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Community Crafting and Crafting Community: The Lithic Artifacts of Zacpeten

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Author
Yacubic, Matthew Patrick

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Community Crafting and Crafting Community:
The Lithic Artifacts of Zacpetén, Guatemala

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of the requirements for the degree of

Doctor of Philosophy

in

Anthropology

by

Matthew Patrick Yacubic

June 2014

Dissertation Committee:
  Dr. Philip Wilke, Chairperson
  Dr. Wendy Ashmore
  Dr. Scott Fedick
  Dr. Prudence Rice
The Dissertation of Matthew Patrick Yacubic is approved:

Committee Chairperson

University of California, Riverside
ABSTRACT OF THE DISSERTATION

Community Crafting and Crafting Community:
The Lithic Artifacts of Zacpetén, Guatemala

by

Matthew Patrick Yacubic

Doctor of Philosophy, Graduate Program in Anthropology
University of California, Riverside, June 2014
Dr. Philip J. Wilke, Chairperson

Zacpetén is a Lowland Maya site in the Central Petén Lakes Basin of Guatemala that was an important center for the Kowoj, a Maya ethnic group with strong ties to Mayapán. The purpose of this study is to examine how Zacpetén functioned to meet its economic needs while creating and sustaining a communal identity between the Late Postclassic (A.D. 1200–1525) and Early Contact (A.D. 1525–1700) periods. At this time, a complex political economy existed across the Maya Lowlands. However, social and economic connections across the Central Petén varied according to the degree of regional political integration. When communities were united under a single polity, economic and political power was vested in regional institutions, and the identity of individual communities was strongly influenced by outside forces. In periods of socio-economic
autonomy, the relations of production were retained by individual communities, facilitating the formation of a localized identity.

Under an interactional perspective, communities are seen as the combination of people, place, and premise created through regularized, but not predetermined, interactions. By looking at the archaeological record, the interactions of the past can be inferred from the study of lithic artifacts. The Zacpetén lithics were examined according to their physical, geochemical, technological, use-wear, and spatial attributes. Based on this analysis, it is argued that the acquisition, production, and distribution of stone tools at Zacpetén during the Late Postclassic and Early Contact periods were highly autonomous, community-based activities. Most of the stone tools at Zacpetén were produced and used by individual households, though several cottage industries in the community specialized in the production of obsidian blades, chert bifaces, and millstone tools. Through community interactions, the Kowoj at Zacpetén made clear attempts to maintain their own identity despite regional influences exerted by Itzá during the Late Postclassic Period and the Spanish during the Early Contact Period. As the Kowoj interacted through economic activities associated with the production and distribution of stone tools, a highly localized identity was created and reinforced.
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Preface

The ancient Maya have a unique culture history with distinctive styles of art, writing, and architecture. They developed advanced knowledge in mathematics, astronomy, and engineering, and it was through these developments that the Maya were able to construct elaborate cities with large temples, irrigation networks, and extensive road systems. Interestingly, the complexity of Maya society developed within a semitropical environment. This was unique among ancient civilizations because most state-level societies developed within arid or semi-arid environments such as Mesopotamia, Egypt, or the Basin of Mexico (Braidwood and Braidwood 1983; Flannery 1973). The tropical environment of the ancient Maya offers a contrasting location for archaeologists who study complex societies and their development (Demarest 2004b:148).

Western fascination with the ancient Maya is not a new phenomenon. Interest in Maya culture and society began in the mid-eighteenth century with the publication of John Lloyd Stephens’s *Incidents of Travel in Central America*. Stephens, an American explorer and writer, traveled across Central America documenting Maya sites such as Copan, Quiriguá, Palenque, and Uxmal (Hammond 1994:9). Stephens published his exploits with the illustrations of Frederick Catherwood in his 1841 book and its successor, *Incidents of Travel in Yucatan* (1843). Both titles were international successes, and they generated significant public interest in the Maya, leading to subsequent archaeological studies across Mesoamerica. However, the focus on ruined temples and monuments swallowed up in the tropical jungles of Central America created a view of the
Maya as a fallen society (Rice and Rice 2004:1). Subsequently, academic scholars perpetuated this perspective of the Maya through the traditional view of the Maya collapse.

According to this traditional view, the Terminal Classic period (A.D. 800–950) was a time when a dramatic event or series of events (overpopulation, drought, warfare, and environmental degradation) led to the cataclysmic collapse of Maya society. First, it has been argued that Terminal Classic declines in temple construction and monument dedication, the abandonment of important civic-ceremonial centers, and increased regional warfare are clear evidence of the Maya collapse. Second, the application of terminology and models used to describe the ancient societies of Western civilization has reified the traditional view of the Maya collapse. Dividing Maya history (Table 1) into Preclassic, Classic, and Postclassic periods creates a bias toward thinking of the Classic period (A.D. 200–950) as the height of Maya society, and the subsequent Postclassic period (A.D. 950–1525) is relegated to a position of lesser importance in Maya history (Rice et al. 2004:3).

The traditional model of the Maya collapse has also been sustained by a romantic view of the Classic period. Many early Maya scholars viewed the Classic period as a peaceful time when stargazing priest-kings governed an enlightened population of farmers (Thompson 1954:263-264). This “peaceful society” was weakened by internal revolt, which facilitated the invasion of the Maya area by foreigners. Consequently, Maya culture was transformed through acculturation with groups from central and western Mexico. Archaeological work from the 1950s onward has dispelled the myth of the
peaceful Maya. The discovery and decipherment of murals, altars, and stelae from
Classic-period sites indicate this period was a time of militarization and conflict. Despite
these discoveries, the romantic view of a peaceful Classic period persists in public
sentiment, along with idea that there was a mysterious and cataclysmic collapse during
the Classic period.

Identifying social collapse and the reasons behind it has been an important aspect
of Maya archaeology, but the Maya collapse is highly contested, and few topics are as
vigorously argued as the timeline, scale, and rationale for the Maya collapse. A
significant complication in these discussions is the lack of a clear definition of social
collapse. Collapse has been defined as the fall, fragmentation, and death of something
meaningful or its decay into something that is morally or aesthetically inferior (Yoffee
1998:14). For archaeologists, social decline may be examined through the analysis of

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<tr>
<th>PERIOD</th>
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<th>GREGORIAN DATES</th>
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<tr>
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Table 1. Maya Chronology
economic, technological, and demographic features. Once quantitative data is gathered, a benchmark for social collapse may emerge. However, such analyses will only identify social collapse; it will not explain the reasons behind it.

Understanding social collapse requires knowledge of societal organization and, in particular, of social institutions and their degree of interdependence. With one or more social institutions fail, shockwaves will move across society, but complete social collapse is unlikely to occur if the remaining institutions are sufficiently independent or have the capacity to absorb the fallout from failure. For the Maya collapse, it is important to understand what institutional changes occurred during the Terminal Classic period and the effect that these changes had on this and the following Postclassic period.

Another critical issue in Maya archaeology is the perceived degree of control that elites had over the production, distribution, and use of prestige and utilitarian goods. Early models of Maya economics stressed the role of social leaders (elites) in organizing the production and long-distance exchange of goods such as salt, grinding stones, and obsidian (Rathje 1972). The Maya were an agrarian society, and the tropical forests they inhabited were a patchwork of natural resources with low carrying capacities. Due to environmental constraints, the Maya Lowlands could not sustain large populations, and the long-distance exchange of critical goods under the patronage of Maya elites developed as an adaptive strategy.

Subsequent studies of the Maya Lowlands changed the perception of tropical inadequacy and produced a new model of lowland political economics. Ecological studies of the Lowlands have shown that the diversity of the forests provided the Maya with a
large number and variety of organic and inorganic resources that were more than sufficient to sustain numerous lowland polities. For example, Voorhies (1982) documented 150 plant species and 25 animal species in the lowland forests that were used by the Maya as trade goods.

In addition, lowland ecological studies showed that the Maya developed advanced agricultural techniques. The Maya were able to sustain large populations through swidden cultivation, the construction of artificial canals and reservoirs, raised-field agriculture, and terracing (Fedick 1991, 1994; Turner and Harrison 1981). There was a high degree of agricultural variation across the Maya Lowlands, and these subsistence differences appear to have resulted from local environmental conditions (Dunning 1996:66). Often, a community simultaneously adopted several subsistence strategies as part of a comprehensive risk management strategy designed to address seasonal instability (Fedick 1996:129). Contrary to early conclusions about the Maya Lowlands, the carrying capacity of the area and its many regions was sufficient to sustain large, complex societies for over 2,000 years (Pyburn 1996:236).

With the development of a cultural ecology model that emphasized a self-sustaining Maya Lowlands, questions arose about the purpose of elite-sponsored activities in Maya society. Succeeding economic studies have stressed household activities and local control over the production, exchange, and use of goods and posed a very limited role for elite-sponsored activities (McAnany 1993; Potter and King 1995; Rice 1987). With the increased focus on nonelite activities, a new perspective in Maya studies has emerged that highlights intraregional interactions and their role in creating
and sustaining communities. Despite these critical developments in Maya archaeology, scholars still know more about Maya religion and ritual than about their economic patterns; a state of knowledge that is the reverse of that for most prehistoric societies (Demarest 2004a:175). This issue is particularly acute for lithic artifacts, for which there are insufficient quantitative data to assess regional economic trends (Masson 2002b:17).

Historically, cultural ideas and values have tremendous influence over stone tool production and use. It is through culture that perceptions about the proper raw materials, tool design, and tool implementation are defined and transmitted (Collins 1975:24). Economic activities, including access to raw materials and control over labor, also are shaped by cultural values. As the Maya societies changed, the behaviors associated with stone tools may have changed as well (Clark 1987:259). In addition, archaeological perceptions about culture influence the analysis of stone tools, and contrasting views about cultural behaviors and social complexity can lead to differing interpretations about stone tools. A clear example of this situation is provided by the debates that surrounded Mousterian stone tool assemblages (Binford and Binford 1969; Bordes 1972).

Because of the ubiquitous nature of lithic artifacts across the Maya Lowlands, it may be possible to infer both short- and long-term cultural patterns through the analysis of stone tools. For areas like the Maya Lowlands, lithic studies can provide insight into social development because stone was the dominant raw material used by the Maya from the time of early hunter-gatherer bands through the era of hierarchical states. As Maya society became more complex, so did the behaviors and ideas associated with the acquisition, production, and distribution of stone tools. This is particularly true for the
development of specialized production of obsidian pressure blades (Clark and Bryant 1997; Clark and Parry 1990).

In the next chapter, an overview of the Maya Lowlands, including the geography, geology, climate, flora, and fauna is presented, with emphasis placed on the environment of the Central Petén Lakes region. In addition, a summary of Maya social developments from the Classic through the Early Contact periods is provided. The goal of both summary presentations is to provide the background for a subsequent discussion of the Kowoj and Zacpetén during the Postclassic and Early Contact periods. The Maya had a complex political economy during this period that integrated communities across the region through social, political, and economic ties. Studies of community interactions, particularly economic interactions, can provide insights into community identity.
Chapter 1- Introduction

Some see the Postclassic period (A.D. 950–1525) as a time of decline in Maya history (Willey 1986:30). As a result, scholars have looked at the period for what it lacks and not what it has (Chase and Chase 2004:13). Adding to the research ethnocentrism are the challenges archaeologists face in studying the period. Postclassic stratigraphic deposits are thinner than those of earlier periods, and they are often eroded or badly disturbed by natural and cultural transformations.

Further complicating Postclassic studies are the calendar dates found in Postclassic codices, monuments, and buildings (Chase and Chase 1985a:9). During the Classic period, dates were recorded using the 260-day Tzolk’in calendar, the 365-day J’aab’ calendar, and the Maya long-count. Postclassic scribes continued to record dates using the Tzolk’in and J’aab’ calendars, but they infrequently used the Maya long-count. Because the Tzolk’in and J’aab’ complete their calendric cycles every 52 years, Postclassic calendar dates are not absolute and have multiple Gregorian calendar correlations. These relative and absolute dating issues create problems in organizing Postclassic chronology.

Despite the challenges, Postclassic studies are incredibly worthwhile for several reasons. First, there are historic records about the Late Postclassic (A.D. 1200–1525) and Early Contact periods (A.D. 1525–1700) written by both Spanish and Maya chroniclers. These records provide detailed accounts of a broad range of activities from which archaeologists may draw correlations to the archaeological record. Second, the Postclassic
was a period of interesting economic developments in Maya history. During this time, multiple Maya polities were linked through expansive interaction networks. Information, goods, and people moved across the Maya Lowlands, linking communities together in what some have suggested was a large, Precapitalist world-system (Smith and Berdan 2000:284).

During the Early Postclassic period (A.D. 950–1200), the exchange of prestige and utilitarian goods dramatically increased across the Maya Lowlands. This expanded trade activity was caused by the rise of a semi-autonomous merchant class and the development of an extended network of trading centers and markets. The growth of exchange networks also created a shift in settlement patterns to areas along the Caribbean coast and interior lakes and rivers (McKillop 1996:58). This shift in settlement patterns is exemplified by the rise of Postclassic trade centers such as Cozumel (Sabloff and Freidel 1984) and Lamanai (Pendergast 1986).

The impacts of Postclassic interaction networks on lowland Maya communities went beyond increased access to goods. Information networks moved new ideas and religious practices across the region, many of which were codified in a new form of art and iconography known as the “Postclassic International Style” (Boone and Smith 2003:187). In addition, the migration of multiple ethnic groups across the Maya Lowlands brought different groups together through new political and military interactions. Overall, the economy of the Postclassic period was very complex, with many interrelated parts working at local and regional levels.
The Economy of Communities

Economies are open systems that involve the processes by which resources are extracted, products are manufactured, commodities and labor are moved, and goods and services are consumed (Earle 2002:8). However, there are many different ways economies accomplish these goals. These variations are attributed to social differences and the embedded nature of the economy (Polanyi et al. 1957). Economies are part of societies, and as societies vary across time and space, so do economies.

Social variations create two significant issues. First, not all economies function in the same ways or for the same purposes. There are significant cultural differences along the social continuum from bands to states. Some see these differences as more than contrasts in complexity, as different societies have unique sets of values and ideas that create economies that are different “not in degree but in kind” (Dalton 1967:164). As a result, it is important to look at the social customs, laws, and regulations under which economic activities are organized (Masson 2002a:2).

Second, a priori assumptions about noncapitalist societies cannot be made using modern capitalist or “traditional” economic theories. Notions of rational choice, diminishing rates of return, and insufficiency are associated with the modern capitalist economy, which has its roots in commercialization, privatization, industrialization, and the operations of modern nation states. Even when similar economic institutions are found in noncapitalist settings, they often operate on different principles than their capitalist counterparts (Plattner 1989:174).

For example, the pre-colonial Tiv markets in West Africa were a critical part of
society, but Tiv markets were organized according to their own cultural values and not according to capitalist market principles (Bohannan 1955). Among the Tiv, personal prestige and social rank were more important than personal wealth, and economic exchanges were seen more as gifts than transactions. Another important aspect of Tiv markets was luck, and the bad luck of an individual or the influence of witchcraft could create bad economic transactions (Bohannan 1955:60).

The emphasis on personal relationships and individual status over capitalist ideas of equivalency, supply and demand, or price making led to three distinct exchange spheres in Tiv markets. The first exchange sphere included subsistence goods with low social value. The second exchange sphere included socially important items associated with personal prestige (cattle, brass rods, and a large white cloth, or tugundu). The third and most prestigious exchange sphere involved the trade of slaves and women. These three Tiv economic spheres were distinct, and while goods within one sphere were exchanged within each sphere, goods could not be exchanged across spheres.

Economic processes have always been subjects of interest in Maya archaeology. During the middle twentieth century, Maya studies focused on regional settlement patterns and the long-distance exchange of critical resources and prestige goods. During the early 1970s, archaeologists shifted their focus to the types of interactions that took place within households. With this change, scholars examined economic activities associated with household subsistence. While regional and household economic perspectives continue to be important in Maya studies today, there is a theoretical space in the middle. To examine the complex economic dynamics of Maya Lowlands, many
scholars include community activities in their studies as well.

Communities are universal social institutions created and sustained by shared beliefs and practices. Community members have a connection with a real or imagined space, and it is often through this shared space that community activities take place. Such communal activities are pivotal in creating a shared identity among individuals within a particular community. In this sense, communities become a conjunction of people, place, and premise created through regularized, but not predetermined, interactions (Watanabe 1992:12).

However, communities are difficult to observe in the archaeological record because they are, in part, a shared idea. One method archaeologists have used to overcome this challenge is to study communities using an interactional perspective in which community identity is seen as constructed through regular interactions that take place between individuals, households, and regional institutions. All of these interactions affect community identity, and it is important to examine the impacts of both local and regional interactions, including economic interactions, on the formation and maintenance of communities.

**Methodology**

A good study of ancient Maya community interactions comes from work at Joya de Cerén in El Salvador. Cerén was a small, Classic-period village of about 100 individuals in the southeastern Maya Lowlands (Sheets 2000:217). Around A.D. 600, an eruption from the Loma Caldera volcano caused the abandonment and preservation of
Cerén until it was rediscovered in the 1970s. The incredible level of preservation at the site gave archaeologists the opportunity to examine household and community activities at an unprecedented level of detail. At Cerén, three different categories of economic activities were identified.

The first category was the household economy and included all subsistence activities associated with household maintenance. For Cerén households, economic activities at this level centered on maize cultivation, which, along with beans and squash, formed the basis of the ancient Maya diet. However, Cerén households were not limited to cultivation and agriculture; they supplemented their subsistence needs with plants and animals collected from the forest.

The second category of economic activity at Cerén was the part-time, specialized production of goods that were exchanged between households. This type of production, in which goods are manufactured for trade with other households, is known as cottage industry production (Prentice 1983:18). What is interesting about cottage industry production at Cerén is that all of the excavated households showed clear evidence of engagement in at least one type of specialized production (Sheets 2000:218). For Cerén, cottage industry production was important to the community because it was through this economic category that essential goods were produced and distributed between individual households. In many cottage industries, independent specialists produced goods for other local households, usually on a part-time basis. Beyond provisioning households, production at the community level created opportunities for interactions between households that fostered a sense of unity, belonging, and identity.
The third economic category identified at Cerén was the regional economy. Activities in the regional economy included the production of polychrome pottery, salt, and objects of obsidian, jade, and hematite by attached craft specialists (Sheets 2000:219). There is little evidence at Cerén to suggest that it controlled the regional economy. Instead, control over the regional economy was located at the larger center of San Andrés, approximately 2 kilometers southwest of Cerén. However, all of the households excavated at Cerén received some regional goods, indicating a degree of participation within the regional economy.

Stone tool studies of the Maya Lowlands suggest that prehistoric economic activities were more complicated than a simple dichotomy between substantive household economies and regional political economies. Archaeological work at Cerén shows that the community had three categories of economic interactions: household, community, and regional. Most individual household needs were met through household and community interactions, while the regional economy often focused on the political and social activities beyond the community. Other Maya Lowlands communities may have had similar categories of economic interactions, though such trends could have been spatially limited to the southwestern Maya Lowlands or temporally limited to the Classic period.

**Research Purposes and Outline of Chapters**

The purpose of this dissertation is to study how Zacpetén met its economic needs between the Late Postclassic (A.D. 1200–1525) and Early Contact periods (A.D. 1525–
1700). Zacpetén is an ancient Maya community located in the Central Petén, approximately 30 kilometers south of Tikal. Archaeological work and historic records indicate Zacpetén was an important Kowoj community. Previous studies of Zacpetén also show that a broad range of activities took place at the site during these periods (Pugh 2001). While this work focuses on Postclassic Maya economics as they relate to the lithic industries of Zacpetén, it may provide a generalized model for community economics within the larger social context of the Maya Lowlands.

The economic activities of Zacpetén may have been organized at three levels: household, community, or regional. Within each level, the manufacture, distribution, and use of stone tools involved different social relations that created distinct lithic production sequences, distribution characteristics, and use patterns. Inferences about the Zacpetén economy are drawn from the analysis of lithic artifacts collected during several seasons of fieldwork. The lithic classes in this study are obsidian, chert, millstone, handstone, and lapidary artifacts. Each of these classes was subdivided into different categories according to their visual, geochemical, technological, and use-wear attributes.

A key issue in this study is the location of economic control. If the stone tools used at Zacpetén were produced at the household or community level, then dependency on regional authority would have been low. However, if the stone tools used within the community were imports, then a dependent, possibly hierarchical, relationship may have existed between Zacpetén and regional institutions. Such a relationship would have had a strong impact on community identity.

In the second chapter, “The Community and Community Studies in
Anthropology”, anthropological perspectives of communities are examined. This chapter also looks at the dichotomy between local and regional economic activities and the impacts that these activities had on community identity. The third chapter, “The Culture History of the Central Petén Lakes Basin”, explores the cultural context of Zacpetén and provides an overview of lowland Maya culture history from the Terminal Classic through the Early Contact periods. The Kowoj occupied the area around Zacpetén between the Late Postclassic and Early Contact periods, and the fourth chapter, “The History of Zacpetén and the Kowoj”, discusses Kowoj historical references and the archaeological history of Zacpetén. Two critical aspects of research at Zacpetén have been the studies of the architecture and ceramics, both of which have strong affinities with Mayapán.

The theories and methods used to study the lithic artifacts from Zacpetén are discussed in the fifth chapter, “Research Methods”. The next three chapters discuss the results from the analysis of the chipped-stone and ground-stone artifacts of Zacpetén. The sixth chapter, “Obsidian Artifacts”, discusses the obsidian artifacts recovered from work at the site. The seventh chapter, “Microcrystalline Quartz Chipped-Stone Artifacts”, provides a similar study of the chert artifacts. The eighth chapter, “Millstone, Handstone, and Lapidary Artifacts”, examines several classes of artifacts from Zacpetén. The final chapter, “Conclusions”, is a summary and discussion of the research and its findings. The rest of this introductory chapter presents a general overview of the Maya Lowlands, including the geography, environment, and geology of the area.
The Maya Lowlands

Zacpetén is located in the heart of the Maya culture area. Based on the distribution of archaeological sites and modern Maya settlements, this area is roughly 324,000 square kilometers in size and includes Guatemala, Belize, southeastern Mexico, western Honduras, and eastern El Salvador (Sharer 2006:23). The Maya area was home to multiple ethnic groups that interacted with one another over several millennia. Proof of these cultural interactions can be seen in the shared syntax of twenty-eight different Maya dialects and in the common set of cultural ideas and practices, many of which have been used to define the larger Mesoamerica culture area (Kirchhoff 1943:99-100).

Archaeologically the Maya area is defined by the distribution of features associated with an elite-oriented culture: corbel vaulting, hieroglyphic inscriptions, carved monuments, and certain types of polychrome pottery (Hammond and Ashmore 1981:20).

Geography

The Maya culture area is one of the most environmentally diverse areas on earth. Within its boundaries are lush tropical forests, rugged mountains, and arid coastal plains. Because of these environmental variations, the Maya area is typically divided into three distinct sub-areas: the Maya Lowlands, the Pacific Piedmont, and the Maya Highlands (Figure 1). The Maya Lowlands are the largest of the three sub-areas and, with the exception of the Maya Mountains, are hot and flat, with elevations of 800 m or less (Sharer 2006:29). Scholars further divide the Maya Lowlands into three regions, each with its own characteristic elevation, climate, and ecology; these regions are the Maya the
Figure 1. Map of the Maya area.
Figure 2. Map of the Maya Lowlands.
Northern (Yucatan) Lowlands, the Southern (Transitional) Lowlands, and the Central (Petén) Lowlands (Figure 2).

The Northern Lowlands include the Mexican states of Yucatan, Quintana Roo, Campeche, and a small part of eastern Tabasco. This region is semi-arid and has the lowest amount of rainfall in the Maya Lowlands. There are virtually no surface streams in the Yucatan, and most of the water comes from limestone cenotes formed by the collapse of rock above subterranean stream channels (West 1964:72). The Southern Lowlands are a transitional zone between the Lowlands of the north and Highlands to the south. This region includes the northern parts of Huehuetenango, El Quiché in Guatemala as well as Tabasco, northern Chiapas, and southern Campeche in Mexico. The surface geology of the Southern Lowlands is mostly limestone, but soils are deep and fertile, particularly within the Usumacinta and Pasión river basins.

The Central Lowlands include the Department of Petén in Guatemala and the adjacent parts of central and southern Belize (Figure 3). This region contains a diverse range of soils, forests, and surface drainages. The northern limits of the Central Lowlands are marked by one of the last pristine semitropical rainforests in the Mirador Basin. Thick forests and low-lying swamps, or bajos, dominate this region (Rice and Puleston 1981:122), and the ancient Maya used these depressions intensively as water reservoirs (Matheny 1982:168-169).

The southern part of the Central Lowlands is an irregularly shaped savanna with poor soils. The southern Central Lowlands extends from the southwestern boundary of the Central Petén region to the Subin River, and it is characterized by a broad and grassy
Figure 3. Map of the Central (Petén) Lowlands.
savannah with low scrub and thorn brush vegetation (Rice 1993:23). Interspersed within the grasslands are conical, denuded limestone hills (Lundell 1937:81). In the center of the Central Petén is an interior basin roughly 100 kilometers long and 30 kilometers wide (Rice and Rice 1990:123). The main feature of this basin is a chain of fourteen freshwater lakes that were seasonally interconnected (Figure 4). With a total area of about 99 square kilometers and a maximum depth of 160 meters, the largest of these lakes is Lake Petén Itzá. Other lakes in the Central Petén region include Perdida, Sacpuy, Quexil, Petenxil, Salpetén, Macanché, Yaxhá, and Sacnab.
Like the Mirador Basin, the Central Petén is composed of semitropical forests, though a significant amount of deforestation has occurred from farming, ranching, and the expansion of modern settlements. The richness of the Central Petén Lakes Basin, including its fresh water and irrigable land, was, and continues to be, an important draw for immigrants. Much of the richness is a direct result of the Maya Lowlands climate.

**Climate**

The Lowlands climate is classified as *tierra caliente*, with temperatures ranging from 18° C to 35° C and average humidity levels between 69 and 83 percent (Vivó Escoto 1964:192). While temperatures are generally hot and humid, they are also stable. The average temperature in the Central Petén is 26° C, with an annual variance of less than 10° C. The topography of the region, ocean currents, and seasonal atmospheric changes all shape the climate of the Maya Lowlands. During the winter, the heat from the thermal equator creates stable air masses that cause dry conditions. Humidity is lower during the dry season, and the skies generally lack clouds. The low humidity and clear skies create dry conditions across most of the Maya Lowlands.

From May to November, the movement of trade winds across the Caribbean and the Gulf of Mexico causes atmospheric instability, bringing rainfall into the region (Vivó Escoto 1964:192). During the rainy season, precipitation occurs on a daily basis, with heavy rains from August to October. During these months, tremendous amounts of rainfall often cause destructive floods and mudslides (Vivó Escoto 1964:195). Despite its
associated perils, the high annual rainfall is a critical element that sustains the biodiversity of the area.

**Flora**

Most of the Central Petén flora can be categorized into three types of ecosystems: bajos, savannas, or quasi-rainforests (Rice 1993:24). Bajos are common in the northeastern part of the Central Petén, particularly around the sites of Uaxactún and Tikal (West 1964:73). While these closed depressions hold standing water during the wet season, they lose water during the dry season, creating significant water shortages (Ford 1996:300). Because of the seasonal nature of rainfall, the vegetation around bajos must endure periods of both extended drought and inundation (Rice 1993:23). Common vegetation in this zone includes grasses, scrub brush, and several varieties of palms.

The southern part of the Central Petén is a savanna of mixed vegetation that grows in locations with minimal soil development or extreme soil degeneration (Rice 1993:24). Some upland species do occur within small groves scattered around the savanna, but vegetation diversity within the southern Central Petén is low and mostly consists of drought-resistant scrub brush and grasses. Because of the poor soils and weak vegetation, few Maya settlements are located in the Central Petén savannas.

The majority of the Central Petén is classified as a quasi-rainforest (Lundell 1937):7. Typically, these areas are evergreen, but the amount of foliage varies according to plant species and annual rainfall. Quasi-rainforests are characterized by three or more levels of trees within a forest canopy (Wagner 1964:230). The trees in the upper layer of
quasi-rainforests can reach heights of up to 50 m and include species such as mahogany and ceiba. The second layer has a greater diversity of trees and plants, and the biomass is sufficient to create a closed canopy. Important species found within this layer include the breadnut (*Brosimum alicastrum*), sapodilla (*Manilkara zapota*), and rubber (*Hevea brasiliensis*) trees. The lower layer of the forest includes several varieties of sweetwood (*Ocotea*), Spanish moss (*Tillandsia usneoides*), and numerous flowers and tropical vines. Because of the density of the trees in the rainforest, ground cover is limited to leaves, vines, branches, and fallen trees (Wagner 1964:230). Along the forest floor, grasses appear sporadically and only are in areas where the canopy is open.

**Fauna**

The Maya Lowlands are part of the corridor that connects North and South America. As a result, it is one of the most biologically diverse places in the world. About 50 species of mammals live in the Lowlands, including opossums (*Didelphis virginiana*), porcupines (*Erethizon dorsatum*), rabbits (*Lagomorpha Leporidae*) anteaters (*Tamandua Mexicana*), foxes (*Urocyon cinereoargenteus*), deer (*Odocoileus virginianus*), peccary (*Tayassu pecari*), coyotes (*Canis latrans*), and several species of bats. Some of the more exotic species are the agouti (*Dasyprocta*), jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), puma (*Puma concolor*), and tapir (*Tapirus bairdii*). Several primates, such as the howler (*Alouatta pigra* and *Alouatta palliata*), and spider monkey (*Ateles geoffroyi*) live in the Maya Lowlands (Stuart 1964:323).
Over 1,400 species of birds have been identified in the Maya Lowlands. Most of these birds are migratory, but a significant number of them are in the region year-round. Waterfowl include several species of herons and egrets and ducks. The area is also home to a number of forest birds, including several varieties of parrots, toucans, and the quetzal (*Euptilotis neoxenus*), whose feathers were valued across ancient Mesoamerica as a symbol of rulership.

