229).

Name: Hobonmo Incised: Ramsey Variety

Frequency: This description is based on five sherds: two from Zacpetén and three from Tipuj. The five sherds comprise three percent of the Augustine ceramic group and .91 percent of the total sherds in this sample.

Ware: Vitzil Orange-Red ware

Established: Chase (1983) first described Hobonmo Incised: Ramsey Variety based on a pottery collection from Tayasal.

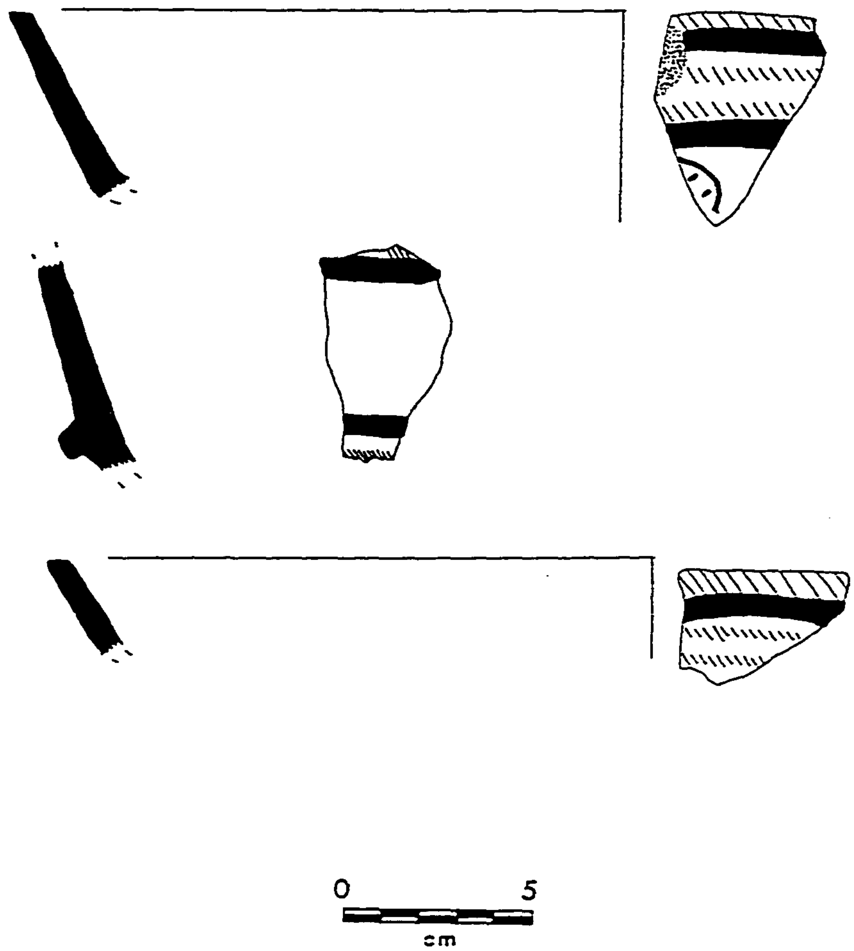


Figure 32: Graciela Polychrome: Graciela Variety Rim Profiles from Zacpetén.

Types of analysis: "Low-tech" (5 sherds); petrographic (2 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (2 sherds).

Principal identifying modes: 1) Pre- or post-fire fine line incising; 2) Red slip; 3) Red to brown carbonate paste; 4) Tripod dishes, collared jars, and short neck jars.

Paste and firing: Paste colors range from red (2.5YR 5/8, 4/8, 5YR 5/6) to brown (10YR 5/3). All but one sherd is completely oxidized and estimated firing temperatures range from 300-800°C. The sherd that was fired to an estimated 300°C has a darker core. The sherd that was fired to and estimated 800°C has a red paste that is dominated by calcite to such an extent that the paste color appears almost white. Core hardness is 3 on the Mohs' hardness scale.

All Hobonmo Incised: Ramsey Variety sherd clay matrices are dominated by cryptocrystalline calcite. In addition to the cryptocrystalline calcite, subhedral and euhedral calcite, quartz, hematite, and chert occur in the clay matrix.

Surface treatment and decoration: Sherds are slipped red (2.5YR 5/6, 4/8, 7.5R 4/6, 10R 4/6). The slip is .125-.25 mm thick with a Mohs' hardness of 2-3. Exterior surfaces of tripod dishes, and exterior and interior neck surfaces of collared jars and narrow neck jars are slipped red. Better preserved sherds have a glossy finish while poorly preserved sherds have a low luster to matte finish.

Collared jars are incised on the exterior surfaces. Post-fire, fine line incising begins below or at the neck/shoulder junction. Single upper and lower circumferential bands delineate the decoration. In this case, the decoration is paneled by two vertical lines. The decorative motif is an *ilhuitl* glyph.

The short neck jar is slipped on the exterior and is incised on the interior neck.

The mat motif is delineated by two top and bottom circumferential bands. A decoration below the bottom band exists, but the sherd is broken below that point.

The tripod dish is incised on an interior surface that does not appear to have a primary slip. The fine line, pre-fire incised area is encompassed by a single black painted circumferential band. A decoration of plumes and circles is paneled by two vertical incised lines.

Form and dimension: Hobonmo Incised: Ramsey Variety appears on tripod dishes (n=1), collared jars (n=1), and short neck jars (n=1). The tripod dish has slightly outcurving walls and a direct rim with a rounded lip shape. The rim diameter is 24 cm and the wall thickness is 6.43 mm.

The collared jar has a flared neck and a direct rim with a interiorly beveled lip shape. The rim diameter is 18 cm with a wall thickness of 5.03 mm.

The short neck jar's neck height is 3.1 cm. The direct rim has a rounded lip shape. The jar's rim diameter is 24 cm with a wall thickness of 4.75 mm.

Although not included in the sample for the above description, some flanged collared jars and/or bowls have flanges that are decorated with vertical incisions.

Illustrations: Figure 33

Intrasite references: The two sherds from Zacpetén come from level 2 of Structure 764 (a temple) and 606 (an open hall). The three sherds from Tipuj were found in the first two levels of excavation (humus and collapse) in Structures 2 (temple) and 3(open hall). Hobonmo Incised: Ramsey Variety sherds were also located in Structure 1 (oratorio) at Tipuj.

Intersite references: Fine line post-fire incising is common in all Postclassic

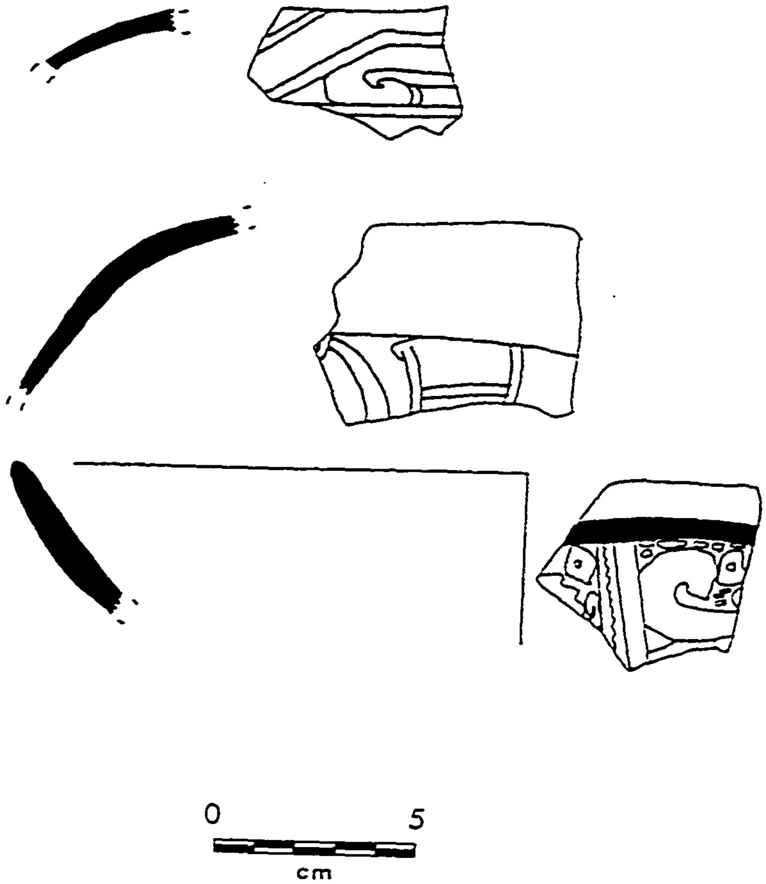


Figure 33: Hobonmo Incised: Ramsey Variety Rim Profiles from Tipuj.

slipped ceramic groups and includes the following types: Picú Incised: Picú Variety, Xuluc Incised: Ain Variety, Dulces Incised: Dulces Variety, and Mengano Incised: Mengano Variety. Decoration boundaries are defined in all groups by one to three top and bottom circumferential bands. For the most part, the decoration complex of the various types is similar, except Hobonmo Incised: Ramsey Variety has an added motif: the *ilhuitl* glyph.

I examined Hobonmo Incised: Ramsey Variety sherds from Tayasal. The incised sherd has circles and diagonal small lines. The coarse paste has a darker red color than most other Augustine group ceramics from Tayasal.

Outside of the Petén lakes area, incised decoration is common. At Barton Ramie, the closest analogy to Hobonmo Incised: Ramsey Variety is Mauger Gouged-incised: Mauger Variety. This type name implies gouging which does not appear on Petén lakes slipped Postclassic pottery. However, the intersite descriptions provided by Sharer and Chase (1976:293-294) draw comparisons to Pico [sic.] Incised of the Paxcamán ceramic group. The same Mauger Gouged-incised: Mauger Variety occurs at Colhá (Valdez (1987:216-217).

According to Graham (2000, personal communication) and Rice (1999, personal communication) the incised *ilhuitl* glyph occurs at Lamanai which may suggest ties/contact between Tipuj and Lamanai. (The *ilhuitl* glyph also occurs on two examples of Paxcamán painted pottery.) In addition to Postclassic pottery at Lamanai, the *ilhuitl* glyph is common at Tulum and Tancah (Sanders 1960). Incised types at most archaeological sites in northern Belize and northern Yucatán are more common than polychrome types. Therefore, it would not be surprising to observe stylistic connections between the northern and southern Maya lowlands. Decorative motifs, such as scrolls, mats, hooks, and stepped frets, at Mayapán are similar to those seen in the Petén lakes region (Smith 1971:48-67).

Name: Hobonmo Incised: Hobomno Variety

Frequency: Seven sherds comprise this description: two from Ch'ich', two from Ixlú, and three from Tipuj. Hobonmo Incised: Hobonmo Variety comprises five percent of the Augustine ceramic group and1.27 percent of the total sherds in the study.

Ware: Vitzil Orange-Red ware

Established: Chase (1983) established this type and variety based on pottery collections from Tayasal.

Types of analysis: "Low-tech" (7 sherds); petrographic (4 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (2 sherds).

Principal identifying modes: 1) Pre-fire wide- line incisions; 2) Red slip; 3) Reddish yellow to light reddish brown carbonate paste; 4) Drums and grater bowls.

Paste and firing: Paste colors range from reddish yellow (5YR 6/6) to light reddish brown (10YR 6/4). Half of the sherds are oxidized throughout, with the remaining having light brownish gray (10YR 6/2) margins. All of the sherds but one were estimated to have been fired between 450-750˚C . The remaining sherd was fired to an estimated 300˚C. The low fired sherds (with estimated firing temperatures below 500°C) produced a black core just below the slip surface when fired to 400˚C in an electric kiln. Core hardness is 3-4 on the Mohs' hardness scale.

Two different clay matrices occur in this group. The first group has abundant voids and with approximately 15% of the clay matrix being quartz, biotite, ferruginous lumps (hematite), and cryptocrystalline calcite. The second group is dominated cryptocrystalline calcite with 20% of the clay matrix consisting of quartz, chert, ferruginous lumps (hematite), chert, and subhedral and euhedral calcite.

Surface treatment and decoration: Exterior and interior surfaces are slipped red (2.5YR 5/8,4/8, 10R 4/8, 7.5R 4/8). Some slips have a low luster and occur mainly on grater bowls. Drum sherds, on the other hand, tend to have a matte finish. Black fireclouds occur near rims and on bowl walls. Slip hardness is 2-3 on the Mohs' hardness scale.

Grater bowls are incised on the interior base of the bowl. The pre-fire deep incising appears as parallel lines that are bounded by one or two circumferential bands. Slip remains on the incised area, suggesting that incisions were made before the vessels were slipped.

Drums have a series of vertical incisions that begin below the vessel's exteriorly thickened or folded rim. Length of the incisions varies between 1.50-3.00 cm and they occur in groups of three. The incised area is not slipped, but slip does begin 1-3 cm below the incisions.

Form and dimensions: Grater bowls (n=3) and drums (n=4) appear with wide line, pre-fire incising. Grater bowls are represented in this study by bowl base fragments that are slightly concave. Base thicknesses range from 4.82-5.01 mm ($\bar{x}$=4.92 mm).

All but one drum sherd is represented by vertical walls that have exteriorly thickened direct rims. Although there are five drum sherds, only one has a measurable rim with a diameter of 16 cm. One drum sherd has a direct rim with a rounded lip shape.

Wall thicknesses range from 8.16-10.21 mm (mean=8.72 mm).

Illustrations: Figure 34

Intrasite references: All sherds described above were located on or above the latest floor (levels 1-3). Sherds from Ch'ich' came from Structure 188 (open hall), sherds from Ixlú came from Structure 2034 (temple), and sherds from Tipuj came from Structures 1 (oratorio) and 2 (temple).

In addition to the above locations, drum fragments were excavated from Structure 2 (temple) at Tipuj. Additional grater bowl fragments were located in Structure 719 (residence), Structure 748 (unknown), and Structure 764 (temple) at Zacpetén, Structures 2023 (temple) and 2041(residence) and Ixlú and Structure 3 (open hall) at Tipuj.

Intersite references: Grater bowls and drums exist in all Postclassic slipped pottery types: Picú Incised: Thub Variety, Xuluc Incised: Tzalam Variety, Dulces Incised: Bebeto Variety, and Mengano Incised: Bobo Variety. Grater bowls with tripod supports are similar among the types, but drum rim forms differ. For example, Dulces Incised: Bebeto Variety has straight walled jar necks while Hobonmo Incised: Hobonmo Variety have everted rims and some are exteriorly thickened. All drums have incising below the rim. Smith (1971:77) suggests that the incisions were added for traction for the cloth that was placed over the opening. Although this may be the case, Hobonmo Incised drums have incisions that occur in groups separated by non-incised areas. This may suggest that the incisions held a dual role: traction and decoration.

Hobonmo Incised: Hobonmo Variety occurs at Tayasal and Flores Island. I examined grater bowl sherds from the Tayasal collection. The outer one-half portion of the sherd paste is tan. This type of oxidation resembles the sherd cores common at Tipuj

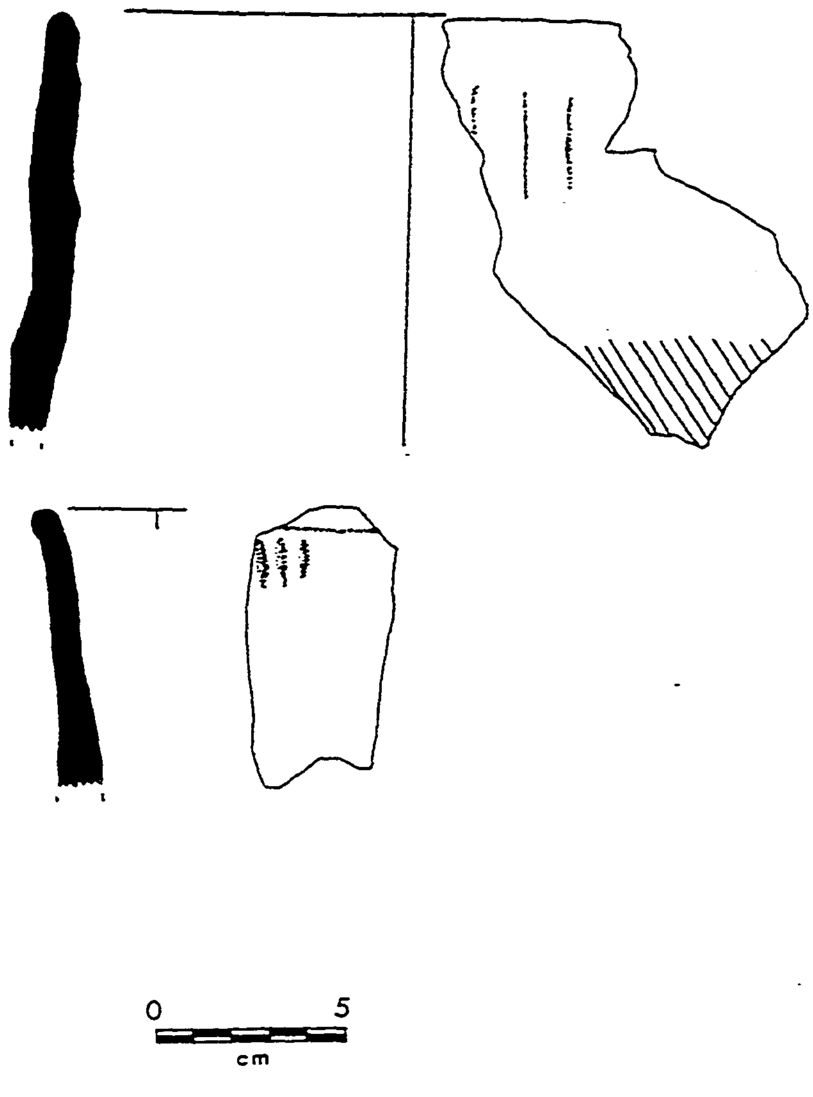


Figure 34: Hobonmo Incised: Hobonmo Variety Rim Profiles from Tipuj.

and in the Augustine Red types described above. The sagging bottom bowls have bulbous supports that are hollow and have vertical slashes. All of the examples in Chase's collection at the University of Cental Florida show use wear. In addition to grater bowls, a possible drum fragment also exists. The fragment is small and undiagnostic as to form and lip shape.

Cowgill (1963:84, Figure 2g) notes the presence of two grater bowls with cross-hatching on the interior base on Flores Island.

No other examples of Hobonmo Incised: Hobonmo Variety exist outside of the Petén lakes region. However, grater bowls and drums with a similar shape exist in northern Yucatán. Xuku Incised (Chichen Red ware), Pencuyut Incised: Pencuyut Variety (San Joaquin Buff ware), Xcanchakan Black-on-cream (Peto Cream ware), and Chichen Slate ware have grater bowl forms that resemble those found in the southern lowlands (Smith 1971:16,17, 27, 45). Grater bowls and drum also occur in Late/Terminal Classic contexts at Uaxactún (Smith 1955).

Name: Johnny Walker Red: Black Label Variety

Frequency: This description is based on one sherd from Tipuj. Johnny Walker Red: Black Label Variety comprises one percent of the Augustine ceramic group and .18 percent of the sherds in this study.

Ware: Vitzil Orange-Red ware

Established: Rice (1985:13-14) first described the type from Tipuj pottery collections.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction

(0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Black slipped incised area; 2) Fine line, post-fire incising; 3) Red exterior slip surrounding incised area; 4) Red carbonate paste.

Paste and firing: The red (2.5YR 4/8) paste is completely oxidized and was estimated to have been fired between 650-700°C with a Mohs' hardness of 2. The clay matrix is dominated by cryptocrystalline calcite with quartz, biotite, and hematite inclusions.

Surface treatment and decoration: The exterior surface is slipped reddish-brown (2.5YR 5/4) and the incised area is slipped black (7.5YR 2.5/1). The red slip is very eroded while the black slip is better preserved. Both slips may have had a low luster, but only the black slip retains its low luster.

The post-fire incised decoration is marked by a single lower circumferential band. The decorative motif is most probably a bird; however only plumes exist on the fragmented sherd.

Form and dimension: The above description is based on a body sherd of indeterminate form with a wall thickness of 8.28 mm.

Illustration: Figure 35

Intrasite references: The sherd was located in level 1 (collapse) of the Postclassic plaza floor of Complex I at Tipuj.

Intersite references: Johnny Walker Red: Black Label Variety does not exist at other Petén lakes sites. However, Rice (1985:13) notes that similar vessels have been reported at Lamanai and in northern Yucatecan traditions in the Terminal Postclassic to Historic period deposits. She also notes that this type is an example of the "general

Figure 35: Johnny Walker Red Rim Profile from Tipuj.

decline in the attention given to finishing, slipping, and firing" during the later periods of occupation at most Maya sites (Rice 1985:13).

Topoxté Ceramic Group

Name: Topoxté Red: Topoxté Variety

Frequency: This description is based on 55 sherds: 17 from Ixlú and 38 from Tipuj. Topoxté Red: Topoxté Variety constitutes 45 percent of the Topoxté ceramic group and10 percent of the total sherds in this study.

Ware: Clemencia Cream Paste ware.

Established: Bullard (1970) first described Topoxté Red pottery from collections of pottery excavated at Topoxté Island. Rice (1979:15-21) modified this type and variety CPHEP excavations on Canté Island.

Types of analysis: "Low-tech" (55 sherds); petrographic (24 sherds); x-ray diffraction (1 sherd); EDS and SEM and strong-acid extraction ICPS (9 sherds).

Principal identifying modes: 1) Red to yellowish red slip; 2) Cream to light gray to pale brown marly paste; 3) Tripod plates, narrow neck jars, collared jars, and restricted orifice bowls.

Paste and firing: Topoxté Red: Topoxté Variety pastes have two different paste colors: pale brown (10YR 8/2, 8/3, 7/3, 7/4) and light gray (10YR 7/1, 2.5Y 7/1). Although the majority of the sherds are oxidized throughout, three sherds have gray to light gray cores. Estimated firing temperatures vary from 400-650°C with a core hardness of 2-3 on the Mohs' hardness scale.

The fine marly textured paste has fine inclusions of euhedral, subhedral, and cryptocrystalline calcite, quartz, hematite, biotite, and chert minerals. Different inclusions combine together to form three different clay matrix groups: 1) voids and few (<1 percent) inclusions; 2) calcite, quartz, hematite, and biotite; and 3) calcite, quartz, hematite, biotite, and chert.

Surface treatment and decoration: Interior and/or exterior surfaces are slipped red (10R 5/6, 4/6, 2.5YR 5/8, 4/8) to yellowish red (5YR 5/6). Black fireclouds occur on the exterior of many of the sherds. Slips are .25-.575 mm thick and oxidized layers exist directly below the slip. Most slips have a matte finish; however some exhibit a low luster finish that may be the result of double slipping (red and creamy white) or deposition. Slip hardness is 2-3.

Forms and dimensions: The present sample of Topoxté Red: Topoxté Variety includes narrow neck jars (n=9), tripod plates (n=2), collared jars (n=5), and restricted orifice jars (n=1). Narrow neck jar rim diameters range from 6-32 cm ($\bar{x}$=20.67 cm) with wall thicknesses of 4.96-8.53 mm ($\bar{x}$=5.44 mm). Narrow neck jar heights range from 8.5-6.0 cm (most sherds are too fragmentary to measure neck height) with outcurving walls. Direct rims are exteriorly thickened with round lip shapes.

Tripod plate rim diameters vary from 20-24 cm ($\bar{x}$=22 cm) and wall thicknesses range from 5.28-5.32 mm ($\bar{x}$= 5.30 mm). The slightly flared walls have direct rims with rounded and interiorly beveled lip shapes. Although not included in the study, tripod supports are cylinder, scroll, and bulbous forms.

Collared jar rim diameters range from 14-40 cm ($\bar{x}$=29.2 cm) and wall thicknesses range from 5.28-8.2 mm ($\bar{x}$=7.25 mm). The direct rims of the outflared necks have rounded, squared, and interiorly beveled lip shapes.

One restricted orifice bowl has a rim diameter of 22 cm and a wall thickness of 6.51 mm. The direct rim is rounded.

Illustrations: Figures 36, 37, and 38

Intrasite references: All sherds in this description come from the first three levels of excavation (humus, collapse, floor). Four structures from Ixlú had Topoxté Red: Topoxté Variety sherds: 2022 (open hall), 2023 (temple), 2034 (temple), 2041 (residence). Structure 2041 had the highest number of Topoxté Red sherds. Topoxté Red: Topoxté Variety sherds from Tipuj were located in Complex 1 at the following structures: 1 (oratory), 2 (temple), 3 (open hall), and 4 (colonnaded hall).

In addition to the sherds used in the above description, all of the structures at Zacpetén had varying amounts of Topoxté Red: Topoxté Variety sherds.

Intersite references: Topoxté Red sherds also occur at Tayasal, Macanché Island, and Topoxté Island. Zacpetén, Macanché Island, and Topoxté Island have the highest concentrations of Topoxté Red pottery in the Petén lakes area. All sites with Topoxté Red: Topoxté Variety sherds have a variety of paste colors and qualities. However, my observations of Zacpetén and Topoxté Island Topoxté Red pottery suggest that the two sites have the highest frequency of well-oxidized creamy "white" sherds. While Tayasal and Macanché Island have some of the "white" paste sherds, the majority of the pastes have a yellowish tint or darker cores (personal observation). Most of the sherds from Macanché Island have a creamy white overcoat on the exterior slipped surfaces. This may be a case of double slipping, or it may be a result of deposition because the same phenomenon does not appear at other sites. In addition to sherds sherds from Macanché

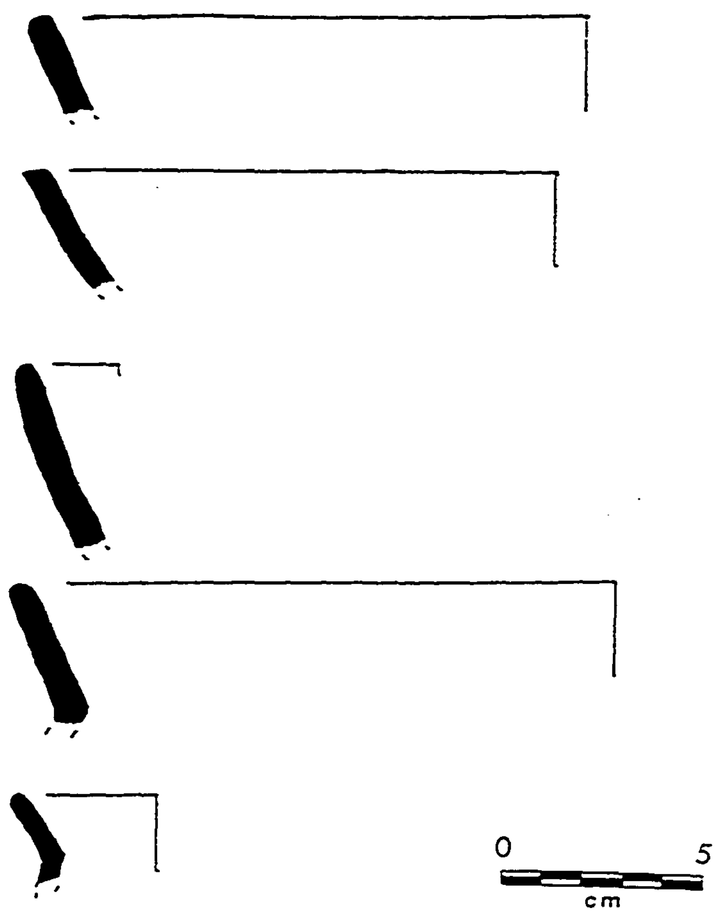


Figure 36: Topoxté Red Tripod Plate Rim Profiles from Tipuj.

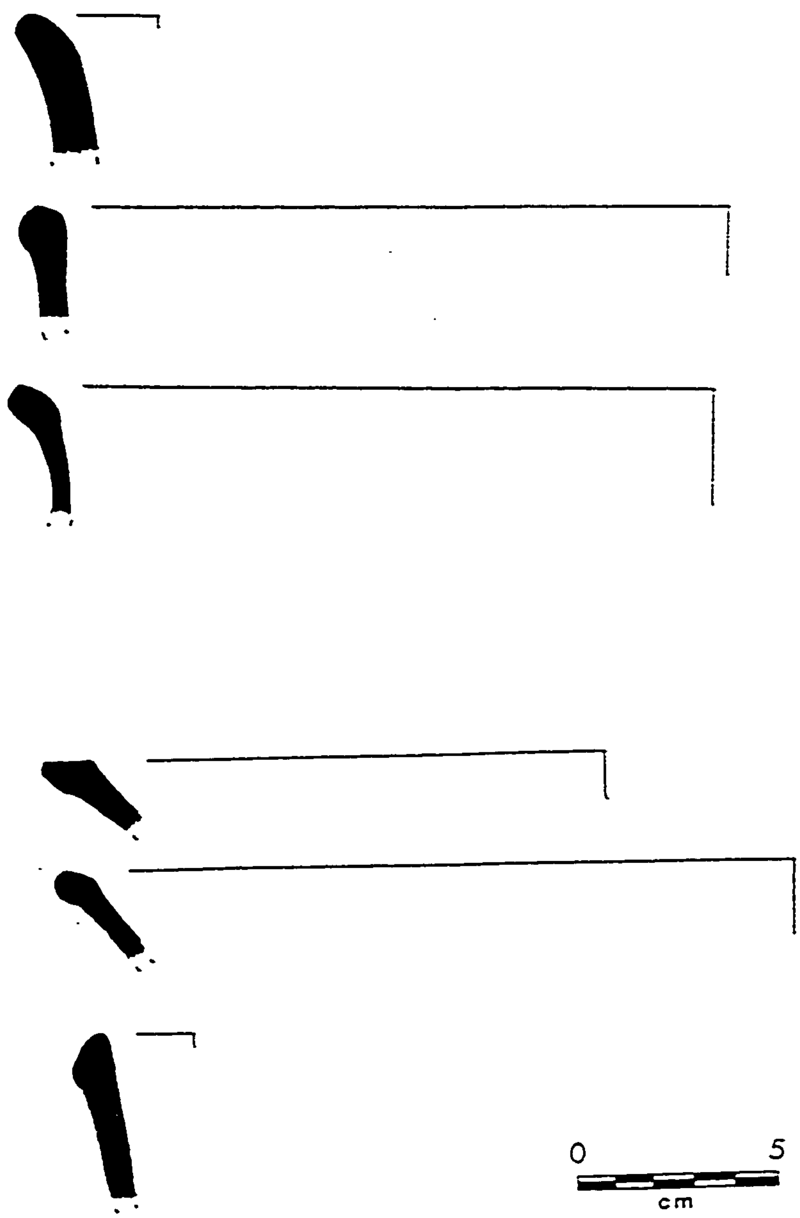


Figure 37: Topoxté Red Jar Rim Profiles from Tipuj.

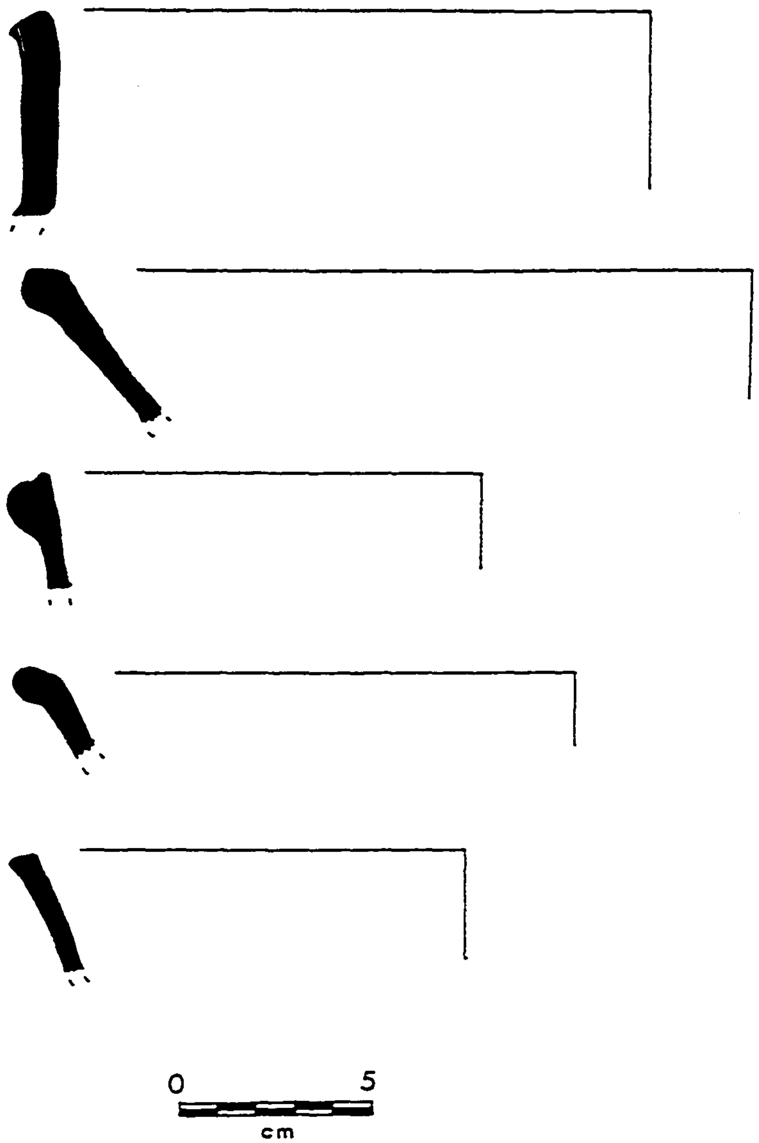


Figure 38: Topoxté Red Miscellaneous Rim Profiles from Tipuj.

Island, three Topoxté Red: Topoxté Variety sherds were reported at Tayasal; however, no description is given (Chase 1983).

Red monochrome slipped vessels have a widespread distribution in the Maya lowlands that begins in the Preclassic period and continues through the Historic period. In addition to the Petén Lakes region, red slipped vessels occur in Yucatán (Chichen Red, Tulum Red, and Mayapán Red).

Name: Pastel Polychrome: Pastel Variety

Frequency: Eight sherds comprise this description: seven from Zacpetén and one from Tipuj. Pastel Polychrome: Pastel Variety represents seven percent of the sherds from the Topoxté ceramic group and 1.5 percent of the total sherds in this sample.

Ware: Clemencia Cream Paste ware.

Established: Rice (1979:21-28) first defined Pastel Polychrome: Pastel Variety based on the ceramic collection from Canté Island excavated by the CPHEP in 1974.

Types of analysis: "Low-tech" (8 sherds); petrographic (4 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (2 sherds).

Principal identifying modes: 1) Black painted decoration on the interior of tripod dishes and exterior of restricted orifice bowls; 2) Red to reddish yellow to yellowish red slip; 3) Pale brown to white marly paste; 4) Tripod dishes and restricted orifice bowls.

Paste and firing: Paste colors range from white (2.5YR 8/1) to very pale brown (10YR 8/2, 8/3, 7/3). All of the sherds are completely oxidized and estimated firing temperatures range from 300-700°C with core hardness of 3 on the Mohs' hardness scale.

The fine textured marly paste is dominated by cryptocrystalline calcite, but also contains euhedral and subhedral calcite, quartz, hematite, biotite, and chert.

Surface treatment and decoration: Tripod dish exteriors are slipped red (2.5YR 6/8, 5/8, 5YR 6/6, 6/8, 5/8). Restricted orifice bowls are slipped the same color below the black painted decorations and on the lip. Slips have a matte texture and are .25-.75 mm thick. Slip hardness ranges from 2-3 on the Mohs' hardness scale.

Interior surfaces of tripod dishes and exterior surfaces of restricted orifice bowls are painted with black (7.5YR 2.5/1) or very dark gray (10YR 3/1, 2.5Y 3/1) bands and decorative motifs. The bands and decorations are painted on a white (5Y 8/1) primary slip. Tripod plates have one or two circumferential bands near the rim and one circumferential band at the wall/base junction. The bands delineate decorative motifs. While most of decorative elements are eroded, two elements remain: hooks and parentheses.

Forms and dimensions: Tripod dishes (n=5) and restricted orifice bowls (n=2) comprise the two forms included in the sample of Pastel Polychrome: Pastel Variety. Tripod dishes have slightly flared walls, direct rims, and round, square, and interiorly beveled lip shapes. Rim diameters range from 20-28 cm ($\bar{x}$=24.8 cm) and wall thickness ranges from 5.2-6.49 mm ($\bar{x}$=5.50 mm).

Restricted orifice bowls have curved walls, direct rims, and rounded and interiorly beveled lip shapes. The bowl rim diameters range from 20-28 cm ($\bar{x}$=24 cm) and wall thicknesses vary from 5.07-6.33 mm ($\bar{x}$=5.71).

Illustrations: Figure 39

Intrasite references: Pastel Polychrome: Pastel Variety sherds were excavated at Zacpetén and Tipuj. At Zacpetén, the sherds were located in Structure 719 (a residence)

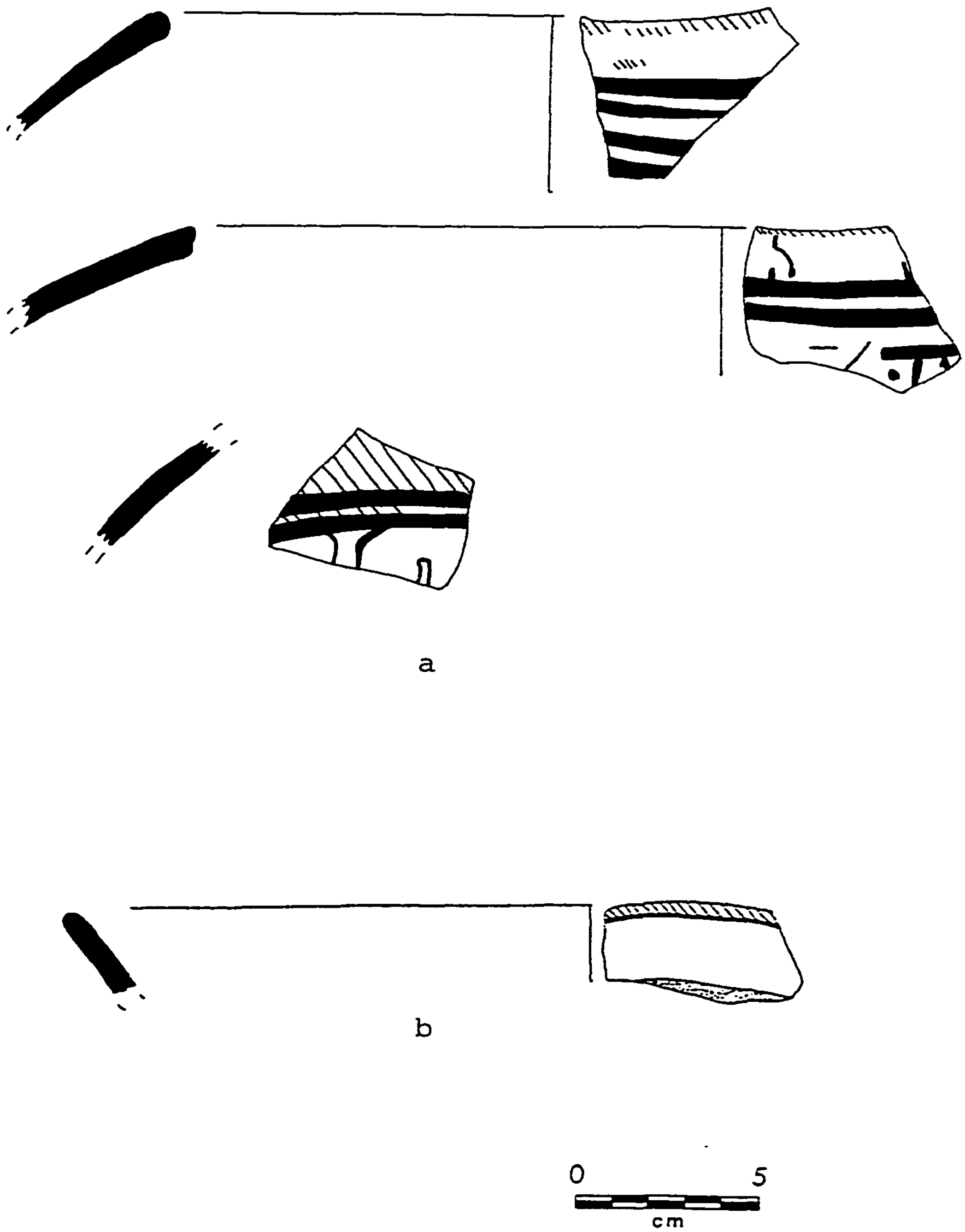


Figure 39: Pastel Polychrome Rim Profiles from Zacpetén (a) and Tipuj (b).

at levels 2 (collapse), 3 (floor), and 5 (construction fill), in Structure 765 (a raised shrine) at level 2 (collapse), and in Structure 767 (an open hall) at level 3 (floor). The sherd from Tipuj was located in Structure 1 (oratorio) at level 1 (humus).

Additional Pastel Polychrome sherds not included in the present study were located in the first three levels of Structure 758 (residence), Structure 764 (temple), and Structure 766 (statue shrine).

Intersite references: Pastel Polychrome's black line decoration has parallels to Pek Polychrome, Ixpop Polychrome, and Mul Polychrome. Decoration areas in all of the types are delineated by black circumferential bands, have a thin primary slip, and a similar decorative element complex. Common decorative elements include hooks, curls, and parentheses. For a comprehensive comparison of the types and decorative elements see Rice (1979:24-28).

I observed Pastel Polychrome sherds from Macanché Island and Topoxté Island. The two sherds from Macanché Island are similar to those excavated at Zacpetén. One sherd represents a tripod dish and the other a restricted orifice bowl. Further discussion is not possible due to poor preservation and the fragmentary nature of the sherds.

Topoxté Island excavations by Guatemalan archaeologists in 1998 and by Bullard in the 1960s provide more examples of Pastel Polychrome sherds. Again, tripod dishes and restricted orifice bowls dominate the form categories. A light red (2.5YR 6/8) primary slip appears on most of the tripod dish fragments. Decorative motifs are similar to those discussed above and those on Pek Polychrome, Ixpop Polychrome, and Mul Polychrome types. Tripod dishes from Bullard's collection have notably smaller rim diameters (19-21 cm) than those at Zacpetén and Tipuj.

Sherds from the 1998 excavations at Topoxté Island produced sherds with hook, mat, and small line dash decorative motifs. The majority of these sherds have gray cores and do not have the same clear "white" colored paste as those at Zacpetén, Tipuj, and earlier excavations at Topoxté Island.

Pastel Polychrome has not been located outside the Petén lakes region, but there are some affinities in northern Yucatán. Black painted decoration that resembles Pastel Polychrome occurs in northern Yucatán as Mama Red: Black-on-unslipped Variety Polychrome (Mayapán Red ware) (Smith 1971:22-23).

Name: Canté Polychrome: Canté Variety

Frequency: The following description of Canté Polychrome: Canté Variety is based on four sherds: three from Zacpetén and one from Tipuj. This sample constitutes three percent of the Topoxté ceramic group and .73 percent of the total sample in this study.

Ware: Clemencia Cream Paste ware.

Established: Rice (1979:42-45) first described Canté Polychrome: Canté Variety based on pottery from Bullards' excavations at Topoxté Island.

Types of analysis: "Low-tech" (4 sherds); petrographic (4 sherds); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Red and black painted decoration; 2) Red to yellowish red slip; 3) Very pale brown marly paste; 4) Tripod dishes and collared jars.

Paste and firing: Pastes are very pale brown (10YR 7/2, 7/3, 7,4) and are completely oxidized. Estimated firing temperature range between 300-600°C. The oxidized sherds have a Mohs' hardness of 2-3.

The light colored fine marly pastes resemble those of Pastel Polychrome. The paste is dominated by cryptocrystalline calcite but also contains euhedral and subhedral calcite, quartz, hematite, biotite, and chert.

Surface treatment and decoration: Exterior surfaces are slipped red (2.5YR 5/8, 10R 4/4) to light red (2.5YR 6/8) to yellowish red (5YR 6/6) and have a matte finish. The slips are .25-.75 mm thick with a Mohs' hardness of 2-3. While no fire clouding occurs, one sherd has small black spots throughout the slipped surface.

Interior surfaces of tripod dishes and collared jars are decorated by red and black paint on a thin pale brown (10YR 8/3, 7/3) to pale yellow (2.5Y 7/3) primary slip. The decorative panel is delineated by red (17.5R 4/4, 10YR 4/6) and black (10YR 3/1, 2/1) alternating circumferential bands in the following patterns: red, black, and red; red, red and black; or red and black. Bands defining the bottom of the decoration area are not present due to the fragmentary nature of the sherds. Decoration panels are eroded; however, one decoration consists of a black curvilinear decoration with red dots.

One tripod base sherd from Tipuj is decorated with a series of red rounded bands and circles with a black curvilinear line that connects two black open circles.

Forms and dimensions: Canté Polychrome: Canté Variety sherds represent tripod dish (n=3) and collared bowl (n=1) forms. Tripod dishes have slightly flared or rounded walls with rounded and interiorly beveled lip shapes. One sherd has a measurable rim diameter of 30 cm and a wall thickness of 6.55 mm.

The collared jar sherd has a rim diameter of 20 cm with a wall thickness of 6.38. The neck is outflaring with a direct rim and a rounded lip shape.

Illustrations: Figure 40

Intrasite references: The three sherds from Zacpetén were located in Structures 719 (a residence) at levels 3a and 3b, and 767 (an open hall) at level 2 (collapse). The sherd from Tipuj was located in level 2 (collapse) of Structure 1 (an oratory).

In addition to the sherds described above, Canté Polychrome sherds were also located in structures 605 (oratorio) and 767 (open hall) at Zacpetén.

Intrasite references: Canté Polychrome's red and black painted decoration techniques resemble those of Graciela Polychrome, Sacá Polychrome, and Dolorido Polychrome types. All of the types have a series of red and black circumferential bands with red and/or black decorative motifs. Although decorative elements are eroded, similarities exist in curvilinear lines, mat motifs, and circles.

Canté Polychrome sherds also occur at Topoxté Island in the Petén Lakes region. From Bullard's collection from the 1960s, I examined Canté Polychrome sherds that represented tripod dishes, restricted orifice jars, and collared bowls. The decoration area is delineated by circumferential red and black bands and has a "thin orange slip over the cream paste background" (Rice 1979:43). Decorative elements include those described above, as well as hooks, mat motifs, and stepped frets. Some stepped frets are outlined in black and colored with red paint. The stepped frets also occur in Chompoxté Red-on-cream: Kayukos Variety and Macanché Red-on-paste: Tachís Variety types.

Excavations by Guatemalan archaeologists in 1998 at Topoxté Island also produced Canté Polychrome sherds. I observed that decorative motifs include filled black chevrons outlined in red, large circles surrounded by smaller dots, pyramids, mat motifs,

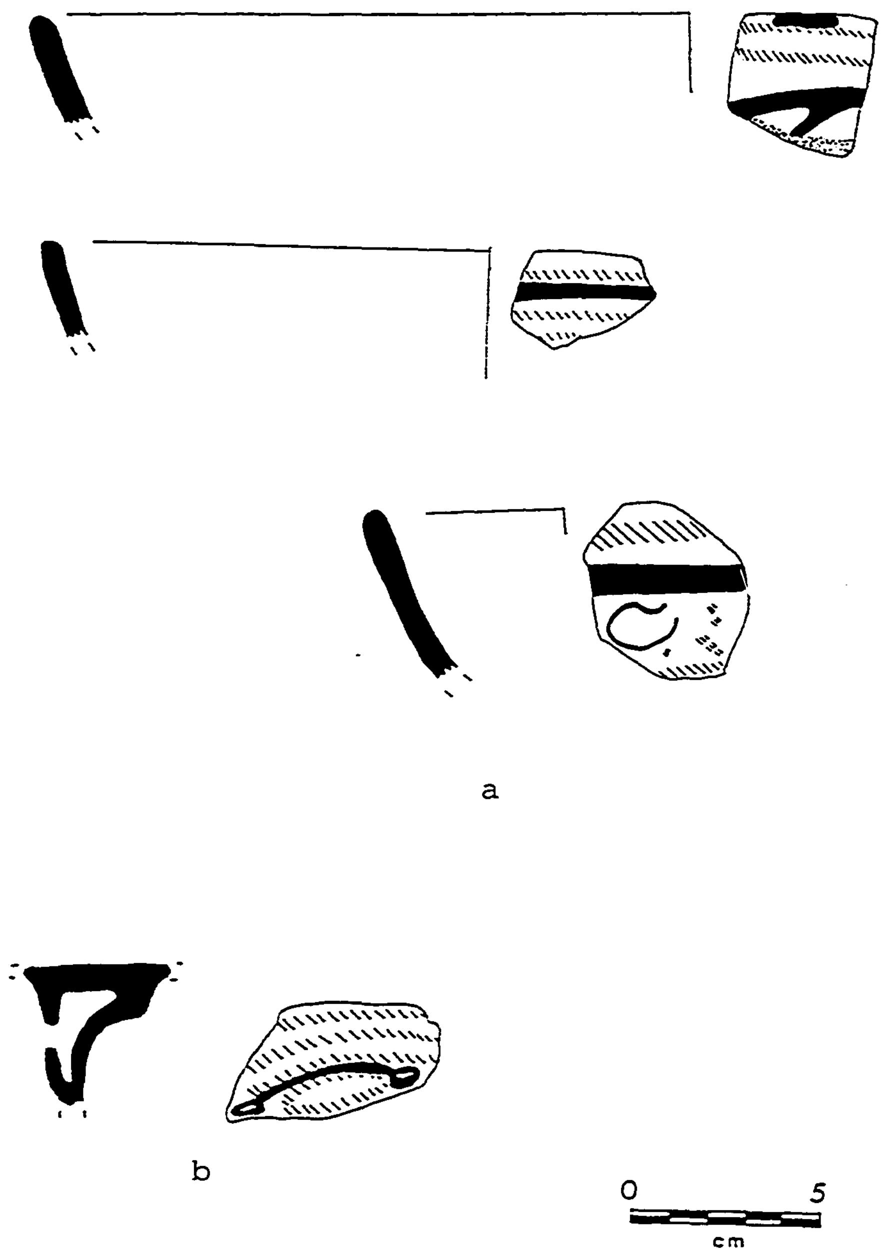


Figure 40: Canté Polychrome Rim Profiles from Zacpetén (a) and Tipuj (b).

and alternating red and black "Serpent Y Complexes" motif as seen in at Uaxactún (Smith 1955:70-71). One jar had alternating black or red painted decorative panels. The red decoration color on the majority of sherds is dusky red (10R 3/3). Pastes have a tendency to be slightly pink (5YR 8/2) and well fired.

Red and black decoration on Postclassic pottery is rare in the Maya lowlands. Pele Polychrome jars of San Joaquin Buff ware at Mayapán may be similar (Smith 1971:229).

Name: Chompoxté Red-on-cream: Kayukos Variety

Frequency: This description is based on one sherd from Zacpetén. This sherd constitutes one percent of the Topoxté ceramic group and .18 percent of the total sherds in the study.

Ware: Clemencia Cream Paste ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherds); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Angular and geometric red banded decorations; 2) Yellowish red primary slip; 3) Gray marly paste; 4) Jars.

Paste and firing: The incompletely oxidized sherd has a gray (10YR 6/1) core with light yellowish brown (10YR 6/4) margins. The estimated firing temperature was 650°C with a core hardness of 3.

The marly paste is dominated by cryptocrystalline calcite. Euhedral and subhedral calcite, hematite, quartz, chert, and biotite also occur in the clay matrix.

Surface treatment and decoration: The exterior surface of the jar neck and shoulder is unslipped; however a yellowish red primary slip (5YR 6/6) occurs under the decoration. The red (2.5YR 4/4) decoration is more brown than most Chompoxté Red-on-paste decorations. Three circumferential bands delineate the bottom of the decorative area. Above the bands is an angular geometric decoration that appears to be a stepped pyramid with nested chevrons in the interior of the pyramid. A circle surrounded by small red dots appears to the left of the pyramid/triangle motif.

Forms and dimensions: The sherd is a combination of a jar neck and shoulder. No rim diameters were measurable, but the wall thickness is 6.59 mm. Based on the neck fragment, this may be a narrow neck jar with a relatively high neck (approximately 6-8 cm in height).

Illustration: Figure 41

Intrasite references: This sherd was located at Zacpetén in level 3a of Structure 732 (a residence). Other sherds of this type were also located at Zacpetén.

Intersite references: Chompoxté Red-on-paste: Kayukos Variety's angular and geometric decoration style resembles those of Macanché Red-on-paste: Tachís Variety and the Tachís ceramic group described by Cowgill (1963:112-115). Similar triangle and pyramid decorations occur in both types.

At Topoxté Island, Rice (1979:33-34) noted that tripod dishes and jars subsumed under the Chompoxté Red-on-cream: Chompoxté Variety description have chevrons, geometric shapes, and nested rectangles. I examined Kayukos Variety sherds from recent

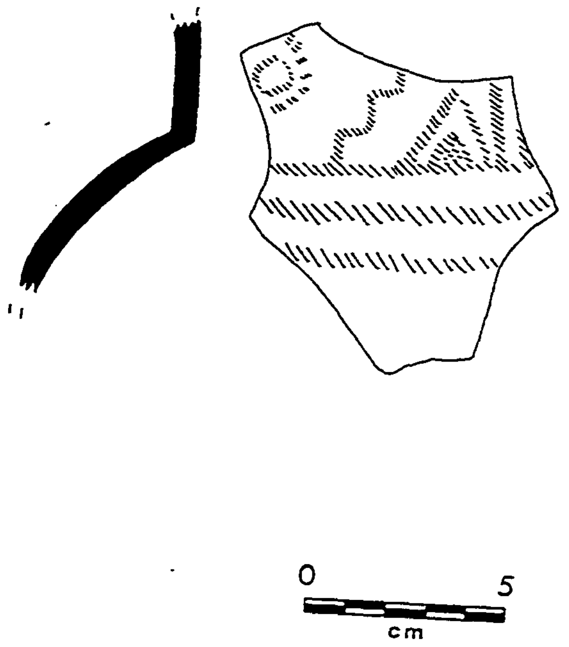


Figure 41: Chompoxté Red-on-paste: Kuyakos Variety Rim Profile from Zacpetén.

excavations (1998) at Topoxté Island with chevrons, pyramids, and stepped frets. Some of these sherds have Maya blue on the surfaces.

Outside of the Petén lakes regions affinities can be seen in decorative elements from Mayapán (Smith 1971:48-67). Chevrons, pyramids, stepped frets and embedded triangles appear on most Postclassic pottery in northern Yucatán.

Name: Chompoxté Red-on-cream: Chompoxté Variety

Frequency: The following description is based on four sherds: three from Zacpetén and one from Tipuj. This sample represents three percent of the Topoxté ceramic group and .73 percent of the total sample in this study.

Ware: Clemencia Cream Paste ware.

Established: Rice (1979:31-42) first defined Chompoxté Red-on-cream: Chompoxté Variety from pottery collections of Topoxté Island.

Types of analysis: "Low-tech" (4 sherds); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (2 sherds).

Principal identifying modes: 1) Non-banded dark red complex decorations; 2) Red exterior slip; 3) Light brownish gray to very pale brown marly paste; 4) Tripod dishes.

Paste and firing: Chompoxté Red-on-cream: Chompoxté Variety pastes are pale brown (10YR 8/2, 8/3) to very pale brown (10YR 6/2). Unlike most Topoxté group ceramics, darker cores appear in one-half of the sherds and estimated firing temperatures are also lower--300-500°C. Core hardness is 3 on the Mohs' hardness scale.

Cryptocrystalline calcite dominates the clay matrix. Euhedral and subhedral calcite, hematite, quartz, and chert also occur in the clay matrix.

Surface finish and decoration: Exterior surfaces and interior rim surfaces of the tripod dishes are slipped red (10R 5/8, 4/6, 7.5R 3/6). Red slips have a matte finish and black fireclouds occur on vessels walls and near rims. The slip is .5 mm thick and has a Mohs' hardness of 2-3.

Interior walls and some bases are decorated with dark red (7.5R 3/6) to red (10R 4/4, 4/6) paint. Decoration elements are not banded, but are often a result of negative painting (the background is painted red rather than an element outline). Interior colors have a low luster and a hardness of 2-3. Decorations are painted over a light gray (10YR 7/2) to very pale brown (10YR 8/3) primary slip. Decorative elements include circles, birds, mats, and possible aquatic creatures. One tripod dish wall has decorative elements on interior (eroded) and exterior (mat motif) surfaces.

Forms and dimensions: Although there are four sherds that represent tripod dishes in the study, only one provides a rim diameter. The tripod dish has slightly rounded walls, no basal angle, and a direct rim with a rounded lip shape. The rim diameter is 28 cm. Wall thicknesses of all four sherds range from 5.98-8.17 mm ($\bar{x}$=7.10 mm).

Illustrations: Figure 42

Intrasite references: Sherds from Zacpetén came from levels 1 (humus) and 3a (below the latest floor) of Structure 719 (a residence) and level 2 of Structure 732 (a residence). The sherd from Tipuj came from level 1 (0-101.5 cm) of Structure 2 (a temple).

Chompoxté Red-on-cream: Chompoxté Variety sherds not included in the study

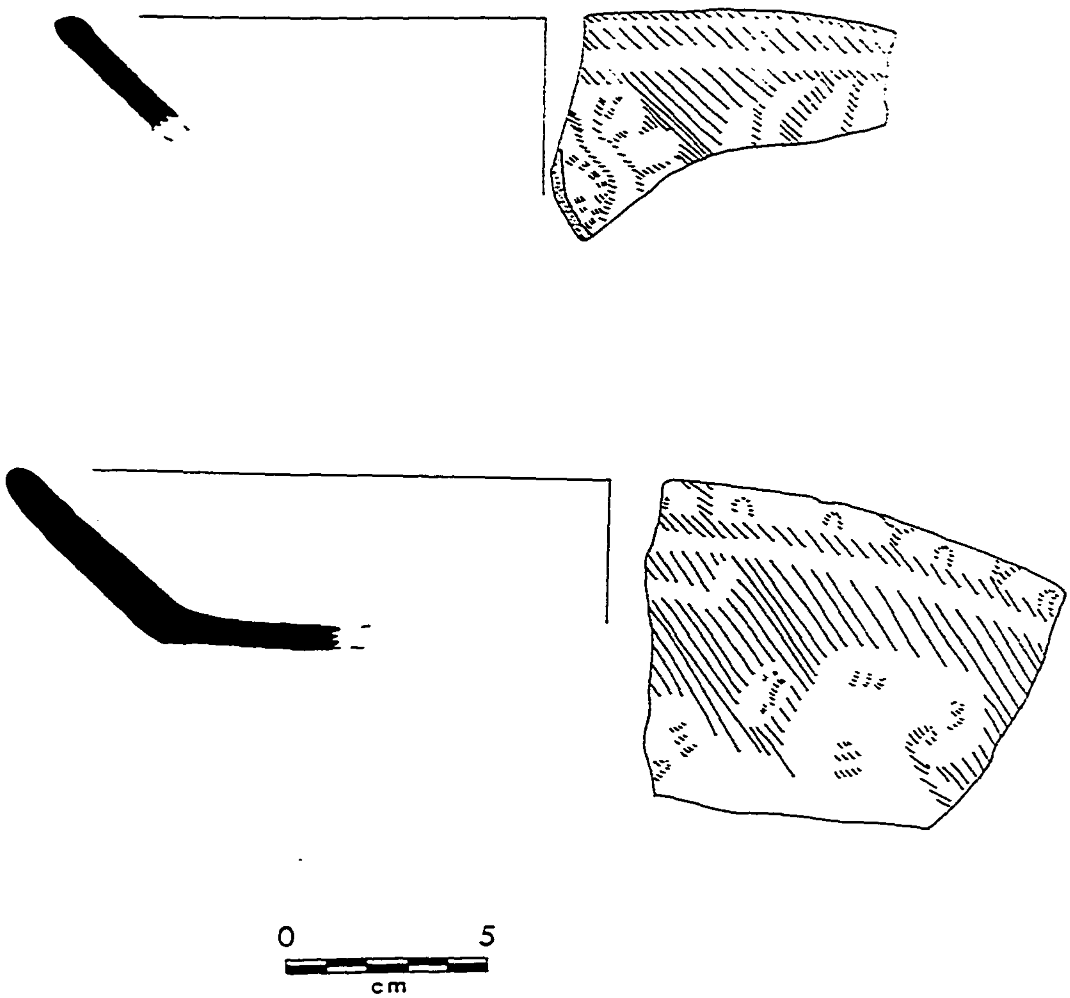


Figure 42: Chompoxté Red-on-paste: Chompoxté Variety Rim Profiles from Zacpetén.

were also located in Structure 603 (oratorio) and Structure 615 (open hall) at Zacpetén.

Intersite references: The non-banded red decoration of Chompoxté Red-on-cream: Chompoxté Variety resembles other non-banded red decorated types (Macanché Red-on-paste and Picté Red-on-paste: Ivo Variety) in the Petén Lakes region. Unfortunately, the decorative elements of the Postclassic types are too eroded to allow for decoration analogies.

I examined Chompoxté Red-on-cream: Chompoxté Variety sherds from Macanché Island and Topoxté Island. Sherds from Macanché Island represent tripod dishes similar to those described above as well as collared bowls, neckless jars, and miscellaneous jars. Although paste and slip colors are similar to those previously described, exterior surfaces appear to have a creamy overcoat which may be a result of deposition rather than an actual double slip.

Topoxté Island Chompoxté Red-on-cream: Chompoxté Variety sherds from the 1998 excavations and from Bullard's collection are well preserved. The decorations are complex with combinations of curls, hooks, mat motifs, and an underwater motif (combination of a mat motif and a hook) (Helmuth1987:156). The decoration colors are darker red (7.5R 3/4) than the exterior slip, have a low luster, and are painted over a cream colored primary slip. Execution of decorative elements on sherds from Topoxté Island appears to be more carefully produced. Paste colors are highly variable from light gray to pink to white/buff.

Other red-on-cream/paste/buff painting traditions exist throughout the Maya lowlands. Although the examples are not great in quantity, Mayapán's Tecoh Red-on-buff (Smith 1971:29) and Naco's Nolasco Bichrome types (Wonderley 1981) resemble those in the Petén lakes region.

Name: Chompoxté Red-on-cream; Akalché Variety

Frequency: Fifty sherds (41 from Zapetén and 9 from Tipuj) represent the sample for the following description. The sample constitutes 41 percent of the Topoxté ceramic group and 9.09 percent of the sherds in this sample.

Ware: Clemencia Cream Paste ware.

Established: Based on a pottery collection from Canté Island, Rice (1979:28-31) first described the Akalché variety.

Types of analysis: "Low-tech" (50 sherds); petrographic (22 sherds); x-ray diffraction (3 sherds); EDS and SEM and strong-acid extraction ICPS (9 sherds).

Principal identifying modes: 1) Banded dark red painted decoration; 2) Exterior light red to dark red slip; 3) Very pale brown marly paste; 4) Tripod dishes, collared jars, flanged collared jars, and narrow neck jars.

Paste and firing: All but three of the fine marly pastes are completely oxidized resulting in a very pale brown (10YR 8/3, 7/3, 7/4) color. Estimated giring temperatures range from 300-650°C; however, it is estimated that the majority of the sherds were fired from 300-500°C. Core hardness is 3 based on the Mohs' hardness scale.

Although the paste of Chompoxté Red-on-cream: Alkaché Variety resembles those of other Topoxté ceramic group pastes, three distinct groups of inclusions occur in this type. The first group consists of euhedral and subhedral calcite, hematite, quartz, plus biotite. The second group consists of euhedral and subhedral calcite, hematite, quartz, plus chalcedony. The final group consists of euhedral and subhedral calcite, hematite, quartz, plus chalcedony and biotite.

Surface treatment and decoration: Exterior surfaces of tripod dishes and collared bowls are slipped light red (2.5YR 6/8), red (2.5YR 5/8, 4/8, 10R 5/6, 5/8, 4/6), and dark red (2.5YR 3/6). Slipped surfaces have a matte finish and black fireclouds are common.

Exterior surfaces of narrow neck jars and interior surfaces of tripod dishes and collared bowls are decorated with a darker red (10R 5/8-3/4, 7.5R 4/8-4/4, 2.5YR 5/8-4/4) pigment than the red slip. Decorations are painted over a very light brown (10YR 8/3, 7/3) primary slip and are delineated by circumferential bands. Vertical lines create decoration panels on some vessels.

The series of bands closest to the rim appear as single or double circumferential bands. A single band defines the bottom of the decorative area that is he near the base. Most tripod dish and collared bowl decorative motifs are eroded; however, hooks, parentheses, circles, plumes, and dots occasionally occur. There is one flanged collared jar with a series of three circumferential bands above the flange and red slip below the bands. The flanges are painted with vertical red stripes.

Narrow neck jar decorations are on the exterior of the vessel. Sherds from Zacpetén typically have two areas of decoration: one on the neck and one on the shoulder. The two areas are separated by two or three circumferential bands. Jar shoulder decoration areas are paneled. Decorative motifs include glyphic representations of the *Ajaw* glyph, mat motifs, and curvilinear lines. These decorations appear in positive and negative painting styles. One sherd has chevrons along the rim followed by three circumferential bands and vertical lines beneath the three bands.

The narrow neck jar from Tipuj is slipped a solid color 4 cm from the lip. Below the solid slip at the neck/shoulder junction, two circumferential bands appear. The area below the bands is eroded.

Forms and dimensions: Tripod dishes (n=30), collared jars (n=1), flanged, collared jars (n=1) , and narrow neck jars (n=3) have banded red decorations. Tripod dishes have slightly flared walls and direct rims with square, round, and interiorly beveled lip shapes. Rim diameters range from 18-28 cm ($\bar{x}$=24.76 cm) and wall diameters range from 4.65-7.85 mm ($\bar{x}$=5.84 mm).

The one collared jar fragment has an outflaring neck with a direct rim and a square lip shape. The rim diameter is 26 cm and the wall thickness measures 6.39 mm.

The flanged collared jar fragment has flanges that are 7.89 mm tall. The wall thickness is 4.94 mm. Because this sherd is a body fragment, no other measurements are possible.

Narrow neck jars have short (4 cm) straight and slightly curved tall (8-9 cm) necks. The direct rim on the short neck jar has a rounded lip shape, a rim diameter of 8 cm and a wall thickness of 6.35 mm. The remaining 3 tall rim sherds have everted, exteriorly thickened lip shapes. Rim diameters are 18 cm, 18 cm, and 20 cm and wall thickness are 7.76 mm, 7.88 mm, and 7.38 mm, respectively.

Illustrations: Figure 43

Intrasite references: The 41 sherds from Zacpetén were located in levels 1, 2, and 3 in a variety of locations: Strs. 601 (raised shrine), 606 (open hall), 664 (residence), 719 (residence), 721 (temple), 748 (unknown), 758 (residence), 764 (temple), 765 (raised shrine), and 767 (open hall). The nine sherds from Tipuj were found in the first four levels of Structures 2 (temple) and 3 (open hall).

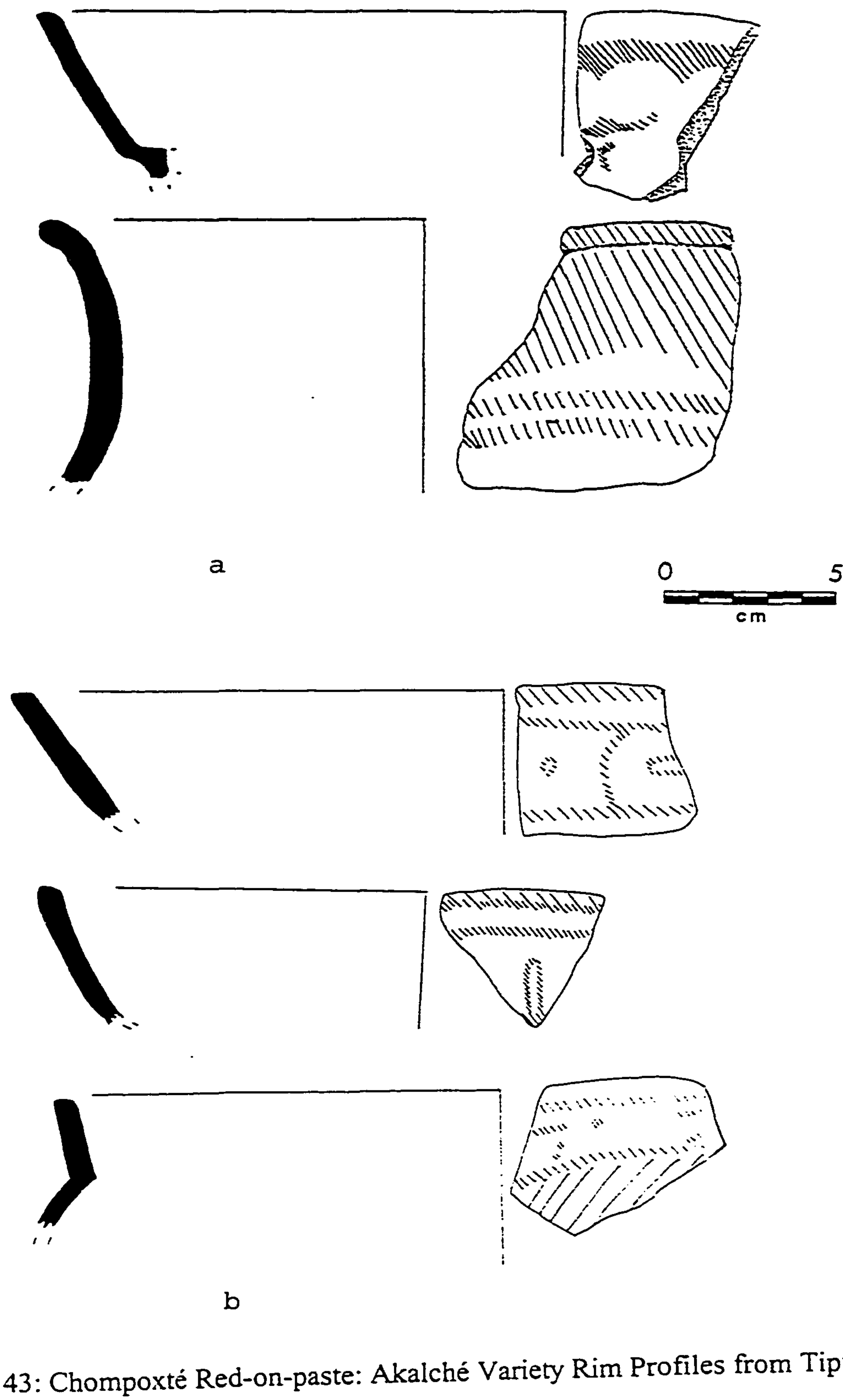


Figure 43: Chompoxté Red-on-paste: Akalché Variety Rim Profiles from Tipuj (a) and Zacpetén (b).

Chompoxté Red-on-cream: Akalché Variety sherds were also located in all structures at Zacpetén except Structure 607 (statue shrine). Tipuj's Structure 1 (oratorio) also had a Chompoxté Red-on-cream: Akalché Variety sherd.

Intersite reference: The decoration and forms of Chompoxté Red-on-cream: Akalché Variety do not vary in the Petén lakes region. Forms and decorative elements mimic those on Ixpop Polychrome: Ixpop Variety, Macanché Red-on-paste: Macanché Variety and Sotano Red-on-paste: Sotano Variety sherds. Black line banded polychrome types are a variant of the red line decoration described above.

I examined Chompoxté Red-on-cream: Akalché Variety pottery from Tayasal, Macanché Island, and Topoxté Island. One Akalché Variety sherd was located by Chase (1983) at Tayasal. This sherd has a very pale brown (10YR 7/4) paste and is similar to sherds at other sites in the Petén lakes region. The Tayasal tripod dish's red decoration is darker than the exterior slip, the decorative area may have a creamy primary slip, and there are two top and one bottom circumferential bands to delineate the decorative motifs that are eroded. The rim diameter is 28 cm.

Sherds from Macanché Island are eroded, but their dark red decoration and a lighter slip color is similar to the sherds from Zacpetén. All of the tripod dishes with some painted decoration have a double circumferential band near the rim and a single circumferential band near the base. Bands are painted over a creamy primary slip. One bowl has a four-step basal flange that is stepped to the right. The tripod dish with a measurable rim diameter is 24 cm.

Chompoxté Red-on-cream: Akalché Variety sherds from Bullard's excavations at Topoxté Island yielded tripod dishes, restricted orifice bowls, high neck jars, and flanged collared jars. Similar to the sites discussed above, decoration areas are delineated by circumferential bands and have a creamy primary slip. The pastes tend to vary in color from white to light gray and sherds with lighter colors have a higher hardness reading and are most likely fired at a higher temperature. Decorative motifs include hooks, plumes, parentheses, and dots.

One collared bowl and one tripod dish are coated with Maya Blue pigment on the interior surfaces. The blue pigment is over the red decoration suggesting that the vessels may have held the pigment.

Guatemalan excavations at Topoxté Island in 1998 also revealed Chompoxté Red-on-cream: Akalché Variety sherds that were better preserved than most of those described above. Pastes range from white to pale yellow (2.5Y 8/2) to gray. Again, most of the decoration areas are delineated by two top and one bottom circumferential bands and painted on a creamy to light red (2.5YR 6/8) primary slip. Decorative elements are similar to those described for Zacpetén and Macanché Island. However, in addition to employing vertical red bands as panel dividers, wavy lines are also used to delineate decorative panels. Similar to sherds from Bullards' excavations, some tripod dishes have large areas of Maya Blue pigment.

Outside of the Petén lakes region, red-on-paste decoration occurs in northern Yucatán, Naco, Honduras, and the western Guatemalan highlands. Chompoxté Red-on-paste: Akalché Variety closely resembles that of Tecoh Red-on-buff (San Joaquin Buff ware) and Chumayel Red-on-slate and Canche Red-on-slate in northern Yucatán (Smith 1971:29, 44-45). At Naco, Honduras, Nolasco Bichrome resembles Chompoxté Red-on-paste: Akalché Variety pottery (Wonderley 1981:172). Many red-on-white types with banded decoration areas and curvilinear lines also exist in the western Guatemalan highlands (Wauchope 1970).

Name: Dulces Incised: Bebeto Variety

Frequency: One sherd from Zacpetén is the basis for this description. Dulces Incised: Bebeto Variety comprises one percent of the Topoxté ceramic group and .18 percent of the total sherds in the study.

Ware: Clemencia Cream Paste ware.

Established: Present work based on collections from Zacpetén.

Types of analysis: "Low-tech" (1 sherd); petrographic (1 sherd); x-ray diffraction (0 sherds); EDS and SEM and strong-acid extraction ICPS (0 sherds).

Principal identifying modes: 1) Pre-fire deep incisions; 2) Very pale brown marly paste; 3) Drums.

Paste and firing: The Dulces Incised: Bebeto Variety sherd is completely oxidized with a very pale brown (10YR 8/3) core color. Like other Topoxté ceramic groups, cryptocrystalline calcite dominates the fine marly paste. Other minerals in the clay matrix include euhedral and subhedral calcite, quartz, ferrougonous lumps (hematite), chert and biotite. The sherd was estimated to have been fired to 600°C and has a core hardness of 3 on the Mohs' hardness scale.

Surface finish and decoration: The exterior of the vessel has pre-fired deep incisions that appear approximately one centimeter below the rim and are approximately 1.25 cm in length. The sherd, although fragmentary, has a group of four incisions that suggests that the incisions may have been grouped around the circumference. The unslipped exterior surface is light gray (10YR 7/2) with a hardness of 3. The interior surface is also unslipped.

Forms and dimensions: The sherd represents a drum form. The neck is slightly flared and has a direct rim with a rounded lip. The rim diameter is 8 cm and the wall thickness is 6.36 mm.

Illustrations: Figure 44

Intrasite references: The Dulces Incised: Bebeto sherd was located in level 2 (collapse) of Structure 721 (temple) at Zacpetén. A grater bowl and other miscellaneous Dulces Incised: Bebeto Incised sherds not included in the study were located in Structure 719 (residence) at Zacpetén. No other sherds of this type were found in excavations at Ch'ich', Ixlú, or Tipuj.

Intersite references: Dulces Incised: Bebeto Variety is rare in the Petén Lakes region. The only other example of this type comes from recent excavations (1998) at Topoxté Island where I examined one grater bowl. Grater bowls show signs of use wear. This type of deep groove pre-fire incising is also common in other Petén ceramic groups:

Picú Incised: Thub Variety, Xuluc Incised: Tzalam Variety, and Hobonmo Incised: Hobonmo Variety.

Drums occur in northern Yucatán in the Mayapán Red ware (Smith 1971:22). Drums may also have begun in the Classic era. Individuals are seen on Late Classic polychrome vessels carrying and/or playing "drums."

Although this is a typological description of the five Postclassic slipped pottery groups, some significant differences begin to come to the foreground. Most of these

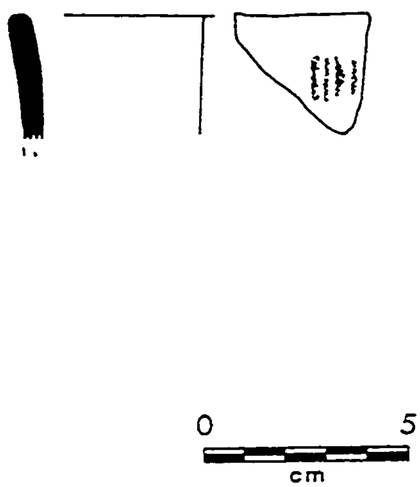


Figure 44: Dulces Incised: Bebeto Variety Rim Profile from Zacpetén.

differences are in terms of painted and incised decoration. In the Paxcamán and Topoxté ceramic groups, Ch'ich', Tayasal, and Tipuj lack a black-and-red painted decoration category (Sacá Polychrome and Canté Polychrome). In addition to this difference, Macanché Red-on-paste pottery only is found at Zacpetén and Flores Island. See Table 8 for a visual representation of the pottery types and varieties and the sites where they are located.

Decorative motif presence or absence is also interesting. As stated before, most of the Tipuj decorative motifs in the Paxcamán and Augustine ceramics involve the *ilhuitl* glyph. At Zacpetén, this motif appears three times and not at all at Ch'ich' and once at Ixlú. Prominent decorative motifs at Ch'ich', Ixlú, and Zacpetén are curls, chevron, and bird decorations.

The third most striking difference between the sites is the number of form categories. With the exception of Augustine group ceramics, Zacpetén has more form categories of Postclassic slipped ceramics. The vessels at Zacpetén, primarily jars, are also much larger in capacity than those at Tipuj, and Paxcamán tripod dishes at Macanché Island are smaller than those at any other site in the Petén lakes region.

Technology represents the fourth difference of Postclassic slipped ceramics at the sites in the Petén lakes region. There is a higher proportion of apparently overfired sherds in all three ceramic groups at Ixlú and Tipuj. Fireclouding colors also differ. At Tipuj, the majority of fireclouding of Augustine and Paxcamán ceramics is tan, whereas the prominent fireclouding color at Ch'ich', Ixlú, and Zacpetén is black. These differences may result form differences in the minerals used for slip pigment. In addition to differences in fireclouding colors, the Paxcamán, Trapeche, and Augustine ceramic

Table 8: Postclassic Types and Varieties and the Sites Where They are Located

	Ch'ich'	Ixlú	Zacpetén	Tipuj
Paxcamán Red: Paxcamán Variety	X	X	X	X
Paxcamán Red: Escalinata Variety	X	X*	X*	X
Ixpop Polychrome: Ixpop Variety	X	X	X	X
Sacá Polychrome: Sacá Variety		X	X	
Sacá Polychrome: Rasgo Variety			X	
Macanché Red-on-cream: Tachís Variety			X	
Macanché Red-on-cream: Macanché Variety			X	
Picú Incised: Picú Variety	X	X	X	X
Picú Incised: Thub Variety	X	X	X*	X
Picú Incised: Cafetoso Variety			X	
Fulano Black: Fulano Variety	X	X	X*	X
Sotano Red-on-paste: Sotano Variety		X	X	
Mengano Incised: Mengano Variety			X	
Trapeche Pink: Tramite Variety	X	X	X	
Mul Polychrome: Manax Variety			X	
Picté Red-on-paste: Ivo Variety			X	
Xuluc Incised: Tzalam Variety		X	X	
Augustine Red: Augustine Variety	X	X	X	X
Pek Polychrome: Pek Variety	X	X	X	X
Graciela Polychrome: Graciela Variety			X	
Hobonmo Incised: Ramsey Variety			X	X
Hobonmo Incised: Hobonmo Variety	X	X	X*	X
Johnny Walker Red: Black Label Variety				X
Topoxté Red: Topoxté Variety		X	X	X
Pastel Polychrome: Pastel Variety			X	X
Canté Polychrome: Canté Variety			X	X
Chompoxté Red-on-cream: Kayukos Variety			X	
Chompoxté Red-on-cream: Chompoxté Variety			X	X
Chompoxté Red-on-cream: Akalché Variety			X	X
Dulces Incised: Bebeto Variety			X	

X* indicates that the type and variety is present at the site, but was not used in this study.

group sherds have a translucent over-slip giving the exterior surfaces a "waxy" feel. Other than these differences, paste and slip variability are similar.