The Lowlands forests are home to at least 900 species of reptiles, including several species of frogs, snakes, crocodiles, lizards, and turtles. The lakes, rivers, and streams of the Central Petén are also home to 35 varieties of fish. Most of these species are not very large, and the stocking of several lakes with non-local sport fish has dramatically affected native populations. In sum, the Central Petén region is one of the most ecologically diverse areas in the entire Lowlands, and the ancient Maya heavily relied on the diverse plant and animal species within it.

**Geology**

Geologically, the Maya Lowlands are composed of a single limestone shelf. Half of this shelf is submerged under the Gulf of Mexico, and the other part is bounded by water to the east, north, and west. To the south are three mountain ranges: the Sierra Madre del Sur in Guatemala, the Sierra de Chiapas in Mexico, and the Maya Mountains of southern Belize and western Honduras (Rice 1993:12). The Central Petén is composed of a series of intermittent, east-west limestone folds that form a line of ridges and troughs with elevations between 100 and 300 m (Rice 1993:15). These ridges are composed of
marine shale and continental limestone of Paleocene and Early Eocene age (Vinson 1962:442). Within these limestone matrices are many deposits of chert and of varying size and quality. At some locations, the nodules can be quite large. In northern Belize, high-quality chert nodules as big as one meter wide and one-half meter thick have been found in outcrops near the site of Colha (Shafer and Hester 1983:521).

Along the southern and eastern portions of the Central Petén are the Maya Mountains. This well-vegetated range extends about 115 kilometers, rising over 900 meters in the Central Petén until it drops into the Caribbean (Owner 1928:596-597). Geologically, the Maya Mountains are a folded and dissected mass of schists, sandstone, shale, and limestone (Willey et al. 1965:21). The Maya Mountains are similar in composition to ranges in Chiapas and the Guatemalan Highlands (West 1964:38). However, the Maya Mountains lack of obsidian deposits.

Despite the lack of obsidian, a wide variety of other minerals are found in the Maya Mountains, including hematite, pyrite, quartz, quartzite, granite, and alabaster (Graham 1987:756). The site of Caracol is located near some of the highest concentrations of pyrite, and it is very likely that this mineral was a major trade item for the community. Two additional minerals likely traded from the Maya Mountains were granite and quartz, and several artifacts from sites in the Central Petén have been traced to granite and quartz outcrops in the Maya Mountains (Shipley and Graham 1987). In the Central Petén, raw materials for chipped-stone and millstone tools can be found, but they vary in their quality and quantity.
Differences in the distribution of Central Petén resources provided unique opportunities and limitations for different communities across the region. The geologic patchwork not only facilitated trade between basin communities, but it likely aided in the establishing long-distance exchange with other locations outside of the Maya Lowlands (Rathje 1972:368). Clearly, people could find what they needed in the Central Petén, but they also traded for high-quality materials such as basalt and obsidian. Overall, the diverse range of plants, animals, minerals, and the year-round water supply, drew people into the Central Petén region for thousands of years.
Chapter 2 - The Community and Community Studies in Anthropology

Economic studies examine the production, exchange, and use of goods and services within a society. While the types of interactions that people engage in to meet their economic needs vary according to social rules and cultural values, all individuals participate in economic interactions within their respective societies regardless of the level of social complexity. Early economic studies in anthropology looked at the contrasts between individual and household interactions at the local level, and they examined the regional political interactions of elites, groups, and institutions. More recently, some of this focus has shifted to examining the economic interactions that take place midway between the local and regional levels. As such, it is important to examine the nature and role of communities in society.

The community is a fundamental unit of human society, and it has been an important anthropological topic for over a century (Rapport 2002:114). There are several reasons why community studies are important. First, communities are universal. Despite variations in social complexity, subsistence patterns, and cultural values, all humans belong to at least one community (Arensberg 1969:11). Because of the ubiquity of the community, cross-cultural studies can provide insight into the origin and development of human society.

Second, the community is an important social entity that bridges biological affiliation and social organization (Kolb and Snead 1997:609). As an institution, the community is located between biological entities (families) and larger cultural
institutions, such as kin groups, classes, and ethnicities (Patterson 1993:91). As a result, communities play an important role in the creation of personal identity. Finally, communities are the medium through which anthropological studies are conducted.

Archaeologists also focus on communities in their studies of ancient societies, but, unlike other anthropologists, they cannot directly observe community interactions. This situation creates a challenge for archaeologists, who must determine how the material remains of past people correlate with modern anthropological theories and practices. While communities have been, and continue to be, important to anthropological studies, anthropologists have found it difficult to come up with a comprehensive definition of community.

**Theoretical Perspectives on Community Studies**

The perception of communities in anthropology has changed over time in response to major theoretical developments. This is particularly true for studies of Mesoamerican communities. In looking at the history of ethnographic research in Mesoamerica, Chambers and Young identified four phases of community studies: the evolutionary approach, the traditional approach, the historical-developmental approach, and the symbolic approach (Chambers and Young 1979).

Under an evolutionary approach, communities are examined in an evolutionary framework that considers their development over time. Like organic life, societies evolve from small and unspecialized to complex and interrelated. Because biological evolution was universal, all societies were thought to have passed through similar stages of
development, and it was believed that each society could be “ranked” according to its subsistence patterns, political organization, and social institutions. Using an evolutionary perspective, early anthropologists hierarchically categorized societies and their constituent communities according to their level of complexity. In his analysis of cultural evolution, Herbert Spencer (1860:54) outlined the evolutionary perspective of communities:

We may observe that the lowest types of animals do not increase to anything like the size of the higher ones; and similarly, we see that aboriginal societies are comparatively limited in their growth. In complexity, our large civilized nations as much exceed the primitive savage ones, as a vertebrate animal does a zoophyte.

According to the evolutionary approach, “primitive” societies in the present represent early stages of cultural development for “advanced” civilizations. Another early anthropologist, Edward Tylor (1861:249), used this concept to find broad similarities between Aztec obsidian weapons from Mexico and those found in ancient European civilizations.

The family-likeness that exists among the stone tools and weapons found in so many parts of the world is very remarkable. The flint-arrows of North America . . . in the land of the Dacotahs, and which, in the wild northern states of Mexico, the Apaches and Comanches use to this day, might be easily mistaken for the weapons of our British ancestors.
There are many critiques of the evolutionary approach. First, this research method is biased towards nineteenth-century European social values, and it led to an ethnocentric view of non-Western cultures. More important, anthropological research found significant contradictions in the application of evolutionary concepts to society. Societies do not always progress from simple to complex, and some societies have actually moved away from higher levels of social complexity because of historical developments or environmental pressures. These problems in the evolutionary approach led directly to the development of the traditional approach in community studies.

The traditional approach is aligned with structural-functionalist theory. One of the key ideas of structural-functionalism is a belief that social institutions are interrelated and that change in any single institution leads to changes in the other aspects of society. However, it can be difficult to achieve institutional social change, and even when such change is successfully instituted, it tends to happen at a slow pace. This intransigency to social change occurs because the main purpose of social institutions is to maintain society as it is over time.

The inclusion of structural-functionalist theories into community studies was not the most important contribution of the traditional approach. Instead, the most significant aspect of the traditional approach was the introduction of a new set of anthropological methods used to study people and their culture. It was through structural-functionalism theory that communities became the laboratory for testing anthropological theories.

In their research, many structural-functionalists looked for communities that were not connected to modern capitalism or nation states. Because of their relative isolation,
these “traditional” or “peasant” communities were viewed by structural-functionalists as economically, politically, and culturally autonomous. These traditional communities were thus to serve as cultural microcosms for the wider analysis of universal cultural phenomena (Arensberg 1961:241). Structural-functionalists also saw traditional communities as highly homogenous, and it was thought that to study one community was to study all communities within a particular society (Evans-Pritchard 2004[1940]:185).

Beginning in the 1960s, critiques of the traditional approach challenged the structural-functionalist view of the community. In his work at Chan Kom, Yucatan, Redfield applied structural-functionalist theories to his research with mixed results. Redfield observed a high degree of internal cohesiveness within the community. For Redfield, Chan Kom represented the “little community”, which was small and self-sufficient and in which subsistence practices were replicated between households (Redfield 1963:4). However, he also observed that Chan Kom was not completely isolated “but [was] part of a much larger, more complicated system” (Redfield 1963:4). This larger system, or “great tradition”, includes nation states and “civilized societies” that incorporated local communities through the diffusion of goods, ideas, technology, and capital.

Other anthropologists drew similar conclusions about the external influence of great traditions on little communities. For Wolf, “certain relationships among the features of peasant culture are tied to bodies of relationships outside the peasant culture, yet [they] help determine both its character and continuity” (Wolf 1955:454). Because external forces influence the community, it is important to study the historical connections
between the community and these forces. Critiques of the traditional approach, particularly the view of the community as an isolated entity, led directly to the historical-developmental approach in community studies.

Under the historical-developmental approach, communities do more than just replicate social institutions. Communities are locations of conflict created by factional competition. Communities are not internally homogeneous, and individuals and groups within a community can be at odds with each other. This internal tension fosters various types of diversity and contradiction (Patterson 1993:91). Not all community groups are interested in maintaining continuity, and community divisions emerge as factions compete for economic, political, and social power. Factionalism in communities is common, and the prevalence of community divisions within ethnographic discourses has led some anthropologists to suggest that factionalism is a fundamental aspect of communities (Murdock 1949:90; Redfield 1963:132). Factionalism within and between communities can lead to political and economic change as well as to the emergence of new social institutions.

For example, many Mississippian communities between the eleventh and thirteenth centuries A.D. were brought into the Cahokia chiefdom through the politicization of community traditions and ceremonies (Pauketat 2000:15). Integration into the Cahokia is inferred from higher numbers of Cahokia-related artifacts and features such as chunkey stones and platform mounds at Mississippian communities (Pauketat 2000:33). By breaking local communal economic interactions and ceremonies, the Cahokia polity established itself as the focal point of community life. However, some communities
resisted integration, as demonstrated by their dispersal away from the regional centers and their lack of Cahokia paraphernalia. By rejecting Cahokia and maintaining local traditions, these communities retained their own identity (Pauketat 2000:16).

As anthropologists looked at communities through the historical-developmental approach, a new set of challenges emerged. This model for community studies was criticized for emphasizing the political economy and regional institutions at the expense of local, internal community forces (Yaeger and Canuto 2000:2). While external forces do have a strong influence over communities, local households retain a level of agency in the assimilation process. As each new aspect of a “great tradition” is introduced into the community, it is modified according to the local beliefs and practices. Furthermore, the transmission of new ideas into a community is not always harmonious, and community symbols can be areas of contention (Preucel 2000:59). These conflicts are ideological in nature, so it is important to examine the symbolic aspect of communities.

The symbolic approach to community studies looks at the notions, ideas, and beliefs of community members and how those beliefs are represented. The symbolic approach focuses less on the material aspects of communities and more on how people define and give meaning to their community (Rapport 2002:115). Under this approach, communities exist in the minds of people who share a common set of symbols, behaviors, and ideals (Urban and Schortman 1999:138). Shared community symbols can unite people, but they can also differentiate community members from others through such things as dialect, dress, food, and mortuary practices (Cohen 1985:117). Through symbols, boundaries are created between those inside the community and those outside of
Over time, community studies have shifted according to theoretical developments in anthropology. As anthropologists moved from evolutionary, functional, historical, and symbolic approaches, new perspectives on the community emerged as an object and as a place of anthropological research. Each approach examines the community using a distinct lens, and most anthropologists will take different pieces from the various approaches to create their own individualized definition of the community. The emphasis on one community aspect over another is not incorrect; communities are complicated and have many dimensions. However, such ambiguity can create significant challenges in defining communities.

What is a Community?

A community is multi-faceted, and as each anthropologist tailors his or her approach using different theoretical perspectives, varying definitions of “community” emerge. Murdock, in his analysis of the community, provided one of the earliest definitions: “the maximum group of persons who normally reside together in face-to-face association” (Murdock 1949:79). This definition describes three fundamental aspects of the community: people, place, and regularized interactions.

A community is more than an individual, but it is difficult to determine how many people are required to form a community. Arensberg defined a community as “the minimum number of people required to carry and transmit culture” (Arensberg 1969:10-11). Lipe offered a similar definition of community, but with greater specificity. A
community is “a minimal, territorially-based aggregate, including individuals of the two sexes and at least three generations, capable of maintaining itself through time” (Lipe 1970:86). Both definitions suggest that the number of people required to form a community is equal in size to a kin group. A kin group is a body of people with a common social bond that can be affinal, consanguineal, or ritual. All societies have kin groups, but the magnitude and size of kinship social bonds vary considerably (Wolf 1997:89).

Community members also share an affiliation with a common space. Chambers and Young defined a community as “a group of people living in close proximity, most often in a place with geographical or political boundaries” (Chambers and Young 1979:40). For most pre-modern communities, membership and space are linked to patterns of residence and subsistence. These two factors create a sense of place that is intimately linked with community identity (Kolb and Snead 1997:611). For some communities, the recognized space can act as a type of totem though which local households create a connection with each other and distinguish themselves from outsiders.

Interestingly, community space does not have to be a physical location. Because the community is partly a symbolic construct, the common space may be an imagined or mythological setting. Examples of imagined spaces include virtual communities. Virtual reality is “the mechanisms by which human beings interact with computer simulations”, and it is synonymous with “computer-based” or “online” activities (Bartle 2004:3). With virtual communities, the physical location of the hardware where data are stored and retrieved is irrelevant; the virtual world is the space where activities take place and where
identity is shaped. For many, what happens in the virtual world is often just as meaningful to community members as what takes place offline (Taylor 2006:19).

The final aspect of a community is the regularized interactions that occur between community members. People interact with each other for a variety of reasons. For pre-modern societies, community interactions were important for pooling people and resources for defense, risk minimization, technological investment, and trade (Johnson and Earle 2000:131). Foraging, pastoral, and agricultural activities have higher yields when they are cooperatively undertaken. In addition, communal aid and sharing provide a form of insurance against devastating loss. However, community interactions are about more than survival. Communities provide opportunities for individual gratification through social interaction. Community members come together to talk, laugh, tell stories, and share personal experiences that enrich their lives.

In looking at community interactions, Murdock’s definition of face-to-face association may be too restrictive. Community affiliations can be powerful enough to transcend time and space without face-to-face interactions. This is certainly true for diasporas. A diaspora is an expatriate, minority community that maintains a memory, vision, or myth about its original homeland (Clifford 1994:304). In many cases, members of a diaspora cannot return to their communal homeland for economic or political reasons, despite a desire to do so.

Today, many diasporas stay in contact with their homelands through technology and mass media. However, past diasporas also maintained strong connections with their home communities despite a lack of advanced communication technologies. At
Teotihuacan, Maya from the Merchant’s Barrio maintained a distinctive ethnic identity, as demonstrated by the artifacts and features found at the site. In the barrio, several round structures dating to the Early Xolapan Phase (A.D. 400–550) were built according to the lowland Maya style, and large quantities of chert and jadeite from Belize were found in contemporaneous complex deposits (Rattray 1987:111). The maintenance of a Maya identity in a foreign, urban center for over 100 years, despite a separation of over 1,000 miles, suggests that community identity can be maintained under circumstances where contact may be infrequent.

**Interactional Perspective on Communities**

Archaeology can offer important insights to community studies, particularly in addressing questions of community formation and change. However, archaeological studies of communities are not without important methodological issues. While archaeologists can use ethnographic analogies to reconstruct past communities, these approaches may be limiting because of the uniqueness of the cultures they try to represent. Unlike other anthropologists, archaeologists cannot directly observe community members or their activities in a shared space. Instead, archaeologists infer community interactions from the material remains of archaeological sites.

Archaeological communities are fundamentally synonymous with archaeological sites, but the practical fit between the community and the site is dependent upon the scale and complexity of the site (Kolb and Snead 1997:612). Communities often extend beyond the physical limits of the site to include other locations and features such as
agricultural fields, terraces, quarries, sacred grounds, and even the natural landscape (Mehrer 2000:44). To account for these different natural and cultural features, archaeologists take a broad view of community space. However, community boundaries are difficult to determine because geographic and political boundaries are not universal, and they vary between different societies (Joyce and Hendon 2000:231).

Another challenge archaeologists face in community studies is that communities are, in part, symbolically constructed from the beliefs, shared experiences, and regularized interactions of group members. To examine past communities, archaeologists focus on the types of interactions that occur within and between communities. This perspective relaxes the residential and ideological aspect of the community and emphasizes exchange relations in community dynamics. Under an interactional perspective, the community is defined as “supra-household interactions structured and synchronized by a set of places within a particular span of time” (Yaeger and Canuto 2000:6). It is through these regularized interactions that communities are created and sustained.

Interactional perspectives also include agency theory in the modeling of community dynamics. Community interactions are not predetermined but are structured by a variety of material, social, and cultural conditions. These actions are not always harmonious, nor do they necessarily function to sustain social institutions. Again, community identity can be created through internal conflict and factionalism. Whether these interactions are harmonious or contentious, community identity is formed by the multiple interactions that take place at the local and regional levels. For precapitalist
communities, one category of interactions that are critically important to identity formation is the economic interactions that take place within communities.

The Economy of Precapitalist Communities

For precapitalist societies, there are two interrelated economies: the subsistence economy and the political economy (Johnson and Earle 2000:22). Substantivist economic studies look at the ways households provision themselves through interactions with nature and society. In precapitalist societies, households produce much of what they need, though the degree of economic autonomy varies among societies. When households engage in activities that go beyond their maintenance, the economy shifts from the substantive realm to the political.

Political economies “involve the ways that surpluses are mobilized and allocated to support political activities, lifestyles, and operations of social institutions and their leaders” (Earle 2002:9). Leaders must convince or coerce households to produce beyond their own wants and needs. Thus, political economies are competitive, growth-oriented, and require a high degree of organization. The political economy goes beyond the household to include institutions and practices at the regional level. Communities are affected by both regional and local economic activities, and, as a result, it is important to examine the spaces, people, and interactions of both the substantive and political economies.
Local Interactions

At the local level, community members interact through the domestic and the kin-ordered modes of production. The domestic mode of production (DMP) involves substantive economic activities organized at the household level. The technology and skills used in household production are accessible, and each household undertakes the entire production process, from the extraction of raw material to the fabrication of goods (Sahlins 1972:72). Under the DMP, there is little restriction on how goods are created, distributed, and used within households. Households tend to produce what is needed, and they have little incentive go beyond their own needs unless some external incentive or inducement is provided.

Some see underproduction as a negative aspect of the DMP, which results from the difference between the carrying capacity observed in some studies and the critical carrying capacity of a particular environment with a given population. However, the problem with underproduction is that critical carrying capacity is calculated using capitalist economic concepts and optimum production outputs under modern agricultural techniques (Sahlins 1972:43). As such, underproduction does not mean that the output from the DMP is low; it simply means that it is low compared to the total range of existing possibilities. Furthermore, in most cases the calculation of the critical carrying capacity does not take into consideration the local cultural beliefs and historical interactions with the local environment (Strang 1997).

Under the DMP, labor is divided among gender and age sets, but it is not always proportioned evenly among household members. In many cases, less than half of a
household provides the majority of its subsistence efforts. In his study of peasant farm reports from the Volokolamsk community in Russia, Chayanov noticed that labor intensity varied between individual households (Chayanov 1966). Chayanov measured differences in household labor against variations in household size, with the assumption that larger households would have higher annual production rates. Interestingly, he found that as households grew in size, their potential labor power expanded, but the total number of hours worked per household did not increase. Instead, individuals worked fewer hours, resulting in considerable stocks of unused time (Chayanov 1966:75-76).

The final, and most important, aspect of the DMP is the high potential for households to fail to meet their own needs, even though they are organized to do so (Sahlins 1972:69). Shortfalls can occur for many reasons. Illness, disease, and injury to household members, crop and herd disease, and natural disasters can cause households to fall below their productive abilities. Demographic shifts in household size over time also lead to variations in the DMP. Because of these shortfalls, households are not entirely self-sufficient during their lifetime, and they require supplemental support beyond the DMP. Most of this additional support comes from obligations created under the kin-ordered mode of production.

Under a kin-ordered mode of production, individuals and households are bound together through kinship ties. The extent and intensity of these ties varies considerably, and some communities have strong kinship affiliations while others have weak or fluid connections. Kinship organization varies in two fundamental ways: how broadly kinship
relations extend across society and the degree of obligations placed on group members (Wolf 1997:89).

For some societies, kinship rules are weak and do little more than govern lineage affiliation and enforce marriage taboos. Among societies where kinship plays a much larger role, it creates “rights and obligations for the social labor by symbolically defined relations between people” (Wolf 1997:91). Within such kin networks, individuals and households are required to provide goods or services to others. These obligations ensure that the household needs are met, particularly when those households cannot provide for themselves.

Kinship also provides individuals with the financial means to participate in important rites of passage that would otherwise be inaccessible. However, kinship can also create significant strains on household labor power when participation in kin group activities is mandatory. It may not be practical for a person to opt out of kinship activities if formal or informal social sanctions exist to compel compliance. Kinship obligations for a household may become incredibly oppressive if the household incurs excessive social debts or if social rank exists within the kin group.

Under the DMP, the means and relations of production are maintained within households. However, with the kin-ordered mode of production, some of a household’s productive forces may be distributed across a community according to kinship relations and obligations. Typically, the exchange system used to move goods and services between households under DMP and kin-ordered mode of production is reciprocity.

Reciprocity is a system of exchange in which goods move between people and
households (Polanyi et al. 1957:249). The key aspect of any reciprocal exchange is the social relationship between the parties involved. As one moves outward from the household and community, the social relationship between exchange partners shifts from close and familiar to distant and impersonal (Earle 2002:11). Reciprocal exchanges come in three forms: generalized, balanced, and negative.

Generalized reciprocity is altruistic exchange, and it occurs within households or between members of the same kin group. Through generalized reciprocity, donors give aid freely to recipients who usually are close friends and family. If made, payment under generalized reciprocity usually is delayed or is not of equivalent value. This unequal exchange “creates a level of ambiguity that strengthens the social obligation and subsumes material interest to [the] needs of the recipient” (Narotzky 1997:45). However, the inequality associated with generalized reciprocity does not cause the donor to stop giving. Instead, it creates a sustained flow of goods where people are all in debt to one another (Sahlins 1972:193).

Balanced reciprocity is the equal exchange of goods, and payment is made during the moment of transaction or soon afterwards. Unlike generalized reciprocity, balanced reciprocity is less personal, “and the parties involved confront each other with distinct economic and social interests” (Sahlins 1972:194). In balanced reciprocity, items are exchanged to meet individual needs, but they do not necessarily create or sustain social relationships. Because balanced exchanges do not sustain social relationships, the parties involved in these exchanges do not share a close affinity with each other. As a result, balanced reciprocal exchanges are not governed by social relationships (Narotzky
As relationships move outside of the community, they become more anonymous, and the potential for negative reciprocal exchange increases. Negative reciprocity is the most impersonal form of exchange, and includes activities such as haggling, bartering, and gambling as well as more despised activities such as theft (Sahlins 1972:195). Under negative reciprocity, a social relationship does not have to exist between parties involved in the transaction, and it may be advantageous for both parties to remain unattached for the purpose of the exchange. Usually, negative reciprocal exchanges take place outside of households, kin networks, and communities, and they involve unaffiliated parties at the regional level. Two forms of negative reciprocity are market exchange and redistribution.

**Regional Interactions**

Redistribution and market exchange are integral parts of political economies, and regional institutions regulate these two forms of exchange. Household and community involvement in the political economy begins with the extraction of a surplus by elites. At one end of the political economy continuum, leaders have little real power over households other than their ability to encourage, harass, or cajole individuals to give. An example of this type of political power is found within “big man” societies where power is completely derived from the size of a big man’s support group and his ability to receive support from its members (Johnson and Earle 2000:228). If a big man loses the support of his followers, he also loses his status.

At the other end of the spectrum, elites have the authority to force households and
communities to produce a surplus and give it over. In traditional Hawaiian society, chiefs amassed large amounts of surplus through the annual collection of tribute from the makahiki ceremonies (Earle 2002:92-93). During these ceremonies, an effigy of the god Lono was sent to each community, or ahupua’a. Accompanying Lono was a contingent of the chief that included armed warriors. If the company did not receive an acceptable offering, the community was plundered.

Surplus extraction takes many forms. One common form is redistribution. Redistribution is the negative exchange of goods to a central location, person, or group (Dark 1995:126). Redistribution usually involves the mobilization of surplus through tribute or corvée labor. In theory, redistribution has two functions. The first is to sustain households in times of need by pooling communal resources and labor. Through pooling, community members can draw from the collective based on their community, kinship, or political affiliations. The second function of redistribution is to draw resources in to sustain political institutions.

The surplus collected through redistribution typically comes in two forms, staple finance and wealth finance, and in precapitalist societies, both forms were widely used to finance political activities. Staple finance is an obligatory payment with subsistence goods such as grain, livestock, and clothing (D’Altroy and Earle 1985:188). One advantage of surplus finance is that it does not require advanced technology or complex social institutions for its management. Because staple finance involves items produced through the DMP and kin-ordered modes of production, it can quickly be mobilized.
However, there are several disadvantages to staple finance. First, staple finance is available as a form of payment only seasonally because staple goods are available in surplus only at certain times of the year. Second, staple goods are difficult to store and often require special facilities to slow their deterioration. Finally, the exchange of staple goods can be difficult because of the costs associated with their transportation (Brumfiel and Earle 1987:6). These factors limit the ability of staple goods to act as a reliable system of finance for political activities within Precapitalist political economies.

Wealth finance is the manufacture and procurement of special products that are used as means of payment (D’Altroy and Earle 1985:188). The main advantage of wealth finance is that it provides administrative simplicity for polities with extensive territories. Wealth finance may be channeled to control or create valuable trade items that are exchanged with outlying polities. Wealth items, such as money and luxury goods can be stockpiled for long periods without loss from decay. In addition, wealth items can be transported over long distances while retaining a high exchange value (Brumfiel and Earle 1987:6).

However, there are two problems associated with wealth finance, and both issues can hinder the exchange of wealth items between communities and polities. First, the value of wealth goods can be difficult to determine because they are rare. The more unique the item, the more difficult it is to determine its exchange value. Second, wealth items are not easily convertible into staple goods (Earle 2002:193). In many cases, ownership of wealth items increases an individual’s political or social status, but the exchange of wealth items for subsistence goods incurs a significant reduction in status.
Despite these challenges, wealth finance provides greater benefits for elites involved in the political economy than does bulk finance. Furthermore, many of the problems associated with the wealth finance can be mitigated through the introduction of markets and market exchange into society.

Market exchange is the trading of goods within a marketplace with the goal of making a profit (Earle 2002:15). With market exchange, goods and services are traded according to a set price agreed upon by both parties at the time of the transaction. Under this system, social rules do not govern the transaction, though larger political institutions may be directly involved in market regulation through such activities as taxing market transactions, maintaining a currency system, and creating standardized weights and measures. With standardization, some of the challenges associated with wealth finance can be overcome, particularly with the introduction of money as a medium of exchange.

Redistribution and market exchange are two types of economic interactions used to finance elite activities and complex institutions at the regional level of society. However, there are additional interaction networks through which members of society interact with one another at regional levels. In their analysis of precapitalist societies, Chase–Dunn and Hall (1991) identified four important regional interaction networks: bulk goods networks, prestige good networks, information networks, and political-military networks.

Information networks involve the movements of ideas, behaviors, and values. Information is weightless, which allows it to travel easily across political boundaries (Hall and Chase-Dunn 2006:41). As a result, information networks are large in scale and
are found in all societies, regardless of their level of complexity. The number of ideas that can be transported along information networks is virtually unlimited and is only bound by human imagination and ingenuity. Information networks likely were the first type of interaction network, and they were incredibly important in prehistory, even if they are difficult to reconstruct. In fact, some have suggested that information may have been the most important “good” moved between societies (Upham 1982:122).

For the ancient Maya, information networks extended across the entire culture area. Most of the information exchanged in Maya society tended to be esoteric in nature and may relate to the existence of a pan-Mesoamerican religion (Boone and Smith 2003:190-191). Information exchanged across these networks required literacy in codex reading and a certain level of bilingualism. Because literacy levels were low in Mesoamerican society, a significant portion of the information was intended for high-status individuals from different polities, and correspondences dealt with elite activities such as marriage alliances, luxury gift exchanges, and the sponsorship of ritual events.

The second type of regional interaction network is the political-military network. This network results from military conflicts or the efforts to avoid or end such encounters. Because prestige goods often were presented as tribute extracted from military incursion, political-military networks often fostered the establishment of prestige goods networks. Political-military networks are smaller than information networks because of the costs associated with the movement of people such as soldiers, bureaucrats, and political leaders and their support (Hall and Chase-Dunn 2006:40).

The third type of regional interaction network is the bulk goods network. Goods
exchanged through this network are subsistence goods produced by households. Generally, the range of these networks is smaller than the information or political-military networks because of the higher costs associated with the exchange of bulk goods. The use of watercraft or domesticated animals decreases the effort and travel time associated with the transportation of bulk goods across regions, while increasing the overall volume of bulk goods that can be moved. When watercraft or domestic animals are not available, human porters are used to move bulk goods. Bulk goods networks that rely on human transportation are usually small, decentralized, and located near regional centers dependent upon subsistence imports (Santley and Alexandri 1992:26).

The final type of regional interaction network is the prestige goods network. Prestige goods are wealth items that are durable, rare, and have a reputation for quality control in their production (Schneider 1991:56). For precapitalist societies, typical prestige goods networks include and include metals, spices, textiles, and slaves. Prestige goods served several functions. First, prestige goods were central to creating and maintaining revenues for elites involved in the political economy. Second, prestige goods were part of a system of patronage that involved people from many different social classes. Individuals were contracted as either attached or independent producers to make prestige goods. In many cases, prestige goods were difficult and expensive to produce, and specialists often required several years of apprenticeship and regular access to specific raw materials to master their craft (Clark 2003:221). Trade in exotic prestige goods also provided employment for intermediaries, and people worked as merchants and transportation specialists, moving prestige goods from region to region. Third, prestige
goods were used by elites as conspicuous displays of status, and the social value of prestige goods was maintained through strict sumptuary laws or by the high cost of luxury goods (Brumfiel 1987:111).

Participation in prestige goods networks could be very costly for communities and households because elites collected a significant amount of household surplus to finance the production and exchange of prestige goods. Despite the costs, participation in regional interaction networks may not have been optional for many precapitalist communities. For local elites, social power was created and sustained through these networks. As elites competed among themselves for control, the exchange of prestige goods attracted supporters and created alliances. With more support, additional surplus could be mobilized, creating a continuous, cyclical process of political activity (Kristiansen 1987:46; Schortman and Urban 1987:52). Removal from the prestige goods networks may have had more severe consequences for subordinates because participation in these networks provided economic opportunity as well as military and political protection (Graziano 1975:25).

**Discussion**

The location of economic control is a critical component in the study of communities. If the relations of production that control the manufacture, distribution, and use of goods and services are locally controlled, then community identity will be highly autonomous. On the other hand, if economic control is vested in regional institutions, then community identity will be heavily influenced by outside forces. At the local level,
community interactions are organized under the domestic and the kin-ordered modes of production. Most community activities organized under these modes of production are geared towards the maintenance of individual households and communities.

At the regional level, interactions are focused on sustaining the political economy. Regional activities are funded by the surplus extracted from households, kin networks, and communities through wealth or staple finance. Through surplus wealth, social elites and ruling institutions compete both within and between polities for economic, social, and political power (Freidman and Rowlands 1977:211). For example, the Han dynasty used wealth finance to expand its territory. By giving lavish gifts to their rivals, the Han established a network of patrons who were indebted to the Han (Schneider 1977:24).

During the Postclassic and Early Contact periods, much of the Maya Lowlands were connected through a system of competing and cooperating polities. Interactions took place at both local and regional levels through a variety of interaction networks. The importance of regional and local interactions within lowland Maya communities varied during this time from region to region. The arrival of the Spanish changed some interaction networks in significant ways, but these networks were maintained by the Maya as a form of resistance to subjugation and conversion. By looking at communities like Zacpetén and the interactions that took place within it, it is possible to understand more completely the role of regional and local institutions in controlling community activities and identity.
Chapter 3 - The Culture History of the Central Petén Lakes Basin

Zacpetén was initially settled during the Middle Preclassic period, but the most significant occupation of the site took place between the Late Postclassic (A.D. 1200–1525) and Early Contact (A.D. 1525–1700) periods. During this time Zacpetén likely was the capital of the Kowoj, a distinct ethnic group in the Central Petén region with strong Mayapán affiliations. This connection to the Postclassic Yucatan center had a strong effect on the identity of Zacpetén, as did the economic interactions that took place within the community. To understand these interactions and their influence on the identity of the Zacpetén community, it is important to examine the Postclassic and Early Contact periods as well as the preceding Terminal Classic period (A.D. 800–950).

The Terminal Classic Period

While the Terminal Classic is not part of the Postclassic period, many of its material features, such as demographic shifts, alterations to elite power structures, decline in monumental construction, and changes in the ceramic patterns are part of the Terminal Classic (Chase and Chase 1985a:1). As a result, it is relevant to include this period in any discussion of the Postclassic. According to the traditional model of the Terminal Classic period, the Maya Lowlands experienced a cataclysmic series of events that culminated in severe population declines and the abandonment of a significant number of Classic-period communities. The construction of public structures, stela, and altars with hieroglyphic writing declined at many of these centers, and there is archaeological
evidence for increased levels of conflict during this period. Together these events have created a view of the Postclassic as an “impoverished” version of the Classic period (Willey 1986:52).

Ironically, the dramatic changes featured in the traditional model of the Terminal Classic collapse came on the heels of the Classic period, a time considered by most scholars to be the height of Maya social, artistic, and technological developments. The occurrence of such dramatic changes to Maya society over such a short period has created some doubt about the severity of the Terminal Classic collapse (Miller 1986:199). Contemporary research in the Maya Lowlands has supported some aspects of the traditional collapse model, but it has also caused the revision others (Culbert and Rice 1990).

The Terminal Classic was a period of warfare, but the level of violence varied across the lowlands. For example, the Petexbatún region experienced heightened levels of conflict during the Terminal Classic period until it was nearly abandoned around A.D. 830. Archaeologists working in the region have uncovered walled fortifications, evidence for the violent destruction of buildings, military weapons in civic-ceremonial centers, and the celebration of militarism in art and iconography.

Nevertheless, heightened levels of warfare were not a new cultural characteristic that appeared during the Terminal Classic period. Archaeological work has shown that the Classic period Maya were also highly militarized, based on the presence of fortifications, skeletal trauma, and graphic descriptions of warfare in Classic period iconography and epigraphy (Webster 1993). In fact, it was argued that Terminal Classic
hostilities, including those in the Petexbatún, were directly linked to events that began during the Classic period (Demarest 2004a:102).

Evidence from the Petexbatún supports the traditional collapse model, but such events did not occur in all regions of the Maya Lowlands. In fact, some locations flourished during the Terminal Classic. For example, Seibal weathered the collapse and grew in size during the Terminal Classic and early Postclassic periods (Tourtellot and Gonzalez 2004). The success of Seibal and its rise in power may have been a direct result of its political and economic ties to Chichén Itzá in the Northern Lowlands (Kowalski 1989:183).

At Caracol and Xunantunich, leaders took advantage of Terminal Classic events to expand their power by continuing ritual ceremonies and expanding construction activities (Chase and Chase 2004). In northern Belize, Lamanai began a period of growth during the Terminal Classic that would continue well into the Postclassic period (Pendergast 1986:228). The growth and expansion of some communities within the lowlands during the Terminal Classic period indicate the ancient Maya may not have suffered an irreconcilable collapse.

In the Central Petén Lakes Basin, the Terminal Classic was a period of settlement and demographic changes, but it was not a complete collapse of Maya society (Rice and Rice 1984). Terminal Classic settlement patterns do show population declines at the largest basin settlements (Rice and Rice 1990:141). For example, there was a 75 percent Terminal Classic decline in building occupation at Yaxhá, and the site experienced a significant decline in construction activity. The few public structures built during the
Terminal Classic period were poorly constructed, or they were uncompleted. Interestingly, the highest settlement densities were in areas that did not have well-established Classic-period centers. Outside of Yaxhá, declines in settlement patterns were not as dramatic, and construction activity increased at the elevated areas located along the perimeter of the Yaxhá basin (Rice and Rice 1980:445).

In other locations such as the western Petén Lakes basins, the number of domestic buildings increased, suggesting that a slight rise in population size (D. Rice 1986:331). While there were population decreases at some locations in the Central Petén, these declines have been argued to be part of the normal developmental cycle associated with agricultural communities (Rice and Rice 1990:135). The establishment of Terminal Classic settlements outside of the major Classic-period centers in the Central Petén region could be evidence for the rejection of Classic period authority by households who voted with their feet.

These new Terminal Classic settlements may also have resulted from immigration by non-Petén Maya into the Central Petén (P. Rice 1986:332). Examples of Terminal Classic architecture in many of these new communities have architectural features with no clear Classic-period antecedents (D. Rice 1986:304), and the ceramics found in these new settlements were made using local pastes and slips that were different from Classic period wares (Rice and Forsyth 2004:5). The regionalization of Terminal Classic ceramics in the Central Petén may also indicate the establishment of new political hierarchies by communities in transition (P. Rice 1986:280).

The archaeological evidence from the Terminal Classic period in the Central Petén
region emphasizes a new paradigm of change with continuity. This period was not a time of widespread decline and collapse for the Maya Lowlands. Some communities were abandoned, but new settlements were created and a few even expanded. As these new communities began to dominate the Central Petén Lakes Basin, they adopted many Classic-period themes and traditions in order to assert their own social and political authority by projecting a notion of continuity with the past. At sites such as Flores and Ixlú, the construction of monuments and stela continued during the Terminal Classic period, though foreign elements and styles were added (Graham 1973). The Maya calendar system and associated period-ending rituals also continued, particularly those associated with the K’atun and May cycles (Rice and Rice 2004:136).

Broad changes across the Maya Lowlands occurred during the Terminal Classic, but these changes were not indicative of a complete breakdown of the Lowland Maya social system. Exchange routes shifted, but long-distance exchange networks across in region continued. Many rituals and symbols changed, but ceremonial activities continued to be of central importance to Maya communities. This continuity has even led some scholars to push the dating of the Maya collapse forward in time to the decline of Chichén Itzá (Sabloff and Henderson 1993:5).

The Early Postclassic Period

Typically, the Postclassic period is divided into two eras, each marking the rise of a new power center in the Maya Lowlands. The Early Postclassic period (A.D. 950–1200) coincides with the rise of Chichén Itzá, arguably the largest and most powerful Maya
polity in the Maya Lowlands. The Itzá were a group of prominent lineages that controlled much of the northern and western coasts of the Yucatan peninsula (Cobos Palma 2004:532).

One key to the success of Chichén Itzá was its combination of old and new social institutions (Sharer 2006:586). As with its lowland predecessors, political authority at Chichén was controlled by a few elite lineages that personified state power in the office of a divine king controlling a city-state. City-states are small polities with a single capital city or town that controlled the surrounding territory and communities (Smith 2003:35). City-states varied in size and complexity, but they typically had two or three hierarchical tiers in their organization. City-states were not an entirely new feature of lowland Maya culture. These polities existed during the Classic period, but it was during the Postclassic period that they expanded across the Maya Lowlands.

A key characteristic of city-states was their high degree of internal cohesion. Even when specific city-states were subject to another polity, they usually retained their leadership hierarchies. The main reason for such internal integrity within city-states was their affiliation with specific rulers who maintained their power through religious ideology and connections with other city-states. While they often were politically autonomous, city-states were rarely self-sufficient because they regularly engaged in trade with other city-states. In addition, city-states often were subjects to more powerful polities because of conquest or political alliances. These political vacillations created a high degree of regional instability as city-states moved between periods of centralization and independence (Marcus 1993:121).
Ethnohistorical accounts about the Early Postclassic indicate many lowland communities were organized under a city-state political system known as the *cuchabal*, which is defined as a “territory, jurisdiction, province, region, or people subject to one ruler” (Martinez-Hernandez 1929:205-209). Thus, a *cuchabal* could be a single autonomous city-state, or it could be a series of city-states hierarchically organized under a powerful central authority. Each *cuchabal* was administered by a local leader called the *batab*. In the different city-states, political, social, and economic connections were sustained by the *batabs* through kinship networks. These networks were critical in regional military defense and in organizing important cultural rituals.

The most complex *cuchabals* consisted of multiple city-states and *batabs* organized under a central ruler known as the *halach unic*. This leader controlled his own city-state, but he had additional provincial rights including the extraction of tribute and the mustering of individuals for military service (Roys 1957:6). However, large *cuchabals* were inherently unstable because *batabs* were concerned with their social rank, and *batabs* competed amongst themselves for power through the conquest of others (Marcus 1993:120).

In the Central Petén Lakes Basin, Early Postclassic communities had a strong inward focus, with little influence from larger polities such as Chichén Itzá. Ceramic production was confined to the basin, and the decorative structures and ceramic types remained identical to their Terminal Classic counterparts (P. Rice 1986:282). This localization in ceramic production was found at Macanché. This site is located on a small, triangular island in the northeast corner of Lake Macanché. At Macanché, Early
Postclassic ceramic groups include Paxcaman and Trapeche slipped ceramics as well as three unslipped Late Classic types (Rice and Rice 1985:174). Different pastes are present in the slipped groups, suggesting that ceramic production was widespread across the Central Petén Lakes Basin. However, the quality of pottery production was not uniform. Fire-clouding is found on a significant number of Macanché wares, indicating a low level of skill is associated with the manufacture of ceramics, or a poor understanding of the local clays (Rice and Rice 1985:174).

There is very little evidence for long-distance exchange networks at Macanché during the Early Postclassic. Only a single piece of obsidian and a few fragments of Fine Orange ceramics were recovered from archaeological work at Macanché (Rice and Rice 1985:175). Overall, the Early Postclassic period was a time of relative economic, social, and political isolation for communities in the Central Petén Lakes Basin, though this situation would dramatically change during the Late Postclassic.

**The Late Postclassic Period**

The Late Postclassic period (A.D. 1200–1525) marks the emergence of Mayapán as the center of power in the Maya Lowlands. According the Diego de Landa, Mayapán means “standard or banner of the Maya” (Pollock 1962:2). Mayapán is smaller than Chichén Itzá, but it is still an impressive 4 square kilometers in size and includes 4,000 buildings enclosed within two city walls. The rise of Mayapán as a major economic and political center may have come at the expense of Chichén Itzá. According to books of *Chilam Balam*, Mayapán sacked Chichén Itzá on K’atun 8 Ajaw (A.D. 1186–1204). With
the fall of Chichén Itzá, a group of Itzá Maya moved from Chak’am Putun, a place thought to be within the Central Petén (Rice 2009:29).

At its height, Mayapán controlled most of trade routes established by Chichén Itzá, and, like their Chichén predecessors, Mayapán merchants exchanged a wide variety of utilitarian and prestige goods. The most prominent prestige goods included jadeite, quetzal feathers, jaguar pelts, Spondylus shell, gold, cacao, copper, and turquoise. Another important trade item exchanged from Mayapán was a mass-produced effigy incensario. These incensarios were widely distributed across the Maya Lowlands, and they may indicate attempts by Mayapán to establish commercial or religious ties with different lowland communities. All of these items have been found in Late Postclassic sites (Sharer 2006:599).

For the Maya Lowlands, Postclassic trade items are classified as prestige or utilitarian goods. The key aspect of prestige goods is their ability to act as political currency in establishing status or in conferring the rights and obligations associated with a particular social position (Johnson and Earle 2000:256). For Maya societies, the exchange of prestige goods was an important activity from the Preclassic through the Contact period. During the Preclassic and Classic periods, prestige goods were controlled by elites, and social rules regulated their consumption. However, the social value of many prestige goods changed during the Postclassic from political to economic. This shift in social value is inferred from the presence of a variety of previously restricted prestige goods at different Postclassic households.
Trade in utilitarian items such as pottery, salt, cotton, and obsidian expanded as indicated by the increased quantities of these goods in Postclassic communities. An increase in the exchange of utilitarian items during the Postclassic period was attributed to the adoption of market systems and the rise of a semi-autonomous merchant class (Sabloff and Rathje 1972). During the Postclassic period, a wide variety of marketplaces existed across Mesoamerica. Some markets, such as Tlatelolco in the Aztec empire, were very large. In his description of Tlatelolco, Cortés noted that “every kind of merchandise such as may be met with in every land is for sale there, whether food and victuals, or ornaments of gold and silver, or lead, brass, copper, tin, precious stones, bones, shells, snails, and feathers” (Cortés 1961:87). Ethnohistorical documents also indicate the presence of Postclassic markets in the Maya Lowlands (Kepecs 2003; Masson 2003a). These markets ranged from small local “fairs” to larger regional markets where vendors and merchants actively bought and sold both exotic and local goods (Berdan and Smith 2003:248).

In addition to the trade items, merchants disseminated new regional graphic styles and iconography. These styles shared many traits, including the similar use of form, line, color, spatial arrangement, and human figures. Because of this standardization, various regional styles have been loosely classified together as the Postclassic International style (Robertson 1970). The Postclassic International style was more than just art; it was a vital aspect of a larger Mesoamerican network that transported information between polities in the form of codices, mural paintings, and polychrome ceramics.
Postclassic elites deliberately chose to use specific iconographic symbols and stylistic elements as crucial parts of their political strategies and interactions (Boone and Smith 2003a:181). The relationship between the movement of these symbols and styles and the interaction networks that carried them was mutually reinforcing (Smith and Berdan 2003:8). At many lowland sites, elites adopted the Postclassic International style to endow depictions of local rituals and scenes with an international flavor that contributed to their own political power and legitimacy (Masson 2003b:198).

In addition to murals, codices, and stela, other mediums, such as Mayapán effigy incensarios, disseminated information across the Maya Lowlands during the Postclassic. These ceramic vessels consist of a cylindrical base and a top with a full-figure human or deity effigy (Smith 1971:74). There were significant variations in vessel designs, and incensarios were highly stylized, but they also followed iconography and imagery associated with the Postclassic International style (Brown 1999:322).

In the Central Petén Lakes Basin, the Late Postclassic period was a time of revitalization. Postclassic commerce expanded across the territory with the establishment of new trade routes that moved through the Petén Lakes (Sharer 2006:613). One of the most direct trade routes from the Maya Highlands to the Maya Lowlands is through the Central Petén. At Macanché, Late Postclassic improvements in ceramic production were stimulated by the island’s location along inland trade routes. Macanché ceramics continued to be produced using local clays, but the amount of fire-clouding and number of slips decreased. The increase in pottery quality and decrease in slip variety likely was due to a rise in ceramic specialization and better knowledge of ceramic manufacture and
raw materials at Macanché (Rice and Rice 1986:175). As merchants moved goods along trade routes in the Central Petén Lakes Basin, communities had increased access to exotic goods. At Macanché, the number of obsidian, greenstone, and basalt artifacts from Late Postclassic contexts increased.

The Late Postclassic revitalization in the Central Petén Lakes Basin can also be seen at Topoxté. As with Macanche, Topoxté ceramics are produced from local clay sources, and decorative patterns and motifs on many of these ceramics are similar to those from Mayapán, indicating ties to the northern center (Rice and Rice 1986:170-171), though only a handful of Paxcamaan sherds were recovered from the site. More importantly, Mayapán style effigy incensarios were recovered from work at Topoxté. In addition to the ceramics, there are strong architectural connections between the public and domestic structures at Topoxté and at Mayapán. Similarities are found between both sites in the use of open, colonnaded halls and C- and L-shaped residential buildings (Bullard 1970:270; Rice 1988:234-235).

The Mayapán federation fell apart sometime between A.D. 1441 and 1461, when the Xiw led an uprising against the ruling Kokom lineage. The Xiw rebellion weakened Mayapán, but it did not overthrow the Kokom. After the rebellion, the Kokom increased their power, and Xiw authority declined. Subsequently, several Xiw groups and affiliated lineages, including the Kowoj, left Mayapán. Some groups returned to their homelands while others migrated to new locations such as the Central Petén.

The Late Postclassic period was a time of intense balkanization across the Maya Lowlands, and individual communities and ethnic groups competed for regional
domination across much of the region (Marcus 1993:165). The movement of new populations into the Central Petén Lakes Basin created tensions between immigrant and established groups (Chase and Chase 1985b:7). The most powerful and well-known ethnic group in the Central Petén was the Itzá, who migrated into the region during the Late Postclassic between the fall of Chichén Itzá and the fall of Mayapán. According to the Chilam Balam of Chumayel, the Xiw forced the Itzá to flee to Tan Xuluk Mul, or the heart of the forest, an area traditionally viewed as the Central Petén Lake Petén Lakes Basin (Rice and Rice 2005:144). Archaeological evidence for a Late Postclassic Itzá migration into the Central Petén was inferred from the significant increase in regional population size during the Postclassic (Chase 1990).

The Itzá established a complex cuchabal with several city-states and powerful regional center at Nojpetén. It was from these communities that the Itzá controlled most of the western and southern basins in the region. Each Itzá city-state was led by a batab, and the entire polity was unified under a halach unic with the title of Aj Kan Ek’. However, Itzá domination of the Central Petén was not absolute, as the Kowoj occupied territory within the basin as well. The Kowoj were the principal rivals of the Itzá, and both groups were in a state of chronic hostility (Jones 1998:18).

Much of the Late Postclassic and Early Contact period conflicts in the Central Petén were fostered by the expansion of city-state polities (Demarest 2004b:97). Late Postclassic settlement patterns in the Central Petén reflect the conflict and tensions of the period. Communities are not broadly distributed across the landscape but are nucleated centers located on defensible positions like islands, peninsulas, and terraces (Rice
Postclassic buildings do not align themselves around a central patio or plaza. Instead, structures are spaced along elevated terrain, with little clustering (Rice 1988:236). Manufactured fortifications and natural features such as islands, ravines, and cliffs protected communities at several Postclassic basin sites (Pugh 2004:353). The arrival of the Spanish in the Maya Lowlands during the Contact period (A.D. 1525–1700) did not alleviate tensions between ethnic groups in the Central Petén.

The Early Contact Period

Initial contact between Europeans and the Maya involved communication and trade. During his fourth voyage, Columbus encountered a large Maya canoe near the Gulf of Honduras, and a few trade goods were exchanged between European sailors and Maya merchants (Cohen 1969:288). Sporadic contact between the Maya and the Spanish would continue after Columbus, fueling a belief that Mesoamerica was a land of untold wealth and abundance.

By A.D. 1511, the Spanish had established several colonies in the Caribbean, with a capital in Havana (Sharer 2006:758). From these colonies, a series of expeditions were launched into the Maya Lowlands fueled by the mantra of god, gold, and glory. Unfortunately, diseases such as smallpox and measles decimated Maya populations, and entire communities were abandoned long before the arrival of the Spanish. Those individuals who lived through these pandemics were subjected to brutal conquest and colonial rule.
The expansion of the Spanish empire into the New World during the sixteenth century initiated radical political, economic, and cultural changes across the Maya Lowlands. However, the colonization process, with its associated shifts in settlement patterns and economic strategies, was met with a variety of responses from native populations (Alexander and Kepecs 2005:1). Some groups used the changes to gain economic and political power, while others alienated the Spanish regime. Indigenous communities were not passive agents of their European overlords. Instead, native groups used a variety of tactics, including passive resistance, avoidance, and active revolt (Alexander and Kepecs 2005:8).

Spanish interactions with the Central Petén Maya focused on the conversion and conquest of the Itzá. Colonial authorities and Catholic officials thought the Central Petén Maya were a single polity united under the *Ajaw Kan Ek*. It was for this reason that the Spanish contacted the Central Petén Itzá multiple times to bring them under Spanish control. Contact between the Spanish and the Itzá was categorized into three phases: exploratory, proselytization, and commercial/military (Means 1974).

The exploratory phase of Spanish contact with the Central Petén Maya began three years after the fall of Tenochtitlan. Hernán Cortés sent Cristóbol de Olid to subdue Honduras, but Olid rebelled and declared himself governor upon his arrival in the area. Consequently, Cortés launched his own expedition with 140 Spanish soldiers and 3,000 Mexican warriors (Sharer 2006:762). On March 13, 1525, Cortés reached Lake Petén Itzá and met with *Ajaw Kan Ek*. During the meeting between Cortés and the Itzá ruler, a catholic mass was celebrated. *Ajaw Kan Ek* promised to convert to Catholicism, and he
invited Cortés to visit Tayasal. Cortés gave one of his horses to Itzá as a sign of friendship, and then left the Central Petén for Honduras. After Cortés’ visit, there was little Spanish interest in the region for nearly 100 years.

During the proselytizing phase, several visits were made by missionaries to the Central Petén Lakes Basin in an attempt to convert the Itzá to Christianity. Around A.D. 1616, Father Juan de Orbita, a Franciscan missionary, left Mérida for Nojpetén. Orbita had some initial success among the Itzá, and he returned to Mérida in A.D. 1617 with 150 Itzá converts. However, the Ajaw Kan Ek’ of Nojpetén did not convert during this initial visit, so Orbita returned to Nojpetén with his followers in A.D. 1618.

Orbita’s second attempt at conversion was less successful, and he was quickly thrown out of Nojpetén after destroying an “idol”, which was reported to be a representation of the horse given by Cortés to the Itzá in 1525. Orbita’s converts were severely punished, and the Ajaw Kan Ek’ changed his mind about conversion and subjugation. Internal political pressure against a Spanish alliance had grown between the Itzá, and many members of the governing council, including the wife of Ajaw Kan Ek’, violently opposed any alliance with the Spanish.

Beginning in A.D. 1670, the military and commercialization phase began when the Spanish initiated a new series of campaigns against the Central Petén. These efforts were primarily aimed at establishing new colonial towns and missions, but these efforts were unsuccessful, and the Maya continued to resist Spanish rule.

In A.D. 1690, the Spanish authorities at Mérida and Antigua collaborated on a plan to subdue the remaining Central Petén polities (Rice and Rice 2005:157). The
colonial plan focused around the construction of the El Camino Real. Road construction simultaneously began at Mérida and Antigua, with both parties meeting in the Central Petén. El Camino Real road construction completed with the support of military, religious, and political agents from Mérida and Antigua. As part of these efforts, Fray Andrés de Avendaño y Loyola left Mérida in December of 1695 to convert the Itzá. Avendaño’s mission was inspired by an Itzá delegation that visited Mérida earlier in that year. One of the Itzá emissaries was Aj Chan, a young Itzá noble and son of Ix Kante, the deceased sister of Ajaw Kan Ek’ (Jones 1998:167). Aj Chan told colonial officials in Mérida that the Petén Itzá and the Ajaw Kan Ek’ were ready to convert to Christianity and submit to Spanish authorities.

Avendaño and his party arrived in the Central Petén region on January 13, 1696. Avendaño met with Ajaw Kan Ek’ and several Itzá lords who shared information on Maya calendrics, language, and culture, and they allowed Avendaño to wander around Lake Petén Itzá, (Jones 1998:194). Despite the hospitality, Ajaw Kan Ek’ did not convert to Christianity. Internal and external political pressures kept the political or personal motives of Ajaw Kan Ek’ in check. While Avendaño was at Nojpetén, two Kowoj leaders, Aj Kowoj and Kulut Kowoj, arrived at the community dressed in full war regalia for a meeting with the friar and Ajaw Kan Ek’ (Jones 1998:206). At the meeting, Aj Kowoj argued against submission to the Spanish and threatened the lives of Avendaño and his company. Subsequently, Avendaño left Nojpetén under cover of night with armed Itzá escorts. The next contact between the Itzá and the Spanish would occur a year later with conquest of the Nojpetén.
Discussion

The Central Petén has a deep history of human occupation. The richness of the tropical environment and fresh water drew people into the Central Petén from the Middle Preclassic through the Early Contact period (Rice and Rice 1990:123). During the Terminal Classic, the Ajaw political-economic system and the network of patrons that supported it was abandoned in many lowland Maya communities (Rice et al. 2004:9). As this economic system declined, broad changes occurred across the Lowlands, but this change did not represent a complete breakdown of the entire social system. Some communities were abandoned during the Terminal Classic “collapse”, but others grew in the wake of the dramatic social changes.

Research in the Central Petén Lakes Basin indicates this area had a long tradition as a frontier region, continuously receiving immigrants as far back as the Classic period (Chase and Rice 1985:147). The demise of Chichén Itzá caused a wave of Itzá immigrants to move into the Central Petén, bringing with them many cultural traditions from the Northern Lowlands. It was also through such migrations that the Itzá came to dominate the Central Petén, as seen by the establishment of large centers at Tayasal and Nojpetén.

During the Late Postclassic period, the Central Petén experienced additional social, economic, and political changes. More groups migrated into the region, spurred by the collapse of Mayapán and by the establishment of new overland trade routes that crossed through the Central Petén. These two factors created a significant amount of tension and conflict between different ethnic groups in the region, including the Itzá and
the Kowoj. Conflict between these two rivals was common through the Early Contact period, as the Spanish incursion exasperated tensions in the region. Interestingly, conflict between the Spanish and the Maya did not completely diminish the level of economic interactions that took place across the Lowlands. During the Early Contact period, the Maya area had a complex system of local and regional markets and various kinds of merchants (Feldman 1985:19-20). Petty vendors and traders bought and sold raw materials and craft goods in local markets, professional merchants exchanged bulk and prestige goods over long distances, and administrators collected taxes from markets under their domain.

The Spanish believed that they had direct control over a contiguous territory, but there were areas such as the Central Petén Lakes Basin that remained outside of Spanish control (Alexander and Kepecs 2005:8). The Spanish did not understand the political diversity of the Central Petén, and their efforts to convert and control communities in this region exacerbated internal tensions between such groups as the Itzá and Kowoj. The migration of Maya fleeing Spanish expansion in the Yucatan stressed fragile political and social relationships in the Central Petén Lakes Basin until Spanish conquered the region in A.D. 1751.
Chapter 4- The Kowoj and Zacpetén

Studies of the chert, obsidian, millstone, handstone, and lapidary artifacts from Zacpetén have produced a better understanding of the Kowoj political economy during the Late Postclassic and Early Contact periods. However, a comprehensive discussion of the Kowoj and their history in the Central Petén is required before presenting the analysis of the lithic artifacts. References about the Kowoj are found in both Maya and Spanish documents from the seventeenth and eighteenth centuries, but it was not until the ethnohistorical work of Grant Jones (1998) that that they were presented in a single body of work. Following Jones’s synthesis, a new edited volume dedicated exclusively to the Kowoj was published (Rice and Rice 2009). From both of these works, a new understanding of the Kowoj and their presence in the Central Petén Lakes Basin emerged.

Kowoj has several meanings based on the translation of the Maya pseudonyms: Co Uoh, Cohouj, Cobox, Coboje, Colox, Chiwo, and Colah. The term Co Uoh has been translated as beak glyph (Edmonson 1986:287), and two other pseudonyms, Coh and cooh, have been translated as puma. However, the most likely translation for Kowoj comes from the Yucatec term cououh, which means spider or tarantula (Rice 2009e:45). In addition to these Kowoj references, several colonial documents indicate the Kowoj controlled territory in the Campeche region of the Northern Lowlands (Antonio and Mirambell 1991:103; Scholes and Roys 1968:18; Tozzer 1941:9-13).

Ethnohistorical references also suggest that a Kowoj presence at Mayapán during the Postclassic (Rice 2009e:45). The books of Chilam Balam are a series of nine
handwritten documents named after the Yucatec towns in which they were originally kept. These texts serve as records of traditional Maya knowledge, history, and prophecy. The books are attributed to Chilam Balam, or jaguar priest, who likely was a Maya priest and nobleman. The nine books were written in Yucatec using the Latin alphabet. In several instances, the texts also use hieroglyphic script.

In the Chilam Balam de Chumayel (Roys 1967) the Kowoj are mentioned three times. In the first reference, the Kowoj are guardians of a main gate at Mayapán. In the second reference, the Kowoj are one of four jolopops, or “head mats”. This reference is particularly important because pop is the Maya seat of kingship. Mayapán was governed by a multepal system controlled by the Kokom, Xiw, Chel, and Kanul lineages (Sharer 2006:601). A multepal is a system of rule by which the decision-making is shared among a council that included political, religious, and military officers (Roys 1957). At Mayapán, the multepal was a group of sixteen territories united under the Mayapán federation. This federation linked different communities for approximately 200 years until it fell apart between A.D. 1441 and 1461 (Restall 1998:141). Membership in the Mayapán multepal likely rotated over time, and this second Chilam Balam ethnohistorical reference suggests that the Kowoj likely were part of the multepal.