The differences suggested here are not numerous, but these small differences that may prove to be important when discussing the technological styles and social identity of groups in the central Petén lakes region. Two provisional macro-typological technological style groups can be defined. The first macro-group reflects the differences in ware categories. The sherds are discussed and grouped according to differences in wares that reflects differential selection of clays by the Postclassic Maya potter. Thus, the first macro-group can be divided into three smaller technological styles based on the ware categories (Volador Dull-Slipped, Vitzil Orange-Red, and Clemencia Cream Paste wares).

The second macro-typological technological groups reflects the differences in decorative modes. There are four painting modes (monochromatically slipped, red-on-paste , black-on-paste, and red-and-black) and two incising modes (fine- and broad-line incising). These decorative modes occur in most of the ware categories and reflect the stylistic choices made by the Postclassic Maya potter.

CHAPTER 6

"LOW-TECH" ANALYSES

This chapter represents the second level of analysis used to obtain pottery technological style group information. Analyzing sherds through visual examination, refiring experiments, and hardness measurements provides information as to Postclassic Maya technology. By beginning with "low tech" methods of pottery analysis, I can gather qualitative and quantitative data of the composition and structure of the entire pottery sample that is free from aesthetic judgments in order to evaluate its properties as well as possible Postclassic Maya operational choices of pottery manufacture. This type of analysis permits an unbiased evaluation of the pottery sample because I employ standard units of measurement, conduct experiments that can be easily replicated, and utilize statistical methods to evaluate the variability in the archaeological sample.

Choices made by the Postclassic Maya potter during the manufacturing and firing of pottery may result at any stage of the operational sequence. First, potters must obtain clay from a geological feature. They bring the clay back to the place of manufacture and may sort through it picking out various items such as larger rocks and organic materials. In addition to the initial cleaning of the clay, they may also levigate and/or seiving the clay to ride it of specific minerals. Once the clay is "clean," temper may be added to the clay to correct its stickiness, increase porosity, decrease shrinkage, and decrease deformation during drying. Water is then added to the clay and allowed to age to the state where it can be manipulated. When the clay is ready, the potter takes clay and forms coils and/or slabs and joins them in such a manner to produce vessel bases, walls, and rims. The body is smoothed through rubbing and/or pounding of the clay with some hand-held material (e.g. rocks or sticks) so that the coils/slabs are joined together producing a strong vessel. The completed vessel is placed out of the sun and wind and allowed to dry to the leather hard stage.

At the leather hard stage, the potter may choose to decorate the vessel. It may be smoothed, slipped, burnished, and/or incised. Slipping involves either wiping a colored clay mixture onto the vessel or the vessel may be placed into the slip. The slip may be smoothed or burnished at this point and is then allowed to dry as the vessel dries completely.

When the vessel is ready to be fired, the potter must gather enough material (wood, grasses, or any other agricultural product) for the firing process. The ground may be heated with a preliminary fire and the vessels may be placed around this fire so that they too are warmed. This process helps to lessen the stress from thermal shock cause by firing. When the ground and vessels are heated, the vessels are arranged in the fire and fuel is added until the vessels are fired. To produce a reducing atmosphere, grasses or other materials may be placed over the fire to smoother it and decrease the amount of oxygen present. After the firing, the vessels may be taken from the fire or they may be allowed to cool with the fire. Once they are cooled, the potter may apply a resin to the vessel to decrease porosity and/or they may incise decoration on the vessels.

Choices made at most of these stages can be detected by this level of analysis. Ultimately, this variability in the sample allows me to develop coherent groups based on paste, slip, and decoration characteristics from which I can suggest basic technological style characteristics that pertain to Postclassic slipped pottery from Ch'ich', Ixlú, Zacpetén, and Tipuj. Postclassic slipped pottery observations from Tayasal, Macanché Island, and Topoxté Island are included only in form and design analysis sections because of the inability to conduct refiring and hardness measurements.

I. Color Measurements

Slip colors provide much more information than simply color notation. If used with descriptive statistics, colors can suggest technological characteristics of pottery and the skill of manufacture. By coding color measurements and determining the degree of variablity, archaeologists can compare ceramic wares and groups, level of skill or quality control, inter-assemblage comparisons, and intersite comparisons (Frankel 1994:205).

This study of slip color measurements builds on Rice's (1980; 1987a) study of technological characteristics of Macanché Island pottery. Rice (1980) examined manufacturing characteristics (paste and slip) of Postclassic pottery from Macanché Island to suggest that the degree of skill increased throughout the Postclassic period, but that it never achieved the level seen in the Late Classic period. In the Early Postclassic period, potters were combining tan/cream slips with red slips to produce a "pink" slip. The high degree of fireclouding, incompletely oxidized pastes, and large variability in slip colors demonstrates that the Early Postclassic potters experimented with manufacturing techniques (Rice 1980:78-79; 1987a:113) . Potters of the Late Postclassic period achieved greater success by creating a clearer red slip with fewer fireclouds and less variability in paste characteristics. Rice concludes that although Postclassic potters may have made more "successful" pottery by the Late Postclassic period, they did not have a centralized mode of production typical of Monte Alban during the Postclassic period (Feinman, Upham, and Lightfoot 1981).

By employing measures of variance (richness, evenness, and heterogeneity), I suggest relative levels of potter's knowledge/skill at the archaeological sites of Ch'ich', Ixlú, Zacpetén, and Tipuj during the Postclassic period as well as the technology used to manufacture the five different pottery groups (Paxcamán, Fulano, Trapeche, Augustine, and Topoxté). The following color measurements and variability indices of slipped Postclassic period pottery test the hypothesis developed by Rice from Macanché Island; however, I examine pottery from the last occupation phase (Late Postclassic) at the four sites in this study. Initial observations suggest two differences from Macanché Island pottery: 1) the variability of "reds" runs from tan to pink to red to orange-red to dark purple; and 2) black slips occur in addition to red slips. These observations indicate a more diverse collection than what appears at Macanché Island, which is not unexpected given the larger sample.

I.A. Slip Colors With Regard to Archaeological Site (Figures 45 and 46)

Exterior and interior slipped surfaces are described below. Exterior slipped surface measurements are taken from the slip on the exterior surface and interior surface measurements are taken from a monochrome slip color that represents either a primary slip of a decorated sherd (the "creamy" to "orangish" slip over which the decoration is painted) or an interior red slip that resembles that of the exterior slip.

I.A.1 Zacpetén. Zacpetén's exterior and interior slips have a fairly wide range of red colors (10R, 7.5R, and 2.5YR) with the highest frequency of deep red colors occurring at Zacpetén when compared to Ch'ich', Ixlú, and Tipuj. More yellowish exterior colors (10YR and 7.5YR) reflect the inclusion of Trapeche sherds. Interior slips occur more frequently in the YR hues indicating the predominance of decorative types with primary slips in the study. Both exterior and interior slip colors vary.

I.A.2 Ixlú. While slip colors from Ixlú demonstrate a similar degree of variation as those from Zacpetén, most slips are red and not deep red. This clustering reflects the predominance of red slipped sherds and darker Trapeche pink slips. Although interior slip colors also occur more frequently in the red hues, another cluster occurs (7.5YR 7-5/4 and 5YR 6-5/4-6) indicating primary slips of the decorated types.

I.A.3 Ch'ich'. Slips from Ch'ich' do not show the range of variability as seen at Zacpetén and Ixlú. Exterior slips are red (10R and 2.5YR) with a few slip colors in the yellowish hue range. The relatively high number of red slips corresponds to the small number of decorated types present in Structure 188. Interior slips demonstrate a similar range described above with other primary slips.

I.A.4 Tipuj. Exterior slips from Tipuj exhibit the least variability of the four sites. The majority of the slips are red with some slips exhibiting yellowish hues. This color variation reflects the predominance of red and red-orange (10R and 2.5YR) slipped sherds of the

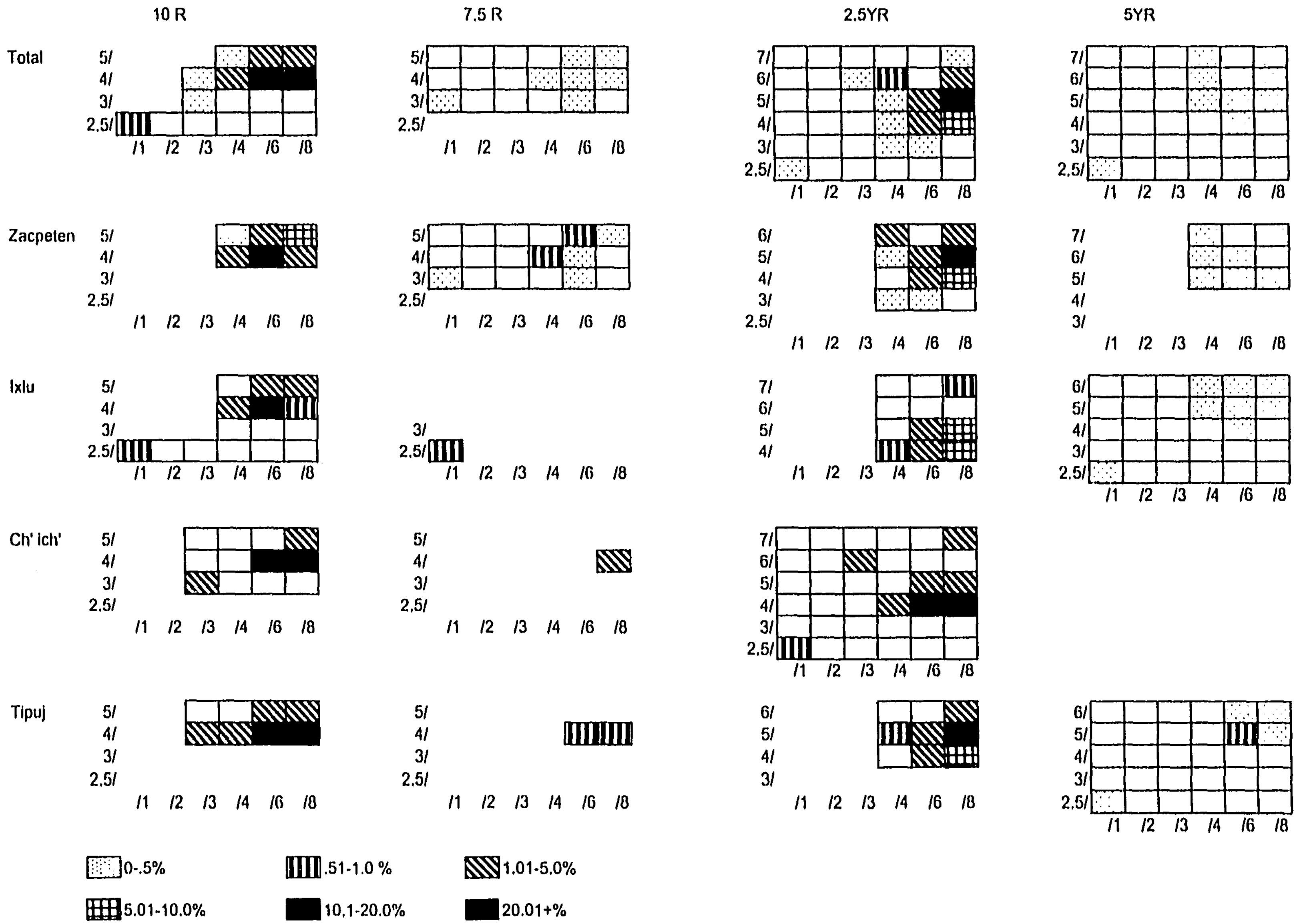


Figure 45: Exterior Slip Color Distribution According to Archaeological Site (figure continued on next page).

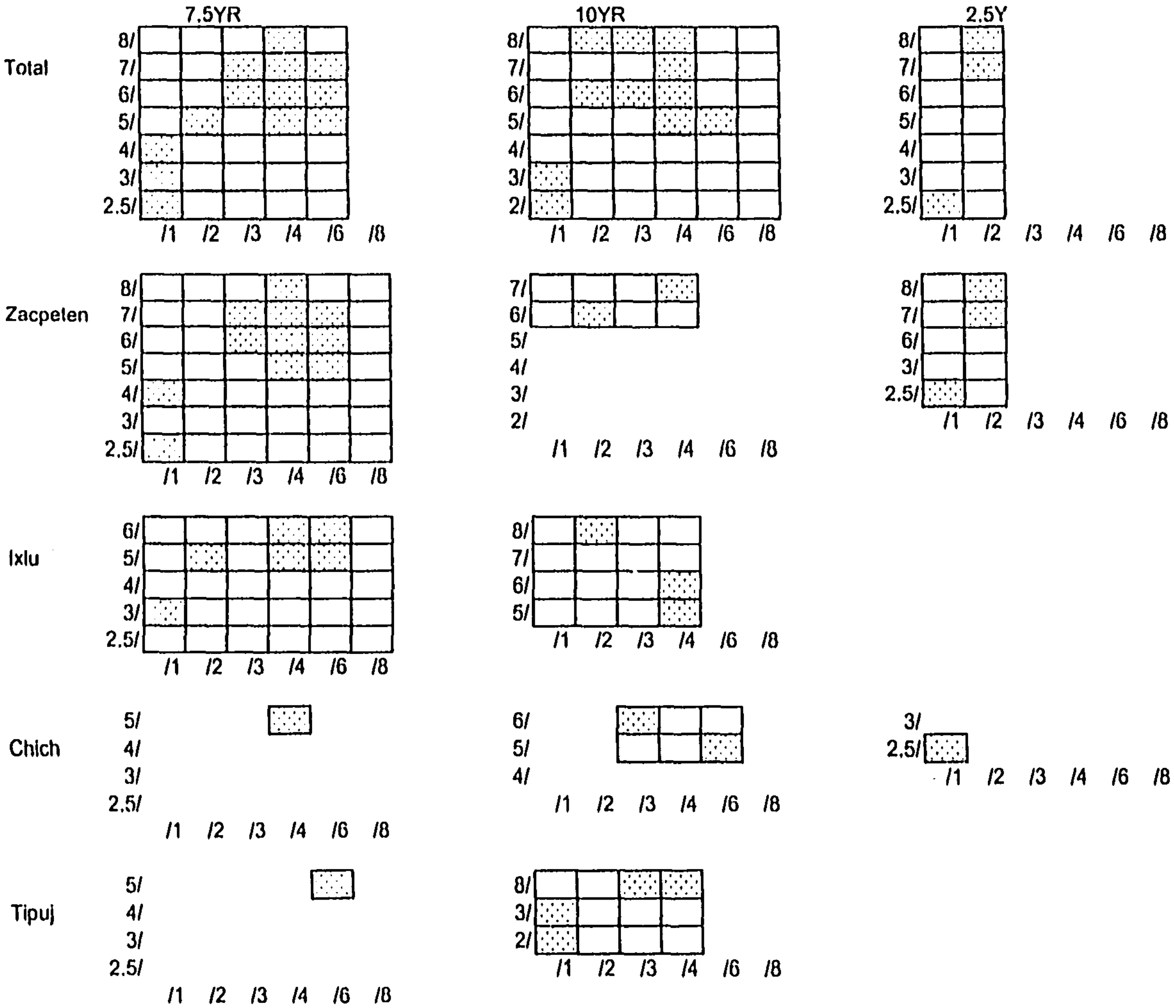


Figure 45: Exterior Slip Color Distribution According to Archaeological Site

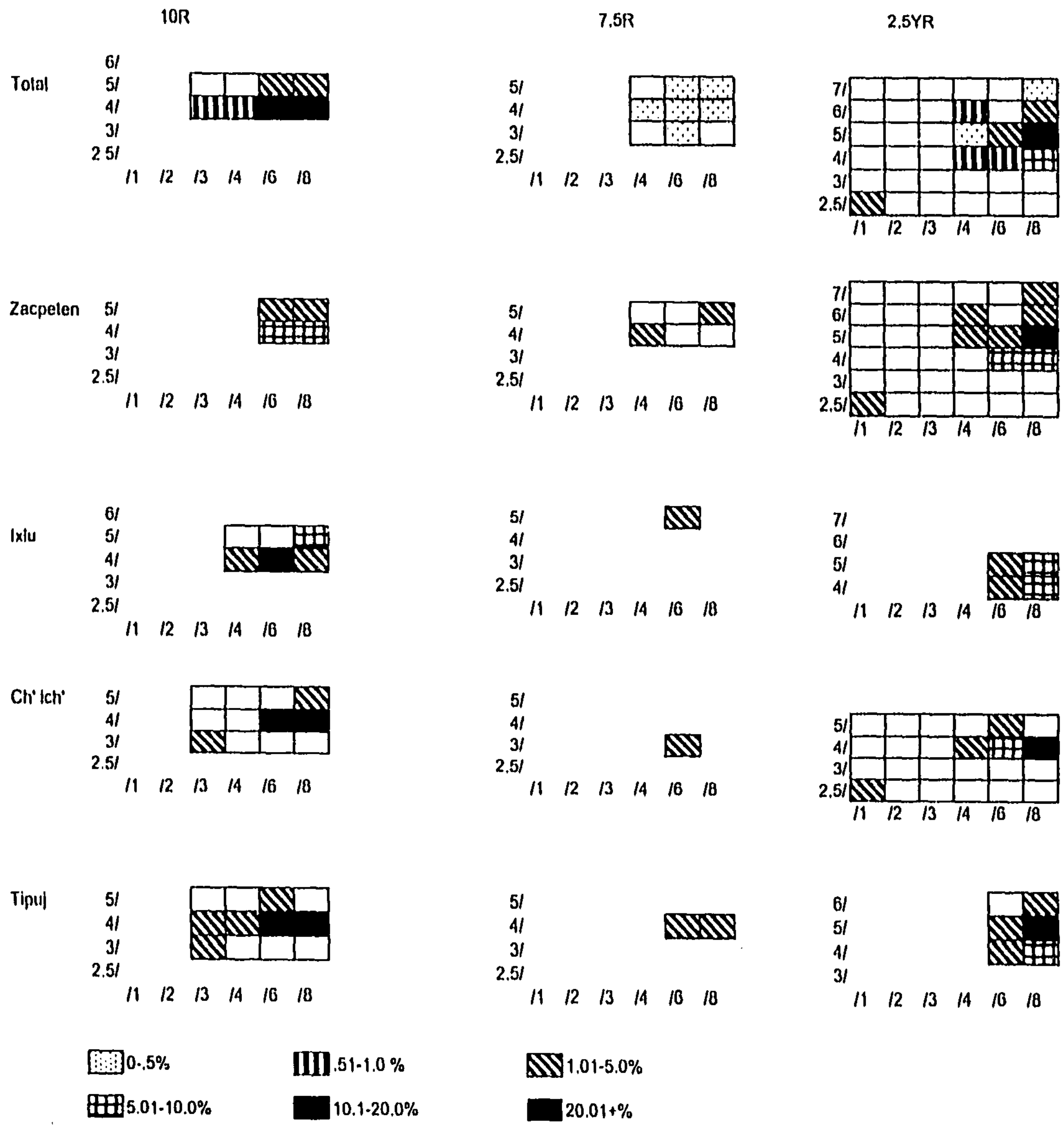


Figure 46: Interior Slip Color Distribution According to Archaeological Site (continued on next page)

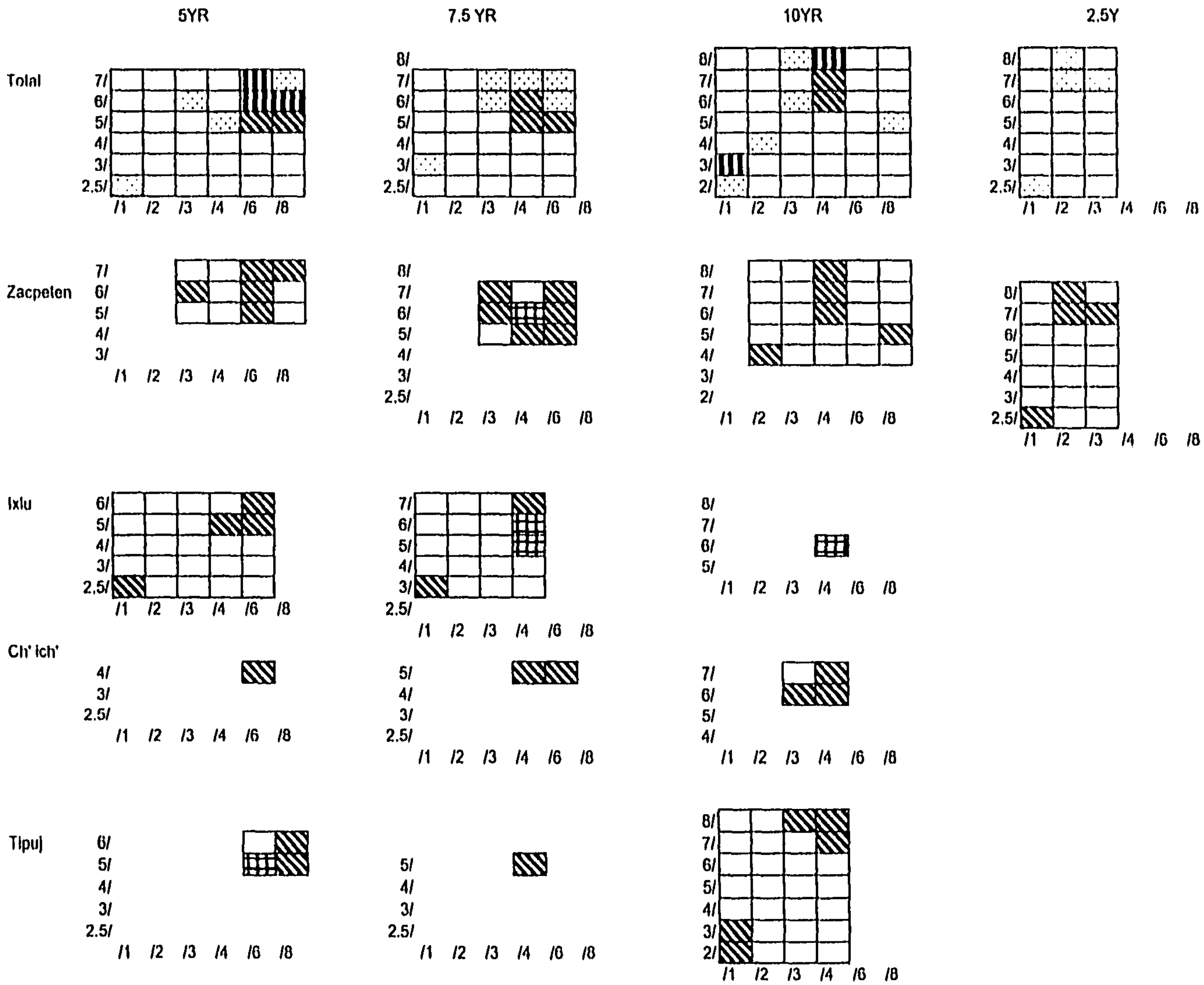


Figure 46: Interior Slip Color Distribution According to Archaeological Site

Augustine and Paxcamán ceramic groups and the absence of the Trapeche ceramic group at Tipuj. Interior slip color variation resembles that described above for Zacpetén, Ixlú, and Ch'ich' and reflects the predominance of decorated types.

I.B. Slip Colors With Regard to Ceramic Group (Figures 47 and 48)

Data used for the presentation of slip colors with respect to archaeological site is re-organized here to demonstrate the differences in exterior and interior slip colors according to the ceramic group.

I.B.2. Paxcamán Ceramic Group. Paxcamán exterior slip colors vary considerably with one cluster of the sample (approximately 1%) having a red (2.5YR 4/8) slip color. Interior slips also vary considerably. The high proportion of interior slips with a 10R hue indicates the high percentage of monochrome vessels at Tipuj and Ch'ich while the range of variability in the yellow color range indicates the diversity of primary slips on decorated sherds.

I.B.2 Fulano Ceramic Group. Not unexpectedly, all exterior surfaces and most interior surfaces of the Fulano ceramic group occur in the gray to black range (7.5R 3/1, 5YR, 7.5YR, 10YR, and 2Y 3-25/1). Although most interior surfaces occur in the gray to black range, few interior surface slip colors occur in lighter values and chromas indicating the lack of primary slips of decorated sherds that may be due to preservation.

I.B.3 Trapeche Ceramic Group. Exterior and interior slips demonstrate a similar variability as those of the Paxcamán ceramic group. Exterior slip colors occur in all Munsell color hue charts except 10R, but are most concentrated at the "pink" values and chromas typical of the Trapeche ceramic group (2.5YR 5/6). Interior slips reflect another

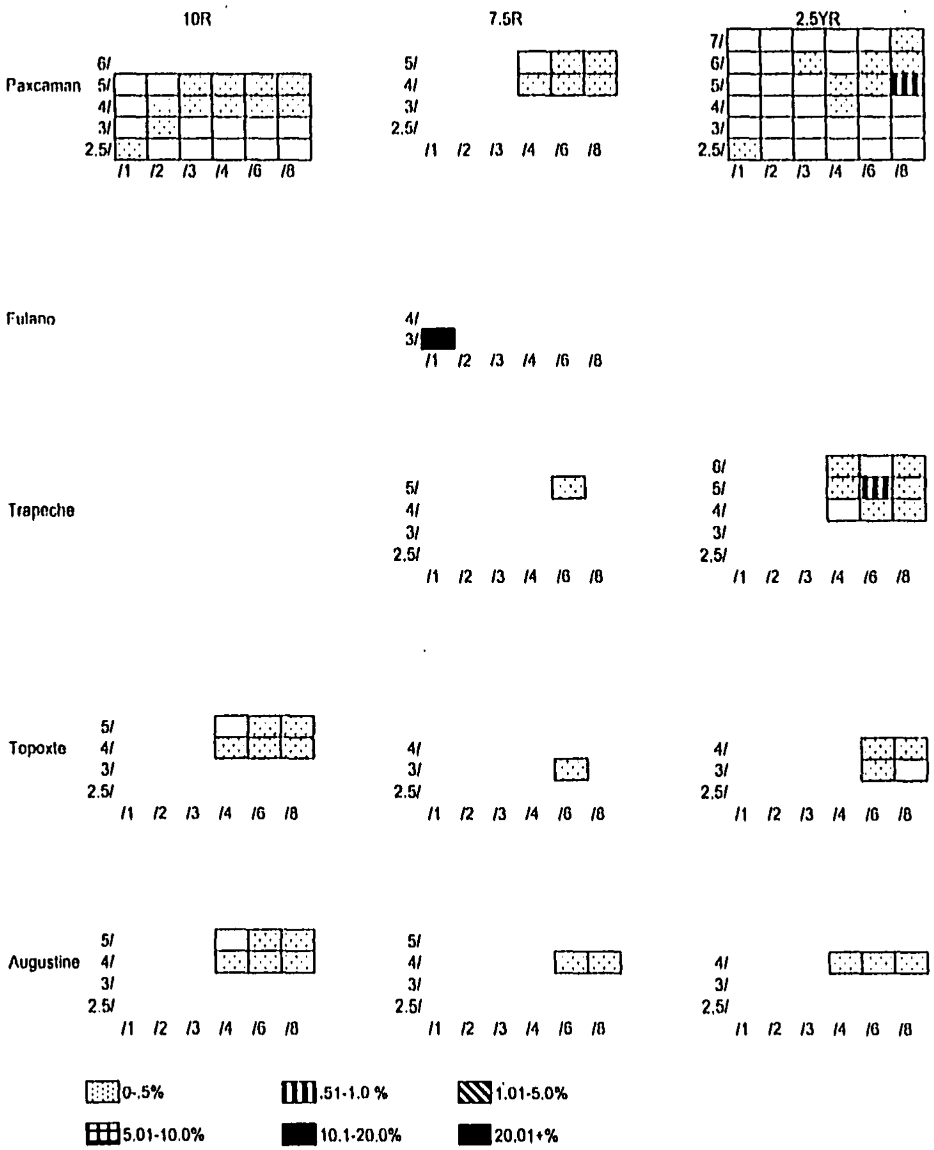


Figure 47: Exterior Slip Color Distribution According to Ceramic Group (continued on next page)

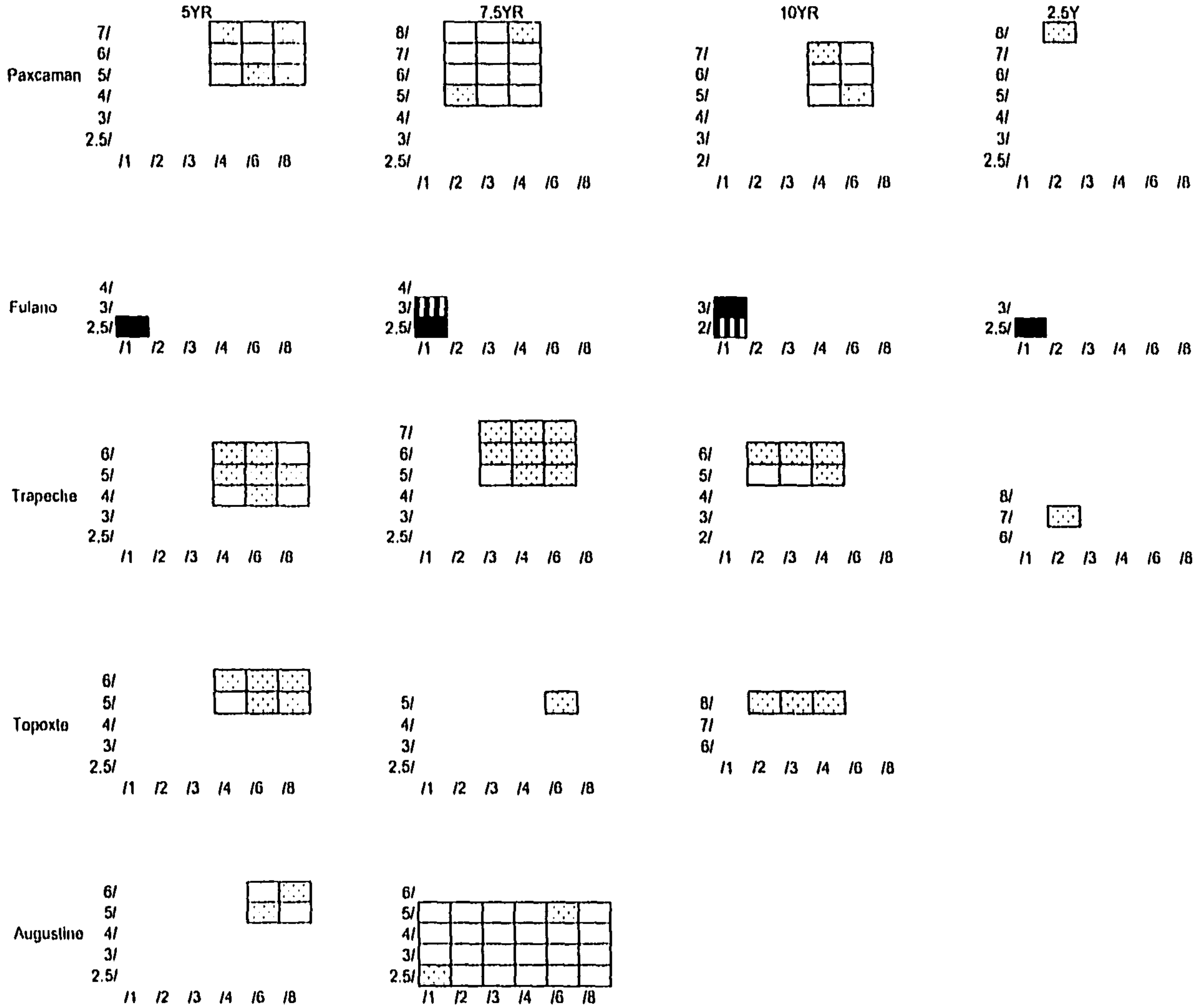


Figure 47: Exterior Slip Color Distribution According to Ceramic Group

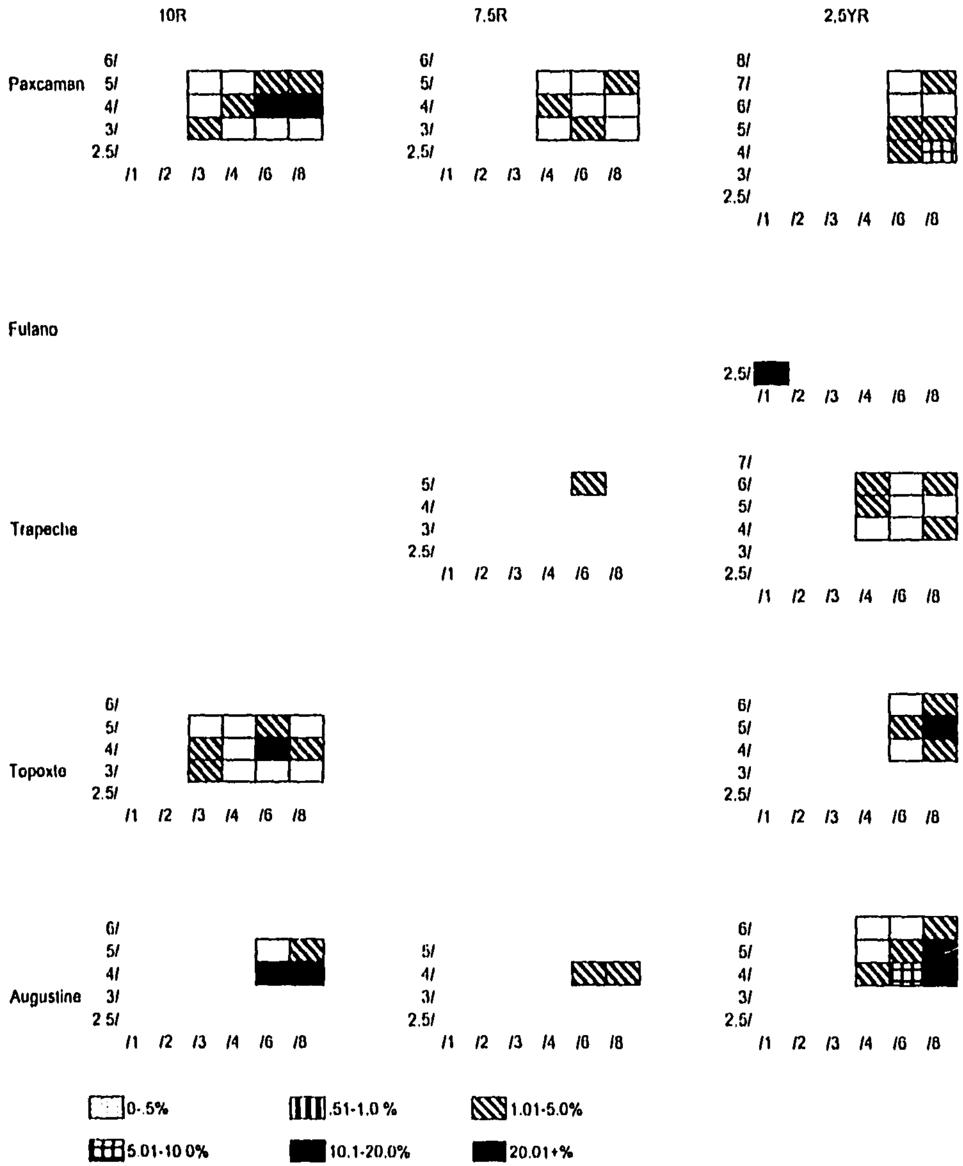


Figure 48: Interior Slip Color Distribution According to Ceramic Group (continued on next page)

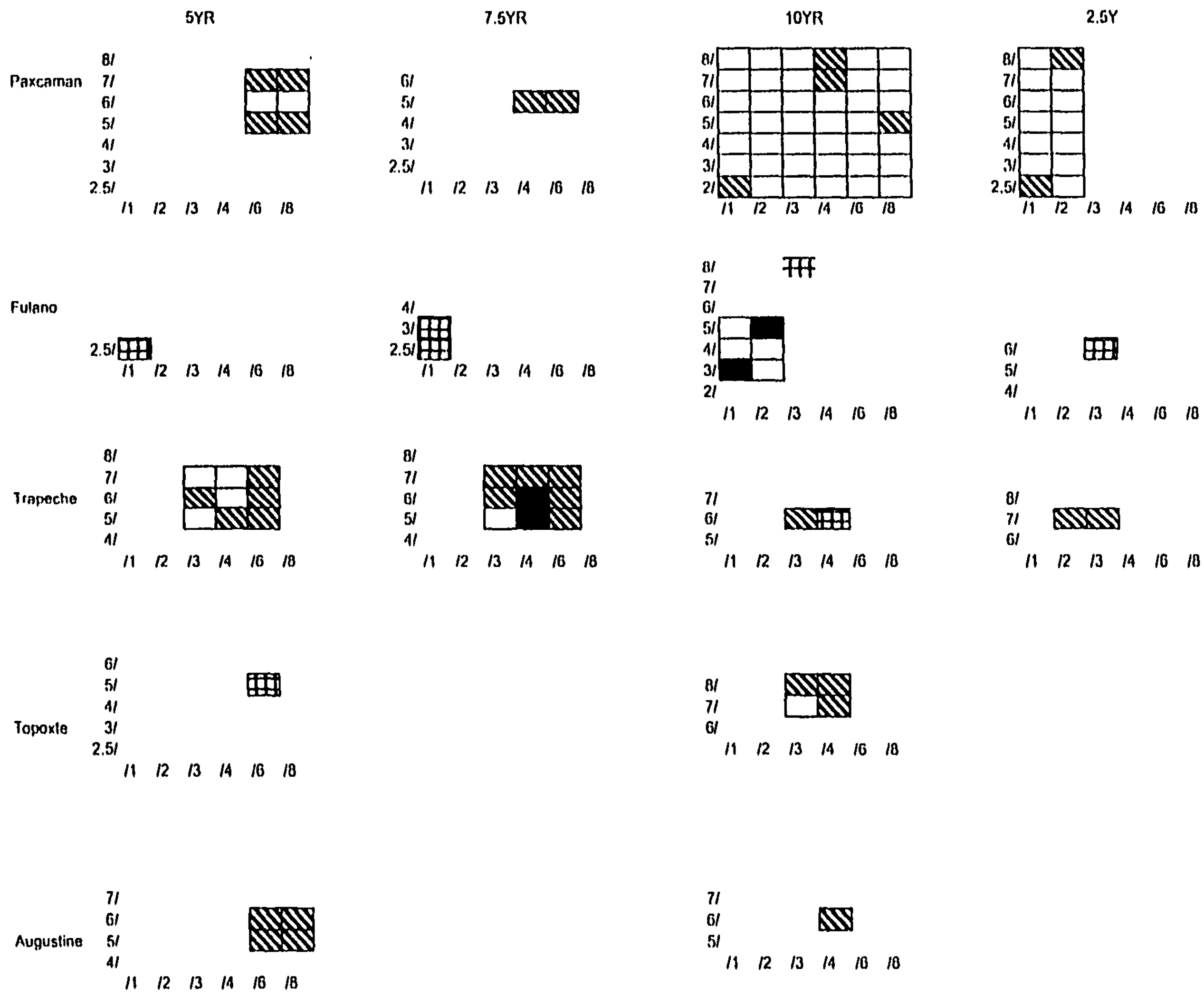


Figure 48: Interior Slip Color Distribution According to Ceramic Group

"pink" color (7.5YR 5-6/4) that defines the ceramic group. In contrast to other interior surface colors, this variation of interior slip colors does not reflect decorative panels (there are only 3 in the study), but instead reflects the variability in slip colors that occur in this group. As Rice (1980:75-76) states, "potters were trying to achieve two slip colors, a cream slip (Trapeche Group) and a red slip (Paxcamán Group). However, their relative lack of technological expertise is noteworthy. There is a considerable range of slip colors. For example, the intermediate tan and pink colors are common, as if the potters were not consistently able to achieve the same degree of oxidation in firing." This may account for the variability in the Trapeche ceramic group from Ch'ich', Ixlú, and Zacpetén.

I.B.4 Topoxté Ceramic Group. Topoxté slips show the same variability as described for the other ceramic groups with two notable exceptions. First, fewer interior and exterior colors occur in the yellowish to greenish hues (10YR, 2.5Y). Second, the difference in interior colors reflects the "whiteness" of the primary slip of the decoration panel.

I.B.5 Augustine Ceramic Group. Augustine exterior and interior slip colors provide a different pattern from the ones described above. Exterior slip colors occur in red or orange-red hues, values, and chroma and no slip colors occur in the 10YR and 2.5Y hues. Interestingly, the predominance of orange-red slips from Tipuj does not dramatically influence the distribution of exterior slip colors. Interior slip colors also cluster in the red and orange-red hues. The lack of a creamy primary slip for Augustine ceramics is evident in the lack of color measurements of the 7.5YR and 2.5Y hues.

I.C. Diversity of Color Measurements

Although diversity is apparent in Figures 45-48 for the archaeological sites and the ceramic groups, quantification of the data provides additional information as to the range of colors in the ceramic sample. In order to quantify the data, I make three assumptions in order to collect discrete variables and produce data that can be compared to other studies of this nature. First, "each color is discrete, and that the differences between them are always of the same degree" (Frankel 1994:212). In order to adhere to the first assumption, I assigned the single closest Munsell color to the slip color and did not assign a series of values or chromas (e.g., 10YR 5-6/1-2). Second, although a multitude of richness, evenness, and heterogeneity formulae exist, I selected the ones that are most appropriate for the present pottery sample. Formulae used in this section are described in detail in Chapter 4. The formulae were also selected for comparability with other published data. Third, sample size will affect the measures of diversity, but not to such an extent that the results will be nullified.

Richness, evenness, and heterogeneity were calculated to determine the diversity of the pottery sample. Richness measures the number of colors present and the sample size. A high richness indicates high variability. Evenness determines the degree to which the sample has an equal proportion of colors in the assemblage. A high evenness number (closer to 1) indicates a mixed assemblage with many colors and a low evenness number (closer to 0) indicates a uniform or homogeneous sample (Frankel 1994:213). Heterogeneity combines the measures of richness and evenness to suggest the complexity of the sample. High heterogeneity (closer to 1) indicates a wide range of colors and low heterogeneity indicates a sample whose colors are very similar.

Based on the measurements of diversity (Tables 9 and 10), several trends occur. These data appear to support Rice's (1980; 1987a) work that states that Postclassic ceramics are not the result of specialized production but instead the result of multiple potters with varying degrees of skill. Richness measurements indicate that slip colors on pottery from Zacpetén and Ixlú are the most diverse with regard to interior and exterior slip colors. This may be influenced by the inclusion of all five of the ceramic groups at the two sites. Ch'ich' and Tipuj have lower richness indices for both surfaces, but some diversity in slip colors occurs. With regard to ceramic groups, the Trapeche ceramic group has the highest richness measurement of exterior and interior slips that may reflect the experimental nature of the slip as stated above. Paxcamán and Topoxté ceramic group exterior and interior slips and the Fulano ceramic group interior slips richness indices are lower than those of the Trapeche ceramic group. Finally, the Augustine ceramic group exterior and interior slipped surfaces and the Fulano ceramic group exterior surfaces have the lowest richness indices suggesting that the slip colors are relatively more uniform. Richness measurements, however, may be skewed by the overwhelming similarities of slip colors for the Augustine ceramic group at Tipuj that accounts for one-third of the sample.

Relatively high evenness indices demonstrate that the exterior and interior slipped surfaces at all sites and all ceramic groups in the study exhibit a mixed assemblage with many colors. Tipuj's interior surfaces and Ch'ich's and Ixlú's exterior surfaces are relatively lower. Although lower indices exist, the values remain high enough to reflect a mixed assemblage of colors. However, the Augustine ceramic group exterior surface has the lowest evenness measurements which may suggest some degree of control in the

Table 9: Diversity Measurements of Interior Slip Colors

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Zacpetén	76	36	36	4.13	.74	.96
Ixlú	40	19	19	3.00	.69	.90
Ch'ich'	41	15	15	2.34	.62	.89
Tipuj	86	21	21	2.26	.54	.89
Paxcamán	85	29	29	3.15	.61	.89
Fulano	12	8	8	2.31	.70	.93
Trapeche	40	22	22	3.48	.79	.93
Augustine	95	16	16	1.64	.76	.84
Topoxté	19	13	13	2.98	.82	.94

Table 10: Diversity Measurements of Exterior Slip Colors

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Zacpetén	180	44	23	3.27	.62	.70
Ixlú	114	30	16	2.81	.57	.84
Ch'ich'	68	18	15	2.18	.51	.84
Tipuj	124	24	12	2.07	.75	.86
Paxcamán	171	34	17	2.60	.77	.83
Fulano	14	7	7	1.87	.93	.88
Trapeche	70	27	11	3.23	.88	.94
Augustine	143	17	10	1.42	.70	.84
Topoxté	101	21	21	2.09	.83	.88

manufacture of the pottery or it may be skewed by the sample from Tipuj.

Heterogeneity indices suggest that the sample's slip color is composed of many colors. Tipuj's exterior surfaces have a higher index as compared to those of Zacpetén, Ixlú, and Ch'ich'. Trapeche ceramic group exterior surfaces, as well as the Topoxté ceramic group's interior surfaces, have a high heterogeneity. The heterogeneity index for the Topoxté ceramic group's interior surfaces may reflect differences in primary slip colors that range from red to white. Other than these two differences, the Paxcamán, Fulano, Augustine, and Topoxté ceramic group exterior surfaces have high diversity indices.

Taken together, the slip color measurements presented above support Rice's (1980) initial observations that Postclassic pottery reflects pottery that was manufactured by multiple people with varying degrees of skill. The Augustine ceramic group may be an exception because of its lower indices suggesting a relatively more standardized production. However, Augustine production by no means reflects a true specialized mode of production. Postclassic potters may have been better able to create an orange-red slip than a red or pink slip. Nevertheless, Postclassic pottery in the Petén lakes region is highly variable with regard to slip color.

II. Original Hardness

Firing temperature, time, and atmosphere determines the hardness of pottery (Rice 1987b:354-355). Hardness can also measure "the porosity, grain-size distribution, post-depositional environment and mineral composition" of archaeological pottery (Orton, Tyers, and Vince 1993:138). Although hardness measurements have the potential to quantify a great deal of data, the data are ordinal data and cannot be examined by statistical procedures that involve a sample or population mean. However, mode, median, and range descriptive statistics provide considerable insight into this sample of Postclassic slipped pottery.

Tables 11-16 display mode, median, and range information of hardness of interior, exterior, and core surfaces. In general, interior surface hardness measures the hardness of the primary slip of the decorated area. Exterior surface hardness measures the slipped surfaces, and core hardness indicates the paste hardness. I took core hardness measurements on a freshly cut surface so that the jaggedness of a freshly broken sherd did not influence the hardness measurement. Tables 11-13 represent hardness demonstrating the differences of all pottery groups by site and Tables 14-16 represent hardness with regard to the ceramic group.

Hardness measurements with regard to the archaeological site where the sherd was excavated provided some trends. Interior surfaces at Zacpetén demonstrate the most variety, resulting from the high quantity of decorated sherds in the sample. Core hardness is more variable at Ch'ich' and Ixlú than at Zacpetén and Tipuj. The difference may result from more overfired sherds at Ch'ich' and Ixlú. Exterior surfaces from Tipuj have the softest surfaces of the four archaeological sites, and all sites except Ch'ich' demonstrate a two point range.

Table 11: Interior Surface With Regard to Archaeological Site

	Median	Mode	Range (Min.-Max)
Zacpetén	2	2	2-4
Ixlú	2	2	2-3
Ch'ich'	2	2	2-3
Tipuj	2	2	2-3

Table 12: Exterior Surface with Regard to Archaeological Site

	Median	Mode	Range (Min.-Max)
Zacpetén	3	3	2-4
Ixlú	3	3	2-4
Ch'ich'	2	2	2-3
Tipuj	2	2	1-3

Table 13: Core Hardness with Regard to Archaeological Site

	Median	Mode	Range (Min.-Max)
Zacpetén	3	3	2-3
Ixlú	3	3	2-4
Ch'ich'	3	3	2-3
Tipuj	3	3	2-4

Table 14: Interior Surface Hardness with Regard to Pottery Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	2	2	2-3
Fulano	2.5	3	2.5-3
Trapeche	2	2	2-3
Augustine	3	3	2-4
Topoxté	2	2	2-3

Table 15: Exterior Surface Hardness with Regard to Pottery Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	2	2	2-4
Fulano	3	3	2-3
Trapeche	2	2	2-3
Augustine	3	3	1-4
Topoxté	3	3	2-3

Table 16: Core Hardness with Regard to Pottery Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	3	3	2-3
Fulano	3	3	3-3
Trapeche	3	3	2-3
Augustine	3	3	2-4
Topoxté	3	3	2-4

When sherd hardness is examined with regard to ceramic group, some interesting trends also occur. Augustine and Fulano ceramic group interior surfaces are relatively harder than other interior surfaces. This results from more interior surfaces being monochrome slipped than decorated. The range of exterior slips is larger in the Paxcamán and Augustine ceramic groups, reflecting more variety of slips and/or different depositional contexts. The Augustine and Fulano ceramic groups represent the two largest samples of exterior slips that range from a "waxy" slip with high (4) hardness measurements to a soft, easily eroded slip (2).

While cores of the five ceramic groups have similar median and mode statistics, the range provides some differences. The differences correlate to differences seen in paste characteristics described in Chapters 4 and 5. Augustine and Topoxté ceramic groups have three categories of clay pastes. Augustine ceramic group clay pastes are either dominated by pores, dominated by calcite, or a mixture of calcite, chalcedony, and biotite. Topoxté ceramic group sherds also form three clay paste groups: 1) dominated by pores; 2) calcite and biotite; and 3) calcite, biotite, and chalcedony. Hardness differences may be the result of the different clay pastes and demonstrate that the technology involved in pottery production affects the hardness of a vessel.

In general, hardness measurements of Petén Postclassic slipped pottery are low. The low hardness measurements support the refiring experiments that demonstrate low estimated firing temperatures (300-600°C). These data, together with color measurement diversity, suggest that Postclassic pottery manufacturing was not well controlled.

III. Firing Conditions

III.A. Atmospheric Conditions

Time, temperature, and atmosphere affect the appearance of pottery. In order to reconstruct prehistoric firing conditions (time, temperature, and atmosphere), the archaeologist examines core variation and conducts refiring experiments. Cores observed from a freshly broken sherd provide information as to oxidizing and reducing firing atmospheric conditions and refiring experiments (discussed below) suggest possible firing temperatures and clay and slip characteristics (e.g., color and hardness). Rye (1981:114-118) provides descriptions and figures from which archaeologists can compare data and obtain ordinal data for analysis. Of his four categories of firing atmospheres and amount of organics present in the sherd described by Rye, only three occur in the present study.

Paxcamán and Trapeche ceramic group sherds were fired in an oxidizing atmosphere and the resulting sherd had organic material present (a darker gray zone) in the core (Rye 1981:115). The medium to dark gray clay pastes contain a great deal of organics that burn out by 800°C (see below) resulting in a dark buff or light gray clay paste. Most of the sherds in the two ceramic groups were incompletely oxidized as evident by comparing cores to Figure 2. According to Rye (1981:115), dark gray clay pastes with no core (Figure 2-1) and dark cores with lighter margins (Figure 2--3, 4) indicate pottery that was not completely oxidized and contained at least 10 percent organic material.

On the other hand, most Augustine and Topoxté ceramic group pottery in the present sample represents firing in an oxidizing atmosphere with little to no organic material present in the clay (Rye 1981:115). Their cores (Figure 2–2) have a uniform color. However, some Augustine group ceramics also have cores that are half oxidized and half unoxidized (Figure 2–5).

The third type of firing atmosphere occurs in the Fulano ceramic group. The Fulano ceramic group sherds represent a reducing atmosphere with organic material present (Rye 1981:116). These cores have darker margins and a lighter "core." Refiring experiments (described in Chapter 5 and below) indicate that the black slip is the result of a reducing atmosphere.

In addition to oxidizing and reducing atmospheric conditions, some cores demonstrate the effects of cooling during the firing procedure. Rye (1981:117) suggests that if pottery was originally fired in a reducing atmosphere and allowed to cool in the open air, a thin, sharp layer of lighter clay color will occur near the surface. This occurs in some Fulano ceramic group sherds. The second effect of cooling appears on three Paxcamán and two Augustine sherds (Figure 2–8). A "striped" core is the result of a series of oxidizing and reducing atmospheres during firing. According to Rye (1981:118), the stages are as follows: "1) heating under reducing or non-oxidizing conditions, preserving a dark core of unburned organics; 2) oxidizing above about 600°C, removing organics adjacent to the surfaces but leaving the core unaffected; 3) reducing for a time sufficient for carbon deposition to blacken the surface but not to eliminate the oxidized zone; and 4) removing the vessel from the fire and allowing it to cool rapidly in air so only the surface layer (about 1 mm thick) is oxidized."

Tables 17 and 18 present frequencies of cores based on Figure 2 with regard to archaeological site and ceramic group. The majority of sherds from all sites and ceramic groups occur in the first three categories of fired core descriptions. Dark cores are the next most abundant core category, and finally, cores that are a result of extreme cooling are the rarest.

In addition to determining the atmosphere at which vessels were fired, comparison of median, mode, and range data of fired cores (based on Figure 2) provides measures of central tendencies that demonstrate differences among archaeological sites and among ceramic groups (Tables 19 and 20). While pottery cores from all sites have a median value of 2, mode and range values differ. Zacpetén, Chi'ch', and Tipuj exhibit the widest range reflecting the incorporation of most of the Postclassic ceramic groups. The data from Zacpetén represents a bimodal distribution between core types 1 and 2. The bimodal distribution reflects the inclusion of Volador Dull-Slipped and Clemencia Cream wares. Cores from Ixlú represent a multi modal distribution reflecting the presence of oxidized Augustine group ceramics and completely unoxidized or partially oxidized Paxcamán, Fulano, and Trapeche ceramic group pottery. Ixlú cores have the smallest range of core variability resulting from the lack of variability in the Augustine ceramic group sherds and sherds fired in a reducing atmosphere.

With regard to ceramic group, variability occurs at all levels (Table 20). Paxcamán group ceramics have a median and a mode similar to Trapeche group ceramics, but Paxcamán group sherds reflect a larger range of variation in types of cores. Both ceramic groups have a bimodal distribution. The Fulano ceramic group also

Table 17: Comparison of Firing Core Variation (see Figure 2) with Regard to Archaeological Site

	Zacpetén	Ixlú	Ch'ich'	Tipuj
1	71	35	30	24
2	95	31	17	73
3	27	40	0	23
4	0	2	6	7
5	8	9	8	14
6	4	0	0	6
7	0	0	0	1
8	2	0	1	3

Table 18: Comparison of Firing Core Variation by Pottery Group

	Paxcamán	Fulano	Trapeche	Augustine	Topoxté
1	108	6	47	0	0
2	0	0	0	123	98
3	45	4	20	18	9
4	10	1	2	1	0
5	17	1	1	11	11
6	4	1	0	1	0
7	1	1	0	0	0
8	3	0	0	2	0

Table 19: Core Variation Statistics with Regard to Archaeological Site

	Median	Mode	Range (Min.-Max.)
Zacpetén	2	1, 2	1-8
Ixlú	2	1,2,3	1-4
Ch'ich'	2	1	1-8
Tipuj	2	2	1-8

Table 20: Core Variability Statistics with Regard to Ceramic Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	1	1, 3	1-8
Fulano	3	1,3	1-7
Trapeche	1	1,3	1-5
Augustine	2	2	2-8
Topoxté	2	2	2-5

demonstrates a bimodal distribution and a large range of variation. Paxcamán, Fulano, and Trapeche ceramic group (Volador Dull-Slipped ware) measures of central tendency contrast to those of the Augustine and the Topoxté ceramic groups. Both ceramic groups have a unimodal distribution. Augustine group ceramics have a large range and Topoxté group ceramics demonstrate the smallest range. The small range of core variability of the Topoxté ceramic group may reflect a higher degree of skill in manufacture and/or better control of firing conditions. These data support data obtained in the examination of color diversity.

III.B. Firing Temperatures

Refiring pottery in a controlled setting produces two types of data: the determination of the original clay color and an estimate of temperatures at which the sherd was originally fired. According to Rice (1987b:344), by refiring sherds to 800°C for 30 minutes, one can better determine the original clay color. If this assumption is true, Volador Dull-Slipped ware clays were originally pink (2.5YR 7/6; 5YR 8/3-4; 7.5YR 8/3) to reddish yellow (5YR 7/6; 7.5YR 7/6). Clemencia Cream ware sherds were composed of a white to pink (7.5YR 8-7/2-3) to very pale brown (10YR 8/2-3) clay. Finally, Vitzil Orange-Red ware sherds were composed of a reddish brown (2.5YR 5/4) to light red (2.5YR 6/6) to red (2.5YR 5/6) to yellowish red (5YR 7-6/6) clay.

I conducted laboratory refiring experiments to estimate the approximate (within 50°C) original firing temperature. Table 21 provides counts and frequencies of the number of sherds according to archaeological site and ceramic group that were estimated to have been fired at the following temperatures: 300°C, 400°C, 500°C, 550°C, 600°C, 650°C, 700°C, and 800°C.

After being refired to 800°C in an oxidizing atmosphere, only 38 sherds (7%) exhibited dark cores. The majority of the remaining dark cores (29; 5%) occurred in the gray paste sherds (Volador Dull-Slipped ware). The remaining five percent were evenly distributed throughout the orange paste (Vitzil Orange-Red ware) and the cream paste (Clemencia Cream Paste ware) sherds.

The data suggest that while most sherds from the four sites are estimated to have been fired to 550-600°C, at least 25 percent of the sherds were fired at relatively low temperatures (300°C). The low estimated firing temperatures and the wide distribution of different firing temperatures supports the proposition that Postclassic pottery in the Petén lakes region resulted from varying firing technologies that may have included bonfire firing. The data also suggest that there was not a great deal of control over firing temperatures.

An examination of the firing temperatures with regard to ceramic group demonstrates similar trends as seen in the data grouped by archaeological site. Again, a bimodal pattern occurs: one cluster at 300°C and one cluster at 550-600°C. In addition to the bimodal distribution, more Paxcamán and Augustine ceramic group sherds were fired at temperatures above 650°C. The relatively low number (n=12) of sherds fired at higher temperatures (700°C and over) may be the result of "firing accidents."

Table 21 : Estimated Firing Temperatures (°C)

	300	400	500	550	600	650	700	800
Zacpetén	55 (26%)	4 (2%)	7 (3%)	43 (21%)	52 (25%)	43 (21%)	3 (1%)	3 (1%)
Ixlú	38 (32%)	3 (3%)	3 (3%)	28 (23%)	33 (28%)	9 (8%)	3 (3%)	0
Ch'ich'	13 (18%)	13 (18%)	1 (1%)	29 (40%)	10 (14%)	5 (7%)	0	2 (2%)
Tipuj	32 (21%)	0	3 (2%)	42 (28%)	47 (31%)	25 (17%)	1 (1%)	0
Total	138 (25%)	20 (4%)	14 (3%)	142 (26%)	142 (26%)	82 (14%)	7 (1%)	5 (1%)
Paxcamán	33 (18%)	17 (9%)	5 (3%)	56 (31%)	45 (24%)	23 (12%)	6 (3%)	0
Fulano	1 (7%)	2 (14%)	0	9 (65%)	2 (14%)	0	0	0
Trapeche	14 (20%)	0	1 (2%)	32 (45%)	20 (28%)	3 (5%)	0	0
Topoxté	31 (25%)	3 (4%)	8 (6%)	25 (20%)	36 (30%)	19 (15%)	0	0
Augustine	57 (33%)	3 (2%)	8 (4%)	25 (15%)	38 (22%)	36 (21%)	2 (1%)	4 (2%)

From the above data concerning original clay color and refiring temperatures as well as general typological characteristics described in Chapter 5, it can be said that Postclassic potters utilized local clays to create all pottery forms and many Petén Postclassic potters shared a general firing technology that varied with regard to the potter's skill.

III.C. Refired Color Diversity at 800°C

Slip color distribution variability (Figures 49 and 50) and color diversity statistics of refired sherds may provide additional information as to the degree of variation in the pottery sample. Again, the comparison is based on sherds fired at 800°C. Table 22 provides richness, evenness, and heterogeneity statistics with regard to archaeological site and ceramic group. By examining the refired exterior slip surface colors, one can better compare the effects of time, temperature, and atmospheric conditions of the sherds across archaeological sites and ceramic groups because all sherds were fired to 800°C allowing comparisons at the same time, temperature, and atmosphere.

Generally, richness values decrease when refired sherds are compared to the original sherds. This is not unexpected because as the organic matter present in the clay paste is burned out, there is a reduction of low values and chromas resulting in lower richness values. Sherds from Ch'ich' and the Fulano and Topoxté ceramic groups provide the only exceptions. Richness values of ceramics from Ch'ich and from the Fulano and Topoxté ceramic groups increase substantially. The increase in the Fulano ceramic group reinforces the idea that the Fulano ceramic group black slips resulted from 6.6

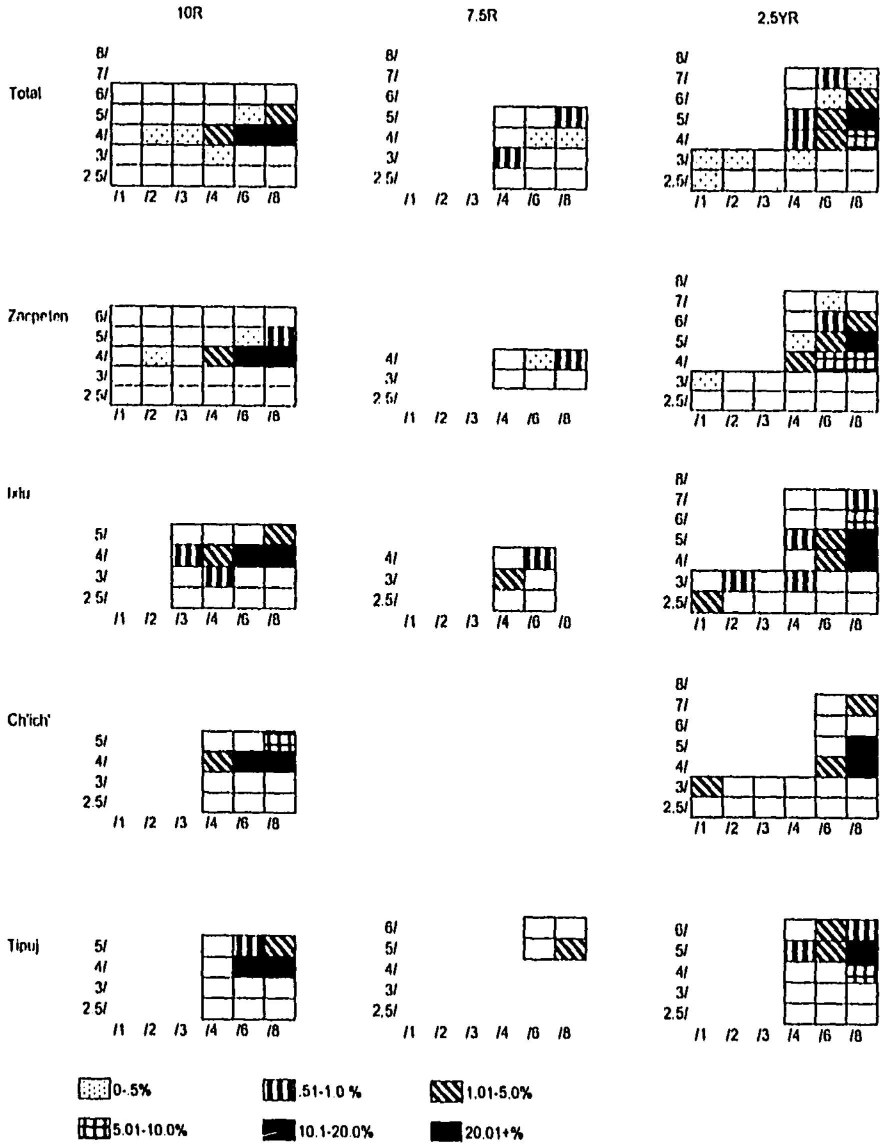


Figure 49: Refired Exterior Slip Color Distribution According to Archaeological Site (continued on next page)

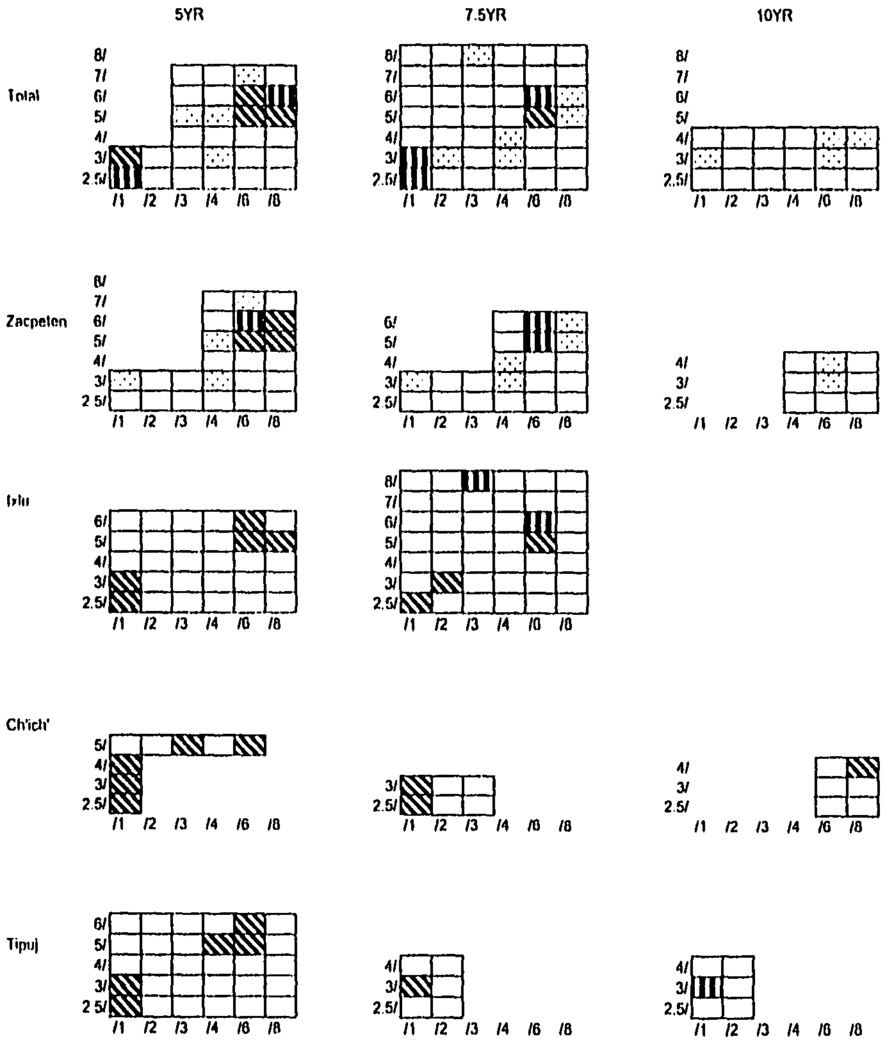


Figure 49: Refired Exterior Slip Color Distribution According to Archaeological Site

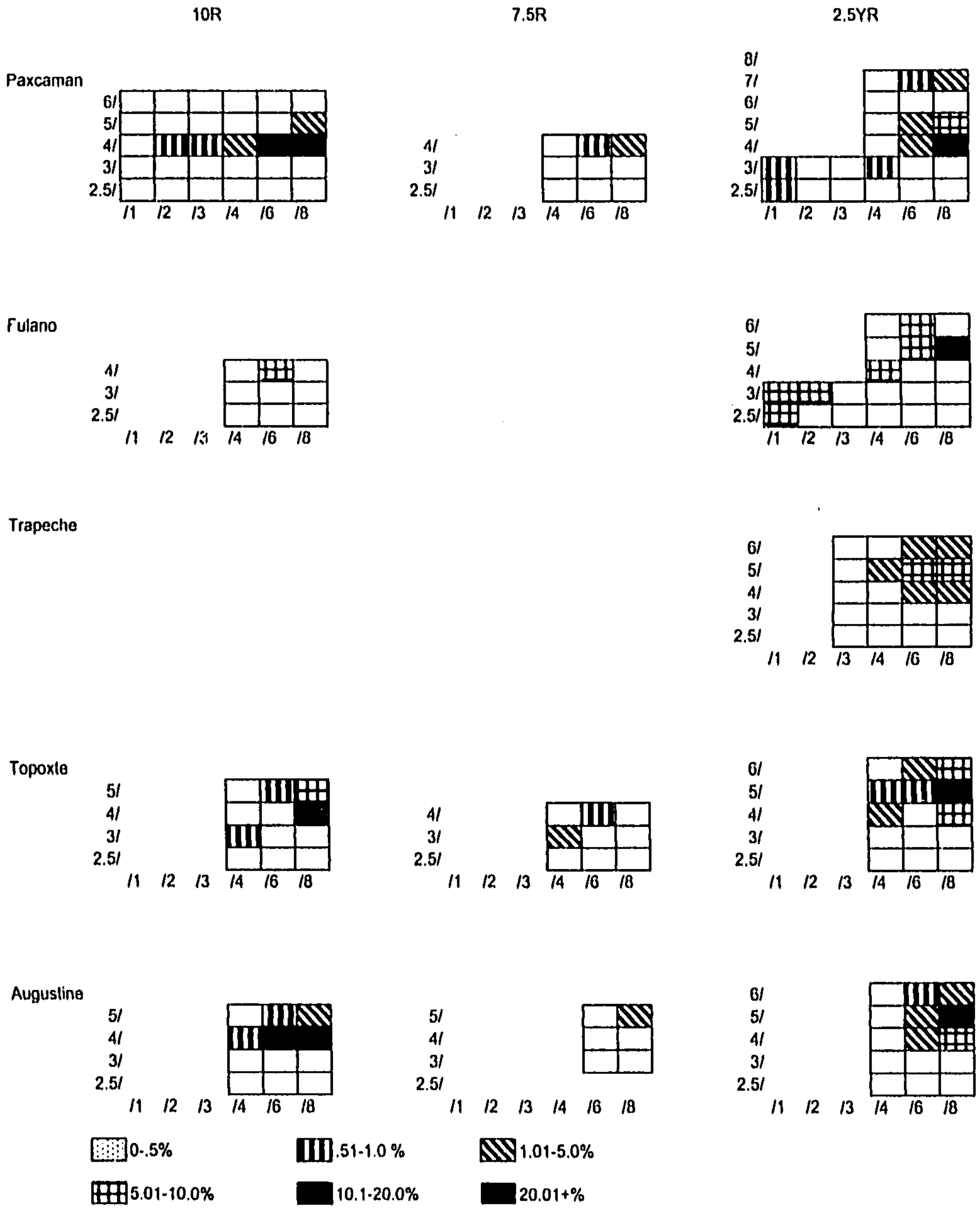


Figure 50: Refired Exterior Slip Color Distribution According to Ceramic Group (continued on next page)

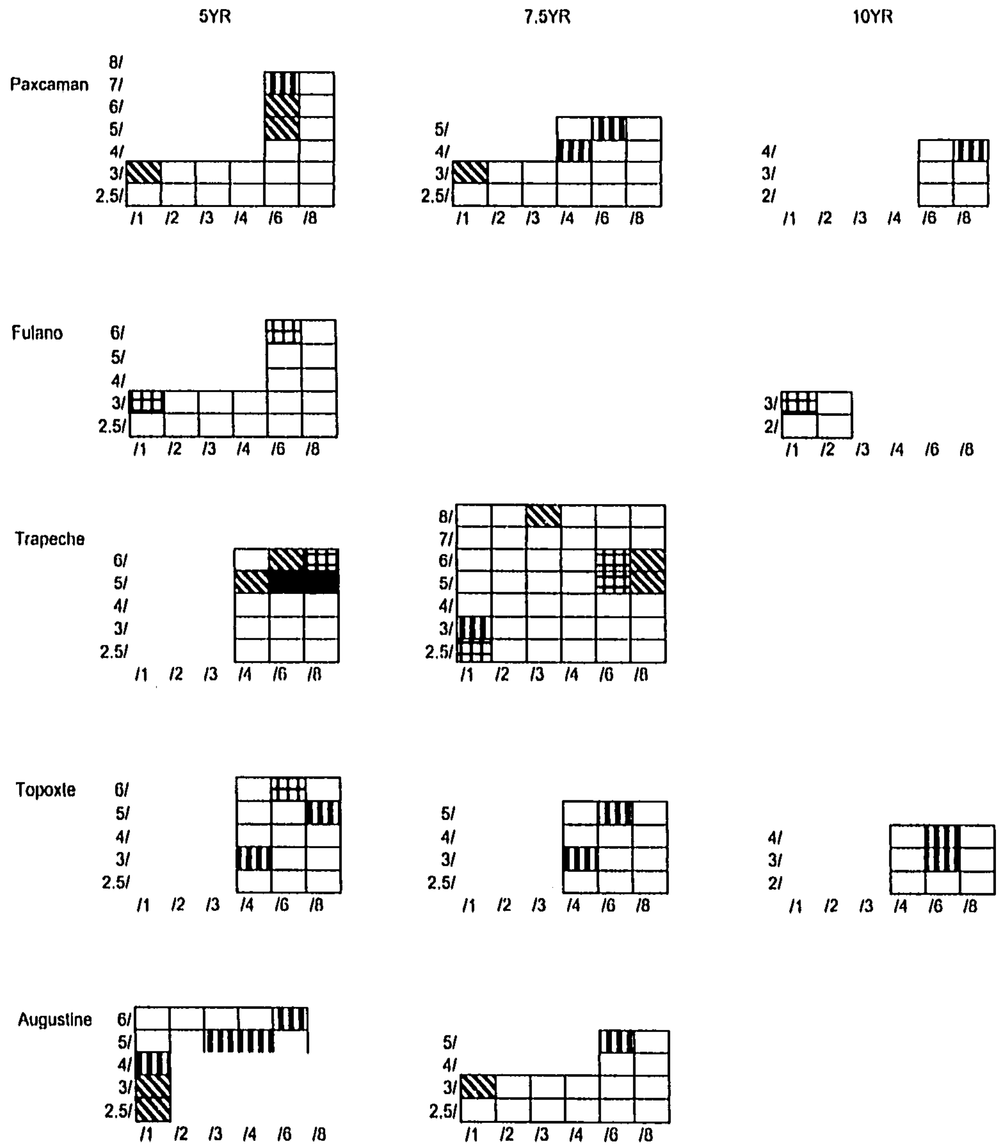


Figure 50: Refired Exterior Slip Color Distribution According to Ceramic Group

Table 22: Color Diversity Measurements for Refired Exterior Slipped Surfaces

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Zacpetén	202	36	12	2.53	.73	.90
Ixlú	106	27	19	2.62	.86	.91
Ch'ich'	69	17	17	3.25	.83	.86
Tipuj	131	18	14	1.57	.73	.88
Paxcamán	176	25	14	1.88	.76	.83
Fulano	14	10	10	2.67	.96	.97
Trapeche	66	19	18	2.34	.90	.92
Topoxté	110	20	9	1.91	.70	.86
Augustine	142	18	12	1.51	.86	.85

a red slip in a reducing environment. The increased richness at Ch'ich' and within the Topoxté ceramic group may suggest a better control over firing technology.

Although evenness measurements of refired slips are on the average higher than those of the original sherds, similar trends occur. The only exception occurs with Tipuj and Paxcamán ceramic group sherds having a lower evenness value than in Table 46, but the value is not significantly lower to warrant further discussion.

On the whole, heterogeneity values are higher with regard to refired slips than those of original exterior slipped surfaces. As suggested above, the high diversity of slipped surfaces indicates a wide variety of slip colors as well as the possibility that Petén Postclassic Maya potters aimed to create "specific" slip colors.

III.D. Refired Hardness

In addition to firing atmosphere, firing temperature, and refired slip color diversity, laboratory refiring experiments allow the archaeologist to test the hardness of the sherd surfaces and cores in order to determine changes in slip and clay properties when fired to 800°C, which in turn may suggest potters' knowledge with regard to clay properties. Tables 23-28 provide measurements of central tendencies of refired interior surfaces, exterior surfaces, and cores with regard to archaeological site and ceramic group.

Tables 23 and 24 provide information concerning interior surfaces. When fired to 800°C, sherds from all sites and ceramic groups increase in hardness (from 2 to3) and the range of hardness increases. The increase of range of variability of interior surfaces

Table 23: Refired Interior Surface Hardness Measurements by Archaeological Site

	Median	Mode	Range (Min.-Max.)
Zacpetén	3	3	1.5-5
Ixlú	3	2, 3	2-4
Ch'ich	3	3	2-5
Tipuj	3	2, 3	2-5

Table 24: Refired Interior Surface Hardness Measurements by Ceramic Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	3	3	2-5
Fulano	3	2, 3	2-5
Trapeche	2.5	2, 3	2-4
Augustine	3	3	2-5
Topoxté	2	2	1.5-4

Table 25: Refired Exterior Surface Hardness Measurements by Archaeological Site

	Median	Mode	Range (Min.-Max.)
Zacpetén	3	3	1.5-5
Ixlú	3	3	2-5
Ch'ich	3	3	2-5
Tipuj	3	2, 3	2-5

Table 26: Refired Exterior Surface Hardness Measurements by Ceramic Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	3	3	2-5
Fulano	3	3	2-5
Trapeche	3	3	2-4
Augustine	3	3	2-5
Topoxté	3	2, 3	1.5-5

Table 27: Refired Core Hardness Measurements by Archaeological Site

	Median	Mode	Range (Min.-Max.)
Zacpetén	3	3	2-5
Ixlú	3	3	2-4
Ch'ich	3	3	2-4
Tipuj	3	3	2-5

Table 28: Refired Core Hardness Measurements by Ceramic Group

	Median	Mode	Range (Min.-Max.)
Paxcamán	3	3	2-5
Fulano	3	3	2-3
Trapeche	3	3	2-3
Topoxté	3	2,3	2-4
Augustine	3	3	2-4

may reflect the variability of the primary slip. Ixlú and Tipuj represent a bimodal distribution and the Fulano and Trapeche ceramic group refired sherds also occur in a bimodal distribution.

Measures of central tendencies of exterior refired surface hardness are presented in Tables 25 and 26. Zacpetén and Ixlú surface medians and modes remain constant while Ch'ich' and Tipuj exterior surfaces increase in hardness. Tipuj's distribution becomes bimodal when sherds are refired to 800°C. In addition to the increase in hardness, the range of hardness values also increases. The Fulano ceramic group is the only ceramic group whose median and mode remain constant. All other ceramic group exterior surfaces increase in hardness and the range of hardness variability also increases.

Core hardness median and mode values remain constant with regard to archaeological site and ceramic group (Tables 27 and 28). However, the Topoxté ceramic group is characterized by a bimodal distribution. With the exception of Ixlú and the Trapeche, Augustine, and Topoxté ceramic groups, ranges of hardness variability also increase.

From the above laboratory refiring experiments, I suggest that the pottery sample for this study reflects a great deal of variability. This variability supports Rice's (1980; 1987a) proposition that Postclassic pottery reflects Maya experimentation with clays, slips, and firing techniques. The experimentation with clays, slips, and firing techniques may result from the restriction of resources due to the enforcement of social boundaries. It may also result from a depletion of resources for firing due to clearing for settlement.

IV. Form Measurements

Measurement-based classifications of Postclassic forms also suggest variability during the Postclassic period in the Petén lakes region. The following discussion is based on measurements of rim diameters of the different Postclassic vessel forms (tripod plates, bowls, grater bowls, collared jars, and narrow neck jars). Descriptive statistics (mean, mode, median, and standard deviation) for each vessel form are grouped according to archaeological site and ceramic group to provide possible differences that may be reflected in the technological styles of Petén Postclassic slipped pottery. Information from Tayasal, Topoxté Island, and Macanché Island are included in this section.