In the third Chilam Balam reference, the Kowoj complain about the internal fighting and conspiracies at Mayapán (Edmonson 1986:81, 106-109). Despite these complaints, the Kowoj could not avoid involvement in the factional rivalries. The Chilam Balam de Oxcutzcab (Roys 1967) describes a massacre in A.D. 1536 of several noblemen on pilgrimage from Maní to Chichén Itzá. At Otzmal, the pilgrims were ambushed by a
group of Kokom Maya who had promised safe passage through their territory (Jones 1998:17). Of the entire party, only two pilgrims survived, including an elite named Na Pot Couoh (Rice 2009b:46).

The Kokom attack against the Kowoj may have been motivated by a deeper rivalry with another Maya lineage, the Xiw. Historic accounts indicate the Mayapán federation fell apart on K’atun 1 Ajaw (A.D. 1382–1402) after the Xiw led an uprising against the ruling Kokom. The rebellion significantly weakened Mayapán, but it did not overthrow the Kokom. Approximately 40 years later, the Xiw and their allies, including the Kowoj, left Mayapán. With their exodus from Mayapán, many Kowoj returned to their homeland in the Northern lowlands. In addition, many Kowoj likely migrated to the Central Petén Lakes Basin.

**Kowoj in the Central Petén Lakes Basin**

The exact period of Kowoj migration into the Central Petén is disputed. Ethnohistorical accounts indicate it occurred between A.D. 1520 and A.D. 1543 (Jones 2009:59-61). Archaeological work in the Central Petén suggests that an earlier migration into the basin during fourteenth century (Rice 2009b:46). In either case, Kowoj entrance into the Central Petén likely took place through several waves. The first Kowoj immigrants likely established Early Postclassic settlements at Topoxté and Muralla de Leon. During the Late Postclassic, the Kowoj moved west, establishing additional settlements at Ixlú and Zacpetén (Pugh and Rice 2009a:147). It was also at this time that the Kowoj conquered the Yalain territory along the eastern side of Lake Petén Itzá.
At the time of the Spanish conquest of the Petén in A.D. 1697, the Kowoj controlled the northern shore and the eastern areas of Lake Petén Itzá, inland territory north and northeast towards Tikal, and the area around Lakes Sacnab, Salpetén, and Yaxhá (Figure 4). Within the northeastern portion of Lake Petén Itzá, the Kowoj had twelve communities: Chaltunja, Pop, Sojkol, Yaxtenay, Tz’ola, Uspetén, Ajb’ojom, Xilichi, B’oj, Chak’an Itzá, Saklemakal, and Ketz. Each of these communities would have had a batab, who was part of a ruling council headed by a halach unich. This hierarchical pattern of political organization is similar to that of other city-state polities from the Late Postclassic and Early Contact periods (Jones 2009:65).

Ethnohistoric documents state that the Kowoj regional capital in the Central Petén was Ketz (Jones 2009:65), and archaeological surveys in the basin identified this community along the northeast shore of Lake Petén Itzá. However, The most likely candidates for a Kowoj capital, based on their sizes and locations, are Ixlú and Zacpetén. Both of these communities are located along the edges of Lake Salpetén. In addition to Zacpetén and Ixlú, the sites of Muralla de Leon and Topoxté were important Kowoj settlements during the Late Postclassic and Early Contact periods.

**History of Archaeological Work at Zacpetén**

Archaeological work at Zacpetén began in 1979 and continued to 1981 under the Central Petén Historical Ecology Project (CPHEP) Proyecto Lacustre. This project investigated the archaeology around the basins of Lakes Macanché, Salpetén, Quexil, and Peténxil (Rice and Rice 1980). The major goals of the project were to understand the
temporal and spatial distributions of settlements in the Central Petén and the role of environmental and sociopolitical factors in establishing Maya settlements in the region.

As part of the CPHEP Proyecto Lacustre, three transects were placed around Lake Salpetén, resulting in the mapping of 190 buildings and the subsequent excavation of 17 test pits at Zacpetén. The CPHEP project estimated Zacpetén to be about 0.25 square kilometers in size (Rice 2009b:81). Radiocarbon dates collected from Zacpetén range between A.D. 1070 and A.D. 1750, indicating a relatively late Kowoj occupation (Pugh 2001:162).

At the end of the CPHEP Proyecto Lacustre, archaeological research at Zacpetén ceased for 14 years. In 1994, work began again at the site under the Proyecto Maya Colonial. Two of the goals of the project were to better understand the chronological development of Zacpetén and to document the cultural connections between the site and the Maya of the Central Petén Lakes Basin (Pugh and Rice 2009b:85). To meet these goals, 66 test units were excavated across the buildings and plazas of the site. The Proyecto Maya Colonial also revised the site map and updated the population estimates for Zacpetén to 1,400 individuals, based on the simultaneously occupation of all structures (Rice 2009b:81).

During the 1996 and 1997 field seasons, the Proyecto Maya Colonial cleared and excavated 26 buildings and a nearby plaza (Pugh 2001:241). During these two field seasons, the Late Postclassic and Early Contact period civic-ceremonial and residential architecture of Zacpetén was recorded and various activity areas were documented (Pugh and Rice 2009a:86). In 2002, Zacpetén was excavated once again, refining chronological
affiliations and illuminating additional ceremonial and domestic activities at the site (Duncan 2005).

Under the Proyecto Maya Colonial, archaeologists excavated over 4,600 units at Zacpetén (Pugh 2001:191). These excavations included work in both civic-ceremonial areas and residential buildings. Most of these excavations were surface operations dating to the Late Postclassic or Early Contact periods. These operations were conducted with concern for the spatial location of artifacts and their relationship to architecture (Pugh 2001:222).

To identify buried caches and deposits, several 1 x 1-meter units were excavated from the floor of a structure or feature to bedrock. All of the artifacts from the Zacpetén assemblage were recorded according to cultural and natural stratigraphic levels, and soils from the 1 x 1-meter units were screened through one-eighth inch mesh (Pugh 2004:353). Through these efforts, Proyecto Maya Colonial excavations revealed a substantial quantity of primary refuse on the floors of structures and a large number of artifacts in secondary contexts and collected artifacts (Pugh 2009b:173).

Work at Zacpetén took place across five Late Postclassic to Contact period architectural groups (Figure 5). All five groups (A, B, C, D, and E) are located on natural elevations that were modified for the construction of ceremonial and residential structures. Interestingly, shorelines along Lake Salpetén were avoided at this time, which may reflect the need for safety or changing lake levels (Pugh 2009b:173).
Figure 5. Zacpetén architectural groups (After Pugh 2001:17).
One of the most interesting architectural features of Zacpetén is a defensive system located along a narrow gap at the north end of the site. This system consists of a canal, a large wall with side extensions (Wall 1), and a second smaller wall (Wall 2) constructed in a deep ditch (Rice et al. 2009:132). Several projectile points, bifaces, and biface fragments were found during excavations into the defensive structure. The presence of these artifacts in and around the walls indicates the defensive system was tested at least once (Pugh 2004:353). In addition to the defensive system, several residential buildings and civic-ceremonial areas were excavated within the Zacpetén architectural groups. Three of these groups (A, B, and C) have a combination of ceremonial and residential buildings. Group D is a residential group composed of three structures in the southwestern part of the site. Located on a small hill in the eastern portion of the site is residential Group E. Although the individual construction histories of the five architectural groups are unique, there is clear evidence for construction activity at all five groups during the Postclassic and Early Contact periods.

**Zacpetén Ceremonial Buildings**

Zacpetén has two Postclassic to Early Contact period civic-ceremonial areas located within architectural Groups A and C. Both ceremonial groups share several features with the ceremonial architecture of Mayapán. Civic-ceremonial groups at Mayapán are typically composed of temples, oratorios, open halls, statue shrines, and raised shrines (Pugh 2003b:410). These buildings were configured into two architectural
layouts: the basic ceremonial group and the temple assemblage (Proskouriakoff 1962b:91).

The Mayapán basic ceremonial group consists of an open hall, a shrine, and an oratorio. In this group, the oratorio and shrine often centered and faced an open hall, with an additional shrine between the hall and oratorio. The Mayapán temple assemblage includes the open hall, shrine, and oratorio of the Mayapán basic ceremonial group as well as a central temple. Variants of the Mayapán temple assemblage have been found in the Central Petén Lakes Basin at Topoxté, Cante, Paxte (Johnson 1985:163), Muralla de Leon, and Zacpetén (Rice 1988:241; Rice and Rice 1985:278-279).

The largest of the Zacpetén architectural groups is Group A (Figure 6), which is centrally located on a natural hill about 30 meters above Lake Salpetén. Group A has a long architectural history and includes deposits dating to the Middle Preclassic, Terminal Classic, and Late Postclassic periods (Pugh 2001:295). While several domestic groups surround the area, most of the excavations within Group A focused on the civic-ceremonial center and its immediate plaza (Figure 6). During the Early Postclassic period, the entire layout of Plaza A was transformed to a Mayapán basic ceremonial assemblage (Pugh and Rice 2009:103). During the Late Postclassic period, Group A was modified again through the construction of a small sakbe that divided Group A into eastern and western halves (Str. 603).

The focus of Ceremonial Group A is Str. 602 (Figure 7). This structure is a westward-facing temple with four terraces. The temple measures 14 meters by 17.1 meters at the base and has a height of 3.6 meters. The top of Str. 602 has a superstructure
Figure 6. Group A civic-ceremonial area (After Pugh 2001:301).

enclosed by walls to the north, south, and east (Pugh 2001:233). The interior of the superstructure has a medial altar along the east wall, an L-shaped bench along the southern part of the east wall, and an interior altar that extends north-south (Pugh 2001:234). In front of Str. 602 are a long, low-platform shrine (Str. 607A) and a small altar (Str. 607B). The base of Str. 607A measures 1.8 meters by 7.1 meters, and it has a
height of 0.25 meters. The smaller altar, Str. 607B, measures 0.8 meters by 1.8 meters along the base and has a height of 0.3 meters (Pugh 2001:269).

Northeast of Strs. 607A and 607B is Str. 605, a westward-facing oratorio. The structure was built on a single platform and features a western facing, C-shaped superstructure and inset staircase. The oratorio measures 13.3 meters by 18 meters along the base and has a height of 1.1 meters. Inside of the east and north walls of the superstructure is an L-shaped bench and niche.

Perpendicular to Str. 602 and Str. 605 is an open structure with two halls (Str. 606). The base of Str. 606 measures 17.5 meters by 38.9 meters at the base and has a height of 1.1 meters. This structure is the most architecturally complex building at Zacpetén and has three sub-structures: 606A, 606B, and 606C (Pugh 2001:264). Str. 606A is a C-shaped
open hall in the southeastern part of Str. 605. To the north of 606A is Str. 606B. This building is a large colonnaded hall with a C-shaped wall and bench interrupted by a large medial niche. West of 606B is a small end room, 606C.

West of Str. 606 is a poorly preserved C-shaped oratorio (Str. 614). This structure features a medial niche and a bench, but no masonry walls (Pugh 2001:273). On the south side of Plaza A is a raised shrine, Str. 601, which is a stepped pyramid, topped by a large building platform (Pugh 2001:228). The base of Str. 601 measures 12.2 meters by 10.2 meters and has a height of 3.42 meters. The superstructure of Str. 601 is a small building featuring an altar/bench along the south wall. In the southwest corner of Plaza A is a small eastward-facing hall (Str. 615). This structure is a single-tiered, C-shaped colonnaded hall that measures 8.6 meters by 21.6 meters at the base and has an overall height of 0.1 meters (Pugh 2001:275). Str. 601 has an exterior wall and a bench broken by a medial niche.

North of Str. 615 and directly behind Str. 614 is a large oval-shaped pit constructed into the bedrock. The depression measures seven meters east-west and nine meters north-south. At its lowest point, the pit has a depth of 3.75 meters. The pit originally was created during the Middle Preclassic period, but it was used as a mass grave between A.D. 1389 and A.D. 1437. The grave contained the remains of at least 37 individuals, including male and female adults, juveniles, and infants (Duncan 2009:344). While a significant number of obsidian blades were found in the mass grave, no definitive grave goods were found.
The human remains recovered during excavation work in Operation 1000 were highly disarticulated, and the bone pathology did not show patterns of heightened disease, malnutrition, or trauma (Duncan 2009:359). As such, the death of the individuals located in the mass grave was not caused by a single event. Interestingly, bones, such as those of the right forearm, and molars were significantly underrepresented in the mass grave.

Analysis of the mass grave and the pathology of the interments suggest that the grave represents a large reburial act whereby the Kowoj intentionally moved these remains of individuals from their original burial positions (Duncan 2009:366). This act of ritual violence had two purposes. The desecration of graves at Zacpetén weakened the enemies of the Kowoj and established their control over the site and the region. If the Kowoj were intentionally desecrating ancestor graves at Zacpetén, the removal of bones and teeth (and their potential use as trophies) may represent Kowoj attempts at punctuating the cycle of rebirth associated with the remains of the deceased (Duncan 2009:366).

The second civic-ceremonial center at Zacpetén is located on a high hill in the southern part of the site in architectural Group C (Figure 8). The central plaza in Group C was constructed during the Postclassic period (Pugh and Rice 2009:105). Like Group A, the focal point of Group C is a civic-ceremonial temple assemblage. This assemblage features a large temple (Str. 764) on the eastern edge of the platform (Pugh 2001:364). Str. 764 has a multi-terraced base topped by a five-doorway superstructure. The temple measures 15.5 meters by 17.8 meters at the base and has a height of 2.5 meters. The
interior of the superstructure features a medial altar, an L-shaped bench, and an interior wall that runs north-south, dividing the building into two rooms.

In front of Str. 764 is a platform shrine, Str. 766. The shrine is divided into two components, Str. 766A and Str. 766B. The elongated shrine (Str. 766A) measures 1.8 meters by 9.5 meters at the base and has a height of 0.16 meters. The top of the shrine is
divided into two halves. The western half of the shrine has two small rectangular masonry features, and the eastern side features a three-tiered circular platform (Pugh 2001:381). Just west of Str. 766A is a rectangular masonry altar (Str. 766B) constructed from hard limestone rubble and set as vertical slabs. The altar measures 1.5 meters by 1.8 meters at the base and has a height of 0.36 meters.

Str. 767 is located on the southern side of the Group C temple assemblage. This building is a C-shaped open hall that measures 34.2 meters by 8.3 meters at the base and has a height of 0.25 meters. The building is at a right angle to Str. 764 and faces north. The interior of the Str. 767 features a bench with four altars along the western edge. The bench was constructed of a single face of coarse stone and vertical slabs. Plaster remnants from the wall and bench of Str. 767 indicate the interior of the hall was painted red.

North of Str. 764 is an oratorio, Str. 1002. This building has a basal dimension of 17 meters by 9 meters and a height of 1.73 meters. The oratorio does not have any additional features or a superstructure, which is notably different from the oratorio in Group A (Str. 605).

In the northwest corner of Group C is Str. 765, a raised shrine. Str. 765 measures 5.7 meters by 5.9 meters at the base and has a height of 0.24 meters. The top of the shrine features a small rectangular superstructure with a small medial altar against the rear wall.
Zacpetén Residential Structures

Five residential groups (732, 758, 747, 664, and 719) were investigated under the Proyecto Maya Colonial. These residential groups were selected for study based on their size, content, and location within Zacpetén and included both elite and nonelite buildings. Residential Group 732 is located east of Group C (Pugh 2001:443). This group features a small patio on an artificially leveled slope, a residence to the southwest (Str. 732), with an open patio to the northeast. A small platform of unknown function (Str. 1004) is also located on the patio.

Str. 732 is a large, well-constructed, tandem-shaped residence measuring 8.2 meters by 11.3 meters (Pugh 2004:356). The front room has a L-shaped bench in the northwest and plastered floor and walls (Figure 8). The back room had a simple dirt floor backed by a crude row of stone foundation slabs. Based on the architecture of the building and the types of utilitarian objects found in Str. 732, it was classified as an elite residence.

Domestic Group 747 lies in the center of architectural Group E. This domestic group was constructed on an artificially leveled hilltop, and it is 390 m² in size (Pugh 2001:446). Domestic Group 747 features a residence (Str. 747) and a low platform (Str. 748). The residence is a tandem-shaped building with an L-shaped bench on the western side and measures 8.2 meters by 12.8 meters (Pugh 2001:447). This residence has an interior wall that divides the building into a front and back room. Str. 758 was determined to be an elite residence based on its architectural features.
Domestic Group 758 is located on the side of a hill, 40 meters south of the Group C ceremonial center. This domestic group includes a residence (Str. 758) and a patio to its east. Group 758 is the smallest and most poorly constructed of the residential groups at Zacpetén, and the history and layout of Group 758 was difficult to reconstruct (Pugh 2004:354). The lack of masonry walls indicates Str. 758 apparently was constructed with perishable materials (Pugh 2001:454).

Str. 748 is also found in Group E and is located on a low platform along the western edge of the plaza, approximately 3.3 meters south of Str. 747. This residence was poorly preserved, and the exact dimension of Str. 748 could not be determined. An L-shaped bench was found along the south side of the building, but very little additional architecture information was recovered from Str. 747. Based on the architecture, this structure was determined to be an elite residence.

Domestic Group 664 is located on a 180 square-meter patio platform east of Group B and approximately 35 meters west of Lake Salpetén (Figure 13). This group consists of a residence (Str. 664) and a small rectangular shrine or kitchen (Str. 789). The residence is located in the northwest corner of the patio and measures 5.2 meters by 7.9 meters (Pugh 2001:429). Str. 664 features an L-shaped bench, perishable walls, and a perishable interior wall at the center of the structure. Based on its architecture, Str. 664 was determined to be a nonelite residence.

Domestic Group 719 is located on a natural saddle approximately 102 meters from Group A and 92 meters from Group C (Figure 9). This location is one of the most desirable living areas of Zacpetén, as the terrain around the domestic group has a gradual
Figure 9. Domestic Group 719 (After Pugh 2001:471)

slope, is not prone to flooding, and has optimal access to water. Domestic Group 719 is a tandem-room structure (Str. 719), an oratorio/temple (Str. 721), and a small shrine (Str. 720) built on a large platform approximately 1,200 m² in size (Pugh et al. 2009:192).

Str. 719 is on the northern side of Domestic Group C and was the focus of the entire residential group. The residence measures 11.5 meters by 24 meters and, based on these dimensions, is the largest residential structure at Zacpetén (Pugh et al. 2009:193). Str. 719 is divided into a front and back room by a long interior masonry wall, broken by a single door west of center. The front room has a plaster floor and an L-shaped bench that was painted with curvilinear designs similar to shapes found on Kowoj pottery (Cecil 2001). The L-shaped bench in Str. 719 features ten slabs of cut and embedded limestone.
Based on the architecture, location, and features of Str. 719, this structure was an elite residence.

**Discussion**

A significant amount of archaeological data was recovered from Zacpetén during the course of the CPHEP Proyecto Lacustrine and the Proyecto Maya Colonial. Through these projects, the temporal and spatial dimensions of Zacpetén were defined, and the cultural connections between the Kowoj and Zacpetén were archaeologically verified. Architectural patterns, radiocarbon dates, and ceramic evidence suggest that the Kowoj migrated to the eastern part of the Central Petén during the Early Postclassic period.

The decorative ware that is the most prevalent at Zacpetén during Late Postclassic to Early Contact periods is a variant of the Topoxté ceramic group, known as Clemencia Cream Paste (CCP) Ware. Technologically, CCP ware is distinctive, based on two characteristics: a cream-colored paste low in organic matter (Cecil 2009a) and a bright orange-red (Chompoxte Red-on-cream) or a red-and-black color (Cante Polychrome and Saca Polychrome) applied over the clay with a red or red-and-black painted decoration (Rice 1979).

Differences between the Topoxté and other ceramic groups in the Central Petén Lakes region (Paxcaman, Augustine, Trapeche, and Fulano) appear to be spatial, suggesting the use of certain ceramic pastes by particular socio-political groups (Cecil and Neff 2006:1460). In the western portion of the Central Petén Lakes Basin, the Paxcaman, Trapeche, and Fulano groups are more prevalent, while the Topoxté group is
dominant in sites in eastern basin. Augustine ceramics have a much broader distribution across the basin are found at multiple sites across the entire region. The distribution of the different ceramic groups across the Central Petén indicates Paxcaman, Trapeche, and Fulano ceramics likely were associated with the Itzá, and Topoxté ceramics were associated with the Kowoj.

As the Kowoj conquered new territory, their wares quickly became the dominant ceramic type at these locations. Interestingly, the Postclassic Kowoj decorative pattern began to appear on shell-inclusion pastes in locations outside of the Yaxhá basin during the Late Postclassic period, which indicates the adoption of Kowoj decorative patterns by local potters in these communities (Rice and Cecil 2009a:242). During the Late Postclassic period, a clear distinction emerged between Kowoj ceramics in the eastern part of the Central Petén and non-Kowoj (Itzá) ceramics in the western part of the basin.

The residential and civic-ceremonial architecture at Zacpetén from the Late Postclassic and Early Contact periods is different from the architectural forms and patterns of the Classic period in the Central Petén Lakes Basin. Unlike Classic-period structures, nearly all of the Postclassic buildings at Zacpetén have square or rectangular single-level platforms (Rice 1986:304). In addition, Postclassic communities in the Central Petén Lakes Basin are not configured around a single centralized ceremonial area but contain multiple civic-ceremonial locations within public and private spaces. At Zacpetén, civic-ceremonial centers in Groups A and C were modified to form variants of the Mayapán temple assemblage during the Postclassic period. Postclassic settlements are highly nucleated around easily defensible positions. In addition, the defensive system in
the north end of the site was improved at this time, and a mass grave was created in the plaza of Group A.

The social meaning behind the ceramic innovations, architectural changes, and the mass grave at Zacpetén was the assertion of a distinctive Kowoj ethno-political identity during the Late Postclassic and Early Contact periods (Rice and Cecil 2009a:242). After establishing this identity at Zacpetén, the Kowoj continued to take steps to maintain their identity through the continuation of rituals and ceremonies. Within the Zacpetén civic-ceremonial architecture, a number of ritual censers, vessels, drums, flutes, eccentrics, human remains, and animal bones were found in and around the niches and altars of several shrines, temples, and oratorios.

Rituals are symbolic performances that condense a broad range of social phenomena into a limited number of items (Tu 1967:28-32). Through rituals, values and ideas are conveyed that allow individuals to create a shared identity and sense of community. The temples, oratorios, and altars at Zacpetén served as models of the Maya universe and the place of the Kowoj within it. These were sacred places of socialization, and they contributed to identities of gender, adulthood, family, community, and ethnicity (Pugh 2009a:384).

Interestingly, ritual activities at Zacpetén coincided with increased levels of hostilities in the Central Petén, and they may have served as social acts that maintained ethnic distinctions between the Kowoj and their neighbors, specifically the Itzá. Maintaining socio-political distinctions may have had economic repercussions as well. Whether by choice or necessity, the behaviors associated with the acquisition, production,
and use of stone tools at Zacpetén may have been distinct from those of other Central Petén groups and potentially represented another aspect of identity formation within the community.
Chapter 5- Research Methods and Theory

Cultural ideas shape the way stone tools are produced, used, and exchanged. Through culture, individual perceptions about proper raw materials, tool design, and tool use are defined (Collins 1975). Archaeological perceptions of culture also influence the analysis of stone tools, and contrasting views about cultural behaviors and social development can lead to differing interpretations about stone tool production and function. A clear example of the influence of archaeological theory on lithic studies was the debates about the interpretation of Mousterian stone tool assemblages (Binford and Binford 1969; Bordes 1972). The theoretical developments within archaeology have influenced lithic studies, and, as archaeological theory changed over time, so have the ideas and methods used in lithic analysis.

In the early developmental period of archaeology, stone artifacts were seen as the mental templates of the toolmakers, and their forms were preserved in the archaeological record until their recovery in modern times (Odell 2001:47). Using this normative view of culture, the culture history approach was established in archaeology to examine temporal and spatial sequences for culture areas (Willey and Phillips 2001:11).

The first significant lithic study in the Maya lowlands took place at Uaxactún. This study was conducted by A. V. Kidder, who developed the culture history approach through his work at Pecos, New Mexico. For Kidder, the process of analyzing the Uaxactún lithics was a simple act of grouping artifacts into well-defined categories similar to those used to study ceramics (Kidder 1947:4). Previous archaeological studies
in the Maya Lowlands had paid little attention to lithic artifacts, and Kidder’s work was the first substantial description of the subject (Hester 1976:12). Kidder documented 23 major lithic categories with multiple sub-types. What is also significant about Kidder’s work was his inclusion of artifact function. While many of the methods used in the Uaxactún study are considered inadequate by today’s standards, Kidder’s attempt to look beyond simple visual categories was an important development in archaeology, and his typologies became the standard classification scheme used in other early Maya studies, such as those of Mayapán (Proskouriakoff 1962a) and Piedras Negras (Coe 1959).

A shift in archaeological theory began during the Great Depression. At that time, archaeologists were employed in the survey and excavation of areas marked for large-scale public works projects (Chapman 2000:551). Through these efforts, multiple sites within the same region were surveyed and excavated, allowing for the comprehensive analysis of past societies. This approach, called settlement pattern archaeology, is the study of the past based on the distribution of sites, buildings, habitation debris, and landform modifications created by human activities (Ashmore and Willey 1981:3).

By looking at different settlements, households, features, and activity areas within sites and across sites, archaeologists gained new insight into the lives of a broader range of people in the past. Settlement pattern archaeology also emphasized the role of ecology in shaping culture. The inclusion of cultural ecology (Steward 1972) in these studies led to the development of a multi-disciplinary approach within archaeology, whereby methods such as aerial photography, cluster analysis, hydrologic and geologic studies, and faunal and floral analysis were integrated into archaeology (Chapman 2000:552).
In the Maya Lowlands, the ideas and methods of settlement pattern studies were used to study Barton Ramie. Under the direction of Gordon Willey, Barton Ramie was selected because it had been cleared for farming, inadvertently exposing numerous mounds and features. Because it was cleared, Barton Ramie held great potential for addressing questions about settlement locations, population size, socio-economic organization, and urbanization (Willey et al. 1965:vii).

Like Uaxactún, the lithic categories at Barton Ramie were mostly descriptive and were based on variations in tool morphology, location, and artifact quantity (Willey et al. 1965:391). The two main artifact classes at Barton Ramie were chipped-stone tools and ground-stone tools. These categories were subdivided into additional types with multiple varieties. Unlike those of Uaxactún, the lithics from Barton Ramie were categorized into a larger set of 32 artifact types and 29 varieties. This was a significant increase in lithic categories compared to those of Uaxactún, and it was the direct result of a larger sample size. The categories used at Barton Ramie provided archaeologists with more information on the lives of nonelite Maya, but they did not provide any substantive data on tool production or use (Hester 1976:14). For example, 3,000 pieces of “chert scrap” were recovered from work at Barton Ramie, but technological or use-wear studies of thedebitagewere not completed at the time of the initial site report (Willey et al. 1965:440).

Another theoretical shift in archaeology occurred from 1960 to 1970 with the processual movement, also known as “the New Archaeology”. Processual archaeology called for a focus on generalizations to find universal theories of culture and culture change. To this end, archaeologists insisted on the rigorous testing of theories as a means
to make empirical claims about archaeological knowledge (Gibbon 1989:68) and integrated new approaches such as systems theory, functionalism, and multilinear evolution (Chapman 2000:552). Improvement in scientific techniques, such as radiocarbon dating, pollen analysis, and dendrochronology also increased the link between science and archaeology (Johnson 1999:35).

Dissatisfaction with the theoretical trends led to new approaches used to study archaeological assemblages. This was particularly true for lithic artifacts, where, “such rethinking especially [was] needed with regard to the ‘cost/benefit analysis’ of lithic source locations and differential relationships between reduction strategies, raw materials, tool design, recycling, reuse, and the relative contributions of each to assemblage variability” (Binford 1979:271). Two methods used in processual archaeology are ethnoarchaeology and experimental archaeology.

Ethnoarchaeology uses ethnography to answer questions about the archaeological record. By observing modern activities and their impact on the environment, archaeologists can create behavioral analogies between ethnographic observations and archaeological discoveries. Strong analogies can be created through experimental work if certain controls are enacted to account for variability in the archaeological record. Unfortunately, there is little ethnographic information on stone tool production, and, in the few cases where such information exists, these accounts do not always include manufacturing techniques because of a lack of interest in or knowledge of tool making by the ethnographers (Clark 1986:48).
In the absence of ethnographic data, experimental archaeology may be the only available means to reconstruct ancient tool technologies. Experimental archaeology attempts to understand past dynamics by duplicating them in laboratory settings. One type of experimental study that became important during the processual movement was replicative studies. Replicative studies examine the production of stone tools by recreating the tool production process. Replication studies are bound by two important principles. First, stone tool production is a subtractive process that is irreversible (Collins 1975:16-17). This process creates a set of attributes that are affected by the tools, techniques, and decisions made by the toolmaker, and it creates a visible record of that process on lithic artifacts. Second, the physical nature of brittle solids imposes limitations on how they can fracture. Lithics break in a finite number of ways. As such, fracture patterns provide analysts with a limited set of possible explanations for how tools were made (Cotterell and Kamminga 1979, 1987). Using fracture mechanics as a baseline, analysts can use replication studies to examine the idiosyncratic behaviors associated with the production of stone tools.

Replicative studies have an accepted set of procedures with good experimental controls (Crabtree 1972; Flenniken 1981). First, raw material of similar composition to the identified artifact is selected and, if necessary, thermally treated (Flenniken 1984:189). Second, the raw material is reduced using similar fabricators and techniques. Third, experimentally produced tools are used and recycled until they are exhausted. By following this process, “the end products, including the debitage, sequential stages of manufacture, and rejuvenated tools should be the same or very similar to the aboriginal
controls in terms of technical category percentages, morphologies, and technologies” (Flenniken 1981:2). Once tools and debitage are produced through a replicative study, they are organized in a systematic repertoire known as a reference assemblage (Statham 1985:230). Reference assemblages are important in lithic studies because they furnish comparative tool assemblages that establish “baselines” of artifact variability (Santley et al. 1986:103).

Multiple approaches can be used to organize and study both reference assemblages and artifacts. One of the most comprehensive and effective approaches is the chaîne opératoire. The term chaîne opératoire was first used in the late 1960s (Brézillon 1968:78), but the concept was not fully developed by French archaeologists until the 1980s (Lemonnier 1983; Pelegrin et al. 1988). The chaîne opératoire is a succession of mental operations and technical gestures that satisfy a need, immediate or not, of a preexisting project (Leroi-Gourhan 1964:323; Perlès 1987:23). The main goal of the chaîne opératoire is to provide a description and understanding of all physical gestures and mental objectives associated with the transformation of raw materials into tools (Sellet 1993:106).

Each link in the chaîne opératoire represents a different mental construct and physical behavior. Individual links are chained together in a chronological sequence that represents an entire technological process. By linking different processes into a technological system, larger chains in the chaîne opératoire are formed. While individual subsystems can be isolated and studied, it is essential to take a holistic approach and to examine the entire chaîne opératoire because of the strong influence each link has on the
A critical aspect in the study of the chaîne opératoire for lithic tools is how variables from one link influence other links in the chain and the associated behaviors of ancient toolmakers.

A second type of experimental study that gained prominence during the processual movement was use-wear analysis. Like replicative studies, use-wear studies predated the processual movement. Use-wear studies developed in Russia during the 1930s through the work of Sergei Semenov. At that time, Semenov initiated a program of experimental use-wear studies that involved the microscopic examination of chipped- and ground-stone tools under magnification (Semenov 1964). Subsequent refinement of Semenov’s techniques led to the development of two methods for use-wear analysis: low-power magnification (Odell and Odell-Vereecken 1980) and high-power magnification (Keeley 1980). Through magnification, archaeologists can identify patterns such as polish, striations, and edge damage on stone tools.

When used in conjunction with replication experiments, use-wear analysis can identify how a tool was used. First, replicated tools are used in experimental tasks to create wear patterns on their edges. Second, the use-wear patterns found on experimental tools are compared with the patterns found on actual artifacts to infer the type of activities for which the ancient tools were used.

With the growth of lithic studies during the processual movement, lithic artifacts were addressed with greater frequency in archaeological studies. One of the most comprehensive Lowland Maya lithic studies using processual theory and methods comes from La Libertad (Clark 1988). La Libertad is located in the central Chiapas depression.
near the borders of Mexico and Guatemala. The site is a large Middle Preclassic center with over 30 large and small mounds spread across a 45-hectare area. La Libertad includes plazas, a large acropolis, a ball court, and the remains of several bajos. Based on the layout and architecture pattern of the site, La Libertad likely was the regional center of a paramount chiefdom.

At La Libertad, 6,860 lithic artifacts were recovered from 14 major and eight minor mounds. The analytical methods used in the lithic study were based on ethnographic and replicative studies of stone tools, and they were selected to understand the economic activities at the site. All of the artifacts were categorized into three lithic tool industries: obsidian, microcrystalline chipped-stone, and ground-stone. Within each industry, artifacts were subdivided according to their physical attributes (raw material, color, and texture), production characteristics (technological typology, cortex, and size), use-wear patterns, and spatial distribution. In the analysis of artifact distribution, all of the lithics from a single mound were considered part of the same analytical unit.

A major goal of the La Libertad lithic study was to go beyond descriptions of stone tool types and produce important inferences about the economic patterns of the community. Through his analysis of the lithic assemblage, Clark made several interesting conclusions about the economic patterns of the site. First, the economy was composed of two separate, but complementary, sectors: the public economy and domestic economy (Clark 1988:195). The public economy was hierarchically organized under the control of the paramount chief, who made economic decisions for the entire community. The domestic economy was organized and controlled by individual households.
There are no obsidian sources in the La Libertad region, and all obsidian was brought into the community under elite sponsorship. Visual and geochemical sourcing of obsidian showed that 99 percent of the artifacts were from the San Martín Jilotepeque (SMJ) source, supplemented by a very small percentage of obsidian of El Chayal, Pachuca, Tajumulco, and Zaragoza. Analysis of the obsidian debitage revealed that a specialized pressure-blade industry and a nonspecialized flake-tool industry coexisted within the community.

Obsidian pressure-blade production was controlled by the La Libertad elites. The high technological requirements associated with the production of pressure blades created barriers for individual households in acquiring the skills and materials necessary for pressure-blade production (Clark 1997). Obsidian was brought into La Libertad as early stage percussion-blade cores and was reduced by part-time specialists (Clark 1988:30).

After their production, obsidian blades were distributed across La Libertad by elites as a means to increase their social standing in the community (Clark and Blake 1994). In addition to obsidian, nonlocal materials used in the chipped-stone industries (fine-grained “Morelos” chert) and ground-stone tool industries (basalt, andesite, quartz, and fine-grained quartzite) were brought into the site under elite sponsorship. However, these materials were reduced or used within the domestic economy.

Within the domestic economy, households engaged in different activities that were organized around their maintenance and reproduction. At La Libertad, elite and nonelite households engaged in activities such as food production, house construction and repair, and agriculture, and the production of stone tools using local raw materials (low-grade
black chert, quartzite, and sandstone). Obsidian tools with similar use-wear patterns were found in all of the sampled mounds, suggesting that tasks associated with obsidian were replicated between households (Clark 1988:45).

Obsidian flake-tool production was part of the domestic economy. Unlike the manufacture of pressure blades, obsidian flake-tool production was simple and accessible. These tools were produced through a one- or two-step process that involved the reduction of exhausted blade cores, core fragments, macroblades, and macroflakes (Clark 1988:15). Debitage and tools associated with the obsidian flake-tool industry were found in all excavated mounds at La Libertad, suggesting that each household likely produced flake tools from blade industry byproducts that were scavenged or acquired through some type of exchange.

All of the chipped-stone and ground-stone tools, regardless of raw material type, were used in the domestic economy. Among the chipped-stone industries, local and regional raw materials were brought into La Libertad as unshaped cores and were subsequently reduced by households through direct percussion or bipolar percussion techniques. Ground-stone tools produced from nonlocal materials were brought into La Libertad as finished or nearly finished products. All tools produced from local raw materials were procured and produced by individual households.

While the La Libertad lithic study comes from a community outside of the Central Petén Lakes Basin, it is relevant because it includes a wide variety of different raw materials, tools, and debitage types. The exhaustive nature of the La Libertad study provided a holistic look at multiple activities conducted across a relatively short period
(300 to 400 years). La Libertad was an important regional center in Chiapas, and it was part of a larger political system of agrarian-based chiefdoms. In this sense, La Libertad shares many similarities with Zacpetén, and many of the methods used in the La Libertad study were applied to the analysis of the Zacpetén lithic assemblage.

**Zacpetén Research Methods**

The analysis of the Zacpetén lithics included the technological, visual, geochemical, functional, and spatial aspects of all artifacts collected from the site. Visual studies examine the physical properties of raw materials. By looking at the physical properties of lithic artifacts, inferences can be made about the production strategies chosen by toolmakers (Torrence 1986:164). The Visual analysis of the Zacpetén lithics was based on a modified version of techniques used to study the lithics artifacts from Blackman Eddy (Yacubic 2006) and was similar to the methods used by Clark in his study of the La Libertad artifacts.

**Visual Analysis**

The Zacpetén artifacts were first visually classified according to their raw material type (e.g., obsidian, chert, chalcedony, limestone, basalt). In cases where the raw material could not be visually identified, artifacts were further studied using Mohs scale hardness picks and a mineral identification kit. Once the raw material was determined, artifacts were categorized according to color and texture.
All artifacts were color-coded using a Munsell soil color chart to avoid ambiguity. For artifacts with banding or inclusions, the color within the raw material matrix was noted. In archaeology, the classification of texture often provides a description of artifacts as fine-grained or coarse-grained. However, what is actually being described in texture studies is not grain size but the fracture surface of the artifact (Luedtke 1992:70). For this study, artifacts were classified as coarse-, medium-, or fine-grained, through visual and tactile analysis. Lithics with an uneven surface or rough texture were classified as coarse-grained, while those with a smooth texture were classified as fine-grained. Medium-grained artifacts had a moderately rough surface with a small but visible grain.

In addition to identifying the physical characteristics of the raw materials, visual studies can be used to draw inferences about tool procurement strategies. By comparing artifacts found at a site to artifacts from known lithic quarries and outcrops, archaeologists have created distribution models for different raw material types. For obsidian artifacts, visual sourcing can be a fast and effective method for identifying different parent sources in Mesoamerica (Moholy-Nagy and Nelson 1990:71). The technique involves holding an obsidian artifact to a light source and noting the color, inclusions, texture, luster, and flow structure (Clark 1988:42). Once the visual attributes of the artifacts are noted, they can be compared to the characteristics of known obsidian sources.

For Mesoamerica, the visual characteristics of the major obsidian sources, including those from the Maya area, have been published (Braswell et al. 2000:272). After the Zacpetén obsidian artifacts were visually sorted, they were assigned to a source
based on published data. A representative sample of 300 obsidian artifacts was drawn from these visual categories and was subjected to trace-element chemical analysis to verify the accuracy of the visual sourcing.

The trace-element analysis of the Zacpetén obsidian samples was completed using X-ray fluorescence (XRF). In XRF, a high-energy X-ray photon ionizes a sample. The ionization process also releases energy, called fluorescent radiation, due to differences between the bond strength of inner- and outer-ring electrons. Because the energy levels for elements are fixed, fluorescent radiation can be used to determine the type and percentage of elements present in a sample (Shackley 2010:16).

XRF measurements for the Zacpetén obsidian artifacts were collected using a Niton XL3t GOLDD (Geometric Advantage, Optimized Excitation, and a Large Drift Detector) series analyzer. Each obsidian sample was analyzed for three minutes using two different settings (high energy/low element detection and low energy/high element detection) calculated to a confidence level of 99.7%. Using the Niton XL3t, trace amounts of Zirconium (Zr), Uranium (U), Rubidium (Rb), Thorium (Th), Selenium (Se), Zinc (Zn), Cobalt (Co), Manganese (Mn), Chromium (Cr), Titanium (Ti), Scandium (Sc), Calcium (Ca), Potassium (K), Sulfur (S), Barium (Ba), Cesium (Cs), Antimony (Sb), Lead (Nb), Aluminum (Al), Phosphorus (P), Silicon (Si), Chlorine (Cl), and Magnesium (Mg) were detected in obsidian samples from the Zacpetén assemblage.
Technological Analysis

The two main classes of lithic artifacts at Zacpetén are chipped-stone tools and millstone tools. Chipped-stone tools are produced through the flaking of raw stone by percussion and/or pressure techniques. Millstone tools are also manufactured by percussion, but they are finished through pecking. Abrasion, if desired, was only a minor aspect of millstone production. Typically, millstone tools were used to process foodstuffs. Both of these lithic tool classes were subdivided into formal tool and debitage categories as part of their technological analysis. In addition to the chipped stone and millstone classes, artifacts were also placed into two minor categories, handstones and lapidary artifacts.

Formal tools are the final products created through a reduction sequence, and they are the intended products envisioned by the toolmaker. In the analysis of the Zacpetén lithics, formal tools were categorized according to the reduction sequence that produced them. For example, Zacpetén bifaces were created through a bifacial flake-core reduction chaîne opératoire. Formal tool classes were subdivided into subtypes according to their visual features. The length, width, thickness, and weight of all formal tools were measured to examine variability within formal tool categories and types.

In addition to the technological analysis of formal tools, the various byproducts, or debitage, created through the production process were examined. The Zacpetén debitage categories are technologically meaningful in that they reflect specific reduction sequences and production techniques. Debitage categories were based on characteristics such as platform characteristics, presence of cortex; distal termination; and dorsal,
ventral, and edge-scarring patterns. By looking at these production variables, the technological types associated with particular reduction strategies were inferred from the debitage. At Zacpetén, several production strategies were used among the various tool industries. The chaîne opératoire associate with each industry is discussed in detail in Chapters 6, 7, and 8.

Use-Wear Analysis

Use-wear studies examine the function of tools to determine how they likely were used over time. When tools are used, they may acquire observable micro-chipping patterns along their worked edges (Odell 2003:138). These patterns are unique to the kind of activity for which they were used and the type of materials on which they worked. The five main types of use-wear categories used to study the Zacpetén lithic assemblage were longitudinal, transverse, rotative, incising, and retouch. All of the Zacpetén artifacts were examined macroscopically using a 10x hand lens.

Cutting activities create one-way, longitudinal scars along the worked surface of a tool. This type of use-wear is unevenly distributed across the working edge of the tool, but it is not random (Tringham et al. 1974:188). Scraping activities create one-way, longitudinal scars along the worked surface of a tool. Scraping use-wear is similar to cutting patterns, but flake scars occur in greater density across the edge of the worked material, and they often have an overlapping pattern because of the regular, continued use of the tool in the same way.
Rotative use-wear patterns are created when drills are moved in a circular motion across the worked material (Tringham et al. 1974:189). Stone tools become dull through use, but they can remain effective if a sharp edge is maintained on the tool through a process called retouch (Frison 1968:149). Tools that have been modified through retouch exhibit one or more series of small pressure-flake scars along the working edge of the tool, and they will decrease in size as tools are sharpened.

**Spatial Analysis**

The spatial analysis of lithic tools and debitage may provide information about where artifacts were produced and used within a community. One important issue that is examined through spatial analysis of lithic is specialization. All societies engage in some form of specialized production; even among hunter-gatherer societies, some individuals produce goods and services beyond their own needs. How this surplus production is used is dependent upon the social rules that govern the distribution of items created through specialized production.

In unattached specialization, individuals generally retain ownership over their goods after they are made. The workshops or activity areas where goods are produced through unattached specialization usually are located at or near individual households. Under attached specialization, the rights of ownership are not retained by the toolmakers but are held by their sponsors, who usually are elites. Within Mesoamerican societies, attached specialized production typically took place at workshops and activity areas near
elite residences or civic-ceremonial centers (Ashmore 1988; Ford 1986; Vandenbosch 1999; and Widmer 1997).

By looking at the structures and features within an archaeological site where debitage and tools are found, a better understanding of the political economy can be obtained. If production debitage is identified within each household and the ratio of debitage types between households is consistent, then it is likely that unattached specialists produced tools within each household. In contrast, if production debitage ratios and debitage type are limited to a few structures, then it is likely that tools were produced at a few households and were subsequently distributed to others. If the loci of production within a community are located near elite residences or civic-ceremonial structure, then it is likely that tool production is organized under attached specialization.

For the Zacpetén assemblage, all of the tools and debitage were categorized according to structures in which they were found. For structures where debitage associated with one or more stages of production were identified in primary contexts, it was concluded that production likely took place within that structure. Lithic artifacts from secondary deposits are more analytically problematic compared to artifacts recovered from primary contexts.

In large quantities, production debitage can be a hazardous waste product, and production areas must be cleared on a regular basis to avoid accidents, such as the laceration to hands or feet. In an ethnoarchaeological study of Lacandon chert blade and arrowhead production in Chiapas, it was noted that disposal of chert debitage by household toolmakers was based on the size and angularity of the debris and the location
of production (Clark 1991:72). When collected, debitage was removed from the house and was disposed of in trash middens or in low-traffic areas. In considering debitage disposal patterns, it is very likely that secondary deposits of lithic debitage found within the Zacpetén structures represent disposal patterns at the site and not *de facto* production refuse.

At Zacpetén, the various tools and debitage types from each excavated structure or feature were counted and classified according to their production sequences, and all artifacts were weighed to examine their concentration within each structure by excavation unit. By looking at the different locations at Zacpetén where raw materials, tools, and debitage were found, inferences were made about the location of lithic tool production, distribution, and use.
Chapter 6- Obsidian Artifacts

Obsidian is a natural glass that forms when magma with a high silicate or rhyolite composition rapidly cools. The process through which tool-quality obsidian forms is based on the rate at which a lava flow cools, its chemical composition, and the percentage of water in the matrix (Shackley 2005:22). Because of these factors, the formation of obsidian is a rare natural event (Taylor 1976:vii). Obsidian is composed of oxygen, silicon, aluminum, iron, calcium, sodium, potassium, and magnesium, with trace amounts of other elements (Bell and Wright 1985:76). Although black is the most common color, obsidian is found in red, green, and clear varieties, and it may have inclusions or banding.

Obsidian was an important commodity in Mesoamerica, and multiple studies have been conducted on resources from different sites, regions, cultures, and periods (Hirth 2003:3). These studies cover the entire chaîne opératoire for obsidian tools, ranging from the analysis of artifacts at quarries to studies of obsidian found in households. The distribution of obsidian sources across Mesoamerica is limited to regions that are tectonically active and where volcanism has brought igneous exposures to the surface. Most obsidian identified in the Maya Lowlands originates from three major sources in Guatemala: El Chayal, San Martín Jilotepeque (SMJ), and Ixtepeque, though lesser amounts of obsidian from Mexico have also been identified.

El Chayal is an extensive source area, with obsidian outcrops intermittently occurring over 100 square kilometers (Sidrys et al. 1976). The major deposits begin 25 kilometers northeast of Guatemala City (Cobean et al. 1991:76), and include two large
flows at La Joya and El Chayal (Asaro et al. 1978). In general, El Chayal has a medium gray to black color and a milky, or waxy, appearance. Inclusions in the matrix are frequent and include black speckles or banding (Braswell et al. 2000:272).

The SMJ source, also referred to as Chimaltenango (Hurtado de Mendoza and Jester 1978) and Rio Pixcaya (Stross et al. 1983), is located approximately 35 kilometers northwest of Guatemala City (Cobean et al. 1991:76). SMJ obsidian has a very dark gray or black appearance, with a slight brown hue that is visible along the thin edges of flakes. Three additional characteristics of SMJ are a low luster, nearly opaque translucence, and a large number of inclusions in the form of small clouds and uneven black bands (Braswell et al. 2000:272).

Located in the southeastern part of Guatemala near the border with El Salvador is the Ixtepeque obsidian source (Cobean et al. 1991:76). This source is larger than El Chayal and SMJ, covering about 300 square kilometers (Sidrys et al. 1976). Typically, Ixtepeque obsidian has a brown color and high luster, but a rare opaque variety has been documented (Braswell et al. 2000:272). Ixtepeque obsidian usually has a clean appearance and lacks inclusions.

Analysis of the Zacpetén obsidian also identified material from the Sierra de Pachuca source, located about 50 kilometers northeast of Mexico City. Pachuca obsidian was the principal source used at Teotihuacan (Spence 1981), Tula (Healan et al. 1983), and Tenochtitlan (Charlton and Spence 1982). The Pachuca outcrops begin 2 kilometers south of Huasca, Hidalgo and extend approximately 15 kilometers south to Cruz del Milagro. At this point, the source continues east for an additional 15 kilometers (Cobean
Pachuca obsidian has a green apple color, high level of translucence, and few inclusions.

Two artifacts in the assemblage did not visually correlate to an obsidian source. Both artifacts have a light green color and cloudy translucence. Subsequent XRF analysis revealed chemical correlations between these artifacts and the Tulancingo source in Central Mexico. This source, also referred to as Pizzarín, is located in the Tulancingo Valley, approximately 20 kilometers east of the Pachuca outcrops (Cobean et al. 1991:74). Tulancingo obsidian has an opaque black or gray color with a slight green tint. This source is distinct from Pachuca obsidian in that it is more opaque and has a coarser texture (Cobean et al. 1991:74).

XRF analysis of the Zacpetén obsidian identified two additional Mexican sources in the assemblage, Ucareo and Zacualtipán. The Ucareo source is located in northeastern Michoacán, approximately 15 kilometers northeast of the town of Zinapecuaro (Healan 1997:77). The obsidian from this source has a fine gray color (Cobean et al. 1991:74). The Zacualtipán source is located in the state of Hidalgo, and obsidian from this source has a light gray to black color and a slight green tint (Smith et al. 2007:443).

Visual and XRF Analysis of the Zacpetén Obsidian Artifacts

Visual analysis of obsidian can be an effective technique used to source artifacts, but it requires some practice to learn the different variables in an assemblage (Clark 2003:33). Analysis of the Zacpetén obsidian included the classification of artifact color, inclusions, luster, and texture. Visual sourcing was completed through three rounds of
analysis. The categories were defined before the first round of analysis and were subsequently refined after each round. Each visual category correlated to a specific source, with several subtypes created for the presence of banding, inclusions, and secondary colors.

After the final round of analysis, a stratified sample of 300 artifacts from each category was selected for XRF analysis using a Portable Niton XL3t analyzer. The main goal of this analysis was to identify the obsidian sources in the assemblage based on their chemical composition. Correlations between obsidian sources and the trace elements identified in the artifacts were based on the assumption that obsidian has a distinct chemical composition. Through the visual and chemical analyses of the Zacpetén artifacts, seven different sources were identified (Table 2). The detailed results of the XRF analysis are presented in Appendix A.

Most of the obsidian in the assemblage (75 percent) is from the El Chayal source. El Chayal obsidian also has the greatest range of color, banding, inclusions, and translucence. Variations in these obsidian attributes led to the identification of nine El Chayal subtypes. Ixtepeque is the second most numerous source at Zacpetén, comprising 22 percent of total number of obsidian artifacts in the assemblage. Differences among the Ixtepeque obsidian are minor, with more than 75 percent of these artifacts classified as the same subtype. Approximately two percent of the Zacpetén obsidian visually corresponds to the San Martín Jilotepeque (SMJ) source. There is no variation within the SMJ obsidian at Zacpetén, but this source is generally homogeneous because of its very dark color and opaque luster.
Table 2. Obsidian sources at Zacpetén.

Within the assemblage, 16 obsidian artifacts from Central Mexico were identified. Five of these artifacts are from the Pachuca source and have the distinctive green color, translucence, and texture associated with this obsidian type. Two artifacts are from the Tulancingo source, and seven are from the Ucareo source. The Tulancingo artifacts in the assemblage have a cloudy green-grey color, and the Ucareo samples have a light gray color similar to a light gray variety of El Chayal.

Finally, two obsidian artifacts in the assemblage chemically correspond to the Zacualtipán source. These artifacts have a light gray color similar to the light gray varieties of Ucareo and El Chayal.

While the percentage of obsidian from Central Mexico in the assemblage was very small, these artifacts are important because they originated from sources over 1,000 kilometers northwest of Zacpetén (Figure 10). During the Classic period, Central Mexican sources were brought into the Maya Lowlands. The quantity of obsidian from these sources grew during the Postclassic Period, and this increase has been attributed to the establishment of new trade networks in the northern Lowlands.
Figure 10. Location of Zacpetén obsidian sources.

Technological Analysis

The technological analysis of the Zacpetén obsidian is based on several typologies developed during previous studies of Mesoamerican obsidian industries (Clark and Bryant 1997; Flenniken and Hirth 2003; Hintzman 2000; Hirth et al. 2003). Using these typologies, the obsidian artifacts in the assemblage were classified according to the chaîne opératoire that likely produced them.

At Zacpetén, there is no strong evidence for the local production of obsidian bifaces during the Late Postclassic and Early Contact periods. No bifaces or biface fragments are in the assemblage, and there are no debitage types associated with early- or
late-stage biface production. Only three obsidian artifacts in the assemblage, an early-stage pressure thinning flake and two late-stage percussion biface-thinning flakes were categorized. All three flakes are small, and they likely are associated with biface maintenance. The general lack of obsidian bifaces and biface debitage in the assemblage does not mean that bifaces were not used at the site. Rather, there is simply no clear evidence to account for their production.

At Zacpetén, obsidian production likely was directed at the manufacture of small projectile points (Table 3). Three complete obsidian projectile points, one projectile point preform, two proximal projectile point fragments, two distal projectile point fragments, and one medial projectile point fragment are in the assemblage (Figure 11). Two points and the medial fragment are side-notched examples produced from obsidian blades (Figure 12). The proximal and distal projectile point fragments have similar dimensions, but they are incomplete. The final projectile point has a triangular outline and likely was produced from an obsidian flake. The obsidian projectile point preform has a triangular tip and ovoid base. All of the obsidian points in the assemblage are very small, and they likely were manufactured for use with the bow-and-arrow.

Most of the Zacpetén obsidian artifacts are associated with the production of pressure blades. Mesoamerican pressure-blade production was a specialized process that required large quantities of raw material, a high level of skill, and specialized tools (Clark 1988:13). The chaîne opératoire associated with the transformation of raw obsidian into pressure blades involved multiple steps and several techniques.
<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
<th>Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proj. point, side-notched</td>
<td>21.96</td>
<td>14.2</td>
<td>2.82</td>
<td>1.1</td>
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<tr>
<td>Proj. point, side-notched</td>
<td>22.67</td>
<td>8.47</td>
<td>4</td>
<td>0.7</td>
</tr>
<tr>
<td>Proj. point, proximal</td>
<td>8.12</td>
<td>4.85</td>
<td>1.67</td>
<td>0.1</td>
</tr>
<tr>
<td>Proj. point, distal</td>
<td>20.24</td>
<td>7.33</td>
<td>2.51</td>
<td>0.2</td>
</tr>
<tr>
<td>Proj. point, distal</td>
<td>21.45</td>
<td>11.62</td>
<td>2.41</td>
<td>0.5</td>
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<tr>
<td>Proj. point, distal</td>
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<td>15.6</td>
<td>3.57</td>
<td>0.9</td>
</tr>
<tr>
<td>Proj. point, triangular</td>
<td>17.09</td>
<td>11.62</td>
<td>2.49</td>
<td>0.5</td>
</tr>
<tr>
<td>Proj. point proximal</td>
<td>10.29</td>
<td>6.88</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Proj. point blank</td>
<td>14.02</td>
<td>9.49</td>
<td>2.64</td>
<td>0.7</td>
</tr>
<tr>
<td>Proj. point fragment</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Table 3. Zacpetén obsidian projectile points.

Figure 11. Triangular projectile point (left) and projectile point blank (right).
The first step required the creation of a flat platform for the core. Typically, this step was accomplished by removing one or more platform preparation flakes through direct percussion. These flakes are large and often have angular arises or cortex from the outer shell of the core. Secondary platform preparation flakes were removed from a core to smooth and flatten the intended platform or to correct production errors created by the removal of initial platform preparation flakes. These secondary flakes are tabular, with little or no cortex on their dorsal faces, though cortex may be present along their lateral margins.

During the second stage of obsidian pressure-blade production, the sides of the core were regularized, and parallel ridges, oriented perpendicular to the core platform, were formed in preparation for the removal of pressure blades (Clark 1988:14). The
byproducts created during this second stage are large flakes and blades, called macroflakes and macroblades (Clark 1988:15). These items were removed from the core through direct percussion and were often used as the blanks for other tools. Once the basic shape of the core was created, it was refined by the removal of smaller percussion blades and flakes until the detachment of blades by pressure was introduced to the chaîne opératoire.

The final stage in the production of obsidian pressure blades is an important topic in Mesoamerican studies, and it has been examined through archaeological, ethnographic, and experimental perspectives. Several accounts of Mesoamerican pressure-blade production were produced at the time of the Spanish conquest. The most comprehensive description of obsidian pressure blade production was given by Juan de Torquemada, a Dominican priest (Clark 1982; Titmus and Clark 2003). In his account, Torquemada discusses the removal of pressure blades by toolmakers in a seated position while holding the core between the feet and using a lance-like tool called an itzcolotli (Clark 1982:357; Titmus and Clark 2003:74). This technique, known as the Mexica foot-held technique, appears to have been extensively used at many locations from the Preclassic through the Early Contact period.

In obsidian pressure blade production, the first objects pressed off the core are classified as first-series blades. These blades are shorter and irregular in their symmetry, as compared to blades produced in later stages. Typically, these blades have direct percussion scarring or cortex on their dorsal faces and pressure scarring on their ventral faces (Clark and Bryant 1997:114). By removing first-series blades, the ridges along the
core are regularized, which facilitates the removal of thin, parallel-sided blades. Second-series blades are longer and more regularized in their symmetry compared to first-series blades. These blades feature the same pressure-flaking characteristics on their ventral faces, but the percussion scarring and cortex on the dorsal faces are limited to the distal ends of the blades. Final-series blades contain no evidence of percussion scarring on their dorsal faces, and they are nearly parallel-sided.

Once blades could no longer be removed using pressure techniques, the core is classified as an “exhausted” core. Experimental studies of obsidian pressure-blade production using the Mexica foot-held technique have concluded that feet can only stabilize large-sized cores; once a core is reduced to between 8 and 10 cm in length, it becomes difficult to effectively hold (Titmus and Clark 2003:86). Additional experimental studies of blade-core reduction by pressure techniques have found that it is also difficult to remove blades from “bullet-shaped” cores immobilized by the feet because of the angle, size, and form of the platform (Hirth 2000:139).

However, this does not mean that additional products cannot be removed from exhausted cores through other means. Two options are available for the production of tools from exhausted cores. The first option is the reduction of an exhausted core through bipolar percussion. The second is the production of additional blades using a hand-held, pressure technique. Although there are no ethnohistorical descriptions of hand-held blade production, archaeologists have found cores, core fragments, and pressure blades at several Mesoamerican sites that are too small to have been reduced using the Mexica foot-held technique (Hintzman 2000; Hirth et al. 2003; Rovner 1974). In addition,
replicative studies have documented the rejuvenation of exhausted cores for the removal of pressure blades from small-sized cores (Hintzman 2000; Trachman and Titmus 2003).

There are several steps in the chaîne opératoire for the reduction of exhausted cores in the hand. First, an exhausted core was pecked or scored near the platform. Second, the core was placed on an anvil or hard surface, and the scored area was hit with a hammerstone to create a new platform. The distal end of the core may also have been notched by pecking and removed by indirect percussion using a short, angled chert flake as a chisel. This technique gives the core a more parallel-sided configuration and facilitates distal support (Hintzman 2002:22). An experimental study of small pressure-blade production in the Near East (Wilke 1996) concluded that distal support, core immobilization, and space for the removal small pressure blades are critical elements in the chaîne opératoire. In addition, the production of small pressure blades using a hand-held technique likely required the use of a slotted block made of bone or wood to provide core support (Hintzman 2000:35-36; Wilke 1996:3; Wilke 2007:223).