IV.A. Tripod Plates

A total of 223 tripod plate rims from the sherds in the present study were measured and the descriptive statistics appear in Table 29. The total distribution of tripod plate rim diameters results in a unimodal distribution centered at 24 cm with the majority of rim diameters occurring between 20 and 30 cm. Rim diameters from Ixlú and Zacpetén follow the same general trend. On the other hand, Ch'ich' and Tipuj have slightly larger means (approximately 26 cm) and larger rims (36-44 cm). Tipuj has the largest measured tripod plate diameter at 44 cm.

When one examines the tripod plate rims with regard to ceramic group, some differences occur that may reflect differences in time period (i.e., earlier vs. later Postclassic). Rice (1980:73) states that rim diameters decrease from the Terminal Classic

Table 29: Tripod Plate Rim Diameter (cm) Descriptive Statistics

	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	111	23.8	22	24	3.63
Ixlú	30	24.6	24	24	3.41
Ch'ich'	35	26.9	28	28	4.28
Tipuj	47	25.9	26	26	4.05
Paxcamán	136	25.0	24	24	3.83
Fulano	5	21.6	16	22	5.90
Trapeche	12	26.0	28	27	3.81
Augustine	32	26.5	24	26	4.13
Topoxté	39	23.7	26	24	3.08
Total	193	24.0	25	24	7.56

period to the Postclassic period. If the Augustine and Trapeche ceramic groups represent the Early/Middle Postclassic period, their rim diameters should be larger than those of the Paxcamán and Topoxté. The present data set supports this statement. Augustine ceramic group tripod plate rim diameters have a mean of 26.5 cm with a range of 20-44 cm and Trapeche tripod plate diameters have a mean of 26 cm with a range of 20-34 cm. According to Rice (1987a), the Paxcamán ceramic group appears in all Postclassic contexts suggesting that rims should vary when examined as a whole. According to the data for this sample, the Paxcamán tripod dish rim diameter mean is 25.0 cm with a range of 14-38 cm which demonstrates the variability that Rice describes. Finally, Topoxté ceramic group tripod plate rim diameters should be the smallest because Topoxté pottery is largely a Late Postclassic phenomenon. The present Topoxté tripod plate diameter mean is 23.7 cm with a range of 18-28 cm.

Because the Fulano ceramic group is a new Postclassic ceramic group, I am unsure as to its placement in the Postclassic scheme. However, if one follows the above outline of the relationship of ceramic groups, rim diameter means and ranges, and relative time period placement, I place the Fulano ceramic group as a later Postclassic ceramic group. The tripod plate diameter mean is 21.6 cm with a range of 16-30 cm. The range resembles that of the Topoxté ceramic group.

In addition to the present sample, I measured tripod plate rim diameters of all of the tripod plates from Ixlú, Ch'ich', Zacpetén, and Tipuj, as well as Tayasal, Macanché Island, and Topoxté Island. Table 30 presents rim diameter data for all tripod plates from Ch'ich, Ixlú, Zacpetén, and Tipuj. The descriptive statistics suggest that the sample used for this study represents the range of the entire Postclassic tripod plate sample with two minor exceptions. First, differences in rim diameters at Ch'ich' suggest that the sample used in this study represents tripod plates that are four centimeters larger than the average tripod plate at Ch'ich'. Second, the sample of Trapeche ceramic group sherds in this study has larger diameters than the whole sample.

I measured rim tripod plate rim diameters from Tayasal, Macanché Island, and Topoxté Island. Table 31 presents descriptive statistics for tripod plates from Tayasal. When examined as a whole sample, the rim diameters are slightly larger (1.4 cm) than the four sites discussed above. While Augustine and Paxcamán ceramic group tripod dishes from Tayasal are nearly identical to those presented above, Trapeche ceramic group tripod dish diameters are 4.5 cm larger. Although this is a large difference, it may be accounted for by a small sample size (n=4).

Tripod dish diameters from Macanché Island show interesting differences (see Table 32). Total tripod dish rim diameters and Paxcamán and Trapeche ceramic group tripod dish rim diameters are on the average three centimeters smaller than tripod dish rim diameters from all other sites in the Petén lakes region. This difference may indicate a difference between ritual pottery and non-ritual pottery. On the other hand, the two late ceramic groups (Topoxté and Fulano) have similar rim diameters as compared to the other sites in the Petén lakes region. Again, sample size of the Fulano and Topoxté ceramic groups from Macanché Island may influence the data, but it may also suggest that late Postclassic tripod dishes have less variability as to rim diameter.

Table 30: All Postclassic Tripod Plate Rim Diameter (cm) Descriptive Statistics

	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	180	24.1	24	24	2.91
Ixlú	107	24.6	24	26	2.55
Ch'ich'	22	24.8	24	24	2.58
Tipuj	22	26.0	28	28	4.14
Paxcamán	253	24.6	24	24	3.01
Fulano	0	0	0	0	0
Trapeche	5	24.0	24	24	1.41
Augustine	15	26.3	28	28	2.81
Topoxté	58	23.6	24	24	2.48
Total	331	24.5	24	24	2.94

Table 31: Tayasal Tripod Plate Rim Diameter Descriptive (cm) Statistics

	Number	Mean	Mode	Median	Standard Deviation
Paxcamán	13	24.9	24	24	2.51
Trapeche	4	28.5	28	28	2.52
Augustine	11	26.1	26	26	2.30
Total	27	25.9	26	24	2.70

Table 32: Macanché Island Tripod Plate Rim Diameter (cm) Descriptive Statistics

	Number	Mean	Mode	Median	Standard Deviation
Paxcamán	38	21.8	22	22	2.52
Trapeche	67	21.4	22	22	2.41
Fulano	6	20.8	22.5	24	4.58
Topoxté	10	23.8	24	24	2.74
Total	121	21.7	22	22	2.66

Tripod dish diameters from Topoxté Island resemble those at other sites in the Petén lakes region (see Table 33). This is not surprising since Topoxté pottery is believed to have been made at the Topoxté Islands and traded to other sites (Rice 1986:278).

IV.B Bowls

I measured 20 bowl rim diameters and the corresponding descriptive statistics appear in Table 34. Bowl rim diameters form an unimodal distribution with a mean of 20.3 cm and a range of 9-40 cm. Bowls from Ixlú are smaller than bowls from the other three sites with a mean of 14 cm and a range of 10 to 18 cm. On the other hand, Ch'ich' has the largest bowl rim diameter mean at 26 cm with a range of 16-36 cm. Tipuj and Zacpetén have similar means, but Zacpetén has the largest bowl rim diameters in the collection.

Trapeche ceramic group bowls have the smallest diameters with a mean of 12 cm and a range of 10-14 cm. The remaining three ceramic groups (there are no Fulano bowls in the sample) have similar means (20-22 cm) and ranges; however, the Paxcamán ceramic group has the widest range of rim diameters (9-40 cm). The differences in bowl rim diameter means with regard to ceramic groups does not correspond to the potential chronological differences present in tripod plate rim diameters, but this may be the result of a smaller sample size.

Table 33: Topoxté Island Tripod Plate Rim Diameter (cm) Descriptive Statistics

	Number	Mean	Mode	Median	Standard Deviation
Topoxté	12	24.9	24	24	2.31

Table 34: Bowl Rim Diameter Descriptive Statistics

	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	9	22.2	20	20	9.13
Ixlú	4	14.0	14	14	3.24
Ch'ich'	2	26.0	NA	26	14.14
Tipuj	5	19.6	22	22	6.19
Paxcamán	8	20.6	NA	17	11.55
Fulano	0	0	0	0	0
Trapeche	2	12.0	NA	12	2.83
Augustine	6	21.5	20	22	5.58
Topoxté	4	22.0	NA	21	4.32
Total	20	20.3	20	20	8.31

IV.C. Grater Bowls

Table 35 provides the descriptive statistical information for the eight grater bowls rim diameters in the present sample. When one examines all grater bowls, a bimodal distribution (22 cm and 26 cm) occurs, with a mean of 25 cm and a range of 22-28 cm. Grater bowls from Ixlú have the smallest mean (24 cm) and the widest range of diameters (22-28 cm). Ch'ich' grater bowls occur with diameters of 22 cm and 28 cm. The grater bowl from Tipuj has a rim diameter of 26 cm and the grater bowl from Zacpetén has a diameter of 28 cm.

Grater bowls only occur in the Paxcamán and Augustine ceramic groups. Most Petén Postclassic grater bowls have the snail inclusion paste typical of the Paxcamán ceramic group and have a similar hardness as other vessels forms. The Augustine grater bowl has a rim diameter of 28 cm. On the other hand, grater bowls of the Paxcamán ceramic group have a mean of 24.6 cm and a range of 22 cm to 28 cm.

IV.D. Collared Jars

Collared jars typically have larger rim diameters than tripod plates and narrow neck jars (Table 36). The total collared jar rim diameter mean is 26.0 cm with a range of 6-40 cm. The sample is unimodal with a negative kurtosis centered at 32 cm. Collared jars from Tipuj have the largest rim diameters, the second largest mean, and the widest range of rim diameters (6-40 cm). Tipuj's distribution resembles that of all of the diameters having the smallest range (28-30 cm) and the largest mean. Augustine ceramic group collared jars demonstrate a bimodal distribution centered at 28 cm and 34 cm.

Table 35: Grater Bowl Rim Diameter Statistics

	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	1	28.0	NA	28	NA
Ixlú	4	24.0	22	22	2.83
Ch'ich'	2	25.0	NA	25	4.24
Tipuj	1	26.0	NA	26	NA
Paxcamán	7	24.6	22	24	2.76
Fulano	0	0	0	0	0
Trapeche	0	0	0	0	0
Augustine	1	28.0	NA	28	NA
Topoxté	0	0	0	0	0
Total	8	25.0	22	25	2.83

Table 36: Collared Jar Rim Diameter Statistics

	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	20	25.2	28	27	6.94
Ixlú	5	23.6	32	30	3.05
Ch'ich'	3	29.3	NA	30	3.05
Tipuj	22	26.8	32	27	7.82
Paxcamán	14	23.3	32	25	9.00
Fulano	1	32	NA	32	NA
Trapeche	4	30.5	32	31	1.91
Augustine	22	27.1	28	28	5.33
Topoxté	9	24.7	26	26	10.39
Total	50	26.0	32	28	7.54

Topoxté and Paxcamán group collared jars have the smallest rim diameter means but the largest ranges. Topoxté ceramic group collared jar rim diameters range from 6-40 cm and Paxcamán ceramic group collared jar rim diameters range from 6-32 cm. The Paxcamán ceramic group distribution is bimodal and centered at 16 cm and 32 cm.

Collared jars occur in all five Postclassic ceramic groups. Fulano, Trapeche, and Augustine ceramic group collared jars have the largest rim diameter means. Ch'ich' collared jars have the largest rim diameter mean (29.3 cm) with rim diameters of 30 cm and 32 cm. On the other hand, Ixlú collared jars have the smallest rim diameter mean (23.6 cm) with rim diameters of 8 cm, 16 cm, and 32 cm. Zacpetén has the highest frequency of collared jars and has a bimodal distribution at 20 cm and 28 cm.

IV.E. Narrow Neck Jars

I measured 54 narrow neck jar rim diameters and the descriptive statistics are presented in Table 37. The overall rim diameter mean is 20.5 cm with a bimodal distribution centered at 20 cm and 30 cm. Zacpetén has the smallest narrow neck jar rim diameters with a mean of 18.8 cm and a range of 8 cm to 32 cm. Ixlú and Tipuj narrow neck jars have similar means (20.6 cm and 20.8 cm, respectively) with similar ranges (6-38 cm and 8-34 cm, respectively). Tipuj's narrow neck jar distribution is also bimodal with centers at 24 cm and 32 cm. Ch'ich' narrow neck jar rim diameters have the largest mean of 26 cm with a range of 20 cm to 36 cm.

Trapeche and Fulano ceramic group narrow neck jars have the smallest means (16.67 cm and 18 cm, respectively). While most of the Trapeche ceramic group narrow

Table 37: Narrow Neck Jar Rim Diameter Statistics

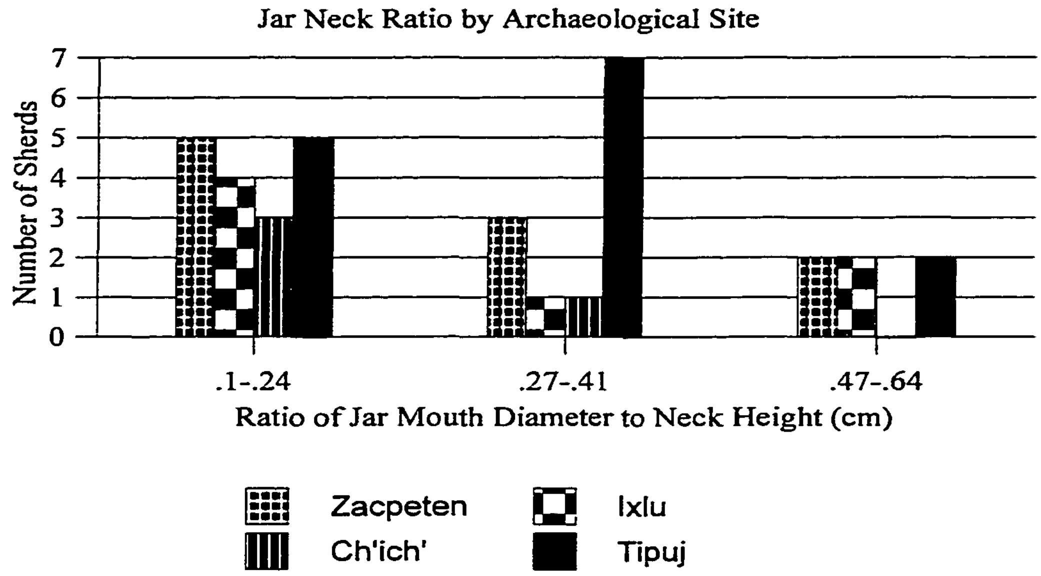
	Number	Mean	Mode	Median	Standard Deviation
Zacpetén	12	18.8	14	17	16.79
Ixlú	7	20.6	14	20	9.64
Ch'ich'	4	26.0	14	14	7.12
Tipuj	30	20.8	24	20	7.22
Paxcamán	16	21.7	10	21	8.40
Fulano	3	18.0	14	14	6.93
Trapeche	6	16.7	12	14	7.66
Augustine	18	21.0	24	20	6.62
Topoxté	11	20.6	20	20	8.44
Total	54	20.5	20	20	7.57

neck jars have rim diameters between 12 cm and 16 cm, one rim has a diameter of 32 cm. Fulano ceramic group narrow neck jar diameters are 14 cm and 32 cm. Paxcamán, Topoxté, and Augustine ceramic group narrow neck jars have similar rim diameters (20-21 cm). Paxcamán and Augustine ceramic group narrow neck jar diameters have the largest range. The Topoxté ceramic group has a bimodal distribution centered at 20 cm and 32 cm.

Neck height measurements may provide information as to functional categories. Jars with wide mouths may be cooking or storage jars whereas jars with tall restricted necks may have been used as jars to hold liquids (Rice 1987b:239-240). Of the 54 narrow neck jar rims, 37 have complete necks. When the jar rim diameters are compared to neck heights, the resulting ratios provide categories such as low neck, medium neck, and high neck jars that may represent the above functions.

For this sample of 37 jar neck to height ratios, three groups exist. Low neck jars are those that have ratios between .10 and .24, medium neck jars have ratios between .27 and .41, and high neck jars have ratios between .47 and .64. Figure 51 provides the graphic distribution of the data.

From these data according to archaeological site and ceramic group, some interesting differences appear. First, Zacpetén, Ixlú, and Tipuj jar necks vary from short to tall whereas Ch'ich' jars are characterized by short and medium neck heights. This may be a result of limited excavations at Ch'ich'. Second, Paxcamán and Augustine ceramic group jar neck heights vary while Trapeche and Topoxté ceramic group jars tend to have medium to tall neck heights. Overall differences in rim diameters and neck



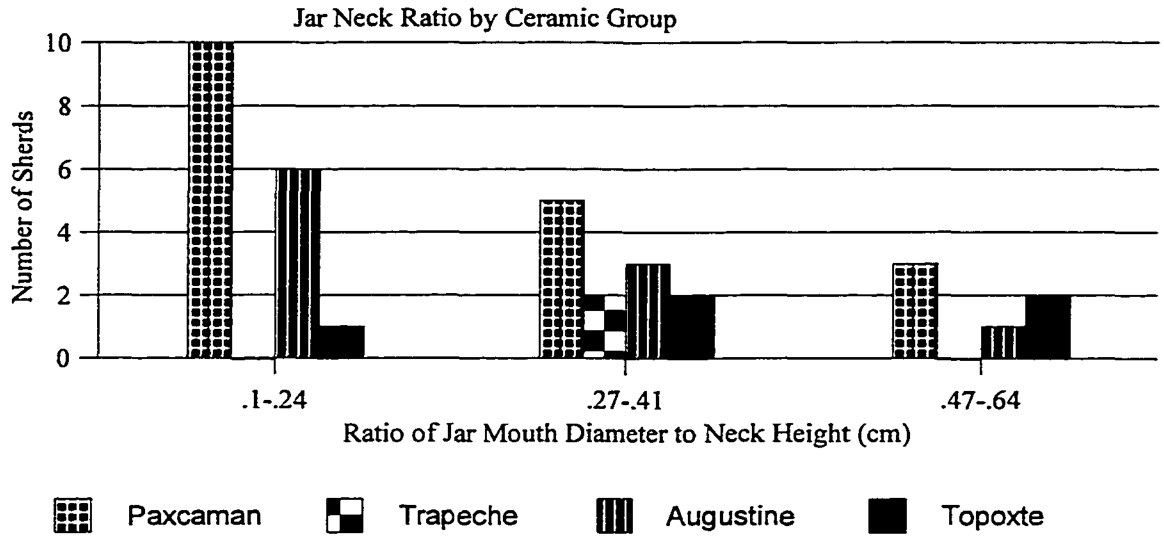


Figure 57: Narrow Neck Jar Ratios by Archaeological Site (top) and by Ceramic Group (bottom).

heights suggest that while jars may have been manufactured and used for different functions, not all archaeological sites and pottery types had an even distribution of jars types.

IV.F. Drums

Four drums are included in this sample. With the exception of the small (8 cm) Dulces Incised: Dulces Variety drum from Zacpetén, drum diameters range from 16 cm to 18 cm. Ixlú has two drums with diameters of 16 cm (Xuluc Incised: Tzalam Variety) and 18 cm (Picú Incised: Thub Variety) and Tipuj has an Hobonmo Incised: Hobonmo Variety drum with a 16 cm diameter. All other drums not included in the study but excavated at Zacpetén, Ixlú, and Tipuj have diameters that range from 16 cm to 22 cm.

V. Surface Treatment and Decoration

V.A. Surface Treatment

As discussed in Chapter 5, monochrome slipped surface finishes have a matte, low luster, or "waxy" finish. Surfaces with matte finishes often show striation marks under low magnification (10X). The striation marks are not fresh, indicating that they are not the result of washing after excavation. While most undecorated sherds have a matte finish, some have a low luster to "waxy" finish. Striation marks are not visible under low magnification, but the burnished surfaces have a glossy, uneroded appearance. "Waxy" finishes may be the result of two layers of slip and heavy burnishing (Rice 1987b:149-150). As stated previously, "waxy" surface finishes typically occur on Augustine pottery from Tipuj.

Decorated Postclassic sherds typically have low luster exterior surfaces.

Decorated surfaces were first slipped with a creamy to light red-orange primary slip with a matte to low luster finish that is not heavily burnished. However, most interior surfaces are very eroded and determination of a burnished slip is difficult. Circumferential bands were painted on top of the primary slip. The design was painted next as is evident from design lines crossing the circumferential bands. Specific design elements are discussed below. After the design was painted, slip was applied to the exterior surface, interior rim, and interior bases (e.g., tripod dishes). Slip from the interior rim often appears over the circumferential bands and may "bleed" into the design panel. Design execution is clumsy as compared to most Late Classic polychrome design executions.

V.B. Decoration

Eighteen decorative motifs appear on Postclassic Petén slipped pottery used in this study. Of the 18 decorative motifs, 8 also occur on pottery from earlier time periods, in codices, on murals, or on incised material culture such as stela. Some decorative styles of Petén Postclassic slipped pottery have previously been analyzed, with special reference to the significance of reptile motifs (Rice 1983, 1985b, 1989). This study builds on those analyses. The following section describes the 8 decorative motifs as found on Petén Postclassic slipped pottery, other media where the decorative motifs occur, and their possible significance.

V.B.1. Hook or Curl (Figure 52). The most common decorative motif on Petén Postclassic slipped pottery is the hook or curl. Hooks and curls that appear as single elements on pottery are typically flanked by parentheses. In this sample, hooks and curls occur on Ixpop Polychrome: Ixpop Variety and Chompoxté Red-on-paste: Akalché

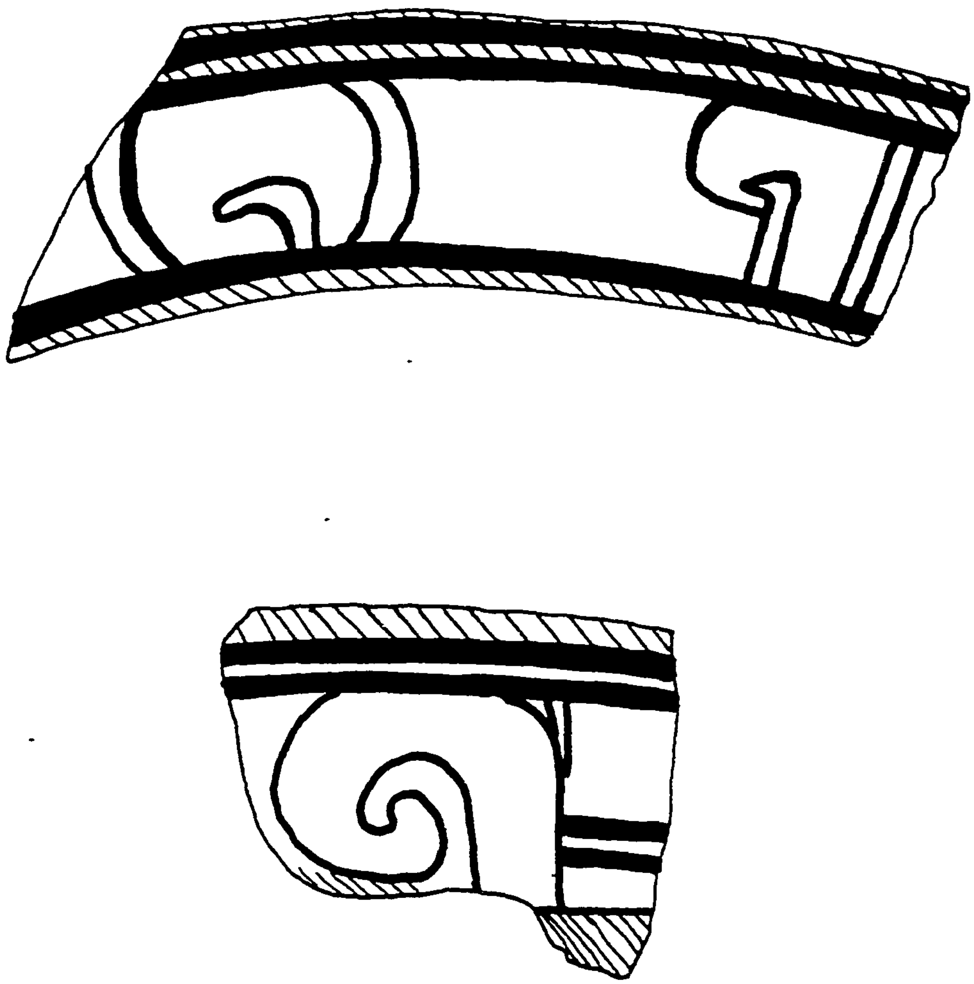


Figure 52: Hook or Curl Motif (Ixpop Polychrome).

Variety pottery from Zacpetén, Ixpop Polychrome: Ixpop Variety and Picú Incised: Picú Variety pottery from Ixlú, Ixpop Polychrome: Ixpop Variety and Pek Polychrome pottery from Ch'ich', Ixpop Polychrome: Ixpop Variety pottery from Macanché Island, and Chompoxté Red-on-paste: Akalché Variety and Pastel Polychrome pottery from Topoxté Island.

The first appearance of the hook or curl motif appears on Early Classic period pottery and continues through the Late Postclassic period pottery. Hellmuth (1987:Figure 5) presents Early Classic pottery from the Uaxactún region with encircled hooks or curls as the dominant decorative feature. He states that these hooks designate the surface of the underworld from which monsters emerge. In addition to representing the underworld surfaces, hooks also appear as water monster pupils (Hellmuth 1987:156). Smith (1955:66) also notes the presence of the hook on Tzakol 1, 2, and 3 pottery from Uaxactún.

Late Classic polychrome pottery has hooks and curls in three contexts. First, hooks form the pupil of reptiles in underworld scenes (Kerr 1989:Figures 1834, 1119; 1990:Figure 2713; 1992:Figure 3622; 1994:Figure 4926, 4957). Second, individuals who are the center of the painted design sit on round stones (altars) made of hook or curl elements (Kerr 1989:Figure 1398; 1992:Figure 3422, 3007) or are pictured reclining next to large hooks or curls (Kerr 1992:Figure 3198). Finally, hooks and curls appear in shells used to make noise (Kerr 1989:Figure 808).

In the Terminal Classic and Postclassic period, the hook or curl becomes more prevalent and occurs in northern Yucatán from the Cehpech to the Tases periods (Smith 1971). The curl also appears at Seibal as an incised and polychrome decorative motif on

Isla Gouged-incised and Lombriz Orange Polychrome pottery. The incised hook appears on a vessel with a central design element of the long nosed god (Sabloff 1975:Figure 392). Gifford (1976:Figure 196) also notes the presence of the hook or curl element with a reptilian element on Ixpop Polychrome pottery.

In addition to occurrences on pottery, hooks and curls commonly appear in murals and codices. At Tulum, curls and hooks co-occur with underworld scenes and Chac (Miller 1982:91). Love (1994:44) notes that Chacs, God C/Ku sit on hooks or curls in the Dresden and Paris codices.

From the appearance of hooks and curls throughout Maya history as described above, one may suggest that the decorative element represents part of the underworld–the watery surface because of its importance with regard to the underworld surface and the appearance of the hook or curl as the pupil of the water monster (Hellmuth 1987). They may also represent the Maya hieroglyphs for *mu* and/or *waj* (Hofling, personal communication 2001). The same element continues to the Postclassic period in much the same context and may thus have the same significance.

<u>V.B.2. Mat Motifs (Figure 53)</u>. Three variations of the mat motif appear on Petén Postclassic slipped pottery: stepped frets to make coils or mats, horizontal and vertical braids, and S-shaped curves. Stepped fret mat motifs appear on Picú Incised: Picú Variety pottery from Ixlú. Horizontal braided mat motifs appear on Chompoxté Red-on-paste: Chompoxté Variety, Chompoxté Red-on-paste: Akalché Variety, and Macanché Red-on-paste: Macanché Variety pottery from Zacpetén, on Picú Incised: Picú Variety pottery from Ixlú, on Dulces Incised: Dulces Variety, Canté Polychrome: Canté Variety,

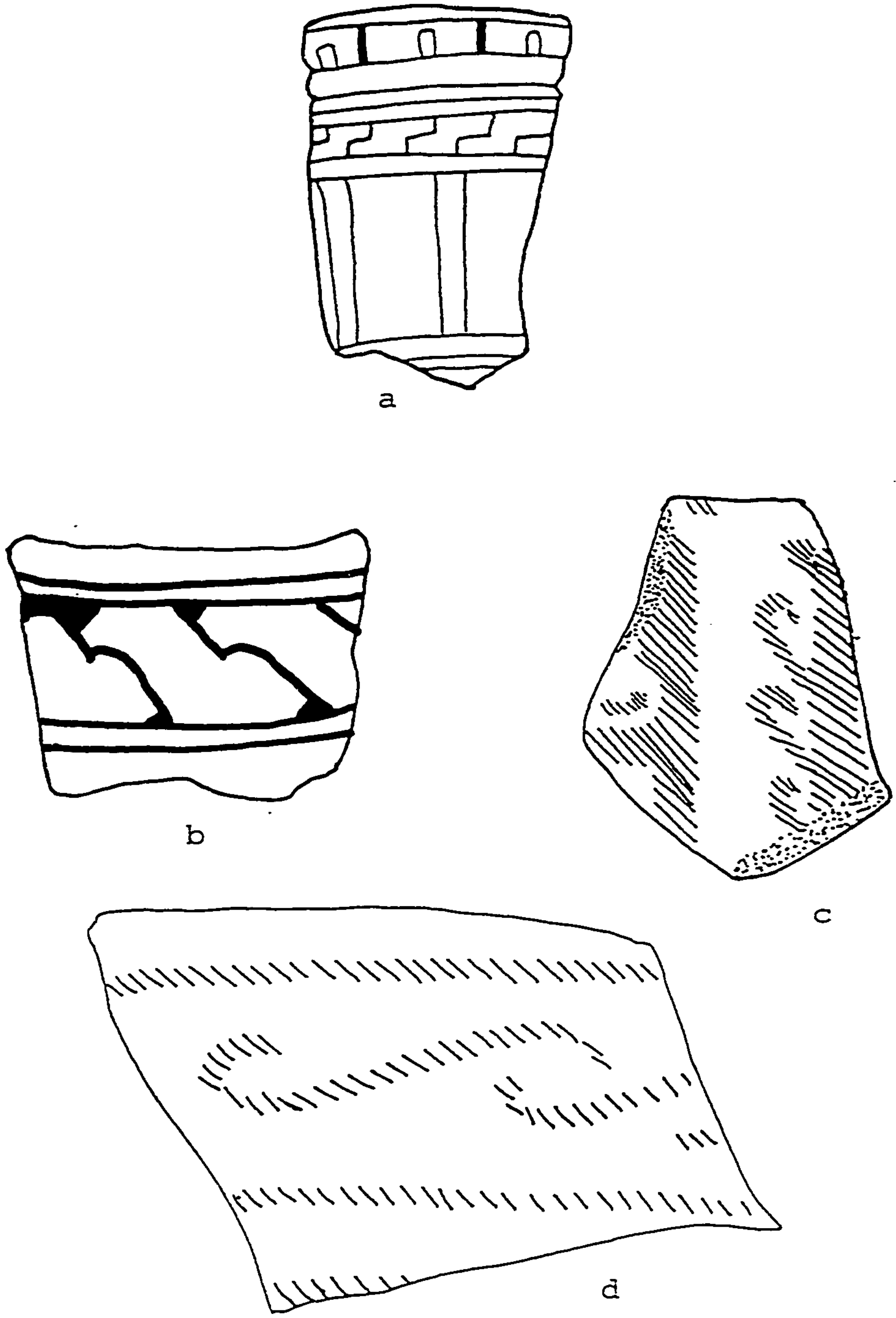


Figure 53: Mat or Braid Motifs: a) Stepped-fret (Picú Incised: Picú Variety); b) Horizontal Braided Mat (Ixpop Polychrome); c) Vertical Braided Mat (Chompoxté Red-on-paste: Akalché Variety); d) S-shaped Mat (Macanché Red-on-paste: Macanché Variety).

Chompoxté Red-on-paste: Akalché Variety, and Picú Incised: Picú Variety pottery from Topoxté Island, and on Xuluc Incised: Ain Variety pottery from Macanché Island. Vertical braided mat motifs occur only on Chompoxté Red-on-paste: Chompoxté Variety pottery from Zacpetén. S-shaped curves occur on Hobonmo Incised: Ramsey Variety, Chompoxté Red-on-paste: Akalché Variety, and Macanché Red-on-paste: Macanché Variety pottery from Zacpetén, on Picú Incised: Picú Variety pottery from Ixlú, on Pek Polychrome: Pek Variety and Picú Incised: Picú Variety pottery from Tipuj, on Ixpop Polychrome: Ixpop Variety, Picú Incised: Picú Variety, and Xuluc Incised: Ain Variety pottery from Macanché Island, and on Dulces Incised: Dulces Variety and Canté Polychrome: Canté Variety pottery from Topoxté Island.

Stepped fret and braided mat motifs first appear during the Early Classic period in the Maya lowlands region. Stepped fret mat decoration appears on Ixcanrio Orange polychrome, Dos Arroyos Orange polychrome, and Juleki Cream polychrome pottery at Barton Ramie (Gifford 1976:Figures 72, 96, 126) and Lucha Incised pottery from Seibal (Sabloff 1975:113).

Late Classic polychrome pottery also has the stepped fret as a mat motif. Kerr (1992:Figure 4339) presents a roll out picture of a scene with the step fret design motif on its jar neck. In addition to Late Classic occurrences, Brainerd (1958:Figure 24f 2, 4) shows that black slateware from Mayapán has the same stepped fret mat design as seen in Kerr's example.

Postclassic murals from Tulum Structures 5 and 16 and the door frame from Las Monjas at Chich'en Itzá use braids composed of the stepped fret to symbolize the path of the sun (Millbrath 1999:74) or an umbilical cord. Miller (1992:94) suggests the braided cords made of stepped frets represent umbilical cords seen in the Paris Codex Folio 19 and 22 and

> may refer to a joining of the mythical umbilical cord described in the Kusansum Myth. . . . It is also possible that the myth's severed, blood-filled cord is reconnected through the ritual ceremony depicted in these murals [at Tulum] and that this joining is indicated by the circular knotlike motif at the exact center of the Structure 5 mural. The vegetal forms growing out of the 'umbilical cord' may refer to a pictorial metaphor for a cord containing blood (i.e., Kusansum) and generating life. The twisted cords shown in the interior paintings of Structures 5 and 16 may therefore be umbilical cords: 'The rope of tying together, The womb of heaven, The womb of earth. . . .'

Miller further explains that similar umbilical cords appear in Postclassic codices from Highland Mexico that may represent Robertson's (1970) Late Postclassic International Style.

The braided or woven mat motif is the most common mat motif in the lowland Maya region. It first appears on Tzakol pottery from Uaxactún (Smith 1955:64) and Chich'en Itza (Smith 1971:48). The mat motif becomes synonymous with kingship by the Late Classic period and is present on most carved stela and pottery that depicts rulers (Robicsek 1975). Rulers are shown holding bicephalic monster scepter bars with mat motifs on the body of the bar or seated on mats or thrones with the braided design. In addition to denoting Maya royalty, mat motifs serve as design panel dividers. Kerr (1989:Figure 1117; 1994:Figure 4628, 4629) presents Late Classic polychrome braided mat motifs that divide glyph bands from main design areas, that divide round reptile faces, and that divide the lip/rim area from the body of a vessel.

Postclassic pottery and mural paintings also use braided mat motifs. In addition to Petén Postclassic pottery, mat motifs occur on Ardilla Gouged-incised pottery from Copán (Willey et. al. 1994:Figure 67t), on Mauger Gouged-incised pottery from Barton Ramie (Gifford 1976:Figure 190), and on Mexican Fine Orange ware and Chichen Slate ware from Chich'en Itza (Brainerd 1958:Figure 80bb; Smith 1971:48). Vertical mat motifs occur on Papacal Incised pottery and Yobain Plano-relief pottery from Mayapán (Smith 1971:Figure 47 i,o).

In addition to Postclassic pottery, mat motifs appear on murals from Tulum. Miller (1982:91, Plate 37) suggests that the mat motif in combination with chevrons on the mural from Tulum Structure 16 depicts the Underworld because confronting figures are positioned above braided mat motifs that separate the figures from the underworld scene. The same motifs are found on Chamá funeral pottery (Miller 1982:92).

The least common mat motif design is created by a series of S-shaped curves. The earliest occurrence of this version of the mat motif, appears at Uxmal on Tzakol pottery (Smith 1971:58). While Smith states that this motif occurs in northern Yucatan from the Early Classic to Late Postclassic period, the S-curve mat motif appears more frequently during the Postclassic period. Brainerd (1958:18je, 50i3, 57d, 61b, e, 77b) presents drawings of Postclassic slateware from Uxmal, Kabah, and Chich'en Itza with this design motif.

The differences in mat motif depictions may represent two distinct meanings: umbilical cords and signs of Maya kingship. Although additional meanings may be attributed to the mat motif, the longevity of the design motif as well as its context through time suggests that Petén Postclassic pottery with similar mat motifs may represent similar meanings.

V.B.3. Night Eye (Figure 54). The eye motif in Figure 54 appears on Ixpop Polychrome: Ixpop Variety pottery and Picú Incised: Cafetoso Variety pottery from Zacpetén and on Ixpop Polychrome: Ixpop Variety and Picú Incised: Picú Variety pottery from Ixlú. Although this motif does not thus far occur on pottery outside of the Petén lakes region, it occurs in Postclassic murals at Tulum and Santa Rita and Maya and Aztec codices. Tulum's Structure 5 mural and Santa Rita's Mound 1 mural have this element in the top band. Eyes appear in the center of a diving god or bee abdomen as viewed from the top of the creature (Roys 1965:65). Miller (1982:85) suggests that the eye represents the starry night sky with a jaguar pelt as the sun transforms into a jaguar at night. In addition to this meaning, the night eye may be part of the cult of Venus as Morning Star (Miller 1982:97). The cult of Venus as Morning Star depicts the reemergence of Venus from the Underworld at dawn as the result of Quetzalcoatl-Kukulcan cyclically passing into and out of the Underworld as Venus so that the sun may appear.

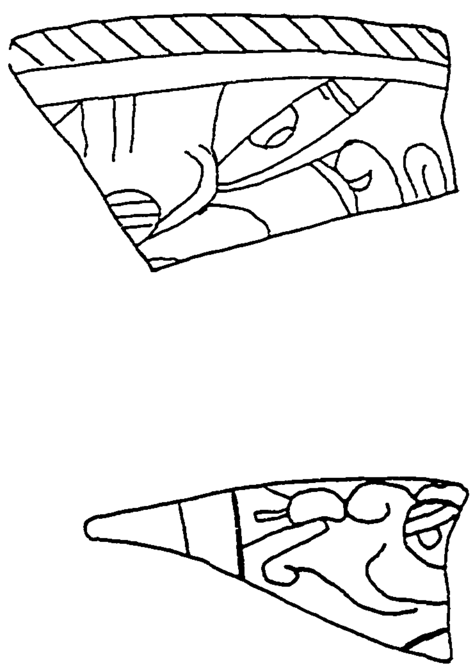


Figure 54: Night Eye Motif (Picú Incised: Picú Variety).

In addition to depictions on murals, the eye motif also occurs as part of the heavenly sphere in glyph T646 at House E in the Palace of Palenque (Hellmuth 1988:169). The Codex Nuttall (Nuttall 1975), the Codex Mendoza Folio 60r (Berdan and Anawalt 1997), and the Codex Borgia (Seler 1963:83) also depict the eye as part of the night sky.

From the above examples of the eye motif, one can suggest that the eye represents an element of the night sky. More specifically, the eye and its attached body may depict the "underlying unity in the concentration on cosmic boundaries between night and day, death and life, underworld and upper world, immortal and mortal, ritual disorientation and spiritual reintegration" (Miller 1982:97-98).

V.B.4. Embedded Triangles (Figure 55). Embedded triangles appear on the following Petén Postclassic pottery types: Sacá Polychrome: Sacá Variety and Macanché Red-on-paste: Tachís Variety pottery from Zacpetén and on Dulces Incised: Dulces Variety pottery from Topoxté Island .

In addition to Petén Postclassic pottery types, embedded triangles also occur on Late Preclassic Ixcanrio Orange-polychrome pottery from Barton Ramie (Gifford 1976:Figure 72c), on Early Classic Lucha Incised pottery from Seibal (Sabloff 1975:113), and on Mamon, Chicanel, and Tzakol 1, 2, and 3 pottery from Uaxactún (Smith 1955:68).

During the Late Classic period, the embedded triangle appears more frequently and over a wider geographical area. It is found on northern Yucatán pottery (Smith

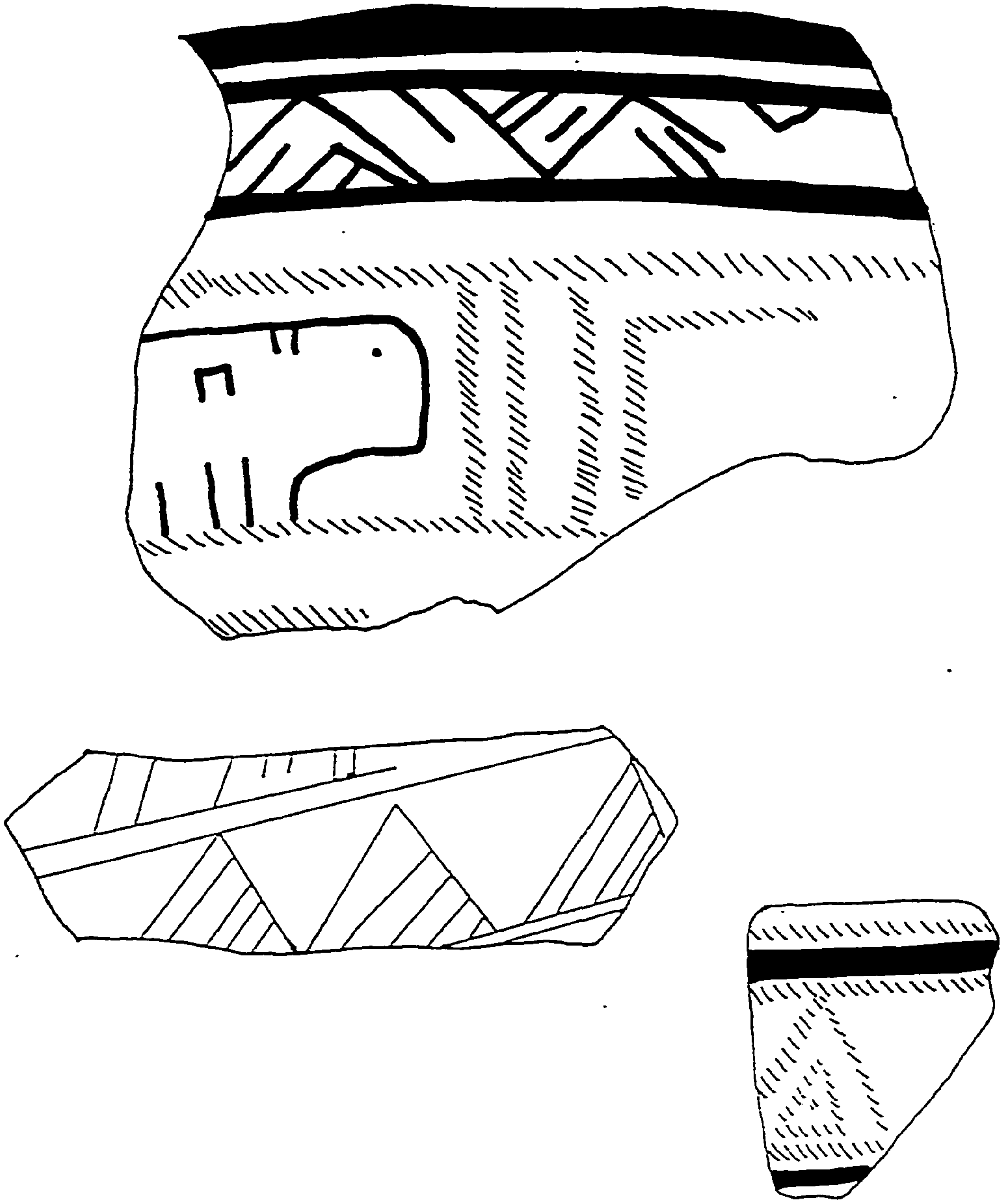


Figure 55: Embedded Triangle Motif (Sacá Polychrome and Picú Incised: Picú Variety).

1971:61), on Tepeu 1, 2, and 3 pottery from Uaxactún (Smith 1955:68), and on Masica Incised pottery at Copán (Willey 1994:Figure 108a). In addition to embedded triangles appearing as primary decorative motifs, Kerr (1994:Figure 4929; 1997:Figure 744) presents Late Classic polychrome vessels with embedded triangles as part of various central figures' thrones.

Postclassic pottery from Colhá and northern Yucatán have embedded triangle designs that resemble those of Petén Postclassic slipped pottery. Triangles commonly occur on Mauger Gouged-incised pottery from Colhá (Valdez 1987:Figure 57d) and Tinum Red-on-cinnamon pottery from Uxmal and rarely on other Tases period pottery (Smith 1971: 61-62). The connection between Petén and northern Yucatán pottery is clear in that the designs are almost identical.

Although no scholar has stated the significance of the embedded triangle, it may represent some aspect of royalty because of the presence of embedded triangles on thrones.

V.B.5 *Ajaw* Glyph (Figure 56). The *ajaw* glyph appear on Chompoxté Red-on-paste: Akalché Variety pottery from Zacpetén. Similar *ajaw* glyphic representations appear in the *Chilam Balam of Chumayel* (Craine and Reindorp 1979), on a vessel from northern Yucatán (Kerr 1990:Figure 3199c), and in Postclassic Maya codices. In addition to Postclassic contexts, the *ajaw* glyph occurs more frequently during the Late Classic period on pottery (especially Codex style pottery) as well as other forms of material culture such as stelae and lintels. The glyph usually signifies the *ajaw* calendric day name or the rulership title.

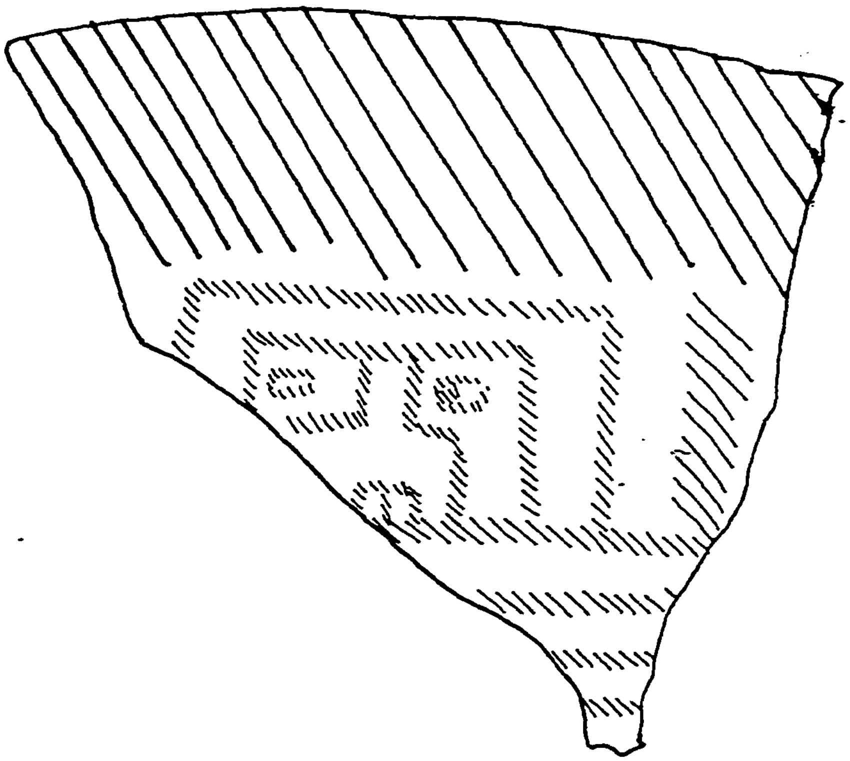


Figure 56: *Ajaw* Glyph Motif (Chompoxté Red-on-cream: Akalché Variety).

V.B.6 Terraces or Stepped Pyramids (Figure 57).

Terraces or stepped pyramids (hereafter, terraces) occur on Chompoxté Red-on-paste: Kayukos Variety and Ixpop Polychrome: Ixpop Variety pottery from Zacpetén and on Canté Polychrome: Canté Variety and Chompoxté Red-on-paste: Akalché Variety pottery from Topoxté Island.

The terrace motif first occurs on Tzakol 2 and 3 pottery from Uaxactún (Smith 1955). Late Classic pottery with terrace motifs appears on Tepeu 1 and 2 pottery from Uaxactún (Smith 1955:61) and on the Saxche Orange polychrome pottery from Altar de Sacrificios (Adams 1971:Figure 44b). The interior element of the Uaxactún design is u-shaped while the interior element at Altar de Sacrificios is a hook or curl. Kerr (1994:Figure 4550, 4661) presents two examples of the terrace motif as design panels. On one vessel (Figure 4550), the panel divider may also serve as the back wall of the place where the scribe sits. The other vessel (Figure 4661) has ghost-like creatures in the interior of the terrace. The terrace panel is above a serpent scene.

Terminal Classic pottery from El Mirador (Zacatel Cream-polychrome) and Seibal (Torro Gouged-incised) have the terrace motif in design panels near the rim of the vessel.

During the Postclassic period, the terrace motif occurs more frequently. At Chich'en Itza and Mayapán, the terrace motif appears on Cerro Montoso Polychrome, Yalton Black-on-orange, Papacal Incised, and Xuku Incised pottery types (Brainerd 1958:82a, 42, b30-31; Smith 1971:61). Terraces with interior hooks or curls also occur at

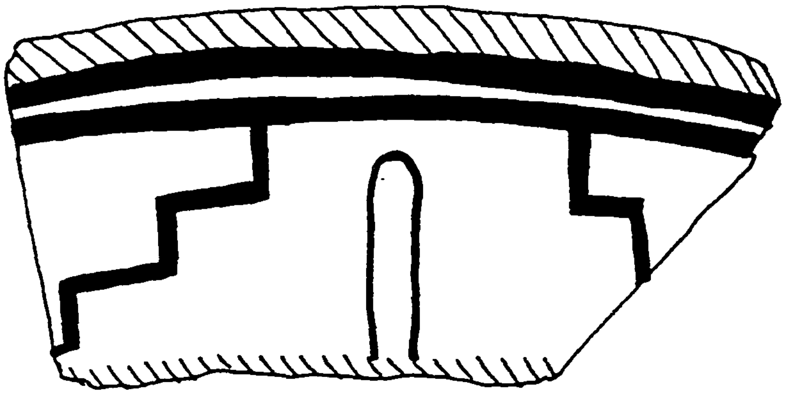


Figure 57: Stepped Terrace/Pyramid Motif (Ixpop Polychrome).

Mayapán and other sites in northern Yucatán occupied during the Sotuta to Tases periods (Smith 1971:61).

Finally, terraces frequently occur in the Codex Nuttall (1975) as design panels, "sky bands," thrones, and pyramids. Pohl (1994:88) states that the terrace in Mixtec codices indicates a place sign such as Tollan "place of the reeds."

While terraces may suggest place names such as those seen in Mixtec codices, no other information exists as to their meaning in the Maya lowlands.

V.B.7. Sky Band Motifs

Many Postclassic design motifs also occur on other media as part of sky bands. Thus, the following section describes the design elements found on Petén Postclassic slipped pottery and on depictions of skybands in the lowland Maya area. Typically, skybands that appear carved on structures, lintels, and stela and painted on pottery depict a bicephallic celestial monster (Freidel and Schele 1988:73). The bicephallic monster consists of a long snouted reptile on the left side and an alligator/cayman creature with a Venus glyph on the right side (Carlson and Landis 1985:117). The two heads have open jaws that symbolize the symbolic cave, dragon mouth, or niche of emergence from which creation and dynastic mythology originates (Carlson and Landis 1985:118).

Carlson and Landis (1985), Freidel, Schele, and Parker (1993), and Millbrath (1999) provide four different contexts for skybands. First, skybands appear as a symbolic canopy. The symbolic canopy depicts the intersection of the Milky Way and the ecliptic (Millbrath 1999:259). In this case, glyphic elements in the body of the bicephallic monster bear symbols of planets and constellations. In addition to celestial glyphic elements, Venus signs form collars around the two heads of the bicephallic monster (Carlson and Landis 1985:118). This type of symbolism typically appears in Postclassic codices.

Second, skybands function as frames surrounding dynastic scenes. By surrounding a royal figure with a skyband, the skyband connects the individual to the celestial realm. Pacal's sarcophagus lid provides one of the best examples of this type of symbolism.

Third, skybands form part of bases, platforms, and thrones. When rulers are depicted standing or sitting on skybands, they become elevated to the heavenly realm (Carlson and Landis 1985:121). Skybands as bases, platforms, and thrones "impart a celestial context to the individual seated on them" (Carlson 1988:288).

Fourth, skybands often appear on the edge of royal clothing or as part of royal costume. Skyband glyphs that represent the bicephalic monster's body commonly occur on ceremonial bars carried by rulers, belts, loincloths, cloaks, mantles, and headdresses. By wearing ritual regalia with skyband imagery, the individual "becomes, in his person, a microcosm. He is placed in the celestial house and the ancestral niche of emergence" (Carlson and Landis 1985:122).

Carlson (1988:279) further states that "placing skyband elements around rims or inside or outside lips of plates and bowls creates for the bowl a cosmological boundary like that provided by the heavenly spanning dragon." Taking the argument further, it may be possible to suggest that design elements that occur in the body of the bicephallic monster and singly on a vessel may represent the cosmological boundary that is important to the portrayal of royal Maya dignitaries resulting in a vessel with ritual or royal significance.

The bicephallic monster's body contains a number of different glyphic elements that are each enclosed by a rectangle and represent scales of the reptile. Carlson and Landis (1985) provide analysis for 13 main signs that appear in the body of the bicephallic celestial monster: the *K'in* symbol, the sun deity, the mirror/shield pendant, the lunar symbol, Venus/*Lamat* symbol, the two eyes symbol, the *K'an* cross, the *Akbal* symbol, the serpent segment, the *Zip* monsters, the crossed bands, the bearded sky and bearded sky cross, and the beard and scroll. While many of the symbols are deciphered, more remain unknown (Schele and Miller 1986:47).

Petén Postclassic slipped pottery has four of the 13 main signs (the *Lamat* glyph, the *Akbal* glyph, the *Zip* monster, and the beard and scroll motifs) that occur in combinations of threes or fours.

V.B.7.a. *Lamat* Glyph (Figure 58a). The *Lamat* glyph appears on Ixpop Polychrome: Ixpop Variety and Picú Incised: Picú Variety pottery from Ixlú.

Lamat glyphs appear on Late Classic pottery as parts of benches with a seated Moon Goddess (Kerr 1997:Figure K504), as parts of skybands (Kerr 1989:Figure 1898, 1994:Figure 5007), and as part of an underwater scene with fish (Kerr 1992:Figure 3134).

Lamat glyphs also occur in the Postclassic Paris, Dresden, and Madrid codices. The first year bearer page is 5 Lamat which is signified by a vertical column of *Lamat* glyphs. The Tancah cenote cave also contains *Lamat* glyphs in conjunction with 1 *Ajaw*

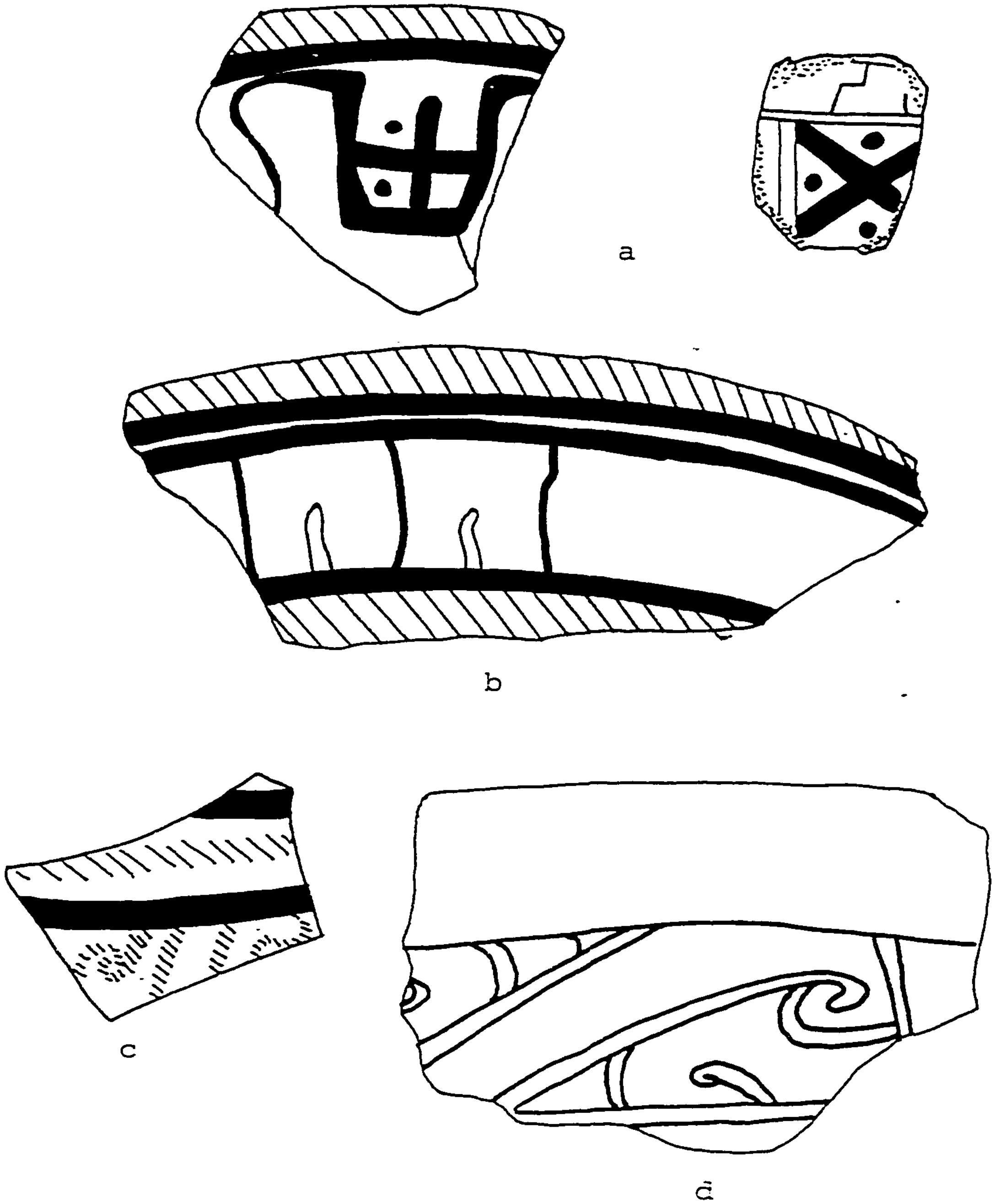


Figure 58: Skyband Motifs: a) *Lamat* Glyphs (Ixpop Polychrome and Picú Incised: Picú Variety); b) *Akbal* Glyphs (Ixpop Polychrome); c) *Zip* Monster (Sacá Polychrome); and d) Beard and Scroll/*Ilhuitl* motif (Picú Incised: Picú Variety).

glyphs.

Miller (1982:87) states that the combination of glyphs in the Tancah cenote signifies Venus as morning star during the five *Uayeb* days for the new year. In addition to Miller's interpretation of the Tancah cenote cave, Thompson (1970:220) and Carlson and Landis (1980), state that the *Lamat* glyph is a variant of the Venus glyph.

V.B.7.b. *Ak'bal* Glyph (Figure 58b). The *Akbal* glyph appears on Ixpop Polychrome: Ixpop Variety pottery from Zacpetén and Macanché Island and on Canté Polychrome: Canté Variety pottery from Topoxté Island.

Akbal glyphs appear on Late Classic polychrome pottery as part of a stone or altar with a seated ruler (Kerr 1994:Figure 4689). The glyphic representation also occurs in Postclassic contexts. The Paris Codex presents the *Akbal* glyph (similar to those seen on Postclassic pottery) in skybands where *Pawajtuns* sit, on the *Akbal* year bearer page as a vertical column, and as skybands and thrones throughout the codex (Love 1994:71,83, 89; Miller 1982:93).

In Cholan and Yucatec, *Akbal* means "night" or "darkness" and is associated with jaguars and the Underworld (Carlson and Landis 1980:126). Willson (1924) states that *Akbal* glyphs co-occur with the sun sign to complete the day/night dyad. The *Akbal* skyband element may also represent two insect eyes above an undulating body of a serpent or dragon (Carlson and Landis 1985:126; Beyer 1928). The motif consists of two eyes with fang-like pupils, a triangular nose, and a scalloped bottom (Carlson and Landis 1985:126). Postclassic pottery motifs consist only of the eye elements that Carlson and Landis (1985:126) suggest resemble the scroll eye motif seen in other depictions of reptiles.

V.B.7.c. *Zip* Monster (Figure 58c). This motif occurs on Sacá Polychrome: Sacá Variety pottery from Ixlú and on Chompoxté Red-on-paste: Akalché Variety pottery from Topoxté Island.

The *Zip* monster takes many glyphic forms, but the form painted on Postclassic slipped pottery has its origin in the Olmec dragon (God I) (Lowe1981:42). Both forms of the motif commonly appear on Late Classic pottery. The Princeton vase 14 (Coe 1978) and the Grolier vase (Coe 1973) have the s-shaped fret.

Postclassic Medium Red wares and the skybands from Las Monjas from Chich'en Itza have the *Zip* monster motif (Brainerd 1958:Figure 83b16, 17, 18). It also appears as an element in a throne, as a roof top sky band with the death god seated on top on the *Lamat* year page, and in constellation pages of the Paris Codex (Love 1994:11, 71, 89). The Mexican Codex Mendoza Folio 70r depicts a scribe with a box that has the *Zip* monster symbol on the outside of the box (Berdan and Anawalt 1997:231).

The *Zip* monster is the patron of the third month and is composed of crossed bands representing the sky, a main sign of chac signifying red or great (Carlson and Landis 1985:127). Carlson and Landis also believe that the s-shaped fret discussed as a possible mat motif may represent the *Zip* monster in its most abstract form. Hofling (personal communication 2001) and Wanyerka (personal communication 2000) also state that the *Zip* monster may refer to Mars because of its affiliation with the four Mars beasts in the Dresden Codex.

V.B.7.d. Beard and Scrolls (Figure 58d). The beard and scroll motif occurs on Hobonmo Incised: Ramsey Variety and Picú Incised: Picú Variety pottery from Tipuj.

This variant first appears in Olmec pottery (Lowe 1982) and may also be classified as the *Zip* monster as discussed above. Smith (1955:74) notes that the decorative element occurs on Tepeu 3 pottery from Uaxactún as a variant of the *ilhuitl* glyph. Tulum Red pottery from Tulum and Ichpaatun have incised decorations identical to those of the Petén lakes region and Tipuj (Brainerd 1960:Figure 4, and 5e). Graham (personal communication 2000) notes the presence of the same decorative motif at Lamanai and Valdez and Guderjan (1992:23, Figure 1j) note its presence on a Palmul Incised vessel with a similar decorative motif.

Carlson and Landis (1985:127) "interpret the 'beard and scrolls' element as containing the 'beard' and 'scroll' diagnostics of the bearded dragon, where the 'scroll' may be either the ophidian eye scroll or a nose ornament, such as appears on page 4 of the Codex Madrid." This decorative element also resembles the Aztec *ilhuitl* sign for day, sun, or festival (Nicholson 1955). The *ilhuitl* symbol has its origin in the Zip monster in the Maya area and is also part of the "Eye of the Reptile" symbol at Teotihuacán and Xochicalco (Nicholson 1955:106). According to Nicholson (1955:104, 110), the *ilhuitl* symbol represents the celestial band in Aztec sculptures and ceramic and indicates the profession of *tlacuilo* or scribe. Carlson and Landis (1985:127) agree that the scroll over scroll variant may be related to the *Zip* monster and/or the bearded dragon complex. The scroll over scroll variant best resembles Petén Postclassic design elements.

<u>V.B.8. Bird and/or Feathered Serpent Motifs (Figure 59)</u>. A number of bird motifs occur on Mengano Incised: Mengano Variety and Macanché Red-on-paste: Macanché Variety pottery from Zacpetén, on Picú Incised: Picú Variety pottery from Ixlú, on Johnny

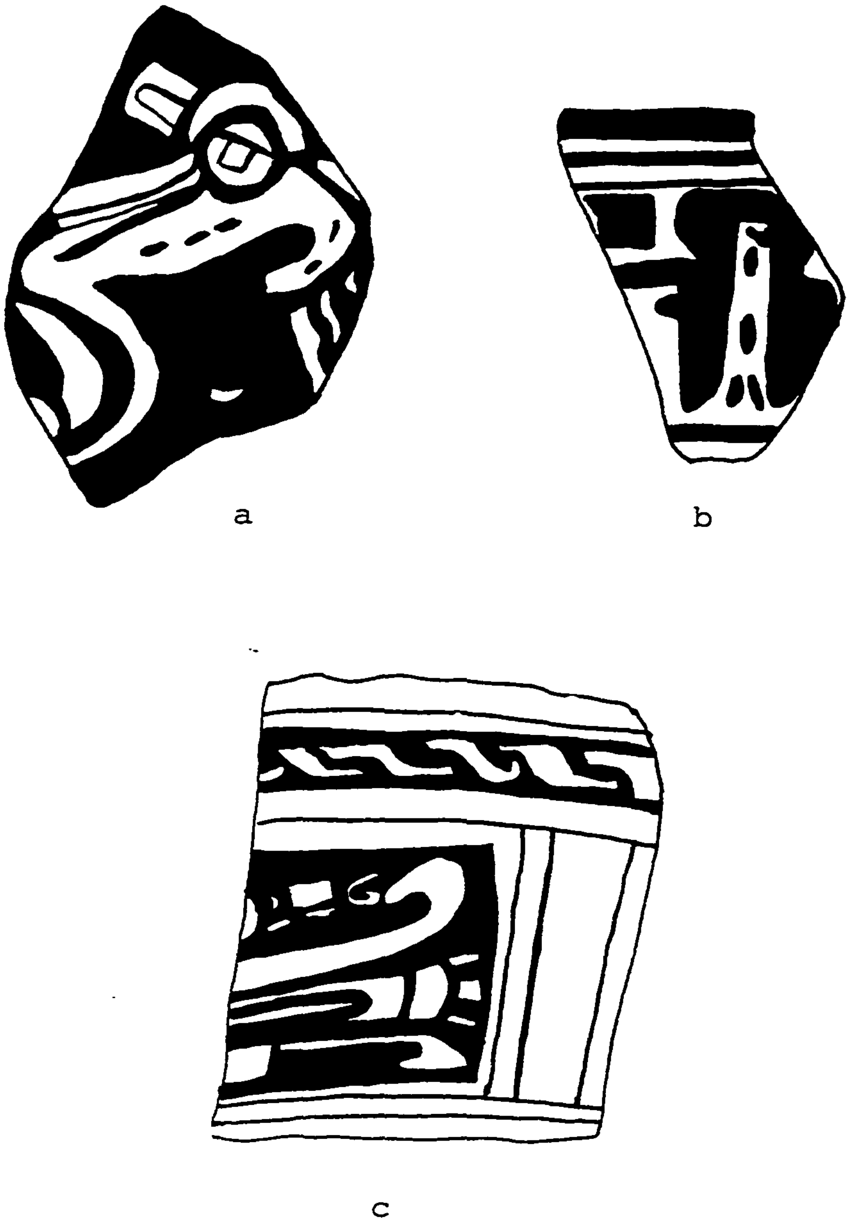


Figure 59: Bird Motifs [a) Macanché Red-on-paste: Macanché Variety; b) Mengano Incised; and c) Picú Incised: Picú Variety].

Walker Red: Black Label Variety and Picú Incised: Picú Variety pottery from Tipuj, on Chompoxté Red-on-paste: Akalché Variety and Chompoxté Red-on-paste: Chompoxté Variety pottery from Topoxté Island, and on Chompoxté Red-on-paste: Akalché Variety and Xuluc Incised: Ain Variety pottery from Macanché Island.

Birds occur on all types of pottery throughout the history of the Maya. Figure 59a may represent a vulture that appears on Folio 13 of the Dresden Codex. In addition to Folio 13, a vulture stands on a snake that may represent Venus as "the planet in conjunction with a vulture constellation" on page 36b (Milbrath 1999:270, Figure 5.4b). In the Paris Codex zodiac pages, a vulture appears as a zodiac sign (Bricker and Bricker 1992:171). Vultures also occur in the Popul Vuh and are associated with the Sun God, the Moon Goddess, and Hunahpu, and as signifiers of deity names in glyphic contexts. Similar birds also appear in the central design panel (Kerr 1994:Figure 4687, 1997:Figure K5082, K5722).

Most of the "bird" motifs on Petén Postclassic slipped pottery appear as a result of the presence of feathers (Figure 59c). The presence of feathers may indicate a bird motif in general, or they may also represent the plumed serpent that is important in Maya history and cosmology. In the Popul Vuh, the plumed serpent is present during creation and has personal traits of a great knower and great thinker (Tedlock 1985:73). The plumed serpent may also be Kukulcán/Quetzalcoatl. In addition to the mythical context of Kukulcán, Landa (Tozzer 1941:20-23 n. 128) states that the Itzá of Chich'en Itzá were ruled by someone named Kukulcán who came from central Mexico and was known as Quetzalcoatl. At the time of his fiery death, Kukulcán reappears as the morning star, Venus. At Chich'en Itza, Quetzalcoatl is associated with warrior and in Venus-warfare contexts as seen in murals (Milbrath 1999:181) and in Postclassic Mexico, Quetzalcoatl served as a title of rulership (Weaver 1993:492).

V.B.9. Miscellaneous Design Elements (Figure 60). These design elements may represent glyphic variants, but I was unable to locate correlates in published material. All elements except Figure 60e occur on

Ixpop Polychrome: Ixpop Variety pottery from Zacpetén. Figure 6.18ee occurs on Ixpop Polychrome: Ixpop Variety pottery from Tipuj and Chompoxté Red-on-paste: Akalché Variety pottery from Topoxté Island.

From the data presented above, I preliminarily define three technological style groups that reflect differences in ceramic ware categories. Although five types of "low-tech" analyses were completed (slip and paste color measurements, hardness measurements, firing conditions, form measurements, and surface treatment and decoration), only slip and paste color measurements, firing conditions, and surface treatment provide enough variability to initially divide the pottery sample into possible technological style groups that reflect the choices made by Petén Postclassic Maya potters.

The first technological style group contains Volador Dull-Slipped ware pottery that includes the Paxcamán, Fulano, and Trapeche ceramic groups. Pottery from this technological style group has the greatest variability in slip colors (as reflected in higher richness, evenness, and heterogeneity indices for slip colors before and after refiring), revealing that Maya potters were not able to achieve uniform slip colors perhaps because of variations in firing technologies and/or differences in slip mineral characteristics. The

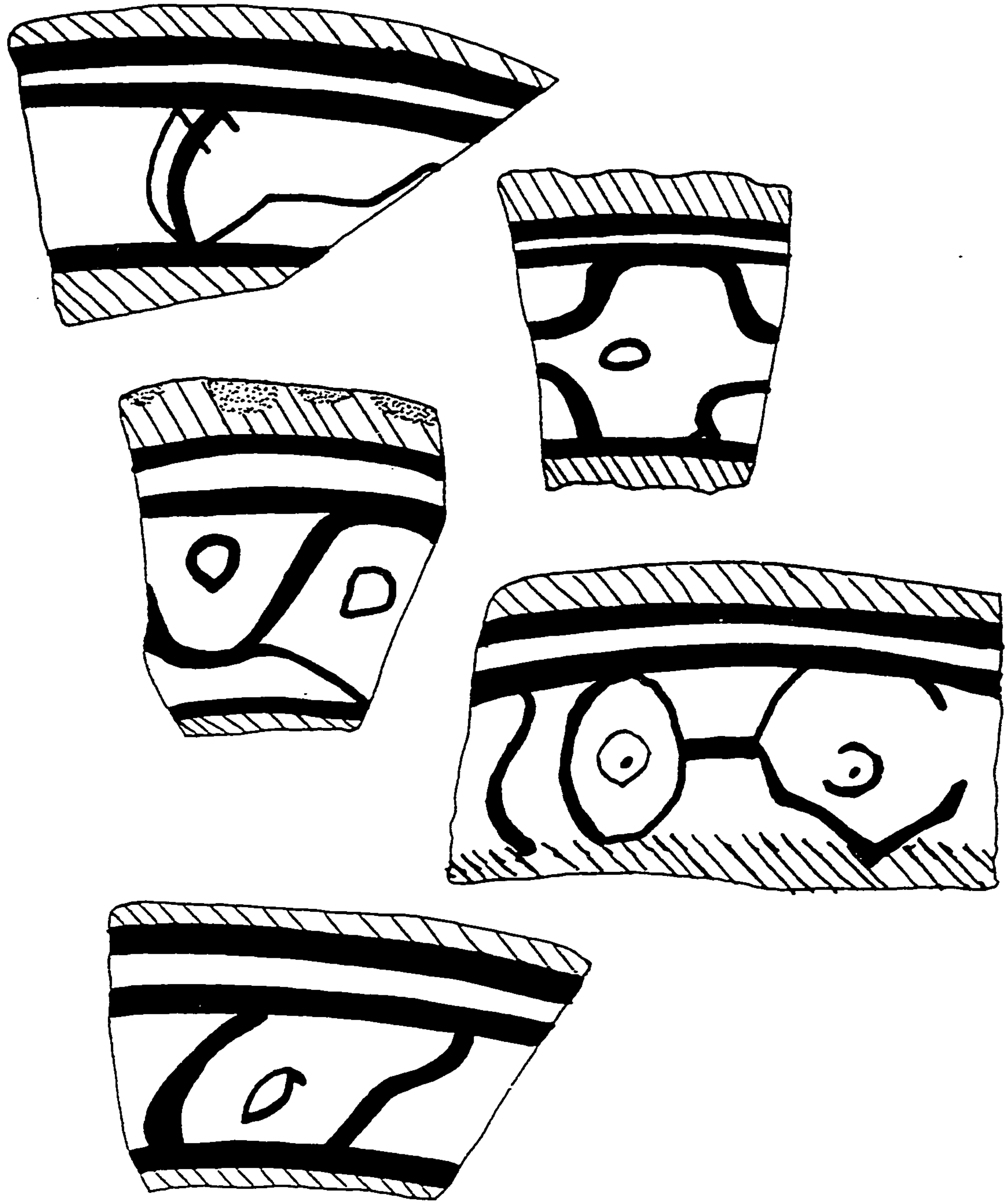


Figure 60: Miscellaneous Motifs (Ixpop Polychrome).

variability of slip colors in this technological style group is not the result of the inclusion of three ceramic groups with different slip colors (e.g., red, black, and "pink"), but rather is distinctive because of the within-group slip color variability of each ceramic group. In addition to differences in slip colors, this technological style group exhibits the most variability in paste composition and core color, and the greatest presence of double slipped and/or "waxy" surface finishes. The overall variability of this technological style group reflects differences in access to resources such as clays, materials used during firing such as fuel, and manufacturing procedures. If social boundaries were being contested during the Postclassic period, it is possible that Itzá and Kowoj potters may have had differential access to resources such as clays, materials for temper, pigments for decoration, and fuel for firing. In addition to limited access to resources because of possible boundary conflicts, fuel for firing may have been restricted due to the depletion of wood and grasses in populated areas. These factors may have contributed in the choices that the Petén Postclassic Maya potters made during manufacturing.

The second technological style group is represented by Vitzil Orange-Red ware pottery. Slip color variability is relatively lower than that of technological style group 1, but not as low as in technological style group 3. A distinctive feature of this group occurs in firing technologies. When these sherds were refired in an electric kiln to temperatures above 600°C, the majority of the sherds developed a black layer just below the slipped surface. Because the black layer is not present in the original archaeological sherd, I suggest that the Petén Postclassic Maya potters who produced this pottery may have known about this effect and fired pottery so as to avoid the black layer that interferes with the probably intended slip color. In addition to the black layer, the majority of tripod plates of this technological style group have a "waxy" surface finish. Potters who produced the "waxy" surface finish may have a "specialized" knowledge regarding surface finishes and/or differential access to the material that produced the surface finish.

The third initial technological style group consists of pottery from the Clemencia Cream Paste ware. Pottery in this group exhibits the least variability in slip and core colors and lacks exterior slips with a "waxy" surface finish. While variation exists, it is not to the extent of the previous two technological style groups. The reduction in variability may support the idea that Clemencia Cream Paste ware pottery is believed to have been made at a single location--the Topoxté Islands--and traded to other sites. It also suggests that Petén Postclassic Maya potters who produced this pottery may have been restricted to a particular type of cream-colored clay, but had equal access to fuel resources for firing. In addition to resource allocation, potters may have had a better working knowledge of the cream-colored clays.

Technological styles developed from this level of analysis demonstrate the technological and decorative variability of Petén Postclassic slipped pottery. The technological and stylistic differences are the result of potter's behavioral patterns and the choices that were made during manufacture, and may reflect differences in Petén Postclassic Maya social reality and indigenous knowledge.

CHAPTER 7

MINERALOGICAL ANALYSIS

Mineralogical analyses represent the third level of analysis and results from petrographic and x-ray diffraction analyses are presented below. Employing these types of analyses, I identify slip characteristics and the minerals present in the sherds of this study as well as the abundance, association, granulometry, and shape of minerals and other inclusions in the clay pastes. It may be possible to determine minerals that are naturally present and those that were culturally added in the process of pottery manufacture. This level of analysis also provides suites of minerals in the clay paste that correlate to technological style groups.

I. Slip Observations

Red and black slipped surfaces have a relatively uniform slip that ranges from .25-.75 mm. While this range includes most slipped surfaces some (n=6) Topoxté, Paxcamán, Trapeche, and Fulano slips have thicknesses of 1.75-2.75 mm. Most sherds, regardless of the thickness of the slip, have an oxidized layer (tan in color) that appears directly below the slipped surface. This layer ranges in thickness from .25-1.25 mm. An oxidized layer does not occur on sherds where the clay paste is dominated by pores.

Through the use of the petrographic microscope, I can determine the existence of "double slipping" on some exterior surfaces of Trapeche and Paxcamán ceramic group sherds from Ixlú, Zacpetén, and Tipuj. The slip that is next to clay paste is red and typically contains small amounts of cryptocrystalline calcite. These slips have thicknesses that range from .5-.75 mm. On top of the red slip is a tan slip that has a relatively even thickness of .5 mm. The tan slip also includes some cryptocrystalline calcite. The red and tan slips have different extinction angles.

Some Ixpop Polychrome, Paxcamán Red, Augustine Red sherds from Tipuj have a "double-slip" that consists of a red slip nearest to the clay paste similar to those previously discussed. The second slip is different from the red slip in color and because of its high quantities of quartz inclusions. This outer layer ranges in thickness from 1-1.75 mm. Again, the two layers of slip have different angles of extinction.

Interior surfaces can also be slipped and have the same general characteristics as those discussed above. In addition to general red and/or black slips, decorative areas have a "primary" slip over which a decorative motif is painted. This slip is placed directly over the clay paste and has a thickness that typically ranges from .3-1 mm and is tan in color. Black and red decorative motifs have thicknesses that are slightly thinner than typical exterior slip (.25-.5 mm) and do not contain observable mineral inclusions such as quartz and cryptocrystalline calcite. Some Ixpop Polychrome and Sacá Polychrome sherds from Ixlú and Zacpetén have a layer of translucent (tan in color) slip applied over the decorated panel. This overcoat is devoid of minerals such as cryptocrystalline calcite and quartz and is approximately .5 mm thick.

II. Petrographic Analysis of the Clay Pastes

Petrographic analysis allows the archaeologist to note differences in the pottery sample that may not be apparent through "low tech" analyses or binocular microscopy. The identification of mineral inclusions in a pottery paste also provides information concerning the variability of the paste within a ceramic group and/or ceramic type and the relationship between ceramic group and/or ceramic type. The range of variability is important when discussing the possibility of the technological styles of pottery because "tempering material is the least likely to be obtained from distant sources, because its specifications are broad and because something that will serve the purpose can be found nearly everywhere" (Shepard 1956:165). As such, differences in mineral inclusions in a ceramic paste may correlate to differences in decoration which may ultimately suggest differences in social/ethnic identity.

Because of this possibility, the following section presents general information about the inclusions present in the 273 thin sections that I analyzed as well as qualitative and quantitative data of these inclusions minerals.

II.A. Inclusions Present in Petrographic Analysis

II.A.1. Quartz SiO_2. Quartz occurs naturally in most rocks and unconsolidated sediments. It is deposited in aqueous solutions, such as sea or lake water, with the enclosing rock and can form chert horizons when replacing limestone (Klein and Hurlbut 1993:529). The quartz crystallographic structure does not readily break down with erosion, but breaks down into smaller sand-sized particles. At 573°C, quartz undergoes a crystalline inversion that often changes the volume by 2% and slightly changes its molecular structure (Shepard 1956:29). Its hexagonal crystallographic structure produces a mineral with a hardness of 7 that fractures conchoidally (Klein and Hurlbut 1993:527).

In thin section, uniaxial positive quartz minerals have no pleochroism, no cleavage, low relief, and first order birefringence colors (.009) (Ehlers 1987:32-33).

In pottery, quartz can act as a flux and form glass at temperatures above 950°C (Rye 1981:34). Rye (1981:34) suggests that because of the enlargement of the molecular structure at 573°C, vessels with quartz inclusions "would be detrimental in low-fired cooking vessels, which can be exposed to temperatures higher than this each time they are used, with consequent danger of fracture." Therefore, in theory, large amounts of quartz in a clay paste may suggest a non-cooking function for the vessel. However, archaeologists do not find evidence of this quartz inversion in low-fired prehistoric pottery.

II.A.2. Chert SiO_2. Chert is a microcrystalline granular variety of quartz and results from the replacement of limestone with solutions carrying silica (Klein and Hurlbut 1993:529). It can take two forms depending on original recrystallization: nodule formations and bedded rocks. Similar to quartz, chert is hard, fractures conchoidally, and does not erode, but will recrystallize (Chesterman 1995:723).

In thin section, chert may occur with siliceous skeletons of shell or algae and with similar birefringence colors as quartz. In the present study, chert appears as sub-rounded fragments that resemble a conglomeration of small quartz crystals.

II.A.3. Chalcedony SiO_2. Chalcedony is a microcrystalline, fibrous variety of quartz. It is deposited in aqueous solutions and "usually forms at or near surface conditions in cavities, veins, or as a replacement of preexisting minerals or fossils" (Ehlers 1987:234). Chalcedony can also be a detrital grain in sediments and may be derived from weathering of silicate rocks. Chalcedony tends to recrystallize to quartz with time.

In thin section, chalcedony appears as a uniaxial positive mineral with a colorless pleochroism, a fibrous habit, no cleavage planes, and a hexagonal crystallography. Birefringence colors occur up to first order white (.005-.009).

II.A.4. Hematite Fe_2O_3. Hematite is a widespread mineral that occurs in a great variety of soils and most commonly in soils of tropical and warm temperate regions (Klein and Hurlbut 1993:380). Within those regions, it is more common in well-drained soils and its occurrence may be the result of a more rapid decomposition of organic matter in these soils. Hematite is also a significant authigenic component of clay fractions (Allen and Hajek 1989). The total amount of iron in the clay fraction may be the result of small nodules of magnetite, pyrite, and/or hematite "rather than being evenly distributed as fine particulate matter" (Rice 1987b:335-336).

Hematite is a uniaxial negative mineral with a hexagonal crystallography, no cleavage, red-brown pleochroism, and a hardness of 5-6. Its tabular to flaky habit appears in thin sections with a high order white birefringence (.28).

II.A.5. Biotite $K(Mg, Fe)_3(AlSi_3O_{10})(OH)_2$. Biotite commonly occurs in igneous and metamorphic environments. In igneous environments, biotite appears in granites, diorites, gabbros, and perodotites and in metamorphic environments it occurs in most volcanic or plutonic rock (Elhers 1987:177). Biotite alters to kaolin or montmorillonite in extreme weathering conditions (Elhers1987:177). Although it is unlikely that biotite is intentionally added to clay, poorly crystalline biotite can increase the plasticity of clays (Rye 1981:35).

In thin section, biotite is a monoclinic, biaxial negative mineral with perfect cleavage, a tabular habit, and a strong pleochroism that ranges from brown to reddish-brown to green (Ehlers 1987:177). The mineral is relatively soft (2.5-3) with a third order birefringence color (.04-.07).

II.A.6. Gypsum $CaSO_4 \bullet 2(H_2O)$. Gypsum occurs in sedimentary deposits as an interstratified layer between limestone and shale and underlying rock salt beds (Klein and Hurlbut 1993:428). It is one of the first minerals to form with the evaporation of salt water. In such environments, gypsum is often associated with anhydrite, calcite, dolomite, and halite. It also occurs in volcanic regions "where limestones have been acted upon by sulfur vapors" (Klein and Hurlbut 1993:428). Gypsum is a soft mineral (2).

In thin section, gypsum is a colorless, monoclinic, biaxial positive mineral with a negative relief. Its monoclinic structure appears as euhedral, elongated, tabular, or stubby prisms that have good to perfect cleavage (Ehlers 1987:253). Bifrengence colors are first order pale yellow (.01).

II.B.7. Calcite $CaCO_3$. Calcite is a major mineral in sedimentary deposits and is usually the sole mineral of limestone. As part of a limestone bed, calcite results from the decomposition of shells and other skeletons from sea animals (Klein and Hurlbut 1993:406). As part of a carbonate sediment, calcite can recrystallize resulting in euhedral calcite and/or polycrystalline calcite. Euhedral calcite recrystallizes in carbonate cements in open spaces and polycrystalline calcite typically is of replacement origin (Fifarek, personal communication 2001). Calcite also occurs with gypsum in limestones and commonly decomposes into clays with a high calcareous content. In addition to sedimentary deposits, calcite combines with quartz sand to form sandstone crystals found primarily in France and South Dakota, and occurs as a secondary mineral in igneous rocks as a late crystallization product of lavas (Chesterman 1995:432).

Calcite minerals have a hexagonal crystallography, perfect cleavage, a variety of habits, and is commonly twinned. When calcite appears as single crystals, it takes a rhombohedral or scalenohedral habit. In coarse aggregates, the crystal habit is typically anhedral and in sedimentary environments, such as limestones, calcite occurs as oolites or spherulites (Ehlers 1987:108). Calcite crystals are typically colorless to white to pale shades of gray and can vary from yellow to red to green with impurities or elemental substitutions in the mineral structure (Chesterman 1995:432).

Calcite frequently occurs in pottery. It is a relatively inert mineral at temperatures below 750°C, but when calcite is heated above 750°C, it decomposes into CO_2 and CaO (Rice 1987b:98). As CaO, lime absorbs moisture to form quicklime ($Ca[OH]_2$), releases heat, and expands in volume causing stress and cracking in the clay body (Rice 1987b:98). Because of this chemical decomposition, pottery typically crumbles. At 950°C, calcite becomes vitrified when it combines with sodium and silica to form glass (Rye 1981:33). In thin section, calcite minerals are uniaxial negative with a higher order white birefringence color (.172) (Ehlers 1987:108).

<u>II.A.8. Plagioclase Felspar $CaAl_2Si_2O_8$ or $NaAlSi_3O_8$</u>. Plagioclase feldspar typically occurs in volcanic, metamorphic, and detrital rocks. It can alter to kaolin, and with metamorphism, plagioclase can alter to epidote (Ehlers 1987:151). The triclinic mineral has euhedral, anhedral, tablet, lath, or microlite habits, perfect cleavage planes, and polysynthetic and Carlsbad twins.

In thin section, plagioclases are biaxial positive minerals (except for oligoclase, bytownite, and anorthite), have a colorless pleochroism, and a first-order white to yellow birefringence color (.008-.013).

II.A.9. Alkali Feldspar Na, K $AlSi_3O_8$. Alkali feldspars occur in igneous and metamorphic rocks. Many different types of feldspars exist, but microcline is the feldspar variant present in this study. Feldspars are characterized by "good cleavages in two directions which make an angle of 90°, or close to 90°, with each other," a hardness of 6, and simple and polysynthetic twinning (Klein and Hurlbut 1993:532). Their triclinic crystal habits range from stubby prisms to tabular crystals to laths (Ehlers 1987:138).

In thin section, microcline is a triclinic, biaxial negative mineral with a colorless pleochroism and a first order white birefringence color (.007) (Klein and Hurlbut 1993:536).

II.A.10. Shell. Volador Dull-Slipped ware sherds are characterized by shell inclusions. On the basis of pottery from Macanché Island, Rice (1987a:105-106) suggests that all shell inclusions represent fresh water animals skeletons that commonly occur in local lake beds and lake shore clays. Rice (1987a:105-106) states that the following genuses occur in the soils around Lake Macanché and in the sherds from Macanché Island: *Pyrgophorus*, *Cochliopina*, *Tropicorbis*, and *Aroapyrgus*. Cowgill(1963:282) also notes the presence of *Cochliopina* shells in pottery from Lake Petén Itzá.

In thin section, shells have a similar birefringence to calcite, are thin and slightly curved. In some instances, shells are cut in cross-section showing the different chambers of the shell.

II.A.11. Pores/Voids. Pores exist in pottery because of the natural interstitial spaces in the clay mineral (primary pores) or because of the release of gases (secondary pores)

(Rice 1987b:350). Secondary pores result from the shrinkage of the clay body due to the release of water vapor (Velde and Druc 1999:113). If the clay body is no longer plastic when the gas forms, irregularly shaped pockets form. Rice (1987b:Figure 12.3) illustrates many different forms of pores. In addition to pockets of gas, sherds with long, linear and somewhat wavy pores parallel to the vessel wall may indicate pores that are the result of a potter compressing and/or smoothing the clay in more than one area (Velde and Druc 1999:113). Pores can also be the result of organics or sponge spicules present in the clay body, burned out during firing, or the result of the evaporation or erosion of a soluble mineral such as salt. In thin section, pores appear as empty spaces with no color.

II.A.12. Fossils. Fossils occur in some sherds. Although no attempt was made to identify the genus or species of fossil, they may be the result of animal skeletons that create limestone and/or calcite. In thin section, fossils appear similar to chert but are smaller in size.

II.A.13. Organics. Organics in clay pastes represent plant material naturally present in the clay or added by the potter to reduce "shrinkage and improve the workability of clays that are too plastic" (Rye 1981:34). Naturally occurring organics tend to be larger and more irregularly shaped, whereas added organic material may have a more even distribution of size due to cutting or chopping of the organic material. While most of the organic material burns out during firing, low fired pottery may contain a great deal of organics. In thin section, organics appear dark brown to black and do not produce a birefringence color.

II.B. Qualitative Analysis of Clemencia Cream Paste Ware Sherds

The following section provides qualitative information about the inclusions present in the Clemencia Cream Paste ware sherds (n=51) of this study.

Quartz

Size: Coarse (1.6-.575 mm) and Medium to Very Fine (.425-.025 mm)

Frequency/Percentage: Rare (1-2 %), Sparse (4-6 %), or Common (20%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity or sub-rounded, high sphericity

Chert

Size: Coarse (1.25-.75 mm) and Medium to Fine (.3-.15 mm)

Frequency/Percentage: Rare (less than 1 %)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity

Chalcedony

Size: Coarse (1.125-.625 mm) and Medium to Fine (.425-.075 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity, or rounded

Hematite

Size: Coarse (.8 mm), Medium (.5-.25 mm), and Fine to Very Fine (.15-.025 mm)

Frequency/Percentage: Rare (less than 1%), Sparse (3 %), and Common (10%)

Degree of Sorting: Poor

Roundedness: Sub-rounded, high sphericity or sub-angular, low sphericity

Biotite

Size: Coarse (1.25-.525 mm), Medium (.425-.25 mm), and Fine (.25-.1 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Angular, rectangular, sub-angular, low sphericity, and veins

Calcite

Euhedral Calcite

Size: Coarse (1.35-.575 mm) and Medium to Fine (.5-.1 mm)

Frequency/Percentage: Rare (1 %) to Sparse (2-6 %)

Degree of Sorting: Poor

Roundedness: Angular, low sphericity

Polycrystalline Calcite

Size: Coarse (1.375-.625 mm) and Medium to Very Fine (.5-.025 mm)

Frequency/Percentage: Rare (1-2 %)

Degree of Sorting: Poor to Very Poor

Roundedness: Sub-angular, low sphericity

Cryptocrystalline Calcite

Size: Coarse (.75-.575 mm), Medium (.275-.25), and Fine (.175-.075 mm)

Frequency/Percentage: Rare (less than 1 %), Common (20-25%), and Abundant (30-45%)

Degree of Sorting: Poor to Fair

Roundedness: Sub-angular to sub-rounded, low sphericity

Plagioclase

Size: Coarse (.075 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity

Feldspar

Size: Fine (.25-.2 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity

Shell

Size: Medium (.375-.25 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Circular

Pores/Voids

Size: Coarse (2.325-.6 mm) and Medium to Fine (.5-.05 mm)

Frequency/Percentage: Sparse (2-7%), Common (10-20%), and Abundant (40-70%)

Degree of Sorting: Fair to Poor

Roundedness: Angular to sub-angular and veins, low sphericity

Fossils

None counted

Organics

Size: Fine to Very Fine (.15-.025 mm)

Frequency/Percentage: Rare (1 %) to Sparse (3-10 %)

Degree of Sorting: Fair to Poor

Roundedness: Rounded

Clemencia Cream Paste wares may be characterized petrographically as dominated by poorly sorted, sub-angular calcareous minerals (primarily cryptocrystalline calcite) with lesser amounts of quartz, and minor amounts of chert, chalcedony, feldspar, biotite, and hematite minerals. In general, most sherds are not highly porous, but a sub-sample of Clemencia Cream Paste ware sherds are highly porous. These sherds can also be identified by their clay birefringence colors that range from .003-.007, with the most porous sherds having a clay birefringence color that ranges from .016-.019.

In addition to these general ware-based characteristics, Clemencia Cream Paste ware sherds (n=51) form three distinct groups based on the suite of minerals present in the clay paste. First, eleven sherds have a small percentage of minerals that range from fine to very fine in size. These clay pastes are dominated by pores that comprise 50-80 percent of the paste volume and are the only Clemencia Cream Paste ware sherds to contain plagioclase and feldspar minerals. Clay birefringence colors of this group range from .016-.019.

The second clay paste group consists of seven sherds with the following mineral suite of inclusions: euhedral, polycrystalline, and cryptocrystalline calcite, hematite, and biotite minerals, and organics. Angular euhedral and polycrystalline calcite may have been added during the pottery manufacturing process. A bimodal distribution of mineral inclusions (30-45 percent and 55-70 percent) exists in the clay pastes of this group. Clay birefringence colors range from .006-.007.

The final group consists of 33 sherds that have euhedral, polycrystalline, and cryptocrystalline calcite, hematite, shell, organics, biotite, chert, and chalcedony minerals and shell and organics present in the clay paste. Thin sections of fired white clay from Yaxhá that may have been used in the manufacture of Clemencia Cream Paste wares demonstrate the presence of naturally occurring chalcedony and biotite in the raw clay. Therefore, euhedral and polycrystalline calcite and chert may have been added as temper during the processing of the clay. All minerals of this group typically comprise 40-60 percent of the clay paste. However, seven sherds have a clay paste with 25-30 percent mineral inclusions and two sherds have a clay paste with 70 percent mineral inclusions. Clay birefringence colors of this group range from .003-.007.

II.C. Qualitative Analysis of Vitzil Orange-Red Ware Sherds

The following section provides qualitative information of the inclusions present in the Vitzil Orange-Red ware sherds (n=80) of this study.

Quartz

Size: Coarse (.9-.575 mm), Medium (.45-.275 mm), and Fine (.225-.025 mm)

Frequency/Percentage: Sparse (3-5 %) and Common (10-30%)

Degree of Sorting: Fair to Poor

Roundedness: Angular to sub-angular, low sphericity

Chert

Size: Coarse (.575 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity

Chalcedony

Size: Coarse (1.45-.5 mm), Medium (.4-.3 mm), and Fine to Very Fine (.225-.075 mm)

Frequency/Percentage: Rare (1%) to Sparse (2%)

Degree of Sorting: Poor

Roundedness: Sub-rounded, low sphericity

Hematite

Size: Coarse (1.3-.575 mm), Medium (.475-.4 mm), and Fine to Very Fine (.25-.025 mm)

Frequency/Percentage: Sparse (2-5%)

Degree of Sorting: Fair to Poor

Roundedness: Rounded

Biotite

Size: Coarse (1.35-.75 mm) and Medium to Very Fine (.5-.075 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Angular to sub-angular, low sphericity

Calcite

Euhedral Calcite

Size: Coarse (1.05-.575 mm) and Medium to Fine (.5-.1 mm)

Frequency/Percentage: Rare (1%), Sparse (3-8%), Common (10-30 %), and Abundant (45-70%)

Degree of Sorting: Poor to Fair

Roundedness: Angular, low sphericity

Polycrystalline Calcite

Size: Coarse (1.575-.575 mm) and Medium to Very Fine (.45-.075)

Frequency/Percentage: Rare (1%)

Degree of Sorting: Poor

Roundedness: Sub-angular, low sphericity

Cryptocrystalline Calcite

Size: Coarse (.625 mm), Medium (.45-.25 mm), and Fine to Very Fine (.25-.025 mm)

Frequency/Percentage: Rare (1%), Sparse (2-4%), Common (15-35 %), and Abundant (40-80 %)

Degree of Sorting: Fair to Poor

Roundedness: Sub-angular, high and low sphericity

Plagioclase

None counted

Feldspar

Size: Very Fine (.075 %)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Angular, rectangular, low sphericity

Shell

Size: Coarse (.675 mm) and Fine (.175 mm)

Frequency/Percentage: Rare (less than 1 %)

Degree of Sorting: Poor

Roundedness: Rectangular, low sphericity

Pores/Voids

Size: Coarse (3.25-.5 mm), Medium (.4-.375 mm), and Fine (.25-.075 mm)

Frequency/Percentage: Sparse (3-7 %), Common (10-30 %), and Abundant (50-80 %)

Degree of Sorting: Fair to Poor

Roundedness: Angular to sub-angular, low sphericity

Fossils

None counted.

Organics

None counted.

Vitzil Orange-Red wares may be characterized petrographically as dominated by poorly sorted, sub-angular calcareous minerals (primarily cryptocrystalline calcite) with lesser amounts of quartz and hematite, and minor amounts of chert, chalcedony, feldspar, and biotite minerals and organics. In general, most sherds are not highly porous, but a sub-sample of Vitzil Orange-Red ware sherds are highly porous. Some of the pores in this ware category are the result of sponge spicules that have been burned out during firing

(Utgaard, personal communication 2000). Vitzil Orange-Red sherds can also be identified by their clay birefringence colors that range from .09-.11, with the most porous sherds having a clay birefringence color that ranges from .006-.01.

In addition to these general ware-based characteristics, Vitzil Orange-Red ware sherds (n=80) comprise four distinct groups according to the type of inclusions present in the clay paste. The first group consists of 17 sherds with minerals and pores that comprise 60-80 percent of the clay paste. Mineral sizes range from fine to very fine and represent 5-10 percent of the clay paste. This group is the only group of the Vitzil Orange-Red ware sherds to have feldspar in the clay paste. The remaining 55-70 percent of non-clay material in the clay paste is pores. While most of the pores represent organic material that burned during firing, some of the longer, thinner pores represent sponge spicules (Utgaard 2000, personal communication). Clay birefringence colors range from .006-.01.

The second group of 48 sherds have quartz, chert, chalcedony, hematite, biotite, euhedral, polycrystalline, and cryptocrystalline calcite minerals, and shell inclusions in the clay paste that range in size from very fine to coarse. One sherd has coarse quartz minerals with embedded hematite (aventurine quartz) and two sherds have long, wavy pores that parallel the vessel wall. The angular quartz minerals may have been added during pottery manufacture. Minerals and pores comprise 40-60 percent of the clay paste. Birefringence colors range from .09-.11.

Five sherds comprise the third group that contain fine to very fine cryptocrystalline calcite. The calcite occupies 80-90 percent of the clay paste. Clay bifringence colors range from .09-.11

The fourth group contains 10 sherds. Cryptocrystalline calcite and quartz make up 50-70 percent of the clay paste. Similar to the second group, some quartz minerals have embedded hematite veins (aventurine quartz) and long, wavy pores that parallel the vessel walls. The angular quartz may also have been added during the processing of the clay. Clay birefringence colors range from .09-.11.

II.D. Qualitative Analysis of Volador Dull-Slipped Ware Sherds

The following section provides qualitative information of the inclusions present in the Volador Dull-Slipped ware sherds (n=142) of this study.

Quartz

Size: Coarse (.625 mm), Medium (.5-.275 mm), and Fine (.25-.025 mm)

Frequency/Percentage: Sparse (2-5%), Common (10-25%), Abundant (40%)

Degree of Sorting: Poor to Fair

Roundedness: Sub-angular, low sphericity

Chert

Size: Medium (.25 mm)

Frequency/Percentage: Rare (1%)

Degree of Sorting: Good

Roundedness: Sub-angular, low sphericity

Chalcedony

Size: Coarse (1.25-.525 mm), Medium (.475-.3 mm), and Fine (.2-.125 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Sub-angular to sub-rounded, high sphericity

Hematite

Size: Coarse (3.75-.525 mm), Medium (.375-.25 mm), and Fine (.15-.075 mm)

Frequency/Percentage: Rare (1%), Sparse (2-5%), and Common (10%)

Degree of Sorting: Very Poor to Poor

Roundedness: Sub-rounded, high sphericity, sub-angular, low sphericity, and veins

Biotite

Size: Coarse (2.5-.525 mm), Medium (.5-.25 mm), and Fine (.2-.075 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Angular, rectangular, low sphericity, and veins

Calcite

Euhedral Calcite

Size: Coarse (1.5-.525 mm) and Medium to Fine (.375-.075 mm)

Frequency/Percentage: Rare (less than 1%), Sparse (3-5%), Common (15-25%), and Abundant (40%)

Degree of Sorting: Very Poor to Poor

Roundedness: Angular, low sphericity

Polycrystalline Calcite

Size: Coarse (1.875-.525 mm), Medium (.5-.275 mm), and Fine (.25-.075 mm)

Frequency/Percentage: Rare (1%), Sparse (2-4%), and Common (10-30%)

Degree of Sorting: Poor to Fair to Good

Roundedness: Sub-angular, low sphericity

Cryptocrystalline Calcite

Size: Coarse (1.625-1.5 mm), Medium (.3-.275 mm), and Fine (.25-.05 mm)

Frequency/Percentage: Sparse (2%), Common (15-35%), and Abundant (40-80%)

Degree of Sorting: Poor to Fair

Roundedness: Sub-angular, low sphericity

Plagioclase

None counted.

Feldspar

None counted.

Shell

Size: Coarse (2.75-.525 mm) and Medium to Fine (.4-.1 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Circular

Pores/Voids

Size: Coarse (3.75-.625 mm), Medium (.5-.25 mm), and Fine (.1-.05 mm)

Frequency/Percentage: Sparse (3-7%) and Common (10-15%)

Degree of Sorting: Very Poor to Poor

Roundedness: Sub-angular, low sphericity

Fossils

Size: Fine (.175-.075 mm)

Frequency/Percentage: Rare (less than 1%)

Degree of Sorting: Poor

Roundedness: Rounded, sub-rounded, high sphericity

Organics

Size: Medium (.5-.225 mm) and Fine (.15-.075 mm)

Frequency/Percentage: Sparse (2-8%)

Degree of Sorting: Fair

Roundedness: Rounded and sub-rounded, high and low sphericity

Volador Dull-Slipped wares may be characterized petrographically as dominated by poorly sorted, sub-angular calcareous minerals (primarily cryptocrystalline calcite) with lesser amounts of quartz and euhedral and polycrystalline calcite, and minor amounts of chert, chalcedony, feldspar, biotite, and hematite minerals and organics and shells. In four cases, the sherds were dominated by medium sized quartz with lesser amount of calcareous minerals, and minor amounts of chert, biotite, and hematite minerals and shells. Volador Dull-Slipped sherds are not highly porous. These sherds can also be identified by their clay birefringence colors that range from .006-.017.

In addition to these ware-based characteristics, Volador Dull-Slipped ware sherds form two groups based on the presence of different suites of inclusions that comprise the clay paste. The first group contains 105 sherds and is characterized by quartz, chert, chalcedony, hematite, biotite, euhedral, polycrystalline, and cryptocrystalline calcite minerals, and shell, fossils, and organic matter that range in size from very fine to coarse. The majority of the sherds have minerals, pores, and organics that comprise 40-60 percent of the clay paste; however, 12 sherds have minerals that occupy 15-35 percent of the clay paste and one sherd has minerals that comprise 70 percent of the clay paste.

There are five unique pore and mineral characteristics in this group. First, twenty percent of the sherds of this group are characterized by long, wavy pores parallel to the vessel wall. Second, shell fragments in this group are more complete (similar to a cross section). Third, some quartz and calcite minerals are perfectly oval in shape. Fourth, quartz minerals tend to occur in two size categories suggesting naturally present and intentionally added quartz. Finally, small fragments of biotite occur in larger hematite minerals. Birefringence colors range from .006-.017.

Thirty-seven sherds comprise the second group. This group has quartz, cryptocrystalline calcite, hematite, shell, and organic inclusions in the clay paste and they comprise 45-50 percent of the clay paste. In contrast to the above group, only one sherd has long, wavy pores that parallel the vessel wall. Birefringence colors range from .006-.017.

II.E. Quantitative Analysis of Petrographic Data

The following section employs point counting data to further describe the variability of the ceramic wares described above. In order to better analyze the effect of the association of minerals in a clay paste, combinations of three types of inclusions are examined below through the use of ternary charts. Because of the requirement of three data values, those sherds that do not have the three values being plotted are not included. Five different combinations of minerals and pores of the three pottery wares reinforce the groupings previously described above and correspond to data presented in Chapter 8.

II.E.1. Ternary Plots of Euhedral, Polycrystalline, and Cryptocrystalline Calcite. As a result of petrographic examination, I detected the presence of calcite with different types of crystallinity. In order to test the possibility of groupings based on calcite crystallinity, euhedral, polycrystalline, and cryptocrystalline calcite frequencies were plotted. Ternary charts of the data counts of three crystalline forms of calcite present in the clay paste of the sherds in this sample appear in Figures 61-63.

Clemencia Cream Paste ware sherds typically lack polycrystalline calcite, have small amounts of euhedral calcite, and have relatively high quantities of cryptocrystalline calcite (Figure 61). This is not surprising given the marly texture of the paste. Although most sherds group together, four Chompoxté Red-on-paste: Akalché Variety sherds and one Canté Polychrome sherd each from Zacpetén and Tipuj have distinctive quantities of euhedral and cryptocrystalline calcite.

Vitzil Orange-Red ware sherds form three groups according to the presence of calcite (Figure 62). The first group lacks polycrystalline calcite, has small amounts of euhedral calcite, and high quantities of cryptocrystalline calcite. This group corresponds to the third and fourth groups described in section II.C. The second ternary chart group consists of small amounts of polycrystalline calcite and moderate quantities of euhedral and cryptocrystalline calcite. Two of the Augustine Red sherds come from Zacpetén and one from Tipuj. The third group is dominated by euhedral calcite and lacks polycrystalline and cryptocrystalline calcite. Three of these Augustine Red sherds come from Ixlú, one from Zacpetén, and one from Ch'ich'.

Volador Dull-Slipped ware sherds also form three groups (Figure 63). The majority of the sherds lack or have small quantities of euhedral and polycrystalline calcite and have high quantities of cryptocrystalline calcite. Another group has moderate amounts of euhedral calcite and relatively high quantities of polycrystalline and cryptocrystalline calcite. These Trapeché Pink sherds come from Zacpetén. Finally, the

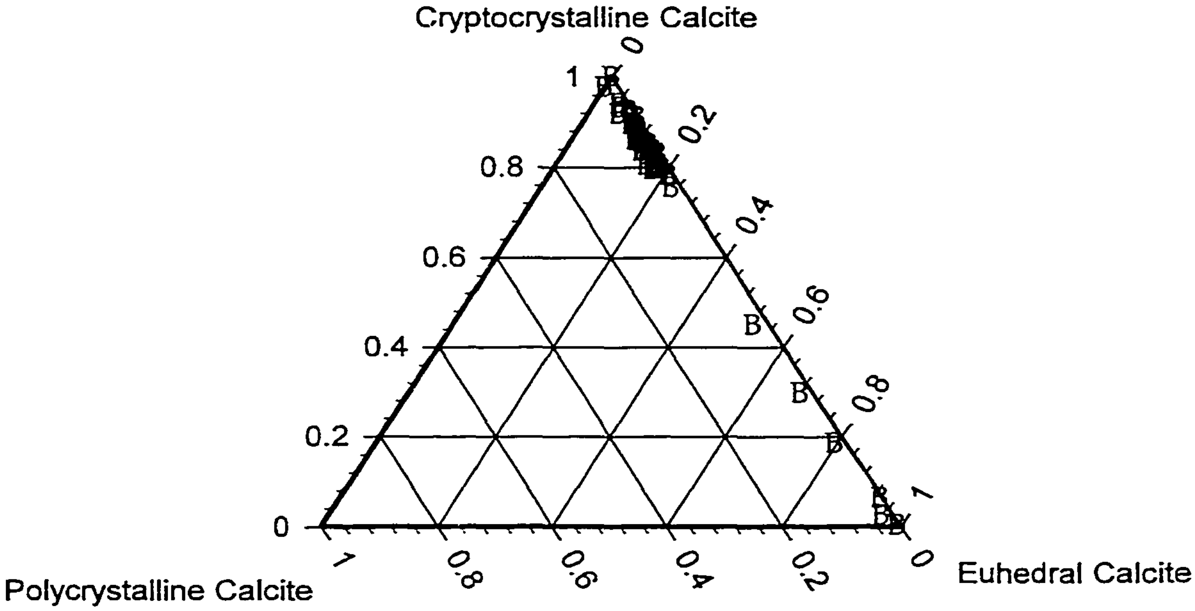


Figure 61: Clemencia Cream Ware Paste Sherds

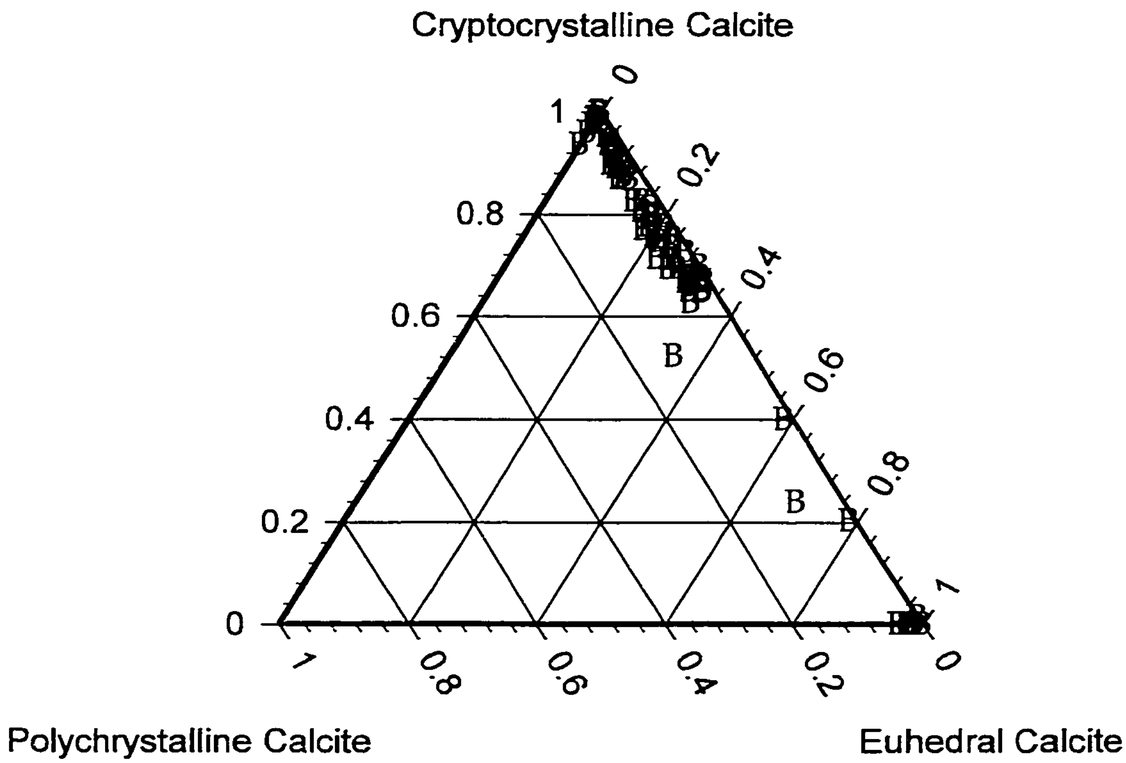


Figure 62: Vitzil Orange-Red Ware Sherds

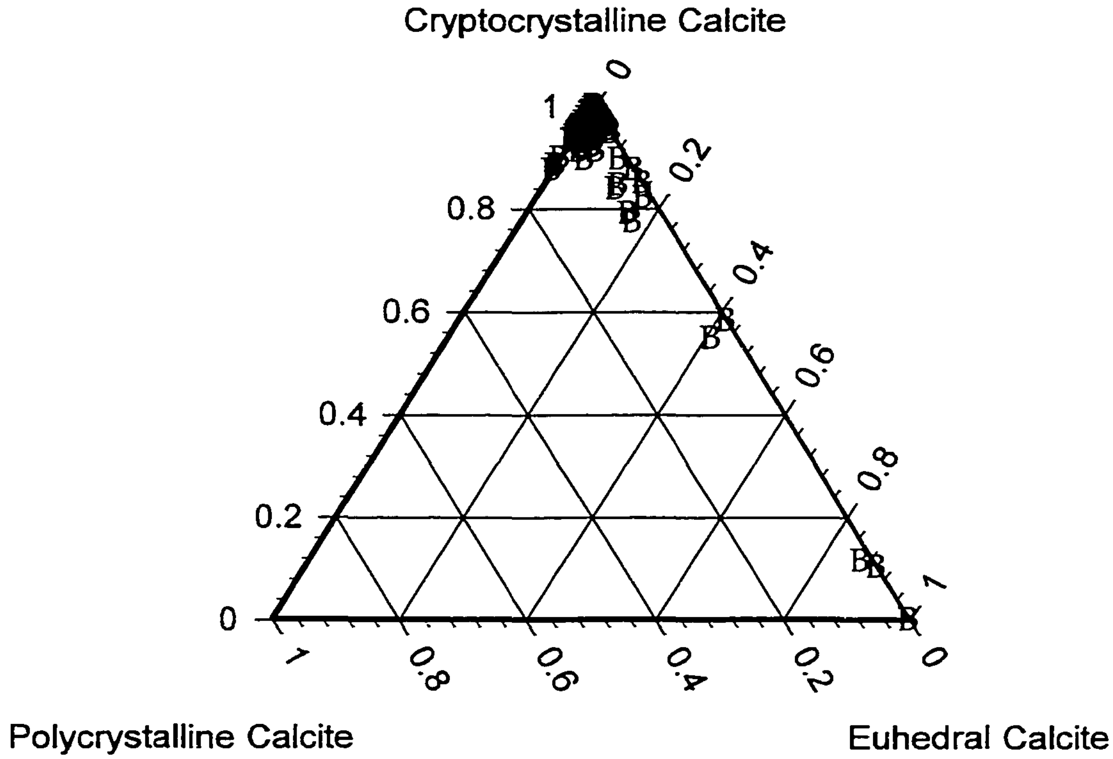


Figure 63: Volador Dull-Slipped Ware Sherds

third group consists of sherds with high amounts of euhedral calcite and low amounts of cryptocrystalline and polycrystalline calcite. All but one of these sherds are decorated and three come from Zacpetén, one from Chi'ch', and one from Tipuj.

II.E.2. Ternary Plots of Pores/Voids, Quartz, and Cryptocrystalline Calcite. Ternary charts of the combination of counts for pores/voids, quartz, and cryptocrystalline calcite appear in Figures 64-66. I chose to examine the combination of pores/voids, quartz, and cryptocrystalline calcite because of the presence of these components in the majority of sherds and because petrographic analysis suggests that the quantities of these components of the clay pastes may form clusters.

Clemencia Cream Paste ware sherds form two groups that correspond to the groupings based on petrographic examination described above in section II.B(Figure 64). The first group consists of relatively low to moderate quantities of pores/voids and quartz and high quantities of cryptocrystalline calcite. This group corresponds to groups two and three discussed in section II.B. The second ternary chart group is dominated by pores/voids and has small amounts of quartz and calcite. This group corresponds to the first group of sherds discussed in section II.B. and includes all Topoxté Red sherds from Ixlú and two Topoxté Red sherds from Tipuj.

Vitzil Orange-Red ware sherds form three loosely defined "groups" based on the presence of pores/voids, quartz, and cryptocrystalline calcite (Figure 65). The first group consists of low to moderate quantities of pores/voids and quartz and moderate to high quantities of cryptocrystalline calcite. The second group has moderate to high quantities of pores/voids and low amounts of quartz and voids and includes three Augustine Red

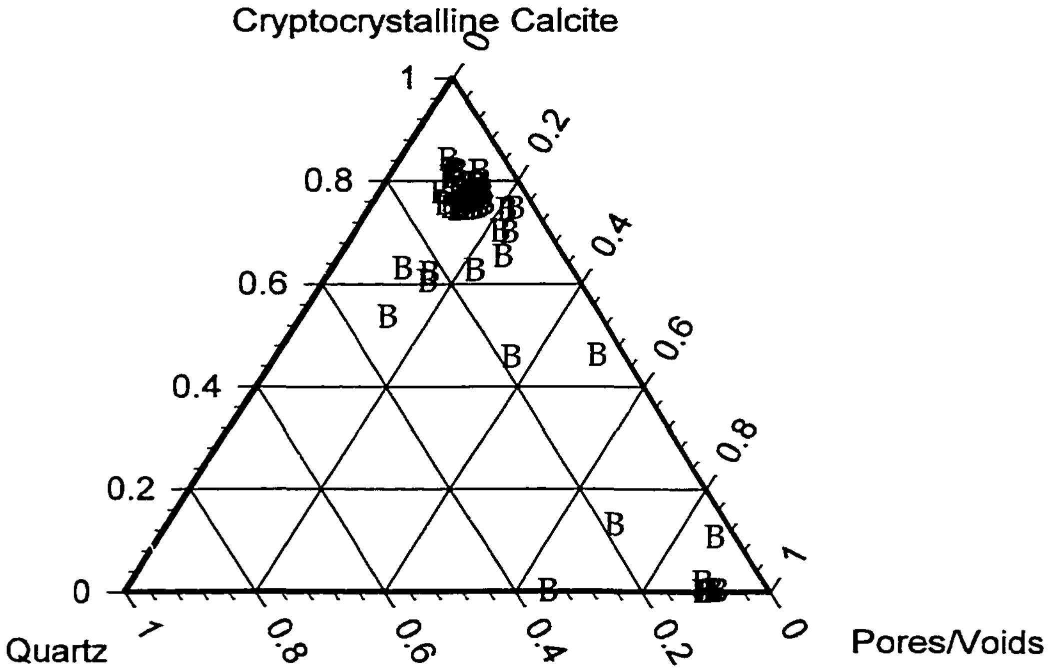


Figure 64: Clemencia Cream Paste Ware Sherds

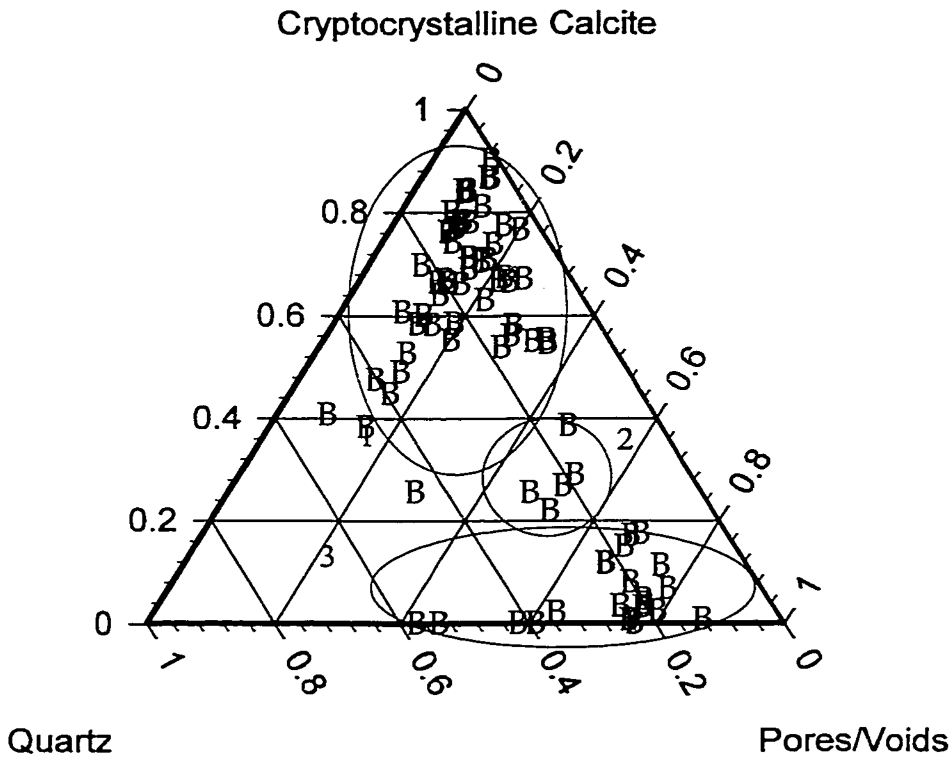


Figure 65: Vitzil Orange-Red Ware Sherds

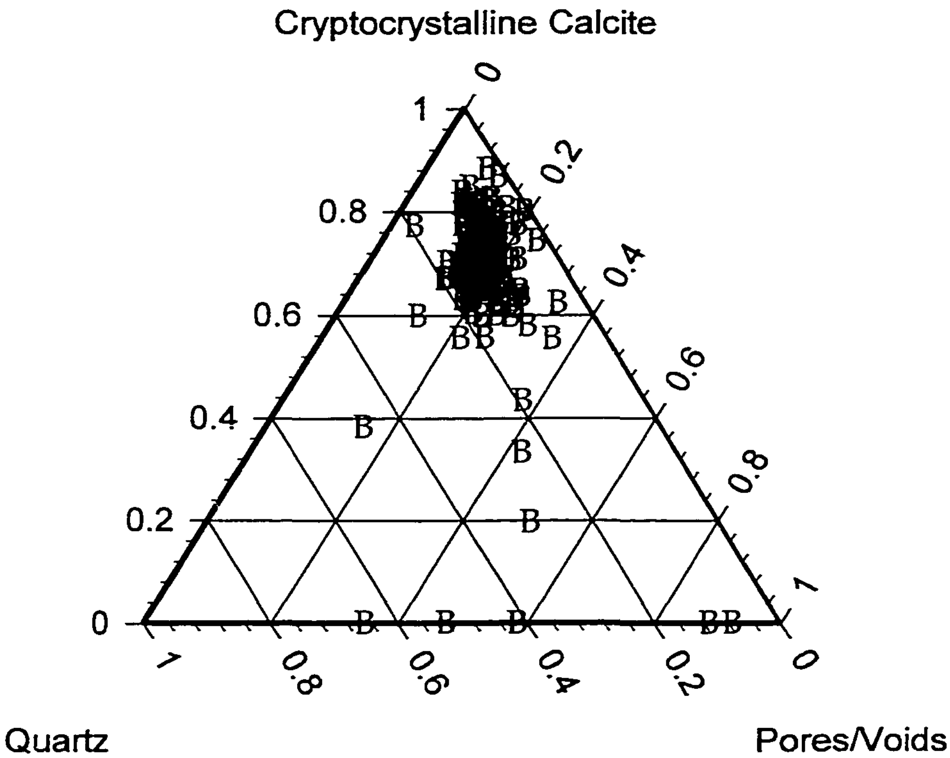


Figure 66: Volador Dull-Slipped Ware Sherds

sherds from Chi'ch' and two sherds from Zacpetén. Finally, the third group has a high quantity of voids, low to moderate quantities of quartz, and moderate to high amounts of cryptocrystalline calcite. This group has three decorated sherds and 10 Augustine Red sherds from Ixlú, five Augustine Red sherds from Ch'ich, and four Augustine Red sherds from Zacpetén and corresponds to the first petrographic group discussed in section II.C.

Volador Dull-Slipped ware sherds also form three groups as seen in the ternary plot of the data (Figure 66). The first group has low quantities of pores/voids and quartz and high amounts of cryptocrystalline calcite. Another scatter of sherds has moderate amounts of pores/voids and cryptocrystalline calcite and moderate to high quantities of quartz. This scatter is composed of two sherds (Macanché Red-on-paste and Ixpop Polychrome) from Zacpetén, one Picú Incised: Picú Variety sherd from Ch'ich', and one Paxcamán Red sherd from Tipuj. The final group has high quantities of voids and varying amounts of quartz and cryptocrystalline. All sherds in this group come from Zacpetén.

II.E.3. Ternary Plots of Cryptocrystalline Calcite, Quartz, and Hematite. Ternary charts that display the quantities of cryptocrystalline calcite, quartz, and hematite of the sherds in this study are presented in Figures 67-69. I chose this combination of minerals because of the relatively consistent presence of cryptocrystalline calcite and the varying amounts of quartz and hematite minerals noted in petrographic examination. Hematite was chosen because of its abundance in Vitzil Orange-Red paste wares that have orange-red pastes due to the presence of hematite in the clay paste and the relative lack of hematite in the Clemencia Cream Paste ware and the Volador Dull-Slipped ware sherds.

Clemencia Cream Paste ware sherds form two distinct groups (Figure 67). The

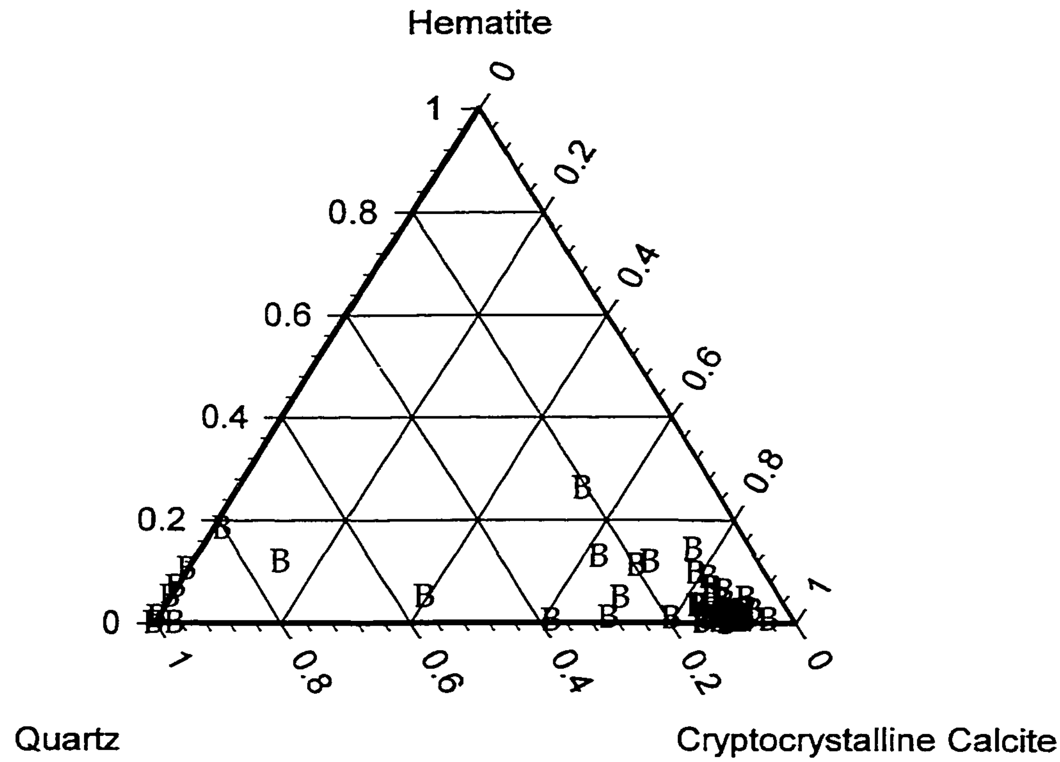


Figure 67: Clemencia Cream Paste Ware Sherds

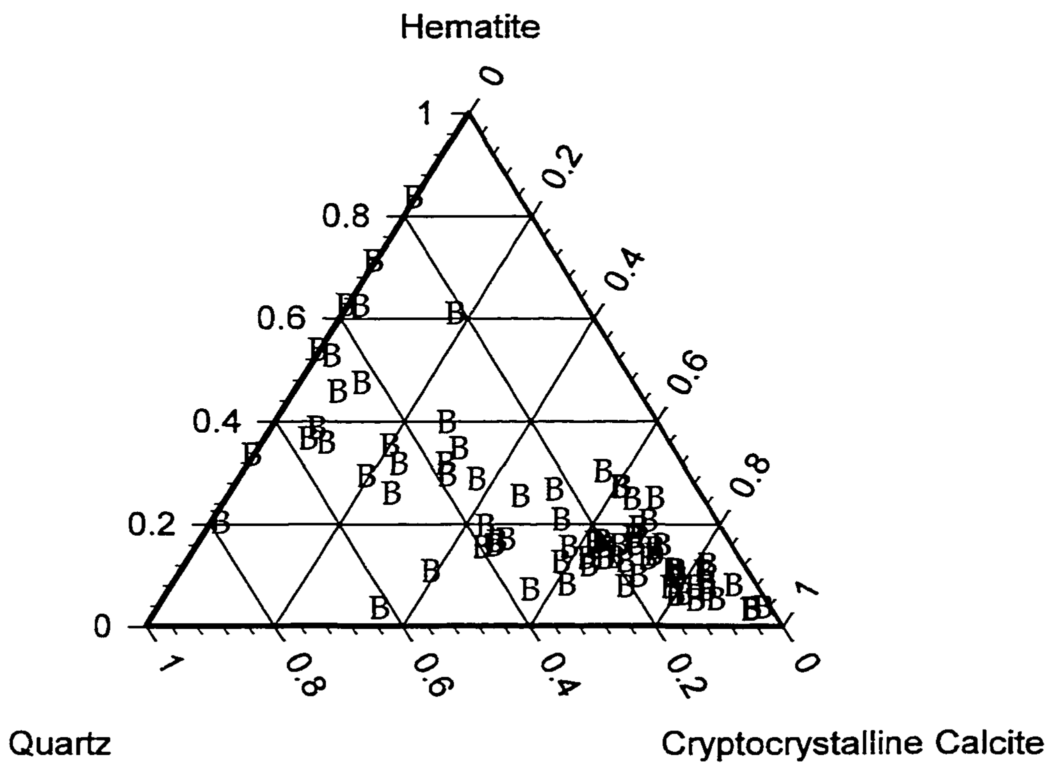


Figure 68: Vitzil Orange-Red Ware Sherds

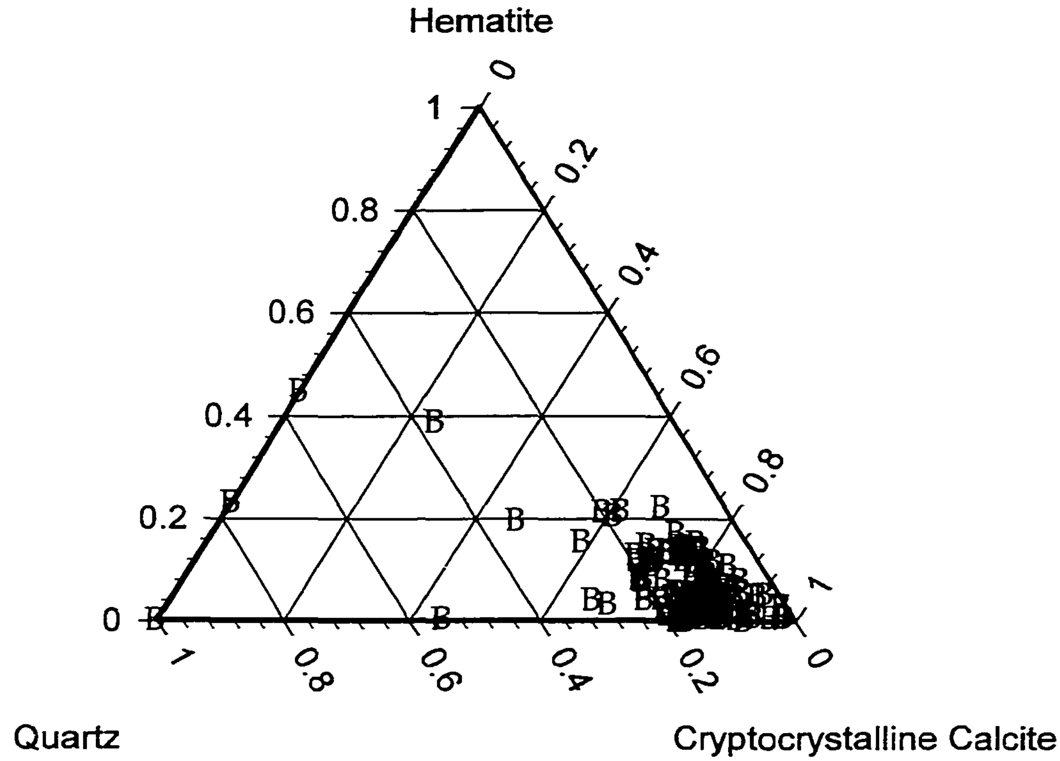


Figure 69: Volador Dull-Slipped Ware Sherds

ceramic paste of the first group consists of high quantities of cryptocrystalline calcite and hematite and low quantities of quartz. All sherds from Ixlú appear in this cluster. The second group is the exact opposite with high quantities of quartz and low quantities of hematite and calcite in the sherd paste.

The Vitzil Orange-Red ware sherds do not form distinctive groups based on these three elements, which suggests a continuum of minerals present in the clay matrix (Figure 68). Although no distinct groups occur, one cluster of sherds has high quantities of cryptocrystalline calcite and hematite and low to moderate frequencies of quartz. Most of the sherds that comprise this group are from Ixlú and three are from Ch'ich' and three from Zacpetén.

Volador Dull-Slipped ware sherds form one main group characterized by a large amount of cryptocrystalline calcite and low quantities of quartz and hematite (Figure 69). Five sherds exist outside of this group and three of them have high quantities of quartz and low quantities of hematite and cryptocrystalline calcite. These sherds represent three decorated sherds and two undecorated sherds from Zacpetén, one undecorated sherd from Ch'ich, and one decorated and one undecorated sherd from Tipuj.

II.E.4. Ternary Charts of Pores/Voids, Quartz, and Hematite. Ternary charts for pores/voids, quartz, and hematite are found in Figures 70-72. This combination of clay paste components represents three inclusions that are present in the majority of sherds and have shown to be distinctive in the ternary charts previously discussed. Therefore, by comparing the three components, it was hoped that their relative importance as far as frequency in the clay paste would be better illustrated. Unfortunately, obvious

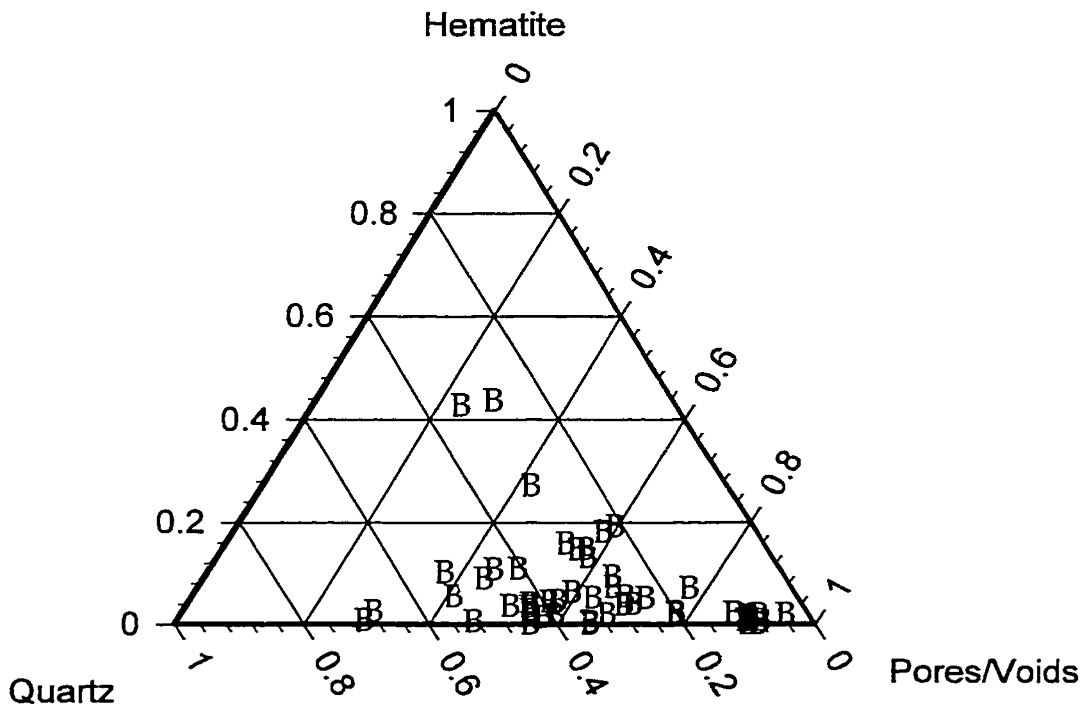


Figure 70: Clemencia Cream Paste Ware Sherds

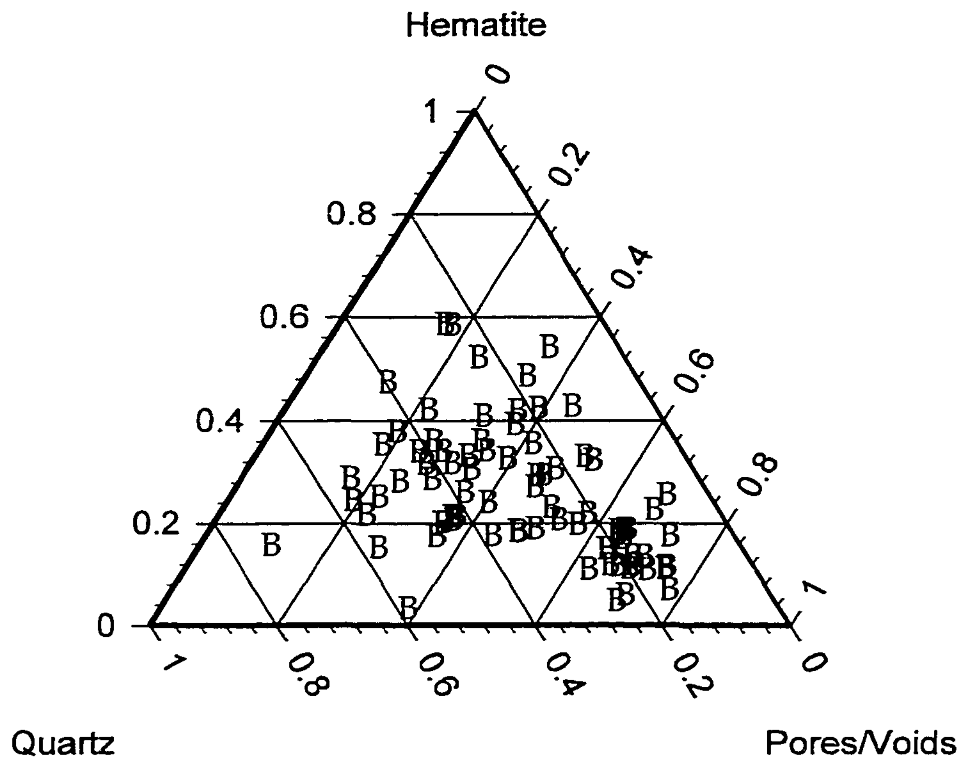


Figure 71: Vitzil Orange-Red Ware Sherds

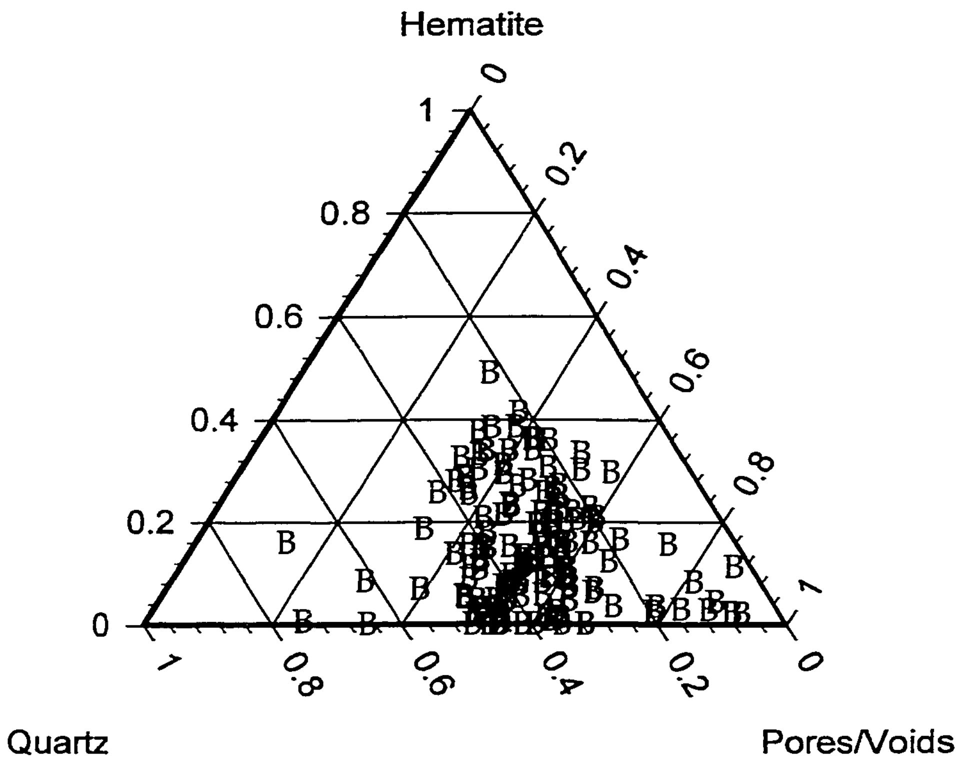


Figure 72: Volador Dull-Slipped Ware Sherds

differences only occur in the Clemencia Cream Paste ware sherds.

Clemencia Cream Paste sherds form one large group with two outlier groups (Figure 70). The large group has moderate to high amount of pores/voids and a variation in the quantity of hematite and quartz minerals. The two outlier groups, composed of Chompoxté Red-on-paste: Akalché Variety sherds from Zacpetén and Topoxté Red sherds from Ixlú, have a low quantity of pores/voids and a moderate amount of quartz and hematite. This chart is confusing because of the absence of the distinct groupings based on high quantities of pores/voids in petrographic examination and previous ternary charts. Although this division is not obvious in the current ternary chart, there are five sherds from Ixlú slightly separated at the lower right corner.

Vitzil Orange-Red ware sherds also form one large cluster in the center of the ternary chart suggesting a common occurrence of the components in all sherds (Figure 71). Although Vitzil Orange-Red clay pastes should form distinct groupings as evident from petrographic analysis, the distinction is not obvious from these three components. However, a small cluster of these sherds occurs in the lower right corner of the chart.

Sherds of the Volador Dull-Slipped ware demonstrate the same trend as discussed above for the Clemencia Cream Paste and Vitzil Orange-Red ware sherds (Figure 72). The only apparent difference exists in the tightness of the cluster of sherds due to the moderate amount of quartz present in the majority of sherds. Unfortunately, the relative importance of these components in the clay pastes is not apparent in the ternary charts.

II.E.5. Ternary Charts of Cryptocrystalline Calcite, Chalcedony, and Biotite. Ternary charts that plot the presence of cryptocrystalline calcite, chalcedony, and biotite appear

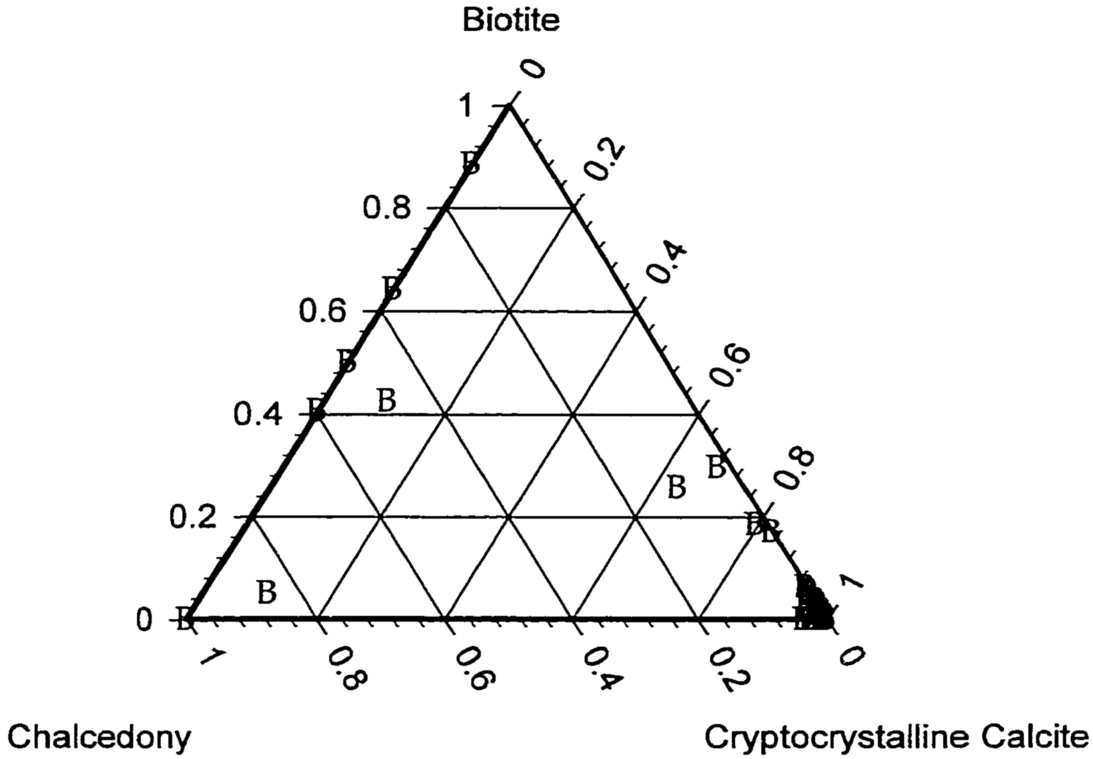


Figure 73: Clemencia Cream Paste Ware Sherds

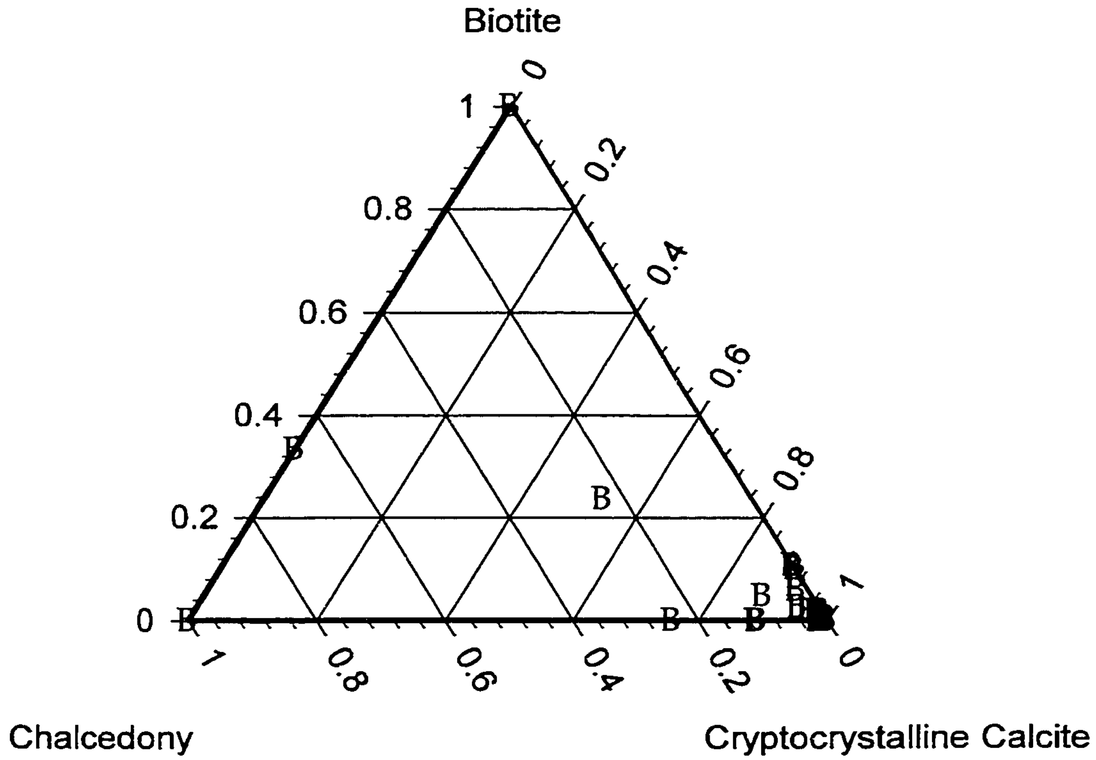


Figure 74: Vitzil Orange-Red Ware Sherds

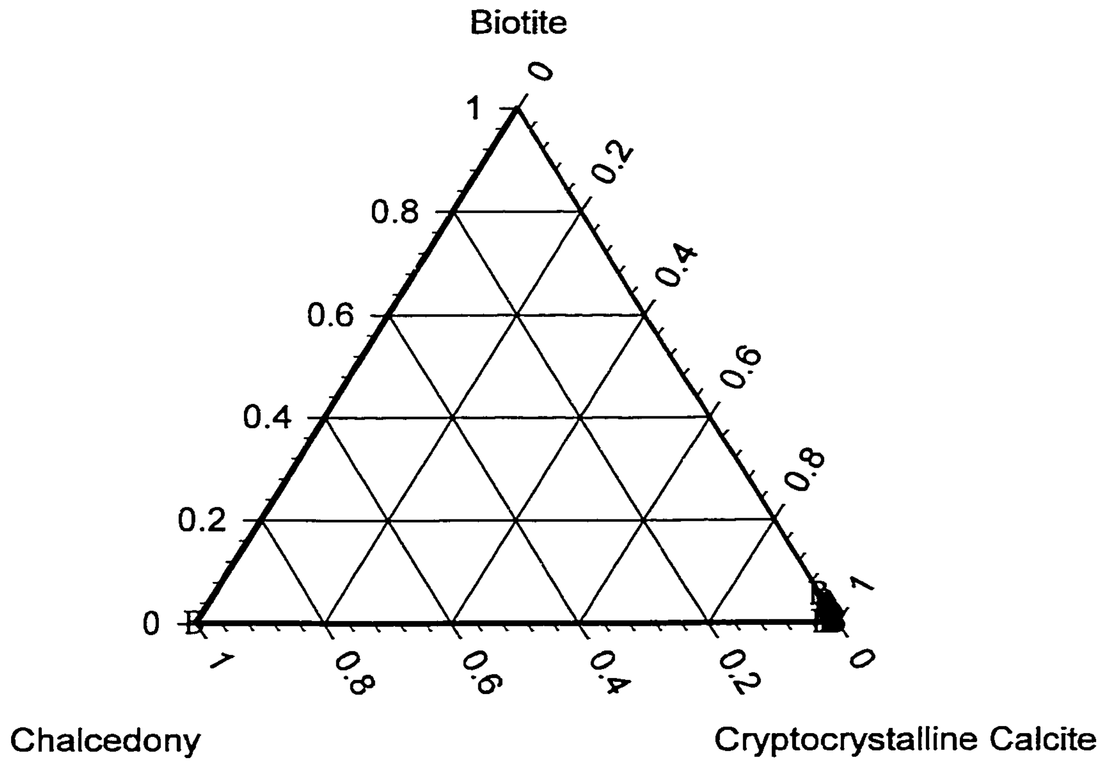


Figure 75: Volador Dull-Slipped Ware Sherds

in Figures 73-75. I chose to compare these three minerals because of the varying presence of chalcedony and biotite in the clay pastes of the three ceramic wares. In petrographic examination, biotite occurs with calcite or with calcite and chalcedony to form two distinct groups (see sections II.B., II.C., and II.D.). Therefore, by examining the presence of the three minerals, the petrographic groups based on the presence of biotite and chalcedony may be further illustrated through the ternary charts.

Clemencia Cream Paste ware sherds form two “groups” or scatters when the three minerals are plotted together (Figure 73). The first “group” consists of high quantities of cryptocrystalline calcite, no chalcedony, and low amounts of biotite. This “group” corresponds to the second petrographic group discussed in section II.B. The other scatter contains low quantities of cryptocrystalline calcite and varying amounts of biotite and chalcedony. This scatter consists of Topoxté Red sherds from Ixlú.

Vitzil Orange-Red ware sherds form two “groups” or scatters that appear on the right and left sides of the ternary charts (Figure 74). The first group consists of high quantities of cryptocrystalline calcite and low quantities of chalcedony and biotite. A few sherds in this group lack chalcedony and biotite. The second scatter contains a range (low to high) of quantities of the three minerals. Equal quantities of sherds from the four archaeological sites in this study occur throughout the graph.

Volador Dull-Slipped ware sherds form one group with an outlier from Zacpetén (Figure 75). The group is represented by high amounts of cryptocrystalline calcite and by low quantities of chalcedony and biotite. This group may represent the first petrographic group discussed in section II.D. Unfortunately, the ternary chart group does not reflect the division of sherds with the presence of biotite and chalcedony and those without either of the two minerals as determined through petrographic analysis.

In sum, the petrographic analysis presented in sections II.B., II.C., and II.D. the ternary plots presented in section II.E. suggest various groups of clay paste components. In general, the differences in the groups of the three pottery wares result from the presence of pores/voids, chalcedony, and biotite. Clemencia Cream Paste ware sherds form three mineralogical groups: 1) clay pastes that lack mineral inclusions and have an abundance of pores/voids; 2) clay pastes with biotite minerals; and 3) clay pastes with chalcedony and biotite minerals. Vitzil Orange-Red ware sherds form two basic groups of mineral components: 1) clay pastes with an abundance of pores/voids; and 2) clay pastes with the presences of all minerals in varying quantities. Finally, Volador Dull-Slipped ware sherds also form two basic groups of minerals: 1) clay pastes with biotite and chalcedony and 2) clay pastes lacking biotite and chalcedony. These differences correlate to differences in elemental concentrations (Chapter 8) and to differences in technological styles (Chapter 9).

II. X-Ray Diffraction Analysis

Clays from Yaxhá and Zacpetén as well as 15 sherds representing all of the ceramic wares and groups and some of the pottery types were analyzed using x-ray diffraction analysis. Only 15 sherds were tested because these sherds had estimated original firing temperatures below 450°C. Preliminary tests on sherds fired above 450°C demonstrated that clay mineral peaks were not detected because clay mineral structures begin to collapse at this temperature.

II.A. Clays of the Petén Lakes Region

To fully understand the variability of clays and other minerals present in the mineralogical analysis described below, a discussion of the geology of central Petén is warranted. The Petén lakes region is characterized by a karstic surface with slumped bedding composed of sediments that date from the late Cretaceous to the Eocene periods (Vinson 1962). The chain of lakes, of which Lake Petén Itzá is the largest, lies in an east-west anticline and exhibit superficial interior drainage patterns (Cowgill et. al. 1966:2). The oldest unmetamorphosed or partly metamorphosed sediments of the Santa Rosa Formation overlie pre-Carboniferous metamorphic rocks and granites (Vinson 1962:429). The Santa Rosa Formation is overlain by the Todos Santos Formation (upper Jurassic) that resulted from the embayment deposition from the Gulf of Mexico (Vinson 1962:431). This series of red beds (called so because of the iron content in the clays to make them "red") exists throughout Guatemala, Belize, and the Yucatán Peninsula. Although the description of "red beds" suggests that the beds are colored red, in fact, the colors range from white to reddish brown and include quartz gravels (Lopez Ramos 1975:271). Salts interlayer the Santa Rosa Formation's red beds (Lopez Ramos 1975:272; Vinson 1962:431).

Cretaceous limestones, dolomites, and argillaceous to arenaceous clastics (the Coban Group) overlay the Santa Rosa Formation. The Coban Group is a thick sedimentary sequence of "carbonates and evaporites deposited under restricted to open marine conditions" (Banks and Carballo 1987a:60). Carbonate and evaporite beds are interbedded with anhydrites and halite and different concentrations of minerals and carbonates allow geologists to divide the Coban Formation into four distinct levels (A-D): Level D consists of limestones and dolomites that developed in a salt facies and has the thickest layer of evaporites; Level C is 20 percent carbonate; Level B is 50 percent carbonate; and Level A is not discussed in detail (Banks and Carballo 1987b:72; Vinson 1962:432).

The Coban group is overlain by the Campur Formation (Upper Cretaceous) that consists of limestone facies. The limestone facies are "gray, gray-brown, and tan limestone interbedded with shale, siltstone, and limestone breccia" (Vinson 1962:432).

Above the Campur Formation is the Lacandon Formation of the Verapaz Group (Upper Cretaceous) that consists of white detrital limestone characteristic of algal beds (Vinson 1962:441). The Lacandon limestone beds produce the karstic surface of Petén, Belize, and the Yucatán Peninsula.

The Petén group (Early Tertiary/Lower Eocene) is divided into the Toledo and Cambio Formations in the Petén lakes area. The sediments of the two formations were deposited contemporaneously and are differentiated by lithology. The Cambio Formation consists of shale and graywacke facies and contains fragmented limestone, siltstone, marlstone, and conglomerate limestones (Vinson 1962:443). Above the Cambio Formation, the Toledo Formation appears as a series of indurated shale and clay shale that are brown to olive gray and contain chert (Vinson 1962:448).

The Santa Amelia and Buena Vista Formations (lower Eocene) define what is commonly referred to as "Petén marls and limestone" (Wadell 1928:344). The lower Santa Amelia Formation is composed of dolomite, limestone, and marl shelf facies (Vinson 1962:447). Cream-colored microgranular sediments are interbedded with reddish evaporitic clays and limestone breccias. Tikal sits on the Santa Amelia Formation (Cowgill et. al. 1963:5). The formation is distinguished from the Buena Vista

Formation by an extensive basal gypsum bed (Vinson 1962:447). "[L]enticular layers of massive gypsum, white and cream-colored fine granular limestone and dolomite, chalky dolomite, chalky marlstone, pellet limestone, limestone breccia, and conglomerate and reddish gypsiferous clay" compose the extensive gypsum bed (Vinson 1962:448). Because of the proximity of this bed to the Buenavista Formation, evaporites predominate the dolomitic formation.

As stated above, the lakes in Petén region are a result of karstic landscapes and regional faulting. Sediment cores from Lakes Petenxil (Cowgill et. al. 1966), Yaxhá and Sacnab (Deevey et. al. 1979,1980), and Salpetén and Quexil (Brenner 1994) provide mineralogical evidence for the types of clay minerals that line the lake beds and are found in the surrounding inland areas. Each lake differs as to its specific water chemistry (see Table 38) because of the base exchange of clays, evaporites (especially gypsum), and dolomite (Deevy et. al. 1980:440).

Cowgill and Hutchinson (1963) and Cowgill et al. (1966) cored Lake Petenxil, Bajo de Santa Fé, and Bajo de Santa Ana Vieja. X-ray diffraction analysis of the clay sediments from the cores determined that halloysite (2H_2O form) with minor amounts of montmorillonite, gypsum, quartz, and pyrite composed the clay matrix (Cowgill et. al.. 1966:52). However, when cores from the northern portion of the Petenxil drainage were

Table 38: Ionic Proportions in Petén Lake Waters (percentage composition in milliequivalents (from Deevey et. al. 1980:Table 8).

	Ca	Mg	Na	K	HCO_3	Cl	SO_4
Yaxhá	32.07	5.64	8.77	3.23	39.5	6.67	4.07
Sacnab	24.65	9.35	12.47	4.48	35.6	8.30	5.13
Quexil	36.3	5.7	6.8	1.7	40.6	5.4	3.5
Petenxil	39.7	3.5	5.4	.4	32.8	2.8	15.3
Sacpuy	27.2	8.1	13.5	2.6	37.0	8.7	3.0
Petén Itzá	32.0	14.5	3.8	1.1	14.9	3.1	30.5
Macanché	14.6	28.0	4.8	1.8	19.7	5.6	25.5
Salpetén	28.7	16.7	3.4	.6	.8	2.6	47.1

mineralogically tested, the clay matrix was almost entirely montmorillonite with small amounts of halloysite and large quantities of quartz (Cowgill et. al. 1966:55). Bajo Santa Ana Vieja sediments were primarily poorly formed halloysite as evident in lower than expected x-ray diffraction peaks (Cowgill et. al. 1966:125). Bajo de Santa Fé (near Tikal) contained montmorillonite and halloysite clay minerals and some quartz minerals (Cowgill and Hutchinson 1963:25-26). Low x-ray diffraction peaks for montmorillonite again suggest small, poorly developed crystalline structures. Cowgill and Hutchinson (1963:26) stated that clay minerals form poorly developed crystals when the sediments are embedded in high concentrations of organic matter and are formed *in situ* by decomposition. In addition to the gray montmorillonite/halloysite clays of Bajo de Santa Fé, Cowgill and Hutchinson (1963:32) also examined nearby montmorillonite and quartz red clays. These clay beds also had a small quantity of halloysite.