After the core was prepared, small pressure blades (bladelets), ranging from 5 to 7.2 cm in length, can be removed using hand-held pressure techniques (Flenniken and Hirth 2003:100). Through this process, 30 to 40 bladelets can be pressed from a core between 2.5 and 3.0 cm in diameter (Wilke 1996:300). Bladelet production at Zacpetén likely produced a similar number of blades from small cores of comparable size and shape. Once bladelets could no longer be pressed from a core, bipolar techniques were introduced into the chaîne opératoire. The tools and debitage produced from the bipolar
percussion of exhausted cores may include bipolar flakes, flake fragments, bipolar core fragments, and shatter.

At Zacpetén, there is no evidence for early-stage obsidian pressure-blade production. No platform preparation flakes, macroflakes, macroblades, or large obsidian core fragments are in the assemblage. The lack of early-stage obsidian blade-core production debitage is common at many lowland sites because most of the initial work took place at quarries.

Early-stage blade-core production involved high-risk procedures, and quarries were the ideal location for this work. Performing the initial work at quarries also increased the likelihood that good-quality cores with the potential to produce a large number of blades for exchange or use were manufactured. The technological analyses of quarry debitage at the Pachuca source in Central Mexico (Pastrana 2002) and at the SMJ quarry in highland Guatemala (Braswell 1998) support the staging of early-stage, high-risk production techniques at quarries.

While no macroflakes or macroblades are in the assemblage, five percussion blade fragments were cataloged, including one percussion blade with visible grinding wear on the dorsal face (Figure 13). In addition, 38 obsidian percussion flakes were found. Most of these of these flakes ($n = 36$) are noncortical, but two flakes have cortex (Figure 14). A small number of early-stage pressure-blade segments were also identified (Table 4). These blade segments likely are first- or second-series pressure-blade segments based on the cortex or remnant percussion scars found along their dorsal faces, but their technological type could not be determined due to their fragmentary nature (Figure 15).
Figure 13. Percussion blade fragments, dorsal face.

Figure 14. Partially cortical obsidian flake, dorsal and ventral faces.
At Zacpetén, only two complete pressure blades were found. These blades are similar in size, measuring 70 and 60 mm in length, 14 mm in width, and 3 mm in thickness. Obsidian pressure blades are most often found as proximal, medial, or distal blade segments, and the majority of obsidian artifacts in the assemblage are final-series pressure blade segments (Table 5). The classification of blade segments is dependent
Table 5. Zacpetén late-stage pressure-blade segments.

<table>
<thead>
<tr>
<th>Techno Type</th>
<th>Total</th>
<th>Length (mm)</th>
<th>Width (mm)</th>
<th>Thickness (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$\bar{x}$</td>
<td>min</td>
<td>max</td>
</tr>
<tr>
<td>Prox. blades</td>
<td>452</td>
<td>12.2</td>
<td>5.2</td>
<td>57</td>
</tr>
<tr>
<td>Med. blades</td>
<td>1092</td>
<td>18.1</td>
<td>5.9</td>
<td>45.4</td>
</tr>
<tr>
<td>Dist. blades</td>
<td>140</td>
<td>20.8</td>
<td>6.5</td>
<td>44.6</td>
</tr>
</tbody>
</table>

upon the surviving section of the blade (Clark 1988:16). Proximal blades include the platform end of the blade and indicate the method of fracture initiation. Distal blades come from the distal end of the blade and display fracture terminations. Medial blades have neither the tip nor the distal end of the blade.

There are 452 proximal blades segments in the Zacpetén assemblage (Figure 16). Of these artifacts, 286 blades (approximately 63 percent) have ground platforms (Figure 17). The grinding of obsidian core platforms was a common preparation technique during the Postclassic period, and it was documented at Tula (Healan 1989). To create a uniform platform surface, Tula blade makers lightly pecked cores with a hammerstone and ground them against a hard surface with an abrasive agent (Healan 2002:30). This technique created a flat platform on the core, and it produced a nonslip surface, which reduced the chance of production errors during blade removal (Healan 2002:35).

Medial blades are the most numerous type of pressure-blade segment among the Zacpetén obsidian artifacts (Figure 18). The large number of these segments ($n = 1,088$), compared to proximal and distal segments, can be explained by the fact that a broken pressure blade will have only one proximal and one distal segment, but it can be broken into two or more medial segments, depending on the length of the blade.
Figure 16. Proximal blade segments.

Figure 17. Ground platform on pressure-blade segment.
While not as numerous as proximal or medial blade fragments, 140 distal blade segments were catalogued (Figure 19). Distal segments were subdivided into three types: distal blades, distal overshot blades, and distal truncated blades. Distal overshot blades are created when the base of the core is not properly supported during blade production, resulting in the removal of the distal end of the core with the blade. In the assemblage, 25 distal blade fragments (18 percent) are overshot blades.

Among the distal blade segments are eight truncated blades. These blades have a flat distal end. In addition to being a technique for repairing core errors, the distal truncation of small blade cores can be a means to prepare them for the removal of small blades through a hand-held technique. With a truncated distal end, a small core, also
Figure 19. Distal blade fragments, ventral face.

Figure 20. Blade core fragment, side views.
called a microcore (Wilke 1996:290), is more effectively immobilized when placed in a slotted device.

Only one exhausted obsidian core fragment was categorized in the assemblage. The fragment is very small, measuring 33 mm in length, 21 mm in width, and 14 mm in thickness (Figure 20). The core fragment is bi-directional and both ends are truncated. One section of the core fragment has a remnant scar from a previously removed flaked, perhaps to flatten the back of the core for placement in a slotted device. Based on the size and shape of this fragment, the last blades likely were removed from this core through a hand-held pressure technique.

Obsidian debitage types associated with hand-held blade-core reduction were identified in the Zacpetén assemblage. The technological typology and debitage categories associated with the reduction of small hand-held cores were created by Hintzman (2002) in his analysis of obsidian blade production at an obsidian workshop in the Belize River Valley (Site 272-136). The debitage categories used in the analysis of the obsidian artifacts from this site were, in part, adapted from experimental studies and the analysis of Neolithic microblade cores from the Near East (Wilke 1996).

The debitage types associated with the reduction of small hand-held blade cores are platform isolation elements, platform faceting flakes, platform tablets, distal faceting flakes, and distal tablets (Hintzman 2000:29). Platform isolation elements are small flakes removed from a core to straighten blade ridges and to isolate the platform for the removal of a blade. Platform faceting flakes aid in the removal of irregularities from the
platform and create an even topography across the top of the core. These flakes typically are flat and have facetted platforms.

Distal core faceting flakes have features similar to platform faceting flakes, except they are removed from the distal end of the core. Platform tablets and distal tablets are percussion flakes that remove the entire platform or distal end of an exhausted core.

Among the Zacpetén artifacts are fragments from three platform tablets (Figure 21). Two of these artifacts are pecked and ground, and the third has several faceting flake scars. In addition, one distal core tablet and four distal core-faceting flakes were categorized in the assemblage (Figures 22 through 24). No platform isolation elements were found among the obsidian artifacts, and it is likely that this debitage type was not collected due to its very small size.
Figure 22. Distal core tablet, top view.

Figure 23. Distal core tablet, side view.
The main products created from the reduction of small blade cores are bladelets and bladelet segments. Unfortunately, no clear distinction can be made between pressure blade segments produced using the Mexica technique and bladelets produced through a hand-held pressure technique based on the dimensions of these artifacts. In general, narrow blades result from the reduction of cores with working faces of small radius. Wide blades cannot generally be produced from narrow cores, but narrow blades will occasionally be produced from wide cores (Wilke 1996:290). For this study, the distinction between blade segments and pressure bladelet segments was somewhat arbitrary and was based on visual features. Following Wilke (1999:220), bladelets in this study are small pressure blades reduced from small, bladelet cores. Among the Zacpetén artifacts are 609 bladelet segments (38 percent of the total number of pressure blades).
In the Zacpetén obsidian assemblage, 13 core-maintenance artifacts were identified. Among these objects are five percussion blade segments with visible grinding wear along their dorsal faces. The pecking and grinding of the core, referred to as direct rejuvenation (Clark and Bryant 1997:115; Rovner 1974:26), is a tactic used to remove mass from the face of the core.

A second error-correction technique identified in the assemblage was lateral rejuvenation. With this technique, small flakes were alternately removed perpendicular to the long axis of the core (Clark and Bryant 1997:115). This series of alternate flakes creates a new ridge on the core from which a crested blade is removed to complete the repair process. In the assemblage, one crested blade (Figure 25) and three pressure-blade segments with lateral-rejuvenation flake scars were categorized (Figures 26).

Analysis of the Zacpetén obsidian indicates bipolar percussion was used to produce additional tools when bladelets could not be removed from small cores. Ten bipolar core fragments were categorized in the Zacpetén assemblage. These core fragments are quite small, with a mean dimension of 24.7 mm by 18.5 mm by 12.2 mm (Figure 27). The bipolar cores are of similar size and shape, with only minor variations in their dimensions. Associated with the bipolar cores are 51 bipolar flakes (Figure 28). Finally, 108 flake fragments and 42 pieces of shatter were found among the obsidian artifacts.

Use-wear analysis of the assemblage identified 377 artifacts (18 percent) with rotative, transverse, longitudinal, or retouch patterns (Table 6). Most of the obsidian artifacts with use-wear are pressure-blade segments. These artifacts make effective tools
Figure 25. Crested blade, dorsal and ventral faces.

Figure 26. Error-correction pressure-blade segments, dorsal view.
Figure 27. Bipolar core fragments, side view.

Figure 28. Bipolar flakes and flake fragments, side view.
because they are extremely sharp and can be hafted or used in the hand. Obsidian blades are also brittle, which creates discernible use-wear patterns after little use, and obsidian tools can be rejuvenated through retouch along the worked edges.

The spatial distribution of obsidian was variable across the different Zacpetén structures and architectural groups (Table 7). In Ceremonial Group A, 80 obsidian artifacts were found in Strs. 601, 602, 606, 607, and 615. The majority of these objects are final-series blade segments, followed by a small number of obsidian flakes and flake fragments. Interestingly, a large number of artifacts are from the burial pit and central plaza (Ops. 1000 and 1001). Within these two were 1,112 pressure-blade segments, two obsidian projectile point fragments, and 163 obsidian flakes, bipolar flakes, flake fragments, and shatter.

Residential Groups 719, 732, 747, and 758 contained 456 obsidian artifacts (Table 8). Similar to Ceremonial Groups A and C, the majority of artifacts found in these structures are final-series blade segments.
Table 7. Zacpetén Obsidian Artifacts per ceremonial structure.

<table>
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<th>Technological Type</th>
<th>1000</th>
<th>1001</th>
<th>601</th>
<th>602</th>
<th>603</th>
<th>606</th>
<th>614</th>
<th>615</th>
<th>760</th>
<th>765</th>
<th>766</th>
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Table 8. Zacpetén obsidian artifacts per residential structure.

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<th>732</th>
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Very little evidence for obsidian pressure blade production was found in Strs. 732, 758, and 747. A handful of debitage, mostly in the form of flakes and flake fragments, was recovered from these residential buildings. Only Str. 719 yielded evidence for *in situ* obsidian pressure-blade and flake-tool production. This elite residence had more blade segments than any other structure at Zacpetén.

While the front room of Str. 719 was relatively free of lithic artifacts, a high number of obsidian ($n = 301$) was found in the back room of Str. 719. In addition, several debitage types, such as flakes, flake fragments, blade-core preparation flakes, error-correction flakes, bipolar cores, and bipolar flakes, were recovered from this elite residence in cortical and noncortical varieties. While the full range of debitage types associated with pressure blade production was not found in Str. 719, there is sufficient evidence from within this structure to suggest that late-stage pressure blade production, bladelet production, blade-core maintenance, and bipolar-flake production took place within it.

**Production, Distribution, and Use of Obsidian at Zacpetén**

Over 2,000 obsidian artifacts from Zacpetén have been studied through visual, chemical, technological, use-wear, and spatial analyses. Through this work, several conclusions have been made about the production, distribution, and use of obsidian at the site, providing additional information about Kowoj society during the Late Postclassic and Early Contact periods. The visual analysis of the Zacpetén obsidian artifacts examined their physical attributes, and it was verified through an XRF study. While the
XRF results are mixed, they parallel conclusions from a previous study of obsidian from Zacpetén (Rice and Cecil 2009). Sources from Guatemala account for 99 percent of the obsidian artifacts found in the assemblage. Approximately 75 percent of these artifacts are of material from the El Chayal source, followed by Ixtepeque (22 percent) and SMJ (1 percent) sources. Less than 1 percent of the obsidian originated from sources in Central Mexico.

The high percentage of El Chayal obsidian at Zacpetén between the Late Postclassic and Early Contact periods differs from the general trend for source exploitation in the Maya Lowlands. During these periods, most obsidian at lowland sites comes from the Ixtepeque source (Hammond 1972; Nelson 1980; Nelson and Clark 1990, 1998a). The increase in the use of Ixtepeque obsidian during the Late Postclassic and Early Contact periods has been attributed to the establishment of coastal trade routes along the Caribbean coast and Yucatan peninsula (McAnany 1991; Sabloff and Freidel 1984).

There are two hypotheses for the higher percentage of El Chayal at Zacpetén. First, the community may have been part of an exchange network that brought obsidian from this source through overland trade routes. Exchange networks between the highlands and lowlands have been documented at numerous Preclassic- and Classic-period sites, and it is likely that these networks continued through the Postclassic and Early Contact periods.

Kowoj connections to overland trade networks may have developed because of their exclusion from coastal trade networks. Preliminary analysis of the obsidian from
Nixtun-Ch’ich’ indicates Ixtepeque obsidian was the dominant source in this Itzá community during the Late Postclassic and Early Contact periods (Yacubic and Meissner 2013). If the Itzá were integrated into coastal exchange networks, then the Kowoj may have been excluded from them because of their extended conflicts with the Itzá.

Under a second hypothesis, the high percentage of El Chayal artifacts at Zacpetén may have resulted from the adoption of obsidian scavenging by the community. Under this strategy, obsidian cores could have been collected from locations in the Central Petén and brought back to Zacpetén, where they were rejuvenated and reduced (Rice and Cecil 2009:335). As an acquisition strategy, obsidian scavenging has been documented in the Maya Lowlands. During the Early Postclassic, residents of Copan scavenged exhausted polyhedral cores, macroblades, and large flakes from locations around the site (Aoyama 2001:356).

During the Early and Late Classic periods, El Chayal was the dominant obsidian source in Maya Lowlands, and the scavenging of obsidian from abandoned locations in the Central Petén would produce a much higher percentage of this material in the Zacpetén assemblage. Several Classic-period sites, such as Yaxhá, Tikal, and Uaxactún, are located within 40 kilometers of Zacpetén, and the Kowoj could have made regular trips to these locations to collect obsidian.

The adoption of a scavenging strategy by the Kowoj could also have resulted from the introduction of new technologies into the Central Petén. The large number of small projectile points at Zacpetén indicates the use of the bow and arrow at this time, and these arrowheads may have been produced from scavenged obsidian cores. Another
important Postclassic development was the rejuvenation of exhausted cores to produce bladelets through hand-held techniques. At Zacpetén, small exhausted cores could have been collected from abandoned sites and subsequently rejuvenated at Zacpetén for the production of additional pressure bladelets.

The general lack of early-stage blade-core debitage at Zacpetén suggests that cores were brought into the site as late-stage blade cores. While a small number of early-stage pressure-blade segments were found in the assemblage, a much larger number of these debitage types should be present if early-stage blade cores were brought into the community. In the assemblage, approximately 38 percent of the pressure-blade segments likely were produced from rejuvenated cores using a hand-held technique. Once blades could no longer be removed from a core using the hand-held technique, small obsidian flakes were produce from “exhausted” bladelet cores using bipolar percussion.

Despite the significant number of obsidian artifacts recovered from civic-ceremonial Groups A and C, there is no strong evidence to indicate obsidian blade production at these locations. Instead, obsidian tool production at Zacpetén appears to have been limited to a couple of elite residential buildings, Strs. 719 and 747. Based on the size and population estimates for the community during the Late Postclassic and Early Contact periods, obsidian blades likely were produced on a part-time basis by specialists from these households.

Obsidian blades were all-purpose tools used for a variety of tasks. Longitudinal, transverse, and rotative use-wear patterns were found on 377 artifacts. The use-wear identified on the Zacpetén obsidian is light, and only a small number of tools and
debitage types have evidence of retouch. Obsidian clearly had utilitarian value at Zacpetén, and it may have been preferred over other raw materials for use as tools. However, obsidian was not essential to household maintenance, and obsidian artifacts comprise less than 10 percent of the total lithic assemblage. Interestingly, the real worth of obsidian within the community may have been its value in creating interactions between different households and groups.

The location of obsidian tool production within elite households indicates these members of the community had an important function in these endeavors. If obsidian acquisition was sponsored by elites at Zacpetén, then the obsidian products manufactured by them would have been traded across the community under their auspices. Small cores may have been purchased by elite households at Zacpetén, who subsequently reduced these cores and distributed their products to other households in the community.

If obsidian cores were brought into Zacpetén through a scavenging strategy, then the items produced from collected cores could have been given to households as payment for their recovery. Under both hypotheses, the acquisition of and distribution of obsidian tools would have created regular interactions between different households at Zacpetén. These interactions likely were organized at the community level, and they would have fostered a highly localized community identity.
In addition to obsidian, microcrystalline quartz was used to produce stone tools at Zacpetén. Microcrystalline quartz, also called cryptocrystalline quartz, is a broad category of sedimentary rocks with grains that are not visible to the naked eye (Luedtke 1992:5). Unfortunately, this definition creates some issues among archaeologists and geologists because a wide variety of microcrystalline quartz types, such as flint, chert, chalcedony, and jasper, are included within it. The term flint typically refers to any siliceous nodule found in chalk or marly limestone (Gaines et al. 1997:1576). Flint nodules tend to be elliptical, discoidal, or irregular in shape, and they range in size from a few centimeters to a couple of feet in diameter. The color of flint is variable, and it can be found in gray, brown, black, red, and green varieties.

Chert is located in bedded deposits ranging in thickness from a few inches to over ten feet (Gaines et al. 1997:1576). Like flint, chert is found in different colors, sizes, and shapes. An important type of chert is chalcedony. Typically, chalcedony is highly translucent, and it has a pale appearance compared to chert or flint (Frondel 1962:195). In this study, all highly translucent microcrystalline quartz is classified as chalcedony, and less-translucent materials are classified as chert. No distinctions are made between flint and chert because the exact locations and forms of the raw materials associated with these artifacts are not known.

Chert is a chemical rock, and it is created through the precipitation of limestone silica in a solution of water. Precipitation is a critical step, because it is in water that the
irregularities and fossils in limestone are replaced with quartz. However, this process is not uniform, and as a result, chert is not homogenous, even within the matrix of a single nodule. The factors that control the formation of chert are temperature, pressure, pH level, particle size, the type of quartz silica, and impurities present in the limestone (Luedtke 1992:11). Because it is a chemical precipitate, chert is subject to additional reactions after it is formed. Chert will often patinate after contact with water, creating a thin rind along the weathered surface as silica and other materials are leached out (Whittaker 1994:70).

Chert has a relatively smooth fracture surface similar to obsidian, but it is much harder (7) on the Mohs scale. Because of its durability, chert was extensively used for a variety of heavy-duty tasks. Chert comprises less than one percent of the rocks in the earth, but it is found in a variety of geological contexts and environmental settings (Luedtke 1992:11). A significant portion of the Maya Lowlands is a single limestone shelf that was submerged at varying times, and geologic studies of the region have identified multiple locations where soluble limestone was transformed into chert (Weidie 1985:2).

Visual Analysis of the Zacpetén Chert Artifacts

In the assemblage, 9,365 chert artifacts were analyzed. The research criteria used to analyze these objects were discussed in Chapter 5. The Zacpetén chert was visually sorted according to color and texture. To avoid ambiguity, artifacts were categorized with reference to a Munsell soil color chart. Using this approach, nine major chert color types
Color | Texture | Total
--- | --- | ---
Black | 3 | 1 | 1 | 5
Brown | 4 | 592 | 276 | 872
Gray | 56 | 500 | 320 | 876
Tan | 85 | 1,666 | 787 | 2,538
White | 88 | 943 | 416 | 1,447
Yellow | 84 | 1,523 | 279 | 1,886
Pink | 27 | 488 | 290 | 805
Red | 33 | 663 | 240 | 936
Total | 380 | 6,376 | 2,609 | 9,365

Table 9. Zacpetén chert artifact colors and textures.

(Table 9) and 39 sub-types of banded colors were classified. Within each type and subtype, chert artifacts were also classified as fine-, medium-, or coarse-grained varieties. Most of the chert artifacts (68 percent) were produced from fine-grained chert. Medium- and coarse-grained chert artifacts were also found, though in much smaller numbers. The total count of chert artifacts in the assemblage with different colors and textures strongly suggests that most of these items were produced from raw materials found in the Central Petén.

The one possible exception to this pattern is the fine-grained brown chert in the assemblage. A similar variety of chert was documented at Colha, a major producer of tools from the Preclassic through Postclassic periods (Shafer and Hester 1983). Trade in Colha chert was extensive, and fine-grained brown chert artifacts from Colha were found at Cuello (McSwain and Johnson 1991), Pultrowser Swamp (McAnany 1989), Barton Ramie (Willey et al. 1965), Blackman Eddy (Yacubic 2006), Yaxhá (Aldenderfer 1991), and Tikal (Moholy-Nagy 1997).
At Zacpetén, 68 percent of the brown chert has a fine-grained texture, and 32 percent has a medium- to coarse-grained texture. Among the fine-grained brown chert, 52 artifacts (approximately 11 percent) display cortex. While the fine-grained chert in the assemblage may have been imported from the region around Colha, the presence of medium- and coarse-grained brown chert and brown chert with cortex suggests that most of these raw materials originated from local sources.

Thermal alteration was identified on 27 percent of the chert. Thermal alteration is the modification of stone through the application of heat, and its presence may be due to two mechanisms. Deliberate thermal alteration, or heat treatment, involves the careful heating of raw material to facilitate the removal of long, thin flakes from a core (Rick and Chappell 1983). There are several visible indicators of heat treatment, but not all chert types exhibit these changes when heated (Quintero 1996:239-240). First, some heat-treated chert types show a reddish-pink color after they are thermally altered. Second, chert that was heat treated and subsequently fractured may show a greater degree of luster on a newly flaked surface compared to the old (Rick and Chappell 1983:62).

Unintentional thermal alteration occurs when chert is excessively heated, ruining the raw material. This type of thermal alteration typically is a post-production process and commonly results in irregular surface cracks or potlid scars on artifacts. Potlids are small, round ejections that spall off the surface of excessively heated material, and they have no platforms (Whittaker 1994:73).

The identification of unintentional thermal alteration on the chert artifacts was based on color and the presence of irregular cracks or potlid scars. Artifacts with
unintentional thermal alteration at Zacpetén can be attributed to the burning of middens that have lithics as part of their fill, or from natural processes such as brush fires. In such cases where lithic artifacts were thermally altered after their production, heat treatment should not be viewed as part of the production process, but it should be considered thermal destruction.

**Chert Flake Tools and their Production**

The technological analysis of the chert artifacts identified three types of production at Zacpetén: flake-tool, biface, and projectile point. Flake-tool production at Zacpetén involved the manufacture of items through the reduction of flake cores. Flakes are “any mass of stone removed from a larger mass by the application of force, intentional, accidentally, or by nature” (Crabtree 1972:64). The attributes of flakes depend on how and when in the reduction sequence they were removed, but all flakes are characterized by a platform and bulb of force at their proximal end.

In the assemblage, single-directional and multi-directional cores were identified. Single-directional cores have a prepared platform upon which force was applied to remove flakes. The first step in the production of single-directional cores is the creation of a platform. This is achieved by removing one or more platform-preparation flakes through direct percussion. The debitage created during this initial step may include primary and secondary platform preparation flakes. After the platform is created, primary flakes are removed from the core. Primary flakes are relatively large, have irregular dorsal ridges, and may have cortex. Secondary flakes typically feature very little or no
cortex. Flake fragments, core fragments, and shatter also may be produced from single-directional cores during any stage of flake-tool production.

The production of flake tools from multi-directional cores is a more expedient process compared to the production of tools from cores with prepared platforms. With multi-directional flake cores, flakes are removed from any available platform, producing cores with a variety of scars, platforms, and irregular angles. Due to their expedient nature, multi-directional flake cores usually are discarded before they were completely exhausted, and they may retain some cortex.

A significant number flake cores are in the assemblage (Table 10). About half of these cores are multi-directional, and half are single-directional. The final core in the assemblage is an opposed-platform type.

All of the cores in the assemblage are relatively small, were created with minimal preparation, and more than half have cortex. In addition, most of the flake cores were discarded before they were completely exhausted. All of these characteristics suggest that the Zacpetén flake cores were expediently produced and reduced within the community.

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Table 10. Zacpetén chert flake core types.
<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Cortex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Complete</td>
<td>Partial</td>
</tr>
<tr>
<td>Primary platform spalls</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Secondary platform spalls</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Crested Blades</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Flakes</td>
<td>125</td>
<td>1,421</td>
</tr>
<tr>
<td>Flake fragments</td>
<td>889</td>
<td>501</td>
</tr>
<tr>
<td>Core fragments</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td>Shatter</td>
<td>56</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,077</td>
<td>1,937</td>
</tr>
</tbody>
</table>

Table 11. Flake core debitage types.

A large number of chert artifacts associated with the reduction of flake cores, including early- and late-stage flake-core debitage, were identified in the assemblage (Table 11). Among the early-stage flake-core debitage are primary- and secondary-platform preparation flakes (Figures 29 through 36). Debitage in the assemblage consists of flakes and flake fragments, along with some of shatter and core fragments.

**Chert Biface Tools and their Production**

Bifaces are formal tools that have been flaked and reduced on both faces (Crabtree 1972:38). The chaîne opératoire for biface production typically is a two-stage process (Wilke et al. 1991:245). The first stage, or immediate strategy, begins with the selection of a large blank, usually in the form of a macro-flake or nodule. Next, the blank is shaped into a bifacial flake.
Figure 29. Single-directional cores, side view.

Figure 30. Single-directional cores, top view.
Figure 31. Multi-directional cores, side view.

Figure 32. Primary platform spalls, dorsal face.
Figure 33. Secondary platform spalls, dorsal face.

Figure 34. Flakes, dorsal face.
Figure 35. Linear flakes, dorsal face.

Figure 36. Core fragments.
core. If the core features one or more squared edges, alternate flakes might be removed to create a bifacial margin or edge.

Subsequently, the core is reduced by the removal of large flakes across both faces. These flakes are used as cutting tools or as production blanks for additional items such as projectile points. The second stage, or ultimate strategy, may result in the production of bifaces. During this second stage, a bifacial core is reduced into one or more biface blanks. These blanks are then shaped into their final forms through the removal of percussion and pressure flakes.

The main debitage types associated with early-stage bifacial-core reduction are alternate flakes and early-stage biface-thinning flakes. Alternate flakes are usually short, asymmetrical flakes with a wide platform that features remnants of the squared edge. Biface-thinning flakes are thin, curved flakes with a slightly angled platform (Whittaker 1994:185). The bulb of force for a biface-thinning flake is relatively flat compared to other flake types, and the platform may have a small interior lip with remnants of the edge of the biface. Early-stage biface-thinning flakes often have cortex and highly pronounced dorsal ridges. Late-stage biface-thinning flakes seldom have cortex, and they have relatively flat faces with low dorsal ridges.

Bifacial cores, bifaces, and debitage types associated with biface production were categorized in the assemblage (Table 12). All of the bifacial cores are relatively thick, and they have large flake scars, rough topographies, or cortex (Figure 37). In addition, about 10 percent of the bifacial cores exhibit some form of batter along one or more of their margins, indicating their secondary use as hammerstones. Based on their dimension
<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Cortex Complete</th>
<th>Cortex Partial</th>
<th>Cortex None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biface-thinning, early-stage percussion</td>
<td>24</td>
<td>38</td>
<td>117</td>
<td>179</td>
</tr>
<tr>
<td>Biface-thinning, late-stage percussion</td>
<td>-</td>
<td>66</td>
<td>112</td>
<td>178</td>
</tr>
<tr>
<td>Biface-thinning, pressure</td>
<td>-</td>
<td>-</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Bifacial Cores</td>
<td>-</td>
<td>34</td>
<td>10</td>
<td>44</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>139</strong></td>
<td><strong>262</strong></td>
<td><strong>423</strong></td>
</tr>
</tbody>
</table>

Table 12. Biface debitage types.

Figure 37. Bifacial Cores
and characteristics, the bifacial cores in the assemblage are expedient, and they did not reach the ultimate stage of production.

Although the amount of debitage associated with the chert biface industry is much smaller than the debitage from the flake-tool industry, it is large enough to suggest that bifacial cores were reduced to produce flake tools and bifaces at Zacpetén. Both early- and late-stage biface-thinning flakes are in the assemblage (Figures 38 and 39), and these artifacts are found in cortical and partially cortical varieties (Figures 40 and 41). Late-stage bifacial flake-core reduction at Zacpetén can be inferred from the presence of small, noncortical biface-thinning flakes produced through percussion or pressure flaking.

About 50 percent \((n = 94)\) of the biface-thinning flakes in the assemblage have lipped platforms on their ventral faces. Lipped platforms are characteristic of biface production using a soft hammer, or billet, made from bone, antler, or wood. Soft-hammer percussion is particularly useful for thinning and shaping bifaces because it removes flat, thin flakes with small bulbs of percussion (Whittaker 1994:185). The presence of a large number of lipped biface-thinning flakes in the assemblage suggests that the final steps in the chaîne opératoire of biface production were completed through soft-hammer percussion.

In addition to the debitage, several biface types were found among the chert artifacts (Table 13). The typology used to examine these bifaces is visual, and it is based on descriptions of bifaces from previous lowland Maya lithic studies (Kidder 1947;
Figure 38. Early-stage biface-thinning flakes, dorsal view.

Figure 39. Early-stage biface-thinning flakes, ventral view.
Figure 40. Late-stage biface-thinning flakes, dorsal face.