Deevey et. al. (1979, 1980) cored the Eocene sediments of Lakes Yaxhá and Sacnab. They stated (Deevey et. al. 1979:420) that the main sediment is allochthonous with a large quantity of montmorillonite clay that most likely eroded from impure limestone.

Brenner (1994) core Lake Salpetén and Quexil and determined that the main clay mineral was montmorillonite with a small portion of halloysite.

These differences in clay minerals and other minerals in the area may have presented Postclassic Maya potters with a variablity of clays with different working properties. Montmorillonite clays swell in the presence of water and potter's would have had to understand the problems associated with clay shrinkage in order to produce a successful vessel. In addition to the types of clay minerals, other minerals such as quartz and gypsum may also have affected the clay properties making it more manageable.

II.B. X-Ray Diffraction Analysis of Clemencia Cream Paste and Volador Dull Slipped/Snail Inclusion Ware Raw Clays

II.B.1. Clay Samples. Four clay samples representing clays used in the manufacture of Clemencia Cream Paste ware pottery came from the mainland around Lake Yaxhá, the location of Topoxté Island. The Central Petén Historical Ecology Project (CPHEP) collected the clay during the 1973-1974 field seasons. Clay sample 11836 came from Brecha 4 at a depth of 100-110 cm near Mound S12, west of the Late/Terminal Classic site of Yaxhá, on the mainland across from the Topoxté Islands. The raw clay has a gray color (2.5Y 6/0) and after the clay is filtered, the color changes to light gray (10YR 7/1). Clay sample 11846 came from a road cut near the intersection of the road to Yaxhá and the road to Melchor de Mencos at kilometer marker 64-65. No depth was given. The color of the raw clay is gray (5YR 5/1) and when filtered the color changes to pale brown (10YR 6/3). This clay appears similar in texture in its dry state to clay 11836. The third clay sample 11886 also came from a road cut at the Lake Yaxhá cruce at kilometer marker 62. It is a white clay (5YR 8/1) that forms rather large "clumps" and when filtered changes color to a lighter white (7.5YR 8/0). When this clay was prepared for XRD analysis, it flaked off the slide when air dried. The final clay sample, Fine, is a very fine powdery white clay (10YR 8/1) in its natural state that came from Pit 3 in Brecha 2 at Yaxhá (no depth is given). When filtered the clay does not change color.

In addition to the Clemencia Cream Paste ware clays, one sample of gray, snail inclusion clay was sampled from Zacpetén on the west lake shore between architecture Groups A and C. The dry clay has a gray (1GLEY 6/1) color that does not change when filtered.

II.B.2. Results of X-Ray Diffraction Analysis

II.B.2.a. Clemencia Cream Paste Wares. Raw clay samples 11836, 11846, and Fine were analyzed untreated and treated with ethylene glycol, and sample 11886 was only tested treated with ethylene glycol because once it air dried, the clay separated from the glass slide. The untreated samples exhibited peaks around 6.5 2θ that range in d-spacing from 12.9-14.0 Å (Figures 76-79). When the samples were treated with ethylene glycol, the 6.5 2θ peaks shifted to approximately 5 2θ. In addition to the 100 percent peak at 6.5 2θ, the treated sample shows other peaks of intensity at approximately 10.5 2θ, 16 2θ, 20.5 2θ, and 26 2θ. These peaks indicate the presence of smectite clay minerals (Moore and Reynolds 1997:241-243). Upon closer examination, clay samples treated with ethylene glycol demonstrate montmorillonite peaks almost identical to those noted by Moore and Reynolds (1997:Figure 7.8) and Figure 6 and Table 5 presented above.

In addition to clay mineral peaks, calcite and quartz also occur. Calcite is represented by peaks at approximately 29.37 2θ, 36 2θ, 39 2θ, and 43 2θ (Chen 1977). Quartz is represent by a 100 percent peak at 26.67 2θ (Moore and Reynolds 1997:251). Other minerals may exist, but due to the background noise and the abundance of calcite no other minerals can be detected with certainty.

II.B.2.b. Zacpetén Raw Clay Sample. The clay sample taken from Zacpetén was analyzed untreated because when treated with ethylene glycol, the clay did not adhere to

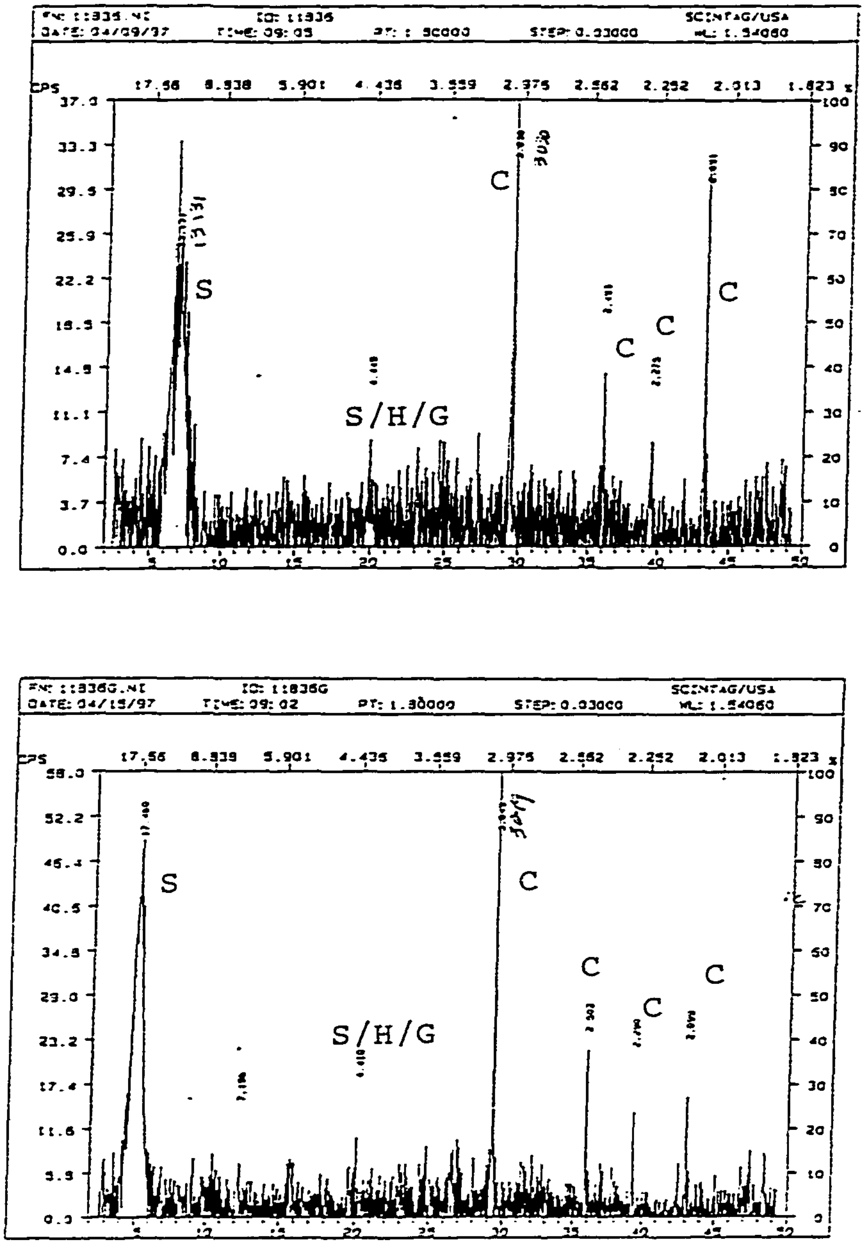


Figure 76: X-ray diffraction pattern for clay sample 11836. Graph A shows untreated clay and Graph B shows clay treated with ethylene glycol. (S=smectite, H=halloysite, G=Gypsum, C=Calcite)

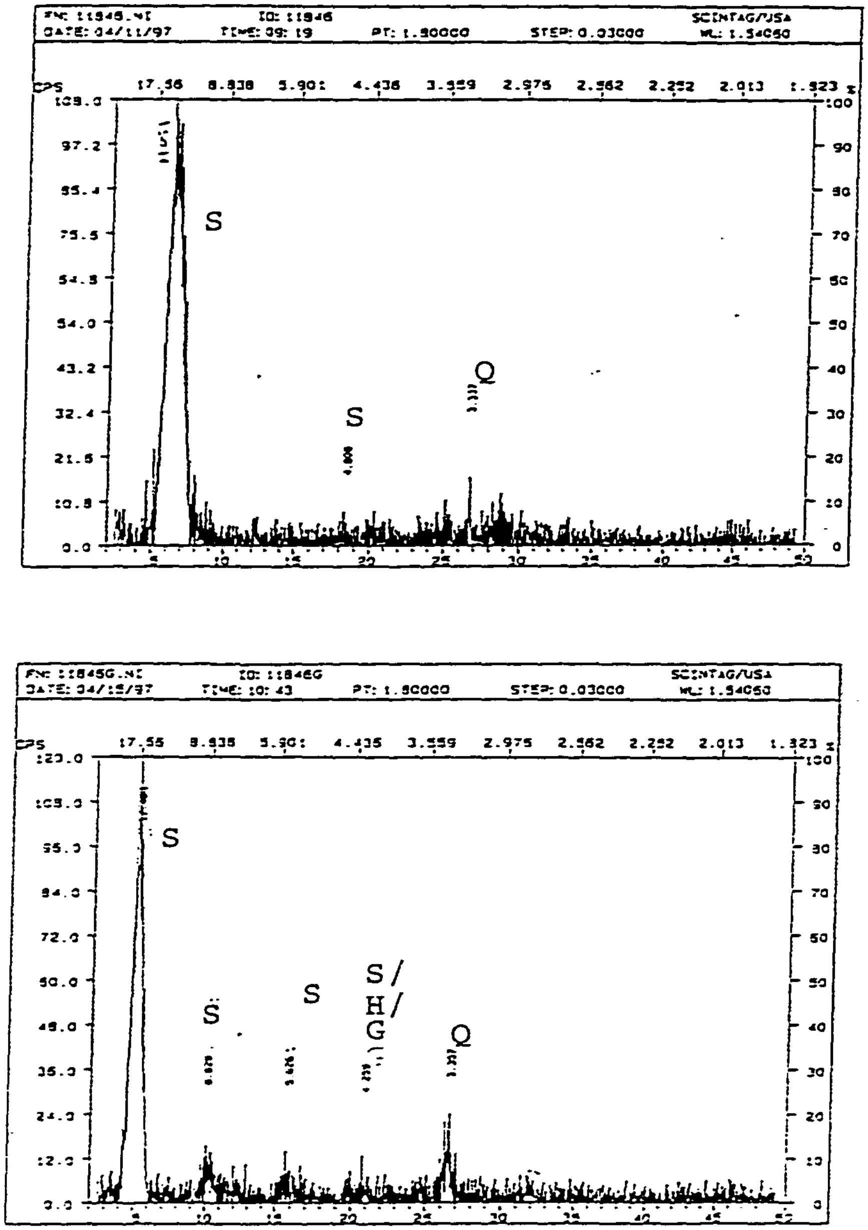


Figure 77: X-ray diffraction pattern for clay sample 11846. Graph A is untreated clay and Graph B is clay treated with ethylene glycol. (S=smectite, Q=quartz, H=halloysite, G=gypsum)

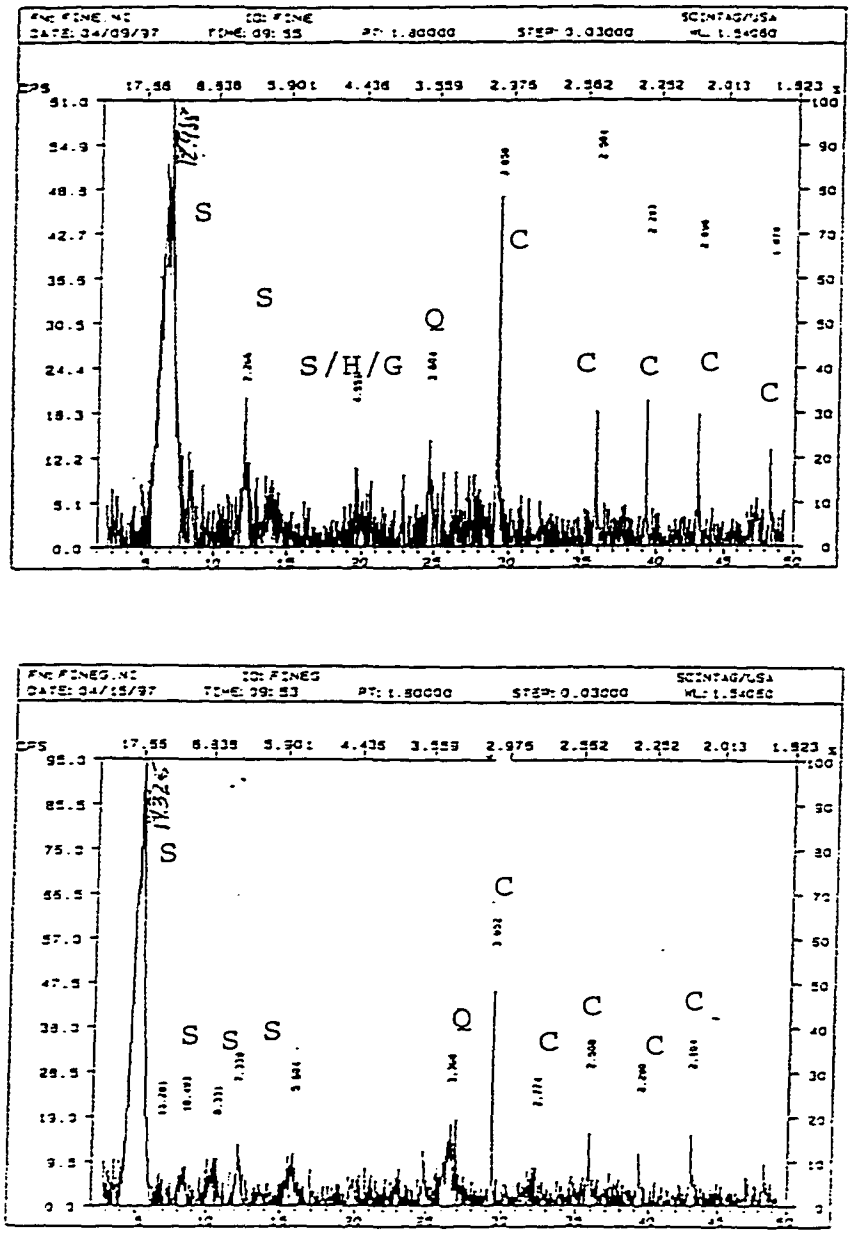


Figure 78: X-ray diffraction pattern for clay sample Fine. Graph A is untreated clay and Graph B is clay treated with ethylene glycol. (S=smectite, H=halloysite, G=gypsum, Q=quartz, C=calcite)

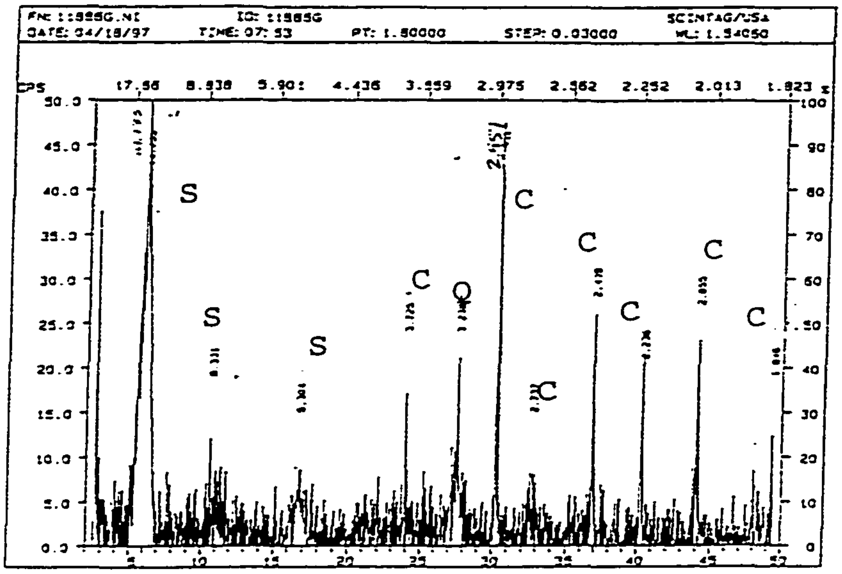


Figure 79: X-ray diffraction pattern for clay sample 11886G. The sample is treated with ethylene glycol. (S=smectite, C=Calcite, Q=quartz)

the slide. Although it was not analyzed treated with ethylene glycol, the peaks can be compared to those of untreated clay samples of the Clemencia Cream Paste ware and to figures in Moore and Reynolds (1997) to determine the possible presence of smectite clays.

Clay intensity peaks occur at approximately 6.5 2θ and 20 2θ (Figure 80). Unfortunately, many of the other probable smectite peaks (24 2θ and 29 2θ) are masked by the abundant calcite. Nevertheless, the unmasked peaks suggest that montmorillonite may be the clay mineral present in this sample.

In addition to montmorillonite, calcite peaks occur at approximately 23 2θ, 29 2θ, 36 2 2θ, 39 2 2θ, 43 2θ, and 43-49 2 2θ. Biotite may be present as suggested by a peak at approximately 8 2θ. Gypsum also occurs in the clay sample with two possible peaks at approximately 20.5 2θ and 31 2θ. Other minerals may occur, but because of the abundance of calcite, their peaks may be obscured.

II.C. Sherds Analyzed

Only a very small number of sherds (15) were analyzed by x-ray diffraction. As previously noted, only sherds with a low estimated firing temperature (below 450°C) could be tested because clay minerals begin to loose their hydroxyl water at 500°C, resulting in a change of the clay mineral structure. Although this is a small sample size, it represents most of the 10 groups discussed in the EDS section of Chapter 8. Table 39 presents the basic characteristics (site, structure, type, and variety) of the sherds analyzed and their corresponding EDS group.

All sherds samples were initially analyzed untreated to determine the presence of

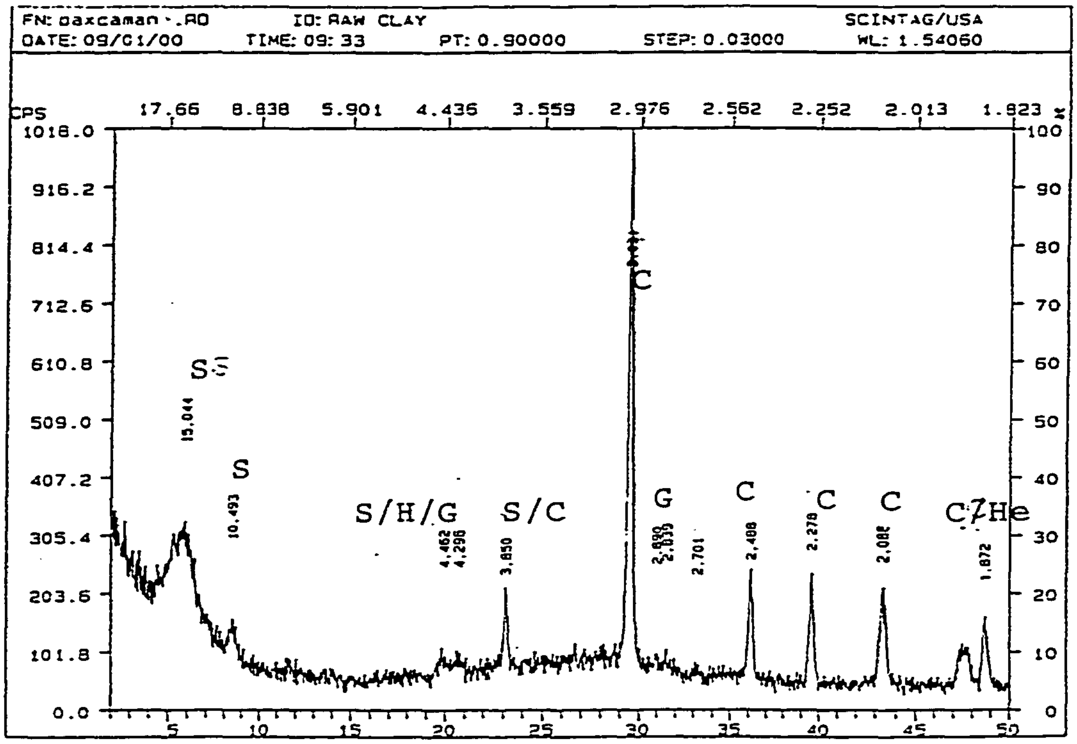


Figure 80: X-ray diffraction pattern for clay sample from Zacpetén. The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, He=hematite)

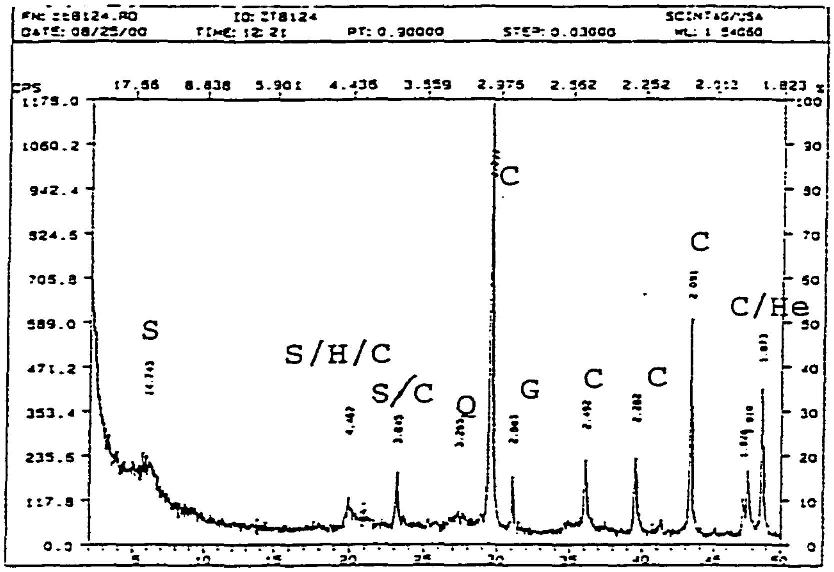
Table 39: Basic Characteristics of the Sherd Samples Used for X-ray Diffraction Analysis

Sherd Sample	Site	Structure Number	Type: Variety	EDS group
ZT 7181	Zacpetén	606	Chompoxté Red-On-Paste: Akalché Variety	E
ZT 15666	Zacpetén	767	Chompoxté Red-On-Paste: Akalché Variety	E
ZT 18124	Zacpetén	615	Chompoxté Red-On-Paste: Akalché Variety	F
IT 21875	Ixlú	2034	Topoxté Red: Topoxté Variety	I
IA 23640	Ixlú	2022	Augustine Red: Augustine Variety	E
IA 21831	Ixlú	2034	Pek Polychrome: Pek Variety	D
ZA 18019	Zacpetén	719	Augustine Red: Augustine Variety	C
CA 3702	Ch'ich'	188	Augustine Red: Augustine Variety	D
IP 21870	Ixlú	2034	Picú Incised: Thub Variety	D
IP 25463	Ixlú	2016	Paxcamán Red: Paxcamán Variety	D
TP 143	Tipuj	2	Picú Incised: Picú Variety	A
ITR 20463	Ixlú	2023	Trapeché Pink: Trapeché Variety	J
ITR 28518	Ixlú	2041	Trapeché Pink: Trapeché Variety	A
CTR 3916	Ch'ich'	188	Trapeché Pink: Trapeché Variety	C
ZTR 12260	Zacpetén	721	Trapeché Pink: Trapeché Variety	A

clay mineral peaks. Two sherds (ZT 8124 and IA 21831) presented stronger clay mineral peaks and were thus analyzed a second time after being treated with ethylene glycol. The following section presents data from these two samples as they serve as the baseline XRD data for the remaining 13 analyzed sherds. Where differences occur, they are noted, but because of the lack of clear clay mineral peaks and the basic pattern of calcite and gypsum peaks, no further discussion is needed. X-ray diffraction graphs of all samples are presented in Figures 81-95.

Treated sherd samples ZT 8124 and IA 21831 (Figures 81 and 82) demonstrate smectite peaks at approximately 6 2θ, 10 2θ, 19-20 2θ, and 27 2θ. Other smectite peaks may occur, but they are masked by calcite peaks at approximately 23-24 2θ and 29 2θ. The smectite peaks resemble montmorillonite peaks described by Moore and Reynolds (1997:Figure 7.8). Halloysite may be present at approximately 20 2θ, but its presence is masked by montmorillonite and gypsum mineral peaks. Literature suggests that halloysite is present in the lake clays in the Petén lakes region and therefore should be included as a possible clay mineral (Cowgill and Hutchinson 1963; Cowgill et al.1966).

In, addition to montmorillonite and possible halloysite peaks, calcite and gypsum peaks can be identified with certainty. Calcite peaks at 23 2θ, 29 2θ, 36 2θ, 39 2θ, 43.5 2θ, and 47-49 2θ constitute the majority of peaks present in the x-ray diffraction graphs and mask many other mineral peaks. Gypsum peaks occur at approximately 20.5 2θ and 31 2θ.



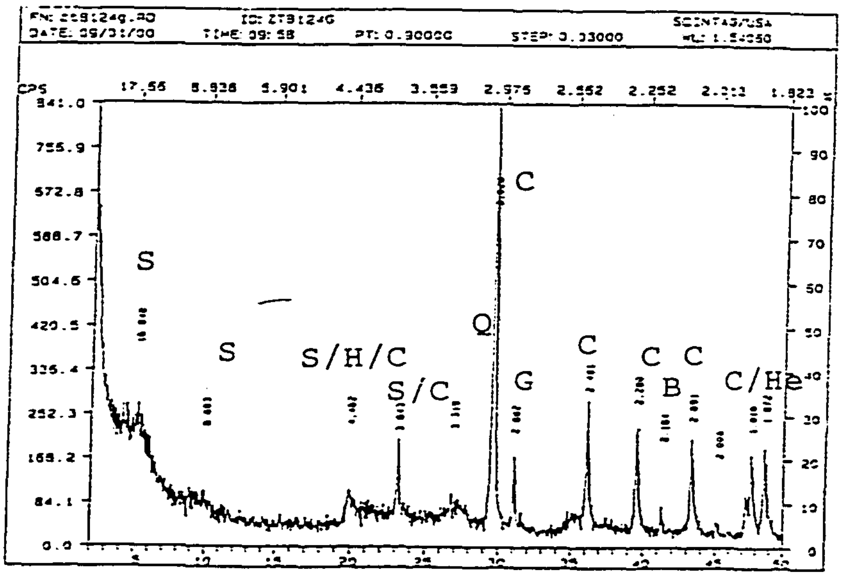
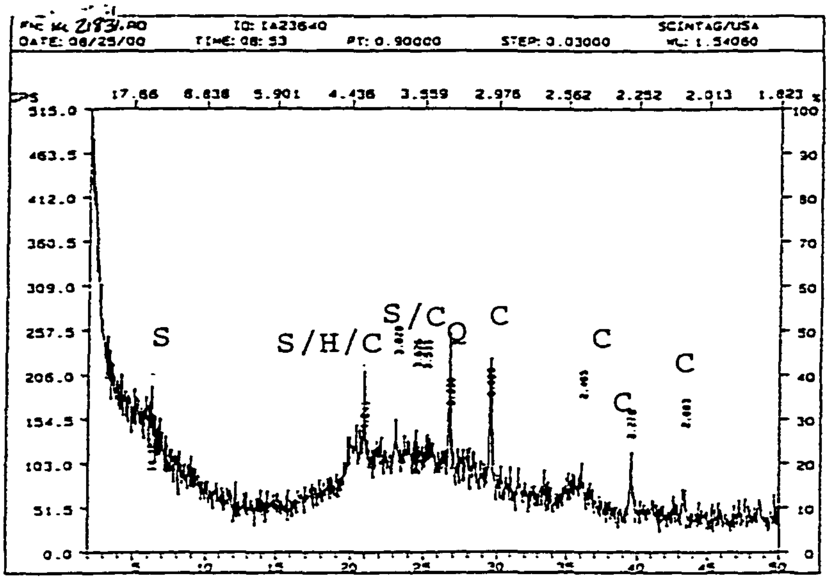


Figure 81: X-ray diffraction pattern for sherd sample ZT 8124 (Chompoxté Red-on-paste: Aklaché Variety from Zacpetén). Graph A is untreated and Graph B is treated with ethylene glycol. (S=smectite, H=halloysite, C=calcite, Q=quartz, G=gypsum, B=biotite, He=hematite)



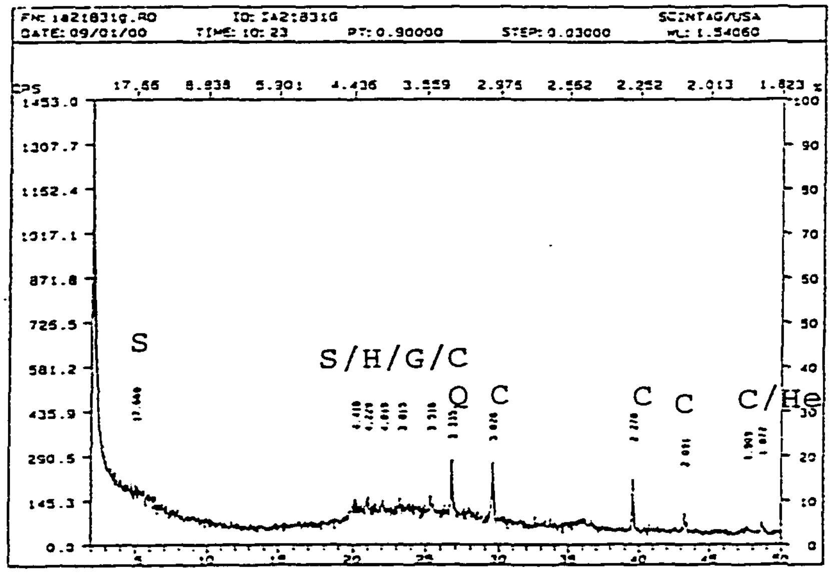


Figure 82: X-ray diffraction pattern for sherd sample IA 21831 (Pek Polychrome from Ixlú). Graph A is untreated and Graph B is treated with ethylene glycol. (S=smectite, H=halloysite, C=calcite, Q=quartz, G=gypsum, He=hematite)

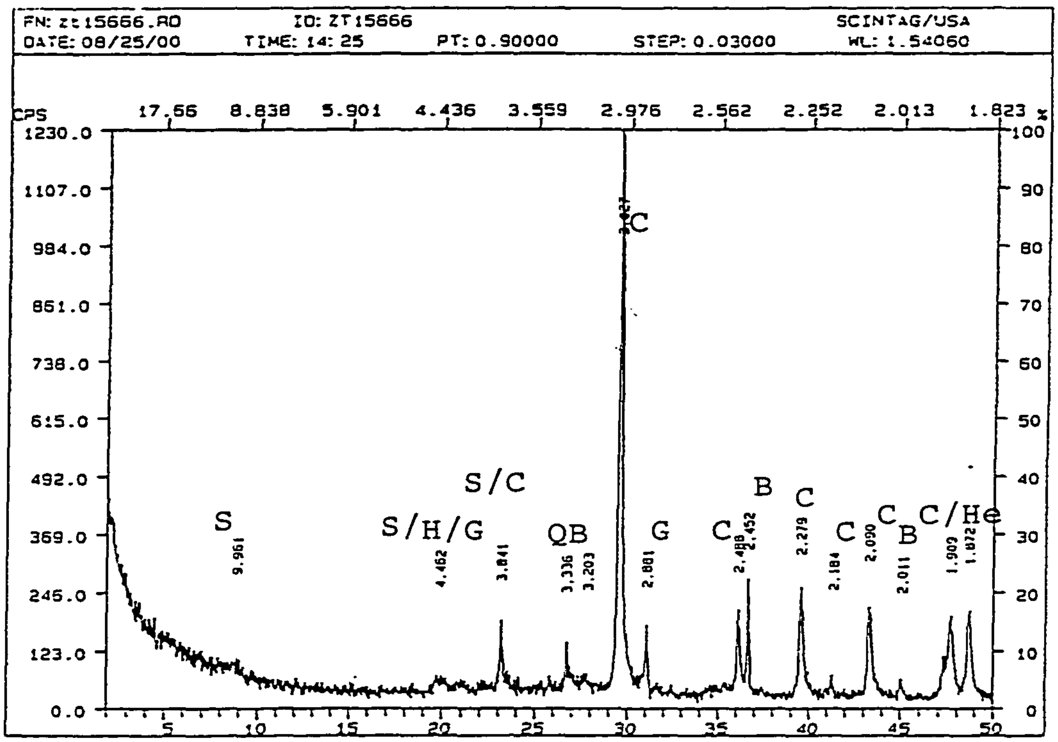


Figure 83: X-ray diffraction pattern for sherd sample ZT 15666(Chompoxté Red-on-paste: Aklaché Variety from Zacpetén). The sample is air dried.(S=smectite, H=halloysite, G=gypsum, Q=quartz, B=biotite, C=calcite, He=hematite)

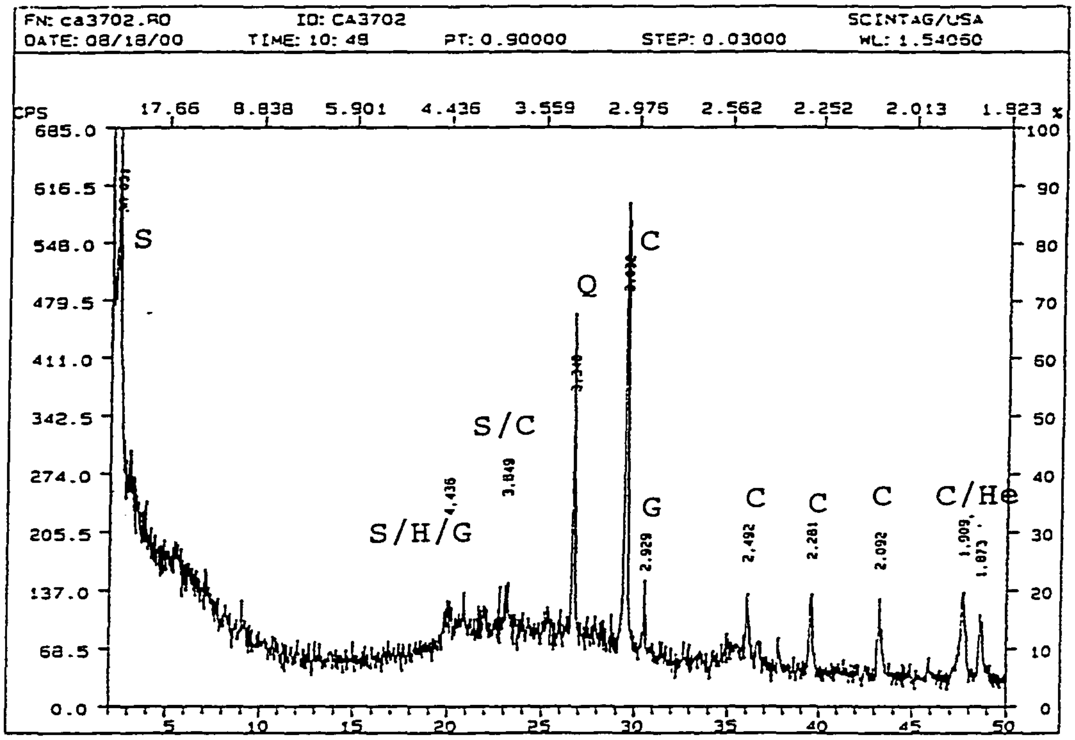


Figure 84: X-ray diffraction pattern for sherd sample CA 3702 (Augustine Red from Ch'ich'). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

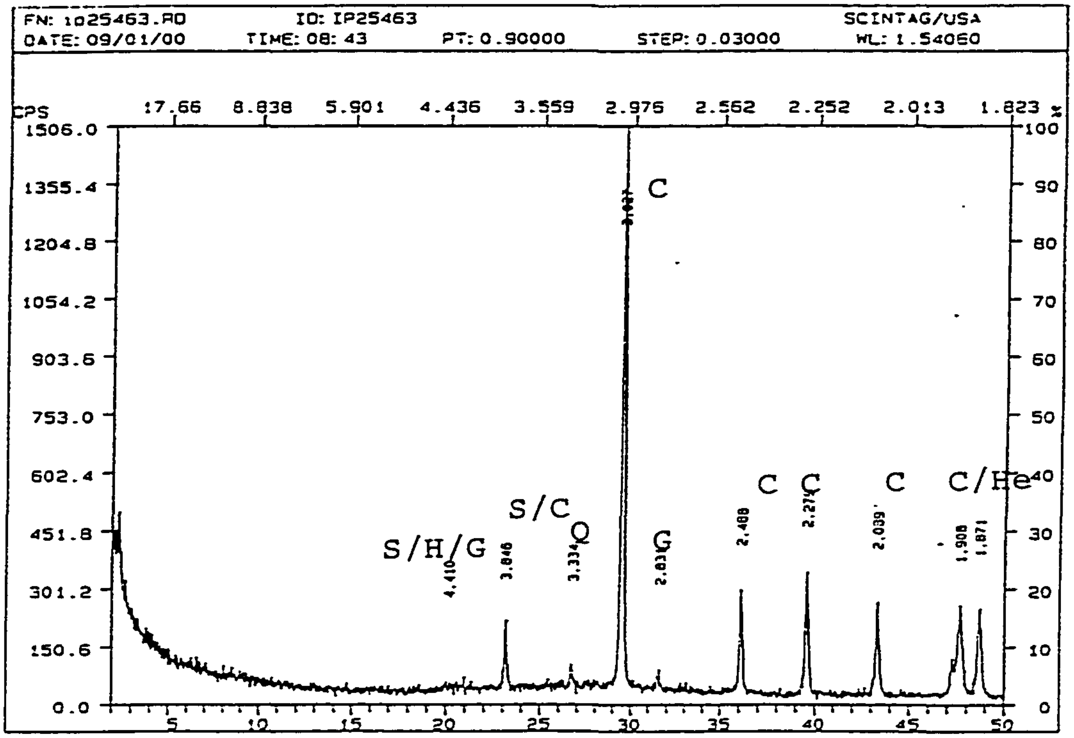


Figure 85: X-ray diffraction pattern for sherd sample IP 25463 (Paxcamán Red from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

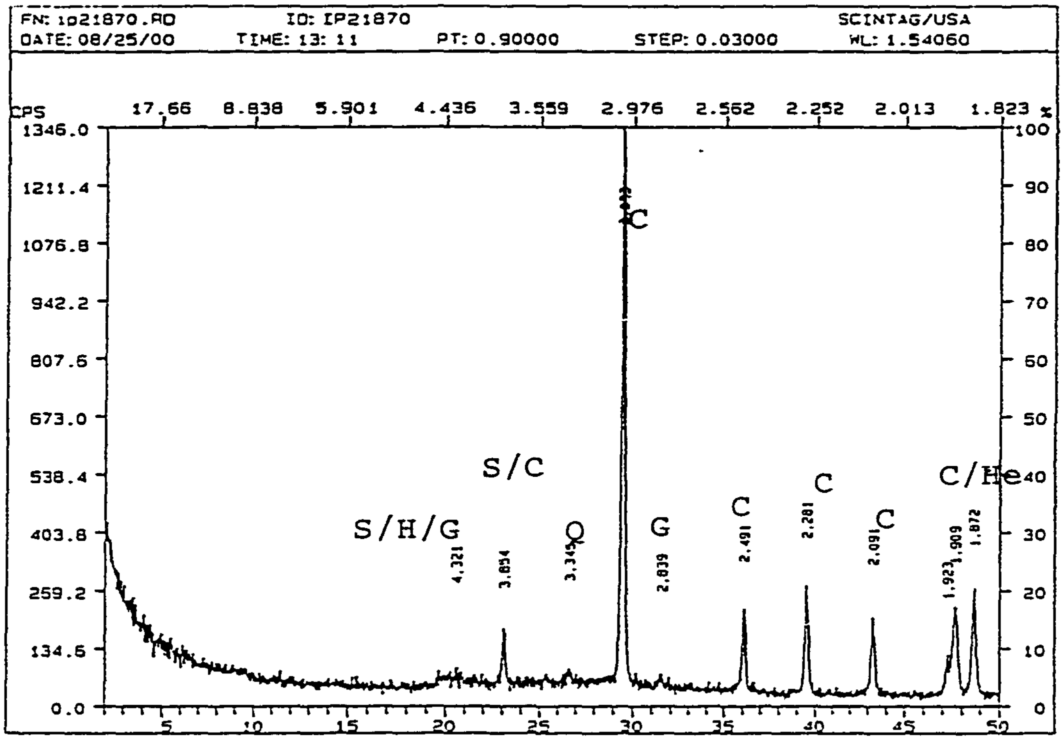


Figure 86: X-ray diffraction pattern for sherd sample IP 21870 (Picú Incised: Thub Variety from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

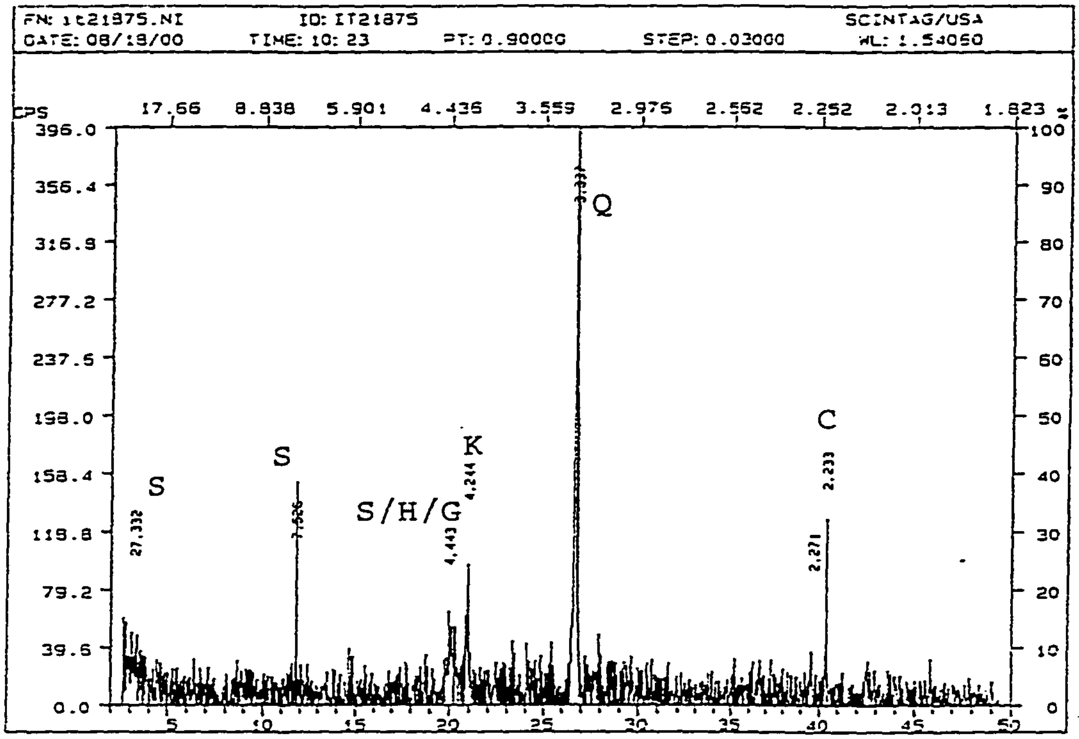


Figure 87: X-ray diffraction pattern for sherd sample IT 21875 (Topoxté Red from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, K=k-feldspar)

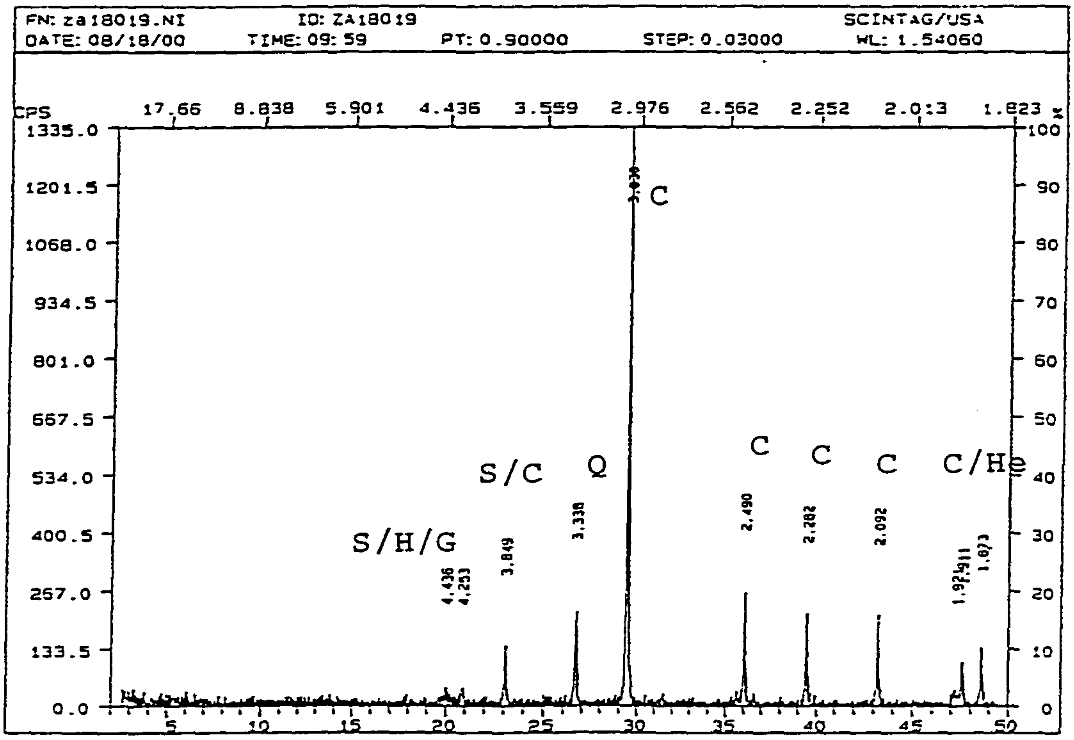


Figure 88: X-ray diffraction pattern for sherd sample ZA 18019 (Augustine Red from Zacpetén). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

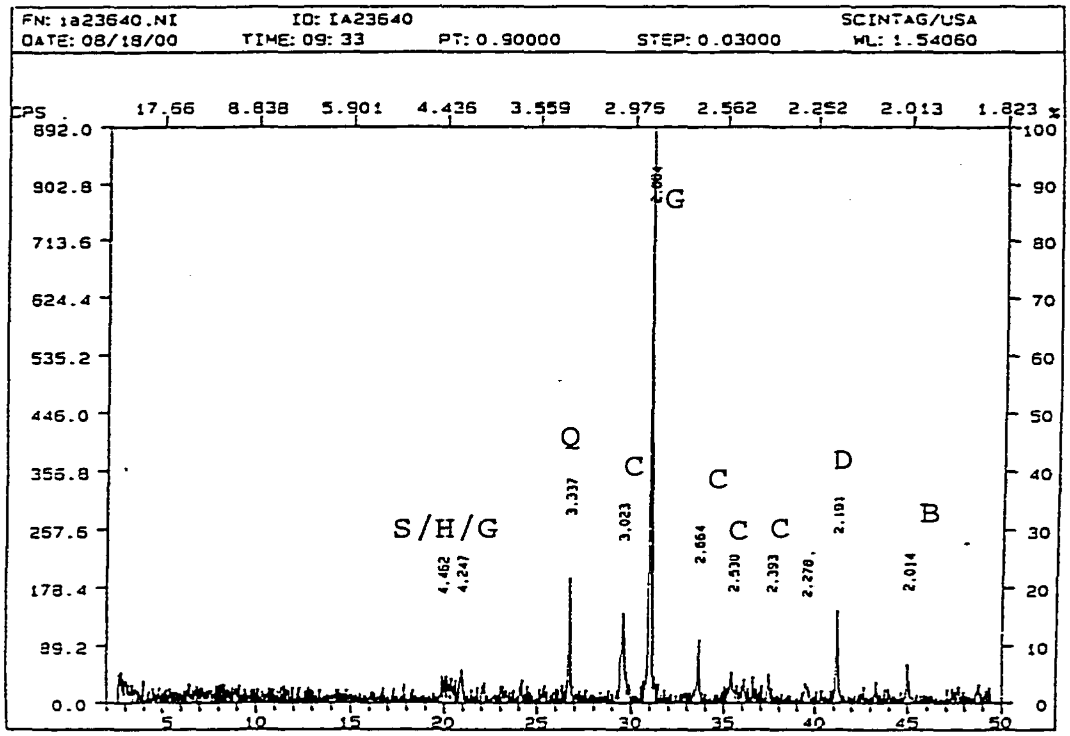


Figure 89: X-ray diffraction pattern for sherd sample IA 23640 (Pek Polychrome from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, B=biotite, D=dolomite)

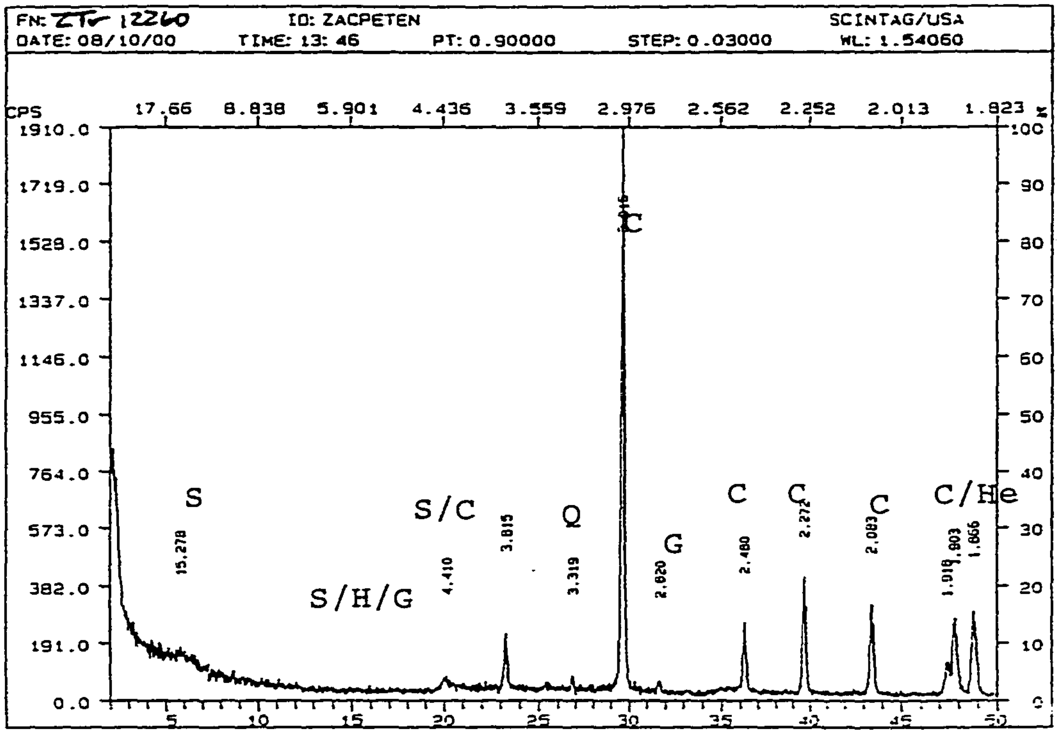


Figure 90: X-ray diffraction pattern for sherd sample ZTR 12260 (Trapeché Pink from Zacpetén). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

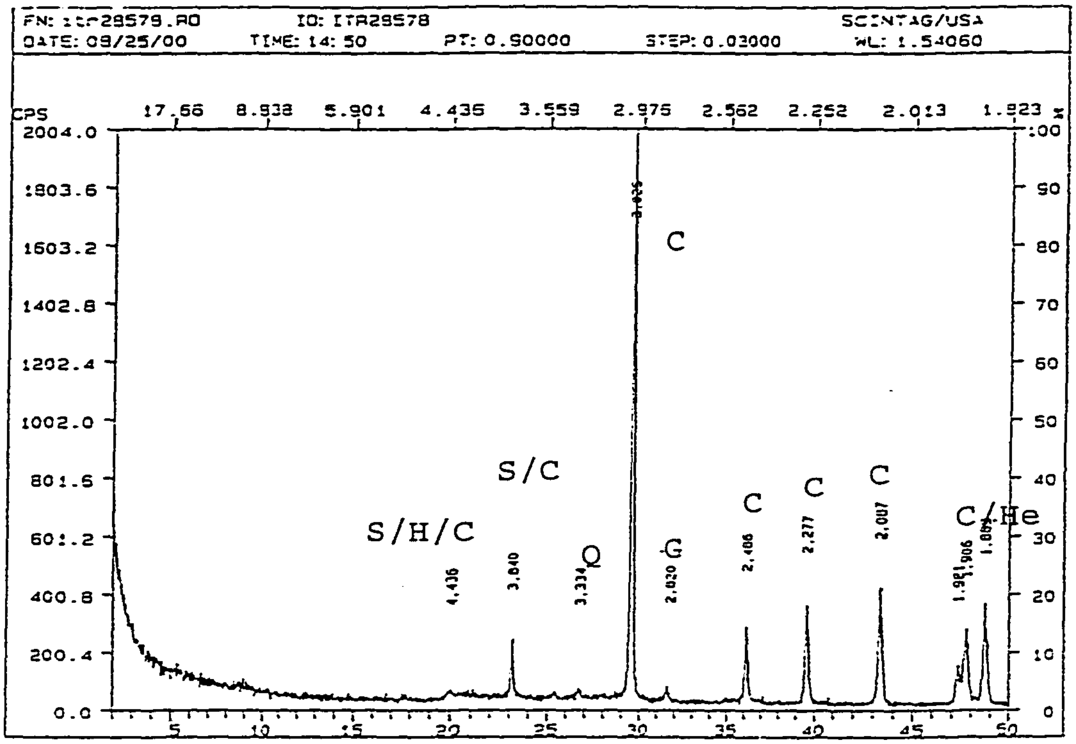


Figure 91: X-ray diffraction pattern for sherd sample ITR 28518 (Xuluc Incised: Tzalam Variety from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

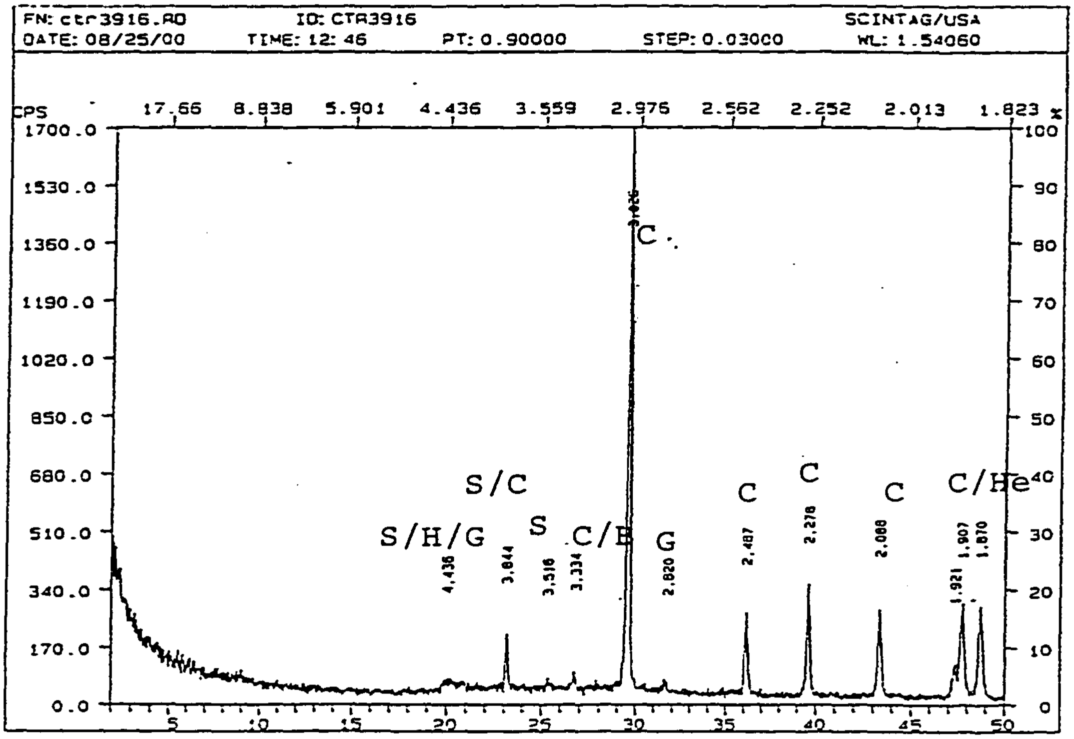


Figure 92: X-ray diffraction pattern for sherd sample CTR 3916 (Trapeché Pink from Ch'ich'). The sample is air dried.(S=smectite, H=halloysite, G=gypsum, C=calcite, B=biotite, He=hematite)

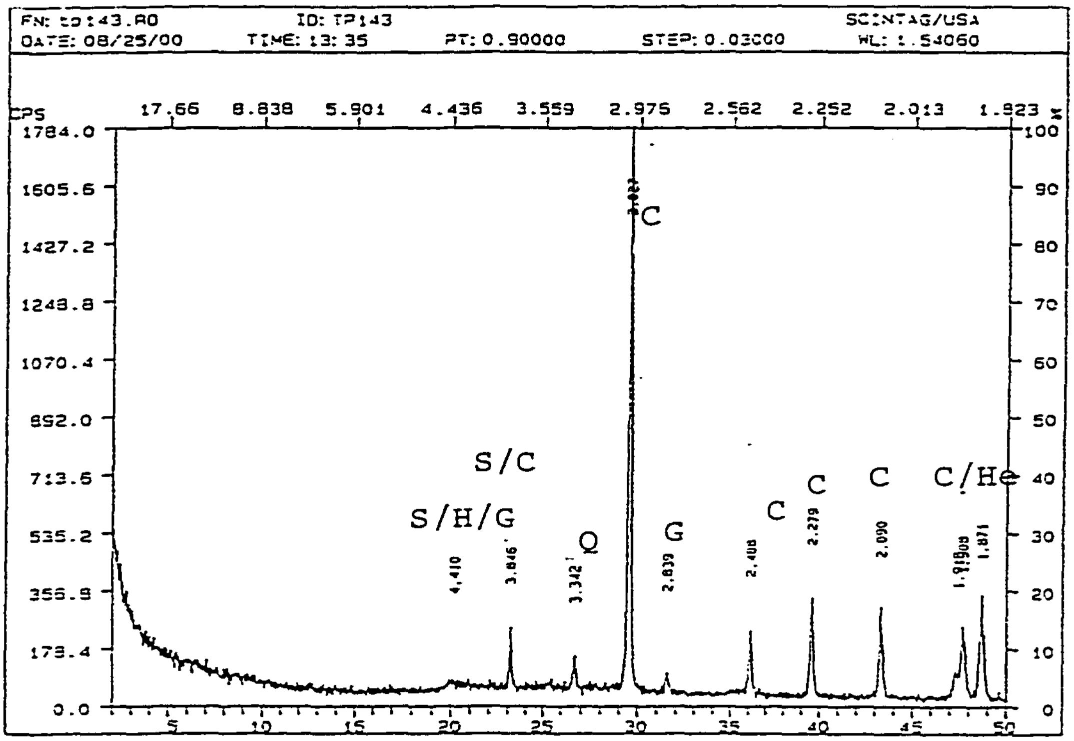


Figure 93: X-ray diffraction pattern for sherd sample TP 143 (Picú Incised: Picú Variety from Tipuj). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

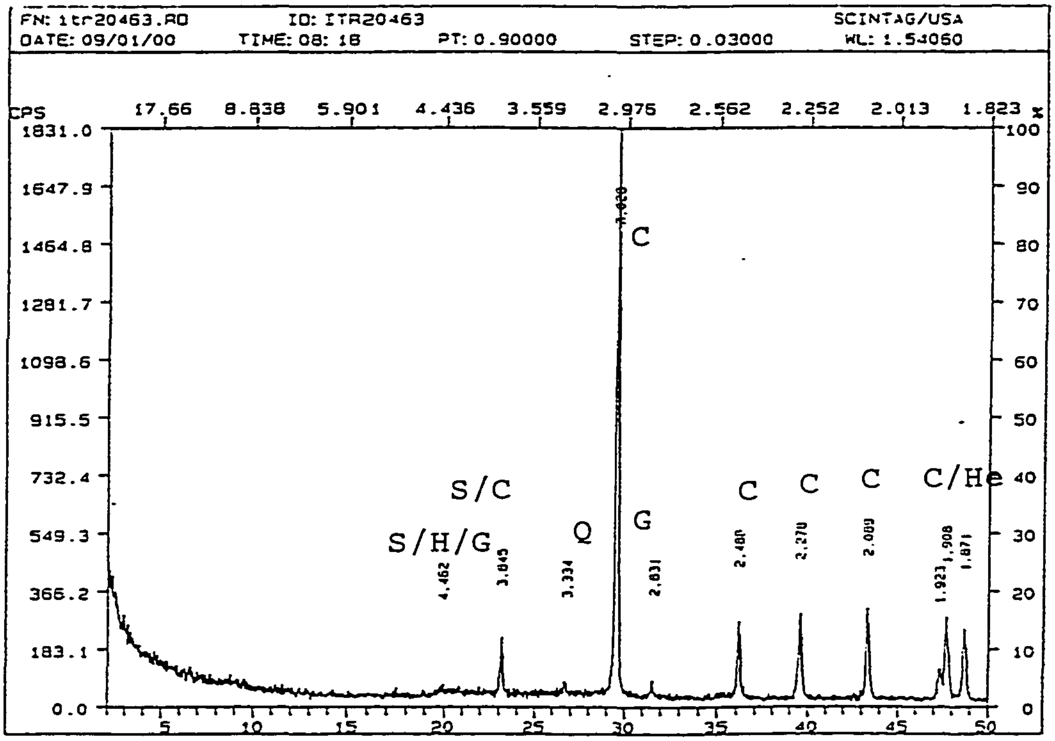


Figure 94: X-ray diffraction pattern for sherd sample ITR 20463 (Trapeché Pink from Ixlú). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

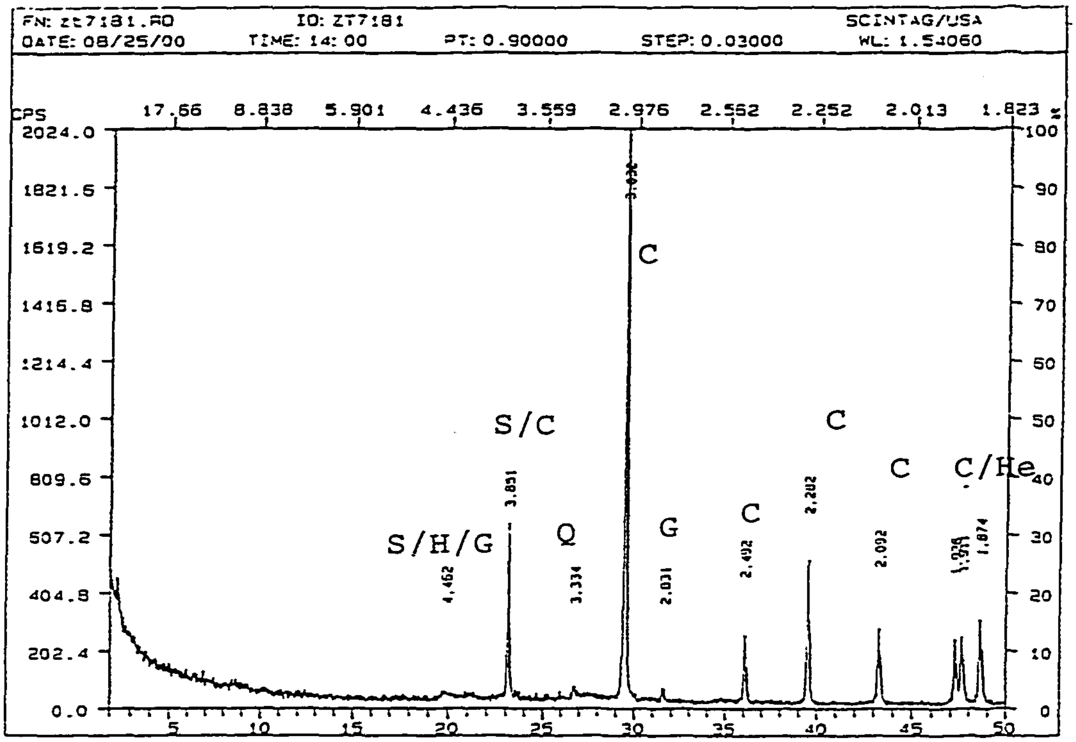


Figure 95: X-ray diffraction pattern for sherd sample ZT 7181 (Chompoxté Red-on-paste: Akalché Variety from Zacpetén). The sample is air dried. (S=smectite, H=halloysite, G=gypsum, C=calcite, Q=quartz, He=hematite)

Quartz, k-feldspar, hematite, and biotite may also occur in the clay paste of the analyzed sherds. In most samples that contain quartz, the 100 percent intensity peak occurs at 26.67 2θ and is typically the second tallest peak after the 100 percent clay peak of the diffraction graph. However, in sherd samples from this study, the quartz peak is uncharacteristically small. It is possible that the quartz mineral is also masked by a montmorillonite peak in the same 2θ area.

K-feldspar occurs in the sherd sample of this study; however, its 100 percent intensity peak rarely appears. Instead, a secondary peak appears at approximately 21 2θ. It is difficult to identify because of the lack of the primary peak, because it does not occur as a separate peak, and because it occurs with a combination of montmorillonite and halloysite mineral peaks.

Hematite and biotite are difficult to identify in the current x-ray diffraction graphs. Hematite may occur in the series of peaks ranging from 46-49 2θ and is most likely masked by the presence of calcite. The strongest example of biotite appears on the x-ray diffraction graph of sherd ZT 15666 (Figure 83). Peaks at approximately 27.5 2θ, 37 2θ, and 45 2θ suggest the presence of biotite. Unfortunately, the 100 percent intensity peak at 17.73 2θ does not appear on any of the graphs. Nevertheless, petrographic analysis suggests that the occurrence of biotite is rare and this may result in low intensity peaks.

X-ray diffraction analysis of clays from Yaxhá and Zacpetén and sherds from the sites of Ch'ich', Ixlú, Zacpetén, and Tipuj demonstrate that montmorillonite and possibly halloysite clay minerals occur as the clay minerals present in the clay pastes. The presence of montmorillonite and halloysite is supported by the lack of mineral identifying peaks of sherds that are estimated to be fired to 500°C when their mineral structures begin to change. In addition to the clay mineralogy of the sherds, this analysis demonstrates the extent to which calcite is an abundant mineral in the clay paste because some calcite peaks tend to overlap and mask other mineral peaks. Finally, while x-ray diffraction analysis did not identify all of the minerals present in the sherds, it did complement the petrographic analysis, providing a more complete mineralogical picture of the sherds in this study.

Based on the mineralogical data presented above, I suggest four preliminary technological style groups that reflect the mineral suites of the sherd pastes. In addition to similar mineral suites, the refined technological style groups exhibit differences in decorative modes previously described. Unlike the preliminary technological styles presented in Chapter 6, these technological styles do not correlate to Postclassic ceramic ware categories.

The first technological style group consists of sherds of the Topoxté and Augustine ceramic groups where clay pastes are dominated by pores. Sherds in this group have monochrome slips, matte surface finishes, and similar core colors.

The second technological style group includes sherds from the Paxcamán, Trapeché, and Augustine ceramic groups. Sherds from this technological style group have large quantities (50-80%) of cryptocrystalline calcite in the clay paste. The majority of sherds from this group have a monochrome slip; however, a few sherds have black line decoration or fine line post-fire incised decorations.

Clay pastes of the third technological style group contain quartz, chert, chalcedony, hematite, and calcite mineral inclusions. Sherds from the Paxcamán, Trapeché, Fulano, Augustine, and Topoxté ceramic groups are represented in this technological style group and the majority of sherds are decorated with black or red painted decoration or incised decoration.

Finally, the fourth technological style is represented by sherds from the Paxcamán, Trapeché, Fulano, Augustine, and Topoxté ceramic groups that have quartz, chert, chalcedony, hematite, calcite, and biotite minerals in the clay paste. Again, the majority of sherds in the fourth mineralogically based technological style are decorated; however, the decoration appears as black, red, red-and-black, or incised decoration.

Unfortunately, x-ray diffraction did not yield additional information by which to define mineralogical technological styles because of the presence of montmorillonite and halloysite clay minerals and an overwhelming dominance of calcite in all of the clay pastes.

The differences that delineate these four mineralogically based technological styles demonstrate that technology (clay pastes) affects style. This is seen through the choices made by the Petén Postclassic Maya potters with regard to materials used in pottery manufacture (e.g., clays and mineral inclusions) and painted decorations. The choice of clays, mineral inclusions, and pigments for painted decoration may be influenced by the resources that were readily available. If the Itzá and Kowoj Maya were in conflict with each other, it is probable that potters from the different communities may have been restricted to resources within their culturally defined territories. Choices at the resource level may reflect sociological and cultural constructs that underlie and direct the producer's actions, resulting in differences that can influence the social representation of material culture and indicate social/ethnic identity.

CHAPTER 8

CHEMICAL ANALYSIS RESULTS

This chapter represents the fourth level of analysis of Petén Postclassic slipped pottery and combines geochemical (major, minor, and trace elements) analysis with multivariate statistics to determine the existence of groupings of sherds based on the elemental compositions of the clay pastes of the sherds in this sample. Results from this stage of analysis support the data presented in the previous chapters as well as provide additional data that were not detected by type-variety analysis, "low-tech" analyses, and mineralogical analyses.

Here I use a different approach to chemical compositional analysis than most scholars employing the same methodology. I am seeking to combine the chemical analysis with stylistic and mineralogical data to identify groups of ceramics, rather than to define ceramic paste groups solely on the basis of elemental analysis. By combining chemical compositional data obtained from SEM, EDS, and strong-acid extraction ICPS analysis with typological, "low-tech," and mineralogical analyses, I am not relying solely on chemical composition data to identify the different pottery groups. As such, I am expanding the type of research conducted by Maya archaeologists with regard to chemical composition data to suggest possible behaviors (choices) that may have resulted in the selection of certain clays and/or minerals for the manufacture of Petén Postclassic slipped pottery. I also demonstrate that anthropologically based questions can be supported through chemical composition data.

I. Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectroscopy (EDS) analysis

Scanning Electron Microscopy (SEM) and Electron Dispersive X-Ray Spectroscopy (EDS) analyses were completed for the same 100 sherd sample used for strong-acid extraction Inductively Coupled Plasma Spectroscopy (ICPS) analysis discussed below with different but complementary results. The sample was originally to be examined by x-ray diffraction to determine the clay mineral content of the clay paste. However, because of problems obtaining clay mineral identification as discussed above, I collected preliminary clay mineral data through SEM and EDS analysis. In addition to sherd samples, raw clay standards for halloysite, montmorillonite, and kaolinite were analyzed to provide comparative clay mineral data.

EDS data (elements present in the clay paste) result from an electron beam striking the sherd paste and emitting different energy signals according to the mineral that is being measured. The energy sources are noted as distinctive elements and their intensities are measured so as to produce semi-quantitative data. The energy signals are also recorded by the SEM where the data are gathered and the SEM produces an image.

Although the goal was to measure only the clay minerals present in the clay pastes of the sherd sample, this was not always accomplished. First, the data from the x-rays come from the selected spot of analysis and the surrounding area due to the "spreading" of the x-ray throughout the sample. Second, it was impossible to separate calcite from the sherd sample resulting in measurements that were not entirely clay mineral samples.

Element presence and relative elemental intensity of raw clay minerals (halloysite, montmorillonite, and kaolinite) and sherd paste minerals were obtained through EDS analysis and images of the different clay minerals from the raw clays and sherd pastes were obtained through SEM analysis. From the elemental data and research of the elements that compose clay minerals and other mineral inclusions present the clay paste, as determined from petrographic analysis, I was able to determine the clay minerals present in the sherd paste and to account for the remaining elements through the identification of other minerals present in the sherd paste. When compared to the raw clay sample data, I can suggest the range of possible clay minerals that may be present in the sherd samples based on elemental presence, peak intensities, and photograph comparison. The groups may be the result of local geography or the result of culturally added minerals used as temper. From these data, I detected 10 elemental combinations in the sherd sample (Table 40). Figures 96-105 are the EDS graphs of the 12 different elemental concentration groups and corresponding SEM images. Figures 106-108 represent EDS graphs and SEM images for the three clay standards.

Table 40 Elements Present in the 10 EDS Groups and the Ceramic Groups Associated with the EDS Groups

EDS Groups	Elements Present in the EDS Group	Ceramic Groups Represented by EDS Groups
A	C, O, Al, Si, Ca, Fe	Augustine, Paxcamán, Trapeche, Topoxté
B	C, O, Al, Si, K, Ca, Fe	Augustine, Paxcamán, and Topoxté
C	C, O, Al, Si, K, Ca, Ti, Fe	Augustine, and Paxcamán
D	C, O, Al, Si, Cl, K, Ca, Ti, Fe	Augustine, Paxcamán, Fulano, Trapeche
E	C, O, Al, Si, Mg, K, Ca, Ti, Fe	Augustine, Paxcamán, and Topoxté
F	C, O, Al, Si, Mg, Cl, K, Ca, Fe	Topoxté
G	C, O, Al, Si, Na, Cl, K, Ca, Ti, Fe	Augustine
H	C, O, Al, Si, Mg, Cl, K, Ca, Ti, Fe	Augustine, Paxcamán, Fulano, Trapeche, Topoxté
I	C, O, Al, Si, Mg, Na, Cl, K, Ca, Ti, Fe	Topoxté
J	C, O, Al, Si, Mg, Cl, S, K, Ca, Ti, Fe	Paxcamán

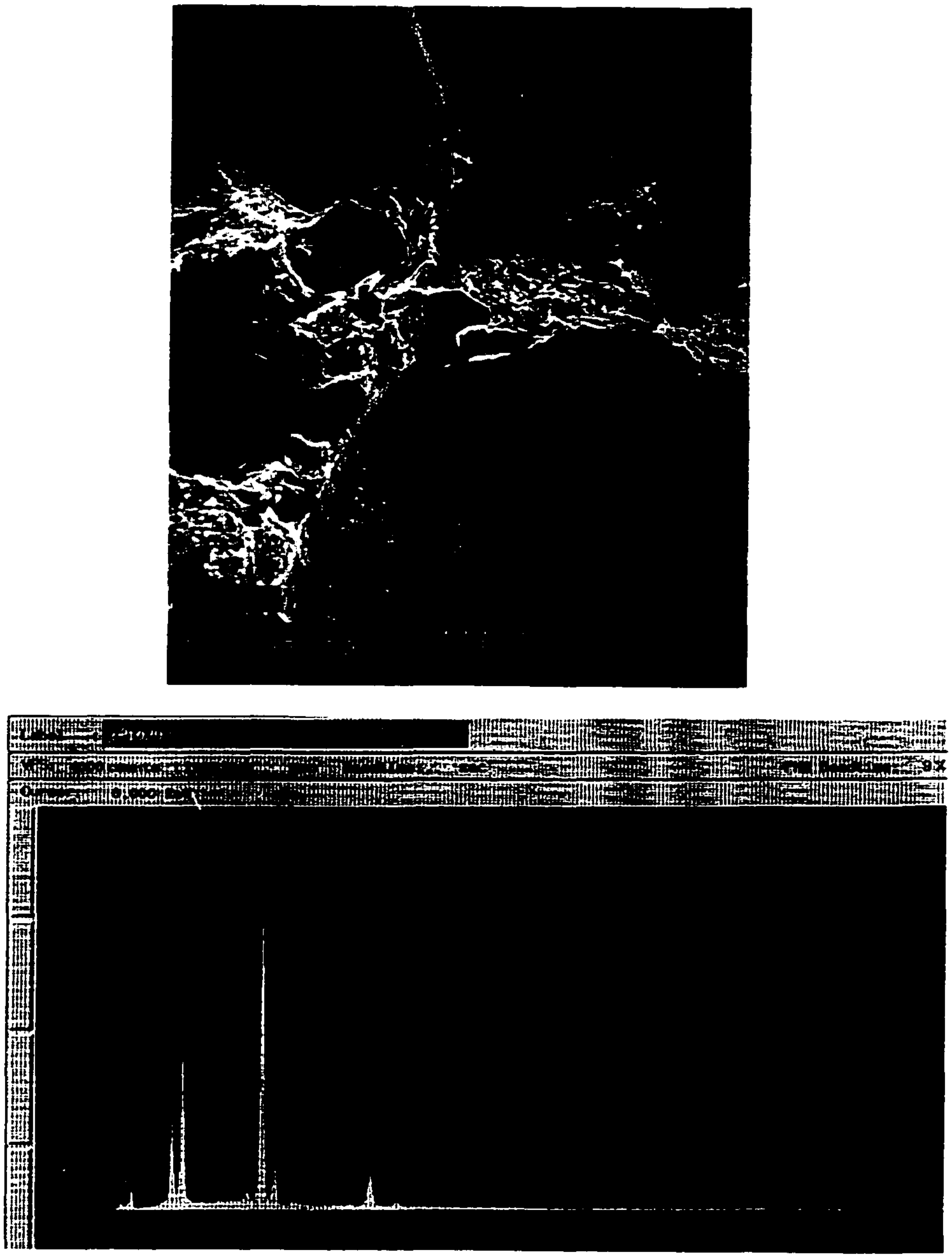


Figure 96: SEM and EDS data for ZP 10797 (Macanché Red-on-paste: Macanché Variety). This sherd represents EDS group G.

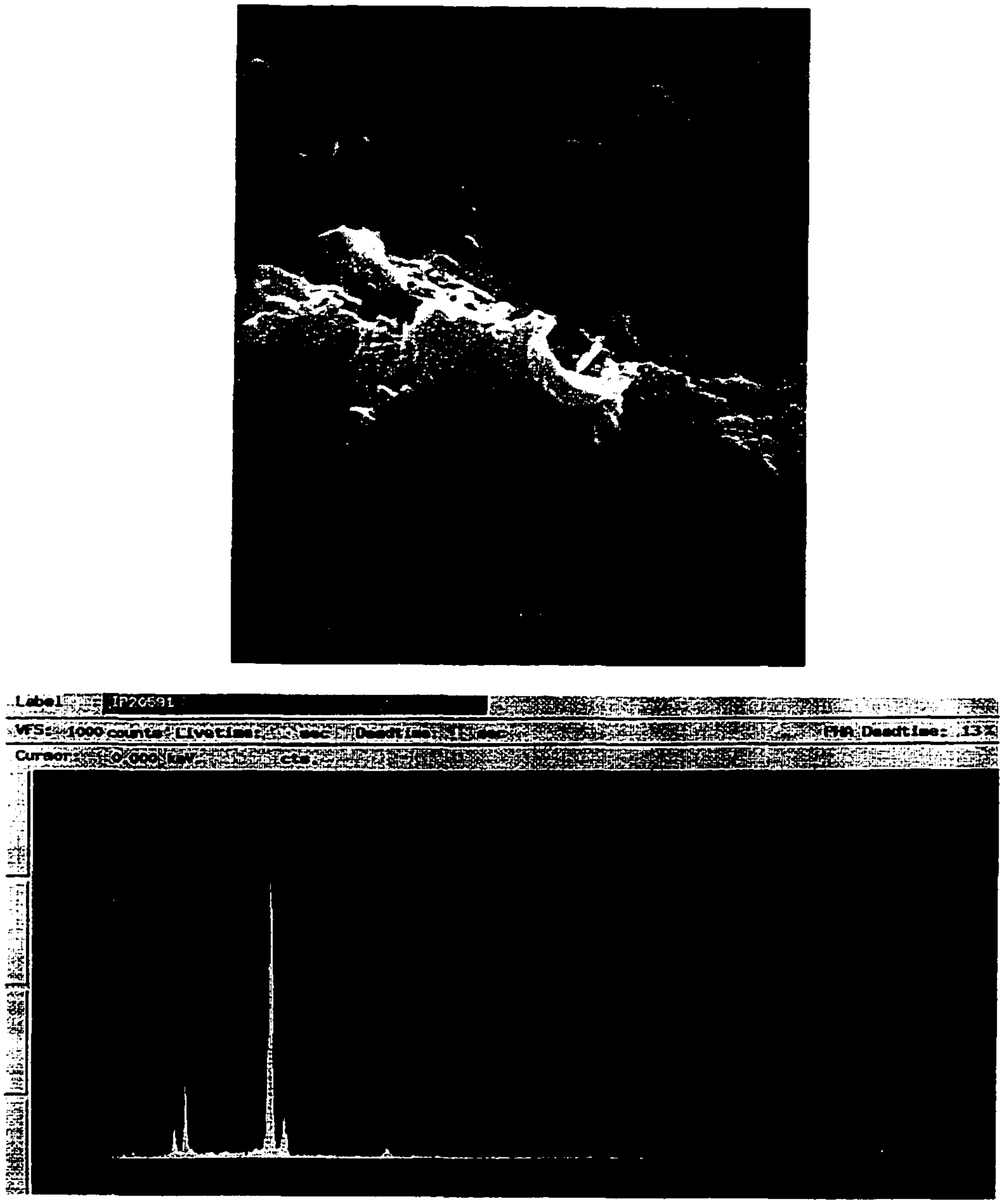


Figure 97: SEM and EDS data for IP 20591 (Ixpop Polychrome: Ixpop Variety). This sherd represents EDS group A.

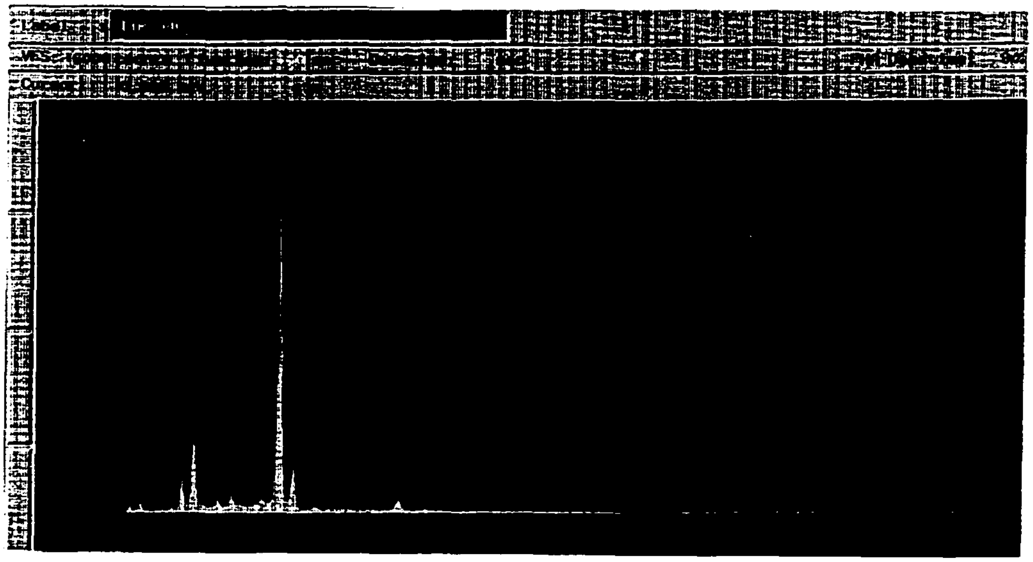


Figure 98: SEM and EDS data for ITR 20463 (Trapeché Pink). This sherd represents EDS group J.

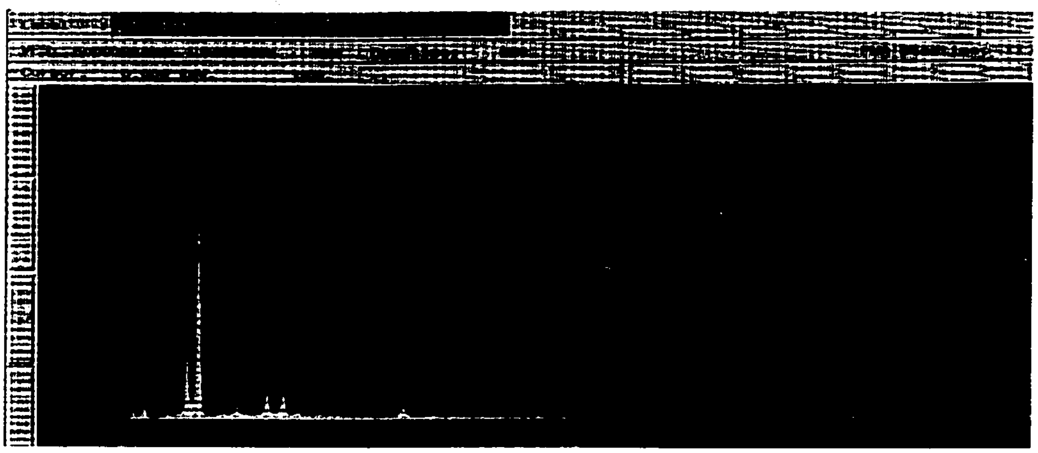


Figure 99: SEM and EDS data for IT 30499 (Topoxté Red: Topoxté Variety). This sherd represents EDS group G.

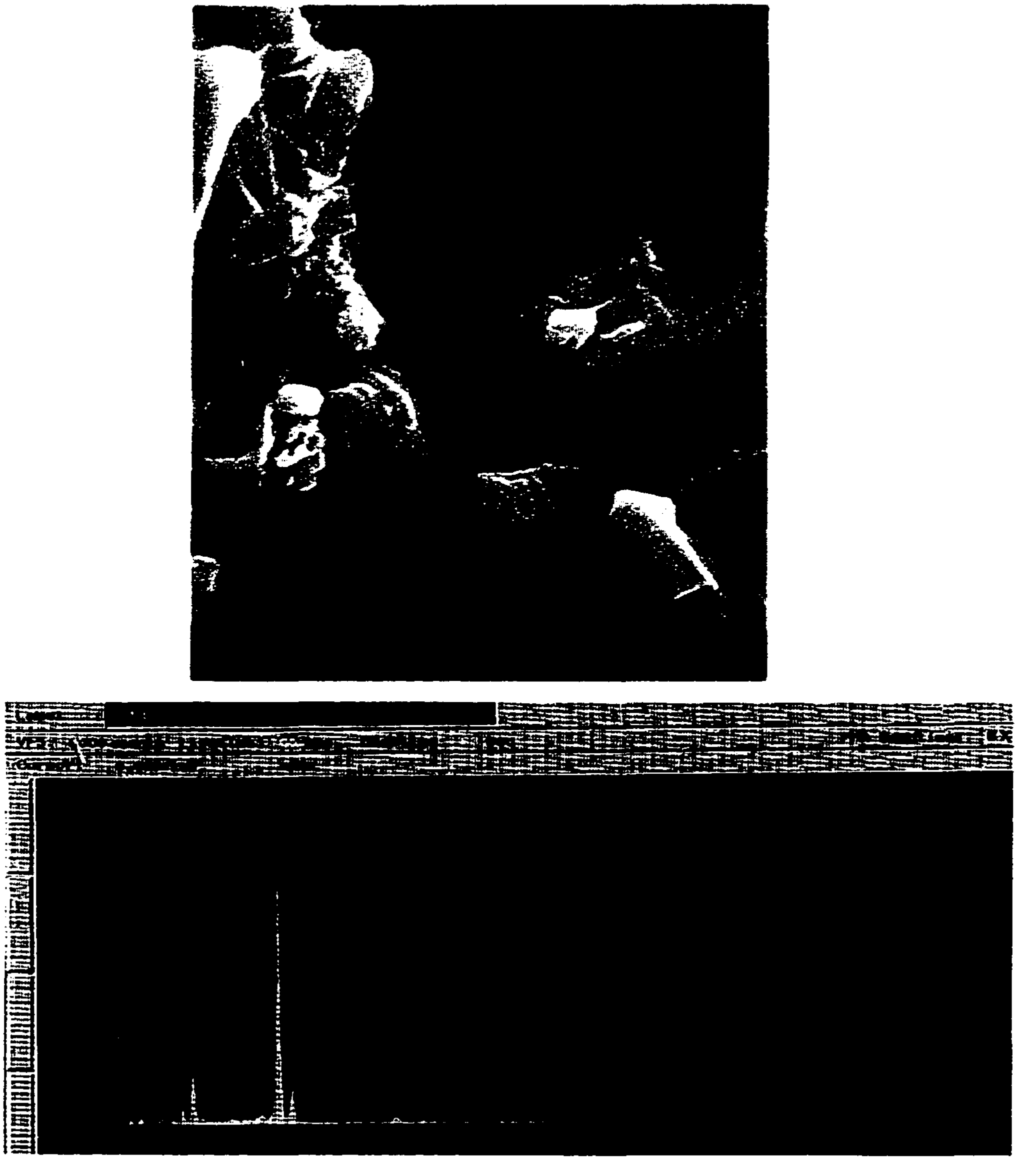


Figure 100: SEM and EDS data for TT 51 (Chompoxté Red-on-paste: Akalché Variety). This sherd represents EDS group F.

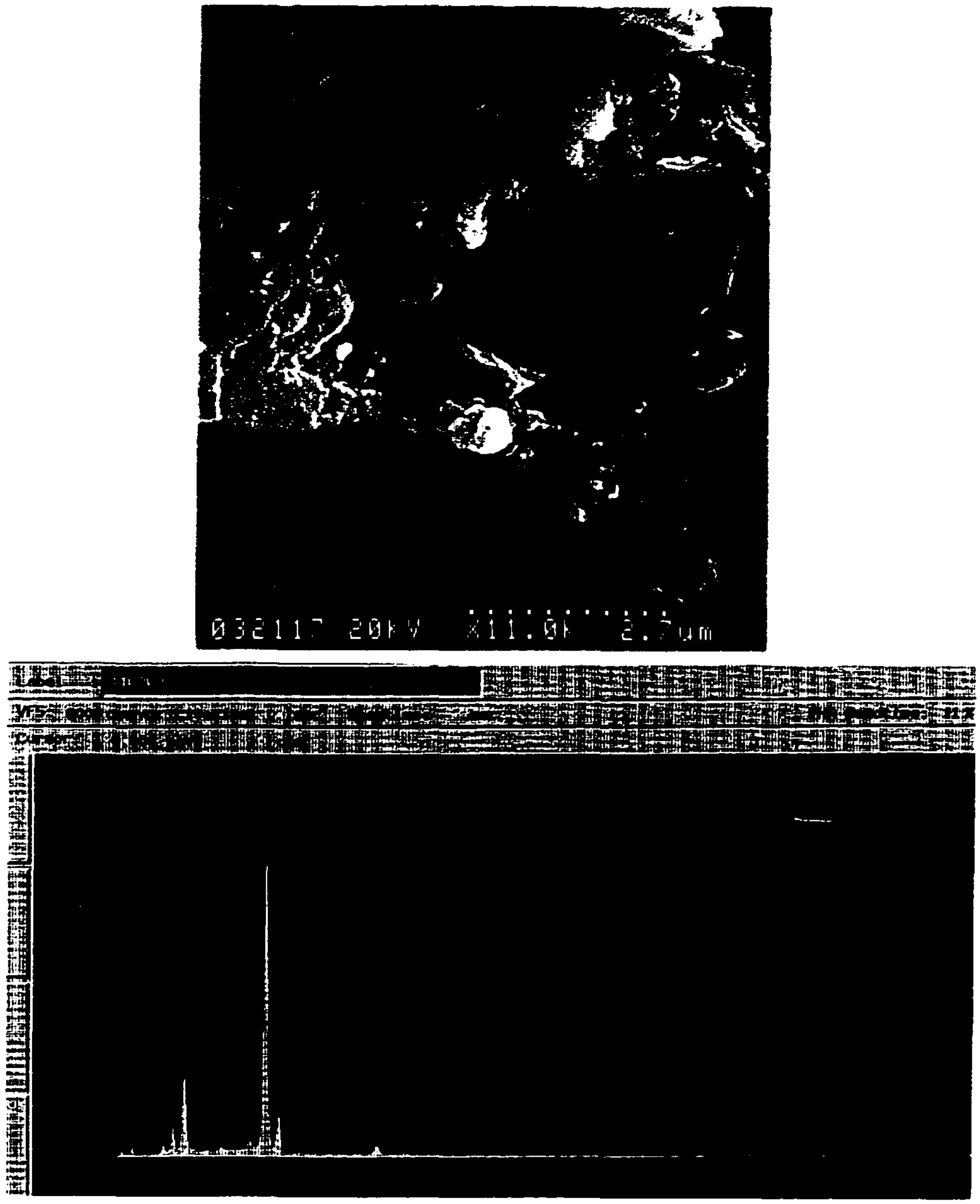


Figure 101: SEM and EDS data for TT 6262 (Chompoxté Red-on-paste: Chompoxté Variety). This sherd represents EDS group F.

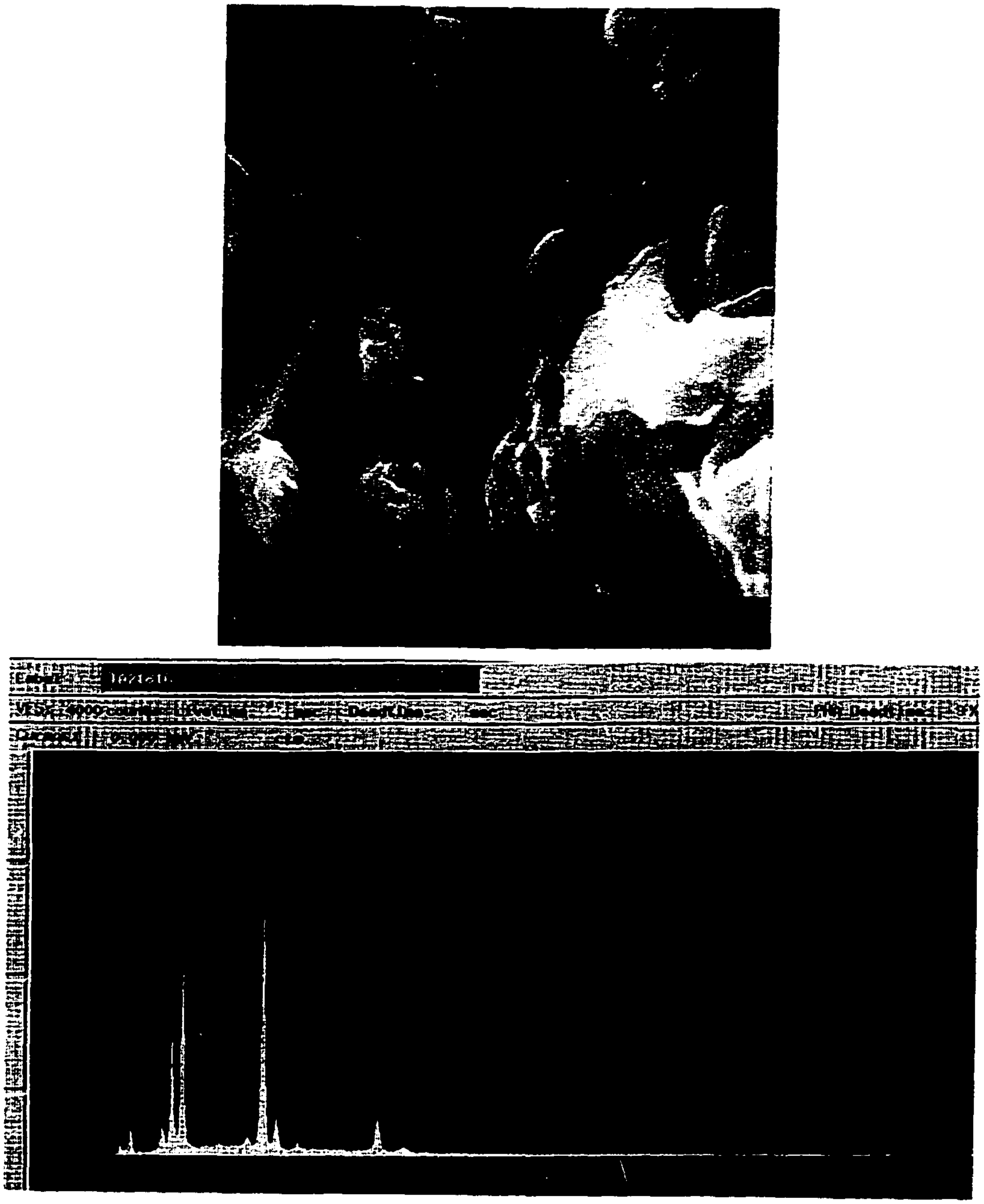


Figure 102: SEM and EDS data for IA 21816 (Augustine Red). This sherd represents EDS group H.

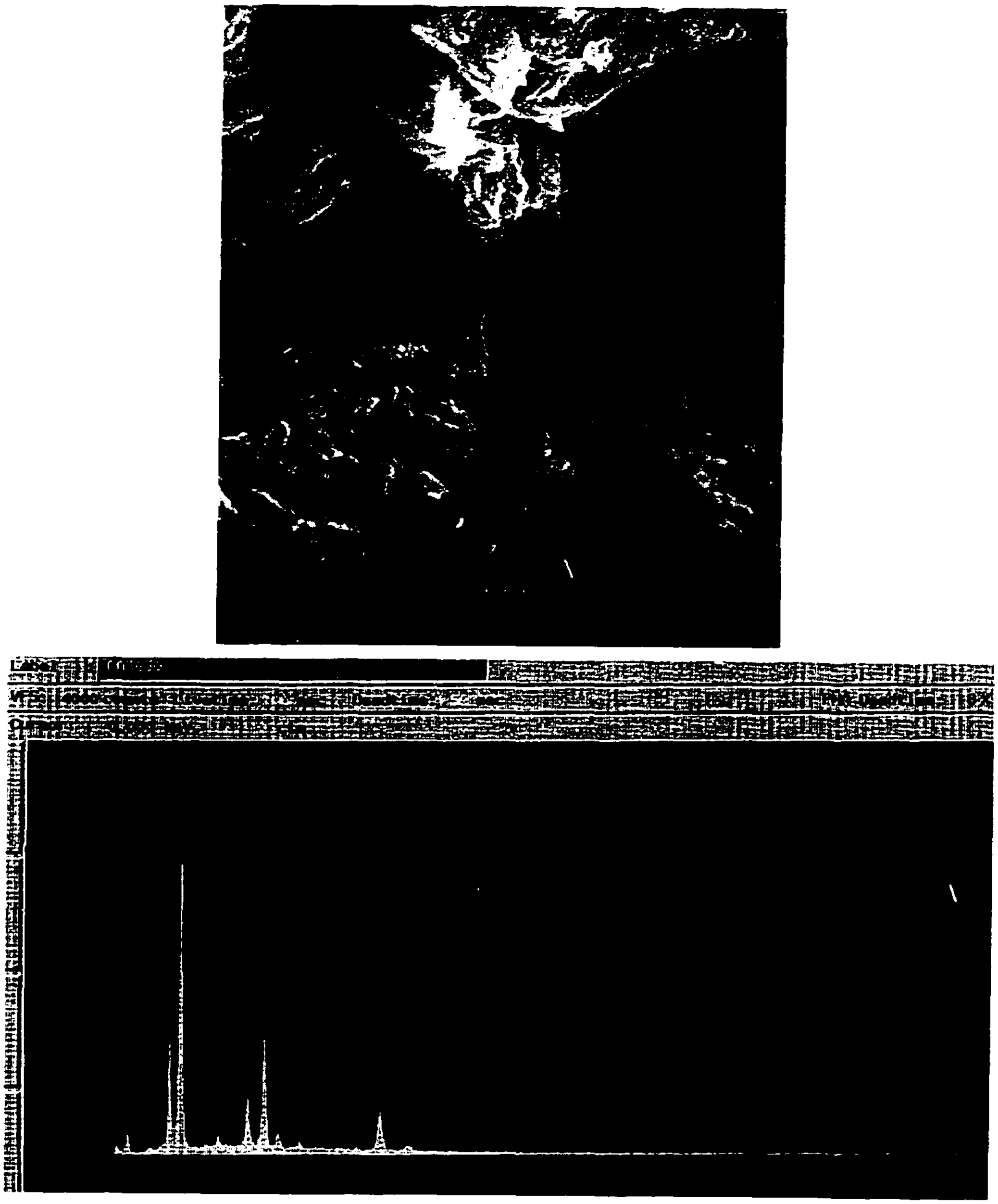


Figure 103: SEM and EDS data for CA 3690 (Augustine Red). This sherd represents EDS group G.

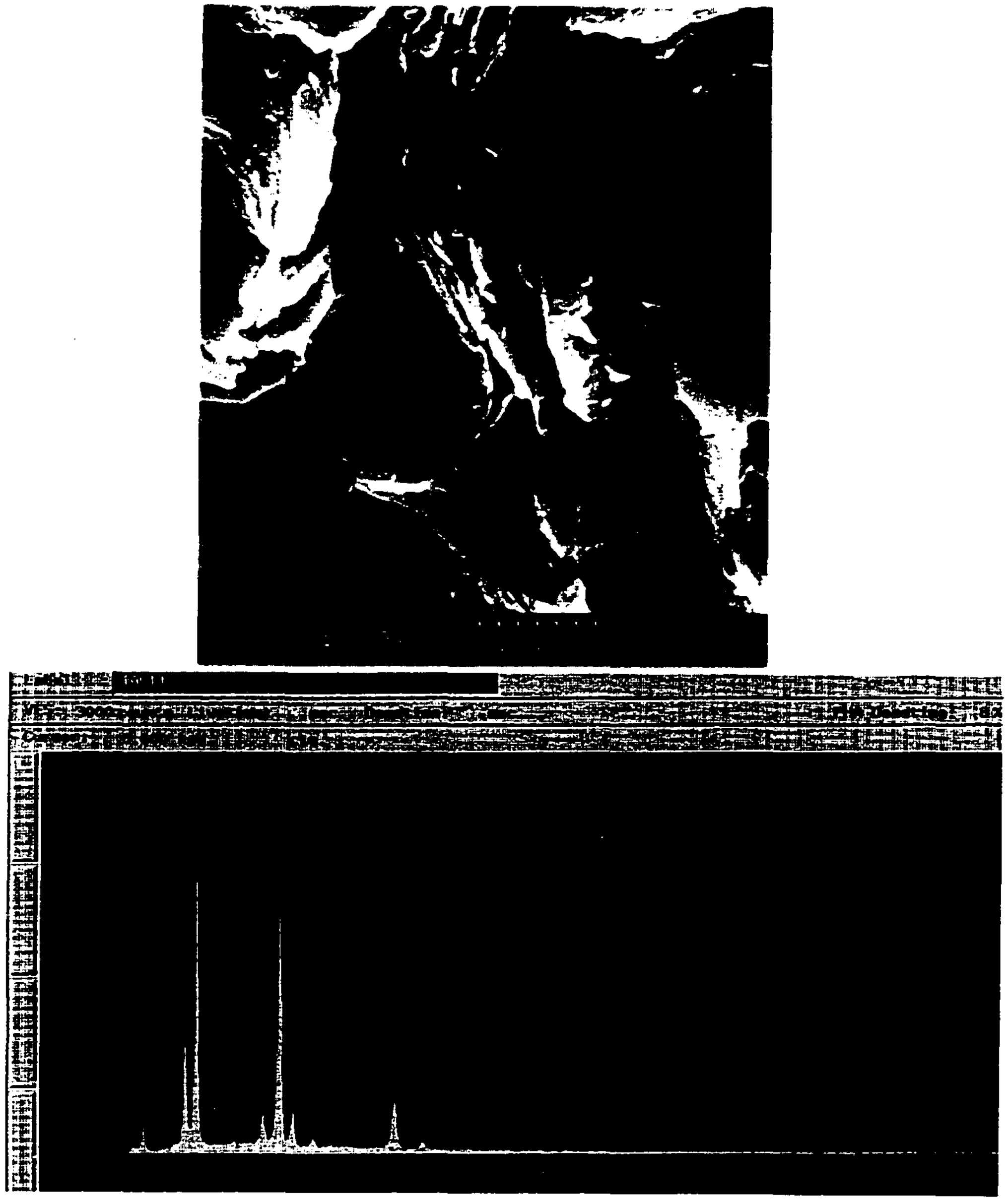


Figure 104: SEM and EDS data for TA 611 (Hobonmo Incised: Ramsey Variety). This sherd represents EDS group C.

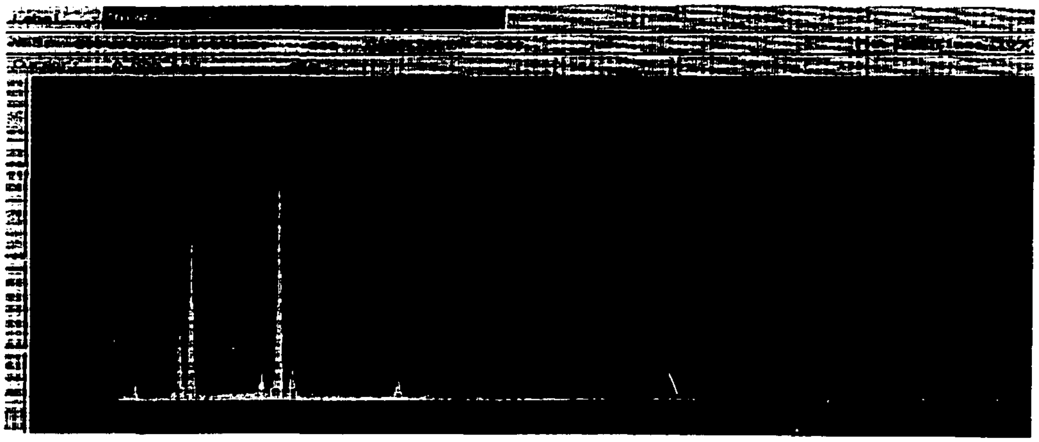


Figure 105: SEM and EDS data for TA 768 (Pek Polychrome). This sherd represents EDS group B.

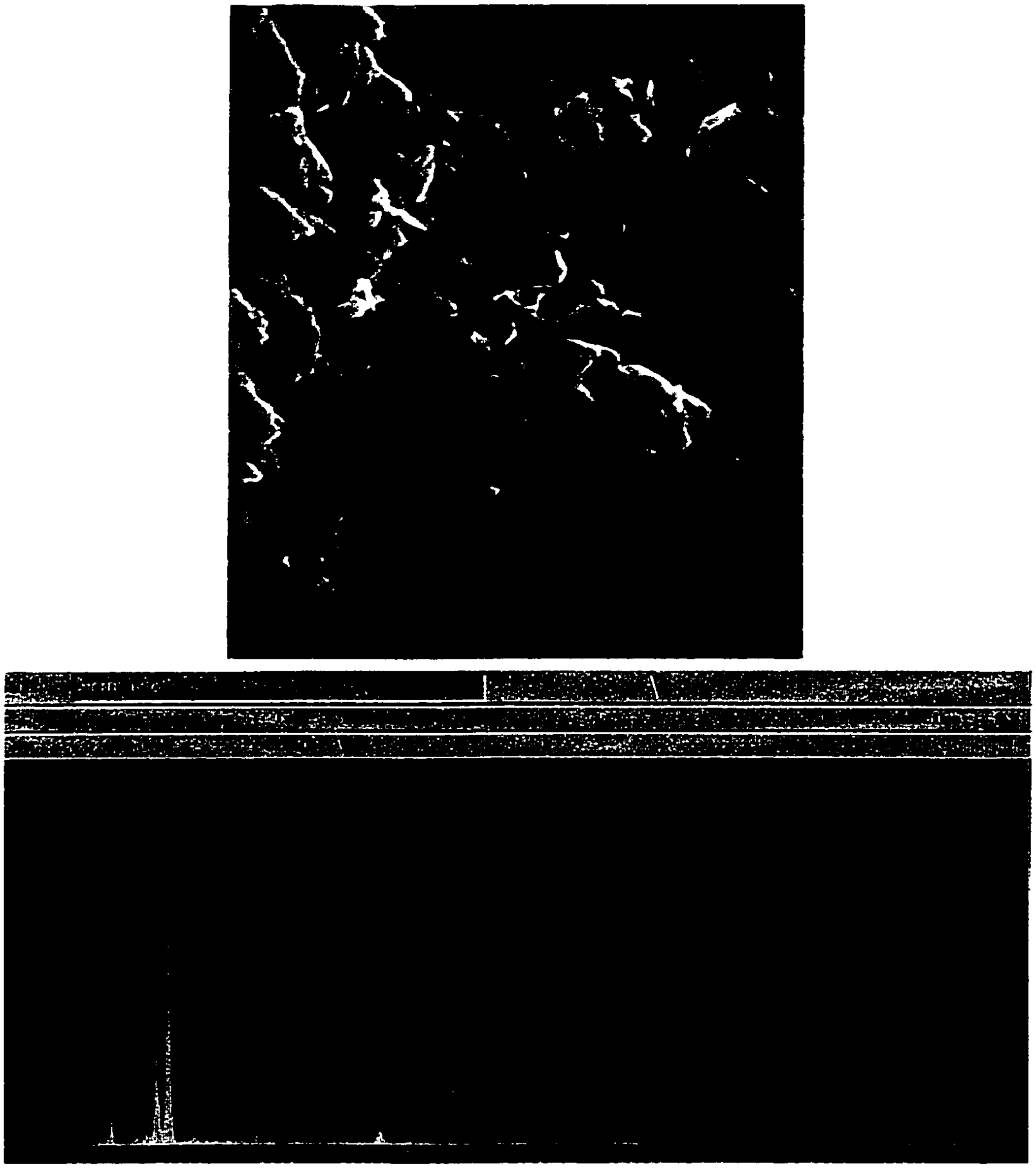


Figure 106: SEM and EDS data for montmorillonite clay sample.

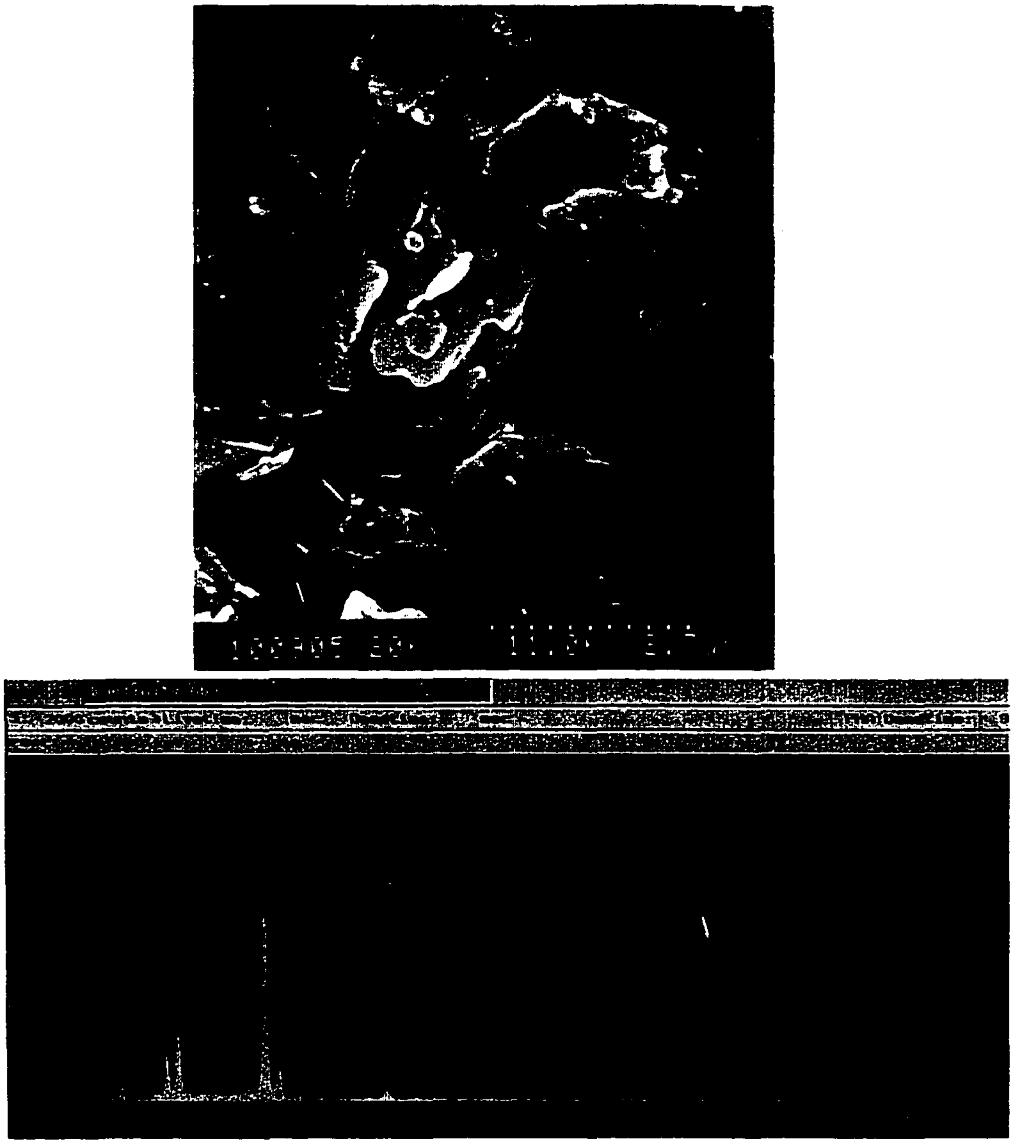


Figure 107: SEM and EDS data for kaolinite clay sample.

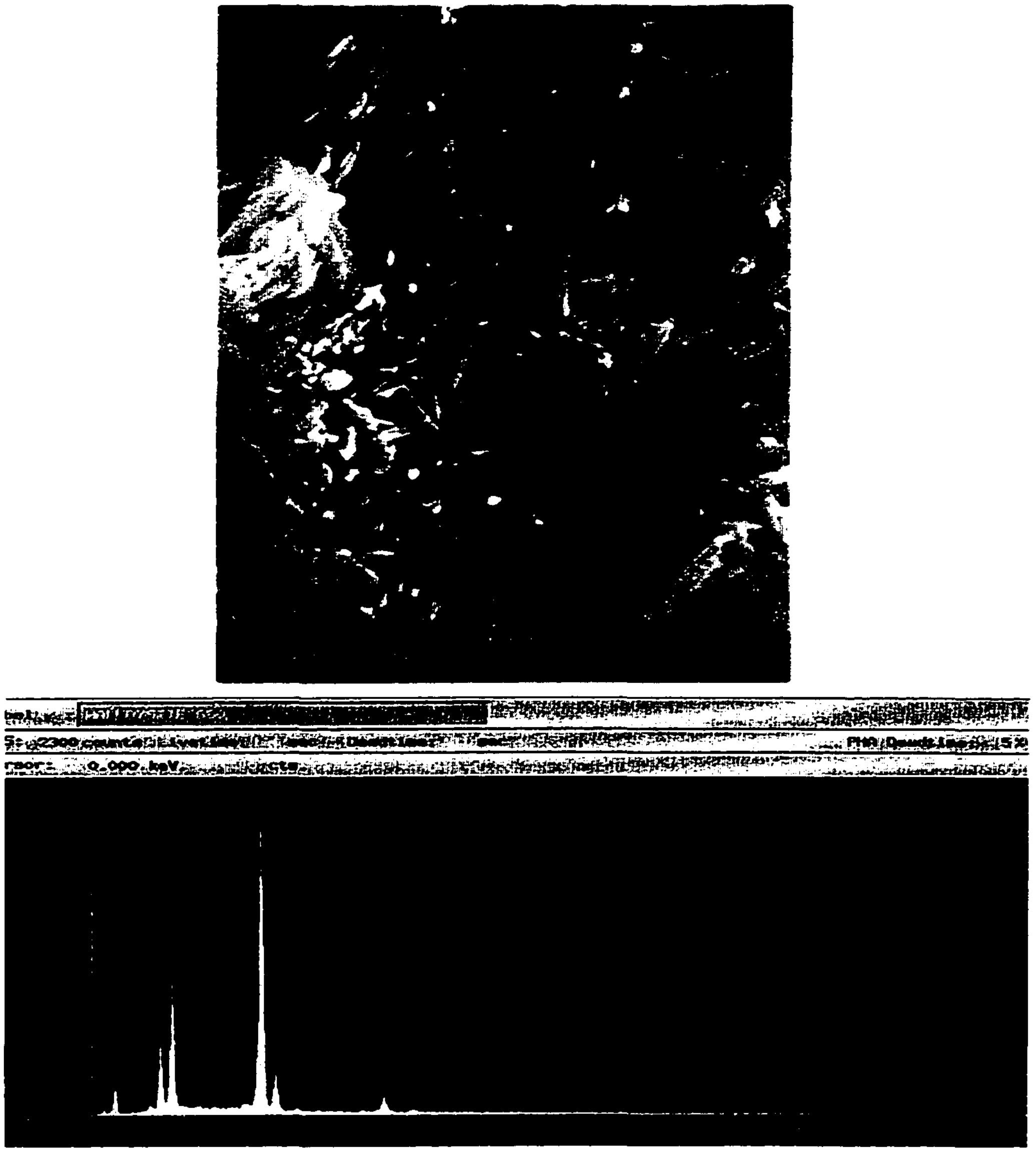


Figure 108: SEM and EDS data for halloysite clay sample.

The three clay minerals and all sherd pastes have the following elements: C, O, Al, Si, Ca, and Fe. This elemental suite is not surprising given that clays are hydrous aluminum silicates with substitutions in the crystalline structure of Mg and Fe ions. The presence of Ca in all of the mineral suites may be the result of an abundance of calcite in the carbonate clays. Differences in sherd paste samples occur with the detection of K, Ti, Na, Cl, and S elements. In order to account for the presence of these five elements in the sherd pastes, I compared raw clay mineral EDS data to the sherd sample data. Montmorillonite clay sample contains C, O, Al, Si, Na, Mg, S, Ca, and Fe elements, the halloysite clay sample has C, O, Al, Si, Mg, K, Ca, Ti, and Fe elements, and that the kaolinite clay sample is identified by the presence of C, O, Al, Si, Mg, K, Ca, Ti, and Fe elements. Thus, all of the elements except Cl can be accounted for by the presence of montmorillonite, kaolinite, and halloysite clay minerals in the sherd samples. Chlorine may result from the presence of halite (NaCl) or sylvite (KCl). These minerals typically result from the evaporation of saline lakes similar to those in the Petén lakes region. During the process of evaporation, calcite, gypsum, and halite occur more commonly than sulfates and chlorines (Klein and Harlbut 1993:577). Therefore, chlorine most likely occurs in the clay pastes because of the presence of evaporitic beds in the Petén lakes region.

All EDS groups may contain halloysite and montmorillonite. Kaolinite may be an additional clay mineral present in groups E, H, I, and J, but the EDS intensity peaks of samples from groups E, H, and J have higher intensities indicating halloysite rather than kaolinite clay minerals. This data corroborates the x-ray diffraction data (Chapter 7, Section III) as to the inclusion of halloysite and montmorillonite clay minerals in the clay paste.

When EDS groups are examined in conjunction with the ceramic groups that are represented by the 10 EDS groups, some interesting patterns occur. Sherds from the Topoxté ceramic group occur exclusively in EDS groups F and I and with Augustine, Paxcamán, and/or Trapeche ceramic group sherds in EDS groups A, B, E, and H. Augustine ceramic group pottery is represented by EDS groups A, B, C, D, E, G, and H. In EDS groups A, B, C, D, E, and H, Augustine ceramic group pottery co-occurs with Paxcamán, Trapeche, Fulano, and/or Topoxté ceramic group pottery and is the sole ceramic group in EDS group G. Paxcamán ceramic group pottery is the sole member of EDS group J and co-occurs with Augustine and/or Topoxté ceramic group sherds in EDS groups A, B, C, D, E, and H. From these data, it is possible to suggest that some Paxcamán, Augustine, and Topoxté ceramic group sherd pastes are chemically different from others. Sherd pastes dominated by pores (EDS Groups G and I) may be distinguished because of the lack of additional minerals. The differences in the clay paste chemical composition as detected by EDS analysis may also reflect differences in clay resources and/or differences of mineral inclusions in the clay paste.

II. Strong Acid-Extraction ICPS Analysis

I analyzed Petén Postclassic slipped pottery groups employing strong acid-extraction ICPS in order to better understand the chemical composition of the clay paste. The resulting concentrations (measured in parts per million– ppm) measure only the components of the clay paste that are soluble in acids used in the digestion process. The resulting elemental concentrations reflect technological characteristics of the clay matrix as well as its use and postdepositional alteration– or its total history (Burton and Simon 1993:46). As such, my goal is not to determine provenance information, but to suggest possible technological aspects reflected in the elemental compositional groups, through potters' choices and decisions, that may be associated with social identity.

Unlike INAA procedures that measure rare earth and other trace elements, the present strong acid-extraction ICPS analysis includes some rare earth elements as well as major and minor elements likely to be present in the clay paste. "These elements were chosen because they, along with silicon, are the most abundant cations in ceramic pastes and as such they are less susceptible to sampling heterogeneity, they can be measured with high precision, and they have given highly reproducible results" (Burton and Simon 1993:46). The pottery sample used for strong acid-extraction ICPS analysis yielded seven compositional groups based on 30 elements: Be, B, Na, Mg, Al, Si, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Se, Rb, Sr, Ag, Cd, Sb, Cs, Ba, La, Tl, and Pb. These elements exist in the sherd sample and can be tested by the process of strong acid-extraction IPCS because they can be extracted by the HF and HNO_3 digestion process. In addition to being able to be extracted through strong-acid digestion, I use this suite of elements to ensure comparability to other studies that use similar elements and because most of the elements can substitute in the clay structures and/or occur in minerals detected through petrographic analysis.

Below is a description of the 30 elements.

Be- Beryllium is a minor earth element and when it occurs in minerals it is not affected by water, air, acids, or alkalies. Its small cation radius allows it to easily substitute for other cations (such as Al) in silicates. Beryllium compounds are associated with granitic rocks (Day 1963:158-161).

B- Boron is a minor earth element that when in minerals is unreactive to water, oxygen, acids, and alkalies, but will react to other metals to form borides. Boron occurs as a result of the late stages of magmatic crystallization and in evaporite deposits of lake waters. Similar to Be, boron has a small ionic radius and can replace Si in some silicate minerals (Day 1963:188-192).

Na- Sodium is a soft, silvery-white alkali metal element that in minerals oxidizes rapidly and reacts with water. Sodium can occur in aluminohalide minerals, in silicate minerals of igneous rocks such as feldspars, and as soluble salts. Na can substitute for Ca because of its similar size (Day 1963:129-135).

Mg- Magnesium is a major element and in minerals it burns in air and will react in hot water. It appears in metamorphic minerals, evaporitic deposits, and phyllosilicates. Magnesium can replace Ca in the calcite lattice to produce dolomite (Day 1963:162-166).

Al- Aluminum is a major element and as a metal it has an outer protective oxide filmy surface. In minerals, aluminum dissolves in concentrated hydrochloric acid and sodium hydroxide solutions. Aluminum enters into silicate structures because it occurs in four-fold and six-fold coordination. It is abundant in clay minerals and feldspars (Day 1963:193-203).

Si- Silicon results from a reduction of sand with carbon and is a major element. The resulting element only reacts in hydrofloric acid and will dissolve in hot alkalies. In tetrahedra sheets of phyllosilicates, silicon shares three oxygen atoms. It also appears as quartz. Silicon can be replaced by K, Ag, Tl, and Na (Day 1963:225-231).

K- Potassium is a soft white alkali metal element that when in minerals oxidizes in air and reacts in water. It is an abundant element and typically occur as complex halides, silicates such as feldspar and mica, and soluble salts (Day 1963:135-139).

Ca- Calcium is a soft, white alkali earth element that occurs in igneous rocks such as feldspar and granite, as inosilicates, and in sedimentary rocks such as limestone (Day 1963:167-173).

Sc- Scandium is a rare earth element that burns easily and tarnishes in air. It also reacts with water to form hydrogen gas. As one of the most abundant rare earth metals, scandium occurs in granites, granite pegmatites, and as a substitute for Mg of Fe in ferromagnesian minerals (Day 1963:348).

Ti- Titanium minor earth element and in minerals it burns easily, but is only affected by HF, H_3PO_4, and concentrated H_2SO_4. Titanium occurs in oxide minerals and in igneous and metamorphic rocks (Day 1963:232-234).

V- Vanadium is minor earth element and a shiny, silvery, soft oxyphile metal with a protective oxide surface that only reacts to acids. It mainly occurs as a trace element in siliceous diorites and granites. Because its ionic radius is similar to that of Fe, it will replace Fe in magnetite (Day 1963:263-266).

Cr- Chromium is a metal element and when in minerals it dissolves only in hydrochloric acid and H_2SO_4. It occurs in igneous silicate rocks. Chromium can replace Fe^{3+} and Al (Day 1963:291-295).

Mn- Manganese minor earth element that in minerals burns in oxygen, reacts to water, and dissolves in dilute acids. It occurs in igneous rocks, sulphide minerals, and sediments, and is most abundant when iron is present. Manganese can substitute for Fe^{2+}, Ca, and Mg (Day 1963:320-325).

Fe- Iron is major earth element and in mineral form it dissolves in dilute acids. It occurs as free metallic iron, in oxide and sulphide minerals, in silicate minerals of igneous rocks, as compounds with oxygen, and in sedimentary rocks. Although iron is resistant to weathering, it can be leached from sediments depending on acidity conditions (Day 1963:327-336).

Co- Cobalt is a minor earth element and as a metal it has a lustrous silvery-blue color and reacts to dilute acids. It can be found in olivines and ilmetite (Day 1963:336-339).

Ni- Nickel is minor earth element that in minerals dissolves only in acids. It occurs in sulphides, dunites, and gabbros. Nickel can also occur as a hydrous silicate mineral in montmorillonite. It does not weather (Day 1963:339-341).

Cu- Copper is a minor earth element that can appear as a reddish metal that is resistant to air and water. Limestone may contain copper as wells as sulphides and ores (Day 1963:142-150).

Zn- Zinc is relatively rare element that found in oxy-salts and sulphides such as sphalerite. It can pass into solution and become deposited in carbonates, silicates, and phosphates (Day 1963:179-183).

As- Arsenic is a brittle metalloid that resists reactions to water, acids, and alkalis. It occurs in magmatic rocks and sulphide minerals (Day 1963:269-271).

Se- Selenium is a silvery-grey metal or a red amorphous powder that burns in air, is unaffected by water, and dissolves in HNO_3 and alkalis. It can replace sulfur in some minerals. Selenium occurs in sulphide ores and agricultural soils (Day 1963:286-287).

Rb- Rubidium is a soft white alkali metal element that oxidizes rapidly in air and reacts with water when part of a mineral. It commonly occurs in micas and kaolinite and may substitute for K in pot feldspars (Day 1963:139-140).

Sr- Strontium is a silvery-white, relatively soft alkaline earth "metal" that burns if ignited and reacts with water. Its cation can enter calcium and barium minerals and replaces K in barium minerals. Strontium is found in igneous rocks and silicates of granitic rocks (Day 1963:173-175).

Ag- Silver is a minor earth element that appears as a soft malleable metal that is attacked by sulfur and dissolves in HNO_3 and H_2SO_4. Silver occurs as pure deposits or in ores of other metals (Day 1963:150-154).

Cd- Cadmium is minor earth element that dissolves in acids when part of a mineral. It is found in calcium minerals (Day 1963:183-185).

Sb- Antimony is a minor earth element that does not react with acids or alkalies when part of a mineral. Antimony occurs most frequently is crystalized magmas with a hexagonal crystallographic structure and in sedimentary rocks (Day 1963:272-274).

Cs- Cesium is a soft, shiny, gold colored alkali metal element that when in minerals oxidizes rapidly in air and reacts with water. Clay minerals commonly adsorb this mineral and it can replace K and Rb in clays (especially kaolinite) (Day 1963:140-141).

Ba- Barium is an alkaline earth element that oxidizes in air and reacts with water. Because it reacts with water and is easily dissolved, barium may be leached from minerals such as pot feldspars (where it substitutes for K) and biotite (Day 1963:176-179).

La- Lanthanum is a rare earth element that in its metal form tarnishes in air and reacts with water to produce hydrogen gas. This element can substitute for Ca in Ca-rich minerals (Day 1963:348-351).

Tl- Thallium is a rare earth element that appears in igneous rocks and silicates. In silicates it can replace K. Because the Tl ionic radius is the same size as that of Rb it can replace Rb in potash feldspars (Day 1963:206-207).

Pb- Lead is a minor earth element that is also a soft, weak, dull grey metal that dissolves in HNO_3. Lead results from low-temperature hydrothermal solutions and can occur in sulphates, silicates, and magmatic minerals (Day 1963:244-248).

Cluster analysis using Ward's method was used to graphically portray the degree of compositional grouping present in the sample. I used the SPSS cluster analysis program to analyze the elemental concentrations of the 100 sherd sample.

According to the hierarchical cluster analysis dendrogram, eight clusters exist (see Figure 109). The eight clusters are mixed as to the inclusion of the Fulano, Augustine, and Topoxté ceramic groups. Cluster II has clay pastes that are dominated by pores or sherds with a multitude of mineral inclusions and a smaller quantity of cryptocrystalline calcite. The group of four clusters (IA, IB and IIA and IIB) are distinguished by differences in ceramic groups: IA differs from IB because IB is composed of only Augustine ceramic group sherds (with the exception of on Trapeche sherd) and

Rescaled Distance Cluster Combine

```
        C A S E                      0         5        10        15        20        25
        Label         Num            +---------+---------+---------+---------+---------+

        cp3492         67   ðø
        cp3433         68   ðú
        itr20348       57   ðú
        cp3922         66   ðú
        cp3732         62   ðôðø
        ctr3684        60   ðú ó
IA1     cp3672         69   ð+ ó     I
        ctr3916        61   ðø ùðððððððððø
        cp3715         63   ðú ó          ó
        itr29011       58   ðú ó          ó
        itr30310       59   ðôð+          ó
        ta615          98   ð+            ó
        zt8124         20   ðø            ó
        zt181251       23   ðôðø          ó
        tt51           89   ðú ó  2       ó A
        tt6261         90   ð+ ùððððø     ùðððø
        tt616          87   ðø ó     ó    ó   ó
        tt647          88   ðú ó     ó    ó   ó
IA2     tt371          92   ðôð+     ó    ó   ó
        tt351          91   ð+       ó    ó   ó
        ip20327        34   ðø       ó    ó   ó
        ip20374        35   ðú       ó    ó   ó
        itr28518       56   ðôðø     ó    ó   ó
        ztr18255       31   ðú ó     ùððð+    ó
        itr20360       55   ð+ ùðø   ó        ó
        ztr16663       25   ðûðø ó   ó        ó
        ztr5491        29   ð+ ó ó   ó        ó
        zt11308        24   ðø ó ó   ó        ó
        ztr8676        27   ðú ó ó   ó        ó
        ztr12260       26   ðôð+ ó   ó        ó
        ip21870        33   ðú   ó   ó        ó             I
        ztr11493       28   ðú   ùððð+        ó
IA3     zt15666        21   ðú   ó  3         ùððððððððððððððððððððððððððððððø
        zt181252       22   ð+   ó            ó                                ó
        ip25463        38   ðø   ó            ó                                ó
        ip22419        40   ðú   ó            ó                                ó
        ip20591        37   ðú   ó            ó                                ó
        cp3474         65   ðôðø ó            ó                                ó
        cp3692         64   ðú ó ó            ó                                ó
        tt415          86   ð+ ùð+            ó                                ó
        ip22241        36   ðø ó              ó                                ó
        ip21926        39   ðôð+              ó                                ó
        ztr11627       30   ð+                ó                                ó
        ia20327        51   ðø                ó                                ó
        ia21816        53   ðôðø              ó                                ó
IB1     ia23640        47   ðú ó 1            ó                                ó
        ia21870        50   ðú ùððððø         ó                                ó
        itr20463       41   ð+ ó     ó        ó                                ó
        ia23926        48   ðôð+     ó        ó                                ó
        ia21874        52   ðø       ùððððððð+                                 ó
        ia21831        54   ðôðððððø ó      B                                  ó
        ia21893        49   ð+     ó ó                                         ó
IB2     ta361          94   ðø     ùð+                                         ó
        ta853          99   ðôðø   ó 2                                         ó
        ta768          97   ð+ ó   ó                                           ó
        ta611          95   ðø ùððð+                                           ó
        ta453          96   ðú ó                                               ó
        ta823         100   ðôð+                                               ó
        ta850/2        93   ð+                                                 ó
        za7516         13   ðø                                                 ó
        za15529        14   ðú                                                 ó
        May738         10   ðôðø                                               ó
IIA1    zp16766         4   ð+ ó 1                                             ó
        tp81           78   ðø ùðø                                             ó
        tp48           80   ðú ó ó                                             ó
        ca3687         74   ðôð+ ó                                             ó
```

Figure 109: Cluster Analysis of Elemental Concentrations (continued on next page).

```
         zp18069    2   ðú   ó                                    ó
         ca3480    70   ð+   ó        A                           ó
         zp8826     1   ðûðø ùðððððððððððððø                      ó
         za8403    12   ð+ ó ó             ó                      ó
         zp10797    3   ðø ó ó             ó                      ó
         za18019   15   ðú ó ó             ó                      ó
         ca3702    73   ðú ó ó             ó                      ó
         ca3690    76   ðððûð+             ó                      ó
IIA2     ca3678    72   ð+ ó  2            ó                      ó
         tp106     77   ðø ó               ó                      ó
         tp143     79   ðú ó               ó                      ó
         zp16625    7   ðú ó               ó                      ó
         ca3600    71   ðú ó               ó                      ó
         zp12258    6   ðú ó               ó                      ó
         zp18024    9   ðú ó               ùððððððððððððððððððððððððððð+
         zp5491     8   ðú ó               ó
         zp18135    5   ðú ó               ó          II
         tp520     83   ððð+               ó
         tp516     81   ðú                 ó
         tp615     84   ðú                 ó
         tp286/1   82   ðú                 ó
         ztr12224  32   ðú                 ó
         tt6262    85   ð+                 ó
         za11446   16   ðûðø  1            ó
         zt7181    18   ð+ ùððððø          ó
IIB1     za15419   11   ðø ó      ó        ó
         zt18294   19   ððð+      ó        ó
         zt7133    17   ð+        ùðððððððð+
         it21810   43   ðø        ó    B
         it21875   46   ðú        ó
         IIB2   it30499   44   ðððø     ó
         it21914   45   ð+ ùððððð+
         it21910   42   ððð+  2
```

Figure 109: Cluster Analysis of Elemental Concentrations.

IIA differs from IIB because IIB is dominated by sherds from the Topoxté ceramic group (except for two Augustine ceramic group sherds). Groups IA and IIA are composed of a mixture of Paxcamán, Fulano, Trapeche, Augustine, and Topoxté ceramic group sherds. The final group of eight clusters (IA1, etc.) is distinguished by finer distinctions of clay pastes included in the above larger groups. Each of these clusters is discussed below.

Group IA1 contains Paxcamán Red and Trapeche Pink sherds from Ch'ich', Trapeche Pink sherds from Ixlú, and one Hobonmo Incised: Hobonmo Variety sherd from Tipuj. These sherd pastes are dominated by cryptocrystalline calcite.

Group1A2 has one Chompoxté Red-on-paste: Akalché Variety sherd and one Pastel Polychrome sherd from Zacpetén and four Chompoxté Red-on-paste: Akalché Variety sherds and two Topoxté Red sherds Tipuj. The clay pastes of this group are characterized by the presence of crystalline, polycrystalline, and cryptocrystalline calcite, hematite, quartz, biotite, chalcedony, and chert mineral inclusions.

Group 1A3 is composed of Picú Incised: Thub Variety and Picú Incised: Picú Variety sherds from Ixlú, Paxcamán Red sherds from Ixlú and Ch'ich', Trapeche Pink sherds from Ixlú and Zacpetén, Xuluc Incised: Tzalam Variety sherds from Zacpetén, Fulano Black sherds from Ixlú, Topoxté Red sherds from Tipuj, and Chompoxté Red-on-paste sherds from Zacpetén. All of these sherds have clay pastes dominated by cryptocrystalline calcite and approximately one-half of the sherds of this group also have biotite inclusions.

Group 1B1 has Augustine Red sherds from Ixlú and one Trapeche Pink sherd from Ixlú. The clay pastes of these sherds are dominated by crystalline calcite.

Group 1B2 is composed of Augustine Red sherds from Ixlú and Augustine Red, Pek Polychrome, and Hobonmo Incised: Ramsey Variety sherds Tipuj. The sherds from Ixlú have clay pastes dominated by pores and the clay pastes from Tipuj have crystalline, polycrystalline, and cryptocrystalline calcite, hematite, quartz, biotite, chalcedony, and chert mineral inclusions in the clay pastes.

Group IIA1 has Augustine Red and Graciela Polychrome sherds from Zacpetén and Augustine Red sherds from Ch'ich', Ixpop Polychrome and Mengano Incised sherds from Zacpetén and Ixpop Polychrome and Paxcamán Red sherds Tipuj, and a Topoxté Red sherd from Zacpetén. The clay pastes in this group are not similar. The Augustine Red sherds from Ch'ich' are dominated by pores and the Paxcamán and Fulano ceramic group sherds are dominated by cryptocrystalline calcite.

Group IIA2 consists of Paxcamán Red, Ixpop Polychrome, Sacá Polychrome, and Macanché Red-on-paste sherds from Zacpetén, Paxcamán Red, Picú Incised: Picú Variety, Picú Incised: Picú Variety, Fulano Black sherds from Tipuj, a Trapeche Pink sherd from Zacpetén, and Augustine Red sherds from Ch'ich', Zacpetén, and a Chompoxté Red-on-paste: Chompoxté Variety sherd Tipuj. The majority of Paxcamán, Fulano, and Augustine ceramic group sherd pastes have crystalline, polycrystalline, and cryptocrystalline calcite, hematite, quartz, biotite, chalcedony, and chert mineral inclusions. The Augustine Red sherds from Ch'ich' have clay pastes dominated by pores and the remaining sherd pastes of these two groups are dominated by cryptocrystalline calcite and

Group IIB1 has an Augustine Red and a Graciela Polychrome sherd from Zacpetén and Chompoxté Red-on-paste: Akalché Variety sherds from Zacpetén. All of the clay pastes have crystalline, polycrystalline, and cryptocrystalline calcite, hematite, quartz, biotite, chalcedony, and chert mineral inclusions.

Group IIB2 is composed of Topoxté Red sherds from Ixlú. The clay pastes of these sherds are dominated by pores.

Using the Ward's method of cluster analysis data as a base for the number of possible elemental compositional groups, I conducted a factor analysis based on the same elemental data. The factor analysis was completed using the SPSS principal component analysis. The variables (elemental concentrations of the sherd samples) were examined with a covariance matrix and varimax rotation. The resulting analysis yielded 30 principal components that account for 100 percent of the total variance (Table 41).

The first eight principal components account for 71 percent of the variance. The first principal component, accounting for 16.7 percent of the variance, consists of Ca, Rb, K, Na, La, Si, and Sc (Table 42). Fourteen percent of the variance is accounted for by principal component 2 that represents Tl, Fe, B, V, Al, and Cu. Principal Component 3, 11.1 percent of the variance, is composed of Be, Cd, and Mn. Approximately 9 percent of the variance is accounted for by Se, Pb, and Ni in principal component 4. Principal component 5 includes Cr and Sr and accounts for 6.83 percent of the variance. Approximately 5 percent of the variance is accounted for in principal component 6 that is composed of Sb and Zn. Principal components 7 and 8 each account for approximately four percent of the variance and are represented by Ag and As, respectively.

Factor analysis of the sample of 100 sherds from the five Petén Postclassic slipped pottery groups produced seven distinct compositional groups when plotting principal components 1 and 2 (Figure 110 and 111). The seven compositional groups also exist in a variety of bivariate elemental plots (Figures 112-115). Figures 112 and 115 show a correlation between Fe and Al and Ti and Fe in the sample. The correlation may be due to differences in clay sources, clay mineral structure and ionic substitution, and/or other undetermined variation. Table 43 lists the mean elemental concentrations for each group. The compositional groups generally correspond to the hierarchical cluster analysis discussed above; however, the groupings based on factor analysis are more specific and will later be shown to correlate to petrographic and stylistic analyses (Chapter 9).

Below is a description of the seven chemical compositional groups that includes data such as the ceramic ware and types of sherds that compose the group as well as the major elements that differentiate the groups. This data is also summarized in Table 44.

Composition Group 1 represents sherds from the Clemencia Cream ware, Topoxté Red type, from the archaeological sites of Ixlú and Tipuj. Sherds in this group have a relatively higher mean concentration of Fe, K, and Al, and relatively lower concentrations of Ca, Sc, and V.

Composition Groups 2 and 3 represents Vitzil Orange-Red ware sherds. While group 2 has sherds from Ch'ich', Ixlú, and Zacpetén, group 3 has sherds from all four archaeological sites in the study. Both groups have relatively high mean concentrations of Fe, Al, and Ti and relatively moderate concentrations of Zn. Group 2 has relatively higher Al, Na, and K mean concentrations and a relatively lower Ca concentration than does group 3. Augustine Red sherds and two Hobonmo Incised: Hobonmo Variety sherds represent compositional group 2. Compositional group 3 consists of Augustine Red, Pek

Table 41: Principal Eigenvalues and Associated Variance

Component	Total	% of Variance	Cumulative %
1	5.017	16.724	16.724
2	4.197	13.990	30.714
3	3.329	11.097	41.811
4	2.684	8.946	50.757
5	2.048	6.828	57.585
6	1.579	5.264	62.848
7	1.290	4.300	67.148
8	1.252	4.174	71.322
9	1.175	3.918	75.240
10	.920	3.065	78.305
11	.853	2.844	81.150
12	.787	2.622	83.772
13	.699	2.329	86.101
14	.623	2.078	88.179
15	.611	2.036	90.215
16	.549	1.831	92.046
17	.441	1.471	93.516
18	.399	1.331	94.848
19	.2887	.995	95.803
20	.277	.923	96.726
21	.232	.774	97.500
22	.223	.745	98.245
23	.196	.653	98.898
24	.113	.377	99.275
25	.008	.268	99.542
26	.005	.151	99.693
27	.003	.109	99.802
28	.003	.1	99.894
29	.002	.006	99.955
30	.001	.005	100.0

Table 42: Rotated Component Matrix and Composition Group Membership

	1	2	3	4	5	6	7	8
Ca	.881*			.206				
Rb	.859*							
K	-.795*				-.279			
Na	-.781*		.392		.254			
La	.703*				-.228			
Si	-.665*						.218	
Sc	.576*	-.254	.257	.339	.355			
Ti		.935*						
Fe		.929*						
B	-.206	.891*						
V	.346	.819*						
Al	-.393	.798*				-.212		
Cu		.528*	.435			.214	.347	
Be			-.716*					.355
Cd		-.246	.691*					
Mn	-.385		.650*					
Se	.231			.714*				
Pb				-.698*				
Ni			.240	-.516*		.495		
Co	.317	-.315		-.450			-.421	-.221
Mg	.387	-.331		-.398	-.230	.321		
Cr		.221	.243		-.747*			
Sr	.536	.227			.617*		.231	
Ba	-.273	.545			.570			
Sb					.476	.637*		
Zn	-.207					.611*		
Tl		-.445		.272	-.225	.452		
Ag							.852*	
As								.786*
Cs		-.246	-.416	.342		-.375		-.458

* indicates the elements that compose the component

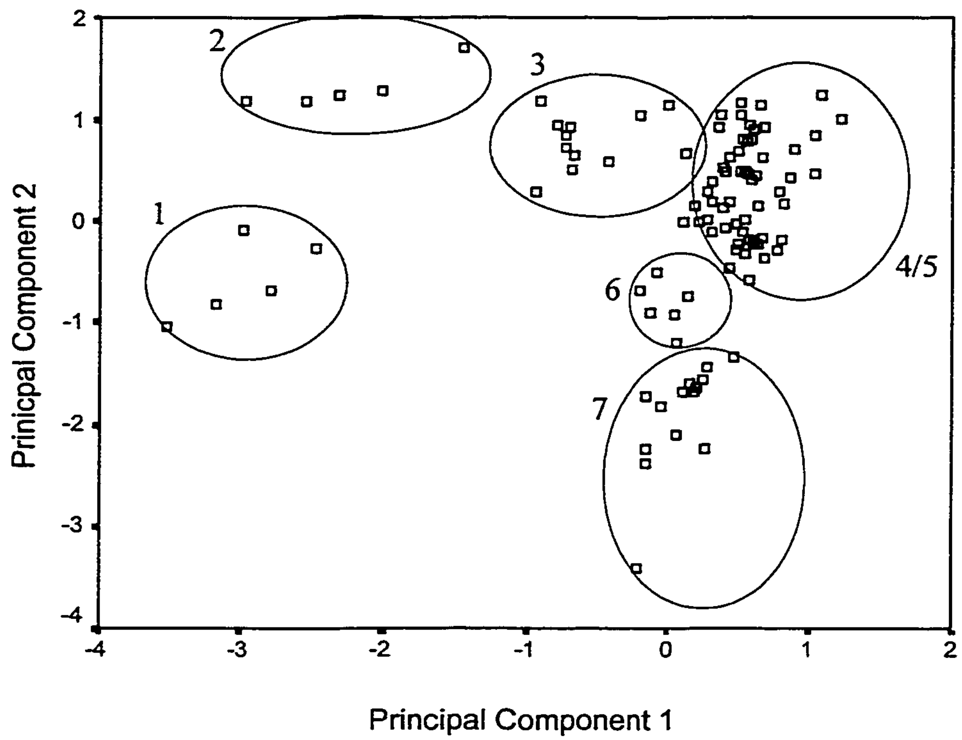


Figure 110: Chemical Composition Groups

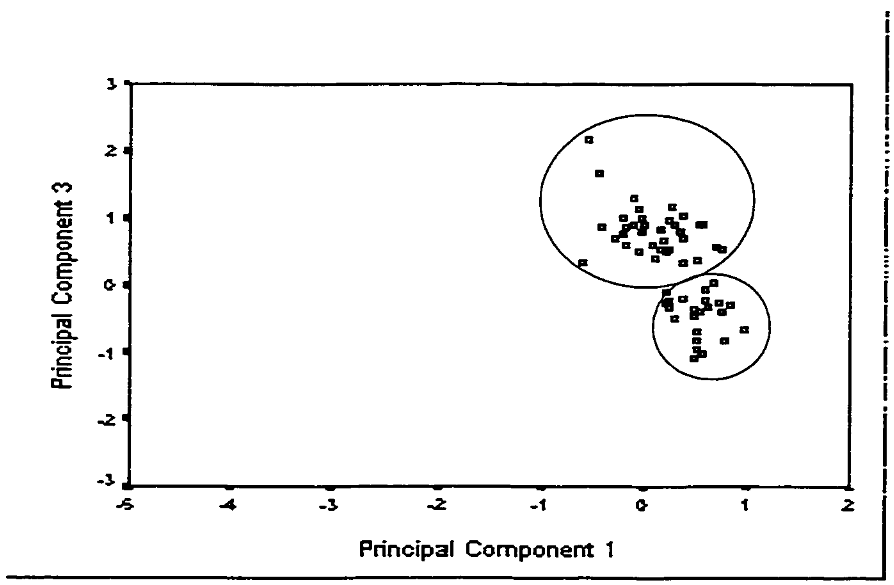


Figure 111: Compositional Groups 4 (upper) and 5 (lower)

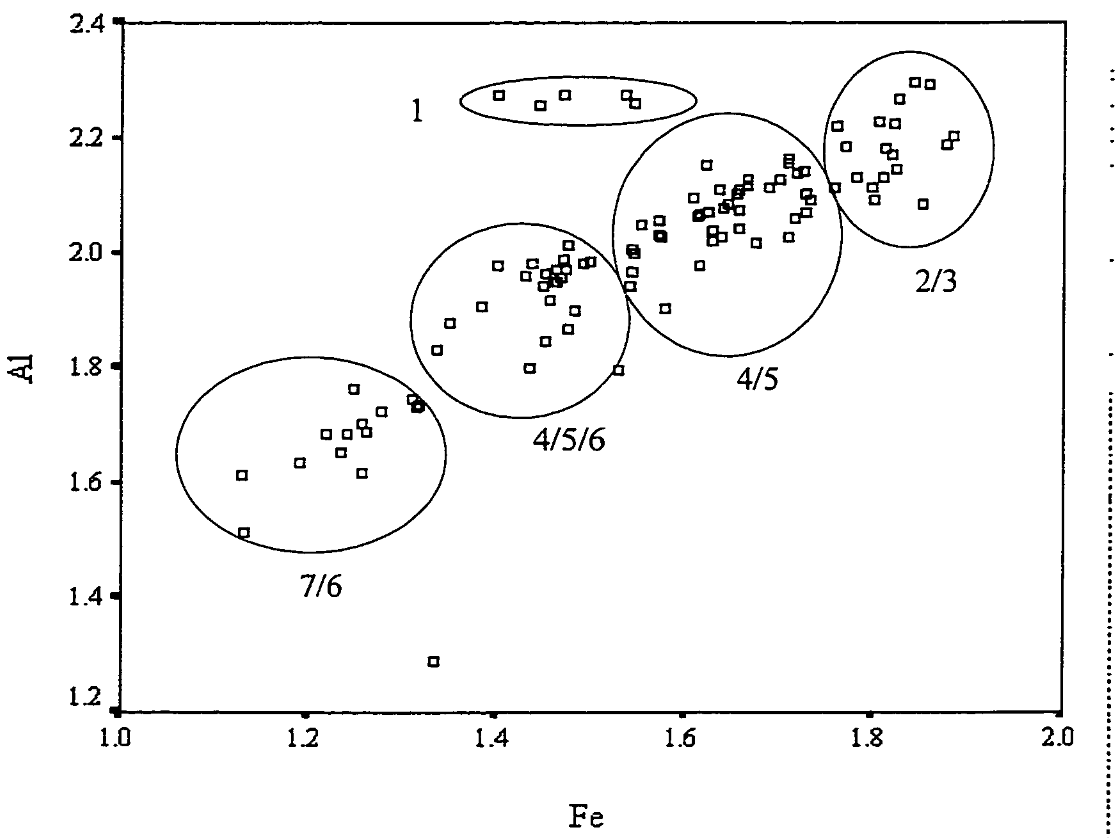


Figure 112: Fe and Al concentrations of the seven composition groups. Element concentrations are plotted as base log 10 values.

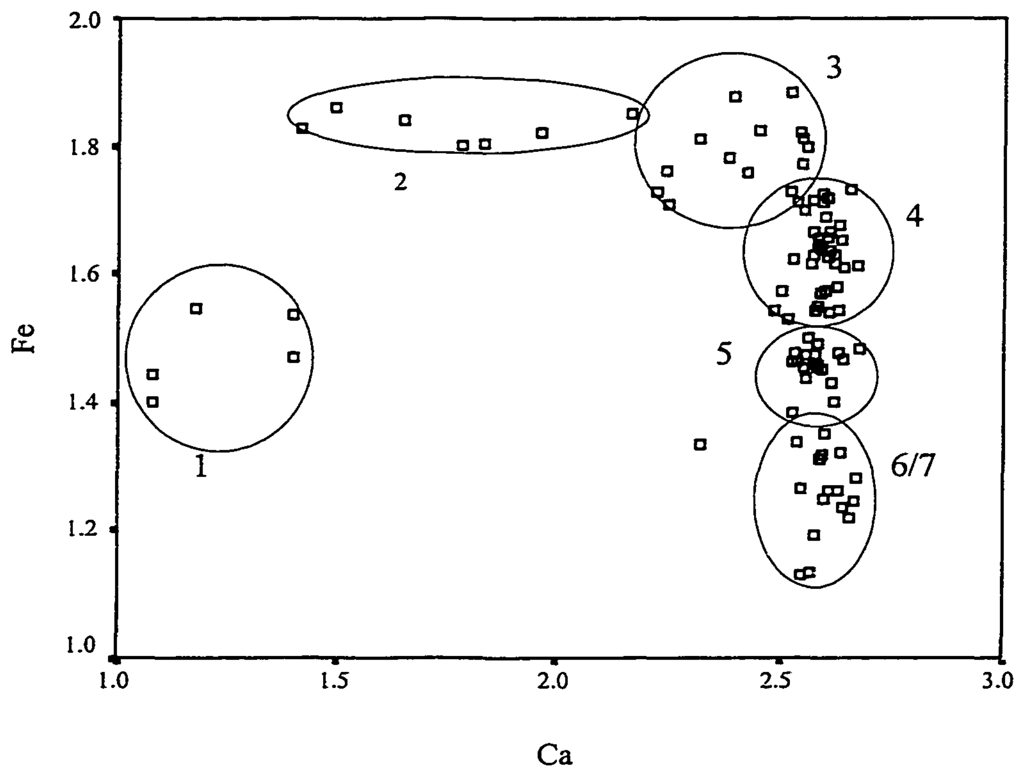


Figure 113: Ca and Fe concentrations of the seven composition groups. Element concentrations are plotted as base log 10 values.

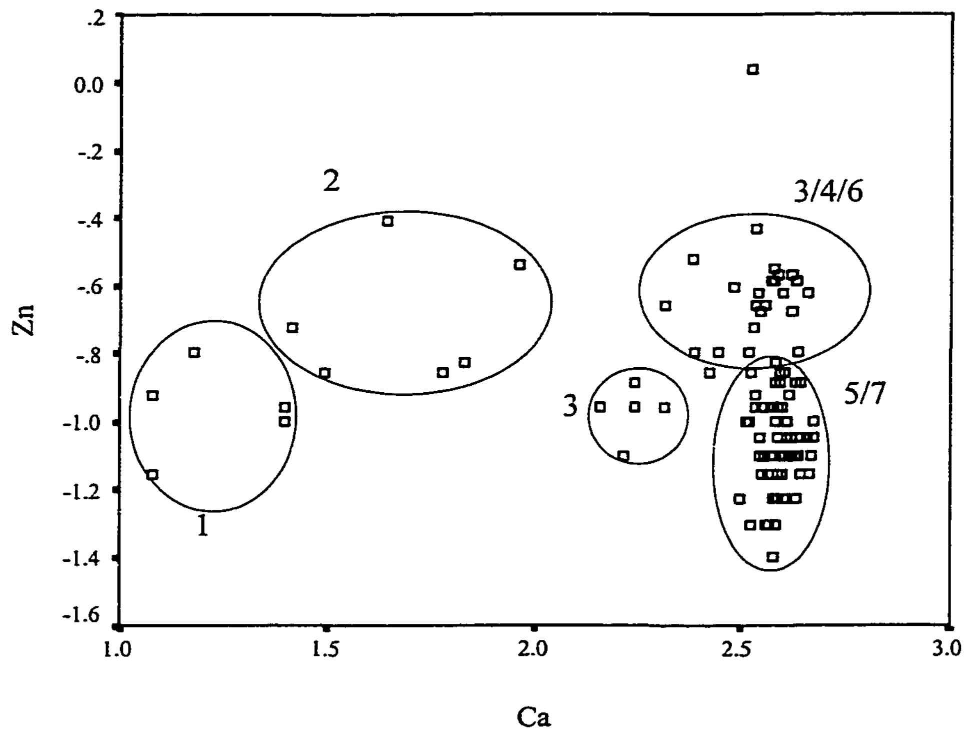


Figure 114: Ca and Zn concentrations of the seven composition groups. Element concentrations are plotted as base log 10 values.

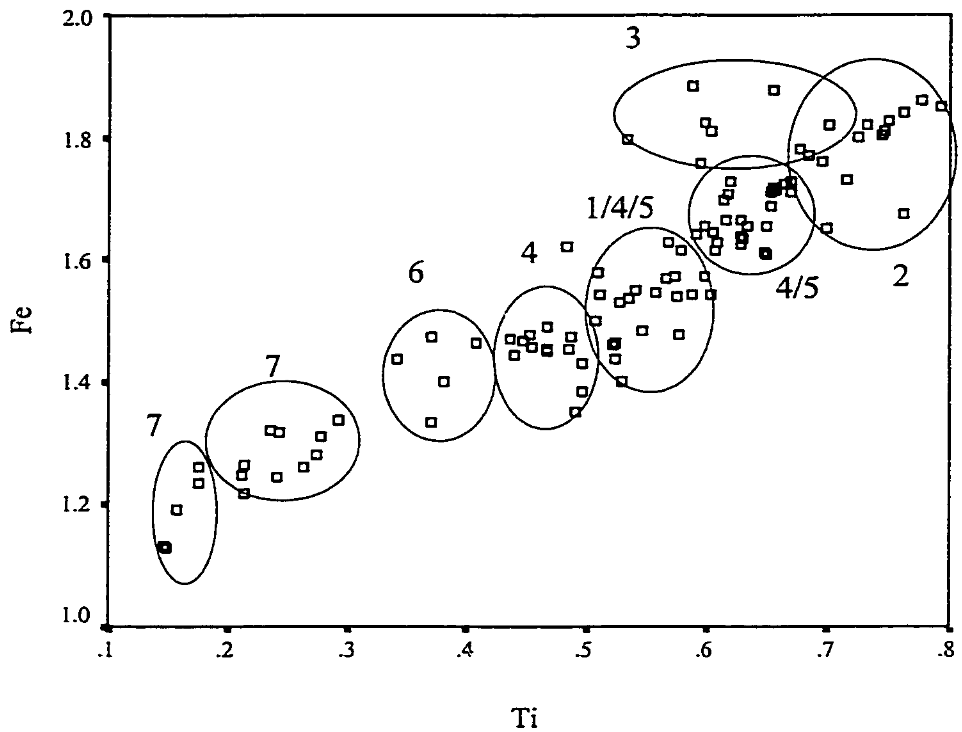


Figure 115: Ti and Fe concentrations of the seven composition groups. Element concentrations are plotted as base log 10 values.

Table 43: Mean Elemental Concentration (ppm) of Compositional Groups (continued on next page)

	Group 1, n=5		Group 2, n=5		Group 3, n=24		Group 4, x=35		Group 5, n=16		Group6, n=4		Group 7, n=13	
	x̄	sd	x̄	sd	x̄	sd	x̄	sd	x̄	sd	x̄	sd	x̄	sd
Ca	27.00	6.44	119.33	125.85	297.09	106.35	376.47	52.57	397.07	28.51	333.00	84.01	405.77	43.32
Rb	22.80	8.70	37.00	12.44	57.22	11.50	66.00	4.87	67.73	2.37	64.50	6.56	65.46	3.91
K	32.40	7.02	23.67	9.95	11.83	9.10	5.24	4.08	5.13	1.68	11.75	2.99	9.23	2.89
Na	25.00	1.73	14.00	6.72	1.48	3.13	1.12	1.30	1.07	1.71	2.50	1.00	.54	.88
La	.02	.02	.005	.008	.0009	.004	0	0	.002	.005	0	0	.002	.001
Si	6.21	1.10	3.87	2.51	2.50	4.13	1.58	1.15	1.13	.58	1.63	.33	1.39	.59
Sc	.02	0	.007	.01	.008	.008	0	0	.0006	.003	0	0	.003	.01
Ti	2.98	.05	5.43	.46	4.30	.97	3.82	.65	3.64	.61	1.97	.40	1.66	.18
Fe	30.40	4.27	65.3	5.77	55.06	13.92	38.84	8.67	35.53	8.74	21.26	4.82	17.96	2.49
B	.04	.01	.08	.20	.02	.02	.08	.03	.02	.07	.11	.22	.01	.02
V	.03	.01	.16	.02	.12	.02	.11	.03	.11	.02	.056	.02	.05	.02
Al	185.82	3.89	178.03	18.04	126.47	23.92	107.99	.03	102.58	23.00	45.33	19.04	49.59	8.78
Cu	.032	.001	.06	.01	.04	.01	.05	.02	.04	.01	.05	.01	.03	.02
Be	.001	.001	.002	.002	.0008	.001	.001	.002	.0003	.0009	.001	.001	.0006	.00001
Cd	0	0	0	0	.002	.004	.002	.004	.001	.005	0	0	.0007	.003
Mn	.92	.11	1.51	.64	.35	.42	.25	.25	.14	.14	.41	.29	.48	.26
Se	.012	.013	0	0	.003	.007	.01	.02	.005	.02	.01	.01	.006	.02

	Group 1, n=5		Group 2, n=5		Group 3, n=24		Group 4, x=35		Group 5, n=16		Group6, n=4		Group 7, n=13	
	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd	$\bar{x}$	sd
Pb	0	0	.032	.03	.01	.02	.02	.02	.005	.01	.01	.02	.02	.02
Ni	0	0	.02	.01	.04	.04	.03	.01	.03	.01	.04	.02	.03	.01
Co	0	0	.02	.01	.01	.01	.01	.01	.01	.005	.01	.01	.01	.01
Mg	8.82	.88	3.67	1.75	19.08	29.04	10.44	5.11	9.4	1.45	31.50	7.59	25.00	11.61
Cr	.02	.01	.057	.01	.09	.05	.06	.05	.06	.04	.04	.04	.052	.02
Sr	.11	.03	.28	.23	.24	.24	.85	.35	1.02	.25	.31	.15	.14	.10
Ba	1.59	.44	2.10	.22	.96	.46	1.02	.59	1.63	1.43	.49	.29	.45	.32
Sb	.02	.02	.04	.02	.02	.01	.03	.02	.023	.01	.01	.01	.02	.01
Zn	.11	.03	.20	.12	.18	.21	.11	.06	.09	.04	.24	.03	.14	.08
Tl	.01	0	.02	0	.02	.01	.01	.01	.01	.006	.01	.01	.01	.01
As	.002	.004	0	0	0	0	.0008	.005	0	0	.003	.01	0	0
Cs	49.2	1.64	51.17	6.11	50.13	4.69	51.05	4.44	51.93	3.92	50.50	3.32	53.62	2.90

Table 44: Comparison of ICPS Compositional Groups with Groups formed through Cluster Analysis and EDS analysis and the Ceramic Groups Represented

ICPS Group	**Distinctive Elemental Concentrations**	**Cluster Analysis Groups**	**EDS Groups**	**Ceramic Groups Represented**
1	Fe, K, Al, Ca, Sc, V	IIB2	I	Topoxté
2	Al, Na, K, Ca	IB2, IIA1, IIA2	C, D, G	Augustine
3	Al, Na, K, Ca	IB1, IB2, IIA2, IIB1	A, B, C, D, E, H	Augustine
4	Ca, Ti, Fe, Al	IA1, IA3, IB2, IIA1, IIA2	A, B, D, E, H	Paxcamán, Trapeche, Fulano
5	Ca, Ti, Fe, Al	IA1, IA3, IIA1, IIA2	A, C, D, H, J	Paxcamán, Trapeche, Fulano
6	Ca, Zn, Fe, Al, Ti	IA2, IA3	E, H	Topoxté
7	Ca, Zn, Fe, Al, Ti	IA2, IA3, IB1	A, B, E, F, H	Topoxté

Polychrome, Hobonmo Incised: Ramsey Variety, Graciela Incised: Graciela Variety, and Hobonmo Incised: Hobonmo Variety sherds.