Figure 41. Late-stage biface-thinning flakes, ventral face.
<table>
<thead>
<tr>
<th>Biface Tool Type</th>
<th>Biface Reduction Stage</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early</td>
<td>Middle</td>
</tr>
<tr>
<td>Biface, Oval</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Biface, Stemmed</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>Biface, Laurel-leaf</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Biface, Heavy Axe</td>
<td>23</td>
<td>7</td>
</tr>
<tr>
<td>Biface, Adze</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Biface, Elongated</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Biface, Proximal</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Biface, Medial</td>
<td>41</td>
<td>2</td>
</tr>
<tr>
<td>Biface, Distal Flat</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Biface, Distal Pointed</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Biface, Distal Round</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Biface, Distal Stemmed</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>162</td>
<td>21</td>
</tr>
</tbody>
</table>

Table 13. Zacpetén biface tool types.

Willey et al. 1965). In the assemblage, three unifaces and six uniface fragments were also categorized. Unifaces are produced from large flakes that are worked and shaped along their dorsal faces. Unlike bifacial tools, the ventral faces of unifaces are not worked.

As bifaces and unifaces are used, they are reshaped. This process of use and retouch reduces the overall size of the tool (Flenniken and Wilke 1989; Frison 1968). To account for retouch, bifaces and unifaces were classified as early-, middle-, or late-stage tools (Table 13). Early-stage tools have a thickness that exceeds their widths, exhibit rudimentary biface reduction on their faces, and may include cortex. Late-stage tools have a thickness that is less than their widths. These artifacts are more refined than early-stage objects and exhibit multiple flake scars, including biface-thinning flake scars. Middle-stage bifaces and unifaces represent a transitional stage between early- and late-stage tools, and they have characteristics of both types.
Among the 223 bifaces and biface fragments, six varieties were visually identified: oval, stemmed, laurel-leaf, heavy axe, adze, and elongated bifaces. As indicated by the name, oval bifaces have ovate shapes and convex cross sections. Seven oval bifaces are in the assemblage (Figure 42). These bifaces average 72.5 mm in length, 55.5 mm in width, and 33.1 mm in thickness.

Stemmed bifaces have converging margins along their proximal ends and nearly parallel margins along their distal ends (Willey et al. 1965:412). These bifaces likely were hafted and used as knives or spear points by the Maya. Among the Zacpetén chert artifacts are ten stemmed bifaces (Figure 43). These bifaces average 84.4 mm in length, 34.9 mm in width, and 8.2 mm in thickness.

Laurel-leaf bifaces have a variety of lengths and widths, but they all have margins that taper to a point at their proximal or distal ends. The laurel-leaf bifaces found at Zacpetén are similar to the unstemmed biface variety identified at Barton Ramie (Wiley et al. 1962:412). The eight laurel-leaf bifaces in the assemblage average 93.8 mm in length, 36.8 mm in width, and 7.6 mm in thickness (Figure 44).

Heavy axe bifaces, traditionally called general utility bifaces, have variable shapes that range from oval to rectangular in outline. These bifaces are roughly flaked, thick in cross section, and often feature cortex. The heavy axe bifaces in the assemblage average 71.4 mm in length, 53.4 mm in width, and 28.1 mm in thickness.

These bifaces feature minimal amounts of biface reduction (Figure 45). There is no evidence of retouch or pressure flaking on the heavy axe bifaces, and 17 have cortex. A significant number of heavy axe bifaces also feature batter use-wear along their
Figure 42. Oval bifaces.

Figure 43. Stemmed bifaces.
Figure 44. Laurel-leaf bifaces.

Figure 45. Heavy axe bifaces.
margins and edges. Most of the heavy axe bifaces in the assemblage are well-worn, but some of the flaking and wear patterns found near the distal end of the heavy axe bifaces could indicate areas where broken or reduced heavy axe bifaces were shaped for rehafting. The visual, technological, and use-wear patterns identified on the heavy axe bifaces suggest that they were used in high-impact activities such as the clearing and digging of agricultural fields or the ringing and chopping of trees.

Like the heavy axe bifaces in the assemblage, adzes were produced for high-impact work. However, these tools are more refined than heavy axe bifaces, and they have truncated bits, giving them a trapezoidal outline. At Zacpetén, two adzes were identified (Figure 46). These artifacts average 79.7 mm in length, 48.3 mm in width, and 23 mm in thickness.

Elongated bifaces ($n = 2$) have a long, linear shape. In the Maya Lowlands, elongated bifaces have been found with flat ends (chisels and punches) as well as tapered, rounded, or pointed ends (gouges) (Kidder 1947; Willey et al. 1967). The elongated bifaces in the assemblage average 54.6 mm in length, 34 mm in width, and 8.4 mm in thickness. The elongated bifaces both have rounded ends, and neither has cortex (Figure 46).

A significant number of biface fragments also were identified in the assemblage. These fragments were classified as proximal ($n = 19$), medial ($n = 64$), and distal ($n = 83$) segments. Like the intact bifaces, these artifacts were categorized as early- ($n = 126$), middle- ($n = 3$), and late-stage bifaces ($n = 35$).
Chert Projectile Points and Their Production

There is strong archaeological evidence in the Central Petén Lakes to indicate the use of the bow and arrow during the Late Postclassic and Early Contact periods. Among the chert artifacts (Table 14) are 224 project point preforms, points, and point fragments (Figures 47 and 48). Side-notched points are the most numerous point type (Figure 49), though corner-notched, tapered, and double side-notched points (Figure 50) are also present in the assemblage.

The chaîne opératoire for projectile point production begins with the selection of a projectile point preform. While some projectile points were produced from blade
<table>
<thead>
<tr>
<th>Projectile Point Type</th>
<th>Count</th>
<th>Averages</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length</td>
<td>Width</td>
<td>Thickness</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, side-notched</td>
<td>108</td>
<td>24.5</td>
<td>12.3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, double side-notched</td>
<td>2</td>
<td>32.4</td>
<td>10.5</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, corner-notched</td>
<td>10</td>
<td>26.8</td>
<td>15.7</td>
<td>4.1</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, tapered</td>
<td>3</td>
<td>33.6</td>
<td>16.9</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, preform</td>
<td>66</td>
<td>27.8</td>
<td>17.8</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, proximal</td>
<td>20</td>
<td>22.6</td>
<td>14.4</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, medial</td>
<td>2</td>
<td>28</td>
<td>16</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Proj. Point, distal</td>
<td>12</td>
<td>27.3</td>
<td>19.2</td>
<td>6.7</td>
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</tr>
<tr>
<td>Total</td>
<td>224</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Table 14. Projectile points and debitage types.

Figure 47. Projectile point preforms.
Figure 48. Projectile point performs.

Figure 49. Side-notched points.
Figure 50. Corner-notched, tapered, and double-notched points.

segments, most of these artifacts were created from flakes or flake fragments (Carballo 2011:73). During the initial stage of projectile point production, a rough outline was produced through the flaking of a preform with a pressure-flaking tool. Preforms have a rounded or irregular shape, and they often have flake attributes such as bulbs of force, remnant platforms, or ridges. As projectile point preforms are shaped and reduced on both sides, a thinner, triangular shape develops. In the final production stage, notches were often added along the base or lateral edges, or the points may have been thinned along the base to facilitate hafting.

The debitage types created during projectile point production include small thinning flakes, notching flakes, and shatter. Notching flakes result from the removal of
small pressure flakes from both faces of a preform, creating an indented margin along the base or edges. These flakes have a unique appearance compared to other debitage types. In cross section, notching flakes are short and broad, and they have minute, concave platforms. No notching flakes were found in the assemblage, but a few pressure flakes ($n = 12$) were categorized. Flake scars identified on completed projectile points and fragments indicate these points were finished through the detachment of short, non-patterned pressure flakes from the lateral margins. No projectile points in the assemblage have parallel, transverse, or transverse-parallel flake scars.

**Chert Eccentrics and Their Production**

Eccentrics are finely flaked chipped-stone objects with deep symbolic meaning. These objects do not have utilitarian shapes, and they are found in forms such as crescents, perforated disks, lanceolates, zoomorphs, and anthromorphs (Titmus and Woods 2003:132). Of all the chipped-stone industries in Mesoamerica, the production of large eccentrics was the most complicated. Smaller eccentrics did not have as intricate a chaîne opératoire, but they likely followed a similar production sequence.

The initial stage of eccentric production involved the production of a biface free of significant hinge-terminations, step-terminations, or high arises on either face (Titmus and Woods 2003:134). Producing a biface with uniform faces decreases the potential for catastrophic production errors to occur during the later stages of production. During the second stage of production, notches were flaked in the biface to create major design elements such as heads, torsos, arms, and headdresses (Titmus and Woods 2003:135). Experimental studies and analysis of Mesoamerican eccentrics indicates indirect
percussion was used to notch large bifaces (Titmus and Woods 2003:135), but notches on smaller bifaces could have been produced through soft-hammer percussion or pressure flaking.

No debitage associated with eccentric production was categorized among the chert artifacts. However, two chert eccentrics were found in the assemblage. These objects were recovered from the medial altar of the central temple in Civic-ceremonial Group A (Str. 602). Both artifacts are made from a fine-grained, yellow-white chert. The first eccentric is a fragment of a large piece of unknown design and measures 36.9 mm by 31.7 mm by 10.6 mm (Figure 51). This eccentric has several isolation elements along one
of the lateral margins and a large hook-shaped notch on one of the ends. A bending break along the opposite end of the piece makes it difficult to identify the intended design or image for this eccentric. While this artifact may have been intentionally destroyed during a ritual within Str. 602, the lack of complementary fragments suggests that it was placed into the altar in its current form.

The second Zacpetén eccentric has a quincunx design that was created by four isolation elements placed along the edges of an oval biface (Figure 52). This eccentric measures 94.5 by 65.2 by 12.7 millimeters. In Mesoamerica, the quincunx can be a visual representation of the world and its four corners. The quincunx also represents the fundamental cosmic order, which centers on the Mesoamerican world tree (Miller and
Taube 1997:186). The placement of this eccentric within the medial altar of the central temple in the main Zacpetén civic-ceremonial group was a clear attempt by the Kowoj to create a sacred place within the community.

**Use-wear Analysis of the Zacpetén Chert Artifacts**

Unfortunately, the percentage of chert artifacts with discernable use-wear patterns in the assemblage is much lower than expected. Only five percent of the artifacts exhibit use-wear, and a much larger number of the chert artifacts likely were used as tools across the community. There are two hypotheses for the low percentage of chert with use-wear patterns in the assemblage.

First, chert is not as brittle as obsidian, so micro-fractures are less likely to form unless tools are extensively used or are applied against hard materials. Second, the texture of chert generally is coarser than is obsidian, so it is difficult to discern use-wear patterns under low magnification. Despite these issues, transverse, longitudinal, rotative, and batter use-wear patterns were identified on 419 chert artifacts (Table 15), suggesting that chert flakes, flake fragments, bifaces, and biface-thinning flakes likely were used for a variety of cutting, scraping, drilling, and hammering activities.

Use-wear on linear flakes was particularly interesting because these artifacts have a similar size and shape as obsidian blades. Among the linear flakes, 28 artifacts have some type of longitudinal \((n = 12)\), transverse \((n = 3)\) or retouch \((n = 13)\) use-wear. Use-wear patterns are also found on 93 bifaces. Most of the biface use-wear is batter \((n = 51)\), though transverse \((n = 8)\), retouch \((n = 29)\), and longitudinal \((n = 5)\) wear is present.
### Table 15. Zacpetén chert artifacts with use-wear.

<table>
<thead>
<tr>
<th>Use-Wear</th>
<th>Degree of Use-Wear</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light</td>
<td>Medium</td>
</tr>
<tr>
<td>Longitudinal</td>
<td>N = 122</td>
<td>34</td>
</tr>
<tr>
<td>% =</td>
<td>72</td>
<td>22</td>
</tr>
<tr>
<td>Transverse</td>
<td>N = 64</td>
<td>38</td>
</tr>
<tr>
<td>% =</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>Rotative</td>
<td>N = 3</td>
<td>7</td>
</tr>
<tr>
<td>% =</td>
<td>27</td>
<td>63</td>
</tr>
<tr>
<td>Batter</td>
<td>N = -</td>
<td>23</td>
</tr>
<tr>
<td>% =</td>
<td>0</td>
<td>30</td>
</tr>
<tr>
<td>Retouch</td>
<td>N = n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>% =</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refined biface varieties with an average thickness of 33 mm or less have longitudinal, transverse, or retouch wear, while expedient bifaces with an average thickness greater than 45 mm feature batter use-wear.

**Spatial Analysis of the Zacpetén Chert Artifacts**

The spatial analysis of the chert assemblage revealed a wide distribution for these artifacts across the community (Tables 16 through 21). In Civic-ceremonial Groups A, flakes, flake fragments, biface-thinning flakes, cores, and core fragments were found in ceremonial and residential structures and features. A handful of formal tools, such as chert bifaces and projectile points, were recovered in or near caches, burials, or altars, and these objects likely were associated with ritual activities. Despite the large amount of chert debitage found in Civic-ceremonial Group A, there is no clear evidence to indicate tools were produced within any buildings or features from this group.
### Technological Type

<table>
<thead>
<tr>
<th>Flake Core Production</th>
<th>1000</th>
<th>1001</th>
<th>601</th>
<th>602</th>
<th>603</th>
<th>605</th>
<th>606</th>
<th>615</th>
<th>764</th>
<th>765</th>
<th>766</th>
<th>767</th>
<th>Total</th>
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<tr>
<td>Primary platform spalls</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary platform spalls</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>1</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Crested blades</td>
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<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<td>1</td>
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<tr>
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<td>6</td>
<td>9</td>
<td>4</td>
<td>5</td>
<td>30</td>
<td>11</td>
<td>-</td>
<td>2</td>
<td>13</td>
<td>89</td>
<td></td>
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<tr>
<td>Partially cortical flakes</td>
<td>76</td>
<td>99</td>
<td>52</td>
<td>89</td>
<td>64</td>
<td>69</td>
<td>313</td>
<td>302</td>
<td>27</td>
<td>28</td>
<td>25</td>
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<td>1386</td>
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<tr>
<td>Noncortical flakes</td>
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<td>230</td>
<td>81</td>
<td>174</td>
<td>307</td>
<td>153</td>
<td>552</td>
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<td>48</td>
<td>47</td>
<td>234</td>
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<td>Cortical flake fragments</td>
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<td>20</td>
<td>71</td>
<td>34</td>
<td>36</td>
<td>131</td>
<td>84</td>
<td>11</td>
<td>11</td>
<td>42</td>
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<td>59</td>
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<td>15</td>
<td>7</td>
<td>54</td>
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<tr>
<td>Flake Cores</td>
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<td>3</td>
<td>5</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>3</td>
<td>44</td>
</tr>
<tr>
<td>Core fragments</td>
<td>2</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>15</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>16</td>
<td>54</td>
</tr>
<tr>
<td>Noncortical shatter</td>
<td>12</td>
<td>11</td>
<td>8</td>
<td>15</td>
<td>6</td>
<td>26</td>
<td>16</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>16</td>
<td>33</td>
<td>169</td>
</tr>
<tr>
<td>Potlids</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>378</td>
<td>478</td>
<td>229</td>
<td>530</td>
<td>468</td>
<td>354</td>
<td>1467</td>
<td>840</td>
<td>101</td>
<td>93</td>
<td>367</td>
<td>1016</td>
<td>6321</td>
</tr>
</tbody>
</table>

### Table 16. Flake core technological types per ceremonial structure.

<table>
<thead>
<tr>
<th>Biface Production</th>
<th>1000</th>
<th>1001</th>
<th>601</th>
<th>602</th>
<th>603</th>
<th>605</th>
<th>606</th>
<th>615</th>
<th>764</th>
<th>766</th>
<th>767</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biface-thinning, percussion flakes</td>
<td>11</td>
<td>12</td>
<td>6</td>
<td>18</td>
<td>5</td>
<td>14</td>
<td>77</td>
<td>27</td>
<td>1</td>
<td>5</td>
<td>36</td>
<td>212</td>
</tr>
<tr>
<td>Biface-thinning, pressure flakes</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>9</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>18</td>
</tr>
<tr>
<td>Bifaces</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>10</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>38</td>
</tr>
<tr>
<td>Biface fragments</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>5</td>
<td>38</td>
<td>16</td>
<td>3</td>
<td>6</td>
<td>36</td>
<td>129</td>
</tr>
<tr>
<td>Unifaces</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Uniface fragments</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>19</td>
<td>15</td>
<td>36</td>
<td>11</td>
<td>22</td>
<td>134</td>
<td>48</td>
<td>5</td>
<td>12</td>
<td>79</td>
<td>401</td>
</tr>
</tbody>
</table>

### Table 17. Biface technological types per ceremonial structure.

<table>
<thead>
<tr>
<th>Projectile Point Production</th>
<th>1000</th>
<th>1001</th>
<th>601</th>
<th>602</th>
<th>603</th>
<th>605</th>
<th>606</th>
<th>615</th>
<th>764</th>
<th>766</th>
<th>767</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projectile point preforms</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>6</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Projectile points</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>5</td>
<td>17</td>
<td>6</td>
<td>15</td>
<td>-</td>
<td>7</td>
<td>63</td>
<td></td>
</tr>
<tr>
<td>Projectile point fragments</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Eccentric Production</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Eccentrics</td>
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<td>-</td>
<td>-</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>15</td>
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<td>28</td>
<td>10</td>
<td>22</td>
<td>4</td>
<td>20</td>
<td>120</td>
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</tr>
</tbody>
</table>

### Table 18. Projectile point and eccentric technological types per ceremonial structure
### Table 19. Flake core technological types per residential structure.

<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Elite Residences</th>
<th>Nonelite Residences</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>747</td>
<td>732</td>
<td>719</td>
</tr>
<tr>
<td><strong>Flake Core Production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary platform spalls</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Secondary platform spalls</td>
<td>-</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>Cortical flakes</td>
<td>-</td>
<td>15</td>
<td>16</td>
</tr>
<tr>
<td>Partially cortical flakes</td>
<td>-</td>
<td>139</td>
<td>167</td>
</tr>
<tr>
<td>Noncortical flakes</td>
<td>55</td>
<td>287</td>
<td>188</td>
</tr>
<tr>
<td>Cortical flake fragments</td>
<td>-</td>
<td>73</td>
<td>171</td>
</tr>
<tr>
<td>Noncortical flake fragments</td>
<td>22</td>
<td>150</td>
<td>417</td>
</tr>
<tr>
<td>Flake cores</td>
<td>-</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Core fragments</td>
<td>-</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td>Shatter</td>
<td>-</td>
<td>21</td>
<td>62</td>
</tr>
<tr>
<td>Potlids</td>
<td>-</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>77</td>
<td>695</td>
<td>1053</td>
</tr>
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</table>

### Table 20. Biface technological types per residential structure.

<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Elite Residence</th>
<th>Nonelite Residence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>747</td>
<td>732</td>
<td>719</td>
</tr>
<tr>
<td><strong>Biface Production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biface-thinning, percussion flakes</td>
<td>-</td>
<td>65</td>
<td>59</td>
</tr>
<tr>
<td>Biface-thinning, pressure flakes</td>
<td>-</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Bifaces</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Biface fragments</td>
<td>2</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>Unifaces</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Uniface fragments</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5</td>
<td>85</td>
<td>83</td>
</tr>
</tbody>
</table>

### Table 21. Projectile point and eccentric technological types per residential structure.

<table>
<thead>
<tr>
<th>Technological Type</th>
<th>Elite Residence</th>
<th>Nonelite Residence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>747</td>
<td>732</td>
<td>719</td>
</tr>
<tr>
<td><strong>Projectile Point Production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projectile point preforms</td>
<td>1</td>
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<td>2</td>
</tr>
<tr>
<td>Projectile points</td>
<td>4</td>
<td>13</td>
<td>28</td>
</tr>
<tr>
<td>Projectile point fragments</td>
<td>1</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Pressure flakes</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>6</td>
<td>33</td>
<td>44</td>
</tr>
</tbody>
</table>
Two buildings, Strs. 606 and 767, may have been locations for biface production at Zacpetén. Within these civic-ceremonial structures, a large number of bifaces, biface fragments, anddebitage associated with biface production were recovered. However, the artifacts were found in secondary contexts, and they likely are associated with the disposal ofdebitage and broken bifaces. Ethnographic studies of the Lacandon Maya revealed that waste products generally were discarded at least 100 m away from production areas and outside of residences (Clark 1991:73). As such, Strs. 606 and 767 may have been used as locations for the disposal of production debris.

Chert artifacts were also found in Civic-ceremonial Group C. Like Civic-ceremonial Group A, most of the artifacts from this Group C are biface or flake-core debitage found near the collapsed walls of the various buildings and features. There is no clear evidence for in situ production of chert tools in Group C based on artifact provenance.

The Zacpetén residential groups also contained a significant number of chert tools and debitage. Among the elite and nonelite structures, 2,801 chert artifacts, including 123 formal tools and 2,119 pieces of debitage were found. Most of these artifacts are from Str. 719, and they include early-stage and late-stage debitage associated with biface, projectile point, and flake tool production.

Chert artifacts also were recovered from Str. 732. Bifaces and biface fragments from this elite structure included stemmed, heavy axe, and round bifaces. Early- and late-stage debitage associated with bifacial-core and flake-core reduction, such as cortical, partially cortical, and noncortical biface-thinning flakes, bifacial cores, flakes, flake
fragments, and shatter, were identified in this structure. These artifacts were found spread across the floor and along the interior and exterior walls of Str. 732. It is possible that the chert artifacts from Str. 732 represent the production of flake and bifacial tools within this residence based on the spatial location and the artifact and debitage types identified within this structure.

Archaeological work within the nonelite structures of Zacpetén also recovered chert artifacts. Most of the chert objects from these buildings (84 percent) were classified as debitage. Interestingly, Str. 758 contained a high number of chert artifacts compared to the other nonelite residences. Tools and debitage types recovered from Str. 758 included flakes, flake fragments, biface-thinning flakes, cores, core fragments, and shatter. The chert objects from this residence are associated with flake tool, projectile point, and biface production. While most of these artifacts were found on the floor of Str. 758, a few artifacts were mixed within the collapsed walls of the residence.

**Production, Exchange, and Use of Chert Artifacts at Zacpetén**

Over 9,000 chert artifacts were categorized according to their visual, technological, use-wear, and spatial attributes. Visual analysis identified a high number of artifacts produced from local sources, including examples made from fine-grained brown chert. The presence of early-stage debitage indicates most of the chert was brought into the community as nodules, early-stage flake cores, or biface preforms.

The technological analysis of the chert artifacts indicates tool production at Zacpetén was focused on the production of simple flake tools, bifaces, and projectile
points. The high number of small projectile points, fragments, and preforms in the assemblage strongly indicates the use of bow and arrow technology during the Late Postclassic and Early Contact periods. Unlike obsidian artifacts, chert tools were produced in elite and nonelite residences. Early- and late-stage debitage associated with chert bifaces, projectile points, and flake cores were found at both residence types, and it is likely that the majority of chert tool production in the community was expedient and occurred at the household level.

If specialized biface production occurred within the community, then it likely was a part-time cottage industry. A large number of bifaces, biface fragments, and debitage types associated with biface production were recovered from Strs. 602 and 606. However, the artifacts found in these structures may not represent in situ production debitage. Two buildings that are more likely to have been locations for specialized biface production are Strs. 719 and 732. Both of these elite residences have a high number of chert bifaces, unifaces, and debitage types associated with biface production.

Longitudinal, transverse, rotative, and batter use-wear patterns are found on multiple chert flakes, flake fragments, bifaces, and biface-thinning flakes. However, there are no concentrations of chert tools or debitage types with the same use-wear pattern to indicate specialized production areas. Instead, objects with observable use-wear were spread across the residential and civic-ceremonial structures, suggesting that most of these artifacts were produced and used as all-purpose tools in a variety of different contexts.
During the Late Postclassic and Early Contact periods, each Zacpetén household likely manufactured chert tools to meet its individual needs. People made and reduced flake cores to produce informal, sharp-edged hand-held tools. As such, chert tool production at Zacpetén was highly autonomous. Community members would have relied on kinship networks to meet any shortfalls associated with their regular supply of chert tools or raw materials, and it is through these interactions that community identity at Zacpetén would have been maintained.

There is no evidence among the chert artifacts to indicate community dependency on regional forces for the supply of chert tools or raw materials. As such, all activities associated with chert tool production were organized at the household or community levels, and the interactions associated with these artifacts would likely have created a greater sense of unity among the Kowoj at Zacpetén.
Chapter 8- Millstones, Handstones, and Lapidary Artifacts from Zacpetén

The lithics in this chapter have all been discussed in other archaeological studies under the category “groundstone artifacts”. However, use of this term is misleading, and it needs significant revision. One general assumption about millstones is that they are produced by grinding or abrasion, hence the term “groundstone”. Nevertheless, ethnoarchaeological studies of millstone production in highland Guatemala (Hayden 1979; Hayden and Nelson 1981) and Oaxaca, Mexico (Cook 1973), along with replicative studies of millstone production (Wilke and Quintero 1996; Schneider 1996) have shown that these tools were primarily manufactured through percussion techniques. In addition to percussion, a significant amount of time and effort went into the pecking of millstone tools during their production. Thus, millstone tools, such as manos, metates, mortars, and pestles, are chipped-stone artifacts similar to those discussed in Chapters 6 and 7.

There are six basic stages in the chaîne opératoire for millstone production: 1) quarrying the raw material, 2) initial reduction to create a millstone blank, 3) preforming the millstone, 4) detailed millstone shaping, 5) dressing the millstone surface through pecking, and 6) finishing or smoothing of the millstone surface (Wilke and Quintero 1996). The first step in millstone production involved the procurement of good-quality raw material. This step could be difficult, and considerable energy was spent locating raw materials and hammerstones of sufficient size and quality (Hayden 1979:24).

Once the appropriate raw materials and tools were found, millstone blocks and blanks were quarried using large hammerstones. In addition, antler and wooden levers,
picks, and wedges likely were used to pry blocks from large boulders (Schneider 1996:303). Quarrying probably required the efforts of more than one person, as a significant amount of force was needed to detach large blocks and flakes. In addition, the immobilization of the work piece was vital to minimize vibration as flakes were removed (Wilke and Quintero 1996:255), and quarried material was regularly propped against rocks and the ground, or the individuals involved in the work stabilized it. If successful, the techniques employed during the initial production stage would typically remove about 50 to 60 percent of the mass from the block or blank. The debitage types associated with the initial stage of millstone production usually are very large flakes and flake fragments (Hayden 1979:28).

In the second stage, the millstone block was reduced until a blank was created. Smaller hammerstones, beveled hammerstones, or hammerstones with small contact points likely were used to shape the blank, and most of the cortex was removed during this stage. Debitage types associated with the second stage of millstone production typically include large and small flakes and flake fragments.

During the third step of millstone production, the final shape of the tool was formed as the blank was reduced to create a preform. This step was the most crucial in the chaîne opératoire because it was during the preforming stage that production failures were most likely to occur (Wilke and Quintero 1996:255). As a result, flake removal during this stage required more precision and care. Beveled hammerstones were regularly employed to allow for the precise placement of strikes, particularly in the production of pestles.
When obtuse or right-angled platforms were encountered, a new platform was often pecked into the blank, or the problem area was carefully isolated and removed by a series of flakes. Occasionally, indirect percussion was employed to detach flakes from linear striking platforms. The debitage types associated with the preforming stage may include percussion flakes of varying sizes, many of which have carefully prepared platforms and flat bulbs of force (Wilke and Quintero 1996:255). Once the basic form of the millstone was produced, the preform was further reduced and shaped by percussion techniques during the fourth production stage. This step is a continuation of the previous chaîne opératoire stage, but it includes more detailed flaking before the final dressing of the millstone (Wilke and Quintero 1996:256).

During the fifth stage of millstone production, the preform is pecked with a beveled hammerstone. Through pecking, irregularities were removed from the preform while reducing the potential for the tool to break from percussion-induced errors. This step removed the smallest amount of material, but it involved the largest amount of time compared to the other production stages.

Replicative studies of andesite pestles found that eight to eleven hours were required to deliver 80,000-100,000 individual hammerstone blows to complete the shaping of these tools (Wilke and Quintero 1996:256). Vesicular basalt may have required less effort to dress because it is softer than andesite, but ethnographic studies of Guatemalan millstone production (Hayden 1979) found that considerable time and effort was spent pecking basalt manos and metates. The main debitage types produced during the fifth production stage may include small rock meal and dust.
The final step in the chaîne opératoire of millstone production was the smoothing of the surface through grinding and abrasion. This step was optional and was conducted to eliminate potential grit that would be detrimental to the food-grinding process (Wilke and Quintero 1996:256). This stage required only a few minutes to complete and removed an insignificant amount of material.

**Manos and Metates**

Millstones are used to grind and pulverize. While these tools typically were used to process foodstuffs, they also were employed in the production of goods such as mineral pigments and dyes. The two millstone tool types identified in the Zacpetén assemblage are manos and metates. Metates are the larger, stationary component, and manos are the upper, hand-held tools worked against metates.

In the assemblage, metates were classified according to the shape of the grinding surface, which is created according to the hardness of the metate, the type of mano, and the grinding motion used over time (Clark 1988:94). The basic forms of metates in the assemblage are flat and basin-shaped. If the metate was made from raw material that was harder than the mano, it was more likely to maintain a flat, unrestricted surface. If the metate was less resistant, it would wear down and gain a restricted grinding surface with a concave shape.

Two varieties of basin metates, deep and shallow, were cataloged in the assemblage. Deep-basin metates have a pronounced lip along the edges of the grinding surface that forms as the metate is reciprocally worked by two-handed manos. Shallow-
basin metates have a broad lip that typically is produced through rotary motions using one-handed manos. All of the manos in the assemblage were classified as one-handed or two-handed types based on their sizes, and they were subdivided into round or flat varieties based on their shapes.

In the assemblage, millstone artifacts were made from basalt, granite, and limestone. Basalt is an igneous rock formed by the cooling of lava exposed at or near the surface of the earth. The basalt objects in the assemblage were produced from fine-grained, vesicular basalt with a dark gray color \((n = 15)\) and a medium- to coarse-grained basalt with a light gray color \((n = 16)\).

Based on their features, the darker basalt artifacts likely originated from sources in the Guatemalan highlands (Figures 53 and 54). These metate fragments are flat, and they have a square shape. The grinding surfaces are smooth from use, but they retain a rough texture along their sides and bases. Two of the dark gray basalt metate fragments have feet, which indicate the presence of a tripod base on some of these artifacts. In addition to the basalt metate fragments, six dark gray basalt mano fragments were identified in the assemblage (Figures 55). All of these fragments have long, rectangular shapes and round cross sections. Based on their size and shape, these manos likely were used with two hands.

The light gray metate fragments have round bases, slightly concave grinding surfaces, and shallow lips (Figure 56). These fragments are of poorer quality compared to the dark variety metates, which may account for their increased thickness.
Figure 53. Flat basalt metate fragments.

Figure 54. Flat basalt metate fragments.
Figure 55. Basalt manos.

Figure 56. Basalt metate fragments, basin type.
The light gray fragments are from an unknown source, and they may have been procured from quarries in the Maya Mountains.

Granite metates \( (n = 1) \) and metate fragments \( (n = 19) \) also were categorized in the assemblage. Granite is a common igneous rock with visible quartz, mica, and feldspar grains (Pough 1996:23). The granite millstones in the assemblage are tan-gray \( (n = 7) \), gray-pink \( (n = 6) \), or white-gray \( (n = 7) \) in color. Based on their physical characteristics, these artifacts likely originated from sources in the Maya Mountains. The complete granite metate is flat and has a thick, round base (Figure 57). This metate is quite large, measuring 355 by 376 by 62 millimeters. The granite metate fragments all have flat grinding surfaces and thick, round bases similar to the complete metate (Figure 58).
Millstone tools also were produced from limestone, a sedimentary rock composed of grains made from marine organisms (Pough 1996:23). Among the limestone artifacts are 18 flat metates (Figures 59 and 60), 21 deep-basin metates (Figure 61), four shallow-basin metates (Figures 62), and 15 metate fragments. All of the limestone metates and metate fragments are thick and have round bases without feet. One-handed manos \((n = 17)\), two-handed manos \((n = 12)\), and mano fragments \((n = 14)\) are represented among the limestone artifacts (Figures 63 and 64), as are 77 pieces of limestone debitage, most of which are flakes and flake fragments.

There are 29 quartzite manos and mano fragments in the assemblage. Quartzite is a hard metamorphic rock created from sandstone that was transformed through heat and pressure (Pough 1995:34). Among the quartzite artifacts are 13 round, one-handed manos
Figure 59. Flat limestone metates.

Figure 60. Flat limestone metate fragments.
Figure 61. Limestone metates, deep-basin variety.

Figure 62. Limestone metates, shallow-basin variety.
Figure 63. One-handed limestone manos and mano fragments.

Figure 64. Two-handed limestone manos and mano fragments.
A small number of quartz, chert, and metamorphic manos are also in the assemblage. Both quartz manos are round, one-handed types. The chert manos include 12 one-handed examples, a two-handed type, and three mano fragments. Finally, two one-handed manos and a two-handed mano of unknown metamorphic material were classified in the assemblage (Figure 66).

**Handstone Artifacts (Polishers, Barkbeaters, and Hammerstones)**

Handstones are a general lithic category used to describe several types of tools that are not used with metates. The handstone types identified in the assemblage are

(Figure 65), a two-handed mano, and 15 mano fragments.
polishers, barkbeaters, and hammerstones. Polishers are handstones with a relatively smooth texture.

Typically, polishing stones were associated with pottery production, but they also were used to manufacture bone and wooden tools (Kidder 1932:63-65). Among the Zacpetén artifacts are nine polishing stones (Figure 67). All of the polishers have a round shape, and they are made from limestone, quartz, or gray pumice (Figure 68).

Among the lithic artifacts are four barkbeater fragments. Typically, these artifacts were used to pound tree bark to produce paper. In the Maya area, paper production was a multi-stage process (Clark 1988:136-137; Hernández 1959:137). First, tree bark from the
Figure 67. Limestone (top) and quartzite (bottom) polishers.

Figure 68. Pumice polisher and polisher fragment.
mulberry, wild fig, or rubber tree was removed and soaked in water. Next, the pulp was separated from the bark and pounded on a wooden board with a barkbeater that was hafted or used in the hand. The paper was continuously soaked and cleaned to keep the fibers pliable, and additional layers of pulp were added and pounded until the paper matted together to form a smooth surface.

The barkbeaters in the assemblage include a grooved limestone barkbeater fragment (Figure 69) and three ungrooved barkbeaters produced from limestone and quartzite (Figure 70). The grooved fragment was produced from a light gray limestone, and it has a large groove along the outer edge, indicating that it likely was hafted. This artifact has four small linear groves across both faces and a reddish hue from a red pigment along one face.

The quartzite and tan-white limestone barkbeaters have round shapes, and the dark gray limestone barkbeater is rectangular. These complete barkbeaters are scored with linear lines across their faces, but they do not have grooves along their outer edges, indicating they were likely used in the hand.

Hammerstones are percussors used to manufacture stone tools. All of the hammerstones \( (n = 24) \) and hammerstone fragments \( (n = 2) \) in the assemblage are one-handed types. These hammerstones and hammerstone fragments were found in a variety of shapes and sizes, but they all have extensive batter use-wear along their edges and faces.
Figure 69. Grooved barkbeater, side views (left) and top view (right).

Figure 70. Ungrooved quartzite (left) and limestone (right) barkbeaters.
Jadeite, Serpentine, and Greenstone Artifacts

Within the assemblage are several jadeite \((n = 12)\), serpentine \((n = 3)\), and greenstone \((n = 5)\) artifacts. Jadeite is a dense metamorphic mineral with a hardness between 6.5 and 7 on the Mohs scale. Jadeite typically is found in a variety of green colors.

In Mesoamerica, the most important jadeite source is in the Motagua Valley of Guatemala, and the unique blue-green color of material from this source was extremely valuable to the Maya (Seitz et al. 2001). In the assemblage are three jadeite celt fragments (Figure 71), two pendants, a cylindrical bead, a circular disk, and four flake fragments. Celts are highly polished axes with a wedge shape. While some celts may have been hafted for use in agricultural activities, jadeite celts typically were reserved for ceremonial purposes and for use as jewelry. For the Maya, jadeite was related to kingship, water, maize, and centrality (Taube 2000), and rulers often were depicted with jadeite ornaments (Taube 2005:23). The three jadeite celt fragments in the assemblage are small, round segments from larger celts. Unfortunately, the exact size or shape of the original celts cannot be determined from these fragments.

The circular jadeite bead in the assemblage measures 7.6 mm in diameter, and the jadeite cylinder measures 37.8 mm by 13.0 mm by 9.8 mm (Figure 72). Both beads are biconically drilled. The four jadeite flake fragments in the assemblage are thin and have rectangular shapes. Unlike the other jadeite artifacts, these fragments have rough textures (Figure 73).

Often, jadeite appears in formations with serpentine. This metamorphic mineral is
Figure 71. Jadeite celt fragments.

Figure 72. Jadeite beads.
opaque when held up to a light source, and it is significantly softer than jadeite (3 to 4.5 on the Mohs scale). Serpentine typically has an olive green color, but it also can be found in white, gray, or yellow varieties. In the assemblage are a serpentine ear spool, pendant, and flake fragment (Figure 74). The ear spool is circular, has a small hole in the center, and features a circular groove around one face. The serpentine pendant also has a circular shape and central hole.

In archaeology, greenstone is a generic term used to describe green-hued, metamorphic rocks such as schist, olivine, and nephrite. Among the Zacpetén artifacts are five greenstone fragments (Figure 75). These small fragments are of various sizes, but they all have smooth faces or edges. These artifacts range in color from olive to dark green.
Figure 74. Serpentine ear spool, pendant, and flake fragment.

Figure 75. Greenstone celt fragments.
Spatial Distribution of Millstones, Handstones, and Lapidary Artifacts

The millstone, handstone, and lapidary artifacts were widely distributed across Zacpetén (Tables 22 and 23). Civic-ceremonial Groups A and C contained 78 finished objects and 60 pieces of debitage. Unfortunately, no clear distribution patterns were found among the civic-ceremonial structures to indicate production areas for these artifacts.

Within the elite residences of Zacpetén were 139 millstone, handstone, and lapidary artifacts. Most of these objects were recovered from Str. 719. The front room of this structure was relatively clean of artifacts, but a jadeite bead and a rectangular jadeite fragment were found in a bowl below the medial shrine. This cache may have been part of a ritual ceremony enacted to renew or protect the structure (Pugh et al. 2009:195). In addition, limestone, quartz, and quartzite artifacts were found along the interior walls of the front room.

The rear room of Str. 719 contained a large quantity of refuse, including two limestone metates embedded in the floor. Additional artifacts found in the back room include three basalt manos, nine basalt metate fragments, eight granite metate fragments, 17 limestone metates and metate fragments, 39 quartzite and limestone manos, two limestone polishers, 16 chert and quartzite hammerstones, one jadeite celt fragment, and two greenstone celt fragments.

The number of manos and metates found in Str. 719 ($n = 68$) is much higher than any other structure at Zacpetén, but there is no evidence to indicate millstone tools were produced within this elite residence. Instead, these artifacts likely were used in the
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Table 23. Millstone, handstone, and lapidary artifacts per residential structure.
production of other objects. The back room of Str. 719 also contained obsidian, ceramics, hematite, and gypsum (Pugh et al. 2009:200), and the association of millstone artifacts with these items could be evidence of ochre grinding, plaster-of-Paris production, and the use of millstones as anvils for the bipolar reduction of obsidian cores.

Production, Exchange, and Use of Millstone, Handstone, and Lapidary Artifacts at Zacpetén

The visual, technological, and spatial analyses of the millstone, handstone, and lapidary artifacts have provided some additional insight into the economic activities of the Kowoj during the Late Postclassic and Early Contact periods. Basalt from the Maya Highlands and granite from the Maya Mountains were imported into Zacpetén for use as millstones. Jadeite and serpentine were brought into the community, probably from sources in the Motagua Valley. While the parent source of the light-gray basalt artifacts is not known, it is possible that these artifacts were brought into the community from the Maya Mountains. However, these regional imports comprise only eight percent of the millstone, handstone, and lapidary artifacts. A much larger number of tools and debitage from these categories likely were produced from local limestone, chert, quartz, quartzite, and greenstone sources.

The technological analysis of the millstone artifacts suggests that few steps associated with the production of these objects took place inside of the community. Instead, most of the initial production was completed at quarries and workshops outside of Zacpetén. Any millstone production at the site would have been associated with the
final chaîne opératoire stages. Millstone pecking may have taken place in the community, representing a significant production activity in terms of time and effort. Dressing of millstone tools by pecking may have been completed by individual households, or it may have been part of a cottage industry that specialized in millstone tool production on a part-time basis.

Among the lapidary artifacts are seven finished objects (beads, ear spools, and pendants), eight celt fragments, and five flake fragments. Similar to the millstone artifacts, no clear evidence for the production of these items was found in the assemblage. Only three jadeite fragments from the back room of Str. 719 can be considered production debitage, but this number is too small to indicate lapidary production in this elite residence.

Interestingly, the presence of greenstone celt fragments among nonelite residential structures suggests that many of these objects were repurposed by households for use in domestic rituals. The recycling of jadeite and greenstone artifacts by Postclassic Maya households has been documented in the Upper Belize River Valley at Chan (Keller 2013). Similar to the ceremonies in civic-ceremonial structures, the placement of jadeite, serpentine, or greenstone items within domestic homes likely was an act to renew and protect them.

The distribution of the Zacpetén millstone, handstone, and lapidary artifacts suggests that each household had access to local and non-local goods. Millstone and handstone tools produced from local limestone, quartz, quartzite, and chert sources were recovered from elite and nonelite residences, as were basalt, granite, jadeite, and
serpentine artifacts. However, elite residences contained a higher number of non-local items, indicating that elites had greater access to regional goods compared to nonelites.

While there is no clear proof for the specialized production of millstone and lapidary artifacts within the community, there is some evidence for the exchange of these goods at Zacpetén. Many of the millstone and lapidary artifacts are not local to the Central Petén and could have been brought into the community through market exchange or elite-sponsored distribution networks. Each household had some access to these items, and if the distribution of millstone and lapidary artifacts were controlled at the local level, these activities would have fostered a greater sense of community identity.
Chapter 9- Conclusions

Under an interactional perspective, communities are the combination of people, place, and premise created through regularized, but not predetermined, interactions (Watanabe 1992:12). The size and composition of communities vary, but the minimum number of individuals needed to form a community is about that of a kin group from a small band-level society. All community members share an affiliation with a place, real or imagined, and the regular interactions between individuals and households from the same community create obligations and a sense of interdependence.

In looking at ancient communities, archaeologists must infer past interactions based on interpretations of the archaeological record. Among the material remains of past societies, lithic artifacts may provide an avenue of research for identifying prehistoric activities. Through the visual, geochemical, technological, use-wear, and spatial analyses of the Zacpetén lithic artifacts, a better understanding of community interactions and the role regional and local institutions played in shaping community identity was inferred.

During the Late Postclassic and Early Contact periods, a complex political economy existed across the Maya Lowlands. However, this system was not uniform, and social, political, and economic connections varied at different times and places. As individual city-states competed for power, local communities vacillated between periods of integration and independence. When communities were united under a single polity, economic and political power was vested in regional institutions, and communal identity was influenced by outside forces. In periods of socio-economic autonomy, the relations
of production remained at the local level, and individual communities maintained their own identity. These two forces, the local and regional, are not mutually exclusive but work simultaneously to influence households, kin groups, classes, and factions.

With the collapse of the Ajaw tribute system during the Terminal Classic period, economic and political power shifted to the northern lowlands, and the Central Petén became a peripheral area during the Late Postclassic and Early Contact periods. However, the region was not a cultural backwater. Information, people, and goods continued to move into the Central Petén because of the abundant natural resources in the region.

During the Early Postclassic, the Itzá of the Central Petén developed a complex series of city-states united under the rule of a single lord, or halach unic, at Nojpetén. During the Late Postclassic, the migration of additional groups, such as the Kowoj, created new tensions in the region. Kowoj-Itzá conflicts likely involved control of territory and resources, but ethnohistorical accounts suggest that these feuds may have originated from earlier disputes at Mayapán. These strained relations continued through the Early Contact period with the migration of additional groups into the Central Petén looking to avoid Spanish rule.

As the Kowoj moved into the Central Petén, they asserted their own identity and distinguished themselves from the Itzá while trying to legitimize their political authority through connections to Mayapán. Many of these connections are reflected in the ceramics and architecture at Kowoj sites in the Central Petén Lakes Basin. Maintaining socio-political distinctions may have had economic repercussions for the Kowoj as well.
Whether by choice or necessity, behaviors associated with the acquisition and production of stone tools at Zacpetén are different from the patterns found at non-Kowoj sites, and they may represent another avenue through which community identity was formed.

Both local and regional raw materials were used in the production of stone tools at Zacpetén. Basalt from the Maya highlands and granite from the Maya Mountains were imported into the community for use as millstone tools. Jadeite and serpentine were also imported the site from sources in the Motagua Valley. However, most of the tools and debitage in the assemblage are produced from chert, limestone, quartz, and quartzite collected from local sources. The high percentage of tools and debitage produced from raw materials located in the Central Petén suggests that control over stone tool procurement remained at the local, community level.

Artifacts from sources outside of the Central Petén (obsidian, basalt, granite, jadeite, and serpentine) may have been exchanged into the community through regional interaction networks, but they could have entered into Zacpetén via community-based activities as well. The majority of obsidian in the assemblage is from El Chayal, and the high reliance on this source could have resulted from the scavenging of obsidian from abandoned sites in the Central Petén.

Obsidian likely was brought into Zacpetén as late-stage pressure-blade cores. These cores were subsequently reduced in elite households by specialists on a part-time basis. The main products created through blade-core reduction were small pressure blades and blade segments. Obsidian blades are general-purpose tools that can be used for multiple tasks. The distribution of obsidian was influenced by the methods through which
it was imported into the community. If obsidian cores were scavenged, then they may have been exchanged to specialists for finished products. If obsidian cores were brought into Zacpetén through regional exchange networks, they may have been circulated to households in the community through market exchange or as gifts from elites for political support.

Chert was brought into Zacpetén as nodules, flake cores, and bifacial preforms. Based on the distribution of chert tools anddebitage, each household produced simple, all-purpose flake tools, biffaces, and projectile points using expedient production strategies. While most of these tools were used by the households wherein they were manufactured, some projectile points, biffaces, and flake cores may have been distributed to different households via reciprocal exchanges.

While exact locations for specialized biface production in the community were not identified, the large number of bifaces, broken bifaces, and bifacial debitage found in Strs. 719 and 732 suggest that the production of refined bifaces likely was a part-time cottage industry. Several types of highly refined bifaces were identified in the assemblage, indicating some biface production within the community was not expedient. These bifaces were produced through several manufacturing steps, including soft-hammer percussion. These refined bifaces were not distributed through reciprocal exchanges, but they may have been allocated to different households through more formal distribution systems such as market exchange.

Very little millstone production likely took place at Zacpetén. Archaeological and ethnographic studies revealed that most of the initial steps in the production chaîne
opératoire of millstone tools likely took place at quarries and workshops outside of communities. However, some late-stage millstone production may have taken place at Zacpetén as a part-time cottage industry. All of the handstone artifacts in the assemblage likely were procured, manufactured, and used by individual households for a variety of tasks and activities.

Only a small number of lapidary artifacts were recovered at Zacpetén. Most of these artifacts were finished goods (beads, ear spools, and pendants), and they may have been brought into the community via market exchange, through elite-sponsored interaction networks, or they may have been scavenged from other locations in the Central Petén. A few jadeite flake fragments were found in the back room of Str. 719, but there is not enough evidence from this elite residence or any other structure at Zacpetén to indicate lapidary production occurred in the community.

Similar to the obsidian and chert artifacts, the millstone, handstone, and lapidary objects were widely distributed across Zacpetén. Both elite and nonelite households contained these artifacts, suggesting these items were not restricted to particular social classes. However, basalt, granite, jadeite, and serpentine artifacts were found in larger quantities in elite residences, reflecting their greater economic power.

Analyses of the Zacpetén lithics indicate the acquisition, production, and distribution of stone tools were autonomous, community-based activities. Most of the stone tools at Zacpetén were produced and used by individual households, but several cottage industries may have specialized in the production of obsidian blades, chert bifaces, and millstone tools. The recovery of in situ production debitage in the back room
of Str. 719 provides good evidence for the specialized production of stone tools at Zacpetén. This elite residence was an important structure in the community based on its location, architectural features, and contents. Several stone tool and debitage types were found in the back room, indicating the residents of Str. 719 may have been merchants or elites involved in the production and exchange of obsidian, chert, and millstone tools.

The interactions associated with the lithic artifacts at Zacpetén fostered a sense of community identity at the local level. The Kowoj at Zacpetén made clear attempts to maintain their own identity despite regional influences exerted by Itzá and Spanish during the Late Postclassic and Early Contact Periods. As the Kowoj interacted through ceremonies, rituals, and communal activities, a highly localized identity was created. Economic interactions associated with the production and distribution of stone tools also reinforced local solidarity.

Not all of the questions raised in this study were completely answered. Additional research is needed in the Central Petén to fully address the organization of stone tool industries at other communities. Specifically, the visual, geochemical, and technological studies of stone tool assemblages at additional Kowoj and Itzá sites may provide more information on how each group met its economic needs. If similarities in the acquisition, production, and distribution of stone tools are identified between Kowoj and Itzá communities, then the Central Petén may have had similar socio-economic constraints. If clear differences are found between Kowoj and Itzá assemblages, then it is probable that different social forces played an important role in the overall economy of the Central Petén Lakes Basin during the Late Postclassic and Early Contact periods.
Appendix A

For the sampled Zacpetén artifacts, only five elements: Zirconium (Zr), Rubidium (Rb), Thorium (Th), Zinc (Zn), and Iron (Fe) had consistent parts-per-million (ppm) measurements that correlated to specific Mesoamerican obsidian sources (Table 24). Correlations between obsidian sources and trace-element profiles obtained through XRF analysis can be made using bivariate studies using two-dimensional scatterplots. Bivariate analysis is a simple form of quantitative analysis whereby two variables are compared to measure how they simultaneously change, and it is often used to test simple hypotheses of association (Shennan 1997:140-141). For this study, bivariate analysis was used to determine whether the covariance of two trace elements identified during the XRF analysis corresponded to the Mesoamerica obsidian sources. Bivariate analysis was used in previous studies to find correlations between elements and obsidian sources, and it is a useful for identifying outliers in the data (Glascock et al. 1998:27).

The results of the scatterplots of Zirconium (Zr), Rubidium (Rb), Thorium (Th), Zinc (Zn), and Iron (Fe) are mixed due to the significant overlaps in the ppm measurements of these five elements. Despite the overlaps, bivariate scatterplots of Th and Zr (Figure 76), Th and Rb (Figure 77), Zr and Rb (Figure 78), Zr and Fe (Figure 79), and Fe and Rb (Figure 80) correlate with several Guatemalan and Mexican obsidian sources.
<table>
<thead>
<tr>
<th>Source</th>
<th>Zr  ±</th>
<th>Rb  ±</th>
<th>Th  ±</th>
<th>Zn  ±</th>
<th>Fe (%) ±</th>
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<td>18.7</td>
<td>43.8</td>
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<td>SMJ</td>
<td>131</td>
<td>9</td>
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<td>-</td>
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<td>4.9</td>
<td>40.9</td>
<td>1.1</td>
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</table>

Table 24. Trace element profiles for obsidian from Zacpetén.

![Scatterplot of Th and Zr for the Zacpetén artifacts.](image)

**Figure 76.** Scatterplot of Th and Zr for the Zacpetén artifacts.
Figure 77. Scatterplot of Th and Rb for the Zacpetén artifacts.

Figure 78. Scatterplot of Zr and Rb for the Zacpetén artifacts.
Figure 79. Scatterplot of Zr and Fe for the Zacpetén artifacts.

Figure 80. Scatterplot of Fe and Rb for the Zacpetén artifacts.
Figure 81. Distribution of Zr for the Zacpetén artifacts.

Because there are overlaps in the bivariate clustering of the Zacpetén XRF obsidian profiles, a series of dispersion measurements in the form of boxplots were produced to study the median, inter-quartiles, and outlier values for the XRF measurements on each artifact. By presenting the data through boxplots, a closer look at spacing between the XRF measurements is possible. Analysis of the distribution of Zr among the Zacpetén artifacts yielded several trends (Figure 81). For the El Chayal artifacts, Zr ppm measurements are the lowest, averaging 116.3 (± 8.4) ppm. The Zr measurements for the SMJ artifacts are slightly higher than El Chayal, averaging 131 ppm (±9). The Zr measurements for the Ixtepeque artifacts are the highest among the
Figure 82. Distribution of Rb for the Zacpetén artifacts.

Guatemalan sources, averaging 188.1 (± 18.7). Interestingly, there are no similarities between the Zr ppm measurements for the Guatemalan sources.

The ppm measurements of Zr for the Mexican sources have averages higher than the Guatemalan sources. The Tulancingo artifacts average 189 ppm (± 4.9), followed by Pachuca (905.1 ± 3) and Zacualtipán (925 ± 31). Overall, the Zr measurements for the Zacpetén obsidian artifacts are sufficiently homogeneous to correlate to specific obsidian sources, and consistent trace element profiles are identifiable for the seven obsidian sources found in the assemblage, despite some minor overlaps between outlier measurements (Figure 82).
Figure 83. Distribution of Th for the Zacpetén artifacts.

Analysis of the trace amounts of Rubidium (Rb) within the Zacpetén obsidian artifacts also identified correlations with specific obsidian sources, with some minor overlaps in the bivariate clustering. Among the Guatemalan sources, Ixtepeque artifacts have the lowest Rb counts, averaging 43.8 ppm (± 3.4). Following Ixtepeque, the Rb ppm measurements for SMJ average 53.1 ppm (± 6.1). For the El Chayal artifacts, the Rb ppm measurements average 64.2 (± 10.7).

The Rb ppm measurements for the Mexican sources are similar to those from the Guatemalan sources. The Tulancingo artifacts have the lowest Rb ppm measurement (40.9 ± 1.1), followed by Zacualtipán (56.2 ± 5) and Ucareo (78.5 ± 35.8). Pachuca
obsidian has the highest Rb ppm counts (129 ppm) for all of the obsidian sources in the collection. Despite a modest overlap in ppm measurements, the distribution of Rb for the Zacpetén obsidian artifacts correlates with the obsidian sources in the collection (Figure 83).

Due to significant bivariate clustering overlaps between all of the ppm measurements, analysis of the amount of Thorium (Th) among the obsidian artifacts did not yield clear correlations between the Zacpetén XRF profiles and the obsidian sources. For the Ixtepeque artifacts, the ppm of Th has the lowest average (6.9 ± 1.1). The ppm of Th for SMJ artifacts is slightly higher, averaging 9.1 (± 1.1). Among the Guatemalan sources, El Chayal artifacts have the highest Th counts, averaging 11.3 (± 2).

The Th ppm averages for the Mexican sources are somewhat higher than for the Guatemalan sources. The ppm for the Tulancingo artifacts average 6.3 (± .2), followed by Zacualtipán (11.3 ± 0.1), Pachuca (10.6 ± 0.2), and Ucareo (18.7 ± 13.3). The XRF distribution of Th within the Zacpetén samples do not correlate with the obsidian sources identified in the collection, and trace element profiles cannot be confidently produced from their ppm measurements. There are significant overlaps within and between the Guatemalan and Mexican sources, despite a relatively low standard deviation (Figure 84).

Analyses of the XRF profiles for Zinc (Zn) among the Guatemalan sources yield several correlations between the ppm counts and known obsidian sources. Among the Guatemalan sources, Ixtepeque artifacts have the lowest Zn average, but these artifacts also have the highest standard deviation (30 ± 12.6). The SMJ artifacts have the second
Figure 8.4. Distribution of Zn for the Zacpetén artifacts.

lowest Zn ppm average (33 ± 0.6), and the Zn ppm measurements for the El Chayal artifacts are the highest for the Guatemalan sources (38.5 ±4).

The Tulancingo artifacts have a Zn ppm average of 26.5 (±1.9), which overlaps with the ppm measurements of the Guatemalan obsidian artifacts. The remaining four Mexican sources have significantly higher Zn ppm measurements. Ucareo artifacts average 60.4 (±15.8), followed by Zacualtipán (180.2 ± 16.9) and Pachuca (180.3 ± 15.8). While there is no overlap in the Zn measurements for the Mexican sources, there are distinct overlaps among the Guatemalan sources (Figure 8.3). As a result, clear XRF profiles for Zn are present for the Mexican sources, but similar profiles cannot be created for the Guatemalan sources.
XRF analysis of Fe profiles among the Zacpetén artifacts show some correlations with the obsidian sources identified in the collection. For the Guatemalan sources, the El Chayal artifacts have the lowest Fe ppm average (4701.1 ± 1523.9), followed by the SMJ (4977.2 ± 932.2), and the Ixtepeque (7579 ± 2976.8). For the SMJ artifacts, the Fe ppm has the lowest average, at 437.1 ppm (± 138). Unfortunately, there are significant overlaps between the Guatemalan sources, and no discrete profile patterns can be found among these artifacts based on the Fe ppm measurements.

The Fe ppm averages are much higher among the Mexican sources compared to the Guatemalan sources. Ucareo artifacts have the lowest ppm counts, averaging 18,076.6 (± 12,686). Following Ucareo obsidian were Pachuca (20,634.2 and Zacualtipán (31,836.1 ± 19,768.4). Similar to what was seen in the distribution of Fe ppm among the Guatemalan sources, there are significant overlaps between the Mexican sources. The one exception to this pattern is the Tulancingo source, which has a very low ppm average that overlaps with the Guatemalan sources. Due to high variations between the obsidian sources identified in the collection, clear XRF profiles could not be produced for the Zacpetén artifacts based on the trace element ppm of Fe (Figure 85).

Based on their unique visual aspects and the low variability of source characteristics, Pachuca and SMJ artifacts can be identified within the assemblage through visual sourcing. However, the visual similarities between the El Chayal and Ixtepeque sources, along with the variations identified within these two sources, necessitate stronger XRF correlations for effective identification. As a result, the level of
Figure 85. Distribution of Fe for the Zacpetén artifacts.

confidence for the visual sourcing of El Chayal and Ixtepeque artifacts is lower than was initially hypothesized.

A final source visually identified in the Zacpetén collection is an unknown variety of gray-green obsidian that corresponded to the Tulancingo source. While the trace element analysis of these artifacts show that they correspond to the Tulancingo source, the sample size for the Tulancingo source is small (n = 2), and there is a significant amount of variation in the trace element profiles for both samples. Two additional obsidian sources from central Mexico, Ucareo and Zacualtipán, were not identified during visual sourcing of the Zacpetén artifacts but were identified through XRF analysis. Like the sample size of the Tulancingo, those for the Ucareo and Zacualtipán artifacts are
small \((n = 9)\). However, there is little variation in the trace element profiles of these obsidian sources, suggesting the trace element profiles for these sources are correctly measured.

A second issue with the XRF data is that the ppm profiles collected for the Zacpetén obsidian artifacts do not match the profiles from previous reports on the major Mesoamerica obsidian sources (Cobean et al. 1991). The published XRF trace element profiles for Mesoamerican obsidian sources resulted from two long-term projects that collected over nine hundred obsidian samples from 25 source areas. All of these samples were subjected to trace element analysis using neutron-activation analysis (INAA). The XRF profiles from both of these studies, referred to as the “Yale collection”, formed the baseline for the XRF data collected for the obsidian artifacts from Zacpetén.

A comparison of the trace element profiles of the Yale collection to those of the Zacpetén data showed that the ppm counts from Zacpetén are much smaller, and the Zacpetén samples do not match the Yale trace element patterns. For example, the Zr ppm counts for the SMJ artifacts in the Zacpetén collection are the lowest among the Guatemalan sources. However, the Zr ppm counts for SMJ artifacts in the Yale collection have the highest ppm averages. As a result, the published XRF data from previous studies of Mesoamerican obsidian sources cannot be accurately used to verify the PXRF results found in the Zacpetén study.

Additional studies are needed to improve the correlations between data collected through traditional XRF techniques and the data from PXRF studies. In particular, artifacts from the Zacpetén collection should be analyzed using traditional XRF
instruments to measure, with a higher degree of precision, a wider range of trace elements within the artifacts. The results from these additional studies should have a much closer correlation with those of the Yale collection.
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