Volador Dull-Slipped ware sherds represent Compositional Groups 4 and 5 from the four sites included in this study. Both groups have relatively high mean concentrations of Ca and moderate mean concentrations of Ti, Fe, and Al. Because compositional groups 4 and 5 have similar mean concentrations, the two groups cannot be separated on bivariate elemental plots of the five elements. Compositional group 4 consists of Paxcamán Red, Ixpop Polychrome, Sacá Polychrome, Macanché Red-on-paste, Picú Incised: Picú Variety, Picú Incised: Thub Variety, Pink, Mul Polychrome, Xuluc Incised: Ain Variety, Xuluc Incised: Tzalam Variety, and Fulano Black sherds. Compositional group 5 includes Paxcamán Red, Ixpop Polychrome, Picú Incised: Thub Variety, Pink, Mengano Incised, and Sotano Red-on-paste sherds.

Compositional Groups 6 and 7 are characterized by Clemencia Cream ware sherds from Tipuj and Zacpetén. Both groups have relatively high elemental concentrations of Ca and Zn and relatively low concentrations of Fe, Al, and Ti; however, group 7 has a slightly higher relative Ca concentration than does group 6. Again, bivariate plots of these five elements do not obviously separate the two groups. Compositional group 6 consists of Topoxté Red and Chompoxté Red-on-paste: Akalché Variety sherds. Compositional group 7 has Topoxté Red, Chompoxté Red-on-paste: Akalché Variety, Chompoxté Red-on-paste: Chompoxté Variety, Pastel Polychrome, Dulces Incised and Canté Polychrome sherds.

The above chemical composition data suggest definite elemental differences of ceramic wares and groups and more minor elemental differences reflected by pottery types. The differences within the three ceramic wares may be the result of the presence of different minerals in the clay paste or the result of ionic substitution in the clay structure. The variation present in the sherd pastes representing the three Petén Postclassic ceramic wares may be the result of the substitution of Fe, K, Ti, Na, and Al in the montmorillonite clay structure. Cationic replacement is highly likely because montmorillonite dioctahedral and trioctahedral layers expand to absorb water (Moore and Reynolds 1997:155). As the layers expand, the interlayer cation can be exchanged as long as the layer charge is restored. Therefore, the differences in the sherd paste chemical composition groups may be the result of the presence of different minerals and/or differences due to cation exchanges in the clay structure itself.

In addition to these data, Rice (1987a:108-110) conducted an INAA study of Paxcamán/ and Topoxté sherds as well as local clays that demonstrate variability at the ceramic group level. Because INAA and ICPS results are not directly comparable (Burton and Simon 1996:405-406), I only cite this study to support the degree of regional variability in the Petén lakes region during the Postclassic period.

As a result of elemental data obtained from EDS, SEM, and strong-acid extraction ICPS examinations, I define seven chemical composition technological style groups. The seven technological style groups (described above) tend to conform to Petén Postclassic ware categories: groups 1, 6, and 7 are Clemencia Cream Paste ware sherds; groups 2 and

3 represent Vitzil Orange-Red ware sherds; and groups 4 and 5 consist of Volador Dull Slipped ware sherds. These differences are not surprising given the differences of the clay pastes of the three wares discussed in Chapters 5, 6, and 7.

In addition to differences that reflect ware categories, various suites of mineral inclusions in the clay pastes also differentiate the seven chemically based technological style groups. Again, differences based on mineral inclusions are not surprising due to the chemical structure of different minerals. The mineralogical differences among groups 1, 6, and 7 are the differences between clay pastes dominated by pores; by clay pastes with calcite, quartz, hematite, chert, and chalcedony; and by pastes with calcite, quartz, hematite, chert, chalcedony, and biotite, respectively. Groups 2 and 3 differ because of the variation between clay pastes dominated by pores and clay pastes with inclusions, respectively. Finally, groups 4 and 5 are differentiated by the presence of chalcedony and biotite in group 4 and the absence of these minerals in group 5.

When "stylistic" data, such as surface treatment and decoration, are examined in conjunction with mineralogical and chemical composition data, some interesting characteristics of each group occur. Group 1 is composed of monochrome slipped Topoxté ceramic group body sherds. Group 2 consists of monochrome slipped sherds and three decorated (black line painted or incised decoration) Augustine ceramic group sherds; forms of group 2 include tripod dishes, collared jars, restricted orifice bowls, and narrow neck jars. Group 3 has black, red, red-and-black, and incised decoration on Augustine ceramic group tripod dish, flanged tripod dish, narrow neck jar, collared jar, restricted orifice bowl, and drum sherds. Group 4 is composed of Paxcamán, Fulano, and ceramic group tripod dish, flanged tripod dish, narrow neck jar, collared jar, restricted orifice bowl, grater bowl, and drum sherds decorated with black, red, red-and-black, or incised decoration with a minority of sherds being monochrome slipped. Group 5 has primarily monochrome slipped Paxcamán, Fulano, and ceramic group sherds with a few black, red, or incised decorated sherds. Vessel forms of this group include tripod dishes, flanged tripod dishes, grater bowls, narrow neck jars, collared jars and restricted orifice jars. Group 6 is composed of Topoxté ceramic group tripod dish, collared jar, narrow neck jar, and drum sherds that are either monochrome slipped or have red or black painted decoration. Group 7 has Topoxté ceramic group tripod dish, collared jar, restricted orifice bowl, and narrow neck jar sherds. These sherds have red, black, red-and-black and incised decoration with a minority of the sherds being monochrome slipped.

The combination of data from "low-tech", mineralogical, and chemical analyses demonstrates that seven Petén Postclassic slipped pottery groups exist and represent differences in technological and stylistic choices. The seven technological style groups demonstrate that choices made by potters with regard to clay, mineral inclusions, form, decoration, and specific knowledge of pottery manufacture influence (the representation of) material culture. These differences may reflect choices made because of environmental constraints as discussed in previous chapters. Although resources may have been restricted, the existence of the seven groups reflects the choices made by

Postclassic Maya potters with regard to raw materials the s/he used.

CHAPTER 9

PETÉN POSTCLASSIC TECHNOLOGICAL STYLE GROUPS

In the previous four chapters, I described my sample of Petén Postclassic slipped pottery through typological, "low-tech," mineralogical, and chemical methods of analyses. As a result of each level of analysis, I define preliminary technological style groups that pertain to data gathered in that chapter.

Type-variety analysis, the first level of analysis, yielded two broad typological technological style groups that each have "sub-technological style groups." The first broad technological style group consisted of three divisions based on differences in pastes that reflect the existence of the three Petén Postclassic slipped ware categories: Volador Dull-Slipped ware; Vitzil Orange-Red ware; and Clemencia Cream Paste ware. The second broad technological style group is based on decorative modes and yields five groups of decoration on slipped pottery: red-on-paste; black; red-and-black; fine line incising, and broad line incising.

The second level of analysis, "low-tech" analysis, produced three technological style groups based on slip and clay paste color measurements, refiring experiments, and surface treatment and decoration. The three groups mirror differences of the ware categories previously discussed in the typological technological style groups. "Low-tech" technological style groups reflect the relative variability in paste and slip color and firing technologies. Differences at this level may reflect choices made by Petén

Postclassic Maya potters with regard to resources such as clays, slips, and firing resources.

Mineralogical analysis, the third level of analysis, involved the petrographic and x-ray diffraction analysis of minerals in the clay pastes and slips of the sherds in this sample. I defined four mineralogical groups based on the presence of different paste characteristics or mineral suites of the pastes: 1) clay pastes dominated by voids; 2) clay pastes dominated by cryptocrystalline calcite; 3) clay pastes with quartz, chert, chalcedony, hematite, and calcite mineral inclusions; and 4) clay pastes with quartz, chert, chalcedony, hematite, calcite, and biotite mineral inclusions. Again, the differences in mineral inclusions in the clay paste may reflect differential access to various clay and mineral resources.

The final level of analysis, chemical composition analysis, yielded seven chemical groups based on EDS, SEM, and strong acid-extraction ICPS methodologies. The seven groups reflect differences in ware categories and mineral suites previously described. As with the previous levels of analysis, the differences in the chemical technological style groups may be the result of choices made due to access to resources.

When the technological groups of the four levels of analysis are compared, seven interesting technological and stylistic combinations occur that reflect operational sequence choices and may reflect different social/ethnic identities (see Table 45). The seven Technological Style Groups (TSGs) (discussed below) demonstrate within-group homogeneity and between-group heterogeneity when typological, "low-tech," mineralogical, and chemical characteristics are examined. Below is a discussion of the

Table 45: Comparison of Preliminary Technological Style Group Data

Type-Variety Wares	"Low-Tech" Groups (relative variability of slip and paste color, firing characteristics, and surface treatment)	Mineralogical Groups [types of inclusions (mineralogical technological style group)]	Chemical Composition Groups
Clemencia Cream Paste	Least	Pores (1)	1
		Quartz, chert, chalcedony, hematite, calcite (3)	6
		Quartz, chert, chalcedony, hematite, calcite, biotite (4)	7
Vitzil Orange-Red	Moderate	Pores (1)	2
		Cryptocrystalline calcite (2)	3
		Quartz, chert, chalcedony, hematite, calcite, biotite (4)	3
Volador Dull-Slipped	Greatest	Cryptocrystalline calcite (2)	5
		Quartz, chert, chalcedony, hematite, calcite, biotite (4)	4

seven different TSGs that includes paste, firing, surface finish and decoration, form, and provenience characteristics of each.

I. Technological Style Group 1

TSG 1 consists of Topoxté Red pottery from Ixlú (n=17) and Tipuj (n=2). Body sherds of this group are thin and exteriorly slipped with no decoration.

The marly Clemencia Cream Paste ware pastes of TSG 1 range in color from light greenish gray (1 GLEY 7/1) to pink (7.5YR 8/2-3) to light gray and very pale brown (10YR 7/1-4, 8/1-3). Although these clay pastes are dominated by pores (60-80%), they also include small quantities of quartz (less than 1%). XRD analysis of sherds from this group demonstrates that the clay paste is composed of montmorillonite clay minerals. Additional minerals detected by XRD analysis and not by petrographic analysis include gypsum and dolomite. Strong acid-extraction ICPS analysis suggests that TSG 1 is distinctive due to its moderate relative concentrations of Fe and relative low concentrations of Ca and Zn.

Estimated firing temperatures range from 400-650°C. Approximately one half of the sherds exhibit a darker core and are estimated to have been fired below 600°C. The median and modal estimated firing temperature is 600°C with a range of 250°C (400-650°C). Core and interior surface (unslipped) hardness is 3 before and after refiring experiments (Tables 46 and 47).

The slipped surfaces exhibit low luster to "waxy" finishes. Slip colors range from red (10R 5/6-2.5YR 4/8) to light reddish brown and yellowish red (5YR6/4-5/6). Exterior red slip hardness before refiring experiments is 3 and after refiring experiments increases to 4 (Table 48). Although slip hardness is fairly homogeneous for TSG 1, general exterior slip color is heterogeneous (Figure 116). Table 49 provides diversity measurements for richness, evenness, and heterogeneity of exterior slips. When TSG 1 exterior slip colors are compared to general data for Topoxté exterior slips (Table 9 and 10), the slip colors of TSG 1 represent a sample characterized by a high variability with a mixed assemblage of many colors (Table 49). TSG 1 richness indices are higher than other groups, suggesting that the relative number of colors present in Group 1 are higher than those of the entire Topoxté sample. Evenness measurements for Group 1 are similar to those of the entire Topoxté sample. Pre-refired Group 1 exterior slip colors have a higher diversity (heterogeneity) index while the post-refired diversity (heterogeneity) index is similar to the general Topoxté ceramic group. This trend suggests that the original slip color represents a larger range of colors than is present in the Topoxté sample as a whole.

All sherds represent body sherds that range in thickness from 4.88-11.35 mm ($\bar{x}$=5.98 mm, s.d.=1.64).

Table 46: Core Hardness Measurements for Technological Style Group 1

	Pre Refiring Hardness	Refired Hardness
Mode	3	3
Median	3	3
Range	2-3	3-4

Table 47: Interior Surface Hardness Measurements for Technological Style Group 1

	Pre Refiring Hardness	Refired Hardness
Mode	3	3
Median	3	3
Range	2-3	2-4

Table 48: Exterior Surface Hardness Measurements for Technological Style Group 1

	Pre Refiring Hardness	Refired Hardness
Mode	3	4
Median	3	4
Range	2-3	2-5

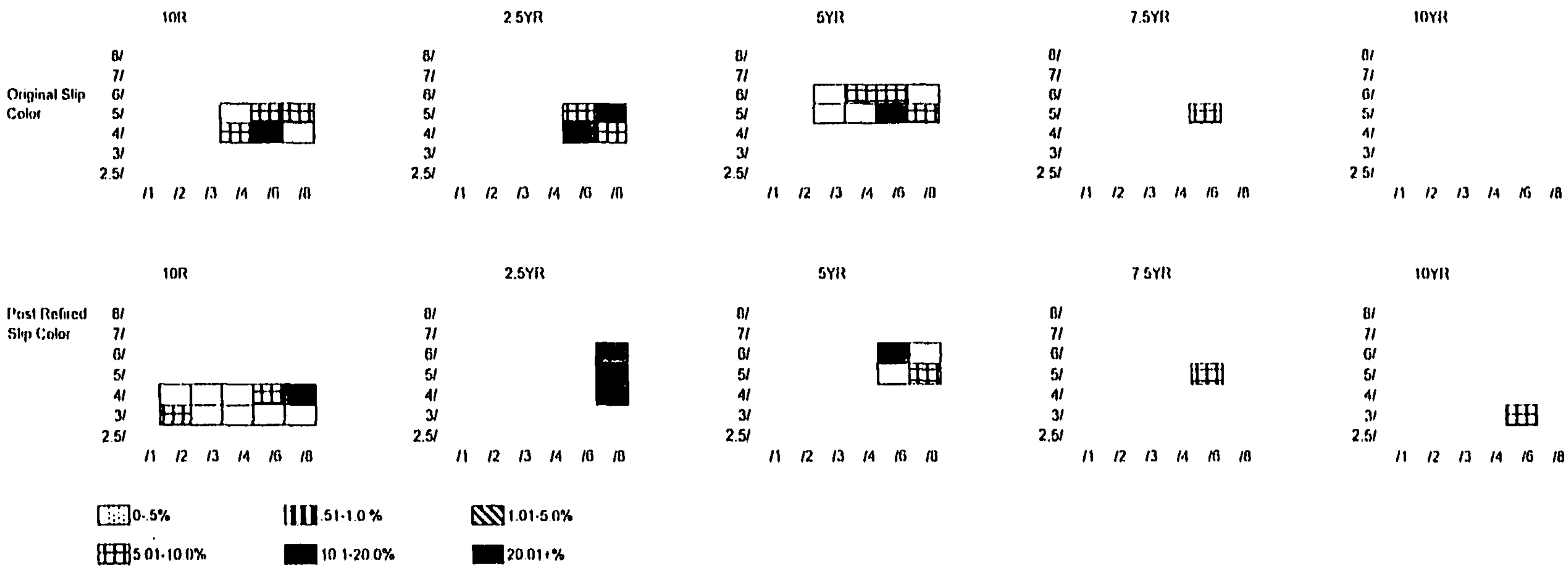


Figure 116: Exterior Slip Color Distribution of Technological Style Group 1

Table 49: Exterior Slip Color Diversity Indices for Technological Style Group 1

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	19	13	13	2.98	.83	.95
Post refiring	18	9	9	2.12	.69	.88

TSG 1 sherds were excavated at Ixlú and Tipuj. All Topoxté Red sherds excavated at Ixlú occur in this group. All sherds but one were located in the first three levels of Structures 2022 (open hall), 2023 (temple), 2034 (temple), and 2041 (elite residence). The other sherd was located in level 6d2 (the level of the skull line burial discussed in Chapter 2) of Structure 2023. At Tipuj, both sherds were located in surface collections of Structures 2 (temple) and 3 (open hall).

Small quantities of Topoxté Red sherds from Topoxté Island and from Macanché Island would also fit into this category. Thin Topoxté Red body sherds from Topoxté Island resemble those excavated at Ixlú and a small quantity of thin body sherds (2 mm) with a high percentage of voids in the clay paste also occurring at Macanché Island. These sherds have a low luster finish red slip (7.5 R 7/6 to 5YR 7/4), a pale red paste color (10YR 7/4), and a paste and slip Mohs' hardness of 2-2.5.

II. Technological Style Group 2

TSG 2 represents Augustine ceramic group sherds from Ch'ich' (n=6), Ixlú (n=9), and Zacpetén (n=6). The majority of the sherds in this group are slipped without decoration; however, three sherds have either black line painted decoration or incisions.

The dark red to yellowish red pastes (2.5YR5/8-5YR 5/6) of this group are dominated by pores with small amounts (less than 1%) of quartz, cryptocrystalline calcite, and hematite. Some long angular pores are the result of the inclusion of sponge spicules (Utgaard, personal communication, 2000). XRD analysis indicates that montmorillonite clay minerals compose the sherd paste and strong acid-extraction ICPS analysis distinguishes this group from TSG 3 (also an Augustine ceramic group) because of its low relative concentrations of Ca.

While the majority of TSG 2 sherds are estimated to have been fired to 600°C, 38% (eight sherds) of the sherds have a dark core and are estimated to have been fired between 300-550°C. The median estimated firing temperature is 600°C with a mode of 300°C and a range of 500°C (300-800°C). As a result of low original firing temperatures, core hardness is 3 and did not change after refiring experiments (Table 50).

Exterior and interior slipped surfaces have matte to low luster finishes and are red (10R 4/6-8 and 2.5YR 5-4/8). The two decorated interior surfaces have a yellowish-red (5YR 5/6-8) primary slip with a matte finish. All slipped surfaces have a hardness of 3 (Tables 51 and 52). When the exterior slip color diversity indices of TSG 2 (Figure 117 and Table 53) are compared to those of the Augustine ceramic group sample (Tables 9 and 10), some differences are noted. Richness indices of Group 2 are low except for a slightly higher index for post-refired sherds. Nevertheless, the overall lower richness numbers as compared to those of the other technological style groups suggest a lower level of variability. Evenness indices of TSG 2 are also considerably lower than those for the Augustine ceramic group, indicating that the slipped surfaces are more homogeneous than other technological style groups.

In addition to monochrome slipped sherds, two Pek Polychrome sherds and two Hobonmo Incised: Hobonmo Variety sherds occur in TSG 2 (Figure 118). Pek Polychrome decoration consist of curvilinear motifs, but the fragmentary nature of the

Table 50: Core Hardness Measurements for Technological Style Group 2

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	1 (3-4)	1 (3-4)

Table 51: Exterior Hardness Measurements for Technological Style Group 2

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	1 (3-4)	2 (3-5)

Table 52: Interior Hardness Measurements for Technological Style Group 2

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	1 (3-4)	1 (3-4)

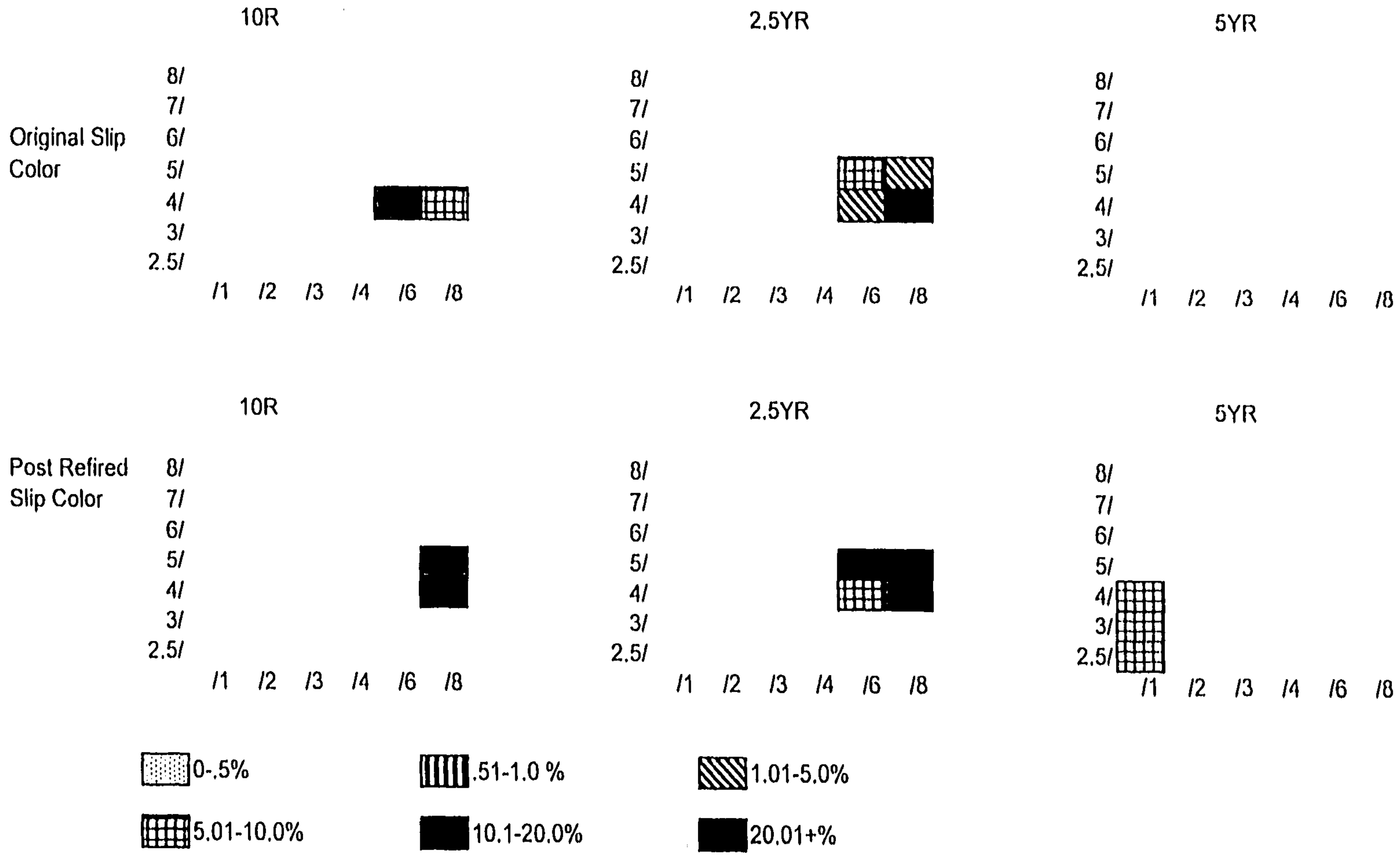


Figure 117: Exterior Slip Color Distribution of Technological Style Group 2

Table 53: Diversity Measurements of Exterior Slip Colors for Technological Style Group 2

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	21	6	6	1.31	.53	.81
Post Refiring	19	9	9	2.06	.68	.89

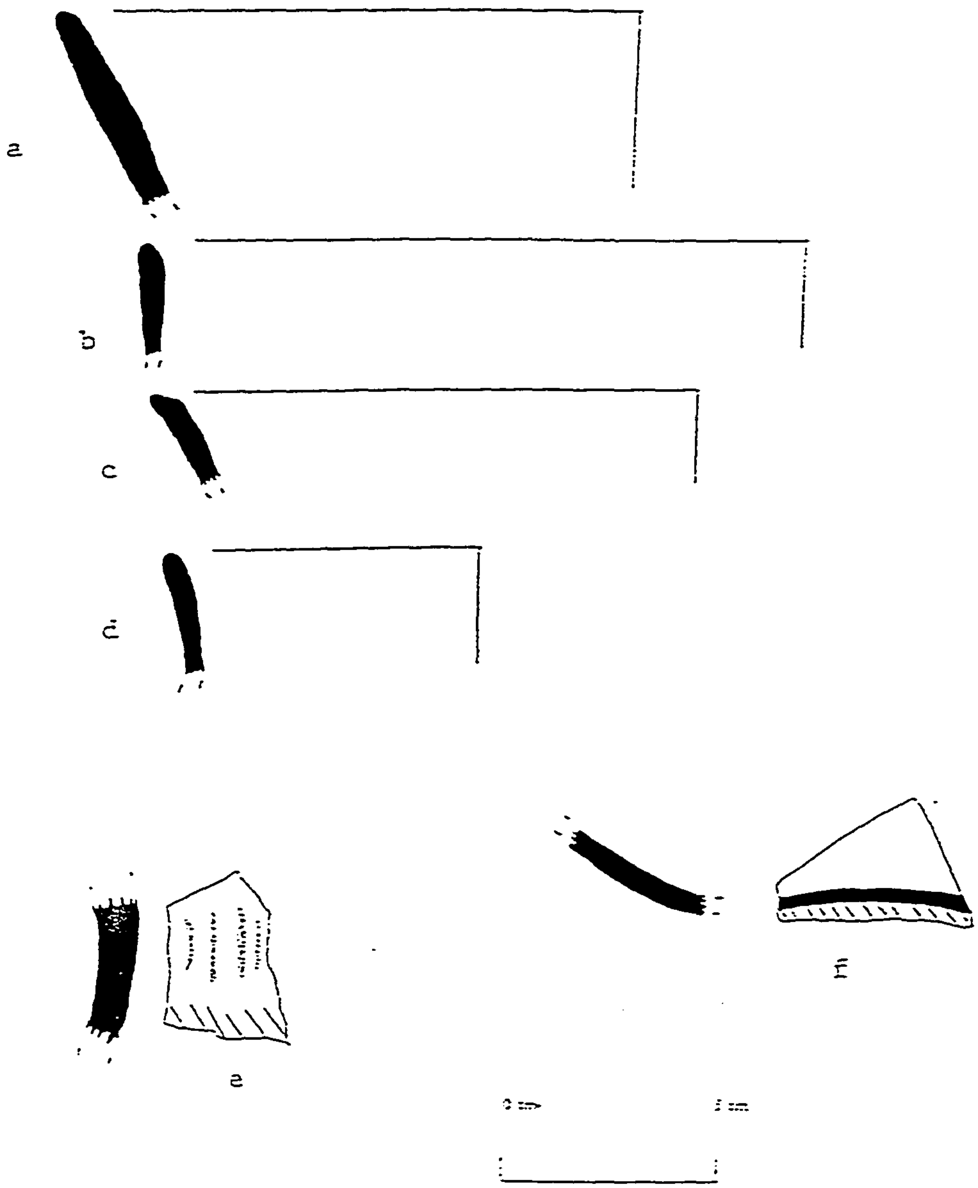


Figure 118: Technological Style Group 2 Sherd Profiles: a-d) Augustine Red; e) Hobonmo Incised: Hobonmo Variety; and f) Pek Polychrome.

sherds does not allow further interpretation. Hobonmo Incised drum sherds have groups of four vertically incised lines and slip begins 4-5 mm below the incisions.

Plates (n=2), collared jars (n=1), restricted orifice bowls (n=1), and narrow neck jars (n=1) occur in TSG 2. Plates from Zacpetén and Ch'ich' have diameters of 24 cm and 26 cm, respectively. The collared bowl from Zacpetén has a rim diameter of 18 cm. The restricted orifice bowl from Zacpetén has a rim diameter of 12 cm and the narrow neck jar from Ixlú has a rim diameter of 20 cm. The remaining 16 sherds represent body sherds from various vessel forms.

Sherds from Zacpetén were located in the first three levels of the following Structures: 719 (elite residence, open hall); 721 (temple); 748 (elite structure); and 764 (temple). Ixlú Structures 2021 (open hall), 2034 (temple), and 2041 (residence) contained TSG 2 sherds in the first three levels. Sherds from Structure 188 (open hall with shrine) at Ch'ich' came from the second level. All sherds in this group come from elite and/or ceremonial contexts.

TSG 2 sherds are also present at Tayasal and Macanché Island. Some Augustine Red and Hobonmo Incised: Hobonmo Variety sherds from Tayasal exhibit a fairly compact red (2.5YR 5-4/8) paste with a predominance of pores and small quantities of inclusions. Exterior slips appear to be thick with a low luster and a darker red color (10R 4/6). A small quantity of Augustine Red sherds from Macanché Island also resemble those previously described.

III. Technological Style Group 3

TSG 3 represents Augustine ceramic group sherds from Ch'ich' (n=20), Ixlú (n=19), Zacpetén (n=44), and Tipuj (n=50). The majority of sherds in this group are decorated by incising, or by black, or red-and-black painted decoration.

Red (10 R 4/6, 2.5YR 5-4/6-8) to reddish-brown (2.5YR 6/4) to reddish yellow (5YR 5/6) colored pastes contain euhedral, polycrystalline, and cryptocrystalline calcite, quartz, chert, chalcedony, biotite, and hematite inclusions. Five sherds have clay pastes dominated by small cryptocrystalline calcite (50%). XRD analysis demonstrates that montmorillonite clay minerals compose the clay portion of the sherds. In addition to the clay minerals and mineral inclusions listed above, XRD analysis also indicates the presence of gypsum in the clay paste. Strong acid-extraction ICPS analysis separates TSG 3 from TSG 2 because of its higher relative concentration of Ca (calcium).

The majority of sherds are estimated to have been fired to approximately 600°C. Few sherds in this group have a dark core (n=7), but approximately one half of the sherds are estimated to have been fired below 600°C (50 were estimated to have been fired to approximately 300°C and 15 were fired to approximately 550°C). The median estimated firing temperature is 600°C with a mode of 300°C and a range of 500°C (300-800°C). Core Mohs' hardness ranges from 2-4 and does not change when refired to 800 °C (Table 54).

Exterior slipped surfaces are red (10R 5-4/8, 2.5YR 5-4/8) and black (7.5YR 2.1) (Figure 119). Hardness of the exterior slips ranges from 1-5 with a median of 3 (Table

Table 54: Core Hardness Measurements of Technological Style Group 3

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	2-4	2-4

Table 55: Exterior Slip Hardness Measurements of Technological Style Group 3

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	1-3	2-5

Table 56: Interior Slip Hardness Measurements of Technological Style Group 3

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	2.5	3
Range	2-3	2-5

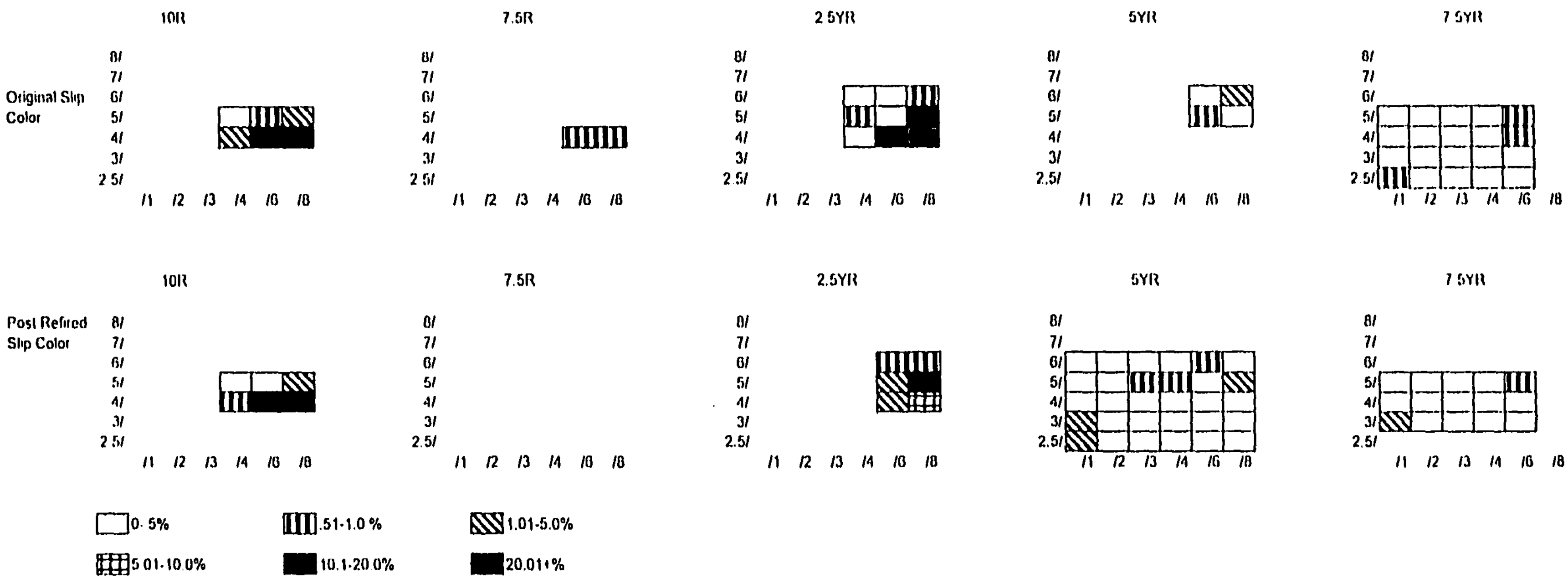


Figure 119: Exterior Slip Color Distribution of Technological Style Group 3

55). Interior slipped surfaces vary more because of the presence of primary slips of decorative panels. Interior red slips are red (10R 4/6 to 2.5YR 5-4/6-8) and primary slips range from light brown and reddish-yellow (7.5YR 6/4-8, 5YR 6/6-8) to very pale brown and yellow (10YR 7-6/4). Interior slip Mohs' hardness ranges from 2-5 with a median of 2.5 (original) and 3 (post-refiring) (Table 56). Exterior and interior slips have matte, low luster, or "waxy" finishes with "waxy" finished sherds occurring most frequently at Tipuj. The richness index of the slip colors of TSG 3 (Table 57) are similar to those of the Augustine ceramic group, suggesting low variability (Table 9 and 10). Evenness indices are lower than those of the Augustine ceramic group and TSG 2 indicating that the exterior slip color of TSG 3 has a smaller range of colors suggesting a better control of firing. Heterogeneity indices suggest that the exterior slips of TSG 3 encompass a wide range of colors similar to those of the Augustine ceramic group sample and TSG 2.

Although decoration areas are highly eroded, some black (Pek Polychrome) or red and black (Graciela Polychrome) painted or incised decoration remains (Figure 120). Pek Polychrome decorative motifs include hooks, plumes, curvilinear lines, and mats. Graciela Polychrome sherds most likely had decorated panels, but because of the fragmentary and eroded nature of the sherds, motifs are not detectable. Hobonmo Incised: Ramsey Variety decorations occur as *ilhuitl* glyphs, mat motifs, and plumes. Hobonmo Incised: Hobonmo Variety drum sherds from Tipuj have a series of four vertical incisions below which red slip begins.

Table 57: Diversity Measurements of Exterior Slip Colors for Technological Style Group 3

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	129	17	8	1.50	.43	.84
Post Refiring	123	18	12	1.62	.47	.85

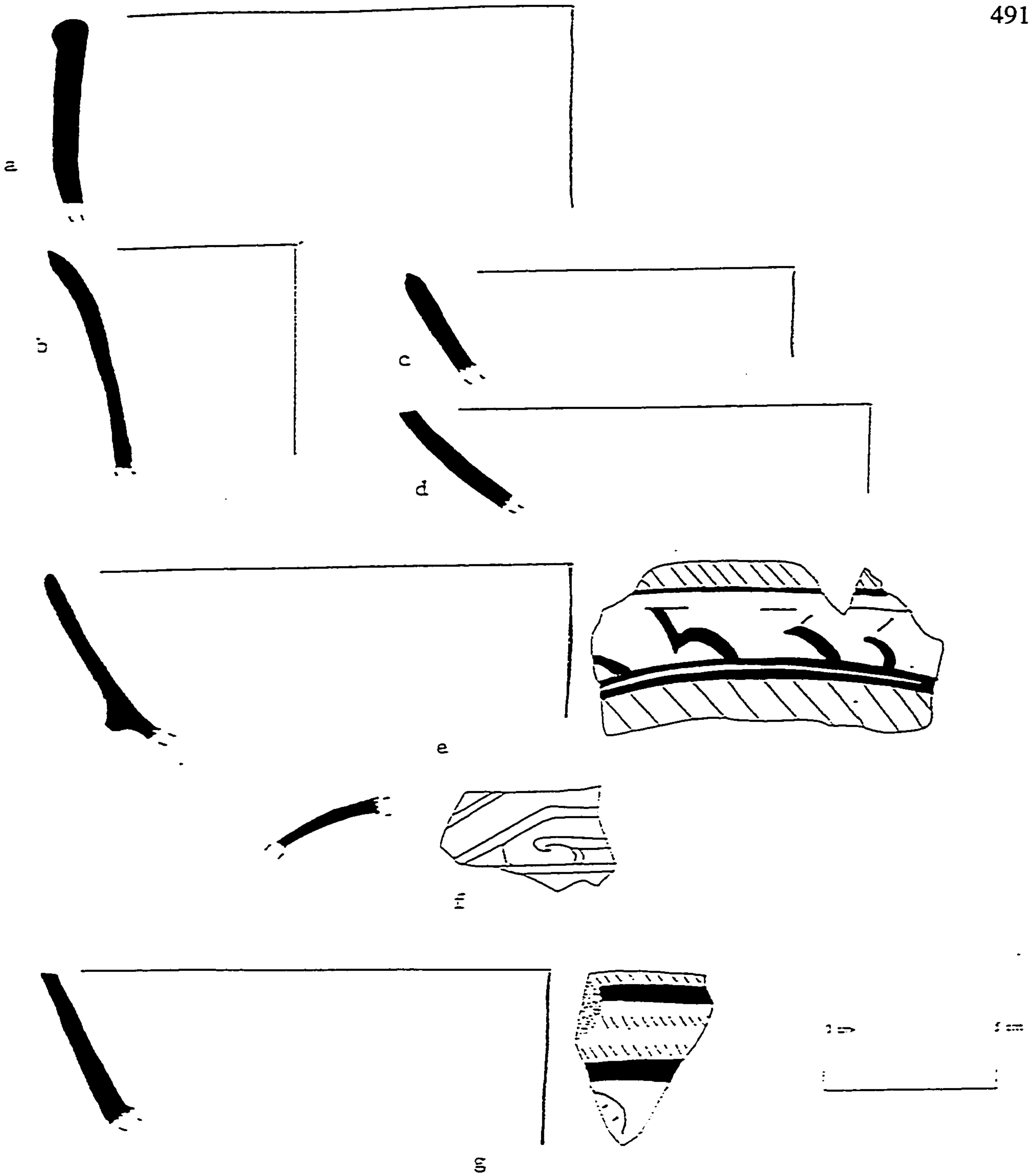


Figure 120: Technological Style Group 3 Sherd Profiles: a-d) Augustine Red; e) Pek Polychrome; f) Hobonmo Incised: Ramsey Variety; and g) Graciela Polychrome.

Tripod plates (n=29), flanged tripod plates (n=2), narrow neck jars (n=15), collared jars (n=23), restricted orifice bowls (n=3), and drums (n=2) occur in TSG 3. Descriptive statistics for the vessel forms appear in Table 58. The vessel rim diameter measurements are similar to those presented in Chapter 6.

Sherds from Zacpetén came from the first three levels of all structures except Structure 664 (residence). TSG 3 sherds also came from level four of Structure 764 (temple) and level 5 of Structures 758 (residence) and 766 (shrine). Sherds from Tipuj were found in all five excavated Postclassic structures and in all levels of Complex 1 at Tipuj. At Ixlú, TSG 3 sherds came from the first three levels the following structures: 2003 (domestic), 2006 (domestic), 2021 (open hall), 2022 (open hall), 2023 (temple), 2034 (temple), and 2041 (residence). TSG 3 sherds appear in the first three levels of Structure 188 (open hall with shrine) at Ch'ich'.

TSG 3 sherds can also be identified at Tayasal, Flores Island, and Macanché Island because of the similarities in the variety of pastes, slip colors, decoration, and vessel forms. Tayasal and Flores Island have a much higher frequency of TSG 3 sherds than does Macanché Island. In addition to their presence in the Petén lakes region, Augustine ceramic group vessels and sherds from Barton Ramie (Sharer and Chase 1976: 291-293) and Colhá (Valdez 1987:212, 216) can also be classified in TSG 3.

Table 58: Descriptive Statistics for Rim Diameters (cm) of Technological Style Group 3

	Mean	Mode	Median	Standard Deviation	Range
Tripod Plate (n=29)	26.38	24	26	4.33	20-44
Flanged Tripod Plate (n=2)	29	NA	29	1.41	28-30
Narrow Neck Jar (n=15)	21.60	24	22	7.10	8-34
Collared Jar (n=23)	26.91	28	28	5.42	16-36
Restricted Orifice Bowl (n=3)	21.67	20	20	2.89	20-25
Drum (n=2)	14.50	NA	14.5	2.12	13-16

IV. Technological Style Group 4

TSG 4 has sherds from the Paxcamán (n=126), Fulano (n=7), and Trapeche (n=41) ceramic groups from Ch'ich' (n=24), Ixlú (n=41), Zacpetén (n=75), and Tipuj (n=33). The majority of the sherds are decorated with incisions, or red, black, or red-and-black painting.

The light and pale brown (7.5YR 6/4, 5/3, 10YR 7-5/3) to pale yellow (2.5Y 7/3) to gray (2.5Y 5/1) pastes of this group are characterized by the presence of euhedral, polycrystalline, and cryptocrystalline calcite, pores, biotite, chalcedony, chert, quartz, and hematite minerals and shell. XRD analysis of sherds from TSG 4 demonstrates that montmorillonite is the primary clay mineral and that gypsum also occurs in the sherd paste. Strong acid-extraction ICPS analysis separates this group from TSG 5 (also a Volador Dull-Slipped ware group) because of slightly higher relative Fe and Zn concentrations.

Most sherds of TSG 4 have estimated firing temperatures of approximately 550°C. While the majority of the sherds are estimated to have been fired to temperatures from 550°- 800°C, 45 sherds (26%) have estimated firing temperatures that range from 300-500°C. These sherds exhibit a dark core that disappears when fired to 800°C. Paste Mohs' hardness ranges from 2-5 with a median of 3 (Table 59).

Exterior slips of this group vary more than most TSGs because Group 4 consists of red (10R 4/6, 2.5YR 5-4/4-8) Paxcamán ceramic group slips, dark gray to black (7.5R 3/1, 7.5YR 3/1, 5 YR 2.5/1) Fulano ceramic group slips, and "pink" (2.5YR 5/6-4, 7.5YR 6-5/6), Trapeche ceramic group slips (Figure 121). These slips have matte, low luster, or occasional "waxy" finishes with Mohs' hardnesses that range from 2-5 with an original hardness median of 2 that increases to 3 when refired to 800°C (Table 60). Interior slips demonstrate a similar color variability due to the inclusion of the three pottery groups and the presence of primary slips in the decorative panels of some sherds. Interior surface hardness resembles that of exterior slips described above (Table 61).

As would be expected from the variety of ceramic groups and types included in TSG 4, richness indices (Table 62) are also higher than most other TSGs and higher than those of the Paxcamán, Fulano, and Trapeche ceramic group richness measurements (Table 9 and 10). Although richness indices indicate a higher degree of variability in the number of colors present, evenness measurements are lower than those of the Paxcamán, Fulano, and Trapeche ceramic groups. The evenness indices resemble those of TSG 3 and suggest a more homogeneous sample. Conversely, heterogeneity indices suggest a wide range of colors resembling most other TSGs in this study and the Paxcamán, Fulano, and Trapeche ceramic groups.

Two-thirds of the sherds in TSG 4 are decorated with black (Ixpop Polychrome and Mul Polychrome), red (Macanché Red-on-paste, Sotano Red-on-paste, and Picté Red-on-paste), red-and-black (Sacá Polychrome) or incised (Picú Incised and Xuluc Incised) decoration (Figure 122). Typical black decorative motifs include hooks, plumes, stepped pyramids, circles with connecting lines, possible reptilian motifs, and variations of the *Lamat* glyph. Black-and-red decorative elements include hooks, plumes, embedded triangles, as well as other eroded geometric shapes. Red decoration typically appears as circles, hooks, curvilinear mat motifs, birds painted in negative relief (the background is red), stepped pyramids, and *ilhuitl* motifs. Incised decorative elements include the *ilhuitl*

Table 59: Core Hardness Measurements of Technological Style Group 4

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	2-3	2-5

Table 60: Exterior Slip Hardness Measurements of Technological Style Group 4

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	3
Median	2	3
Range	2-4	2-5

Table 61: Interior Slip Hardness Measurements of Technological Style Group 4

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	3
Median	2	3
Range	2-3	2-5

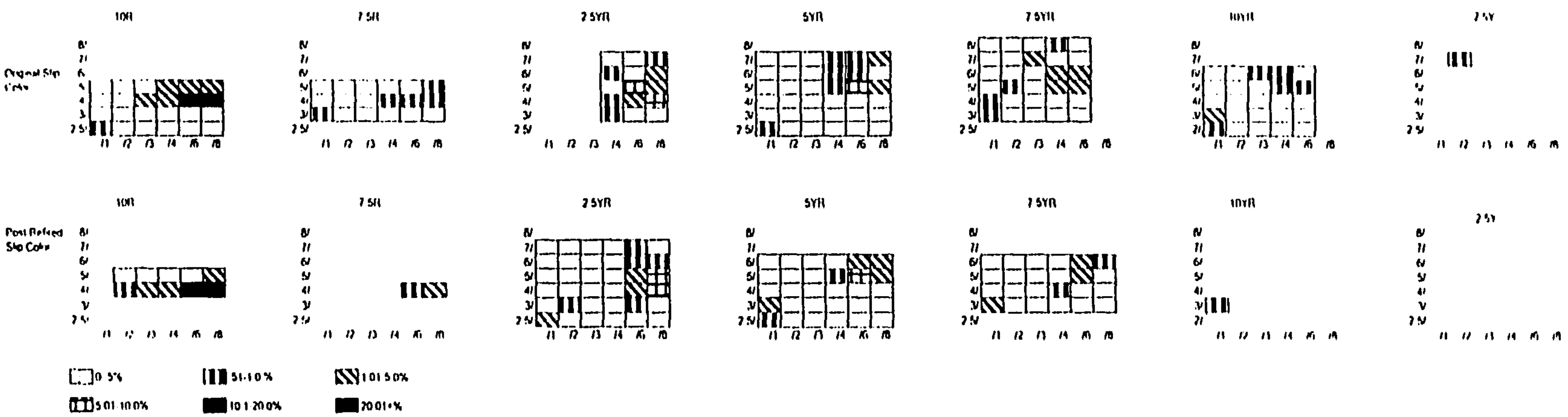


Figure 121: Exterior Slip Color Distribution of Technological Style Group 4

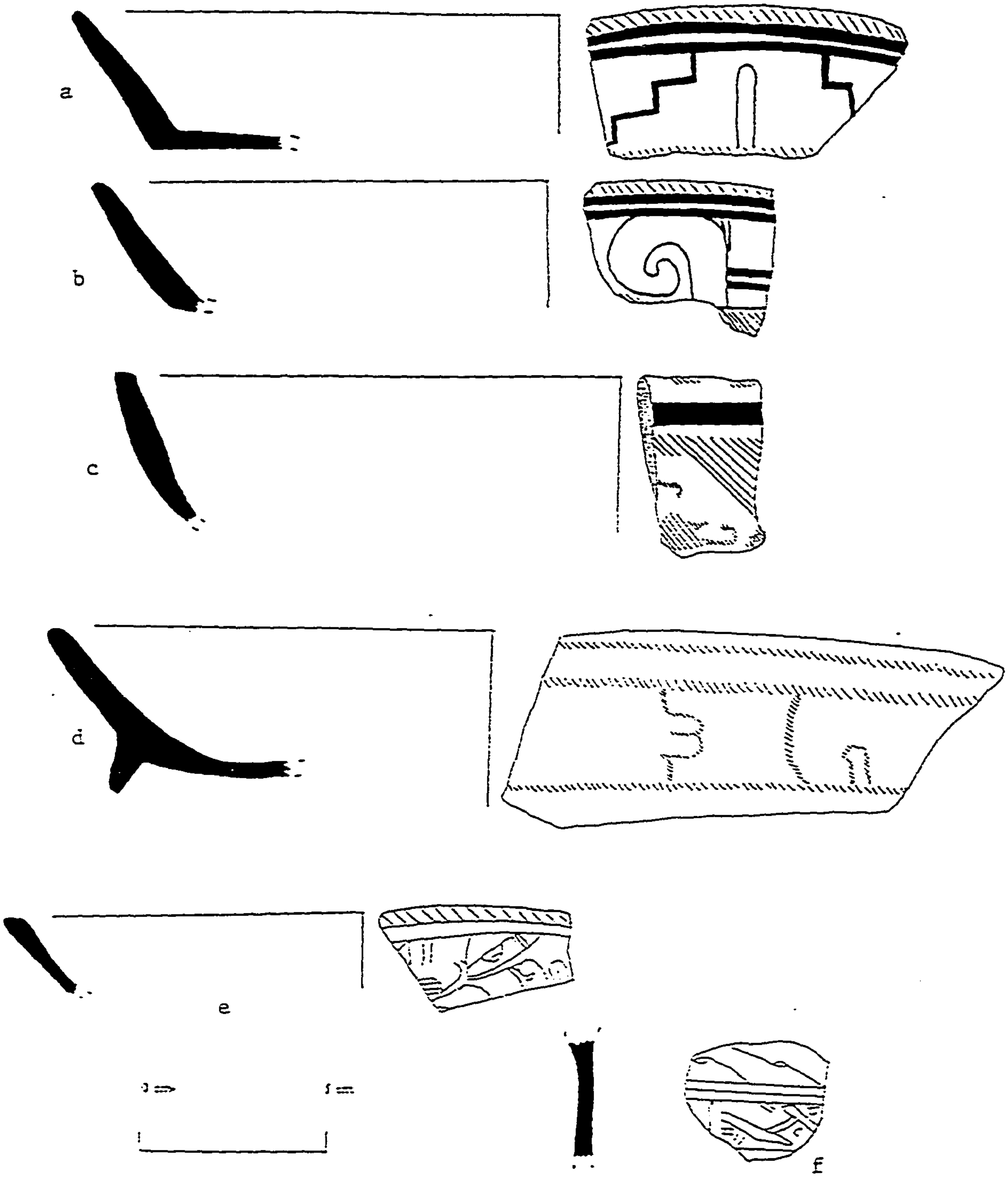


Figure 122: Technological Style Group 4 Sherd Profiles: a-b) Ixpop Polychrome; c) Sacá Polychrome; d) Macanché Red-on-paste: Macanché Variety; and e-f) Picú Incised: Picú Variety.

Table 62: Diversity Measurements of Exterior Slip Colors for Technological Style Group 4

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	159	48	21	3.81	.61	.92
Post Refired	171	31	19	2.37	.50	.92

motif, embedded triangles, hooks, plumes, circular elements, mat motifs, birds, and a possible split representation of the RE glyph.

TSG 4 consists of tripod plates (n=69), flanged tripod plates and bowls (n=4), collared jars (n=18), narrow neck jars (n=21), grater bowls (n=6), restricted orifice bowls (n=7) and drums (n=1)–in other words all of the Postclassic forms. Rim diameter measurements are within the range discussed in Chapter 6 and presented in Table 63.

Sherds from this group occurred in the first three levels of all structures; however, no sherds from Structures 602 (temple), 614 (oratorio), and 1002 (oratorio) at Zacpetén are included in this technological style group. They also occurred in levels 1-8 of Structure 719 (residence) at Zacpetén. TSG 4 sherds were located in the first three levels of all the structures at Ixlú [no sherds came from Structures 2010 (open hall) or 2017 (open hall)]. Sherds from this group were also located in level 6d2 (the level of the skull line burial) of Structure 2023. Sherds from Ch'ich' were located in the first three levels of Structure 188. Tipuj's TSG 4 sherds came from all levels and structures except for Structure 4 (open hall).

TSG 4 sherds also occur at Tayasal, Macanché Island, Topoxté Island, and Flores Island. All of these archaeological sites have black painted and incised types of the Volador Dull-Slipped ware. Of the black and incised types with hook or mat motifs, only a few have crystalline calcite, biotite, or chalcedony that are detectable by a hand lens. Sherds with red-and-black decoration exist in very small quantities at Macanché Island and Flores Island (n=14, each) and two sherds occur at Tayasal. All decorative motifs are eroded. Red decorations at Tayasal, Flores Island, and Macanché Island occur as

Table 63: Descriptive Statistics for Rim Diameters (cm) of Technological Style Group 4

	Mean	Mode	Median	Standard Deviation	Range
Tripod Plate (n=69)	24.78	22	24	3.96	14-34
Flanged Tripod Plate/Bowl (n=4)	24.50	20	21	7.72	20-36
Narrow Neck Jar (n=21)	20.33	14	20	7.29	11-38
Collared Jar (n=18)	24.89	32	28	8.55	6-34
Restricted Orifice Bowl (n=7)	17.57	10	14	10.98	9-40
Drum (n=1)	16	NA	NA	NA	16
Grater Bowl (n=6)	26.00	28	27	2.53	22-28

embedded triangles, hooks, and plumes. Therefore, I would include most of these sherds in Group 4 with the caveat that petrographic analysis was not possible. In addition to pottery from the Petén lakes region, vessels from Barton Ramie and Punta de Chimino described in Chapter 5 may also be included in this group.

V. Technological Style Group 5

TSG 5 is also composed of Paxcamán (n=63), Fulano (n=7), and Trapeche (n=32) ceramic group sherds from Ch'ich' (n=21), Ixlú (n=31), Zacpetén (n=31), and Tipuj (n=18). The majority of the sherds in this group are monochrome slipped.

The gray (1GLEY 4/1, 10YR 6/1, 2.5Y 6-5/1) to very pale brown (10YR 7/3) pastes are dominated by cryptocrystalline calcite with lesser amounts of hematite, shell, and pores. XRD analysis of the clay pastes in TSG 5 demonstrates that montmorillonite is the primary clay mineral and that gypsum also occurs in the clay paste. Strong acid-extraction ICPS analysis distinguishes TSG 5 from TSG 4 because of lower relative concentrations of Fe and Zn.

One-half of the sherds in this group have dark cores. Seventy percent of the sherds in TSG 5 have firing temperatures between 300-550°C with the remaining 30 percent of sherds being fired between 600-700°C (only 6 sherds are fired above 600°C). Median core Mohs' hardness is 3 with a range from 2-5 (Table 64).

Exterior slip colors vary from red (10R 5-4/6-8, 2.5YR 5-4/6-8) to black (2.5Y 2.5/1) to "pink" (2.5YR 5/6, 7.5YR 7-6/4, 10YR 6/2) (Figure 123). The variation in slip colors reflects the inclusion of the Paxcamán, Fulano, and Trapeche ceramic groups.

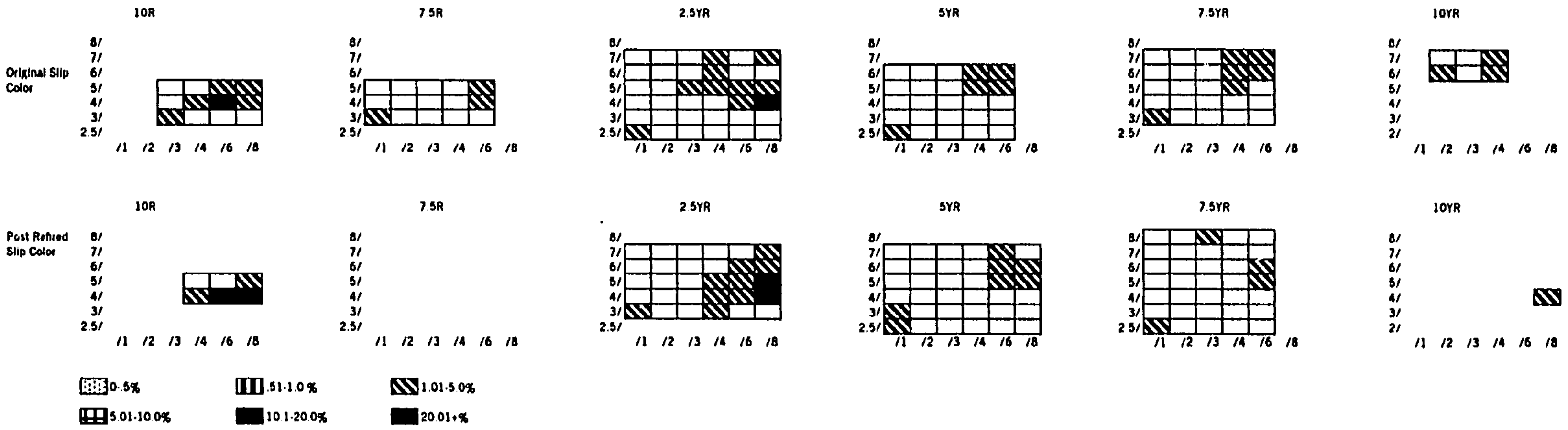


Figure 123: Exterior Slip Color Distribution of Technological Style Group 5

Interior slipped surfaces demonstrate a similar variety of colors with the addition of light gray to very pale brown primary slip colors (10YR 7/2-3) indicating the decorated sherds of this group. Exterior and interior Mohs' hardness ranges from 2-5 with pre-refiring mean hardness of 2 and a post-refiring mean hardness of 3 (Tables 65 and 66).

Diversity indices for TSG 5 (Table 67) differ slightly from those of TSG 4 and from the Paxcamán, Fulano, and Trapeche ceramic groups described in Chapter 6 (Table 9 and 10). Richness measurements are higher than those for the three ceramic groups and slightly lower than that of the original fired surfaces of TSG 4. Conversely, after refiring the sherds to 800°C, the richness index for TSG 5 is higher than that of TSG 4 suggesting that the exterior slips of TSG 5 have a slightly higher variability in color. Evenness indices are also slightly higher than those of TSG 4, but lower than the three ceramic groups that compose TSG 5. This demonstrates that while a mixed assemblage of slip colors exists in this group, the diversity is not as great as that of the Paxcamán, Fulano, and Trapeche ceramic groups. Finally, heterogeneity indices are identical to those of TSG 4 and only slightly higher than those of the three ceramic groups suggesting a wide range of colors in the technological style group.

The majority of the sherds in this group have a monochrome slip with matte, low luster, and "waxy" finishes (Figure 124). Thirty-two percent of the sherds are decorated with black (Ixpop Polychrome), red (Macanché Red-on-paste), red-and-black (Sacá Polychrome), or incised (Picú Incised and Mengano Incised) decorations. The majority of the decorated sherds (79%) have black painted decoration with hook, stepped pyramid,

Table 64: Core Hardness Measurements of Technological Style Group 5

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	2-3	2-5

Table 65: Exterior Slip Hardness Measurements of Technological Style Group 5

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	3
Median	2	3
Range	2-3	2-5

Table 66: Interior Slip Hardness Measurements of Technological Style Group 5

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	3
Median	2	3
Range	2-3	2-5

Table 67: Diversity Measurements of Exterior Slip Colors for Technological Style Group 5

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	93	34	34	3.53	.65	.92
Post Refiring	97	27	27	2.74	.60	.92

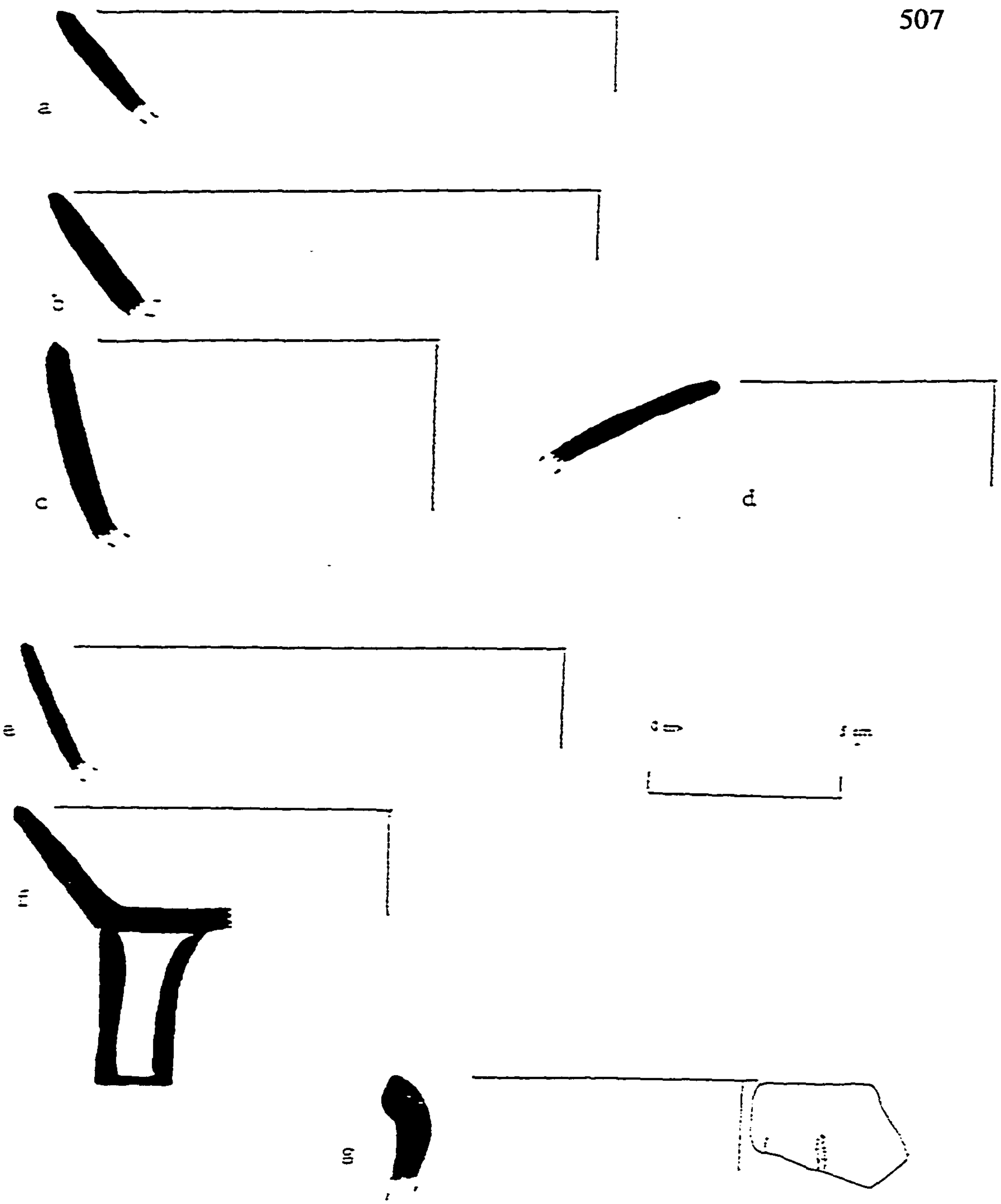


Figure 124: Technological Style Group 5 Sherd Profiles: a-d) Trapeche Pink; and e-f) Xuluc Incised: Tzalam Variety.

Lamat glyph, and other eroded design motifs. The three Sacá Polychrome sherds are fragmentary and eroded with only circumferential bands denoting a decorative area. Macanché Red-on-paste decorative motifs (n=2) consist of hooks and Picú Incised: Picú Variety and Mengano Incised decorations occur as circumferential bands of repeated mat motifs.

Tripod dishes (n=38), flanged tripod dishes (n=3), grater bowls (n=3), narrow neck jars (n=6), collared jars (n=7), and restricted orifice bowls (n=2) occur in TSG 5. With the exception of tripod dishes and flanged tripod dishes, TSG 5 rim diameters are slightly smaller, but within the range of the standard deviation (Table 68). Tripod plates and flanged tripod dish diameter means are slightly larger than TSG 4, but again are within the standard deviation range of Group 4.

TSG 5 sherds from Zacpetén were excavated in the first three levels of Structures 601 (raised shrine), 603 (sakbe), 605 (oratorio), 606 (open hall), 719 (residence), 720 (statue shrine), 721 (temple), 732 (residence), 747 (residence), 758 (residence), 764 (temple), and 765 (raised shrine). In addition to the first three levels of excavation, TSG 5 sherds also came from excavation levels 4 and 7 of Structure 719 and level 4 of Structure 758. All structures but Structure 2006 (residence), 2010 (residence), 2015 (open hall), and 2020 (oratorio) at Ixlú had sherds from this group in the first three levels. Ch'ich' Structure 188 (open hall with shrine) and Tipuj's Structures 1 (oratorio), 2 (temple) and 3 (open hall) also had these sherds in the first three levels of excavation.

TSG 5 sherds also exist at Tayasal, Flores Island, and Macanché Island. In general, most Paxcamán, Fulano, and Trapeche ceramic group sherds with the ceramic

Table 68: Descriptive Statistics for Rim Diameters (cm) of Technological Style Group 5

	Mean	Mode	Median	Standard Deviation	Range
Tripod Dish (n=38)	25.11	22	25	3.91	16-36
Flanged Tripod Dish (n=3)	26.67	NA	26	3.06	24-30
Narrow Neck Jar (n=6)	17.00	10	12	10.94	8-36
Grater Bowl (n=3)	24.00	22	22	3.46	22-28
Collared Jar (n=7)	32.29	30	32	3.55	28-38
Restricted Orifice Bowl (n=2)	15	NA	15	1.41	14-16

paste and mineral inclusions described above are monochrome slipped. Nine sherds from the three sites are decorated with black or red painted designs in the form of hook motifs. I would also include the gray and black paste Paxcamán sherds and vessels from Barton Ramie (Sharer and Chase 1976:295), the gray compact paste Paxcamán sherds and vessels from Punta de Chimino (Foais 1996:721-726), and the Paxcamán sample from Colhá (Valdez 1987:224) in TSG 5.

VI. Technological Style Group 6

TSG 6 represents Topoxté ceramic group sherds from Zacpetén (n=22) and Tipuj (n=15). The sherds are either monochrome slipped (Topoxté Red) or decorated with red paint that is darker than the red slip color (Chompoxté Red-on-cream).

Cryptocrystalline calcite dominates the very pale brown (10YR 8/2-4, 7/3-4) to light brownish gray (10YR 6/2) to white (10YR 8/1) marly pastes of this group. Small quantities (less than 3 %) of euhedral and polycrystalline calcite, quartz, hematite, and biotite minerals also occur in the sherd pastes. XRD analysis indicates that montmorillonite is the primary clay mineral and that gypsum minerals are also in the sherd paste. Strong acid-extraction ICPS analysis distinguishes this group from TSGs 1 and 7 (other Clemencia Cream Paste ware groups) because of its slightly higher relative concentrations of Zn and Ca.

The majority of sherds in TSG 6 (63%) were estimated to have been fired below 600°C (10 were estimated to have been fired to 300°C, 4 were fired to an estimated 500°C, and 9 were fired to an estimated 550°C). Only nine sherds were estimated to have been fired to 600°C and five were fired to an estimated 650°C. Although a large range of estimated firing temperatures exists with a mode of 300°C, only six sherds have a darker core. Core Mohs' hardness is 3 and does not change after refiring experiments (Table 69).

Exterior and interior slips are red (10R 5-4/6-8, 2.5YR 5/8) with matte to low luster finishes. Decorated sherds have motifs painted directly on the paste or a creamy primary slip (10YR 8-7/2-3) with a similar color as the paste color. Exterior slip Mohs' hardness ranges from 1.5-4 with a median of 2 or 3 (pre- and post-refiring, respectively) and interior slipped surfaces have a median hardness of 2 with a range of 1.5-3 (Tables 70 and 71).

TSG 6 original exterior slip color diversity (Figure 125) and richness measurements are lower than those of TSGs 1 and 7 and the Topoxté ceramic group; however, the post-refiring richness is higher than any other Topoxté group (Table 72). This indicates that the original slip colors were less variable and perhaps the result of a better controlled firing process. In support of this statement, when the same sherds were refired to 800°C, the exterior slip colors became more variable. Evenness indices are higher than those of TSGs 1 and 7 and the Topoxté ceramic group suggesting a mixed assemblage of colors. Heterogeneity indices are similar to those of TSGs 1 and 7 and higher than those of the Topoxté ceramic group also indicating a wide range of colors.

Banded and unbanded red (10R 4/4-6, 7.5R 3/6) painted decoration is darker than the exterior red slip. Curvilinear lines, parentheses, and *ajaw* glyphs encompass the decorative motifs of the TSG 6 (Figure 126). One unslipped drum fragment with three

Table 69: Core Hardness Measurements of Technological Style Group 6

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	3
Median	3	3
Range	2-3	2-3

Table 70: Exterior Slip Hardness Measurements of Technological Style Group 6

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	2
Median	2	3
Range	2-3	1.5-4

Table 71: Interior Slip Hardness Measurements of Technological Style Group 6

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	2
Median	2	2
Range	2-3	1.5-3

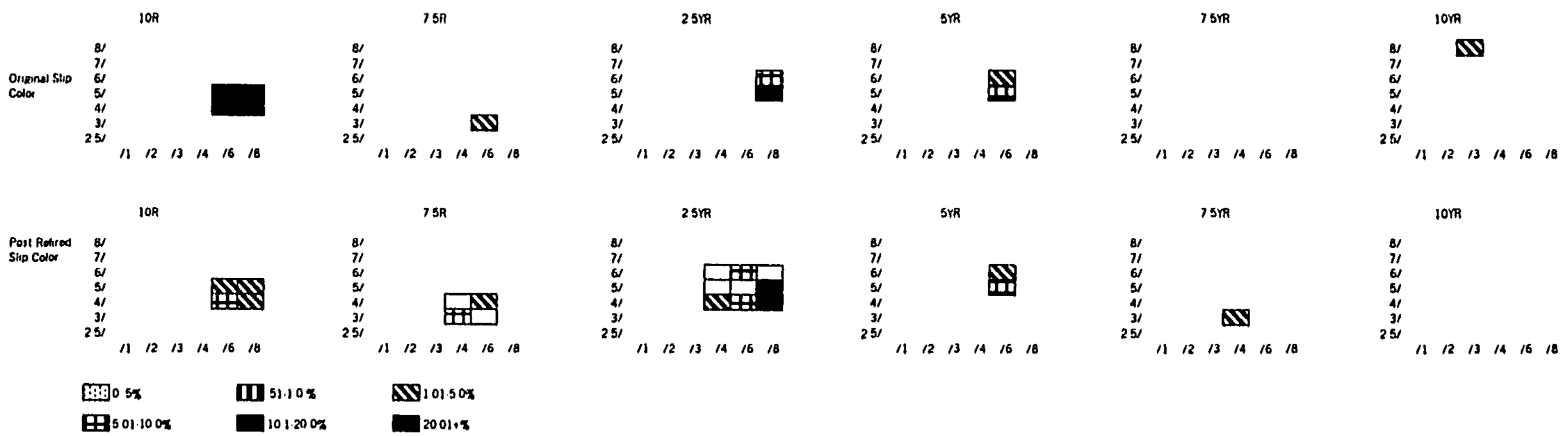


Figure 125: Exterior Slip Color Distribution of Technological Style Group 6

Table 72: Diversity Measurements of Exterior Slip Colors for TSG 6

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	28	9	9	1.70	.90	.94
Refired Slip	32	14	14	2.47	.91	.92

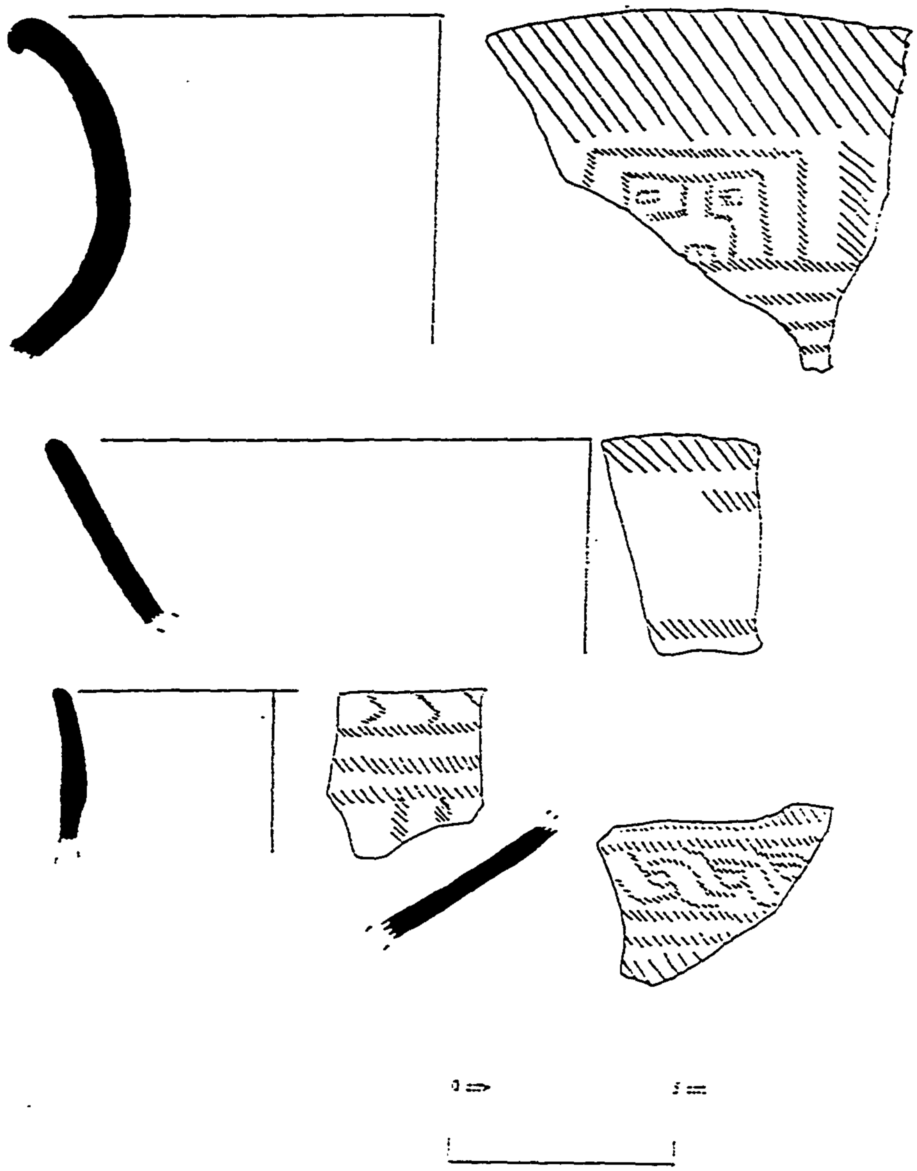


Figure 126: Technological Style Group 6 Sherd Profiles: Chompoxté Red-on-paste: Akalché Variety.

vertical incisions below the rims is also included in this group.

Vessel forms represented by this group include tripod plates (n=11), collared jars (n=2), narrow neck jars (n=2), and drums (n=1). Rim diameter descriptive statistics appear in Table 73. Tripod plates and collared jars have small rim diameter means of 22.7 cm and 20 cm, receptively. These means resemble those at Macanché Island and Topoxté Island. Too few narrow neck jars and drums occur for comparison.

TSG 6 sherds were excavated from the first three levels of Structures 606 (open hall), 615 (open hall), 664 (residence), 719 (residence), 721 (temple), 732 (residence), 748 (unknown), 758 (residence), 765 (raised shrine), and 767 (open hall), as well as from level 5 of Structure 719 at Zacpetén. Sherds from Tipuj were excavated from the first two levels of Structures 1 (oratorio), 2 (temple), and 3 (open hall).

Sherds from Tayasal, Macanché Island, and Topoxté Island were also included in TSG 6 because of decoration and paste similarities. The two Chompoxté Red-on-paste: Chompoxté Variety and four Topoxté Red sherds from Tayasal have marly pastes that lack euhedral calcite. Various Chompoxté Red-on-paste sherds from Macanché Island and Topoxté Island also have pastes that lack euhedral calcite as well as similar decorative motifs described above.

VII. Technological Style Group 7

TSG 7 also includes Topoxté ceramic group sherds from Zacpetén (n=33) and Tipuj (n=34). The majority of sherds in this TSG have black (Pastel Polychrome), red (Chompoxté Red-on-paste), and red-and-black (Canté Polychrome) painted decoration as

Table 73: Descriptive Statistics for Rim Diameters (cm) of Technological Style Group 6

	Mean	Mode	Median	Standard Deviation	Range
Tripod Dish (n=11)	22.7	22	22	2.87	18-28
Collared Jar (n=2)	20	NA	20	8.49	14-26
Narrow Neck Jars (n=2)	13	NA	13	7.07	8-18
Drum (n=1)	8	NA	NA	NA	8

well as some undecorated sherds.

White, pink, and very pale brown (7.5YR 8-7/3, 10YR 8-7/1-3) marly pastes contain euhedral, polycrystalline, and cryptocrystalline calcite, hematite, quartz, biotite, chalcedony, and chert minerals. XRD analysis demonstrates that montmorillonite is the primary clay mineral and that gypsum is also present in the clay paste. Strong acid-extraction ICPS analysis separates this group from TSGs 1 and 7 because of lower relative concentrations of Al, Fe, and Ti.

Dark cores are uncommon (12%) and this is reflected in a wide range of firing temperatures (300-700°C). The median estimated firing temperature was 550°C with slightly less than one-half of the group being estimated to have been fired between 600-700°C. Although a large portion of the sherds in this sample were estimated to have been fired at relatively high temperatures, 21 sherds were estimated to have been fired to approximately 300°C. The median Mohs' hardness of the original core is 3 and changes to 2 when refired to 800°C (Table 74).

Undecorated exterior and interior surfaces are slipped red (10R 5-4/4-8, 2.5YR 5-4/6-8). Decoration panels have a very pale brown (10YR 8-7/2-3) to red (2.5YR 5/8) primary slip. The slipped surfaces have a matte, low luster, or "waxy" finish with a median hardness of 2 and 2.5 (pre- and post-refiring experiments, respectively) (Tables 75 and 76). Exterior slips demonstrate a moderate degree of variation as seen in the diversity of slip colors (Figure 127) and in richness indices. The variability decreases when all sherds are fired to 800°C and the indices are within the same range as TSG 1 and the Topoxté ceramic group (Table 77). Evenness and heterogeneity indices also resemble

Table 74: Core Hardness Measurements of Technological Style Group 7

	Pre Refiring Hardness	Post Refiring Hardness
Mode	3	2
Median	3	2
Range	2-4	2-3

Table 75: Exterior Slip Hardness Measurements of Technological Style Group 7

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	2
Median	2.5	2
Range	2-3	2-4

Table 76: Interior Slip Hardness Measurements of Technological Style Group 7

	Pre Refiring Hardness	Post Refiring Hardness
Mode	2	2
Median	2	2
Range	2-3	2-4

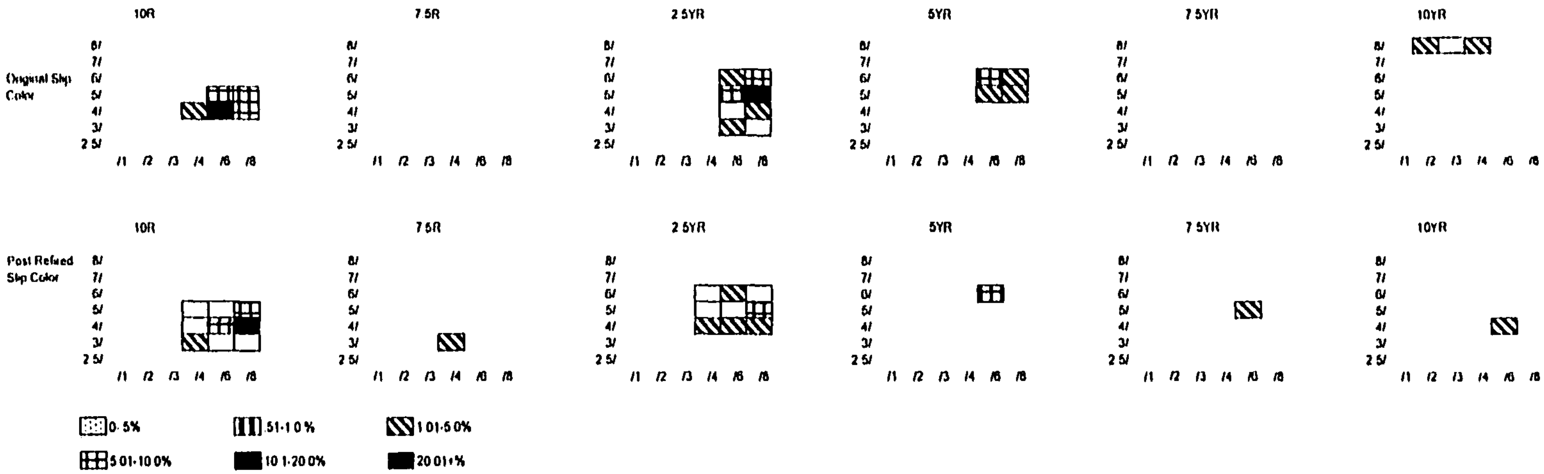


Figure 127: Exterior Slip Color Distribution of Technological Style Group 7

Table 77: Diversity Measurements of Exterior Slip Colors for Technological Style Group 7

	Sample Size	Total Number of Colors Recorded	Number of Colors Consisting of More than 1.0% of the Sample	Richness	Evenness	Heterogeneity
Original	56	18	18	2.41	.85	.96
Refired Slip	63	15	15	1.89	.75	.83

those of TSG 1 and the general Topoxté ceramic group. The diversity indices indicate a mixed assemblage of slip colors.

In addition to monochrome slipped sherds (Topoxté Red), black (Pastel Polychrome), red (Chompoxté Red-on-paste) and red-and-black (Canté Polychrome) painted decorations occur on sherds from TSG 7 (Figure 128). Black decoration typically occurs as hooks and parentheses motifs. Although most red-and-black painted decorations are eroded, one sherd has a black curvilinear decoration surrounded by red dots. Unlike black and red-and black painted decorations, red motifs appear in positive and negative painting. Decorative motifs include stepped pyramids, stepped pyramids encircled by small red dots, circles, birds, plumes, mats, and possible aquatic creatures.

Tripod plates (n=28), collared jars (n=8) , restricted orifice bowls (n=3), and narrow neck jars (n=8) occur in TSG 7. Descriptive statistics for the rim diameters of these forms are presented in Table 78. Most vessel rim diameters are similar, with the exception of tripod plates that have slightly larger rim diameters.

TSG 7 sherds from Zacpetén were excavated from the first three levels of Structures 601 (raised shrine), 603 (sakbe), 606 (open hall), 664 (residence), 719 (residence), 732 (residence), 747 (residence), 748 (unknown), 758 (residence), 764 (temple), 765 (raised shrine), and 767 (open hall) as well as from level 5 of Structure 719 and level 4 of Structure 758. Sherds from Tipuj were excavated from the first three levels of Structures 1 (oratorio), 2 (temple), 3 (open hall) and 4 (open hall).

Pastel and Canté Polychrome sherds from Macanché Island and Topoxté Island would also be included in TSG 7. In addition to the polychrome types of this group, I would include Chompoxté Red-on-paste sherds that have euhedral calcite in the clay

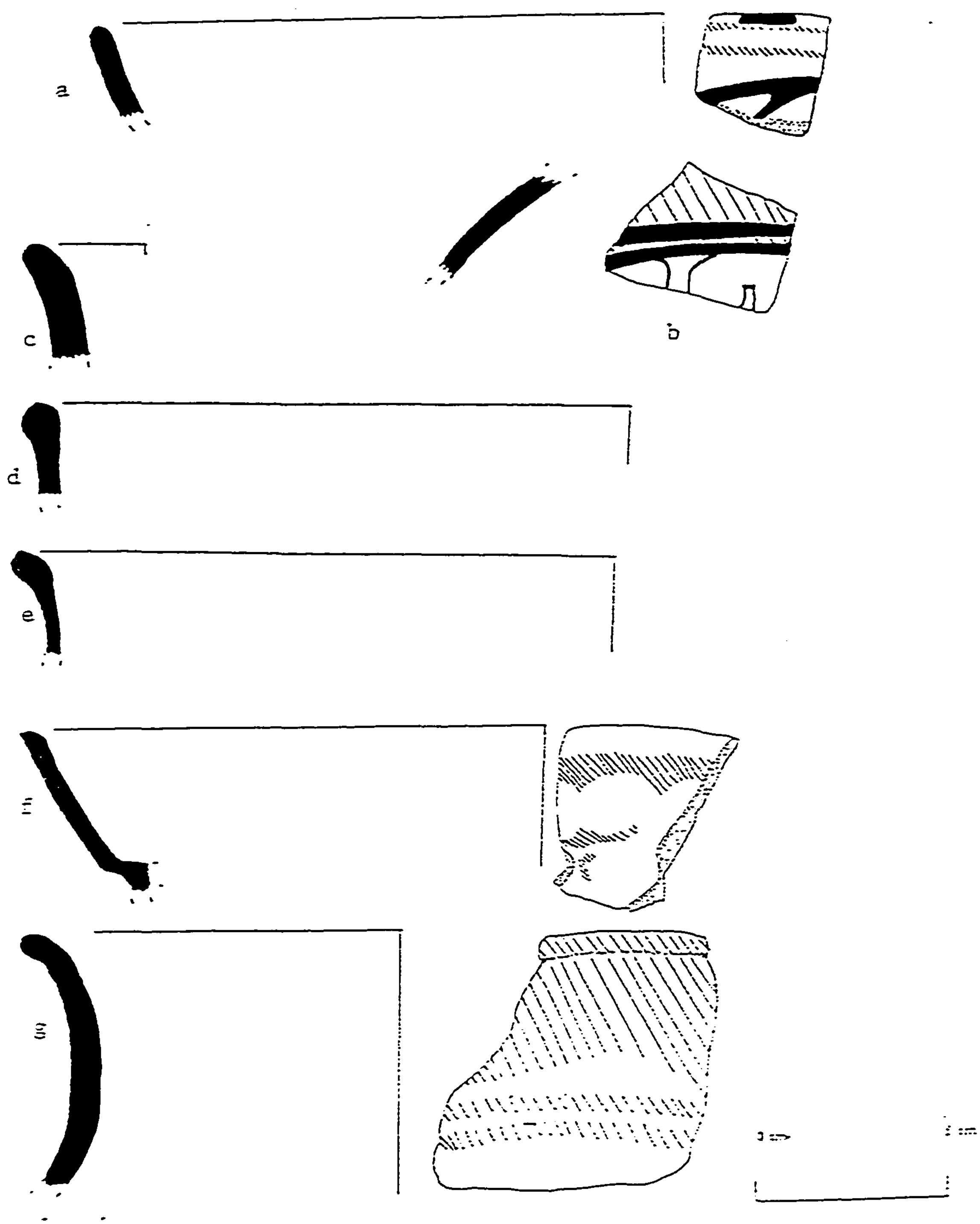


Figure 128: Technological Style Group 7 Sherd Profiles: a) Canté Polychrome; b) Pastel Polychrome; c-e) Topoxté Red; f) Chompoxté Red-on-paste: Chompoxté Variety; and g) Chompoxté Red-on-paste: Akalché Variety.

Table 78: Descriptive Statistics for Rim Diameters (cm) of Technological Style Group 7

	Mean	Mode	Median	Standard Deviation	Range
Tripod Dish (n=28)	23.93	26	24	3.20	18-28
Collared Jar (n=8)	22.00	NA	25	11.41	4-34
Restricted Orifice Bowl (n=3)	23.33	NA	22	4.16	20-28
Narrow Neck Jar (n=8)	24.25	20	22	5.70	18-32

paste. However, to ensure correct identification, petrographic examination needs to be conducted to ensure the presence of biotite, chalcedony, and chert in the clay paste.

In sum, the combination of clay paste characteristics, inclusions, and decorative attributes result in seven technological style groups. The technological style groups combine choices made by potters such as clay, mineral, and pigment resource selection as well as general knowledge of the potter as seen in firing technologies and decorative motifs. The existence of technological styles based on the above three criteria demonstrates that the Kowoj and the Itzá made technological and stylistic choices in the manufacturing of pottery that reflect their separate social identities (Figure 129). Petén Postclassic slipped pottery was created with different types of clay pastes, inclusions, and decoration and these choices reflect the compatibility of technological and stylistic choices as defined by cultural groups. The differences reinforce existing social structures present in other forms of material culture. The next chapter will discuss how and why these technological style groups reflect Petén Postclassic Maya social/ethnic groups during the 17th century.

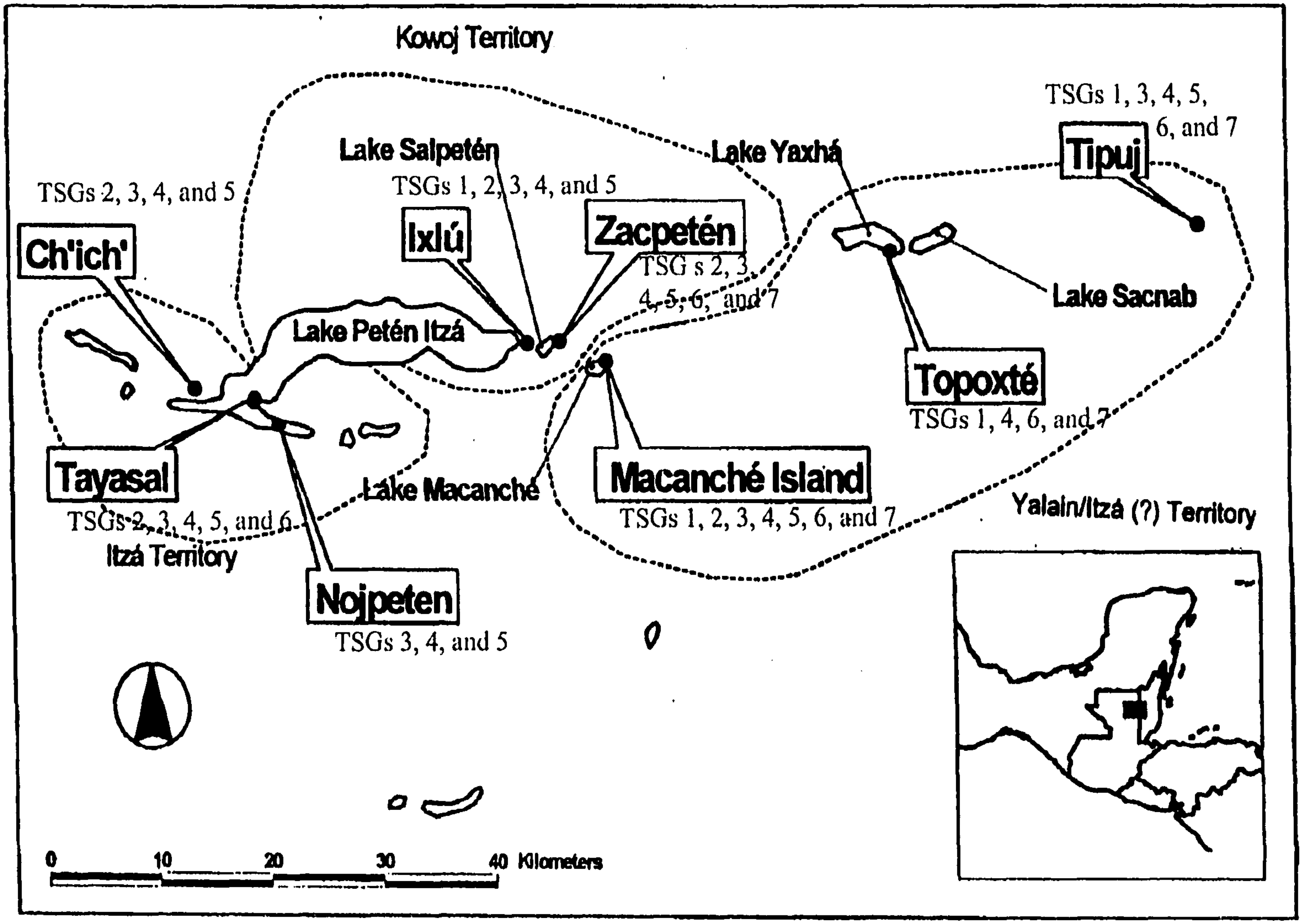


Figure 129: Technological Style Groups and Their Presence at Archaeological Sites in the Study.

CHAPTER 10

INTERPRETATION OF PETÉN POSTCLASSIC SLIPPED POTTERY TECHNOLOGICAL STYLES AND THEIR RELATION TO SOCIAL GROUPS IN THE PETÉN LAKES REGION

"Low tech," mineralogical, and chemical analyses distinguish the seven technological style groups (TSGs) described in Chapter 9. When these characteristics are examined together with ethnohistorical, architectural, burial, and decoration color and motif data from archaeological sites in Petén and northern Yucatán, I can suggest which social group may have produced which technological style. This is because technological styles result from choices made by Postclassic Petén Maya potters within a social structure that embodies their identity. The existence of technological style characteristics, embedded in structure and agency, allows the archaeologist to study materials such as clay and mineral inclusions and patterns of pottery manufacture such as vessel form and decoration as practice. As such, the patterns of manufacture are not merely "'added on' in order to signal group identity," but are choices made by the potter "by which a sense of group identity is formed and transformed as being coeval with and identical to the process by which a sense of technique is formed and transformed" (Dietler and Herbich 1988:247). A sense of group identity may have been important in Postclassic Petén because of the unstable conditions brought on by wars, changing social boundaries, and changing positions of dominance. As such, Maya potters, as well as other members of Maya society, may have continually constructed and reconstructed their identity by creating and recreating their social structures through daily activities such as pottery manufacture (Giddens 1984:17).

As a daily activity, pottery manufacture becomes a social activity when the choices made during the manufacturing process are examined as a social phenomenon. The patterns of manufacture (choices) are made in a specific manner, under the umbrella of the Postclassic Maya social structure and are reproduced. As such, patterns of manufacture may be reproduced without the potter being fully cognizant of the set of "rules" or operational sequences established through the mediation of structure and agency. For example, a clay source may be continually used without question because one social group does not have access to clays in another territory or because it is customary to use that source. "These dispositions of choice and perceptions of the possible in the technical domain are interwoven with similarly formed patterns of choice and perceptions in the domain of social relations and cultural categories in ways that evoke and reinforce each other such that they come to be perceived as 'natural'" (Dietler and Herbich 1998:246). Therefore, clusters of traits of Postclassic Petén pottery technological styles, architectural designs, and burial practices are compatible with the social structures and they reflect the social identity and history of the culture that produced them.

According to ethnohistorical documents, Petén Postclassic social/ethnic groups, primarily the Itzá, Yalain, and Kowoj, contested socio-political boundaries and changed alliances (Jones 1998). If boundaries were established because of this unrest, access to resources may have influenced the choices that Maya potters made during manufacturing because some social groups may not have access to specific resources within another social group's territory. Choices based on resources include clays, pigments, and fuel for firing.

I. Pottery Wares

The seven Petén Postclassic slipped pottery technological styles correlate to the three archaeologically recognized wares: Clemencia Cream Paste ware (TSGs 1, 6, and 7); Volador Dull-Slipped ware (TSGs 4 and 5); and Vitzil Orange-Red ware (TSGs 2 and 3). The ware distinctions are partially based on differences in clay paste colors, "cream," gray, and red, respectively, suggesting the existence of at least three different resources used for pottery manufacture. Although archaeologists have not located the different clay resources, discussion of the distribution of sherds made from these clays in the Petén lakes region provides information as to why there are differences in technological styles and who produced the different technological styles.

First, pottery of Clemencia Cream Paste ware is made from marly clays with very little iron content. A petrographic and x-ray diffraction examination of clays from the Yaxhá area and sherds made from the Clemencia Cream Paste ware suggest that Clemencia Cream Paste ware pottery was made from local clays near Yaxhá. Late Classic "cream" paste pottery from Yaxhá suggests that these clay resources may have been used before the Postclassic period (Hermes et al. 1996). Postclassic Clemencia Cream Paste ware pottery is found primarily at sites in the eastern portion of the central Petén lakes region–Zacpetén, Macanché Island, Topoxté Island, and Tipuj. Some sherds appear at sites to the west (Ixlú and Tayasal); however, they do not occur in any appreciable quantity. According to Jones (1998:Map 5 and 6), the ethnohistoric data suggest that the Yalain and/or Kowoj occupied the eastern portion of the Petén lakes region in the Late Postclassic period (see Figure 1). Archaeological evidence, civic-ceremonial and burial, also indicates Kowoj affiliation. Therefore, I would suggest that the Clemencia Cream Paste ware clay source existed in the Yalain and/or Kowoj territory and pottery made from that clay was traded mainly within that territory.

Second, in contrast to the Clemencia Cream Ware pottery, Vitzil Orange-Red ware pottery is made of coarse high-iron clays with calcite, quartz, chert, chalcedony and biotite mineral inclusions. This pottery is found most prominently at archaeological sites in the western portion of the central Petén lakes region–Ch'ich', Tayasal, and Nojpeten. In addition to these three sites, Vitzil Orange-Red ware pottery is prominent at Tipuj in Belize. The majority of slipped Postclassic pottery at Barton Ramie is also Vitzil Orange-Red ware pottery (Sharer and Chase 1976). Although Vitzil Orange-Red ware sherds appear at all sites in the Petén lakes region, they do not constitute the majority of the sherds in the various pottery collections at all sites. Therefore, differential distribution may reflect social identity and trade patterns. According to Jones (1998:Map 4, 19-22), the Itzá controlled the western end of the Petén lakes region and the Mopan may have controlled the corridor between Lake Petén Itzá and Tipuj as a result of defeating the Itzá three times in battle. Architectural and burial information from the sites in this area suggest that differences in material culture from the west to the east indicate occupation by different social groups. Therefore, I would suggest that pottery made from the Vitzil Orange-Red ware clays and traded primarily to sites within the Itzá and/or the Mopan territory reflects pottery made from resources controlled by the Itzá and/or the Mopan.

The third pottery ware, Volador Dull-Slipped, represents a third possible clay resource or set of resources. I am unable to conclude that clays used to make pottery of this ware were controlled by a specific social group because pottery made from this clay appears in appreciable quantities through the Petén lakes region. I also believe that these gray-to-brown firing clays with frequent inclusions of lacustrine snail shells, came from lakeshores and were not difficult to obtain given that most Petén Postclassic sites are located near lakes. One possible manufacturing area may occur in the area of Macanché Island. Low-fired gray pottery at Macanché Island has a distinct sulfur odor when broken (Rice 1987a) and Lake Macanché has a high magnesium sulfate content. Pottery with the same odor occurs at Tipuj and Zacpetén, suggesting that Macanché Island potters traded their pottery to the inhabitants at Tipuj and Zacpetén.

II. Inclusions

The presence and/or absence of minerals and voids in the clay paste also reflects choices made by the Petén Postclassic potter because the presence/absence of inclusions affects the properties of the clays during manufacture and firing. On the basis of petrographic analysis of 273 sherds, I suggest that three categories of inclusions indicate potter's choices during manufacture: 1) the abundance of pores in the clay paste; 2) the presence of angular or oval-shaped minerals in the clay paste; or 3) the presence of a multitude of minerals that may naturally occur in the raw clay. These categories demonstrate that Postclassic Maya potters chose to alter the natural clay source (1 and 2) or to use it in its raw state (3).

Some clay pastes from the Clemencia Cream Paste and Vitzil Orange-Red wares from Ixlú, Zacpetén, and Tipuj are dominated by voids. The absence of clastics suggests that the potters eliminated (through sieving and/or levigating the clays) most minerals from the raw clay and added either organic material, evaporitic minerals, and/or sponge spicules. When the clays with these intentionally added inclusions were fired, the inclusions burned out leaving voids or pores. In addition to this cultural manipulation of the raw clay, the abundance of voids may be the result of post-fire leaching of calcite in acidic soils. Interestingly, sherds with this type of clay paste are not decorated. The resulting fired sherd pastes are relatively harder than other Clemencia Cream Paste and Vitzil Orange-Red ware sherds. These sherds represent thin-walled vessels. I believe that these sherds were manufactured in the Early/Middle Postclassic period, and as such, it may be possible that Postclassic Maya potters were trying to emulate hard Late Classic compact pastes. Many of these compact pastes were the result of volcanic ash tempered clay pastes that were characteristic of the Late Classic period. The volcanic ash tempered clay pastes continued into the Early Postclassic period and occasionally occur in the Paxcamán and Trapeche ceramic groups. Therefore, it is not unlikely that Postclassic potters were also attempting to create pottery with the same hard compact paste in the Clemencia Cream Paste and Vitzil Orange-Red wares.

Some Volador Dull-Slipped and Vitzil Orange-Red ware clay pastes from Zacpetén and Tipuj are dominated by the presence of euhedral calcite or quartz minerals in the absence of appreciable quantities of other minerals. An examination of gray clay from Zacpetén and clay samples from the area of the archaeological site of Yaxhá indicates that these raw clays are not dominated by either euhedral calcite or rounded quartz minerals. Although it is possible that the "correct" clay resources were not sampled, I suggest Petén Postclassic Maya potters intentionally added these minerals to a raw clay that was sieved and/or levigated to rid it of most minerals. Potters may have added angular minerals to a "clean" clay to modify the clay properties when it was "wet or dry as well as during firing" (Rice 1987b:407). By altering the mineral content of the original raw clay and adding angular and relatively large minerals to the clay paste, Petén Postclassic Maya potters manipulated the properties of the clays in order to successfully create tripod dishes and collared jars.

Finally, the majority of clay pastes of the three ceramic wares and from all four sites (Ch'ich', Ixlú, Zacpetén, and Tipuj) have relatively similar suites of minerals with the exception of the presence of biotite in some sherds. I suggest that Petén Postclassic potters may not have altered the raw clays, but successfully used them in their natural state to manufacture pottery. The presence of biotite in some clay pastes may indicate additional clay resources with biotite or that biotite was intentionally added to the clay (although highly unlikely); however, I believe that the presence of biotite reflects different clay resources because of the low frequency of biotite in the clay pastes. Therefore, while Petén Postclassic Maya potters may not have been altering these clays, they may have selected clays from at least two resources for each ware based on the presence of biotite in the sherd pastes. One clay resource may have been weathered from a non-biotite parent rock, whereas another clay resource may have been the result of weathering of biotite. The idea that there were at least two resources is further demonstrated because pastes with biotite are typically decorated while those lacking biotite are typically undecorated. Thus, Petén Postclassic Maya potters were intentionally choosing different clay resources for different decorative modes and technological styles.

Data from the clay paste mineralogy may suggest that potters from the eastern portion of the Petén lakes region tended to alter their clays during the manufacturing process. This idea is speculative for two reasons: 1) the lack of excavations in the western portion of the Petén lakes region and 2) the lack of thin-sections of pottery collected from excavations at Tayasal and Nojpeten. However, if this distinction exists, it suggests that Yalain, Kowoj, and/or Mopan potters made choices as to the types of minerals to include or to exclude in the clay pastes. If Yalain or Mopan potters were attempting to emulate the hardness of Late Classic clay pastes or to continue the technological traditions (volcanic ash tempered pottery) of the Late Classic period, it may suggest that they occupied the area longer because they were trying to duplicate regional technological features. Potters who utilized clay resources without modifying the clays, as is typical of Late Postclassic pottery, may not have been familiar with the clay and mineral resources of the area and used what was available without modification. The use of Late Postclassic unmodified clays may also signify a decline in standards of manufacture due to socio-political uncertainty such as wars and migrations. Nevertheless, it is evident that Petén Postclassic potters occasionally manipulated the raw clay resources during pottery manufacture.

III. Slips and Firing

Slip characteristics also demonstrate choices made by Petén Postclassic Maya potters. Some earlier Postclassic ceramic groups (Trapeche and Augustine) have "waxy" slipped surfaces whereas later Postclassic ceramic groups (Paxcamán and Topoxté) slipped surfaces rarely have a "waxy" surface finish. The "waxiness" of the slipped surface is most likely due to a creamy over-slip and heavy burnishing or the application of a substance after firing. Preclassic Sierra Red pottery slips resemble the "waxy" slips of some Postclassic pottery types. Gifford (1976:85) states that the "waxy" slip of the Sierra Red pottery is a result of a double slip and polishing.

I believe that this type of slipped surface was an attempt by earlier Petén Postclassic potters to emulate Late Classic polychrome gloss-slipped surfaces. Obviously the Postclassic surfaces are not identical to those of the Late Classic period, and this difference may be due to the difference in available resources and the lack of knowledge on the part of Postclassic potters. However, the "double-slipping" of the Trapeche ceramic group and the "waxy" nature of some of the slips of the Trapeche and Augustine ceramic groups at Tayasal, Ixlú, Zacpetén, and Tipuj is intentional. In addition to slipped surfaces, some sherds have a black painted and/or fireclouded rim that resembles those of Late Classic polychrome pottery. If these types of surface finishes are indicative of early Postclassic Maya potters attempting to recreate Late Classic polychrome surfaces, it may also suggest that people at these archaeological sites may have lived in the Petén lakes region early in the Postclassic period. Jones (1998:10) suggests that the Itzá/Yalain may have occupied the Petén lakes area, including Tipuj, in the early Postclassic. Thus, the slips may be part of Itzá/Yalain technological styles and therefore social identity.

The variability in slip colors in all of the ceramic groups demonstrates that while Petén Postclassic potters attempted to create red or black slips, they were not able to achieve a slip color that was similar on all vessels. I suggest two possible causes of this variation: 1) potters were using local resources and were unfamiliar with slip characteristics and/or firing technology, or 2) potters had a limited amount of resources for firing pottery.

The variability in slip colors may reflect that Maya potters initially may have been unfamiliar with the minerals used for slips. Resources in the Petén lakes region may also have varied across the landscape such that the pigment used for the red slip at Ch'ich' and Zacpetén may not have been the same or potters in the different communities had a different knowledge of the effect of slips on the air dried vessel and during firing. Petén Postclassic potters may have known how to make red or black slips; however, they may not have been able to control the firing conditions in order to produce a "standard" slip color.

In addition to general slip color variability, firecloud color indicates that Petén Postclassic Maya potters may have been unfamiliar with Petén slips/clays and firing technology. First, when potters can control the firing environment (e.g., constant temperatures and atmosphere, stacking, and proximity to the flame), few vessels show evidence of fireclouding. Fireclouding is fairly common on Petén Postclassic slipped pottery (especially Volador Dull-Slipped and Vitzil Orange-Red ware pottery) suggesting that the potters could not or did not control the firing environment. Second, firing temperatures were not uniform in the Petén lakes region (see Chapter 6). This is evident in the presence of tan and black fireclouds on pottery vessels (primarily tripod dishes). Tan fireclouds occur when the estimated firing temperature is below 550°C while black fireclouding occurs when the estimated firing temperature approaches 600°C or higher. Because tan and black fireclouding are most prevalent at Tipuj and Zacpetén, I suggest that potters who manufactured this pottery may not have had an extensive knowledge of firing technologies to control fireclouding during firing.

One reason that Petén Postclassic potters may not have been able to control firing conditions is because of differential access to fuel for firing. It is likely that during the

Postclassic period wood, grass, bark, palm fronds, and other agricultural by-products were difficult to obtain. Due to population concentrations and the placement of sites on islands and other defensible locations, land in the immediate vecinity of places of pottery manufacture may have been cleared of wood and grass essential for firing of pottery. While the Petén lakes region was not deforested during the Postclassic period, potters may have had to travel a distance to obtain hard wood for firing making manufacturing of pottery more "expensive." As a result this "cost," potters may have used whatever resources were readily available such as corn cobs and stalks. Specific firing resources, such as hard woods for firing, also may have been restricted due to reinforcement of social boundaries. Thus, some potters may have had differential access to resources for firing. Because estimated firing temperatures are relatively low for this sample of Petén Postclassic pottery, I suggest that the potters were not obtaining hard woods to achieve high temperatures. On the other hand, high firing temperatures with calcite based clays proves detrimental to fired pottery–the vessels crumble due to the conversion of calcite to carbon dioxide and lime. While high firing temperatures may not have been desired, the variability of estimated firing temperatures suggests that the Petén Postclassic Maya potters used a variety of resources for firing resulting in different slip and paste colors or had poor control of the firing environment.

IV. Pigments and Decoration

In addition to clay resources and slips, an examination of pigment resources may also suggest which social group created what technological style. The primary pigments used on Petén Postclassic slipped pottery are black and red. Again, the creation of territorial boundaries of warring social groups may have restricted access to pigments influencing choices with regard to decoration color. I believe that the iron-based mineral(s) used to paint red decoration on the pottery may have been restricted due to territorial boundaries and/or geological resources. These iron-based mineral may occur in the well-drained tropical soils of the Petén lakes region, as an authigenic component of clay fractions, as nodules of magnetite, pyrite, or hematite, and/or associated with gypsum (found near Zacpetén). The darker red painted designs may be the result of the use of specular hematite. The red color present in design panels is generally darker than the exterior red slip color which may suggest that two different pigments were being used for manufacture of pottery. Pottery with red or red-and-black painted decoration (Macanché Red-on-paste, Sacá Polychrome, Picté Red-on-paste, Sotano Red-on-paste, Chompoxté Red-on-paste, and Canté Polychrome) occurs most prominently at sites in the eastern portion of the central Petén lakes region. Again, ethnohistorical and archaeological data suggest that this area was controlled by the Kowoj, Yalain, and/or Mopan. Red-and-black decoration occurs almost exclusively at the archaeological sites of Macanché Island, Topoxté Island, Zacpetén, and Tipuj. Therefore, the red pigment used for painted decoration, but not for slips, may have been located in a territory controlled by the Kowoj, Yalain, and/or Mopan.

Although it is possible that the red pigment used to paint decorative motifs in design panels of Petén Postclassic slipped pottery may have been restricted due to socio-political boundaries and/or geological location, the use of red and red-and-black decoration may relate to differences that reinforce the ancestral identity of the social groups. As noted previously, the Kowoj state that they had ancestral ties to Mayapán.

One way to examine this is through the colors of pottery and the decorative motifs at Mayapán. If such correlations exist, they may reinforce the connections of the Petén Kowoj with their ancestral homeland. One of the most telling similarities is the color of the slips and decoration used on Postclassic pottery from northern Yucatán. Most of the Postclassic pottery at Mayapán in the Hocaba (A.D. 1200-1300) and Tases (A.D. 1300-1450) periods is either slipped red and incised, has red painted decoration, or has red-and-black painted decoration. At Tulum and Tancah, the majority of the Late Postclassic pottery is slipped red and incised. Smith (1971:30) and Sanders (1960) note the similarities between Tulum and Mayapán with regard to pottery slip color and decorative motifs.

In addition to the color of the slipped surfaces, decoration motifs and elements at Mayapán and Tulum also appear at archaeological sites in the eastern portion of the Petén lakes region. These decoration motifs include the *ajaw* glyph, embedded chevrons, terraces/stepped pyramids, and the *ilhuitl* glyph.

In contrast to red and red-and-black painted pottery, Postclassic pottery from Chich'en Itza is dominated by the overwhelming presence of black painted decoration and black slipped and incised pottery (Chung and Morales 2000). Decorative motifs include feathers, reptilian motifs, and flowers (Brainerd 1958). Sites on the east coast of Yucatán, in Quintana Roo, lack black decorated pottery.

The presence/absence of decoration color and decorative motifs at Mayapán, Chich'en Itza, and Tulum and archaeological sites in the Petén lakes region suggests that color and motif correlations may reflect more than differential access to resources. Although resources are important and can limit the possibility of choices a potter may make, references to ancestral ties on pottery may provide the best manner by which the archaeologists can interpret the choices available to a potter and the association of those choices with social identity.

V. Socio-Political History and Geography

Although choices made by the Petén Postclassic Maya potter based on different zones of resources (clay, mineral, pigment, and wood for firing) may aid in answering a portion of the question of why different technological styles may have existed, a discussion of the socio-political history and geography will further establish which social/ethnic group may have produced what technological style. This section interprets the socio-political situation as suggested by ethnohistorical and archaeological data and incorporates the choices previously discussed to suggest which social group may have produced which technological style and why they may have been produced.

Beginning in the Late Terminal Classic to Early Postclassic (ca. A.D. 900-1100) period in the Petén lakes region, new social groups entered and brought with them L-shaped and C-shaped bench structures (D. Rice 1986:326). Although we do not currently know who these people were, this type of architecture together with a similar ceramic "complex" (Paxcamán, Trapeche and Augustine ceramic groups) appears at sites throughout the Petén lakes region with the exception of Topoxté Island. At this time, three social groups, the Itzá, Yalain, and Mopan, may have been present in the Petén lakes region. Schele and Grube (1995) and Rice et al. (1996) believe that the Itzá may have had a migration of portions of their population to Petén throughout the Postclassic period leaving the possibility that the Itzá were present in the Petén lakes region in the

Early Postclassic period. The Yalain may also have been present at eastern sites in the Petén lakes region at this time (Jones 1998:Map 6). In addition to the Itzá and Yalain, Jones (1998:433n47) states that the Mopan "appear to have occupied Petén and Belize long before the Itzas." Although there may have been some conflict and boundary issues, the presence of similar pottery (Augustine, Trapeche, and Paxcamán) at all sites seems to suggest that either everyone was making similar pottery or that trade of vessels and/or ideas was common.

Based on archaeological and ethnohistorical data, I believe that the Itzá were in the Petén lakes region during the Early Postclassic period and occupied territory from Ch'ich' (and perhaps farther to the west) to Ixlú and perhaps farther east to Tipuj. Their presence would account for the introduction of the Trapeche, Augustine, and Paxcamán ceramic groups and the presence of long range and C-shaped structures at the sites of Ch'ich' and Tayasal and perhaps the Quexil Islands. In contrast to Ch'ich' and Tayasal, architecture from the sites of Ixlú, Zacpetén, Yalain, Macanché Island, and Tipuj is different, and I believe that these sites may have been occupied by the Yalain and/or the Mopan. At this time, Topoxté Island was not occupied (Hermes and Noriega 1997). A similar ceramic complex suggests open trade, equal access to resources, and similar pottery manufacturing and firing technologies that resulted in common technological and stylistic "choices."

The Middle Postclassic period (ca. A.D. 1100-1300) became more socio-politically complex. During this period another social group, most likely the Kowoj, entered the central Petén lakes region and may have displaced the Itzá, Yalain, and/or Mopan social groups from Topoxté Island and/or Zacpetén. Hermes and Noriega

(1997:757-758) state that the Topoxté islands were occupied at this time by a social group that built civic-ceremonial architecture similar to that at Mayapán.

Architecture on Topoxté Island (the largest of the five islands) resembles the temple assemblage arrangement at Mayapán (Bullard 1970:255-267; Hermes and Noriega 1997; Johnson 1985:162-163; Rice 1988:241). The highest point of Topoxté Island has a series of temples, open/colonnaded halls, altars, and stelae built on terraces at various elevations (Bullard 1970:255). The temple (Structure C) faces west with an altar directly in front. Parallel to the temple are two colonnaded halls (Structures D and E) with a smaller south-facing temple perpendicular to Structure E. Perpendicular and to the south of the temple is another colonnaded hall (Structure B) that faces north.

Bullard notes that the main temple (Temple C) is built on a higher terrace that elevates it above the surrounding open halls. The temple has a series of three terraces with balustraded stairways that lead to the superstructure (Bullard 1970:259). The temple superstructure is composed of a back room with a bench and front room. Its two rooms are separated by two columns and two columns also occur at the front entrance (Bullard 1970:Figure 4). The front room was littered with censer fragments while very few sherds were found in the back room (Bullard 1970:262).

The collection of pottery used for this study comes from Bullard's excavations of Temple C and from Guatemalan excavations of the area around Structure C and excavations of Structures D and E.

Similar Mayapán-like civic-ceremonial architecture (temple assemblages) also appears at Zacpetén (Pugh 1997, 1999, 2000) and Tipuj. Zacpetén's Group A and C civic-ceremonial architecture also resembles temple assemblages present at Mayapán.

"Not only do these groups contain the largest Postclassic structures at the site, they conform to plans that are identical to Mayapán architectural groupings called 'temple assemblages'" (Rice, Rice, and Pugh 1997:240). Group A consists of a "temple (Str. 602) fac[ing] west with an oratorio (Str. 605) to its north facing in the same direction. In front of the temple are numerous small shrines (Str. 607, Str. 1001). Statue fragments were associated with Str. 607, the shrine closest to the temple. At a right angle to the temple and oratorio on the north side of the plaza is an open hall, Str. 606a" (Rice, Rice, and Pugh 1997:241). This ceremonial group also has a *sakbe* connecting the open hall to the southern edge of the plaza, a second open hall, and a large shrine/platform that faces the second open hall on the southern side also occur in Group A (Rice, Rice, and Pugh 1997:240). Stucco from Structure 606 has red pigment and stucco from Structure 605 has black pigment (Pugh, personal communication 2000).

The temple assemblage of Group C consists of a west-facing temple (Str. 764) and an oratorio (Str. 1002), two small shrines (Str. 766) in front of the temple, and an open hall to the south and at a right angle to the temple (Rice, Rice, and Pugh 1997:241). Stucco from the exterior of the temple was painted with red lines and stucco from the floor had black pigment (Pugh, personal communication 2000). Based on these characteristics, Rice, Rice, and Pugh (1997:252) state that although "Sakpeten is listed as a Yalain community [in Spanish documents], we believe that the two Mayapán-style temple assemblages at the site mark the presence of Kowoj or Kowoj-affiliated occupants late in the site's history."

Complex I at Tipuj may also be related to the temple assemblages at Mayapán, Topoxté, and Zacpetén; however, many differences should be noted. Structure 2 is a temple with an interior altar. It faces west into the platform plaza and is defined by non-balustraded steps that access the temple top (Jones, Kautz, and Graham 1986). To the north of the temple and facing in the same direction appears Structure 1. This structure faces a feature, perhaps a low platform, that faces Structure 1. While Structure 1 may represent an oratorio, extensive excavations and analysis have not been carried out, and as a result, little information is known about its internal structure. Structure 3 occurs to the south of the temple and appears to be a hall and Structure 4 appears to be a colonnaded hall that occurs directly across from and faces into Structure 1. The alignment of Structures 1 and 4 with a smaller altar/shrine resembles a basic ceremonial complex (Pugh, personal communication 2000). The addition of Structure 2 (temple) and Structure 3 (open hall) may be a variant of a basic temple assemblage; however, the alignment of these structures does not correlate to those of Mayapán, Topoxté, or Zacpetén. Therefore, while a comparison to Mayapán, Topoxté, and Zacpetén is tempting, it should be done with caution because of the lack of interpretation from the excavation data. Based on the civic-ceremonial data and the presence of Clemencia Cream Paste ware pottery at Tipuj, I suggest that the site is occupied by Kowoj and/or Mopan in the Middle Postclassic period.

In addition to similarities in civic-ceremonial architecture, interment patterns demonstrate that a social group other than the Itzá may have occupied some of the sites around Lakes Salpetén and Yaxhá. Individual skull burials and ossuaries at Topoxté Island and Zacpetén appear in conjunction with Mayapán-like temple assemblages. In opposition to individual skull burials and ossuaries, rows of crania, *tzompantli*, were documented at Macanché Island (Rice 1986:264), Ixlú, and Chich'en Itza (Ruppert 1952).

Rows of crania occur in the Petén lakes region in the ethnohistorically defined territory of the Yalain (Jones 1998:Map 3).

Around this same time, Clemencia Cream Paste ware, especially Chompoxté Red-on-paste and Canté Polychrome pottery, appears at sites in the eastern portion of the Petén lakes region and Tipuj. I believe that these traits (civic-ceremonial architecture, interments, and pottery) represent Kowoj social identity and Kowoj occupation at Topoxté, Zacpetén, and Tipuj.

The archaeological sites of Yalain, Macanché Island, and possibly Ixlú may have been occupied by the Yalain during the Middle Postclassic period. Architecture at these sites is different from that of Topoxté Island, Zacpetén, Tipuj, Ch'ich', and Tayasal. Yalain, Ixlú, and Macanché Island, have similar Postclassic architectural groupings that are dissimilar to the civic-ceremonial complexes at Mayapán, Topoxté Island, and Zacpetén. The basic pattern, present at Yalain, involves a south-facing open hall facing two north-facing smaller open halls with a shrine between the larger and smaller open halls (D. Rice, personal communication 2000).

At Ixlú, this assemblage has an east-facing temple to the west of the large open hall. Ixlú has additional Postclassic complexes composed of open halls, temples, and oratorios that may represent a variant of the basic ceremonial group, but none of the complexes resemble those at Mayapán, Topoxté, and Zacpetén. Structures 2023 (temple) and 2022 (open hall) have red painted stucco on the exterior surfaces.

Limited excavations from Macanché Island suggest that the structure on the raised platform may have been an open hall with a possible L-shaped bench (Rice 1987a:Figure 23; Pugh, personal communication 2000). Two or more smaller halls may have faced the larger open hall. D. Rice (personal communication 2000) states that the combination of open halls and shrines/oratorios is typical of architecture seen in the Itzá/Yalain region.

Macanché Island and Ixlú have Clemencia Cream Paste ware pottery (mainly Topoxté Red), but in smaller quantities than that of Zacpetén and Tipuj. The presence of this pottery suggests that the inhabitants of these sites (perhaps Yalain) may have had trading relations with the Kowoj.

The western portion of the Petén lakes region was occupied by the Itzá in the Middle Postclassic period. The archaeological sites of Ch'ich' and Tayasal have a different architectural pattern. Postclassic architecture at Ch'ich' and Tayasal consists of a series of halls and shrines with occasional oratories that are more similar to civic-ceremonial architecture at Chich'en Itza than at Mayapán, Topoxté Island, Zacpetén, Ixlú, Yalain, and Tipuj (Rice et al. 1996). Chich'en Itza architecture is dominated by colonnaded halls and the presence of ball courts (Ruppert 1952). Unfortunately, more excavations are needed in the Itzá territory in the Petén lakes region before correlations can be made. In addition to architecture patterns, these archaeological sites have few (less than 10) Clemencia Cream Paste ware sherds.

This information (civic-ceremonial architecture, interment, and pottery) suggests that the Kowoj did not trade with the Itzá, creating an east-west dichotomy indicating that social boundaries may have existed limiting trade. If territorial boundaries are becoming less fluid, potters' choices may also be changing due to the restriction of resources available within a specific socio-political territory. This may be indicated by the presence of three zones of clay resources (red, gray, and "white" clays) and a variety of red slip colors with a variety of surface finishes.

The Late Postclassic period (ca. 1350-1697) is a period during which socio-political groups of the Petén lakes region were changing alliances, changing dominance relations, and experiencing the repeated migrations of social/ethnic groups from northern Yucatán and possibly elsewhere. Established and defended boundaries and migrations of population bases may have further restricted trade and access to resources needed for pottery manufacture and firing.

According to their histories, additional populations of Itzá and Kowoj from northern Yucatán migrated into the area during the Late Postclassic period. Hermes and Noriega (1997:762) state that a new social group moved to Topoxté Island and began remodeling the structures of the main plaza on Topoxté Island. This may indicate a new migration of Kowoj because the building types were not changed but only refurbished. People occupying this site continued to make Clemencia Cream Paste ware pottery and not importing any appreciable quantities of other Petén Postclassic pottery wares. Sometime around A.D. 1450, Hermes and Noriega (1997:762-763) state that Topoxté was abandoned along with the manufacturing of Clemencia Cream Paste ware pottery. This date corresponds to the date of the migration of the Kowoj from northern Yucatán to Petén. Debate exists as to the abandonment of Topoxté at this date, but if it was abandonded, its population may have relocated to other Kowoj towns such as Zacpetén.

In A.D. 1525, Cortés traveled through Petén on his way to Honduras (Cortés 1976:219-285). At this time, he stated that the Itzá were centered at Nojpeten and that they were ruled by the Kan Ek' lineage. Therefore, the Itzá were a strong presence in central Petén by at least the last half of the 15th century. The archaeological sites of Ch'ich', Tayasal, and Nojpeten were within the Itzá territory. In addition to these towns, the Itzá controlled, or at least had influence over, the towns of Yalain and Tipuj due to marriage alliances and Yalain may have served as an outpost area for the Itzá to protect them against Spanish invasions (Jones 1998:167) .

The Itzá also had a strong presence at Tipuj during the Late Postclassic period. AjChan, an Itzá noble and father of a famous Itzá diplomat of the same name, was a resident of Tipuj and led at least one decisive battle over Yalain, probably in the late 17th century (Jones 1998:56). In addition to the presence of AjChan, Itzá compound names resulting from intermarriage commonly occurred at Tipuj as documented in Pérez's 1655 *matrícula* (Jones 1989:14).

To complicate matters, the Itzá are said to have had a series of three wars with the Mopan (dates unknown), the result of which found the Mopan victorious (Jones 1998:21, 101). These battles allowed the Mopan to temporarily regain control of the corridor to Tipuj. Therefore, while the Itzá may have had a strong presence at Tipuj, the population may have been a mix of Itzá and Mopan.

The site of Ixlú may have been included in Itzá and/or Kowoj territory throughout the Postclassic period. The lack of a large Late Postclassic population evident by the paucity of Late Postclassic pottery suggests that it was not occupied by a large population (similar to Zacpetén) and may not have been occupied during the entire Postclassic period.

The Kowoj appear to have occupied the site of Zacpetén (Pugh 1999) and possibly sites along the north shore of Lake Petén Itzá (Jones 1998:Map 3). Although more excavations are needed to determine the extent of the Kowoj in the Petén lakes region, Spanish documents state that the Kowoj were present at Zacpetén until just before

A.D. 1697 when the Itzá and the Spanish attacked.

VI. Technological Choices and Social Identity

I believe that some Kowoj traditions/customs begun at Topoxté Island around A.D. 1000 continued at Zacpetén after Topoxté Island was abandoned. I believe that a "hallmark" signature of the Kowoj was red-on-paste decoration. It began on Clemencia Cream Paste ware pottery with the florescence of Chompoxté Red-on-paste pottery. After the Topoxté islands were abandoned in A.D. 1450, this pottery type was no longer produced, but an analogous pottery type–Macanché Red-on-paste–began. I suggest that the Kowoj at Zacpetén recreated Chompoxté Red-on-paste decoration on local clays, the gray pastes of Volador Dull-Slipped ware pottery, to reinforce their social/ethnic identity. Macanché Red-on-paste pottery, found almost exclusively at Zacpetén, is a Late Postclassic type and as such may reflect this practice. In addition to its presence at Zacpetén, 28 sherds were identified at Macanché Island, four sherds at Nojpeten, and eight sherds at Tayasal. This distribution suggests that the Kowoj traded limited quantities of Macanché Red-on-paste pottery into Itzá/Yalain territory. Trade of this pottery may have occurred early in the Late Postclassic period while the Itzá/Yalain were allied through marriage to the Kowoj. In addition to the earlier trade of limited quantities of Macanché Red-on-paste pottery to the west and eastern lakes, Cowgill (1963) notes a large quantity of Tachís pottery (similar to Macanché Red-on-paste pottery but with "purplish" decoration instead of red) at Nojpeten. This may suggest trade with Kowoj or that a faction of Kowoj were living on Nojpeten (the latter being highly unlikely). Nevertheless, red-on-[gray] paste pottery is rare outside of Zacpetén and I suggest that this indicates Kowoj social identity.

In addition to red-on-paste decoration, I also believe that red-and-black decoration may indicate Kowoj social identity for the same reasons stated above. Sacá Polychrome pottery (Volador Dull-Slipped ware) may be an attempt to recreate Canté Polychrome pottery (Clemencia Cream paste ware). Canté Polychrome was most prevalent at Topoxté Island and also occurred at Zacpetén and Tipuj (2 sherds). However, Sacá Polychrome pottery exists almost exclusively at Zacpetén (18 sherds occur at Macanché Island, two sherds at Tayasal, and 14 sherds at Nojpeten). Again, this type of pottery may exist at these three sites because of marriage ties and trade relations in the early 1600s. Red-and-black decoration also occurs almost exclusively at Mayapán in northern Yucatán. Therefore, I suggest that red-on-black decorated pottery may also indicate Kowoj social identity and after the abandonment of Topoxté Island at approximately A.D. 1450, the Kowoj of Zacpetén recreated this decorative mode in order to reinforce social/ethnic identity.

Because operational sequences, choices of manufacturing materials and techniques reflect the socio-political situation of the Postclassic period in Petén, I suggest that the seven technological styles described in Chapter 9 reflect Petén Postclassic social/ethnic identities. I believe that Clemencia Cream Paste ware pottery was produced at and traded from the Kowoj site of Topoxté from the Early to early Postclassic periods (ca. A.D. 1100-1450). "[T]he Topoxté Islands do not share in the other Petén Postclassic ceramic traditions. No Trapeche group sherds, for example, were found at Topoxté, and no Chilo Unslipped; only one sherd was tentatively classified as Augustine, and only three sherds were identified as being of probable Yucatecan manufacture. The inhabitants of the Topoxté Islands, in short, seem to have sent some of the pottery throughout a relatively broad territory in Petén [and elsewhere], but to have brought in very little in return" (Rice 1986:278). Topoxté can be defined as a Kowoj site because Topoxté's architecture (temple assemblages) resembles that of Mayapán (the ancestral homeland of the Kowoj) (Pugh, personal communication 2000). Thus, it is possible to suggest that the Clemencia Cream Paste ware pottery produced at Topoxté Island reflects Kowoj identity because of architectural, burial, and pottery decoration similarities to Mayapán, the Kowoj ancestral homeland. In addition to these similarities, Clemencia Cream Paste ware pottery is found more frequently at sites with temple assemblages within the Kowoj territory as defined ethnohistorically by Jones (1998:17-19). Therefore, Clemencia Cream Paste ware pottery (TSGs 1, 6, and 7) reflects Kowoj social/ethnic identity.

Kowoj identity may also be defined by red-and-black and red painted decoration that appears in TSGs 3, 4, 6, and 7. Although red-and-black painted pottery is rare, its distribution is distinctive. Two characteristics of material culture in the Maya lowlands support this proposition. First, red and red-and-black decorated pottery occurs most frequently at Topoxté Island (a Kowoj site) and in the ethnohistorically defined Kowoj territory as well as more frequently at Mayapán than at Chich'en Itza. Second, temple structures at Zacpetén, Topoxté, Ixlú, and Mayapán (Kowoj sites) have red and red-and-black painted stucco (Bullard 1970; Pugh, personal communication 2000; D. Rice, personal communication 2000). While the presence of painted stucco may be the result of preservation, painted stucco is not reported at other archaeological sites in the Petén lakes region.

Itzá social identity is more difficult to define through technological style data because most of the sites excavated have thus far been in Kowoj territory. However, Itzá social identity may be reflected through the use of black decorative painting on Vitzil Orange-red ware pottery (TSGs 2 and 3) and on Volador Dull Slipped/Snail Inclusion ware pottery (TGSs 4 and 5). These technological style groups occur most commonly in ethnohistorically defined Itzá territories. Additionally, reptilian motifs occur more commonly in Itzá defined territory, the western portion of the Petén lakes region (Rice 1983, 1989). Serpent (*Kan*) motifs may signal the Kan Ek' lineage of the Petén Itzá (Rice, Rice, and Pugh 1997:59). Further research into Itzá archaeological sites will contribute to the discussion of technological styles that reflect Itzá social identity.

CHAPTER 11

CONCLUSIONS

Historical, ethnohistorical, and architectural data suggest that multiple social groups occupied the Petén lakes region of Guatemala during the Postclassic (A.D. 950-1524) and Contact (A.D. 1524-1700) periods. Through a comparison of pottery technological style data with civic-ceremonial architectural and burial data from the archaeological sites of Ch'ich', Tayasal, Ixlú, Zacpetén, Macanché Island, and Topoxté Island in Petén and Tipuj in Belize, I suggest what Petén Postclassic slipped pottery technological styles represent which social/group and at which sites the technological styles appear. Thus, my study of technological styles of the Itzá and Kowoj of Petén suggests that Petén Postclassic potters produced and reproduced pottery technological styles as part of the social identities.

Technological style groups 1, 6, 7 and the red-and-black decorated pottery from Technological Style Groups 3 and 4 represent Kowoj identity. These technological styles are most common at Zacpetén, Macanché Island, and Topoxté Island, they occur less frequently at Ixlú and Tipuj, and are rare at Ch'ich' and Tayasal. In addition to their site location, some intra-site proveniences also occur. Although Kowoj technological styles exist at most excavated structures at Zacpetén, Ixlú, and Tipuj, they are concentrated most heavily in temples, open halls in temple assemblages, oratorios, shrines, and elite residences. This may suggest that pottery that is most important in displaying social identity is related to ritual functions associated with elite and/or ritual structures.

Technological Style Groups 2 and 3 and black line decoration of Technological Style Groups 4 and 5 may represent Itzá social/ethnic identity because of the presence of reptilian *(kan)* motifs that may reflect the ruling Kan Ek' lineage of the Petén Itzá. These characteristics are abundant of these technological style groups at Ch'ich', Tayasal, and Tipuj and are almost absence at Zacpetén, Macanché Island, and Topoxté Island (Technological Style Groups 2 and 3 only). Sherds that represent these technological style groups occur in all types of excavated buildings except oratorios.

In order to identify patterns of Postclassic technological styles from pottery at sites in the Petén lakes region, I conducted several kinds of analysis (described in detail in Chapter 4) to gather technological and stylistic data: type-variety analysis, "low-tech" analyses; petrographic analysis; x-ray diffraction analysis; EDS and SEM analyses; and strong-acid extraction ICPS analysis. From the data gathered by these methodologies, I inferred technological styles that reflect the choices made by potters during the process of manufacture that may indicate restricted resources and potter knowledge.

The first step of analysis consisted of a typological examination of all Postclassic slipped sherds from all of the sites in this project. A detailed description of the five Postclassic slipped pottery groups (Paxcamán, Fulano, Trapeche, Topoxté, and Augustine) and three ware categories (Volador Dull-Slipped ware, Clemencia Cream ware, and Vitzil Orange-Red ware) appears in Chapter 5. Variations in the painted and incised decorations, the presence and absence of decorative motifs, the number of form categories, and the firing and slip technology occurred differentially throughout the Petén lakes region. Although the differences were not numerous, variations in pastes, slips, and decorations of the various types and varieties demonstrated that technological style analysis goes beyond stylistic and type-variety analyses to suggest that the combination of the choices available to a potter may ultimately reflect the social/ethnic identity of the Postclassic social groups in the Petén lakes region.

"Low-tech" analysis, the second level of analysis to determine the existence of Postclassic technological style groups, included the examination of a sample of 551 sherds from Ch'ich', Ixlú, Zacpetén, and Tipuj. I examined the slip colors (using Munsell Soil Charts), the degree of dark coring and core color, the hardness of the exterior surface, interior surface, and the paste (using the Mohs' hardness scale), the estimated firing temperatures (using an electric kiln), the form measurements, and the surface treatment and decoration of these sherds (detailed results are presented in Chapter 6). The resulting qualitative and quantitative data based on paste, slip, and decoration characteristics allowed me to refine the groups preliminarily defined in the previous typological analysis. I defined three technological style groups based on the differences in slip and paste color variability, firing technology, and surface treatment. These "low-tech" technological styles correlate to the three Petén Postclassic slipped ware categories (Volador Dull-Slipped, Vitzil Orange-Red, and Clemencia Cream Paste wares). From this data, it is possible to observe technological and stylistic choices made by the Petén Postclassic Maya potters in order to mediate their social reality.

Chapter 7 presents data obtained through mineralogical analyses–the third level of analysis. I examined all of the sherds through binocular microscopy to observe the gross modal differences in paste categories. As a result of the differences in the various pastes, I selected a sample of 273 sherds for further petrographic thin-section analysis to better identify slip characteristics and non-plastic inclusions, minerals, and rock fragments in the clay paste as well as slip characteristics. In addition to identifying the presence of various minerals, I also recorded the abundance, association, granulometry, and shape of the minerals and other inclusions in the clay paste. Ternary charts of the percentage of various mineral inclusions and pores, as well as other qualitative data, elucidated differences in each ware category based on the abundance of pores, chalcedony, and biotite.

Because petrographic thin-section analysis cannot identify clay minerals by their optical properties, I examined 15 sherds and five raw clay samples by x-ray diffraction. Data from the raw clay and sherd samples demonstrated that the raw clays and clay pastes of the sherds were composed of montmorillonite and halloysite clay minerals. In addition to the identification of the clay minerals, x-ray diffraction analysis demonstrated the extent to which calcite is a dominant mineral component of the raw clays and the sherd samples.

Because the clay mineralogy of the sherds in the sample were very similar, I defined four mineralogical technological style groups based on inclusions in the clay pastes of the sherds in this study. The first mineralogical technological style group includes Augustine and Topoxté ceramic group sherds that have clay pastes dominated by pores. The second group consists of Paxcamán, Trapeche, and Augustine ceramic group sherds with clay pastes dominated by cryptocrystalline calcite. Paxcamán, Trapeche, Fulano, Augustine, and Topoxté ceramic group sherds with quartz, chert, chalcedony, hematite, and calcite mineral inclusions comprise the third mineralogical technological style group. Finally, the fourth mineralogical technological style group is composed of

Paxcamán, Trapeche, Fulano, Augustine, and Topoxté ceramic group sherds with quartz, chert, chalcedony, hematite, calcite, and biotite mineral inclusions. The four technological styles based on mineral inclusions in a clay paste reflect some technological choices made by the Petén Postclassic Maya as to the material for the manufacture of slipped pottery.

The fourth and final level of analysis involved the chemical characterization of the clay pastes of 100 sherds that represented the variability described in previous chapters. A combination of EDS and SEM analyses and strong-acid extraction ICPS analysis of major, minor, and trace elements with multivariate statistics (Ward's Cluster Analysis and Principal Component Analysis) resulted in seven chemical composition technological style groups based on clay paste elemental characteristics (detailed results appear in Chapter 8). The elemental frequencies suggest that clay paste compositional differences correlate to ceramic ware categories and mineral inclusions. This is not surprising given the visual differences of clays used to produce the various vessels and the different suites of mineral inclusions in the different clay pastes.

When the "low-tech" data are combined with the mineralogical and chemical data, some interesting differences occur that reflect variation in chemical and mineralogical composition, stylistic (painted and/or incised decoration), and formal categories.

The description of the seven technological style groups with regard to paste color, mineral inclusions, distinctive elemental concentrations, estimated firing temperatures, Mohs' hardness measurements, surface treatment and decoration, form measurements, provenience in the Petén lakes region, and occurrences throughout the Maya lowlands appears in Chapter 9.

Group 1 represents Topoxté Red pottery from Ixlú and Tipuj. The body sherds of this group are thin and exteriorly slipped with no decoration. Petrographically, this group is distinguished by voids in a marly clay paste. A few quartz inclusions can be seen, but they do not occur in any significant quantity. Chemical analyses suggest that this group is distinctive due to its moderate relative concentrations of Fe (iron) and Ti (titanium), and low relative concentrations of Ca (calcium) and Zn (zinc).

Group 2 represents Augustine sherds from Ch'ich', Ixlú, and Zacpetén. Tripod dishes, collared jars, restricted orifice bowls, and narrow neck jars occur in this group. The majority of the sherds are slipped without decoration, and three sherds have either black line decoration or incisions. Petrographically, voids also predominate the clay paste. Chemical analyses distinguish this group from group 3, also composed of Augustine ceramic group sherds, because of its low relative concentrations of Ca (calcium).

Group 3 again represents Augustine sherds, but they are from the sites of Ch'ich', Ixlú, Zacpetén, and Tipuj. Jars and tripod dishes dominate the form categories with the exception of one drum sherd. Two-thirds of the sherds in this group are decorated by incisions, black, and red-and-black motifs. Decorative motifs include plumes, birds, mats, and the *ilhuitl* glyph. Petrographically, these sherds share an abundance of calcite and quartz inclusions. Chemical analyses separate this group from group 2 because of its high relative concentration of Ca (calcium).

Group 4 has Paxcamán, Trapeche, and Fulano ceramic group pottery from Ch'ich', Ixlú, Zacpetén, and Tipuj. Tripod dishes, collared bowls, flanged plates and bowls, jars, grater bowls, and drums occur in this group. Two-thirds of these sherds are decorated with incisions or black, red, or red-and-black decorations that are geometric, mat, bird, or *ilhuitl* motifs. The other one-third are slipped without decoration. Petrographically, this group has a calcite rich clay paste that is characterized by the presence of voids, biotite, chert, chalcedony and quartz. Chemical analyses separate this group from group five, also composed of the same ceramic groups, because of lower relative concentrations of Be (beryllium), Cd (candidum), and Mn (manganese).

Group 5 has a similar mix of Fulano, Trapeche, and Paxcamán sherds from Ch'ich', Ixlú, Zacpetén, and Tipuj as does Group 4. However, ninety percent of these sherds represent slipped but undecorated plates and jars. Petrographically, the clay matrix is dominated by calcite. Chemical analyses separate this group from group 4 because of its higher relative concentrations of Be (beryllium), Cd (candidum), and Mn (manganese).

Group 6 represents Topoxté ceramic group sherds from Zacpetén and Tipuj. The sherds represent bowls, plates, and jars. The majority of the Topoxté ceramic group sherds have red decoration with motifs that are either two parentheses or a depiction of the *ajaw* glyph. Petrographically, this group has a marly clay paste that is dominated by cryptocrystalline calcite with the presence of a few (< 3%) euhedral and polycrystalline calcite and biotite inclusions. Chemical analyses distinguish this group from groups 1 and 7 (other Topoxté ceramic groups) because of it slightly higher relative concentrations of Fe (iron) and Ti (titanium).

Group 7 has Topoxté ceramic group sherds from Zacpetén and Tipuj. Plate, bowl, and jar forms predominate this group. The majority of these sherds are decorated with red, red-and-black, or black painted decoration. Petrographically, these sherds have a marly paste with calcite, chert, quartz, chalcedony, and biotite inclusions. Chemical analyses separate this group from groups 1 and 6 (other Topoxté ceramic groups) because of lower relative concentrations of Al (aluminum), Fe (iron), and Ti (titanium).

In addition to technological style data, Chapter 10 describes various civic-ceremonial architecture, burial, and polychrome pottery color and design motif data that occurs in the Maya lowlands and its relation to the archaeological sites in this study. Based on the data from multiple lines of material culture, I suggested that Clemencia Cream Paste ware pottery and pottery with red-and-black and red-on-paste decoration indicates Kowoj identity. Although Itzá social identity is more difficult to identify due to the lack of excavation in the Petén lakes region, I suggested that Vitzil Orange-Red ware pottery with black decoration and reptilian motifs on Petén Postclassic pottery wares may represent Itzá social identity. The existence of technological styles based on the above criteria demonstrates that the Kowoj and the Itzá made technological and stylistic choices in manufacturing of pottery that reflected their separate social identities. Petén Postclassic slipped pottery was created with different types of clay pastes, inclusions, and decoration and these choices reflect the compatibility of technological and stylistic choices as defined by cultural groups and reinforced by existing social structures present in other forms of material culture.

As a result of my analysis of Petén Postclassic slipped pottery, technological styles of this pottery demonstrate that: 1) technological and stylistic choices have a social context; 2) technology and style are social reproductions of Postclassic society; 3) some technological and stylistic choices were more compatible than others within Postclassic Maya society; 4) technology affects style; and 5) these compatible choices reinforced the existing technology and social ideology.

Technological and stylistic choices have a social context because they are products of producers who are active social agents in a social structure (Dietler and Herbich 1998; Lemonnier 1992). The operational sequence (choices) that resulted in the different Postclassic Maya technological styles reflected the social context of the culture because the pottery was created from interrelated choices of matter, energy, specific knowledge, etc., learned in social settings that "guide the perception of an acceptable range of variation and choice" (Dietler and Herbich 1998:250; Lemonnier 1992). Because potters are part of a larger social group and social structure, they "understand" the group ideologies that are structured and systematic of their social/ethnic group. Thus, through practice, potters display, form, and transform the social context of technological and stylistic choices.

Because technological and stylistic choices are embedded in a social context, they are also social reproductions of Petén Postclassic society. The seven technological styles described above reflect technological and stylistic changes that may be the result of different/new social groups of the Postclassic period. The technological styles in the Petén lakes region are associated with two distinct socio-political groups that describe very different origin and migration myths and histories. Although Robertson (1970) described an "International Style" that occurs throughout the Maya lowlands, the Petén Itzá and Kowoj used specific symbols, colors, and pottery pastes that have resulted in the differentiation of seven technological styles of pottery. The differences between the two social groups and between Postclassic and earlier cultural periods are also reflected in other elements of material culture such as ritual pottery, civic-ceremonial architecture, and burial practices. Because the mental construction of being a member of Petén Postclassic Maya society and more specifically a member of the Itzá or Kowoj socio-political group appears in multiple lines of material culture, the technological styles of Postclassic slipped pottery serve as symbols of social/ethnic identity.

In order for the technological styles of Petén Postclassic slipped pottery to be perpetuated, the technological and stylistic choices must be compatible with Postclassic Maya society. Archaeologists can determine which technologies and styles were most compatible by examining the changes from the Late/Terminal Classic period to the Postclassic period. Changes are most notable in the presence of the flat-bottomed tripod dish, the collared jar, the flanged collared jar, and various ritual and censer vessel forms. Although some forms continue from the Late/Terminal Classic period, such as the jar, Postclassic Maya potters have changed some rim shapes (e.g., outflaring rims of collared jars). In addition to the changes in form, different pastes were used in the Postclassic period. The volcanic ash tempered paste of the Late/Terminal Classic period begins to disappear during the Early Postclassic and is gone by the Late Postclassic period. Orange, cream, and gray snail inclusion pastes are commonly used throughout the Postclassic period suggesting that Postclassic potters changed the source of clays used in pottery manufacture. Decorative motifs are also vastly different from those of the Late/Terminal Classic period. The Late Classic elaborate ceremonial polychrome designs with glyphic texts change to occasional pseudo-glyphs and other motifs not dominant in the Late/Terminal Classic period indicating a change in decoration. Compatibility of technological and stylistic choices within Postclassic Maya society can also be seen in the similarities between some design motifs (triangles, *ilhuitl* glyphs, etc.) and form characteristics (tripod dishes, jars, and censers) present in the Petén lakes region and northern Yucatán (the ancestral homeland of the Itzá and Kowoj). These changes demonstrate some choices that were more compatible than others during the Postclassic period in Petén, Guatemala.

The presence of technological styles in the Petén lakes region also demonstrates that technology affects style because technologies are performances or behavioral events and "their styles are the symbols through which communication occurs. The relationships among the formal elements of the technology establish its style, which in turn becomes the basis of a message on a larger scale" (Lechtman 1977:13). Technologies also affect styles because the resulting product is a reflection of the attitude of the producer toward the product and the attitude of the community toward the technology and the product with regard to compatibility of the product in the existing social melieu (Lechtman 1977:10). While a multitude of technological alternatives for the production of an object exist, cultures tend to select a technology compatible with and perhaps restricted by its social and physical environment (Sackett 1982:72-73). As such, the chosen technology is a behavioral performance that results in a style and a cultural message (Lechtman 1977:12). Technological behaviors not only moderate "between society and the natural world" but act "as an important vehicle for creating and maintaining a symbolically meaningful environment" (Lechtman 1977:17).

Finally, technological styles demonstrate that compatible choices reinforced the existing technology and social ideology of Petén Postclassic society. Because potters are agents acting in a specific social milieu that they have "not created nor can control," the resulting product may reflect social, political, and/or economic structures particular to the potter's culture that may also occur in other forms of material culture (Shanks and Tilley 1987:148). These reflections of Petén Postclassic technology and social ideology are most notable in the differences of clay sources, decoration colors, design motifs, and forms previously discussed. Technological and stylistic choices illuminate the Petén Itzá and Kowoj social structure and social practice because social structure and potter agency are mediated through the practice of pottery production making pottery production a social activity through which compatible choices are reinforced (Dietler and Herbich 1998:238).

As a result of my analysis of technological styles, I demonstrated that Itzá and Kowoj potters produced and reproduced pottery technological styles that reflected their social environment and displayed their social identities during the Postclassic and Contact periods. Through the analysis of the Mayas' choices of technologies and styles, it is also possible to suggest the extent to which social representations are reflected in the performance of technological and stylistic action, and so aid in defining Itzá and Kowoj social/ethnic identities to refine our understanding of the settlement and socio-political relations in the Petén during the Postclassic and Contact periods.

This study of Petén Postclassic slipped pottery technological style groups and their relationship to the socio-political groups that may have produced them is based on archaeological and ethnohistorical data. My combination of type-variety, "low-tech," mineralogical, and chemical analyses with ethnohistorical data allows me to go beyond an analytical description of Petén Postclassic pottery to further our understanding of the socio-political complexity of the Postclassic period.

My research builds on over 75 years of analysis of Maya pottery. Maya archaeologists, like those studying cultures world-wide, rely on classification procedures such as the type-variety system to begin their studies of pottery and provide regional chronological sequences (e.g., Adams 1964, 1971; Ball 1977; Bullard 1970; Gifford 1976; Sabloff 1970, 1975). Most of these studies are centered around a typological description of excavated pottery and archaeologists situate pottery from that excavated site in time and space. Some scholars (e.g., Gifford) believe that the classification of pottery in the type-variety system allows the archaeologist to gather information concerning social and economic uses of the pottery. These scholars believe that the type-variety system is not an artificial construct and that the ceramic groups, types, and varieties aid in the understanding of cultural reality because the kinds of pottery that are produced are reflections of societal activities. However, a ceramic study based solely on typology rarely addresses issues beyond classification. My study of ceramic typologies emphasizes ware level, allowing me to obtain information about paste attributes and surface finishes that aid in the definition of technological styles and basic choices made by the Petén Postclassic potter.

In addition to typological studies, many past and present examinations of Maya pottery have relied on style to draw conclusions as to production and exchange. Studies based on design element analysis elucidate different ceramic styles based on color a degree of exactness with lines. For example, Beaudry (1984) uses swimming figures, monkey, glyphs, and geometric figures to establish 16 design layout categories of Late Classic polychrome from Copán. Houston, Stuart, and Taube (1989) and Houston and Taube (1987), Grube (1986), MacLeod (1990) have studied the primary standard sequences of "Codex style" pottery to determine who the pot belonged to and what it might have contained. In addition to information concerning the vessel, work has been conducted to suggest the provenience of these vessels (Marcus 1983) as well as their context and broader significance as pottery bearing Maya codices (Robiscek and Hales 1981). In addition to determining the existence of "stylistic workshops," other works combine decoration with chemical paste data to suggest that different pastes and styles indicate "workshops." For example, Reents-Budet, Bishop, and MacLeod (1994) correlate Late Classic "workshop"styles and ceramic paste data with social groups and Hodge and Minc (1991, 1993) suggest different Late Aztec pottery workshops based on stylistic elements and differences in the chemical composition of the pottery.

Because of the lack of anthropological theory, one may come to the conclusion that the different pottery styles simply represent different classificatory types of pottery. As such, some of the stylistic information could easily appear in a ceramic report based on type-variety analysis because many of the works do not go beyond a simple description of what constitutes a style, and the who's and why's creation and perpetuation of the style. My study differs from these because I use the theory of technological style to answer anthropological questions about how and why people may have decorated and made their pottery in a specific manner.

Another topic of much of Maya pottery research is the elucidation of statistically "real" pottery groups based on the chemical analysis of paste structures. The main interest of scholars who use Instrumental Neutron Activation Analysis (INAA) is to use multivariate data to identify lowland Maya areas of production and trading spheres. From these data, scholars interpret the relationships of people and the pottery they produced and traded. For example, the Maya Fine Paste Ceramic Project (Bishop, Harbottle, and

Sayre 1982; Sabloff 1970, and others) examined the clay composition of Fine Orange pottery from the Usumacinta and Pasión River areas to determine the presence of different production sites. They determined that two general areas were used for clay resources–upstream and downstream (Bishop and Rands 1982). Most of these bulk methods of analysis address archaeometric methods of pottery analysis rather than answering anthropological questions about its manufacture and use. Unlike INAA methodologies, my use of ICPS chemical characterizations tests the variability in chemical signatures to indicate the differences in technological choices in order to infer behavior characteristics of the potter.

Unfortunately, mineralogical analysis of pottery has lagged behind chemical analyses. Shepard (1956, 1958) was one of the first to systematically employ petrographic thin-section analysis in pottery studies including an examination of northern Yucatán pottery. From her work with northern Yucatán pottery and other pottery types in the Maya region, she established the standard of petrographic analysis. Although many of her colleagues did not find her work important enough to include in a site's main report, her petrographic analyses did appear as appendices. These continue to influence work done by Maya archaeologists including work presented in this study. Perhaps Shepard's most influential contribution is her concern with history and ecology and how the potter interacted with her/his raw materials and with other aspects of her/his natural and socio-political environment. It was Shepard's concern with the details of petrographic analyses that allowed her to answer questions about production locations and chronologies. My use of mineralogical analysis builds on Shepard's contributions by demonstrating that choices of resources made by Petén Postclassic potters can be investigated by petrographic analysis.

Although much of Maya ceramic research focuses on chemical and mineralogical analyses, some scholars employ "low-tech" levels of analyses in combination with chemical and mineralogical analyses to obtain the fullest complement of data. One can often obtain as much information through "low-tech" analyses alone as from chemical or mineralogical analyses. For example, Rice's (1983, 1987a, 1989) examination of Late Postclassic pottery utilizes decorative styles, paste composition, and data obtained from "low-tech" analyses to explain a complex messaging system that existed in the Petén lakes region. The differences in decorative motifs and design templates demonstrate that the Petén Postclassic Maya potters created different styles that made social interaction more predictable by supplying visual information that reinforced social differentiation and by signifying and maintaining political boundaries. For example, Rice (1983) stated that pottery affiliated with the political realm of Topoxté is a red-on-cream decoration that is painted, unbanded, unpaneled, and has unspecific representations of serpent motifs. On the other hand, pottery that represent social groups at Macanché Island, Ixlú, and Zacpetén has a black-on-cream decoration that is incised, banded, paneled, and depicts reptiles in profile, in split image, or in a RE-glyph with bands of mat design. Although not all of these observations still hold (see above), it is this type of analysis and interpretation on which I base this study.

In general, Maya ceramic analysis seems to suffer from a need to obtain results that indicate chronology through typology and socio-economic behavior through archaeometry, without considering other levels of analysis. My integrative approach demonstrates that it is possible to obtain valuable and complementary data from all levels of analysis (classification to chemical analysis). The breadth of these data allow me to suggest who made the pottery and why as well as interpret some choices made by the potter during the manufacture of pottery that may have been influenced by the socio-political situation. This goes beyond simple classification or the concept of a production zone to answer anthropological questions about the Maya who produced and exchanged Petén Postclassic slipped pottery.

Although my research shows the utility of technological style studies in the identification of social/ethnic groups in the Petén lakes region of Guatemala, Postclassic scholars will benefit from a better understanding of the socio-cultural ties between social groups in the Petén lakes region and northern Yucatán during the Postclassic period with additional research. My research and that of Proyecto Maya-Colonial suggests a distinctive constellation of cultural patterns and traits that appear as an east-west dichotomy in the Petén lakes region resulting from the presence of various social groups. This same pattern (east-west) may also be present in northern Yucatán during the Postclassic period and may further support the origin and migration histories of the Petén Itzá and the Kowoj (Roys 1957). In order to fully appreciate the possibility of an east-west division of socio-political groups in Petén and northern Yucatán and to determine the extent of inter-regional interactions that have thus far been ignored, a re-examination of the published record of artifacts (specifically ceramics) from northern Yucatán as well as data from current archaeological projects is needed.

In addition to a re-examination of data from northern Yucatán, to fully understand the complexity of social and political organization of the social groups in the Petén lakes region in the Postclassic period, more archaeological excavations are needed.

Jones (1998) has suggested that up to six social groups may have co-existed in the Petén lakes region during the 17th and 18th centuries. To date, extensive excavations have taken place mainly in Kowoj territory. Excavations that involve clearing and test-pit sampling of a number of civic-ceremonial and domestic structures in the Itzá and Yalain territory as well as that to the north, south, and east of the Petén lakes will add more architectural, burial, and pottery data. With the addition of pottery data, as well as data from other forms of material culture from archaeological sites in these regions, the association of technological styles with social/ethnic groups will undoubtably become clearer.

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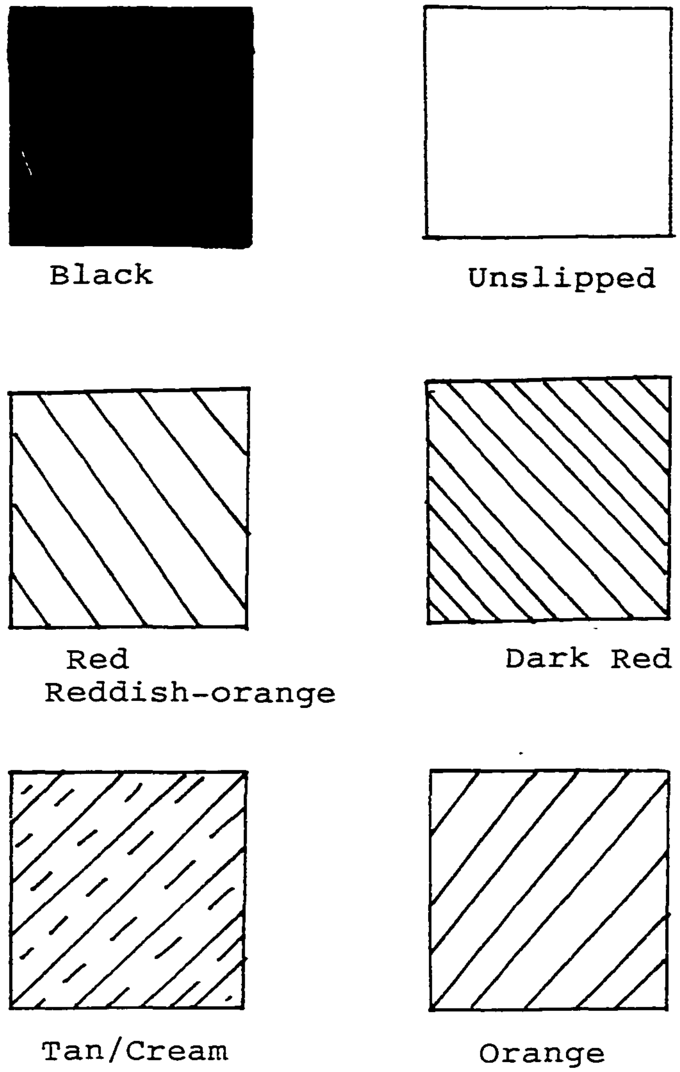
APPENDIX



Key to Conventions Used in Slipped Pottery Illustrations.

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The Technological Styles of Late Postclassic Slipped Pottery from the Central Petén Lakes Region, El Petén, Guatemala

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Publications:

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